ALL-WAVE RADIO

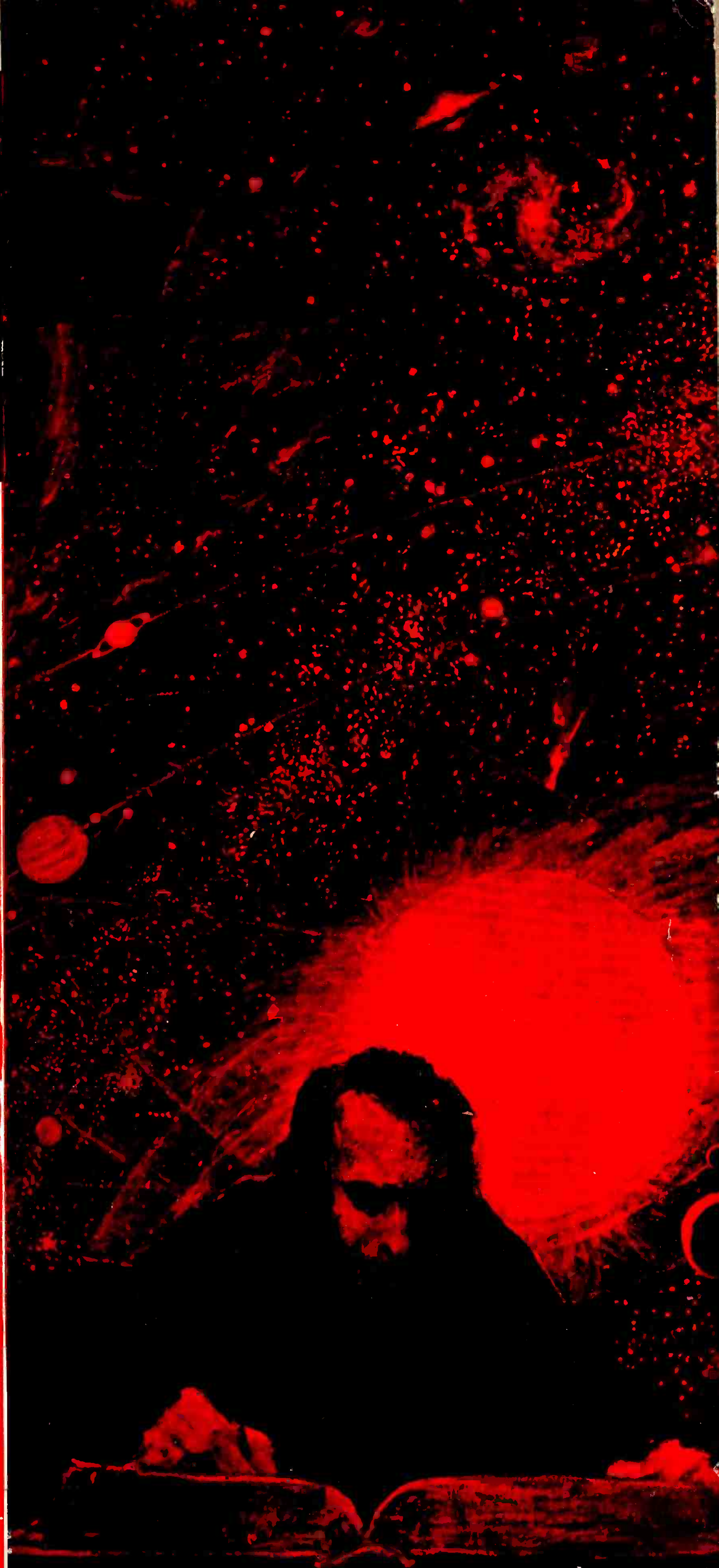
FEBRUARY • 1937

VOLUME EXPANDER

TEN-METER CONVERTER
with regenerative mixer

A HAM'S PARADISE
perched on a hilltop

NEW ALL-WAVE SUPER
with phase-inverted a.f.



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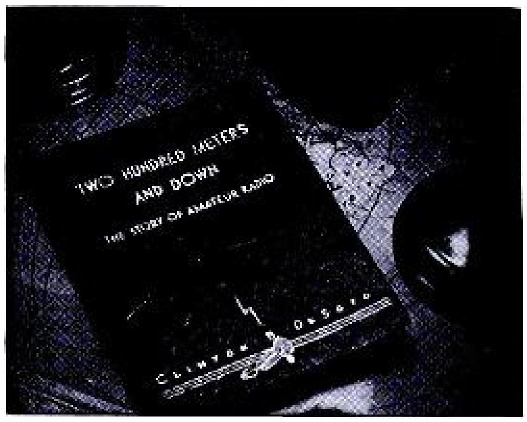
THE JOURNAL of WORLD RADIO

PUBLISHED FOR THE AMATEUR
• PRESENT AND FUTURE •

TWO HUNDRED METERS AND DOWN

The Story of Amateur Radio by CLINTON B. DeSOTO



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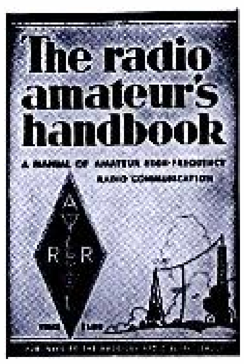

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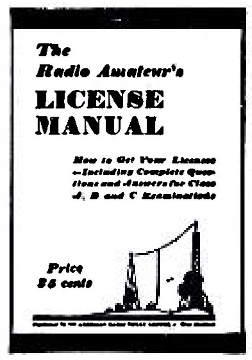

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Edited by M. L. Muhleman

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ALL-WAVE RADIO

Reg. U. S. Pat. Off.

VOLUME 3 • NUMBER 2

GENERAL

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COVER

The radio voice of the earth pervades outer space—the knowledge of our people is far-flung. *(From the oil painting by D. Owen Stephens —Courtesy American Museum of Natural History)*

FEATURES

DEPARTMENTS

EDITORIAL QUOTES

BY THE EDITOR

THAT we may be in a position to publish last-minute developments without loss of time, it has been our habit to keep ALL-WAVE RADIO open for a much longer period than most newsstand publications. This has meant that the major portion of the work must be done in the shadow of the "deadline"—that heart-rending period before the presses begin to roll.

We have found this "newspaper schedule" highly advantageous to the reader, and apart from the wear and tear on nerves the schedule has been maintained month after month with no serious hitches—until this month when the influenza hit the east and laid low practically our entire office force.

That accounts for the lateness of this issue. But our force is now on the mend, and with the optimism that goes hand-in-hand with a recovery from illness, each of us is ready to dig in and make up for lost time.

The "newspaper schedule" shall be continued, but in the future we shan't again be caught short-handed—we have made provisions against that possibility. We ask only that you excuse us this once for a condition quite beyond our control.

✦

To Katyscope Builders

THE CIRCUIT DIAGRAM of the AWR Midget Cathode-Ray Oscillograph, appearing on page 11 of the January issue, may prove confusing. An arrow branching off from the plate lead of the half-wave rectifier tube, V, gives the impression that if a lower voltage is desired one portion of the secondary of transformer, T, should be shorted.

This is not correct; the arrow was meant to indicate that the plate lead of tube V could be connected to *either* the low-voltage or high voltage tap on the transformer secondary, but not to *both*. If the arrow is disregarded, the circuit is correct.

✦

Hams Praised, But . . .

IN THE ANNUAL report of the Federal Communications Commission, the licensed radio amateur was praised for his services to the public in time of disaster. It was pointed out that amateur stations rendered valuable aid to the public beginning early in July, 1935, with the flood in the Finger Lakes region of New York State, and continuing through the winter when the Hams provided the sole means of communication between stricken areas and the "outside" in numerous instances.

The Commission likewise stated that it had granted 46,850 amateur licenses up to July 1st, or, in round numbers, six stations for every kilocycle of available space, including the 4,000 kc available in the 5-meter band and the 2,000 kc available in the 10-meter band, good parts of which are not usable under present conditions.

No recommendations were made by the Commission.

✦

Listener Praise

THAT THE RADIO listener can also render valuable service is evidenced by the fact that Harry C. Castator, of Hamilton, Ohio, intercepted what were purported to be signals of distress from a missing T.W.A. plane, and informed officials of the company of the few words he was able to pick up.

It is not always the commercial station that intercepts the distress call; there have been many instances when a listener or an amateur has picked up the message and passed it on. This is not curious, as it is often the case that distress signals are so weak they can be heard only by someone in the immediate vicinity.

In time to come it may be that members of the Radio Signal Survey League will be in a position to form emergency listening networks that can go into immediate action in any locality. With the cooperative features of the League as the formative factor, it should be comparatively simple to institute such corps in all areas.

The listener may yet find that he is in a position to render public service, and it is in anticipation of this that the Directors of the R.S.S.L. have recommended that special certificates be made available for issuance to members who perform a notable service.

✦

Insensitive Receivers?

IT IS SURPRISING the number of letters we receive from readers complaining that they are unable to pick up DX stations in the short-wave ranges of their receivers.

Most of these complaints are directed at the more expensive stock model receivers, which is even more surprising, and we are at a loss to explain the reasons.

There is always the possibility, of course, that a receiver insensitive to weak signals is merely out of alignment, in which case a good serviceman can put matters right. Stock receivers are often out of alignment when they are shipped from the factory, just as autos are often out of adjustment when they are delivered, but most sets produced by reliable companies are properly aligned to begin with.

There is the further possibility that the avc action in a given model of receiver may function too well on weak signals and thereby "hold down" the sensitivity of the receiver. If the avc action is delayed so that it does not go into effect except on moderately strong signals, the sensitivity of the receiver to weak signals is not reduced.

The average modern receiver is protected against a loss of sensitivity to weak signals. In sets where this is not the case, the condition can be rectified by the installation of a switch to cut out the avc action when hunting for DX. It is only necessary to use a single pole, single throw toggle switch that will connect the avc lead to ground (chassis) when avc action is not desired. It should be pointed out, however, that other means of cutting out the avc must be used in receivers wherein the avc lead also carries the initial bias voltage for the controlled tubes. Most receivers do not, but there are exceptions to the rule.

But it is still our opinion that most complaints come from readers who either do not employ an efficient antenna system in conjunction with the receiver, or have not as yet mastered the art of tuning in weak stations in the short-wave bands. There are few receivers so bad that they will not bring in *some* DX—and by DX we do not mean the powerful European stations.

✦

Ten Meters

IF YOUR RECEIVER doesn't hit 10 meters, the chance of making it do so is outlined in this issue—by means of a simple but highly efficient converter that can be hooked on to the "front" of your present set. There is nothing makeshift about this unit; it has been carefully designed to do the job outlined for it, and when used with the average receiver will give results comparable to the best of 10-meter sets.

The 10-meter band is highly interesting. It has all the DX features of the 20-meter band, but minus the heavy station interference.

THE ALL-WAVE OSCILLATOR—

A TOOL FOR THE LISTENER

By Glenn Browning*

THE all-wave oscillator has long been considered solely as a service instrument. True, it is probably the second most important piece of equipment in the serviceman's laboratory. However, its utility to the serious all-wave listener—the listener who takes radio as a hobby rather than as an incidental source of entertainment—is such as to make it indispensable to the fullest possible enjoyment of all-wave listening.

An oscillator is nothing more than a miniature transmitter. The type we have in mind is designed to transmit over a continuous and wide range of frequencies from around 100 kilocycles to 30,000 kilocycles. The power output is variable from a very weak to a strong signal, which may be modulated with a 400-cycle note if desired. But most important of all, the oscillator is calibrated so that the frequency on which it is transmitting is known at all times with a good degree of accuracy. Some oscillators have built-in output meters with which relative receiver outputs can be measured. This is desirable, at least from the listener's point-of-view as it makes unnecessary the purchase of an additional instrument.

The all-wave oscillator is very easy to operate, and requires no experience whatsoever in the work we shall describe. It can be connected to the receiver in a few seconds, and, as will be shown, in many instances no connection to the set is required. In appreciation of its utility to the all-wave listener, some manufacturers have decked out the oscillator in more lively designs than the usual laboratory appearance. Figs. 1 and 2 show an all-wave oscillator which is housed in a walnut cabinet with gold trim. Incidentally, this oscillator fits in well with the considerations outlined above.

* Chief Engineer, Tobe Deutschmann Corp., Canton, Mass.

Logging Stations

Perhaps the primary utility of the all-wave oscillator from the fan's point of view is the assistance it renders in logging and identifying unknown stations, particularly those announcing in a foreign tongue. However, when the frequency is known with considerable exactitude, reference to any up-to-date call-list and time table will usually identify the station. While most receivers are themselves calibrated in kilocycles and megacycles—a few of the more expensive models very accurately indeed—the oscillator, in the vast majority of cases, is of superior accuracy. That is the express purpose for which it is designed—to supply a signal of known frequency—and a good oscillator is carefully and painstakingly calibrated at the factory, and an individual chart prepared showing where it is off frequency and indicating how much compensation must be provided with a simple trimming adjustment to bring it back into line at a given frequency. Also, no matter how well a receiver may be calibrated originally, small variations in a variety of circuits—r-f, i-f, osc., etc.—of insufficient proportion to affect the efficiency of the receiver, will throw it off calibration. On the other hand, the oscillator is a relatively simple and stable circuit. In addition, receiver calibration has almost lost its significance with the advent of automatic - frequency - control circuits where a station snaps into tune a good many kilocycles on either side of its logical position.

Of course it is easy enough to identify stations by the frequency-schedule method within the international broadcast bands around 20 meters, 25 meters, 30 meters and 49 meters. However, the hard-to-get stations—many of the Asiatics and other spectacular "catches", employ frequencies in the wide and relatively uncharted spectra between these bands. It is a simple matter to log say Germany, England and France in the 25-meter region and check the calibration of the receiver against these widely advertised frequencies, and thereby place and recognize other stations broadcasting within or close to this band without aid from an oscillator. But where such "ethermarks" (coining from landmark) do not exist, a good oscillator should be depended upon rather than the calibration of the receiver.

Fig. 1. An all-wave oscillator provides the quickest check on whether a receiver is operating at its peak of efficiency. There are many simple tests the layman can make with this instrument.

Process Simple

The process is elementary. The simple directions which accompany the oscillator should be followed in every detail, with the exception of connecting the output to the antenna post of the set. In other words the oscillator should be grounded, and the controls manipulated in accordance with instructions—but a small antenna—two or three feet long will do in most instances—should be permanently erected somewhere very close to the receiver, and one end clipped or otherwise connected to the oscillator output. Such an aerial can be conveniently tacked to the back of the receiver cabinet.

With the oscillator turned on, and connected to the small antenna, a half

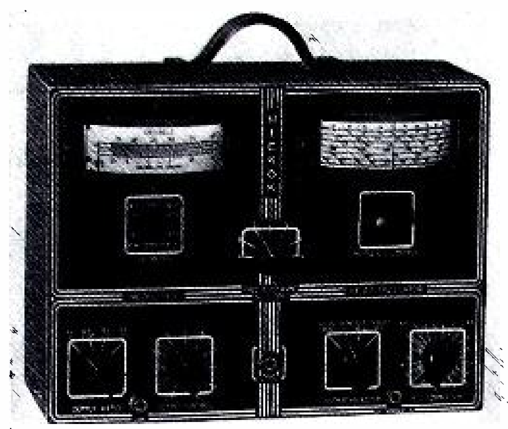


Fig. 2. A Hickok Model OS-10 all-wave oscillator—typical of the types available for test purposes and logging. The dial to the left is the decibel output meter.

hour's practice will familiarize you with its operation. Experiment with different power outputs, with and without modulation, and you will find that you can set up a signal at any desired frequency within the tuning range of your receiver. Tune in a broadcasting station of known frequency, and set the oscillator (unmodulated) at its approximate frequency as indicated on the receiver dial. Consult the correction chart that accompanies your oscillator, and set the compensation adjustment, if necessary, for the nearest frequency on the chart. Now tune the oscillator carefully in the direction of the station. As the frequency of the oscillator approaches that of the station, a high-pitched whistle will be heard, which becomes lower and lower and finally disappears at "zero beat" when the oscillator is tuned to the exact frequency of the station. It will rise in pitch on the other side. This whistle is known as a "beat note." Compare the oscillator reading with the station frequency and the reading on the dial of the receiver. Experiment in this way with a number of stations in the various frequency bands.

When an unknown station is encountered, the oscillator is set to the approximate frequency, the compensator adjusted, the oscillator tuned to zero beat and the frequency is then read from the oscillator. The output of the oscillator should be weak for weak stations and powerful for strong stations.

Of course, if desired, the receiver can be calibrated against the oscillator, a correction curve prepared for the set dial, and the oscillator dispensed with until some frequency shift suggests that the receiver has "lost" its calibration. Such a chart is shown in Fig. 3. However, the author favors the consistent use of the oscillator, for in almost every instance it is possible to read the oscillator dial directly with greater precision than the set dial.

Checking the Receiver

Every serious all-wave fan should keep a consistent check on the efficiency of his receiver. Additional checks should be made during periods of poor reception to determine whether the set or natural conditions are to blame. Such a test may well save a service call when entire bands go dead for days and weeks at a time.

The set-up is exactly as described for logging, with the exception that the output or "db meter" is connected to the audio amplifier as directed in the instruction sheets accompanying the oscillator. *(Read these instructions carefully, or you may damage the meter.)* In the case of the oscillator illustrated, a single lead is slipped under the plate prong of an output tube. Consult your receiver operating directions for tube positions and any tube chart, or serviceman, will locate the plate prong for you.

Turn on the oscillator with 400-cycle modulation, and adjust for the *weakest output.* Low output is necessary, otherwise the automatic-volume-control action of the receiver may result in a useless reading on the meter. Set the oscillator close to the end of any band, and tune it in on the receiver. Turn the volume control all the way up, and note the reading on the db meter. (If it is obvious that the meter will go off scale, turn the volume control up until it is at full-scale deflection and note the exact position *of the volume control.*)

Record the date, the frequency and the reading on the output meter (or the position of the volume control for full-scale deflection). Make this test on both ends and the middle of each band. If subsequent tests show a lower deflection on the meter, or more volume control is required for full-scale deflection, it is an indication that the receiver is falling off in efficiency. It is, of course, assumed that the original tests were made with new tubes and the receiver in perfect condition.

Some output meters have double ranges. If possible a range should be selected so that less than full-scale deflection is obtained with the volume control on full, as a better reading can be made on the meter than of the volume control position. In some cases, and on some bands, it may be necessary to advance the output of the oscillator. Needless to say, such an adjustment should be noted in the records, and all conditions exactly duplicated in future tests.

Excessive output, even at the minimum setting of the oscillator, can be corrected by shortening the oscillator aerial. In many cases, the noise level of the receiver may be such that the volume control cannot be turned full on. In such instances it should be turned one-half or three-quarters up, and the output of the oscillator adjusted so that the signal can be heard, weakly but plainly, above the hash. Once again, all conditions must be duplicated in subsequent tests, excepting that one which determines, or rather indicates, the relative state of the receiver's efficiency.

The set-up described for testing the receiver can also be employed in checking the a-v-c action. Tune in the modulated oscillator at any convenient frequency. Set the volume control of the receiver about half way up, and the output of the oscillator at minimum. As the output of the oscillator is increased the reading on the db meter should go up fairly rapidly to a point where the increase definitely slows (where the automatic-volume-control action begins), and relatively small increases in the readings should be noted with further advance of the output. Variations in sound intensity from the loudspeaker will follow the same characteristic rise.

Adjusting the I. F.

A falling off in the efficiency of a receiver, as noted in the tests already suggested, may be due to the intermediate-frequency transformers getting out of adjustment. It is a good idea to check these anyway, and, while this is usually considered as a serviceman's job, it is really very simple for anyone with an oscillator.

The output meter is connected as previously described, but the antenna is discarded and the oscillator connected directly to the receiver in accordance with the directions accompanying the former. In the cases of five and six tube receivers (with no r.f. or preselection), the connection can usually be made directly to the antenna post. On larger sets the output is clipped to the grid cap of the first detector tube. Again the lowest possible output is used from the oscillator, and the set volume control turned full on. The oscillator is set to the intermediate frequency of your receiver, which will usually be found stated in the literature accompany-

(Continued on page 106)

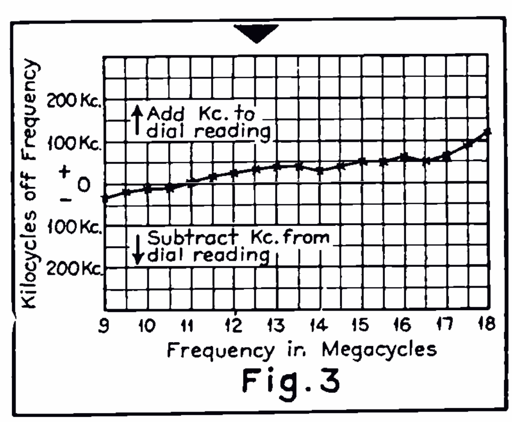


Fig. 3. A calibration curve on a modern receiver made with an accurate oscillator. The crosses indicate the exact frequencies at which measurements were made. The receiver has a micrometer dial which made it possible to read within close to 10 kc over most of the band.

PRACTICAL, INEXPENSIVE

A Modified Circuit Which Furnishes

By L. A. deRosa, E. E.

WITH the advent of high-fidelity receivers, engineers have worked along every road, no matter how narrow, as long as it led to a more natural and higher quality reproduction.

One of the most noticeable faults with radio reception and one which radio engineers have attempted to remedy for some time, is that variations in loudness as they occur in the broadcast studios, are not faithfully reproduced at the receiving end. An orchestra, when it goes from a very soft passage to one in which every instrument is playing as loudly as possible, certainly is a disappointment to the critical listener. Instead of the thrill which a sudden increase or crescendo should give, the reproduction sounds as if the main portion of the power were being absorbed somewhere, and, while the listener senses from the strained quality of the music that every instrument is playing as loudly as possible, there is but little change in volume.

It is amazing to note that an orchestra, when it passes from a very soft to a very loud passage, increases its power about ten million times, that is, a change of 70 db. Even a man in ordinary conversation may change the level of his voice 500,000 times, from about .01 microwatt to 5000 microwatts, a difference of 57 db. There is no evidence of these differences in level in radio or phonographic reproduction. The leveling off of the dynamic peaks of both radio and phonograph reproduction is the work of the operator in the control booth at the transmitting or recording end, a well-meaning fellow who is more or less a necessary evil.

Volume Compression

It is evident that in the broadcasting station if the transmitter were adjusted so that it would not overload on the loudest parts of the program, then, when the softer passages were being transmitted the modulation would be so small that static and other noise interference would drown out the program. The efficiency of the transmitter would also be very low because, during most of the time, only a small portion of the available carrier power would be utilized. For the same reason, if the phonograph recording were made with all amplitudes recorded in their proper levels, the

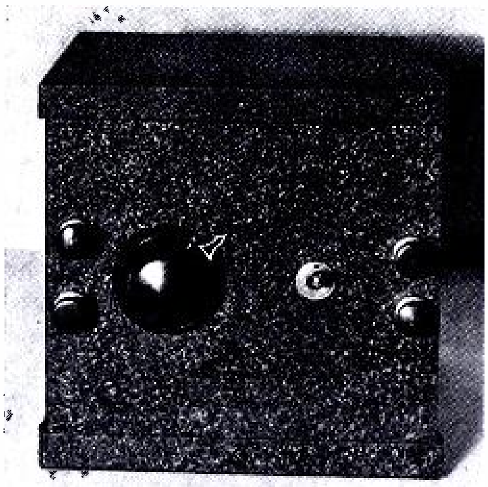


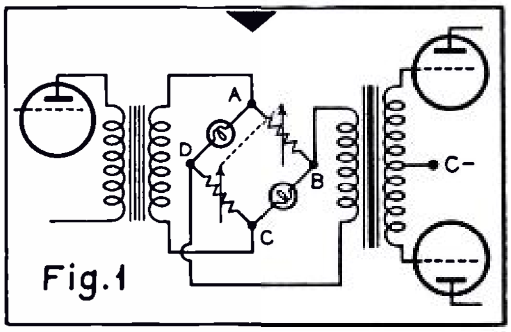
Fig. 4. Front view of volume expander, showing control and the input and output binding posts at left and right respectively.

needle scratch and mechanical noise would drown out the soft passages. A very wide sound track would also be required in order to reproduce the high levels or fortissimos; thereby necessitating the use of short-playing records.

In order to overcome these difficulties and still be able to reproduce these dynamic changes in their true proportions, engineers have devised systems of amplifying the louder signals more than the softer signals. This increases the contrast between the soft and loud passages, thus improving the reproduction enormously. This scheme, while it works splendidly on phonograph reproduction, will not perform equally as well on all types of broadcast reception. To operate properly for all radio signals, a device which compresses the audio amplitudes must be used at the transmitter end. When this is done, the combination of devices, one at the transmitter and one at the receiver will result in faithful dynamic contrasts and at the same time, avoid the difficulties involved in their transmission.

Volume Expansion

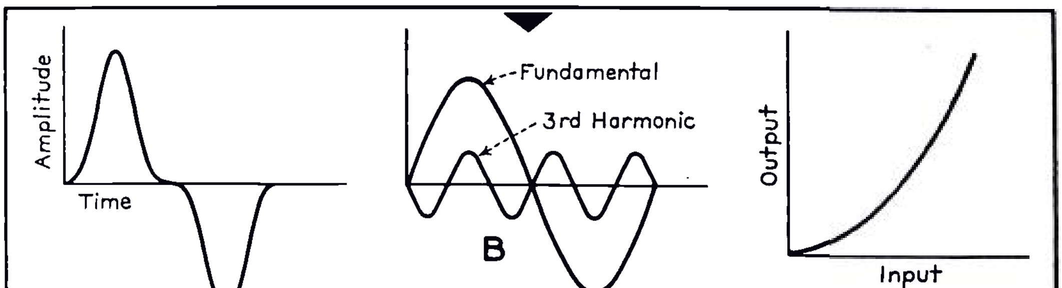
Recently, two systems of expanding the signal in the audio channels of the receiver have appeared. Both systems were tested out in the laboratory and not found to be entirely satisfactory. It was therefore thought advisable to modify one of the systems so as to eliminate its disadvantages. After several months of experimentation with all kinds of devices and systems, a method was developed which could expand the output of an amplifier as much as is desired with a minimum of power loss and at the same time introduce but a negligible amount of distortion.



Manner of connecting expander between driver and output audio tubes.

Another advantage of this modified system is the fact that if a Class AB output stage is used, it will operate on the "A" portion of its plate characteristic except for the peak powers, thus keeping the harmonic distortion to a negligible value at ordinary volumes.

The operation of the device, as also used in one of the present-day commercial receivers, is based on the change of resistance of an enclosed tungsten fila-



Showing distortion introduced by expander having insufficient time lag. (A) The distorted, peaked wave which results when a pure sine wave is fed through such an expander; (B) How the distorted wave (A) can be broken up into at least two major components, one of which is the original wave and the other an extraneous third harmonic distortion factor; (C) The input vs. output characteristic of a representative expander circuit.

VOLUME EXPANSION

Any Desired Degree of Expansion

Engineering Dept., Electrad, Inc.

ment as its temperature is raised by the passage of a large current. Two bulbs are connected in a Wheatstone bridge arrangement as shown in Fig. 1. When the voltage across A and C is increased, the current in both sides of the bridge is increased and more heat is evolved in the lamp filament causing a rise in temperature, and because of the high temperature co-efficient of this wire, an unbalance occurs causing a current to flow between the B and D terminals of the bridge.

Improved Expander

The circuit to be described differs from the commercial type in that the expander is always operated *at low levels and near its balance point.* This is accomplished by inserting the expander proper after the first tube of the audio amplifier, and following it by additional audio amplification and the output stage.

If a voice coil were connected across B and C as is done in one of the commercial systems now in use, then in order to obtain a moderate amount of expansion, an enormous loss must be expended across the elements of the Wheatstone bridge. This fact also places a practical limit to the expansion possible. Should a Wheatstone bridge be operated with a large unbalance, two opposite resistance arms must be increased or decreased quite a bit before there is an appreciable change in the unbalance current. A bridge operated near its balance point, however, requires but a small change in resistance of two diametrically opposite arms to cause a huge increase in unbalance current. Since the change in resistance of a bulb filament is limited by its temperature coefficient, it is obvious that, in order to secure a large increase in unbalance current by a minimum increase in input voltage, the bridge should be operated at a point very close to balance. In fact, if the bridge is balanced and the slightest unbalance occurs, the ratio of increase will be infinite since it was originally zero and the resultant value no matter how small, when divided by zero, results in infinity.

Time Lag

Another advantage in operating the bridge near balance is the increase in time lag which results therefrom. The bulbs used in the bridge require an appreciable time to heat up and change their

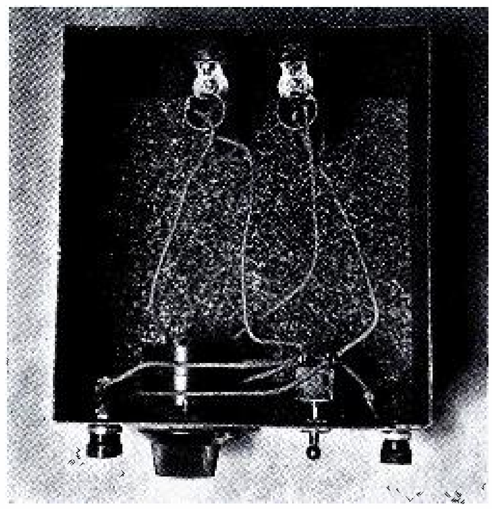


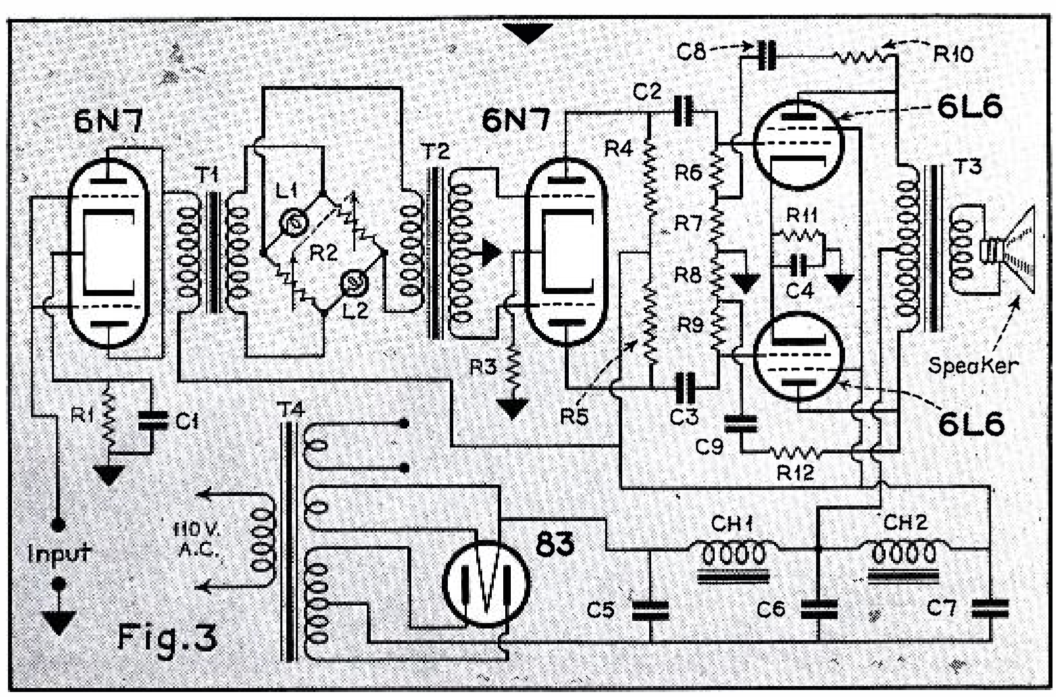
Fig. 5. Interior of the volume expander, showing the dual control resistor and the two auto headlight bulb mountings.

resistance. This fact is advantageous since it introduces a delay and does not allow all the expansion to occur on one or two lobes of the signal wave. If the system responded instantly to changes in impressed voltage, the result would be a peaked wave, highly distorted and containing large odd order harmonic components. This resulting distortion is shown in the sketches of Fig. 2. The (A) portion of this figure shows the distorted wave which issues when a pure sine wave passes through a device having a characteristic such as that shown in (C). This distorted wave is composed in the main of the original wave and a third harmonic as shown in (B). The time lag required to keep the odd harmonics down to tolerable values is dependent both on the frequency and amplitude of the lowest tone which is impressed on the expander. This time lag is determined by the mass of the filament and by the operating temperature of the filament. Since a very hot bulb takes less time, proportionately, to become cool than one heated to a lower temperature, the bulbs should preferably be worked at lower power levels. This will make the time lag proportionately greater for the same filamentary mass.

Operation Notes

Any degree of expansion or compression is possible with this bridge arrangement. The amount of change is determined by the setting of the variable resistances. If the bridge is balanced for a just audible signal, then any slight increase in signal amplitude will result in a huge change in contrast. If the resistances are made less than the bulb resistances at low volumes, then the expansion will not be so great. If on the other hand, the resistance arms are made greater than the bulb resistances, then an increase in signal amplitude will re-

(Continued on page 110)



Complete schematic diagram of audio amplifier designed for use with the volume expander described. Values of the components are given in the parts list at the end of the article.

R. S. S. L. NEWS

THIS newly-instituted department will henceforth appear in each issue of ALL-WAVE RADIO. It is to be devoted entirely to the activities of the Radio Signal Survey League. Herein will be published the lists of stations requesting surveys, member correspondence, the reports of sectional managers, survey standards, league regulations, and, of interest to members and non-members alike, the results of surveys that are considered by the Directors to have universal value.

Purpose of League

The R.S.S.L. has been formed for the purpose of improving domestic and international radio transmission and reception conditions. Progress in these directions will be made by establishing a world-wide network of Monitoring Stations, maintained and operated by members of the League, which will be placed at the free disposal of transmitting stations requesting signal surveys. It is intended that the Monitoring Stations will also be used in any other manner by which they may contribute to the improvement of local radio conditions, or perform a public service in cases of emergency.

By far the most important function of the League will be the simultaneous monitoring by the member network of transmitter signals. By means of this service, broadcasting stations in the standard and short-wave bands, licensed amateurs, commercial code stations handling press dispatches, and other communication facilities, may obtain on short notice a complete and accurate statistical report on field patterns, signal characteristics, etc.

The efficient functioning of the League is predicated upon the cooperation of its members. The headquarters of the League is set up to serve both as the central point of direction and as a clearing house for the reports from each monitoring section. The data obtained from each section will be averaged and worked into chart form, and the chart forwarded to the organization or individual representing the station for which the survey was made.

It is not a purpose of the League to duplicate or otherwise trespass upon the activities of listeners' clubs at present devoted to the collection and compilation of information on DX stations in the standard and short-wave bands. On the contrary, it will be the aim of the League to cooperate with such clubs wherever and whenever it may. In turn, it is the hope that listener organizations will lend their support to the League in its efforts to establish an efficient monitoring network.

League Membership

Those wishing to become members should apply to the Radio Signal Survey League, 16 East 43rd St., New York, N. Y. An application blank will be forwarded immediately. There are no dues, and no obligations other than a sincere effort on the part of each member to assist in the survey work to the best of his ability. No special equipment is necessary. Though not obligated to do so, each member is requested to solicit new members, as the success of the survey service will depend to a large degree on the number of Monitoring Stations in operation. The work will be hampered if all areas are not covered.

Each applicant shall receive a membership card bearing his name and the code number allotted to his Monitoring Station. Each station number shall carry the international prefix for the country in which the station is located—for instance, W for the United States, LU for Argentina, etc. It will be requested that a member place the code number of his station on each signal report to expedite the sorting, checking and compilation of reports at headquarters. Another use for the code numbers will be recommended at a later date.

No membership certificates are to be issued. It is the opinion of the Directors that a membership identification card of a size that will fit the average wallet is more practical, and may in time serve much the same purpose as a press card. Certificates—and in time we hope a medal—will be issued at the end of each year to those members who perform an outstanding public service, or otherwise contribute to the progress of the League or the improvement of radio conditions. The directors have also considered the issuance of special certificates to members who turn in the largest number of survey reports over a period of a year. If this policy is put into effect, it may be necessary to leave the selection to the judgment of the Sectional Managers who will be in a better position to determine what members in their territory are entitled to such certificates.

Voting Power

So far these ideas are tentative only and are being submitted as recommendations to the member body to comment and pass upon. Until some practical system of voting is developed it will be necessary to arrive at decisions by averaging opinions received at headquarters by mail. Eventually it should be possible to decide policies, etc., by direct vote through the medium of the Sectional Managers who will in all cases represent the members in their territory.

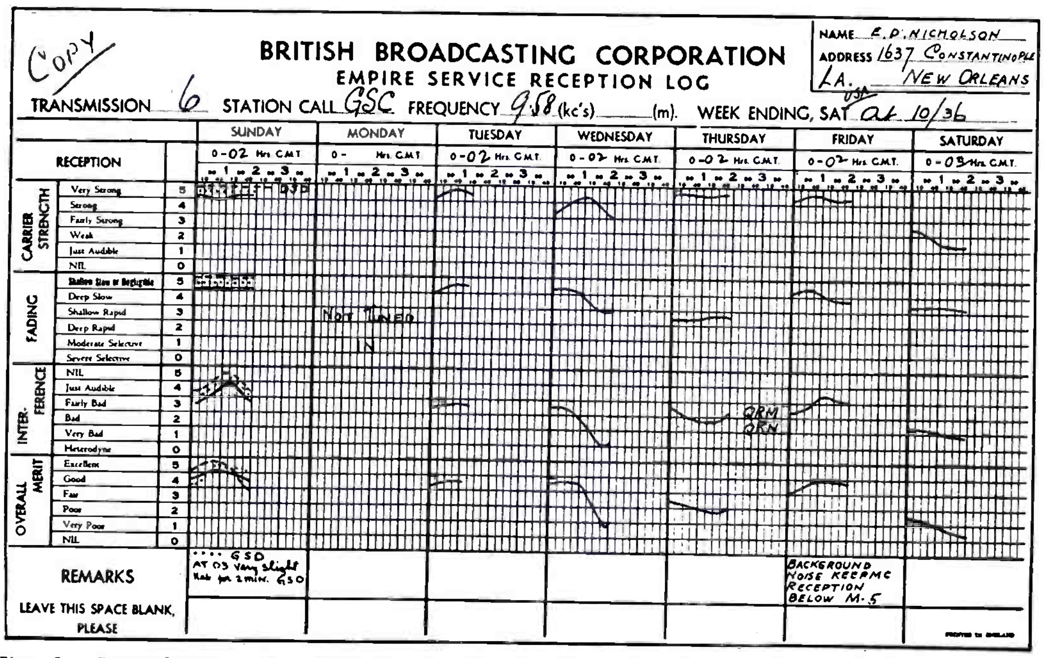


Fig. 1. Reproduction of a BBC Empire Service Reception Log with signal data filled in in graph form.

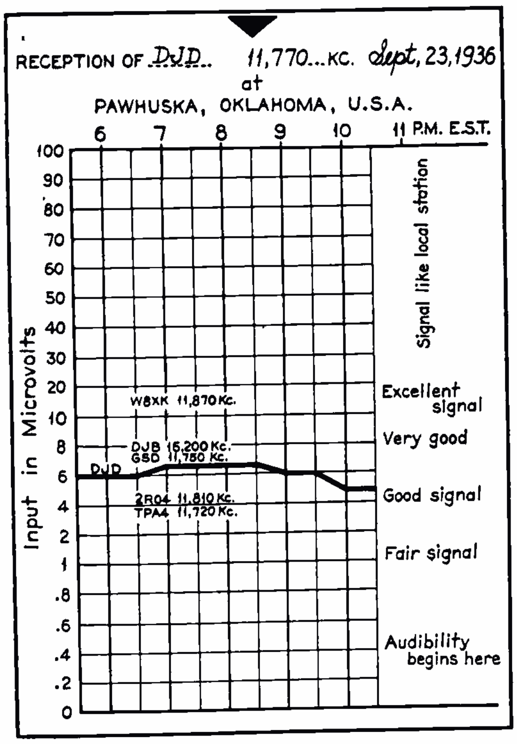


Fig. 3. Station log in graph form, indicating strength of signal in microvolts.

It was originally decided to sectionalize the United States and Canada in conformance with the present amateur radio districts, and to use the same system in other countries where territory is similarly divided. However, the average radio district covers a large area, and if signal survey reports were compiled on this basis it would be difficult for engineers to determine with any degree of accuracy how well signals were being received within the boundaries of a single state or province—particularly so if the engineer analyzing the report were not acquainted with the radio district boundaries. It has therefore been deemed advisable to sectionalize all countries by states or provinces, as the case may be, so that summarized signal reports may be analyzed with the least amount of reference work. This means, therefore, that each state in this country, for instance, will constitute a section, and will be represented by a Sectional Manager. Sections will be referred to always by the name of the state or province (rather than a number, for example) so that no confusion may exist. Any method of sectionalizing that calls for reference to numbers or codes would only complicate matters.

For the present the appointment of Sectional Managers will have to be left to the discretion of the Directors of the League. Once all regulations and policies have been definitely formulated (through the indirect voting of members by correspondence) it should be possible to promote a system whereby members in each section can elect their own territorial representatives. For the time being at any rate, the Sectional Managers selected by the Directors of the League will serve for one year only.

League Divisions

There are at present five League Divisions. A member may serve one or all of the Divisions, as he sees fit.

The *Standard Broadcast Division*, under the direction of Ray La Rocque, is given over entirely to the survey of signals in the standard broadcast band. The *Short-Wave Broadcast Division*, under the direction of J. B. L. Hinds, will handle surveys on short-wave broadcast *and* commercial phone stations. The *Amateur Phone Division*, directed by Zeh Bouck, will cover surveys of amateur phone stations in the 5-, 10-, 20-, 75- and 160-meter bands. The *Amateur C.W. Division*, under the direction of Willard Bohlen, has been set up to survey not only c.w. signals in all the amateur bands, but commercial c.w. stations as well.

The *Noise Survey Division*, under the direction of E. W. Lederman, has been instituted for the purpose of alleviating conditions of severe man-made electrical interference in local areas. In instances where League members are able to determine the source of such interference and the approximate area it covers, a detailed report to headquarters will be analyzed and the condition brought to the attention of the numerous radio and electrical trade associations who are co-operating in the attempt to eliminate this form of interference in the broadcast and short-wave bands.

A report on the most practical means of tracking down such interference and classifying it, will be made next month.

Signal Reporting

The only practical form of signal reporting is one universally used and understood. The measurement of signal input in microvolts is an accurate means of stating the reception conditions, and is clear to any engineer analyzing a summarized report. However, this type of reading is beyond the scope of the average receiver and it is therefore necessary for the present at least, to fall back on the standardized "QSA" and "R" systems which, though having arbitrary values, are sufficiently accurate for the purpose of survey work.

The "QSA" reports deal strictly with signal readability and the "R" reports with signal strength. When both are stated, some indication is given as to other reception conditions, which makes this form of reporting doubly valuable.

The "QSA" scale follows:

QSA1—Hardly perceptible, unreadable

QSA2—Weak, readable now and then

QSA3—Fairly good, readable, but with difficulty

(Continued on page 109)

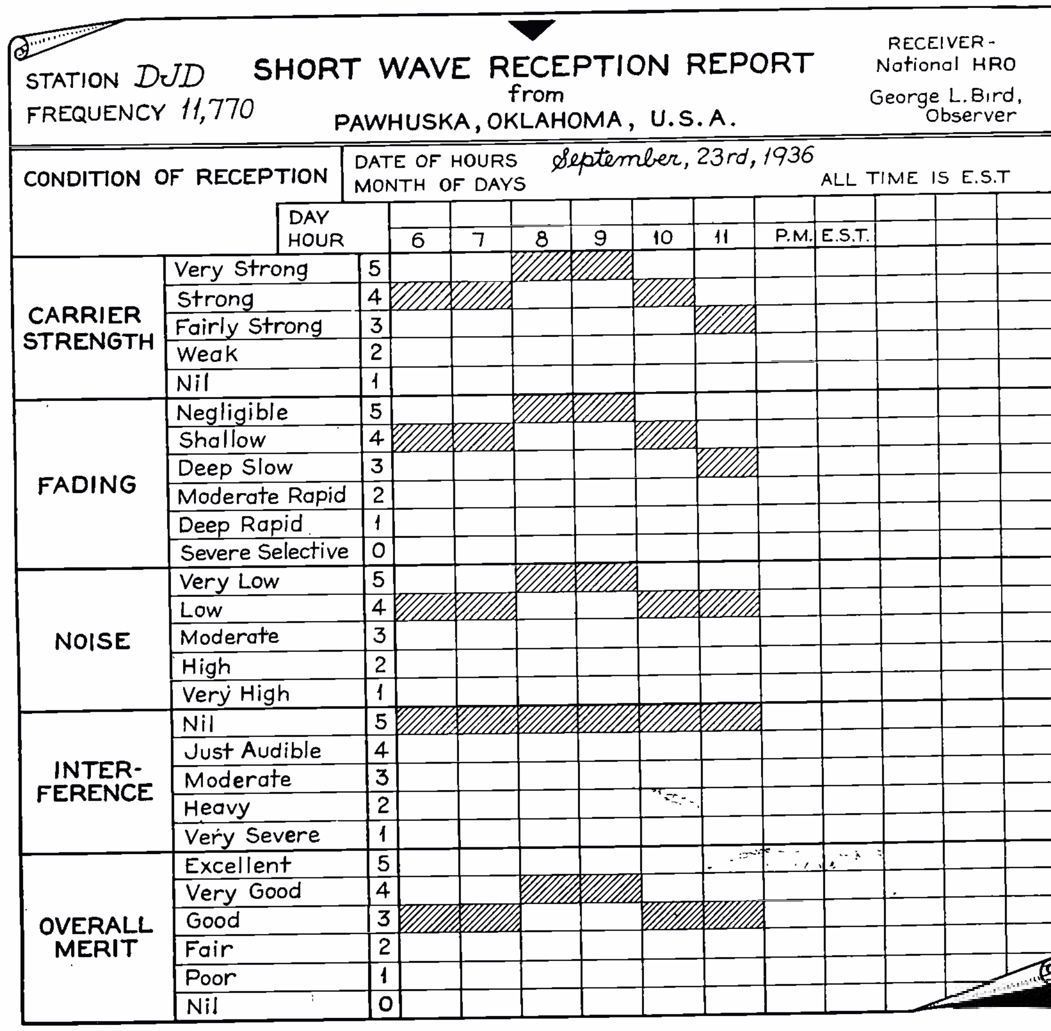
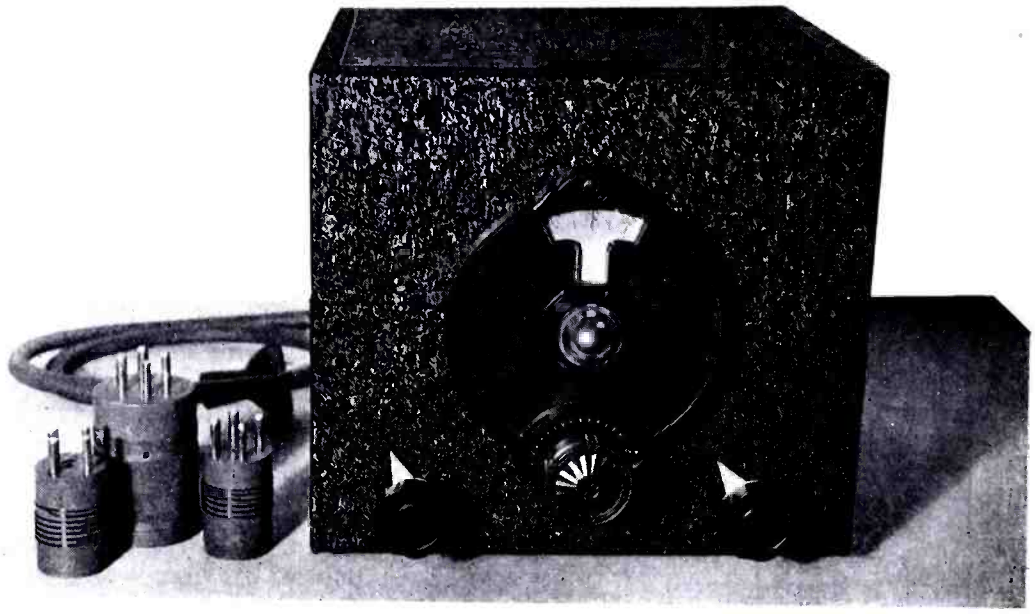


Fig. 2. Reception report somewhat similar to the BBC Log, but with signal data indicated by shaded areas.

The AWR Regenerative TEN-METER CONVERTER



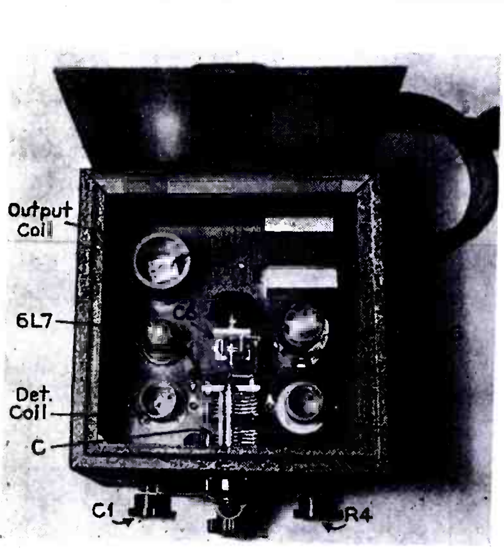
Front view of the completed converter. At the left are shown the three plug-in coils.

BY C. WATZEL, W2AIF, AND W. BOHLEN, W2CPA

THERE are a number of commercially-built supers in use which use band-switching. While some of the later models cover the amateur ten-meter band, the majority do not. Most of these receivers provide satisfactory performance on the ham bands that they do cover, so that one is reluctant to buy a new receiver just so he may cover ten meters. Moreover, not everyone can afford to meet such an expense. This means that the ten-meter band does not get the attention and use that it should.

The cheapest and best solution of this problem is to use a well-designed ten-meter converter. Your receiver will then give the same satisfactory performance on ten meters that it does on the other frequency bands.

There is nothing tricky about a converter. It operates on the superheterodyne principle, making a "double super" out of the super to which it is connected.



Interior view of the converter, showing location of components each of which is designated. See list of parts for values.

Superheterodyne Principle

A standard superheterodyne is composed of three sections. The first section works on the signal frequency, which is the frequency on which the desired station is transmitting. The second section is the "intermediate-frequency amplifier," which generally works on a frequency of 465 kc. The third section is the "high-frequency oscillator." This is tuned to a frequency which is either 465 kc. higher or lower (generally higher) than the frequency of the station being received. This action will automatically produce a beat frequency of 465 kc. This is then fed into the i.f. amplifier, which is tuned to the beat frequency.

The i.f. frequency need not necessarily be 465 kc. It may be, for instance, 4000 kc. In this case it is necessary to tune the high-frequency oscillator either 4000 kc. higher or lower than the frequency of the station being received.

Both of these frequencies are employed when a ten-meter converter is used with a standard superheterodyne receiver. The dial of the receiver is set to 4000 kc. The frequency change to 465 kc. is taken care of by the receiver itself. The signal frequency circuit of the converter—in this case the tuned circuit of the converter first detector—is tuned in the ten-meter band to a frequency of, say, 28,000 kc. The oscillator circuit of the converter is then tuned to 32,000 kc. The resultant frequency of 4000 kc. which is produced is then fed into the receiver which is already tuned to the frequency. If the received signal frequency were, instead, 29,500 kc, the oscillator circuit in the converter would be tuned to 33,500 kc. and so on for any given frequency being received.

This frequency of 4000 kc. for the receiver to work on was chosen for several reasons. For one thing, every receiver can tune to this frequency, whether it be of the all-wave type, or of the amateur communication type which covers only several ham bands. Secondly, the image frequency will be a full 8000 kc. away from the received frequency, which provides almost complete elimination of this type of interference. Also, harmonics of the oscillator in the receiver can be kept out of the ten-meter band. In actual practice the receiver should be tuned a little higher than 4000 kc. to eliminate any 80-meter signals which might leak through to the receiver, but in order to use round numbers we may as well call the receiver frequency 4000 kc.

From this brief résumé of converter fundamentals, it will be seen that a ten-meter converter need only consist of a detector or mixer stage that covers the ten-meter band, and an oscillator stage that covers a frequency range either 4000 kc. higher or lower than the detector stage. There is, however, one important factor that must be considered in laying out the circuits of a converter. This is the ever-present problem of signal-to-noise ratio. It must be high if quiet reception is to be had. In brief, a high degree of gain is needed in the ten-meter stages of the converter.

Several stages of r.f. amplification

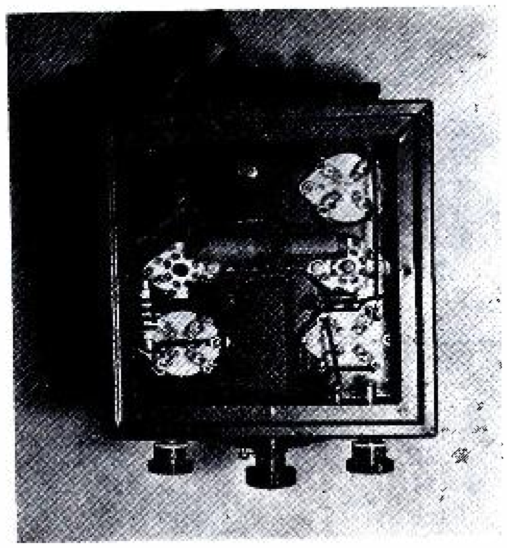
ahead of the detector in the converter would be desirable in this respect. This, however, unnecessarily complicates the converter design, defeating the original goal of a simple, inexpensive unit. After considerable experiment in superheterodyne and converter design for ten meters, it has been found that a regenerative detector stage using the 6L7 mixer tube, together with an oscillator circuit giving a high output, does the trick nicely. The signal-to-noise ratio on ten meters using the converter with our communication receiver is as good as when the receiver alone is used on ten meters, even though this particular receiver is a star performer in the ten-meter band.

Reference to the diagram will show the simplicity of design of this converter. As just mentioned, only two stages—detector and oscillator—are required. The unfamiliar tube number, 6J5G, is that of a newly developed triode particularly adaptable as a converter oscillator. Chief among its advantages is the low capacities between elements. The plate-to-filament, or output, capacity is only 3.3 mmfd., as compared to 13 mmfd. for the more usual type 6C5. The 6L7 used in the detector stage is the popular mixer type designed for this express purpose. It is especially effective in producing a high conversion gain when used in a regenerative circuit of the type shown.

It will be noticed that two different types of oscillatory circuit are used in the two stages. In the oscillator stage an r.f. choke is placed in the cathode lead, leaving the cathode floating insofar as r.f. is concerned. This obviates the necessity for a cathode tap on the oscillator coil. While this circuit is an excellent, fool-proof oscillator, it has been found to be quite undesirable in the detector circuit if high gain and smooth regeneration is to be had in this stage. A separate cathode winding on the detector coil has been found to give the best results in this instance.

Band Spread

The tuning condenser for each stage (C and C5) is tapped down on its respective coil in order to provide band spread. Series condensers were used in the original model for this purpose, but this arrangement was found too awkward in setting the band. The present arrangement is simple and easy to adjust. Condenser C6, which is a type UM-15 mounted on the chassis in back of the main tuning condensers, is the band-setting condenser for the oscillator circuit. Condenser C1 is the trimmer condenser for the detector circuit. It is mounted under the chassis with its control knob at the lower left of the panel. With this condenser controlled from the panel it is not necessary to worry about exact tracking of the two stages, as the



Under-chassis view of the converter, showing layout of parts. See sketch on page 68 for coil socket connections.

detector can be brought into exact trim with the oscillator at all times by a slight readjustment. Any variation in detector tuning caused by a change to a different antenna can also be taken care of with this condenser without having to shove a screwdriver or other adjusting tool into the innards of the converter.

C9 and L3 provide a tank circuit for the detector plate which resonates around 4000 kc. This tuned circuit provides a much better impedance match to the receiver input, and consequently a higher gain and better signal-to-noise ratio, than if an untuned output circuit were to be used. Winding L4 on this coil is of relatively low impedance to match the receiver antenna coil input. A change in the number of turns on this winding will provide best matching to the receiver being used, although the 15 turns specified will be close enough for any receiver.

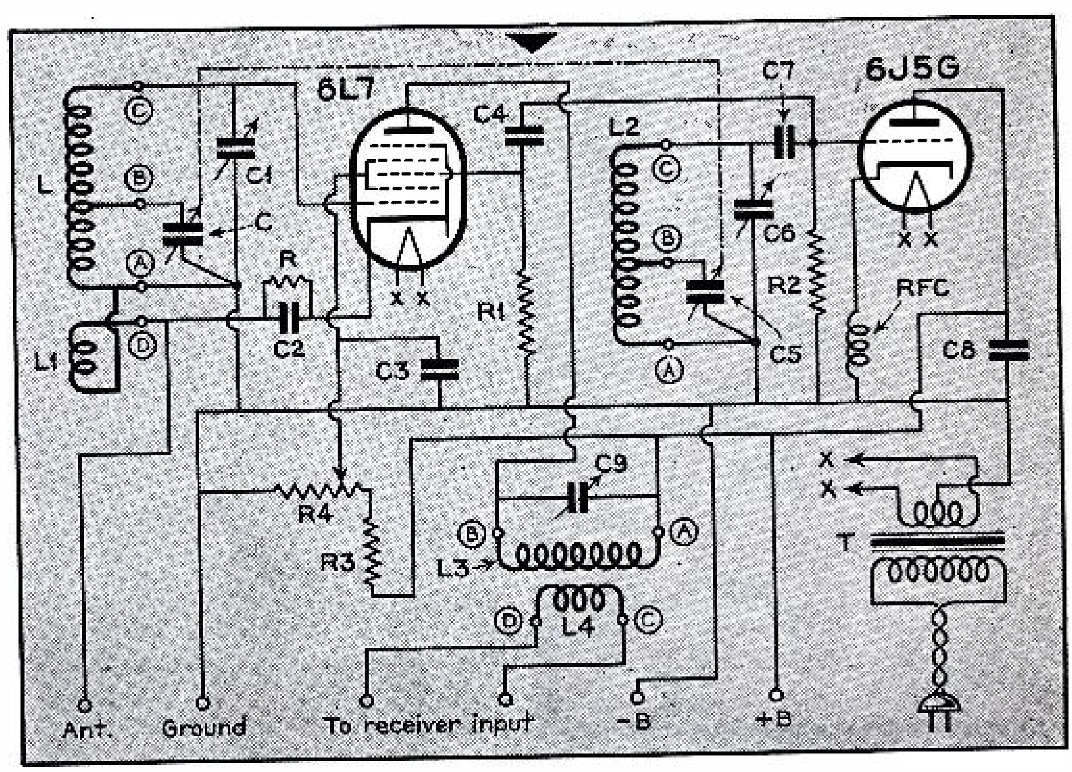
A filament transformer is contained in the converter. If it is desired to control this transformer separately a potentiometer with a built-in switch can be used instead of the one specified. High voltage for the tubes may be easily obtained by clipping to the chassis and speaker B plus lead of the receiver. The current drain of the two tubes in the converter is too small to affect in any way the operation of the receiver.

Construction

The construction of the converter is straightforward. Small washers should be used under the mounting bolts of the dial so that it will clear the nut that holds the gang condenser to the panel. The coil sockets should be mounted in the same position as shown in the coil sketch. The tube sockets should be mounted with the pin slots toward the outside of the chassis.

In wiring, the tank leads from coil to condenser should be kept short. The two mounting bolts, for the coil sockets, which are adjacent are used for grounding points. Above the chassis the frame lug at the back of the ganged tuning condenser is connected directly to soldering lugs which are slipped under the heads of these bolts. Below the chassis wires go directly from lugs on these bolts to the "ground" prongs on the coil sockets. This provides short, direct ground leads from the coils to the condensers.

Three rubber grommets should be inserted in the chassis holes indicated. The one nearest the panel carries the lead from the stator of the detector tuning section (the front one) to the detector coil socket. That directly in back is for the grid lead of the 6L7. The leads from the stator of the oscillator tuning sec-



Schematic diagram of the 10-meter converter. Note that coil L1 is both antenna primary and cathode regeneration coil.

tion (the back one) and the stator of the oscillator band-setting condenser pass through the remaining grommet. Following these wiring instructions will keep the tank leads of a similar converter very close in length to those of the one described, so that coils wound as per instructions should hit ten meters with little or no adjustment of turns.

Six binding posts should be mounted on the back of the cabinet an inch from the bottom, as well as a rubber grommet for the a-c cord to come through.

Adjustment

The converter is simple to put in operation. With the binding posts properly connected to antenna and receiver and the a-c cord plugged in the unit is ready to go.

With the receiver tuned to a frequency just slightly higher than 4000 kc. (just out of the 75-meter fone band) the mica trimmer, C9, should first be adjusted to resonance, which will be indicated by a rise in background noise.

Next the oscillator band-setting condenser, C6, should be set at approximately three-quarters of full capacity. The detector trimmer condenser, C1, should be swung back and forth through resonance while the regeneration control is slowly advanced. If advanced too far the detector will oscillate and the control should be backed a little below this point.

The converter will then be tuned to maximum gain either in or close to the ten-meter band. The band can be set at the right place on the dial by adjusting the oscillator band-setting condenser a bit one way or the other. The detector can always be kept in perfect trim by means of the trimmer control on the panel.

The ten-meter ham band on this particular converter covers from 20 to 80 degrees, which is a spread of 60 degrees. With the dial set at its full 20-to-1 tuning ratio the band may be tuned and logged smoothly and easily.

Operation

The actual operation of this converter came as a distinct surprise and pleasure to us. We had expected to do a great deal of fiddling with the coils before we hit ten meters with a band spread that was neither too large nor too small. On first trial the coils hit ten meters with the degree of band spread previously mentioned. After pushing the cathode winding of the detector coil a bit nearer the grid winding, so that oscillation of the detector could be obtained with the particular antenna being used, no further adjustments of the coils were necessary. The two stages did not track perfectly, although this could have been easily accomplished by slightly altering the spacing of the turns on the coils. With the detector trimmer control placed on the front panel this is a needless refinement.

The use of a different antenna will change the point on the regeneration control at which oscillation of the detector will take place. This point should be reached at from half to full setting of this control. Sliding the cathode winding of the detector coil up or down a bit will take care of this. A midget condenser can also be placed in the antenna lead and adjusted for optimum regeneration. This could well be another type M-30 (such as used for C9) placed under the chassis.

Another surprising feature of this converter is the absolute lack of detuning effect by the detector trimmer. With the oscillator working right on ten meters, and with its grid coupled to the detector, a detuning effect was originally expected as inevitable. Its absence makes tuning that much more easier. With a station tuned in it is only necessary to swing the detector condenser for maximum signal strength.

A good performance from this converter was expected to be reached after the usual period of "bug hunting." The very excellent performance which was obtained immediately on first trial still leaves us flabbergasted. If everybody is as lucky as we were, the ten-meter band should soon become a bit more populated.

There are a couple of thousand kilocycles practically going to waste in this band and we would sure like to meet some of you fellows down there. The band is plenty "hot" now and should stay that way for some time to come.

Parts for Converter

RAYTHEON
1—type 6L7
1—type 6J5G

NATIONAL
1—type STD-50 dual tuning condenser (C, C5)
1—type STHS-15 tuning condenser (C1)
1—type UM15 tuning condenser (C6)
1—type M30 mica trimmer (C9)
1—type B dial, scale 1
3—isolantite 4-prong receiving sockets
2—isolantite octal sockets
2—type XR-1 coil forms
1—type XR-4 coil form
1—type 8 grid clip
1—type R-100 RF choke
1—type C-SRR cabinet

CENTRALAB
1—50,000-ohm potentiometer (R4)

CORNELL DUBILIER
2—type DT4P1 .1 mfd. 400 volt tubular condensers (C3, C8)
1—.00005 mfd. midget mica (C4)
1—.0001 mfd. midget mica (C7)
1—.006 mfd. midget mica (C2)

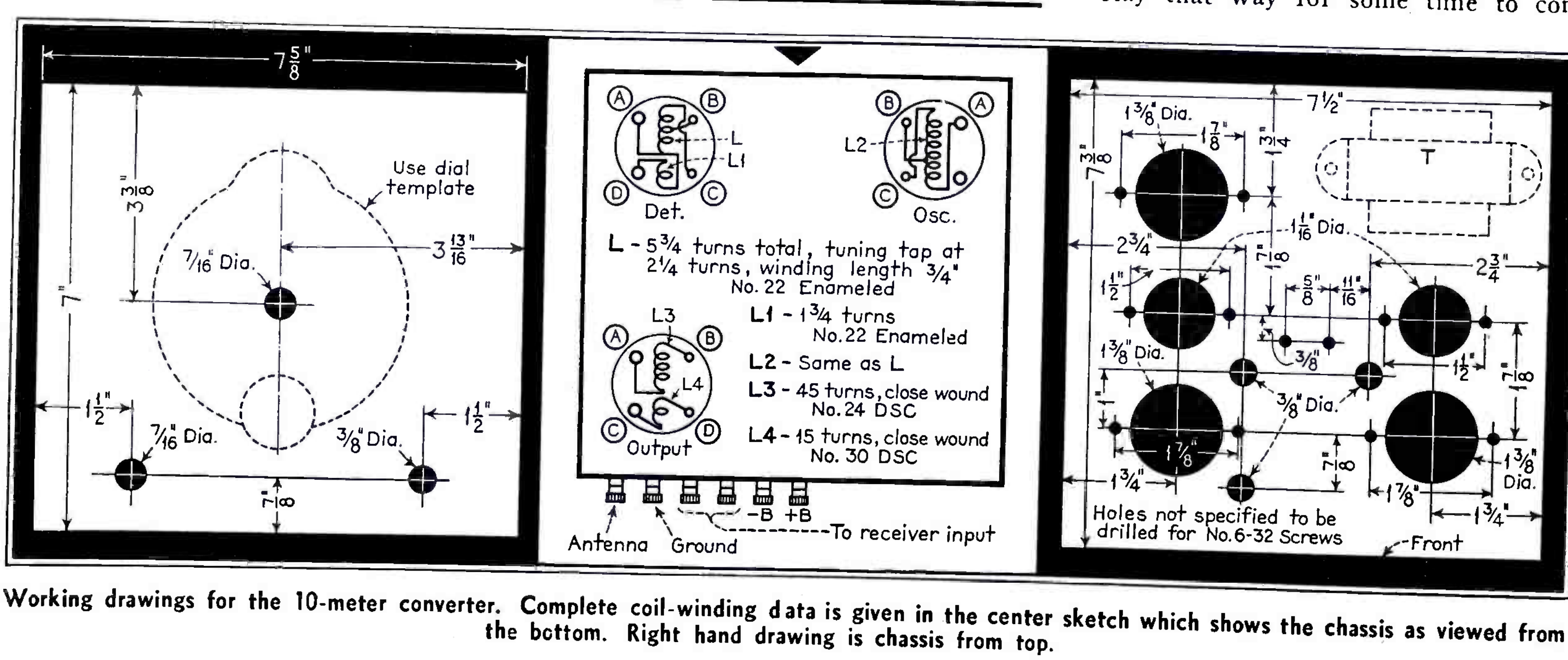
IRC
1—500 ohm, ½watt resistor (R)
2—50,000 ohm, ½ watt resistor (R1, R2)
1—30,000 ohm 1 watt resistor (R3)

KENYON
1—type T-351 filament transformer, 6.3V at 3A. (T)

GENERAL RADIO
2—small knobs with pointers

MISCELLANEOUS
6—binding posts with insulating washers
1—AC cord and plug
4—rubber grommets

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



Working drawings for the 10-meter converter. Complete coil-winding data is given in the center sketch which shows the chassis as viewed from the bottom. Right hand drawing is chassis from top.

Channel Echoes

By Zeh Bouck

ether belchers . . . flash-in-the-pan . . . exotics via arctic circle . . . mormon broadcasts

We have long maintained that the average American broadcast fare is not what the average American would choose if he had any real choice in the matter. However, the broadcasting stations, the advertising agencies and the sponsors behind them, all continue to kid themselves into believing that they are feeding the radio listener with not merely palatable but delicious stuff, and their answer to such epithets as "drivel," "putrid," "nauseating," etc., flung by every intelligent critic from a few unhamstrung radio columnists to college presidents, is their vast fan mail with a large preponderance of commendatory epistles. Tied-up with the sound psychology that homo sapiens is a chronic kicker and is more readily stirred to complaints by something he does not like than he is to praise by that which pleases him, it reads like a good argument in favor of labels, box tops, cartons, wrappers and facsimiles.

However, in the case of radio listening, the psychology is neatly reversed. When it is so easy to tune off, one rarely listens to an objectionable program long enough to boil over on paper. In other words, the broadcaster will hear only from say a thousand persons who like the program, but not from the tens of thousands who refused to listen to it!

That this is so has been nicely demonstrated in our personal experience. Our home, laboratory and wordshop are located in rural New York State, just thirty air-miles south of Schenectady, in an area serviced largely by WGY. Programs originated by this station are, and always have been, tailor-made for a rural audience, while the sponsors of programs piped from the NBC over WGY have similar ideas that their gracious offerings are gulped gratefully by the Schoharie County hill-billys.

It happens that last fall we had occasion to run tests on a goodly number of 1937 model receivers, many of which had to be purchased on the open market. At the conclusion of the tests the lab looked like the corner of Cortlandt and Church Streets, N. Y. C., so we piled the rumble seat full of magic brains, magic eyes, visoglos, automatic maestros, etc., and cruised around the countryside in an effort to peddle this superfluity of radios. We succeeded in selling the good sets on the simple guarantee that WGY could be tuned out and other stations received! We had to take back one of the sets with which this blessing could not be achieved. The cheaper sets, capable of tuning only WGY to any degree of satisfaction—or rather dissatisfaction—are still gathering dust on our shelves.

The question encountered at every contact was—"Will this set tune out WGY, so's a person can get something decent?"

One of these sets is now installed in a small factory operated in conjunction with a novelty shop and filling station. The only time WGY is ever tuned in is on Friday afternoons—from 2:00 to 3:00—for Walter Damrosch's Music Appreciation Hour! With the CBS and the Red and Blue networks of the NBC, plus the Mutual chain at the farmer's finger tips, WGY is rarely out of the dog house.

✦

A FREE SUBSCRIPTION goes to L. M. Clark, research engineer of 222 Audubon Drive, Snyder, N. Y., for refusing to be teased by the old timer's teaser in our December column. He rightly identified the towers as those atop old Aeolian Hall, New York City, which at that time housed WJZ and WJY. The antenna was split in two sections—one for each station. Reradiation, plus cross-talk between the control room channels and piping to the transmitters on the roof, occasionally made it possible to receive both stations, simultaneously, on either wave.

And Professor Armstrong, of superhetrodyne, superregeneration and frequency-modulation fame, did go the gal on the bridge at midnight one better by posing for a photograph while standing on his head atop one of the gold balls adorning one of the towers. As Clark remarks, "he attained perhaps his greatest heights that night."

We had a chat with Armstrong at the last annual banquet of the Radio Club of America, and he refreshed our memory of the occasion with a few details. It was a windy night, with a veritable gale blowing at four hundred and some feet above 42nd Street. Every time the photographer was ready to shoot the picture, the wind made merry with the powder in the flash pan, and the gadget merely sparked feebly like your cigarette lighter and mine. The photographer had to refill the pan some five times while Armstrong swayed gently in the breeze probably wondering who would inherit his brand new Hispano Suiza and equally new and gorgeous wife.

Folks on the roof below picked up three pennies, two nickels and a dime, while George Clark (no relation to L. M.) recovered a fountain pen he had missed since the Radio Club of America banquet in 1923.

✦

THIS IS THE TIME of the year when the Asiatics between 30 and 40 meters (10 to 7.5 megacycles) should pound through nicely in the eastern U. S. A. almost any operating time between dusk and dawn. Best reception will be with an aerial favoring signals from the *north*—not west or east. Signals of this frequency have excellent night-time characteristics, and during the north American winter, the shortest path (the great circle distance) between the far east and New York City goes north to the Arctic Circle through the barren wastes of six months midnight and hits the eastern seaboard headed south (i.e. coming from the north). The area for best reception, under the conditions outlined above, will be within a radius of five hundred miles of New York City.

Stations that should be particularly well received are JYS (9870 kc), YDB (9610 kc), CQN (9553 kc), VPD2 (9540 kc), XGOX (9500 kc), ZBW (8750 kc) and JVP (7510 kc).

✦

E. O. CULTER, vice president of the Newark News Radio Club writes us that, in his opinion, the finest domestic program on the air is broadcast Sunday nights at 1:00 A. M., Eastern Standard Time, by KSL, Salt Lake City. The program is known as "Sunday Evening on Temple Square," and is broadcast directly from the Mormon Tabernacle.

In this general view of station W1HRX may be seen some of the more important elements that go to make this "radio farm" one of the most famous ham hide-aways in the country. The bungalow is large enough to house a small family, but it is used as an operating station and recreation house as well as sleeping quarters for ham visitors.

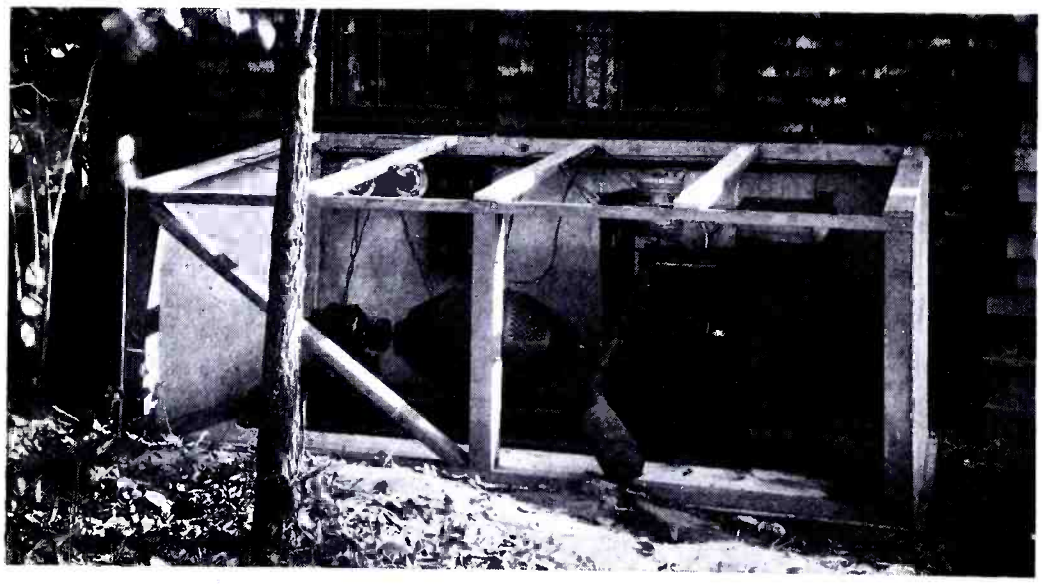
W1HRX—A HAM'S PARADISE

By Arthur H. Lynch, W2DKJ

In order that you may have a mental picture of the owner and operator of the station we are about to describe, it may be desirable to tell you something about the gentleman himself. His contributions to the radio art are quite generally recognized in that field but his personal characteristics are known to only a limited few with whom he comes in contact in the course of business or with whom he converses on the air. Of course, for the past three years, the National Company's rather intimate conversational page, written by Mr. Millen and published in *QST*, has given most of us, in the amateur game, some inkling of his ability and personality, to say nothing of some very valuable engineering facts.

"Jim," as he is generally known by the radio fraternity, is a very modest, unassuming sort of gentleman who hates hustle and bustle and noise in a profound fashion. The "M. E." which follows his name, is a degree which he received from Steven's Institute of Technology, at Hoboken, New Jersey. He was most fortunate in having, among his instructors at Steven's, the now famous Professor Hazeltine, of neutrodyne fame, as well as Professor Vreeland, whose valuable contributions in connection with band-pass tuning have done so much for high-fidelity radio reception.

At that time, Jim lived with his mother at Elmhurst, Long Island. The trek from Elmhurst to Hoboken, was, in those days, something which would not be envied by the present-day college man. While it is generally considered that getting through Steven's is no cinch, Millen found time to prepare magazine articles which started appearing in *Radio Broadcast*. In addition to his technical pursuits, he found sufficient time week-ends to build for himself, and with very little help, a bungalow at High Hill Beach, which is now a part of the famous Jones' Beach State Park. All of the wood for the bungalow had to be transported by boat from the mainland to the little

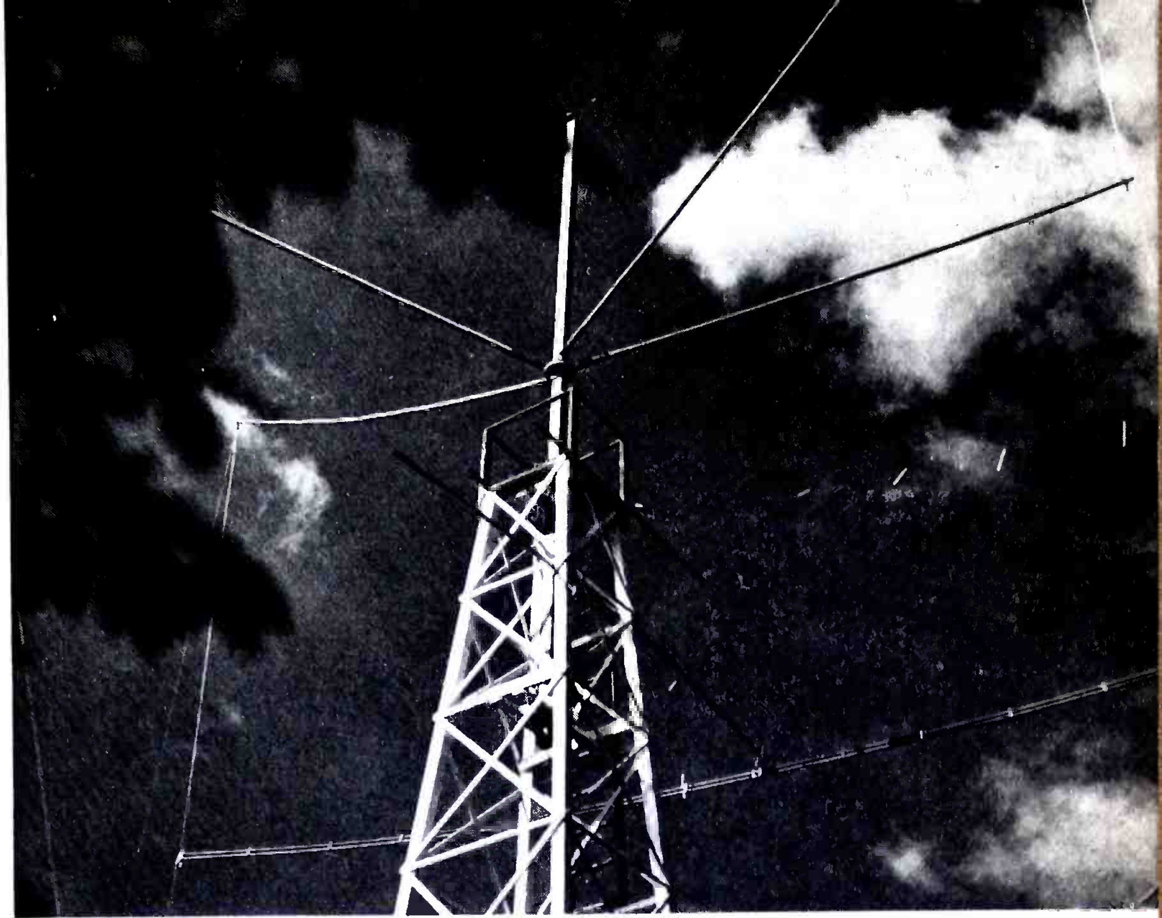


A bruiser of a power supply—this high-voltage generator, driven by a 4-cylinder automobile motor, is controlled from the operating room and it is used only during periods of transmission; that use is plenty because its appetite for gas is almost insatiable.

dock at High Hill Beach, and from there it was toted piece-meal to the bungalow's location, a little over a mile away.

After the bungalow was completed, battery-operated radio equipment was installed and some remarkable results were obtained with extremely long antennas stretched along the beach.

However, that is an entirely different story and our principal point in mentioning it is that the owner of the "Paradise" we are about to describe is a person who has a certain amount of push, and who understands that only by having such seclusion is it possible to secure the kind of radio results that all of us would like to obtain.



More or less typical of Millen's radio fairyland is this extremely practical type of 20-meter array. If the framework atop the tower were enclosed, we might expect to be called to evening prayer by a Muezzin.

The Hilltop Haven

The hilltop on which Mr. Millen's present station is located just north of Middleton, Massachusetts. It is a considerable distance from other homes and one of the highest spots in the Boston area.

The hilltop is reached by dirt roads which branch off the main thoroughfare passing a half mile in either direction from the top of the hill. The dirt roads have the character of mountain trails and would be ideal for Rocky Mountain goats. Among other things, the property includes a large sized pond, a very pretty brook and a pine grove, which puts one in mind of the redwood tree area in the far west.

The main house is a white colonial, located on a small plateau, near the top of the hill. It was built 200 years ago and some of the boards in the floors and in the roof are thirty inches wide. It has been modernized by Mr. Millen and his mother to the extent of incorporating a most up-to-date bathroom and kitchen. This modernization has been done so skillfully that the New England colonial atmosphere of the dwelling has been preserved.

On a clear day, the Customs House, at Boston, some twenty-eight miles away, may be seen from the front porch. The porch, too, provides a view of the excellent swimming pool, some hundred feet down the slope.

The bungalow, shown in the general view of the hilltop, is the radio station itself, and is approximately one-hundred yards away from the main house. The house itself is located to the left of the bungalow and the swimming pool is located quite close to the grape arbor which appears in the lower left-hand corner of the general picture. There is an extension on the side of the bungalow, not in view in the picture, which has recently been added and which serves as a bedroom, with twin beds, for the accommodation of visiting radio amateurs who insist on staying up all hours to work the rig. The provision of this bedroom in the bungalow makes it unnecessary for the visiting brass-pounders and voice-throwers to wake up the remainder of the household when they *do* decide to go to bed, and it has the distinct advantage of enabling them to sleep late in the morning, without being aroused by those who would care to be about in the main house.

The "QSO Department"—the really important corner of the Millen radio establishment. In the rack to the left is the complete low-power transmitter using a pair of RK-20's in the push-pull final. The relay rack to the right carries the power supply for the HRO, a couple of metal shelves for miscellaneous equipment, a wooden operating desk, the HRO receiver itself, a metal coil-storage cabinet, the oscilloscope, and the p-m dynamic speaker.

The Antennas

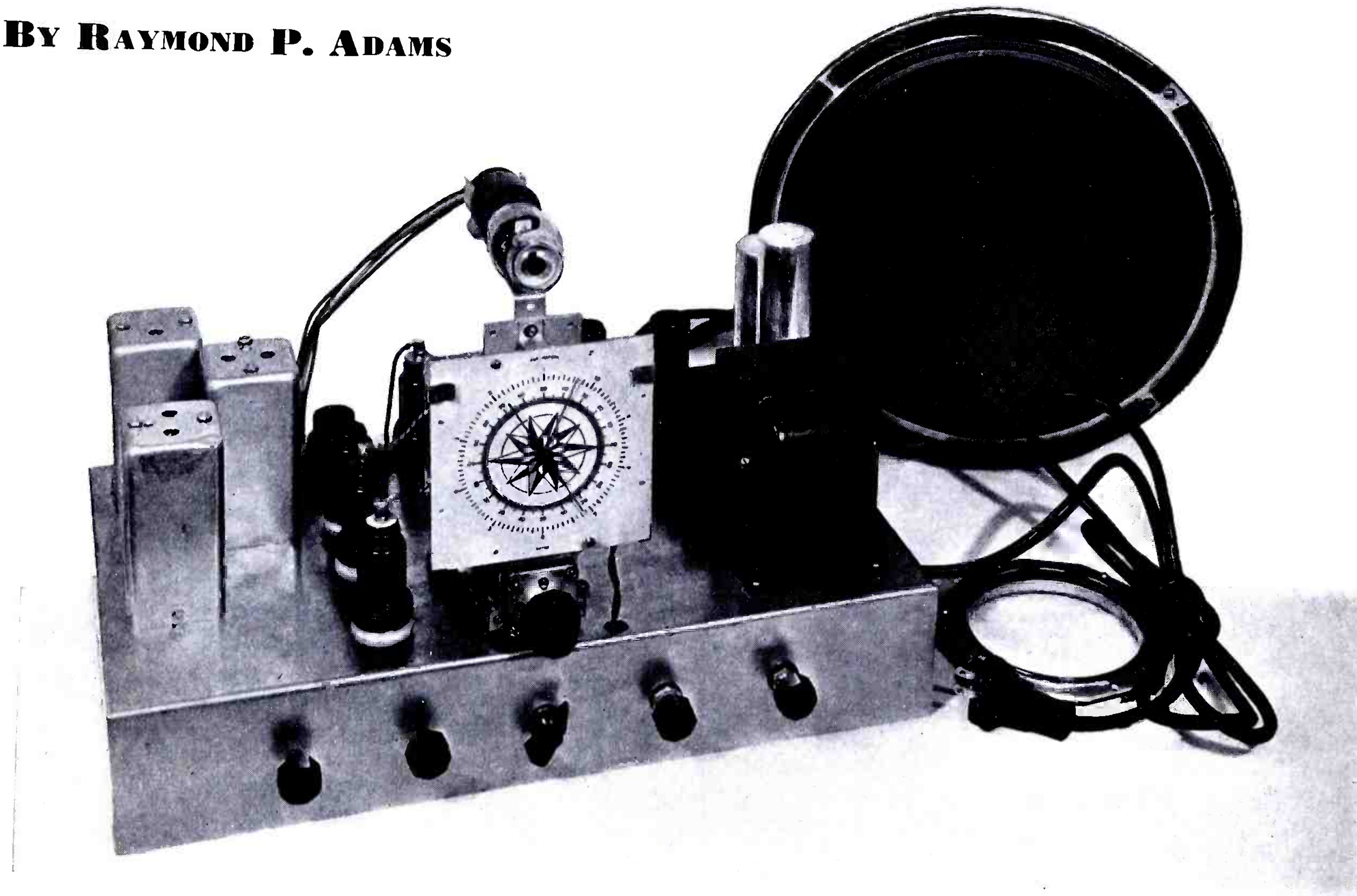
The mast sticking up from the chimney supports a short antenna which is used for local reception and particularly for operation on five meters. The large frame-work tower in the center of the picture and the cumbersome contraption which it supports, reminds one of the rotary aerial swings that one finds at seaside resorts and at county fairs. Actually, it is a 20-meter, four-element beam antenna. Signals from this beam have been heard in all parts of the world.

The original plan for this antenna called for a motor, located at the top of the tower, to be used for rotating

(Continued on page 106)

THE "ORTHOTECH 10-4" ALL-WAVE SUPER

By Raymond P. Adams



The completed Orthotech 10-4 All-Wave Superheterodyne Receiver.

THE 10-4 All-Wave Superheterodyne has been expressly developed for the average listener who desires reliable all-wave reception and faithful reproduction of standard broadcast band programs.

General Description

Our ten-tube circuit uses 6K7's in single r.f. and i.f. stages, a 6L7 mixer, 6C5 high-frequency and beat frequency oscillators, a 6F5 first a.f. and phase inverter, two 6F6 pentodes in a push-pull output stage, and a 5Z4 rectifier. The second detector is a 6H6.

The r.f. coil assembly is pre-trimmed, pre-padded, and mounted on its own chassis. It tunes from approximately 25 mc. to 550 kc., with four bands. The i.f. transformers are iron core and provide good selectivity without affecting overall audio fidelity.

The 6H6 second detector develops both the avc and the audio voltages, with its audio output feeding the phase inverter. The inverter, wired in an exceptionally simple and foolproof circuit, provides out-of-phase voltages for the push-pull pentode Class A amplifier.

We have avoided the use of Class A beam, Class A direct-coupled, and Class A prime output tubes primarily in the interests of low constructional and upkeep costs. The 6F6 pentodes deliver plenty of audio power, require no costly high - voltage or high - current - capacity power transformer, and afford excellent quality of reproduction when properly matched into the dynamic speaker.

The Circuit

A single 6K7, its individual bias-limiting resistor connected between cathode and the center arm of potentiometer R30 (this control provides a manual means for varying the receiver gain) is used in the r.f. stage.

The 6L7 mixer is biased through R7 for a measured cathode voltage of —6. The 150 volt screen potential is obtained from the dropping resistor R8, and the voltage developed by the high-frequency oscillator is fed to the mixer circuit via the 6L7 injector (the number 3 grid at socket terminal No. 5).

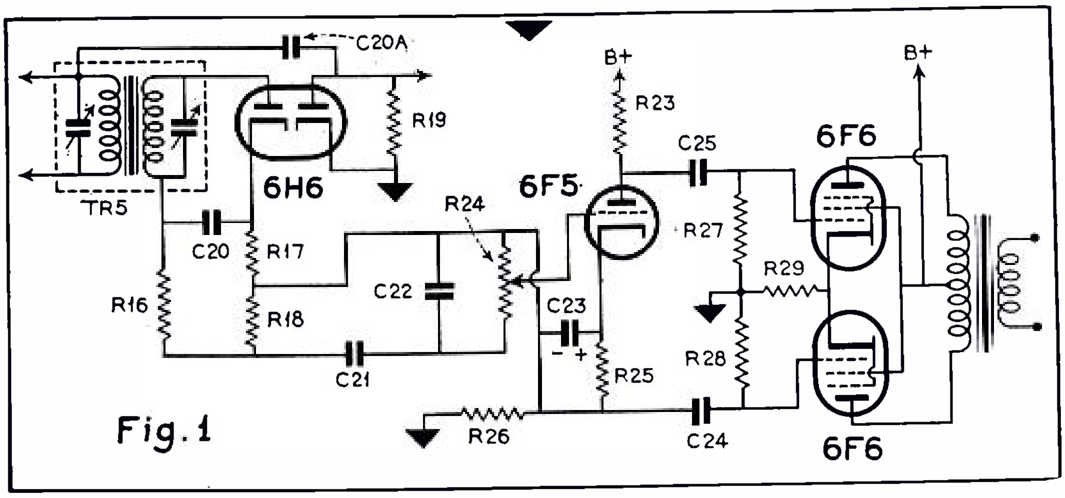
The 6C5 triode high-frequency oscillator feeds off its self-generated r.f. voltage through C15 to the 6L7 injector grid. Note that the feedback is made through C14 to the plate or tickler windings of the h.f.o. coils and that no d.c. therefore flows through the tickler windings.

Like the r.f. tube, the 6K7 in the i.f. stage has its individual bias-limiting resistor, tied between cathode and the center arm of R30. Both input and output transformers are of the iron core, low resistance, high Q type, and the efficiency of this single stage, viewed in terms of usable gain and practical selectivity, is quite above the ordinary. No staggering or trimmer tuning was found necessary to assure a blunt-nosed, steep-sided selectivity curve.

The particular phase inverter system used in the 10-4 calls for a 6H6 second detector. And here we begin a somewhat radical departure from customary receiver circuit design. One set of elements in this double diode tube is used to develop the avc voltage, and the other set the audio voltage.

The output i.f. transformer secondary is connected to the 'audio supply' diode plate and through three resistors to the proper cathode. R18 is the resistor across which the audio voltage is developed.

The second set of 6H6 elements rec-



The detector-avc and phase-inversion audio circuit, explained in text.

tifies the signal picked up from the i.f. transformer primary through C20A, and develops an avc voltage across R19. The avc line feeds the r.f., i.f. and mixer stages, all of which have individual filtering or decoupling resistors.

Note that no delay bias is provided for the avc system. For those who desire it, Fig. 2 shows the necessary circuit alterations.

The Phase Inverter

Resistance coupling to the push-pull audio stage, eliminating a.f. transformer cost and assuring humless wide-range amplification, is obtained through a set-up made possible by the simplified phase-inversion circuit.

Let's go back to R18 (see Fig. 1), across which our audio voltage develops. Two leads are brought from this resistor, one connecting through C21 to one side of the audio volume control R24, and the other connecting directly to the other side of R24.

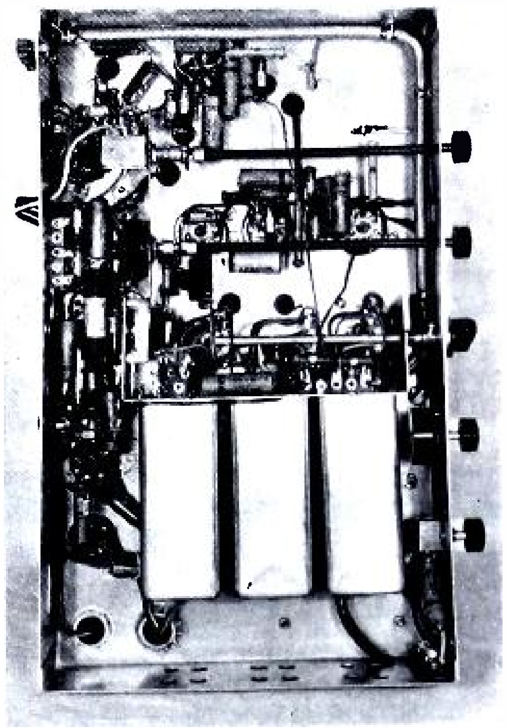
The variable arm of the potentiometer feeds the grid of the 6F5 inverter tube. The minimum level terminal connects to the return point of the cathode resistor, R25. This latter resistor does not tie directly to ground but completes the tube output circuit through the 100,000-ohm resistor, R26. R26 has the same electrical value and physical size as R23 in the plate lead to B plus.

The amplified output appears across both R23 and R26, the potentials at the plate and at the point of juncture between R25 and R26 being equal in magnitude but 180 degrees out of phase. The out-of-phase voltages are fed to the push-pull output stage through C25 and C24.

The Beat Oscillator

The 6C5 beat oscillator circuit is conventionally wired. The method of introducing the beat voltage, however, is somewhat unusual—and simple, the B lead being by-passed through C26, not to ground, but to the cathode of the i.f. tube.

SW1 and SW2 are collectively a double pole, single throw rotary switch so wired that when the beat circuit is connected to B plus and the 6C5 made operative,



Under-chassis view of the receiver, showing location of r.f. coil units and circuit controls.

the avc line is automatically grounded. This feature prevents the introduction of the beat voltage from affecting the avc and thus lowering the sensitivity of the receiver.

Construction

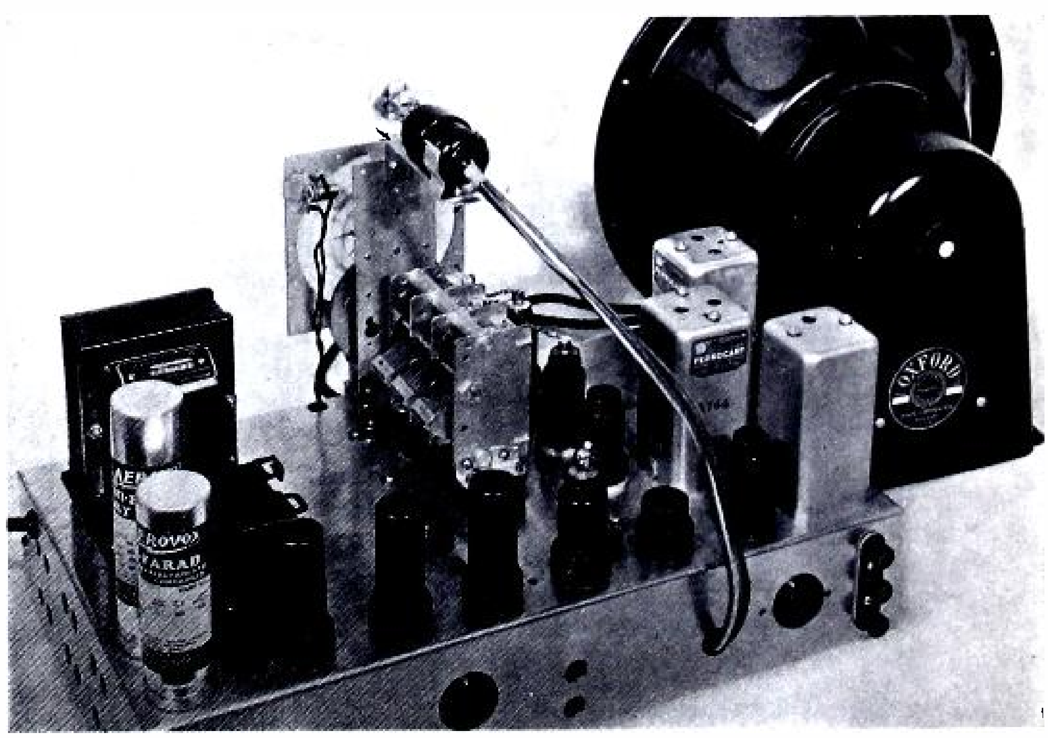
Too many constructional details might test the reader's patience. So we'll simply give information which for one reason or another seems necessary—leaving the odds and ends up to the initiative and common sense of the builder.

First of all, mount the sockets, the i.f. transformers, and the power transformer and filter units.

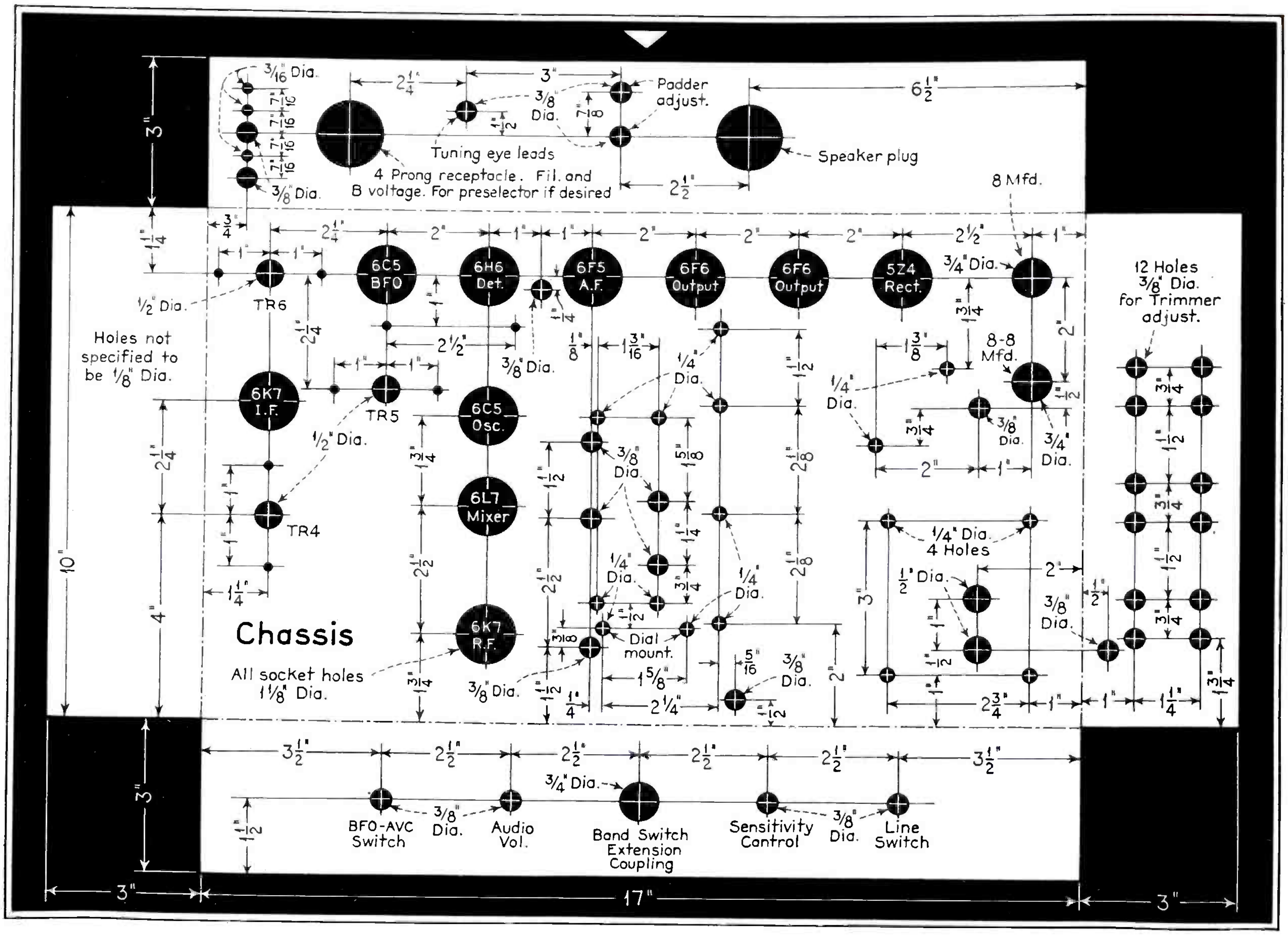
Next, cut out the small shield partition for the audio volume control and the beat-avc switch. *Do not mount the volume control on the front chassis drop.* Leads from this unit should be short—with the potentiometer installed near the detector and inverter tubes and on the shield partition.

Now the r.f. coil assembly. This unit is mounted underneath the chassis as shown—but before it is installed, the builder should wire in the condensers C4 and C9, connecting them between the assembly frame (close to points of supporting contact with the receiver chassis) and the coil terminals to which are soldered the short, heavy, black avc leads. Pull these leads up through the band switch and connect them to a three point tie assembly (carrying resistors R1 and R5) soldered securely on the assembly frame. The coil unit may now be installed by means of small right angle brackets, to be bolted both to the coil unit chassis, in the holes provided, and to the receiver chassis.

The tuning condenser is mounted on supporting legs or washer spacers until it lines up accurately with the dial, itself



Rear view of receiver, showing speaker and pre-selector plugs.



PARTS FOR RECEIVER

AEROVOX

5—type 284 .02 mfd, 200 volt—(C4, 5, 9, 16, 21)
3—type 484, .02, 400 v.—(C24, 25, 26)
6—.1 mfd, 200 v. (C6, 7, 10, 11, 17, 18)
3—.1 mfd, 400 v. (C8, 12, 19)
6—type 1468 or 1463, .0001 mfd—(C13, 15, 20, 20A, 22, 27)
1—type 1462 .003 mfd—(C14)
1—GL5 8 mfd electrolytic—(C28)
1—GGL5 8-8 mfd dual—(C 29, 30)
1—PR25 25 mfd, 25v.—(C 23)

CONTINENTAL

3—1000 ohm, ½ watt—(R4, 9, 15)
2—150 ohm, 1 watt—(R2, 13)
2—250,000 ohm, ½ watt—(R1, R5)
6—100,000 ohm, ½ watt—(R3, 12, 14, 18, 26, 23)
1—2600 ohm, 1 watt (or 1-2000 and 1-600 ohm in series) (R25)
3—500,000 ohm ½ watt—(R22, 27, 28)
5—50,000 ohm ½ watt—(R6, 10, 16, 17, 21)
1—5000 ohm, ½ watt—(R20)
1—300 ohm, 3 watt—(R29)
1—20,000 ohm, ½ watt—(R11)
1—25,000 ohm, 1 watt—(R8)
1—600 ohm, 1 watt—(R7)
1—1 megohm ½ watt—(R19)

ELECTRAD

1—type 206, 1 meg. potentiometer—(R24)
1—type 573, 12,000 ohm pot.—(R30)

MEISSNER

1—type 5780, 4-band all-wave coil assembly—(TR 1, 2, 3)
1—type 5782 input IFT—(TR4) (456 kc)
1—type 5784 output IFT—(TR5) (456 kc)
1—type 6074 beat oscillator trans. to match—(TR6)

JEFFERSON

1—type 463-361 power transformer with upright mount—(TR7)
1—type 466-125 choke (AF)-(CH1)
1—type 469-841 fuse block
1—type 188-534 line fuse.

CROWE

1—type 317 Micromaster dial (0-100 for cond. closing right)
1—type 13554 magic eye escutcheon
1—type 588 pointer knob
4—type 284 round knobs
Change-O-Name or other dial plates if desired

EBY

1—S.P.S.T. rotary switch—(SW3)
1—D.P.S.T. rotary switch—(SW1, SW2)
1—three-post antenna assembly

OXFORD

1—twelve-inch type 12DS, 1000-ohm field dynamic, with transformer (TR8) for push-pull 6F6s

DE JUR-AMSCO

1—three-gang low minimum capacity variable, quarter inch shaft, closing right, maximum capacity approx. .000420 mfd. (See text)

AMERICAN PHENOLIC

7—octal moulded sockets, type S8
3—octal steatite sockets, type RSS8
1—5-prong moulded socket for speaker connection, type S5
1—5-prong speaker plug, type PM5
1—new type PF6 magic eye assembly, with mounting supports, and leads, and with resistor installed

INSULINE

3—brass or 1 brass and 2 flexible couplings for quarter inch shafts
2—12-inch lengths of quarter inch fenoline rod

LENZ ELECTRIC

1—two-foot length, low capacity shielded tubing
1—roll special RF wire—No. 20 solid
1—roll special RF wire—stranded 10/30
1—roll red push-back, No. 18

YAXLEY

1—4-point band selector plate if desired
2—pilot light assemblies
2—6.3-volt pilot lights

RAYTHEON

1—6H6, 1—6F5, 1—6L7, 2—6C5, 2—6K7, 1—5Z4, 2—6F6, 1—6E5

MISCELLANEOUS

Quarter and three-eighths inch (hole diameter) grommets. Heavy cable for filament wiring. 17x10x3 inch chassis; 19x12 inch panel if desired.

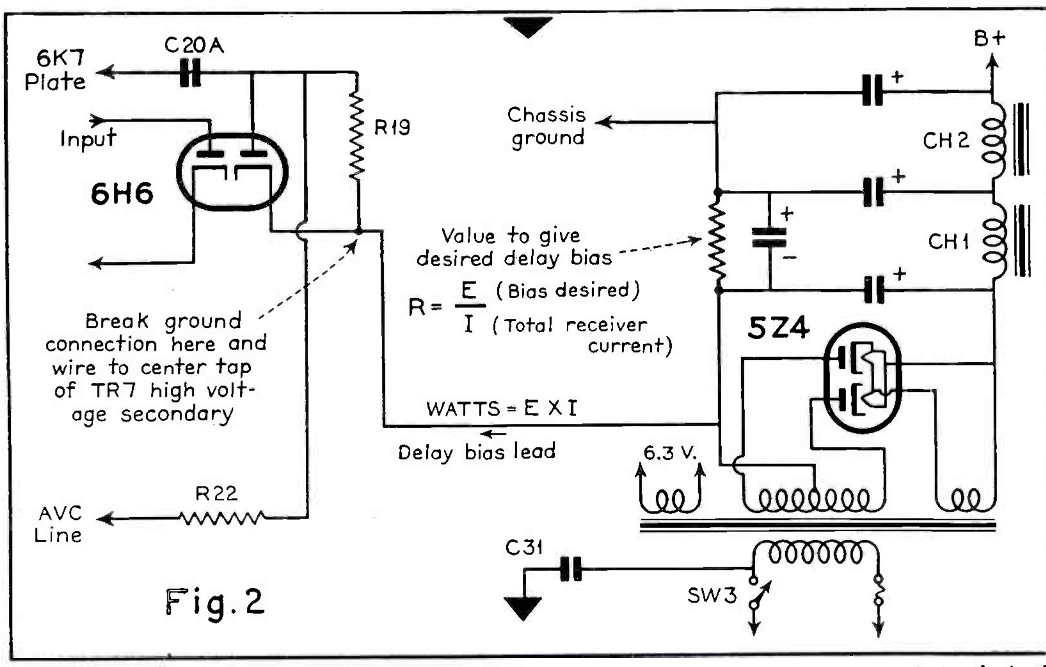
This receiver has been thoroughly tested and has given satisfactory performance. The parts listed or their equivalent will give satisfactory results. Substitutions should be made with care.

mounted to the chassis by means of small right angle brackets secured to the dial frame.

Wire the filament circuit with reasonably heavy cable. Use plenty of tie points to support r.f. and i.f. bypass condensers and voltage dropping and decoupling resistors, grouping units for the individual circuit around the associated socket, and making ground contact for such grouped units at one chassis point wherever possible.

In wiring up the second detector and phase-inverter circuits, unusual care must be taken in keeping essential a.f. leads short and direct. Resistors R16, 17, and 18 should be mounted on a tie point assembly, soldered, as shown in the under-chassis view, near and above the detector tube socket. R25 and C23, in particular, should be mounted in such a position that though their leads to associated components may be kept short—their capacity to chassis-ground is held at a minimum. In other words, R25 and C23 should be pulled away from the chassis. Use the particular type of bias by-pass (C23) specified. It must be definitely of small physical size and self-supported by its own leads.

No panel is shown in the photographs and no layout data for such a panel has been given, as it is thought that this particular receiver lends itself primarily to installation in a console cabinet.



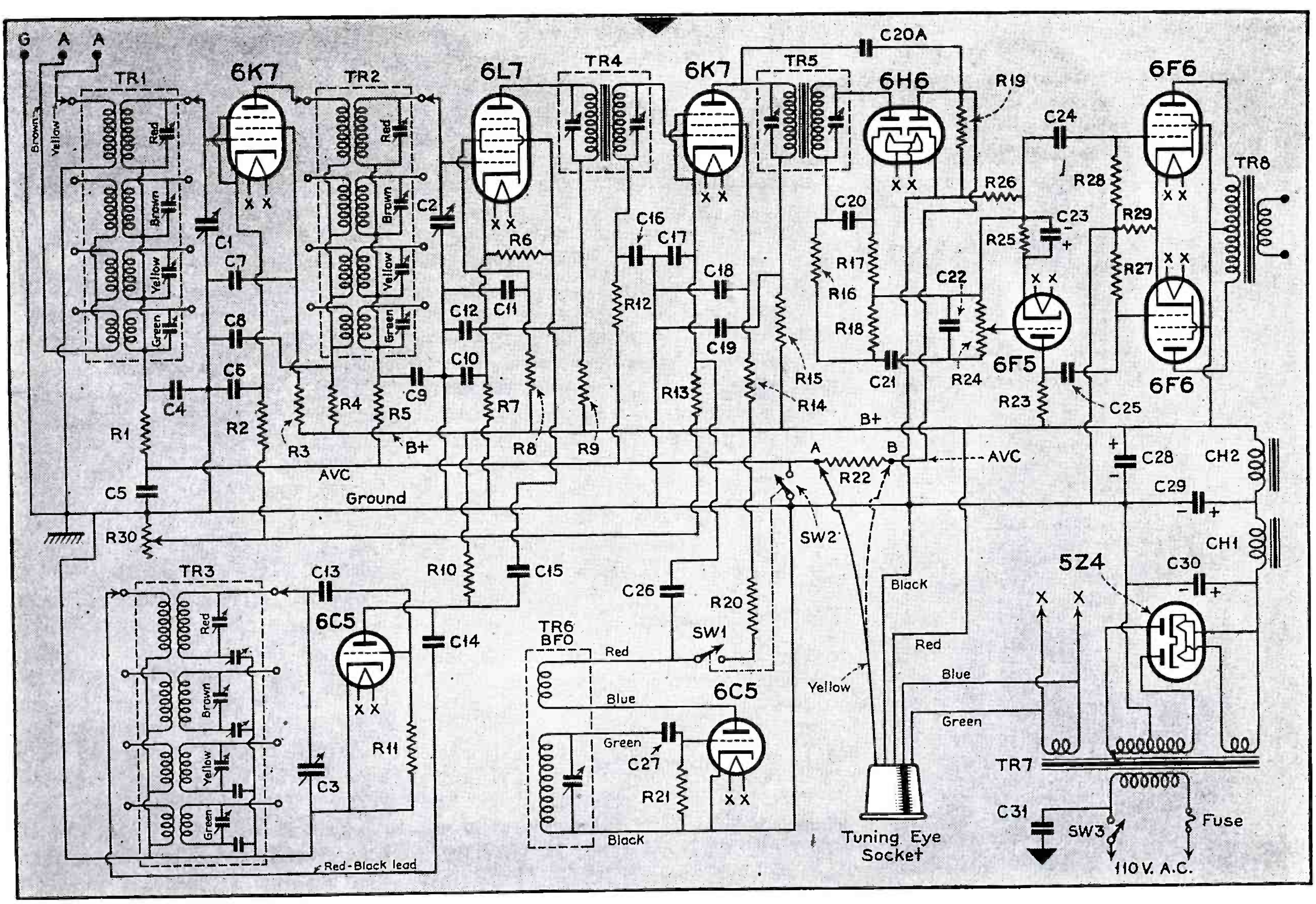
Showing changes to be made in circuit if delayed automatic volume control is desired. This is explained in text.

Adjustments

The first job here, of course, is to go over the wiring for shorts and opens, once the receiver has been constructed. Point to point tests are recommended.

If the 6F6 pentodes are to be operated in Class A Prime, a power transformer supplying a higher voltage than the unit specified may be required, the potential supplied the plates being on the order of 375 volts. Here, the voltage for the output stage would be taken from the point of juncture between CH1 and CH2. CH2 would necessarily have to have a field resistance of about 2,500 ohms, as the current drawn through it

(Continued on page 109)



Complete schematic diagram of the Orthotech 10-4. Parts values are given in the list on the opposite page.

Globe Girdling

By J. B. L. Hinds

phone stations reported . . . the good ship "awatea" . . . ynlf mystery . . . the dope on khabarovsk . . . praha schedules . . . harmonic veri club . . . the "no veri" club

YOU will find elsewhere in this issue a new department given over entirely to the recently formed Radio Signal Survey League. The League has a number of functions, some of which may not interest you at all, but we urge you and your listener associates to join up under the Short-Wave Division, of which we are Director.

The League is in a position to be of material help to the listener as well as the broadcaster. Reception reports from all parts of the world will be gathered together and analyzed in such manner that you as a listener will be able to determine not only how reception should stack up in your locality but also what should be expected in the way of reception from various directions and countries at all seasons of the year.

This is the first time in the history of short-wave reception that any coordinated effort has been made to amass world-wide reception data and present it in statistical form for the benefit of all. However, the success of the venture is dependent upon your cooperation. If we all pull together, great things can be accomplished.

Don't feel that your knowledge of radio may be too scant to permit you to undertake handling detailed reception reports. Such is far from the case. All the necessary details will be published in the department given over to the League. No technical knowledge is required.

So, let's start the ball rolling . . . write in for a membership blank today, before it slips your mind.

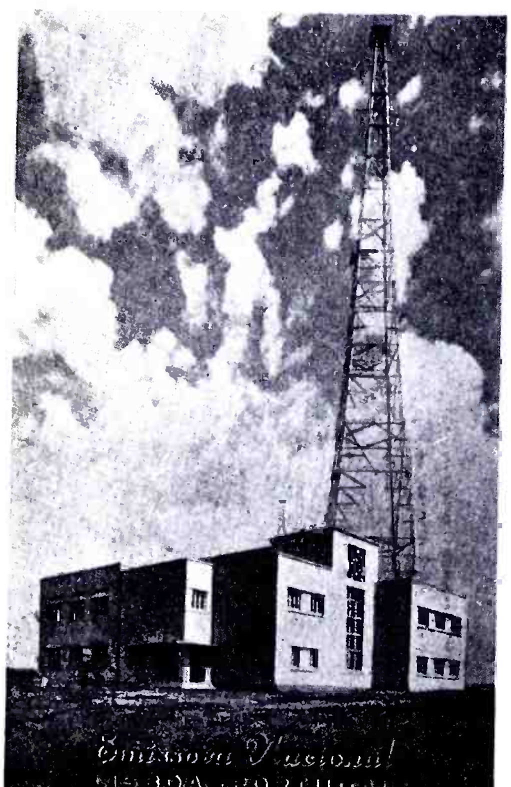


Photo-veri from CSW, Lisboa, Portugal —9,550 kc.

NEW STATIONS

Kc	*Meters*	*Call*	*Location*
15530	19.32	HSC2	Bangkok, Siam
15530	19.32	HS8PJ	Bangkok, Siam
15190	19.75	ZBW	Hong Kong, China
13760	21.80	TYE2	Paris, France
11730	25.57	PHI	Huizen, Holland
6580	45.59	YN1GG	Managua, Nicaragua
6000	50.00	RV59	Moscow, USSR.
5910	50.76	YV15RV	Valencia, Venezuela
5758	52.10	YNOP	Managua, Nicaragua

STATION CHANGES

New Frequency	*Call*	*Old Frequency*
19020	HS8PJ	19200
15795	XOJ	15785
10955	HSG (From HS8PJ)	10955
9940	CSW	9930
8960	FVA (Call added)	8960
7955	HSJ	7968
6450	HI4V (Location changed to San Francisco de Macoris)	6450
6345	YV1RG (From YV1RV)	6350
6280	COHB (From CO9WR)	6280
6132	VP3BG	7220
6005	HJ1ABC	6011

STATIONS DELETED

Kc	*Meters*	*Call*	*Reason*
10169	29.50	HSG	Not in service

NON-AUTHENTICATED STATIONS

Frequency	*Call*	*Location*
15740	TFM	Reykjavik, Iceland (Dec.)
14000	PZ1AA	Paramaribo, Dutch Guiana (Dec.)
11895	HP5I	Aguadulce, Panama (Dec.)
11740	HP5L	David, Panama (Nov.)
10520	GOA	Shanghai, China (Jan.)
9590	VK6ME	Perth, West Australia (Dec.)
9540	CB954	Santiago, Chile (Dec.)
7580	HI9J	Cuidad Trujillo, R.D. (Dec.)
6500	YV1RM	Cristo de Aranza, Venezuela (Feb.)
6330	YV13RV	Valencia, Venezuela (Mar.)
6270	YV14RC	Caracas, Venezuela (Aug.)
6120	HP5Z	Panama City, Panama (July)
6075	HI3E	Puerto Plata, R.D. (Nov.)
Various	6 stations	Peru, South America (Dec.)
Various	8 stations	Costa Rica, C.A. (July)
Various	5 stations	Czechoslovakia (Jan.)
Various	13 stations	Norway (Jan.)

Station Changes

The changes in station lists for this month are covered in the accompanying tables:

Phone Stations Reported

XOJ, Shanghai, China, 15795 kc, phones JVD, 15860 kc, Japan, at 8 P. M. and later. Reported by R. E. G. Langton, Port Hammond, B. C., Canada.

JVD, 15860 kc, Nazaki, phones San Francisco 4 A.M. daily. Reported by Lyle Nelson and Kendall Walker, Yamhill, Oregon.

SS *Ile de Piere* reported heard by Norman G. Wiswell, Colebrook, N. H., near 8800 kc at 6:15 A.M., 150 miles northwest of New Zealand.

HBJ, 14535 kc, Geneva, heard testing with Riverhead, N. Y., near 1 P.M. by John E. Gill, Dorchester, Mass.

JYS, 9840 kc, Japan, reported heard by R. Simpson, Australia, at 8 A.M. E.S.T.

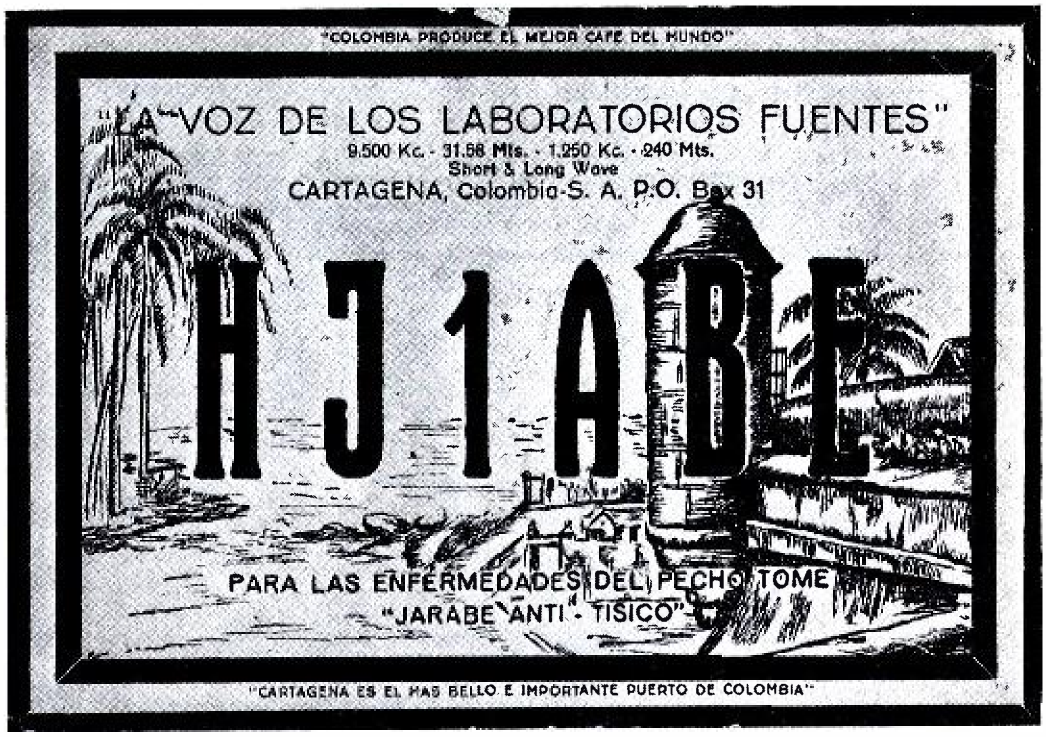
ZLT, 11050 kc, Wellington New Zealand, heard calling Sydney and phoning VLZ between 1 and 1:30 A.M. by Roy Waite, Ballston Spa., N. Y.

IUC, 11955 kc, and IUG, 15450 kc, Ethiopia, heard by E. H. Clark, Hollister, Calif., between 12 and 1 A.M. and 9:40 and 10 A.M., respectively.

ZMBJ, 8850 kc, reported by the Western World Wave Club as located in Western (British) Samoa appears to be the call of TSS *Awatea* of the Union Line. Unofficial information is that the ship has two frequencies, namely 8840 and 13600 kc. Station is said to be on the air on 8840 kc each Sunday from

1:30 to 4 A.M. and at times on 13600 kc. Letter from J. Herbert Hyde, Elmwood, Conn., states that he has veri card from this ship covering his reception on August 8, 1936, on approximately 13200 kc. Verification card does not show frequency but imparts the information that transmitter is called "The Ears and Voice of the Tasman," and has 300-400 watts power in antenna. Card signed by L. H. Jones, Operator. When picked up by Mr. Hyde it was on its maiden voyage from England to New Zealand, where it was put in service for the New Zealand-Australia trade. The TSS *Awatea* is a luxurious new liner modelled after the *Queen Mary*.

In connection with experimental and radiophone stations shown in station lists, the information as to time on the air, contact with other countries, etc., is constantly changing. It would therefore be appreciated if listeners following such stations, and conversant with the scheduled contacts and call letters of stations contacted, would carefully check the lists and advise this department of changes which should be made so that the lists may be kept as correct and up to date as possible. It is necessary to follow this plan as the stations involved will not advance the information.



Red, white and blue veri from Cartagena, Colombia. This is HJ1ABE's new card, and well worth having.

Broadcast Station Reports

COCX, Havana, Cuba, 11435 kc in station list, is reported as 11650 kc in list of frequencies just received from the Secretary of Communications of Cuba.

COKG, Havana, recently changed from 6150 to 6200 kc although list from Cuba shows frequency as 6150 kc. Reports from listeners would be appreciated.

TYE2, Paris, France, a new radiophone station, has been added to lists. It works days in phone and experimental service with New York.

RV59, Moscow, U.S.S.R., 6000 kc, is now broadcasting on the 4 to 5 P.M. English hour on Sunday, Monday, Wednesday and Friday in place of RNE, 12000 kc. The latter station is on the morning broadcasts as scheduled.

RV96 has been taken off the Sunday broadcast 1:30 to 2 P.M. on 15183 kc.

YV1RM, 6500 kc, is the call of a new short-wave broadcasting station to be installed in "La Aggeaga," in the municipality of Cristo de Aranza, District of Maracaibo, in the State of Zulia, Venezuela. The long-wave call will be YV1RN and the frequency 780 kc.

HI4V, 6450 kc, has transferred its transmitter from Cuidad Trujillo to San Francisco de Macoris, Dominican Republic. It is assumed that no change in frequency has been made.

HI8Q, 6240 kc, and HI4D, 6482 kc, both listed at Cuidad Trujillo, Dominican Republic, may have consolidated. Mr. Howard Wilson, Jr., Ithaca, N. Y., reports both calls are now announced near 6540 kc. Any advice will be appreciated.

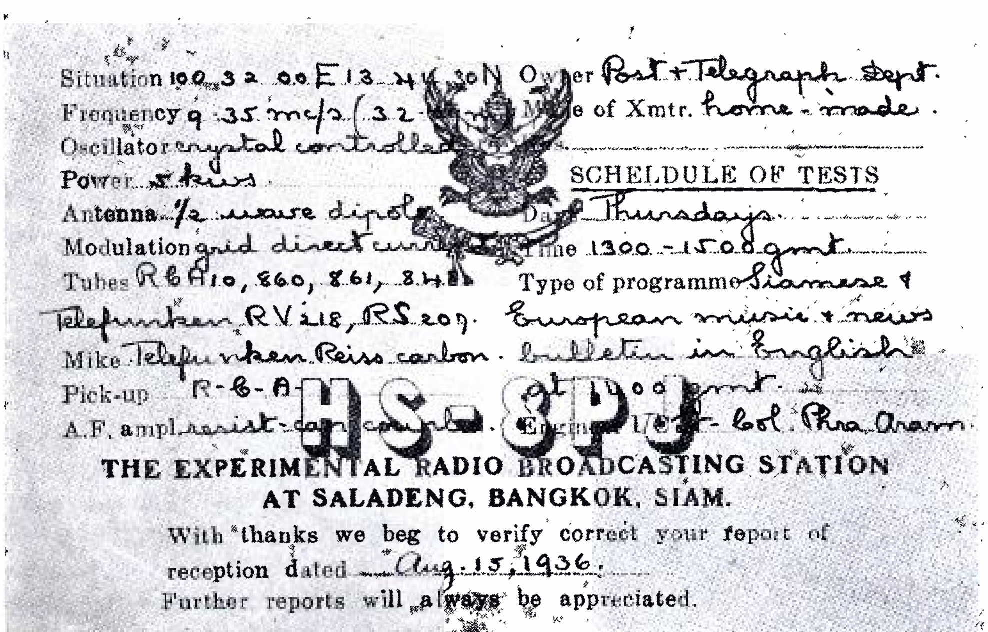
HI9B, 6040 kc, may have shifted in frequency, as it has been reported heard near 5884 kc.

ZBW, Hong Kong, China, is now listed on 5410, 8750, 9525 and 15190 kc and reported as heard by many on last three frequencies named. Lyle Nelson and Kendall Walker, Yamhill, Oregon, report that Hong Hong has a number of frequencies and that calls are numbered as follows: ZBW2, 6120 kc; ZBW3, 9530 kc; ZBW4, 15190 kc and ZBW5, 17790 kc. Later developments will be reported in next issue.

VK6ME, Perth, West Australia, 9590 kc, in non-authenticated section, will not be on the air for some time. It is said that the transmitter which was being tested out for VK6ME was shipped to Suva and is to be used by VPD2.

HCK, Quito, Ecuador, listed on 3750 kc reported heard by Mr. H. Wilson, Jr., Ithaca, N. Y., on 7500 kc. As no advice has been received from station of change in frequency this may be the second harmonic of the fundamental frequency.

JZI, 9535 kc; JZJ, 11800 kc and JZK, 15160 kc, are the only ones of the new 50-kw Japanese overseas transmitters heard so far according to reports received. No definite schedule yet. Heard 2 to 3 P.M. Tuesdays and Fridays, 4 to 5 P.M. Mondays and Thursdays, and 12 to 1 A.M. and 4 to 8 A.M. on various dates.



Veri from Bangkok, Siam, with plenty of dope on station. Call and insignia in red.

LKU, 11830 kc, one of the new chain of Norway short-wave stations has been reported heard on test programs.

YNOP, Managua, Nicaragua, is shown in station list in this issue on 5758 kc. This station is sending out good signals and transmitting some good program material. Frequent announcements are made in Spanish and English.

CSW, Lisbon, Portugal, experienced difficulty in getting out on 9930 and are announcing they are now using 9940 kc and have again been changed in station list.

YNLF, Managua, Nicaragua, still listed on 9595 kc and reported heard by several listeners on 7700 kc, 9668 kc and 9595 kc. R. B. Oxrieder, State College, Pa., has received veri card for 9650 kc, although reported received on 9668 kc. And now to make the case a little more complicated, the writer has veri card from YNVA covering several reception reports for that station on 8590 kc. On the back of card appears the following: "Your report O.K. Thanks. Our new call is YNLF. New report—new YNLF verification." Can you help solve the mystery?

HJ2ABD, Bucaramanga, Colombia, 5980 kc, has not been heard on the 31-meter band since 2RO Rome came on 9635 kc, but has again been heard on its assigned frequency of 5980 kc. The writer, however, has a veri card from them showing 9580 kc although not received on 9580 kc. It would seem they would experience considerable difficulty in being heard when GSC was on that frequency with its regular programs.

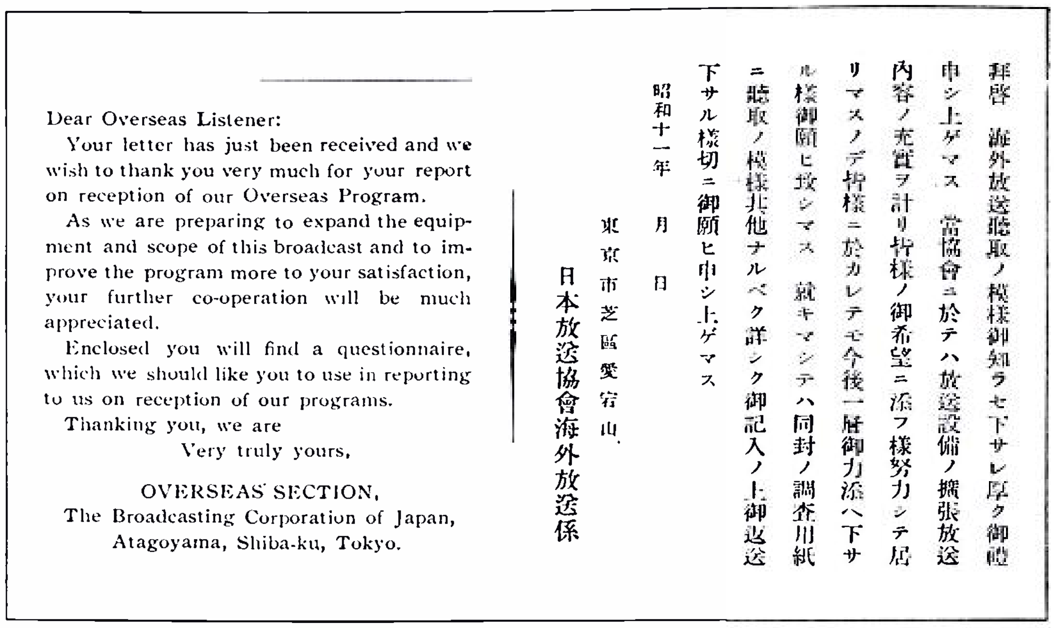
COCE reported by several as being heard relaying a program of CMCE, Havana, has not been heard of late. A letter addressed to both stations was returned uncalled for and neither station appears in the listing of the Cuban Radio Commission.

HS8PJ, Siam, 10955 kc, is no longer used for broadcasting, the call having been changed to HSG, the transmitter to be used irregularly in radiophone service. HS8PJ, 9350 kc, experimental station, will broadcast programs on Thursdays 8-10 A.M., E.S.T. HS8PJ, 19020 kc, will transmit most of the broadcast programs on Mondays 8 to 10 A.M., E.S.T. while HS8PJ, 15530 kc, will broadcast occasional programs on Mondays. The frequencies of radiophone and broadcasting stations have been revised in this issue in station lists, complete information having been received direct from the Radio Technical Section of Siam.

At the opening of their experimental short-wave broadcast programs on HS8PJ, three chimes are sounded on a gong beginning from the lowest note.

The announcements are made in order in Siamese, English, German and French. The titles of recording selections are also announced.

RV96, Moscow, U.S.S.R., is shown in lists at 15183 kc or 19.76 meters. This reporting made on information received from Moscow. Last program shows RV96 as 19.88 meters which should be about 15090 kc. Information as to correct frequency would be appreciated.



Dear Overseas Listener:

Your letter has just been received and we wish to thank you very much for your report on reception of our Overseas Program.

As we are preparing to expand the equipment and scope of this broadcast and to improve the program more to your satisfaction, your further co-operation will be much appreciated.

Enclosed you will find a questionnaire, which we should like you to use in reporting to us on reception of our programs.

Thanking you, we are

Very truly yours,

OVERSEAS SECTION,
The Broadcasting Corporation of Japan,
Atagoyama, Shiba-ku, Tokyo.

拜啓　海外放送聽取ノ模様御知ラセ下サレ厚ク御禮申シ上ゲマス　當協會ニ於テハ放送設備ノ擴張放送內容ノ充實ヲ計リ皆様ノ御希望ニ添フ様努力シテ居リマスノデ皆様ニ於カレテモ今後一層御力添ヘ下サル様御願ヒ致シマス　就キマシテハ同封ノ調査用紙ニ聽取ノ模様其他ナルベク詳シク御記入ノ上御返送下サル様切ニ御願ヒ申シ上ゲマス

昭和十一年　月　日

東京市芝區愛宕山
日本放送協會海外放送係

Veri from Japan. Other side carries photograph.

The Dope on Khabarovsk

RV15, Khabarovsk, U.S.S.R., 4273 kc, 70.21 meters, is correct in listing. A letter dated November 10th so advises. This station broadcasts every day of the month except 6-12-18-24 and 30th from 7 A.M. to 12 midnight, Khabarovsk time (3P.M. to 8 A.M., E.S.T.) On 6-12-18-24 and 30th from 11:10 A.M. until 12 midnight, Khabarovsk time (7:10 P.M. to 8 A.M., E.S.T.). Beginning January 1, 1937, the English program will be given every day of the month beginning at 6 P.M. Khabarovsk time or 2 A.M., E.S.T., except 6-12-18-24 and 30th.

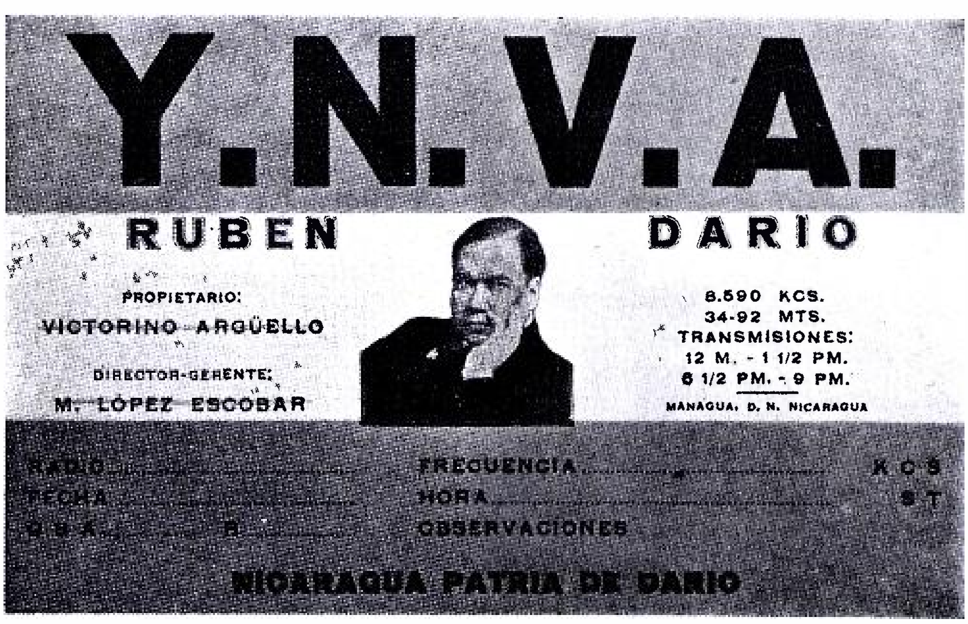
No bells, chimes or interval signals are used. The station opens every morning at 7 A.M. sharp with an electrical transcription of a march—a different march rendered every morning. Then the announcer states the time and station call in Russian. The day's regular broadcast then begins with the first part of the morning's physical culture exercises. The announcement after the march each morning is as follows:

"Vremya saychass sem chassev tree minuti Khabarovskava." (The time is now three minutes after 7 A.M. Khabarovsk time.)

"Vnimaniye, Gavorit Khabarovsk." (Attention, Khabarovsk speaking.)

"Cherez peredatchik Er Veh Pyatnattzet na volnye sendyesat i dve desatih metrah." (Broadcasting from RV15 on a wave length of 70.2 meters.)

The day's broadcast ends at 12 midnight with the playing of the "International," English programs begin in the following manner:



Blue bands with the call in gold—but the new call is YNLF according to written notation on rear of card.

"Hello, everybody, Station RV15 on the air. Broadcasting from Khabarovsk, in the Far Eastern Region of the U.S.S.R." And concludes: "Our next English broadcast is on ——— (date). Until then, goodbye everybody."

No mention is made of this station broadcasting or testing on any other frequency than 4273 kc, although several reports were received of station said to be RV15 on 5700-5710-5720-5770-5900 and 5170 kilocycles.

Lyle Nelson and Kendall Walker, Yamhill, Oregon, report a "mystery" station on 5700 or 5710 kc but are not of the opinion that it is RV15. So here is a puzzle for the listeners to solve.

F3ICD, Saigon, Indo-China, 11730 kc, has been reported heard by several listeners in early morning, but some doubt expressed as to the call letters as shown. Further reports would be appreciated.

VK3LR, Melbourne, Australia, 9580 kc, is on the air Sundays 3 A.M. to 7:30 A.M. and week days 3:30 to 8:30 A.M., E.S.T. Of late it has been broadcasting from 8:55 P.M. to 8:30 A.M. each day except Sunday, Wednesday and Thursday and each week day from 8:45 to 9:45 A.M. It is not believed that this schedule is to be maintained regularly.

Praha Schedules

ORL, Praha, Czechoslovakia, states in a letter to the writer that they are still in the experimental stage and do not issue any advance programs as yet. They are still testing on various frequencies.

They further state that they are transmitting every day from 2:25 to 4:30 P.M. for the European zone and twice a week from 7 to 9 A.M. on Tuesdays and Fridays for the American zone. Promise is made that advance programs will be sent this department as soon as they shall start regular broadcasts. Their announcements would indicate that they are on 15320 or 11870 kc from 9 A.M. to 1 P.M.; on 11870 or 11840 kc from 2:25 to 4:30 P.M. and on 11840 kc from 7 to 9 P.M. on Mondays and Thursdays. They have also been reported heard on 11870 or 11840 kc irregularly after midnight E.S.T.

The writer has received one of their new veri cards which is a photo postcard featuring Hradcany Castle, former castle of Czech Kings, now the home of the President of the Republic of Czechoslovakia. In the foreground of the photo is shown an ancient bridge dating from the distant past, with the River Vltava flowing beneath it. The above information was given me by Mr. Charles W. Havlena, Washington, D. C., a reader of ALL-WAVE RADIO, who has also received one of these veri cards, which means much to Mr. Havlena, for it is a pleasant reminder of the days spent by him in Prague several years ago. Mr. Havlena further states that Dr. Ladislav Sourek, President of the Czechoslovakia Broadcasting Company, has recently been in the United States, making a survey of transmission effectiveness of "Radio Praha." Experimentally OLR is to continue short-wave broadcasts until the end of 1936 at which time four directional antennas will be used in connection with regular broadcasts.

New Venezuelan Calls

Under a new radio law in Venezuela all call letters are being changed and the old and proposed calls for short-wave stations are listed below:

Frequency	*Old*	*Proposed*	*Location*
6545	YV11RB	YV6RB	Ciudad Bolivar
6520	YV6RV	YV4RB	Valencia
6400	YV9RC	YV5RH	Caracas
6375	YV4RC	YV5RF	Caracas
6360	YV1RH	YV1RH	Maracaibo
6300	YV12RM	YV4RD	Maracay
6156	YV3RC	YV5RD	Caracas
6070	YV7RMO	YV1RD	Maracaibo
5880	YV8RB	YV3RA	Barquisimeto
5850	YV5RMO	YV1RB	Maracaibo
5800	YV2RC	YV5RC	Caracas
5710	YV10RSC	YV2RA	San Cristobal

The list from the radio authorities, however, shows the frequencies of certain old calls as follows: YV4RC—6170 kc, YV1RH—6350 kc, YV3RC—6150 kc, YV7RMO—5810 kc, YV1ORSC—5720 kc.

The last report from YV4RC reported frequency as in station list; 6375 kc. YV1RH reports 6350 kc on veri card but is announcing 6360 kc. YV3RC recently reported their frequency changed from 6150 to 6156 kc. All reports of YV7RMO have been 6070 kc. YV1ORSC recently reported frequency changed from 5720 to 5710 kc. YV15RV reported testing on 5910 kc and listed on that frequency but not shown in list received.

YV1RG, Radio Valera at Valera, is shown in station list at 6345 kc but not shown on list received. Mr. R. B. Oxrieder, State College, Pa., has veri giving this information.

Station YV5RP reported heard on 6270 kc with announcement that P.O. Box 508, Caracas, is address. This may be YV14RC shown in non-authenticated section. This station will therefore not be shown in station lists until authentic information is received. YV13RV and YV14RC shown in non-authenticated section are not shown in list received. The writer expects to receive a revised listing explaining the differences, which information will be published at the earliest possible time.

It is understood that the Marconi Company has received a contract for the erection of five radio stations in Afghanistan. The principal station will be at Kabul, which will be equipped with a transmitter for telegraphy and telephony, to cover a wave range of 15 to 80 meters with an output of 5 to 6 kw to aerial feeders on telegraphy and 3½ to 4½ kw on telephony. Both receiving and transmitting stations will be separate but connected by land lines with the Central Telegraph Office at Kabul.

Cuba—The Department of Communications has granted permission for the construction of two additional short-wave broadcast stations, one by the Compania Cubana Nacional de Radio, which now operates long-wave station CMJK, at Camaguey, to be assigned to the 31-meter band, and the other to be operated by Mr. Bernabe de la Torre, long-wave station CMGF at Matanzas, to be assigned to the 25-meter band.

COCQ, Havana, Cuba, 9750 kc, is contemplating increasing its power to 25 kw.

More Power For Daventry

Daventry—Big changes are planned at the BBC Empire Broadcasting station at Daventry which should result in im-

White card, blue printing, call in red—from Maracaibo, Venezuela.

proved reception of the BBC Empire programs in all parts of the world. This will ensure that the British short-wave broadcasting service shall not be inferior to any other similar service in the world.

At the present time there are three short-wave transmitters at Daventry. These transmitters can all radiate on a number of different frequencies with an average power in the aerial of 10 kw. Experience during the past three years, however, has shown that better reception would result by the use of higher power.

The BBC has therefore decided to install three new transmitters, which will operate with a power of 50 kw in the aerial. The three present transmitters will probably be retained, as experience has shown that their power is sufficient to provide good reception in the less distant parts of the Empire. Space has also been allowed for the installation of a fourth high-power transmitter at some later date.

At the time of writing there are seventeen different aerials at Daventry, supported by two masts 500 feet high and two steel towers each 350 feet high. Construction has already started on eight new masts, with an average height of 300 feet, which, together with the existing masts, will support a total of twenty-four beam aerial arrays of the latest design, a number of the new aerials being fitted with reflectors. The increase in the efficiency of the aerial system should, apart from the increase in power, lead to much better reception generally.

India—Proposals for the erection of several new short-wave broadcasting stations for India were recently considered by the Standing Finance Committee of the Legislative Assembly. These stations will be installed at Madras, Delhi and Calcutta.

Sweden—Plans are laid for the improvement of broadcasting facilities in general. Short-wave broadcasting equipment has been ordered for a new station at Motala.

Yugoslavia—The Marconi Company will construct a 20-kw transmitter to be installed near Belgrade and which is to replace the existing low-powered station which has been in service for seven years.

"Harmonic Veri Club"

The "Harmonic Verification Club" is progressing nicely. When comment was made in the December issue, little did we think that such a club would materialize, but three applications for membership from those qualified have put in appearance in letter form. Two of them are from the West and one from the East Coast.

Lyle Nelson, Yamhill, Oregon, has veri on harmonic from TGWA, Guatemala City; J. Wendell Partner, Tacoma, Washington, is in possession of one from HIT, Ciudad Turjillo, Dom. Rep. Both letters dated November 27, 1936. Carroll H. Weyrich, Baltimore, Md., has veri from W3XEY, Baltimore, Md.

Membership in this club will not, of course, be built upon the set rules and requirements of a Heard All Continents Club or similar organization, but conferred upon the written word of the recipient of the veri card and no certificate of membership issued.

While I closed the December comment with one "Hi!" it would seem to be fitting to close this paragraph with "Hi! Hi!"

"No Veri Club"

The following stations are slow in forwarding verifications and complaints are regularly filed: HJ1ABB, HJ3ABD, HJ4ABD, HJ4ABB, HJ2ABD, Colombia; HCETC, Ecuador; XBJQ, Mexico; HRN, Honduras; YNVA, Nicaragua; CB960, Chile; H12D, H14V, H15N, H17P, H19B, Dominican Republic.

Red printing—blue design. Schedule now 6 to 10:00 P. M.

With particular reference to HRN, Tegucigalpa, Honduras, it might be said that several Dx clubs have instructed its members not to make reception reports to this station as no veri card has been received by anyone. This station is known to have received several thousand reports with which International Reply Coupons were forwarded. For a time they read the letters to listeners over the air but this has been discontinued, but no replies received.

Amateur Phone Stations

The following is a list of 20-meter amateur phone stations as listed in late reports which have not been listed in previous reportings. Australia, "LF"—VK3WW (7 A.M.); Argentina, "LF"—LU6KE—LU1EX, LU9PA (5 to 7 P.M.); Brazil, "HF"—PY2BJ (6:15 P.M.); France, "LF"—F8MG (5:14 P.M.Q; French Morocco, "LF"—CN8AA (7 P.M.).

We are grateful to the following for reports which assisted in giving this information: L. R. McPherson, Chicago, Ill.; Galen Balfe, Lowell, Mass.; S. A. Whitt, Itmann, W. Va.; H. W. Bower, Sunbury, Pa.; Fred L. Van Voorhees, Miller Place, N. Y.; Harry E. Kentzel, Averill Park, N. Y.; and Werner Howald, Los Angeles, Calif.

It is noted that the reports on 20-meter phones are lessening in number and some reporters are not supplying the information requested in previous issues. It is essential that they be listed by countries, time received, and whether received on the low- or high-frequency side of the band.

In Appreciation

It affords me pleasure to acknowledge reports and letters from Donald D. Campbell, New York City, N. Y.; Crittenden Davis, South Swansea, Mass.; Roy E. DeMent, Plainview, Texas; H. H. Flick, Portland, Oregon; Nathan Goldfort, Rock Island, Ill.; Judson Greer, Fort Smith, Ark.; John E. Gill, Dorchester, Mass.; George B. Hart, Detroit, Mich.; Leo Herz, Chicago, Ill.; Charles W. Havlena, Washington, D. C.; Matthew E. Leshner, Lawrence, Mass.; Charles C. Norton, San Francisco, Calif.; Russell Powell, Southern Pines, N. C.; Carroll H. Weyrich, Baltimore, Md.; Norman G. Wiswell, Colebrook, N. H.; and to extend to them and to many others the thanks of ALL-WAVE RADIO and the writer.

Address your letters to me at 85 St. Andrews Place, Yonkers, New York, enclosing self-addressed stamped envelope should you desire a reply.

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

Night-Owl Hoots

By Ray La Rocque

wor dx bc . . . contest scores . . . "down under" stations . . . xera up-power's . . . ether jamming . . . international listener organization . . . more hi power

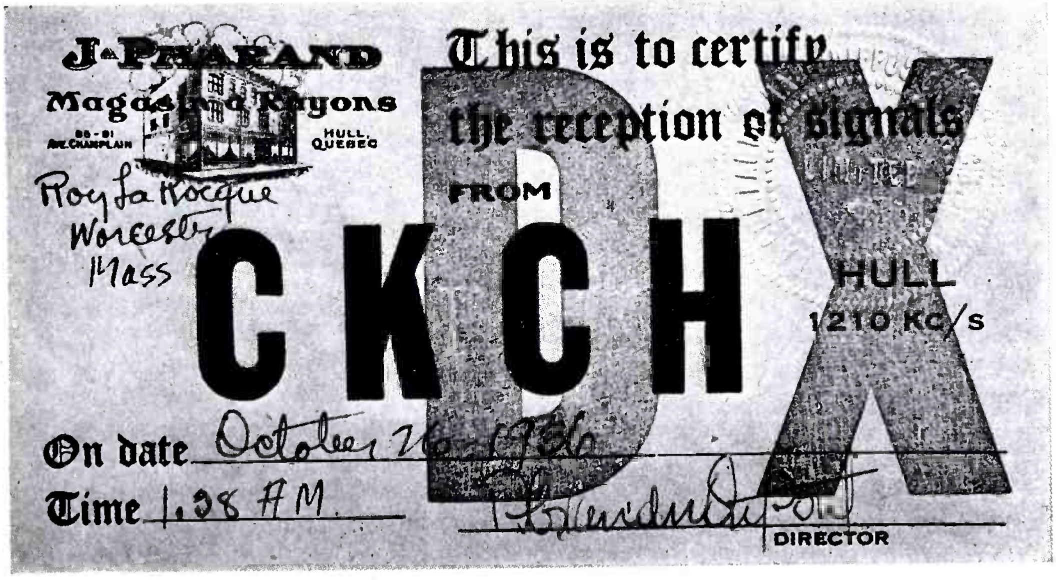
FEELING rather lazy after the rush of the Winter Holiday season, the Chief Night Owl is going to sit back for a few paragraphs and let someone else do some writing for him. That someone is Morton W. Blender, Chief Announcer at WCOP, who has long been connected with radio both as a broadcaster and as a listener, for Morton is also an ardent DXer while he's not at work. Okay Mort, the air is yours!

International Organization Suggested

"Writers lately are constantly expounding the cause of the DXer, the radio station, the verification, methods of verifying and subjects related. It seems to me that a good deal of trouble could be eliminated and things put on a smoother basis if we were to get together and form an outfit similar to the ARRL. I don't mean to have a grand radio station supported by DXers or have highly paid officers. But some plan should be formulated whereby DXers could band together in one great organization, have their own tip programs, have *one* CPC to arrange programs in all parts of the world and therefore eliminate the grand display of courtesy programs that so often get nowhere and bring down criticism from DXer and broadcaster alike. I realize that there are such clubs as NNRC, CDXR, IDA and others that are firmly established—I realize that there will be fierce opposition from their members if such a plan were suggested—still, it is my firm belief that this is the only solution to the many problems that confront the DXer today. The plan would enable us to have a standard report form. Whoever said there is no standardized form has his modulation reversed. The very fact that it is, or rather, would be, an international organization would be enough to ensure the cooperation of the radio stations. Existing clubs would not have to go out of their well-earned existence, but become local chapters of the organization. I could enumerate a whole flock of benefits that would result from the organization of such a league of DXers. This may sound pretty radical, but new things must come and it is my firm conviction that only a world-wide league of DXers is the proper solution to all the problems of DXing today.

"The average DXer is not the slightest bit interested in what the station may get out of his report. Too often, the weather, distance, temperature, receiver, number of tubes, antenna and ground, are left out in favor of a program report. It occurs to me that I read somewhere that if enough DXers throughout the world submitted a number of reports on different stations periodically, receiving conditions could be determined for any season in any part of the globe. I'm very much afraid that this could never be accomplished for the simple reason that there is no cooperation in such ventures among the clubs and there is no driving, inspiring force to create the necessary interest."

Ho-hum, thanks for the help, Morton—now we'll have to go back to work. Of the above paragraphs we'll make no comments for they speak for themselves. We will however note the resemblance of your ideas with those of the new Radio Signal Survey League which AWR is sponsoring. The Chief Night Owl would greatly appreciate hearing from various DXers (especially club officials) regarding Morton's plan.



Reception certificate from CKCH, Hull, Quebec.

Station Changes

In the United States three construction permits were granted for new stations in the following cities: Santa Rosa, Calif., 1310 kc, 250 watts, daytime only. Gallup, New Mexico, 1500 kc, 100 watts. Great Bend, Kans., 1370 kc, 100 watts.

Stations WSMB (1320), KFVD (1000), KRNT (1320), and WHAZ (1300) will increase their power to 1000 watts. WPRO (630) will jump to 500 watts . . . KLS will soon move from 1440 to 1280 kc . . . The following changes in call letters have taken place: WLBF (1420) to KCKN, WOCL (1210) to WJTN, WDRB (1370) to WSAU, and WBJW (1200) to WFTC. KRMC has been assigned to the station in Jamestown, N. D., WNNY to the new one in Watertown, N. Y., KOAM to the station in Pittsburg, Kans., and KVOX to the new station in Moorhead, Minn. The grant made to WATR for an increase in power and change of frequency has been reconsidered and set for hearing because of protest of WJAS. Likewise the grant made to WLB, WCAL, and WTCN last month. The grant made for a new station in Hammond, Ind., on 1480 has also been suspended because of WKBW's protest. It has been set for a hearing.

New Stations

In the foreign station list, we have a

few more changes and as usual the indication (IDA) signifies that the information is from the IDA "Globe Circler."

Call	*Location*	*Kc.*	*Power*
VUD	Delhi, India	882	20,000
VUP	Peshavar, India ...	1500	250
VUA	Allahhabad, India .	1070	100
VUU	Dehra Dun, India .	1000	300
CMCN	Havana, Cuba	1500	—
HJ1ABR	Cartagena, Col. ...	1400	—
CMKW	Santiago, Cuba (IDA)	1330	—
XEBG	Tiajuana, Mexico .	820	500

Changes in Power: VUB (855) from 3000 to 2000 and VUC on (810) from 3000 to 2000 watts. Athlone, Irish Free State (565) from 60,000 to 100,000 watts., and the power of the Assiut, Egypt station on 731 kc. is 100 watts. Change CMCX from 1500 to 570 kc. and delete XEOO (1150) from the list.

Contest News

We smile a little more as we glance at the contest records for November when 73 reports were received on 22 different stations. The standing of the leading contestants on December 1, 1936 were:

George Brode, Philadelphia, Pa. ..1110
Bernard Ahman, Jr. Baltimore, Md. 969
Joe Lippincott, Tufts College, Mass. 580
Enrique Hidalgo, Cienfuegos, Cuba 183
John Gardner, New York, N. Y. 150
Bob Beadles, Salt Lake City, Utah 117
Kendall Walker, Yamhill, Ore. 100
Earl H. Lever, Worcester, Mass. 94
Carl Sylvester, Yale, Mich. 83

The above scores are the totals of the leaders for the entire contest. Scores this month were Brode 727, Lippincott 580, Ahman 569, Hidalgo 183, Lever 94, Beadles 17, and Gardner 17. Next to the showing of the leader who submitted 32 reports, that of Joe Lippincott who bounced up to third place in his first month in the contest stands out as remarkable. George Brode scored highly on the border Mexicans, having six reports on XERA and five each on three of the others. Honorable mention for unusual reception goes to Enrique Hidalgo of Cuba for his reception of CFCN. Honors for the most "bullseyes" (100 pts.) this month are shared by the three leaders with four each. Brode scored 100 on CMOX, CMBX, WTRC, and KWSC; Ahman scored on XEBG, CMBY, CMCG, and CMX; while Lippincott scored his on CMQ, XEMO, CMCD, and Rennes, France—the latter being the only station outside of North America reported thus far. Hidalgo scored the only other "bullseye" with his TGW report.

Stations reported this month with the number of reports on each are as follows: XELO and XERA 12, XEPN 11, XEAW 9, XENT 7, CFCN 3, XEP, LR1 and WKAQ 2, TGW, CMX, CMCG, CMBY, XEBG, Rennes, CMCD, XEMO, CMQ, KWSC, WTRC, CMBX, and CMOX one report each.

ALL-WAVE RADIO'S
Time Table of DX Programs

(All time is given in Eastern Standard Time)

Specials

SUNDAY MORNING, JAN. 17
WOR, Newark, N. J. — 710 kc.
NNRC feature program starts at 2 A.M.

TUESDAY MORNING, JAN. 19
WHAZ, Troy, N. Y. — 1300 kc. 12:30-1:30

WEDNESDAY MORNING, JAN. 20
WOPI, Bristol, Tenn. — 1500 kc. 3:00-5:00

THURSDAY MORNING, JAN. 21
CMHJ, Cienfuegos, Cuba — 1160 kc. 4:00-5:00

SATURDAY MORNING, JAN. 23
WTRC, Elkhart, Indiana — 1310 kc. 6:00-7:00

SUNDAY MORNING, JAN. 24
CMCD, Havana, Cuba — 950 kc. 1:00-4:00

WEDNESDAY MORNING, JAN. 27
KHBC, Hilo, Hawaii (NNRC) — 1400 kc. 3:00-4:00

SUNDAY MORNING, JAN. 31
CFLC, Prescott, Ont. — 930 kc. 2:00-5:00
KWSC, Pullman, Wash — 1220 kc. 3:00-7:00

THURSDAY MORNING, FEB. 4
CMHJ, Cienfuegos, Cuba — 1160 kc. 2:00-3:00

SUNDAY MORNING, FEB. 7
TINRH, Heredia, Costa Rica — 920, 980, or 1450 kc. 2:00-3:00
KGDY, Huron, S. D. — 1340 kc. 4:00-4:30

SUNDAY MORNING, FEB. 14
WLVA, Lynchburg, Va. — 1200 kc. 1:00-1:20

TUESDAY MORNING, FEB. 16
WHAZ, Troy, N. Y. — 1300 kc. 12:30-1:30

WEDNESDAY MORNING, FEB. 17
WOPI, Bristol, Tenn. — 1500 kc. 3:00-5:00

THURSDAY MORNING, FEB. 18
CMHJ, Cienfuegos, Cuba — 1160 kc. 3:00-6:00

SATURDAY MORNING, FEB. 20
WTRC, Elkhart, Indiana — 1310 kc. 6:00-7:00

Regulars

EVERY SUNDAY MORNING
TGW, Guatemala City, Guat. — 1210 kc. 12:00-6:00
XED, Guadalajara, Mex. — 1160 kc. 12:01-2:00
WLAC, Nashville, Tenn — 1470 kc. 12:45-1:00
CMCW, Havana, Cuba — 750 kc. 1:00-3:00
XEP, Juarez, Mex. — 1160 kc. 2:00-4:00

EVERY TUESDAY MORNING
LR1, Buenos Aires, Arg. — 1070 kc. 2:15-3:30

EVERY THURSDAY MORNING
LR1, Buenos Aires, Arg. — 1070 kc. 2:15-3:30
——, Belfast, N. Ireland — 977 kc. 1:30-3:00

EVERY FRIDAY MORNING
CFCN, Calgary, Alberta — 1030 kc. 12:00-2:00

EVERY SATURDAY MORNING
CMKW, Santiago, Cuba — 1330 kc. 1:00-2:00
LR1, Buenos Aires, Arg. — 1070 kc. 2:15-3:30

In order to allow Senor Enrique Hidalgo to take part a special ruling not permitting him to report on Cuban stations unless listed in the time table was deemed necessary—otherwise he would have an unfair advantage over his American competitors. That's all for this month, and as a special inducement to enter the contest the Chief Night Owl is offering a beautiful map of the world in colors to the DXer scoring the greatest number of points during the month of January.

With the Night Owls

Thanks to our active Cuban Night Owl, Enrique Hidalgo, for dedicating musical selections to the Chief Night Owl on those CMHJ special programs, and also for the generous announcements concerning the contest . . . "It may interest you to know that I was the second to report tests on WTRC's new outfit," speaks George Brode leading contender for 1936-37 DX championship honors. . . . From the guiding hand of the CDXR, Charles Hesterman up in Saskatoon, Saskatchewan, comes a little news on the station down under: "The new 2NR sure is walloping in around this neck of the woods of late—around 3:30 A.M. (MST) they come in R6 to R8. 2BL gives them a close run for honors, but I believe that 2NR has the edge. The other A.M. 2GZ came in R8—I have never heard them before or since! I have heard 4YA as early as 12:15 A.M. (MST) and that is early for a TP to bust in! No South American reception yet." That's our first report on reception conditions in the west.

George Roche of Amesbury, Mass., has turned BCB DXer, thanks to the efforts of his XYL along with some coaxing from the Chief Night Owl, and George seems to be really serious as he has challenged us and we recently heard his report read over WCOP.

A report of DXing in Kitchener, Ontario, comes from Night Owl Meredith M. Stroh who sends us a list of calls heard in one evening which includes CMQ at R2, WOAI at R5, KSL at R4, CKSO at R4, WMMN at R1, and others. Night Owl Stroh gives us the following news, "CFRB will increase to 50,000 watts. WMMN sends out a neat veri in black and white with large call letters. CKCR, with studios in Kitchener, verifies for return postage with a card showing their antenna system and inviting the DXer to visit the city of Kitchener." Mentioning the fact that XERA has increased to 350,000 watts, friend Stroh asks, "What is CRCT going to do?" There's not much they can do as far as we can see—except to start a campaign to raise funds for a million-watt transmitter, or sumpin'!

Correspondence is also acknowledged from Walter V. Scholz, Carlinsville, Ill.; John Gardner, New York City; Mrs. A. C. Johnson, Henry, S. D.; Bob Beadles, Salt Lake City, Utah; Earl Lever, Worcester, Mass.; Ed Hatch, Philadelphia, Pa.; Joe Lippincott, Tufts College,

Cordial veri from WCX.

Mass.; Reginald Vining, Cortland, N. Y.; and Ray Geller, Brooklyn, N. Y.

Kilocycling Around

Alexandre Dupont, Director of radio station CKCH in Hull, Quebec, informs us that they broadcast daily from 11 to 2 A.M. They are always glad to receive reports and have at the disposal of fans a special verification certificate. The certificate is a pastel shade of yellow 6 x 3¼ inches and bears the large letters DX in light red, these forming a background for the printing which shows the call in 1-inch black letters and a picture of the J. Pharand Silk Store in Hull in the upper left corner . . . Those Monday morning specials advertising the City of Jacksonville over WJAX went on the air with the regular power of 1000 watts. The management was denied its request for 5000 watts to be used on this broadcast only. Evidently the Jacksonville C. of C. was interested in informing even the Eskimos up in Aklavik of the wonderful climate in sunny Florida, for the 1 kw. was enough to pack a real sock up here in northern U.S.A.

Did the Spanish-speaking station on 1275 or thereabout every morning around 5 A.M. fool ya? Well, you're not the only one. 'Seems someone started a rumor that the station was YNLF and everyone began to think they were hearing the 20-watt Nicaraguan! No one could furnish positive information on the station as it never did show up very strong, but we doubted it's being YNLF when we failed to hear its short-wave relay at the same hour. The station now seems definitely identified as XEMX, being reported as such by several reliable DXers. Now don't look so downcast—a 12-watt Mexican is not such bad DX, even though it isn't a 20-watter in Managua!

The Newark News Radio Club is the source of a couple of timely tips: KCMO (1370 kc.) DXes every Sunday morning until 5 and will verify for return postage. KBIX (1500) does ditto on the 1st, 3rd, and 4th Tuesday of each month from 6-6:30 A.M. . . . From the Universal News of the Universal DX Club comes the following: "Iceland, familiar on the short waves, may soon be heard in America on the long waves (BCB). Nils Jorgen Jynge (Norway) reports that a new 100-kw. transmitter will soon be operating on 1442 kc." The Universal DX Club will be glad to hear from DXer's interested in joining a real friendly club with a neat and well-written bulletin. A note to Dave Owen, 508 Summit Ave., Oradell, N. J., who edits the BCB department of the bulletin, will bring any information desired regarding the UDXC.

A new transmitter, claimed to be the most powerful in the Southern Hemisphere, has been ordered by the New Zealand National Broadcasting Service for 2YA, Wellington. The power is to be 60 kw., and the transmitter is to be erected on the high land north of Tahiti Bay. A single mast 700 ft. high will be used, and the wavelength will be 526 meters . . . More super power transmission! In Estonia, it has been decided to build a central high-power station of 120 kw., on a site near Turi, about 8 miles from Paide . . . And in India, the Government is planning to add five more stations to the All-India system. The Madras station will be taken over under this scheme, while three new stations in Dacca (Bengal), Rajahmundry and Trichinopoly (South India) are under contemplation, with one more at a point yet undetermined. Tenders have been called for 1 kilowatt broadcasting equipment for each of the proposed stations. It is probable that the Madras station may be increased to 5 kilowatts.

YV1RG the new station in Maracaibo, Venezuela, on 1120 kc. has been heard in the early morning hours with all-night dance programs on a few occasions.

Season's Event

The outstanding event of the season in the DX world will go on the air over WOR on January 17, 1937, commencing at 2 A.M. and sponsored by the Newark News Radio Club. Last season's program over KNX developed into the outstanding feature in DX programs last season, and this program plans to overshadow last year's event by featuring during the program the reproduction of voices of NNRC members from all over the Western Hemisphere for the edification of those members and friends who never meet one another.

Present plans include rebroadcasts of transmissions from LR5, a station in Caracas, Venezuela; a station in England, CKLW in Windsor, Ontario, and possibly a station in Cuba. "From Buenos Aires," says Milton W. Fleischman, executive Secretary of the club, "we plan to present our honorary member Mr. A. B. Dougal, owner of LR5. From Caracas we will hear our Director Jesus Maria Lander Garcia, an enthusiastic club worker. Milton P. Christa, our Michigan Director will speak over CKLW. We also expect to include John Baxter our English representative."

All of these voices and transmissions will be rebroadcast over station WOR, (710 kc.) in Newark, N. J., with 50 kilowatts power, and all of them will be heard the same morning on the same program.

Cheers and Jeers

Out come the jeers—we can't hold them any longer. The cheers can wait till we unloose a few of our choicest jeers on station WEVD (FCC take notice) who not only refused to stand by during the week of the FCC monitoring tests, but actually continued broadcasting while the test program from WIOD was being conducted. We hope that the inspectors monitoring WIOD were able to experience better reception than the Chief Night Owl. Why should WEVD and WNEW be allowed to continue their recorded jam sessions during the week of the FCC tests, when other stations, some of them all-nighters who aren't even on affected channels, must remain silent? There's something wrong somewhere—and three more jeers to those responsible.

Now let's hand out a few cheers. Three hip-hip, hooray's to WLNH up in the Lake Region of New Hampshire for the informal friendliness of the announcer toward the DXers on their monthly monitoring tests and for their prompt reply to all reports. WLNH's 100 watts have been heard in New Zealand! Three cheers for a really *big* little station!

The Chief Night Owl welcomes reports and information of value to other DXers. Please address your communications to Ray La Rocque, 135 Highland Street, Worcester, Mass.

U-H-F DIRECTIONAL AERIALS

By George B. Hart • W8GCR

Dreams of directional antennae and concentrated signal beams have filled the sleepless nights for many amateurs since Eve made the first QSO with Adam. With the opening of the 28, 56 and 112-megacycle bands the fever has mounted until it has approached a delirium with many of us.

But directional antennae are not all peaches and cream. The average fellow is limited to the simpler schemes unless he has an engineer-friend who can, and will, give him a lift where the going is tough.

Now if you will just assume that we can help you, we'll try.

Fundamentals

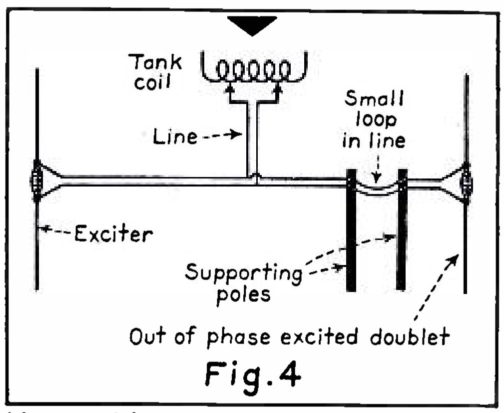
Before going into the discussion of types of beams and results to be obtained, it is well to consider the fundamentals surrounding directional antenna arrays. First, there is no basic difference between a standard antenna and a directional one; second, our principal problem is one of phase relationship. Forgetting the second statement until later we can return to the first and look at our ordinary antenna. Normally constructed in half-wave segments it has a definite field that is influenced by any surrounding objects. When located in free space our half-wave element, or doublet, radiates uniformly in all directions perpendicular to its axis. However, an antenna, either vertical or horizontal, is greatly influenced by the earth which partly absorbs and partly reflects that portion of the field radiated below the horizon. The portion reflected reenforces the radiated field at the angle it is reflected from the earth. The greater this angle the smaller will be the ground wave.

The presence of ground near our antenna has lowered its impedance as well as changed its field pattern. Should we substitute another doublet for the ground the same effect will be obtained. Like the ground it will absorb and reradiate energy, but, unlike the ground, it is readily controllable.

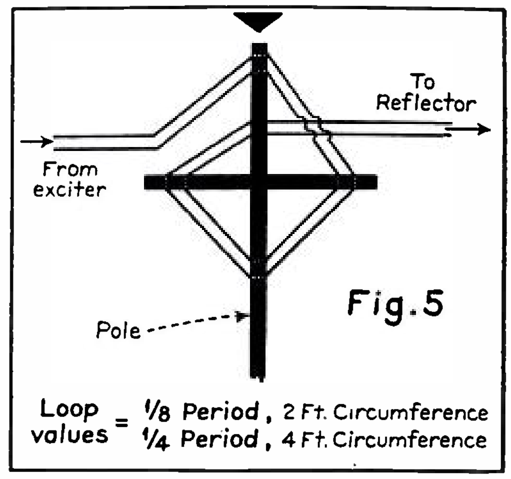
We now have a second doublet or reflector added to our system, and without too much mental strain find that we also have a directional antenna in the making.

Angle of Radiation

Since the ground caused a reflected wave that added to the radiated field at a certain definite angle we may expect the reflector to do likewise. Inasmuch as our greatest power is being radiated at this angle it behooves us to know just where our signal is going, for if too sharp an angle is used our beam may penetrate the ionosphere and be lost in cosmic space entirely, or it may strike the layer and be reflected in a path that misses the earth altogether. This is most important in a consideration of the frequencies above the border-line frequency of 28,000 kc, except under abnormal conditions when it may apply to the lower frequencies. Thus we see that the angle of radiation at the ultra-high frequencies must not be too high nor too low. An angle between 3 and 20 degrees seems to be about right.



Manner of looping transmission line to create slight phase difference.



Simple manner of looping transmission line to develop large phase difference between exciter and reflector.

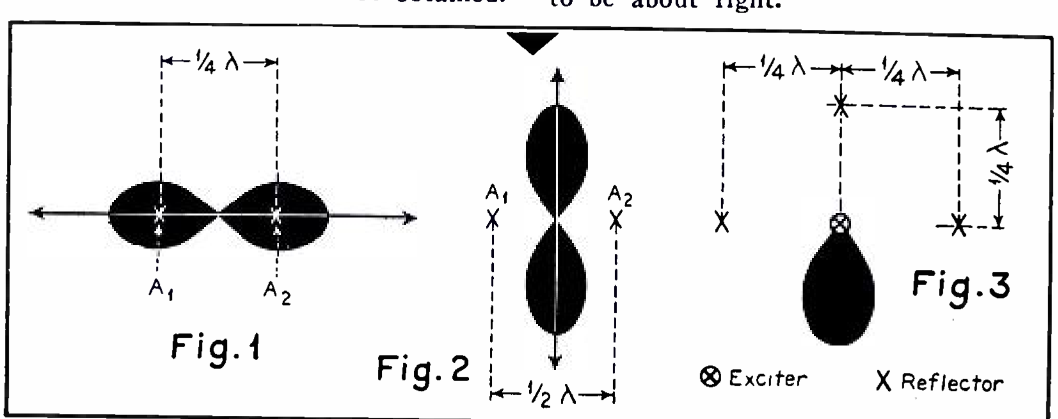
Short, vertical one-quarter wave antennae give a very concentrated ground wave when grounded; another low-angle radiator is a one-half wave antenna whose electrical center is one wave above ground. Such an antenna radiates most of its energy at about 7.5 degrees. It is extremely efficient at ultra-high frequencies.

Phase Differences

Commercial radio companies use arrays that radiate vertically-polarized waves beamed only slightly above the horizontal path. Vertical polarization causes a decided improvement that is especially noticeable as the frequency increases. At the higher amateur frequencies we can take advantage of the small space required for such an array and obtain a very efficient directional antenna, for two vertical doublets separated one-quarter wave have a phase difference of 90 degrees and radiate strongly in one direction along the axis of the array, with zero amplitude in the opposite direction, as in Fig. 1. The same two doublets spaced one-half wave apart with a phase difference of 0 degrees, radiates strongest in both directions perpendicular to the axis of the array, as in Fig. 2. It is apparent, then, that we can obtain a parabolic field pattern through the use of two or more doublets erected one-quarter wave to either side of the existing antenna, or exciter, and obtain a signal increase of from 5 to 8 db in the direction of the transmitted beam, as indicated in Fig. 3.

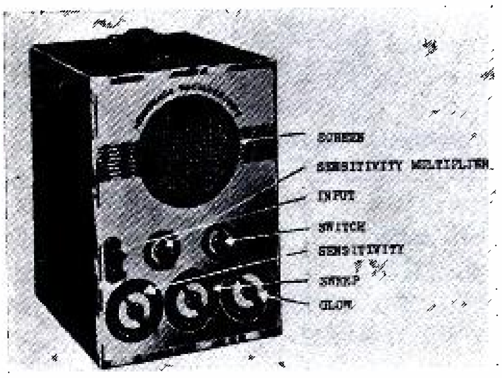
Having mentioned phase differences it is best that we mention a simple method of obtaining the desired phase change. Slight changes in the phase re-

(Continued on page 108)



Directional characteristics of arrays described in the accompanying article.

The Neobeam Oscilloscope—
How It Works



The Neobeam Oscilloscope.

A GOOD deal of interest has been given to gaseous tube oscilloscopes in the last year and while the basic principles are not new, some of the recent developments are.

The essential part of one of these oscilloscopes is the tube itself and an understanding of the principles of gaseous discharge tubes is necessary.

Gaseous discharge tubes are roughly divided into two classes—direct discharge tubes and glow tubes. In the direct discharge type the conduction of current is directly between electrodes and through the ionized rarefied gas; a neon sign is an example. In the glow type the direct discharge is usually limited by design as much as possible and the discharge is confined to a glow on the electrodes only. The familiar glow lamp is an example. The gaseous oscilloscope tube belongs to the glow type.

The Glow Discharge Tube

Going back to 1861 we find Feddersen discovered the area of glow covering the electrode of a gaseous discharge tube was directly proportional to current passing through the tube. It had been discovered earlier than this that only the negative electrode glows. In 1904 Gehrke and Disselhorst combined these two principles to produce an oscilloscope by using a tube with elongated electrodes and a rotating mirror to scan the electrodes across them. Since only the negative electrode glows, on alternating current the glow shifts from one electrode to the other at a rate equal to the impressed frequency. The same set-up has been used recently to check the modulation of amateur phone transmitters.

The early type gaseous tube oscilloscope had several inherent disadvantages. In the first place, the easily ionized rare gases were practically unknown and nitrogen was usually used as a medium. The high ionizing potential of nitrogen limited the use of the instrument to the observation of relatively high potentials such as condenser discharges. Even with neon or the other rare gases the lowest practical "striking" voltage obtainable is about 200 volts d.c. and about 10 mils are required to operate the tube at full cathode glow. These values are entirely too high for practical use as an all-around oscilloscope.

New Operating Principle

In the new Neobeam oscilloscope this difficulty has been overcome in a unique manner. Instead of making the electrodes glow directly from the input voltage a 6L6 beam power radio-frequency oscillator is provided to keep *both* the electrodes *glowing all the time.* This changes the entire picture—the disadvantage of high striking voltage is eliminated, but more than that, an amplifier and modulator may then be used to modulate the 6L6 oscillator which in turn causes the glow on the electrodes to rise and fall in direct proportion to the input to the amplifier. This action is illustrated in Fig. 1.

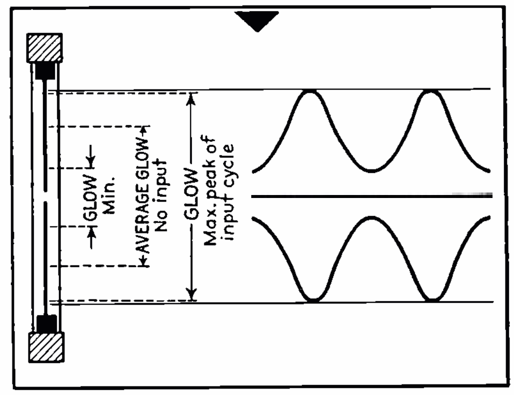


Fig. 1. Action of Neobeam tube in operation.

The tube is essentially the same design as formerly used and is comparatively small—6″ long by 9/16″ in diameter. The elongated electrodes measure 2″ each, thus permitting a 4-inch image. Distortion in the input is portrayed by changes in the wave outline. Thus, instead of 200 volts and 10 mils minimum to operate the tube, it is possible to use inputs as low as 1 microvolt across an input potentiometer of 1 megohm and obtain 100% modulation. By means of a built-in multiplier switch the range is extended to 200 volts. The number of applications for the instrument by these methods is greatly extended.

Since the upper limit of frequency response of a gaseous oscilloscope tube is about 10,000 cycles the use of the Neobeam is in the range below these frequencies. The scanning mirror is driven by a constant speed induction motor with an adjustable friction disc clutch. The speed of scanning is calibrated directly in r.p.m., an especially useful feature in making quick frequency determinations. Frequency is determined by the simple formula $f = \frac{rpm}{L_2}$ where f = frequency, rpm = sweep and L = distance between cycle peaks in inches. To facilitate

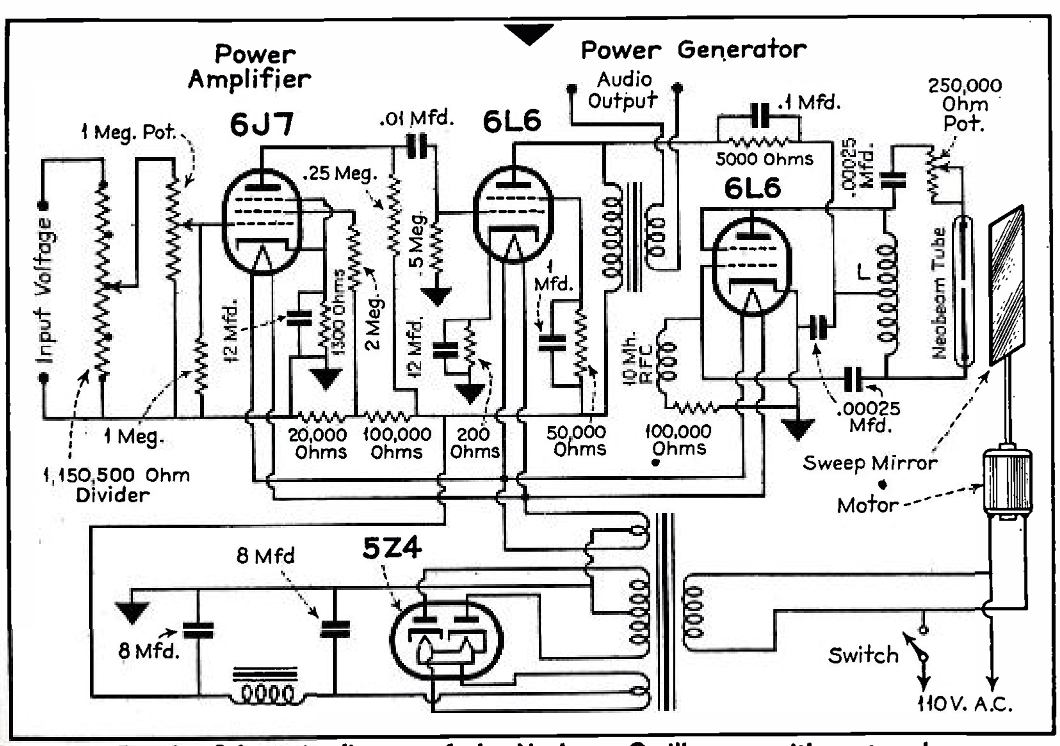


Fig. 3. Schematic diagram of the Neobeam Oscilloscope with parts values.

measurements the image is observed through a screen calibrated in ¼-inch spaces. A typical image is shown in Fig. 2.

In demonstrating waveform it is often desirable to hear as well as see the input signal. For this purpose a loudspeaker connection is provided. With the speaker connected the instrument becomes in effect a small public-address system capable of direct input from a crystal microphone on the input and a 5-watt speaker on the output. While this feature has its uses in making demonstrations in a large classroom, its greatest usefulness lies in the fact that distortion can be shown visually that would be impossible to detect audibly. A very practical use lies in demonstrating and comparing the fidelity of different receivers with the same signal input. In teaching work it is used to show the effect of timbre on tones of similar pitch. This outlet also provides a connection for self recording equipment. Another outlet of 60 cycles is provided for checking purposes.

Oscilloscope Circuit

The circuit diagram of the Neobeam Oscilloscope is shown in Fig. 3. The input signal is fed into a resistance shunt and potentiometer arrangement to permit inputs from 1/1,000,000th volt to 200 volts.

The first amplifier stage is a 6J7 high-gain amplifier with the constants set to secure the highest possible gain and still retain linear amplification characteristics. The modulator is one of the new 6L6 beam power tubes and the oscillator is also the same type. The oscillator is set at 100 kc. and serves to keep the oscilloscope tube constantly ionized.

The pattern shown by the Neobeam is the modulated wave type—that is, each half cycle is shown double symmetrically about the zero axis. Thus, a sine wave is shown as in Fig. 1. Changes in waveform are shown by the outline and a 320 cycle complex wave is shown in Fig. 4.

Uses of Device

The uses of this type of oscilloscope are far too many and varied to cover in this article. While it does not have the high-frequency response of the cathode-ray oscillograph, its great simplicity and good response to audio frequencies opens fields for its use by non-technical lay-

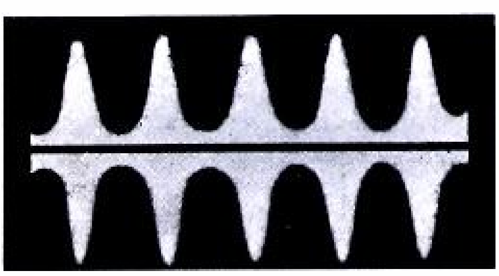


Fig. 2. Typical image as developed by the Neobeam Oscilloscope.

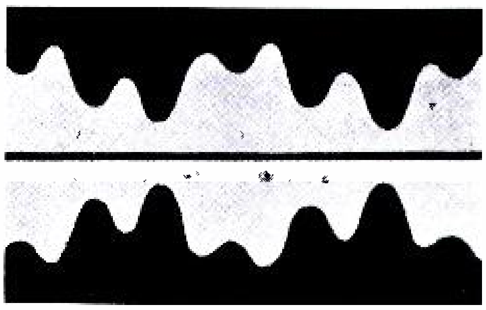


Fig. 4. Complex waveform as it appears on the screen of the Neobeam Oscilloscope.

men who could not operate the more complex forms of devices. Thus it is ideally suited to music teaching work particularly in voice culture. Being ideally suited for demonstrations of how sound waves look, it is used for portraying sound and electrical waveform in physics and electrical engineering laboratories. In combination with the speaker attachment it demonstrates the principle of frequency, amplitude and timbre visually and audibly in a way hardly possible by any other means and with relatively low-cost equipment.

In amateur radiophone work it is used for checking modulation, excitation, line levels, amplifier gain, feedback and for tuning. In radio servicing work it is used for balancing receivers, hum tracing, and for checking distortion and fidelity. In motion picture work it is used for checking and servicing sound equipment as well as theatre acoustics. In the laboratory it serves the purpose of a microvoltmeter, a super-sensitive a.c. galvanometer, a 125-db. gain amplifier capable of direct input from a crystal microphone and a 5-watt speaker output.

◆

INTERNATIONAL DX CONVENTION

WITH THE OBJECT of creating greater fellowship among DX'ers throughout the world, an International DX Convention will be held in San Francisco during the month of July, 1939. Although originated and sponsored by the International DX'ers Alliance, all DX Clubs, radio periodicals, and other organizations interested in radio are being asked to participate.

The Convention will be replete with all the customary trimmings, including banquet, talks by prominent DX'ers and radiomen, contests, prizes, visits to local radio stations, recreation, etc. The program will also include special demonstrations of the latest radio and television apparatus.

The most outstanding attraction, however, will be the Golden Gate International Exposition—A Pageant of the Pacific! This $40,000,000 World's Fair will mark the completion of the world's two largest bridges across San Francisco Bay. Its theme will be modern developments in transportation and communication as symbolized by the bridges, by the transoceanic air services and the progress in radio and television. The Exposition has been accorded official United States Government recognition and participation of foreign countries already is being arranged.

In sponsoring this Convention, the International DX'ers Alliance does not intend to radiate a lot of glory on itself, but offers equal credit and honors to all participating organizations. This meeting is being planned in the spirit of good fellowship for the mutual advancement of all concerned and for the promotion of the DX'ing spirit in particular. All clubs and organizations wishing to cooperate should write immediately to George C. Sholin, Director, Golden Gate International DX Convention, 55 Lapidge St., San Francisco, California, United States of America.

◆

V. W. O. A. DINNER-CRUISE

THE COMPLETION BY the Veteran Wireless Operators Association of twelve years of progress will be celebrated simultaneously with Dinner-Cruises being held in New York, Boston, Chicago, Miami, New Orleans, San Francisco, Honolulu and several other cities of the United States, Canada and the world, on February 11th, 1937.

The Twelfth Annual Dinner-Cruise of the New York group will be held Thursday evening, February 11th, 1937, at the Hotel Great Northern, 118 West 57th Street, New York City. The magnificent Crystal Room of the Great Northern will be the scene of this old-timers get-together and to those attending an evening of jollification and comraderie is assured.

A delicious steak dinner accompanied by a "VWOA Cocktail" will be served and there will be entertainment and dancing until the wee small hours—music furnished by a popular radio orchestra—and the good news—tickets are but $3.00 per person—obtainable from William J. McGonigle, Secretary, 112 Willoughby Avenue, Brooklyn, N. Y.

For tickets for the Dinner-Cruises in other cities please contact the following: Boston—Charles C. Kolster, U. S. Radio Supervisor, or Harry Chetham, Chief Operator Somerville Police Radio. Chicago—Geo. I. Martin, Superintendent RCA Institutes, Merchandise Mart. New Orleans—J. A. Pohl, Radiomarine Corp. Superintendent. Miami—V. H. C. Eberlin, Tropical Radio Plant, Hialeah, or C. J. Corrigan, Little River Radio Company, Miami. San Francisco—T. M. Stevens, Radiomarine Corp. Superintendent. Honolulu—George Street, RCA Communications Supt., or Arthur Enderlin, Mackay Radio, Honolulu.

The Ham Bands

By George B. Hart

W8GCR

20-meter cow-catcher . . . red-face chinaboy . . . weatherproof feeders . . . mars on five . . . that kansas cyclone net . . . sixes on ten

SIXTEEN years of Ham Radio slipped by us on December 24th. We started in the game when we were ten years of age, but in all that time we have never heard anything in the game that struck us so humorously as a QSO recently with a certain "8" at Piqua, Ohio, who was suffering from severe local QRM. Boy that cow had a really rough note for 20-meter phone. It seems "Bossy" wanted to be milked and was emitting a damped wave all over the place.

✦

WE WERE talking to W8JYU, Ferndale, Michigan, on 20 via W8IAC, concerning 10-meter results. He uses a 20-meter Johnson Q antenna, but tunes the feeders to an odd multiple of the quarter-wave for 10-meter operation. So far the best QSO has been G6CW. The Englishman was held for ten minutes. JYU believes that his 90 watts would get out better with a more effective antenna. Changes are now in order. A Bruce antenna is being experimented with and is expected to supplant the present system.

JYU's rig employs a 6L6 xtal oscillator driving a pair of these tubes in a push-push doubler circuit to swing a pair of 801's in push-pull with 90 watts on all bands. Class B 46's handle the modulation. An ACR 175 is JYU's pet as with it he has worked 40 countries from Australia to Russia on 20-meter phone.

✦

A CERTAIN 20-meter phone artist was recently heard trying to kid the boys with a little cq from XU2CU, Shanghai, China. Unfortunately (for him) we speak two Chinese dialects; in fact, we handle company mail in that language. So the boys prevailed upon us to go back to him. We did. That was the end of *that*.

✦

WHEN USING twisted pair feeders, the feeders should be of the waterproof variety and be taped at the point where they separate, otherwise they may cease to function in rainy weather. A layer of rubber tape wrapped with a layer of friction tape and a good coating of clear lacquer will make this point really water-tight and weatherproof.

THE EQUIVALENT of 36 kw of power! . . . That is what W6AM claims for his 5-degree bidirectional beam. Wallace is getting in here when all other 6's are dead.

✦

IT CAN be done! . . . Mars has been worked on 56 mc., reports W8OSL. . . . Mars, Pennsylvania.

✦

WE HAVE RECEIVED a number of inquiries since we mentioned the Kansas Cyclone Network on this page. As a result we are quoting the "Radio Times" of Clyde, Kansas, on the subject.

"At the time the 'Kansas Cyclone Network' was organized, W9ECF and I did not think that the idea would spread more than locally.

"Lately there has been some interest shown in the idea by W9UVX of Rushville, Mo., W9WWJ of Juniata, Nebr., and others. The aim that we had in mind in organizing the net was to eliminate much of the present QRM. There are no dues or regular scheduled meetings, and no officers. It is wise, however, to have one centrally-located station that can act as a control.

"We also suggest that you keep your calls short when attempting to contact a member of the net who can usually hear you without difficulty, equipping yourself to work break-in or duplex if possible. Every member is expected to handle any traffic that they can within reason, and to move it within 24 hours or mail it.

"For further information write to W9FWY, 1331 Poyntz Ave., Manhattan, Kansas."

✦

ONE EVENING not so long ago, W8LTH had to QRX while in the midst of a QSO long enough to extract his son's aching tooth . . . with the aid of a pair of radio pliers. Nice work, OM!

✦

WE WERE talking to W6EXL, Salt Lake City, Utah, several nights ago on 20 meter phone, again via W8IAC's rig, when the bottom dropped out of the band and there we were talking for gosh knows how long into a dead ether. Which reminds us of the time we were on duty at WLW and a visitor asked one of the ops—pointing to the dry nitrogen tank—"is that where you put the program on the ether?"

✦

W8JZC IS CERTAINLY getting out on 40 with 460 watts to an 852 in the final. We have heard him giving WAC a break quite often.

✦

WITH AN R9 harmonic in the middle of 56-60, all W8IAC needs for operation on that band is a 5-meter receiver.

✦

STARTING BY MAKING his own iron-filing coherer detector in 1909, J. F. Satterthwaite studies skip effects for a hobby. He has a 10-year-old log covering over 4000 ham phones and more than 150,000 c.w. QSO's.

Satterthwaite, who lives in Toledo, Ohio, told us that his six children raise too much QRM for a transmitter, but he uses an RME-69 with a new DB20 unit for reception. His 10-meter log is one of the most interesting we've ever seen. It should be of value to any 10-meter ham. If you 10-meter men want to know anything about your sigs may we suggest that you contact Fred Satterthwaite, 544 Colonial Court, Toledo, Ohio. We're certain he can help you.

✦

WHILE SPEAKING OF ten, the sixth district has been doing right well by itself in the number of boys who have dived into the cool expanse of 28 mc. During short skip periods, the 6's dominate the ten-meter scales on east coast receivers. The 5's run a close second, and a fair number of 9's come rolling through when conditions are right.

Around noon, on November 1st, the following were Q5 in New York: (c-w sigs in italics)

W6FQY, GEI, GHU, GRL, GRX, JNR, KRI, MDN, *TJ, W5AFX, BXC, DQD, ESS,* FJ, *GAR,* W9CVM, GHY, *LBB, PRI, SIE,* UL, *VWW*.

(Continued on page 112)

"BARB" AND "ERNEST"— THEY CRAM

The Time Draws Near

Dear Gerald:

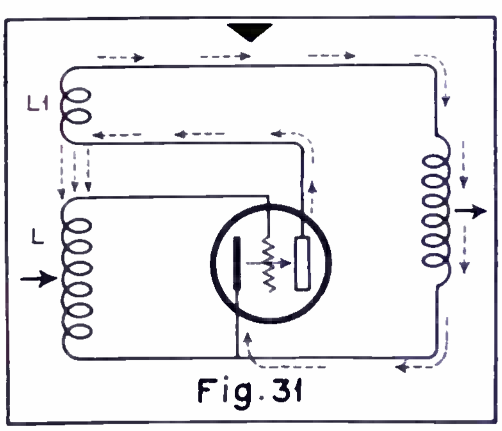
It was nice having lunch with you last week. From what you said, I take it that you intend concluding the preliminary instruction next month, and that from then on we will be more or less on our own until we get a "ticket." Well, that's okay with us, and unless you change your mind and decide to carry the instruction a bit further, we'll figure on taking the examination in February.

In the meantime we are going to go in for intensive study of the questions and answers in the License Manual and back this up with dope from the Amateur Handbooks in instances where the questions and answers themselves are not clear to us. As for the code, we will merely continue our practice to keep us in form. We have reached "a good fifteen" and feel that if we hold this we should have no difficulty with the sending and receiving tests.

So, it won't be long now (we hope). Both of us are looking forward to getting on the air, and since our success (?) with the code has left us with an interest in c.w., we like your suggestion that we plan using the 10-, 20- and 40-meter bands, with phone on 10 meters. We understand that "ten" is good only at times, but it should satisfy our "phone inclinations" until such time as we may be able to get Class A licenses.

For all of our confidence, we would like a bit of coaching before we take the exam. Will you go over the questions and answers with us to see where we stand? A final check-up on your part would help a lot.

Barb and Ernest



Illustrating regenerative or feedback action in vacuum-tube circuit.

Station Plans

Dear Barb and Ernest:

I agree with you that we should get together and go over the questions and answers prior to the examination. Suppose we plan on doing this shortly after you have had the opportunity of digesting my next, and possibly last, letter. I can determine then whether you have progressed far enough in your supplementary studies of the License Manual and the Handbooks to take the examination. If not, I will plan to continue these letters until I am confident that you are fully prepared.

On the other hand, if you have the questions and answers down pat, I will commence the preparation of a series of letters dealing with transmitting and receiving equipment. This data will form the basis of the design of your own station. The "plans" will be handled in much the same way an architect deals with the plans of a house—your requirements will be studied and the plans made accordingly. Barb and yourself will be the "prospective builders" and I will be the "architect." It will be up to you to advise me of the general requirements of the equipment—such as, where it is to be used, the space that can be alloted to it, the frequency bands in which you wish to work, etc. When these requirements are known, I will make recommendations, and in doing so, point out the advantages and limitations of various points of design. I believe that you will be able to pick up a great deal of practical knowledge in this way, to say nothing of a clear understanding of the basis of transmitter and receiver design.

But, we'll get around to the fine points of this idea when the time arrives. For the present we have more to say with regard to the application of vacuum tubes—so let's get on with it.

Tube Services

In my last letter I dealt with the basic operation of the vacuum tube and illustrated the differences between such types as the diode, the triode, the tetrode and the pentode. There are definite uses for each type in both receivers and transmitters, and such tubes as the triode and the pentode in particular may be employed in a number of different ways. In some instances a given tube type may be made to perform an entirely different service by merely changing the values of the voltages applied to it.

The requirements of each section or stage of a radio receiver or transmitter are not identical. Each stage has a certain service to perform and must be designed accordingly. In a receiver, for instance, the input or first stages must be so designed that they will be sensitive to the very weak signal impulses picked up by the antenna. It is necessary, therefore, that the tubes in these circuits have a high amplification factor so that the minute signal voltages may be built up in strength as they pass from one circuit or stage to the next. For this reason it is customary to employ pentode tubes in these circuits as the pentode has a much greater amplifying factor than a triode or tetrode. This was explained in my last letter.

After the radio-frequency signal voltages have been brought up to a satisfactory level to actuate a detector tube, they are rectified, as explained in my last letter. This process consists of separating the audible component of the signal from the radio-frequency carrier and is often referred to as *demodulation.* The diode tube is used for this purpose in modern receivers.

The resultant audio-frequency voltage in the output of the detector is still too weak to actuate a loudspeaker, although it might actuate a pair of headphones satisfactorily. It is therefore necessary to build up these audible voltages in much the same way that the radio-frequency voltages were built up in the first stages of the receiver. This is done by passing the signal through an audio-frequency amplifier stage, and the tube used in this stage may be a triode or a pentode, depending upon how much gain or amplification is needed to actuate the output tube.

Voltage and Power Amplification

Up to this point in a receiver, all tubes dealing directly with the signal—with the exception of the diode detector—are *voltage amplifiers.* They are not called upon to develop power for the simple reason that the vacuum tube itself is a voltage-operated device. It is sufficient, therefore, that each of these tubes, including the audio-frequency amplifier, merely increase the signal voltage level so that the amplification will be

EMBRYO RADIO HAMS

FOR EXAM

progressively greater in each succeeding stage. In this manner a signal at the input or antenna circuit of the receiver having, say, a value of one-millionth of a volt is progressively built up so that its value may be in the neighborhood of 20 volts at the output of the audio amplifier tube.

But it takes power to actuate a loudspeaker, and power is not developed unless there is appreciable current flow. You are aware of the fact that a 25-watt light bulb will not produce as much light as a 100-watt bulb, yet both operate at the same voltage. The difference is that the 100-watt bulb draws more current. The watt is the unit of measure of electrical power and is equal to the voltage multiplied by the value of current in amperes. Thus, if the voltage is 100 and the current is one ampere, the power in watts is 100.

In a receiver, therefore, it is necessary to convert the signal voltage into actual power in order that it may actuate the loudspeaker. The function of the output tube is therefore that of a *power* amplifier rather than a voltage amplifier, and since the signal voltage has already been stepped up appreciably, it is not necessary that the output or power tube have a high amplification factor. It may therefore be a triode of huskier proportions than the triode voltage amplifier, and capable of delivering from 2 to 10 or more watts to the loudspeaker. Or it may be a power pentode, in which case less signal voltage will be required to "drive" it and in consequence the number of voltage amplifier tubes may be reduced.

Transmitter Tubes

In a transmitter, a small amount of radio-frequency power is built up by stages and eventually fed into the antenna. No so-called voltage amplifiers are used in the transmitter proper as a sizeable amount of power is generated to begin with. The tubes are therefore of the power type, each succeeding tube being of a type capable of handling a greater amount of power than the preceding one. The output tube is usually referred to as the *final amplifier* and it is this tube that feeds the radio-frequency power into the antenna where it is radiated into space.

If a transmitter is designed for code transmission only, no audio-frequency voltage- or power-amplifier tubes are used—and, of course, there is no detector tube in any case. The first tube in a typical transmitter of this type is the *oscillator*. It is this tube that generates the radio-frequency current, the frequency of which is determined by the values of the coil and condenser in the circuit.

If the transmitter is designed to operate on a single frequency only, the second tube in the line-up is a radio-frequency power amplifier or *buffer*. The circuits related to this tube are tuned to the same frequency as that of the oscillator. The third and last tube is the final amplifier. The circuits related to this tube are also tuned to the same frequency as that of the oscillator. The final amplifier tube is of a type capable of developing high power and is usually larger than the audio power amplifier tubes used in radio receivers.

In transmitters designed to operate in more than one frequency band, and where the frequency of the oscillator remains fixed, the second tube is often made to function as a *frequency doubler*. In this instance the output circuit of the doubler tube is tuned to twice the frequency of the oscillator and the tube itself so biased that it develops a strong second harmonic of the fundamental oscillator frequency. If, for instance, the oscillator tube generates a frequency of 7000 kilocycles (40-meter band) the doubler tube will produce a frequency just twice that amount, or 14,000 kilocycles (20-meter band). If the circuits of the final amplifier are then tuned to 14,000 kilocycles, the radiated signal will be in the 20-meter band.

The above is purposely sketchy as it is intended only to point out the purposes to which the tubes may be put. These points will be covered in detail in my next letter. In the meantime it may also be pointed out that final amplifier tubes may be so operated that their power output for given voltage values is proportionately higher than the outputs obtainable from the power amplifier tubes used in receivers. This is due to the fact that we can tolerate certain forms of distortion developed in amplifiers of radio-frequency power that cannot be tolerated in audio-frequency amplifiers. When so operated the tubes reach high values of plate current not permissible in audio power tubes.

Generally speaking, there is little difference between a code transmitter and a phone transmitter. In the former the radio-frequency section alone is used, and the power interrupted by a key at some point in the circuit to form dots and dashes. In the latter an audio-frequency amplifier with large power output is added to the radio-frequency section so that the r.f. in the final amplifier stage may be voice-modulated.

This audio amplifier is no different in operation than the audio amplifier in a receiver. The voice impulses from the microphone are amplified and eventually used to mould or modulate the radio-frequency carrier. In this case, however, the audio power amplifier tubes are referred to as *modulators*.

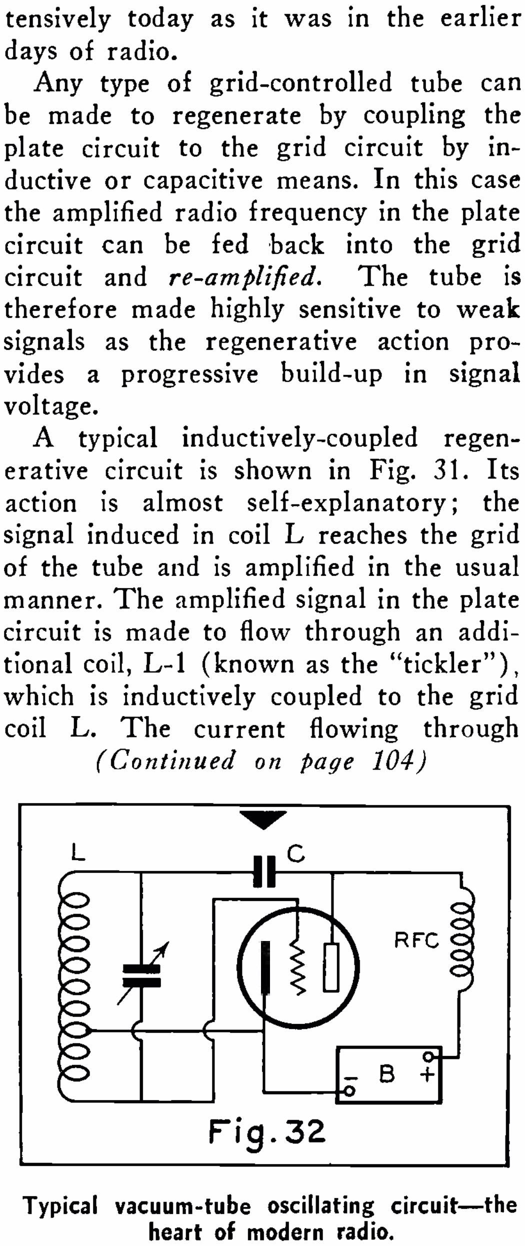
Regeneration

Regeneration is a very important function even though it is not used as extensively today as it was in the earlier days of radio.

Any type of grid-controlled tube can be made to regenerate by coupling the plate circuit to the grid circuit by inductive or capacitive means. In this case the amplified radio frequency in the plate circuit can be fed back into the grid circuit and *re-amplified*. The tube is therefore made highly sensitive to weak signals as the regenerative action provides a progressive build-up in signal voltage.

A typical inductively-coupled regenerative circuit is shown in Fig. 31. Its action is almost self-explanatory; the signal induced in coil L reaches the grid of the tube and is amplified in the usual manner. The amplified signal in the plate circuit is made to flow through an additional coil, L-1 (known as the "tickler"), which is inductively coupled to the grid coil L. The current flowing through

(Continued on page 104)



Typical vacuum-tube oscillating circuit—the heart of modern radio.

RADIO PROVING POST

SKY-BUDDY and SUPER SKY RIDER

Two Hallicrafters Sets Tested Simultaneously

THE following review is the result of simultaneous tests conducted on two receivers of the same make but differing considerably in price. The purpose of this direct comparison was to determine the performance of each set in relation to its own price as well as in relation to the price of the other.

The receivers selected for this comparative test were the Hallicrafters Model 5T Sky-Buddy and Model SX11 Super Sky Rider. The Sky-Buddy has 5 tubes and the Super Sky Rider eleven counting the electron-ray tuning indicator.

Test Set-up

The receivers were set up on the same table and separated by about 2 feet and at opposite angles, so that the operator, centrally located, could tune either set without having to alter his position. The sets were connected to separate outlets on opposite sides of the room and both left "fired up" during entire test periods. The antenna system was connected to a low-capacity double pole, double throw switch and the outer terminals of the switch connected to the receivers. This arrangement permitted an instantaneous switching of the same antenna system from one set to the other.

It was taken for granted that the more expensive receiver would prove superior on all counts. Consequently the Super Sky Rider was made to "set the pace" for the Sky-Buddy. That is, each test was made first on the Super Sky Rider and followed up by a similar test on the Sky-Buddy. Comparative notes were then made.

Before getting down to the actual tests, it will be well to review the mechanical and electrical features of each receiver. We will cover each receiver separately in this case and then sum up the advantages and limitations.

The Hallicrafters Model SX-11 Super Sky Rider.

The Sky-Buddy

The Sky-Buddy is illustrated in Fig. 1. A 4½-inch dynamic speaker is mounted behind the grill on the left side of the front panel. The airplane type dial to the right of the speaker grill is of the same diameter and has three scales directly calibrated in kilocycles and megacycles. The direct-reading pointer is double and its rate of travel with respect to the tuning knob is 1 to 36. The supplementary or "second hand" pointer is red and travels over a 360-degree logging scale with divisions reading from 0 to 100. The red pointer travels at the same rate as the tuning knob which is located just to the right of the dial.

All other controls are ranged along the lower edge of the front panel. The knob at the extreme left is the pitch control for the beat-frequency oscillator. To the right of this is the headphone jack. The toggle switch near the center turns on and off the beat oscillator. The power switch and volume control are combined on the one knob to the right of the beat oscillator toggle switch.

The band selector switch is located just below and to the right of the tuning dial. This switch has three positions, as follows: No. 1—1680 to 545 kc; No. 2—1680 to 5500 kc; No. 3—5.5 to 18 mc.

The toggle switch at the extreme right permits the operator to cut out the automatic volume control during beat reception or the reception of weak signals.

The schematic diagram of the Sky-Buddy is shown in Fig. 2. Use is made of double-purpose tubes so that in effect the receiver is approximately equivalent to an 8-tube set employing a single tube for each function. The circuit, of course, is a superheterodyne. Provisions are made for the use of a grounded antenna or an aerial of the doublet type. (at A1-F1)

The 6A7 (at B7) tube combines the functions of first detector and high-frequency oscillator. All the manually-tuned circuits are common to this tube. The 6F7 (B11) combines the functions of intermediate - frequency amplifier and beat-frequency oscillator. It should be noted that the input i.f. transformer (C9) is of the iron-core type which provides an increase in sensitivity and selectivity. The type 75 tube (B15) has three functions; second detector, automatic volume control and audio amplifier. The audio triode section of this tube is resistance coupled to a type 42 power pentode which in turn is coupled to the dynamic speaker. The headphone jack (B20) is connected in the plate circuit of the power tube in such a manner that when the phones are plugged in the speaker is automatically disconnected. The fixed condenser (at B19) in series with the jack lead prevents plate current from flowing through the headphones.

Summary

In summarizing the structural features of this receiver strictly on its own merits, it may be said that it is unusual to find a beat oscillator, pitch control, headphone jack and avc switch in a set so low in price. And these additions seem to have been made without skimping at other points. The cabinet and chassis, for instance, are of substantial material. The band-selector switch is nothing to rave about, but it is adequate and one cannot very well expect it to operate as smoothly as the switch in a more expensive receiver. The gang condenser and dial are floated, the pitch control for the beat oscillator is mounted in a shield and has shielded leads. Shields are used on all the tubes with the exception of the power and rectifier tubes which is common practice.

The rear of the cabinet is left open, which provides good ventilation and at the same time prevents speaker howl. The full volume of the receiver may be used without the speaker getting the jitters—something that earlier receivers of this type having built-in speakers were not guarded against.

So much for the features of the Sky-Buddy.

The Hallicrafters Model 5T Sky-Buddy which was tested simultaneously with the Super Sky Rider.

The Super Sky Rider

The Super Sky Rider is illustrated in Fig. 3. There are so many controls that it is difficult to decide where to begin—but suppose we start with the large, centrally-located general-coverage tuning dial. This is made of solid metal, nickel plated, on which are engraved the calibrations for all five of the frequency ranges. The pointer above the dial is mechanically coupled to the band-selector switch and moves from one scale to the next as the switch is rotated. There is a sixth scale at the very edge of the dial which reads from 0 to 213 degrees and is used in conjunction with the micro-vernier scale which permits re-setting the main dial to within a tenth of one division. The main dial rotates through an arc of 338 degrees and each of the five frequency scales are directly calibrated in kilocycles and megacycles. A small dial light, with black metal hood, is mounted to the right of the micro-vernier scale.

The main dial is controlled by the knob to its left. This knob has a heavy flywheel on the end of its shaft which not only provides a decidedly smooth operating control but permits the operator to twirl the knob for rapid rotation of the dial. A single twirl is sufficient to swing the dial through nearly half of its arc, so it takes only a second or two to swing the dial from one extreme to the other on any of the five bands.

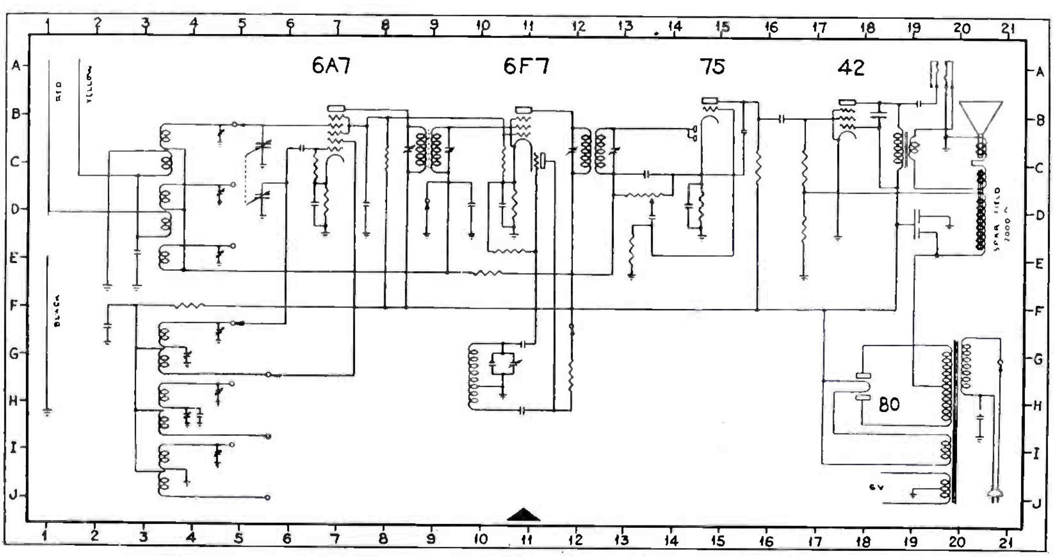
The electron-ray tuning indicator is located behind the small window directly above the main tuning control knob. The band-spread scale is behind the window to the right of the main dial and its control knob directly below. This controls a separate three-gang condenser of low capacity which is in shunt with the main tuning gang condenser.

The controls along the lower edge of the front panel are, from left to right; phone jack (which disconnects the speaker when in use), audio gain control, avc switch, r.f. gain control, send-receive cutout switch, band-selector switch, crystal phasing control, and beat oscillator injection. The beat oscillator pitch control is directly above the injector, and occupying the same relative position on the opposite end of the panel is the combined power switch and tone control.

All controls are smooth in operation. The band-selector switch is of sound construction and its five positions cover the following frequency ranges: No. 1—545 to 1230 kc; No. 2—1.18 to 2.85 mc; No. 3—2.75 to 6.82 mc; No. 4—6.75 to 16.40 mc; No. 5—15.40 to 38.10 mc, or a continuous wavelength coverage of 550 to 7.85 meters.

The receiver structure is exceptionally rigid. The black crackle finished aluminum front panel is ⅛-inch thick. This is anchored to the chassis by means of husky angle braces, one on each end. And, glory be, the chassis is *cadmium plated,* with a satin finish—and if you don't think this is important, you don't know what hell a plain steel chassis can raise with connections after things settle down and begin to mature! The receiver front panel is bolted to the cabinet by means of a series of large solid metal thumb screws. These may be easily removed when one wishes to pull the chassis for inspection.

The receiver is completely self-contained with the exception of the speaker. Since it is entirely enclosed (though vents are provided) and uses beam-power tubes in the output, a considerable amount of heat is developed in the left-



Road-map circuit diagram of the Hallicrafters Model 5T Sky-Buddy.

hand section where the "heavy" equipment is located. With rectifier, two beamers and a power transformer going full blast, heat is to be expected—but personally we should like to see a bit more ventilation for the sake of reducing the fire-up frequency drift.

The Circuit

The schematic diagram of the Super Sky Rider is shown in Fig. 4. There is a stage of r.f. (B5) (on all bands) using a 6K7. This feeds a 6L7 mixer (B9) which derives its frequency-conversion energy from the 6C5 in the high-frequency oscillator circuit (I7). The output of the 6L7 feeds an i-f circuit composed of two iron-core i-f transformers and the crystal filter (B11). The latter is cut in and out of circuit (opened or shorted to be exact) by the switch SW-1. There are two i.f. stages (B13-15), both using 6K7 tubes and iron-core transformers. The i.f. output is fed to the paralleled diodes of the 6R7, the diodes performing the function of detection and supplying avc bias for the r.f. and two i.f. stages. The triode section of the 6R7 functions as an audio amplifier and is transformer coupled to the push-pull Class A-operated 6L6 tubes in the output (B19). The secondary of the output transformer is tapped to feed a 500-ohm line and/or the 5000-ohm terminals provided for the permanent-magnet dynamic speaker. The phone jack (G20) is also in this circuit and so connected that when the phones are plugged in, the secondary of the output transformer is shorted. Audio for the phones is picked up from the grid circuit of the upper 6L6, so there is no high voltage in the headphone circuit.

The r.f. gain control (H4) is independent of the avc circuit. It controls the bias, and therefore the gain, of the r.f. and two i.f. tubes by varying the voltage drop in the common cathode circuits.

The 6G5 tuning indicator tube (H11) operates in the usual manner. The grid is tied to the avc line and therefore the tube is inoperative when the avc is cut out by means of the switch on the front panel of the receiver.

The 6K7 beat-frequency oscillator (H14) is capacity coupled to the diode second detector. The degree of beating voltage injected into this circuit is controlled by a potentiometer (G17) (the BFO injector control on the front panel). This permits the operator to adjust the degree of beat-oscillator voltage injected into the diode circuit for the most favorable reception of weak or strong c.w. signals.

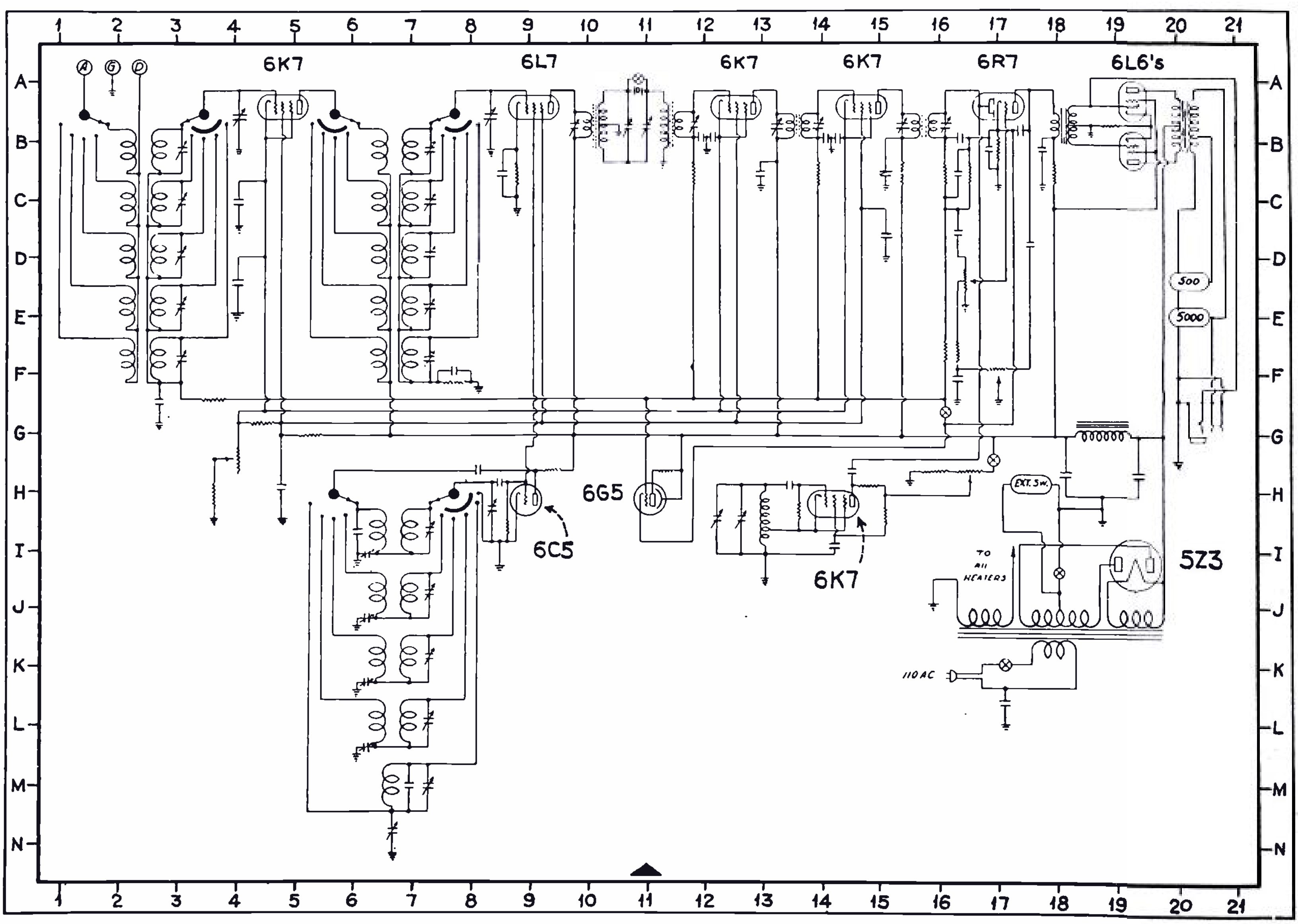
Summary

The high points are: substantial construction, flywheel tuning control, the possibility of accurately re-setting the main dial so that band-spread dial loggings really mean something, the crystal filter which may be used effectively on both c.w. and phone signals. The low points, in our opinion, are: excess heat generation, crowded divisions on band-spread scale (although the band-spread itself is adequate), and a tone control that does not appear to provide as wide a range of audio shading as it should. The latter is relatively unimportant as the high audio-frequency attenuation is sufficient to reduce background noise.

Simultaneous Tests

The frequency drift of both receivers was measured at 14 megacycles from a cold start up to temperature stability at the end of a half hour. The drift of the Sky-Buddy was approximately 35 kc and that of the Super Sky Rider approximately 25 kc. The high drift of the latter seemed due to the amount of heat developed inside the cabinet, so to be fair in the matter a second test was made with a crystal-controlled oscillator, to determine how much of this drift might be translated into unstable opera-

(Continued on page 111)



Road-map diagram of the Hallicrafters Model SX11 Super Sky Rider.

Queries

what is wrong with my receiver? . . . circuitwist

Question Number 24

"I have an 11-tube Philco, and am able to get only a few of the European short-wave stations and some of the South Americans. I have a good antenna installed by a serviceman. I am also troubled with quite a bit of noise. From the reports I read every month in *Globe Girdling,* I am convinced that there is something wrong with my receiver. Can you make any suggestions?—*A. R. C., Atlanta, Georgia.*"

Answer

Your best bet is suggested in the photograph of Fig. 1—call in an expert serviceman, have him check your receiver and determine whether or not you are getting all you should out of it. Your second best bet is to consult neighbors who have all-wave receivers, and determine whether they are securing similar results—taking into consideration, of course, any large difference in receiver cost.

Thirdly, if you will supply us with *full information* it is possible that AWR can help you. But on the basis of the meager report above, little can be done. A. R. C.'s complaint is comparable to writing a doctor stating that one has a sore throat and inquiring what is the trouble. It might be many things from tonsillitis to diphtheria. While it is impossible to diagnose a large percentage of radio difficulties without personally examining the faulty apparatus, there are many instances where helpful suggestions can be made if a complete case history is presented. As the information contained in most inquiries of this nature is as inadequate as that supplied by A.R.C., we outline below just what the Queries Department would like to know in order to be of most assistance to readers who suspect that they are not obtaining the best possible results from their receivers.

1. Did your receiver ever operate better than it does now? If so, in what way? What stations were you once able to receive that cannot be picked up now? *(The manner in which reception deteriorates is often indicative of the trouble. Also, certain stations will be well received during one season of the year and then not be heard in one location for six or nine months. The same applies, in a general way, to frequencies.)*

2. At what time do you do most of your listening? *(The majority of short-wave stations have very short schedules, and many of them do not maintain daily schedules. Check your listening habits against the* AWR *Short-Wave Station List.)*

3. How consistently do you listen? *(Relatively few short-wave broadcast stations transmit on high powers. Thus reception is very often in the nature of a freak, and only consistent listening, month after month, will pile up a spectacular log.)*

4. How much experience have you in short-wave tuning? *(It takes some skill to pull in many of the distant catches. A goodly number of Mr. Hind's followers have been tuning short-wave receivers for years.)*

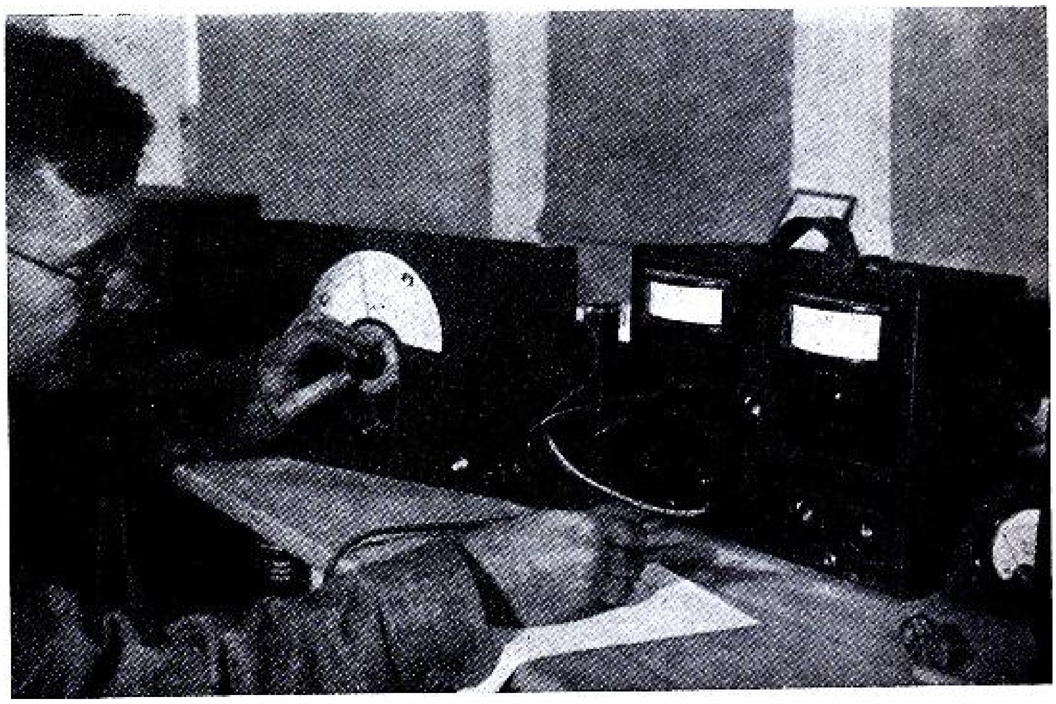
5. How well do you receive Germany, England, Italy, Prague, France and Holland? *(These stations are practically "locals." They are very easy to locate and tune, and should be received quite well on some of their frequencies most of the time. If such is the case, the chances are there is nothing wrong with your set and that the considerations implied in questions 2, 3 and 4 have something to do with your lack of satisfaction.)*

6. How old are your tubes and when were they last checked okay?

7. Please give the make and model of your set and the type of each tube used. *(Some receivers have typical troubles which are readily identified—and the same goes for tubes.)* If you have a diagram of your receiver, please send it along, as it may save your very busy Queries Editor the trouble of look-

(Continued on page 104)

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.



There are many instances when only personal inspection by an expert can determine whether your receiver is operating at full efficiency. However, where full information is supplied, the AWR Queries Department can often be of assistance, with real savings to its readers.

SHORT-WAVE STATION LIST

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

KC	Meters	Call	Location	Time
31600	9.4	W1XKA	• Boston, Mass.	Daily 9 A.M.-12 A.M.
31600	9.4	W8XKA	• Pittsburgh, Pa.	3-11 P.M. daily
31600	9.4	W3XKA	• Philadelphia, Pa.	Daily 12-10 P.M.
31600	9.4	W8XWJ	• Detroit, Mich.	Sunday 2:30-7:30 P.M. Daily 6:15 A.M.-12:30 P.M., 2-5 P.M., 7-10 P.M.
24380	12.3	CRCX	• Bowmanville, Ont.	Experimental
21540	13.92	W8XK	• Pittsburgh, Pa.	6:45 A.M.-9 A.M. daily
21530	13.93	GSJ	• Daventry, England	Not in use.
21520	13.94	W2XE	• Wayne, N. J.	7:30 A.M.-1 P.M. daily
21520	13.94	JZM	• Nazaki, Japan	Irregular
21500	13.95	NAA	Washington, D. C.	(E) Time signals
21470	13.97	GSH	• Daventry, England	6-8:45 A.M., 9 A.M.-12 noon daily
21420	14.01	WKK	Lawrenceville, N. J.	(P) Phones LSN - PSA daytime; HJY - OCI-OCJ irregular
21160	14.19	LSL	Buenos Aires, Arg.	(P) Phones GAA mornings; DFB-DHO-PSE-EHY irreg.
21140	14.19	KBI	Manila, P. I.	(P) Tests and relays P. M. irregular
21080	14.23	PSA	Rio de Janeiro, Brazil	(P) Phones WKK-WLK daytime
21060	14.25	KWN	Dixon, Calif.	(P) Phones afternoon irregular
21020	14.29	LSN	Buenos Aires, Arg.	(P) Phones WKK-WLK daily; EHY, FTM irregular
20860	14.38	EHY	Madrid, Spain	(P) Phones LSM-PPU-LSY mornings
20860	14.38	EDM	Madrid, Spain	(P) Phones LSM-PPU-LSY mornings
20835	14.40	PFF	Kootwijk, Holland	(P) Phones Java days
20830	14.40	PFF	Kootwijk, Holland	(P) Phones Java days
20825	14.41	PFF	Kootwijk, Holland	(P) Phones Java days
20820	14.41	KSS	Bolinas, Calif.	(P) Phones Far East A.M.
20380	14.72	GAA	Rugby, England	(P) Phones LSL mornings; LSY-LSM-PPU irregular
20040	14.97	OPL	Leopoldville, Belgian Congo, Africa	(P) Tests with ORG mornings and noon
20020	14.99	DHO	Nauen, Germany	(P) Phones PPU-LSM-PSA-LSL-YVR A.M.
19987	15.01	CFA	Drummondville, Que.	(P) Phones north America irregular
19980	15.02	KAX	Manila, P. I.	(P) Phones KWU evenings; DFC-JVE A.M.; early A.M.
19820	15.14	WKN	Lawrenceville, N. J.	(P) Phones GAU A.M.
19720	15.21	EAQ	Madrid, Spain	(P) Relays & tests A.M.
19680	15.24	CEC	Santiago, Chile	(P) Phones OCI - HJY afternoons
19620	15.29	VQG	Nairobi, Kenya, Africa	(P) Phones GAD 7-8 A.M.
19600	15.31	LSF	Buenos Aires, Arg.	(P) Phones and tests irregularly
19530	15.36	EDR2	Madrid, Spain	(P) Phones LSM-PPU-YVR mornings
19530	15.36	EDX	Madrid, Spain	(P) Phones LSM-PPU-YVR mornings
19520	15.37	IRW	Rome, Italy	(P) Phones LSM-PPU-mornings. Broadcasts irregularly
19500	15.40	LSQ	Buenos Aires, Arg.	(P) Phones daytime irregularly
19355	15.50	FTM	St. Assisse, France	(P) Phones LSM-PPU-YVR mornings
19345	15.52	PMA	Bandoeng, Java	(P) Phones PCK-PDK early mornings
19270	15.57	PPU	Rio de Janeiro, Brazil	(P) Phones DFB-EHY-FTM mornings
19235	15.60	DFA	Nauen, Germany	(P) Phones HSP-KAX early mornings
19220	15.61	WKF	Lawrenceville, N. J.	(P) Phones GAS-GAU mornings
19200	15.62	ORG	Brussels, Belgium	(P) Phones OPL A.M.
19160	15.66	GAP	Rugby, England	(P) Phones Australia A.M.
19140	15.68	LSM	Buenos Aires, Arg.	(P) Phones DFB-FTM-GAA-GAB A.M.
19020	15.77	HS8PJ	• Bangkok, Siam	Mondays 8-10 A.M.
18970	15.81	GAQ	Rugby, England	(P) Phones ZSS A.M.
18960	15.82	WQD	Rocky Point, N. Y.	(E) Tests LSY irreg.
18920	15.85	WQE	Rocky Point, N. Y.	(E) Programs, irreg.
18910	15.86	JVA	Nazaki, Japan	(P) Phones Europe days to 8:30 P.M.
18890	15.88	ZSS	Klipheuvel, So. Africa	(P) Phones GAQ-GAU mornings
18830	15.93	PLE	Bandoeng, Java	(P) Phones PCV mornings early; KWU evenings
18680	16.06	OCI	Lima, Peru	(P) Phones CEC-HJY days; WKK-WOP noon
18620	16.11	GAU	Rugby, England	(P) Phones VWY-ZSS early A.M.; Lawrenceville, daytime
18545	16.18	PCM	Kootwijk, Holland	(P) Relays and phones Java early A.M.
18540	16.19	PCM	Kootwijk, Holland	(P) Relays and phones Java early A.M.
18535	16.20	PCM	Kootwijk, Holland	(P) Relays and phones Java early A.M.
18480	16.23	HBH	Geneva, Switzerland	(E) Relays to N. Y. mornings irreg.
18450	16.26	HBF	Geneva, Switzerland	(E) Commercial; irreg.
18440	16.25	HJY	Bogota, Colombia	(P) Phones CEC - OCI noon; music irreg.
18410	16.29	PCK	Kootwijk, Holland	(P) Phones PLE - PMC early A.M.
18405	16.30	PCK	Kootwijk, Holland	(P) Phones PLE - PMC early A.M.
18400	16.31	PCK	Kootwijk, Holland	(P) Phones PLE - PMC early A.M.
18388	16.31	FZS	Saigon, Indo-China	(P) Phones FTK early mornings
18340	16.36	WLA	Lawrenceville, N. J.	(P) Phones GAS A.M.
18310	16.38	GAS	Rugby, England	(P) Phones WLA-WMN mornings
18295	16.39	YVR	Maracay, Venezuela	(P) Phones DFB-EHY-FTM mornings
18270	16.42	IUD	• Addis Ababa, Ethiopia	Irregular
18250	16.43	FTO	St. Assise, France	(P) LSM-LSY A.M.
18220	16.46	KUS	Manila, P. I.	(P) Phones Bolinas nights
18200	16.48	GAW	Rugby, England	(P) Relays and phones N. Y. irreg.
18190	16.49	JVB	Nazaki, Japan	(P) Phones Java early mornings, U. S. evenings
18180	16.51	CGA	Drummondville, Que.	(P) Phones GBB A.M.
18135	16.54	PMC	Bandoeng, Java	(P) Phones PCK - PCV early A.M.
18115	16.56	LSY3	Buenos Aires, Arg.	(E) Phones DFB-FTM-GAA-PPU A.M.; evening broadcasts occasionally
18075	16.59	PCV	Kootwijk, Holland	(P) Phones PLE early mornings
18070	16.60	PCV	Kootwijk, Holland	(P) Phones PLE early mornings
18065	16.61	PCV	Kootwijk, Holland	(P) Phones PLE early mornings
18060	16.61	KUN	Bolinas, Calif.	(P) Phones Manila afternoons and nights
18040	16.63	GAB	Rugby, England	(P) Phones LSM noon
18020	16.65	KQJ	Bolinas, Calif.	(P) Phones afternoons; irregular
17980	16.69	KQZ	Bolinas, Calif.	(E) Tests and relays to LSY irreg.
17940	16.72	WQB	Rocky Point, N. Y.	(E) Tests with LSY, A.M.
17920	16.74	WQF	Rocky Point, N. Y.	(P) Phones Ethiopia irregular
17900	16.76	WLL	Rocky Point, N. Y.	(E) Relays to Geneva and Germany, A.M.
17850	16.81	LSN	Buenos Aires, Arg.	(P) Phones S. A. irreg.
17790	16.86	GSG	• Daventry, England	6-8:45 A.M. daily
17785	16.87	JZL	• Nazaki, Japan	Irregular
17780	16.87	W3XAL	• Bound Brook, N. J.	9 A.M.-5 P.M. daily
17780	16.87	W9XAA	• Chicago, Ill.	Not in use at present.
17775	16.88	PHI	• Huizen, Holland	Sunday 7:30-9:30 A.M., 1-2 P.M.; Mon., Thu., Fri., Sat., 7:30-9:30 A.M.
17760	16.89	DJE	• Zeesen, Germany	12:05-5:15 A.M.; 5:55-11 A.M. daily
17755	16.90	ZBW5	• Hong Kong, China	Daily 11:30 P.M.-1:30 A.M. ex. Sat. Mon. & Thurs. 4-10 A.M. Tues., Wed., Fri., Sun., 3-10 A.M. Sat. 3-11 A.M., 9 P.M.-1:30 A.M.
17750	16.91	IAC	Pisa, Italy	(P) Phones and tests to ships A.M.
17740	16.91	HSP	Bangkok, Siam	(P) Phones DFB early A.M.
17710	16.94	CJA-3	Drummondville, Que.	(P) Phones Australia and Far East early A.M.
17699	16.95	IAC	Pisa, Italy	(P) Phones and tests to ships A.M.
17620	17.03	IBC	San Paolo, Italy	(P) Irregular
17545	17.10	VWY	Poona, India	(P) Phones GAU-GBC-GBU mornings
17520	17.12	DFB	Nauen, Germany	(P) Phones PPU-YVR-KAY mornings
17480	17.16	VWY	Poona, India	(P) Phones GAU-GBC-GBU daytime
17260	17.37	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.

KC	Meters	Call	Location	Time
16385	18.31	ITK	Mogdishu, Somaliland, Africa	(P) Irregular
16305	18.39	PCL	Kootwijk, Holland	(P) Special relays and phones irreg.
16300	18.44	WLK	Lawrenceville, N. J.	(P) Phones England irreg.
16250	18.46	FZR	Saigon, Indo-China	(P) Phones FTA-FTK early A.M.
16240	18.47	KTO	Manila, P. I.	(P) Phones JVE-KWU evenings
16140	18.59	GBA	Rugby, England	(P) Phones Argentina & Brazil irreg.
16117	18.62	IRY	Rome, Italy	(P) Phones IDU - ITK A.M.
16050	18.69	JVC	Nazaki, Japan	(P) Phones Hong Kong early A.M.
16030	18.71	KKP	Kahuku, Hawaii	(P) KWU A.M. & P.M. Tests JVF - KTO - PLE mornings
15930	18.83	FYC	Pontoise, France	(P) Phones 9:00 A.M. and irreg.
15880	18.89	FTK	St. Assise, France	(P) FZR-FZS-LSM-PPU-YVR mornings
15860	18.90	JVD	Nazaki, Japan	(P) Phones Shanghai early A.M.; to KWU 4 P.M. and 4 A.M. daily
15860	18.90	CEC	Santiago, Chile	(P) Phones OCJ A.M.
15810	18.97	LSL	Buenos Aires, Arg.	(P) GAA, A.M.; GCA, PSE, PSF, P.M.
15795	18.99	XOJ	Shanghai, China	(E) Phones GBA 6-7 A.M., JVD 8 P.M. and later
15760	19.04	JYT	Kemikawa-Cho, Japan	(E) Tests KKW-KWE-KWU evenings
15740	19.06	JIA	Chureki, Japan	(P) Nazaki early A.M.
15700	19.11	WJS	Hicksville, L. I., N. Y.	(P) Phones Ethiopia irregular
15670	19.15	WAE	Brentwood, N. Y.	(E) Tests afternoons
15660	19.16	JVE	Nazaki, Japan	(P) Phones PLE early A.M.; KTO eves.
15625	19.20	OCJ	Lima, Peru	(P) Phones CEC days
15620	19.21	JVF	Nazaki, Japan	(P) Phones KWO-KWU after 4 P.M.
15595	19.24	DFR	Nauen, Germany	(E) Tests and relays mornings irreg.
15530	19.32	HSC-2	Bangkok, Siam	(P) Phones JVE late P.M. and early A.M.
15530	19.32	HS8PJ	● Bangkok, Siam	Mondays 8-10 A.M. occasionally
15505	19.36	CMA-3	Havana, Cuba	(P) Phones and tests irregularly
15490	19.37	KEM	Bolinas, Calif.	(P) Phones Java and China; irregular
15475	19.39	KKL	Bolinas, Calif.	(P) Phones Manila and Japan; irregular
15460	19.41	KKR	Bolinas, Calif.	(P) Phones Manila and Japan; irregular
15450	19.42	IUG	Addis Ababa, Ethiopia	(P) Phones irregular
15430	19.44	KWE	Bolinas, Calif.	(P) Tests JYK - JYT - PLE evenings
15415	19.46	KWO	Dixon, Calif.	(P) Phones JVF evenings
15370	19.52	HAS3	● Budapest, Hungary	Sunday 9-10 A.M.
15360	19.53	DJT	● Zeesen, Germany	Irregular
15355	19.54	KWU	Dixon, Calif.	(P) Phones Japan, Manila and Java evenings
15340	19.56	DJR	● Zeesen, Germany	8-9 A.M. daily
15330	19.56	W2XAD	● Schenectady, N. Y.	10 A.M.-3:45 P.M. daily
15320	19.58	OLR	● Prague, Czechoslovakia	4 A.M.-9 P.M. daily
15310	19.60	GSP	● Daventry, England	Not in use
15305	19.60	CP7	La Paz, Bolivia	(E) Relays CP4; tests daytimes
15280	19.63	LRU	● Buenos Aires, Arg.	7 A.M.-7 P.M. daily
15280	19.63	DJQ	● Zeesen, Germany	6-8 A.M., 8:15-11 A.M. daily. Sun., 11:10 A.M.-12:25 P.M.
15270	19.64	W2XE	● Wayne, N. J.	1-6 P.M. daily
15260	19.66	GSI	● Daventry, England	12:15-4 P.M. daily
15252	19.67	RIM	Tashkent, USSR.	(P) Phones RKI early mornings
15243	19.68	TPA2	● Pontoise, France	6-11 A.M. daily
15230	19.69	OLR	● Prague, Czechoslovakia	4 A.M.-9 P.M. daily
15220	19.71	PCJ	● Eindhoven, Holland	Tuesday 4:30-6 A.M.; Wednesday 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. daily; 11:10 A.M.-12:25 P.M. Sunday 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	3-5 A.M. daily
15160	19.79	JZK	● Nazaki, Japan	Irregular
15150	19.80	YDC	● Soerabaja, Java	5:30-11 A.M., 5:45-6:45 P.M., 10:30 P.M.-1:30 A.M. daily
15145	19.81	RKI	● Moscow, USSR.	Broadcasts 10-11 A.M. Sun. Phones RIM A.M.
15140	19.82	GSF	● Daventry, England	9 A.M.-12 noon 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.
15055	19.92	WNC	Hialeah, Fla.	(P) Phones daytime
15040	19.95	HIR	Ciudad Trujillo, R. D.	(P) Phones WNC days
14985	20.02	YSL	San Salvador, Salvador	(P) Phones days irreg.
14980	20.03	KAY	Manila, P. I.	(P) Phones DFC-DFD-GCJ early A.M.; KWU evenings
14970	20.04	LZA	● Sofia, Bulgaria	Weekdays 5-6:30 A.M., 12-2:45 P.M. Sundays 12 A.M.-4:30 P.M.
14940	20.06	HJB	Bogota, Colombia	(P) Phones WNC-PPU-YVQ days
14935	20.07	PSE	Rio de Janeiro, Brazil	(P) Phones LSL-WLK day irreg.; EDM-EHY 8 A.M. Broadcasts irreg.
14920	20.11	KQH	Kahuku, Hawaii	(P) Tests irregularly
14910	20.12	JVG	Nazaki, Japan	(P) Phones Formosa and broadcasts 1-2:30 A.M. irreg.
14845	20.19	OCJ2	Lima, Peru	(P) Phones HJY and others daytime
14800	20.27	WOV	Rocky Point, N. Y.	(E) Tests Europe irreg.
14790	20.28	RIZ	Irkutsk, USSR.	(P) Calls RKI 9:30 A.M.
14770	20.31	WEB	Rocky Point, N. Y.	(E) Tests with Europe; irregular
14730	20.37	IQA	Rome, Italy	(P) Phones Japan and Egypt; sends music at times
14690	20.42	PSF	Rio de Janeiro, Brazil	(P) Phones LSL-WLK-WOK daytime
14653	20.47	GBL	Rugby, England	(P) Phones Nazaki early A.M.
14620	20.52	EHY	Madrid, Spain	(P) Phones LSM mornings irreg.
14620	20.52	EDM	Madrid, Spain	(P) Phones PPU-PSA-PSE mornings
14600	20.55	JVH	● Nazaki, Japan	(E) Phones DFB-GTJ-PCJ - TYB early mornings. B.C. music 12-1 A.M. daily. Mon. & Thurs., 4-5 P.M.; Tues. & Fri., 5-6 P.M.; Wed. & Sat., 2-3 P.M.
14590	20.56	WMN	Lawrenceville, N. J.	(P) Phones England days
14535	20.64	HBJ	Geneva, Switzerland	(E) Relays to Riverhead daytime
14530	20.65	LSN	Buenos Aires, Arg.	(P) Phones PSF-WLK-WOK irreg.
14485	20.71	TIR	Cartago, Costa Rica	(P) Phones WNC days
14485	20.71	TIU	Cartago, Costa Rica	(P) Phones WNC days
14485	20.71	YNA	Managua, Nicaragua	(P) Phones WNC days
14485	20.71	HPF	Panama City, Panama	(P) Phones daytime
14485	20.71	HRM	Tela, Honduras	(P) Phones WNC days
14485	20.71	TGF	Guatemala City, Guatemala	(P) Phones WNC days
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 daytime
14460	20.75	DZH	● Zeesen, Germany	Irregular
14440	20.78	GBW	Rugby, England	(P) Phones Lawrenceville daytime
14410	20.82	IBC	San Paolo, Italy	(P) Irregular
14410	20.80	DIP	Zeesen, Germany	(E) Experimental; irreg.
14250	21.00	W10XDA	Schooner Morrissey	(P) Irregular
13990	21.44	GBA2	Rugby, England	(P) Phones Argentina & Brazil irreg.
13900	21.58	WQP	Rocky Point, N. Y.	(E) Test daytime
13820	21.70	SUZ	Cairo, Egypt	(P) Phones DFC-DGU-GBB daytime
13780	21.77	KKW	Bolinas, Calif.	(P) Special relays; tests afternoon and evening
13760	21.80	TYE-2	Paris, France	(P) Phones U. S. days
13745	21.83	CGA-2	Drummondville, Que.	(P) Phones Europe irreg.
13738	21.82	RIS	Tiflis, USSR.	(P) Tests with Moscow irregular
13720	21.87	KLL	Bolinas, Calif.	(P) Special relays; tests afternoon and evening
13690	21.91	KKZ	Bolinas, Calif.	(P) Tests Japan and Java early A.M.; days Honolulu
13667	21.98	HJY	Bogota, Colombia	(P) Phones CEC afternoons
13635	22.00	SPW	● Warsaw, Poland	11:30 A.M.-12:30 P.M., Mon., Wed., Fri.
13610	22.04	JYK	Kemikawa-Cho, Japan	(E) Tests irregular A.M.
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	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

KC	Meters	Call	Location	Time
13345	22.48	YVQ	Maracay, Venezuela	(P) Phones WNC-HJB days
13285	22.58	CGA3	Drummondville, Que.	(P) Phones England days
13240	22.66	KBJ	Manila, P. I.	(P) Phones nights and early A.M.
13220	22.70	IRJ	Rome, Italy	(P) Phones Japan 5-8 A.M., and works Cairo days
13180	22.76	DGG	Nauen, Germany	(P) Relays to Riverhead days
13020	23.04	JZE	Nazaki, Japan	(P) Phones ships irreg
13000	23.08	FYC	Paris, France	(P) Phones CNR A.M.
12985	23.11	DFC	Nauen, Germany	(P) Phones KAY-SUV-SUZ early A.M.
12865	23.32	IAC	Pisa, Italy	(P) Phones ships irreg
12860	23.33	RKR	Novosibirsk, USSR.	(P) Daily, 7 A.M.
12840	23.36	WOO	Ocean Gate, N. J	(P) Phones ships days
12830	23.37	HJC	Barranquilla, Colombia	(P) Phones HJB-HPF-WNC days
12830	23.38	HJA-3	Barranquilla, Colombia	(P) Phones HJB-HPF-WNC days
12830	23.38	CNR	Rabat, Morocco	(P) Phones FYB-TYB-FTA near 4 P.M.
12830	23.38	CNR	● Rabat, Morocco	Special broadcasts irreg.
12795	23.45	IAC	Pisa, Italy	(P) Phones ships and tests Tripoli, irreg.
12780	23.47	GBC	Rugby, England	(P) Phones VWY early A.M.
12394	24.21	DAN	Nordenland, Germany	(P) Phones ships irreg. mornings
12300	24.39	PLM	Bandoeng, Java	(P) Phones 2ME near 6:30 A.M.
12295	24.40	ZLU	Wellington, N. Z.	(P) Phones ZLJ early A.M.
12290	24.41	GBU	Rugby, England	(P) Phones Lawrenceville days
12280	24.43	KUV	Manila, P. I.	(P) Phones early A. M.
12250	24.49	TYB	Paris, France	(P) Phones JVH-XGR and ships irreg.
12235	24.52	TFJ	Reykjavik, Iceland	(P) Phones England days
12235	24.52	TFJ	● Reykjavik, Iceland	English broadcast each Sun., 1:40-2:30 P.M.
12220	24.55	FLJ	Paris, France	(P) Phones ships irreg.
12215	24.56	TYA	Paris, France	(P) Algeria days
12150	24.69	GBS	Rugby, England	(P) Phones Lawrenceville days
12130	24.73	DZE	● Zeesen, Germany	Irregular
12100	24.79	CJA	Drummondville, Que.	(P) Tests VIY early A. M. and evenings
12060	24.88	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12055	24.89	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12050	24.90	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12020	24.95	VIY	Rockbank, Australia	(P) Tests CJA6 early A.M. and evenings
12000	25.00	RNE	● Moscow, USSR.	Sundays 6-7 A.M., 10-11 A.M., 4-5 P.M.; Mon. 4-5 P.M.; Wed., 6-7 A.M., 4-5 P.M.; Fri-day 4-5 P.M.
11991	25.02	FZS	Saigon, Indo-China	(P) Phones FTA - FTK early A.M.
11955	25.09	IBC	San Paolo, Italy	(P) Irregular
11955	25.09	IUC	● Addis Ababa, Ethiopia	12-1 A.M.; music at times
11950	25.11	KKQ	Bolinas, Calif.	(P) Relays programs to Hawaii eve.
11940	25.13	FTA	St. Assise, France	(P) Phones FZS - FZR early A.M.
11935	25.14	YNA	Managua, Nicaragua	(P) Cent. and S. A. stations, days
11900	25.21	XEWI	● Mexico City, Mexico	Sun., 1-2:15 P.M.; Tues. and Thurs., 7:30-8:45 P.M., 10:30 P.M.-12 A.M.; Mon., Wed., 3-4 P.M.; Fri., 3-4 P.M., 9 P.M.-12 A.M.; Sat., 9-10 P.M.
11885	25.24	TPA3	● Pontoise, France	2-5 A.M., 12:15 A.M.-6 P.M. daily
11875	25.26	YDB	● Soerabaja, Java	5:30-11 A.M., 5:45-6:45 P.M., 10:30 P.M.-1:30 A.M. daily
11870	25.26	OLR	● Prague, Czechoslovakia	4 A.M.-9 P.M. daily
11870	25.26	W8XK	● Pittsburgh, Pa.	7-9 P.M. daily
11860	25.29	GSE	● Daventry, England	Not in use
11855	25.31	DJP	● Zeesen, Germany	Irregular
11830	25.36	W2XE	● Wayne, N. J.	6-10 P.M. daily
11830	25.36	W9XAA	● Chicago, Ill.	Daily 8:30 A.M.-5 P.M.
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	JZJ	● Nazaki, Japan	Irregular
11795	25.43	DJO	● Zeesen, Germany	Irregular
11790	25.43	W1XAL	● Boston, Mass.	News Mon. to Fri. inc., 3:30-5 P.M.; Sat., 3-5:30 P.M.; Sun., 10:15 A.M.-12:30 P.M., 9:30-11 P.M.
11770	25.49	DJD	● Zeesen, Germany	11:35 A.M.-4:30 P.M., 4:50-10:45 P.M.
11760	25.51	OLR	● Prague, Czechoslovakia	4 A.M.-9 P.M. daily
11750	25.53	GSD	● Daventry, England	12:15-5:45 P.M., 6-8 P.M., 9-11 P.M. daily
11730	25.57	F31CD	● Saigon, Indo-China	7:30-9:30 A.M. daily
11730	25.57	PHI	● Huizen, Holland	7:30-9:30 A.M. ex. Tues. and Wed.
11720	25.60	CJRX	● Winnipeg, Manitoba	Week Days 6 P.M.-12 A.M. Sundays 5-10 P.M.
11720	25.60	TPA4	● Pontoise, France	6:15-10:15 P.M., 10:45 P.M.-1 A.M. daily
11710	25.62	VK9MI	● Sydney, Australia; "S.S. Kanimbla"	11 P.M.-7 A.M. Irregular
11705	25.63	SM5SX	● Stockholm, Sweden	Weekdays 6:25-7 A.M., 11 A.M.-5 P.M. Sun., 3 A.M.-5 P.M.
11680	25.68	KIO	Kahuku, Hawaii	(P) Phones Far East early A.M.
11670	25.62	PPQ	Rio de Janeiro, Brazil	(P) Phones WCG-WET-LSX evenings
11660	25.73	JVL	Nazaki, Japan	(P) Phones Taiwan eve. Broadcasts irreg. 1-2:30 A.M.
11570	25.93	HH2T	● Port-au-Prince, Haiti	Sp'l programs irreg.
11560	25.95	CMB	Havana, Cuba	(P) Phones New York irreg.
11538	26.00	XGR	Shanghai, China	(P) Tests irregularly
11500	26.09	XAM	Merida, Mexico	(P) Phones XDF-XDM-XDR irreg.
11495	26.10	VIZ3	Rockbank, Australia	(P) Tests CJA4 early A.M.
11435	26.24	COCX	● Havana, Cuba	8 A.M.-1 A.M. daily
11413	26.28	CJA4	Drummondville, Que.	(P) Phones VIZ3 early A.M.
11402	26.31	HBO	Geneva, Switzerland	(E) Broadcasts Sundays 11:30 P.M.; commercial, irreg.
11260	26.64	HIN	● Ciudad Trujillo, R. D.	Daily 11:40 A.M.-1:40 P.M., 4:30-6 P.M., 7:10-9:10 P.M.
11275	26.61	XAM	Merida, Mexico	(P) Phones XDR-XDM irregular
11050	27.15	ZLT	Wellington, N. Z.	(P) Phones VLZ early mornings
11000	27.27	PLP	Bandoeng, Java	(P) Phones early A.M.; broadcasts 5:30-11 A.M. week days; Sun., 5:30-10:30 A.M.
11000	27.26	XBJQ	● Mexico D. F., Mexico	8:15-10:30 P.M. irreg.
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. daily; Wed. & Sat. 2-3 P.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	CEC	● Santiago, Chile	Daily ex. Sat. and Sun., 7-7:20 P.M. (see CED, 10230 KC.)
10660	28.14	JVN	Nazaki, Japan	(P) Phones JIB early A.M.; Relays JOAK irreg.
10660	28.14	JVN	● Nazaki, Japan	4-7:30 A.M. irreg.; Mon. & Thurs. 4-5 P.M.; Tues. & Fri. 5-6 P.M.
10620	28.25	WEF	Rocky Point, N. Y.	(E) Relays program service irregularly
10620	28.25	EHX	Madrid, Spain	(P) Phones CEC and EHZ afternoons
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.
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.

KC	Meters	Call	Location	Time
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	WCG	Rocky Point, N. Y.	(E) Programs, irreg.
10375	28.92	JVO	Nazaki, Japan	(P) Manchuria and Dairen early A.M.
10370	28.93	EHZ	● Tenerife, Canary Islands	(P) Phones EDN 3:30-6 A.M; B.C. 3-4 P.M., 6-8:15 P.M.
10350	28.98	LSX	● Buenos Aires, Arg.	Near 10 P.M. irregular; 6-7:15 P.M. daily
10335	29.03	ZFD	Hamilton, Bermuda	(P) Phones afternoons
10330	29.04	ORK	● Brussels, Belgium	1:30-3 P.M. daily
10310	29.10	PPM	Rio de Janeiro, Brazil	(P) Tests New York and B.A. evenings
10300	29.13	LSQ	Buenos Aires, Arg.	(P) Phones GCA - HJY - PSH afternoons
10300	29.13	LSL	Buenos Aires, Arg.	(P) Phones GCA - HJY - PSH afternoons. Broadcasts irreg.
10290	29.15	DZC	● Zeesen, Germany	Used irregularly
10290	29.15	HPC	Panama City, Panama	(P) Phones C. A. and S. Am. daytime
10260	29.24	PMN	Bandoeng, Java	(P) Tests VLJ early A.M.; broadcasts 5:30-11 A.M. week days; 5:30-10:30 A.M. Sundays
10250	29.27	LSK3	Buenos Aires, Arg.	(P) Afternoons
10230	29.33	CED	● Antofagasta, Chile	Retransmits programs of CEC, 10670 KC., daily ex. Sat. and Sun., 7-7:20 P.M.
10220	29.35	PSH	Rio de Janeiro, Brazil	(P) Phones LSL-WOK evenings; broadcasts irreg.
10160	29.53	RIO	Bakou, USSR.	(P) Phones RIR-RNE irreg. A.M.; News irreg. 11 P.M.-3 A.M.
10140	29.59	OPM	Leopoldville, Belg-Congo	(P) Calls 7-11 A.M. daily. Phones ORK afternoons
10080	29.76	RIR	Tiflis, USSR.	(P) Phones RIM-RKI 7-11 A.M.
10070	29.79	EDN	Madrid, Spain	(P) Phones YVR after noons
10055	29.84	ZFB	Hamilton, Bermuda	(P) Phones WNB days
10055	29.84	SUV	Cairo, Egypt	(P) Phones DFC-DGU-GCA-GCB days
10042	29.87	DZB	● Zeesen, Germany	Irregular
10040	29.88	HJA3	Barranquilla, Colombia	(P) Tests early evenings, irreg.
9990	30.03	KAZ	Manila, P. I.	(P) Phones JVQ-KWX-PLV early A.M.
9966	30.08	IRS	Rome, Italy	(P) Tests irregularly
9950	30.13	GBU	Rugby, England	(P) Phones WNA evenings
9940	30.18	CSW	● Lisbon, Portugal	4-7 P.M. daily
9930	30.21	HKB	Bogota, Colombia	(P) Phones CEC - OCP - PSH - PSK afternoons
9930	30.21	HJY	Bogota, Colombia	(P) Phones LSQ afternoons
9890	30.33	LSN3	Buenos Aires, Arg.	(P) Phones WOK-WLK; broadcasts evenings irregular
9870	30.40	WON	Lawrenceville, N. J.	(P) Phones and tests; England irreg.
9860	30.43	EAQ	● Madrid, Spain	Saturday 1-3:30 P.M.; daily 5:15-9:30 P.M.
9840	30.47	JYS	Kemikawa-Cho, Japan	(E) Tests irregular
9830	30.50	IRM	Rome, Italy	(P) Phones JVP - JZT - LSX-WEL A.M.
9810	30.58	DFE	Nauen, Germany	(P) Relays and tests afternoons irreg.
9800	30.59	GCW	Rugby, England	(P) Phones Lawrenceville eve. and nights
9800	30.59	LSI	Buenos Aires, Arg.	(P) Relays very irreg.
9760	30.74	VLJ	Sydney, Australia	(P) Phones PLV- ZLT early A.M.
9760	30.74	VLZ	Sydney, Australia	(P) Phones PLV- ZLT early A.M.
9750	30.77	COCQ	● Havana, Cuba	8 A.M.-12 mid. daily
9750	30.77	WOF	Lawrenceville, N. J.	(P) Phones GCU irreg.
9710	30.88	GCA	Rugby, England	(P) Phones LSL afternoons
9700	30.93	LQA	Buenos Aires, Arg.	(P) Tests and relays early evenings
9675	31.00	DZA	● Zeesen, Germany	Irregular
9670	31.02	TI4NRH	● Heredia, Costa Rica	Daily 9-10 P.M., 11:30 P.M.-12 A.M.; Sat. night to 2 A.M. Sun.
9665	31.04	CT1AA	● Lisbon, Portugal	Tues., Thurs., Sat., 3-6 P.M.
9660	31.06	CR6AA	● Lobito, West Africa	3:45-5:30 P.M. Wed. & Sat.
9660	31.06	LRX	● Buenos Aires, Arg.	7-11 P.M. daily, experimentally
9660	31.06	PSJ	Rio de Janeiro, Brazil	(P) Irreg., Argentina
9650	31.09	YDB	● Soerabaja, Java	5:30-11 A.M., 5:45-6:45 P.M., 10:30 P.M.-1:30 A.M. daily
9635	31.13	2RO3	● Rome, Italy	12:30-6 P.M. Mon., Wed., Fri. Amer. Hour, 6-7:30 P.M., Tues., Thurs., Sat. Lat. Amer., 6-7:30 P. M. Sunday, off at 5:30 P.M.
9630	31.15	CFA5	Drummondville, Que.	(P) Phones No. America days
9620	31.17	DGU	Nauen, Germany	(P) Phones SUV A.M. Relays irreg.
9620	31.17	FZR	Saigon, Indo-China	(P) Phones Paris early A.M.
9600	31.25	CQN	● Macao, China	Mon. & Fri. 7-8:30 A.M.
9600	31.25	RAN	● Moscow, USSR.	English 7-7:30 P.M.; German 7:30-8 P.M. daily
9600	31.25	HJ1ABP	● Cartagena, Colombia	Daily 6-11 P.M.
9600	31.25	CB960	● Santiago, Chile	Daily ex. Sun. 11:30 A. M.-2 P.M., 6-8:30 P. M.; Sun. 3-5 P.M., 6-8:30 P.M.
9595	31.27	HBL	● Geneva, Switzerland	Saturday 5:30-6:15 P.M. First Monday each month 6-7 P.M.
9595	31.27	HH3W	● Port-au-Prince, Haiti	1-2 P.M., 7-8:30 P.M.; ex. Sunday
9595	31.27	YNLF	● Managua, Nicaragua	8-9 A.M., 1-3 P.M., 6:30-10:30 P.M. daily
9590	31.28	W3XAU	● Philadelphia, Pa.	12-8 P.M. daily
9590	31.28	VK2ME	● Sydney, Australia	Sunday 1-3 A.M., 5-9 A. M., 9-11 A.M.
9590	31.28	HP5J	● Panama City, Panama	Week days 12-1:30 P.M., 6-10:30 P. M. Sundays 10:30 A.M.-1:30 P.M., 7-10:30 P.M.
9590	31.28	PCJ	● Eindhoven, Holland	Tues. 1:30-3 P.M.; Wed. 7-10 P.M.; Sun. 7-8 P.M.
9580	31.32	GSC	● Daventry, England	4-5:45 P.M., 6-8 P.M., 9-11 P.M. daily
9580	31.32	VK3LR	● Melbourne, Australia	Week days 3:30-8:30 A. M.; Friday also 10 P. M.-2 A.M. Sunday, 3:30-7:30 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.
9560	31.38	DJA	● Zeesen, Germany	12:05-5:15 A.M., 5:55-11 AM., 4:50-10:45 P. M. daily
9560	31.38	HJ1ABB	● Barranquilla, Colombia	7 A.M.-12:30 P.M. daily
9545	31.44	HH2R	● Port-au-Prince, Haiti	Special programs irreg.
9540	31.45	DJN	● Zeesen, Germany	12:05-11 A.M., 4:50-10:45 P.M. daily
9540	31.45	VPD2	● Suva, Fiji Islands	5:30-7 A.M. daily
9535	31.46	JZI	● Nazaki, Japan	Irregular
9530	31.48	W2XAF	● Schenectady, N. Y.	4 P.M.-12 A.M. daily
9530	31.48	LCJ1	● Jeloy, Norway	5-8 A.M., 11 A.M.-5 P. M. daily
9525	31.49	ZBW-3	● Hong Kong, China	Daily ex. Sat. 11:30 P. M.-1:30 A.M.; Mon. & Thurs. 4-10 A.M.; Tues., Wed., Fri., Sun. 3-10 A.M.; Sat., 3-11 A.M., 9 P.M.-1:30 A. M.
9520	31.51	HJ4ABH	● Armenia, Colombia	8-11 A.M., 6-10 P.M. daily
9510	31.55	GSB	● Daventry, England	3-5 A.M., 9 A.M.-12 noon, 12:15-5:45 P.M., 6-8 P.M. daily
9510	31.55	VK3ME	● Melbourne, Australia	Mon., Sat. 4-7 A.M.
9510	31.55	HJU	● Buenaventura, Colombia	12-2 P.M., 8-11 P.M., Mon., Wed., Fri.
9505	31.56	XEFT	● Vera Cruz, Mexico	Not in use. (See 6120 kc.)
9500	31.56	PRF5	● Rio de Janeiro, Brazil	4:45-5:45 P.M. ex. Sun.
9500	31.58	HI5G	● Ciudad Trujillo, 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	Week days 11:30 A.M.-1 P.M., 6-10:30 P.M.; Sundays 9 A.M.-3 P.M.
9490	31.61	KEI	Bolinas, Calif.	(P) Phones Indo-China and China A.M.
9480	31.65	PLW	Bandoeng, Java	(P) Phones Australia early A.M.
9480	31.65	KET	Bolinas, Calif.	(P) Phones WEL evenings & nights
9470	31.68	WET	Rocky Point, N. Y.	(E) Tests LSX-PPM-ZFD evenings
9460	31.71	ICK	Tripoli, Africa	(P) Phones Italy A.M.
9450	31.75	TGWA	● Guatemala City, Guate.	Daily ex. Sun. 12-2 P.M., 8-9 P.M., 10 P.M.-12 A.M.; Sun., 12 noon-2 P.M.; 12 A.M.-6 A.M.
9430	31.80	YVR	Maracay, Venezuela	(P) Tests mornings
9428	31.81	COCH	● Havana, Cuba	Week days 7 A.M.-12 night. Sun., 8-9 A.M., 11:30 A.M.-1:30 P.M., 6-9 P.M.
9415	31.86	PLV	Bandoeng, Java	(P) Phones PCV-PCK-PDK-VLZ-KWX-KWV early A.M.
9400	31.92	XDR	Mexico City, Mexico	(P) Phones XAM irreg., days

KC	Meters	Call	Location	Time
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.
9330	32.15	CGA4	Drummondville, Que.	(P) Phones GCB-GDB-GBB afternoons
9280	32.33	GCB	Rugby, England	(P) Phones Canada afternoons
9240	32.47	PDP	Kootwijk, Holland	(P) Phones East Indies nights
9235	32.49	PDP	Kootwijk, Holland	(P) Phones East Indies nights
9180	32.68	ZSR	Klipheuvel, S. Africa	(P) Phones Rugby afternoons seasonally
9170	32.72	WNA	Lawrenceville, N. J.	(P) Phones GBS-GCU-GCS afternoons
9147	32.79	YVR	Maracay, Venezuela	(P) Phones EHY afternoons
9125	32.88	HAT4	• Budapest, Hungary	6:00-7:00 P.M. Sundays
9110	32.93	KUW	Manila, P. I.	(P) Tests and phones early A.M.
9091	33.00	CGA-5	Drummondville, Que.	(P) Phones Europe days
9020	33.26	GCS	Rugby, England	(P) Phones Lawrenceville afternoons
9010	33.30	KEJ	Bolinas, Calif.	(P) Relays programs to Hawaii eve.
8975	33.42	CJA5	Drummondville, Que.	(P) Phones Australia nights, early A.M
8975	33.43	VWY	Poona, India	(P) Phones GBC-GBU mornings
8960	33.48	FVA	"Radio Algiers" Alger, Algeria, Africa	(P) Phones Paris 12-1 A.M. daily
8950	33.52	WEL	Rocky Point, N. Y.	(E) Tests with Europe irreg.
8950	33.52	W2XBJ	Rocky Point, N. Y.	(E) Tests irregularly
8948	33.53	HCJB	• Quito, Ecuador	7:30-9:30 A.M., 11:30 A.M.-1:30 P.M., 5:30-10 P.M.; Sundays 7:30-9:30 A.M., 12-2 P.M., 5:30-10 P.M. daily except Monday (see 4107 KC.)
8930	33.59	WEC	Rocky Point, N. Y.	(P) Phones Ethiopia irregular
8900	33.71	ZLS	Wellington, N. Z.	(P) Phones VLZ early mornings
8830	33.98	LSD	Buenos Aires, Arg.	(P) Relays to New York early evenings
8795	34.13	HKV	• Bogota, Colombia	(E) Tests early evenings and nights; broadcasts news Mon. and Thurs. 7-7:30 P.M.
8790	34.13	TIR	Cartago, Costa Rica	(P) Phones Cent. America daytime
8775	34.19	PNI	Makasser, D. E. I.	(P) Phones PLV early mornings
8760	34.35	GCQ	Rugby, England	(P) Phones ZSR afternoons
8740	34.35	WXV	Fairbanks, Alaska	(P) Phones WXH nights
8730	34.36	GCI	Rugby, England	(P) Phones VWY afternoons
8710	34.44	KBB	Manila, P. I.	(E) 6-8 A.M. special broadcast
8680	34.56	GBC	Rugby, England	(P) Phones ships and New York daily
8665	34.62	CO9JQ	• Camaguey, Cuba	7:45-9:00 P.M. weekdays. Sundays irreg.
8650	34.68	WVD	Seattle, Wash.	(P) Tests irregularly
8630	34.76	CMA	Havana, Cuba	(P) Phones New York irreg.
8590	34.92	YNVA	• Managua, Nicaragua	1-2:30 P.M., 7:30-10 P.M. daily
8560	35.05	WOO	Ocean Gate, N. J.	(P) Phones ships days
8515	35.23	IAC	Pisa, Italy	(P) Phones and tests irreg.
8500	35.29	JZF	Nazaki, Japan	(P) Phones ships irreg.
8470	35.39	DAN	Nordenland, Germany	(P) Phones ships irreg.
8404	35.70	HC2CW	• Guayaquil, Ecuador	Week days 11:30 A.M.-1 P.M., 7:30-11 P.M.; Sundays 4-4:30 P.M., 9-10:30 P.M.
8190	36.63	XEME	• Mexico, D. F.	10:30 A.M.-3 P.M., 6:30-11 P.M. daily
8185	36.65	PSK	Rio de Janeiro, Brazil	(P) Phones LSL-WOK evenings. Broadcasts irreg.
8155	36.79	PGB	Kootwijk, Holland	(P) Phones Java irreg.
8140	36.86	LSC	Buenos Aires, Arg.	(P) Tests evenings and nights irreg.
8120	36.95	KTP	Manila, P. I.	(P) Phones KWX-KWV-PLV-JVQ A.M.
8110	37.00	ZP10	• Asuncion, Paraguay	8:00-10:00 P.M.
8075	37.15	WEZ	Rocky Point, N. Y.	(E) Program service P.M.; irregular
8035	37.33	CNR	Rabat, Morocco	(P) Phones France nights
8035	37.33	CNR	• Rabat, Morocco	Special broadcasts irreg.
7970	37.64	XGL	Shanghai, China	(P) Tests early mornings
7960	37.69	VLZ	Sydney, Australia	(P) Phones ZLT early A.M.
7955	37.71	HSJ	Bangkok, Siam	(P) Phones Berlin, Manila, Java irregular
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., 6-11 P.M. daily
7840	38.27	PGA	Kootwijk, Holland	(P) Phones Java irreg.
7835	38.29	PGA	Kootwijk, Holland	(P) Phones Java irreg.
7830	38.31	PGA	Kootwijk, Holland	(P) Phones Java irreg.
7797	38.47	HBP	• Geneva, Switzerland	5:30-6:15 P.M. Saturdays. First Mon. each month, 6-7 P.M.
7790	38.49	YNA	Managua, Nicaragua	(P) Phones Cent. & So. America daytime
7770	38.61	PDM	Kootwijk, Holland	(P) Special relays to E. Indies
7765	38.63	PDM	Kootwijk, Holland	(P) Special relays to Dutch Indies
7760	38.66	PDM	Kootwijk, Holland	(P) Special relays to E. Indies
7740	38.76	CEC	Santiago, Chile	(P) Phones evenings to 8:30 P.M.
7735	38.78	PDL	Kootwijk, Holland	(P) Special relays to E. Indies
7730	38.81	PDL	Kootwijk, Holland	(P) Special relays to E. Indies
7715	38.39	KEE	Bolinas, Calif.	(P) Relays programs to Hawaii seasonally
7669	39.11	TGF	Guatemala City, Guate.	(P) Phones TIU-HPF daytime
7626	39.31	RIM	Tashkent, USSR.	(P) Phones RKI early mornings
7620	39.37	IUB	• Addis Ababa, Ethiopia	Irregular
7610	39.42	KWX	Dixon, Calif.	(P) Phones KKH nights; KAZ-KTP-PLV-JVT-JVM A.M.
7565	39.66	KWY	Dixon, Calif.	(P) Phones Shanghai early mornings
7550	39.74	TI8WS	• Puntarenas, Costa Rica	Sun., 4-5 P.M. Week days, 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 Mon., Thurs., 2-3, 4-5 P.M.
7500	40.00	CFA-6	Drummondville, Que.	(P) Phones N. America days
7470	40.16	JVQ	Nazaki, Japan	(P) Relays and phones early A.M.; broadcasts Mon., Thurs., 2-3, 4-5 P.M.
7470	40.16	HJP	Bogota, Colombia	(P) Phones HJA3-YVQ early evenings
7445	40.30	HBQ	Geneva, Switzerland	(E) Relays special B.C. evenings irreg.
7430	40.38	ZLR	Wellington, N. Z.	(P) Phones VLJ early mornings
7400	40.45	WEM	Rocky Point, N. Y.	(E) Special relays evenings
7390	40.60	ZLT-2	Wellington, N. Z.	(P) Phones Sydney 3-7 A.M.
7385	40.62	OEK	Wein, Austria	(P) Tests early evenings very irreg.
7380	40.65	XECR	• Mexico City, Mexico	Sundays 7-8 P.M.; occasionally later
7370	40.71	KEQ	Kahuku, Hawaii	(P) Relays programs evenings
7345	40.84	GDL	Rugby, England	(P) Phones Japan irreg. A.M.
7100	42.25	HKE	• Bogota, Colombia	Monday 6-7 P.M.; Tues. and Friday 8-9 P.M.
7100	42.25	FO8AA	• Papeete, Tahiti	Tues. & Fri. 11 P.M.-1 A.M.
7080	42.37	PI1J	• Dordrecht, Holland	Sat., 10:10-11:10 A.M
7030	42.67	EA9AH	• Tetuan, Spanish Morocco, Africa	4-4:25 P.M. daily; 12-2:30 A.M. irregular
7010	42.80	EA8AB	• Santa Cruz de Tenerife, Canary Islands	Mon., Wed., Fri., Sat., 3:15-4:15 P.M.
7000	42.86	PZH	• Paramaribo, D. Guiana	S. A. Sun., 9:45-11:45 A.M.; Mon. and Fri., 5:45-9:45 P.M.; Tues. and Thurs., 2:45-4:45 P.M., 8:45-10:45 P.M.; Wed., 3:45-4:45, 5:45-9:45 P.M.; Sat., 2:45-4:45 P.M.
6990	42.92	JVS	Nazaki, Japan	(P) Phones China mornings early
6977	43.00	XBA	Tacubaya, D. F., Mex.	(E) 6-8 P.M. daily
6950	43.17	WKP	Rocky Point, N. Y.	(E) Relays programs evenings
6950	43.17	GBY	Rugby, England	(P) Phones U.S.A. irreg.
6922	43.34	IUF	Addis Ababa, Ethiopia	(E) Irregular
6905	43.45	GDS	Rugby, England	(P) Phones WOA-WNA-WCN evenings
6900	43.48	HI2D	• Ciudad Trujillo, R. D.	Daily 6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
6895	43.51	HCETC	• Quito, Ecuador	8:15-10:30 P.M. ex. Sun.
6890	43.54	KEB	Bolinas, Calif.	(P) Tests KAZ-PLV early A.M.
6880	43.60	CGA-7	Drummondville, Que.	(P) Phones Europe days

KC	Meters	Call	Location	Time
6860	43.73	KEL	Bolinas, Calif.	(P) Tests KAZ - PLV early A.M.
6845	43.83	KEN	Bolinas, Calif.	(P) Used irregularly
6830	43.92	CFA	Drummondville, Que.	(P) Phones N. America nights
6820	43.99	XGOX	● Nanking, China	Week days 5:30-8:30 A.M., Sun. 7-9 A.M.
6814	44.03	HIH	● San Pedro de Macoris, R. D.	Sunday, 3-4 A.M., 12:30-3 P.M., 4-5 P.M.; week days 12:15-2 P.M., 7-8:30 P.M.
6800	44.12	HI7P	● Ciudad Trujillo, R. D.	Daily 6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
6795	44.15	GAB	Rugby, England	(P) Phones Canada irreg.
6767	44.33	PMH	Bandoeng, Java	(E) Phone and B.C. early 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 irregular; Phones Point Reyes at times
6750	44.44	JVT	● Nazaki, Japan	1:45-2:15 A.M., 4-7:45 A.M., 5-5:20 P.M., 7-7:15 P.M., 9:45 P.M.-11:45 P.M.
6730	44.58	HI3C	● La Romana, R. D.	Week days 12:10-2:10 P.M., 6:10-7:40 P.M. Sun., 12:10-2:40 P.M.
6725	44.60	WOO	Rocky Point, N. Y.	(E) Tests evenings irreg.
6720	44.64	YVQ	Maracay, Venezuela	(P) Phones and relays N. Y. evenings
6720	44.64	YVQ	● Maracay, Venezuela	8-9 P.M. Saturdays
6718	44.66	KBK	Manila, P. I.	(P) Phones A.M. seasonally
6710	44.71	TIEP	● San Jose, Costa Rica	7:00-10:30 P.M. daily
6690	44.84	CGA-6	Drummondville, Que.	(P) Phones Europe irregularly
6680	44.91	DGK	Nauen, Germany	(P) Relays to Riverhead evenings irreg.
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.
6580	45.59	YN1GG	● Managua, Nicaragua	6-10 P.M. daily
6550	45.81	TIRCC	● San Jose, Costa Rica	Daily 12-2 P.M. 6-7 P.M. Thurs. Extra 7-10 or 11 P.M. Sunday 11 A.M.-1 P.M., 8-10 P.M.
6548	45.82	XBC	Vera Cruz, Mexico	(E) 7-8 P.M. irreg.
6545	45.84	YV11RB	● Ciudad Bolivar, Venez.	7-10 P.M. daily; 3-6 P.M. Sun.
6520	46.01	YV6RV	● Valencia, Venezuela	10:30 A.M.-1:30 P.M., 4:30-9:30 P.M. daily
6500	46.15	HIL	● Ciudad Trujillo, R. D.	12-2 P.M., 6-8 P.M.
6482	46.28	HI4D	● Ciudad Trujillo, R. D.	Mon. & Sat., 11:55 A.M.-1:40 P.M., 4:40-7:40 P.M.
6480	46.30	HI8A	● Ciudad Trujillo, R. D.	Daily ex. Sunday 8:40-10:40 A.M., 2:40-4:40 P.M. Sat., 9:10-10:40 P.M.
6450	46.51	HI4V	● San Francisco de Macoris, R. D.	11:40 A.M.-1:40 P.M., 5:10-6:40 P.M. daily
6420	46.72	HI1S	● Santiago de los Caballeros, R. D.	11:40 A.M.-1:40 P.M., 5:40-7:40 P.M.
6415	46.77	HJA3	Barranquilla, Colombia	(P) Phones HJA2 evenings
6410	46.80	TIPG	● San Jose, Costa Rica	7:30-9:30 A.M., 12-2 P.M., 6-11:30 P.M. daily
6400	46.88	YV9RC	● Caracas, Venezuela	7-11 P.M. irreg.
6375	47.10	YV4RC	● 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
6345	47.28	YV1RG	● Valera, Venezuela	6-11 P.M. daily
6340	47.32	HIX	● Ciudad Trujillo, R. D.	Sun. 7:40-10:40 A.M. Daily 12:10-1:10 P.M. Tues. & Fri. 8:10-10:10 P.M.
6330	47.39	JZG	● Nazaki, Japan	5-7 A.M. irregular
6325	47.43	HH3NW	● Port-au-Prince, Haiti	1-2 P.M., 7-8:30 P.M. ex. Sunday
6316	47.50	HIZ	● Ciudad Trujillo, R. D.	Daily 11:30 A.M.-2:45 P.M., 5:30 P.M.-9 P.M. Sat. to 10 & 11 P.M.
6300	47.62	YV12RM	● Maracay, Venezuela	6:30-9:30 P.M. ex. Sun.
6280	47.69	COHB	● Sancti-Spiritus, Cuba	9-10 A.M., 12-1 P.M., 4-6 P.M., 9-11 P.M. daily
6280	47.77	HIG	● Ciudad Trujillo, R. D.	7:10-8:40 A.M., 12:40-2:10 P.M., 8:10-9:40 P.M.
6243	48.05	HIN	● Ciudad Trujillo, R. D.	(See 11280 KC.) 11:40 A.M.-1:40 P.M., 7:10-9:10 P.M. daily
6240	48.08	HI8Q	● Ciudad Trujillo, R. D.	Daily 10:40 A.M.-1:40 P.M., 4:40-8:40 P.M.
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	HJ4ABJ	● Ibague, Colombia	8-11 P.M.
6230	48.15	OAX4G	● Lima, Peru	7-11 P.M. daily
6200	48.39	COKG	● Santiago, Cuba	Sundays 12:01-1 A.M., 8 A.M.-10:30 P.M. to 12 A.M. daily
6182	48.53	HI1A	● Santiago de Caballeros, R. D.	Daily 11:40 A.M.-1:40 P.M., 7:40-9:40 P.M.
6182	48.53	XEXA	● Mexico City, Mex.	8-11:30 A.M., 3-5 P.M., 7-11 P.M. ex. Sunday
6170	48.62	HJ3ABF	● Bogota, Colombia	11 A.M.-2 P.M. 6-11 P.M.
6156	48.73	YV3RC	● Caracas, Venezuela	Week days 10:30 A.M.-1:30 P.M., 4:30-10 P.M.; Sundays 8:30 A.M.-12:30 P.M., 2:30-10:30 P.M.
6150	48.78	HJ4ABU	● Pereira, Colombia	Daily 9:30 A.M.-12 Noon, 6:30-10 P.M.
6150	48.78	CJRO	● Winnipeg, Manitoba	Week days 6 P.M.-12 A.M., Sundays 5-10 P.M.
6150	48.78	GBT	Rugby, England	(P) Phones U.S.A. days
6150	48.78	HI5N	● Santiago de los Caballeros, R. D.	Daily 6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
6150	48.78	CB615	● Santiago, Chile	4-7 P.M. daily
6140	48.86	W8XK	● Pittsburgh, Pa.	9 P.M.-1 A.M. daily
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	Week days 4:45-6:15 A.M., 12:45-3:15 P.M.; Sundays 5:30-7 A.M., 10 A.M.-12:30 P.M.
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	COCD	● Havana, Cuba	Daily 11 A.M.-1 A.M.
6130	48.94	VE9HX	● Halifax, Nova Scotia	Sun. 3-10:45 P.M., Mon. to Fri. 7:30 A.M.-10:45 P.M., Sat. 11 A.M.-10:45 P.M.
6128	48.96	HJ1ABB	● Barranquilla, Colombia	11:45 A.M.-1 P.M., 5:30-10 P.M. daily
6122	49.00	HJ3ABX	● Bogota, Colombia	Week days 10:30 A.M.-2 P.M., 5:30-11:30 P.M.; Sundays 12-1:30 P.M., 6-11 P.M.
6120	49.02	XEFT	● Vera Cruz, Mexico	Daily 11 A.M.-4 P.M., 7:30 P.M.-12 A.M.
6120	49.02	W2XE	● Wayne, N. J.	10-11 P.M. daily
6115	49.06	OLR	● Prague, Czechoslovakia	4 A.M.-9 P.M. daily
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.
6100	49.18	Belgrade	● Belgrade, Yugoslavia	1 A.M.-5 P.M. daily
6100	49.18	W9XF	● Chicago, Illinois	Daily ex. Sat. 11:05 P.M.-2 A.M.
6100	49.18	W3XAL	● Bound Brook, N. J.	Mon., Wed., Sat., 5 P.M.-1 A.M.
6097	49.20	HJ4ABE	● Medellin, Colombia	11 A.M.-12 noon, 6-10:30 P.M. daily
6095	49.22	JZH	● Nazaki, Japan	Irregular
6090	49.26	CRCX	● Bowmansville, Ont.	Week days 5:30-11:30 P.M.; Sundays 5-11:30 P.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	ZTJ	● Johannesburg, S. Africa	11:45 P.M.-12:30 A.M., 3:30-7:00 A.M., 9 A.M.-4:45 P.M.
6085	49.30	HJ5ABD	● Cali, Colombia	11 A.M.-2 P.M., 6-11 P.M. daily
6080	49.34	W9XAA	● Chicago, Ill.	6:30-8:30 A.M., 5 P.M.-12 A.M. daily
6080	49.34	ZHJ	● Penang, S.S.	6:40-8:40 A.M.
6080	49.34	CP5	● LaPaz, Bolivia	11:30 A.M.-1 P.M., 6-7:45 P.M., 8:30-11 P.M. week days; Sunday 3:30-6:00 P.M.
6080	49.34	VE9CS	● Vancouver, B. C.	Week days 9:30 A.M.-2 A.M.; Sun. 12 noon-1 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
6072	49.41	OER2	● Vienna, Austria	Week days 9 A.M.-5 P.M.; Sat. to 6 P.M.
6070	49.42	YV7RMO	● Maracaibo, Venezuela	Daily 8 P.M.-12 A.M.
6060	49.50	W8XAL	● Cincinnati, Ohio	6:30 A.M.-8 P.M., 11 P.M.-2 A.M. daily
6060	49.50	W3XAU	● Philadelphia, Pa.	8-11 P.M. daily
6060	49.50	VQ7LO	● Nairobi, Kenya Colony, Africa	Mon. to Fri. 5:45-6:1 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	VPB	● Colombo, Ceylon	8-10 A.M. daily
6050	49.59	GSA	● Daventry, England	Evenings, irregular.
6050	49.59	HJ3ABD	● Bogota, Colombia	Daily 9-11 A.M., 12-2 P.M., 6-11 P.M.

KC	Meters	Call	Location	Time
6043	49.65	HJ1ABG	• Barranquilla, Colombia	Daily 11 A.M.-11 P.M. Sun., 11 A.M.-8 P.M.
6040	49.67	HI9B	• Santiago de los Caballeros, R. D.	Daily 6:10-9:40 P.M.; Sat. 11:40 P.M.-12:40 A.M.
6040	49.67	PRA8	• Pernambuco, Brazil	9:30-11:30 A.M., 2:30-8:30 P.M.
6040	49.67	YDA	• Tandjong Priok, Java	Week days 5:30-11 A.M., 5:45-6:45 P.M., 10:30 P.M.-1:30 A.M. Sundays 5:30-10:30 A.M., 7:30 P.M.-2 A.M.
6040	49.67	W4XB	• Miami, Florida	Temporarily off the air. Undergoing repairs.
6040	49.67	W1XAL	• Boston, Mass.	Mon., Tues., Fri., 7:30-9:30 P.M. Sundays 5-7 P.M.
6030	49.75	HP5B	• Panama City, Panama	12 noon-1 P.M., 6-10 P.M.
6030	49.75	HJ4ABP	• Medellin, Colombia	6-10:30 P.M. daily
6030	49.75	PGD	Kootwijk, Holland	(P) Phones Java and E. Indies irreg.
6030	49.75	VE9CA	• Calgary, Alberta, Canada	Week days 9 A.M.-1 A.M.; Thursdays to 2 A.M.; Sundays 12 noon-12:30 A.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., 4:50-10:45 P.M. daily
6020	49.83	XEUW	• Vera Cruz, Mexico	7 A.M.-11 P.M. daily
6018	49.85	ZH1	• Singapore, S.S.	Mon., Wed., Thurs. 5:40-8:10 A.M.; Sat. 10:40 P.M.-1:10 A.M.; 2nd & 4th Sundays, 5:10-6:40 A.M.—organ
6015	49.88	HI3U	• Santiago de los Caballeros, R. D.	Week days 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
6012	49.90	HJ3ABH	• Bogota, Colombia	11:30 A.M.-2 P.M., 6-11 P.M.; Sun. 12-2 P.M., 4-11 P.M.
6010	49.92	VP3MR	• Georgetown, Br. Guiana	Sunday, 7:45-10:15 A.M. Week days, 4:45-8:45 P.M.
6010	49.92	VK9MI	• Sydney, Australia "S.S. Kanimbla"	11 P.M.-7 A.M. Irregular
6010	49.92	COCO	• Havana, Cuba	8 A.M.-10 P.M. daily
6005	49.96	HP5K	• Colon, Panama	7:30-9 A.M., 12-1 P.M., 6-9 P.M.
6005	49.96	CFCX	• Montreal, Que.	Weekdays 7:45 A.M.-1 A.M. Sundays, 9 A.M.-11:15 P.M.
6005	49.96	VE9DN	• Montreal, Que.	Sat., 11:30 P.M.-1 A.M., Fall, Winter & Spring
6000	50.00	IIJ1ABC	• 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.-1:45 A.M.
6000	50.00	FIQA	• Tananarive, Madagascar	3:30-4:45 A.M., 7 A.M.-1 P.M. daily
6000	50.00	RV59	• Moscow, USSR.	4-5 P.M., Mon., Wed., Fri.
5980	50.17	HJ2ABD	• Bucaramanga, Colombia	Daily 11:30 A.M.-12:30 P.M., 6-10 P.M.
5975	50.20	XEWI	• Mexico City, Mexico	Not in use. See 11900 K.C.
59.69	50.26	HVJ	• Vatican City, Vatican	2-2:15 P.M., Sunday 5-5:30 A.M.
59.55	50.35	HJN	• Bogota, Colombia	Daily 11 A.M.-2 P.M., 5-10:30 P.M.
5940	50.51	TG2X	• Guatemala City, Guat.	Daily 4-6 P.M.; Mon., Thurs., Sat., 10 P.M.-1 A.M.; Sundays, 1-2 P.M.
5910	50.76	YV15RV	• Valencia, Venezuela	8-11:30 P.M. daily
5910	50.76	HH2S	• Port-au-Prince, Haiti	7-10 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.)
5880	51.02	YV8RB	• 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.	Daily 6:25-7:40 A.M., 11:40 A.M.-1:40 P.M., 4:40-9:40 P.M.
5853	51.20	WOB	Lawrenceville, N. J.	(P) Phones ZFA P.M.
5850	51.28	YV5RMO	• Maracaibo, Venezuela	Week days 8:45-9:45 A.M., 11:15 A.M.-12:45 P.M., 4:45-9:45 P.M. Sundays 10:45 A.M.-12:45 P.M.
5830	51.28	GBT	Rugby, England	(P) Phones U.S.A. irreg.
5843	31.33	KRO	Kahuku, Hawaii	(P) Tests early mornings
5830	51.46	TIGPH	• San Jose, Costa Rica	8-11 P.M. daily ex. Sun.
5825	51.50	HJA2	Bogota, Colombia	(P) Phones HJA3 afternoons irreg.
5800	51.72	KZGF	Manila, P. I.	(P) Tests A.M. irreg.
5800	51.72	YV2RC	Caracas, Venezuela	Sun. 8:30-11:30 A.M., 1:30-9:30 P.M.; week days 10:45 A.M.-1:30 P.M., 4-9:45 P.M.
5790	51.81	JVU	Nazaki, Japan	(P) Phones JZC early mornings
5780	51.90	CMB-2	Havana, Cuba	(P) Phones and tests irregularly
5780	51.90	OAX4D	• Lima, Peru	9-11:30 P.M. Wed., Sat.
5780	51.90	HJ4ABD	• Medellin, Colombia	Weekdays 10 A.M.-2 P.M., 4-11 P.M. Sunday 11 A.M.-3 P.M., 7-11 P.M. (see 6138 & 5900 KC.)
5758	52.10	YNOP	• Managua, Nicaragua	8:30-10:30 P.M. daily
5750	52.17	XAM	Merida, Mexico	(P) Phones XDR-XDF early evenings
5730	52.36	JVV	Nazaki, Japan	(P) Phones JZC early A.M.
5725	52.40	HC1PM	• Quito, Ecuador	Tuesdays 9-11 P.M.
5713	52.51	TGS	• Guatemala City, Guat.	Sun., Wed., Fri., 6-8 P.M.
5710	52.54	YV10RSC	• San Cristobal, Venez.	5:30-9:30 P.M. daily
5705	52.59	CFU	Rossland, Canada	(P) Phones CFO and CFN eves.; news, 8:30-8:45 P.M.
5670	52.91	DAN	Nordenland, Germany	(P) Phones ships irreg.
5500	54.55	TI5HH	• San Ramon, Costa Rica	3:30-5 P.M., 8-9:30 P.M. daily
5445	55.10	CJA7	Drummondville, Que.	(P) Phones Australia early A.M.
5435	55.20	LSH	Buenos Aires, Arg.	(P) Relays LR4 and tests evenings
5395	55.61	CFA7	Drummondville, Que.	(P) Phones No. America irregular
5260	57.03	WQN	Rocky Point, N. Y.	(E) Program service; irregular
5140	58.37	PMY	• Bandoeng, Java	Daily 4:45-10:45 A.M., 5:45 P.M.-2:15 A.M.
5110	58.71	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
4795	62.56	VE9BK	• Vancouver, Canada	Weekdays 11:30-11:45 A.M., 2:30-3 P.M., 7:30-8 P.M. Sat. (same ex last), 7-7:30 P.M.
4752	63.13	WOY	Lawrenceville, N. J.	(P) Tests irregularly
4752	63.13	WOO	Ocean Gate, N. J.	(P) Phones ships irreg.
4752	63.13	WOG	Lawrenceville, N. J.	(P) Phones Rugby irreg.
4600	65.22	HC2ET	• Guayaquil, Ecuador	9:15-10:45 P.M., Wed. & Sat.
4555	65.95	WDN	Rocky Point, N. Y.	(P) Tests Rome and Berlin evenings
4550	65.93	KEH	Bolinas, Calif.	(P) Phone; irreg.
4510	66.52	ZFS	Nassau, Bahamas	(P) Phones WND daily; tests GYD - ZSV irregular
4465	67.19	CFA2	Drummondville, Que.	(P) Phones No. America; irregular days
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 after noons and eve.
4272	70.22	WOY	Lawrenceville, N. J.	(P) Tests evenings
4107	73.05	HCJB	• Quito, Ecuador	7:30-9:30 A.M., 11:30 A.M.-1:30 P.M., 5:30-10 P.M. daily ex. Mon. Sunday 7:30-9:30 A.M., 12-2 P.M., 5:30-10 P.M. (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	Week days 5:30-11 A.M. 5:45-6:45 P.M., 10:30 P.M.-1:30 A.M.; Sun., 5:30-10:30 A.M., 7:30 P.M.-2 A.M.

Backwash

Station Reports

Editor, ALL-WAVE RADIO:

I read with much interest your article in the September issue of ALL-WAVE RADIO under the heading "Editorial Quotes" pertaining to the use of the cathode-ray oscilloscope in connection with the receiver to study signal characteristics.

I started out some time ago to try and make a report to a station so helpful, informative and of such a technical nature that it would be invaluable to the engineers. I feel that I have had some success in this respect as I have received many telegrams asking for a check on a particular program or test period.

One station writes: "These reports in chart form have given us a very definite idea of conditions of reception in your area. We feel that these checks have at least traced the trouble here."

Another says: "The signal checks in graph form have aided us in determining just how effective each band is and at what time of day a schedule must be sent to reach a specified area."

An engineer writes: "The parasitics came at the same time the crystal box went haywire, and the crystal rectifier acts as a resonant filter tuned to either 60 or 120 cycles."

WIXAL says: "The curves which you send to us are particularly valuable, and indeed we feel that it was due to your efforts that we were able to so quickly correct the difficulty with the transmitter which apparently was causing poor results in many other parts of the world."

This is an example of the service the listener can provide the broadcaster if the reports are technically accurate and reliable. If your suggestions and information are followed, listeners who are technically minded will find that they are rendering a real service to the stations. This will greatly improve transmission conditions by giving the engineers reliable and accurate checks as to conditions in specified areas. Letters received verify this.

The writer uses a National HRO receiver, an oscilloscope, db meter, and a signal generator to keep the receiver calibrated at all times. Records are kept of signal strength over the different seasons of the year of several stations. A report form has been worked out which contains about all the information desired at the transmitter to determine the effectiveness of signals. These are sent in daily to some and weekly to others.

If I can be of any service to the success of your new idea, I will be glad to give any information I have learned along these lines. I will be looking forward to the next article regarding this, and I am sure that much valuable information will be included.

Thanks very much for the fine issue of AWR. Keep up the good work. Mr. Hinds' s-w station list is still the most complete and reliable list being published.

GEORGE L. BIRD,
PAWHUSKA, OKLA.

(Glad to have had this information. Your work may prove to other readers the value of precise station reports.—Ed.)

Another "League" Booster

Editor, ALL-WAVE RADIO:

May I congratulate you on your fine magazine. I have never had the opportunity to read a finer magazine of this type. Among other things I think the column written by Mr. Hinds is top-notch and far above any written by anyone else on any other magazine. For some reason or other your articles carry that intimate touch which is so often lacking in the majority of magazines.

In regard to your listeners' research league, I think it is one of the finest ideas brought forward for some time, and one which will give listeners such as I am something to do besides just copying the program of a new transmitter. I am also certain that transmitters all over the world would appreciate a concerted effort by the listeners to help them (the stations) clear up any troubles they may have, such as QRM, QRN, fading, hum, etc. Personally, I know I would enjoy doing such work provided you at AWR would give definite and complete instructions to all interested in the type of information wanted and how to get it, and then how to report it in such a manner as to be of some benefit to those interested in receiving the information. As you say, the standardized form for this reporting will be the only method which will work.

With this in mind, may I request that I be placed among the first in your new organization when and how it comes into being.

Before closing may I say that there is only one item in your magazine which I do not enjoy and that is Zeh Bouck's pipe! I first smelled that about three years ago and now he brings it to your magazine. I bet he won't change that tie either until he gets soup on it! But I do enjoy his articles. More power to him.

A. G. BAUERNFEIND,
GREEN BAY, WISC.

Thanks. Bouck got some free tobacco because of that pipe—Ed.

Wants Code Station List

Editor, ALL-WAVE RADIO:

I think ALL-WAVE RADIO is a splendid magazine and I hope you continue the good work. Your articles on "Barb" and "Ernest" are very interesting and have cleared up many technical points which have bothered me.

I would like to suggest that you publish a list of commercial C.W. short-wave stations showing their frequencies and hours of operation. A list of these stations will prove helpful to many short-wave listeners using home-made receivers so they can calibrate their dials. I ran into trouble when I tried to find NAA and NPG, the stations that will broadcast the Navy Day messages, October 27th. I listened for many, many minutes last night (October 25th) before I finally found NAA somewhere around 8000 kc and about 10:30 P. M. I heard many commercial C.W. short-wave stations and would have had practically no trouble if I had had a list of these stations and their frequencies.

Ask the readers if they think this would be a good idea.

ED. W. BARRETT,
TOPEKA, KANS.

(A good idea for those who can copy code, but worth little to others. However, we'd be glad to print such a list if there are a sufficient number interested. What say? —Ed.)

A Ham to Be

Editor, ALL-WAVE RADIO:

I think your "mag" is just about the best for the average person interested in Radio.

I am only a S.W.L. but about a year ago I became real curious about amateur radio, and made up my mind to find out what it was all about. I was, or still am, in the same position as Barb and Ernest and about their age. I was real sore at those C.W. sigs which I thought were causing interference. Have since found out that code interference is negligible. In fact, I think the greatest offenders are B.C. stations. Most of the harmonics I hear are from them.

Anyway I bought a code machine and went to work seriously. Manage to get in an hour or two every day. At present, I am able to copy Spanish and German press solid. I have timed them; they run about 20 w.p.m. I am up every day at 3 A. M. to catch WHD (N.Y. *Times*). He is a little too fast for me, but I'll catch him soon. As for keying, I think I can do better than a lot of the boys who have "Tickets." At least I'm alright until my fist gets tired. It seems to me as though some of the amateurs could stand a lot of practice or something.

I surely would like to put a decent rig on the air, but want to do it right, so that I will not be a source of interference to anyone. Well, here's wishing you the very best of luck.

WILLIAM A. GORDON,
NEW YORK, N. Y.

Fine. Hope you crack WHD pronto—Ed.

Wants More U.H.F.

Editor, ALL-WAVE RADIO:

I hope you won't mind a few words of honest opinion regarding ALL-WAVE RADIO. It's a swell magazine for the general radio public, indeed, but I'm of the opinion that we could do without "SW station lists" quite nicely. There are enough publications handling such matters to bother with it ourselves—the space could be used to such good advantage. A bit more u.h.f. transmitting and receiving design articles, and a dash of television. Your antenna dope is really good, and let's have more of it—antennas are the top, after all, to the transmitting lads.

F. A. WALKER, VE4BN
CANDO, SASK.

On the Market

National Type CRM Oscilloscope

THE NEW NATIONAL Type CRM Oscilloscope, shown in the accompanying illustration, is designed especially for use in conjunction with amateur transmitters. It uses the same circuit as the well-known Type CRO Oscilloscope but employs the new midget type 913 cathode-ray tube.

The unit is completely self-contained and includes a 60-volt internal sweep by means of which a waveform pattern may be obtained on the screen of the cathode-ray tube. Controls are provided on the front panel for turning on and off the unit, adjusting spot size and intensity, using internal or external sweep, and horizontal deflection control.

The Type CRM unit is 6 1/8" high 4 1/8" wide and 8" deep. The cathode-ray tube is mounted at an angle so that the viewing screen is in line with the eyes of the operator. ALL-WAVE RADIO.

✦

New Astatic Crystal Pickup

AFTER MONTHS OF research in which literally hundreds of models were made and tested, the Astatic Microphone Laboratory, Inc., of Youngstown, Ohio, has released a new crystal pickup featuring better reproduction and longer record life.

This new crystal pickup is known as the Tru-Tan Model B and is constructed with a unique, scientifically designed off-set head which holds the needle, throughout the entire playing surface of a 12" record, practically true to tangent of the circle at all points—maximum error never exceeding 1.5° from true tangency.

Every engineer, the manufacturer states, will immediately appreciate the value of this off-set design that holds tracking error within 1.5°. It is common knowledge that the average 8" straight arm pickup will track off tangency as high as 15° and the average 12" arm as high as 10°. It would take a straight pickup arm approximately 6 feet long to accomplish the same perfection in tracking as the new Tru-Tan Model B.

Tru-Tan Model B also shows that it is free from mechanical resonance throughout the audible frequency range.

In addition to its performance features of better reproduction and minimum wear on records it also has a full double row ball bearing base swivel, with hardened steel pivot trunnion.

Another outstanding feature is the provision for needle loading—which consists of a reversible head, permitting the needle to be dropped in from the top.

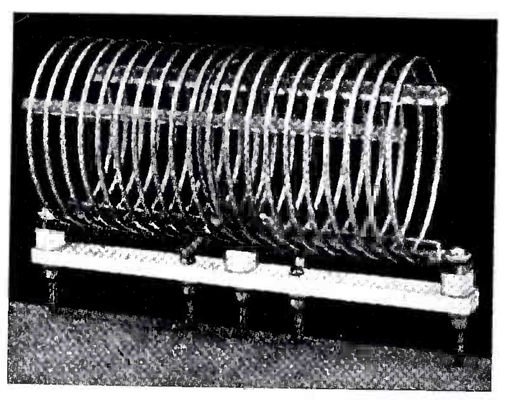
Units are beautifully finished in plain telephone black with chromium trimmings. Special finishes on request.—ALL-WAVE RADIO.

✦

New Coto Link-Coupled Inductors

THE COTO COIL CO., 229 Chapman St., Providence, R. I., are now supplying their low-loss transmitting-type link coils. As may be seen from the illustration, the link coil is inserted inside of the main inductor where the field is strongest. Link leads are brought out through 7000-volt insulation to two banana-type plugs.

For support and insulation, a Steatite bar is employed with equally-spaced banana-type plugs for plug-in band-changing arrangement.



Types available are for tank, buffer and center-tap buffer applications. ALL-WAVE RADIO.

✦

Sensitive Circuit-Breaker

COSTLY TUBES, transformers and condensers need no longer be junked through accidental overloads or short-circuits. The ingenious fully-magnetic, non-thermal Re-Cirk-It breaker available in capacities ranging from 50 milliamperes up to 35 amperes, fully safeguards the radio amateur's major investment at insignificant cost. It is a product of the Heinemann Electric Co., Trenton, N. J.

The Re-Cirk-It breaker has a tumbler handle switching current on and off under normal circuit conditions. There are two types: instantaneous trip and time-delay action. The latter is provided with a hermetically-sealed magnetic trip which ruptures the circuit in from 5 seconds up to 8 minutes on a 125% load, or correspondingly faster on greater overloads, depending on which of four time-overload curves is selected. On short-circuits, it trips within ½ cycle on a.c., or 1/100 second on d.c. The instantaneous trip type may be adjusted for plus or minus 20% of rating.

Precise operation characterizes the Re-Cirk-It, thereby providing real protection for delicate tube filaments and associated equipment. Being fully magnetic and thereby free from usual bi-metallic strips or solder ratchets, the operation is accurate and lightning fast. It is unaffected by ambient temperature and reasonable vibration. Also, the circuit-breaker can be immediately closed after tripping on any overload or short-circuit, providing the abnormal condition no longer exists. The switch handle is simply thrown back to the "on" position.

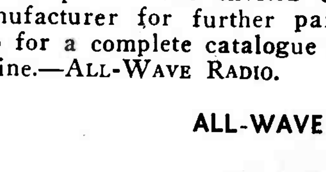
For typical radio work, the bakelite enclosed, exposed-mounting type is offered, measuring 4-1/2 x 2-5/8 x 3-3/4 inches. It mounts on switchboard, panel, control desk or other equipment. A behind-the-panel mounting unit is likewise available. Also two and three pole units in steel safety cabinets.—ALL-WAVE RADIO.

✦

ARHCO Panel Indicator Light Assembly

BELOW IS illustrated a compact and convenient new Panel Indicator Light Assembly engineered and manufactured by American Radio Hardware Co., Inc., 476 Broadway, New York City.

This unit is said to require a minimum of panel space and to facilitate changing of bulbs without dismantling, which is a distinct time-saver in the laboratory, production line or service shop. Furnished with a colored jewel, in various colors, available in miniature base only.



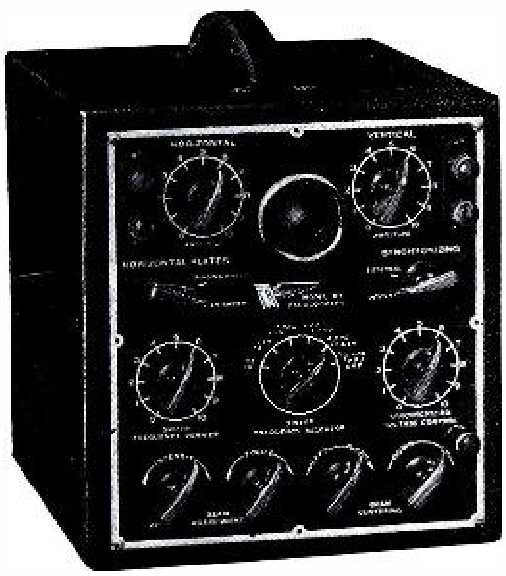
Interested parties are invited to write this manufacturer for further particulars and also for a complete catalogue of their varied line.—ALL-WAVE RADIO.

Midget Cathode-Ray Oscillograph

IN THIS DAY of midget radios, automobiles, and cameras, it is not surprising to see the cathode-ray oscillograph join the trend to compactness and low cost. The new type 913 cathode-ray tube has thus made possible an entirely new form of cathode-ray oscillograph, the Model 105, which has just been announced by the Clough-Brengle Company of 2815 West 19th Street, Chicago, Illinois.

Except for physical size and screen area, this instrument is identical to their larger oscillograph, Model CRA. Every performance feature has been retained, such as the following: built-in linear sweep, separate high sensitivity amplifier for both horizontal and vertical inputs, and beam centering controls on the front panel.

The entire unit is contained in a compact carrying case, 8-7/8" high, 8-1/4" wide, and 9-3/8" deep. The finish is baked black crystalac with an etched silver and green front panel. A unique feature is the adjustable hood which surrounds the cathode-ray tube and may be extended several inches out from the front panel to keep all direct light off the tube screen.



Notwithstanding these advantages, the Model 105 is offered for about one-half former oscillograph prices. It is supplied complete with tubes for direct operation from 110 volts, 60 cycle power supply. Special models for other voltages and currents are available.

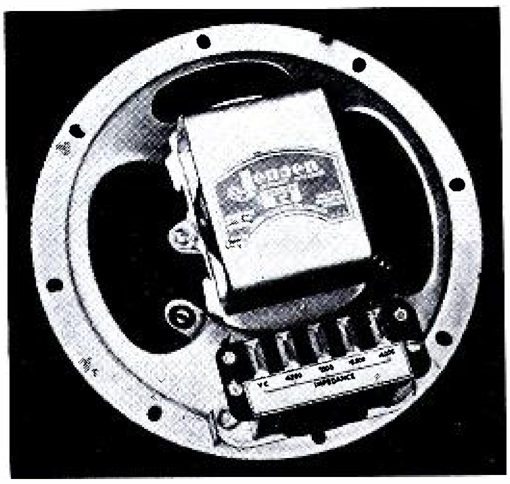
The instrument is complete for all radio servicing, transmitting, and general laboratory applications. For visual alignment, the Model OM-A Frequency Modulated Signal Generator or Model 81-A Separate Frequency Modulator may be connected directly to the oscillograph by means of a plug-in cable.

Complete new descriptive bulletin and price may be secured by writing the manufacturer, Clough-Brengle Company, 2815 West 19th Street, Chicago, Illinois.—ALL-WAVE RADIO.

✦

Jensen "Adjustable-Impedance" Speakers

THE JENSEN RADIO Manufacturing Company has just announced a full line of speakers with adjustable impedance transformers. These transformers have clearly marked terminal boards and impedance adjustment is easily made with flexible lead and pin jack. No soldering required.



There are two types, one to match conventional "plate" impedance values, the other to match conventional "line" impedance values. Thus no serious efficiency reducing compromise is made and Jensen speakers with these transformers are readily adaptable for greatest efficiency in all types of public address work, radio set speaker replacement or in fact any other application of loudspeakers.

Besides a full line of speakers with adjustable-impedance transformers already mentioned, Jensen is also manufacturing and selling adjustment-impedance transformers only, and speakers may be purchased less input transformers. ALL-WAVE RADIO.

✦

Precision Plug-In Resistors

PRECISION RESISTORS in handy plug-in form and of selected ohmages permitting of various combinations for any total resistance value, are now offered by Clarostat Mfg. Co., Inc., 285 North Sixth Street, Brooklyn, N. Y. These plug-in resistors were originally developed for use in resistance bridges and other test equipment employed in the

Clarostat laboratory and plant. Housed in a standard 4-prong tube base, these units are available in values of 1 to 10,000 ohms, with any accuracy up to 1/10th of 1 per cent. Due to the ingenious design, they are quite inexpensive. ALL-WAVE RADIO.

Solar Expanding Replacement Line

A NEW AND expanded exact replacement line of dry electrolytic condensers is announced by Solar Mfg. Corp., 599 Broadway, New York City. This line is designed to be especially helpful to servicemen, including many of the types being used in the current receiver models, such as the Universal cardboard tube units illustrated, with various mounting arrangements.

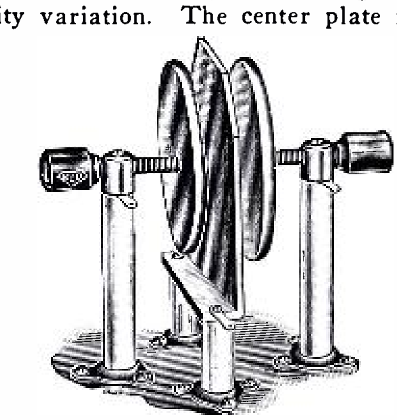
These condensers are stated to be on a quality par with the rest of this line.

Literature will be furnished by Solar Mfg. Corp. upon request. ALL-WAVE RADIO.

✦

New Bud U.H.F. Tuning Condenser

BUD RADIO, INC., Cleveland, Ohio, have just announced their new No. 891 Ultra-High-Frequency Tuning Condenser, shown in the accompanying illustration. This condenser is constructed of aluminum plates with highly polished surfaces. The two round plates are 2 3/16" in diameter and 3/16" thick with rounded edges to minimize corona effects. Both plates are mounted on Isolantite pillars, and very long threaded shafts attached to these plates make possible an exceptionally wide range of capacity variation. The center plate is also



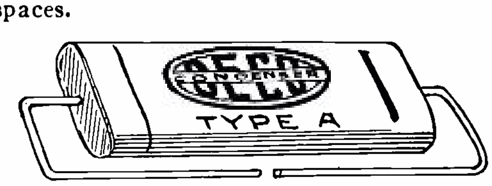
mounted on Isolantite pillars, but is fixed in position.

This condenser is particularly useful either as a split or conventional tank circuit tuning capacitor above 56 megacycles. It may also be easily adapted for use in a parallel plate oscillator. ALL-WAVE RADIO.

✦

New DECO Condensers

DUMONT ELECTRIC CO., INC., 514 Broadway, New York, N. Y., has introduced a new line of condensers of the paper type impregnated with an improved compound which is said to prevent the absorption of moisture. The condenser is protected by a lay of aluminum varnish, and its shape and size permits it to be used in small spaces.



The condensers are said to be manufactured with RMA specifications and to have a useful life of over 10 years. ALL-WAVE RADIO.

QUERIES

(Continued from page 93)

ing it up or obtaining it elsewhere. The instruction sheet that accompanied your set will also be helpful.

8. Describe your antenna in complete detail—giving type, length *(length of all legs if a doublet)*, type and length of lead-in, whether a ground is employed, direction of *span*, height and general surroundings. If you are not versed in the technical terms, just tell us what your antenna and lead-in look like to the best of your ability, and how it connects to the receiver. *(From the above description, we can tell a lot about the noise-reduction qualities and directional effect of your aerial system, as well as its ability to pick-up signals. We request information of the* direction of span—*the direction in which the antenna is stretched —rather than its directional receiving effect, because many short-wave listeners do not judge the latter correctly from the former. Directional effect has a lot to do with good and poor reception and with variation in reception of different stations, on different frequencies at different times of the year.)*

9. Describe your power source—a.c. or d.c. mains, batteries, converter, etc.

10. If other than a.c. or d.c. mains, how long ago was the power system checked and serviced?

11. Approximately how many hours a day is the receiver operated? *(This, along with other information concerning the age of the receiver, and the general symptoms, may point the finger of suspicion at the deterioration of some specific part.)*

12. Describe the general symptoms.

If you are bothered with noise, please answer the following questions: *(Be sure and answer Question 8.)*

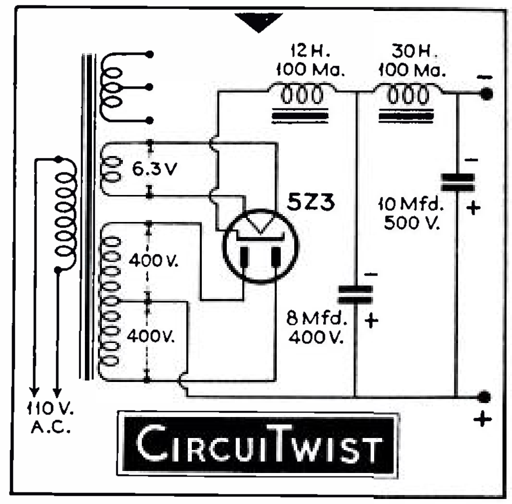
13. In what weather conditions and at what time of the year is the noise most bothersome?

14. How far are you from open power lines?—street car or other form of electric trains?

15. Can you create the noise by hitting the receiver, stamping on the floor or by turning on any particular electric light socket?

16. Can you identify the disturbance with any particular device—refrigerator, washing machine, vacuum cleaner, dial telephone, passing automobiles, flashing sign, traffic light, etc.?

17. Do other people in the neighborhood experience the same noise? If so, do they receive it louder or weaker than you do, and how do their receivers and antennas differ from yours, and are they farther from or nearer to any suspected source of interference?



CircuiTwist

The above is the circuit diagram of a power supply designed about a 5Z3 rectifying tube from which it is desired to obtain maximum output. There are eleven errors in this diagram—some less obvious than others. How many can you find? Turn to page 105 for the answers.

EMBRYO HAMS

(Continued from page 89)

L-1 therefore induces a larger voltage in L than the original and this voltage is again amplified. The amount of regeneration or amplification that can take place is limited by the inherent operating conditions of the tube. If the degree of voltage fed back from the plate to the grid is too large, the tube will break into oscillation and act as a generator of radio-frequency currents, the frequency of which will depend on the circuit constants. Thus the regenerative circuit may be converted into a generator of radio-frequency power by increasing the feedback to the point where the tube oscillates.

The Oscillator

However, if a tube is to function solely as an oscillator, there are other more appropriate circuits, one of which is shown in Fig. 32. This is "stripped down" for the sake of simplicity. The coil L forms the plate and grid inductance, the portion below the cathode tap being in the grid circuit and the portion above the tap being in the plate circuit. The entire coil is tuned to the desired oscillating frequency by means of the variable condenser connected across it.

Such a circuit is self-starting, for any small voltage on the grid will set up a correspondingly larger voltage in the plate circuit. This voltage is in turn fed back to the grid and re-amplified so that almost instantaneously the voltage has become so large that oscillatory currents are developed in coil L. This is brought about by the charging and discharging of the variable condenser through the coil which sets up an alternating current. The voltage developed across the coil alternates from positive to negative values and the grid is therefore alternately positive and negative. When it is negative little or no plate current flows, but when it is positive the plate current reaches comparatively high values. In effect, then, the oscillating circuit composed of the coil and the variable condenser provides the grid stimulus and in turn receives its power from the plate. The action is therefore continually repeated and the frequency of the oscillation is dependent upon the resonant frequency of the coil-condenser combination. If the setting of the variable condenser is changed the frequency of the radio-frequency current generated by the tube will also change. The action, as you will perceive, is similar to that of a pendulum-type clock.

The circuit shown in Fig. 32 is known as the shunt-feed type, because the power from the battery B, is fed to the plate of the tube in shunt or parallel to the oscillating circuit. There are, as a matter of fact, two distinct circuits effectively isolated from each other. The condenser, C, feeds back the radio-frequency currents from the plate to the grid circuit, both of which are common to coil, L, but effectively blocks the high d.c. plate voltage from reaching the grid. On the other hand, the choke, RFC, prevents the oscillating currents from flowing through the d.c. circuit but does not retard the flow of d.c. plate current.

It is this general type of circuit that is used in a transmitter to generate radio-frequency power. Under proper conditions a large tube of the "final amplifier" type can be used in such a circuit and coupled directly to the antenna. However, there are objections to this method—one of them being instability—and it is therefore the practice to use a tube having a lower power rating as the oscillator and to build up the radio-frequency power by degrees through the medium of separate amplifiers.

I have purposely refrained from discussing the various classes of power-amplifier operation as these will fall naturally into the general design considerations which I shall cover in my next letter. At that time I shall also deal with representative receiver and transmitter circuits so that you can get the hang of them. Until then—cheerio.

Gerald

✦

CircuiTwist Untwisted

The 5Z3, as indicated by the first numeral of its designation, operates with a 5-volt filament potential. As the final numeral indicates, it has only three electrodes—no cathode other than the filament. For maximum output, 500 volts should be applied to each plate. Maximum current drain is 250 milliamperes and the inductance of choke coils designed to carry 100 ma would be low at the increased drain. Output polarity is reversed—cathode or filament is always positive or plus. Similarly, the polarity is reversed on both electrolytic filter condensers. The highest capacity and highest voltage condenser should be the closer to the tube. For maximum voltage output, condenser input to the filter system should be used instead of choke input. In other words, the first filter condenser should be connected immediately after the 5Z3.

ALL-WAVE OSCILLATOR

(Continued from page 61)

ing the latter. The trimmers on the intermediate frequency transformers are then adjusted with a nonmetallic screw driver for maximum deflection on the output meter, the output of the oscillator being reduced as the reading on the meter increases.

If the i-f circuit is correctly adjusted, and the receiver still shows a loss in sensitivity, the trouble is elsewhere—perhaps tubes, or poor alignment in the receiver r-f and oscillator circuits. In the latter case, unless you are an expert with the oscillator, it is a job for the serviceman.

Locating Speaker Rattles

However, it does not always take an expert to locate and repair speaker rattles with the aid of an oscillator. The set-up is that employed for logging. If you have a beat-frequency oscillator in your receiver, turn it on, and tune in the all-wave oscillator at any convenient frequency free from a station. Tune to zero beat. Use maximum output from the oscillator, and turn the volume control way up. Detune the oscillator, or the receiver, slowly, listening for the rattle as the pitch of the whistle increases. When the rattle is heard, leave everything set, and touch different parts of the speaker—cone, screws, name plates, mounting bolts, etc., in an effort to find what is rattling. Some times the trouble may be located in a loose part of the chassis. Occasionally one section of the cone may be at fault, and a touch of collodion (new skin or liquid nail polish) or shellac will cure the trouble.

If your receiver does not possess a beat-frequency oscillator, it will be necessary to tune in some unmodulated carrier—the stronger the better. Tune the oscillator to zero beat, and then detune the oscillator slowly until the rattle pitch is attained. If you are unable to secure sufficient output from the oscillator with the small antenna, connect the output directly to the antenna post. Do not modulate the oscillator in this test.

Conclusion

There are many less elementary uses of a good all-wave oscillator which are regularly employed by the expert serviceman and experimenter, such as plotting resonance curves, making quantitative measurements of selectivity, over-all alignment of a receiver, determining audio-frequency characteristics, checking image frequency ratios, etc., all of which contribute to the efficient operation of a receiver. We have described the more simple though highly essential functions of the oscillator which may be readily utilized even by the non-technical listener. However, the oscillator provides a liberal education in many fundamental radio phenomena and a stimulus to further learning. The listener who acquires an oscillator merely as a means toward the end of better logging and more verifications, will almost inevitably find himself becoming more and more of an expert in things radio and will be eventually performing the most complicated operations for which the oscillator is designed. In so doing, he will make the most of radio as a hobby.

HAM'S PARADISE

(Continued from page 71)

the beam. This refinement was never completed, however, as the particular stations with which W1HRX maintains regular schedules can all be worked from the same orientation of the array. Details concerning the manner in which the beam antenna has been made are discernible in the large, close-up picture of the beam itself. Two of the elements are fed in phase from a 600-ohm line and there are two parasitic reflectors behind the radiators.

As is true with nearly every amateur station, each of the important components here is surrounded by an interesting story. Take, for instance, the five-meter, eight-element beam array shown supported by the frame-work at the left of the picture. Before this workmanlike unit appeared, all sorts of makeshift arrangements, of the same general dimensions, were tried and found to be practically useless. The headquarters staff of *QST* wanted to carry on some experimental work, in connection with long-distance transmissions on five meters. Millen's hilltop is about 128 miles from Hartford and it was thought that this distance would be ideal for the experiments. Accordingly, after the preliminary aerial had been abandoned, the unit shown in the picture was built. The results obtained with this antenna are now well known to nearly every amateur, and consistent day and night transmissions between this beam and a similar unit installed at Hartford were carried on for over a year.

Headaches

While W1HRX now appears to be

close to ideal it must not be thought that this station has come into being without any of the aggravating circumstances which the rest of us encounter. A very severe headache was caused during the construction of the lattice work mast which appears very prominently in the general view of the station. The four corner supports are made of 4 by 4 pine joists in a single length. It was found that units of this size, 34 feet long, could be obtained at the local lumber yard. Operating on the basis of this length, complete drawings for the entire tower were made. Later, a piece of lumber, 38 feet long and measuring 8 by 8, was located. At no small cost, it was cut up into four pieces, 4 by 4 and 38 feet long. Millen was perfectly willing to pay a premium for the additional four feet of height. On his arrival at the "farm" that evening you can imagine his distress when he found four pieces of 4 by 4, *four feet long,* lying on the barn floor. He was advised that the carpenter had cut them off the long length so that the tower would coincide with the drawings which had been made.

Even after this catastrophe, troubles continued to hover about. It was difficult to secure a supporting member for the vertical radiator which would have the dual characteristics of strength and lightness. Ultimately, after a two weeks' wait, four 30-foot bamboo poles were secured in New York, and it must be said that 30-foot bamboo poles are not especially easy to find. Nor is it easy to ship them without having them broken, after they have been found.

Two thoughts guided the securing of the "Hilltop" which is now so well known to most amateurs as Radio Station W1HRX. One was Millen's desire to secure a summer retreat, where his many friends could be suitably entertained and where a reasonable degree of privacy could be had. The second and perhaps the more important reason was that he is a firm believer in the policy of giving everything a very thorough trial under severely practical conditions, and he wanted a place where new ideas and new equipment could be put through their paces unhurriedly.

Nearly all of the equipment carried in the right-hand relay rack, shown in the corner of the operating room, is useful for receiving only. Certain tricks in this layout, however, are not immediately apparent. The power supply for the exciters is located at the base of the relay rack, in such a position that the operator can throw the toggle switch on and off with his foot without reaching down. Provision of a wooden shelf, directly beneath the receiver, eliminates the necessity for an extra table or a desk for operating purposes. It will be observed that the log, key and microphone are right at the operator's elbow. The space between this shelf and the top of the power supply was formerly occupied by nothing but blank panels. By the simple expedient of employing a few metal shelves which are attached directly to the relay rack, which was formerly dead space, makes all of the necessary equipment immediately available and at the same time provides a place for ash trays, tall glasses, etc., where they'll not be easily upset.

The power lines do not reach this station. In order to energize the rather powerful equipment which is used here, it is therefore necessary to generate power on the hilltop. Several power plants are available. A "Windcharger" was mounted on the peak of the barn roof about two years ago and it has been doing active duty ever since. It takes care of some of the emergency lighting in the main house by keeping a bank of storage batteries, located in the barn, fully charged at all times. These storage batteries are also used for starting the gasoline engine which drives the intermediate power supply and which is located a considerable distance away from the house. This gas engine drives an alternator which is used for light and for the operation of one of the lower powered transmitters. It is also employed in connection with a pump, used to draw water from a spring and pump it into a huge tank located directly behind the barn.

In addition to the transmitter shown in one of the accompanying pictures, another and very much more powerful unit is located in another corner of the room and is link-coupled to the transmitter shown here. With this higher powered final amplifier it is possible for the station to be run up to the full legal limit.

The installation of the gasoline-driven generator, which is located just outside the windows in the operating room, was a task of no mean proportions, in spite of the fact that Millen had the very valuable assistance of Fred Davis, who is the General Manager of the Rumford Press, among whose tasks are the printing and distribution of the *Reader's Digest*. The very important work of assisting in attaching the fireproof covering to the more or less artistic framework, and the job of running the controls for the gas engine into the operating room, were delegated to Davis and your present reporter.

BEAM AERIALS

(Continued from page 84)

lationship can be secured through the use of small loops in the feeders or transmission line as in Fig. 4. For larger changes, such as ⅛ or ¼ period, larger loops are inserted as in Fig. 5.

What Can Be Done

As a practical example of what can be done with such systems, let us construct one and put it in operation. Assuming 56-megacycle operation, let us erect two 8-foot vertical doublets so that the lower end of each is 12 feet from ground and separated from each other a distance of 8 feet. We shall excite these two vertical doublets at their

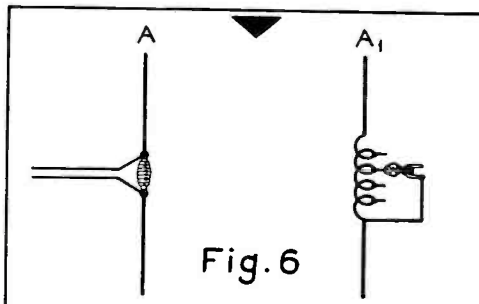


Fig. 6

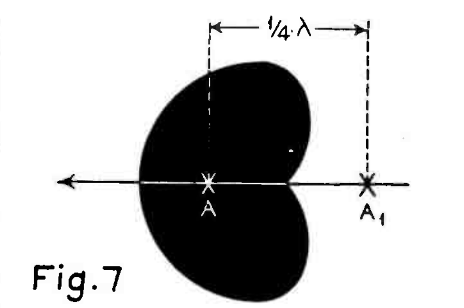


Fig. 7

Pattern obtained by tuning reflector to exciter, as in Fig. 6.

centers by means of a twisted pair transmission line, and by reversing one leg of the double transmission line cause a 90 degree change in the directional characteristics of the array. This will give us field patterns similar to the ones shown in Figs. 1 and 2. Or we may erect two similar doublets 4 feet apart and excite one of them at the center through the usual transmission line. The remaining doublet should have a five-turn, one-inch diameter coil wound self-supporting and placed at its electrical center. A shorting clip here for tuning, as in Fig. 6 will permit tuning the reflector to the exciter to give the pattern illustrated in Fig. 7. By adding additional reflectors, as in Fig. 4, we compress the beam even more and obtain increased concentration and signal strength. Each is adjusted 90 degrees out of phase by the simple expedient employed with the first.

Tuning

In tuning, the exciter doublet is adjusted first, then the rear reflector, and then the two side reflectors, one at a time. The exciter may then be retuned. As each reflector is cut into the circuit, there will be an increase in the currents of the antenna and the existing reflectors due to the lowering of the resistance or load impedance of the antenna.

ORTHOTECH 10-4

(Continued from page 75)

would be confined to that of tubes preceding those in the output stage.

The i.f. transformers should be adjusted to tune to exactly 456 kc, as this is the intermediate frequency which the r.f. assembly is designed to work with.

The high frequency assembly consists of three shielded units, self-supported on a small chassis and already wired to the selector switch, the individual coil trimmers, and the oscillator padding capacities. These three units contain rf., detector, and oscillator coils respectively, the cans being marked for easy recognition.

In the top of the cans and accessible through holes are the color-coded trimmers—red for the low-frequency band, brown for medium low, yellow for medium high, green for high. Exact coverage with each band will depend upon the maximum capacity of the gang tuning condenser used—which should be a low minimum affair (12 mmfd. or thereabouts) with a maximum of from .00037 to .000420 mfd. the approximate extensions being as follows:

Band 1—1500 to 550 kc.
Band 2—1500 to 4000 kc.
Band 3—4 to 10 mc.
Band 4—9 to 23 or 25 mc.

If a large maximum capacity variable is used, and if the alignment is carefully done, a four-band scale may be used. The plain 0-100 reading single scale dial is recommended, however.

Set the band selector switch at its extreme right position. With the dial pointer at about 1400 kc and with the broadcast padder (at the back of the coil assembly) all the way in, adjust the red trimmers for tracking. At 600 kc open the padder until proper alignment is had at the low-frequency limit, readjusting trimmers slightly if necessary. Readjust the trimmers once more at high frequency and middle frequency points. Go through the same process with the band switch brought back to the left position and adjusting both the brown trimmers and the second padder. The two short-wave bands are simply aligned by means of the yellow and green trimmers, no variable padders being necessary.

The electric eye circuit uses a 6E5, with the yellow lead from the assembly connected to either point A or B along the avc line. If overlapping on signals is experienced, substitute a 6G5, which requires a negative bias of 20 volts for full close.

Tune in a code signal strong enough to give an audible "mush" or key-click, then adjust the bfo transformer (TR6) trimmer until a reasonably strong beat note is had. In shifting from avc to bfo, by the way, there should be no necessity for retuning on a desired signal if the receiver has been carefully aligned.

As a quick test to determine if the output stage is working in push-pull, pull one pentode from its socket, then return it and remove the other. Whatever the distortion effected, the output level should be the same for each individual tube. *Don't, of course, leave one tube out for any length of time.*

Tone quality should be found excellent. If there is any evidence that the inverter tube is not working properly to produce voltages 180 degrees out of phase throughout the audio-frequency range, go over the inverter circuit, making definitely sure that R25 and C23 are sufficiently well elevated from the chassis to prevent large capacity to ground. Improper phasing troubles can be largely attributed to such capacity. Also make sure that resistors R26 from cathode to ground and R23 from plate to B plus have identical resistance values.

R.S.S.L. NEWS

(Continued from page 65)

QSA4—Good, readable
QSA5—Very good, perfectly readable
The complete "R" scale is as follows:
R1—Faint signals, just audible
R2—Weak signals, barely audible
R3—Weak signals, copiable in absence of interference
R4—Fair signals, readable
R5—Moderately strong signals
R6—Strong signals
R7—Good strong signals, copiable through interference
R8—Very strong signals
R9—Extremely strong signals

It will be appreciated that if a signal report were QSA3, R6, for instance, that some form of interference was present, for under average conditions an R6 signal, which is strong, would be perfectly readable, or QSA4 at least. The combination of the two reports, therefore, also gives some indication of general receiving conditions, and the above report would suggest the presence of an interfering station or local noise. In such an instance, therefore, the addition of a station call would be sufficient to indicate that it was this station causing the interference, or in the event of man-made noise or static, the addition of the abbreviation "QRM" or "QRN", respectively, would indicate whether the interference was man-made electrical interference or natural static.

In making QSA-R reports it is suggested that the "SA" be dropped and the report merely read, for instance, Q5R9. That is sufficient for all purposes.

Report Forms

The QSA-R system is satisfactory but for one point; i. e., there are instances when a signal carrier can be heard by means of a beat-frequency oscillator, but is absolutely inaudible when the beat-oscillator frequency is removed. Yet it is important to a station engineer to know that the station carrier may be audible in a certain locality even if the modulated signal cannot be heard. For this reason it seems advisable to add another QSA scale for the League reports. Its meaning can be included on the report forms which are in the course of development so that there can be no misunderstanding. "Q0" is the logical abbreviation, and it shall be defined as "audible on heterodyning only." Members having receivers without beat-frequency oscillators can disregard this type of report.

Now as to the report forms—a number of interesting samples have been sent in. Mr. E. D. Nicholson, of New Orleans, forwarded one of the BBC Empire Service Reception Logs, a reproduction of which is shown in Fig. 1. This chart has provision for recordings in graph form of carrier strength, fading, interference and overall merit. It is convenient to fill in since it merely requires the transference of data to the chart in the form of handdrawn lines.

Mr. George L. Bird, of Pawhuska, Oklahoma, sent in two types of report forms he has been using. The one shown in Fig. 2 is similar in some respects to the BBC form, with the exception that carrier strength, fading, noise, etc., are indicated by shaded areas. This probably is a less convenient arrangement than the former insofar as the transferal of the data to the chart is concerned.

Another type of form used by Mr. Bird is shown in Fig. 3. This shows in graph form the signal input in microvolts for the station whose call is printed on the graph line, and the relative strength of other stations in the same approximate frequency band. This is an excellent form of report, but is of a type that cannot be provided by members lacking the necessary equipment for making such measurements.

The report form in the course of development is somewhat similar to the BBC form but has provisions for listing more data in quite a simple manner. This form will be illustrated next month, and an explanation given as to the manner in which it should preferably be filled in. These will be available in pad form to all members of the League, although a member will not be obligated to use them. League stationery will also be made available to those who may wish it.

Conclusion

It is urgently requested that members voice their opinions regarding proposed and existing policies. As matters stand, it is proposed that all signal reports from members in one state or province be forwarded to the Sectional Manager who, in turn, will segregate them into the Divisions in which they belong and forward them on to headquarters. This may not be the best way of handling the reports; any suggestions you may have will therefore be appreciated.

Address all correspondence to: Radio Signal Survey League, 16 East 43rd St., New York, N. Y. And don't forget the drive for new members!

M. L. MUHLEMAN,
Acting Director

VOLUME EXPANDER

(Continued from page 63)

sult in a decrease in output and compression will result.

Since this expander circuit is capable of any degree of expansion, care must be taken not to use too much expansion, since this will result in unnatural reproduction. Remember that until broadcast transmitters incorporate compresser circuits, the use of an expander at the receiving end is apt to be a bit disappointing, especially if the control man at the transmitter is over-zealous. We feel certain however, that this expander will assist greatly in improving the naturalness of recordings and also of some types of broadcast programs.

Construction Suggestions

The circuit of the expander used in the laboratory model is shown in Fig. 3. The output of the receiver or phonograph pick-up is impressed on the grid of a

6N7 operated as a single triode, with both tube sections connected in parallel. The output of the 6N7 is in turn, by means of a step-down transformer, impressed on the bridge circuit. The bridge proper, as connected in this model, consisted of two 6-8 volt, 3 candlepower automobile lamps and a dual rheostat consisting of two 5 ohm sections on a common shaft. The output of the bridge is fed through a step-up transformer to the grids of a pair of 6L6's arranged to operate as a push-pull Class AB amplifier and capable of delivering 34 watts to the speaker.

The constructional details are quite simple and should be easily gleaned by inspection of the schematic shown in Fig. 3 and the photos of the expander unit alone. The transformer, in order to assure a good overall frequency response, should be selected with care. T1 may be an output transformer which was made to match a very low voice coil impedance. For T2, the transformer used was one made to match a velocity microphone to push-pull grids. A set-up using an output transformer of the type made to work a push-pull stage to a voice coil, however, was tried for T2 and gave satisfactory results. The transformers T1 and T2 should be capable of operating at levels of from plus 19 to 20 db., that is, less than one watt. In the expander bridge, if the dual control is not procurable two standard rheostats may be substituted, the only difference being that the adjustment of the bridge will be a bit more difficult with two controls.

Photographs showing the arrangement of the expander proper are shown in Figs. 4 and 5. The actual expander circuit takes up very little room and can easily be connected to practically any receiver. If a driver stage is used to swing the grids of the output stage, then the bridge, with its associated step-down and set-up transformers, may be inserted between the driver and output stage. In many cases, the first audio can be replaced by a tube suitable as a driver and the expander inserted thereafter. In cases where the audio section of a receiver is obsolete, the transformers may be replaced by resistance coupling and the old output tube or tubes used as drivers to work the expander. The output of the expander may then be impressed on a separate output stage consisting of a pair of push-pull 6L6's.

LIST OF EXPANDER PARTS

R1—750 ohms, 1 watt
R2—Tandem Electrad No. 6608 control, or two No. 204-W rheostats
R3—3,000 ohm, ½ watt
R4—75,000 ohms, 1 watt
R5—25,000 ohms, 1 watt
R6, R9—100,000 ohms, ½ watt
R7, R8—10,000 ohms, ½ watt
R10, R12—90,000 ohms, ½ watt
R11—200 ohms, 10 watts, Electrad Vitreous resistor
C1—25 mfd., 25 volt, electrolytic
C2, C3, C8, C9—0.1 mfd., 600 volt
C4—50 mfd., 50 volt electrolytic
C5—4 mfd., electrolytic high voltage
C6, C7—10 mfd., electrolytic high voltage
L1, L2—3 candle power 6-8 volt automobile headlight bulbs
T1—Output transformer high plate impedance to 1.5 or 2.5 ohm secondary load, (A universal output transformer may be used).
T2—A velocity microphone to push-pull grids transformer. (a universal output transformer operated in reverse connection has been found to be fairly satisfactory).
T3—Output transformer, 6L6's in class A'1 to voice coil
T4—Power transformer to supply 6.3 volts at 4.0 amps., 5.0 volts at 2.0 amps., 800 volts C.T. at 180 mils.
CH1—Low resistance 10-15 henry choke
CH2—High resistance 30 henry choke

NOTE: A bleeder resistance should be connected between the output of CH2 and ground if this power supply is used only for audio amplifier. This bleeder is adjusted so that the output voltage at this point is 300 volts.

HALLICRAFTER SETS

(Continued from page 92)

tion once the receiver was warmed up. This test told a different story, as there was no indication of frequency wandering. It can only be concluded, therefore, that in this receiver at least, the degree of fire-up drift is no accurate measure of receiver stability. For that matter, both receivers were found quite stable, and we were surprised at the stability of the beat oscillator in the Sky Buddy.

Both receivers are well calibrated, although the Sky-Buddy was found to be slightly off at the high-frequency end of Band No. 1. Furthermore, *both* receivers had ample selectivity in the standard broadcast band, and there seemed little that the Super Sky Rider could do that the Sky-Buddy could not also do. This apparent high selectivity of the Sky-Buddy, however, was due in part to the fact that, whereas 84 stations were logged on the Super Sky Rider, only 63 stations were intercepted on the Sky-Buddy and with the indication that a few of these were images. Be that as it may, the Sky-Buddy made a good showing.

A marked difference was evident in

the audio quality and frequency range of the two receivers. Though the Sky-Buddy with its midget speaker sounded well even at rather high volume, the difference in range and depth of response between the two was immediately apparent when the 12-inch speaker used with the Super Sky Rider was turned up. The small speaker indicated no apparent distortion but was almost entirely lacking in low-frequency response. Certain instruments in an orchestra that were clear in the large speaker were absent in the small speaker. But this was to be expected.

A simultaneous switch to the 6-megacycle broadcast band again presented the fact that the greater sensitivity of the Super Sky Rider was of real use, for out of 19 stations picked up in a progressive coverage of this band, only 13 of them showed up in the Sky-Buddy. Similar ratios were obtained in the 19, 25 and 31-meter bands. Moreover, all 19 of the stations in the 49-meter band were brought in on the Super Sky Rider without antenna (pick-up only from leads to switch) whereas only two of these stations could be brought in satisfactorily on the Sky-Buddy with the antenna disconnected.

The two receivers were also compared in the 20-meter amateur phone band where CO6OM was brought in equally as well on both sets. The Super Sky Rider was then tuned to W9DEF, who came through with about the same volume level as CO6OM. In switching to the Sky-Buddy, however—and guarding against the possibility of discrepancies due to rapid fades by switching back and forth between the two receivers—W9DEF was found to be down in the noise background. This provided a good demonstration of the real value of reserve gain plus the advantage of wide avc action.

Later on a South African amateur phone station was picked up on the Super Sky Rider and held for a half hour. Three K6's were also picked up on phone, but none of these four stations could be heard in the Sky-Buddy. Nevertheless, the Sky-Buddy brought in a South American and a number of Central-American phone stations, which is indicative of the point that had the South African and Hawaiian stations been just a bit higher in signal level they might well have been audible in the Sky-Buddy as well as in the Super Sky Rider . . . but this again points to the advantage of reserve gain in a receiver.

The avc action in the Super Sky Rider is particularly good, and with the reserve gain available it was difficult to note any change in the signal character of a distant station even though the tuning indicator showed that there were deep fades. On many such stations it was possible to disconnect the antenna from the receiver without noting any drop in signal volume, the only indication of the change being the appearance of background noise.

The avc action of the Sky-Buddy on the other hand is not very pronounced since it can control but two tubes (the mixer and i.f.). The range of control in relation to the range of r.f. gain is therefore restricted, with the result that signals supported by the avc/gain of the Super Sky Rider are beyond the control of the Sky-Buddy and in consequence dive into periodic fades. Because of the limited range of the avc in the Sky-Buddy it is effective only on comparatively strong signals.

The Super Sky Rider gave excellent performance on 10 meters (the Sky-Buddy does not cover this band). There is sufficient band-spread for easy tuning, and during periods when the band was hot, 5's, 6's and a few 7's rolled through with R5 to 9 signals. The G's and VK's were also in evidence, but for short periods only, as the 10-meter band was skittish during these tests. In any event, considering conditions, we could not have asked for better results.

Summary

Both receivers, in our estimation, "out-performed their price." The Super Sky Rider appears to have sufficient sensitivity and selectivity for all purposes, and though it suffers slightly from image interference, the degree of this interference is no more than usually experienced in receivers with one r.f. stage. Considering the fact that this receiver has electrical band-spread, crystal filter, five bands, and a beam-power output of 14 watts, little more could be expected for the price.

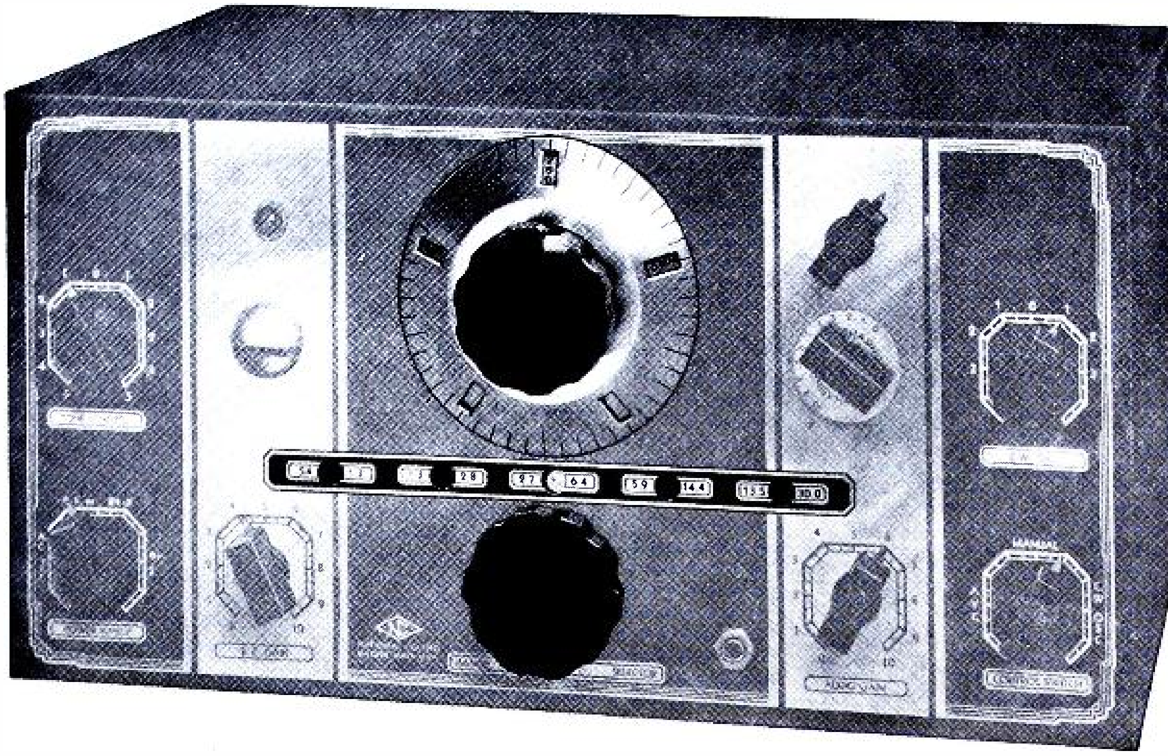
Though the Sky-Buddy does not begin to compare with the Super Sky Rider, it, too, has additional features not usually found in a receiver of such low cost. Moreover, as the simultaneous tests proved, this little set is quite capable of bringing in its share of DX. For one not too critical of performance, it will render more service per dollar than will the Super Sky Rider.

THE HAM BANDS

(Continued from page 87)

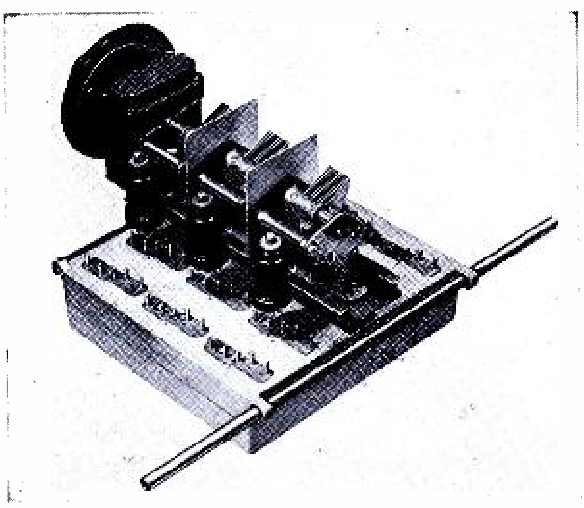
The following were Q5 at noon and early afternoon on November 8th:

W6ATJ, BOS, FTY, *HJT,* IBS, ITH, *KNF,* KR, KVU, MBD, MDN, MFR, MWO, NCT, NLS, W5BB, BDB, BEE, BUK, BXM, *DQB,* EFK, EKF, *ELC,* ERB, EZH, FDE, FDI, *GAR, W9ALV,* EWW, GEG, POY, VAT.



PRECISION THAT STAYS PRECISE

The permanence of calibration for which National Receivers are famous is combined with the convenience of knob-controlled range changing in the NC-100



THE MOVABLE-COIL TUNING UNIT

Accurate positioning of coils insures that calibration will not be affected by changes in stray inductance.

Receiver. The unique Movable-Coil Tuning Unit has such obvious advantages in electrical efficiency—such as short leads and isolation of idle coils—that it is often thought of in that connection alone. But this remarkable unit also makes possible a permanent accuracy in tuning and logging that is invaluable in DX work.

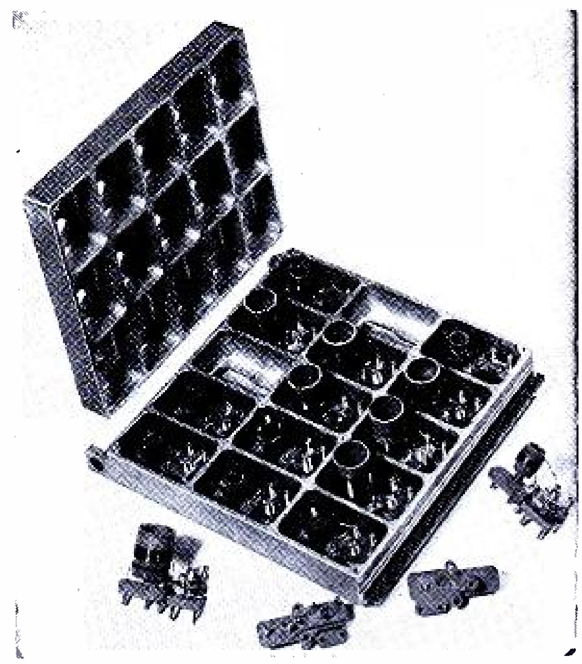
When a twist of the range-changing knob slides the heavy cast aluminum coil shield down its smooth running track, positive detents lock the new set of coils into exact position, close to the tuning condenser and tubes. There are no flimsy switch arms and flexible leads here! Instead, fifteen rigidly-mounted double-side-wipe contacts make permanently dependable connections to tubes and tuning condenser. And the precision tuning condenser is fully worthy of the responsibilities placed upon it. Its preloaded gear drive of 20 to 1 ratio is a revelation in smoothness. Its Micrometer Dial is direct reading to one part in five hundred, and has an effective scale length of twelve feet.

To justify such precision construction, electrical parts must be of the same high quality. There are no compromises on this score in the NC-100! Throughout the entire receiver—both RF and IF stages—air dielectric condensers are used wherever their permanence of adjustment and low losses can improve performance. HF coils are rigidly mounted on low-loss R-39 supports, each in its own shielded compartment. Important connections are made with heavy bus wire. Tuning condenser stators have four point mounting on bars of low-loss Isolantite.

The circuit also has received its share of attention. For example, separate tubes, electron-coupled, are used for high frequency oscillator and first detector. A bias-type power detector and a separate tube for amplified and delayed AVC relieve the second IF stage of the undesirable loading caused by diode rectifiers. From first RF stage to push-pull output, no pains have been spared to make the NC-100 as outstanding in reliability as it is in performance. Whether you tune to 540 KC or to 30 MC, you will find its tuning as smooth as its logging is accurate.

Whether you are about to buy a receiver or not, you will want to know more about the NC-100. Drop in at your dealers. He will be proud to explain its many features to you. Or, if more convenient, write for a copy of the descriptive folder describing the NC-100. It is free for the asking and no coupon is needed. Just send a postcard, saying you are an *All-Wave Radio* reader and want a copy of the NC-100 folder. But be sure to write your name and address plainly!

NATIONAL COMPANY, Inc.
MALDEN, MASS., U. S. A.



THE COMPLETE COIL ASSEMBLY

Permanence of circuit characteristics is assured by the rigid cast aluminum shield and by air dielectric trimmer condensers with R-39 insulation.

NATIONAL NC-100

TWELVE TUBE SUPERHETERODYNE

MIDWEST...

THE RADIO THAT CAUGHT A NATION'S FANCY!

HALF *the Cost..*
(FACTORY-TO-YOU SAVES 50%)

TWICE *the Performance*
(14 TUBES FOR THE PRICE OF 8)

Only $39.95 BUYS A NEW 1937 MIDWEST

30 DAYS FREE TRIAL!

FACTORY-TO-YOU, EASY-PAY PLAN SAVES YOU 50%!

This great new Midwest has caught the nation's fancy, because scores of marvelous new features like Dial-A-Matic Tuning*, Electrik-Saver* (optional*) give magnificent world-wide reception and glorious crystal clear realism. America OK's Midwest radios because they out-perform ordinary sets on a point-for-point comparison. Not a cut-price set, but a more powerful super performing radio in a big, exquisitely designed cabinet of matched walnut! You are triply protected with Foreign Reception Guarantee . . . One-Year Warranty and Money - Back Guarantee. Now, you can roam the world in a flash . . . switching instantly from American programs to police, amateur, commercial, airplane and ship broadcasts . . . to the most fascinating foreign programs. When you buy the Midwest factory-to-you way, you deal directly with the factory that makes radios — instead of paying extra profits to wholesalers, distributors, retailers, etc. Remember! Nothing of value is added to a radio just because it is handled many times. You have a year to pay . . . terms as low as 10c a day . . . you secure the privilege of 30 days FREE trial in your own home.

ZIP!... THERE'S YOUR STATION!

Your radio enjoyment is doubled with Dial-A-Matic Tuning, the amazing new Midwest feature that makes this radio practically tune itself. Zip!. ..Zip!...Zip!...stations come in instantly, automatically, perfectly ..as fast as you can push buttons. Exclusive Midwest Electrik Saver cuts radio wattage consumption 50%, enables Midwest radios to use no more current than ordinary 7-tube sets.

Only **MIDWEST** *RADIOS Offer*
DIAL-A-MATIC TUNING •• ELECTRIK-SAVER •• DUAL-AUDIO PROGRAM EXPANDER •• AUTOMATIC AERIAL TUNING •• 6 WAVE BANDS (4½ To 2400 METERS)
AND SCORES OF OTHER FEATURES AT SAVINGS UP TO 50%!
RUSH COUPON FOR FREE 40-PAGE CATALOG!

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