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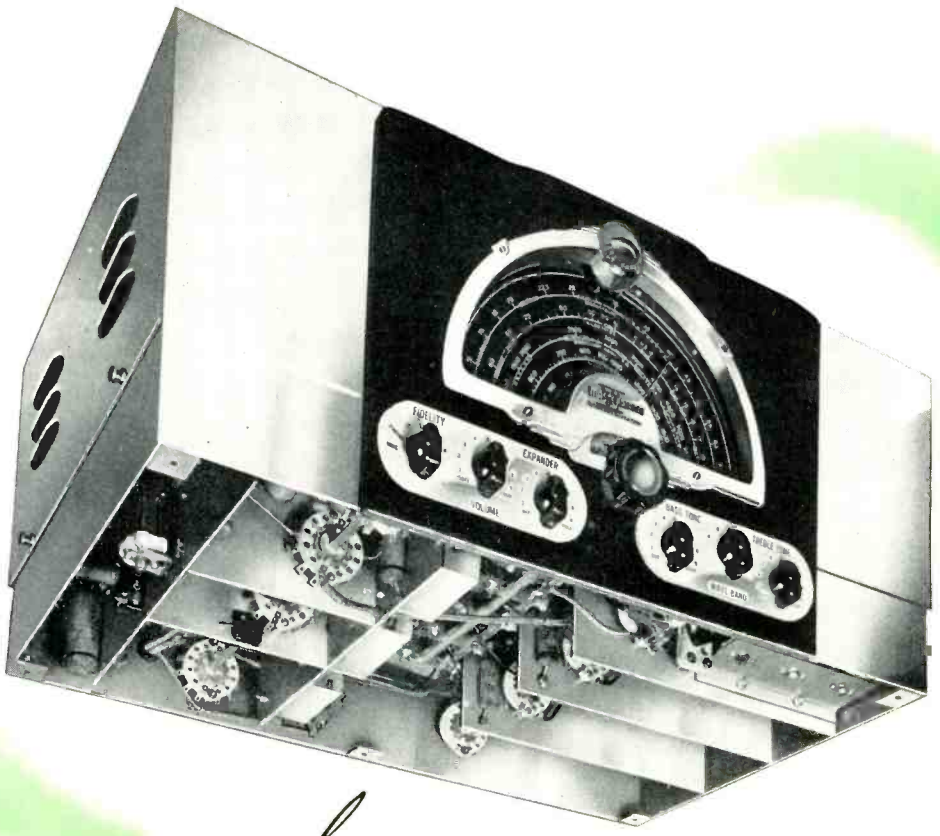

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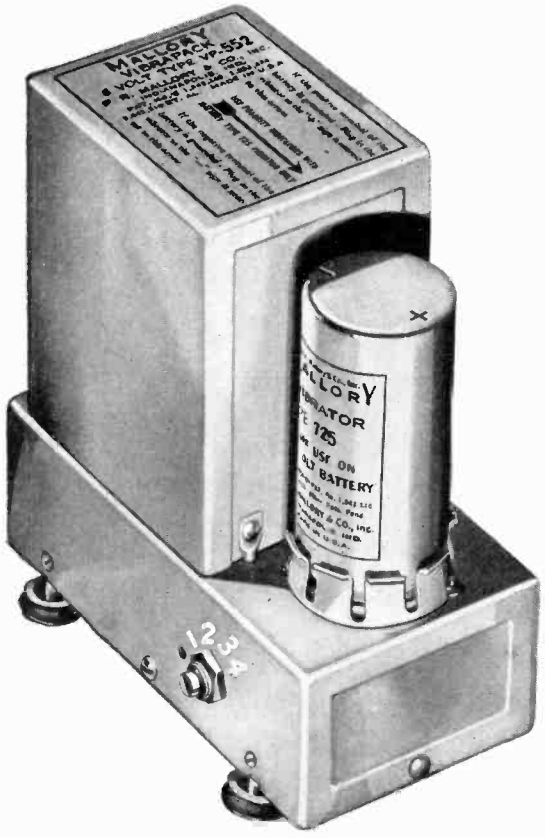

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CONTENTS - JULY - 1937

ALL-WAVE RADIO

Reg. U. S. Pat. Off.

VOLUME 3 • NUMBER 7

GENERAL

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COVER

Off on a trip with the AWR 5-Meter Transmitter-Receiver for Fixed-Portable-Mobile service, described in this issue.

FEATURES

DEPARTMENTS

NO. 1 ON THE HIT PARADE AGAIN!

A 'SURE THING' FOR 12 REPEATS

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EDITORIAL QUOTES

BY THE EDITOR

Paley Award To W8DPY

In recognition of heroic services rendered during the floods of March, 1936, to the citizens of Renovo, Pennsylvania, Walter J. Stiles, Jr., W8DPY, car repairman in the Pennsylvania Railroad's Renovo Shops, was selected by the Columbia Broadcasting System to be the first recipient of the William S. Paley Amateur Radio Award.

The selection of Mr. Stiles for the Paley award, which was established in the fall of 1936 and will hereafter be bestowed annually upon the amateur radio operator in the United States or Canada rendering the most notable and valuable public service during the year, was made by a board of distinguished judges, consisting of the following: Rear Admiral Cary T. Grayson, Chairman of the American Red Cross; Hon. Anning S. Prall, Chairman of the Federal Communications Commission; Hon. C. P. Edwards, Director of Radio for the Canadian Department of Marine; Dr. J. H. Dellinger, Chief of the Radio Section of the U. S. Bureau of Standards; and A. E. Kennelly, Professor Emeritus of Electrical Engineering, Harvard University.

The Board considered a number of noteworthy instances of public service rendered by amateurs during 1936, and after weighing the achievements of all, decided that Mr. Stiles' were the most meritorious and unusual, and involved the greatest personal sacrifice.

Walter Stiles, Jr., W8DPY, first recipient of the W. S. Paley Amateur Radio Award.

The Paley award, by the terms of its establishment, becomes the signal badge of merit and heroism to amateur radio operators. The conditions of the award specify that it shall be presented each year "to that individual who, through amateur radio, in the opinion of an impartial board of awards, has contributed most usefully to the American People, either in research, technical development or operating achievement, and to be open to all amateur radio operators in the United States and Canada."

Members and guests of the Garden City Radio Club, gathered in Dr. Dunn's tap room, illustrating in concert their desire for a sample of Mr. Cooper's best pipe tobacco.

◆

Pipe This, Mr. Cooper

In each instance that ALL-WAVE RADIO has carried the photograph of a chap smoking a pipe, there has turned up for him at these offices a one-pound, vacuum-sealed tin of Sir Walter Raleigh smoking tobacco, accompanied by a charming letter from Mr. George Cooper, President of the Brown and Williamson Tobacco Corp.

Zeh Bouck was the first recipient, and Charlie Stimpson, publisher of the Radio Amateur Call Book Magazine, the second—though it must be confessed that it took a bit of doing for Charlie to get his tin as Ye Editor had designs on it himself.

During his last trip to New York, Charlie cornered us in our den and made way with the tobacco rightfully his. Not willing to acknowledge defeat, we hatched a dirty plot which, had it come off in the manner in which it was conceived, would have netted us not one, but six tins of Mr. Cooper's best. It was our plan to assemble the entire male staff of ALL-WAVE RADIO for a group photo in which each would have appeared with a one-gallon Meerschaum pipe draped over his chin—then to have run the photo in ALL-WAVE RADIO and await the results.

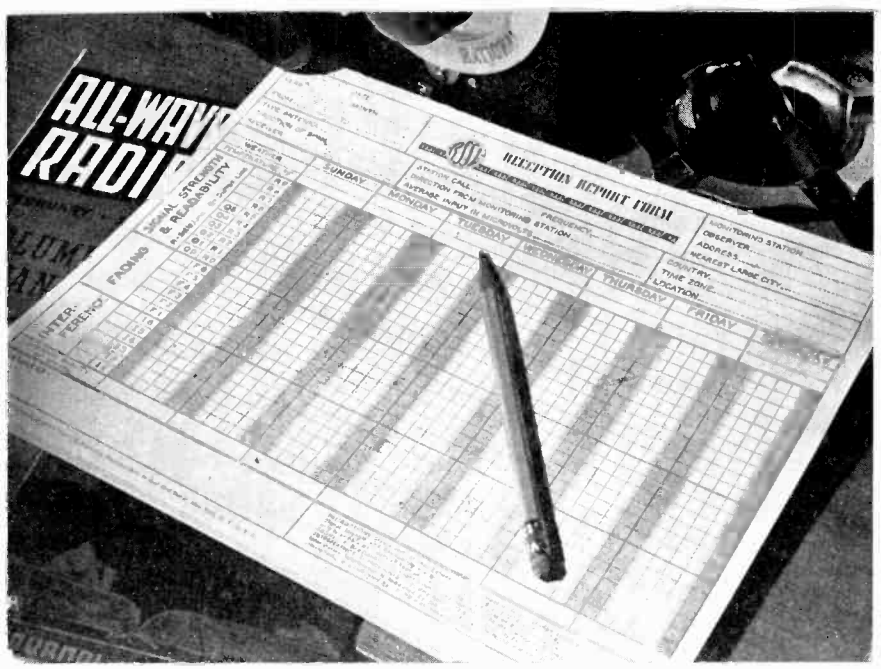
But the plot got off to a bad start, for in an unguarded moment at the recent I.R.E. Convention we outlined the dastardly scheme to Art Lynch who may always be relied upon to steal one's thunder.

What happened may be readily gathered from the photo we grudgingly run on this page . . . this guy Lynch buys clay pipes for guests and members of the Garden City Radio Club, has Stanley P. McMinn, W2PD, Editor of "Automotive Merchandising" take a shot of the gang in Dr. Dunn's tap room, and sends the photo to us for publication!

Ordinarily we would scuttle such an obvious play for a few drams of tobacco, but the joke is on us and we are attempting to take it with good grace. So here's the lowdown:

Bottom Row: Edwin A. Ruth, 3rd, W2GYL, Chairman, Technical Committee, Garden City Radio Club and Chief Engineer, Erco Radio Labs.; Jack Shaughnessy, Technical Assistant to Major Armstrong at Marcellus Hartley Laboratory, Columbia University.

(Continued on page 392)



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They're off! The auto race at Altamont where ham radio played its part.

"YELLOW

KEEPING THE AMATEUR OF THE PUBLIC AT THE

BY STAFF

IN A.A.A. racing parlance a yellow flag means keep your position, caution and watch out for conditions ahead. Which is exactly what every live amateur is doing these days with a variety of things likely to happen at Bucharest this summer, Havana this fall and at Cairo next February which may vitally affect his interests. No one is particularly crazy about the amateur except the amateur himself. To the rest of the world he is pretty much a nuisance—except of course when a flood happens to break loose. Fortunately for the country, though less fortunately for the hams, these disasters occur only sporadically.

Between blizzards and other major catastrophes, it behooves every amateur to do his part, if possible, in keeping the ham favorably in the public eye. Radio club booths, with free traffic handling, at state fairs, trade shows, etc., provide a sound and excellent form of publicity. Cooperation at automobile races is a variation on the theme, with perhaps more emphasis placed on utility.

The Garden City Radio Club did an excellent job with the Vanderbilt Cup races held at the Roosevelt Raceway last fall. It was the pleasure of W8QMR, of the AWR staff, to ride around in the 5-meter equipped automobile of Arthur H. Lynch, impresario with the G.C.R.C., at which time QMR was duly impressed with the cooperative possibilities for ham radio in such advents. While W2DKJ (Lynch's mobile rig) was primarily stationed with the ambulance unit, for direct communication with the judges' stand in case of accident, it also functioned as a taxi for various officials, as the car could be summoned by the transmitter located in the grand stand, or directed from there to any part of the four-mile track.

Ham Radio at Altamont

The possibility of a similar job, if on a smaller scale, occurred to W8QMR, and it was decided to make an initial experiment at the Altamont Auto Races held Decoration Day, or rather May 31st, at Altamont, N. Y. Constructional work being held up on our own transmitters, the Garden City Radio Club graciously cooperated, and W2DKJ traveled northward with the club's transmitter, his own, and a National 5-meter job for W8QMR.

Preliminary tests were made Saturday evening, May 29th between the mobile units and the club transmitter temporarily installed in the radio store of Edward Scribner, Schoharie, N. Y., who was in charge of the P. A. work at the race track. Further tests were made the following morning at the track between W8QMR and the judges' stand. It was during these tests that the installation first demonstrated its utility—QMR sending out an SOS from the south section of the infield where he was stuck in the mud.

DKJ and QMR arrived at the track the following day several hours before the time trials, and organization details were worked out by the latter, after the necessary releases had been signed. (All parties functioning as officials, and permitted to the infield, sign a release for the race organization against injury or death. You are then permitted to get killed, if desired!) It was arranged that DKJ should patrol the entire south half of the infield, while QMR gave himself the north portion—where the mud was a little firmer. All receivers and transmitters were adjusted to the same spot frequency, the receiver at the judges' stand to be left on at all times. Mobile W2DKJ listened for the first half minute of every odd five minutes, and W8QMR the first thirty seconds of every even five minutes. Albany amateurs, W2EGN and W2AGV, were secured to superintend operation of the transmitter in the judges' stand.

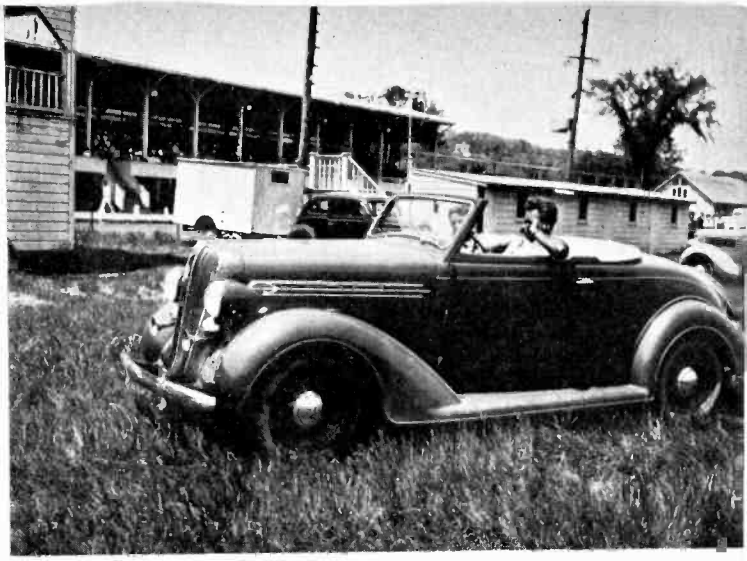
The judges' stand installation was so arranged by Mr. Scribner that the receiver output could be impressed on the P.A. system if desired, and a part of the P.A. output could be utilized to modulate the judges' stand transmitter.

The installation on the judges' stand. Note hand mike and rod antenna.

FLAG"

FAVORABLY IN THE EYE SEASON'S AUTO RACES

REPORTER



W8QMR testing 5-meter mobile rig by contacting judges' stand and outposts.

It was understood by officials, as well as announced over the P.A. system, that communication could be had directly with the judges' stand from either car, the location and description of which were given. This applied particularly to QMR, whose location at the north end of the field was close to the track entrance, main gate, and field offices.

Prior to the races, both cars patrolled the track—one of the fastest and most dangerous half-mile dirt stretches in the east—reporting directly to the judges' stand on track conditions.

DKJ Gets The Breaks

Situated at the south turn, scene of numerous accidents, some of which have been fatal, DKJ was considerably more active than QMR. The south turn follows the straightway in front of the grand stand, where the drivers endeavor to put on their best showing, and they hit the turn at close to seventy miles on hour—often with interesting results. During the time trials, two drivers went into a spin on this turn, the details being duly reported by W2DKJ. There was little further excitement in that sector until shortly after the start of the final, when one of the cars that previously spun on the turn duplicated the performance, catapulted in the air, throwing the driver clear as it crashed into the retaining wall. The ambulance and W2DKJ got there at the same time. The driver was rushed to the hospital, and full details immediately radioed to the judges' stand. The final was restarted after repairs to the retaining wall and the track, with Johnny Duncan, car 99, at the post and Bob Sall, in car 5, in second position, which places they retained for most of the race, with 99 bettering his lead at every lap. Duncan had the race in the bag on the thirtieth lap, when car 24 went into a skid on the south turn, ground looped and came to a stop in the center of the track. Before he could get his car out of the way, 99, who was about to lap him for the second time, crashed into 24, leaving the field and the race to Sall in 5. Once again DKJ gave a full account of the accident to the judges' stand, and the race was permitted to continue as both cars had bounced fairly well off the track.

At the other end of the field the cars took the turn fast but safely, and W8QMR was used mostly for routine work—requesting the judges' stand to page a captain of the state police over the P.A. system, sending through requests for towing cars, etc., . . . not to mention an occasional distress call for beer.

While the experiments outlined above were satisfactorily successful, special equipment will be designed for this work, based on past experience, and will be described in future issues of AWR. Separate transmitters and receivers will be employed in all installations, permitting instantaneous two-way conversations. High quality microphones will be used in the mobile units, permitting perfect modulation of the P.A. system. (The quality of W2DKJ's transmitter was excellent, and his reports were put on the public address system on several occasions.) Special clocks will be designed to turn on the mobile units automatically for the first thirty seconds of every five minutes. The apparatus at the judges' stand will remain on constantly for an emergency call from the field. This will conserve batteries in the mobile units, and at the same time make certain that the operators maintain their schedules. In the excitement of a race it's an easy matter to let thirty seconds slip by!

For half-mile tracks, one mobile unit will probably be sufficient, as it can cover any part of the infield in very short order, being parked at the danger spots during the races and close to the executive end of the field (or beer stand) between events.

Nice little shot of W2DKJ breezing around the track in his Ford V-8.

Making Arrangements

There is considerable opportunity for this work in the northern states during the summer, and in the south over the

(Continued on page 383)

THE AWR 5-METER TRANSMITTER-RECEIVER ON ITS WAY TO THE COUNTRY FOR A TRYOUT.

AWR 5-METER TRANSMITTER-RECEIVER For Fixed-Portable-Mobile Service

BY C. WATZEL • W2AIF and W. BOHLEN • W2CPA

THE amateur five meter band is open (FCC regulations) to three classes of operation. These are "fixed station" operation at the amateur's home address, "portable" operation at any location the amateur chooses and "mobile" operation from a moving car. The small antenna required makes the installation of a five meter transmitter practicable in an automobile. The antenna most useful for this purpose is of the Marconi type, being a quarter-wave long with the car body used for "ground." As a quarter-wave at five meters is only about four feet in length it will be seen that merely a four foot rod clamped to the bumper or other suitable support provides a satisfactory tuned transmitting antenna for this band.

Vacation time is the most enjoyable period of the year for indulgence in the sport of five meter mobile operation. Every hilltop on the vacation trip becomes a potential location from which to attempt "DX" communication of fifty or a hundred miles. If time permits a temporary antenna may be strung up to a tree to provide better signals than the low car antenna. There is always a thrill in talking to another car or station while speeding along (but don't let a cop catch you speeding) while the rig is always useful in making new friends in a strange and far-away town by the simple expedient of contacting local hams over the air from the car and subsequently paying them a visit. Although we have, as yet, to take our first vacation trip in a radio equipped car, previous trips on which amateurs were visited in the towns where an overnight stay was made gave added pleasure to the vacation. Many an otherwise dull evening has been enlivened by "chewing the fat" in person with a ham with whom we had had only a previous "air acquaintance."

Mobile Requirements

Now to get down to the business of studying the actual radio installation necessary in a car to provide effective two-way five meter communication. This problem is quite a different one at the present time than it was several years ago. At that time the simplest of transmitters and receivers sufficed. It did not materially matter if the transmitter frequency "wobbulated" over a good portion of the band when modulated, or if the receiver radiated strongly enough to interfere with reception within a radius of a mile or so. Such an outfit was not very costly, so that the amateur could easily afford separate rigs for the car and for the home station.

Conditions are quite different at present, however. With the advent of low-C transmitting tubes and other recent developments it is now not only possible, but entirely practical, to crystal control five meter transmitters as well as to build superheterodyne receivers for this band having a performance capability of a similar order to that of superhets operating on the other amateur bands. Although the modulated oscillators and radiating receivers are still legal for use on five meters they are rapidly being superseded by more modern equipment. Moreover, they are in decidedly poor taste nowadays.

An amateur who has built a five meter station which meets more nearly present day standards of performance will find that to duplicate such a layout for installation in his car is almost prohibitive in both cost and physical size of the equipment. This means that, in practice the amateur will usually turn to outmoded types of equipment for use in his car, setting up a "double standard" of operation for himself. At home he places a clean, steady signal on the air and does not QRM other hams with unnecessary radiation from his receiver; but on the road he splatters up the ether in a positively indecent manner.

One way of getting around this situation gracefully is to build the home station in a form compact enough so as to be able to use it also as a mobile station. Aside from the problem of fitting the many components of this station into an appropriately small space is the problem

of power equipment. In the home, camp or certain portable locations it is possible to operate the station by merely plugging into a nearby 110 volt AC line. But when operating mobile, or in locations remote from a power line, dependence must be placed on whatever electrical power is available in the car. Unfortunately, the only voltage available in cars is 6 volts, DC, from the car battery. Thus the source of power for a mobile transmitter or receiver, has always been a sore point. Those units, powered from the car battery, that are efficient so far as power factor is concerned proved to be, generally, too noisy. Other types that deliver approximately 60 watts of AC power usually draw in the neighborhood of 15 amperes from the car battery.

Front view of the completed AWR 5-Meter Transmitter-Receiver.

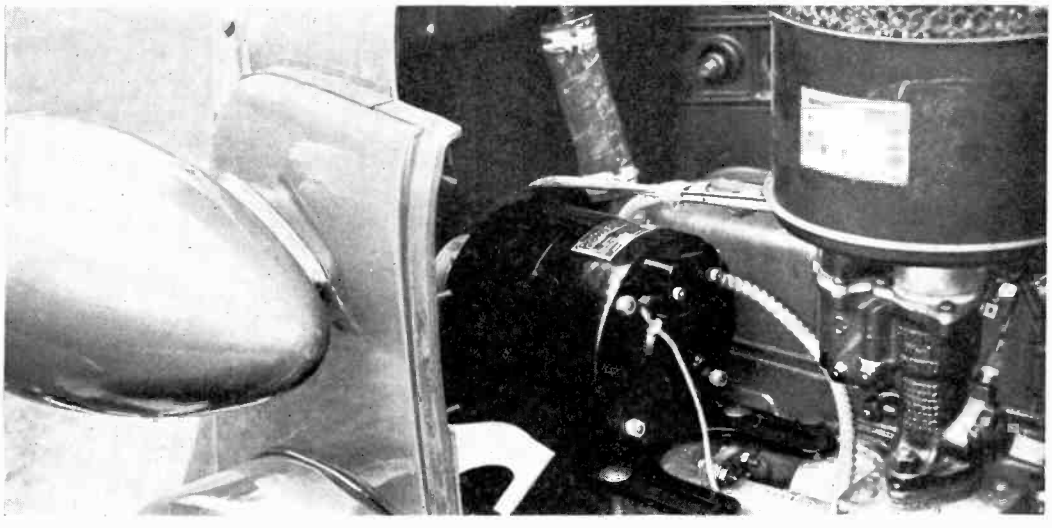
AC Generator

The unit that makes possible practical AC operation of a mobile transmitter-receiver is the Powerack fan belt generator which delivers AC at about 110 volts, making it possible to use the same power supply for both fixed and mobile operation. This generator mounts at the head of the car engine and the same belt that rotates the water pump, car charging generator, etc., operates the Powerack unit. It uses 1.1 amperes from the charging rate of the car generator for excitation and derives most of its power from the mechanical power of the car engine. All the windings in this unit are on the stator side. This eliminates the need for commutators and slip rings and thereby makes the unit absolutely noiseless, even on the highest frequencies.

The Powerack unit can be installed in any car and the AC power is brought from the unit, through a BX cable, to the car dashboard. The unit delivers full output from idling speed to speeds up to and beyond 60 miles per hour and, once installed, provides 50 watts of practically free AC power indefinitely. This output power may also be used to operate either other radio equipment or such devices as trouble lamps or various small electric attachments.

There is one precaution that must be observed when making use of the output of this AC generator, and that is to use up, at all times, the full wattage output of the unit. This applied load must total 50 watts, or close to it, otherwise the voltage will rise and damage the equipment. The use of a slide resistor or suitable light bulbs will take care of the difference between the wattage used and the full 50 watt output of the unit. In the transmitter-receiver described in this article the design is such that a load close to 50 watts is drawn at all times. This is done by using up the full 50 watts with the transmitter section, while a compensating load resistor takes up the unused wattage when the lighter drain of the receiver is placed on the generator. In the latter case the output of the generator is divided approximately half and half between this load resistor and the receiver. The load resistor is switched in and out automatically with the "send-receive" switch. The "off-on" switch for the transmitter-receiver also cuts off the 6 volt battery supply to the generator excitation winding, so that there is no AC output from the generator with this switch in the "off" position.

The Powerack generator installed in the car, up by the fan belt.



General Transmitter and Receiver Design

The next step in the development of a five meter transmitter-receiver-power supply unit is the design of a transmitter and receiver small enough to fit into a single small-sized cabinet along with the power supply. The transmitter presented a greater problem in this respect than the receiver. After mulling over various receiver designs, both for super-regenerative and superheterodyne types, it was decided that the most practical design for the intended purpose would be a super-regenerative receiver having an RF stage on the front end to eliminate radiation of the detector. The practically instantaneous AVC action inherent in a super-regenerative detector not only effects a substantial reduction in ignition QRM but also provides more intelligible speech when the receiver is mounted in a car which is speeding through several standing waves (from a trnnsmitting station) per second. Under such conditions the relatively slower AVC action (time constant usually about one-tenth second) of a superheterodyne is unable to cope with the rapid changes in signal strength met with under such conditions.

On the transmitter end of the rig, crystal control would be nice to have, but is virtually out of the picture even with the simplest of crystal controlled layouts, due to the room they require. An MOPA arrangement is just as wasteful of space as a crystal controlled job. The only layout that will provide a reasonable degree of frequency stability in a small space is an electron-coupled oscillator with the grid circuit tuned to ten meters and the plate circuit tuned to five, this plate circuit being modulated and coupled to the antenna. Only one tube and two tank circuits are necessary in this type of transmitter to comprise the entire RF section. The signal from such an oscillator is stable enough to be received on a selective superheterodyne, such as one employing the usual 465 kc. IF frequency. This order of stability is quite satisfactory for our purpose.

Power Supply and Switching

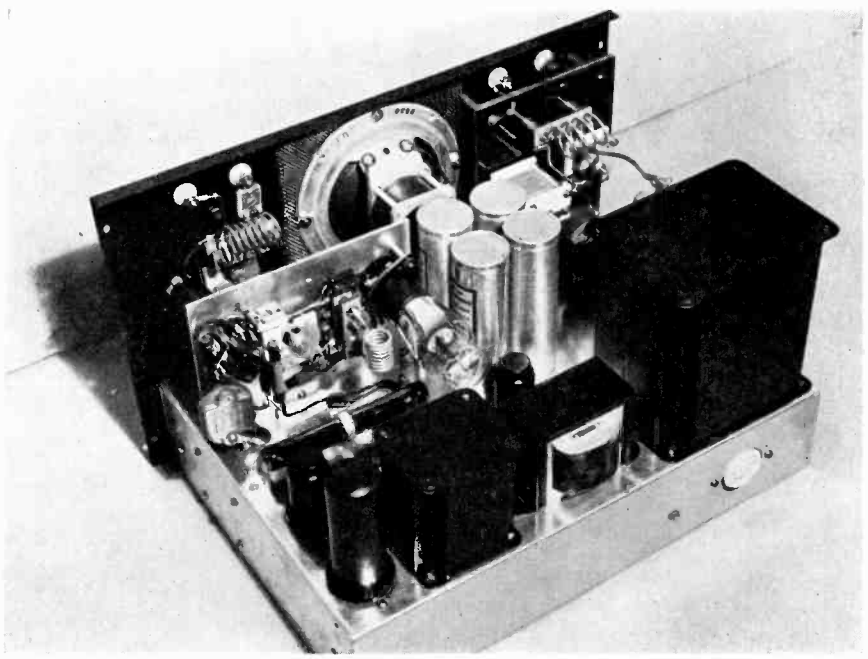
With the general design of the transmitter and receiver taken care of, attention may be turned to the power supply problem and switching methods in the combined job. This problem is simplest when the power supply is plugged into a standard 110 volt power line. The regulation of the line will keep the heater voltage constant and the available wattage is ample to carry the load of both heater and plate voltages for a half dozen or so of these jobs running simultaneously. When operating from the car generator, however, the full 50 watts of AC power is used up by the plate circuits, so that the additional power for the tube heaters must be taken direct from the car battery. This is not as disadvantageous as it may seem at first thought, since the battery will hold the heater voltage to a constant value regardless of the load on the generator. The total drain on the battery from both the tube heaters and the generator excitation load is less than 4 amperes. This figure is low enough as to provide no undue drain on the battery. As the rectifier tube cannot run direct from the battery, a gaseous type of rectifier is employed which requires no heater or filament voltage, but three connections being required to the tube.

Two multiple switches take care of all switching operations. That shown at the left of the "power" section of the diagram is a three position switch which is used as the "off-on" switch for both fixed and mobile operation. When operating from a power line this switch is thrown to the "line" position to turn the rig on. In this position the AC circuit to the primary of the power transformer is closed while the heater circuit is connected to the 6.3 volt winding on the transformer. When operating from the car generator this switch is thrown to the "car" position. In this position the AC circuit is again completed while the tube heaters are switched over to the car battery. This also completes the circuit to the generator excitation leads. Without this latter connection, as mentioned previously, there is no output from the generator. On the connection socket shown at the bottom of the "power" section of the diagram the two lower pins go direct to the car battery. The middle pair of pins connect to the two excitation leads to the generator, while the upper pair go to the AC output leads (in the BX cable) running from the generator. No polarity need be observed for either the set heater circuit or for the generator excitation circuit. Whichever side of the battery, which happens to be grounded in the particular car in which installation is made, becomes the lead which connects to the grounded shield of the excitation cable.

The other switch used is the two position type shown at the right of the "power" section of the diagram. One section of this switch throws the output of the audio section either to the speaker or to the transmitting RF tube shown in the "transmitter" section. Two other sections of this switch, parallelel for greater current handling, switch either to the dummy load resistor, R5, in the "receive" position or to the transmitter bleeder, R7 and R8, in the "transmit" position. The "B" circuits of the two tubes in the "receiver" position switch off and on with the load resistor R5 while the voltage source for the microphone is taken from the junction of R7 and R8 of the transmitter bleeder. In this way the "receiver" section is switched off while transmitting, avoiding any possibility of feedback between transmitting and receiving sections, while when receiving the voltage is automatically removed from the microphone circuit. This prevents talkback from the speaker to the microphone, which would in turn give rise to audio feedback in the form of a howl. This connection, incidentally, also eliminates the necessity for any microphone batteries. The voltage furnished to the microphone with the value of R8 as shown runs between three and four volts. The 25 mfd. condenser, C30, forms the final filter and bypass for this circuit.

The fourth section of the "send-receive" switch is in series with the generator excitation circuit. If this were not done the AC voltage from the generator, and subsequently the plate voltage, would momentarily rise to a much higher value than normal as this switch is thrown between its two positions.

As a further safeguard against possible damage, should the generator AC voltage rise unduly high, a choke input filter is used so as to improve the voltage regulation, while series filter condensers are used, doubling their normal breakdown voltage. The four 16 mfd. filter condensers used are the equivalent of two 8 mfd. condensers.



Interior view of the completed AWR 5-Meter Transmitter-Receiver.

Transmitter Section

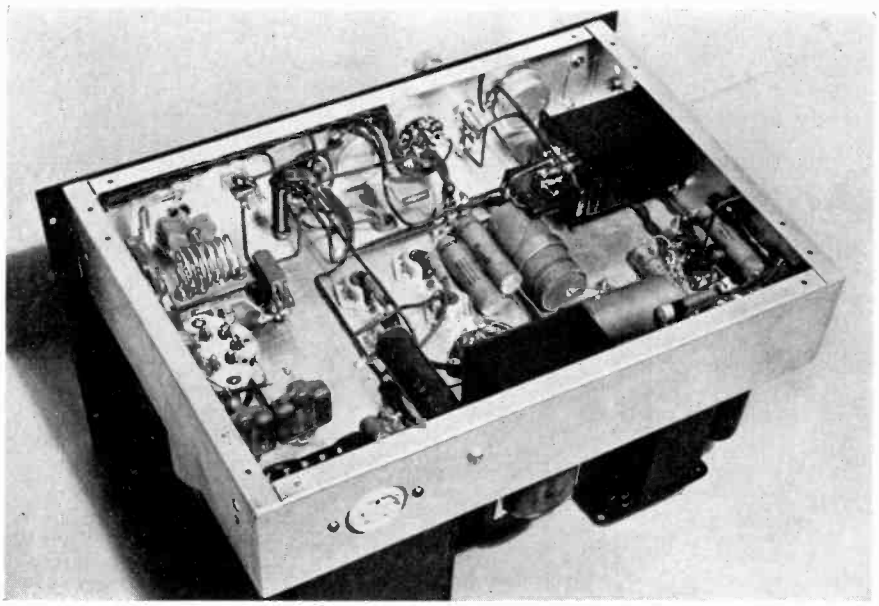
The transmitter portion of this rig is built at the left hand end (panel view) and is contained in the small space between the power transformer and the panel. The grid circuit is entirely un-

der the chassis. This grid tank is tuned by condenser C8, which is controlled by the lower dial at the end of the panel. The coil is mounted in the clear space between this condenser and the tube socket. Jack J is connected between the lower end of the grid coil and ground. A meter plugged into this jack reads the combined plate and screen currents. As tuning condenser, C8, is directly grounded to the panel it is necessary to use C7 to bypass the meter and complete the grid tank circuit. This condenser should, therefore, be considered as part of this grid tank and wired with short leads to L1 and C8.

C, C1 and L comprise a combined plate tank and universal antenna coupler. All three of these components are mounted on a 4" x 4½" piece of hard rubber, which is in turn mounted 1⅛" back of the panel. A pair of type 801 panels bearing assemblies bring the condenser controls out through the panel. A pair of small dials, the same as used for the grid circuit, control these two condensers, the left hand dial of this pair controlling C while the right hand dial takes care of C1. With this type of mounting the leads are very short and direct. A plate bypass condenser, C2, completes the plate circuit. A cutaway shield is used for the tube, but should not be necessary.

This plate tank circuit corresponds with the single-pi type of antenna network more familiarly known to the amateur fraternity as the "Collin's coupler." It actually takes the place of any plate tank. C and C1, together, tune the plate circuit to resonance. The ratio in capacities between the two condensers determines the matching impedance to the antenna. This type of coupling will match any type of single wire antenna feed, such as is usually used in a car, also to many odd lengths of antenna. For fixed operation with a two wire feed system from the antenna, a coupling coil consisting of a few turns of wire, determined by experiment, may be shoved into the cold end of L.

When the transmitter was originally built an RK39 beam type of tube was employed. This was eventually discarded in favor of the RK25 now being used. The RK39, when used in an electron coupled circuit at these ultra high freqencies had a predeliction for oscillating on all frequencies from one to ten meters at one and the same time. Output could be secured with the coil L replaced by a shorting bar! This condition was not satisfactory for five-meter operation so the RK25 was next tried. Although poor output due to low efficiency when doubling was expected, the tube surprised us by turning out a nice output of approximately five watts. This much output, however, could only be secured when the cathode tap on the grid coil L1 was properly located. This point proved, on experiment, to be only three-quarters of a turn from the low end of the coil, which is an 8-turn coil. When the tap was moved further up the coil to a point considered more appropriate for this particular circuit the five-meter output fell off sharply. Experiment with this tap, therefore, is of the greatest importance in securing best five-meter output. The RK25 was found to have a sharply defined resonance peak at five meters, as indicated with a small neon bulb, with no output except at this one point. This was in contrast to the operation of the RK39. With this latter tube the neon bulb never went out between resonance at the various harmonics, with resonance showing very broadly at these points. Theoretically the RK39 is the better tube for this circuit—actually the RK25 is far superior. Ultra high frequency operation is full of these surprises.



Under-chassis view of the 5-meter transmitter-receiver, showing disposition of parts and general wiring.

Receiver Section

The receiver, during the course of development, underwent many changes before a truly satisfactory five-meter operation resulted. Originally the first audio tube, now a 6C5, was a dual type 6N7. The other section was used as a separate interruption oscillator for the super-regenerative detector. It was found that with this arrangement the interruption frequency voltage, which is a very high, inaudible, audio frequency, was strong enough to block the audio amplifier. This was eventually discarded in favor of the self-quenching detector shown in the diagram. This particular circuit has been found to be the least critical and smoothest of the various circuits tried, and is widely used in five-meter receivers. With this type of circuit it was found that the .004 bypass condenser was sufficient to keep the interruption frequency voltage out of the audio amplifier.

The RF stage was originally untuned, using a supposedly self-resonant choke. It was found, however, that this choke was resonant only over a narrow band of frequencies in the band. A change in antenna also affected the frequency of the choke. Another 15 mmfd. Trimair tuning condenser was then mounted on the panel and a coil of the proper size to track with the detector coil replaced the "self-resonant" choke. This change was, fortunately, easily made as it was only necessary to mount the condenser C10 in the panel in place of the bushing and shaft previously used to run the detector condenser shaft out to the dial. A flexible insulated coupling permits the two condensers to be smoothly controlled from the dial. This dial is the large one at the upper right of the panel.

The detector tank circuit, the 6K7 and 76 tubes, and various other smaller components are mounted on an aluminum baffle 6 inches wide and 4½ inches high. This is placed three inches back of the panel. The 6K7 RF tube projects through this baffle plate in a horizontal position, effectively shielding its grid circuit from its plate circuit. The positions of the various resistors, bypasses and other small parts may be spotted from the photographs. These are all mounted into place with the shortest possible leads. Short leads take precedance over appearance in the construction of the RF and detector stages of the receiver. The plug-in type of coil mountings employed conserve space and made for easy change of the coils.

Audio Amplifier

The 6C5 and the 6L6 form an audio

amplifier which is common to both the transmitter and receiver, feeding the speaker in the receiving position and modulating the plate and screen of the RK25 when transmitting. The gain of this amplifier is much higher than can be used for either receiving or transmitting. The gain is padded down by the use of a 100,000 ohm resistor for the 6L6 grid resistor, R11, instead of the usual value of 500,000 ohms. Using a Kellogg single button microphone, which happened to be available for use, and circuit constants as shown, it was necessary to open up the gain control, R16, to almost maximum when transmitting. The gain at maximum setting of this control is high enough to permit of overmodulation of the carrier when speaking in a normal tone of voice several inches from the microphone.

It will be noticed that a common gain control is used for both transmitting and receiving. As the control must be advanced to near the maximum position when transmitting, it was found, at first, that when switching to the receiving position the volume was much too great. This condition was corrected by connecting R14 as a load resistor across the speaker. This brought the received volume down to a normal value, so that the gain control could be left in the same position for both transmission and reception. The value of R14 may be changed to suit the builder. The volume of signals from the speaker with the gain control wide open and resistor R14 disconnected is far higher than can be used unless it is desired to hear the signals a block away from the speaker. If individual gain controls were to be used for transmission and reception it would be necessary to place them in the microphone and speaker circuits, a procedure which is undesirable in several ways.

The output transformer T3 provides a good impedance match between the 6L6 and the RK25 when connected as shown. This furnishes a 5-6 step-up ratio. The input transformer, T4, is mounted under the chassis so as to provide minimum coupling to other transformers. In the finished job there is no feedback trouble or any tendency toward this condition.

No deviation from either the parts used or placement of these parts should be made if the transmitter-receiver is to function as well as the original job does. For instance, if bypass condenser C29 across the audio transformer primary should be left out or changed to a lower value than recommended in the parts list, the gain of the audio section would be severely reduced because of blocking by the interruption frequency. Likewise, leaving bypass condenser C17 out will cause the detector to operate very erratically, and perhaps not superregenerate at all. Adherence to specifications given is the best policy in constructing this transmitter-receiver. The difficulties have been all ironed out in our experimentation.

COIL TABLE

Coil	No. Turns	Tap	Inside Diameter	Turn Spacing
L	4	None	3/4"	1/4"
L-1	8	3/4 T.	3/4"	1/8"
L-2	8	Center	1/2"	1/16"
L-3	7	4 T.	1/2"	1/16"

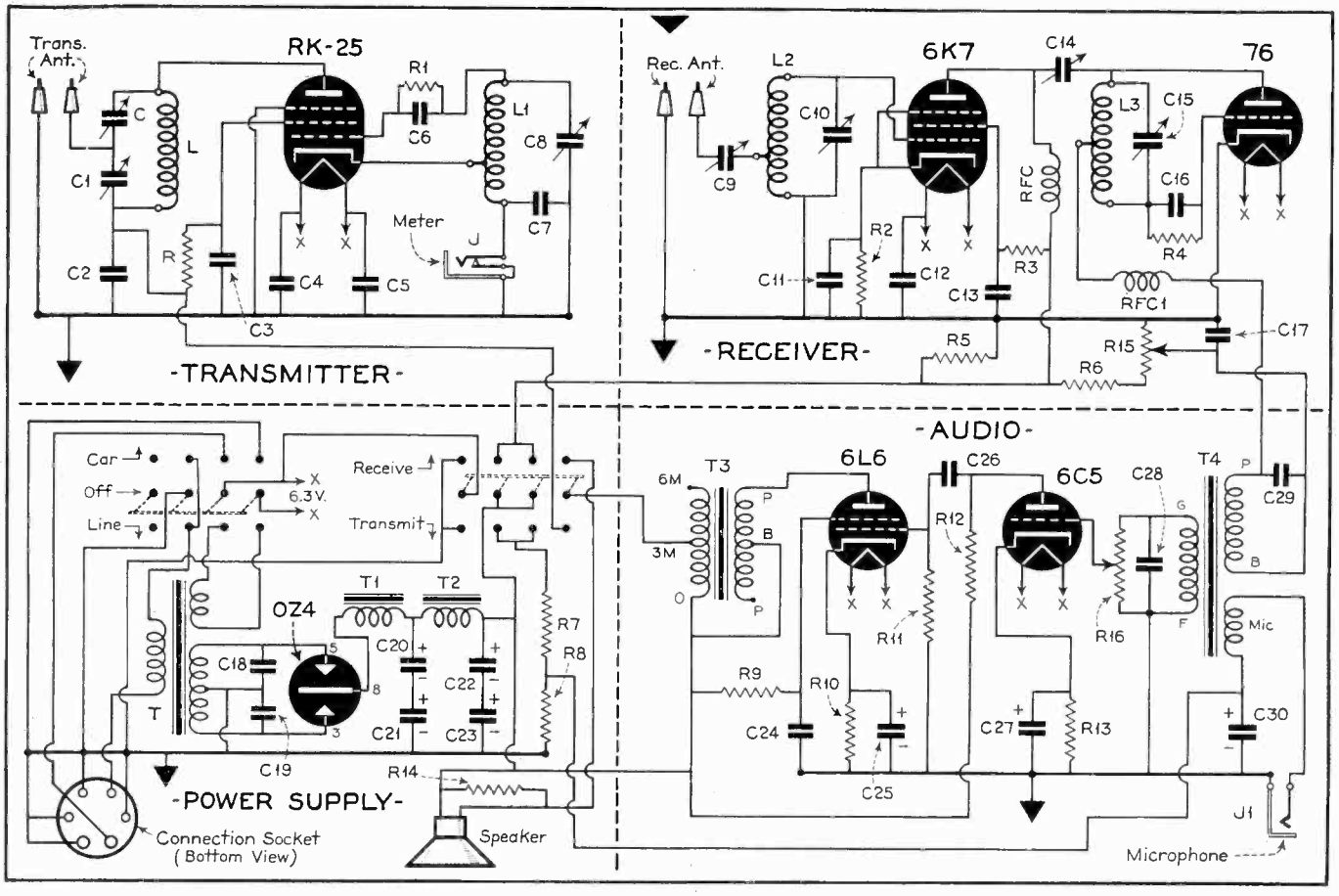
All coils wound with No. 12 wire

Construction

The actual construction is quite well explained by reference to the various photographs. The speaker cone is protected by placing a small square of window screening between the speaker and the panel. Indicator plates and dial markers identify the switches and permit retention of logging. The two unmarked knobs on the panel are the regeneration and gain controls, the former being in the lower center of the panel.

The connection socket is mounted on the back edge of the chassis. A corresponding hole should be drilled in the

(Continued on page 384)

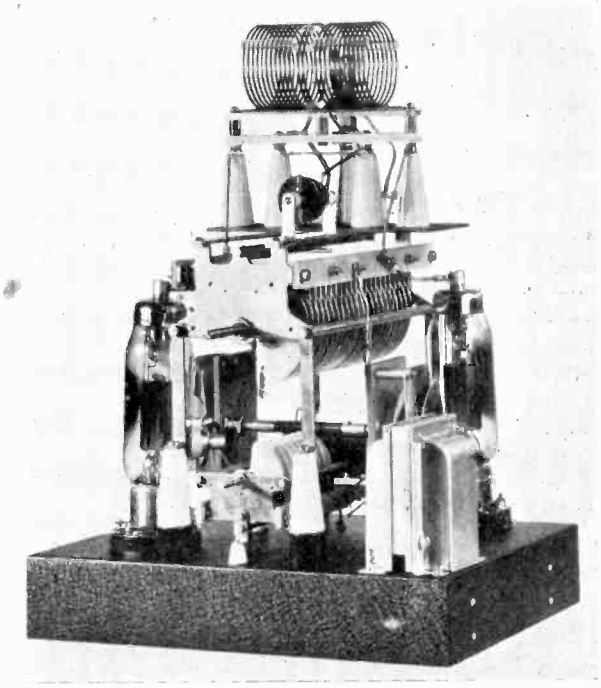


Schematic diagram of the four sections of the transmitter-receiver and their interconnections.

A KILOWATT FINAL FOR ALL-BAND PHONE OPERATION

BY EARL I. ANDERSON

Associate Engineer, Taylor Tubes, Inc.

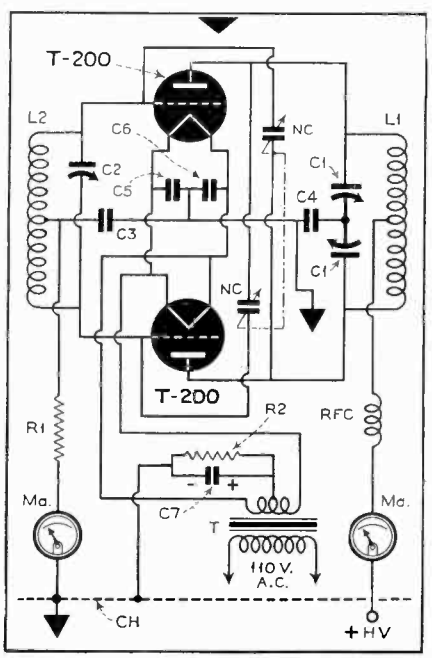


Control-end view of the kilowatt final stage described in the accompanying article.

THE design and construction of a high-frequency one-kilowatt final stage for plate modulation usually offers difficulties which are not encountered with lower power and smaller components. Careful design is necessary to obtain the short lead lengths and symmetrical layout that eliminates the need for re-neutralization when changing bands. The unit shown has as short leads as are possible with the components involved and is symmetrical both electrically and mechanically. As a result the neutralization holds extremely well. The neutralizing condensers are ganged for the utmost in convenience. Such ganging is not necessary but is well worth while where the mechanical arrangement permits.

The Tubes

T-200's were selected because they represent the best compromise between interelectrode capacities and efficiency. Apparently it is not generally realized that low-C tubes are inherently less efficient than higher C tubes. Lower interelectrode capacities are obtained partially by isolating the leads from each other, as by bringing the plate lead out the top, but this decrease in capacity is comparatively small. The greatest decrease in interelectrode capacities is obtained by making the elements smaller or spacing them further apart, or both. As the size of the elements is reduced and the spacing between them increased the amount of voltage required at the plate to attract a given number of electrons also increases. This necessitates the application of higher plate voltage for a given efficiency and increases the grid drive requirements. Consequently the best tube choice is a tube with the highest interelectrode capacities which will permit efficient operation on the highest frequency to be used. The T-200 interelectrode capacities are low enough to permit efficient operation on frequencies as high as 60 mc. yet its efficiency is extremely good. Its construction is also an important factor. The flat type of construction which cannot be successfully used with some types of anode materials permits each leg of the filament to be comparatively widely spaced from each other leg reducing space charge effect. Where the legs of the filament are very close to each other each leg exerts a space charge effect on the others, resulting in higher voltage drop across the tube.



Schematic diagram of the final amplifier. Parts values at end of article.

The Circuit

The circuit arrangement is entirely conventional and the unit is mounted on a 13 x 17 x 3-inch chassis. The plate tuning condenser, C1, has a maximum capacity of 200 mmfd. per section and a minimum of 30 mmfd. With the sections in series the capacity range is approximately 15 to 100 mmfd. Correct L/C ratios are exceedingly important if the harmonic content is to be kept at a minimum and if the stage is to be linear when modulated. Because the efficiency will not suffer greatly it is better to have too much capacity in the circuit than too little With the stage operating at 2000 volts and 500 mils, the values of capacity which will provide good linearity with reasonable harmonic content are as follows: 1.9 mc.—170 mmfd; 3.75 mc.—85 mmfd.; 7.15 mc.—45 mmfd; 14.2 mc.—22 mmfd, and 28.5 mc.—11 mmfd.

The capacity ratio of the condenser, C1, permits optimum ratios on 20, 40, and 80 meters. On 160 meters the plate current should be reduced to 300 mils and the inductance value adjusted until resonance is reached with the condenser plates as far in as will permit proper tuning of the circuit. On 10 meters the capacity in the circuit will be slightly greater than the optimum values but the efficiency will not suffer too greatly. The inductance of the 10-meter plate tank should be as great as will permit proper tuning to resonance.

The grid tuning condenser, C2, has a maximum capacity of 65 mmfd. The low-frequency grid coils (L2) are wound on National XR-13 forms. A single-turn link at the center of each coil provides too tight coupling and excessive grid drive with the T-55 exciter used. With these coils the link cannot conveniently be varied so the grid turning condenser C2 is used as the excitation control. If at res-

(Continued on page 392)

NEW "MULTIBAND" SYSTEM OF I. F.

BY McMURDO SILVER, CHIEF

DURING recent months the author has engaged in considerable research in an analysis of the means of obtaining selectivity in superheterodyne receivers. The purpose has been to evolve means which would in a single radio receiver provide the extreme and intermediate degrees of selectivity today recognized as desirable if not essential, and particularly to devise means of improving the still elemental orders of *selectivity ratio* which have had to be tolerated in obtaining extreme selectivity for voice and music reception.

Choices of Selectivity

In terms of high-quality, all-wave broadcast receivers, practice to date has indicated that four choices of selectivity are desirable. These four choices, to be available at the wish of the operator through a simple control knob, involve bandwidths in terms of substantially flat audio response of 32 kc., 12 kc., 8 kc., and 4 kc., which choices correspond to audio tone modulation ranges of 16,000 cycles, 6000 cycles, 4000 cycles and 2000 cycles. (This is because the selectivity curve must be twice as wide as the desired audio tone range in order to admit both upper and lower modulation side bands).

These four choices obviously satisfy every practical broadcast reception need. The 32-kc. bandwidth will accept modulation up to 16,000 cycles, or higher than can today be profitably used on the great majority of "high-fidelity" stations modulating only up to 9000 to 10,000 cycles. More important, such selectivity is broad enough to make the tuning to and holding of none-too-stable ultra-high-frequency stations easy and practical. The audio response range between 16,000 and 6000 cycles, the next selectivity choice, is most easily regulated to the listener's taste by a treble audio tone control. This next choice of 12-kc. bandwidth is the most generally usable one for "high-fidelity" reception, involving as it does a 6000-cycle audio tone range. This range is dictated by two factors. The first is that 6000 cycles is the customary upper limit of chain broadcasting, and most programs are so brought to the listener. The second governing factor is the prevalence of deep modulation by broadcast stations, resulting in regular overmodulation causing most annoying harmonic distortion in the range above 6000 cycles, even in the rare cases when modulation frequencies above 6000 cycles are present in programs.

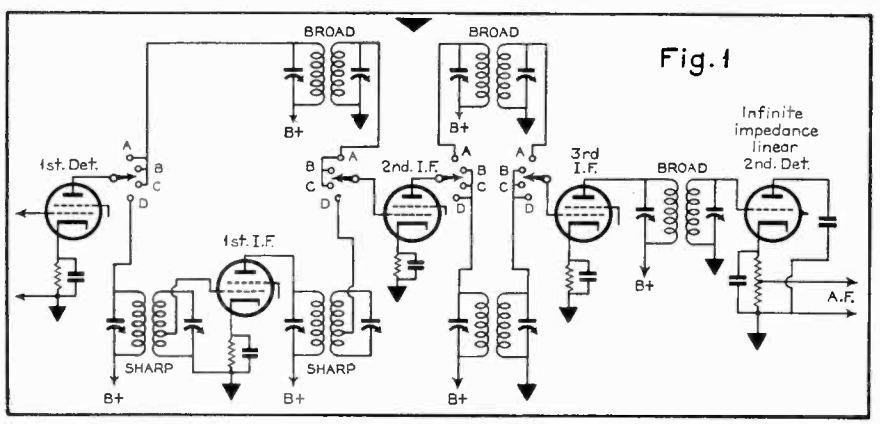
The next choice is the one most valuable to all except urban listeners, for it gives to rural listeners dependent upon relatively distant stations for their entertainment, the ability to select clearly one station at a time without interference from, in their case, comparably strong adjacent-channel signals. This third choice will be an 8-kc. bandwidth, giving the full 4000-cycle fundamental audio tone range and clean elimination of adjacent-channel interference. The fourth choice must be a 4-kc. bandwidth giving a 2000-cycle audio tone range to satisfy the DX fan who demands the ability to split 5-kc. channels, and cleanly pull out of the crowded 49 meter band, for example, the very maximum of stations free from customary interefernce due to excessively close station spacing.

"Selectivity Ratio"

Previous selectivity measurements and ratings have almost completely ignored the vital factor which the author chooses to term *selectivity ratio*. In rating selectivity as "absolute 10 kc.", only the bandwidth at (say) 10,000 times "down" has been considered, with little thought given to the *breadth* of the curve peak. It is this breadth of peak that conveys signal intelligence, bandwidth 10,000 times down measuring only the degree of adjacent-channel interference rejection. Of what value is it to reject interference if in so doing desired signal intelligibility is badly impaired or ruined? Yet this is exactly the price heretofore paid for extreme selectivity—the loss of intelligence. So considered, it is apparent that a new and additional method of rating selectivity is necessary to paint a true picture. This rating may be "selectivity ratio," or the ratio of the width of the intelligence-conveying peak of a selectivity curve to its width 10,000 times down. The lower this ratio, the closer the approach to the ideal band-pass rectangular curve. The higher the selectivity ratio, the poorer is the tone quality obtained for any extreme degree of selectivity. The best previously obtained selectivity ratios have been about 8:1. The new system described herewith improves this by over double, giving a selectivity ratio of better than 4:1 where it is most needed at extreme selectivity. It improves both direct adjacent-channel selectivity and gives an entirely new conception of intelligibility or program brilliance at this greater selectivity.

Satisfying as they do every present and probable future selectivity need of broadcast and even amateur voice reception, the question is how to obtain these four orders, not of side-band cutting V-shaped, but of flat-topped true band-pass selectivity. Examining the maximum-to-minimum ratios involved, we find the result to be 4 to 32 kc. bandwidths, or a ratio of 8:1. Using the conventional methods of varying i.f. amplifier selectivity by varying primary-to-secondary coupling of i.f. transformers either mechanically, or electrically by switching auxiliary coupling coils, the answer is far from ideal. Transformers of high enough coil "Q" to give the desired maximum will, when over coupled to give the minimum selectivity of 32 kc., show two very pronounced double peaks with an excessively deep valley in between them. They are capable of giving in good practice only three of the necessary four selectivity choices. Additionally, it is next to impossible in actual use to avoid detuning as coupling is varied, which results in lopsided curves.

The next method of varying i.f. amplifier selectivity would be to detune in op-



The fundamental switching circuits of the "Multiband" i.f. system are shown here. Position A gives curve A of Fig. 2, position B, curve B, and so on. It will be seen that separate i.f. transformers are used to obtain varying degrees of selectivity.

AMPLIFIER SELECTIVITY VARIATION

ENGINEER, McMURDO SILVER CORP.

posite directions either successive primaries and secondaries or successive i.f. transformer stages. This being essentially only a variant of the coupling variation method, still fails to give an adequately flat-topped curve to insure absence of audio discrimination when adjusted to 32 kc. bandwidth if coil "Q" is initially high enough to give maximum desired selectivity.

Regarded in this light, it is apparent that no single cascaded sequence of i.f. transformers in a conventional i.f. amplifier can be varied to give acceptable flat-topped curves over the desirably wide 8:1 selectivity range of 4 to 32 kc. What is needed is individual and different i.f. amplifiers, one for each selectivity choice. This is further indicated by the increasing lack of symmetry which disadvantageously creeps in as i.f. transformer selectivity is broadened. Not only does this appear as quite dissimilar steepness in the two different sides of the selectivity curve, but it also appears in the form of a no longer flat or only slightly "sway-backed" curve, but as a distinct slope from one side to the other of a none-too-flat curve peak or top. This is the final objection to coupling variation to obtain an ideally large range of selectivity, for through the introduction of audio distortion it tends to destroy the fidelity benefits to be gained by a broad i.f. amplifier.

Separate, Fixed Transformers

All these disadvantages may be eliminated through separate fixed, not variable, i.f. amplifiers or transformers switched into circuit to vary selectivity, and vitally important additional benefits may be obtained. These have to do with *selectivity ratios* at maximum selectivity, as in the 8-kc. and 4-kc. bandwidth choices. Intelligibility and brilliance of speech and music is a direct function of the degree to which high audio frequencies are admitted. Interference rejection is the function of how far "down" the sides of the selectivity curve are immediately outside the desired admittance band. The ideal selectivity curve will have a flat top and vertical sides—it will be a rectangle in shape, not the usual V-shaped curve. If we can obtain such an ideal band-pass curve, we can realize an entirely new order of intelligibility and tone quality at extreme selectivity. Additionally, we can eliminate that old bug-a-boo of microphonic howling on short waves, for it is the invariable accompaniment of sharp and V-shaped selectivity curves, but disappears when the i.f. curve becomes an ideally flat-topped, U-shaped rectangle.

Upon the basis of recent evaluations of selectivity discrimination adequate to eliminate ordinarily encountered adjacent-channel interference, we may consider that if our selectivity curve sides are 5000 times "down" from peak response, all will be well. Actually, considerably less than this will usually do the job. But let us take the doubly safe assumption that the curve "skirts" should be 10,000 times down to insure elimination of adjacent-channel interference. We cannot obtain such discrimination with a flat-top to our curve 4 kc. wide (to give the 2000-cycle audio tone range essential to good speech intelligibility free of "boominess") even with four under-coupled i.f. transformers using coils of the highest currently available "Q" of about 130. If we are to obtain this ideal useful audio tone range at maximum selectivity, together with steep interference-rejecting skirts, we will need coils of a "Q" much higher. Coil Q's of 200 can be had from iron-cored i.f. tuning with such coils. This first guess of permeability tuning must be rejected because of the absence of adequately stable fixed tuning condensers. For high-quality circuit stability air tuning condensers may not be escaped. But much work was done to develop air-core coils with a "Q" of 200, with success finally obtained. With this "Q" or merit improvement of over 50 per cent more than is usually available, the ideal becomes within practical reach.

The I.F. Transformers

Three i.f. transformers with their primaries and secondaries coupled below optimum, where the double-peaked characteristic of over-coupled circuits just becomes apparent, will give the selectivity curve with the perfectly flat 4-kc. top which we are seeking. The extraordinary coil "Q" of 200 will cause the sides or skirts of this curve to fall off almost vertically, but not quite vertically enough to satisfy the ideal goal sought. So, in a three-stage amplifier, a fourth i.f. transformer is used, so broad as not to narrow the flat top, but a considerable help in pulling down the skirts on either side of this flat top, and to keep them symmetrical (to prevent the high-frequency skirt from straying out and failing to duplicate the steepness of the low-frequency skirt.)

The receiver, of course, must follow the finally established good practice of using two tuned r.f. stages to eliminate unavoidable first detector-oscillator noise by the only known method of using high r.f. amplification in conjunction with low i.f. amplication. If this two-stage r.f. amplifier departs from the customary practice of seeking only to improve image selectivity, we can obtain a considerable degree of adjacent-channel selectivity from it. This departure from current practice will materially steepen the sides of our flat-topped i.f. curve, and through careful design will not impair this flat-top.

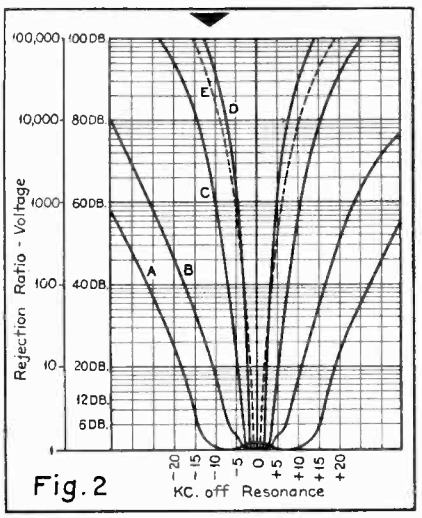


Fig. 2

Selectivity curves obtainable with the new system. The letters correspond to those on the switch positions in Fig. 1

The next result will be curve D of Fig. 2. The extraordinary aspect of this curve is its *selectivity ratio*. Its intelligence-conveying flat top is 4 kc. broad where it is flat to 6 db. (easily compensated in audio amplifier circuits) and then it falls off almost vertically to a width of only 15 kc. at 10,000 times down. This is an intelligence-to-interference-rejection ratio of 3.75:1, coupled with the flat-top that eliminates microphonic howling. The improvement this represents is seen by a comparison with the dotted line curve E, a composite of several of the most selective receivers. Curve E shows a top only 2 kc. broad, resulting in the very poor to almost unintelligible tone quality unavoidable with the only 1000-cycle audio tone range it allows. Despite its lack of symmetry in non-uniform skirt slopes, it is 18 kc. broad 10,000 times down. This is a selectivity ratio of 9:1—less than half as good as the new system depicted in curve D gives for even greater effective rejection of strong interference.

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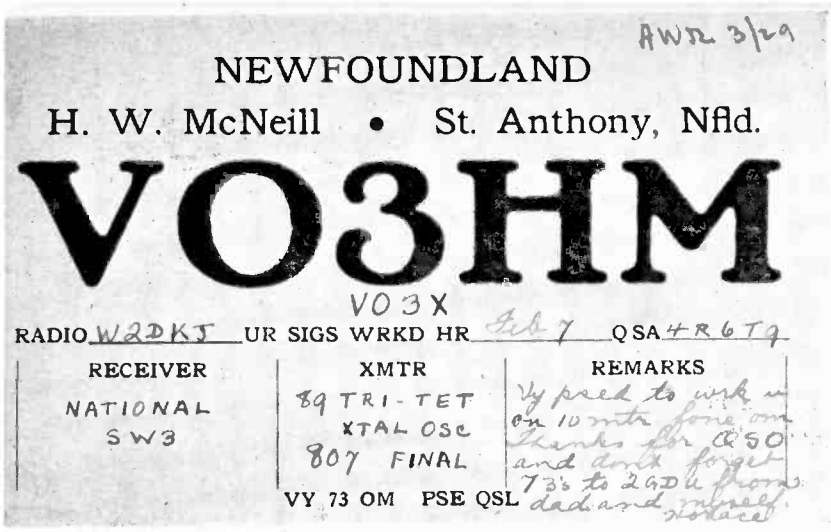
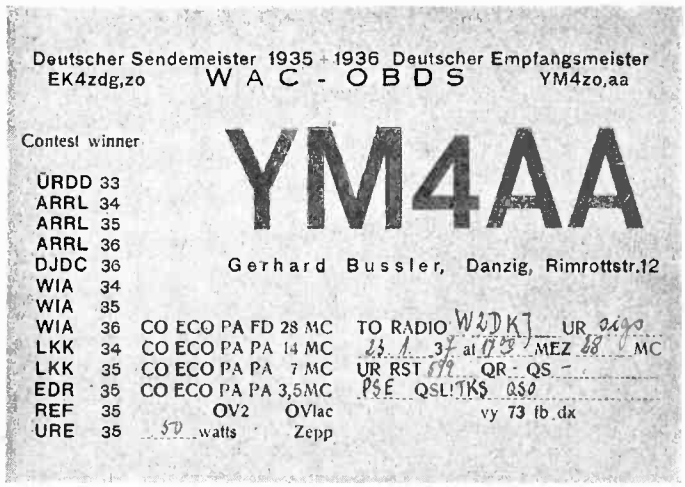
NOTES ON THE IN THE 10-

BY ARTHUR H.





On this page are a few representative QSL cards received by W2DKJ, as well as sketches of two of the antenna systems employed.

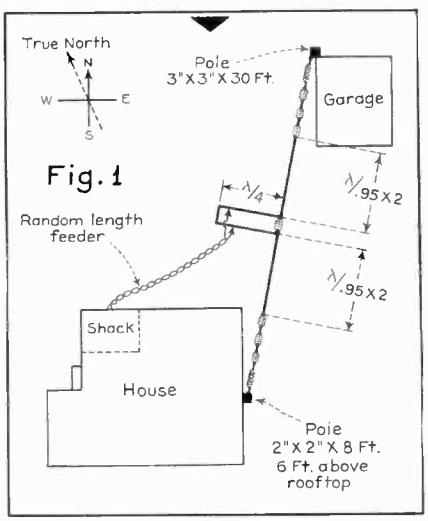
FOR the past couple of years our amateur activity has been confined to operation in the 5-meter band. Our station, W2DLG, located on the roof of the Hotel New Yorker, and later our station W2DKJ, portable, atop the tower at Forty Wall Street, some 927 feet above Manhattan Island, have kept us in fairly close contact with 5-meter operation in the New York area. We have made 5-meter contacts with Boston to the North and Washington to the South. Philadelphia was more or less a common occurrence.

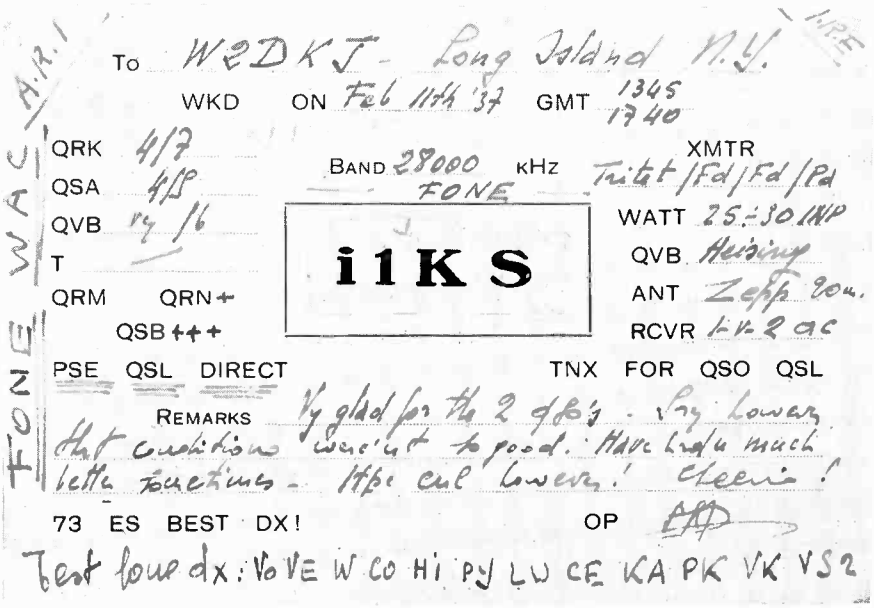
Our 5-meter mobile unit, mounted as a permanent fixture in our car has kept us in touch with amateurs in nearly every part of the country east of Chicago; while related activity has taken us to the International Air Races at Cleveland, to the Yacht Races on Long Island Sound and to the International Automobile Races at Roosevelt Raceway in New York. Long-distance transmission on the other bands never appealed very keenly to us until we gave 10 meters a twirl. We realized then that we were missing a great deal. That, possibly more than anything else, was our fundamental reason for desiring a transmitter that would really step out. The "Flexible 400" was the answer.

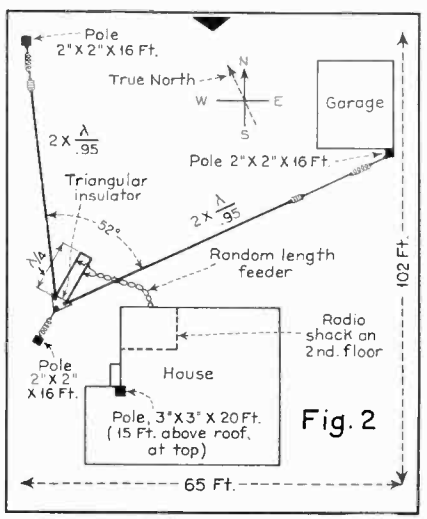
Antenna Experiments

After having tried any number of aerials on the 5-meter band we found that one of the most dependable was two half-waves in phase, mounted vertically. It was natural, therefore, for us to resort to the same general type of antenna for our 10-meter activity, but instead of using the antenna vertically we ran it horizontally. (See Fig. 1.). That antenna has come to be known as Antenna No. 1.

The Rhombic or "Diamond" antenna was given so much attention a few

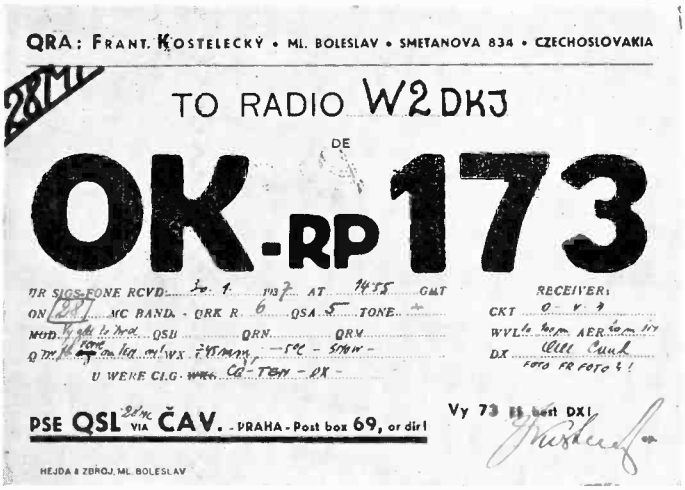






"FLEXIBLE 400" METER BAND

LYNCH • W2DKJ



More QSL cards covering reception of signals from the "Flexible 400" on 10 meters, and two other antenna systems.

months ago that we decided to attempt the construction of such an arrangement. Unfortunately, the amount of property at our disposal is extremely limited and, instead of setting up a Rhombic, we had to be satisfied with a "V" type beam, having two full wave-lengths in each leg (see Fig. 2.) . . . our Antenna No. 2. A third antenna (see Fig. 3.) made with three half-waves in phase was known as our Antenna No. 3. Antenna No. 4, was then provided by using the two half-wave antennas that we had been using on 5-meters and converting them into two quarter-waves on 10-meters. This is shown in Fig. 4.

In general, it would seem that Antenna No. 1 provides the greatest all-round utility and, since it is very simple to set up, it may be of value to others.

The overall reception at distances greater than a thousand miles and in any number of directions, may be observed from the quotations from reports we have received. Unfortunately, an analysis of all of the reports leaves quite a number of questions to be answered. It may be that we will be able to secure the answers to these questions when the 10-meter band opens up again next year and, in the meanwhile, this outline of the procedure that we have followed may be of use to other investigators as well as acting in the nature of a small tribute to the hundreds of operators in all parts of the world who cooperated with us by sending such complete reports as those few which space permits us to reproduce here.

Our original desire was to establish

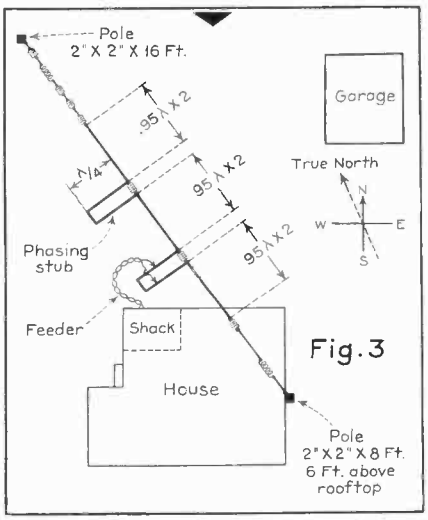


Fig. 3

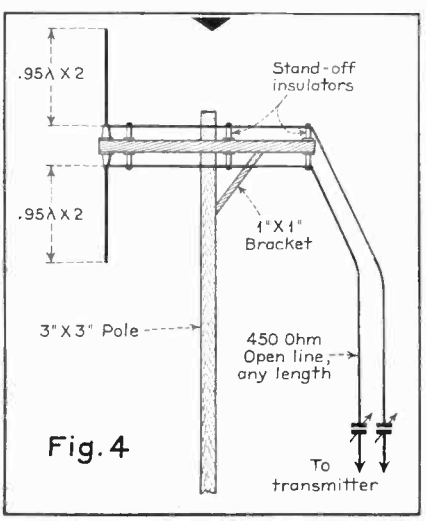
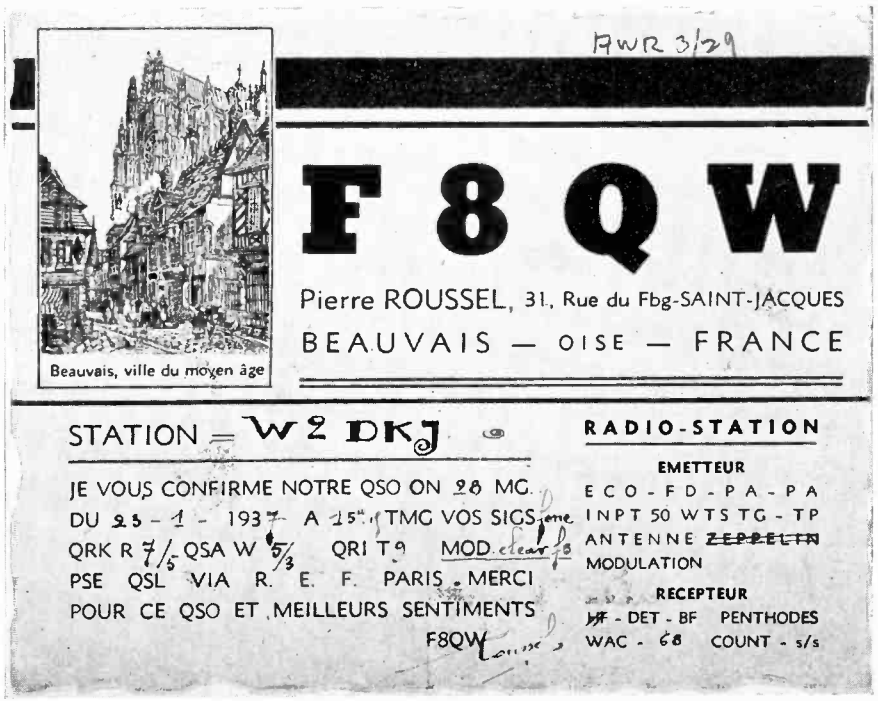


Fig. 4



reasonably regular contacts with Europe on the one side and the West Coast of the United States on the other. As may be seen from Fig. 1, the layout of our lot is such that we are somewhat limited as to available space and there are not many places where suitable supporting poles could be erected. As far as possible we wanted to take advantage of reasonably simple directional aerials and our experience in connection with Antennas Nos. 1, 2 and 3 may be useful to others who are equally limited as far as the size of their property is concerned.

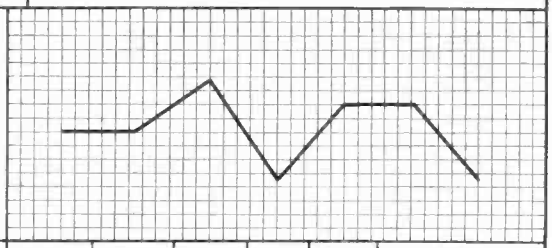
It is most gratifying to report that the cooperation that we have had from stations in foreign lands has been excellent and some indication of this cooperation may be gleaned from the reports which are published in connection with this article.

The report from George F. Nelson, British Short Wave Listener No. 186, gives a rather graphic picture of our signal strength at Liverpool, England.

The report from Mr. Frank Kostelecky, of Czechoslovakia, carries a few bouquets on the back of his QSL card.

We had any number of contacts with Horace D. Cullen, G5KH, of London, and his reports on our transmission are extremely accurate. Using a National HRO receiver, to which he has added an oscilloscope, he is, therefore, able to report not only signal strength but percentage of modulation as well.

Report on signals of W2DKJ received from George F. Nelson, short-wave listener, of Liverpool, England. (He could do with some R. S. S. L. Report Blanks!)

FEBRUARY, 1937							
	6th		7th				
Time G.M.T.	17.29	17.53	15.20	16.05	16.10	17.02	18.12
Strength R 9 / 8 / 7 / 6 / 5 / 4 / R 3							
QSB	RR/4	3	Slight		R/3	RR/6	
Peak	7	7					
Calling or Wkg	F8YZ	Thanking BSWLS for rpts	Giving details of TX	G5KH	G5KH	VO-	

Harry M. Leonard, W6MBD, of Los Angeles, Calif., is technician in one of the large movie companies at Hollywood and his report is more than ordinarily interesting because he is entirely conversant with modern equipment.

The contact that we made with VO3HM was interesting in that we were using the "V" beam which was directed pretty much toward the north and, in spite of the very low power that he was using, his c.w. signal at Garden City was R-8 to 9.

One of the first stations that we contacted in the Middle West was W9VGC, at Denver, and the reproduction of his QSL card with an R5-9 on the back seems to cover the situation from the Denver area quite thoroughly.

One of the first contacts that we made in the Southwest was W5FRA and we faded out completely. However, after setting up the "V" beam, we contacted that station two or three times a week and our signal strength was in the neighborhood of R-8 to 9 and we were reported as one of the strongest and most regular of the eastern stations. That is also true of the reports that we have since received from W5DMB.

Shooting South

We had an idea that our "V" beam would give us reasonably good coverage throughout Cuba and the West Indies because of the excellent reports that we had received from W4EDD, at Coral Gables, Fla. This, however, was not so and we did not make a reasonably good contact with Porto Rico until we began using the horizontal antenna, which is really nothing more than a center-fed, half-wave vertical, when it is used on 10-meters. A similarly interesting report was received from K4EJF, one of the operators at the Broadcasting Station in San Juan, Porto Rico.

The reports of our signals in Holland, Italy, Germany and France are indicated by the interesting QSL cards that we have received. The extent of our operations may be gleaned from the acknowledgements we desire to make to the following for their QSL cards and reports: W5DMB, W6ETX, W6IXC, W7EKA, W9PRI, W9PWU, W9RIL, W9VGC, W9VHR, W9VRG, W9VTD,

(Continued on page 391)

Hamfest

By W8QMR
ex-2PI : LU4S

fair enough . . . epilogged by the fcc . . . code practicioners

THE accompanying illustration really doesn't require a caption—though we might mention (if you can't guess it) that it's a photograph of radio station W4DUG, said call being the hamonicker of the Tampa Amateur Radio Club. This exceedingly neat rig was in-

Putting ham radio on the map at the Florida State Fair.

stalled at the Florida State Fair, held every winter at Tampa, and the alternate ops were Lewis Connolly, ex-commercial and now W5DVO, and Frank Hamlett, W4AKJ. As Hamlett put it, after a week behind that glass he started to sprout gold fish fins.

The fair held sway during last winter's midwestern flood disaster, and traffic through W4DUG was severely cramped by the FCC's QRT on ham radio. Nevertheless 1835 messages were originated at this station during fair week. Most of this traffic was sent directly to distant ARRL trunk-line stations, rather than being shuttled to local stations—despite the severe man-made QRN which is as prevalent as pop-corn on a fair grounds.

◆

THE ORIGINAL FCC QRT order affected 40-meter code as well as the lower frequency bands. During this period of quietus, Hamlett, on duty, heard a neighboring W4 calling CQ—one of these CQ's if laid end to end, etc., etc. W4AKJ came back at him, and informed the lad of the FCC's lid, whereupon the offending operator, his fist still quivering with the inertia of his mile long CQ, goes into an extended argument as to why he couldn't jam QRR traffic, and if so what? Hamlett gave an approved "to be or not to be" shrug to his shoulders, replied that he was merely passing along the word and that personally he didn't care to violate the emergency ordinance by entering into an argument.

Silence reigned for about ten seconds, while the offending operator ransacked his repertoire of snappy comebacks. After a prodigious mental effort he gave birth and returned with that most original, scathing, cutting, corruscating, iridescent, pyrotechnic, brilliant, and castigating of Philippics—"Phooey!"

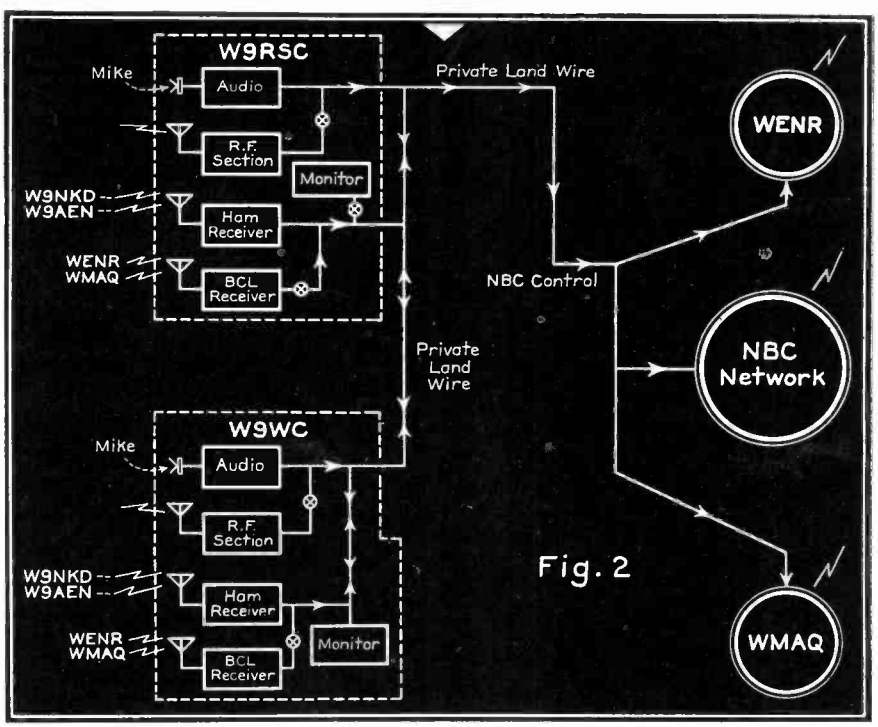
Another period of silence while the lad's cerebral processes recuperated slowly from the recent effort and strain. Then his hand, twitching with the reflex that would not be denied (it'll jerk like an amputated frog's leg long after the lad's in his coffin), recalled him to a minor semblance of consciousness. His fingers leaped greedily at the key—and a defiant CQ raped the startled ether!

EPILOG: An FCC monitoring station happened to be listening. The FCC also said "Phooey"—with a little card of delicate pink.

◆

SPEAKING OF THE Federal Communications Commission—they will have their little jokes, as we have observed before. We mentioned last month, that if code ability means anything when a license is first taken out, some evidence of its survival should be presented when a license is renewed at the end of its three-year tenure—pointing out that communication with three stations by *radio* does not necessarily mean code QSOs. But even this requirement can be dispensed with most easily. All the operator has to do is to move his station about once every two and a half years. Due notice of removal is given the FCC, and the operator notifies the R.I. in the district to which he is moving, and operates with his old call; as a portable, until he receives his new license. The new license, which

(Continued on page 386)



Block diagram of the W9WC-W9RSC QRR flood programs with the NBC.

Globe Girdling

By J. B. L. Hinds

commercial stations . . . experimental skip co9xx . . . s.s. kanimbla . . . bbc veries . . . mexican situation . . . scotland qrm's africa

OCCASIONALLY the lists we publish are questioned with reference to information detailed on radiophone and experimental stations. For the information of those using the lists, it might be said that it is not possible to set up currently accurate information on the use of such stations.

In the first place they are included in the lists merely for calibration purposes —for the benefit of the listener to use as "guides" in locating other stations near such frequencies.

The data now shown for such stations was obtained from various sources and may not be correct in every particular. The majority of operating companies will not furnish a list showing the transmitters or countries with which their stations test and work as this information is considered confidential. It is true, however, that lists published by the Berne Bureau set down countries reported by various governments which are considered the primary points of communication, but even if these were used they could not be depended upon, for in normal practice it is very difficult to adhere to a fixed schedule of frequencies used to particular points because of ever-changing conditions — propagation, interference, etc. In other words, while the data may be of considerable value to the listeners, as explained, there is no guarantee that the stations listed can be tuned in at any time.

NEW STATIONS

K.C.	Meters	Call	Location
21550	13.92	GST	Daventry, England
21460	13.98	W1XAL	Boston, Mass.
21260	14.11	WBU	Rocky Point, N. Y.
21220	14.14	WQA	Rocky Point, N. Y.
18880	15.89	WQH	Rocky Point, N. Y.
15250	19.67	W1XAL	Boston, Mass.
12120	24.75	TPZ	Alger, Algeria, Africa
11760	25.51	XETA	Monterrey, Mexico
7177	41.80	CR6AA	Lobito, West Africa
6485	46.26	"Radio Guardia Civil"	Tetuan, Sp. Morocco, Africa
6420	46.73	YV6RC	Ciudad Bolivar, Venez.
6122	49.00	HP5H	Panama City, Panama
5930	50.59	PJC1	Willemstad, Curacao

STATION CHANGES

New Frequency	New Call	Old Call	Old Frequency
17770*		PHI	17775
12500		HIN	11260
11730*		PHI	11730
11500		COCX	11435
10135		CQN	9600
9666		CR6AA	9660
9645		HH3W	9595
9550		YDB	9610
9480	EAR	EAQ-2	9480
8960	TPZ-2	FVA	8960
8665	COJK	CO9JQ	8665
8650		YN1PR	8670
6975		HCETC	6895
6732.5		KBK	6718
6725	WQO	WOQ	6725
5845		KRO	5843
5755		YV2RA	5710
5110	KEG	KRG	5110

* Location from Huizen to Hilversum.

STATIONS DELETED

K.C.	METERS	CALL	REASON
17920	16.74	WQF	Not in service
8930	33.59	WEC	Not in service
6040	49.67	PRA8	Not in service
5260	57.03	WQN	Not in service

NON-AUTHENTICATED STATIONS

Frequency	Call	Location
11840	KZRM	Philippine Is. (July)
9570	KZRM	Philippine Is. (July)
9565	HP5S	Panama (May)
8910	Radio Eritrea	Africa (May)
8600	HC1EC	Ecuador (May)
7600	HC1RJ	Ecuador (May)
7200	HC1AJ	Ecuador (May)
6600	HI6H	Dom. Rep. (May)
6500	YV1RM	Venezuela (May)
6320	HC1RE	Ecuador (May)
6128	OAX7A	Peru (May)
6122	OAX4P	Peru (May)
6122	OAX6A	Peru (May)
6120	HP5Z	Panama (May)
6035	CXA-2	Uruguay (June)
6000	OAX5C	Peru (May)
5795	TI2H	Costa Rica (July)
....	HP5A	Panama (May)

Veri No. 1105 from HRN, dated May 21, 1937. So they're coming through.

Radiophone and Experimental Stations

JYT, 15760 kc., heard testing with KWE, 15430 kc., between 7 and 10 P.M. Signals fair. Musical selections. English and Japanese in voice tests. Reported by H. Wilson, Jr., Ithaca, New York.

EA8AE, 7020 kc., Las Palmas, Canary Islands, heard broadcasting war news, calling CO2KY, Cuba. Announcements include "Viva Espana."

VQJP, SS. *Queen of Bermuda* on approximately 4400 kc., heard talking with WOO, 4272 kc., Ocean Gate, N. J., and ZFB, 10055 kc., Hamilton, Bermuda. Reported by H. Kentzel, Averill Park, New York.

CO9XX, Tuinucu, Cuba, 15550 kc., heard by J. O. Faris, Danville, Ill., testing with Lakehurst, N. J., and Allentown, Pa. *(Station owner: Frank H. Jones, CO6OM.—Ed.)*

W10XGY, 12865 kc., located on yacht *Orano,* heard talking with a W4 station 4:20 to 5:15 P.M. Mentioned Carib-

bean Sea and coral reefs. Heard by W. E. Blanchard, Bangor, Maine.

Station on 7200 kc., 6:45 to 7:45 P.M., sign-off at 7:45 P.M. Just prior to sign off played "Shadow Waltz" twice and then a march. Bugles at closing. Reported by H. C. Chestnut, Plattsburg, New York.

YSJ, 13410 kc., San Salvador, heard testing with WNC about 12:30 P.M.

Veri Slow

The following stations are still listed as slow in forwarding verifications covering reception reports filed:

HJ1ABB, HJ4ABD, HJ4ABB, Colombia; HCETC, Ecuador; HRN, Honduras; CB960, Chile; VP3BG, British Guiana; PZH, Dutch Guiana.

TIEP, TIGPH and TIPG, Costa Rica and HI2D, Dom. Rep. have been removed from block as the Costa Rican stations are now forwarding quite promptly. HI2D is a question. Some report slow and some prompt, and now comes a report that the station announced over the air that they do not verify!

And while on the subject of veri cards —ZBW in sending card to E. Granger, Syracuse, New York, stated on card that their testing is completed and cards will no longer be sent to listeners, and further stated that if further experimental transmission are decided upon, reports will again be invited by microphone request. From this it would seem that only test programs are to be verified.

And last but not least, HRN continues to forward veri cards. The writer has just received one. Have you?

Broadcasters

PJC1, 5930 kc., Willemstad, Curacao, Netherlands West Indies, the new station heretofore reported in the non-authenticated block, is owned by the government and leased for a year to the Curacaosche Radio Vereeniging (Curacao Radio Club). The output is 150 watts, Philips Transmitter. Broadcasts Sundays from 10:36 A.M. to 12:36 P.M. and week days from 6:36 to 8:36 P.M., E.S.T., for the benefit of the members of the above named club, and is not a commercial transmitter. The station is called "Curom." It is announced by a clock striking from 6:31 to 6:36 P.M.

The call letters mentioned above were taken from veri card, although the letter accompanying the veri gave call as PCJ1, while the "one" in the call could be taken for an "I" in both the letter and card, it is thought to be a "one" according to announcements heard. It is understood that this station operates on Sunday evening on 31.67 meters when contacts are made with Holland, in addition to the entertainment broadcast.

Announcements are in Dutch, English, Spanish and Papia mentor. Station opens and closes with the National Anthem. H. A. Dennert, Hon. Secretary, of the Club advises that the station is heard in the United States, Canada, surrounding countries and Europe. The island of Curacao is one of a group of six in the Caribbean Sea, off the cost of Venezuela, which constitute the colony of the Dutch West Indies.

A honey from Lisbon. The background is in two shades of blue.

Last Minute Flashes

Belgrade, 6100 kc., or 49.18 meters; the call is YUA not YTC. Station advises it operates only on 6100 kc. except 14th and 31st of each month when its transmissions are relayed over DJO, 11795 kc., to America, and over DZC, 10290 kc., to Argentina between 7 and 8 P.M. EST. The Holland relay is presumably suspended.

JZJ, 11800 kc., on Overseas broadcasts from Japan, began transmitting on May 10th through new 50-kw. transmitter.

COGF, about 11800 kc., is on the air with good signal. Station relays long-wave station CMGF, whose address is Betancourt No. 51, Matanzas, Cuba.

XEWW is the late newcomer relaying long-wave station XEW. Announces frequency as 9500 kc., 5 kw. power, and address as Apartado 2516, Mexico, D.F., and styling itself "The Voice of Mexico." Often uses four pretty chimes in downward scale.

A new Japanese station reported heard on 9745 and 9720 kc. early mornings relaying same programs as JVN on 10660 kc.

CO9XX, Tuinucu, Cuba, 15550 kc., special experimental test station, furnishes white veri card, call in red letters and green printing.

SBG, Motala, Sweden, broadcasts daily on 11705 kc. from 1:20 to 2:05 A.M., 6 to 9 A.M. and 11 A.M. to 1:30 P.M. On 6063 kc. from 1:30 to 5 P.M.

OER-2, Wien, Austria, is now shown on 11801 kc. and transmitting programs Monday to Friday from 9 A.M. to 5 P.M., and Saturdays to 6 P.M. with 1½ kw. power.

Veri card from HRN, Tegucigalpa, Honduras, to the writer is numbered 1105.

Radio "El Mundo," Buenos Aires, Argentina, now broadcasts on LRU, 15290 kc., from 7 to 9 A.M. and LRX, 9660 kc., from 9:30 A.M. to 11:30 P.M.

VUC, Calcutta, India, now broadcasts on 6109 kc. or 49.10 meters. VUB, 9565 kc., Bombay, India, discontinued broadcasting on short waves in January, 1937.

CFRX, Toronto, Canada, transmits on week days from 6:30 A.M. to 11 P.M. and on Sundays from 9:30 A.M. to 11 P.M.

EAJ43, Santa Cruz, Tenerife, C. I., operates on 10370 kc. instead of 10380 kc.

COBC, 9363 kc., new Cuban station reported by Oscar Jaime, Jr., Havana, Cuba, as relaying long-wave station CMBC. Address of CMBC is Maximo Gomez No. 139, Havana, Cuba.

KZRM, Manila, P. I., will shortly operate on short waves. A new tower is being erected and the latest equipment in short-wave broadcasting will be installed. This advice comes from Wm. H. Anderson and Co., Inc., New York, and Manila, who operate in conjunction with Erlanger and Galinger, Inc., Manila, owners and operators of KZRM. This station at present usually broadcasts on 618.5 kc. with 25 kw. power, although an occasional relay is made over the high frequency of KZRM, 9510 kc., 31.55 meters. Messrs. Anderson and Company state that they will be able to furnish particulars in connection with the new high frequencies around the latter part of August. It is reported that the long-wave transmitter will employ 60 kw. and the short-wave 1 kw., possibly on frequency of 9570 kc. or 11840 kc. There is another short-wave transmitter at Manila, KZEG, 6140 kc., not listed in station list, which operates in the daytime with 850 watts while KZRM is silent, but heard only locally as far as is known.

OXY, 6060 kc., Denmark, is reported on the air with a new schedule late in the evening. If any one hears this station with its 500 watts power, the writer would be glad to know about it.

HS8PJ, Bangkok, Siam, is said to be heard Mondays on 9350 kc. instead of 19020 kc.

VP3BG, 6132 kc., British Guiana, if on this frequency is not being heard. It has been quite active on the 20-meter phone band.

FIQA, 6000 kc., Tananarive, Madagascar, said to be heard irregularly on 9515 kc. with 500 watts power about 9 A.M. and from 1 to 2:10 P.M.

EAJ43, 10380 kc., Santa Cruz, Canary Islands. Some report frequency as 10370 kc. There seems to be some confusion

with EHZ, 10370, both transmitters being reported in use. Further reports welcomed.

HJ1ABB, Barranquilla, and HJ2-ABC, Cucuta, Colombia, are being heard on 4780 kc. and 4785 kc., respectively. No change will be made until the facts are known.

HP5H, 6122 kc., Panama City, Panama, is on the air and listed in this issue, but being heard near 6050 kc. If frequency is to be changed correction will be made later.

HP5A, Panama City, the new 3-kw. station, should be on the air before this item reaches you, and then we should know its frequency.

No reports yet received of HP5S, 9565 kc., or HP5Z, 6120 kc., having been heard on the air.

HIN, Ciudad Trujillo, Dom. Rep., is being heard close to 12500 kc. and frequency has been changed in list from 11260 to 12500 kc.

YV5RJ, 6250 kc., is correct call of station located at Caracas, Venezuela, according to late announcements heard.

OAX4P, 6122 kc., located at Huancayo, Peru, in non-authenticated section is said to be heard around 5975 kc., which is quite a ways from home, and on account of this fact it has been left in the section mentioned.

VK9MI, S. S. *Kanimbla*, 11710 kc. and 6010 kc., notwithstanding its low power, has been heard by many in the United States, and strange as it may seem to many, it is usually heard on the 6010-kc. frequency. But as the broadcasts are generally in the early morning hours in Eastern United States, its reception is quite possible when atmospheric conditions are favorable. Although the power of transmitter is listed at 50 watts, it really employs about 200 watts.

Some interesting data in connection with this ship has been supplied the writer by Miss Eileen M. Foley, announcer of this marine broadcasting station. The *Kanimbla* claims to be the only ship in the world licensed to broadcast programs of entertainment, which are broadcast three times weekly at 10 P.M. Eastern Australian Time (7 A.M., E.S.T.) while this ship is at sea, which broadcasts are relayed through various stations in Australia. They have three studios facing the ballroom—beautifully fitted out and artistically furnished in green, cream and chromium. A quartet of girl singers live permanently on board and under the direct control of Miss Foley, who claims the distinction of being the only woman in the world in full charge of a broadcasting station. The *Kanimbla* quartet render musical programs for the benefit of the passengers in addition to broadcasting from the ship. Recordings are also broadcast to a great extent, and an enormous library of records is being added to monthly.

XEFT, Vera Cruz, Mexico, as stated previously, is at present regularly broadcasting on 9510 kc. The station advises, however, that they have a license from the Mexican Radio Commission to transmit on 6120 kc. Both frequencies have, therefore, been retained in the lists. Identification signals used are chimes, bugle calls and cockoo-horn, such as that used by XEBT. Opening and closing selection, "Vals Poetico," by Felipe Villanueva.

TI2H or TI2Y, close to 5795 kc., is the latest new station to be heard. It is located at San Jose, Costa Rica.

W1XAL, 15250 kc., Boston, Mass., is now being used daily between 3:30 and 4 P.M. W1XAL on 21460 kc. is used occasionally on special broadcasts and both frequencies have therefore been added to station lists.

The Mexican Situation

XETA, 11760 kc., Monterrey, Mexico, is now in station list. The call was shown incorrectly in "Last Minute Flashes" in June.

XEYU, 9600 kc., Mexico City, Mexico. Although the writer has one of their "envelope" veri or acknowledgement letters, the Director General of Radio in Mexico advises that the call is XEYO.

XEUZ, 6120 kc., Mexico City, has not been heard of late and thereby may hang a tale. The Director General states that this station is not listed by his department, but no further information is advanced. Notwithstanding, the writer possesses a veri card from XEUZ!

XEBM, 15300 kc., Mazatlan, Mexico, sends two veri cards covering our reception for same broadcast. On one the frequency has been changed to 15400 kc., and on the other 15440 kc. is shown. We therefore can take our pick of frequency!

XETM, listed at 11730 kc. and located at Villahermosa, Mexico, has been reported heard on 11520 kc.

XEWV, Guadalajora, Mexico, possibly another new station, is reported heard near 11330 kc.

And speaking of Mexican Government operated stations; from the form letters received it is rather a difficult matter to determine just which Department is operating a particular station. It is hoped that it will eventually be straightened out by the individual stations, and the addresses, which were taken from the Governmental lists of stations, be correctly revised in the address section.

Taking all of the above into consideration, we might say the Mexican situation *is* a situation. But time, they say, rights all things!

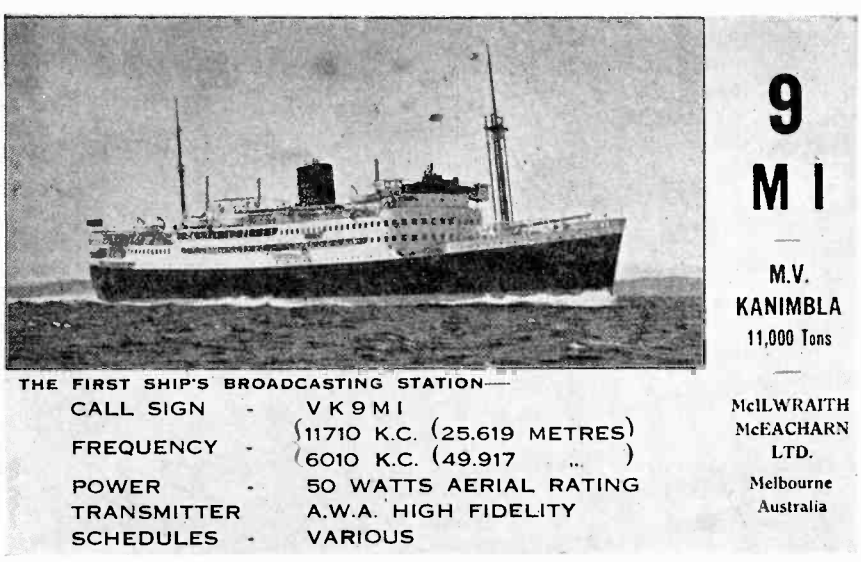
Other Broadcasters

VK6ME, 9590 kc., Perth, West Australia, broadcasts from 6 to 8 A.M. Monday to Saturday, inclusive, according to schedule from the Amalgamated Wireless (Australasia) Ltd. Station announcements are made each fifteen minutes.

CQN, Macao, China, is on 10135 kc. or 29.60 meters, having changed from 9600 kc. on December 7, 1936, and has broadcast on no other frequency than 10135 kc. since then. The schedule of the station is still the same as heretofore. They broadcast only on Mondays and Fridays from 7 to 8:30 A.M. Announcements made in Portuguese and English.

COCX, Havana, Cuba, has been changed from 11435 kc. to 11500 kc. While the first named frequency is that assigned, the station is not operating there. A Cuban situation. . . .

CR6AA, Lobito, West Africa, is now broadcasting on 7177 and 9666 kc. on Wednesdays and Saturdays from 2:45 to 4:30 P.M. Alvaro de Carvalho, Director and Engineer in Charge, advises that station call is given in Portuguese, French and English at 2:45 and 3:30 P.M. The



Veri from VK9MI—the S.S. Kanimbla, "First Ship's Broadcasting Station."

notes on the piano used in the identification signal are A, C, B, this being the same as used at station W3XAL, at Bound Brook, New Jersey.

CR7BH, 11718 kc., and CR7AA, 6137 kc., Lourenco, Marques, Portuguese East Africa, was on the air with special broadcast at 8 P.M., May 14th, but from reports neither broadcast was heard in the United States. Air mail letter from station was received by the writer on May 1st requesting publicity, but, of course, received too late for publication. Although the New York *Sun* kindly gave space to the news on the Saturday preceding the broadcast, J. V. Saxton, Bronx, New York City, was the only one to our knowledge who heard Africa on the evening in question, but it was not CR7AA or CR7BH. After giving up endeavoring to receive them, he transferred operations to the amateur band, and there contacted a North-African amateur with 75 watts power, who was putting on a circus for entertainment—band playing, native singing, war cries, native music, etc., with an R7-8 signal. The call was not learned as each time it was given GM-6RG, Scotland, with R9 ++ caused so much QRM that call could not be heard. But interference usually is strongest during announcements!

HCETC, Quito, Ecuador. Veri card shows station on 6975 kc. instead of 6895 kc. as heretofore shown. Advice from Sr. Manuel Mantilla, is that station is called "Del Teatro Bolivar" and broadcasts its own material from the theatre shown on the card. Transmissions are from 7:45 to 9 P.M. on Mondays and Saturdays. Senor Mantilla states that they broadcast on the nights mentioned on 43.02 meters up to 8 P.M. and on 32.08 meters after 8 P.M. As no exact frequencies in kilocycles were given, other than the one shown on the card, we are only listing the station on 6975 kc. until such time as other facts are obtained. 32.08 meters would place the other frequency at about 9350 kc.

YN1PR-YN1AM Puzzle

YN1PR, 8670 kc., Managua, Nicaragua, has been changed to 8650 kc. as veri card from station shows the latter. Station known as "Radioemisora Pilot" and on the air as now shown in station list. Senor A. Mejewsky is Gerente of YN-1PR. This may be the new call of YNAM shown in station list at 7200 kc., as Howard Wilson, Jr., Ithaca, New York, received card from YN1PR which bears the amateur call YN1AM, while envelope in which the veri came to him shows the station call YNPR.

Those receiving veri cards from South and Central-American stations should not be too "fussy" as to whether the figure is shown or not. It is not always the practice to include it—it being evident that in some countries an indication of the district in which the station is located is not considered a part of the call.

Ham QSL card, from Athens. Note typical Grecian border. Our "card of the month."

H18Q, 6240 kc., Ciudad Trujillo, Dominican Republic, is at present only transmitting on 1475 kc. according to letter advice received from the owner of station, Senor Julio O. Garcia Alardo, who states that they will soon be working in the short wave band on 6206 kc.

PRA8, 6040 kc., Pernambuco, Brazil, has been deleted from lists. It is understood to be off the air. This station was operated by the Radio Club of Pernambuco, and called "The Voice of the North." No reports of the station being heard for some time.

YV6RC, 6420 kc., is now on the air and listed in this issue. This station is located at Ciudad Bolivar, Venezuela, and is to be known as "Radio Bolivar." It is operated by Messrs. Miranda and Behrens.

New Swedish Broadcasters

SM5SX, 11705 kc., Stockholm, Sweden, was mentioned in "Last Minute Flashes" in June Globe Girdling. As stated, it is thought that this transmitter, which was operated by the Royal Technical University of Sweden, is only on 20 meters when on the air. From reports received from various sources, it appears that other government facilities are being employed to care for the broadcasting of Swedish programs, which are located at Motala, and that transmissions are being made daily on the same frequency, 11705 kc., or 25.63 meters, as well as on 6063 kc., or 49.46 meters. Some report the call on 11705 kc., as SBG, but as no definite advice has yet been received from station no changes will yet be made in station list. The information is given so you may be in touch with the situation.

CP5, 6080 kc., CP6, 9120 kc., and CP7, 15300 kc., La Paz, Bolivia, were mentioned in April Globe Girdling. Advice has been receiver from Compania Radio Boliviana that at present CP7, 15300 kc., is the only one being used and that for telephone communications with CP9 in the City of Oruro, which is contacted twice daily. The Board of Directors is reorganizing the entire company and for this reason the broadcasts on the above frequencies have been off the air since February 1, 1937. They are expected to be back on the air shortly and notice will be given later.

LRU, 15280 kc., Buenos Aires, Argentina. Veri card received by R. Behm, Philadelphia, shows frequency as 15290 kc.

VUB, 9565 kc., Bombay, India, and ZHI, 6018 kc., Singapore, are said to be definitely off the air according to reports of listeners said to have been received from English sources.

ZMBJ, S. S. *Awatea,* 13600, 8840 and 4420 kc., is reported closed to broadcasting by order of the Broadcasting Board. Any reports obtained direct from this nautical station will be gratefully received.

VPD2 veri card to H. C. Chestnut, Plattsburg, New York, shows the following:—"At VPD there are three transmitters. Use only one at a time."

PCJ, 15220 kc., and 9590 kc., and PHI, 17770 kc., are carrying the Holland programs as shown in the time schedule. PHI, 11730 kc., is not in use at present. It is understood that the studios for all transmitters are at Hilversum. The broadcasts are enjoyable ones and the "Happy Stations" have many listeners.

New Cuban

COJK is the new call of CO9JQ on 8665 kc. and change has been made in station list. This is evidently one of the two new stations in Cuba which were

mentioned in this section in February issue, on page 79. According to announcements a new 1-kw. transmitter has been installed and relays are being made of programs of long-wave station CMJK, Compania Cubana Nacional, whose address is S. A. Finlay No. 3, Camaguey, Cuba. While this is not the address of CO9JQ as shown in address section, they are both at Camaguey, and the correct address will be given later. COJK has good signal and has been on the air nightly broadcasting musical programs and requesting reports, with the assurance that all would be answered. It is understood that the new transmitter is located six miles from Camaguey, being connected with studios at Camaguey by special line.

YV2RA, 5710 kc., San Cristobal, Venezuela, has changed frequency and is now transmitting on 5755 kc. This station recently installed a new antenna system and improved its facilities with a view to bettering their reception temporarily pending the receipt of the new 1-kw transmitter which they expect at an early date. They would be grateful to listeners for reports on their broadcasts on 5755 kc.

TPZ, 8960 kc., and TPZ2, 12120 kc., are the calls and frequencies of radiophone service at Alger, Algeria, Africa, which work with France. The call of TVA, 8960 kc., shown heretofore in station list has therefore been changed and the new frequency of 12120 kc. added. This information was furnished by the Engineer in Charge, whose address is Service Algerin des Postes, des Telegraphes et des Telephones, 137, Rue de Constantine, Alger, Algeria, Africa.

Yad, Yam, Yan and Yat

Mention was made in February Globe Girdling of several new radio stations to be installed in Afghanistan. It is now reported that these stations will be in operation the latter part of July.

The calls of four transmitters are reported as YAD, YAM, YAN and YAT, all to operate near 4150 kc. with 500 watts power. It is understood that a transmitter of higher power for European traffic will transmit on 18640 kc. and 9650 kc. with call, YAK.

It is also reported that one transmitter, YAA, is at present in use.

It is not known at this time if these transmitters are for phone or broadcasting.

The report that station CT1GO, Parede, Portugal, had been heard again was evidently erroneous, as the Radio Club Portuguese, who operated the station, advise that it has not returned to the air, and that there is no immediate prospect of its return to service.

The radiophone and experimental stations of RCA Communications, Inc., located at Bolinas, Calif., Rocky Point, N. Y., Manila, P. I., and Kahuku, Hawaii, have been revised in this issue.

Czechoslovakia is only using OLR5A, 15230 kc., and OLR4A, 11840 kc., according to June printed programs.

Japan is using JZJ, 11800 kc., JVM, 10740 kc., JVN, 10660 kc., and JZI, 9535 kc., on overseas broadcasts. Although no advice has been received direct from stations, reports continue to come to notice that they are using their new 50-kw. transmitters but from contacts with the frequencies used it is thought by the writer that they are not in operation as yet. They are coming into the United States with a very weak signal.

The station heard testing around 9355 kc. and mentioning 9B and W8—? may be the new radiophone, WNK, at Hialeah, Fla.

If Radio Fort de France is still on the air on 9450 kc. it is not being heard often.

The report which is about that the B.B.C. is to issue veri cards has not yet been confirmed. The writer is of the belief that the comment made over the air by the B.B.C. had reference to a particular test program only.

Amateur Phones

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

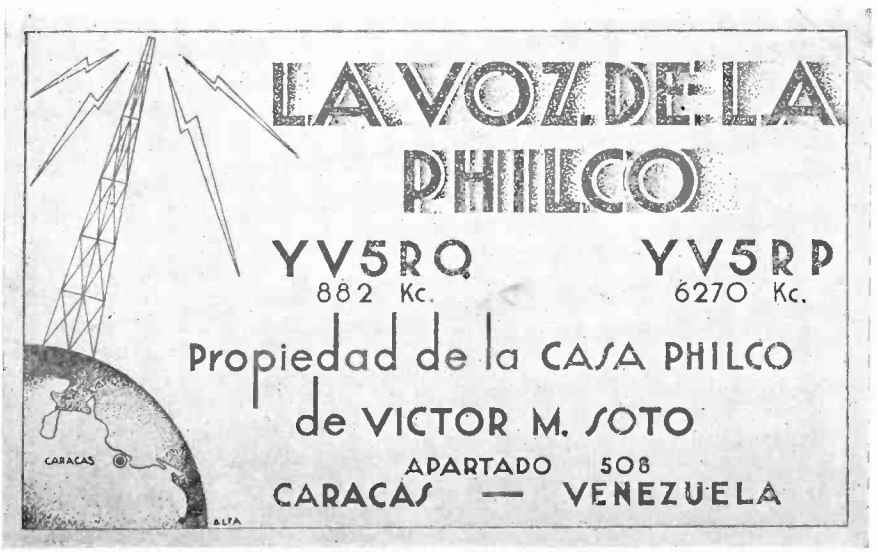
Country	*Frequency*	*Calls*	*Time Heard*
Australia	HF	VK2LX-2CD	7-7:15 A.M.
Australia	LF	VK3WZ-3HK	6:15-6:40 A.M.
Australia	LF	VK4JH	6:35 A.M.
Australia	LF	VK5XB	5:15 A.M.
Argentina	HF	LU4BJ	8-10 P.M.
Austria	LF	OE1CM	7:50 P.M.
Belgium	LF	ON4SS	3:15 A.M.
Belgium	HF	ON4VZ	5:32 P.M.
Brazil	LF	PY1FR	8:00 P.M.
Brazil	HF	PY5AQ	6:23 P.M.
Colombia	LF	HK4AG-HJ1JN	7:15 & 11:50 P.M.
China	LF	VS6AB	9 A.M.
Cuba	LF	CO2RH-2LY	9:50-10:10 P.M.
Cuba	HF	CO7AS	10:00 P.M.
Costa Rica	LF	TI2KP	10:10 P.M.
Denmark	LF	OZ7KG	8:00 P.M.
England	HF	G2MF-2PU	8 & 10 P.M.
England	LF	G5QC	7:10 P.M.
Ecuador	LF	HC1JW	11:35 P.M.
France	LF	F8WK-8UP	6 P.M. & 1:45 A.M.
Holland	LF	PAOFP-GN-XF-CJ	4:30 P.M.-1:30 A.M.
Honduras	HF	HR2A	6 P.M. & 11 P.M.
Hawaii	AM.	K6BAZ-NEB-OQE	6:45 P.M.-12:39 A.M.
Haiti	LF	HH4F	7:45 P.M.
Irish Free State	LF	EI3J	7:40 P.M.
Java	HF	PK3ST-1GL	9 A.M. & 7:25 A.M.
Jamaica	LF	VP5GM	5:50 P.M.
Lithuania	LF	LY1HB	4:45 P.M.
Moluccas Is.	LF	PK6CI	7:30 A.M.
Portugal	LF	CT1CV	6:20 P.M.
Portugal	HF	CT1GU	7 P.M.
Paraguay	HF	ZP2AC	10 P.M.
Porto Rico	LF	K4ENG	5:15 P.M.
Philippine Is.	LF	KA1AP	9 A.M.
Poland	LF	SP1HH	3:55 P.M.
Sweden	LF	SM7YA	1:45 A.M.
Tunis	HF	FT4AA	1:38 A.M.

Acknowledgments

It is with pleasure that we acknowledge letters and reports from Messrs. Al. Bettinger, Omaha, Neb.; Edward A. Flood, Union City, N. J.; Elbert Gross, Brooklyn, N. Y.; Walter Hammar, Glade, Kas.; Phil Miles, Trenton, N. J.; John B. Massaryk, Chicago, Ill.; Frank A. Ranwats, Reading, Pa.; F. Howard Smith, Indianapolis, Ind.; John Szlucha, Owego, N. Y.; Joe Williams, Belton, Mo.; and Charles Walter, Philadelphia, Pa.; and to extend to them and the many others who have assisted so greatly the thanks of ALL-WAVE RADIO and the writer.

It is always our pleasure to answer your questions pertaining to reception, unknown stations, or station matters in general. Address your letters to me at 85 Saint Andrews Place, Yonkers, New York, enclosing self-addressed stamped envelope if you desire a reply.

All questions of a technical nature should be sent to *Queries Editor,* ALL-WAVE RADIO, 16 East 43rd Street, New York, N. Y.



Neat veri from "The Voice of Philco," in Caracas, Venezuela. Card verifies either of two stations, one being in the standard broadcast band. Card in blue with white background.

Channel Echoes

By Zeh Bouck

a few bouquets . . . phillips lord help us . . . radio theraphewtics

THE trouble with the present reincarnation of television is the utter lack of utility of the television receiver once you tire of looking at objects through a green haze, or if it doesn't work, or if you move somewhere more than ten miles from the television transmitter. The receiver itself is good for nothing else. It tunes too broadly, and there is nothing but television transmitted on the bands to which it resonates. The cathode-ray tube is similarly useless. True, it looks like a Dewar flask, and one could saw the end off and store liquid in it. But it won't fit the hip.

That was one of the advantages of television ten years ago—indeed, its principal advantage. Take a look at that nifty television receiver down in the center of this page. In operation it sounded like a buzz saw—the identity of which with the past tense of the verb "to see" provided its main association with vision of any kind. And merely by cutting teeth into the disk, the scanner could be converted into an excellent saw. With other minor modifications it could be used for slicing cucumbers. The radio functioned on the standard broadcast bands, the cabinet could be converted into a cellaret and the motor used to run a washing machine. If you had no more practical use for the disk, you could use it as a hoop on Fifth Avenue.

The neon bulb could be used as a night lamp in the home—or in front of the door if you lived in that part of the town.

✦

THE NEWS-CASTS from Germany, Rome, and Moscow contain about as much news as one would expect from a house organ. Of the European news bulletins those from Daventry, England, are the only broadcasts that can be depended upon to say something good about the rest of the world and admit that everything is not hunky dory in home territory. And yet the British news programs have recently been open to criticism on the grounds of partiality.

If anything, Daventry leans toward the other extreme—the news-casts seeming to be devoid even of an editorial policy or slant. When London tells the world of strikes in the U. S. A., they mention their own bus strike along Piccadilly—and even tell us that the bus drivers have belly aches. One belly ache in five years

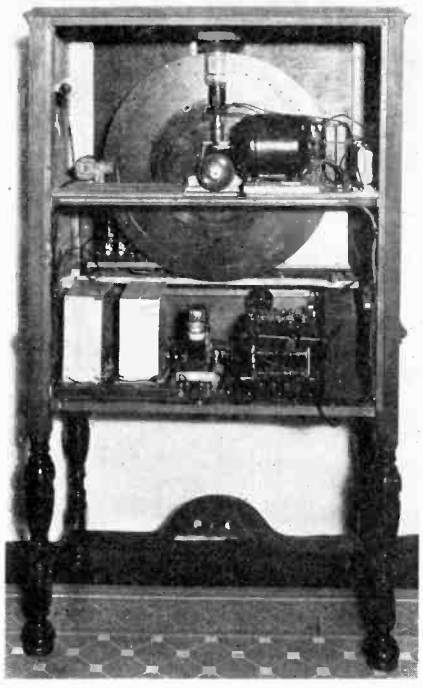


Fig. 1. Behind the television scenes in 1928 —a la Pilot.

of news broadcasting! Contrast that with the one long belly ache from Moscow, Berlin, and Rome!

✦

Radiodor for the month: We nominate Phillips Lord and his *Crime Busters* program. Not because he takes at least five plugs in a half-hour broadcast—not because he breaks up a really tense and perfectly dramatized program with a lengthy announcement in the middle. But mainly because he is silly enough to believe (apparently) and endeavors to give the idea that the radio audience, along around the quarter hour, is literally on its knees begging that the program be postponed in favor of hearing more about Palmolive brushless shaving cream.

✦

THOUGH WE HAVE never heard her ourself, we have been importuned by several listeners to make mention that Jeanne Dickinson, soprano with the Bayer Aspirin program, on 9:30, Eastern Standard Time, Sunday evenings is Lily Pons, Grace Moore, Jessica Dragonette, Gania Zalinska, Countess Albani, Annette McCullough, and Kate Smith all rolled into one. Which is quite something, for Annette McCullough and Kate Smith are not exactly diminutive.

✦

WHICH REMINDS US that for some months we have been intending to toss armfuls of loose bloom to Mildred Anderson, whom we heard some time ago with the General Motors Symphony Orchestra. In Miss Anderson, a Negress, are combined the natural singing beauty of her race, the dramatic appreciation of the

(Continued on page 387)

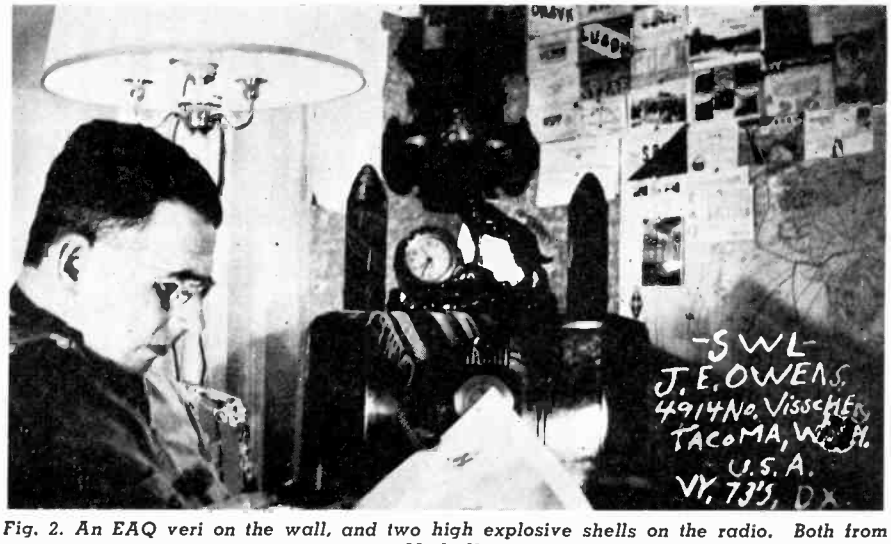


Fig. 2. An EAQ veri on the wall, and two high explosive shells on the radio. Both from Madrid?

Night-Owl Hoots

By Ray La Rocque

anent dx programs . . . station changes . . . x marks the spot in mexico kglo ultra-hi . . . kwyo radio rodeo . . . "party-line" broadcasts . . . dx

THE beaches, mountains, lakes, the open-road—all call the DXer away from his favorite chair by the dials of the old receiver during these sweltering months when Old King Static reigns supreme. Of course it's only natural for the DXer to spend some time at the listening post even during the hottest period. Instead of tuning the dials you perhaps will find him comparing his records and achievements of the past season or preparing for bigger and better things next season. Not being any different than any other DXer in this respect, permit us to look back over the past season.

Retrospect

The first thought that comes to our mind as we cast a quick glance through the log book is that the season was by no means the flop that the prognosticators predicted it would be. Though the TA's and TP's failed to make any great impression on the DXers of North America, those stations from the Latin American countries rode rampant over the dials on many an evening and broke through the mud of local interference much more frequently than has been their habit in the past.

Improvement number two during the past season: There were by far less DX programs needlessly conducted by stations. In most cases, those that were conducted were carefully planned to furnish entertainment as well as opportunity to log the station. However, conditions were still far from perfect. Having had past experience in dealing with the stations regarding the arrangement of courtesy programs, we have pondered many times over this problem and have come to the decision that all clubs do well to leave the matter of scheduling DX programs up to the stations. Instead of a Courtesy Programs Committee, the clubs could appoint a committee to write to stations asking them to notify club headquarters or the committee of any DX programs they intend to conduct during the season. The committee should be a joint one consisting of members of all clubs. This would eliminate a condition now existent. We refer to the flooding of the studios with letters asking for free publicity—for that now seems to be the sole purpose of a DX program. The committee could assign each member to a certain group of stations and each member would be required to use a form letter when writing to a station. This letter would inform the station that the committee proposes to do away with the old CPC and that the co-operation of the station is requested in publicizing any DX programs that the station plans to conduct. The letter would also offer the services of the committee to assist the station in choosing a period for their program that would insure the minimum of interference and the maximum of coverage.

Each program instead of being dedicated to one radio club could be dedicated to all clubs represented by the committee—providing, of course, the station so desires. The committee would in no way solicit DX programs, but would merely assist the stations who are interested in DX programs to select proper time schedules. The reaction of the majority of stations to letters requesting courtesy programs has been so unfavorable as to make us believe that such a plan, if presented properly to the stations would meet with such unanimous approval that there would be a renewed interest in DXing among the broadcasters. We even venture to say that many of them will offer to dedicate programs to the clubs without any solicitation. Take it from the chief, many of the stations are getting very tired of receiving letters (many of them clumsily written) asking, yes, and sometimes even demanding a program. We ask the clubs to think this over and are willing to do our utmost to put this plan into operation.

Club officials, your opinions, please.

A prize from Argentina . . . red design with background printing in blue.

Station Changes, U. S. A.

New Stations: Two construction permits were granted for new stations. One for a station in Wilson, N. C., to operate on 1310 kc., 100 watts, daytime only. The other is for a station in Miami Beach, Florida, to operate on 1500 kc. with 100 watts, unlimited time.

Power Changes: WCOA (1340) 500-1000, WRC (950) 500-1000, KATE (1420) 100-250.

Frequency Changes: KALB 1420-1210, KATE 1200-1420.

Call Letters Changed: KSJS (1500) to KSAL.

Station Changes, Foreign

New Stations:

Call	Location	K.C.	Watts
LR5	Buenos Aires, Arg.	830	29000
XEAB	Toluca, Mex.	1060	250
XEAP	Obregon, Mex.	1240	50
XEBL	Mazatlan, Mex.	1220	50
XEBO	Irapuato, Mex.	1310	25
XEBS	Mexico City, Mex.	1240	200
XEBU	Chihuahua, Mex.	1200	50
XELA	Saltillo, Mex.	1240	50
XEN	Mexico City, Mex.	720	1000
XEXE	Texcoyo, Mex.	1270	17
XEYO	Mexico City, Mex.	610	500
3UL	Warregul, Vict. (IDA)	1000	100

Frequency Changes: CMBC 640-850, CMCU 1280-1290, CMK 730-640, CMOK 1470-1260, LV2 880-960, LT5 1160-1080, LT3 1080-1160, XEAC 1240-980, XEFE 850-980, XEJW 860-870.

Call Letters Changed: XEFJ (1230) to XEG, LV2 (730) to LV1.

Power Change: XEJW (870) 40.

Delete: XEF (1450).

Veri from CMBY, in case you can't make it out.

Contest News

The ALL-WAVE RADIO Championship DX Contest for 1936-37 closed at midnight April 30, 1937. It will be some time before all the reports received have been mailed out to the stations and checked by them. We hope to have the winners ready to announce by next month, but we can make no definite promise at this early date. This month ALL-WAVE RADIO announces the prizes that have been selected as awards to the lucky contestants.

With the Night Owls

Each month we select for this department a few choice hootings of our fellow Night Owls containing items of interest in general. *E. L. (Pete) Peters,* Westport, Nova Scotia: "The following longwave stations are almost daily visitors: Droitwich, Reykjavik, Radio Paris, Deutschlandsender, Moscow No. 1, Hilversum No. 1. Some of them come in every day—always something to hear on that band. It's really surprising what fine signals they are putting in at this late date when BCB TA's have been gone for at least a month."

George L. Brode, Sr., (1st Asst. Publicity Director, National Radio Club) Philadelphia, Penna.: "In behalf of many members of the National Radio Club who took part in your ALL-WAVE RADIO DX Contest, we wish to offer you a vote of thanks. It was indeed appreciated, for untiring effort of this kind does much to popularize our beloved hobby."

Enrique Hidalgo, Cienfuegos, Cuba: "I am glad to see that I have already more than 3000 points in the contest—that news more than satisfies me. I just wanted to prove to the DX World that down here in Cuba somebody was interested in their beloved hobby."

Mary L. Gabriel, Secretary at CMQ, Havana, Cuba. "I hope to continue receiving your valuable reports (contest reports). We are constructing new equipment for CMQ with a power of 25,000 watts. I will soon send you details and a photograph."

Others to whom we owe thanks for their comments and information are as follows: Joe Lippincott, Medford, Mass.; Carroll Weyrich, Baltimore, Md.; Carl Forestieri, Bronx, N. Y.; Charles Hesterman, Saskatoon, Sask.; Ray Prutting, Bridgeport, Conn.; Harry Hawkins, Manchester, N. H.; Harry E. Snyder, Trenton, N. J.; Ken Albrecht, Hartford, Conn.; Leroy F. Nice, Souderton, Pa.; Art Collins, Buffalo, N. Y.; Barney Ahman, Baltimore, Md.; Nancy Lee Saxton, Chicago, Ill.; Anthony C. Tarr, Seattle, Wash.; Jose Rodriguez, Havana, Cuba; F. Joslin (W1KJS) Southbridge, Mass.

Kilocycling Around

We'll never get this Mexican situation straight. Last month we announced that the call XEXM was changed to XEDP. We based this change on the fact that short-wave station XEXA which formerly announced its long-wave call as XEXM is now announcing it as XEDP. Much to our chagrin, we learned later that XEDP is a new station on 1080 kc. So now the question arises, what's happened to XEXM? Has it changed both frequency and call or is it still operating independently on 610 kc.? You'll find more Mexican changes in the list of station changes this month—this time the NNRC gets credit for prying the info out of Mexico. Their list, however, fails to solve the mystery of the Mexican on 780 kc. . . . WNEL is making up for lost time and is now sending out very attractive cards to DXers for every report the station has received during the past season. The card shows a view of San Juan's skyline at sunset with the antenna tower silhouetted against the firmament. . . . By the time you read this, KRLC doubtless will be operating on a new frequency. The new frequency is 1390 kc. An increased power of 250 watts will be fed into a new vertical radiator from entirely new transmitting equipment. . . . WBLK's veri is attractive with its large red call letters. . . . And KUJ's card will have you believe that it's located in "The valley they liked so well they named it twice—Walla Walla!" . . . Leo W. Born, Chief Engineer at KGLO informs that they present a DX program every Wednesday morning at 3.30 A.M. with the exception of the second Wednesday of each month when the program starts at 1 A.M. KGLO is on the air with a government frequency

(Continued on page 388)

CHAMPIONSHIP DX CONTEST PRIZES

The Championship DX Contest is closed. The complete list of winners will be announced in the August issue. As a preliminary to this announcement we are listing below the actual prizes to be awarded so that the entrants may have a taste of what is to come. Watch for full details and illustrations of prizes next month.

FIRST PRIZE	**Pilot TG-520 Super-Dragon IV All-Wave Receiver**
SECOND PRIZE	**Hallicrafters 1937 Super Sky Rider Receiver**
THIRD PRIZE	**American Bosch Model 620 A.C.-D.C. Receiver**
FOURTH PRIZE	**Peak Preselector**
FIFTH PRIZE	**Lafayette 12-inch Dynamic Concert Speaker**
SIXTH PRIZE	**Winner's choice of tubes, total value $7.50**
FIVE PRIZES (each)	**Sky Pilot World Time Clock**
FOUR PRIZES (each)	**Year's Subscription to ALL-WAVE RADIO**

In the event of ties duplicate prizes will be awarded.

R. S. S. L. NEWS

THERE appears on this page a map of the United States whereon is shown the relative signal strength and readability of station TG2, Guatemala City, Guatemala—an analysis in this specific area of the first official R.S.S.L. Signal Survey.

This map, of course, does not represent the entire survey, but a reproduction of a map showing all R.S.S.L. reporting areas would have been too unwieldly. The U. S. map is sufficient to illustrate the manner in which Headquarters works out a complete analysis.

The solid circles represent signal strength and the open circles signal readability. The size of each circle indicates at a glance the relative signal strength or signal readability in one State as compared to that in another. The specific R and Q levels are also included as it is impossible to determine from the circles alone the exact levels obtaining.

In the future Headquarters may carry the analysis a bit further, and provide relative signal levels in sections of each State, Province and Territory, but this is problematical since foreign broadcasters, at least, are content with an average for such small areas. Consequently, for the time being, and with the present method, only one reading is provided for each State. The R and Q levels for a given State are arrived at by averaging all the survey reports received from R.S.S.L. members in the State in question. If dead spots are ignored, signal level does not vary as much throughout a State as one might imagine. There are exceptions, of course, but generally a signal that is, say, R7 in one part of a State will be R7 in other parts, or at least close enough to that level that an average for the entire State is moderately accurate.

This method of presenting a complete analysis of a station's field pattern may not be the best, but it is adequate for the present. Nevertheless, we would appreciate your comments on the method, as well as any suggestions you may have as to improving it.

ANNOUNCING CONTINUOUS, WORLD-WIDE STATION INTERFERENCE SURVEY

Interference Survey

This is the time of year when most of us find it difficult to conform to listening schedules, what with vacations, outdoor sports, and the effects of the heat. Nevertheless, the fabric of the R.S.S.L. can be strengthened during these months, and our plans for the fall crystallized, without interfering with the summer activities of members.

For one thing, the prestige of international broadcasting has been weakened by station interference. The lack of cooperation in this respect is appalling, and the situation has become so serious that steps must be taken to rectify the condition before it is too late and international broadcasting ceases to be an effective instrument.

All nations are fully aware of the situation, and there are good chances that the rough spots may be ironed out at the Cairo Conference, early in 1938, if not at other conferences scheduled for this year. But we can do more than trust that this may be the case—we can contribute our share by conducting an interference survey in all the international short-wave bands, and use the results of this survey not only as an instrument to promote cooperation between overlapping broadcasters, but also as an authentic report on world reception conditions for use by conferees.

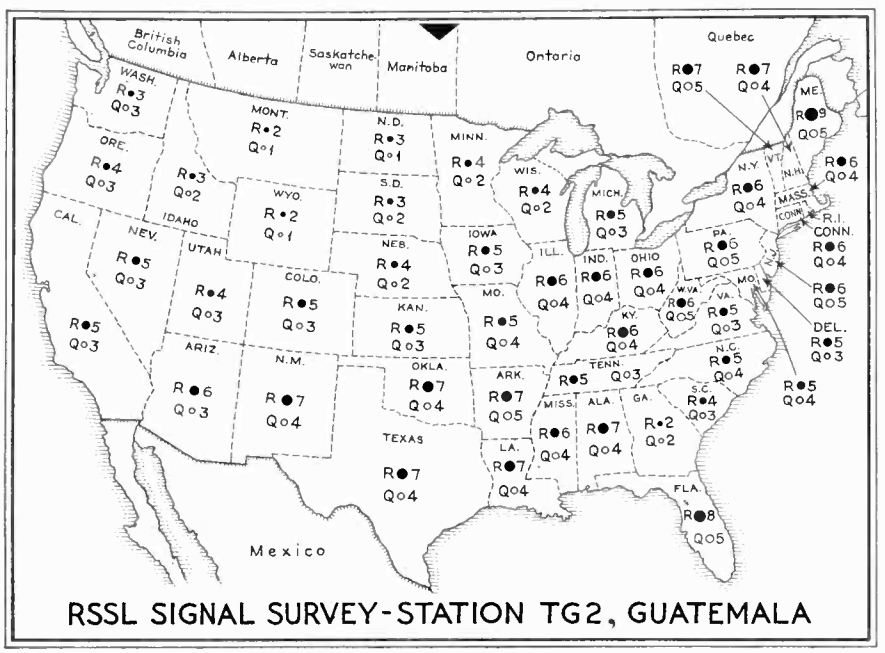
Since the principal aim of the R.S.S.L. is to improve transmission and reception conditions, we should make it our duty to tackle the interference problem at the earliest possible moment. This is but one of the numerous ways in which we can function as the representative body for the thousands of listeners throughout the world who are at the "receiving end" and, having no united voice of their own, must accept conditions as they exist. By assisting them we also assist ourselves *and* the broadcasters.

We are instituting, therefore, a long-range survey of interference conditions in the international short-wave bands, the survey to run continuously until the first of the year. No schedules, and the reports to be based entirely on casual listening. Files will be maintained at Headquarters on each group of interfering stations reported by members, and as rapidly as each individual condition of interference can be analyzed, such stations as are involved will be notified. Requests will be made that they cooperate in the matter of channel usage for their own benefit and the benefit of their many listeners throughout the world. Copies of the notifications will be forwarded to the respective governmental agencies, and to their Consuls in the United States.

Interference Reports

Bear in mind that your reports must be accurate and authentic. Remember, for one thing, that actual station interference is evidenced by heterodyne whistles or a distorted, slopping over of one signal on to another. The mere fact that you may hear two stations

(Continued on page 390)



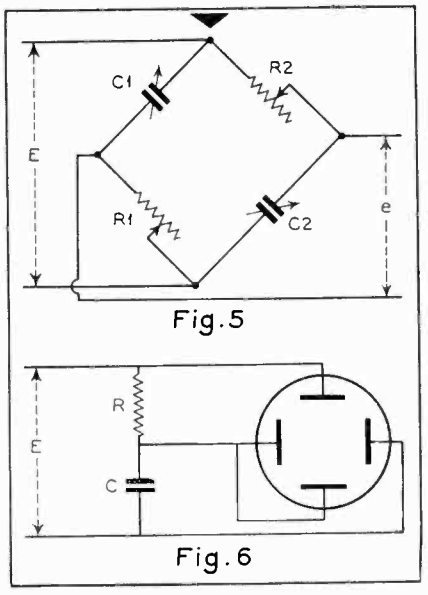
Results of R.S.S.L. Guatemala Signal Survey in the United States.

PHASE-SHIFTING CIRCUITS

BY ENGINEERING DEPT., AEROVOX CORPORATION

ON many occasions it is required to shift the phase of an alternating voltage. This may occur during tests performed on amplifiers where the input and output signals are applied to the vertical and horizontal deflecting plates of a cathode-ray tube. Control circuits associated with thyratron tubes also necessitate the use of phase-shifting equipment. There are many other cases where such circuits are useful.

One of the simplest of phase-shifting methods utilizes the fact that the current passing through a reactance is in quadrature with the voltage across it. If a reactance is placed in series with a resistance, the current differs in phase with the applied voltage by an angle depending on the ratio between reactance and resistance. The voltage across the resistance being in phase with the current through it, is therefore shifted with respect to the voltage applied to the combination.



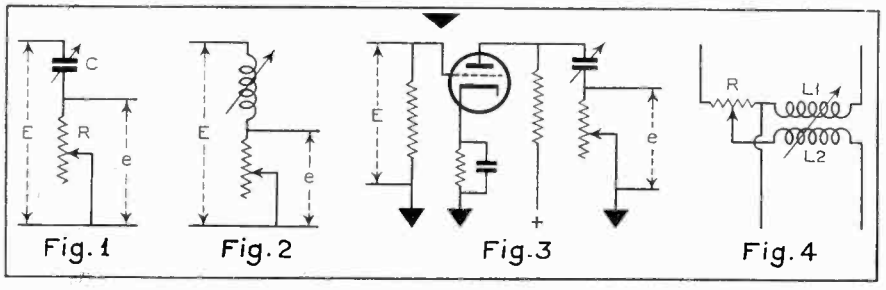
Continuously variable phase angle system, and sweep circuit for oscilloscope.

Simple Methods

An example of this principle is shown in Fig. 1 where a condenser is placed in series with a resistor. In this case the current through C and R will lead the voltage, E, by an angle $a = tg^{-1} X_c/R$. The voltage, e, across the resistor is in phase with the current and if no appreciable current is drawn the phase shift obtained is equal to the angle mentioned above. By suitably choosing the respective values of C and R a voltage can be obtained which leads the applied voltage by any angle between zero and 90 degrees.

A similar arrangement can be used with an inductance and a resistance in series, as in Fig. 2. In this case a test voltage, e, can be obtained which lags the impressed voltage by an angle $a = tg^{-1} X_L/R$; or, when the resistance of the coil is taken into account, $a = tg^{-1} X_L/(R + R_L)$.

Although there are methods of obtaining larger variations in phase shift, these two will suffice in most cases. In fact, the scheme of Fig. 1 alone will do. When it is necessary to bring two voltages into a given phase relation, the lagging one can be advanced by the required angle. Shifts of more than 90 degrees are seldom required but the methods of Figs. 1 and 2 can be combined with other well-known methods so as to obtain any phase difference. In many cases the connections of one circuit may be reversed, which, in combination with the methods above would satisfy any requirement. If this is not possible, a transformer can be employed which will give a phase shift of between 90 and 180 degrees, depending on the load. An ideal transformer would have a phase shift of 180 degrees when the secondary is open. Another way to reverse the phase of an alternating voltage is by employing a tube. When the plate load is a pure resistance, the plate voltage is 180 degrees out of phase with the applied grid voltage; an additional shift may be obtained either before or after the tube by employing a circuit like the one in Fig. 3.



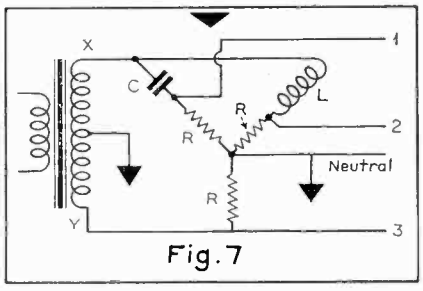
Four simple phase-shifting circuits.

Lag-and-Lead Circuit

A continuously variable phase angle between 90 degree lag and 90 degree lead is possible by the circuit of Fig. 4 where a variable mutual inductance is employed. The current passing through L1 induces a voltage in L2 which can be regulated in magnitude and reversed in phase. Vectorially adding a portion of the voltage across R any phase shift can be had.

Finally, it may be necessary to devise a circuit which will provide a continuously variable phase angle from zero to 360 degrees. The circuit of Fig. 5 shows one method of doing this.

Certain special circuits employing phase-shifting arrangements deserve description in this article. It has been proposed to employ a sweep circuit which would make the luminous spot of a cathode-ray tube trace a circle or a spiral. This requires that voltages applied to the horizontal and vertical deflecting plates be equal and 90 degrees out of phase. A simple series arrangement of a condenser and a resistance will do the work. In this case R should equal X in order to trace a perfect circle, and the condenser should have a low power factor. (See Fig. 6). It also follows that the sizes of the elements are different for different frequencies which is true for all phase-shifting apparatus. There are other ways of obtaining the circular trace such as the combined use of magnetic and static deflection.



Circuit supplying three-phase currents from single-phase supply.

Three-Phase Currents

It is possible to obtain three-phase currents from a single phase supply or make a tube generator into a three-phase generator. As an example, let us consider the circuit of Fig. 7. When the secondary of the transformer is grounded at the center, the voltages at the terminals X and Y are 180 degrees out of

(Continued on page 389)

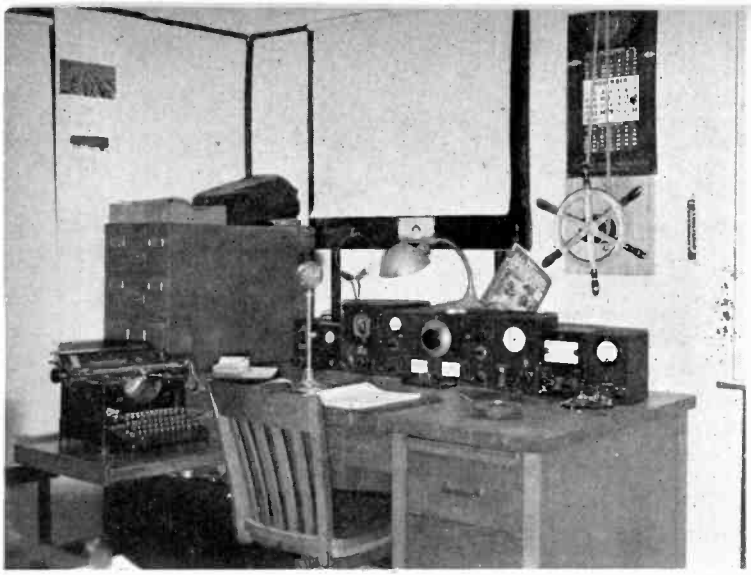


Fig. 1. Operating position at W4DLH, Goulds, Florida. Note pilot wheel on wall for rotating the "Signal Squirter."

'ROUND THE WORLD

The Technique Exhibited

W4DLH appreciates reports from short-wave listeners. These are acknowledged with QSL cards giving full data on his equipment and photographs of the same. Listen for this station on its standard transmitting frequency of 14,210 kilocycles. The usual operating time is 13:00 GMT *(8:00* A.M., *Eastern Stand. Time) and 20:00* GMT. *(3:00* P.M. E. S. T.).

JULES VERNE'S idea of going around the world in eighty days was a good idea at the time—but that was some time ago. Just a few months back four dark lean horses did it in seventeen minutes at no more than a gentle canter. "Four dark lean horses" as most amateurs and swls are aware, is word spelling for amateur radio station W4DLH, located at Goulds, Florida, just south of Miami. And while the all-continent around the world round table of December 30th, 1936—and subsequent records—is a bit of history written in blazing letters across the annals of amateur radio, the equipment that made this record possible is still, as a composite station, a year or so ahead of its time. For while all the elements which contribute to the efficiency of W4DLH are readily available to the amateur, they are rarely all incorporated in a single station.

The Operating Layout

Figure 1 shows the "office," with the following equipment running from left to right—Astatic mike, a G.E. electric clock, field strength meter, Peak preselector, the National HRO receiver, Peak linear detection radiophone monitor, remote control (push-to-talk) cabinet with a Telechron electric clock, and a Triplett combination carrier frequency level indicator, modulation meter and monitor. The boat steering wheel shown just above the remote control box is the helm that controls the . . .

Mims Signal Squirter

. . . the rotary beam antenna illustrated in Figure 2. This is mounted atop the shack, the shaft being brought through the ceiling and coupled to a pointer which indicates on a great circle map the direction in which most of the power is being radiated—which is also the direction from which best reception can be expected. "Bill" Burkhart, who jockeys the four dark lean horses, attributes much of his success to this antenna which is made up in kit form by W5BDB. Tests with this antenna indicate definitely that signals travel the great circle distances only when frequency, light and dark and other conditions are favorable to such direct travel. In other words, a fixed antenna erected in accordance with great circle distances and directions will only be effective in that direction part of the time. The rotary beam antenna, however, can select the direction which best compromises between time of day and year, frequency and distance for peak reception. This antenna was employed both for transmitting and receiving. It consists of a doublet with reflector and it feeds to and is fed from the shack with an EO1 transmission line.

MIM !

It's a long time since --.-- (MIM) meant—back in the old spark days—"Warning, high power." But it fits in with Bill's antenna system, and the transmitter itself. For there is plenty of wallop back of the W4DLH beam—1 kilowatt if necessary, though the normal power is 500 watts. The transmitter is shown in Figure 3, and the line-up starts with an IPS rubber crystal (manufactured by W9IPS) which, doubled to 14 megacycles, permits a 300-kc variation to wiggle inside and out of QRM. The crystal is operated in a stabilized electron coupled circuit, link-coupled to a pair of 46s which drive a single 203A, which in turn is link-coupled to a 1 kw. class C amplifier employing a single Eimac 300T in the final. The speech channel starts with the mike through two 6C6s, a pair of 76s and four 2A3s in parallel push-pull. These feed the modulator—a pair of Taylor HD 203As in class B.

The photograph of Figure 4 shows the final tank circuit of the class C one kilowatt amplifier. The antenna is capaci-

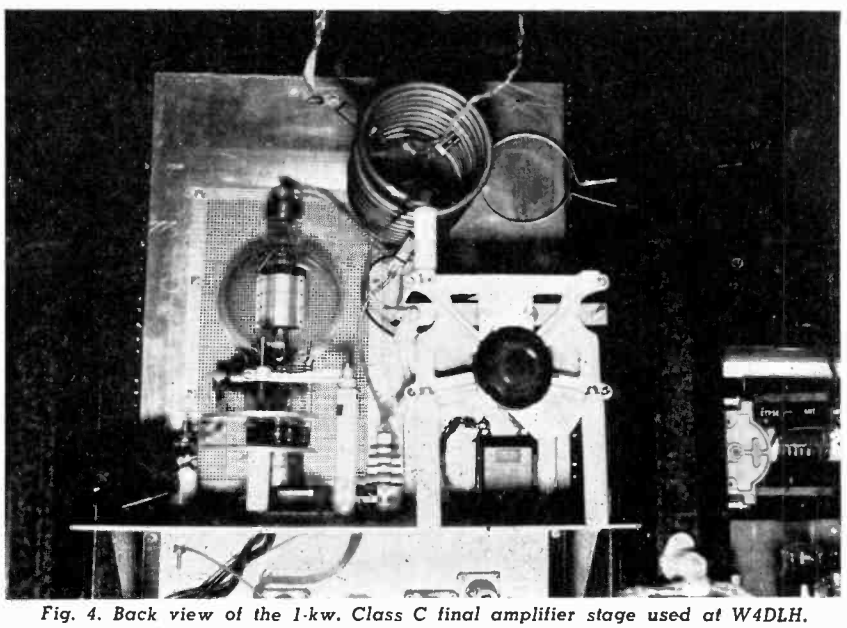


Fig. 4. Back view of the 1-kw. Class C final amplifier stage used at W4DLH.

IN 17 MINUTES!

By "Four Dark Lean Horses"

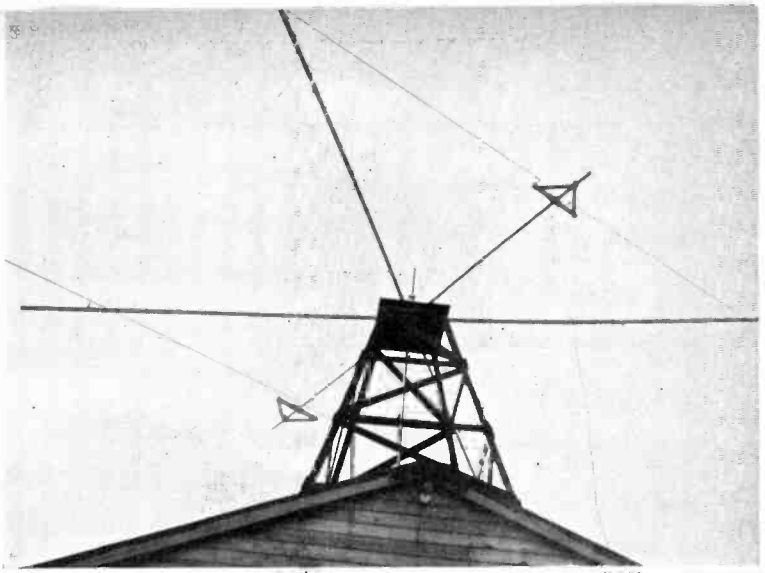


Fig. 2. The rotary beam (Signal Squirter) antenna at W4DLH which is operated from the shack where a pointer on the ceiling indicates direction.

Fig. 5. William (Bill) Burkhart himself, owner and operator of the "Four Dark Lean Horses" that galloped around the world in 17 minutes.

tatively coupled to the tank circuit through two .002 mfd. condensers.

Watts—particularly fone watts—run into money, but fortunately for amateurs desiring to emulate the achievements of W4DLH, the available wattage was probably the least vital of the various factors contributing to the success of the all-continent round table. Other stations in the round table employed considerably less power than Bill.

The Gentleman Himself

Even with the best of equipment the amateur record couldn't have been made without the experience and finesse of Bill Burkhart (ex-spark 8DI and ex-4AAQ—Figure 5)—and the cooperation of the round table stations which backed up W4DLH's organization efforts 100%. Though W4DLH himself must have lost plenty of sleep, he concedes that the inconveniences suffered by the others were probably greater than his. The other stations participating were VU2CQ, Bombay, India, SU1CH, Cairo, Egypt, HK1Z, Colombia, S. A., G5ML, Kenilworth, England, and VK4LO, Brisbane, Australia. HK1Z (as well as W4DLH, of course) was on the air daily for over two weeks at daybreak. VK4LO must have lost plenty of the other end of sleep, because the contacts always carried him well beyond midnight in Australia. VU2CQ probably slipped up on a good many dinner dates while SU1CH needed a flock of grandmothers' funerals to break away from business every day at 2:00 P. M. And G5ML is probably sick of sandwich lunches.

The first round table was achieved on December 30th, 1936. At 12:37 GMT, W4DLH officially called the round table to order, and turned it over to VU2CQ. Bombay checked in and turned it over to "Ed" at SU1CH. Cairo then conceded the ether to "Tony" at HK1Z, who paid his compliments to G5ML ("Fred"). G5ML turned it over to his compatriot on the other side of the globe ("Frank" at VK4LO) at 12:58, and the job was done in twenty-one minutes!

All stations were operating on 14 megacycle fone, and each station in the round table was able to hear all others with satisfactory volume.

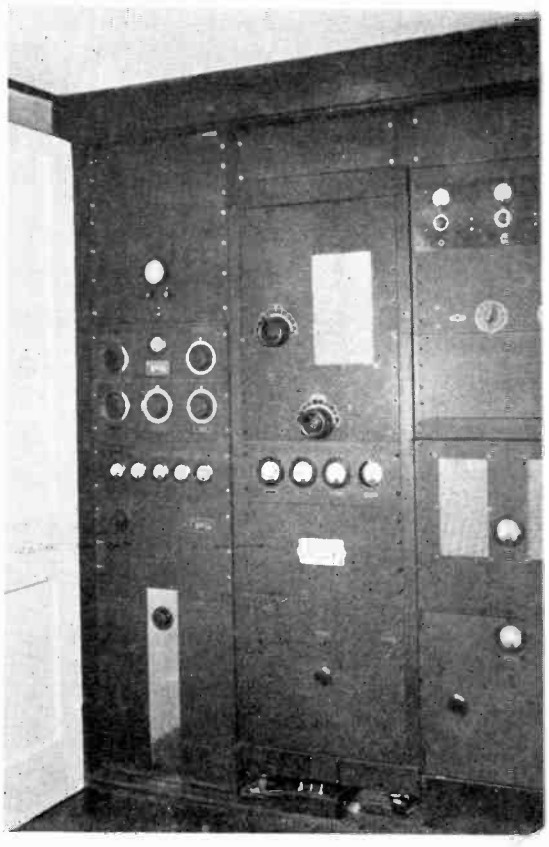
A Distance Record

Figuring on the shortest great circle distances (though some of the signals took longer routes) the knights of the all-continent round table covered some 40,000 miles. W4DLH's voice traveled over 9000 statute miles to Bombay, India. VU2CQ took a "short" hop of 4700 miles to Cairo, and SU1CH pushed his carrier close to 8000 miles in contacting South American. HK1Z covered some 5,500 miles to England, and G5ML spanned half the globe—over 12,000 miles—to VK4LO in Australia.

The original record was broken five days later, on January 4th, 1937, when the round table was completed in seventeen minutes! A third attempt was made on January 19th and all contacts were duly established in eight minutes and ten seconds! However, Bill does not place too much emphasis on this last record due to the fact that perfect reception was not enjoyed by all stations as a result of bad *dx* conditions in England. G5ML was not receiving two of the continents in usual style. Complete success is considered only when each station is hearing all other stations with satisfactory signal strength. All subsequent QSOs were made by the stations establishing the record of December 30th.

In summation, credit for the all-continent round table goes, like most radio achievements, to equipment and personnel. Around the world contacts such as the W4DLH-VU2CQ-SU1CH-HK1Z-G5ML-VK4LO circuit are new marks at which amateur radio is shooting. It's another case of new worlds to conquer—new worlds that are automatically brought into existence with the consistent improvement of transmitting and receiving technique. We wonder if W4DLH got more of a thrill from his first all-continent round table than he did from his first spark QSO over 200 miles. The relative achievements were the same—so was the kick. What next?

Fig. 3. A view of Bill's transmitter . . . like Bill, neat but haughty.



RADIO PROVING POST

FIG. 1. FRONT VIEW OF RACK MOUNTING MODEL OF THE ACR-111 RECEIVER.

RCA MODEL ACR-111 RECEIVER

THE ACR-111 Amateur Communication Receiver is the big brother of the ACR-155, reviewed in the March 1937 issue of ALL-WAVE RADIO. Though it is larger, employs more tubes, and is higher in price than the original ACR-175, it presumably replaces the latter set in the latest RCA line of amateur receivers.

A front view of this new 1938 receiver is shown in Fig. 1. Though there is a cabinet model also, it is convertible to rack mounting, as the heavy metal front panel is of standard rack length and has the usual mounting slots. These do not show in the cabinet model as they are masked by the two front corner posts of the cabinet which are removed when it is desired to pull the chassis.

General Features

Both the cabinet and front panel have the same two-tone gray wrinkle finish characteristic of the ACR-155. The top and bottom surfaces of the cabinet, as well as the dial escutcheon and large tuning knobs on the front panel, are finished in a darker gray than the remaining surfaces, thus lending a pleasing contrast. The RCA insignia is nickel silver with red enamel background, and the control nameplates are nickel silver with reverse etching.

A top view of the chassis, with dust cover removed from r.f. tuning assembly, is shown in Fig. 2. It will be noted that the chassis is secured to the front panel by wide, solid steel support brackets for the sake of mechanical stability and to prevent chassis warping when the receiver is mounted in a relay rack.

All tubes and components associated with the r.f. circuits are mounted on the subsidiary chassis anchored to the center of the main chassis by rubber floats. The tubes and components of the i.f. and a.f. circuits are grouped around the centralized r.f. tuning unit, the power supply being at the right, the i.f. and detection components at the rear, and the a.f. circuits at the left. The socket directly in front of the two power output tubes takes the cable plug from the 8-inch, easel-mounted dynamic speaker supplied with the receiver.

The receiver employs a total of 16 tubes, all but two of which are metal. There are two r.f. stages using 6K7s, a 6J7 first detector, 6J7 converter oscillator, two i.f. stages with 6K7s, a 6H6 second detector and noise limiter, two audio voltage amplifiers using 6C5s, push-pull power stage employing 6F6s, a glass 5Z3 full-wave power-supply rectifier, separate amplified automatic volume control centered in a 6R7, a 6J7 noise suppressor, and a glass 6E5 tuning indicator.

The tuning range of the receiver is continuous from 540 to 32,000 kilocycles, divided into the following five ranges, with generous overlap: Range A—0.54 to 1.6 mc. Range B—1.6 to 4.0 mc. Range C—3 to 8 mc. Range D—6 to 16 mc. Range E—12 to 32 mc.

Referring to Fig. 1, the tuning dial assembly is located at the top center of the front panel. The upper, main tuning scale, calibrated in megacycles, has five sections, the proper section for the band in use automatically coming into view for each of the five settings of the wave-range switch, centrally located at the bottom of the front panel. The pointer traversing the main tuning scale is controlled by the large, cast aluminum tuning knob, with crank, located below and to the right of the dial escutcheon.

Electrical, Constant-Percentage Band-Spread

The band-spread scale, reading from 0 to 100 degrees, is located directly below the main tuning scale. In the ACR-155 receiver, this scale is mechanically coupled to the main tuning scale drive to

permit vernier readings. In the ACR-111 the scale is separately controlled by the band-spread tuning knob below and to the left of the dial escutcheon. The spread is electrical rather than mechanical, and a glance at the chassis view of the receiver, shown in Fig. 2, will show that there are two sets of gang tuning condensers, the left set being the spreaders. Reference to the schematic diagram, Fig. 3, will show that the main, split-stator gang tuning condensers (C41 and C42 in the input circuit of first r.f. tube as an illustration) and the band-spread gang condenser (C40 in same circuit) are arranged in a series-parallel circuit which avoids high minimum and maximum capacity effects. This provides practically constant-percentage electrical band-spread and with resultant greater uniformity of band-spread throughout each tuning range. With this arrangement adequate band-spread is assured at the high-frequency end of each range without excess band-spread at the low-frequency end. Since spreading is undesirable in the standard broadcast band, the Range Switch in the "A" position shorts out the band-spread gang condenser, effectively paralleling the two halves of the main gang tuning condenser.

The tuning drive ratio of both the main and band-spread controls is 100 to 1, which is adequate to insure easy tuning.

The aperture for the 6E5 tuning indicator is at the left of the dial escutcheon. A pilot light is mounted behind the window of the aperture at the right of the escutcheon, which glows when the Selector Switch immediately below it is placed in the "Stand By" position.

The Controls

The upper left nameplate on the front panel carries the phone jack and Noise Suppression Control. The upper right name plate carries the "MOD—C.W." Selector Switch and the Signal Input or Sensitivity Control. The former has four positions, the two to the left for the reception of modulated signals with the a.v.c. on or off, a central "stand by" position, and two to the right for the reception of c.w. signals with the a.v.c. on or off. In either of the two "C.W." positions, the beat-frequency oscillator is energized. In the first of these two positions—"A.V.C. ON"—an additional condenser is connected into the filter circuit of the a.v.c. feed line which alters the time constant sufficiently to hold the gain of the receiver during intervals between code signal characters. Consequently the a.v.c. may be used to advantage on c.w. reception, except for very slow-speed transmission, in which case the second of the two "C.W." positions is used—"A.V.C. OFF."

The Signal Input Control is connected in the common cathode circuit of the r.f. and i.f. tubes, and controls the gain of the receiver. It is calibrated in microvolts so that signal inputs may be measured. This is accomplished by adjusting the control for initial deflection on the screen of the electron-ray tuning indicator.

The pitch of the beat frequency, when the Selector Switch is in the "C.W." position, may be varied by the knob at the extreme left of the bottom bank of controls. This control is also calibrated, and has a central, zero-beat position, and readings in units of 1000 cycles from zero beat up to 3000 cycles. The knob varies the position of a magnetite core in the b.f.o. coil which alters the inductance sufficiently to obtain a reasonable audio-frequency spread either side of zero beat.

The Volume Control is located to the right of the Beat Frequency Control. This requires no explanation other than that it is connected in the input circuit of the a.f. driver tube rather than in the load circuit of the diode second detector.

The central knob controls the Wave-Range Switch. It is small, considering its function, but since the switch mechanism itself is free-moving, the knob provides adequate leverage without making it difficult to turn.

Selectivity Control

The knob below the Selector Switch is the Selectivity Control, associated with the crystal filter in the first i.f. stage. When turned full to the right the crystal is short-circuited. In all other positions the crystal is in use and movement of the knob varies the capacity of the crystal phasing condenser. Near the midway position of the knob pointer, the crystal circuit is balanced and maximum selectivity is obtained. Other positions broaden the crystal selectivity curve on one side of resonance and cause a rejection dip on the other side. The degrees of selectivity obtainable, and the characteristics of the curves, are indicated in Fig. 4. Curve A is selectivity of receiver with crystal out of circuit. Curve B is selectivity with crystal in circuit and control in maximum or midway positions. Curve C shows rejection dip obtainable with control in full clockwise position, while Curve D shows the reverse characteristics when control is in extreme counterclockwise position. An unwanted, interferring signal can be jockeyed into the rejection dip and thrown overboard in favor of a desired signal.

The knob at the extreme right of the bottom bank of controls is the Power Switch and Fidelity Control. The receiver is turned off with knob to full left position. At all other positions, with receiver on, the knob controls a variable resistance in series with a fixed condenser, shunting the input circuit of the push-pull power stage. Maximum attenuation of high audio frequencies is obtained with knob in left position.

The Circuit

Reference to the circuit of Fig. 3 will show that the two r.f. stages are active in all bands. The antenna coupling system is designed to provide optimum coupling from transmission lines (50-500 ohms) or from conventional antenna and ground systems. An antenna rejection filter (not shown) is provided to eliminate interference at or near the i.f. frequency.

Separate sets of coils in all r.f. circuits are used for each of the five wave ranges, and are trimmed with plunger type air dielectric condensers the plungers of which can be seen protruding from the

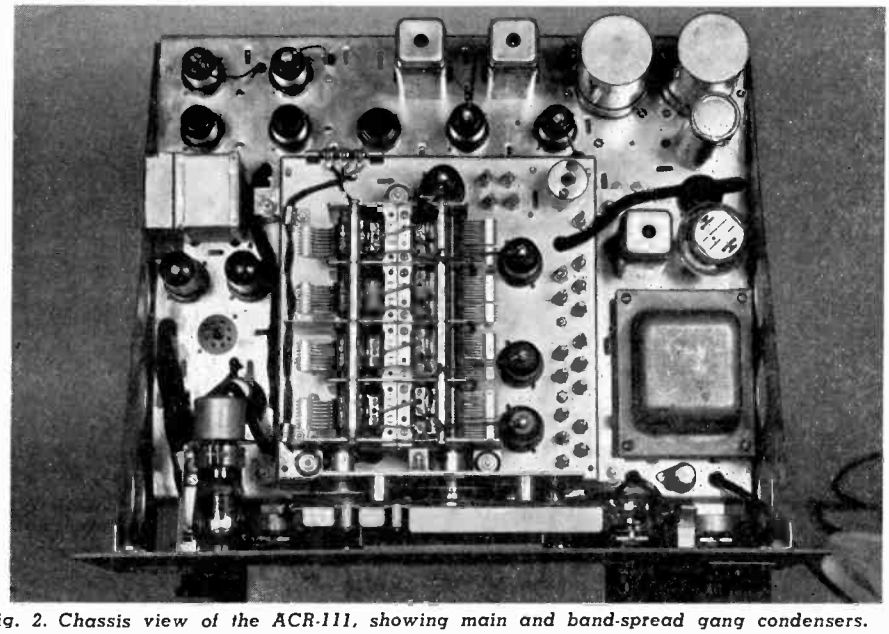


Fig. 2. Chassis view of the ACR-111, showing main and band-spread gang condensers.

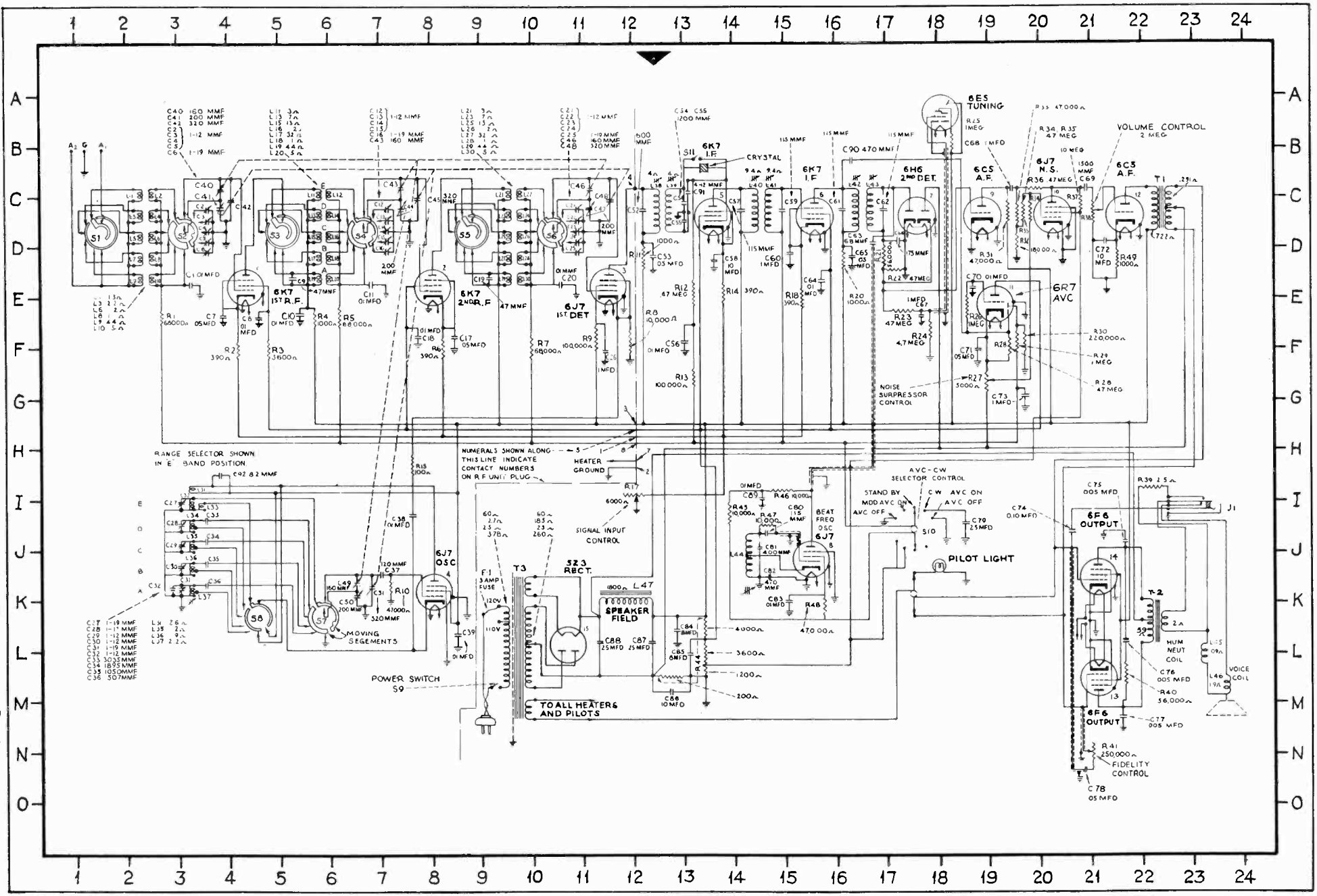


Fig. 3. Complete schematic diagram of the RCA ACR-111 Amateur Communication Receiver.

r.f. tuner chassis in Fig. 2. The Wave Range Switch shorts the coils not in use.

Voltage from the converter oscillator (at K-8 in diagram) is fed to the cathode of the first detector (at F-12) through a capacity coupling. The i.f. transformers (at C-13, 14 and 16) employ fixed condensers and variable magnetite cores, the peaking of the transformers being accomplished by an adjustment of the latter.

The 6H6 second detector (at C-17.5) also functions as a noise limiter, the basic action of the arrangement being similar to that of the Dickert Automatic Silencer, first described in the March 1937 ALL-WAVE RADIO. Signal detection is handled by No. 1 diode (left), the a.f. and d.c. components appearing across resistor R22. No. 2 diode is effectively placed in shunt with R22, with its plate biased approximately 20 volts negative with respect to the cathode, by means of the biasing portion of bleeder resistor R44 in the output of the power supply. Any signal or static of amplitude sufficient to cause the voltage across R22 to exceed 20 volts will cause No. 2 diode to draw current, or present a low impedance across R22, thereby acting as a noise limiter.

The Noise Suppressor

Signal voltage from the diode detector load circuit is fed directly to the grid of the first a.f. voltage amplifier tube (at C-19), the grid of this tube being diode biased. This tube is resistance-capacity coupled to the a.f. driver tube, the grid circuit of which carries the volume control. Also associated with this circuit is the 6J7 noise-suppressor tube (at C-20.5). The action of this tube is somewhat similar to that of the noise limiter, in that it is connected and so biased that its plate impedance is very high for desired signals, and very low for undesired noise impulses of short duration and amplitude greater than the desired signal. The plate impedance will be very high for control-grid bias valves sufficient to cause plate-current cut-off, and low for the bias values which will permit plate current to flow. The audio signal appearing across resistor R37, and consequently across the input circuit of the 6C5 a.f. driver tube will, therefore, depend upon the ratio of the plate impedance of the noise-suppressor tube to the resistance of R36, the series combination being essentially a voltage-dividing network. When the plate impedance is high, the ratio will be high, and practically the total audio voltage appearing across resistors R32 and R33 will appear across the plate circuit. The converse will occur with a low plate impedance. In operation, the bias is adjusted just below the point of plate current cut-off by means of the movable arm on potentiometer R27 (at E-19). Noise impulses of short duration, tending to make the grid more positive, will cause the plate impedance to be low during these impulses with a consequent reduction of input to the a.f. driver during these intervals.

Amplified A.V.C.

The 6R7 a.v.c. tube (at E-19) is employed as an amplifier to provide ample controlling voltage for the grids of the r.f. and i.f. tubes, thus resulting in a substantially flat a.v.c. characteristic. In operation, and under no-signal conditions, the cathode current flowing through potentiometer R27 develops a voltage across it of approximately 29 volts. This is in opposition to the approximate 20 volts drop across the bias section of the bleeder resistor R44, (at L-13) thereby making the cathode approximately 9 volts positive with respect to chassis ground, or to the plate of diode No. 1. When signals are present, a portion of the i.f. voltage is applied to diode plate No. 2, through condenser C90, for rectification. The d.c. voltage which develops across resistor R28 is applied to the control grid of the 6R7 through a resistance-capacity filter, making it more negative with respect to cathode, in turn reducing the cathode

(Continued on page 390)

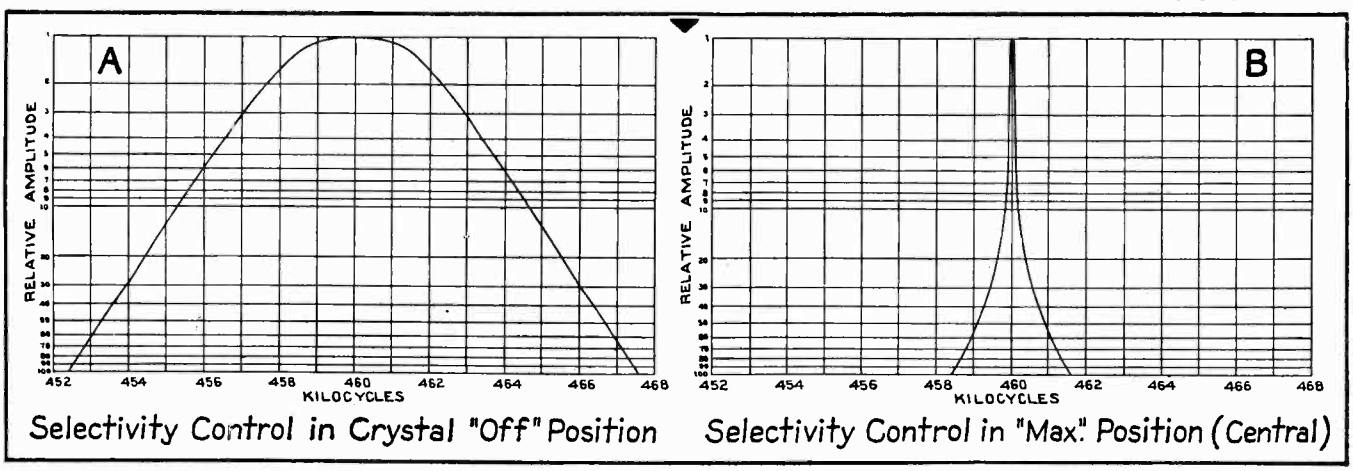
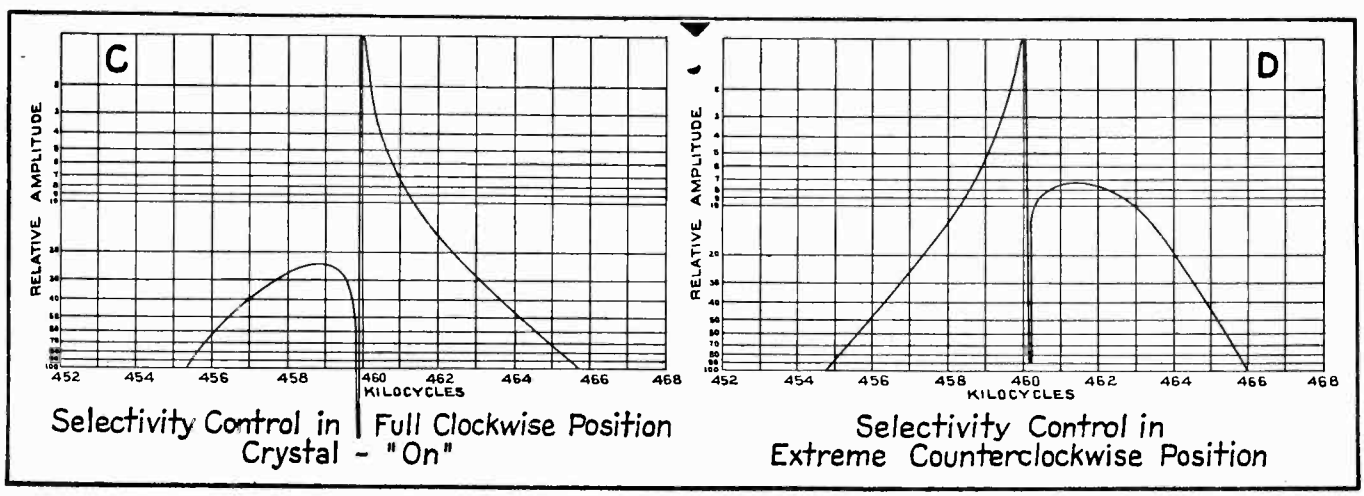


Fig. 4. Selectivity curves of ACR-111 with and without crystal filter.

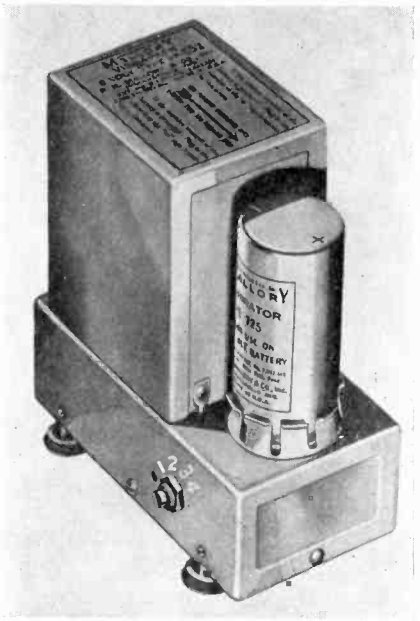


On the Market

New Line of Mallory 6-Volt Power Supplies

TO PROVIDE PORTABLE power for radio transmitters, P. A. equipment and similar apparatus, P. R. Mallory & Co., Inc. have introduced a line of 6-volt power supplies, called "Vibrapack," which are designed to give dependable service in heavy-duty application.

The two high-voltage models of Vibrapacks have a maximum rated output of 300 volts 100 m.a. of easily filtered, rectified d.c. with three lower voltages of 275, 250 and 225 volts instantly available at the turn of a convenient tap switch. The variable voltage is obtained by means of taps on the transformer windings so that maximum efficiency is always obtained.



The lower voltage models of the Vibrapacks deliver 200, 175, 150, 125 volts output and are ideal for converting 110-volt a.c. receivers for 6-volt battery operation.

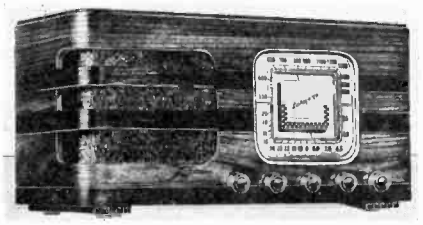
Mallory Vibrapacks are manufactured in both synchronous or self-rectifying types, and in interrupter or tube rectifying types; the latter being required only when B minus cannot be at ground potential. All Vibrapacks are supplied complete with long-life vibrators, designed specially for this particular application.

Mallory Vibrapacks are sold by authorized Mallory-Yaxley distributors who have an interesting free circular on this device. ALL-WAVE RADIO.

✦

Lafayette Trailer Radio

RADIO NEEDS OF the summer tourist for the trailer, the motor boat and summer camp, are met in the luxurious 6 volt d.c.—110 volt a.c. two-band receiver developed by Lafayette Manufacturing Company as their model D-32.



Six-volt storage battery and standard a.c. line serve equally well to operate this attractive, mantel-type radio. Change from one form of power to the other is effected without difficulty or delay, involving no more trouble than throwing the on-off switch to the proper position for the type of power in use. Moreover, mistakes in operating the switch can do no harm—the receiver will simply fail to function for the time being if the switch is put in the wrong position for the type of power applied.

The two-tone hardwood cabinet is designed to harmonize with the luxurious interiors of trailers or cruisers, eliminating the need for using unattractive dash-board receivers in such locations. It is equally suited to the summer bungalow where line power is not available. Measuring only 8½" x 9¾" x 18¾", and weighing 26 pounds, the same receiver is easily transferred to the home, or to a hotel room, where it does double duty as a standard a.c. mantel set of excellent quality.

Two bands are provided: 555 to 193 meters, and 52 to 18.4 meters. American Broadcasts, American Short-wave, European Short-wave, Amateur Calls, Police Calls, etc., reception is of a.c. quality and volume with either form of power supply.

The Lafayette D-32 receiver is sold exclusively by Wholesale Radio Service Company, Inc., at 100 Sixth Avenue, New York City, or through their branches at 901 W. Jackson Blvd., Chicago, Ill.; 430 W. Peachtree St., Atlanta, Ga.; 219 Central Avenue, Newark, N. J.; 542 E. Fordham Road, Bronx, New York City; and 90-08 166th Street, Jamaica, Long Island. It can be purchased by mail. ALL-WAVE RADIO.

✦

New Triad Tube

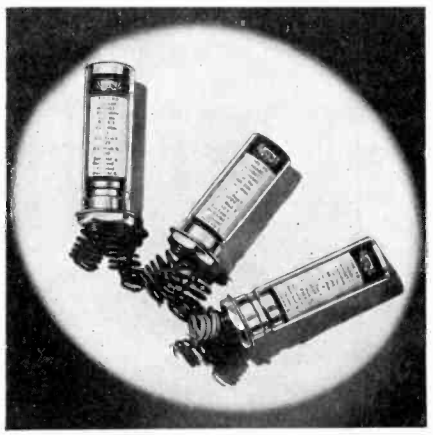
THE RELEASE OF a new output tube for Auto Receivers by the Triad Manufacturing Company, Pawtucket, Rhode Island, has just been made.

During the past year, the Triadyne Series, made up of the 6B5, the 6N6G and 6N6-MG, has been used in automotive radios. This new member of the family, the 6AB6G, has been designed along similar lines. The major improvement lies in the fact that the filament current has been reduced from .8 ampere to .5 ampere, and the bulb size reduced to the small ST-12 Bulb. The base is of the octal type. ALL-WAVE RADIO.

C-D Etched Foil Dry Electrolytics

IT IS A KNOWN fact that the power factor of a condenser is one of the conditions which determines its efficiency. Etched foil dry electrolytic condensers, which are extremely compact, are known to have higher power factors than equivalent plain foil types, due to the increased capacity per unit area. To the radio man, however, the etched foil anode proves a definite advantage, for, in spite of the higher power factor, the higher capacities permitted in such smaller sizes actually provide better filtering, it is said.

A recent development in condenser design is centered around the new etched foil dry electrolytic series of the Cornell-Dubilier Corporation. Engineers in the development laboratories of the South Plainfield, New Jersey, condenser plant announced that they have applied their exclusive hi-formation process to the manufacture of the KR and JR series, popular etched foil dry electrolytics of the Cornell-Dubilier Corporation, resulting in power factors on par with equivalent plain foil types.



C-D Sales Manager Leon Adelman tells us that these new developments precipitate a trend toward etched foil dry electrolytics. ALL-WAVE RADIO.

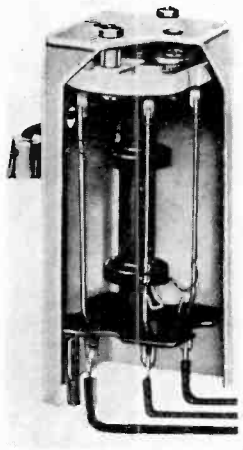
✦

New Aerovox Catalog

IT'S WITH A sigh of relief and perhaps of exhaustion that Bill Many, Advertising Manager of Aerovox Corporation, has put his latest catalog "to bed." Aerovox is issuing its biggest catalog in years —twice the number of pages of recent editions. Also, the entire format has been changed. The new catalog is the last word in attractive layouts, typography, and illustration. A new handy listing of all types of condensers facilitates finding just the kind of condenser best suited for any given application. Copies of the new catalog will be available shortly to those writing Aerovox Corporation, 70 Washington St., Brooklyn, N. Y. ALL-WAVE RADIO.

New Hammarlund Iron-Core Transformer

A NEW GROUP of iron core i.f. transformers are now being made by the Hammarlund Manufacturing Company, Inc., 424 West 33rd St. New York City.



These new transformers provide extremely high gain per stage together with extremely sharp selectivity. Specially developed finely powdered high permeability magnesium alloy, rust proof and non-corrosive, is used for the core. This core affords a great increase in inductance, thus permitting a reduction in the number of winding turns and consequently greatly reducing eddy current losses.

These transformers may be used with all tubes normally used in i.f. amplifiers. A single stage amplifier employing iron core transformers will usually provide as great a sensitivity and selectivity as two stages employing ordinary type of tranformers, it is said. An added advantage is that since less i.f. stages may be used, tube noises are greatly reduced.

Since the gain of these transformers is so high, special precautions must be taken when using them in two stage amplifiers. Therefore, five types are being made for single stage and two stage amplifier types. Their overall size is only 4⅛" high x 1¾" square. They are all tuned to a 465 kc. frequency. ALL WAVE RADIO.

◆

Du Mont Type 154 Oscillograph

DU MONT LABORATORIES have developed a new three-inch oscillograph. This instrument is complete in every detail, it embodies the desired features of the new type 34-XH Du Mont three-inch cathode-ray tube, separately controlled horizontal and vertical high-grain amplifiers, flat from 30 to 30,000 cycles, internal or external positive synchronization, high and low voltage power supplies insuring a brilliant pattern and no interaction of controls, direct connection to the horizontal and vertical deflection plates of the cathode-ray tube, amplified sweep, frequency range allowing observation of a single wave form 15 to 30,000 c.p.s. and separate positioning controls on the front panel.

Although this unit is designed as a service instrument to be used in conjunction with any standard frequency modulated oscillator, it is also designed to serve the many purposes of a really efficient portable three-inch oscillograph. ALL-WAVE RADIO.

◆

New RCA Victor Record Players

RCA VICTOR has announced two improved record-playing instruments in the low-price range. The new instruments are of the type which reproduces phonograph records when connected to electrically-operated radio sets.

As a successor to the R-93 model, RCA Victor introduces record-player model R-93-A. The Camden engineers have made a number of notable improvements in the R-93-A. These include a more efficient motor insuring more constant speed of the turntable; an improved pick-up arm, which gives an even better tonal range; quieter operation and marked improvement in the bass response through the use of bass compensation.

To replace another popular record-player, Model R-93-2, RCA Victor introduces the latest in deluxe record players, Model R-94. This instrument is housed in a handsome hinged cabinet of choice walnut veneers,

beautifully finished. Its mechanism is completely new and a vast improvement over its predecessor. Both 10" and 12" records may be played on it with the lid closed. Automatic starting of the turntable and bass compensation are two of its superior features. The excellent tonal balance of the previous model has been retained and in addition uniformly good reproduction at low volume has been provided by a new compensated volume control. The pick-up on this instrument has also been improved. ALL-WAVE RADIO.

◆

New Cinaudagraph Speakers

THE CINAUDAGRAPH Corporation of Stamford, Connecticut, announces a new series of small speakers. Although the speaker diameters are only five inches, the units incorporate the three features which made the Cinaudagraph line famous—namely: the polyfibrous cone material, the dust-proof

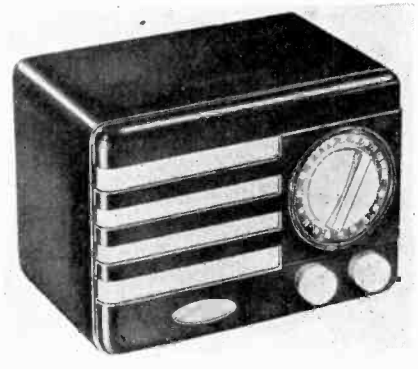
voice coil and the powerful magnet alloy, "Nipermag." The polyfibrous cone provides audio response of a large frequency range, which is said to be unobtainable with other type cones.

There are two models, one of which is 5⅜ inches in outside diameter without mounting holes. This model is to be clamped into position and is designed for intercommunication systems and for Header type automobile installations. The other model is 5¾ inches in outside diameter with mounting holes and is designed for those applications where the six-inch speaker is found to be too large. ALL-WAVE RADIO.

◆

Allied Plastic Radio Sets

PLASTIC RADIO SETS, available in four attractive colors, are featured by Allied Radio Corporation, Chicago. Completely new in every detail, these sets are not only handsome in appearance, but also extremely practical, since the cabinets will not mar or discolor, and always assure excellent acoustical quality. The Knight plastic set illustrated is a 5 tube a.c.-d.c. model which tunes two bands from 75 to 550 meters and employs the new 25L6 Beam Power Amplifier tube. Other features are: 5" electro-dynamic speaker; novel, illuminated dial; built-in antenna, etc. The four optional colors are red, black, ivory and walnut. This receiver is one of the 53 Knight radios described in the 156 page Allied Catalog. ALL-WAVE RADIO.



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.	7 A.M.-1 A.M. Daily
31600	9.4	W1XKB	• Springfield, Mass.	7 A.M.-1 A.M. Daily
31600	9.4	W8XKA	• Pittsburgh, Pa.	9 A.M.-1 A.M. Daily
31600	9.4	W3XKA	• Philadelphia, Pa.	10 A.M.-11 P.M. Daily
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.
27800	10.79	DGF	Nauen, Germany	(P) Phones irreg.
27400	10.95	DGE	Nauen, Germany	(P) Phones irreg.
26800	11.19	DGX	Nauen, Germany	(P) Phones irreg.
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
24300	12.35	DGV	Nauen, Germany	(P) Phones irreg.
23350	12.85	DGT	Nauen, Germany	(P) Phones irreg.
22800	13.16	DGS	Nauen, Germany	(P) Phones irreg.
21550	13.92	GST	• Daventry, England	Not in use
21540	13.92	W8XK	• Pittsburgh, Pa.	6:30 A.M.-9 A.M. daily
21530	13.93	GSJ	• Daventry, England	5:45-8:55 A.M., 9:15 A.M.-12 noon daily
21520	13.94	W2XE	• Wayne, N. J.	7:30 A.M.-12 noon daily
21520	13.94	JZM	• Nazaki, Japan	Irregular
21500	13.95	NAA	Washington, D. C.	(E) Time signals
21470	13.97	GSH	• Daventry, England	5:45-8:55 A.M., 9:15 A.M-12 noon daily
21460	13.98	W1XAL	• Boston, Mass.	Irregular
21450	13.99	OLR6A	• Prague, Czechoslovakia	Irregular (see 15230-11840 kc.)
21420	14.01	WKK	Lawrenceville, N. J.	(P) Phones LSN - PSA daytime; HJY - OCI-OCJ irregular
21260	14.11	WBU	Rocky Point, N. Y.	(P) Irregular
21220	14.14	WQA	Rocky Point, N. Y.	(P) 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.
20500	14.63	DGQ	Nauen, Germany	(P) Phones irreg.
20380	14.72	GAA	Rugby, England	(P) Phones LSL mornings; LSY-LSM-PPU irregular
20140	14.90	DGW	Nauen, Germany	(P) Phones irreg.
20040	14.97	OPL	Leopoldville, Belgian Congo, Africa	(P) Tests with ORG mornings and noon
20020	14.99	DFZ	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.
19947	15.04	DLO	Rehmate, Germany	(P) Phones irreg.
19820	15.14	WKN	Lawrenceville, N. J.	(P) Phones GAU A.M.
19720	15.21	EAQ	Madrid. Spain	(P) Relays & tests A.M.
19700	15.23	DFJ	Nauen, Germany	(P) Phones irreg.
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
19460	15.42	DFM	Nauen, Germany	(P) Phones irreg.
19355	15.50	FTM	St. Assise, France	(P) Phones LSM-PPU-YVR mornings
19345	15.52	PMA	Bandoeng, Java	(P) Phones Amsterdam 3-11 A.M.
19270	15.57	PPU	Rio de Janeiro, Brazil	(P) Phones DFB-EHY-FTM 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
18880	15.89	WQH	Rocky Point, N. Y.	(P) Irregular
18825	15.94	PLE	Bandoeng, Java	(P) Phones San Francisco 7-8:30 A.M. Tokyo 8:30 P.M.-7 A.M.
18776	15.98	TYD-3	Paris, France	(P) Phones Madagascar
18700	16.04	DFQ	Nauen, Germany	(P) Phones irreg.
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 Amsterdam 3-11 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.
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	5:45-8:55 A.M., 9:15 A.M.-12 noon, 12:15-4 P.M., 4-6 P.M. 11:30 P.M.-1:45 A.M. daily
17785	16.87	JZL	• Nazaki, Japan	Irregular
17780	16.87	W3XAL	• Bound Brook, N. J.	Sun. 7 A.M.-6:30 P.M. Weekdays—6:30 A.M.-6:30 P.M.
17780	16.87	W9XAA	• Chicago, Ill.	Not in use at present

Short-Wave Station List

KC	Meters	Call	Location	Time
17770	16.88	PHI	●Hilversum, Holland	Sun. 7-10 A.M., Mon., Tues., Thurs., Fri. 8-9:30 A.M. Sat. 8-10:40 A.M.
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. Sun. 11:10 A.M-12:25 P.M.
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.
17650	17.00	XGM	Shanghai, China	(P) Phones irreg.
17620	17.03	IBC	San Paolo, Italy	(P) Irregular
17545	17.10	VWY	Poona, India	(P) Phones GAU-GBC-GBU mornings
17520	17.12	DFB	Nauen, Germany	(P) Phones PPU-YVR-KAY mornings
17480	17.16	VWY	Poona, India	(P) Phones GAU-GBC-GBU daytime
17341	17.30	DGR	Nauen, Germany	(P) Phones irreg.
17280	17.36	FZE8	Djibouti, French Somaliland, Africa	(P) Irregular
17265	17.38	DAF	Norddeich, Germany	(P) Phones ships irreg.
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.
15800	18.99	XOJ	Shanghai, China	(E) Phones GBA 6-7 A.M., KWO-KWU 8-11 P.M.
15760	19.04	JYT	Kemikawa-Cho, Japan	(E) Tests KKW-KWE-KWU evenings
15740	19.06	IIA	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.
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	DZG	●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., 4:50-10:45 P.M. daily
15330	19.56	W2XAD	●Schenectady, N. Y.	10 A.M.-6 P.M. daily
15320	19.58	OLR5B	●Prague, Czechoslovakia	Irregular (see 15230-11840 kc.)
15310	19.60	GSP	●Daventry, England	6:20-8:30 P.M. daily
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	HI3X	●Ciudad Trujillo, R. D.	Sundays, 7:40-10:40 A.M.; weekdays, 12:10-1:10 P.M.
15280	19.63	LRU	●Buenos Aires, Arg.	6 A.M.-6 P.M.
15280	19.63	DJQ	●Zeesen, Germany	12:05-5:15 A.M., 6-8 A.M., 8:15-11 A.M., 4:50-10:45 P.M. daily. Sun., 11:10 A.M.-12:25 P.M.
15270	19.64	W2XE	●Wayne, N. J.	1-7 P.M. daily
15260	19.66	GSI	●Daventry, England	12:15-4 P.M., 9-11 P.M. daily
15252	19.67	RIM	Tashkent, USSR.	(P) Phones RKI early mornings
15250	19.67	W1XAL	●Boston, Mass.	3:30-4 P.M. daily
15243	19.68	TPA2	●Pontoise, France	6-11:05 A.M. daily
15230	19.70	OLR5A	●Prague, Czechoslovakia	Daily, 7:55-9:50 A.M., 2-2:15 P.M.
15220	19.71	PCJ	●Hilversum, Holland	Tues., 4:30-6 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., 4:55-10:45 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	5:45-8:45 A.M., 4-6 P.M., 6:20-8:30 P.M., 11:30 P.M.-1:45 A.M. daily
15160	19.79	OLR5C	●Prague, Czechoslovakia	Irregular (see 15230-11840 kc.)
15160	19.79	JZK	●Nazaki, Japan	Irregular
15150	19.80	YDC	●Soerabaja, Java	5:30-10 A.M., 6-8:30 P.M., 10:30 P.M.-2 A.M. daily
15145	19.81	RKI	●Moscow, USSR.	Broadcasts irreg. Sun. Phones RIM A.M.
15140	19.82	GSF	●Daventry, England	9:15 A.M.-12 noon, 4-6 P.M., 9-11 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
14665	20.46	DFD	Nauen, Germany	(P) Phones irreg.
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
14605	20.54	DGZ	Nauen, Germany	(P) Phones irreg.
14600	20.55	JVH	●Nazaki, Japan	(E) Phones DFB-GTI-PCJ-TYB early mornings. Broadcasts irreg.
14590	20.56	WMN	Lawrenceville, N. J.	(P) Phones England days
14535	20.64	HBJ	●Geneva, Switzerland	Phones irregular BC-6:45-8:30 P.M. Saturdays
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

Short-Wave Station List

KC	Meters	Call	Location	Time
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	DOT	Konigs W'n, Germany	(P) Phones irreg.
14410	20.82	IBC	San Paolo, Italy	(P) Irregular
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
13667	21.98	HJY	Bogota, Colombia	(P) Phones CEC afternoons
13635	22.00	SPW	●Warsaw, Poland	12:30-1:30 P.M. Mon., Wed., Fri.
13610	22.04	JVK	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
13275	22.60	DAF	Norddeich, Germany	(P) Phones ships irreg.
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
13100	22.90	DAF	Norddeich, Germany	(P) Phones ships irreg.
13020	23.04	IZE	Nazaki, Japan	(P) Phones ships irreg.
13000	23.08	TYC	Paris, France	(P) Phones CNR A.M.
12985	23.10	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.
12500	24.00	HIN	●Ciudad Trujillo, R.D.	11:40 A.M.-1:40 P.M., 7:10-9:50 P.M. ex. Sunday
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
12120	24.75	TPZ	Alger, Algeria, Africa	(P) 12-1 A.M. Irreg.
12100	24.79	CJA	Drummondville, Que.	(P) Tests V1Y early A. M. and evenings
12060	24.88	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12035	24.93	DGL	Nauen, Germany	(P) Phones irreg.
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	V1Y	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., Sun., Mon., Wed., Fri., 4-5 P.M.
11991	25.02	FZS	Saigon, Indo-China	(P) Phones FTA - FTK early A.M.
11960	25.08	HI2X	●Cuidad Tryillo, R. D.	Tues. & Fri., 8-10-10:10 P.M.
11955	25.09	IBC	San Paolo, Italy	(P) Irregular
11955	25.09	1UC	●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 15230-11840 kc.)
11895	25.22	XEXR	●Mexico City, Mexico	6-11:30 P.M.
11895	25.22	HP5I	●Aguadulce, Panama	7:30-9:30 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 15230-11840 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	DIP	●Zeesen, Germany	Irregular
11840	25.34	OLR4A	●Prague, Czechoslovakia	Daily 2:30-4:30 P.M. Mon. & Thurs. 8-10:10 P.M.
11830	25.36	W2XE	●Wayne, N. J.	7-10 P.M. daily
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., 2:30-3:30 P.M., 12-1 A.M. daily
11795	25.43	DIQ	●Zeesen, Germany	Irregular
11790	25.43	W1XAL	●Boston, Mass.	Weekdays 4-5:30 P.M. Sundays 3:30-5:30 P.M.
11770	25.49	DJD	●Zeesen, Germany	11:35 A.M.-4:30 P.M., 4:50-10:45 P.M.
11760	25.50	XETA	●Monterrey, Mexico	7-11 P.M. daily
11760	25.51	OLR4B	●Prague, Czechoslovakia	Irregular (see 15230-11840 kc.)
11750	25.53	GSD	●Daventry, England	12:15-4 P.M., 6:20-8:30 P.M., 11:30 P.M.-1:45 A.M. daily
11740	25.55	RKF	Moscow, U.S.S.R.	(P) Calls U.S.S.R. phones often
11740	25.55	HP5L	●David, Panama	4-7 P.M. daily
11730	25.57	XETM	●Villahermosa, Mexico	6-11 P.M. daily
11730	25.57	PHI	●Hilversum, Holland	Irregular
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
11718	25.60	CR7BH	●Lourenco Marques, E. Africa	Sundays 6-8 A.M., 10 A.M.-12:30 P.M., 1:30-3:30 P. M. Weekdays, Mon. to Sat., 11:45 P.M. (Sunday)-12:30 A.M., 4:30-6:30 A.M., 9:30-11 A.M., 12:30-4 P.M.
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., 8 A.M. and later
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

Short-Wave Station List

KC	Meters	Call	Location	Time
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.
11500	26.09	COCX	●Havana, Cuba	8 A.M.-1 A.M. daily
11495	26.10	V1Z3	Rockbank, Australia	(P) Tests CJA4 early A.M.
11413	26.28	CJA4	Drummondville, Que.	(P) Phones VIZ3 early A.M.
11402	26.31	HBO	●Geneva, Switzerland	Phones irreg. BC 6:45-8:30 P.M. Saturdays
11340	26.46	DAF	Norddeich, Germany	(P) Phones ships irreg.
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	12-6 P.M. daily
11000	27.27	PLP	●Bandoeng, Java	Phones Makasser 2-5 A.M., 8:30-10:30 P.M., BC 5-10 A.M., 6-8:30 P.M., 10:30 A.M.-2 A.M. daily
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.
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; 2:30-3:30 P.M. daily. Overseas
10680	28.09	PLQ	Bandoeng, Java	(P) Phones Knala Lumpur, Medan and Makasser 5:30-9 A.M., 10 P.M.-2 A.M.
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	HPH	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 be'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-HSJ-HSP early A.M.
10430	28.76	YBG	Medan, Sumatra	(P) Phones PLV-PLP early A.M.
10430	28.76	TYE-3	Paris, France	(P) Phones U.S.A. irreg.
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, Tenerife, C. I.	2:15-3:50 P.M., 6-7 P.M., 7:10-9:30 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	●Tablero, Tenerife, C. I.	(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	BC Phones Sydney and Medan 8:30-10:30 P.M., 2-5:30 A.M., 5:30-10 A.M., 6-8:30 P.M., 10:30 P.M.-2 A.M. daily
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.
10210	29.38	DGD	Nauen, Germany	(P) Phones 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
10135	29.60	CQN	●Macao, China	Mon. & Fri., 7-8:30 A.M.
10128	29.62	DON	Konigs W'n., Germany	(P) Phones irreg.
10120	29.64	PSI	Rio de Janeiro, Brazil	(P) Phones LSI, 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	WCU	San Juan, P. R.	(P) Phones WNC irreg., 6-8 P.M. daily
9940	30.18	CSW	●Lisbon, Portugal	6-8 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
9920	30.24	DGM	Nauen, Germany	(P) Phones irreg.
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	FYC-2	Paris, France	(P) Phones U.S.A. irreg.
9840	30.47	JYS	Kemikawa-Cho, Japan	(E) Tests irregular
9830	30.50	IRM	Rome, Italy	(P) Phones JVP-JZT-LSX-WEL A.M.
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	Weekdays 6:55 A.M.-1 A.M. Sundays 6:55 A.M.-12:01 A.M.
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.
9666	31.04	CR4AA	●Lobito, West Africa	2:45-4:30 P.M. Wed. & Sat. (see 7177 kc.)
9660	31.06	LRX	●Buenos Aires, Arg.	6-11:30 P.M. daily
9660	31.06	PSJ	Rio de Janeiro, Brazil	(P) Irreg., Argentina
9650	31.09	CT1AA	●Lisbon, Portugal	Tues., Thurs., Sat., 4-7 P.M.

Short-Wave Station List

KC	Meters	Call	Location	Time
9650	31.09	DGU	Nauen, Germany	(P) Phones SUV in A. M. Relays irreg.
9645	31.10	HH3W	● Port-au-Prince, Haiti	1-2 P.M., 7-8:30 P.M. ex. Sunday
9635	31.13	2RO3	● Rome, Italy	12:30-6 P.M. daily ex. Sat. Sat., 1:20-5:30 P. M. Mon., Wed., Fri., Amer. Hour 6-7:30 P. M.; Tues., Thurs., Sat., Lat. Amer. 6-7:45 P.M.
9630	31.15	CFA5	Drummondville, Que.	(P) Phones No. America days
9620	31.17	HJ1ABP	● Cartagena, Colombia	7-9 A.M., 11 A.M.-1:20 P.M., 6-11 P.M. daily
9620	31.17	FZR	Saigon, Indo-China	(P) Phones Paris early A.M.
9600	31.25	RAN	● Moscow, USSR.	7-9:15 P.M. daily
9600	31.25	XEYU	● Mexico D. F.	7-10 P.M. daily
9600	31.25	CB960	● Santiago, Chile	Daily 11:30 A.M.-2 P.M., 9:30 P.M.-12 A.M.
9595	31.27	HBL	● Geneva, Switzerland	5:30-6 P.M. Saturdays
9595	31.27	YNLF	● Managua, Nicaragua	8-9 A.M., 1-3 P.M., 6:30 10:30 P.M. daily
9590	31.28	VK6ME	● Perth, W. Australia	Daily ex. Sun. 6-8 A.M.
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 12-2 A.M., 5-9 A. M., 11:30 A.M-1:30 P. 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., Mon. 7-8 P.M. Tues., 1:30-3 P. M., Wed. 7-10:30 P. M.
9580	31.32	GSC	● Daventry, England	9-11 P.M. daily
9580	31.32	VK3LR	● Melbourne, Australia	Sun. 3-7 A.M., 8:45-9:45 A.M., Mon to Fri., 4-8:30 A.M., 8:45-9:45 A.M., Sat. 4-8:30 A. M., 8:45-9:45 A.M., 10 P.M.-3 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.
9565	31.36	YV3RB	● Barquisimeto, Venezuela	Daily 11:30 A.M.-12:30 P.M., 5:30-9:30 P.M.
9562	31.38	OAX4T	● Lima, Peru	7-11 P.M.
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	YDB	● Soerabaja, Java	Sun. 5:30-10:30 A.M. 7:30 P.M.-2 A.M. Weekdays 5:30-10:30 A.M. or 11 A.M. (Sat. 11:30 A.M.), 6-7:30 P.M., 10:30 P.M.-2 A.M.
9550	31.41	HI5E	● Ciudad Trujillo, R. D.	Irregular
9550	31.41	OLR3A	● Prague, Czechoslovakia	Irregular (see 15230-11840 kc.)
9545	31.44	HH2R	● Port-au-Prince, Haiti	Special programs irreg.
9540	31.45	VPD-2	● Suva, Fiji Is.	5:30-7:30 A.M. daily
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. 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.
9523	31.50	"Radio Liberte"	● Paris, France	7-8 P.M. daily (see 7380 kc.)
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	12:15-6 P.M., 6:20-8:30 P.M., 11:30 P.M.-1:45 A.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	10:30 A.M.-4:30 P.M., 7:30 P.M.-12:30 A.M. daily. Sundays begin 9 P.M. (see 6120 kc.)
9504	31.57	OLR3B	● Prague, Czechoslovakia	Irregular (see 15230-11840 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.9A.M.-3P.M.
9490	31.61	KEI	Bolinas, Calif.	(P) Phones Indo-China and China A.M.
9480	31.65	EAR	● Madrid, Spain	Tues. & Fri., 7:45-9 P.M. English and irregular
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	"Radio Fort de France"	● Fort de France, Martinique	11:30 A.M.-12:30 P.M., 6:15-7:15 P.M., 8-9 P. M. daily
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.
9440	31.78	HCODA	● Guayaquil, Ecuador	8-11 P.M. ex. Sunday
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 San Francisco 9:30-10:30 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.
9345	32.10	HBL	Geneva, Switzerland	(E) Broadcasts and phones irreg.
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	Weekdays 12-2 P.M., 5-6 P.M. Sundays 11 A.M.-12 noon
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	Sun. 7-8 P.M., Wed. 7-8 P.M., Sat. 6-7 P.M
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
9037	33.19	TYA-2	Paris, France	(P) Phones Algiers, irreg.
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	TPZ2	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 - 8:45 A.M. daily, 11:30 A.M.-2:30 P.M., 5-10 P.M. ex. Mondays (To 7 P.M. on 4107 k.c., after 7 P.M. on 4107 and 8948 k.c.)
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
8765	34.23	DAF	Norddeich, Germany	(P) Phones ships irreg.
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
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	COJK	● Camaguey, Cuba	7:45-9:00 P.M. weekdays. Sundays irreg.
8650	34.68	YN1PR	● Managua, Nicaragua	Weekdays 1:15-2:15 P. M., 8:30-10 P.M.
8650	34.68	WVD	Seattle, Wash.	(P) Tests irregularly
8630	34.76	CMA	Havana, Cuba	(P) Phones N. Y. irreg.

Short-Wave Station List

KC	Meters	Call	Location	Time
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.
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.
8330	36.01	DAS	Rugen, Germany	(P) Phones ships 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
8075	37.15	TYB-2	Paris, France	(P) Phones Morocco irreg.
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.
7812.5	38.40	DFT	Nauen, Germany	(P) Phones irreg.
7797	38.47	HBP	●Geneva, Switzerland	5:30-6 P.M., Saturdays
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	38.39	KEE	Bolinas, Calif.	(P) Relays programs to Hawaii seasonally
7700	38.96	TYC-2	Paris, France	(P) Phones Cairo irreg.
7670	39.11	WDF	San Juan, P. R.	(P) Phones WNC irreg.
7669	39.11	TGF	Guatemala City, Guate.	(P) Phones TIU - HPF daytime
7650	39.22	TYE-4	Paris, France	(P) Phones U.S.A. irreg.
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
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
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	Wien, Austria	(P) Tests early evenings very irreg.
7380	40.65	"Radio Liberte"	●Paris, France	7-8 P.M. daily (see 9523 kc.)
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.
7332.5	40.92	DLC	Rehmate, Germany	(P) Phones irreg.
7211	41.60	EA8AB	●Santa Cruz, Tenerife, C. I.	Mon., Wed., Fri., Sat., 3:15-4:15 P.M.
7203	41.64	EAJ	●San Sebastian, Tenerife, C. I.	4 P.M.-12 A.M. and later
7200	41.67	YNAM	●Managua, Nicaragua	Daily 7-10 P.M.
7177	41.80	CR6AA	●Lobito, West Africa	2:45-4:30 P.M. Wed. & Sat.
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
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
6975	43.01	HCETC	●Quito, Ecuador	Sat. & Mon. 7:45-9 A.M.
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.
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.	Weekdays 12:40-1:40 P. M., 6:40-8:40 P.M. Sundays 9:40-10:40 A. M.
6795	44.15	GAB	Rugby, England	(P) Phones Canada irreg.
6788	44.20	PZH	●Paramaribo, D. Guiana	Sunday, 9:45-11:45 A.M. Weekdays 2:45 - 4:45, 5:45-9:45 P.M.
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
6732.5	44.56	KBK	Manila, P.I.	(P) Phones irreg.
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	WQO	Rocky Point, N. Y.	(E) Tests evenings irreg.
6720	44.64	PMH	●Bandoeng, Java	Phones early A.M. B.C. 5:30-11 A.M. daily
6690	44.84	TIEP	●San Jose, Costa Rica	7-11 P.M. daily
6690	44.84	CGA-6	Drummondville, Que.	(P) Phones Europe irregularly
6675	44.94	HBQ	Geneva, Switzerland	(E) Broadcasts and phones irreg.
6668	44.99	HC2RL	●Guayaquil, Ecuador	Sun. 5:30 - 7:30 P.M. Tues. 9-11 P.M.
6650	45.11	GBY	Rugby, England	(P) Phones U.S.A. irreg.
6650	45.11	IAC	Pisa, Italy	(P) Phones ships irreg.
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.
6600	45.45	DAF	Norddeich, Germany	(P) Phones irreg.
6575	45.63	HC1VT	●Ambato, Ecuador	Mon., Wed., Fri., 8-10:30 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.
6485	46.26	"Radio Guardia Civil"	●Tetuan, Sp. Morocco, Africa	7-8 P.M. ex. Sunday
6482	46.28	HI4D	●Ciudad Trujillo, R. D.	Mon. & Sat., 11:55 A. M.-1:40 P.M., 4:40-7:40 P.M.
6480	46.30	EDR-4	●Palma de Mallorca, Balearic Is.	4:30-5:15 P.M. daily
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., 6:40-9:15 P.M. daily
6445	46.55	YVQ	●Maracay, Venezuela	8-9 P.M. Saturdays
6445	46.55	YVQ	Maracay, Venezuela	(P) Phones LSL irreg.
6420	46.73	HI1S	●Santiago de los Caballeros, R. D.	11:40 A.M.-1:40 P.M., 5:40-7:40 P.M.
6420	46.73	YV6RC	●Ciudad. Bolivar, Venez.	Daily 10:30 A.M.-1:30 P.M., 4:30-9:30 P.M.

KC	Meters	Call	Location	Time
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	Weekdays 11 A.M.-1:30 P.M., 4:30-9:30 P.M. Sun. 9:30 A.M.-1:30 P.M., 5-7:30 P.M.
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	HI1X	● Ciudad Trujillo, R. D.	Sun. 7:40-10:40 A.M. Weekdays 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.
6310	47.54	TG2	● Guatemale City, Guatemala	11 P.M.-2 A.M.
6300	47.62	YV4RD	● Maracay, Venezuela	6:30-9:30 P.M. ex. Sun.
6280	47.77	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
6260	47.92	OAX4G	● Lima, Peru	7-11 P.M. daily
6250	48.00	YV5RJ	● Caracas, Venezuela	5:30-9:30 P.M. daily
6243	48.05	HIN	● Ciudad Trujillo, R. D.	(See 12500 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	8-11 P.M., Sundays 4-6 P.M.
6230	48.15	YV1RG	● Valera, Venezuela	11 A.M.-12:30 P.M., 5:30 8:30 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 7-11:30 A.M. To 12:30 P.M. Saturdays
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, 6:15-10 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	● Moca, 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	OAX1A	● Chiclayo, Peru	7-10:30 P.M. daily
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	Sundays 6-8 A.M., 10 A.M.-12:30 P.M., 1:30-3:30 P.M. Mon. to Sat., 11:45 P.M. (Sunday)-12:30 A.M., 4:30-6:30 A.M., 9:30-11 A.M., 12:30-4 P.M.
6133	48.91	XEXA	● 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	Weekdays 9 A.M.-1 A.M. Sundays 1-3 A.M., 10 A.M.-8 P.M.
6130	48.94	VE9HX	● Halifax, Nova Scotia	Sunday 3-9:45 P.M. Mon. to Fri. 5:30 A.M.-9:45 P.M., Sat. 10 A.M.-9:45 P.M.
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	HP5H	● Panama City, Panama	7-10 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	Not in use (see 9510 kc.)
6120	49.02	W2XE	● Wayne, N. J.	10-11 P.M. daily
6120	49.02	XEUZ	● Mexico City, Mexico	8 P.M.-2 A.M. daily
6115	49.06	OLR2C	● Prague, Czechoslovakia	Irregular (see 15230-11840 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	Daily ex. Mon. 11 A.M.-4 P.M., 7 P.M.-12 A.M. Mondays 9 A.M.-4 P.M.
6100	49.18	Belgrade	● Belgrade, Yugoslavia	1 A.M.-5 P.M. daily
6100	49.18	W9XF	● Chicago, Illinois	Mon. to Fri. 11:05 P.M.-2 A.M. Sat. 12-2 A.M. Sun. 11:05-12 A.M., 1:05-2 A.M.
6100	49.18	W3XAL	● Bound Brook, N. J.	Sun. to Fri. 7-10 P.M., Sat. 7 P.M.-12 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	9:30 A.M.-1 P.M., 5-11:30 P.M. daily
6095	49.22	JZH	● Nazaki, Japan	Irregular
6092	49.24	OAX4Z	● Lima, Peru	7-11:30 P.M. daily
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	9-11 A.M., 1-4 P.M., 8-11:30 P.M. or 12 A.M.
6070	49.42	CFRX	● Toronto, Ont.	Daily 7:30-12.05 A.M.
6070	49.42	YV1RD	● Maracaibo, Venezuela	Daily 8 P.M.-12 A.M. Sun. 8 A.M.-8 P.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. Weekdays
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.
6045	49.62	XETW	● Tampico, Mexico	7 P.M.-12 A.M. daily
6043	49.62	HJ1ABG	● Barranquilla, Colombia	Daily 11 A.M.-11 P.M. Sun., 11 A.M.-8 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.	Tuesdays 6-8 P.M., Sundays 8-9:30 P.M.
6030	49.75	OLR2B	● Prague, Czechoslovakia	Irregular (see 15230-11840 kc.)
6030	49.75	HP5B	● Panama City, Panama	12-1 P.M., 5-10 P.M.
6030	49.75	HJ4ABP	● Medellin, Colombia	8 A.M.-11 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

Short-Wave Station List

KC	Meters	Call	Location	Time
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	Weekdays, 4:45-8:45 P. M. Mon., Wed., Fri. 10:15-11:15 A.M. Sun. 8:45-11:15 A.M.
6010	49.92	VK9MI	● Sydney, Australia "S.S. Kanimbla"	11 P.M.-8 A.M. & later. Irregular
6010	49.92	COCO	● Havana, Cuba	8 A.M.-10 P.M. daily
6010	49.92	OLR2A	● Prague, Czechoslovakia	Irregular (see 15230-11840 kc.)
6005	49.96	HP5K	● Colon, Panama	7:30-9 A.M., 11:30 A.M.-1 P.M., 6-11 P.M.
6005	49.96	CFCX	● Montreal, Que.	Weekdays 7:44 A.M.-1 A.M. Sundays, 9 A.M.-11:15 P.M.
6005	49.96	VE9DN	● Montreal, Que.	Sat. 11 P.M.-12 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.	Not in use.
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.-11:30 P.M.; Sundays, 1-2 P.M.
5930	50.59	PJC1	● Willemstad, Curacao	Weekdays 6:36-8:36 P.M. Sun. 10:36 A.M.-12:36 P.M.
5930	50.59	YV1RL	● Maracaibo, Venezuela	Weekdays, 11 A.M.-1 P.M., 4:30 - 9:30 P.M. Sun., 8:30 A.M.-2:30 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	TILS	● San Jose, Costa Rica	6-11 P.M. daily
5900	50.84	ZNB	● Mafeking, South Africa	Sun., 1:30 - 2:30 P.M. Mon. to Sat., 1-2:30 P.M.
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.)
5885	50.98	HI9B	● Santiago de los Caballeros, R. D.	Weekdays, 7:30 - 8:45 A.M., 12-2 P.M., 5-7:45 P.M. Sunday, 11:45 A.M.-2:45 P.M.
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	Daily ex. Sun. 10:45 A.M.-12:45 P.M., 4:45-9:45 P.M. Sun. 8:45 A.M.-9:45 P.M. Mon., Wed., Fri., 5:45-8:15 A.M. Tues., Thurs., Sat., 5:45-9:45 A.M.
5830	51.28	GBT	Rugby, England	(P) Phones U.S.A. irreg.
5845	51.33	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	Sun. 8:30 A.M.-10:30 P.M. Mon.-Fri., 7-8 A.M., 10:45 A.M.-1:45 P.M., 4-9:30 P.M. Ex. Wed.—off 9:15 P.M. Thurs. off 10 P.M. Sat. 7-8 A.M., 10:45 A.M.-3:30 P.M., 4-9:30 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 ex. Sunday
5755	52.13	YV2RA	● San Cristobal, Venez.	Sundays 5:30-10 P.M. Weekdays 11:30 A.M.-12:30 P.M., 5:30-9 P.M.
5750	52.17	XAM	Merida, Mexico	(P) Phones XDR-XDF early evenings
5730	52.36	JVV	Nazaki, Japan	(P) Phones JZC early A.M.
5725	52.40	HC1PM	● Quito, Ecuador	Saturdays 9-11 P.M.
5713	52.51	TGS	● Guatemala City, Guat.	Sun., Wed., Fri., 6-8 P.M.
5705	52.59	CFU	Rossland, Canada	(P) Phones CFO and CFN eves.; news, 8:30-8:45 P.M.
5670	52.91	DAF	Norddeich, Germany	(P) Phones ships irreg.
5635	53.24	DAS	Rugen, Germany	(P) Phones ships irreg.
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
5355	52.63	DOG	Konigs W'n., Germany	(P) Phones irreg.
5255	57.09	DOF	Konigs W'n., Germany	(P) Phones irreg.
5140	58.37	PMY	● Bandoeng, Java	Daily 4:45-10:45 A.M., 5:45 P.M.-2:15 A.M.
5110	58.71	KEG	Bolinas, Calif.	(P) Phones irregularly evenings
5080	59.08	WCN	Lawrenceville, N. J.	(P) Phones GDW evenings seasonally
5025	59.76	ZFA	Hamilton, Bermuda	(P) Phones WOB evenings
5040	59.25	RIR	Tiflis, 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
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	65.86	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
4500	66.67	DAS	Rugen, Germany	(P) Phones ships irreg.
4465	67.19	CFA2	Drummondville, Que.	(P) Phones No. America; irregular days
4420	67.87	ZMBJ	● TSS "Awatea," Wellington, N. Z.	(See 8840 kc.)
4400	68.18	DAF	Norddeich, Germany	(P) Phones ships irreg.
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.

Queries

headsets . . . microfone connections . . . combatting man-made static

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.

Question No. 35:

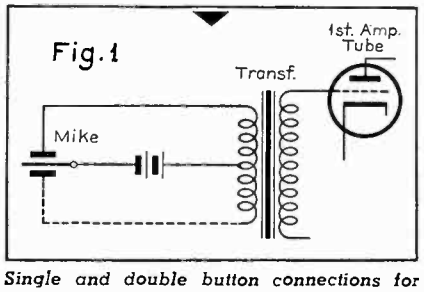
I would like to know the difference between a regular pair of earfones and a pair of crystal earfones. Also, I have a 2-button microphone. If I were to use only one of the two buttons would I have the same result as I would have with a single button microfone?—*A. W., Tacoma, Washington.*

Answer:

Ordinary telephone headsets operate on the familiar magnetic principle—a variation in current causing a corresponding change in magnetism in a small electro-magnet which in turn moves a light diaphragm setting up sound vibrations in air. Such receivers are very sensitive, give a fair frequency response and are quite rugged. They can be plugged into almost any kind of a circuit without the use of additional equipment.

The piezo-electric effect is responsible for the functioning of the crystal type telephone headset. Whenever certain crystals such as quartz or rochelle are subjected to electrical pressure, they are agitated with a corresponding mechanical motion, which, if within the audible frequency range, can be transmitted via a diaphragm, or otherwise, as sound. Crystal headsets are very light in weight, and provide an excellent frequency response —from 60 to 10,000 cycles per second. However, there are circuits into which they cannot be plugged directly—where they require a filter or transformer which may adversely affect the frequency response.

Both the magnetic and piezo-electric effects are reversible. That is, sound waves impinging upon the ordinary headset, and on the crystal headset, will set up electrical potentials across the magnetic windings and crystal plates respectively. The first instance represents the principle of the magnetic pick-up and ribbon and magnetic microphones, and the second the principle of the crystal pick-up and the crystal microphone.



Single and double button connections for a 2-button mike.

You can use one button of your 2-button microphone if you wish—but why not use both buttons? A 2-button transformer costs no more than one for a single button. Many of the so-called single-button transformers are actually 2-button transformers with instructions to use only one-half the primary for single button operation. Fig. 1 shows the correct connection for single-button operations, while the dotted line completes the circuit for the second button—which is desirable. There is no sense in driving a car on four cylinders when you have eight!

If by chance you have a single-button transformer—a transformer with only two primary terminals—be sure and use only a single button on the mike. Some experimenters have attempted using both buttons—in parallel and in series—and have subsequently written to this department with the complaint of unsatisfactory operation. When so used the resistance changes corresponding to the simultaneous compression of one button and the expansion of the other tend to neutralize each other with a net reduction in microphone action.

BAD CASE OF MAN-MADE STATIC

Question No. 36:

I have an all-wave RCA Model C8-15 Receiver operating from an RCA Spider-Web Antenna. I have tried other antennas and receivers but the above combination gives me the best results in my very noisy location. My problem is this: I live five blocks (anti-directional) from a large copper smelter. The Cottrell plant at the smelter uses 60,000 volts from five to twenty generators to recover dust from the smoke. This puts out an R9+ QRM over a radius of about two miles. No one in this end of the town can enjoy radio reception and it has been this way for years. Is there anything that can be done to force the smelter to correct this condition? RCA and G.E. say that it can be stopped if the smelter will pay for it. The QRM is so bad at times that it blankets out local broadcasting stations! We know for certain that the interference comes from the smelter, for about two months ago the Cottrell plant was shut down three days for repairs, and there was no QRM on any frequency (outside of normal radio interference and natural static). There was no limit to dx reception. This would be the best spot in Tacoma for reception if not for the smelter.

Do you think that an automatic noise silencer such as described in the March issue of AWR would help? Would another receiver such as the RME-69, the NC-100X, or some other set with a crystal control help matters?—*J. E. O., Tacoma, Wash.*

Answer:

We publish the answer to this question, despite the fact that it is an economic rather than a technical problem, because there are many other areas throughout the United States of America deprived of their right of radio enjoyment by selfish commercial interests—the executives of which probably enjoy perfect radio reception on palatial estates far removed from their factories and plants.

A noise silencer might help—but is a pound of cure rather than the easy ounce of prevention. There is no justification for a noise silencer when the source of interference is definitely known and is capable of ready elimination at the source. This consideration likewise frowns upon the use of a more selective receiver, which, while it would reduce the noise slightly, would seriously limit

(Continued on next page)

(*Continued from opposite page*)

the quality of reception. Also, there is no reason in the world why the listeners should be placed at an additional expense.

As we say, the solution is economic rather than technical. RCA and the General Electric Company are quite right in their statements that the condition can be corrected—and the cost should not be exorbitant. Pressure must be brought to bear upon the smelting company to have adequate filters installed. There is only one influence that could have any weight with the smelting plant—namely that of the power company. The power companies are vitally interested in selling electricity—every little bit counts—which is the reason they sell directly and sponsor the sales of radios, electric washers, electric irons, additional lighting fixtures, toasters, etc., etc. Appreciating the fact that the ears of the power companies are open to any consideration that will sell more electricity, at least one organization, interested in the manufacture of radio filters, has made the power companies see that it is to their advantage to install such devices where such installation will boost power consumption.

J. E. O. states that the interference often is of R9 strength two miles away from the plant. It is reasonable to suppose that it is more than annoying at even three miles distance—thus covering an area of over 28 square miles. There are some 20,000 radio receivers in Tacoma, Washington, and it is not far-fetched to estimate that at least 2000 of them are affected by this interference. The average receiver consumes 100 watts and is operated three hours a day. If this operation is cut to one hour a day, the lighting company is losing 12,000 kilowatt-hours per month, or, at the rate of .06c per kilowatt-hour a yearly income of $8,640.00. This does not consider the many homes in which there are no radios at all due directly to the poor reception conditions. The cost of an adequate filter system at the smelting plant would probably not exceed the power company's loss, due to the interference, in one week.

A committee of listeners should be formed to present these facts to the power company. You should have no difficulty in securing the cooperation of local radio clubs—listener clubs and amateur clubs. Amateur radio reception is undoubtedly affected within the interference radius of the smelter, and the amateurs will be able to supply you with technical data that will make your protest and presentation that much more impressive. We would suggest that an interference survey be made as a preliminary move—checking the limits of interference with portable receivers, both battery and power-line operated (to determine how much QRM is actually being radiated, and how much is following the lines). The more you can convince the power company that you have a real case against the smelting plant, rather than a few isolated kicks from rabid cranks and misinformed laymen, the greater will be your chance of getting action.

As a last resort—if the power company fails you—the more public spirited among you Tacoma listeners can chip in and have some company specializing in the design and installation of filter equipment, put the quietus on the Cottrell plant.

✦

CircuiTest

HOW GOOD ARE YOU ON VOLTAGE DIVIDERS?

The accompanying diagram is a conventional power-supply circuit. It is assumed that a suitable rectifier is being employed, such as a type 83, and that voltage regulation is satisfactory. Desired are the ohmic values of R_1, R_2 R_3 and R_4, to provide the correct potentials at the indicated current drains.

(Answer on page 389)

"YELLOW FLAG"

(*Continued from page 343*)

winter months. Arrangements are best made through contact with the party—usually a radio serviceman—installing the P.A. equipment. The idea will usually appeal to him as it provides an added service which he can offer at *no extra charge*. This latter thought must be impressed upon him, for no one is permitted to gain pecuniary benefits or the equivalent from the services of amateur radio. What does the amateur get out of it? Primarily the satisfaction of boosting amateur radio in the public eye without the expensive benefit of a flood or national disaster. Secondly, an interesting bit of experimental work. Third, free admission with an official status that provides the finest possible view of the races—as you may gather from Fig. 1 which was snapped by W8QMR during one of his nine-minute and thirty-second rest periods.

The job is probably best put over by a club. In any event arrangements should be made to secure as much publicity as possible. There will be plenty of press photographers on the infield, and they will usually welcome a shot of the radio equipped car. Local papers will be glad to play up the activities of its localities. And two or three announcements should be made, as fillers, over the P.A. system.

Quite a bit can be done in this direction—and a good time will be had by all!

AWR 5-METER TRANSMITTER-RECEIVER

(*Continued from page 348*)

back of the cabinet. For fixed operation an AC cord with an AC plug on one end and a six-prong plug on the other is employed. For car operation a cable of suitable length connects between the set and a corresponding six-prong socket mounted in some convenient place, such as under the dash board. This socket then connects to the battery and the generator.

Coils

Adjustment of the coils is of most importance after the set is completed. It is a good idea to make up a simple absorption type of wavemeter for checking as to whether the transmitter grid coil is on ten meters and the other coils on five. A midget condenser mounted on a piece of hard rubber or wood with a few turns of wire soldered across the condenser will do the trick.

The plate coil, L, has no tap to worry about. The grid coil, L1, is the only coil having a critically placed tap. It should be placed as shown in the coil table at first. It should later be shifted slightly to either side of the original position until best output is secured. The tap on the detector coil, L3, is uncritical and may be left at the center of the coil. The tap on L2, in the RF stage, should be shifted for best coupling to the antenna employed for reception and best signal strength. Series condenser C9 aids in this adjustment.

The RF and detector stages should be tracked by loosening the front set screws on the flexible coupling. This will permit the detector condenser to be tuned independently of the RF condenser. The coils should be adjusted until the condensers take the same set-

LIST OF PARTS

AMERICAN RADIO HARDWARE CO.

1—type 2570 antenna mounting clamp and No. 12 ½-wave 5 meter telescoping antenna (extra set if separate tuned receiving antenna is desired)
2—type 801 panel bearing assemblies
1—type 69 rubber grommet assortment
4—type 1002 three plug strips
4—type 1004 three plug jack strips

BIRNBACH

4—type 478 feedthru insulators

BUD RADIO CO.

3—type 711 1¾ inch dials
1—type 713 2¾ inch dials
2—type 480 knobs
1—type 1150 indicator plate
1—type 1169 indicator plate
3—type 390 octal wafer sockets
1—type 363 six prong wafer socket
1—type 114 five prong wafer socket
1—type 958 large seven prong Isotex socket
1—type 959 octal Isotex socket
2—type 925 ultra high freq. chokes (RFC, RFC1—see text)

CARDWELL

1—25 mmfd. Trim-Air tuning condenser (C)
1—140 mmfd. Trim-Air tuning condenser (C1)
1—50 mmfd. Trim-Air tuning condenser (C8)
2—15 mmfd. Trim-Air tuning condenser (C10, C15)

KENYON

1—type T214 power transformer (T)
2—type KC90 filter chokes (T1, T2)
1—type T451 output transformer (T3—see text)
1—type T53 input transformer, S. B. mic. and plate to grid (T4)

MICAMOLD

1—type MCC 10,000 ohm 1 watt carbon resistor (R1)
1—type BCB 400 ohm ½ watt carbon resistor (R2)
1—type BCB 50,000 ohm ½ watt carbon resistor (R3)
1—type BCB 2 megohm ½ watt carbon resistor (R4)
1—type BCB 50,000 ohm ½ watt carbon resistor (R6)
1—type MCC 25,000 ohm 1 watt carbon resistor (R9)
2—type BCB 100,000 ohm ½ watt carbon resistor (R11, R12)
1—type BCB 2,000 ohm ½ watt carbon resistor (R13)
1—type MCC 3,000 ohm 1 watt carbon resistor (R14)
2—type HM1500 .002 mfd. HV mica condensers (C2, C3)
2—type WM900 .004 mfd. mid. mica condensers (C4, C5)
1—type HM1500 .001 mfd. HV mica condenser (C6)
1—type WM900 .004 mfd. mid. mica condenser (C7)
1—type TA 2.5-45 mmfd. trimmer condenser (C9)
3—type WM900 .004 mfd. mid. mica condensers (C11, C12, C13)
1—type TA 2.5-45 mmfd. trimmer condenser (C14)
1—type WM900 .0001 mfd. mid. mica condenser (C16)
1—type TP400 1. mfd. tubular paper condenser (C17)
2—type TP600 .1 mfd. tubular paper condensers (C18, C19)
4—type VD450 16. mfd. elec. can condensers (C20, C21, C22, C23)
1—type TP400 1. mfd. tubular paper condenser (C24)
1—type RD50 25. mfd. tubular elec. condenser (C25)
1—type TP600 .1 mfd. tubular paper condenser (C26)
1—type RD50 5. mfd. tubular elec. condenser (C27)
1—type WM900 .0005 mfd. mid. mica condenser (C28)
1—type WM900 .004 mfd. mid. mica condenser (C29)
1—type RD50 25. mfd. tubular elec. condenser (C30)

PAR-METAL PRODUCTS CO.

1—type HC9151 black crackle finish cabinet, size 9" x 15" x 11"
1—type C4524 cadmium plated chassis, size 10" x 14" x 3"

POWERACK

1—110 volt AC fan belt generator

RAYTHEON

1—type RK25 tube
1—type 6K7 tube
1—type 76 tube
1—type OZ4 tube
1—type 6L6 tube
1—type 6C5 tube

UTAH

1—type 5UP replacement type permanent magnet dynamic speaker

WARD LEONARD

1—10,000 ohm 10 watt wirewound resistor (R)
1—5,000 ohm 50 watt wirewound resistor (R5)
1—25,000 ohm 50 watt wirewound resistor (R7)
1—400 ohm 10 watt wirewound resistor (R8)
1—300 ohm 25 watt wirewound resistor (R10)

YAXLEY

1—type L 100,000 ohm potentiometer (R15)
1—type M 250,000 ohm potentiometer (R16)
1—type 3242J four circuit 2 contact switch (send-receive)
1—type 3243J four circuit 3 contact switch (car-off-line)
1—type A2 jack (J)
1—type A1 jack (J1)
1—type 75A shielded mic. plug

MISCELLANEOUS

1—piece of copper screen 5½" x 5½"
1—piece of aluminum 4½" x 6"
1—piece of hard rubber 4½" x 4"
1—length of 6 wire cable and 2 six prong connection plugs
1—6 prong socket to mount on dash
1—AC cord with AC plug on one end and 6 prong conn. plug on other end.

ting. This is not critical as the RF stage tunes relatively broad. Incidentally, the detector condenser C15 is insulated from the baffle by mounting it back a bit with short studs. A large hole is drilled in the baffle so that the shaft will clear.

Performance and Air Tests

The transmitter and receiver both have exceeded our original expectations as to performance. The tuned RF stage of the receiver actually provides considerable gain. The regeneration is very smooth, super-regeneration being obtained evenly over the entire dial. The regeneration control is normally set at the maximum position and left there for all signals.

The receiver shows a high degree of sensitivity. The receiver and transmitter were test operated from the second district, in a location a few miles from New York City. Signals from both the first and third districts were well received. The receiver seemed to possess a somewhat better performance than other super-regenerative receivers tested in the same location at various other times.

While the receiver performance was in no way remarkable in comparison with other receivers of this same general type, the performance of the transmitter section was something to gladden the heart of any five-meter operator accustomed to the frequency wanderings and poor quality of previous one-tube self-excited transmitters. A standard superhet using 465 kc. intermediates and capable of an order of selectivity sufficient for good single signal reception was used to check the frequency stability. With the beat oscillator of the receiver turned on the note from the RK25 was found to be a really pure DC, easily mistakable for crystal control in sound and in steadiness. When modulated this note did not waver in the least. Only when overmodulated did the note break up. The quality of the signal as received on this test superheterodyne was very good, considering that a single button microphone was used. This measure of performance is satisfactory for all work

on five meters. The output of approximately five watts was sufficient to work a number of stations, and is comparable in value to the power obtained from most five-meter stations on the air at present. The efficiency of the RK25 seems to be as good as the usual pushpull oscillators customarily employed at a number of stations. Time did not permit of extensive air tests, but indications are that this little self-contained five-meter station is capable of as good a performance, both on transmission and reception, as the usual five-meter station which occupies a much greater space for the results obtained.

HAMFEST

(Continued from page 355)

will come through in due order, is for three years more—without the necessity of demonstrating activity!

✦

GETTING BACK TO THE FLOOD: We guessed rightly in the April issue regarding piped transmissions of W9WC and W9RSC to the NBC network. It was an excellent and spectacular job, and we think the rest of you would like to know how it was done. W. Conrad, W9WC writes—

"I believe the accompanying block diagram (Figure 2) will amply inform you as to how the broadcasts were accomplished. Let me add here that we could have accomplished the same end without the land wire between the stations, but that would have added to the QRM—thus the land wire was installed by the NBC. During the W9WC-W9RSC broadcasts, the transmissions were not radiated via the amateur bands, but were routed by means of the land wire and associated audio equipment.

"At times during the flood emergency work, it was the pleasure of NBC, via the two stations W9WC and W9RSC, to rebroadcast W9NKD, Carrolton, Ky., and W9AEN of Maysville, Ky. These two stations had various city and relief officials present, and their words were picked up at WC and RSC and rebroadcast over the NBC as a part of special Red Cross appeal programs. These people were interviewed by WC and RSC via 3.9 mc. fone, and both ends were put over the broadcasting stations. We believe that this first-hand information from these isolated villages worked wonders in raising Red Cross funds, as they were broadcast from coast to coast. Please note that W9NKD was only using 15 watts to an emergency Xmitter with emergency power supplies.

"Both W9WC and W9RSC have been condemned by other enterprising reporters for the above broadcasts. However, I should like ALL-WAVE RADIO and yourself to have all the facts concerning them. They were made with the complete knowledge of all emergency stations operating on the 3.9-mc band, and with their cooperation. All stations stood by during the broadcast periods, which were arranged some minutes—in one case an hour—in advance. Thus no schedules were interfered with and no unnecessary QRM was caused. All in all I believe a great deal of good was done for amateur radio in addition to being of genuine assistance to the Red Cross and the emergency in general."

John M. Carson, W9RSC, adds a few words: "We actually carried on many bona fide QSOs with the flood areas—many of which were simultaneously fed to the NBC networks. A total of ten rebroadcasts went over the Red and Blue chains. That 80-meter band certainly was a bedlam, and we were indeed lucky to get in a few good transmissions. The breaks were with us!"

✦

K6JLV, HILO, HAWAII, takes the palm—if we may be pardoned for carrying coals to Newcastle—for putting the most consistent dx signal over in these parts for the past month.

Which reminds us of a certain naval station which called K6JLV, on fone, at 6:15 A.M., April 18th. If his log is as sloppy as his operating, he probably won't be able to identify himself. Or perhaps he was just plain SOSsified. Take your choice.

✦

IT JUST OCCURS to us that the R.S.S.L. report form blanks make excellent sheets for mailing to QSOs who want something a little more detailed than an RST report.

✦

"DEAR W8QMR: GHIJ DWZS ICUD SGJT BMKG IOUP NHYB LKJO NJKI SDJK COTY FGYU WOIR WOID. Pretty, isn't it? That's what blessed my ears the other morning, on forty, for a solid hour from 8:30 to 9:30. Then this—"Anyone hearing this code practice broadcast pse QSL stop QRA stop QRA stop—" (I'll give you the QRA if you want it, and in the mean-

time, St. Petersburg, Fla., papers please copy.)

"It was certainly good to hear a signal on forty meters. One does get so lonesome in that void of unholy silence. What a relief for that lone-pebble-on-the-beach feeling. Can't we get a few more stations sending code practice on forty?—before the FCC takes the band away from us for non-occupancy? Yours, with a ray of hope, and 73—H. I."

CHANNEL ECHOES

(*Continued from page 361*)

Latins and the technique of the highly trained artist. To our mind, she simply is without equal.

✦

J. E. OWENS, of Tacoma, Washington, sends the card shown in Figure 2 to SWL correspondents.

✦

A GOOD MANY recordings were made on this side of the briny of the Coronation proceedings, May 12th. But we'll wager not one-tenth so many were sold as were the records of King Edward's farewell address.

The Duke of Windsor postponed his wedding so that it would not detract attention from the Coronation. Rather decent, and cricket, you know. But the way a lot of folks feel about it, George the Sixth should have postponed the Coronation so's not to interfere with the Duke's wedding.

✦

SPEAKING OF CORONATIONS, at the present writing Joe Louis is scheduled to be crowned—one way or the other—June 22nd. We'll be seeing you—at the loudspeaker. (Forecast.)

✦

ALL RADIO COMEDIANS, even the most pathetic of them, seem to be convinced that they are funny. They remind us of Scott's hangman, Petit-Andre, in *Quentin Durward* who was similarly convinced of his wit, and boasted that he could even make his victims laugh during their last minutes. "Such jests I have cracked between the foot of the ladder and the top of the gallows, that, by my halidom, I have been obliged to do my job rather hastily for fear the fellows should die of laughter and not by the rope!"

✦

IN A RAPID succession of old English songs from the G-string on a recent afternoon —"The Leather Bottle" and "Drink to Me Only With Thine Eyes."

✦

WITHOUT ANY INTENTION whatsoever of being sacrilegious, and only to illustrate the extent to which American programs are polluted with commercialism, we mention the following: On Sunday morning, May 2nd, at close to 11:30, Eastern Standard Time, we tuned in on the tail end of a program coming from W8XK. We heard the peroration in which the audience was exhorted to write in on the subject of "What cheeses mean to me." Two friends will testify to the facts, and we wondered momentarily what label, box top, carton, wrapper or reasonably exact facsimile thereof was being requisitioned on Sunday morning. A few seconds later, with the concluding announcement, we all realized that what the announcer had said was "What Jesus means to me."

✦

SUNDAY GIVES TO the world two outstanding radio features—the RCA Music Hall program, at 11:30 A.M. (E.S.T.) and the Ford Symphony Orchestra at 8 P.M.

✦

OUR CONSCIENCE BOTHERS us slightly in reference to Doc Brinkley—not for the things we have written about him, but for not starting a little closer to home. Right down here in Tampa, Fla., our winter listening post and from which point we are inditing this column, there practises one Dr. Urbuteit who has perfected a "Sinuothermic Miracle Radio." According to Dr. Urbuteit, the device can be used by anyone for home treatment of any disease—"no matter how complicated the ailment is, Sinuothermic finds the cause, and then you tune Sinuothermic into the cause about the same as you tune your radio into different stations, and Sinuothermic removes the cause and thereby you are made well."

Presumably there is a dial with divisions indicating not numbers, but "headache," "nausea," "pain in the neck," "bilious," "stomach trouble," "mental collapse," "festering," etc., etc. Not at all a bad idea. As a matter of fact, the same dial could be used on an ordinary radio for program identification.

Ah well—'tis a hot day, and our throat is parched. We could, of course, run down town and have Doc Urbuteit tune out our thirst. But the El Dorado with a mint julep is closer.

"MULTIBAND" SYSTEM

(Continued from page 351)

The "Broad" Transformers

The i.f. transformers that give this new order of selectivity cannot be broadened to give curve A of Fig. 2 without serious loss, so we must turn to the sensible course of using entirely different and suitable transformers to obtain the broad band of curve A. Three transformers, with coil Q's reduced to 60, are required to get curve A, which is 32 kc. broad across a top free of the deep center valley caused by high-Q coils, and level to 12 db. across this top. This 12 db. departure from an ideal flat top is easily made up by providing a 12-db. treble rise in the following audio amplifier. But to keep it this flat all tuned r.f. circuits but one must be cut out, for no method of broadening them that will not introduce stray couplings and capacities through long leads and incidental associated parts is practical. This is desirable in any case, for upon the broadcast band such a wide admittance band may only be used in reception of strong local stations, and switching out of r.f. gain will insure only such use. On short waves the selectivity of the r.f. amplifier, necessarily decreasing with increasing frequency, may be employed satisfactorily when its additional gain and necessary image rejection may be desirable.

Having now two different i.f. amplifiers by virtue of two different, and symmetrical sets of fixed i.f. transformers, together with selectable degrees of r.f. selectivity, we may through discreet joining of the two systems obtain the two remaining choices of selectivity required to qualify the system as ideal.

"Multi-Band" Selectivity

Through substituting one sharp i.f. transformer for one of the three broad ones of curve A, we get curve B 14 kc. wide across its top which is flat to the easily audio-compensated level of 6 db. It insures the 6000- to 7000-cycle audio tone range which will be most useful in day-in and day-out "high-fidelity" reception of regular broadcast stations.

Curve C is obtained with this same i.f. system to which is added the two-stage r.f. amplifier. This curve, 8 kc. broad across its top flat to 6 db., (rendered perfectly flat through audio amplifier compensation) is the most generally useful of the entire four choices, for it is the one which will be used in broadcast band and short-wave reception to give the maximum of tone quality with the maximum of selectivity for stations separated 9 to 10 kc. Its flat band-pass top and extremely steep sides "down" 1000 times for the 10-kc. separated adjacent channels give the selectivity which has heretofore only been obtained at the expense of the tone impairment necessarily associated in the past with side-band cutting.

Such are the wide ranges of selectivity possible through this new i.f. system, which the author has named "Multi-Band" to differentiate it from older systems of selectivity variation. A typical circuit diagram appears in Fig. 1, in which the selectivity (or fidelity) switch positions are marked with the letters corresponding to the selectivity they yield as depicted in Fig. 2. It is possible that this system may lead to further improvement in the older methods of selectivity variation, but not for cheap receivers, for the elimination of the lack of symmetry and side-band cutting V-shaped selectivity curves of the old methods can only be obtained by increasing the excellence and number of permanent, not variable, i.f. transformers—a costly but obviously very beneficial process.

NIGHT-OWL HOOTS

(Continued from page 363)

check program on the second Monday of each month from 5:50-6:10 A.M. . . . And here's news—KGLO plans to operate an ultra-high-frequency experimental transmitter soon!

Best veri of the month: KWYO's picture card showing a most unusual view of the antenna tower and the call letters traced in the clouds above. One of the most unique cards we've seen. . . . And while at KWYO, Herb Seibert, Program Director, wants the Night Owls to know that the station will carry a complete word picture description of the big Sheriden Rodeo to be held this year on July 14-15-16, and assures that the Rodeo is well worth attending for a lot of wholesome fun. . . . The Buenos Aires municipal government station, LS-1, operating on 710 kc., has placed an order for new equipment which will make it one of the world's most powerful and up-to-date transmitters. The power will be increased to 50,000 watts. When the station is ready to go on the air, which will be in about a year, it will be the first station to use the Doherty high-efficiency circuit. . . . A little shifting has

taken place in Cuba due to the vacancy left on 850 kc. by the deletion of CMBN, whose license was recently cancelled by the Cuban Radio Bureau. The changes are shown elsewhere, but the government has decreed that the stations cannot begin operation on new frequencies until they have made provision to use the proper quartz crystals to insure permanent parking on the assigned wave. Say, this Cuban Burea is going to town! We'll have to save a few cheers for them if this keeps up. Never before has such order prevailed among the Cuban broadcasters.

Cheers and Jeers

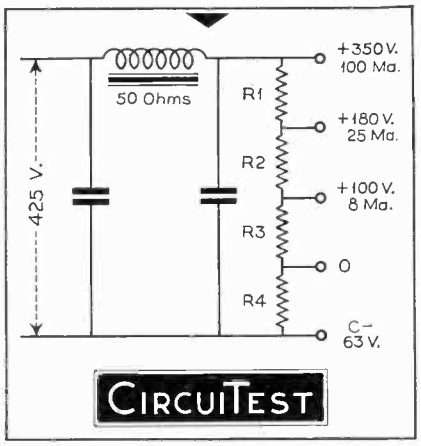
Three cheers this month to Joe Lippincott and to W1XAL. A program was recently conducted by Joe over W1XAL to inform the listeners of the aims of the R.S.S.L. Many thanks for your efforts.

A short time ago we handed out some cheers to WSAI for a novel DX program. Well it seems that such a program as we outlined in this department then has been conducted by WHIS for the past season and until recently has escaped our ears. Our attention was called to this fact by Pat Flanagan, Chief Engineer, who breaks in on the "party line" during the program to chat with the announcer or to register his disapproval of a recording which is being played. The "party line" is the order line between the studio and the transmitter. A lot of fun, these programs. One of the more recent ones brought letters in languages that even an archaeologist couldn't read. These came as a result of an offer of a surprise gift to the writer of the first letter in any foreign language, excluding hog-latin! So to WHIS, and its "party line" a belated three cheers! This, of course, leads up to the only jeers we can hand out this month. They go to WAAB, who's uninteresting all-night session usually blocks out these WHIS programs in this section of the country.

✦

ANSWER TO CIRCUITEST

The correct values are R_1, 1200 ohms; R_2, 700 ohms; R_3, 935 ohms; and R_4, 260 ohms. The method of calculation is as follows: The total drop across the divider under load is 350 plus 63—or 413 volts. The drop across the filter choke must therefore be 425—413, or 12 volts. Total current must equal E/R or 12/50, i.e., 240 milliamperes. Total current to tubes is $100 + 25 + 8 = 133$ milliamperes. The bleeder current will be $240 - 133 = 107$ milliamperes. The current through each resistor will equal the bleeder current plus the current to the tap, or taps. The current through $R_1 = 107 + 25 + 8 = 140$ m.a.; through R_2, $107 + 8 = 115$ m.a.; through R_3, only the bleeder current, 107 m.a.; and through



R_4, the bleeder current plus the combined plate and grid currents to all tubes, i.e., $107 + 100 + 25 + 8 = 240$, the total drain on the power supply. The voltage drop across R_1 is $350 - 180 = 170$ volts; across R_2, $180 - 100 = 80$; across R_3, 100; and across R_4, 63 volts. Given the voltage drops across each resistor and the current passing through each resistor, the values of the resistors are calculated by Ohm's Law — $R = E/I$.

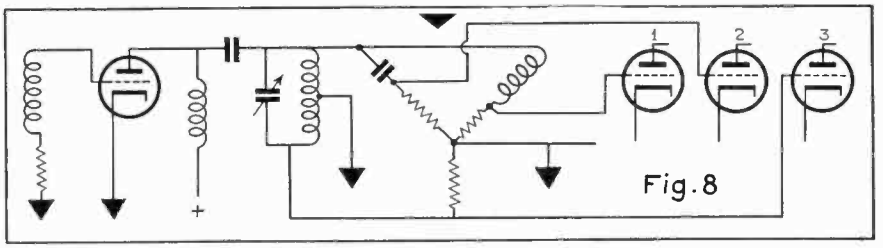
A bleeder current of 107 milliamperes is rather high in proportion to the total current. A bleeder current of ten per cent the cathode current is the usual figure. With a cathode current of 133 milliamperes, this would bring the total current to 148 m.a. and the bleeder current to only 15 m.a. With a total current consumption of 148 m.a. a resistance of 81 ohms will be necessary to effect the required drop from 425 to 413 volts —or an extra resistor of 31 ohms in series with the 50-ohm choke. Then, working on the basis of a 15-m.a. bleeder current, the calculations for the resistors can be worked out as before.

How about the wattages—? Can you work these out too?

PHASE SHIFTERS

(Continued from page 365)

phase with each other. Taking the voltage at point Y as one of the three phases, it is obvious that we must obtain from the other half of the secondary, two voltages which are 60 degrees lagging and 60 degrees leading the voltage at X. The usual combinations of reactances and resistances can be used again. In order that the phase difference



Three-phase system using separate amplifiers.

may be 60 degrees, the following condition has to be fulfilled:

$$\frac{X_c}{R} \quad \frac{X_L}{R} = \text{tg } 60^\circ = \sqrt{3}$$

All the resistors should be of the same value.

A similar procedure can be followed with a tube generator but it will probably be required to have the neutral point of the system at ground potential. To do this, when the tank circuit of the oscillator is in the plate lead, it may be required to modify the oscillator circuit somewhat. Parallel feed might be employed as one possible solution. In this case the resistors should have a high value so as not to load the tank circuit too much. Also, if appreciable power is to be taken from the circuit, it can be had by using three power amplifiers as in the circuit of Fig. 8.

Several variations of the above described circuits are possible and the reader will no doubt be able to discover new applications for them.

R.S.S.L. NEWS

(Continued from page 364)

simultaneously does not necessarily indicate that one is on or overlapping the frequency of the other—it may merely indicate that your receiver has not sufficient selectivity to separate stations actually apart in frequency. Therefore, do not jump to conclusions—make sure that there is actual interference, and once having determined this, make no mistake in the identity of the stations involved.

After determining the actual station calls, check their published frequencies that you may be sure that image reception is not involved in the event that you use a superheterodyne set. In such an instance the actual signal will be found again a few hundred kilocycles away from the image point—912 kc., to be exact, if the intermediate frequency of the receiver is 456 kc. This type of interference is not caused by the station.

A check of the published frequencies will also indicate if harmonic reception is involved. If, for instance, two stations were in interference on a frequency of 12,000 kc., and the list showed that only one of the stations was assigned this frequency, the other would more than likely be found listed at 6,000 kc., in which case it would be evident that the latter station was radiating a strong second-harmonic signal and appearing also at twice its assigned frequency of 6,000 kc. *This form of interference should be reported as it is equally as bad as direct frequency interference.* The report should indicate which of the two stations is radiating the harmonic.

In making direct frequency interference reports give calls of stations involved and indicate which of the two predominates. Also list published frequency of each station as well as the frequency as it appears on the dial of your receiver. Give hours and dates interference was noted and its extent. As usual, send all reports to your Sectional Manager. He in turn will collate them and forward each separate group to Headquarters.

So, let's start the ball rolling and make plenty of hay while the sun shines during the summer months.

M. L. MUHLEMAN,
Acting Director.

RCA MODEL ACR-111

(Continued from page 371)

current or voltage drop across R27, and consequently making the cathode less positive with respect to diode plate No. 1 than under the condition of no signal. Sufficient signal will cause the cathode to become negative with respect to diode No. 1; current will then flow through this circuit causing a voltage drop across R30, which is applied as automatic bias voltage to the r.f., first detector, and i.f. tubes through the usual resistance-capacity filters.

Performance

Controls are adequately spaced, easy to reach and use, and are smooth in operation. The tuning controls are free of

Range	Frequency Megacycles	Noise Equivalent* Microvolts (C.W.)	Image Ratio	Sensitivity Input Microvolts (1 w. output)
A	0.6	2	250,000	10
	1.5	2	100,000	10
B	1.7	1.0	150,000	5
	4.0	0.85	40,000	3.5
C	4.0	1.2	3,000	5
	7.0	0.96	2,000	3.5
D	7.0	1.1	3,000	4.5
	14	0.86	400	3.5
E	14	0.9	200	15
	28	1.0	10	8

* "Noise Equivalent" is a coined term to express input in microvolts through the normal input circuit, which would be required to product an output equal to the receiver noise output.

play, and if our memory serves us, seem more "sure and solid" mechanically than the tuning control knob on the ACR-155. This may be due to some change made in the mechanism for the addition of band-spread—or possibly to our imagination.

Frequency ranges are so divided that, for instance, setting the pointer in the 160-meter band in Range B, the 80, 40, and 20-meter bands appear behind the pointer when switching to Ranges C, D, and E respectively. If the receiver is tuned to the 10-meter band in Range E, it will be tuned to the 20-meter band when switched back to Range D.

The uniformity of band-spread is something of a feature and contributes to the ease and convenience with which the receiver can be tuned. The degree of spread has been well selected—approximately 9 k.c. per division in the 12 to 32 mc. range—and the divisions are large enough to be easily readable, Though not calibrated in kilocycles, the frequency per dial division can be readily determined for each band and thereafter used for close frequency checks.

The noise suppressor really does its stuff. Though it will not kill noise having an amplitude equal to or less than the desired signal, it practically obliterates heavy auto-ignition racket and the like that would ordinarily wash out even a strong signal. It is necessary, of course, to adjust the Noise Suppression Control for each signal level, but once the operator has become acquainted with the control it takes only a second to make the proper adjustment. It's simple, effective, and very much worthwhile. In many instances it spells the difference between perfect signal readibility and a complete washout.

It might be added that this control may also be used effectively as an inter-carrier noise suppressor, with slightly different adjustment procedure. Thus, the usual head-splitting racket between stations can be cut to a minimum, and without sacrificing too much in the way of receiver gain. This stunt is particularly good on intermittent signals, or when standing by on a channel.

Drift, as measured at 14 mc., from a cold start, amounted to 9 kc. Calibration good in all ranges. The a.v.c. action was found to be particularly good. Average performance data is given in the accompanying table.

The intermediate frequency used is 460 kc. The audio power output is 5 watts undistorted; 8 watts maximum. Power consumption is 120 watts.

THE "FLEXIBLE 400"

(Continued from page 354)

G5SA, D4DLC, Heinz Pankow, Muenchen, Germany; Richard Auerbach, Hamburg, Germany; A. Jansen, Boskoop, Netherlands; D. Skipworth, Horncastle, England; H. W. Darvill, Enfield, England; H. Kamp, Scheveningen, Holland; George F. Nelson, Liverpool, England; T. G. Cockrill, Westcliff-on-Sea, England; H. Lister, Pocklington, England; D. E. Meekins, Hertfordshire, England; George Harrison, Whitely Bay, England; F. W. Hattemore, Wootton Waxen, England; James Patterson, Forfar Angus, Scotland; V. V. Button, Breaston, England; A. J. Hayward, Trowbridge, England; Cairnie Farm, Masselburgh, Scotland; N. Kenneth Sunter, Manchester, England; F. C. Smith, South Wales, England; J. E. Lebtern, Winchester, England; J. F. Witt, Fordingbridge, England; K. Gray, Swansea,

England; C. E. Wood, Parkstone, England; G. H. Waters, Worksop, England; Ivor Jones, Holyhead, England; R. W. Allen, Bognor Regis, England.

Antenna Directions

In connection with the diagrams showing the types of our various antennas, some reason for the results that we have obtained may be indicated by considering the directional properties of the antennas and their geographical location. It will be observed that a dotted line is used to indicate the position of "true" north. The north indicated by the compass is shown by the solid line. We used a particularly good compass in setting up all of the aerials—one that was made for the United States Government and which may now be obtained for less than one-sixth of the original price. The one we used is called the Stoppani compass. The deviation of the magnetic compass from true north, in our particular location, is twelve degrees west. In other words, when the compass is pointing north, the true north is twelve degrees west of the position indicated by the compass. Allowances must be made for this deviation when a directional type of antenna is to be set up.

The directional properties on an antenna are not observed well when a flat map is used. The true course of the direction from any beam antenna must be plotted over a great circle route and the simplest method for obtaining a great circle route is by observing the point of origin and the desired point of reception on the globe.

It will be seen that the type of antenna system shown in Fig. 4 may be used as two half-waves in phase on 5 meters or a straight half-wave, center-fed doublet on 10 meters. The 450-ohm line was made up by using transposition blocks without transposing the leads.

KILOWATT FINAL

(*Continued from page 349*)

onance the grid excitation is excessive the condenser should be turned to the high-capacity or low-frequency side of resonance until the desired grid current is obtained. This method of adjusting grid drive is advantageous rather than harmful because it helps to make the grid voltage more sinusoidal, but the condenser must be turned to the high-capacity side of resonance to realize these advantages. Under normal operating conditions for plate modulation with the plate voltage on and the antenna coupled, the grid current should be 80 to 100 m.a. or 40 to 50 m.a. per tube.

Biasing

The bias is furnished partially by the 2000-ohm resistor R1 in the grid return and the balance by the resistor R2 in the filament return circuit. The resistor in the filament return circuit furnishes enough bias to protect the tubes in case the excitation fails or is removed with the plate voltage on, eliminating the need for any source of fixed bias in a phone transmitter.

If the stage is plate-modulated this resistor must be bypassed for audio frequencies. An 8-mfd. 450-volt electrolytic (C7) is suggested. The positive terminal connects to the transformer center tap and the negative connects to ground. In a c-w transmitter, if a previous stage is keyed, enough fixed bias to completely cut off the plate current may be desirable.

The neutralizing condensers, NC, are identical, and have a capacity of 10 mmfd. They were selected not only because they are correct electrically for these tubes, but also because their mechanical construction fits the layout perfectly and permits them to be ganged with a piece of ½-inch fiber rod.

The insulation on all condensers is Mycalex. All other insulation, except for the grid-coil mounting, is ceramic. Below 7 mc. most any insulation such as bakelite is satisfactory, but on the higher frequencies only the very best is good enough and is well worth the slight additional cost.

The filament transformer, T, is mounted on the chassis. It is rated at 10 volts, 6.5 amperes. The T-200 filaments operate at 10 volts, 4 amperes each but the overload does not seem to cause excessive heating of the transformer.

All grounds return to a common central point on the chassis directly below the back end of the grid tuning condenser.

Excitation Requirements

Expressed in terms of power, about 80 watts of grid drive are necessary for most efficient performance with plate modulation. The exact amount of excitation required may vary greatly in different installations but the average should be about 80 watts. On the higher frequencies where circuit losses increase greatly, the output of the driver stage should be enough higher to compensate for these losses. No parasitics, either high or low frequency, were experienced with the unit as shown. If any high-frequency parasitics are experienced on duplicates, lengthening of the leads from grid tuning condenser to grids should effect a cure. No low-frequency parasitics should show up because no r.f. choke is used in the grid circuit.

LEGEND

C1—Cardwell TJ-200-UD
C2—Cardwell XC-65-XS
C3—Sangamo .002 mfd., 600 volts, mica
C4—Sangamo .002 mfd., 5000 volts
C5—Sangamo .006 mfd., 600 volts
C6—Sangalo .006 mfd., 600 volts
C7—(Optional) 8 mfd., 450 volts, electrolytic
NC—Cardwell VZ-10-RS neutralizing condensers
L1—Barker-Williamson 1 kw. swinging link tank inductance
L2—Hand wound on National PB5 assembly with XB5 plug
R1—Ohmite 2000 ohms, 50 watt
R2—Two Ohmite 150-ohm, 100 watt resistors in series
RFC—Bud No. 568 r.f. choke, 2.8 m.h. 1000 m.a.
T—Stancor P-3021 filament transformer
CH—Bud chassis, 13" x 17" x 3".

QUOTES

(*Continued from page 340*)

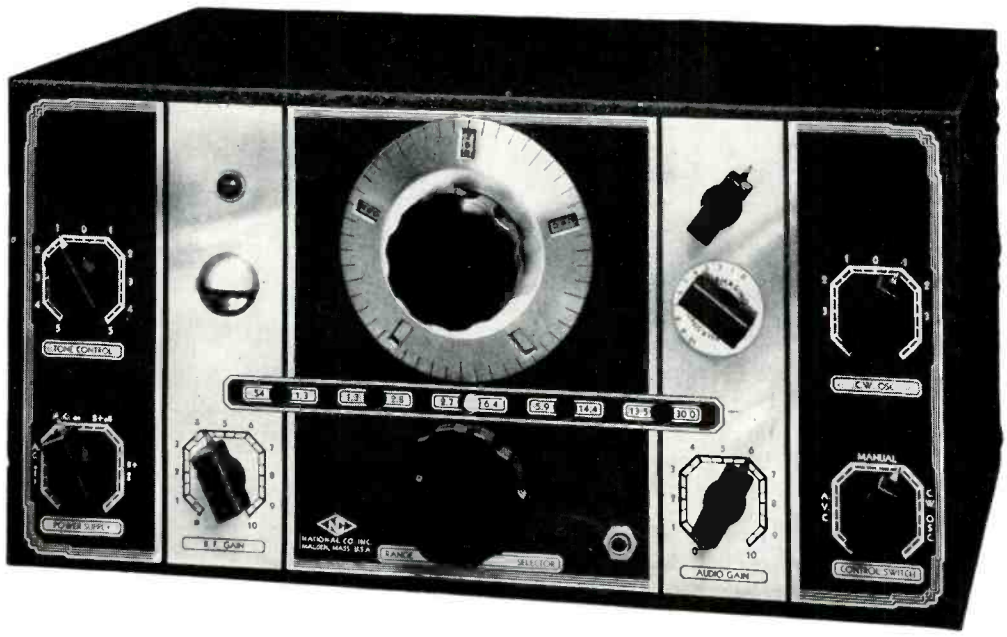
Second Row: Bill Meissner, W2HYJ; Harry Tunstall, W2FPB; Dr. Lawrence J. Dunn, W2CLA, former Hudson Division Director of A.R.R.L.; Bud Clarke, second operator at W2FPB.

Third Row: "Butch" Tynan (with only pipe showing because he refused to sit beside Ed. Ruth, as directed by the photographer—probably because Ed. is proving his rugged individualism by smoking a ceegar); Frank Sommers, W2GDU; Adolph Gross, of Terminal Radio Corp.; Richard H. Depew, W2SB, member of Caterpillar Club, Quiet Bird Men, etc.,—obviously an aviator and another individualist; Frank Ballard, W2ELR; Earl Dannals, W2GG, Engineer for Airplane & Marine Direction Finder Corp.; Charles Stimpson, W9TRD (NO FAIR!); Bill Filler, W2ALQ, Terminal Radio Corp.; Arthur H. Lynch, W2DKJ, (the rascal) representative of the National Company.

Top Row: J. Hynes, U. S. Department Justice; Chester Lord, third operator at W2FPB; William Reuman, W2RB, owner of broadcast station WWRL; Harry Lawson, W2IER, Engineer, Erco Radio Labs.

We have purposely deleted addresses. If Mr. Cooper wants to send tobacco to this bunch of pirates, we'll guarantee its distribution from this office, *providing we receive a commission of one tin for our own pipe!*

PERFORMANCE PLUS:

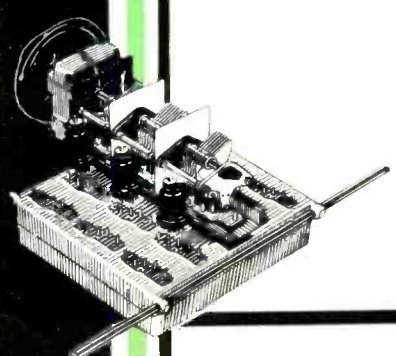


Built for *extra* performance, the twelve tube NC-100 Receiver includes every refinement for difficult short wave work. Among its many unusual features is the unique movable Coil Tuning Unit which combines the high electrical efficiency of plug-in coils with the convenience of the coil switch. Tuning from 540 KC to 30 MC is covered in five ranges, so that stations are well spread out. Each of the fifteen high frequency coils is shielded in its own compartment of cast aluminum. The turn of a knob on the front panel brings the desired range into position and plugs it in. Idle coils are isolated, leads are short, and calibration is exact. There are no dead spots in the NC-100 Receiver.

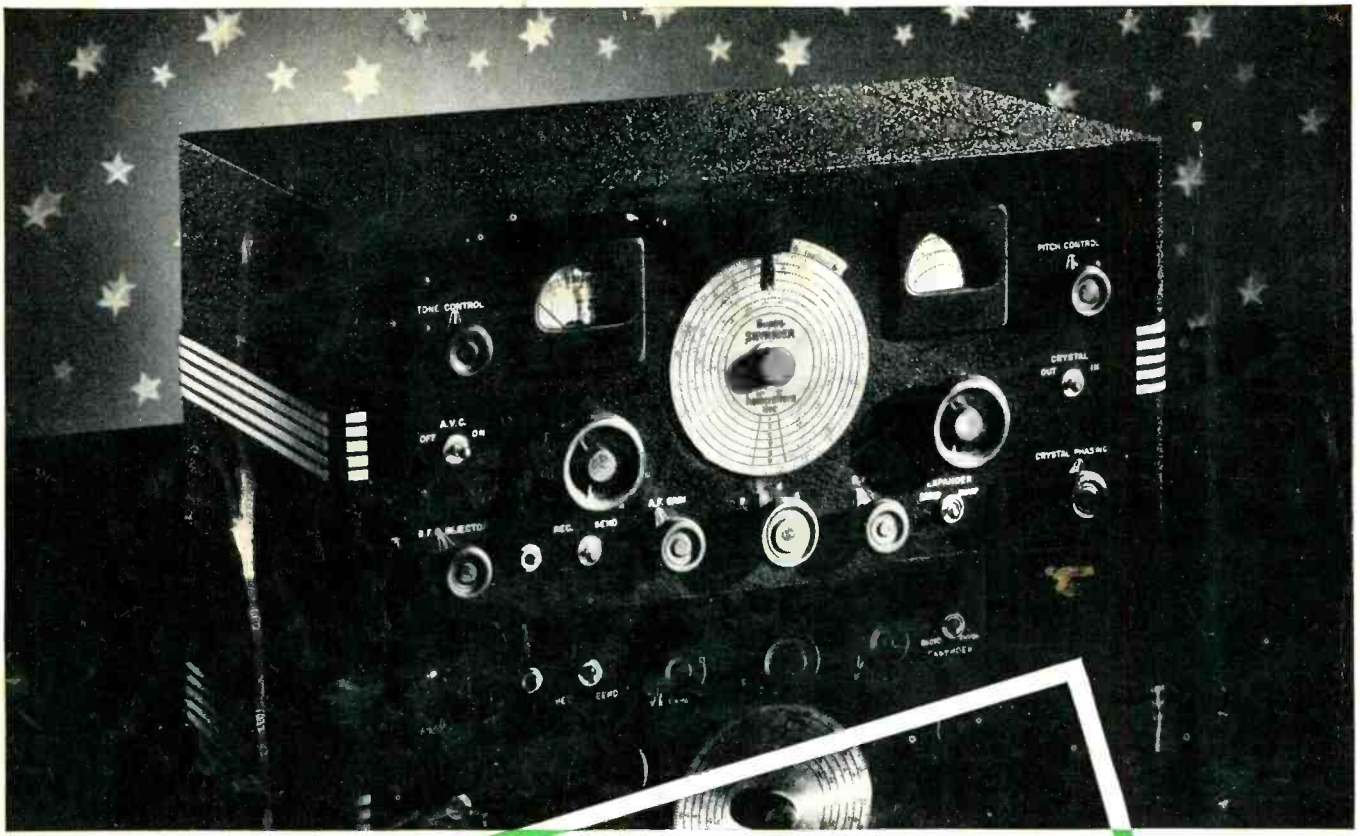
Fully worthy of the advanced performance of the Tuning Unit are other details of the superheterodyne circuit. Thorough use of low loss insulation and of air-dielectric condensers, together with carefully designed high-Q coils, results in exceptionally high signal-to-noise ratio and high usable sensitivity. The advanced design of the (optional) Crystal Filter provides unusual effectiveness when QRM is severe.

Panel controls are complete, and include separate switches for B-supply, Filaments, CW Oscillator, and AVC; as well as dials for Audio Gain, RF Gain, Tone Control, and CW Oscillator Tuning. Crystal Filter controls include Phasing and Selectivity. The precision Micrometer Dial, direct reading to one part in five hundred, provides exceptional ease of tuning together with great accuracy in logging.

These are but a few of the features that combine to make the NC-100's performance so outstanding, and its low price so remarkable An illustrated folder will be mailed on request.



NATIONAL COMPANY, INC., MALDEN, MASS.



WHAT IS A *Communications Receiver?*

It's more than just a "short wave" receiver! A communications receiver is primarily designed for efficient "high frequency" reception—a rugged, "scientific", precision-built job designed to operate at high efficiency under adverse conditions and in emergencies.

Who can design such receivers? Obviously the engineers who use them as their own hobby—and *know* what they should be.

Such men predominate in the Hallicrafters' organization. Here is a group of engineers who have been actively interested in radio since the days of spark transmitters and crystal detectors.

Today they are building fine communications receivers, putting into them all the enthusiasm and craftsmanship they lavish upon their personal equipment.

Because of their extensive, intimate experience with radio problems, and because of their unequalled research and experimental equipment, the Hallicrafters can build a receiver like the New 1938 Super Sky Rider, providing this unexcelled short wave performance but also with complete coverage from 5 to 550 Meters, with more than ample sensitivity for communications work, *plus* wide range variable selectivity that offers true high fidelity, and marvelous tone quality for broadcast reception.

Hallicrafters receivers are fully licensed, thus placing at the disposal of the Hallicrafters staff the developments of a whole generation of leading radio engineers.

When you purchase a Hallicrafters receiver you are not only buying a fine precision-built instrument, but the product of a group of engineers whose pride and life work are represented in that receiver.

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