ALL-WAVE RADIO

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Vol. 2 No. 2

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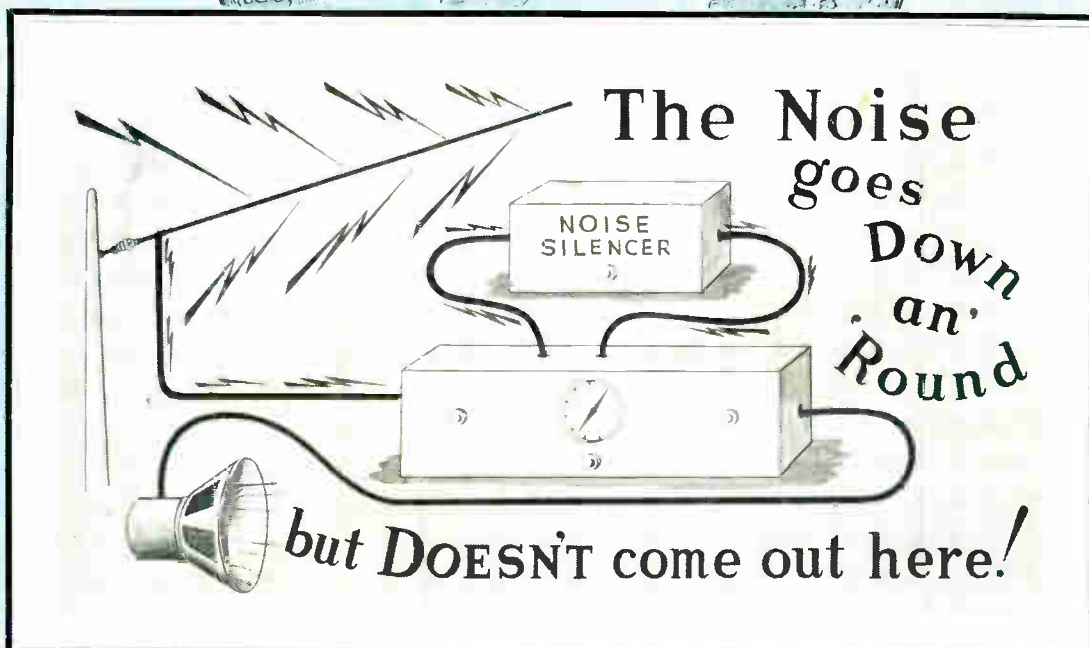

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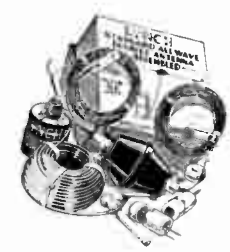

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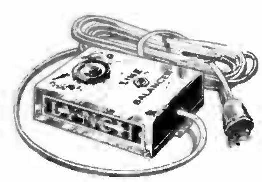

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ALL-WAVE RADIO

VOL. 2 NO. 2

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Cover Illustration

Picturization of the operation of the Lamb Noise Silencer

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Features

Departments

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DIAL LIGHT

THE FEATURE IN this issue of ALL-WAVE RADIO is a detailed explanation of a development of major importance—The Lamb Noise Silencer. This device is the most valuable contribution to the art of radio since the introduction of the superheterodyne circuit, the alternating-current radio tube and the electrodynamic loudspeaker.

The Noise Silencer was not an overnight discovery. More than a year was spent by Mr. Lamb and the engineers who collaborated with him in evolving the device. The circuit is the result of painstaking study into the behavior of noise impulses and their relation to the received signal.

There have been many newspaper reports in the past about new and revolutionary "noise eliminators". As a result, many people probably took the report on the Lamb Noise Silencer with the usual grain of salt. But let us assure you—if you had any suspicions as to the actual value of this device, dispel them from your mind. The Lamb Noise Silencer is no "flash in the pan."

It is true that there are minor objections to the adapter. It is necessary, for instance, to make certain adjustments before the device will function properly, but the average experimenter should have no difficulty in making them. It is also necessary to employ an intermediate-frequency transformer in the adapter that has the same "i-f peak" as used in the superheterodyne receiver with which the adapter is to work . . . the objection being, in this instance, that the average listener has no idea as to what frequency his receiver may be "peaked" at.

Rest assured that these objections are very minor ones —as you will readily appreciate when you read the article in the forthcoming issue of ALL-WAVE RADIO which will deal with the construction of a noise-silencing adapter unit. Don't miss this.

• • •

ONCE AGAIN SOME newspapers have published reports to the effect that we are to have television receivers most any time now.

In response to these reports, Mr. R. R. Beal, acting chairman of the Radio Corporation's committee on television, made the following statement:

"Television has a long way to go before it will be ready for general home service, and any report that RCA is about to market television receivers is absolutely without foundation.

"When RCA announced its three-point development program last spring, it was estimated that it would require twelve to fifteen months to build a television transmitter and a number of experimental receivers necessary to carry out the field tests. We are still engaged in that preliminary phase of the project, and obviously cannot be in a position to contemplate commercial service in the near future."

We believe that these remarks should be sufficient to put at rest any conflicting reports. Television is well on the way, and such recent developments as the electron-multiplier tube have brought it just so much closer to the starting-off point. But it will take a considerable amount of time and a great amount of money to set up a chain of stations capable of providing satisfactory television service to the public.

A complete report on the television situation will appear in an early issue of ALL-WAVE RADIO. This report will tell you what to expect of television and *when to expect it.*

• • •

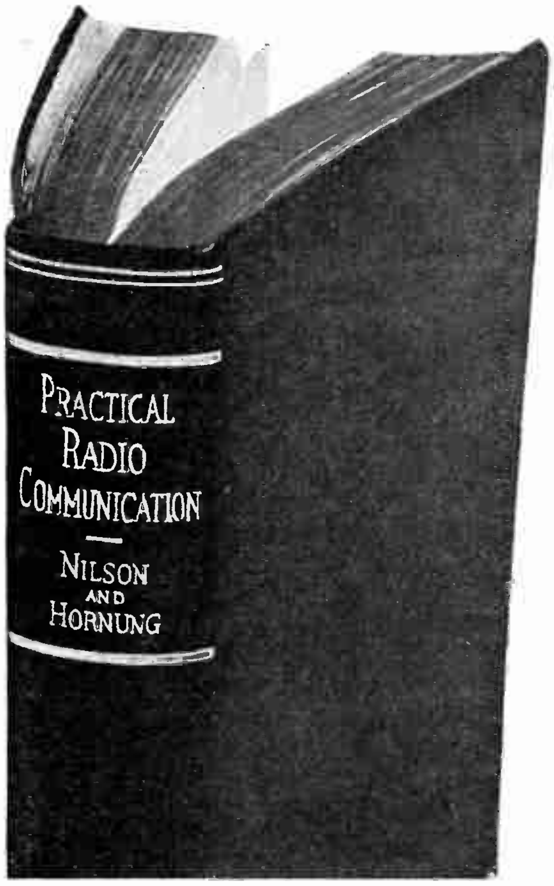
THE PRINCIPAL difference between the radio amateur and short-wave listener is that the amateur has a voice and the listener has not.

In one sense that is a small difference, but the breach between the amateur and the listener has been widened by the shortcomings of a few.

There is, for instance, the radio amateur who, like the small-time politician, has a colossal contempt for anyone not directly associated with his own group. More often than not, these are amateurs of the younger generation who bask in the light of their elders or their more experienced and more competent brethren. This type of amateur is a pain in the neck to everyone, including his own associates, and he does more actual damage to amateur radio than all the silly talk ever spread in the amateur bands.

On the other side of the breach is the type of short-wave listener who knows so little of the technicalities of radio that he is unable to appreciate the efforts of the serious-minded amateur toward the improvement of communication facilities, and is, in consequence, ready, and for some reason eager, to attribute most of his difficulties to the amateur.

Amateur radio is by no means a closed corporation. There are literally thousands of amateurs who welcome visits from short-wave listeners and who welcome intelligent reports from them. We know of listeners who aid materially in amateur work by their own efforts—listeners who cooperate with Hams and get a big kick out of doing it.



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ALL-WAVE RADIO

FOR FEBRUARY, 1936

At Last—A Noise Silencer!

NEW CIRCUIT REDUCES NATURAL AND MAN-MADE STATIC ALMOST TO VANISHING POINT

By G. S. GRANGER

THE noise-silencing circuit, developed by Mr. James J. Lamb, Technical Editor of QST, is probably the most beneficial contribution that has been made to the science of radio in a decade.

The device should not be confused with the many "noise-eliminating" gadgets introduced to the public in the past. The system carries with it no extravagant claims, yet the results that may be obtained with it are remarkable. It does not silence or eliminate all noise, but it does reduce the ear-splitting static and man-made noise to negligible quantities. There are certain types of noise the system cannot readily cope with, but it makes the worst types, such as interference from auto ignition systems, virtually "commit suicide."

The accompanying article by Mr. Granger explains the system in detail. Subsequent articles will deal with the construction of an adapter that may be used with most types of all-wave superheterodyne receivers, and a complete set with the noise-silencing system built in.—Editor.

NOISE AND STATIC—the greatest enemies to radio—have at last had their wings clipped. That which radio engineers and physicists have attempted to conquer in the past, has at last been largely subdued, and there is little doubt that now the clue to the solution has been discovered, we will witness the complete elimination of natural and man-made static in the very near future.

It is an axiom that about the time the scientists have given up hope of solving a problem, someone comes forth with the answer. It has certainly been true in this case. Many statements have been made by radio editors, engineers and physicists to the effect that it was a waste of time to attempt solving the problem of noise interference. A well-known physicist even went so far as to "prove" that the problem could not be solved.

But it has been solved! James Lamb, Technical Editor of QST Magazine, has worked out a noise-silencing system so simple and so logical that the everlasting question again arises—why didn't someone think of it before?

What It Does

Mr. Lamb makes no extravagant claims for his system; it will not silence all noise, but it will relieve the listener of the very noise impulses that are the most bothersome—spark discharges, dial telephone clicks, auto ignition impacts, and noise from such sources as electric light switches, door bells, violet ray machines, electric signs, etc. It will relieve the listener of these noises *providing the amplitude of the noise is greater than the amplitude of the received signal.* If the amplitude of the noise impulse is less than that of the

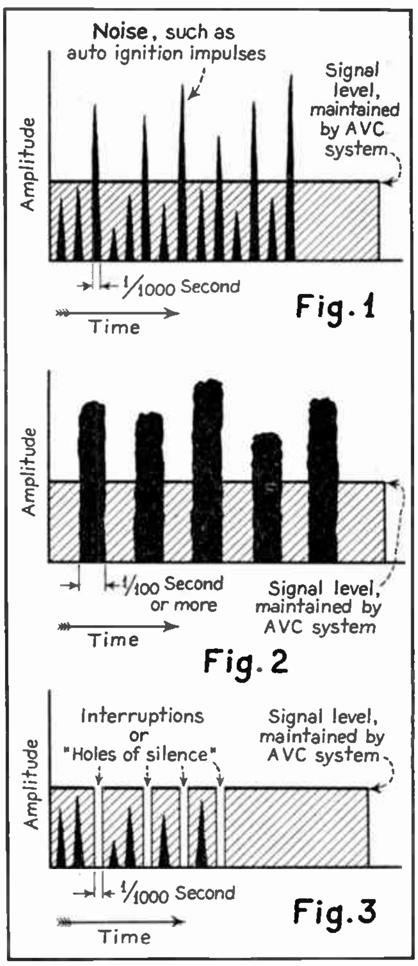
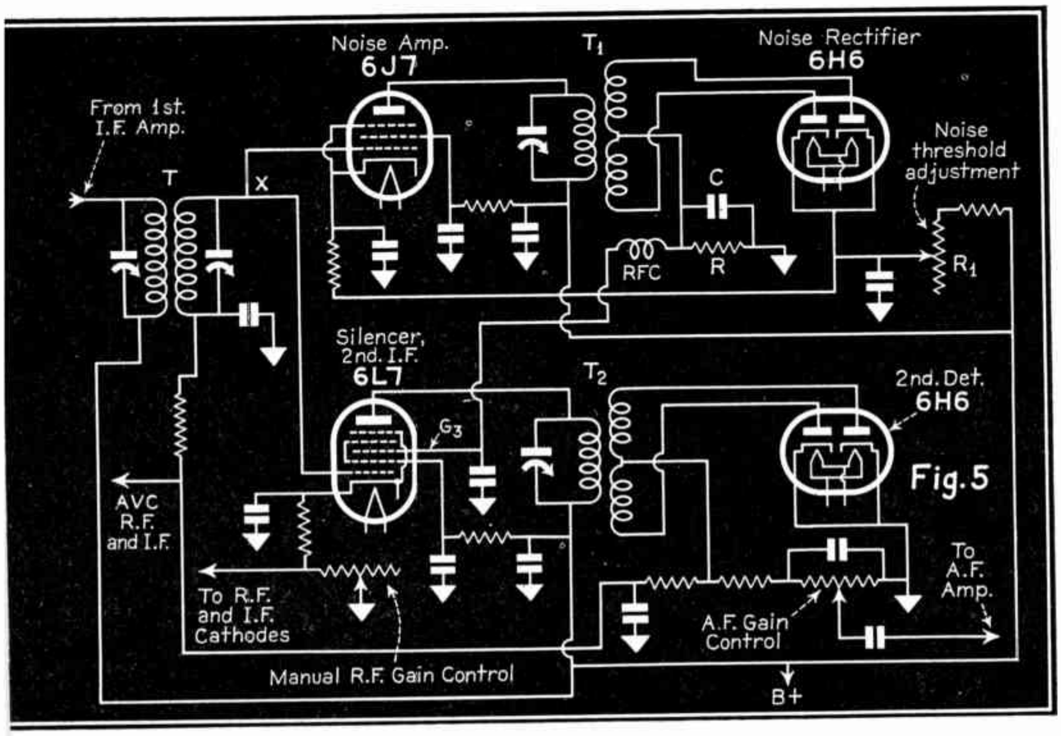


Fig. 1. Signal level and noise impulses as they would appear in the r-f circuit of the receiver. Fig. 2. This shows what happens to the noise impulses after being amplified. Note that their time duration has been increased considerably. Fig. 3. This sketch illustrates what the noise silencer does. It catches the noise impulses before the time duration is increased and virtually makes them "commit suicide."



The complete circuit of the noise silencer as applied to an all-wave superheterodyne receiver. The noise is "killed" in the circuit of the 6L7 i-f amplifier tube.

received signal, the noise-silencing device does not function, but noise disturbances of such low amplitude do not seriously interfere with reception; the signal, in such instances, overrides the noise. The important point is that the noise-silencing system practically eliminates the strong noise impulses that under ordinary circumstances blot out the desired signal.

The system is also capable of silencing natural static of the most bothersome type, but the effectiveness of the system is somewhat limited when it has to cope with forms of natural static or man-made interference having complex waveforms. Fortunately, these types of interference are not as prevalent as the staccato variety.

Basic Principle of System

Mr. Lamb's noise-silencing system would not work were it not for the fact that the most prevalent forms of noise are sharply peaked, of large amplitude and short time duration. Nor would it be effective in operation were it not for the fact that widely spaced interruptions of very short duration in the continuity of sound are imperceptible to the ear. In these two points lies the clue to the problem.

Examine the sketch of Fig. 1. This shows a signal of arbitrary amplitude the level of which is held fairly constant by the action of the automatic volume control system in the receiver. Superimposed on this signal is shown a group of noise impulses, some having an amplitude much greater than the signal and others having an amplitude less than the signal—or, in other words, some of the impulses are above the signal level and others are below it.

The noise impulses of small amplitude, or those below signal level, are seldom bothersome; it is the impulses of large amplitude, or those above signal level, that cause the real trouble.

Now note from this sketch that all these noise impulses are of very short time duration—in the vicinity of *one-thousandth of a second.* This time duration is so short that the ear would not register to its full effectiveness on these noise impulses—*if the ear perceived the impulses as sketched. But this is not what reaches the ear. The sketch of Fig. 1 shows the noise impulses as they are in the input circuit of the receiver—not the output.*

The noise impulses that assail the ears of the listener, and which practically blot out the desired signal, are sketched in Fig. 2. In this sketch we have left out the impulses of low amplitude—those below signal level—as we are no longer concerned with them. But note what has happened to the strong impulses. For one thing, they have been increased greatly in amplitude, as has the signal voltage, through amplification in the receiver circuits. The *relative* signal-noise amplitude may remain the same as it is in Fig. 1. This is entirely dependent upon the character of the noise and the efficiency of the receiver. But the important point to observe is, that irrespective of the signal-noise ratio, *the time duration of the noise impulses has increased tremendously—to as much as one-hundredth of a second.*

There are two reasons for this increase in time duration: First, the amplitude of a given noise impulse may be so large to begin with—possibly 20 times greater than the desired signal—that upon amplification in the receiver circuits it will have sufficient voltage value to drive the grids of one or more r-f or a-f tubes into the positive voltage region, in which case the tube or tubes will draw grid current and produce electrical echoes of the original noise impulse. Secondly, the condition is further intensified by the characteristics of the average loudspeaker. The greatly amplified electrical impulse whacks the loudspeaker so hard that the cone continues to vibrate at some natural resonance point long after the original electrical impulse has ceased. The result of these factors, therefore, is a group of audible noise impulses of long duration, as shown in Fig. 2.

How It Is Done

Now, it is clearly evident that if there were introduced into the receiver some form of quick-acting automatic volume control or silencing system that was made to operate from the noise impulses *after* their time duration had been increased, as shown in Fig. 2, that the signal would be broken up into an intermittent affair, with fairly wide spaces of low amplitude or silence corresponding in time duration to the original noise impulses. Such a signal would not be intelligible any more than a rapid fading signal is intelligible.

But, the ear is insensible to sound impulses both widely separated and of short duration, such as those shown in Fig. 1. Therefore, if the quick-action silencer is made to operate from some point in the receiver circuit where the noise impulses are of short duration, *then the ear would be insensible to the interruptions.*

That is exactly what Mr. Lamb has done. He has added to a receiver a circuit similar in many respects to the usual type of automatic volume control circuit, except that the load wherein the bias voltage is developed is given a very short time constant . . .

so short that it functions almost instantaneously upon the appearance of a noise impulse.

This device virtually "punches holes of silence" in the received signal, with the result that where once there had been a noise impulse of considerable amplitude, there is in its place a space of silence where both noise and signal are wiped out, as shown in Fig. 3. But since the time duration of the interruption or silent space is so short, *the ear is unable to sense the change and the signal is heard as a continuous sound.*

The manner in which the system is used in a superheterodyne receiver is shown in the block diagram of Fig. 4. It will be seen from this drawing that there are two separate channels, both of which are fed from the second intermediate-frequency transformer in the receiver. The lower of the two is the signal channel which is much the same as the intermediate-frequency amplifier and diode second detector stage in a superheterodyne. This channel feeds the audio amplifier and loudspeaker in the receiver.

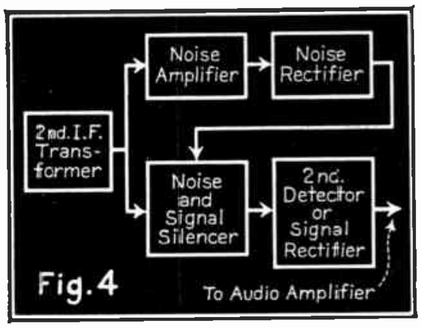
Directly above this is the noise channel. It is much the same as the common type of amplified automatic volume control circuit used in many modern receivers, but is considerably more rapid in action.

It will be noted from Fig. 4 that the output of the noise amplifier is connected to the noise and signal silencer. Thus, any voltage impulses present at the output of the noise amplifier are fed right to the silencer tube. Broadly speaking, the noise impulses are made to meet each other at this point, where they practically "commit suicide."

Functioning of Circuit

Specifically, the system is so adjusted that the signal is effectively amplified and rectified in the lower channel only, and the noise amplified and rectified in the upper channel only. This is readily accomplished by placing the proper bias voltages on the tubes in each channel. The lower channel is biased so that it may operate at maximum sensitivity. The upper or noise-amplifying channel is biased to a point where signal rectification cannot take place. Therefore the upper channel becomes operative only in the event that some voltage greater than the signal voltage is applied to its circuit.

Now so long as the signal fed to both channels is free of noise impulses



Block diagram of the noise silencer, showing the paths taken by the signal and the noise impulses.

the amplitudes of which are less or about equal to the constant amplitude of the signal voltage, no silencing will take place. That is, the signal will be amplified and rectified in the lower channel in the usual manner, and fed to the audio amplifier and loudspeaker.

But, if the signal is accompanied by a noise impulse whose amplitude is greater than that of the signal, the noise amplifier is immediately set into action for the instant the noise impulse appears. The noise impulse is amplified and rectified, and the resultant direct-current voltage of negative value that appears at the output of the noise rectifier is instantly impressed on the noise and signal silencer tube in the lower channel. The effect of this negative voltage is to bias a grid of the silencer tube to such an extent that the tube partly or wholly ceases to function. As soon as the noise impulse ceases, the negative voltage is removed from the grid of the silencer tube and the channel is returned to the condition of maximum sensitivity.

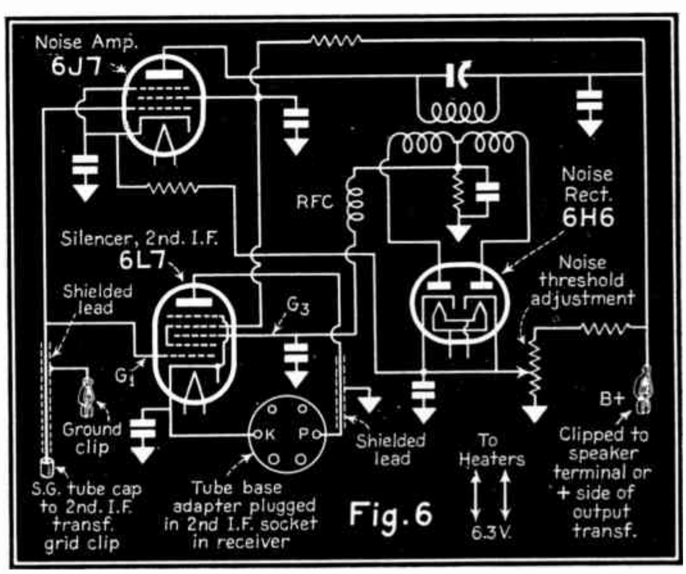
Thus, for each noise impulse of high amplitude appearing with the signal, both noise impulse and signal are virtually wiped out in the lower channel. But, as previously explained, the wipe-out or interval of silence is of such short duration that the ear is insensible to the action.

The Noise Silencer Circuit

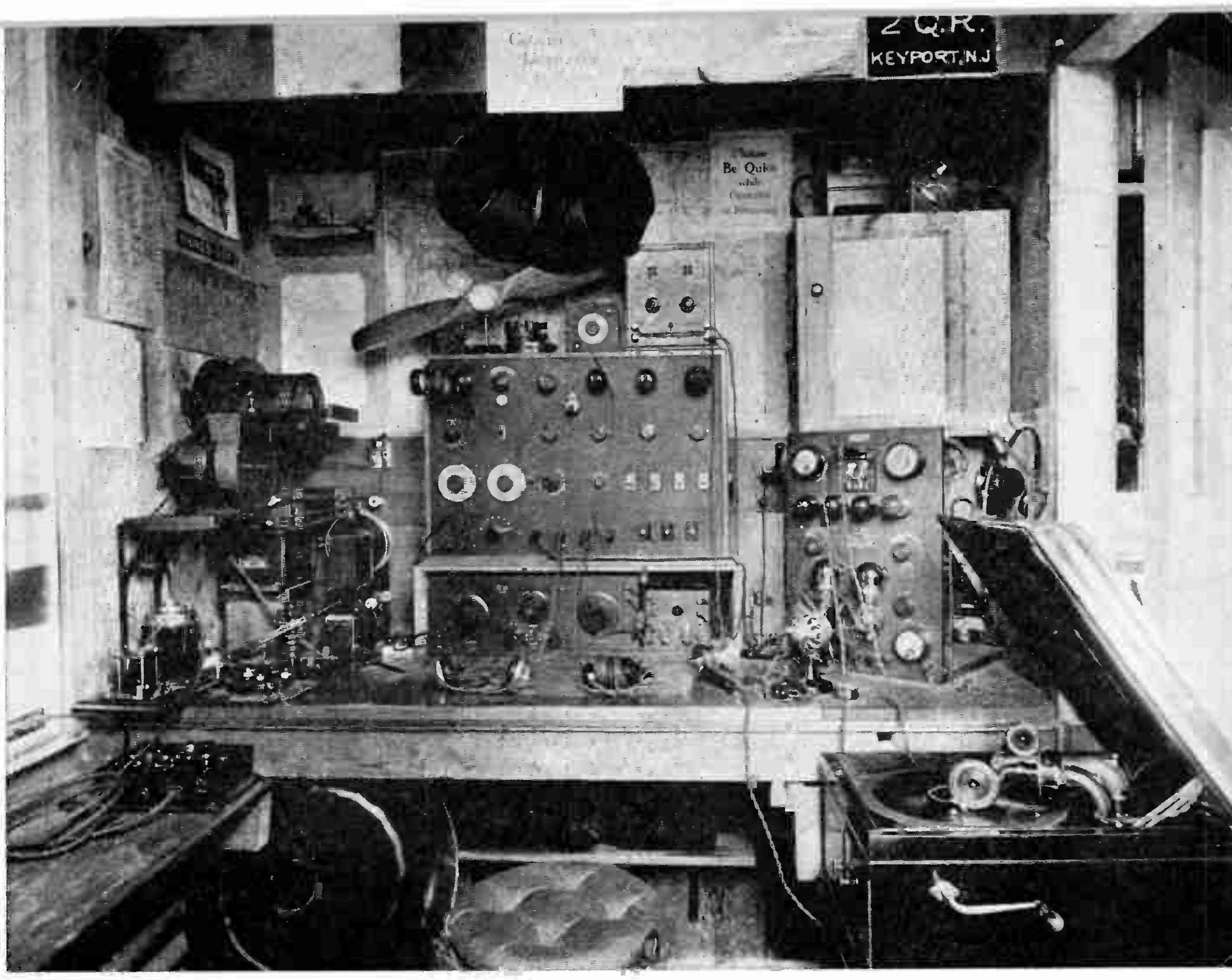
The actual circuit of the noise-silencing system is shown in Fig. 5. The i-f transformer T feeds both channels from the point X. Note that the control grids of the 6J7 noise amplifier and 6L7 silencer are returned through this transformer to the load circuit of the 6H6 diode second detector and avc tube in the lower channel. Thus both the 6J7 and 6L7 tubes are tied in on the avc circuit. This insures the maintenance of a signal of constant level and there is, therefore, no possibility of the noise channel being triggered off due to a rise in signal voltage above the level of the negative bias voltage placed on the noise channel by the adjustment of the noise threshold potentiometer R-1. It is necessary, after all, to adjust this potentiometer to a point where the delay bias on the diode plates of the noise rectifier tube is sufficient to prevent rectification of the signal voltage, but still at a point where any voltage greater than that of the signal will cause the development of a negative voltage in the diode load resistor R.

In operation, the noise channel is adjusted by R-1 so that any noise impulse greater than the signal voltage will be sufficient to overcome the delay bias placed on the 6J7 and 6H6 tubes. In such an instance current flows in the load circuit of the diode noise rectifier. A d-c voltage is therefore developed across the load resistor R. It is this

(Turn to page 95)



Circuit diagram of the noise silencer which may be used with any superheterodyne receiver having two stages of intermediate-frequency amplification.



A very elaborate home station owned and operated by Hugh and Harald Robinson at Keyport, New Jersey, under the call letters 2QR. This was the first amateur radiophone station to be heard on voice across the Atlantic, and music from this station was reported from various parts of England on many occasions. The power employed was approximately 40 watts.
From left to right, most of the important equipment includes the Magnavox amplifier with the first dynamic speaker unit shown directly above it, and above that the nonsynchronous Clapp-Eastham rotary gap and oscillation transformer. In this group will also be found the Murdock antenna switch and Thordarson transformer with an extremely large Dubilier condenser. In the center of the picture, directly below the morning glory horn, is the "all-wave" honeycomb coil three-circuit receiver, which was made in the same housing as the detector and two-stage audio amplifier. Directly below it will be seen the Grebe CR3, one of the first receivers designed for exclusive use on short waves. The business end of the transmitter is shown at the right and the fan in the foreground was employed to prevent the rectifying tubes in the transmitter from burning up.

The Story of Amateur Radio

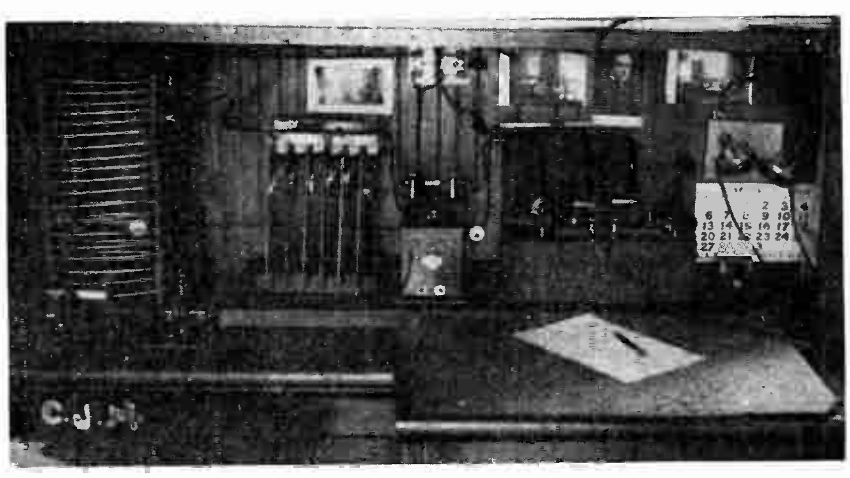
AMATEUR RADIO WAS born the day Marconi succeeded in transmitting signals across the space of a laboratory, and from this time the list of experimenters has increased from a mere handful to the present number of over 50,000 dyed-in-the-wool radio Hams.

"Wireless" filtered into the consciousness of the public at the turn of the century; it also filtered into the inquisitive minds of a few born tinkerers who found in this new marvel an immeasurable fascination.

The Amateur Appears

It seemed almost beyond belief that with the aid of a few instruments it could be possible to hurl waves through space that would actuate a receiving device miles away. But it was being done; the newspapers were running accounts of the remarkable feats of telegraph transmission sans the aid of wires. If this were the case, then surely it should be possible to duplicate the experiments over shorter distances with home-constructed equipment.

The more ambitious experimenters set right to work gathering data on the "commercial" equipment and building from odds and ends the various devices



At about the same time that the equipment used by the late Al. Grebe at FV was in operation, this rather neat ham station was used by Charles J. Mitchell, at Richmond Hill, Long Island. The large helix at the left was a forerunner of the oscillation transformer and the large glass plate condenser adjoining it was made from photographic plates from which the photographic emulsion had been removed. In those days the 2" spark coil shown in the center was considered to be quite modern. Immediately to its right, may be seen one of the first ham loose couplers, and mounted on the same cabinet there are three crystal detectors. A Perrikon at the left, a silicon detector in the center and a galena detector at the right. On the desk, beside the loose coupler, may be seen the very commercial looking telegraphic key, which could break a 5-kilowatt circuit almost as well as it could the 2" spark coil.

We present upon these pages the first of a series of articles dealing with the history, the growth and the technique of Amateur Radio. If these articles serve only to create in the minds of radio fans a clearer understanding of just what Amateur Radio is and what it stands for, they will have performed a valuable service—but we are quite sure that the series will accomplish more than this; we are confident that from these "essays on the development of a unique radio science" the reader who has not entered the realm will appreciate that there is a definite tie between himself and his brother "Ham." We are equally as confident that the series will serve as an inspiration to many readers who will find in Amateur Radio an almost inescapable attraction.

We sincerely trust that the old-time Ham will capture from these accounts of earlier days a bit of pleasant nostalgia, and that the new-comer to the field of Amateur Radio will find in each installment the assistance he earnestly seeks to round out his knowledge of the peculiar, and in many cases intricate, technicalities of this radio fraternity. The photos of stations on these pages were collected by Arthur H. Lynch.

required for transmission and reception of signals. The equipment was crude—crude beyond belief—but somehow it was made to work and communication was carried on over a distance of a few city blocks and later over distances of a mile or so.

These were the days of the spark coil and the coherer. But it was not long before these youthful experimenters learned that transmitters could be tuned by means of coils so that the signal would have a definite "wavelength," and further, that by means of tuning coils at the receiving positions, a number of stations in close proximity could operate simultaneously without interfering with each other.

And thus the art of amateur radio developed. The spark coil gave way to the 110-volt transformer, the straight spark gap gave way to the rotary gap, and the coherer was replaced with the crystal and the electrolytic detector. The transmitted signal took on the character of tone and was reproduced in earphones as sound of varying duration rather than clicks or raspy impulses. And with each improvement in the equipment new distance records were chalked up. Miles were being covered—not just city blocks.

First "Wireless" Club

These were the years 1906 to 1910. As early as 1909 there was formed in New York City, the Junior Wireless Club, Limited, later to become the now famous Radio Club of America. The officers of the club included W. E. D. Stokes, Jr., Prof. R. A. Fessenden George Eltz and Frank King. Others who joined in later years were: George Burchard, E. H. Armstrong, Dr. Hudson, Dr. Goldhorn, Ernest Amy, A. H. Grebe, and Irving Vermilya.

By 1912 there were over 100 members and the club, by then the Radio Club of America, was forced to have typed for its members a list of station calls. Most calls were made up of the operator's initials: Ernest Amy was "EA", although some of the members whose initials were not rhythmic in code, selected more appropriate call signs. George Eltz selected "GZ" rather than the ungraceful "GE." Louis Gerard Pacent selected "ABC"—a letter combination which is used today as a test signal by commercial code stations.

These experimenters were the pioneers of Amateur Radio, but the real pioneer—the motivating force behind the development was W. E. D. Stokes, Jr., just 13 years old when he proposed and carried out the formation of the first wireless club in 1909. Were it not for young Stokes, Amateur Radio might not be in existence today, for in 1910, at the age of 14, he headed a delegation to Washington and effectively killed a bill introduced by the late Senator Chauncey Depew which, if it had gone into effect, would have prohibited all amateur wireless experimentation.

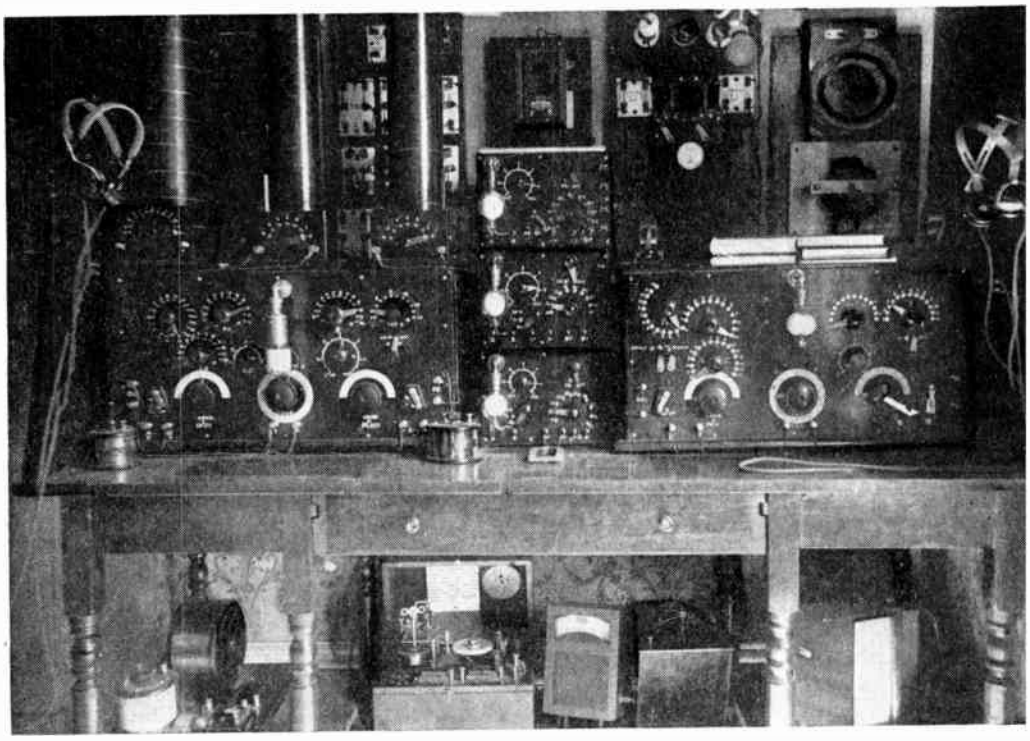
The New York *Globe* of April 28, 1910, carried headlines which read: BOY WARS ON THE AIR TRUST. "Buster" Stokes, 14 Years Old, Talks to Senate Committee. Bill to Curb Amateurs Is Earnestly Denounced by Him.

This was probably the first instance that brought the word "Amateur" to the public in connection with radio.

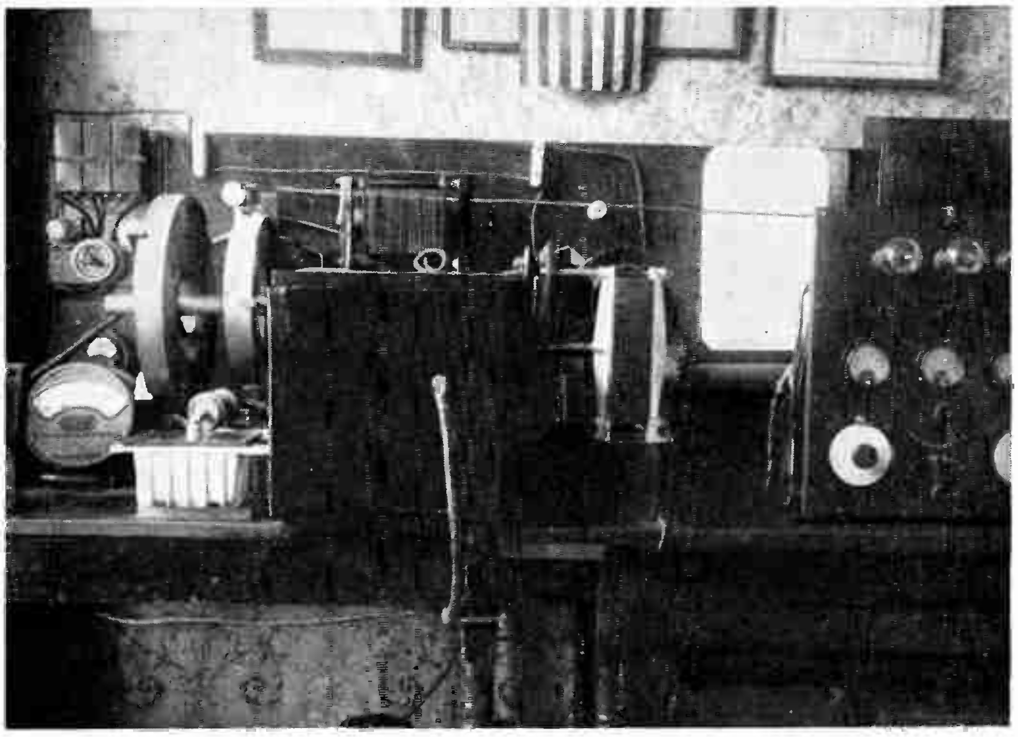
These were the years of Amateur Radio when no licenses were required and no restrictions were placed upon operating practices. Amateurs shared the air with the naval and commercial stations and in more cases than one the amateur used greater transmitting power. It was natural that difficulties arose from such a situation, but it was not long before the amateurs themselves co-operated to the extent of offering practical suggestions for the solution of the interference problem.

A Rough Road

These, too, were the years in which the radio amateur was strengthened by ad-



This elaborate group of equipment was used by Dr. Parker for reception. To the left we have the long-wave receiver with stove pipe or pillar inductances. The pillar inductances were employed in the primary, secondary and tickler circuit and the regenerative receiver shown immediately below. An ultra-audion circuit was employed, and directly to the right, in the center of the photo, will be seen three single stage audio amplifiers connected in "cascade." Each tube was provided with separate filament control, as well as with a switch to provide regulation of the "B" battery voltage. Tubes at that time were not as regular in their performance as they are today, and critical manipulation of the filament current and plate voltage was necessary. On the table, to the right, is shown the short-wave receiver. It, too, was an ultra-audion regenerative arrangement.



This station was owned and operated by Dr. DeWitt L. Parker, at Brooklyn, under the call letters of 2ABA. Old timers will recognize the Acme transformer which is shown right in the center of the picture. The synchronous rotary gap is housed inside the square section which was made from an old icebox and used to muffle the noise produced by the rotary gap. One of the first quench gaps used by amateurs in this country, is shown directly above. The loose coupled spiral wound, brass ribbon, oscillation transformer, made by Earl Dannals, 2GL, is shown directly to the left of the spark gaps. Dannals installed the entire station. To the right, there is a complete radiophone transmitter, incorporating three Western Electric tubes, grid modulated. This type of transmitter became extremely popular in the New York area at that time.

versity. Great slices of the ether were required for naval and commercial wireless communication and slowly the amateur was pressed for a clear space in which to operate. Time and again his existence as an amateur was threatened and time and again he came through, still holding on to that one precious privilege—the right to a share in the then overcrowded wavelength spectrum.

At the same time the amateur came to assume a considerable amount of importance. Young men and elderly men absorbed in radio as a hobby were carrying on their own development work. No longer were they borrowing all their plans and ideas from the "commercials." The amateur himself was contributing to the rapidly increasing store of radio knowledge.

The amateur had progressed so far, as a matter of fact, that in the year 1911 George Eltz and Frank King constructed an arc radiotelephone transmitter and broadcast music for the entertainment of the fleet then anchored in the Hudson River. Both these young men were members of the original Junior Wireless Club, Limited. In 1915, E. H. Armstrong, another young radio amateur and a member of the Radio Club of America, discovered that a signal passing through an audion or radio tube could be fed back to the input of the tube and re-amplified. Thus there came to light the famous feedback circuit which is the very heart of all modern forms of radio transmission and reception. In later years Armstrong developed the Superheterodyne and Super-regenerative circuits.

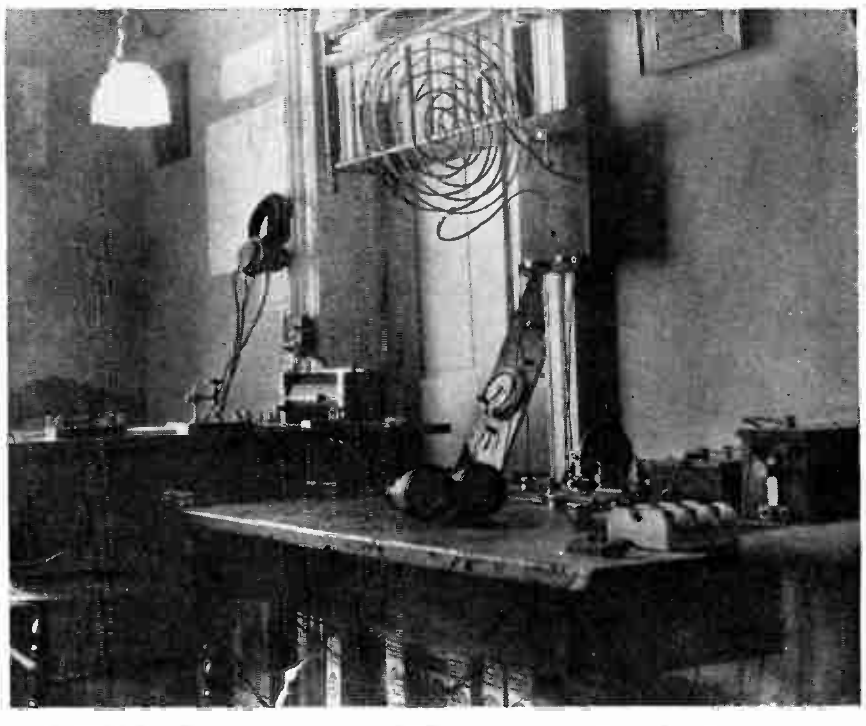
A.R.R.L. Formed

From 1910 to 1915 amateur radio made rapid strides. Many "beginners" entered the ranks, and in Hartford, Connecticut, Hiram Percy Maxim formed the now world-famous American Radio Relay League. Amateur radio was no longer confined to a small part of the east; it had spread out toward the north, the south and the west. Those who could afford it increased power, junked the old rotary gap and the helix and replaced these with synchronous (sink) rotary gaps and "oscillation transformers." The tuning coil was dispensed with in receivers; the loose coupler came into vogue and was shortly thereafter replaced by the variometer. The crystal detector that had served the amateur so well was cast aside for Dr. DeForest's "Audion," the "Audiotron" and the Moorehead Tube. Then the variometer gave way to the straight coil tuned by a variable condenser.

And still the amateur reached out further and further. Fifty miles, a hundred miles, a thousand miles, the Ham flung the husky sound of his "rotory" or the sweet whine of his "sink." And yet the end was not in sight.

In Mount Vernon, New York, the genial Dr. Goldhorn, a member of the Radio Club of America, was doing remarkable things with vacuum tubes and receivers. It was reported that he was

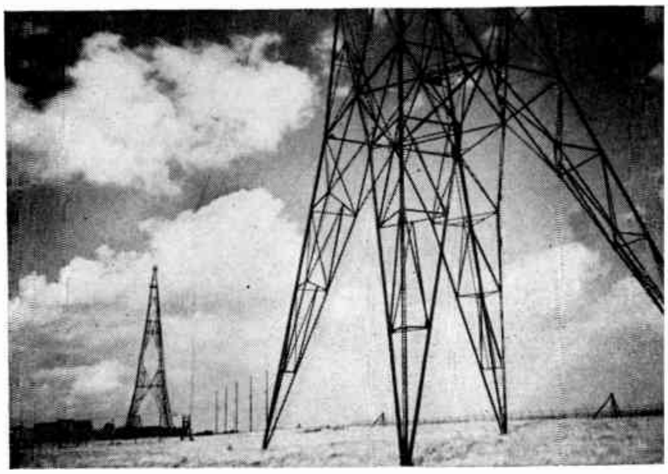
(Turn to page 95)



This interesting rig was the property of Edwin S. Crane and about 1914 it cut a considerable hole in the ether under the call letters of 2EA. Ed has been out of ham radio for some little while, but he is now back on the air on five meters. His call is W1FV and he is located at Hempstead, Long Island. In this layout, we have from left to right, a potentiometer of the multi-contact type which was used to control the current flowing in the electrolytic detector. We have, immediately to its right, a double slide tuning coil. The transmitter is located at the table to the right and one of the first of the very small type rotary spark gaps may be seen. The ubiquitous 2" spark coil may be seen at the extreme right. The large binoculars in the center of the operating table were used to try to locate signals from other stations.

PHI-PCJ

The Voice of the Netherlands



The Short-Wave Stations at Eindhoven, Holland, Which Are Regularly Heard in All Parts of the World. Announcements Are Made in Dutch, English, French, German and Spanish

MARCH 12TH, 1927 was the memorable day upon which the Philips Radio Laboratory in Eindhoven received a cable from Bandoeng saying: "We hear you!"

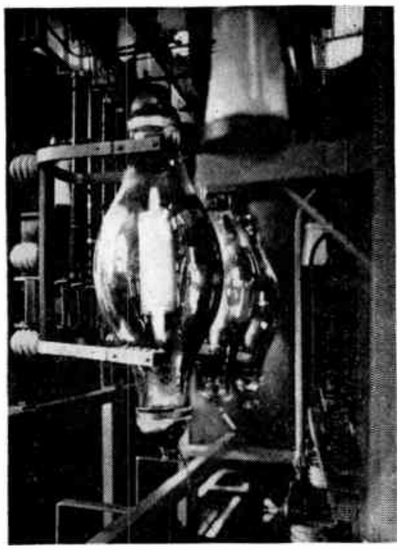
The experimental Philips-transmitter PCJJ, for telephony on short waves, had bridged the distance separating Holland from its colonies. Success crowned the energetic effort before anyone had dared hope for it. The result of the experiment was Holland taking its place among the foremost in the realm of the ether, and a few months later the modest PCJJ laboratory installation developed a world-famous station where reports were being received from listeners-in living in all parts of the world.

The most important factor attached to this event was its cultural value: private initiative serving the good of the country and its people. This was brilliantly proved when on June 1st, 1927, H. M. the Queen spoke, via the PCJJ microphone in Eindhoven, to Her subjects scattered all over the East and West Indies.

The enthusiasm of the Dutch people, at home as well as in the colonies, proved the practical indispensability of such a transmitter. The question of a definite broadcasting station for the Colonies was discussed. The PHOHI was born.

Mr. Edward Startz, the famous PHOHI announcer, who makes announcements in Dutch, English, French, German and Spanish.

Above: The towers supporting the antenna at PHI. Below: The bank of high-power tubes used in the output of the PHI transmitter. These tubes pump 20 kilowatts into the antenna.



The Experimental PHOHI

The first step towards the realization of this plan was the establishment of the N. V. Philips' Omroep Holland-Indië (Phohi = Philips Broadcasting Holland-India). Thanks to the aid of agrarian cultivation enterprises, shipping and oil companies, banks and commercial institutes, who immediately visualized the importance of these transmissions with regard to their employees, the PHOHI could be established. The experience obtained with the PCJJ transmitter was most useful at the time when the new transmitting installation was being built.

In the autumn of 1929 the first experimental transmissions were broadcast. on a wavelength of 16.88 meters. The output of the transmitter was 20 kilowatts which even now is still considerable for a short-wave transmitter.

The results were good from the very beginning. That same Christmas various American transmitters relayed the PHOHI program. The experiment was more than successful. The first mail brought expressions of thanks from hundreds of people in America.

The reception in the East Indies which included the experimental broadcasting of a football-match, was excellent.

Spring 1930

At that time, the Soerabayan "Handelsblad" wrote as follows: We deem the name PHOHI, PHILIPS OMROEP HOLLAND-INDIE (Philips Broadcasting Holland-India) to have become old-fashioned, notwithstanding it being only one year old. It really must be changed into PHOHA, i.e., PHILIPS-OMROEP HOLLAND-AARDE (Philips-Broadcasting Holland-World).

And further, "At this minute, not one other shortwave station can compete with the PHOHI, be it with regard to the transmitter or program."

This, better than anything else, shows how the PHOHI immediately became an integral part of the Dutchman's life in the colonies. The PHOHI brought him compensation in his loneliness far away from his relations, friends and home-country.

Famous artists, ensembles and orchestras collaborated and after a six months' existence the PHOHI reached a pinnacle of appreciation and enthusiasm on the part of its admirers, such as no other broadcasting station probably ever enjoyed. The whole of India and, moreover, many others, were grateful to the PHOHI.

The PHOHI Closes Down

The rather erratic development of the broadcasting in Holland necessitated the government's intervention. The PHOHI-transmitter, entirely the child of private initiative and own capital, with only one aim, serving the Dutch abroad, fell a

(Turn to page 94)

A HIGH-FIDELITY ALL-WAVE RECEIVER

By J. A. WORCESTER, Jr.

THE CONSTRUCTION of a single-control superheterodyne has been complicated to such an extent by the introduction of the "all-wave" coverage angle that it is practically an impossibility for the average constructor to undertake the work unless he is fortunate enough to possess a good signal generator and adequate testing and measuring apparatus. Even with these facilities, there are numerous bugs that crop up in the high-frequency section of the receiver that generally require patient engineering to exterminate.

The R-F Amplifier

The intermediate amplifier and audio system, while requiring reasonable care, are entirely within the capabilities of the home constructor. It is evident, then, that a successful receiver of this nature should have the high-frequency portion engineered, constructed, and adjusted in a complete, ready-to-use, assembled unit. This requirement has been met by using a special tuner which covers the complete spectrum of 550 kc to 22 mc in four ranges. This unit is nicely engineered and constructed and forms an excellent foundation for an all-wave receiver.

Having satisfactorily disposed of the high-frequency portion of the receiver, our next concern is that of the intermediate amplifier. By this time the reader has doubtless been convinced by the numerous articles appearing in the radio press that a really up-to-date all-wave receiver should be capable of high-fidelity reception. In practice this means that the response curve of the intermediate amplifier should be adjustable so that as many sidebands as noise and interference conditions permit are transferred to the audio amplifier. Of course, it also follows that the audio amplifier should be capable of passing all of the useful audio frequencies without appreciable attenuation or non-linear distortion and that the loudspeaker should be capable of reproducing them. These requirements will be dealt with in subsequent paragraphs.

A variable i-f response curve is obtained in this receiver by using variable coupling transformers. A two-stage amplifier is used with only the first two transformers ganged to the selectivity control. The last transformer feeding the diode second detector is loaded sufficiently by the diode resistance so that it is broad enough when coupled for maximum gain.

Two I-F Stages Used

There may be some question as to why a single i-f stage was not employed. It was found that in order to obtain satisfactory sensitivity from a single stage it was necessary to operate it at its maximum efficiency. This means that not only would many constructors fail to obtain this condition, but that a considerable variation in performance with temperature and humidity conditions would result. Furthermore, an appreciable amount of regeneration is necessarily present which results in excessive sideband cutting in the selective position. The selectivity of a single stage also leaves something to be desired; especially at the base of the selectivity curve where the beneficial effects of regeneration disappear.

In view of these disadvantages, it was

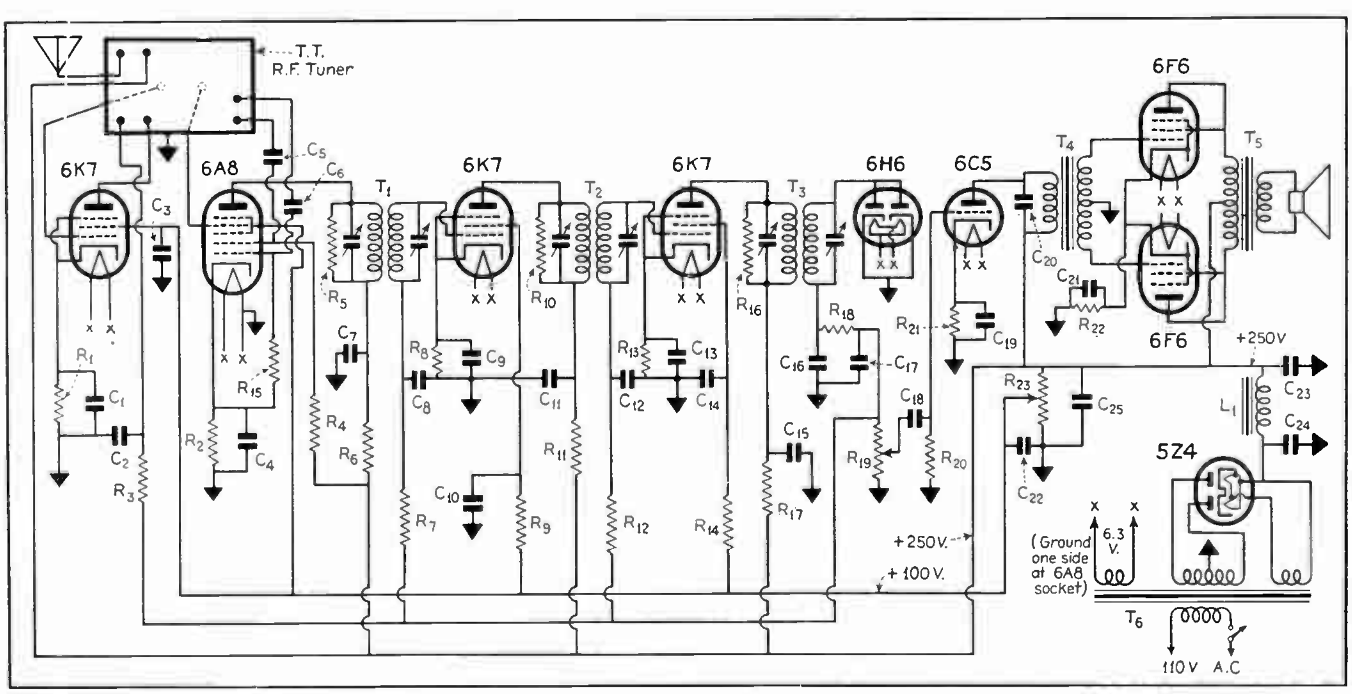
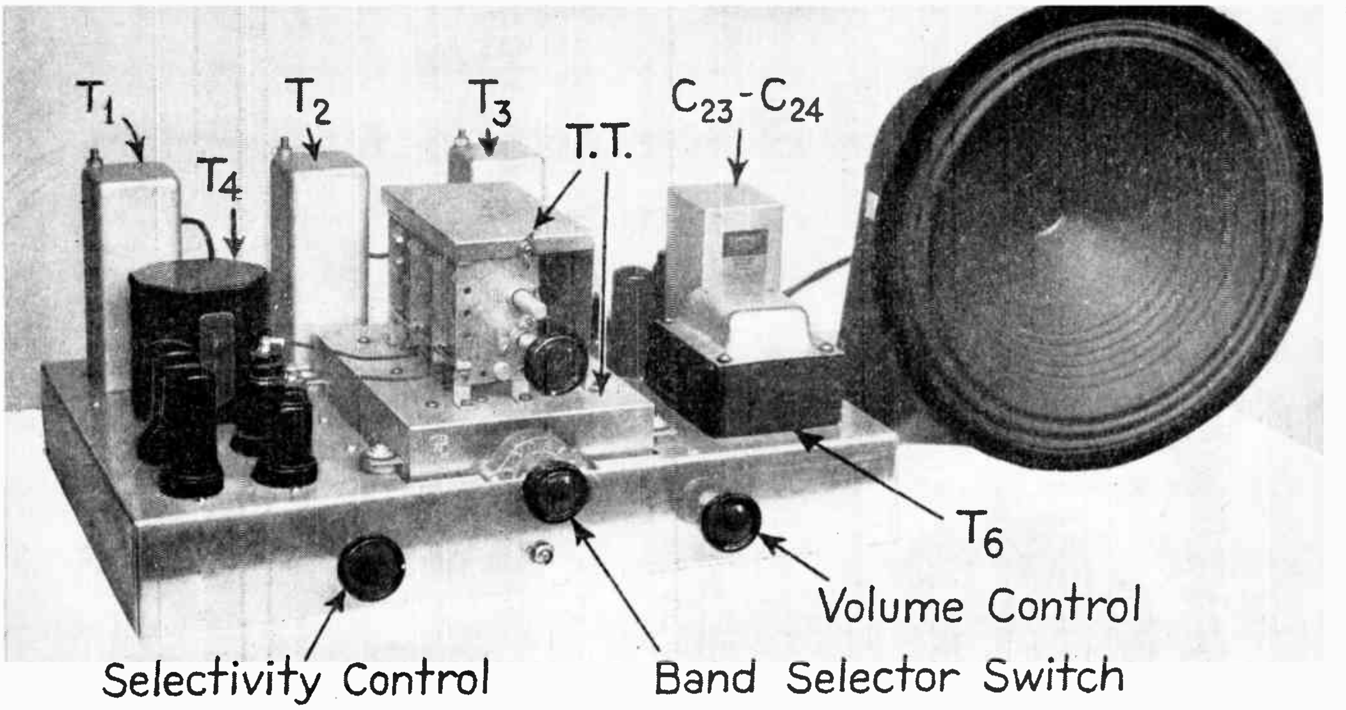


Diagram of the high-fidelity all-wave receiver. See legend on page 64 for parts values.



View of the completed receiver with principal units designated. The tuning dial has been removed from the r-f unit to show the tuning shafts and band-selector switch.

deemed advisable to use two stages of relatively low-gain amplification which would provide substantially greater stable gain with a selectivity curve having a broader nose and steeper sides. Since the windings are damped by shunt resistors across the primaries, there is practically no variation in the gain caused by changes in the coil "Q's" with humidity and temperature changes.

The Audio Amplifier

A diode second detector is employed as it provides the simplest method of obtaining antomatic volume control. The first a-f amplifier tube is a 6C5 triode which readily permits transformer coupling to push-pull output tubes. Obviously, in order to obtain high-fidelity reproduction the audio amplifier has to be carefully designed to pass the useful audio band without appreciable attenuation, as well as to prevent the introduction of harmonic distortion. The former requirement is met by using a strictly high-grade input transformer. Too much stress cannot be laid on the importance of this one unit for high-fidelity results. A cheap transformer will ruin an otherwise perfect layout. Harmonic distortion is minimized by employing a strictly Class A push-pull output stage. For this purpose 6F6 audio pentodes are used with their screens tied to the plates in order to obtain triode operation.

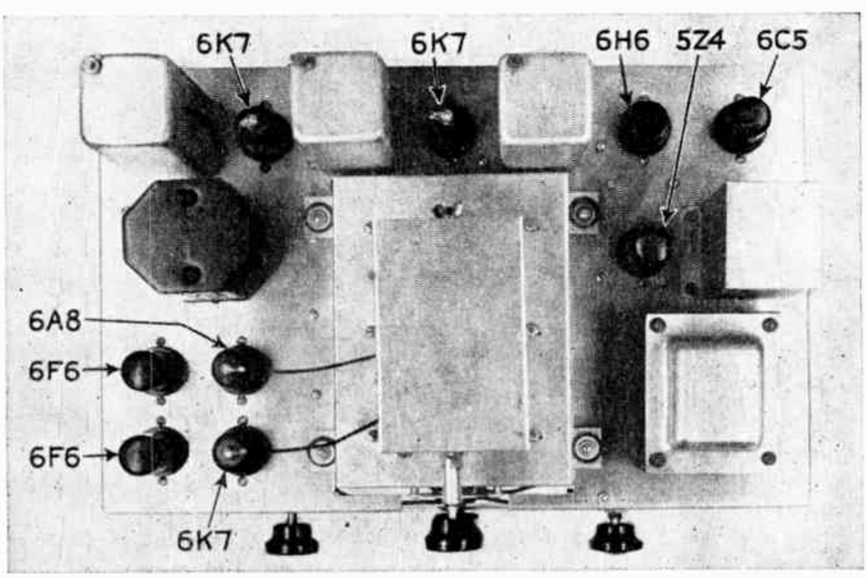
The final link in the receiving system is the loudspeaker. Of course, it goes without saying that perfect attention to all details up to this point will be to no avail if the reproducing system is not capable of passing an adequate frequency band. In order to assure satisfactory results a special high-fidelity loudspeaker is used which is capable of reproducing all frequencies from 30 to 7500 cycles.

Construction Details

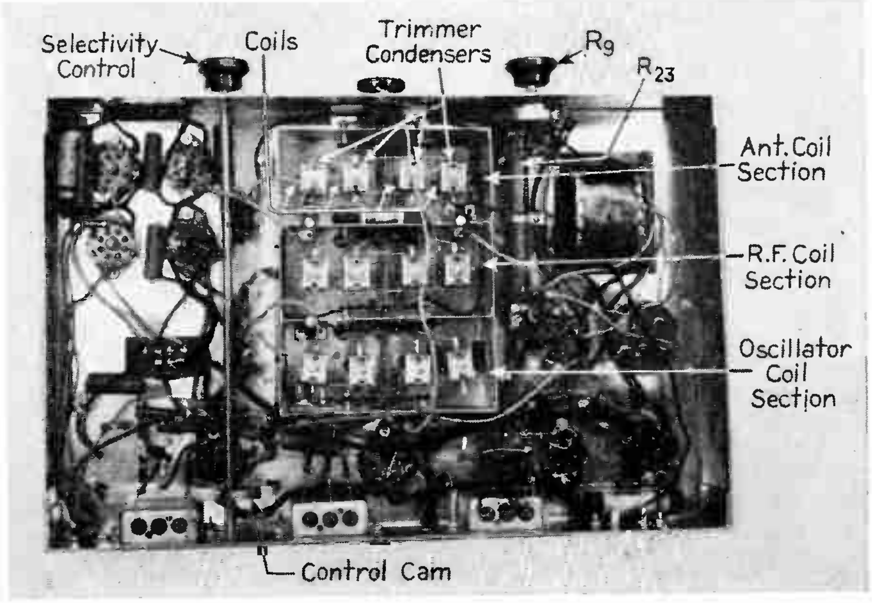
Now for the actual construction of the receiver. The chassis is made from 14 gauge "hardness" aluminum and measures 11" by 17" by 3". The location of the various parts is evident from an inspection of the photographs and no detailed dimensions are necessary. If desired, the chassis can be obtained ready formed and with the large tuner unit hole and socket holes drilled. In mounting the special tuner, it is essential to acoustically insulate the unit from the chassis with the rubber grommets supplied with the unit. Otherwise, howl on the higher frequencies will result on strong carriers when the condenser is set slightly off resonance. This permits any capacity change in the gang or trimmers due to acoustic vibration to wobble the signal up and down the sides of the i-f curve and hence produce an audible signal. Howl is one of the most persistent problems associated with all-wave reception and in order to satisfactorily reduce it the chassis should be cushioned with strips of rubber or felt when mounting in the cabinet.

I-F Controls

The variable coupling i-f transformers are mounted along the rear of the chassis as shown in the photographs. The underside view will give a good idea of the method of ganging the first and second i-f coupling controls. It will be noted that in this design a cam is used to vary the coupling. This cam can easily be made by sawing a quarter-inch length from a ⅞" diameter copper rod and



Top view of the receiver, showing location of each tube on the chassis.



Underside view of the chassis, showing location of coil sections, trimmer condensers, etc.

drilling a ¼" hole in it ¼" off center. This is fastened to a ¼" shaft by means of a set screw. Possible alternative methods will doubtless occur to the individual constructor.

Wiring Details

The wiring for the most part is simple and straight forward. Of course, the usual precautions regarding the use of short and direct connections for "hot" leads apply. Lug terminal strips are extensively used to permit rigid and permanent mounting for resistors and condensers.

The resistors R5, R10, and R16 are used to limit the gain to a desirable level and preferably should be mounted inside the i-f shield cans. The same applies to the diode filter C16, R18, and C17. If the constructor does not care to dismantle the transformers it is, of course, entirely feasible to mount these items externally as was done in the model. Incidentally, it is necessary to bring the grid lead on the last i-f transformer down under the chassis in order to connect to the diode plates. When connecting the dry electrolytics C19 and C21 it is necessary to observe the polarity. The proper procedure is to ground the negative terminal. C21 may be omitted if desired, though it is well to include it as a precautionary measure.

Adjustments

After completing the receiver, the first adjustment is to line up the i-f amplifier. This can best be done with a signal generator and output meter; though it can be lined up fairly well by ear by turning up the volume control with no aerial and tuning for maximum noise. The special tuner has been initially lined at the factory but will probably need some re-alignment due to variations in the stray capacity of the external circuits. The rear (oscillator) section should not be touched unless the tuning does not coincide with the scale calibration. To line up the scale correctly, adjust the trimmers only. Do not touch the larger adjustable padders mounted on the side.

Trimmer adjustments should only be made with the gang tuning condenser at or near minimum capacity. After lining up the oscillator trimmers so the scale reads correctly (do not touch them unless you definitely know them to be out), the next step is to adjust the r-f and antenna circuit trimmers. These can also be adjusted by trimming for maximum noise if no signal generator is available. Remember to have the tuning condenser plates all out when making these adjustments.

Selectivity Control

The speaker should be mounted on as large a baffle as the cabinet will permit. The operation of the fidelity control will become immediately evident. Note the striking improvement in high-frequency response as the rods are raised. Incidentally, the collars should be adjusted so the rods extend about one-eighth inch or until the volume is not appreciably increased by raising farther. With a little experience the proper adjustment of the control consistent with the prevailing noise level and the strength of the signal, will become evident.

LEGEND

T.T.—Tobe Tuner .55-22 mc, 4 ranges.
T1, T2, T3—Hammarlund variable coupling i-f transformers, air tuned, 465 kc.
T4—United (UTC) PA-132 push-pull interstage transformer.
T5—Supplied with Jensen high-fidelity loudspeaker, see below.
T6—Power transformer. Primary 115V, 60 c. Sec. 350/350V, 110 ma, 6.3V. 4 amp., 5V, 3 amp. Trutest YC1520. (United).
R1, R8—IRC 400-ohm resistors, ½ watt.
R2—IRC 350-ohm resistor, ½ watt.
R3, R20—IRC 1 megohm resistor, ½ watt.
R4—IRC 20,000-ohm, 1 watt.
R5, R10, R16—IRC 150,000-ohm resistors, ½ watt.
R6, R11, R17—IRC 5000-ohm, ½ watt resistors.
R7, R12—IRC 500,000-ohm resistors, ½ watt.
R9, R14—IRC 20,000-ohm resistors, ½ watt.
R13—IRC 1,500-ohm resistor, ½ watt.
R15—IRC 100,000-ohm resistor, ½ watt.
R18—IRC 50,000-ohm resistor, ½ watt.
R19—Electrad volume control, 500,000 ohm, tapered, (slow increase at ground end.)
R21—IRC 1000-ohm resistor, ½ watt.
R22—IRC 250-ohm resistor, 1 watt.
R23—Electrad voltage divider, 15,000 ohm, 50 watt.
C1, C2, C3, C4, C7, C11—Cornell-Dubilier .05-mfd tubular bypass condensers, 400 DCWV.
C8, C9, C10, C12, C13, C14, C15, C22, C25—Cornell-Dubilier .1-.1-.1-mfd paper condenser blocks, 400 DCWV.
C5—Cornell-Dubilier .002-mfd mica condenser.
C6, C16—Cornell-Dubilier .0001-mfd mica condensers.
C17 — Cornell-Dubilier .00025-mfd mica condenser.
C18—Cornell-Dubilier .02-mfd tubular paper condenser, 400 DCWV.
C19, C21—Cornell-Dubilier 10-mfd, 25-volt dry electrolytic condensers.
C20 — Cornell-Dubilier .0004-mfd mica condenser.
C23, C24—Cornell-Dubilier 16-8 mfd dry electrolytic filter condenser, 450 DCWV.
L1—Field coil of Jensen high-fidelity loudspeaker, see below.
1—Blan chassis, 14-gauge aluminum, 11" by 17" by 3".
1—Jensen A-12 high-fidelity loudspeaker 14 watt, 150 to 180-volt, d-c field, 8000-ohm input impedance.
8—8-prong laminated metal tube sockets.
1—5-prong laminated metal tube socket.
7—Lug terminal strips, 1 4-lug, 1 3-lug, 5 2-lug, WRS.
3—6K7 metal tubes.
1—6A8 metal tube.
1—6H6 metal tube.
1—6C5 metal tube.
2—6F6 metal tubes.
1—5Z4 metal tube.
1—A-C cord.
1—Antenna-ground strip, Eby.
1—ICA toggle switch. (H&H).

Roses and Razzberries

By BEAT NOTE

WE HAVE come across what we believe to be the most outstanding anti-climax for the year 1936. It is much too good to be lost to the world, so we are recording the essentials.

It has to do with as nice a bit of dramatic writing as any aspiring newspaper reporter could wish to turn out. And, of course, it has to do with radio.

In the opening paragraphs the reader is gripped by the alarming situation of an hysterical woman under the dangerous dominance of her husband suddenly gone completely out of his head. It is almost three o'clock in the morning —and the world is asleep. What chance is there for this woman to gain assistance before it is too late? Would her screams be heard? Could the police arrive in time?

It is, we assure you, a very tense story, and a very tense moment. She manages to reach the telephone and hurl a few broken sentences into the ear of the Captain at police headquarters. And it is at this point that our reporter adds the perfectly swell paragraph that did up the story as neat as a packet of Seidlitz Powders.

Upon learning of the woman's grave danger, the Captain, we are told, "with the ease and assurance of a veteran of many years of radio patrol work, flipped on the two-way set and said, *'Calling both cars.' 'Calling both cars. . . .'* "

◆

OUR GOOD next-door neighbor, Zeh Bouck, spoke last month of the deep-rooted desire of Edward Hope to erect a broadcasting station on a small island in the middle of the ocean, and from this station broadcast every dirty story he had ever heard.

Not until we read this did it occur to us that there might be loads of people with the same inherent desire who might, by virtue of their mental framework, be interested in a little invention of ours that was brought to fruition during a serious attack of *Radiopollyannis.*

The little invention is nothing more nor less than a combination radio-pornograph; a simple device with toggle switch that permits the operator to add to broadcasts a riotous accompaniment of ever-changing pictures of life as she is led.

The device is really no end of fun. One can view the night life of Babylon while listening to a plug on Korn Kookies for Kiddies, or view with pleasure the divine form of a Broadway Venus while the ears toy with a bit of chamber music played by a string quartet.

The combinations that may be obtained are unlimited. It is true that some give about the same effect as if you were to eat stewed tomatoes with maple syrup poured over them, but on the whole the instrument is just a circus of fun.

We recommend it for worn-out cynics in particular.

◆

WE HAVE NOTED with mixed feelings the cases in which are shipped the new metal-tube receivers. They are very plainly marked, GLASS—HANDLE WITH CARE.

We believe an inscription with decidedly improved appeal would be, EXPRESSMAN — NUTS TO YOU!

◆

THERE IS certainly no doubt that the eyes have it. No sooner does RCA come out with Magic Eye receivers than our own Uncle Sam inscribes a similar optic on the reverse side of the new dollar bill.

Boy-oh-boy-oh-boy . . . some pull!

◆

THERE IS nothing more disturbing than to have one's ritual disjointed by a complete stranger. We had this happen to us.

It has been our habit to witness each evening the Swan's Death of the 20-meter band. We recline in a deck chair with earphones on and check out the boys from afar as their signals fade into the beyond—wishing each boy *bon voyage* as he passes by.

This we have done with regularity for quite some time, until an evening recently when an XE persisted in ridding through long after the band had tucked itself into bed.

We had heard the fellow earlier in the evening, and having had some experience with Mexican hospitality, we had fully planned to offer him our best *bon voyage* as he slid off the edge.

Our relations with each other actually became strained as early as 8:30 o'clock. By 9 we had lost what little patience we had left. By 9:30 we had become enraged over the fellow's audacity and fully believed that he was purposely dallying with us.

At 10 we smashed the earphones, dented Moo-Moo's behind and ripped apart a new radio catalog.

We have since, as we implied earlier, given up the nightly ritual. It was a childish idea at best.

◆

OUR SAD experience on the 20-meter band had a great deal to do with our descending to 28 mc. This is a rare band indeed.

We do not know what luck other people have had in the 10-meter band, but we consider our own catches highly satisfactory. At the very first try we intercepted W2HFS, 50 Fords, a Mack truck and a Rolls Royce breezing down Hollywood Boulevard.

(*We have since received a veri from the Rolls Royce*).

◆

NOW THAT Christmas is well out of the way, we feel safe in making the remark that what's duck soup to one man is hog wash to another.

During Christmas week, peace on earth, good will to man was expressed most cheerfully by the little blinking electric lights on the Xmas Trees. People passing houses peeked in at the pretty sights and went their way with hearts full to the brim—while thousands of short-wave listeners and amateurs were slowly driven to insanity by the interference set up by these little messengers of good cheer.

And tucked away in a small-town newspaper is the account of the big, strapping man who dashed out of his house and turned over a Ford parked out front with its motor idling.

The man was judged insane. What do *you* think?

◆

WE WERE interested in observing on a recent Bing Crosby broadcast from California, that a delay in transmission was due to conditions beyond the con-

(Turn to page 93)

GLOBE GIRDLING

CONDUCTED BY J.B.L.HINDS

FROM THE NUMBER of reception reports read over the air each Sunday night from Station HRN, Tegucigalpa, Honduras, one must realize the number of those interested in short-wave, long distance receiving. And after listening to this "Appreciation Hour" for several weeks past it is the opinion of the writer that the great majority of those making the reports that are read, know something about the "R" system of reporting signal strength as well as the accompanying QSA, QSB, QSN, and QSM indications, although I have been somewhat amused by the number reporting R9 plus signals. While I realize that this station has a good consistent output for its present 500 watts power, yet I would not rate it R9 plus at any time. You do not hear such signals often. But human nature is a peculiar make-up and has many bents. It is obvious that some make such reports with the thought that there is a greater possibility of their letter being read over the air. I am of the opinion that the stations would much rather receive reliable reports, but where it is their policy to read *all* letters it is impossible to omit these R9 plus boys from the broadcast.

The object of a report to a station, to my mind, is to impart information of value to the engineering staff. Then why not make an actual, reliable report, existing in fact, and be sincere in your reportings. Insincerity never gets you anywhere, anyhow.

MR. J. B. L. HINDS

To my mind you would then be assisting by service to the station and your verification would be more graciously extended and possibly be more prompt in forthcoming. "R" reports reflect the character of the maker and fool no one.

And generally speaking, if there were more sincerity and less insincerity in our acts and deeds in our contacts with each other, how much more good would be the result.

Data on HRN

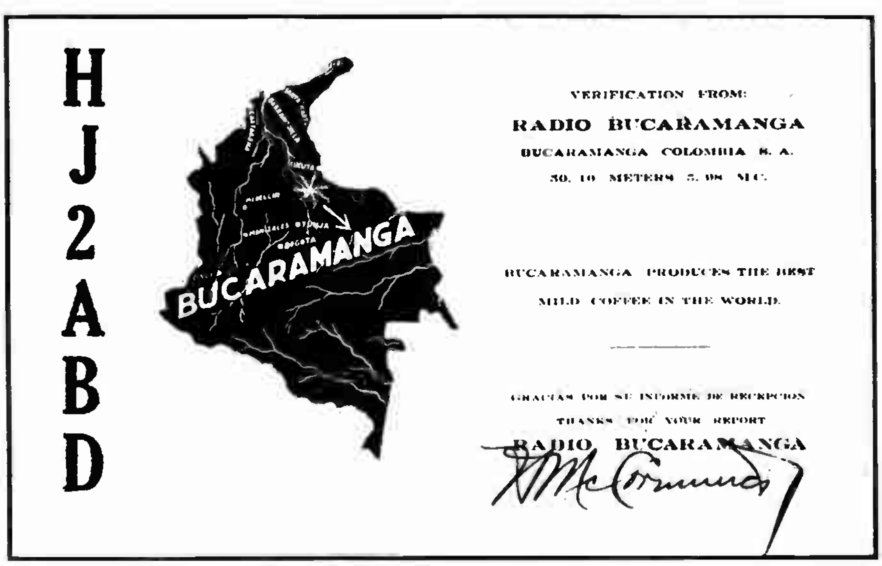
Again referring to station HRN. The latest word from Mr. Paul John, the genial English announcer, is that the question of frequency has been settled and HRN will soon be heard on 5910 kc. It was on account of this pending change that the verification cards were not printed and forwarded. It is understood that they are now being distributed to those who have heard the station and made satisfactory reports. Beginning February 1st HRN will also broadcast weekdays from 12 to 1 P. M., 5:30 to 7 P. M., 7:30 to 9 P. M. Honduras time; Sunday 2:30 to 4:30 P. M., 5:30 to 7 P. M., 7:30 to 11 P. M. or later. "Appreciation Hour" begins at 8:30 P. M. Honduras time is half way between Eastern and Central Standard time. It is also the intention to broadcast church music from a Cathedral in Honduras from 8 to 9 A. M. the last three Sundays of each month, and the Honduras lottery on the first Sunday, beginning at 8 A. M.

Frequency of CEC

In the December issue ALL-WAVE RADIO, mention was made of a change in frequency for station CEC, Santiago, Chile. In a recent letter from them advice has been received that while they have tested out some on the newly designated frequency of 9545 kc, they have not yet used it for broadcast purposes, on account of the close proximity of DJA, and there seems to be some question as to the advisability of making the change.

CEC is broadcasting as follows on 10,670 kc, which is not quite in agreement with the time schedule shown in this issue:—Daily except Thursday and Saturday, 7 to 7:20 P. M. and on Thursday and Saturday from 8:30 to 9 P. M., E.S.T. In addition to radiophone frequencies listed, CEC is also using 7740 kc in phone service evenings until 8:30 P. M. and inverted speech irregular.

The new Chilean station mentioned in the same issue has not yet commenced broadcasting. Its call on 9600 kc will be CB 960.



An imposing veri card from "Radio Bucaramanga", in Colombia.

There is also another Chilean station, CB615, transmitting daily on 6150 kc noon to 1 P. M. and 8:30 to 9:30 P. M., E.S.T. It is a low powered station.

Donald Guy, Newton, Kansas, cites a coincidence. He tuned in HRN while reading my article in the December issue and heard announcer reading my report of reception of station.

Station Reports

XEXA in station list as 6180 kc is on 6130 kc, 48.94 meters, according to late advice from the Secretary of Education, Mexico, D. F., who further states that this station operates from 8 A. M. to 11:30 A. M., 3 to 6 P. M. and 7 to 11 P. M. The address is correctly shown in address section.

HP5F, "La Voz de Colon" on 6080 kc, 49.34 meters, is being heard by listeners at times. Their verification card is done in colors red, white and blue and bears the flag of Panama in the upper left hand corner.

Reports on VPD, Fiji Islands, indicate that this station is still broadcasting on 13,075 kc or 22.95 meters.

After the National Broadcasting Company informed the listeners who stayed with W1OXFH that they could furnish no verifications of what was heard from the gondola of the stratosphere flight, the National Geographical Society very kindly supplied verifications to those who took the trouble to make a report.

VE9HX, Halifax, Nova Scotia, is now being heard with good signal since the overhauling of its transmitter.

Were it not for the code interference with HCJB, Quito, Ecuador, some enjoyable programs could be heard. The station is however coming in better than formerly. While the station is listed on 8214 kc it is thought to be closer to 8775 kc. Correct information will be given later.

Italian Stations

Rome has supplied us with latest time schedule. Call letters changed as follows: 2RO-4 on 25.40 meters or 11,810 kc; 2RO-3 on 31.13 meters, 9,635 kc and 2RO-1 on 49.30 meters or 6,085 kc. In a recent letter to the writer they gave the information that IRG, Massana, on 14,710 kc which many reported as broadcasting test musical programs and phoning Japan in early mornings, is a code station. The station heard by many American listeners as IRG is evidently IRJ. IRJ was changed to IQA on 14,732 kc. The new IRJ works irregularly with Cairo on 13,220 kc. All are high-powered transmitters.

Another station in the Italian Colonies is Radio Tripoli ICK, 9,460 kc or 31.71 meters. Communication is established between Eritrea and Rome through station IDU, Asmara, on 13,380 kc or 22.42 meters.


ESTACION EMISORA

YV 1ORSC

LA VOZ DEL TACHIRA

SAN CRISTOBAL - VENEZUELA

Confirmamos su reporte de recepción de nuestra Emisora correspondiente al dia 4 de Agosto de 1935

por el cual le damos nuestras expresivas gracias.

San Cristóbal, 4 de Novbre de 1935

Por "La Voz del Táchira",

A neat veri from YV1ORSC, postcard size.

CMB-2 in lists at 5,780 kc and CMA-3 at 15,505 kc are radio telephone transmitters located at Havana, Cuba, and are point-to-point communication stations, units of the public service worldwide communications system of RCA Communications, Inc., a subsidiary of the Radio Corporation of America, and operated by Cuba Transatlantic Radio Corporation. No verifications of program material or of messages transmitted will be supplied. No reason can be formed, however, why you cannot use the dial settings for calibration purposes.

COCH Veri

The new report cards from COCH, Havana, are quite unique and pretty in color shadings with a neat picture of Morro Castle in the background. The call letters are discerned by markings and holding the card at a particular angle.

For the benefit of some readers who have asked as to how long it takes to receive a reply from Australia, I might say I made a report to VK3LR on September 20, 1935, and one to VK3ME on September 21, 1935, and received verifications from both on January 4, 1936, the former postmarked Melbourne, November 21, 1935 and the latter Sydney, November 20, 1935. It is noted that VK3ME is now broadcasting each week day from 4:30 to 7 A. M., E.S.T.

It is now understood that CNR, Rabat, Morocco, is not maintaining a broadcast musical schedule on Sundays on 10,830 kc and 8035 kc, but is used for special broadcasts as occasion demands, but both frequencies are used in radiophone transmissions, the former during the day and the latter during the night.

German Time

For the information of those who receive advance programs from the German stations, I would say that there is six hours difference between Central European and Eastern Standard Time.

Requests are being made to other countries for new listings and as received revisements will be made in the station lists.

A new Mexican station is lately being heard around 8100 kc and it is thought that the call letters are XENE or XEME The long-wave call of the station was understood to be XEFC. The station is located at Merida, Yucatan, Mexico. The address is Calle 59 No. 517.

Station YNDA reported in January ALL-WAVE RADIO on 8590 kc is evidently YNDA, now on 8657 kc and located at Managua, Nicaragua.

TI8WS, "Ecos del Pacifico," Puntarenas, Costa Rica, sends a beautiful veri-


POTENCIA 42 W.
FRECUENCIA 5865 K. C
ONDA DE 51 15 METROS

H-I-1-J

DIRECCION:
CALLE ANACAONA MOSCOSO 3
P. O. BOX No. 204

SAN PEDRO DE MACORIS. —— REPUBLICA DOMINICANA. (W. I.)

CONSTRUCTOR-PROPIETARIO FAUSTO M. DONASTORG

Trasmisiones: Todos los días, de 12½ á 2 P. M. y de 6½ á 9 P. M.

Damos las gracias al Sr. J. B. L. Hinds por habernos reportado nuestra trasmisóin de Sept. 27/35 y siendo conforme con nuestros records, gustosos le enviamos nuestra tarjeta de verificación. Esperando nuevamente sus noticias quedamos á sus ordenes.

RADIODIFUSORA
H-I-1-J

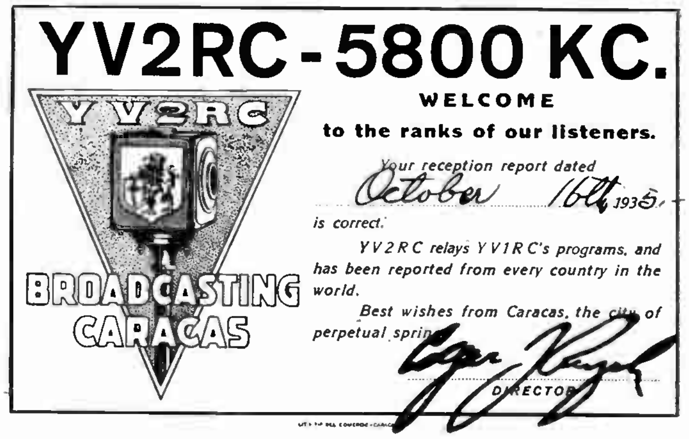
San Pedro de Macorís, 14 de Octubre de 1935

This card, from San Pedro de Macoris, has a red and blue border.

fication card printed in red, white, blue and black with a neat harbor scene set into colors. This station is on 7550 kc.

The station reported by Thomas R. Dunn, of Yonkers, New York, near 48 meters is evidently YV12RM instead of YV1RN.

Verifications are still being received from Addis Ababa, Ethiopia, on 18,270-11,955 and 7620 kc. There are four transmitters working on phone, telegraphy and program work with call letters as follows: ETA, 18,270 kc; ETB, 11,955 kc; ETD, 7620 kc; and ETG, 5880 kc. All four stations are now listed and correct address shown in address section.



A friendly veri card from Caracas . . . "the city of perpetual spring." This one makes a handsome addition to anyone's collection.

New Lisbon Transmitter

Have you listened to radio CT1AA, Lisbon, of late? They tested out their new transmitter with special program on December 14, with fine results. During this test the well known "Cuckoo Call" was absent. It is hoped that it has not been discarded as many will miss this familiar greeting.

It will be noted that changes have been made in the Holland phone transmitters both in calls and frequencies—likewise Brazil. New lists from these governments were received so station lists now reflect correct information.

The exact time schedule of XEVI on 6000 kc and located at Mexico City, is shown in this issue. The Governmental list shows this station also working on 11,900 kc but it has not yet been reported on this latter frequency. The address is Apartado Postal 2874, Mexico, D. F.

XEUW the new station at Vera Cruz, Mexico, verifies by letter. They are on 6020 kc or 49.83 meters and called "The Echo of Leeward from Vera Cruz." Address is 98 Independence Avenue, Vera Cruz, Mexico.

Quito Veri

A verification from HCK, Quito, Ecuador, on 5885 kc is quite a pleasant surprise after reporting the station for nearly three years. So some of you listeners who complain about three months wait please note. I might say for your information that they show on card that they are on the air Monday and Friday nights, 8:30 to 10:30 P. M.

There still seems to be some confusion on stations in Colombia. Some insist there are two HJ4ABD stations broadcasting at the same time, one on 5760 kc and one on 6060 kc. A station HJ4ABP, Medellin, reported on 6135 kc. They are hard boys to keep your hands on down in that country, but it is hoped that the discrepancies will be straightened out.

Report No. 434 from YV8RB, Barquisimeto, Venezuela, was received by the writer. So no doubt Radiodifusora "La Voz de Lara" is being heard by others on 5880 kc.

Guess who! You could almost read this one in the dark! Letters are in red.

Guatemala Stations

Again referring to the Guatemala Stations. In the January issue I mentioned TGS—"The Liberal Progresista Daily," 1400 kc. The call letters should have read TGX. However, I have since received advice from the Director of TGX who says the station is on the air on 50.50 meters or 5491 kc, working daily except Sunday. If they realize their expectations they will have more power in February, and they intend to broadcast special DX transmissions dedicated to American listeners, programs to be announced in English. They are now presenting Marimba band programs as identification music.

TG2X, Guatemala, according to their verification card, is shown as operating on 5940 kc. Their card is signed in the name of Direccion General de la Polica Nacional, and station works on a stated schedule.

A new station VE9EW, location unknown, was heard testing with a musical program in January around 33 meters.

Charles Miller, Covington, Kentucky, has a verification card from TGS which shows this station on 5713 kc and working on a schedule from 6 to 9 P. M., E.S.T. They announce as "Casa de Presidencial."

"Intuition"

Speaking of Mr. Miller, and illustrating my comments on method with initiative in tuning, which subject I dwelt upon briefly in my article in January, I would like to mention how Mr. Miller used his faculties on Christmas Day last. Noting my verification of reception of station PMC on December 25, 1934, which was reproduced in December ALL-WAVE RADIO, he surmised that PMC might be on the air again on the same day in 1935 and to his surprise upon tuning he brought in the station, which was the first time he had received it. Mr. Miller wrote and thanked me for my assistance, but under the circumstances I must decline to accept any credit in this particular coincidence as he is entitled to it all for his intuition, if I may be permitted to stretch my imagination as to the exact definition of the word used. And some folks insist that that faculty belongs only to the opposite sex of man. According to statistics given out and the general belief in the present day and age, I would hesitate to mention them as the weaker sex. But suffice it to say that Charlie is quite delighted that he has added PMC, Java, to his list of stations received through the medium of my printed verification.

TI4NRH To Return

While recently listening to TIRCC, Costa Rica, and our friend, Amando Cespedes Marin, now announcer for the above station, it was learned that TI4NRH would soon be on the air again on its old frequency, 31 meters.

It is noted that GSJ, Daventry, England, on 21,530 kc is being used in program work. Here is an opportunity to test out your receiver on 13.93 meters.

Myron D. Reamy, Yonkers, New York, reports hearing a station HIV, located in Colombia, at about 33 meters, testing with music.

In reply to a recent inquiry, Societe Haitiënne de Radiodiffusion, Port-au-Prince, Haiti, advise that they are only working at present with call letters HH2S on 6070 kc or 49.41 meters. We are carrying this company in station list under assigned frequencies as follows: HH2R, 9545 kc, 31.44 meters; HH25, 6070 kc, 49.41 meters, and HH2J, 11,570 kc, 25.93 meters. Listeners report hearing them on 6070 and 9545 kc and also under call letters HH2S on 5920 kc (50.68) and HH2S on 6178 kc (48.56). Someone must be wrong.

Station TI8FF, 7590 kc is no doubt TI8WS now reported on 7550 kc. The first mentioned station was reported in Jannary issse of ALL-WAVE RADIO.

Estacion Emisora YV10RSC, called "La Voz del Tachira," and located at San Cristobal, Venezuela, is sending out a very pretty verification in blue.

No-Veri Stations

It is difficult to understand why stations request reports and then fail to verify or even make answer. Among such offenders can be named HKV-HJS-HJ3ABI-HJ1ABJ-HC2CW - HCETC-TGX.

The little Republic of Dominica appears to wish to be heard, as new stations are springing up at various points on the dials. The following are listed in this issue: HI5E, Piujillo, 6900 kc, 43.48 meters. HI5N, Santiago de los Caballeros, 6475 kc, 46.34 meters. H15V, Piujillo, 6450 kc, 46.51 meters, and HI3V, Puerto Plata, 6380 kc, 47.02 meters. Two other stations have been reported but not listed, namely: HI1F, Santiago de los Caballeros, 6140 kc, 48.86 meters, and HI1S, 6420 kc, 46.73 meters.

A neat veri, with red border, from 'way down in Buenos Aires. One of these cards is certainly well worth having.

New German Frequencies

Mention was made in the January issue that Germany was adding new frequencies for broadcast service. Well, they have added a few more and assigned regular hours of transmission. The calls and frequencies are as follows: DJR, 15,340 kc (19.56); DJP, 11,855 kc (25.31); DJL, 15,110 kc (19.85); DJO, 11,795 kc (25.43); DZH, 14,460 kc (20.75); DZB, 10,042 (29.87); DJM, 6079 kc (49.35); DZA, 9675 kc (31.01); DJS, 12,130 kc (24.73) and DJT, 15,360 kc (19.53).

DZA, 9675 kc was formerly DJI on same frequency and DZB, 10,042 kc was formerly DJJ on same frequency.

It rather looks as if they would succeed in finishing the alphabet before long.

As we close we hear reports of a new Cuban-styled Radiodifusora Pilot Santiago de Cuba on 9600 kc. If they keep coming in on the 31- 46- and 49-meter bands it will take more than band spreading to separate them.

Appreciation

May I again say that your letters showing stations received in your territory, of new stations heard, etc., are much appreciated. It is a pleasure to hear from you and to answer your questions pertaining to reception and station matters in general. Address such letters direct to me at 85 St. Andrews Place, Yonkers, New York, enclosing a self-addressed stamped envelope in case a reply is desired. When desiring information of a technical nature address your letters to ALL-WAVE RADIO, Queries Editor, 200 Fifth Avenue, New York, N. Y.

Book Review

MAKING A LIVING IN RADIO, by Zeh Bouck, published by McGraw-Hill Book Company, Inc., New York, N. Y. 222 pages, stiff cover. Price $2.00

"Making a Living in Radio" is an impartial and comprehensive survey, discussing the opportunities, remunerative possibilities and *probabilities*, methods and costs of training, problems of getting a start, etc., in the radio field. Both of the major divisions of radio are covered, the technical—servicing, operating, and engineering, and the non-technical—radio writing, broadcasting and selling.

In brief, that is the nature of Zeh Bouck's latest work. But the book calls for more mention than what may be contained in a single paragraph—it is entitled to it, for "Making a Living in Radio" is undoubtedly the first book of its type wherein the author is frank enough to state the facts exactly as they are.

As Mr. Bouck points out, there is big money to be made in radio—in writing, as an announcer, as an engineer, etc., but that doesn't go to say that the field is lush, ready to be picked with ease. There is by no means a scarcity of radio professionals, but there is room in the field for the person willing to study hard in order to achieve his goal, and some of that room is at the top.

The first chapter of the book deals with cold facts—unemployment in certain portions of the radio industry; what opportunities exist or may exist in the future; where such opportunities are most likely to arise, etc.

Subsequent chapters deal with the radio service man, the business of servicing, the radio operator, the engineer, broadcasting, radio writing and industrial radio work. Each branch of the profession is covered in detail.

An appendix includes an extensive bibliography, together with the reviews of books chosen by the author as helpful in the various branches of the profession. There is also a list of addresses to which application can be made for radio operating positions, and of companies specializing in transcribed programs.

Indispensable to anyone interested in any branch of radio as his life work. Just the book to start you off on the right track.

THE FOOTLOOSE REPORTER

Jerry Belcher

"VOX POP"

Parks Johnson

THE LOBBY OF the Hotel Pennsylvania in Manhattan early Sunday afternoon is not a very populated spot. However, when I arrived there with the Vox Pop outfit, I saw that they had no difficulty finding people willing to face the mikes. Willing, did I say? Anxious and eager describes it more clearly. Their greatest difficulty is in preventing people from going on and on once they're on the air.

There seems to be a general desire to be on the receiving end of any questions-and-answers game, intelligence test, etc. The Vox Pop program is, of course, a glorified form of "Questions and Answers," and in spite of the fact that the majority of people suffer agonies from mike fright, there is never a shortage of victims. Since they are asked to give their names and the names of their home towns, and it's logical to suppose that at least one friend is listening to the program, they can talk for months afterwards about the time when they were "on the air."

About an hour and a half before Vox Pop goes on the air, two N. B. C. engineers are at the appointed spot with the necessary equipment. It was interesting to learn that both of them are radio Hams—Fred Walworth, whose call letters are W2AMQ, and Courtney Snell, whose call is W3EGD.

While they are hooking in the microphones and booster on the wire line direct to the studio, they are also kept busy answering the questions of interested spectators. They make two check tests, one an hour, the second twenty minutes before the program starts. By that time there is a crowd around the mike.

Jerry Belcher and Parks Johnson, who own the act, spend about a half hour before they go on the air circulating through the crowd, asking people where they are from and whether they would like to be interviewed. Most of them seem to be from Brooklyn or points west.

In the meantime the announcer, Wallace Butterworth, and Paul Wing, the control man, arrive on the scene. Also a representative of the sponsor, complete with tubes of Mollé Shaving Cream, one of which is given to every person interviewed.

There is a good-natured air about the broadcast and neither Jerry nor Parks, who ask the questions, assumes a superior attitude. They merely ask the questions, of which they have several lists, and wait for the answers. And what answers they do get at times! There is no way of knowing what will be sprung, as the questions come from all over the country through the mails, and some of them are certainly beauts. The program is unrehearsed and absolutely spontaneous, which is where the fun comes in.

Parks and Jerry each have a mike and take turns on interviews, with time out for the commercial plug.

Recently a woman was asked what made an educated man.

"Well—he'd have to be a college graduate," quoth she.

"Do you mean that no man is educated who hasn't graduated from college or even gone to college?" she was asked.

"No, he'd have to go to college to be an educated man," she insisted.

"But what about Will Rogers? Wouldn't you call him an educated man?"

"Oh, no," she replied, "Will Rogers never went to college."

This little gem brought a response of some four thousand letters from the radio public, many of which were rather vehement in tone.

Another girl was asked whether the United States had ever joined the League of Nations.

"Yes, they have," she said.

"In what year did we join, and are we still members of the League?"

She hesitated for a moment, then answered, "I think it was in 1918 that we joined—and yes, we still belong."

That one brought about three thousand indignant letters from people who believe that history is history after all, and caused an announcement to be made on a later program to the effect that the United States had never at any time been a member of the League of Nations.

The fans get their own back occasionally. For instance, on one broadcast the commercial announcement read, "—and Mollé, the fastest growing cream on the market, etc., etc." Their mail was soon full of letters pointing out the fact that beards grow fast enough without cream, and that they really should change the announcement. They did.

Some people facing the mike think it's a swell opportunity to clown or be witty, and sometimes a girl tries to put over her sex appeal a la Mae West. But it's all in fun and everyone enjoys the laughs. Jerry was interviewing a girl and had just asked a question. Instead of answering she gazed up at him and drawled, "Do you know you have the most beautiful, brown eyes?"

The crowd loved it.

Another time a girl was asked whether Romeo and Juliet were ever married. She drew herself up very haughtily and said, "Sir, that's a very personal question."

"But why, is your name Juliet?" was the puzzled query. She looked rather vague for a moment, then said, "No, it isn't."

They managed to get off on another subject, but Jerry and Parks are still trying to figure out what the devil she meant.

They also give problems, the solutions of which require either some study or quick thinking. Their favorite has stopped most people and brought the greatest amount of fan mail. It's the good old one about a man who bought a horse for seventy dollars, sold it for eighty dollars, bought it back again for ninety dollars and sold it for a hundred dollars. How much did he make or lose? Don't ask me—I'm asking you.

One man wrote them that he and his wife had been ideally happy until the sorry day when this problem invaded their home via Vox Pop. Now they each have a solution, different of course, and peace and happiness reign no more in their home. It's horses, horses, horses every evening. As a matter of fact, Parks and Jerry plan to make a movie short based on the trials and tribulations arising from this problem.

While I was getting this story a man was brought before the mike, asked his name, home town and business. It developed that he had been a song plugger on Broadway. He seemed more interested in making a speech on the beauties of popular songs than in answering questions. He named several old songs he had helped make popular, and it began to look as though he planned to spend the rest of the day before the mike.

Of course, the sponsor of a radio program never tires of hearing the name of his product, but he certainly isn't paying for time on the air merely to hear some one else's plugs, so everyone connected with the program was on edge. Particularly Paul Wing, the control man, who was prepared to cut him off. Another thing they worried about was that the man might mention the name of some song, the copyright of which belongs to Warner Brothers. In view of the difficulties the broadcasting chains have been having with Warner Brothers about music, the studio would hardly appreciate such favors. But Parks finally interested him in a question, and things went smoothly.

The control man, by the way, is ready to cut anyone off the air. They are always on the alert for profanity, etc., because of the censorship in broadcasting.

The response to this program is amazing, both during and after it.

After they had signed off I was getting more dope from Parks and Jerry when a man rushed over exclaiming, "Is Vox Pop finished?"

When told that it was he looked disgusted. "My wife and I are in town from Cleveland. We listen to your program back home and thought we'd be able to watch a broadcast while we were in New York. We've been chasing all over town looking for you. Phoned the studio and even went there, but they refused to tell us where you were today."

"That's too bad," Jerry said, "but you see the studio isn't permitted to tell where the broadcasts are to take place. It's part of the impromptu air of the program. Sometimes we don't even decide on the location until the day before the broadcast."

"I can understand that," said our friend from Cleveland, "but the rotten part of it is we're living right here in this hotel. Can you beat that?"

We certainly couldn't.

Parks and Jerry got the idea for Vox Pop back in 1932. At that time Jerry was commercial director for station KRTH in Houston, Texas, while Parks was in the advertising department of the *Chronicle* of that city.

One day they were listening to the radio and tuned in Ted Husing, who was going about the streets of Manhattan with a lapel mike, asking people for their opinion on various subjects. They thought it a clever idea, worked on it for a while, and from it evolved Vox Pop.

Their next job was to find a sponsor. They found one and were set.

They've been on the air for the past four years. During that time they have each missed only one broadcast.

The program hasn't changed at all except for the product they sell, and they handle the entire job themselves. Mail alone keeps them busy most of the time. It averages about three thousand letters a week, most of which have to be answered. They expect it to increase by leaps and bounds very soon, as their sponsor is giving away wrist watches for the best questions sent in by the public. Some of them should be corkers.

Their present contract, which is their first job in New York, has been in effect for six months, giving them a half hour on the air every Sunday afternoon. Soon they expect to be shifted to Tuesday evenings instead of Sundays, which is a break for the boys.

Vox Pop is re-broadcast over Station W2XAD, N.B.C. network's shortwave station at Schenectady, New York. Shortwave fans from all over the world have written them. Capetown, South Africa, is the farthest point at which they have been heard—as far as they know. A listener wrote them from there and sent the letter part way by air mail.

Although Parks was born in Georgia he claims to be just as much a native son of Texas as Jerry, since he spent most of his life there. Jerry is about five feet eleven inches tall, has red hair, the beautiful brown eyes the young lady mentioned, and a friendly smile. Parks is about five feet seven inches, gray haired and rather more serious than Jerry. They are both about ten years older than is usual among the men on the National Broadcasting network.

Both of them are very genial chaps, which helps a lot in their work. They are quiet in manner and dress. The New

(Turn to page 91)

Parks Johnson and Jerry Belcher working out some of their "Vox Pop" riddles on the checker board.

The Reinartz Rotary Beam For Ten and Twenty Meters

By C. S. STIMPSON, W9TRD

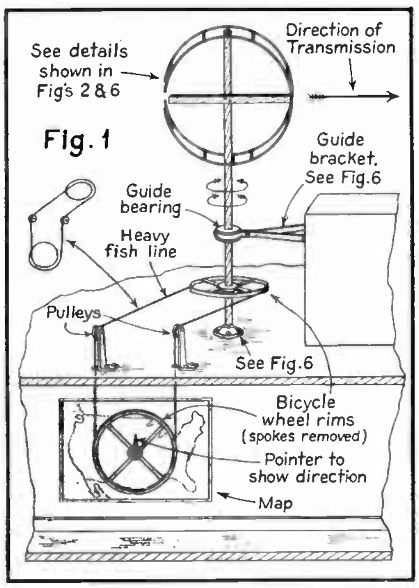
THE original article by Harry Tummonds on the 5-meter Reinartz Rotary Beam Antenna, which appeared in the November issue of ALL-WAVE RADIO, *has created such widespread interest in both amateur and swl circles that we have decided to carry the idea a step further and show how this remarkable beam aerial may be applied to the ten- and twenty-meter bands for both selective transmission and reception.*

For the benefit of those who may have missed Mr. Tummonds' article, we are re-printing the original illustrations so that in this one article complete data is made available for the construction of a rotary beam aerial for five, ten, or twenty meters.—Editor.

AS SOON AS we saw the detail with which Harry Tummonds outlined the design and construction of the Reinartz Rotary Beam Antenna for operation on five meters, we got to work and built one. We have known Mr. Reinartz for many years and have found that the ideas that he suggests are generally well worth while. In connection with the beam idea, however, we must admit that we went about building it with a certain amount of misgiving. It did not seem possible that the concentration of a pair of half-wave radiators, in the form of a loop, could possibly produce the results that Reinartz claimed for them.

Comparisons

In order to have a rather complete check on the subject, we constructed one of these beams ourselves and arranged with a group of five-meter amateurs in the Chicago area to do likewise. Comparing notes on the performance of all the beams, indicates that the results have been beyond our greatest expectations and this form of rotary antenna has provided us with an additional means of cutting down interference, as well as increasing our signal strength, without increasing the power at our transmitter.



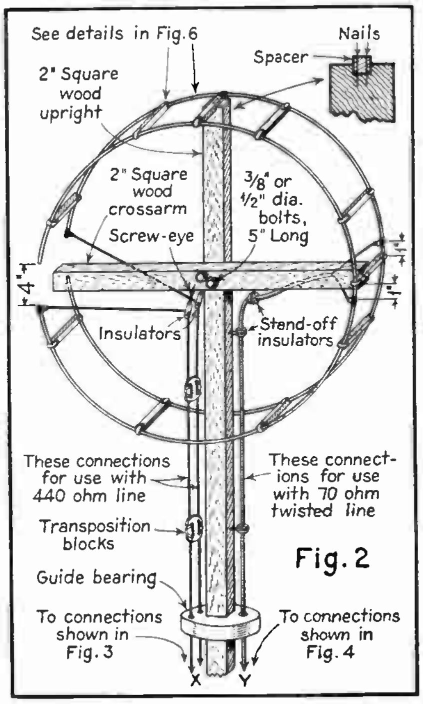
Sketch of a complete Rotary Beam Aerial installation.

Many checks were made on the radiation from a given transmitter with the beam at various angles and it was found that the distribution pattern published in connection with Harry Tummonds' article was as accurate as necessary for all practical purposes. In one instance, the beam, while directed at a receiving station some five miles distant, resulted in an R9 signal report and with the beam turned in the opposite direction, the report was cut down to R3.

This fact is doubly helpful in that it provides us with the cheapest form of increasing our radiation in a desired direction and at the same time it prevents us causing interference in the other directions. By actual test, we have found that we are now able to engage in comparatively interference-free QSO's with stations a reasonable distance away without in any way upsetting the operation of other stations in our immediate neighborhood. This was not at all true when we were operating with the ordinary type of antenna.

As Receiving Loop

In connection with receiving, we have found that very much the same conditions exist and it is possible to pull up a signal from R6, with the ordinary antenna, to R8 or better, with the Reinartz beam and the effect is even more pronounced when the signals from a distant transmitter are weaker.



Details of the aerial proper, and how the transmission lines are connected.

On one case we ran into a condition which we suppose is more or less general and it gave us a very satisfactory demonstration of the beam's utility. Within a short distance of our station, there is a five-meter receiver of the radiating variety and it radiates so badly that signals which would ordinarily be R8 to 9 are brought down to inaudibility. When using the beam we found that the only time this receiver really interfered with our communications was when the beam was turned in the general direction of the radiating receiver, itself. When pointed in other directions, the annoyance was materially reduced and, in some instances it did not bother us at all.

Other Reports

Since this beam was first introduced, we have attempted to communicate with other people in various parts of the country who have been carrying on similar experiments.

Arthur H. Lynch who operates a five-meter station on the top of the Manhattan Company Building, at 40 Wall Street, New York City, and whose signal covers the Metropolitan area like a blanket, tells us that many stations in the New York area have been using the Reinartz with great success. One of the assistant operators at his station, Phil Dennon, W2IGK, who has been using one of the beams at his home station in Ridgewood, reports some extremely interesting results. Using three watts at his transmitter and having a regular type of antenna some 65 feet above the ground, he has been more than ordinarily successful in effecting contacts with stations over considerable distances.

In order to determine the value of the Reinartz beam he set one up on the ground floor of a store in the business section of Brooklyn and under conditions which would be unsatisfactory for ordinary transmitters. The results he has secured can be considered as phenomenal. The beam was approximately four feet off the floor; the ceiling of the store was metal and the frame of the building was steel, while all of the windows were covered with iron bars, as well as the mesh used in connection with burglar alarm systems.

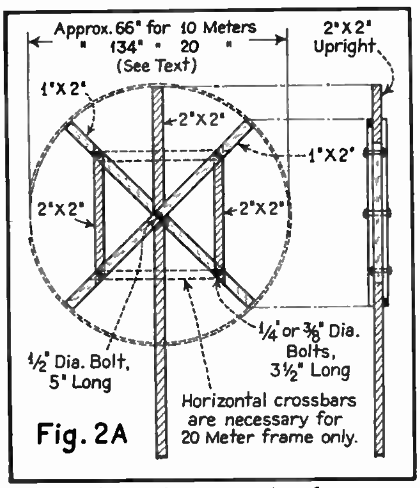
With the beam directed at amateur station W2JCY, at North Pelham, New York, his signal was reported as R8. This station is from twenty to twenty-five miles distant. With the beam turned in the opposite direction, Dennon could not be heard. To further test the effectiveness of the beam a rapid change-over between the beam on the ground floor and a regular antenna on the roof of the store was made. The best report that W2JCY could give Dennon when he was using the regular type of antenna was R5.

W2GZ, Charles A. Lewis, out at Hempstead, Long Island, has been securing similar results and there is little point in discussing this phase of the subject at greater length.

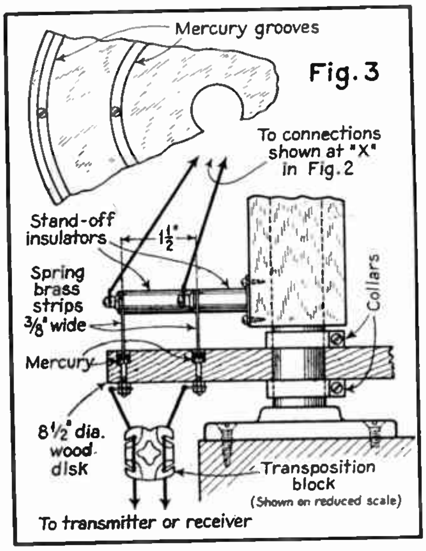
Impedance Matching Tests

The radio activities of the Buffalo Police Department are in the hands of a worthy Ham by the name of Larry Geno. Just as soon as the information on the Reinartz Beam appeared, he had some of his men get busy and try it out. His method for determining the effectiveness of the beam is more than ordinarily interesting. Unfortunately, there are but few of us who have the facilities for undertaking his elaborate procedure, but what he has done may suggest some other beneficial ideas which do not require such elaborate apparatus.

On one floor of one of the buildings, used by the Buffalo police, a five-meter transmitter was set up in one corner; in another corner, several hundred feet distance, a field-strength meter was set-up. At the transmitter end a transit of the type employed by surveyors was set up, so that the field-strength meter could be observed, from the position of the transmitter, itself. Then various adjustments were made at the transmitter for making sure that the oscillator circuit was in resonance with the fundamental frequency of the beam aerial itself. After this had been accomplished, various adjustments were made to determine the effect of suitable impedance matching between the transmission line and the two elements in the beam. When a 70-ohm transmission line cable was employed, it was found that the movement of a quarter of an inch up or down from the center would make a very material difference in the efficiency of the antenna. While the most suitable connections for the high-impedance spaced line showed a similar influence on the overall performance, the changes which could be made without materially effecting the radiation, were found to be much greater.

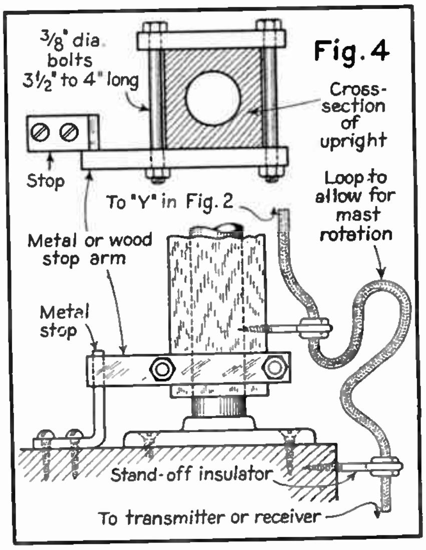


Details of the supporting frame.



How connections are made between the transmission line and aerial.

From this, we have been led to conclude, if the beam is to deliver the greatest satisfaction, it is highly desirable to make various adjustments between the upper end of the transmission line and the beam, and possibly the easiest way to accomplish this in the absence of a field-strength meter is to conduct a series of tests with some station a reasonable distance away, such as two and a half or three miles.



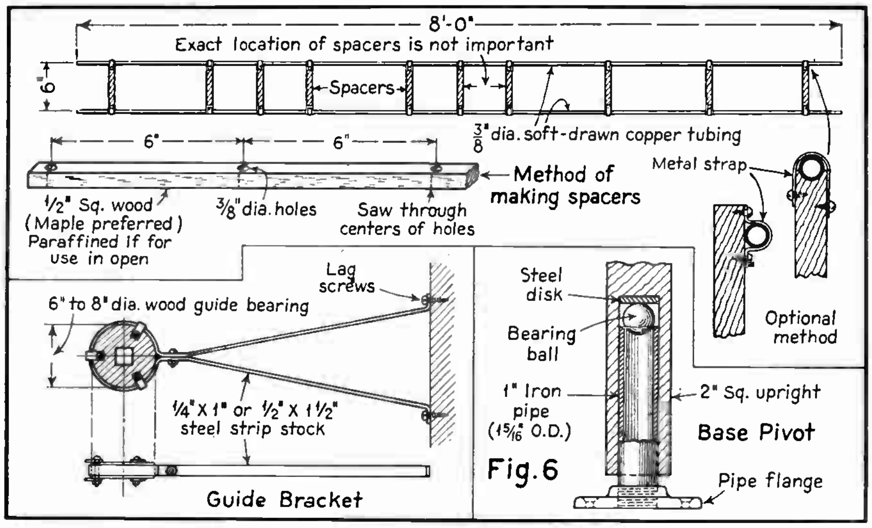
How the base of the aerial is made. Note loop in transmission line.

Beam Aerial Dimensions

The details showing the construction of the Reinartz Rotary Beam which were provided by Tummonds in his article, are so complete that the application of the same general idea to other bands is a very simple proposition. If reference is made to Fig. 2, it will be observed that the dimensions for the mast and cross arm are such as to permit a unit of very much greater size to be employed, without increasing the dimensions of the wooden portions of the supporting member. Therefore, whether we want to operate on either ten or twenty meters, it is not necessary to increase the size of the cross members. However, for use on twenty meters, it may be desirable to use an arrangement such as is indicated in Fig. 2A.

Of course, Fig. 1 covers the details of setting up such a beam without consideration to the frequencies at which it is designed to operate, and without any reference to dimensions.

The arrangements shown in Figs. 3 and 4 may be used regardless of the wavelength on which the beam is designed to operate. This is also true of the units illustrated in the *lower* half of Fig. 6. Obviously, the dimensions for the radiators and the spacers must be changed to coincide with the arrangement shown in Fig. 7, and other dimensions are purely a function of the band in which we desire to operate.

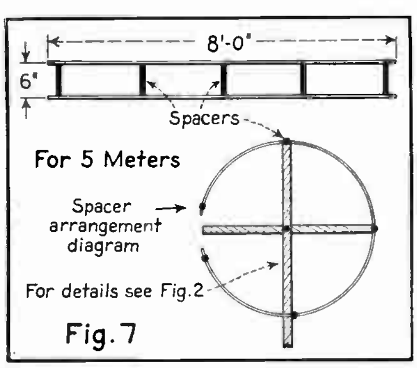


Details of the spacers, guide bracket and base pivot.

The accompanying figures indicate the manner of arriving at the dimensions for the antennas for the five, ten, and twenty meter bands. For five meters, the length of each radiator is eight feet which equals 96 inches and the opening at the mouth of the parallel radiators is 4 inches or a total of 100 inches, which is the total circumference of the beam. The diameter is, therefore, approximately 33 inches. The following table is derived in the same fashion and it makes a handy reference.

Band	*Tube Ft.*	*Length In.*	*Opening*	*Circumference*	*Diameter*
5	8'	96"	4"	100"	33"
10	16'	192"	8"	200"	66"
20	32'	384"	16"	400"	132"

In this connection it should be observed that we have chosen antenna lengths which places the natural period of this system at approximately 58, 29 and 14.5 megacycles, respectively, which is the center of each of the bands. If it is desired to have the antenna resonate at other frequencies in these bands, the normal method of figuring antenna length for particular frequencies, may be employed. It is very unlikely that the theoretical dimensions and the practical dimensions will be exactly alike and most efficient performance will only result after a certain amount of experimentation.



Dimensions of the radiators and spacers for the 5-meter aerial.

In connection with the flat layout for Reinartz Beams for 5, 10 and 20 meters, some consideration must be given to the mechanics of the beam, particularly if it is to be employed in a location where it will be subjected to high winds.

In actual practice, we have found that four separators are plenty for the five-meter band, while several more can be used to advantage in the ten-meter band and the arrangement shown in the lower portion of the illustration makes an ideal arrangement for the twenty-meter band. An additional precaution in connection with operation in the twenty-meter band is the provision of some sort of bracket and guide bearing, as is shown in Fig. 1. These are, as a rule, not necessary in connection with operation on either five or ten meters.

While Fig. 6 shows two methods for attaching the radiators to the insulating spacers between the radiators, the simpler method is the one shown to the left. If the arrangement shown to the right is employed, we call attention to the fact that the screws which are used to hold the metal strap around the copper tubing should be staggered so as to avoid any possibility of splitting the wooden spacer. We have found the italicized suggestion, concerning wood screws, presented by Mr. Tummonds in his article to be extremely valuable, and for that reason we repeat it.

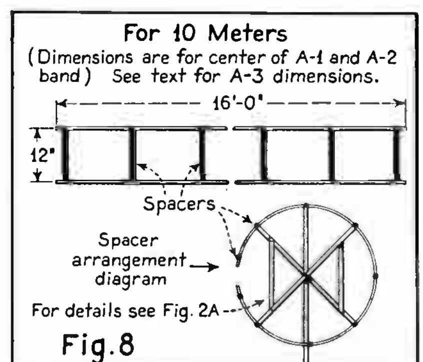
"There is a tendency to split the wood and the screws may be driven home with greater ease if the screws are pushed into a cake of common soap before they are used. The soap acts as a lubricant."

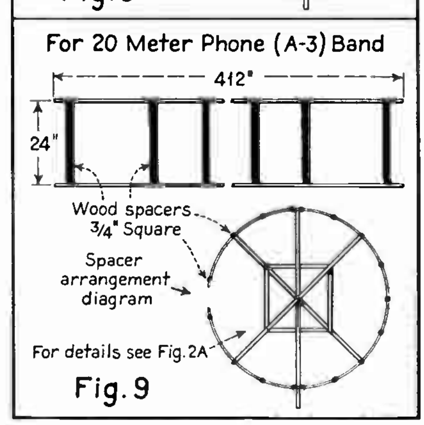
For Ten Meters

For operation in the ten-meter band, the two pieces of 3/8-inch copper tubing which form the radiators are 16 feet in length and they are spaced one foot apart. It is not likely that the number of spacers shown in connection with Mr. Tummonds' article will be necessary and we have found six to be ample. In order to maintain the distance of one foot between the centers of the radiators themselves, the wooden spacers should be 13 inches in length, if the arrangement for supporting the radiator by means of metal straps, shown to the left in Fig. 6, is employed. Naturally, if the arrangement shown to the right is employed, the separators are made so that the saw cuts pass through the centers of the holes, exactly 12 inches apart, instead of six inches, as shown in the figure.

For Twenty Meters

For operation on twenty meters, it will be necessary to have each radiator 32 feet long and the separation between radiators will be two feet. In spite of the fact that an antenna of this nature is very much smaller than any other form of beam array for use in the twenty-meter band, it is a bit more bulky and more difficult to handle than the same type of beam for use in the five- and ten-meter bands. At the same time, operation in the twenty-meter band offers some excellent possibilities for the display of mechanical ingenuity and we feel that the entire idea is so interesting that we will terminate our observations right here and leave the work on the twenty-meter band for those who have had an opportunity to investigate it thoroughly.





Dimensions of radiators, spacers, etc., for the 10- and 20-meter beam aerials.

CHANNEL ECHOES

BY ZEH BOUCK

IN A RECENT issue of that excellent if ultra new dealish trade publication, *Radio Today,* the radio critic is taken for a ride as public enemy numbers one to eight. Having the dubious honor of being the first, and perhaps most consistent, radio critic in the world, we cannot help but take up the challenge—in a perfectly friendly way.

The bone of contention is the scallions tossed at American programs and the orchids to European broadcasts—with the result, so *Radio Today* claims, that the sales of receivers have been affected.

Competent criticism has rarely been responsible for harm—but often for much good. Dramatic criticism definitely has not curtailed the sale of theater tickets. On the contrary it has increased the sale through the improvement of plays. The same holds for the movies. The critical approval for foreign films—German, English, French and Russian—has spurred Hollywood to an occasional meritorious effort. Three centuries of literary criticism has certainly not cramped the production and sale of books. Rather the result is more and better books. The same applies to broadcasting and radio. It has taken a decade of criticism to produce such outstanding programs as the General Motors Hour and the Ford Symphony Concert—programs that sing out gloriously above a plethora of moronic swill—programs the excellence of which (thanks at least partly to the critics) *are often the sole incentive for many persons buying and operating a radio receiver.*

Radio Today, to our mind, puts the cart before the horse in stating that "After all, programs are the things that sell radio sets." That is sort of like a publishing house subsidizing Christianity in order to sell bibles. The point, we appreciate, is a delicate technicality—and we are willing to waive it for argument's sake. Admitting the above premise—surely better programs would sell more radios!

This critic of critics quotes the British point of view—"We in England look upon our jobs primarily as educating and uplifting our radio listeners"—and asks, "How many radio sets would be sold if broadcasters in America pointed their efforts along the same lines?" Plenty, we think—for the majority of folks buying receivers today are being attracted by the possibility of receiving foreign programs, and every manufacturer features "Big Ben" in his advertising! Certainly, *Radio Today* has not been faithful to its theme, and has itself knifed the industry in the back—the industry that plays up the delights and possibilities of all-wave reception—when it implies that British programs constitute "some of the worst drivel that ever came out of a loudspeaker!"

ZEH BOUCK

Radio critic, author . . .

Many persons find the English point of view, as quoted above, highly commendable. Certainly to ignore the educational and "uplifting" possibilities of broadcasting—or even relegate such considerations to a minor factor in the preparation of broadcasts—would be to prostitute the finest medium for cultural progress science has yet brought forth upon this earth. We are not asking for one hundred per cent high-brow programs—or even fifty per cent. You can't uplift and educate overnight, anymore than you can teach differential calculus to a person who knows only elementary arithmetic. As a matter of fact, what the critics are really begging for is the increase of the entertainment value of programs by the elimination of such "drivel" as nauseates the majority of listeners having mentalities above the ten-year old classification. It is inevitable that this must happen—through the efforts of the critics and the reactions, which occasionally become articulate, of those thousands of listeners who daily switch off their receivers in disgust. Entertainment value is of paramount importance. "Uplift" and education that really stick must be assimilated with pleasure.

Aside from some revolutionary technological development, there is no other factor that would give a more powerful impetus to the sale of radio sets—a commendable desire on the part of *Radio Today*—than the improvement of domestic programs toward the par of perfection already established by, alas, all too few programs.

Again quoting this really stimulating and optimistic radio trade journal—"Curiously blind and unsuspecting they [the critics] try to make out . . . that the loudspeaker today has little to offer except mediocre and off color [where, oh where?—we'd like to hear some] entertainment mixed with prolonged descriptions of commercial items."

This paragraph stimulated us to keep a simultaneous log for an hour or so on Monday morning, December 30th. The time is Eastern Standard. At 8:50, DJB was on with semi-classical music—an excellent orchestra. Switching over to WJZ we encountered a trio singing the chronologically correct "About a Quarter to Nine." Good voices, no advertising, but stupid patter. At 9:05, we enjoyed part of the "Bacchanale Waltz" over GSF, England, before switching to WGY, where some one was singing a song that inevitably rhymed "love" with "above" and "alone" with—we'll give you three guesses—"own." This was followed with a piano solo of "her own composition" variety. Next a squeaky soprano sang "I'm in Heaven" with a voice that was decidedly antipodal, and which immediately thereafter murdered Bach's "My Heart Ever Faithful." No advertising—too awful for any sponsor.

A cracker company graciously supplied the correct time at 9:15 (plus glowing details of their products) and we dialed back to GSF for a few bars of Shubert's "Moment Musical." Some kilocycles higher, France was broadcasting music by an excellent military band, while WGY, at 9:20, permitted a few split infinitives on cooking to emerge from the blurb about a pancake flour. Five minutes later we tuned in grand opera from Germany, which we regretfully left for WOR. A talk on "Modern Living," plugging a new "regulator" recommended for relief after excessive smoking, drinking and eating. We stuck with WOR until 9:32, quitting when a woman started on the correct way to bend down in picking-up things from the floor. Up to the megacycles with England broadcasting selections from the "Merry Widow," and ballet music from

(Turn to page 92)

A RESISTANCE-COUPLED CLASS AB MODULATOR

By MAURICE APSTEIN*

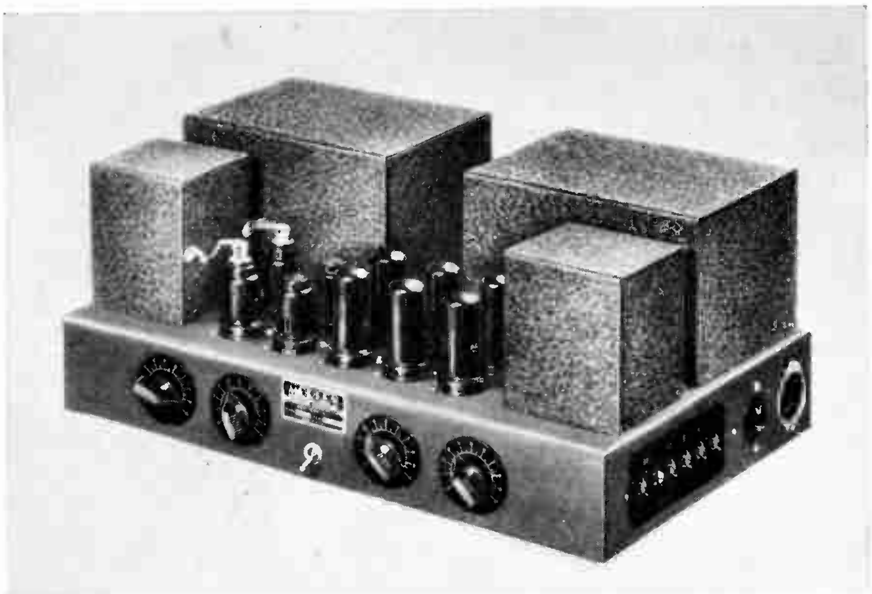


Fig. 1. The completed resistance-coupled Class AB modulator unit. This job has a peak power output of 45 watts.

THOUGH IT IS the general consensus of opinion that a modulator is merely an overgrown audio amplifier, this is only theoretically true. In practice, the modulator is called upon to operate under much more stringent conditions than a straight audio amplifier.

Conditions of Operation

First, the modulator must be inherently stable under rapidly varying and decidedly unfavorable conditions. It is subject to strong r-f fields when situated anywhere near the transmitter proper, and although at ground potential to audio frequencies it is often impossible to maintain it at ground potential with respect to strong r-f radiation. Secondly, it is usually operated from an a-c line which may vary considerably during modulation due to the current drain of the rest of the transmitter. Thirdly, it is almost always operated at maximum power output, for most modulators are so designed that at maximum power output 100% modulation will be achieved.

These conditions are far more stringent than the mere necessity for flat frequency response. Also, harmonic distortion at high frequencies assumes great importance because it is under conditions of distorted output that the amplifier is more than usually susceptible to those parasitic oscillations and transients which are the bane of high-level modulation.

Resistance Coupling

It was with these factors in mind that the applicability of a new, recently developed Class AB circuit to modulation was considered. This circuit is particularly free from harmonic distortion and inherently stable in operation under widely varying conditions.

Briefly, the circuit in question utilizes metal tubes and *resistance coupling* between driver and power stage, which stabilizes the load on the driver tubes and at the same time affords a power stage grid circuit which is not susceptible to transients, parasitic oscillations or r-f feedback from the output tubes.

Fig. 1 illustrates a complete amplifier developed around the principles outlined. Fig. 2 is the complete circuit diagram. The tube complement consists of two 6F5 triodes and two 6C5 triodes in the voltage-amplifier section, followed by two 6F6 triodes as drivers resistance coupled to four 6F6 tubes in the Class AB output stage. The two 6F5 tubes are used as separate voltage amplifiers for two input channels whose individually-controlled outputs are fed into the 6C5 grids. These in turn have their plates connected in parallel as a mixer stage which feeds the balance of the amplifier.

Phase-Inversion Circuit

It will be seen that in order to accomplish the transition to push-pull operation of the drivers, a simplified form of phase inversion is used. After trying several of the more popular methods of phase inversion, the illustrated connection was chosen as the best, due to the fact that it is far more independent of tube characteristics than the conventional methods, and operates with fine stability and a minimum of unbalance even though the driver tubes may not be perfectly matched. A measure of the performance of the push-pull action and the absence of degeneration may be gained from the fact that at 50 cycles, the placing of a 25-mfd by-pass condenser across the common bias resistor of the drivers, makes absolutely no difference in the gain of the stage or otherwise affects its operation. This is an acid test for determining the satisfactory operation of any push-pull stage.

The use of resistance coupling necessitated that driving power be kept at a minimum; hence it was necessary to use output tubes with high power sensitivity and yet capable of high power output.

These requisites are met by the 6F6 in pentode connection. The rising frequency characteristic of the pentode, properly handled, proves to be beneficial rather than harmful; the latter heretofore being the generally accepted viewpoint. The rising characteristic may be used to compensate for many of the high-frequency losses encountered in a-f amplification, provided sufficient attention is paid to the low-frequency end to provide adequate bass and consequently balanced output.

Power Requirements

In the driver stage, the two 6F6's as triodes, provide approximately four times as much power as is required to

* 60 West 15th St., New York City.

drive the output tubes to maximum. This excess power is an absolute necessity for the following reasons: The power-wasting characteristic of the resistance coupling network provides the very beneficial service of acting as a constant load upon the driver tubes at all frequencies, an effect practically impossible to obtain by loading the secondary of an interstage transformer with resistance.

The optimum practical relations between stabilizing load and useful load are such that the coupling network absorbs somewhat more than half the power output of the drivers, with the grids of the power tubes providing an additional load which at full output absorbs an additional 25 percent. Thus the total swing of the driver tubes is about 75 percent of maximum; well within their linear characteristics, and yet the variation in driver load impedance is only one-third that which would normally obtain.

Pentodes in general have fallen into such disrepute due to their misuse in midget receivers, that their many advantages for certain other applications have been overlooked. Most of the peculiarities of the pentode are due to the fact that it is operated with a plate load which is a fraction of its plate resistance. This condition causes the amplification of the pentode stage to be roughly proportional to the load impedance. Since most audio loads are inductive, unless proper corrective methods are exercised, a non-uniform efficiency and response with respect to frequency are the result. However, in the application of the pentode to modulation, the load reflected to the tube is effectively a pure resistance, with the result that none of the usual troubles are experienced from the tubes and the excellent power efficiency and sensitivity of pentode operation can be realized to the fullest extent.

Input Channels

It may seem strange that two input channels are provided in what is presumably a modulator for amateur or experimental transmitters, but the mixing feature which happened to be incorporated in the amplifier selected for modulation tests, was found to be so convenient that it was retained.

In actual operation the extra input channel can be utilized in several applications. It is advantageous, for instance, for use in conjunction with a single-tube audio oscillator employed for transmitter checking and for tone-modulated CW in the bands where this type of transmission is permissible.

The principal advantage of the extra channel, however, lies in its use for duplex cross-channel operation, rebroadcasting and three-way QSOs.

Performance

A few remarks on the general performance of the modulator will probably be helpful. The measured gain of the amplifier and modulator combination with the constants given and the tube line-up shown is 103 db from either channel. This has been found amply sufficient for operation from either the diaphragm or sound-cell type crystal microphones and high-impedance velocity microphones. The power output with constant signal input is 38 watts, with excellent waveform *at all frequencies,* within the speech range. With speech input the modulator stage may be driven to 45 watts with no ill effects. This means therefore that the unit will readily modulate up to 90 watts of r-f input.

Although the importance of r-f shielding is gradually being realized, practically no effort has been made toward modulator shielding. A multitude of modulation ills can be laid at the doorstep of imperfect isolation of the audio equipment from the rest of the transmitter. Mercury-vapor tube radiation, r-f fields, power supply inductive hum are but a few of the many causes which contribute to the varied assortment of background noises and general fuzziness on modulation peaks so annoyingly present on too many amateur phones. It is in no small measure due to the inherently complete shielding of the metal tubes that this modulator has been found to be surprisingly free from these common ills.

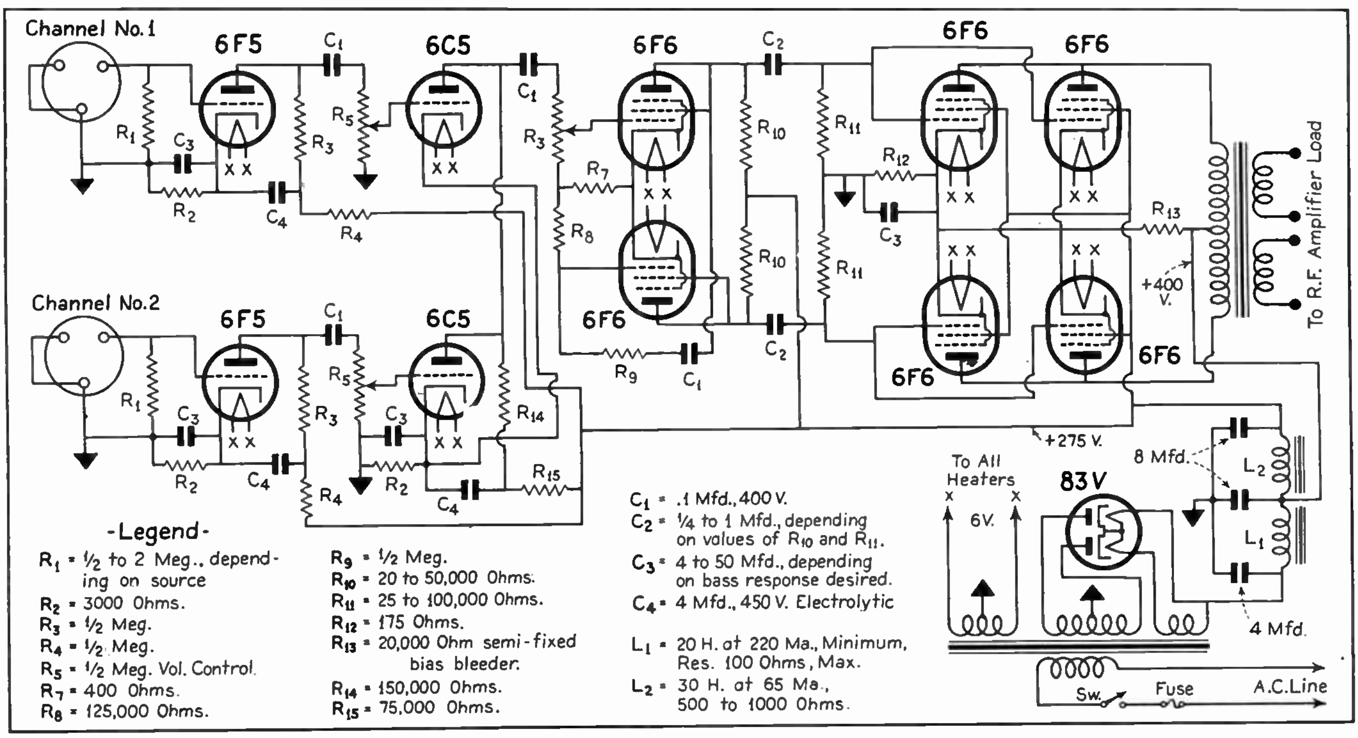


Fig. 2. Circuit diagram and legend for the resistance-coupled Class AB modulator.

QUERIES

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. The editors of ALL-WAVE RADIO *will endeavor to make this a different kind of a Question-Answer department — just as* ALL-WAVE RADIO *is a different kind of a radio magazine. Every question will be answered personally—by mail. A self-addressed and stamped envelope should be included. Rather than publish the answers to many questions each month—in a necessarily abbreviated form — we shall select only one or two of general interest which will be elaborated upon and answered in detail. These questions will be numbered, an index will be published periodically, and, in time, your files of this department should prove a valuable reference work.*

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

SUPERHETERODYNES AND NOISE

Question Number 2.

"I'd like to know why a t-r-f set couldn't be built with metal tubes—say a ten-tube set. In my store, I find it most exasperating to operate a superheterodyne, while the t-r-f receiver isn't one-tenth as noisy. So I figure that a 10-tube, tuned radio-frequency broadcast receiver, with a really efficient short-wave converter, would be ideal."—*A. H. A., Daytona Beach, Fla.*

Answer.

Such a combination would be possible but hardly practical. In the first place the noise level of a modern superheterodyne is quite satisfactory. If a super is noisy—certainly if ten times as noisy as a t-r-f receiver—something is radically wrong with that superheterodyne.

A 10-tube tuned radio-frequency receiver, even with push-pull power amplification and a driver tube, means six tuned circuits. These would be very difficult to line up for single control tuning. About seven tubes—three tuned circuits—is the practical limit for a home construction job. Such a receiver could be easily constructed, and circuits will be found in the files of radio magazines of from five to ten years ago. A modern version could be readily designed by any experimenter, using an up-to-date super as the starting point, and eliminating the second detector and intermediate-frequency section. An additional stage of radio-frequency amplification should be substituted for the oscillator, using the same coils, tubes and general arrangement as in the preselector.

Such a receiver would give satisfactory results on the broadcast band—though lacking the sensitivity and selectivity of the super—and could of course be used with a converter for short-wave reception. However, the moment you use a converter, you are back to the super again (though you would not have a double super)! In a converter-t-r-f combination, the tuned radio-frequency receiver functions as the intermediate-frequency amplifier, second detector and audio amplifier. The receiver is merely tuned to the correct intermediate frequency—somewhere in the broadcast band—and further tuning effected on the converter, the latter merely changing the wavelength of the short-wave incoming signal to the wavelength to which the receiver is tuned. Of course, in some converters, straight tuned r-f reception would be employed in the broadcast band. However, the truly modern converter outputs an intermediate frequency in the neighborhood of 550 kilocycles—which is about the upper wavelength limit of the broadcast band—thus employing the converter for reception on all wavelengths. In other words, the combination of such a converter and a tuned radio-frequency receiver is nothing more than an all-wave superheterodyne. There exists this advantage in such a converter—namely, volume, tuning and on-off switch are controlled at the converter which can be conveniently located so as to provide remote control, for instance, from one's easy chair.

Returning to the original question, we feel that A. H. A.'s problem is best solved by finding out what is wrong with his superheterodyne. It may be one of many things—from antenna to loudspeaker. The sensitivity of such a receiver (assuming that it is a good one) is of so high an order that a deficiency in one part of the circuit (one tube, an out-of-tune coil, etc.) is often compensated by turning up the volume control to the extent that internal noises are amplified beyond a reasonable degree. This effect would not be noticed on a t-r-f receiver, where the controllable sensitivity is not great enough to bring in a signal where minor inefficiencies exist. In other words, no signal would be heard on the tuned radio-frequency receiver, no matter how high the volume control was turned, but noisy reception might result on a good super somewhat out of kilter.

◆

DIRECTIONAL ANTENNAS

Question Number 3.

"Having been an amateur for a few months only, I am not so hot on technical matters, and would like to ask a simple question that has me guessing. When a signal is spoken of as being beamed, does it mean that this signal can only be picked up within a narrow beam or does it merely imply that the signal is stronger on the beamed side of the antenna than on the other? For instance, were a radio signal beamed west from some point on Long Island, could the signal be picked up also in, say, the south-eastern part of the United States?" *C. B. H., Washington, D. C.*

Answer.

The probability is that the signal could be picked up in the south-eastern part of the continent—but the point is, as our correspondent has surmised, that the signal in Florida would be much weaker than the signal in Los Angeles—or even Honolulu. Some signal will probably be picked up hundreds of miles "behind" the beam. However, on the highly efficient commercial circuits, such as are used for trans-Atlantic telephony, the beam system is remarkably efficient in concentrating the signal. The writer has had experience with such "arrays" in South America. During airplane tests, it was necessary to communicate with a

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FOREIGN NEWS

REVIEWING THE MARCH OF WORLD TOPICS

FRANCO-AMERICAN RADIO-TELEPHONE LINK

PARIS:

The French have announced that a direct radio-telephone link will be established between France and New York. Heretofore, all telephonic communications that originated in any Europeon country for America passed through the radio telephone exchange at London. The new station will come into operation sometime this Spring.

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CUBAN TROUBLE

HAVANA:

A very alert announcer at CBQ owes his life to the fact that he kept one eye on the microphone and the other on the window and had enough presence of mind to "sell out" just as twelve masked men entered the studio at the time when it was just being hooked-up to a local network. The intruders proceeded to act like the proverbial "bull in the china shop," wrecking and destroying all the tubes and phonograph records stored in both transmitter and storeroom; the damage was estimated to be about $5,000.

Owners of the station lament the fact that the occurrence should have happened one day earlier because of the new installation of a $1200 tube which was not overlooked.

◆

TELEVISION IN GERMANY

BERLIN:

During the last few months the German Post Office Authorities have been giving public demonstrations of the progress made on television apparatus. Reports indicate that the German public is not yet ready to accept television as a commercial product. Two reasons are given for this reluctance; first, the high cost of television receivers ($200 to $600); and second, loss of detail in reproduction. Of course, development continues, but until such times as price, incongruous distortions, fogging, optical lattice phenomena, and distortion are eliminated, television will remain as one of the scientific "laboratory" wonders of this electrical age.

An article in a German paper "Elektrische Nachrichten Technik" states that Germany proposes national coverage by installing a group of five 7-meter transmitters having output powers from 2 to 20 kw. By selecting the best geographical sites for transmitters, a field strength of 1 millivolt per meter is planned. Transmissions will be of the 180-line, 25-frame sequential scannings per minute. Bandwidth allocated will be 2,400 kc; a number of the stations will be synchronized. At the receiver a heterodyne oscillator will be employed for simultaneously receiving both sound and visual frequencies.

◆

SOUTH AMERICAN PROBLEM

RIO DE JANIERO:

In the fall of last year the great South American newspaper "Jornal de Brasil" inaugurated the most powerful station on that continent; radio TUPY (50 kw). Today, the owners are trying to devise ways and means for spreading and popularizing the value of radio broadcasting. The immensity of the signal coverage from this transmitter can be visualized by taking into account that the area of Brazil is much greater than that of the United States.

Broadcasting in that country on a large scale requires not only plenty of money, but courage and initiative as well.

Incidentally, there are few radio receivers outside of the country's five key cities; one is not surprised to find no sets of any description in some well-populated regions—scarcity of money, compatible with a low I. Q., are factors which prevent sales of receivers.

◆

NOTES FROM RUSSIA

MOSCOW:

In the near future Russia contemplates the erection of the most powerful station-network in the world. By synchronizing a group of super-power transmitters, 2500 kw will be obtained. At present the two highest powered stations in the world are WLW, at Cincinnati, Ohio, and Moscow No. 1 (RW1).

◆

On account of the modern facilities and methods used in the United States in the manufacture of radio equipment, the Amtorg Trading Corporation, New York, purchasing agents for Soviet Russia, have completed a wholesale transaction amounting to $200,000 with RCA. Further orders will be forthcoming according to market observers.

◆

WHY THE HUM?

LONDON:

Post Office engineers have been seeking, without success, the origin of a 120-cycle hum on the Australian and South African beam telephone service. (The Shadow?)

An evening journal recently suggested that the hum was caused through draining of the world's oil supplies, causing wearing of the bearings of the earth's axis! (W. W. Vol. XXXVII, No. 24.)

◆

RADIO IN NAGOYA

NAGOYA, JAPAN:

Unlike the United States, broadcasting in Japan is not commercialized and is operated under complete control of the Department of Communications of the Central Government at Tokyo. This department exercises strict supervision over all electrical apparatus and equipment, including radio sets requiring electrical current for their operation, and all electrical articles, whether imported or domestic, must be presented for inspection and approval by the Department before they may be placed on the market, or used. At present a technical prohibition prevents the use of all-wave or short-wave sets. Odd feature: High degree of clarity and tonal qualities are not essentials in this country. (Abs. Radio Markets).

◆

TELEVISION IN FRANCE

PARIS:

In France, the Ministry of Posts and Telegraphs is extremely interested in having their country match television developments in England and in Germany and are doing everything in their power to speed up this work, realizing that they are behind these two countries in this

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RADIO PROVING POST

THE MIDWEST METAL-TUBE RECEIVER

THE NEW 1936 Midwest Receiver employing 18 metal tubes has a number of special features that in themselves are quite impressive.

The most important feature from the viewpoint of handling and convenience of operation, is the tuning equipment. From the view of the receiver shown in Fig. 1, it will be seen that the tuning mechanism is completely centralized. The low- and high-ratio tuning knobs occupy the center of the large dial. Since the scale calibrations are read at the upper center of the dial, there is no chance of the hand of the operator obstructing the view.

Tuning Equipment

The dial does not use the usual set of second- and hour-hand pointers. Instead the complete dial revolves; very slowly if the small tuning knob is used, and rapidly if the large tuning knob is used. As the dial is revolved, the scale graduations pass across a thin thread of light which is projected on to the translucent dial from the rear. The advantage of this arrangement lies in the fact that the dial reading may be viewed from an angle without introducing error. Moreover, the dial readings with which the operator is concerned always appear in the vertical position, since the dial itself revolves.

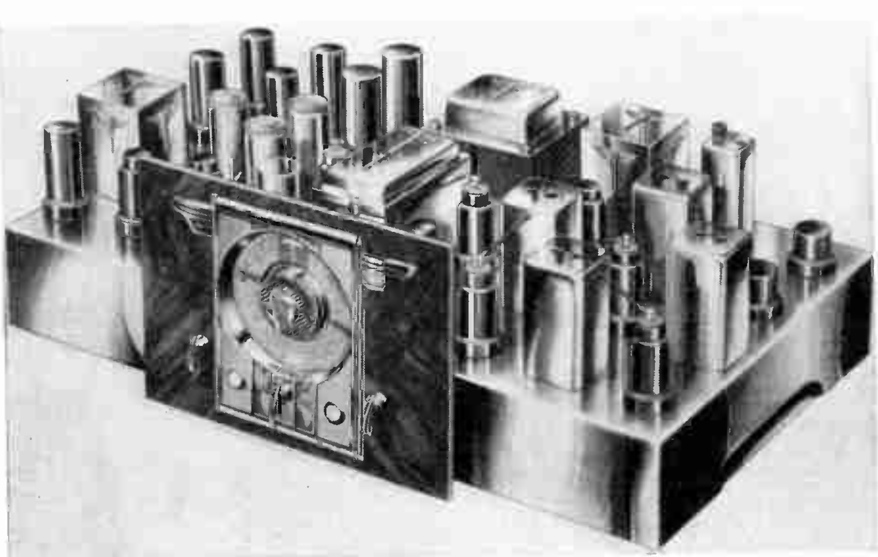
ALL-WAVE RADIO APPROVAL

Only one of the six band scales is visible at a time. This is accomplished by employing a "window of light" that is moved from one scale to another upon the turning of the band-selector switch. There is no possibility, therefore, of reading the wrong dial scale.

There is another "window of light" at the bottom center of the dial scale. This permits the observation of the call letters of the station being received when the set is used on the standard broadcast band, as this portion of the dial carries the calls of the principal stations on the air.

Another important feature of the tuning equipment is the "Tunalite" resonance indicator. This indicates when the receiver is tuned to exact resonance with the desired station, by decreasing in brilliancy. Since the "Tunalite" actually provides the illumination for the upper part of the dial, it is not necessary for the operator to remove his eyes from the dial scale in order to determine if the receiver is correctly tuned. When the receiver is tuned between stations, the "Tunalite" is at full brilliancy. As a station is tuned in, the light diminishes, and the receiver is correctly tuned when the light reaches the point of minimum illumination.

We found upon test that the "Tunailte" appears to have a greater sensitivity than some of the other types of tuning indicators. We had no difficulty in determining the resonance point for stations whose signals were near the level of the background noise.



Chassis view of the Midwest Metal-Tube Receiver. Note the unique tuning scale.

Receiver Controls

As to the other controls on the front panel—the lever at the left is the On-Off Switch and Volume Control. The left push-button is the Station Finder. When this button is pressed the heterodyne or beat-frequency oscillator in the receiver is placed in operation, and so long as this circuit remains closed, any form of station carrier tuned to denotes its presence by a whistle.

The lever in the center of the panel is the Band-Selector Switch. This switch has six positions and covers a range of wavelengths from 4.5 to 2400 meters. A movement of this lever from one band position to another automatically raises or lowers the "window of light" to the proper scale.

To the right of the Band-Selector Switch lever is another push-button. This is used for silent tuning and its use is made possible by the fact that, except for the weakest signals, the presence of a station is made known by a dimming of the "Tunalite" resonance indicator. Thus, the "Silent Tuning" button may be pressed in and the receiver tuned to the desired station by selecting the correct dial reading and watching the "Tunalite." And, of course, station hunting can be accomplished in much the same manner.

The lever on the right of the front panel is the Tone Control. This lever works through a complete 360° and provides most any combination of highs and lows desired. At certain points in the setting of this control, both the high-frequencies and the low-frequencies are emphasized. At another point the higher frequencies are attenuated for the purpose of cutting down background noise when receiving distant stations.

The Receiver Circuit

The circuit of the receiver is shown in Fig. 2. Starting at the left, there is a stage of radio frequency amplification using a 6K7 tube. This stage functions on all six bands. There follows the first detector, also using a 6K7 tube. To this tube is coupled the 6C5 converter oscillator which supplies a voltage of proper frequency to convert the incoming signal to the same resonant frequency as that of the i-f amplifier.

The first detector is followed by two stages of intermediate-frequency amplification, both of which employ 6K7 tubes. The first stage has a switching arrangement in the cathode circuit which automatically increases the gain of the amplifier when the band-selector switch is in any of the four short-wave positions. From the output of this same stage there is a lead which feeds the amplified and delayed automatic volume control channel which uses a 6K7 and a 6H6 tube. This channel provides very wide range avc action, yet, due to the delayed action, does not reduce the sensitivity of the receiver to weak signals.

The output of the second i-f stage feeds the usual 6H6 diode second detector, and also the 6C5 "Tunalite" resonance indicator. The volume control is in the load circuit of the diode second detector. The audio-frequency signal component developed across this control is fed through the contact arm to the 6C5 a-f voltage amplifier.

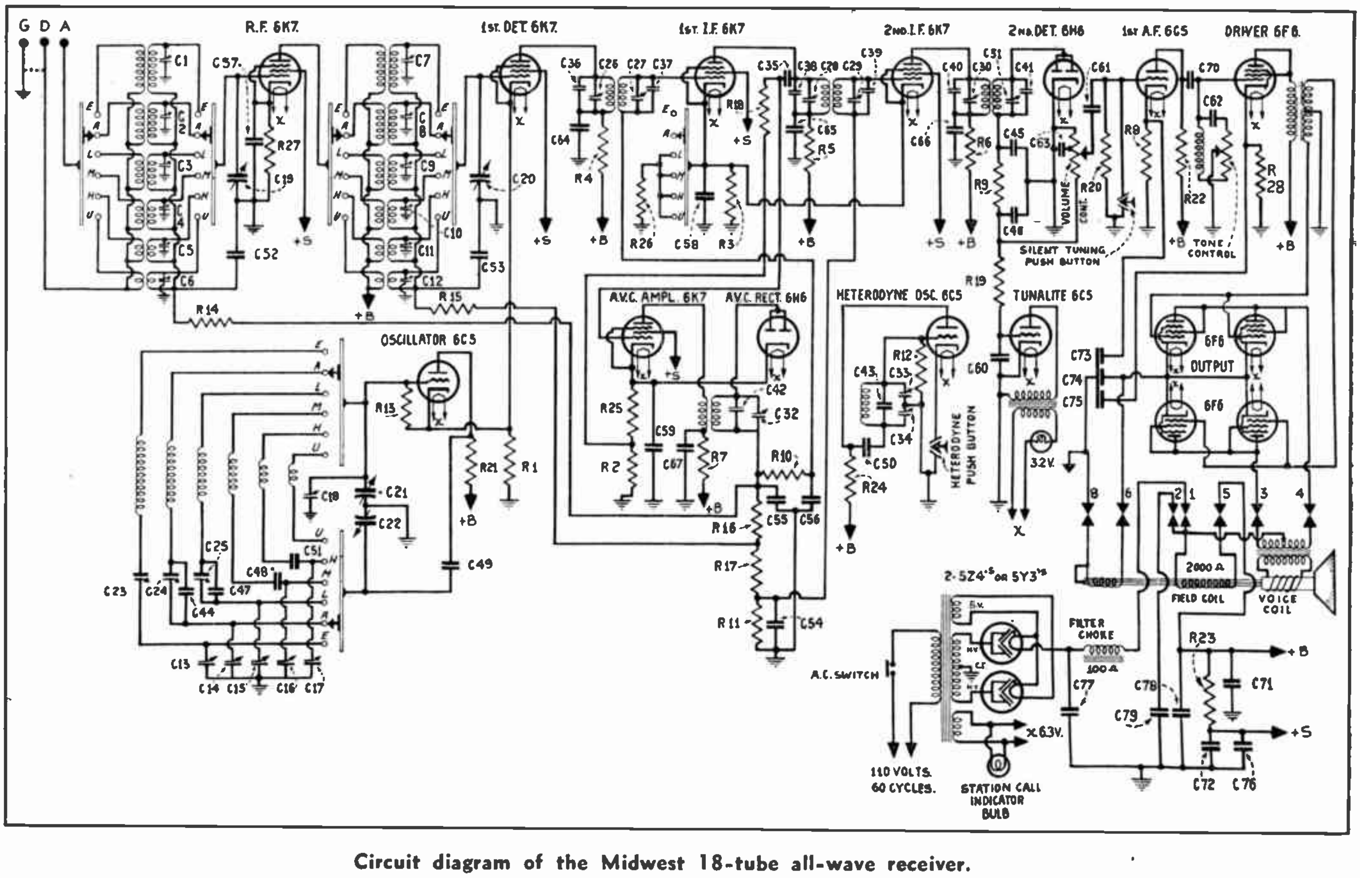
The tone control is included in the input circuit of the 6F6 audio driver tube. The driver tube provides the necessary power for swinging the four 6F6 output tubes connected in parallel push-pull. The output of these tubes is said to be in the vicinity of 20 watts maximum.

High voltage for the operation of the receiver is supplied by two 5Z4 rectifiers connected in parallel.

Receiver Tests

The first test made on this receiver was for frequency drift. After giving the set 10 minutes to get warmed up, the circuit to the beat-frequency oscillator was closed and the receiver tuned to a commercial code station. The receiver was left in this condition for 30 minutes during which period there was no noticeable change in the pitch of the received signal nor any evidence of high-frequency oscillator drift.

The second test covered the power handling capabilities of the receiver. No blasting of the loud-speaker took place with volume control set at maximum, although at this position with a strong local station tuned in, there was evidence of distortion. Retarding the volume control slightly removed the distortion and yet left more volume than was comfortable.



Circuit diagram of the Midwest 18-tube all-wave receiver.

The receiver was then tested for its capabilities of providing satisfactory reception from a group of foreign short-wave broadcast stations. Reception from the English, French and Italian stations was quite satisfactory, being almost on a par with local broadcast reception. The surprise came on DJC, a good station to begin with. We listed the reception of a symphony orchestra from this station on the Midwest receiver as closely approaching a good demonstration of high-fidelity reproduction. The results were better on DJC than they were on a high-powered local—which is mostly to the credit of DJC, of course, but it nevertheless demonstrates the fact that foreign program reception can be something worthwhile if a good receiver is employed and reception conditions are favorable.

There is not sufficient space to list the stations received on each of the six bands, nor is this necessary. Each band turned up its share of distant stations, including two of the Australians and a number of Japanese phone and code stations (JVM, JNA, JAO, etc.). The Newark Police radio W2XEN was picked up on 30.1 mc, the distance between station and receiver being approximately 50 miles. VE5EH was picked up in the 20-meter amateur 'phone band. A number of foreign code stations were picked up in the vicinity of 20 mc, including GLW, PJZ, OEV and PSS.

RCA VICTOR MODEL T10-1

THE RCA VICTOR Magic Brain T10-1 is a 10-tube, 3-band superheterodyne employing metal tubes in all positions except the rectifier socket, which carries a 5Z3. A front view of the receiver is shown.

This receiver has a continuous band coverage from 540 to 18,000 kilocycles, or a little below 16 meters and up through the standard broadcast band.

The knobs arranged in a row along the base of the cabinet match the cabinet wood. From left to right they are: Music-Speech Control and On-Off Switch; Volume Control; Two-Speed Tuning Control; Band-Selector Switch; and Tone Control.

The RCA Victor Model T10-1 All-Wave Receiver.

Receiver Controls

All control actions are smooth. The volume and tone controls are free of noise and are well graduated. The band-selector switch is easy to handle; this may be due principally to the two good gripping surfaces on the knob. The tuning knob is free of play in the low-ratio position but has slight play in the high-ratio position. The play, however, is in the shaft only and in no way affects actual tuning. In the low-ratio position, this control has a ratio of 10 to 1; in the high-ratio position the ratio is 50 to 1—adequate for tuning in the high-frequency bands.

The tuning range is divided into three sections, as follows: Band A, 540 to 1800 kc; Band B, 1800 to 6000 kc; Band C, 6000 to 18,000 kc. A pointer mechanically coupled to the band-selector switch travels over a small arc at the bottom of the dial scale. Three positions are marked and each carries a color corresponding to the three colors used on the tuning dial scales. Band A is red, Band B is blue, and Band C is orange. With this arrangement there is no possibility of using the wrong dial scale.

The receiver employs an 8-inch dynamic speaker and has a maximum audio output of 11.5 watts. This is more than can be used comfortably, and with such high output the percentage of harmonic distortion is rather high. Even at an output of 8.5 watts, where distortion drops to a negligible quantity, the volume is more than one would normally wish to use.

The Circuit

The circuit of the receiver is shown in Fig. 1. There is a stage of radio-frequency amplification preceding the first detector and this stage is used on all bands. The tube employed is a 6K7.

Separate tubes are used for converter oscillator and first detector. This is a distinct advantage on all wavebands as there is less chance of oscillator "pull-in" due to the type of coupling used.

The first detector or mixer is one of the new metal 6L7 hexodes, a tube having many advantages over the usual type of mixer. The principal advantage lies in the increased conversion gain that may be obtained, and the freedom of the tube from oscillator-mixer coupling ailments. This tube shows up particularly well when the receiver is operated in the wavelength range from 16 to 50 meters.

The mixer tube is followed by one stage of intermediate-frequency amplification. This stage uses a 6K7 tube. The output of the 6K7 is fed to a 6H6 diode which functions as second detector and automatic volume control. The circuit of this tube is interesting in that the second diode is used to provide residual bias for the r-f, mixer and i-f tubes when there is no avc voltage. With the application of avc voltage to these tubes, the second diode of the 6H6 removes the residual bias.

The audio component of the signal appearing in the load circuit of the 6H6 tube is fed to a 6C5 a-f voltage amplifier through the volume-control potentiometer. The 6C5 voltage amplifier is resistance coupled to a second 6C5 which functions as a power driver for the two 6F6 output tubes operated push-pull.

Receiver Tests

Sensitivity, selectivity and image ratio were found to be good on all three bands. The avc action is very good. A comparatively large change in signal input due to fading makes no appreciable change in audio output.

The receiver appears to have a definite peak in the vicinity of 100 cycles, which adds materially to the quality of musical renditions. On the other hand, the existence of this peak is inclined to make speech sound "chesty" unless the music-speech switch is thrown to the speech position.

There are no particular remarks to be made about the tuning of the receiver; as we mentioned previously, there is sufficient vernier action to make tuning an easy matter in any band. There is a "second-hand" pointer which is handy for the purpose of logging stations. This pointer travels over a 360° scale on the periphery of the dial face. When tuning in the shorter wavelength bands, this pointer is particularly handy as it is quite impossible for the eye to follow the almost imperceptible movement of the main pointer.

The receiver has a particularly good signal-to-noise ratio which shows up to real advantage in the short-wave bands. Local man-made interference cannot, of course, be obviated, but we found the receiver capable of picking up and holding weak signals well down in the "soup."

Listening tests were carried out in all bands, but not for the purpose of gathering a host of station calls—although we got them just the same. The tests in each band were carried out for the purpose of determining how well the receiver compared with signal data collected on our laboratory standard.

Nevertheless, there seems to be a certain psychological significance in the listing of calls heard, so we will include a few that were intercepted.

Stations Heard

The 16-meter band brought in the inevitable GSG and DJE, as well as PHI and W3XL. On 25 meters the receiver picked up with no difficulty the station at Pontoise, PCJ, DJD, DJB, DJQ, GSF, GSI, HVJ and W8XK.

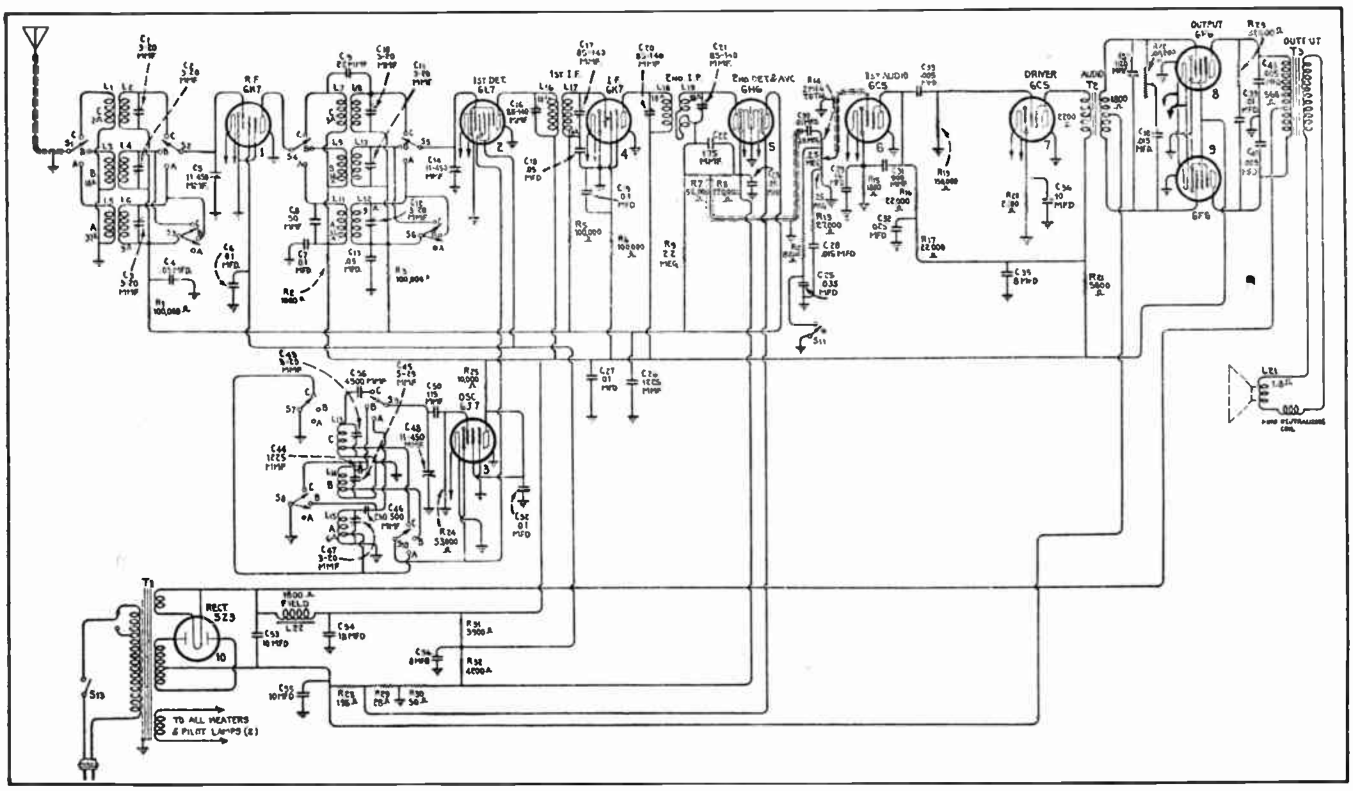
The 20-meter amateur 'phone band brought in twenty 6th District stations in two evenings, as well as five 7th District stations. Some other stations received during the tests were: VE2AW, VE3GS, VE3IT, VE3IX, VE4AW, VE4LA, VE4PF, VE4TI in Canada; K6LJB in Honolulu; G5ML and G5NI in England; LU5CZ in Argentina; XE1G, XE1HH, XE2CK, XE2FM and XE2N in Mexico, etc.

On 25 meters we had W8XL, COCH, EAQ, JVM and 12RO. On 31 meters, not to mention the "locals," we received in good shape CGA4, 12RO and VK2ME.

The first try at the 49-meter band was rather interesting. Without attempting to pick up calls, we ran through the band from about 5.75 mc to 6.5 mc and hauled out 40 stations. In only two cases was inter-station interference noticeable that particular evening, and in no other case did we have any difficulty in actually separating stations. This speaks well for the selectivity of the receiver.

The Police, Aircraft and Standard Broadcast Bands worked in fine shape. Sixteen and twenty-five stations were picked up in the high- and low-frequency police bands respectively. Stations in the broadcast band were equal to one for every 1.5 scale divisions, Canadians and Mexicans included.

We are pleased to recommend this receiver.



Circuit diagram of the RCA Victor Model T10-1 Magic Brain All-Wave Receiver.

In Writing For Veries . . .

ADDRESSES OF PRINCIPAL SHORT-WAVE STATIONS BY COUNTRY

AFRICA

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

ASIA, OCEANIA AND FAR EAST

Call	*Address*
CQN	Government Broadcasting Station CQN, Postmaster General, Post Office Bldg., Macoa, (Portuguese), China.
FZS	Postale Boite 238, Saigon, Indo-China.
HSP	Government Post & Telegraph, Bangkok, Siam.
Java Stations	H. Van der Veen, Engineer, Java Wireless Stations, Bandoeng, Java.
"JV" & "JZ" Stations	International Wireless Telephone Company of Japan, Osaka Bldg., Kojimachiku, Tokio, Japan.
"JY" Stations	Radio JYR, Kemikawa-Cho-Chiba, Ken, Japan.
KAY et al.	Philippine Long Distance Telephone Co., Manila, P. I.
PMY	Radio Station PMY, Nillmy Bldg., Bandoeng, Java, Netherlands Indies.
RV15	Far East Radio Station RV-15, Khabarovsk, U.S.R.R.
VK2ME	Amalgamated Wireless Ltd., Wireless House, 47 York St., Sidney, N.S.W. Australia.
VK3LR	Australian Broadcasting Commission, Broadcast House, 264 Pitt St., Sidney, Australia.
VK3ME	Amalgamated Wireless Ltd., P. O. Box 1272-L, Melbourne, Australia.
VPD	Amalgamated Wireless, Ltd., Suva, Fiji Islands.
VUC	Indian State Broadcasting Service, 1 Garstin Place, Calcutta, India.
VUY-VUB	Indian State Broadcasting Service, Irwin House, Sprott Road, Ballard Estate, Bombay, India.
XGW	Radio Administration, Sassoon House, Shanghai, China.
YBG	Radio Service, Serdangweg 2, Sumatra, Dutch East Indies.
YDA	H. Van der Veen, Engineer, Java Wireless Stations, Bandoeng, Java.
ZBW	Station ZBW, Hong Kong Broadcasting Committee, P. O. Box 200, Hong Kong, China.
ZGE	Radio ZGE, Kuala Lumpur, Malaya States.
ZHI	Radio Service Company, Broadcast House, 2 Orchard Road, Singapore, Malaya.
ZHJ	Radio Station ZHI, Radio Society of Penang, Penang, Malay Straits.
ZLT-ZLW ZLR	Supt. Post & Telegraph, GPO, Wellington, New Zealand.

CANADA

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

CUBA, MEXICO, CENTRAL AMERICA AND WEST INDIES

Call	*Address*
CMA-3 CMB-2	Cuba Transatlantic Radio Corp., Apartado No. 65, Havana, Cuba.
CO9GC	Laboratorio Radio-Electrico, Grau y Caminero, Apartado 137, Santiago, Cuba.
CO9JQ	Estacion Experimental de Onda Corta-CO9JQ, Calle del General Gomez, No. 4, Camaguey, Cuba.
CO9WR	P. O. Box 85, Sancti-Spiritus, Santa Clara, Cuba.
COCO	Post Office Box 98, Havana Cuba.
COCD	"La Voz del Aire, S. A.", P. O. Box 2294, 25 y. g. Vedado, Havana, Cuba.
COCH	Estacion COCH, Calle B No. 2 Vedado, Havana, Cuba.
HI1A	Radiodifusora HI1A "La Voz del Yaque," Santiago de los Caballeros, R. D.
HI3C	Radiodifusora HI3C, Sr. Roberto Bernado, Prop., La Ramona, R. D.
HI3U	Radiodifusora HI3U, Puerto Plata, R. D.
HI4D	Radiodifusora HI4D, "La Voz de Quisqueya," Dominican Republic.
HI4V	Radio HI4V La Voz de la Marina, Santo Domingo, R. D.
HI5E	Radiodifusora Ozama, Santo Domingo, R. D.
HI5N	Radio HI5N, La Voz del Almacen Dominicano, Santiago de los Caballeros, R. D.
HH2T HH2S	Societe Haitienne de Radiodiffusion, P. O. Box 103, Port-au-Prince, Haiti.
HIH	Radio HIH, "Las Voz del Higuamo," San Pedro de Macoris, R. D.
HIL	Radio HIL, Apartado 623, Santo Domingo City, R. D.
HIX	Radio HIX, J. R. Saladin, Director of Radio Communication, Santo Domingo, R. D.
HI1J	Radiodifusora HI1J, Apartado 204, San Pedro de Macoris, R. D.
HIZ	Radiodifusora HIZ, Calle Duarte No. 68, Santa Domingo, R. D.
HP5B	Radio HP5B, P. O. Box 910, Panama City, Panama
HP5F	La Voz de Colon, Hotel Carlton, Colon, Panama.
HP5J	La Voz de Panama, Apartado 867, Panama City, Panama
TGS	Radio TGS, Casa de Presidencial, Guatemala City, Guatemala.
TGX	Radiodifusora TGX, Director M. A Mejicano Novales, 11 Avenue N. 45 Guatemala City, Guatemala
TGW	Radiodifusora Nacional TGW, Republic de Guatemala.
TG2X	Direccion general de la Polica Nacional, Guatemala City, Guatemala.
TIPG	Radio TIPG, Perry Girton, Prop., Apartado 225, San Jose, Costa Rica, C. A.
TI8WS	Radio TI8WS, "Ecos de Pacifico, Sr. Abel Salazar F, Apartado 75, Puntarenas, Costa Rica.
TIEP	"La Voz del Tropico," Apartado 257, San Jose, Costa Rica, C. A.
TIGPH	Radiodifusora TIGPH "Alma Tica," Apartado 775. San Jose, Costa Rica.
TIRCC	Radioemisora Catolica Costaricense, Apartado 1064, San Jose, Costa Rica, C. A.
HRN	Radio HRN, La Voz de Honduras, Tegucigalpa, Honduras
VPN	Station VPN, Nassau, Bahama Island.
WTDV	H. M. McKenzie, St. Thomas, Virgin Islands.
WTDW	S. I. Winde, Christiansted, Virgin Islands.
XAM	Director General de Correos, Merida, Yucatan, Mexico.
XBJQ	Radiodifusora XBJQ, P. O. Box 2825, Mexico D. F., Mexico.
XDA-XDC	Secretaria de Communicaciones, Mexico, D. F.
XEBT	El Buen Tono, S.A., Apartado 79-44, Mexico, D. F.
XECR	Estacian XECR Secretaria de Relaciones Exteriories. Mexico, D. F.

XECW	Radio XECW, Del Caballero Santokan, Bajio 120, Mexico, D. F.
XEFT	Radio XEFT, La Voz de Vera Cruz, Av. Independencia 28, Vera Cruz, Mexico.
XEUW	Radiodifusora XEUW, Av. Independencia 98, Vera Cruz, Mexico.
XEXA	Secretaria de Educacion Publica, Mexico, D. F.
YNA	Tropical Radio Telegraph, Managua, Nicaragua, C. A.
YNIGG	La Voz de Los Lagos; Radiodifusora YNIGG, Managua, Nicaragua, C. A.
YNLF	Radiodifusora YNLF, c/o Ing. Moises Le Franc Calle 15 de Set No. 206, Managua. Nicaragua.
YNVA	Radiodifusora YNVA, Managua, Nicaragua.

EUROPE

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

SOUTH AMERICA

Call	*Address*
CEC	CIA Internacional de Radio, Casilla 16-D, Santiago, Chile.
CP5	Radio CP5, Casila 637, La Paz, Bolivia.
El Prado	Apartado 98, Riobamba, Ecuador.
HC2AT	Radiodifusora HC2AT, P. O. Box 872, Guayaquil, Ecuador.
HC2ET	Radiodifusora del Telegrafo, Casilla 249, Guayaquil, Ecuador.
HC2CW	Radiodifusora HC2CW Casilla 1166, Guayaquil, Ecuador.
HC2JSB	Ecuador Radio Station HC2JSB, Juan S. Behr, Prop., Guayaquil, Ecuador.
HC2RL	P. O. Box 759, Guayaquil, Ecuador.
HCJB	Casilla 691, Quito, Ecuador.
HCK	Radiodifusora Del Estado, HCK, Quito, Ecuador.
HJA7	Radio HJA7, Cucuta, Colombia.
HJ1ABB	Apartado 715, Barranquilla, Colombia.
HJ1ABC	Radiodifusora HJ1ABC La Voz de Quibdo, Quibdo, Columbia
HJ1ABD	Estacion HJ1ABD, Cartagena, Colombia.
HJ1ABE	Apartado 31, Cartagena, Colombia.
HJ1ABG	Apartado 674, Barranquilla, Colombia.
HJ1ABJ	"La Voz de Santa Marta," Radio HJ1ABJ, Santa Marta, Colombia.
HJ1ABK	Radiodifusora HJ2ABK, Apartado 580, Barranquilla, Colombia.
HJ2ABA	"La Voz Del Paiz," Tunja, Boyaca, Colombia.
HJ2ABC	Pompilio Sanchez, Cucuta, Colombia.
HJ2ABD	Hector McCormick Prop., Radiodifusora HJ2ABD, Calle 2A #1205, Bucaramanga, Colombia.
HJ3ABD	Colombia Broadcasting, Apartado 509, Bogota, Colombia.
HJ3ABF	Apartado 317, Bogota, Colombia.
HJ3ABH	"La Voz de La Victor," Apartado 565, Bogota, Colombia.
HJ3ABI	Apartado 513, Bogota, Colombia.
HJ4ABA	Emisora HJ4ABA, "Ecos de la Montana," Medellin, Colombia.
HJ4ABB	Radio Manizales, Apartado 175, Manizales, Colombia.
HJ4ABC	Radiodifusora HJ4ABC "La Voz de Pereira," Pereira-Caldas, Colombia.
HJ4ABD	Radiodifusora HJ4ABD La Voz de Citia, Medellin, Colombia.
HJ4ABE	Radiodifusora de Medellin, Medellin, Colombia.
HJ4ABC	Radiodifusora HJ4ABC, Ecos del Combeima, Ibague, Colombia.
HJ4ABL	"Ecos de Occidente," P. O. Box 50, Manizales, Colombia.
HJ5ABC	"La Voz de Colombia," Radiodifusora HJ5ABC, Cali, Colombia.
HJ5ABD	"La Voz del Valle," Cali, Colombia.
HJ5ABE	Radiodifusora HJ5ABE, Apartada 50, Cali, Colombia.
HJB	Marconi Telegraph Co., Apartado 1591, Bogota, Colombia.
HJN	Ministero de Correos y Telegraph, Bogota, Colombia.
HJY	All-America Cables, Inc., Bogota, Colombia.
HKF	Observatoria Nacional de San Bartolome, Bogota, Colombia.
HKV	Radiodifusora HKV, Radio Dept.—War Ministry, Government of Colombia, Bogota, Colombia.
LSN-LSL, et al.	Compania Internacional, 143 Defensa, Buenos Aires, Argentina.
LSX	Transradio Internacional, San Martin 329, Buenos Aires, Argentina.
OAX4D	Radiodifusora OAX4D, All- American Cables, Inc., (L. N. Anderson, Mgr.) Calle de San Antonio, 677; Casilla 2336, Lima, Peru.
OAX4G	Radiodifusora OAX4G, Roberto Grellaud, Avda. Abancay 915-923 Lima, Peru.
OCI-OCJ	All-America Cables, Inc., Lima, Peru.
PPU-PPQ, et al.	Caixa Postal 500 Rio de Janeiro, Brazil.
PRA8	Radio Station PRA8, Radio Club of Pernambuco; "The Voice of North," Pernambuco, Brazil.
PRF5-PSK	Comp. Radio Internacional Do Brazil, P. O. Box 709, Rio de Janeiro, Brazil.
VP3MR	Radio Station VP3MR, Wellington St., Georgetown, British Guiana.
YV2RC	Apartado Correos 2009, Caracas, Venezuela.
YV3RC	Radiodifusora Venezuela, YV3RC, Caracas, Venezuela.
YV4RC	Estacion S.A.R., Este 10 bis N. 71, Caracas, Venezuela.
YV5RMO	Box 214, Maracaibo, Venezuela.
YV6RV	"La Voz de Carabobo," Radio YV6RV, Valencia, Venezuela.
YV8RB	Radiodifusora YV8RB, "La Voz de Lara," Barquisimeto, Venezuela.
YV10RC	Radiodifusora YV10RSC "La Voz del Tachira," San Cristobal, Venezuela.
YVQ-YVR	Servicio Radiotelegraphico, Maracay, Venezuela.
ZP10	Radio Prieto ZP10, Asuncion, Paraguay.

UNITED STATES

Dixon Stations	140 Montgomery St., San Francisco, Cal.
W1XAL	World Wide Broadcasting Corp., University Club, Boston, Mass.

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SHORT-WAVE STATION LIST

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

KC	Meters	Call	Location	Time
21540	**13.92**	**W8XK**	**Pittsburgh, Pa.**	**7-9 A.M.**
21530	**13.93**	**GSJ**	**Daventry, England**	**6:00-8:45 A.M.**
21520	**13.94**	**W2XE**	**Wayne, N. J.**	**10-11 A.M. Daily**
21500	13.95	NAA	Washington, D. C.	(E) Time signals regularly
21420	14.01	WKK	Lawrenceville, N. J.	(P) Phones LSN-PSA daytime; HJY-OCI-OCJ irregular
21160	14.19	LSL	Buenos Aires, Arg.	(P) Phones GAA mornings; DFB-DHO PSE-EHY irregular
21140	14.19	KBI	Manila, P. I.	(P) Tests and relays P. M. irregular
21080	14.23	PSA	Rio de Janerio, Brazil	(P) Phones WKK-WLK daytime
21060	14.25	KWN	Dixon, Calif.	(P) Phones afternoon irregular
21020	14.29	LSN	Buenos Aires, Arg.	(P) Phones WKK-WLK daily; EHY, FTM irregular
20860	14.38	EHY	Madrid, Spain	(P) Phones LSM-PPU-LSY mornings
20860	14.38	EDM	Madrid, Spain	(P) Phones LSM-PPU-LSY mornings
20835	14.40	PFF	Kootwijk, Holland	(P) Phones Java days
20830	14.40	PFF	Kootwijk, Holland	(P) Phones Java days
20825	14.41	PFF	Kootwijk, Holland	(P) Phones Java days
20380	14.72	GAA	Rugby, England	(P) Phones LSL mornings; LSY-LSM-PPU irregular
20040	14.97	OPL	Leopoldville, Belgian Congo, Africa	(P) Tests with ORG mornings and noon
20020	14.99	DHO	Nauen, Germany	(P) Phones PPU-LSM-PSA - LSL - YVR mornings
19987	15.01	CFA	Drummondville, Que.	(P) Phones: No A. M.; irregular
19980	15.02	KAX	Manila, P. I.	(P) Phones KWU evenings; DFC-JVE A. M.; early A. M.
19820	15.14	WKN	Lawrenceville, N. J.	(P) Phones GAU mornings
19720	15.21	EAQ	Madrid, Spain	(P) Relays and tests in A.M.
19680	15.24	CEC	Santiago, Chile	(P) Phones OCI-HJY afternoons
19600	15.31	LSF	Buenos Aires, Arg.	(P) Phones and tests irregularly
19530	15.36	EDR2	Madrid, Spain	(P) Phones LSM-PPU-YVR mornings
19530	15.36	EDX	Madrid, Spain	(P) Phones LSM-PPU-YVR mornings
19520	15.37	IRW	Rome, Italy	(P) Phones LSM-PPU mornings. Broadcasts irregularly
19500	15.40	LSQ	Buenos Aires, Arg.	(P) Phones daytime irregularly
19355	15.50	FTM	St. Assise, France	(P) Phones LSM-PPU-YVR mornings
19345	15.52	PMA	Bandoeng, Java	(P) Phones PCK-PDK early mornings
19270	15.57	PPU	Rio de Janerio, Brazil	(P) Phones DFB-EHY-FTM mornings
19235	15.60	DFA	Nauen, Germany	(P) Phones HSP-KAX early mornings
19220	15.61	WKF	Lawrenceville, N. J.	(P) Phones GAS-GAU mornings
19200	15.62	ORG	Brussells, Belgium	(P) Phones OPL mornings
19140	15.68	LSM	Buenos Aires, Arg.	(P) Phones DFB-FTM-GAA-GAB mornings
18970	15.81	GAQ	Rugby, England	(P) Phones ZSS mornings
18960	15.82	WQD	Rocky Point, N. Y.	(E) Tests LSY irregularly
18950	15.83	HBF	Geneva, Switzerland	(E) Phones So. America mornings
18910	15.86	JVA	Nazaki, Japan	(P) Phones and tests irregular with Europe
18890	15.88	ZSS	Klipheuvel, So. Africa	(P) Phones GAQ-GAU mornings
18860	15.91	WKM	Rocky Point, N. Y.	(E) Tests and relays irregularly
18830	15.93	PLE	Bandoeng, Java	(P) Phones PCV mornings early. KWU evenings. Music at times mornings.
18680	16.06	OCI	Lima, Peru	(P) Phones CEC-HJY days; WKK-WOP noon
18620	16.11	GAU	Rugby, England	(P) Phones VWY-ZSS early A.M.; Lawrenceville. daytime
18545	16.18	PCM	Kootwijk, Holland	(P) Relays and phones Java early a.m.
18540	16.19	PCM	Kootwijk, Holland	(P) Relays and phones Java early a.m.
18535	16.20	PCM	Kootwijk, Holland	(P) Relays and phones Java early a.m.
18480	16.23	HBH	Geneva, Switzerland	(E) Relays to N. Y. mornings irreg.
18440	16.25	HJY	Bogota, Colombia	(P) Phones CEC-OCI noon; music at times
18410	16.29	PCK	Kootwijk, Holland	(P) Phones PLE-PMC early a.m.
18405	16.30	PCK	Kootwijk, Holland	(P) Phones PLE-PMC early A.M.
18400	16.31	PCK	Kootwijk, Holland	(P) Phones PLE-PMC early a.m.
18350	16.35	FZS	Saigon, Indo-China	(P) Phones FTK early mornings
18340	16.36	WLA	Lawrenceville, N. J.	(P) Phones GAS mornings
18310	16.38	GAS	Rugby, England	(P) Phones WLA-WMN mornings
18295	16.39	YVR	Maracay, Venezuela	(P) Phones DFB-EHY-FTM mornings
18270	**16.42**	**ETA**	**Addis Ababa, Ethiopia**	**Daily 7 A.M. - 3 P.M. Wednesdays 4:50-5:30 P.M.**
18250	16.43	FTO	St. Assise, France	(P) Phones LSM-LSY mornings
18200	16.48	GAW	Rugby, England	(P) Relays and phones N. Y. irreg.
18190	16.49	JVB	Nazaki, Japan	(P) Phones Java early mornings
18180	16.51	CGA	Drummondville, Que.	(P) Phones GBB mornings
18135	16.54	PMC	Bandoeng, Java	(P) Phones PCK-PCV and broadcasts early mornings irregular
18115	16.56	LSY3	Buenos Aires, Arg.	(E) Phones DFB-FTM-GAA-PPU A. M.; evening broadcasts occasionally
18075	16.59	PCV	Kootwijk, Holland	(P) Phones PLE early mornings
18070	16.60	PCV	Kootwijk, Holland	(P) Phones PLE early mornings
18065	16.61	PCV	Kootwijk, Holland	(P) Phones PLE early mornings
18040	16.63	GAB	Rugby, England	(P) Phones LSM noon
17980	16.69	KQZ	Bolinas, Calif.	(E) Tests and relays to LSY irreg.
17940	16.72	WQB	Rocky Point, N. Y.	(E) Tests with LSY mornings
17920	16.74	WQF	Rocky Point, N. Y.	(P) Phones Ethiopia irregular
17900	16.76	WLL	Rocky Point, N. Y.	(E) Relays to Geneva and Germany mornings
17850	16.81	LSN	Buenos Aires, Arg.	(P) Phones S. A. stations irreg.
17790	**16.86**	**GSG**	**Daventry, England**	**6-8:45 A.M. 9:00 A.M.-12:00 noon**
17780	**16.87**	**W3XAL**	**Bound Brook, N. J.**	**9 A.M., 5 P.M. daily**
17760	**16.89**	**W2XE**	**Wayne, N. J.**	**11 A.M.-1 P.M. Daily**
17760	**16.89**	**DJE**	**Zeesen, Germany**	**8-11:30 A.M.**
17750	16.91	IAC	Piza, Italy	(P) Phones and Tests to ships A.M.
17740	16.91	HSP	Bankok, Siam	(P) Phones DFA-DGH-KAY early mornings
17710	16.94	CJA-3	Drummondville, Que.	(P) Phones Australia and Far East early A. M.
17699	16.95	IAC	Piza, Italy	(P) Phones and tests to ships A.M.
17545	17.10	VWY	Poona, India	(P) Phones GAU-GBC-GBU mornings
17520	17.12	DFB	Nauen, Germany	(P) Phones PPU-YVR-KAY mornings
17480	17.16	VWY	Poona, India	(P) Phones GAU-GBC-GBU daytime
17260	17.37	DAF	Nordenland, Germany	(P) Phones ships mornings
17120	17.52	WOO	Ocean Gate, N. J.	(P) Phones ships daytime
17120	17.52	WOY	Lawrenceville, N. J.	(P) Phones England irreg.
17080	17.56	GBC	Rugby, England	(P) Phones ships daytime
16910	17.74	JZD	Nazaki, Japan	(P) Phones ships irregular
16305	18.39	PCL	Kootwijk, Holland	(P) Special relays and phones irreg.
16300	18.44	WLK	Lawrenceville, N. J.	(P) Phones England irreg.
16240	18.47	KTO	Manila, P. I.	(P) Phones JVE-KWU evenings
16214	18.50	FZR	Saigon, Indo-China	(P) Phones FTA-FKT early A.M.
16117	18.62	IRY	Rome, Italy	(P) Phones Cairo, Asmara and others, broadcasts music A. M. and early P. M.
16050	18.69	JVC	Nazaki, Japan	(P) Phones Hong Kong early A. M.
16030	18.71	KKP	Kahuku, Hawaii	(P) KWU afternoons and evening. Tests JVF - KTO - PLE mornings
15930	18.83	FYC	Pontoise, France	(P) Phones 9:00 A.M. and irreg.
15880	18.89	FTK	St. Assise, France	(P) FZR-FZS-LSM-PPU-YVR mornings
15860	18.90	JVD	Nazaki, Japan	(P) Phones Shanghai early A.M.
15860	18.90	CEC	Santiago, Chile	(P) Phones OCJ mornings

KC	Meters	Call	Location	Time
15810	19.02	LSL	Buenos Aires, Arg.	(P) Phones GAA mornings; PSE-PSF afternoons
15760	19.04	JYT	Kemikawa-Cho, Japan	(E) Tests KKW-KWE-KWU evenings
15740	19.06	JIA	Chureki, Japan	(P) Phones Nazaki early A.M.
15700	19.11	WJS	Hicksville, L. I., N. Y.	(P) Phones Ethiopia irregular
15670	19.15	WAE	Brentwood, N. Y.	(E) Tests afternoons
15660	19.16	JVE	Nazaki, Japan	(P) Phones PLE early A. M.; KTO evenings.
15625	19.20	OCJ	Lima, Peru	(P) Phones CEC daytime
15620	19.21	JVF	Nazaki, Japan	(P) Phones KWO-KWU after 4 P.M.
15595	19.24	DFR	Nauen, Germany	(E) Tests and relays mornings irreg.
15505	19.36	CMA-3	Havana, Cuba	(P) Phones and tests irregularly
15430	19.44	KWE	Bolinas, Calif.	(P) Tests JYK-JYT-PLE evenings
15415	19.46	KWO	Dixon, Calif.	(P) Phones JVF evenings
15410	19.47	Prado	Riobamba, Ecuador	5:00-7:00 P.M. Sunday
15370	19.52	HAS3	Budapest. Hungary	Sunday 9-10 A.M.
15360	19.53	DJT	Zeesen, Germany	11 P.M.-1 A.M.
15355	19.54	KWU	Dixon, Calif.	(P) Phones Japan. Manila and Java evenings
15340	19.56	DJR	Zeesen, Germany	1:30-3:30 A.M.
15330	19.56	W2XAD	Schenectady, N. Y.	2-3 P.M. Weekdays-Sunday 10:30 A.M.-4 P.M.
15305	19.60	CP7	La Paz, Bolivia	(E) Relays CP4 tests daytimes
15280	19.63	DJQ	Zeesen, Germany	12:30-2:15 A.M.
15270	19.64	W2XE	Wayne, N. J.	1-6 P.M.
15260	19.66	GSI	Daventry, England	12:15 P.M.-4:00 P.M.
15252	19.67	RIM	Tashkent, U.S.S.R.	(P) Phones RKI early mornings
15243	19.68		Pontoise, France	7-11 A.M.
15220	19.71	PCJ	Eindhoven, Holland	Sunday 8:30-11:00 A.M. Tues. 3-6 A.M. Wed. 7-11 A.M.
15210	19.72	W8XK	Pittsburgh, Pa.	9 A.M.-7 P.M.
15200	19.74	DJB	Zeesen, Germany	3:45-7:15 A.M. 8:00-11:30 A.M.
15140	19.82	GSF	Daventry, England	3-5 A.M. 6-8:45 A.M. 9:00 A.M.-12 Noon 4-5:45 P.M.
15121	19.84	HVJ	Vatican City, Vatican	10:30-10:45 A.M.
15110	19.85	DJL	Zeesen, Germany	4-6:00 A.M.
15055	19.92	WNC	Hialeah, Fla.	(P) Phones daytime
15040	19.95	RKI	Moscow, U.S.S.R.	(P) Phones RIM early A.M.
15040	19.95	HIR	Santo Domingo, R. D.	(P) Phones WNC daytime
14980	20.03	KAY	Manila, P. I.	(P) Phones DFC-DFD-GCJ early A.M.; KWU evenings
14940	20.06	HJB	Bogota, Colombia	(P) Phones WNC-PPU YVQ days
14935	20.07	PSE	Rio de Janeiro, Brazil	(P) Phones LSL-WLK day irreg; EDM-EHY 8 a.m.
14920	20.11	KQH	Kahuku, Hawaii	(P) Tests irregularly
14910	20.12	JVG	Nazaki, Japan	(P) Phones Formosa irregular
14845	20.19	OCJ2	Lima, Peru	(P) Phones HJY and others daytime
14800	20.27	WQV	Rocky Point, N. Y.	(E) Tests Europe irreg.
14732	20.51	IQA	Rome, Italy	(P) Phones Japan and Egypt; sends music at times
14710	20.39	IRG	Massawa, Eritrea, Africa	(P) Phones and tests with JVH 5:00 to 7:00 A. M., and sends music
14690	20.42	PSF	Rio de Janerio, Brazil	(P) Phones LSL-WLK-WOK daytime
14653	20.47	GBL	Rugby, England	(P) Phones Nazaki, early A.M.
14620	20.52	EHY	Madrid, Spain	(P) Phones LSM mornings irreg.
14620	20.52	EDM	Madrid, Spain	(P) Phones PPU-PSA-PSE mornings
14600	20.55	JVH	Nazaki, Japan	(E) Phones DFB-GTJ-PCJ-TYB early mornings and B.C. music
14590	20.56	WMN	Lawrenceville, N. J.	(P) Phones England daytime
14550	20.60	HBJ	Geneva, Switzerland	(E) Relays to Riverhead daytime
14530	20.65	LSN	Buenos Aires, Arg.	(P) Phones PSF-WLK-WOK irreg.
14485	20.71	TIR	Cartago, Costa Rica	(P) Phones WNC daytime
14485	20.71	TIU	Cartago, Costa Rica	(P) Phones WNC daytime
14485	20.71	YNA	Managua, Nicaragua	Phones WNC daytime
14485	20.71	HPF	Panama City, Panama	(P) Phones Daytime
14485	20.71	HRM	Tela, Honduras	(P) Phones WNC daytime
14485	20.7i	TGF	Guatemala City, Guatemala	(P) Phones WNC daytime
14470	20.73	WMF	Lawrenceville, N. J.	(P) Phones England daytime
14460	20.75	DZB	Zeesen, Germany	12-2 P.M.
14440	20.78	GBW	Rugby, England	(P) Phones Lawrenceville daytime
14410	20.80	DIP	Zeesen, Germany	(E) Experimental; 12-4:30 P. M.
14236	21.07	HB9B	Basle, Switzerland	Monday, Thursday, Friday 4-6 P.M.
14200	21.20	W10XFB	The Schooner "Morrissey"	(E) Irregular
14100	21.25	HJ5ABE	Cali, Colombia	11:00 A.M.-12 noon daily ex. Sun. 6:00-10:30 P.M.
13900	21.58	WQP	Rocky Point, N. Y.	(E) Test daytime
13820	21.70	SUZ	Cairo, Egypt	(P) Phones DFC-DGU-GBB daytime
13745	21.83	CGA-2	Drummondville, Que.	(P) Phones Europe irregular
13738	21.82	RIS	Tiflis, U.S.S.R.	(P) Tests with Moscow irregular
13690	21.91	KKZ	Bolinas, Calif.	(F) Tests Japan and Java early A.M.; days Honolulu
13667	21.98	HJY	Bogota, Colombia	(P) Phones CEC afternoons
13635	22.00	S.P.W.	Warsaw, Poland	11:30 A.M.-12:30 P.M.
13610	22.04	JYK	Kemikawa-Cho, Japan	(E) Tests irregular A.M.
13585	22.08	GBB	Rugby, England	(P) Phones CGA3-SUV-SUZ daytime
13560	22.12	JVI	Nazaki, Japan	(P) Phones Manchukuo irregularly
13415	22.36	GCJ	Rugby, England	(P) Tests with JVH afternoons
13390	22.40	WMA	Lawrenceville, N. J.	(P) Phones GAS-GBS-GBU-GBW daily
13380	22.42	IDU	Asmara, Eritrea, Africa	(P) Phones Italy; early A. M. and sends music
13345	22.48	YVQ	Maracay, Venezuela	(P) Phones WNC-HJB days
13340	22.49	KBJ	Manila, P. I.	(P) Phones nights and early A.M.
13285	22.58	CGA3	Drummondville, Que.	(P) Phones England days
13220	22.70	IRJ	Rome, Italy	(P) Phones Japan 5-8 A.M.
13180	22.76	DGG	Nauen, Germany	(P) Relays to Riverhead days
13075	22.95	VPD	Suva, Fiji Islands	Mon. to Sat. 12:30-1:30 A.M.
13020	23.04	JZE	Nazaki, Japan	(P) Phones ships irregular
13000	23.08	FYC	Paris, France	(P) Phones CNR mornings
12985	23.11	DFC	Nauen, Germany	(P) Phones KAY-SUV-SUZ early A. M.
12865	23.32	IAC	Piza, Italy	(P) Phones ships irregular
12840	23.36	WOO	Ocean Gate, N. J.	(P) Phones ships days
12830	23.37	HJC	Barranquilla, Colombia	(P) Phones HJB-HPF-WNC days
12830	23.38	HJA-3	Barranquilla, Colombia	(P) Phones HJB-HPF-WNC days
12830	23.38	CNR	Rabat, Morocco	Special broadcasts irregular.
12830	23.38	CNR	Rabat, Morocco	(P) Phones FYB-TYB-FTA irreg. days
12800	23.44	IAC	Piza, Italy	(P) Phones ships and tests Tripoli, irreg.
12780	23.47	GBC	Rugby, England	(P) Phones VWY early A.M.
12396	24.20	CT1GO	Parede, Portugal	Sun. 11:30 A.M.-1 P.M.; 7:15-8:30 P.M. Tues. to Fri. 7:15-8:30 P.M.
12394	24.21	DAF	Nordenland, Germany	(P) Phones ships irreg. mornings
12300	24.39	PLM	Bandoeng, Java	(P) Phones 2ME near 6:30 A.M.
12295	24.40	ZLU	Willmigton, N. Z.	(P) Phones ZLJ early A.M.
12290	24.41	GBU	Rugby, England	(P) Phones Lawrenceville days
12280	24.43	KUV	Manila. P. I.	(P) Phones early A.M.
12250	24.49	TYB	Paris, France	(P) Phones JVH-XGR and ships irreg.
12235	24.52	TFJ	Reykjavik, Iceland	(P) Phones England days
12235	24.52	TFJ	Reykjavik, Iceland	English broadcast each Sunday, 1:40-2:00 P.M.
12220	24.55	FLJ	Paris, France	(P) Phones ships irreg.
12215	24.56	TYA	Paris, France	(P) Algeria, days—"Inverted Speech"
12130	24.73	DJS	Zeesen, Germany	7-9 P.M.
12060	24.88	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12055	24.89	PDV	Kootwijk, Holland	(P) PLE-PLV-PMC early mornings
12050	24.90	PDV	Kootwijk, Holland	(P) PLE-PLV-PMC early mornings
12035	24.93	HBO	Geneva, Switzerland	(E) Relays programs & phones irreg.
12020	24.95	VIY	Rockbank, Australia	(P) Tests CJA6 early A.M. and evenings
12100	24.79	CJA	Drummondville, Que.	(P) Tests VIY early A.M. and evenings
12000	25.00	RNE	Moscow, U.S.S.R	Sunday 6-7 A.M. 10-11 A.M. 4-5 P.M. Monday & Friday 4-5 P.M.
12000	2500	TGWA	Guatemala City, Guatemala	Daily Ex. Sun.-12-2 P.M. 8-9 P.M. 10 P.M.-12 A.M. Sunday 12 A.M.-5 A.M.
11991	25.02	FZS	Saigon. Indo-China	(P) Phones FTA-FTK early A.M.
11955	25.09	ETB	Addis Ababa, Ethiopia	Wednesday 4:50 - 5:30 P.M. and irregular
11950	25.11	KKQ	Bolinas Calif.	(P) Relays programs to Hawaii eve.
11940	25.13	FTA	St. Assise, France	(P) Phones FZS-FZR early A.M.
11935	25.14	YNA	Managua Nicaragua	(P) Cent. and S. A. stations, days

KC	Meters	Call	Location	Time
11885	25.23		Pontoise, France	11:15 A.M.-2:15 P.M. 3-6 P.M.
11870	25.26	W8XK	Pittsburgh, Pa.	5-9 P.M.
11860	25.29	GSE	Daventry, England	9 A.M.-12 noon
11855	25.31	DJP	Zeesen, Germany	2-4 A.M.
11830	25.36	W2XE	Wayne, N. J.	6-10 P.M. Daily
11810	25.40	2RO4	Rome, Italy	8:15-9 A.M. 9:15-11 A.M. 11:30 A.M.-12:15 P.M.
11800	25.40	HJAABA	Medellin, Colombia	11:30 A.M.-1 P.M. 6:30-10:30 P.M.
11800	25.42	CO9WR	Saneti-Spiritus, Cuba	4-6 P.M. 9-11 P.M.
11795	25.43	DJO	Zeesen, Germany	5-7 A.M.
11790	25.43	W1XAL	Boston, Mass.	Sunday 4-7 P.M. Mon. to Fri. 6-6:30 P.M.
11770	2549	DJD	Zeesen, Germany	12 noon-4:30 P.M.
11750	25.53	GSD	Daventry, England	12:15-4 P.M. 6-8:05 P.M. 10-11:05 P.M.
11730	25.57	PHI	Huizen, Holland	Sat. & Sun. 8:30-11 A.M. Mon. Thurs. Fri. 830-10:30 A.M.
11720	25.60	CJRX	Winnipeg, Manitoba	Week days 8:00 P.M.-12 midnight; Sunday 3-10 P.M.
11713	25.62		Pontoise, France	7-10 P.M.-11 P.M.-1 A.M
11680	25.68	KIO	Kahuku, Hawaii	(P) Phones Far-East early A.M.
11660	25.73	PPQ	Rio de Janerio, Brazil	(P) Phones WCG-WET-LSX evenings
11660	25.73	JVL	Nazaki, Japan	(P) Phones Taiwan evenings
11570	25.93	HH2T	Port-au-Prince, Haiti	(P) Evenings; irregular
11538	26.00	XGR	Shanghai, China	(P) Tests irregularly
11500	26.09	XAM	Merida, Mexico	(P) Phones XDF-XDM-XDR irreg.
11495	26.10	VIZ3	Rockbank, Australia	(P) Tests CJA4 early A.M.
11413	26.28	CJA4	Drummondville, Que.	(P) Phones VIZ3 early A.M.
11385	26.35	HBO	Geneva, Switzerland	(E) Phones and relays irregular
11275	26.61	XAM	Merida, Mexico	(P) Phones XDR-XDM irregular
11000	27.27	ZLT	Wellington, N. Z.	(P) Phones VLZ early mornings
11000	27.27	PLP	Bandoeng, Java	(P) Phones early A.M.: broadcasts 6:30-10 A.M.
11000	27.26	XBJQ	Mexico D. F., Mexico	8:15 P.M.-10:30 P.M. irregular
10975	27.35	OCI	Lima, Peru	(P) Phones CEC-HJY days
10975	27.35	OCP	Lima, Peru	(P) Phones HKB early evenings
10910	27.50	KTR	Manila, P. I.	(P) Phones DFC early A.M. irreg.
10850	27.63	DFL	Nauen, Germany	(P) Relays programs afternoons irreg.
10840	27.68	KWV	Dixon, Calif.	(P) Phones Japan, Manila, Hawaii, mornings
10790	27.80	YNA	Managua, Nicaragua	(P) Phones So. America days, irreg.
10770	27.86	GBP	Rugby, England	(P) JYS and XGR irreg.; Phones VLK early A.M. and eve.
10740	27.93	JVM	Nazaki, Japan	4-7:30 A.M. irregular 12-1 A.M. Daily Mon & Thurs. 4-5 P.M.
10675	28.10	WNB	Lawrenceville, N. J.	(P) Phones ZFB daytime
10670	28.12	CEC	Santiago, Chile	(P) Phones HJY-OCI daytime
10670	28.12	CEC	Santiago, Chile	Daily 7-8 P.M. Sunday and Thurs. 8:30-9 P.M.
10660	28.14	JVN	Nazaki, Japan	(P) Phones JIB early A.M.: Relays JOAK irreg.
10660	28.14	JVN	Nazaki, Japan	4-7:30 A.M. irregular. Daily 12-1 A.M. Mon. & Thurs. 4-5 P.M.
10630	28.22	WED	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 evenings
10535	28.48	JIB	Tawian, Japan	(P) Phones JVL-JVN early mornings
10520	28.52	VK2ME	Sydney, Australia	(P) Phones GBP-HVJ early A.M.
10520	28.52	VLK	Sydney, Australia	(P) Phones GBP-HVJ early A.M.
10520	28.52	CFA-4	Drummondville, Que.	(P) Phones: No A. M. days
10440	28.74	DGH	Nauen, Germany	(P) Phones HSG-HSJ-HSP early A.M.
10430	28.80	YBG	Medan, Sumatra	(P) Phones PLV-PLP early A.M.
10420	28.79	XGW	Shanghai, China	(P) Tests GBP-KAY early A.M.
10420	28.79	PDK	Kootwijk, Holland	(P) Phones PLV A.M. and special programs irreg.
10415	28.80	PDK	Kootwijk, Holland	(P) Phones PLV in a.m. and special programs irreg.
10410	28.82	PDK	Kootwijk, Holland	(P) Phones PLV in a.m. and special programs irreg.
10410	28.82	KES	Bolinas, Calif.	(P) Phones S. A. and Far East irreg.
10400	28.85	KEZ	Bolinas, Calif.	(P) Phones Hawaii and Far East irreg.
10390	28.87	KER	Bolinas, Calif.	(P) Phones Far East, early evening
10380	28.90	WCG	Rocky Point, N. Y.	(E) Special program service irreg.
10375	28.92	JVO	Nazaki, Japan	(P) Manchuria and Dairen early A.M.
10370	28.93	EHZ	Madrid, Spain	(P) Phones EHX daytime
10350	28.98	LSX	Buenos Aires, Arg.	Near 10 P.M. irregular. 6-7:15 P.M. daily
10335	29.03	ZFD	Hamilton, Bermuda	(P) Phones afternoons
10330	29.04	ORK	Brussels, Belgium	2:30-4:00 P.M.
10310	29.10	PPM	Rio de Janeiro, Brazil	(P) Tests New York and Buenos Aires evenings.
10300	29.13	LSQ	Buenos Aires, Arg.	(P) Phones GCA-HJY-PSH afternoons
10300	29.13	LSL	Buenos Aires, Arg.	(P) Phones GCA-HJY-PSH afternoons. Broadcasts irregularly
10290	29.15	DIQ	Zeesen, Germany	(E) Phone and pgm. service irreg.
10290	29.15	DIQ	Zeesen, Germany	Used irregularly.
10290	29.15	HPC	Panama City, Panama	(P) Phones C. A. and S. Am. daytime
10260	29.24	PMN	Bandoeng, Java	(P) Tests VLJ early A. M.; broadcasts 6:30-10 A. M.
10250	29.27	LSK3	Buenos Aires, Arg.	(P) "Inverted Speech" afternoons
10220	29.35	PSH	Rio de Janerio, Brazil	(P) Phones LSL-WOK evenings; special pgm. service irreg.
10170	29.50	RIO	Bakou, U.S.S.R.	(P) Phones RIR-RNE early A.M.
10169	29.50	HSG	Bankok, Siam	(P) Phones DGH early A.M. irreg.
10140	29.59	OPM	Leopoldville, Belg-Congo	(P) Phones ORK afternoons
10080	29.76	RIR	Tiflis, U.S.S.R.	(P) Phones RIO-RNE early A.M.
10070	29.79	EHY	Madrid, Spain	(P) Phones YVR afternoons
10055	29.84	ZFB	Hamilton, Bermuda	(P) Phones WNB daytime
10055	29.84	SUV	Cairo, Egypt	(P) Phones DFC-DGU-GCA and GCB daytime
10042	29.87	DJJ	Zeesen, Germany	2-4 P.M.
10040	29.88	HJA3	Barranquilla, Colombia	(P) Tests early evenings irreg.
9990	30.01	KAZ	Manila, P. I.	(P) Phones JVQ-KWX-PLV early A.M.
9966	30.08	IRS	Rome, Italy	(P) Tests irregularly
9950	30.13	GBU	Rugby, England	(P) Phones WNA evenings
9930	30.21	HKB	Bogota, Colombia	(P) Phones CEC-OCP PSH-PSK afternoons
9930	30.21	HJY	Bogota, Colombia	(P) Phones LSQ afternoons
9890	30.33	LSN3	Buenos Aires, Arg.	(P) Phones WOK-WLK; broadcasts evenings irregular
9870	30.40	WON	Lawrenceville, N. J.	Phones and tests; Eng-irregularly
9870	30.40	JYS	Kemikawa-Cho, Japan	4-7 A.M. irregular
9860	30.43	EAQ	Madrid, Spain	Saturday 1-3 P.M. Daily 5:15 to 9:30 P.M.
9840	30.47	JYS	Kemikawa-Cho, Japan	(E) Tests irregular
9830	30.50	IRM	Rome, Italy	(P) Phones JVP-JZT-LSX-WEL mornings
9810	30.58	DFE	Nauen, Germany	(P) Relays and tests afternoons irreg.
9800	30.59	GCW	Rugby, England	(P) Phones Lawrenceville eve. and nights
9800	30.59	LSI	Buenos Aires, Arg.	(P) Relays very irreg.
9760	30.74	VLJ	Sydney, Australia	(P) Phones PLV-ZLT early A.M.
9760	30.74	VLZ	Sydney, Australia	(P) Phones PLV-ZLT early A.M.
9750	30.77	WOF	Lawrenceville, N. J.	(P) Phones GCU irreg
9710	30.88	GCA	Rugby, England	(P) Phones LSL afternoons
9700	30.93	LQA	Buenos Aires, Arg.	(P) Tests and relays early evening
9675	31.00	DJI	Zeesen, Germany	5-7 P.M.
9650	31.09	CT1AA	Lisbon, Portugal	Tues., Thurs., Sat.., 4:30-7 P.M.
9635	31.13	2RO3	Rome, Italy	Mon., Wed., Fri.. American Hour. Tues., Thurs., Sat., Soth American Hr.
9630	31.15	CFA5	Drummondville, Que.	(P) Phones: No A. M. days
9620	31.17	DGU	Nauen, Germany	(P) Phones SUV A.M Tests and relays irreg.
9620	31.17	FZR	Saigon, Indo-China	(P) Phones Paris early A.M.
9600	31.25	XEFT	Vera Cruz, Mexico	Same as 6120 KC.
9595	31.27	HBL	Geneva, Switzerland	Saturday 5:30-6:15 P.M. First Monday each month 4-6 P.M.
9590	31.28	W3XAU	Philadelphia, Pa.	12-8 P.M.
9590	31.28	VK2ME	Sydney, Australia	Sundays { 1 A.M.-3 A.M. 5:00-9.00 A.M. 9:00-11:00 A.M

KC	Meters	Call	Location	Time
9590	31.28	HP5J	Panama City, Panama	11:30 A.M.-1 P.M. 7:30-10 P.M. Sundays 6:30-10:30 P.M.
9580	31.31	GSC	Daventry, England	4:00-5:45 P.M. 6:00-8:20 P.M. 10-11:05 P.M.
9580	31.31	VK3LR	Melbourne, Australia	Mon. Tues. Wed. Thurs. 3:15-7:30 A.M. Fri. 10:30 P.M.-2 A.M. Sat. 5-7:30 A.M.
9570	31.34	LKJ1	Jeloy, Norway	5-8 A.M. 10 A.M-6 P.M.
9570	31.33	W1XK	Boston, Mass.	Week days 7 A.M.-12 midnight Sunday 9 A.M.-12 midnight
9565	31.36	VUY VUB	Bombay, India	11:30 A.M.-12:30 P.M Wed. & Sat. Sunday 7:30-8:30 A.M.
9560	31.40	YDB	Soeurbaya, Java	5-8 A.M. with Music
9560	31.38	DJA	Zeesen, Germany	12:30-2:15 A.M. 8-11:30 A.M. 5:05-9:15 P.M.
9545	31.44	HH2R	Port-Au-Prince, Haiti	Evenings irregular
9545	31.43	CEC	Santiago, Chile	Daily 7-8 P.M. Sun. and Thurs. 8:30-9:00 P.M.
9540	31.45	DJN	Zeesen, Germany	12:30-2:15 A.M. 3:45-7:15 A.M. 5:05-10:45 P.M.
9530	31.48	W2XAF	Schenectady, N. Y.	Mon. to Fri. 4 P.M.-12 A.M. Sat. 1 P.M.-12 A. M. Sun. 4:15 P.M.-12 A.M.
9510	31.55	GSB	Daventry, England	3-5 A.M. 9 A.M.-12 Noon 12:15-4 P.M. 4:15-5:45 P.M. 6-8:05 P.M.
9510	31.55	VK3ME	Melbourne, Australia	Mon. to Sat. 4:30-7:00 A.M.
9501	31.56	PRF5	Rio De Janeiro, Brazil	4:45-5:45 P.M. daily 9-10:45 P.M. irreg.
9480	31.65	PLW	Bandoeng, Java	(P) Phones Australia early A.M.
94.80	31.65	KET	Bolinas, Calif.	(P) Phones WEL evenings & nights
9470	31.68	WET	Rocky Point, N. Y.	(E) Tests LSX-PPM-ZFD evenings
9460	31.71	ICK	Tripoli, Africa	(P) Phones Italy mornings.
9450	31.75	TG1X	Guatemala City, Guatemala	Sched. same as TGWA 6000 and 12000 KC when regular. Off temporarily.
9430	31.80	YVR	Maracay, Venezuela	(P) Tests mornings
9428	31.81	COCH	Havana, Cuba	10 A.M.-12 noon. 4:00-6:30 P.M. 8:00-10:00 P.M.
9415	31.86	PLV	Bandoeng, Java	(P) Phones PCV-PCK-PDK-VLZ-KWX and KWV early mornings
9400	31.92	XDR	Mexico City, Mexico	(P) Phones XAM irreg. days
9385	31.97	PGC	Kootwijk, Holland	(P) Phones East Indies nights
9375	32.00	PGC	Kootwijk, Holland	(P) Phones East Indies nights
9370	32.02	PGC	Kootwijk, Holland	(P) Phones East Indies nights
9330	32.15	CGA4	Drummondville, Que.	(P) Phones GCB-GDB-GBB afternoons
9280	32.33	GCB	Rugby, England	(P) Phones Canada afternoons
9240	32.47	PDP	Kootwijk, Holland	(P) Phones East Indies nights
9235	32.49	PDP	Kootwijk, Holland	(P) Phones East Indies nights
9180	32.68	ZSR	Klipheuvel, S. Africa	((P) Phones Rugby afternoons seasonally
9170	32.72	WNA	Lawrenceville, N. J.	(P) Phones GBS-GCU-GCS afternoons
9147	32.79	YVR	Maracay, Venezuela	(P) Phones EHY afternoons
9120	32.88	HAT4	Budapest, Hungary	6:00-7:00 P.M. Sundays
9110	32.93	KUW	Manila, P. I.	(P) Tests and phones early A.M.
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 and early A. M.
8975	33.43	VWY	Poona, Ind.	(P) Phones GBC-GBU mornings
8950	33.52	WEL	Rocky Point, N. Y.	(E) Tests with Europe irreg.
8950	33.52	W2XBJ	Rocky Point, N. Y.	(E) Tests irregularly
8930	33.59	WEC	Rocky Point, N. Y.	(P) Phones Ethiopia irregular
8900	33.71	ZLS	Wellington, N. Z.	(P) Phones VLZ early mornings
8830	33.98	LSD	Buenos Aires, Arg.	(P) Relays to N. Y. early evenings
8790	34.13	HKV	Bogota, Colombia	(E) Tests early evenings and nights
8790	34.13	TIR	Cartago, Costa Rica	(P) Phones Central America daytime
8790	34.13	HKV	Bogota, Colombia	6:00-11:00 P.M. irregular
8775	34.19	PNI	Makasser, D. E. I.	(P) Phones PLV early mornings
8760	34.35	GCQ	Rugby, England	(P) Phones ZSR afternoons
8750	34.29	ZBW	Hong Kong, China	Sun. Tues. Wed. Fri. Sat. 5:30-8:30 A.M. Mon. Thurs. 5:30-7:30 A.M. 8-9 P.M.
8740	34.35	WXV	Fairbanks, Alaska	(P) Phones WXH nights
8730	34.36	GCI	Rugby, England	(P) Phones VWY afternoons
8680	34.56	GBC	Rugby, England	(P) Phones ships and New York daily
8665	34.62	CO9JQ	Camagney, Cuba	11:30 A.M.-12:30 P.M. 8:00-9:00 P.M.
8657	34.54	YNVA	Managua, Nicaragua	7:30-10 P.M. Daily
8650	34.68	WVD	Seattle, Wash.	(P) Tests irregularly
8560	35.05	WOO	Ocean Gate, N. J.	(P) Phones ships daytime
8500	35.29	JZF	Nazaki, Japan	(P) Phones ships irregularly
8470	35.39	DAF	Nordenland, Germany	(P) Phones ships irregularly
8400	35.71	HC2AT	Guayaquil, Ecuador	8:00-11:00 P.M. ex. Sunday
8400	35.71	HC2CW	Guayaquil, Ecuador	8-11 P.M. ex. Sunday
8380	35.80	IAC	Piza, Italy	(P) Phones ships irregularly
8214	36.50	HCJB	Quito, Ecuador	12:30-2:15 P.M. 7:15-11:15 P.M. daily ex. Monday
8190	36.65	PSK	Rio de Janerio, Brazil	(P) Phones LSL-WOK evenings and special programs
8155	36.79	PGB	Kootwijk, Holland	(P) Phones Java irreg.
8140	36.86	LSC	Buenos Aires, Arg.	(P) Tests evenings and nights irreg.
8120	36.95	KTP	Manila, P. I.	(P) Phones KWX-KWV-PLV-JVQ mornings
8110	37.00	ZP10	Ascunsion, Paraguay	8:00-10:00 P.M.
8035	37.33	CNR	Rabat, Morocco	Special broadcasts irreg.
7970	37.64	XGL	Shanghai, China	(P) Tests early mornings
7968	37.65	HSJ	Bankok, Siam	(P) Tests and phones early A.M.
7960	37.69	VLZ	Sydney, Australia	(P) Phones ZLT early A.M.
7920	37.88	GCP	Rugby, England	(P) Phones VLK irreg.
7900	37.97	LSL	Buenos Aires, Arg.	(P) Phones PSK-PSH evenings
7890	38.02	CJA-2	Drummondville, Que.	(P) Phones Australia nights
7880	38.05	JYR	Kemikawa-Cho, Japan	(E) Tests and relays irregularly
7860	38.17	SUX	Cairo, Egypt	(P) Phones GCB afternoons
7855	38.19	LOP	Buenos Aires, Arg.	(P) Tests evening irreg.
7854	38.19	HJ2JSB	Guayaquil, Ecuador	9 A.M.-1:30 P.M. 6-11 P.M.
7840	38.27	PGA	Kootwijk, Holland	(P) Phones Java irreg.
7835	38.29	PGA	Kootwijk, Holland	(P) Phones Java irreg.
7830	38.31	PGA	Kootwijk, Holland	(P) Phones Java irreg.
7797	38.47	HBP	Geneva, Switzerland	5:30-6:15 P.M. Saturdays First Monday each month 6-7 P.M.
7790	38.49	YNA	Managua, Nicaragua	(P) Phones Cent. & So. America daytime
7780	38.56	PSZ	Rio de Janerio, Brazil	(P) Tests LSX early evenings
7770	38.61	PDM	Kootwijk, Holland	(P) Special relaps to E. Indies
7760	38.66	PDM	Kootwijk, Holland	(P) Special relays to E. Indies
7735	38.78	PDL	Kootwijk, Holland	(P) Special relays to E. Indies
7730	38.81	PDL	Kootwijk, Holland	(P) Special relays to E. Indies
7765	38.63	PDM	Kootwijk, Holland	(P) Special relays to Dutch Indies
7715	38.89	KEE	Bolinas, Calif.	(P) Relays programs to Hawaii seasonally
7669	39.11	TGF	Guatemala City, Guatemala	(P) Phones TIU-HPF daytime
7626	39.31	RIM	Tashkent, U.S.S.R.	(P) Phones RKI early mornings
7620	39.37	ETD	Addis Ababa, Ethiopia	Irregular
7610	39.42	KWX	Dixon, Calif.	(P) Phones KKH nights; KAZ-KTP-PLV-JVT-JVM mornings
7565	39.66	KWY	Dixon, Calif.	(P) Phones Shanghai. early mornings
7550	39.74	TI8WS	Puntarenas, Costa Rica	6-7 and 8-9 P.M.
7520	39.89	KKH	Kahuku, Hawaii	(P) Tests KEE evenings; Phones KWX-KWV nights
7518	39.90	RKI	Moscow, U.S.S.R.	(P) Phones RIM early mornings
7510	39.95	JVP	Nazaki, Japan	Tests Point Reyes early A. M.; broadcasts Monday and Thursdays, 4-5 P. M.
7500	40.00	CFA-6	Drummondville, Que.	(P) Phones: no A. M. days
7470	40.16	JVQ	Nazaki, Japan	(P) Relays and phones early A.M.: broadcasts Monday and Thursday, 4-5 P.M.
7470	40.16	HJP	Bogota, Colombia	(P) Phones HJA3-YVQ early evenings
7445	40.30	HBO	Geneva, Switzerland	(E) Relays Special B.C evenings irreg.
7430	40.38	ZLR	Wellington, N. Z.	(P) Phones VLJ early mornings
7400	40.54	WEM	Rocky Point, N. Y.	(E) Special relays evenings.
7400	40.50	HJ3ABD	Bogota, Colombia	12 noon-2 P.M. 8:00-11:00 P.M
7390	40.60	ZLT-2	Wellington, N. Z.	(P) Phones Sydney 3-7 A.M.
7385	40.62	OEK	Wein, Austria	(P) Tests early evenings very irreg.
7380	40.65	XECR	Mexico City, Mexico	Sundays 7-8 P.M. Occasionally later

KC	Meters	Call	Location	Time
7370	40.71	KEQ	Kahuku, Hawaii	(P) Relays programs evenings
7282	41.20	HJ1ABD	Cartagena, Colombia	11:15 A.M.-1:15 P.M. Sunday. Weekdays 7:15-9:15 P.M.
7211	41.60	EA8AB	Santa Cruz, Canary Is.	Mon. Wed. Fri. 3:15-4:15 P.M.
7177	41.80	CR6AA	Labito, Angela, Africa	2:30-4:30 P.M. Wed. & Sat.
7118	42.13	HB9B	Basle, Switzerland	Mon., Thurs., Fri. 4-6 P.M.
7100	42.25	HKE	Bogota, Colombia	Monday 6-7 P.M. Tues. and Friday 8-9 P.M.
7080	42.37	PI1J	Dordrecht, Holland	Saturday 10:10-11:10 A.M.
7080	42.37	VP3MR	Georgetown, Br. Guiana	Sun 7:45-10:15 A.M. Mon 3:45-4:45 P.M Tues. 4:45-6:45 P.M. Wed. 4:45-7:45 P.M. Thurs. 5-6:45 P.M. Sat. 4:45-7:45 P.M.
7074	42.48	HJ1ABK	Barranquilla. Columbia	3-6 P.M. Sunday
7000	42.86	PZH	Parmaribo. Dutch Guiana	S. A. 3-10 P.M.
6990	42.92	JVS	Nazaki, Japan	(P) Phones China mornings early
6935	43.25	WEB	Rocky Point, N. Y.	(E) Relays programs evenings
6905	43.45	GDS	Rugby, England	(P) Phones WOA-WNA-WCN evenings
6900	43.48	HI5E	Santo Domingo. R.D.	6-10 P.M.
6900	43.48	HI3C	LaRomana, R. D.	Daily 12-2 P.M. 5-9 P.M. Sat. 12 Midnight-2 A.M.
6895	43.51	HCETC	Quito, Ecuador	8:15-10:30 P.M. ex Sunday
6880	43.60	CGA-7	Drummondville, Que.	(P) Phones Europe days
6860	43.73	KEL	Bolinas, Calif.	(P) Tests KAZ-PLV early A.M.
6840	43.86	KEN	Bolinas, Calif.	(P) Used irregularly
6830	43.92	CFA	Drummondville, Que.	(P) Phones: No A. M. nights
6796	44.15	HIH	San Pedro de Macoris, R.D.	Sunday 3-4 A.M. 12:30-3 P.M. 4-5 P.M. Week days 12:15-2 P.M. 7-8:30 P.M.
6760	44.38	CJA-6	Drummondville, Que.	(P) Phones Australia early A. M.
6755	44.41	WOA	Lawrenceville, N. J.	(P) Phones GDW-GDS-GCS evenings
6750	44.44	JVT	Nazaki, Japan	(P) Phones JOAK irregular; Phones Point Reyes at times
6750	44.44	JVT	Nazaki, Japan	1:45-2:15 A.M. 4-7:45 A.M. 5-5:20 P.M. 7-7:15 P.M. 9:45 P.M. 11:45 P.M.
6740	44.51	WEJ	Rocky Point, N. Y.	(E) Commercial program service evenings
6733	44.53	WDA	Rocky Point, N. Y.	(E) Tests evenings irreg.
6725	44.60	WQO	Rocky Point, N. Y.	(E) Tests evenings irreg
6720	44.96	YVQ	Maracay, Venezuela	(P) Phones and relays N. Y. evenings
6701	44.71	TIEP	San Jose, Costa Rica	7:00-10:00 P.M. daily
6690	44.84	CGA-6	Drummondville, Que.	(P) Phones Europe irregularly
6680	44.91	DGK	Nauen, Germany	(P) Relays to Riverhead evenings irreg.
6650	45.11	IAC	Piza, Italy	(P) Phones ships irregularly
6635	45.00	HC2RL	Guayaquil, Ecuador	5:45-7:45 P.M. Sunday. 9:15-11:15 P.M. Tuesday
6620	45.31	Prado	Riobamba. Ecuador	Thursday 9:00-11:15 P.M.
6610	45.38	REN	Moscow. U.S.S.R.	1:00-5:00 P.M. irregular
6590	45.50	HI4D	Santo Domingo, R.D.	12:15-2:00 P.M. 5:00-8:00 P.M. except Sunday
6550	45.81	TIRCC	San Jose, Costa Rica	Daily 11 A.M.-2 P.M. 6-7 P.M. Thursday 7-10 or 11 P.M. Sunday 11 A.M.-1 P.M. 8-10 P.M.
6520	46.01	YV6RV	Valencia, Venezuela	11:30 A.M.-12:30 P.M. 5:30-10:00 P.M. except Sunday
6503	46.10	HIL	Santo Domingo, R.D.	11:40 A.M.-1:40 P.M. 5:40-7:40 P.M.
6490	46.30	HJ5ABD	Cali, Colombia	7:00-10:00 P.M. ex. Sunday
6475	46.34	HI5N	Santiago de los Caballeros, R.D.	7-10 P.M.
6460	46.44	HJ4ABC	Ibague, Colombia	7-10 P.M. ex. Sunday
6450	46.51	HI4V	Santo Domingo, R.D.	7:15-10:15 P.M.
6447	46.51	HJ1ABB	Barranquilla, Colombia	11:45 A.M.-1:00 P.M. 5:30-10:00 P.M. ex. Sunday
6425	46.69	VE9AS	Fredericton, N.B.	Occasional broadcasts — not regular
6425	46.69	W9XBS	Chicago, Ill.	Not regular. Usually Tuesday and Thursday 1:00-5:00 P.M.
6420	46.70	W3XL	Bound Brook, N. J.	No regular schedule maintained
6415	46.77	HJA3	Barranquilla, Colombia	(P) Phones HJA2 evenings
6400	46.88	YN1GG	Managua, Nicaragua	Daily 1:00-2:30 P.M. 7:00-10:00 P.M.
6385	46.99	TIPG	San Jose, Costa Rica	6:00-11 P.M.
6380	47.02	HI3U	Puerto Plata, R.D.	6-9:30 P.M.
6375	47.10	YV4RC	Caracas, Venezuela	4:30-10:30 P.M.
6357	47.19	HRP1	San Pedro de Sula, Honduras	8 P.M.-12 A.M.
6330	47.39	JZG	Nazaki, Japan	5:00-7:00 A.M. irregular
6315	47.50	HIZ	Santo Domingo, R.D.	Daily 11:30 A.M.-2:45 P.M. 5:30 P.M.-9 P.M. Saturdays to 10 & 11 P.M.
6300	47.62	YV12RM	Maracay, Venezuela	8-11 P.M.
6275	47.81	HJ1ABH	Cienaga, Colombia	Broadcasts and phones. Irregular evenings.
6235	48.10	OCM	Lima, Peru	(P) Phones afternoons
6235	43.00	OAX4G	Lima, Peru	7-10 P.M. Daily
6230	48.15	HJ4ABJ	Ibague, Colombia	8:00-11 P.M.
6198	48.40	CT1GO	Parede, Portugal	Sunday 11:30-1:00 P.M. 7:15-8:30 P.M. Tues. to Fri. inc. 7:15-8:30 P.M.
6185	48.50	HI1A	Santiago de Caballeros, R.D.	11:45 A.M.-1:45 P.M. 7:45-9:45 P.M. ex Sunday
6180	48.53	XEXA	Mexico City, Mexico	Evenings irregular
6170	48.62	HJ3ABF	Bogota, Colombia	6:00-11:00 P.M. ex. Sunday
6165	48.66	YV3RC	Caracas, Venezuela	10:30 A.M.-1:30 P.M. 4:30-10:00 P.M. except Sunday
6150	48.78	HJ5ABC	Cali, Colombia	Daily 11:00 AM.-12 noon; 7:00 P.M.-10:00 P.M. Sunday 12-2 P.M.
6150	48.78	HJ2ABA	Tunja, Colombia	1:00-2:00 P.M. & 7:00-10:00 P.M.
6150	48.78	CJRO	Winnipeg, Manitoba	Weekdays 7:30 P.M.-12 noon. Sundays 3:00-10:00 P.M.
6150	48.78	CO9GC	Santiago, Cuba	12:00 A.M. Sat.-2:00 A.M. Sunday. Friday 7:30 A.M.-11 P.M.
6150	48.78	CSL	Lisbon, Portugal	7:30-8:30 A.M. 2:30-7:00 P.M.
6140	48.86	W8XK	Pittsburgh, Pa.	9:00 P.M.-1:00 AM. daily
6130	48.92	ZGE	Kuala Lumpur, S.S.	Sun. Tues. Fri. 6:40-8:40 A.M.
6130	48.92	COCD	Havana, Cuba	Sunday 11 A.M.-2:00 P.M. 7:00-10 P.M. Weekdays 11:30 A.M. to 11 P.M.
6130	48.92	LKJ1	Jeloy, Norway	10:00 A.M.-6:00 P.M. daily
6120	49.02	XEFT	Vera Cruz, Mexico	Mon. to Fri. 11 A.M.-4 P.M. 7:30 P.M.-12 Midnight. Sat. 11 A.M.-4 P.M. 6:30 P.M.-12 Midnight. Sun. 11 A.M.-4 P.M. 9 P.M.-Midnight
6120	49.02	W2XE	Wayne, N. J.	10-11 P.M.
6120	49.02	YDA	Bandoeng, Java	5:30-11:00 P.M. 5:45-6:45 P.M. 10:30 P.M.-1 A.M.
6115	49.06	HJ1ABE	Cartagena, Colombia	Daily 11 A.M.-12:30 P.M. 4-5 P.M. Monday 7-9:30 P.M. 10:30-11:30 P.M. Tues. to Fri. 7-9:30 P.M. Sat. 6-8 P.M. Sunday 9 A.M.-2 P.M.
6110	49.10	HJ4ABB	Manizales, Colombia	11:00 A.M.-1:00 P.M. 5:00-8:00 P.M.
6110	49.10	VUC	Calcutta, India	Mon. 8-9 A.M. Wed. 10:30-11:30 A.M.
6110	49.10	VE9HX	Halifax, Nova Scotia	4-10 P.M.
6110	49.10	GSL	Daventry, England	12:15-4:00 P.M. 10-11:05 P.M.
6100	49.18	W9XF	Chicago, Illinois	Sun. Tues. Thurs. Fri. 9 P.M.-2 A.M. Mon. Wed. Sat. 1-2 A.M.
6100	49.18	W3XAL	Bound Brook, N. J.	Mon. Wed. Sat. 4:00 P.M. 12:00 A.M.
6095	49.22	CRCX	Bowmansville, Ont.	Sun. 12 noon-12 A.M. Mon. to Sat. 6 P.M.-12 A.M.
6090	49.26	VE9BJ	St. John, N.B.	5:00-11:00 P.M.
6090	49.26	ZTJ	Johannesburg, S. Africa	11:45 P.M.-12:30 A.M. 3:30-7:00 A.M. 9 A.M.-4:45 P.M.
6085	49.30	2RO1	Rome, Italy	Mon. Wed. Fri. 6-7:30 P.M. A.M. Hour
6080	49.34	W9XAA	Chicago, Ill.	Daily 11 A.M.-9 P.M.
6080	49.34	ZHJ	Penang, S.S.	6:40-8:40 A.M.
6080	49.34	HJ4ABC	Pereira, Colombia	9:30-11 A.M. 7-9 P.M. ex. Sun.
6080	49.34	CP5	LaPaz, Bolivia	8:00-9:00 P.M. daily
6080	49.34	HP5F	Colon, Panama	Daily ex. Sunday 11:45 A.M.-1 P.M.; 7:45-10 P.M.; Sunday 10:45 A.M.-11:30 A.M.; 4-6 P.M.
6079	49.35	DJM	Zeesen, Germany	3-5 P.M.
6070	49.42	VE9CS	Vancouver, B.C.	6:00-7:00 P.M. Sunday. 1:45 P.M.-1:00 A.M.
6070	49.42	HH2S	Port-Au-Prince, Haiti	7:30-11 P.M.
6070	49.42	OER2	Vienna, Austria	9:00 A.M.-5:00 P.M. Saturdays until 6:00 P.M.
6065	49.45	HJ4ABL	Manizales, Colombia	11:00 A.M-12 noon Sat. to 5:30. 5:30-7:30 P.M.
6060	49.50	W8XAL	Cincinnati, Ohio	Daily Ex. Sunday 6:30 A.M.-8 P.M. 11 P.M.-2 A.M. Sundays 8 A.M.-8 P.M. 11 P.M.-1:30 A.M.
6060	49.50	HJ4ABD	Medellin, Colombia	6-11 P.M. ex. Sun. 10:30 A.M.-1 P.M.
6060	49.50	W3XAU	Philadelphia, Pa.	8-11 P.M.
6060	49.50	VQ7LO	Nairobi, Kenya Colony, Africa	5:45-6:15 A.M. 11 A.M.-2 P.M.
6060	49.50	OXY	Skamleback, Denmark	1-6:30 P.M. Sunday 11 A.M.-6:30 P.M.
6050	49.59	GSA	Daventry, England	6-8:05 P.M.
6043	49.65	HJ1ABG	Barranquilla, Colombia	11:30 A.M.-2 P.M. 5:30-11 P.M. Sat. to 12:30 A.M. Sunday 11 A.M.-3 P.M 5-8 P.M.
6040	49.67	PRA8	Pernambuco, Brazil	9:30-11:30 A.M. 2:30-8:30 P.M.

KC	Meters	Call	Location	Time
6040	49.67	W4XB	Miami, Florida	Daily 12-2 P.M. 8:30-10:30 P.M. Sun. 3-6 A.M.
6040	49.67	W1XAL	Boston, Mass.	Daily 7:00-9:00 P.M.
6030	49.75	HP5B	Panama City, Panama	12 noon-1 P.M. 8-10:30 P.M.
6030	49.75	PGD	Kootwijk, Holland	(P) Phones Java and E. Indies irreg.
6025	49.79	PGD	Kootwijk, Holland	(P) Phones Java and E. Indies irreg.
6020	49.83	PGD	Kootwijk, Holland	(P) Phones Java and E. Indies irreg.
6020	49.83	DJC	Zeesen, Germany	12 noon-4:30 P.M. 5:00-10:45 P.M.
6020	49.83	CQN	Macoa, China	Monday & Friday 3-5:00 A.M.
6020	49.83	XEUW	Vera Cruz, Mexico	10 P.M.-1 A.M. Daily
6012	49.85	HJ3ABH	Bogota, Colombia	11:30 A.M.-2 P.M. 6-11 P.M. Sunday 4-9 P.M.
6011	49.89	HJ1ABC	Quibdo, Colombia	Sun. 3-5 P.M. 9-11 P.M. Mon. to Sat. 5-6 P.M. Wed. 9-11 P.M.
6010	49.92	ZHI	Singapore, S.S.	Mon. Wed. Thurs. 5:40-8:10 A.M. Sat. 10:40 P.M.-1:10 A.M.
6010	49.92	COCO	Havana, Cuba	Week Days 10:30 A.M.-1:30 P.M. 4 P.M.-7 P.M. Sunday 10:30 A.M.-1:30 P.M. 4-10 P.M.
6006	49.95	HJ1ABJ	Santa Marta, Colombia	11 A.M.-1 P.M. 7-9 P.M. Sunday 1-2 A.M.
6005	49.96	VE9DR	Montreal, Que.	Used very irregular
6005	49.96	VE9DN	Montreal, Que.	Used very irregular
6000	50.00	TGWA	Guatemala City, Guatemala	Daily Ex. Sun. 12-2 P.M. 8-9 P.M. 10 P.M.-12 A.M. Sundays 12-5 A.M.
6000	50.00	XEBT	Mexico City. Mexico	10 A.M.-12 midnight and later at times
6000	50.00	RV59	Moscow, U.S.S.R.	3-6 P.M.
5985	50.13	XEVI	Mexico City, Mexico	Sun. 1-2:15 P.M. Mon. Wed. 3-4 P.M. Tues. & Thurs. 7:30-8:45 P.M. 10:30 P.M.-12 A.M. Fri. 3-4 P.M. 9 P.M.-12 A.M. and Sat. 9-10 P.M.
5980	50.17	HJ2ABD	Bucaramanga, Colombia	Daily 11:30 A.M.-12:30 P.M. 6-10 P.M.
5980	50.17	HIX	Santo Domingo, R.D.	Mon. to Sat. 11:10 A.M.-12:40 P.M. 4:40-5:40 P.M. Tues. & Fri. also 8:10-10:10 P.M. Sunday 7:40-9:40 A.M.
5980	50.17	XECW	Mexico City, Mexico	4-4:45 P.M. 10-12 M.
5969	50.26	HVJ	Vatican City, Vatican	2-2:15 P.M. Sunday 5-5:30 A.M.
5960	50.30	YNLF	Managua, Nicaragua	6-11 P.M.
5950	50.42	HJN	Bogota, Colombia	8-10:45 P.M. Irregular
5940	50.51	TG2X	Guatemala City, Guatemala	Daily 4-6 P.M. Mon. Thurs. Sat. 9-11 P.M.
5941	50.50	TGX	Guatemala City, Guatemala	8-10 A.M. 2-4 P.M. 8 P.M.-12 A.M.
5930	50.60	HJ4ABE	Medellin, Colombia	11 A.M.-12 noon. 6-10:30 P.M.
5900	50.85	HJ2ABC	Cucuta, Colombia	11 A.M.-12 noon. 6:30-9 P.M.
5885	50.98	HCK	Quito, Ecuador	9-11 P.M. Daily.
5880	51.02	ETG	Addis Ababa, Ethiopia	Used irregularly.
5880	51.02	YV8RB	Barquisimeto, Venezuela	12-1 P.M. 6-10 P.M.
5875	51.11	HRN	Tegucigalpa, Honduras	Week Days 12-1:30 P.M. 6-7:30 P.M. 8-9:30 P.M. Sunday 3-5 P.M. 6-7:30 P.M. 8-10:00 P.M. and later
5865	51.15	HI1J	San Pedro de Macoris RD	Daily 12:30-2 P.M. 6:30-9:00 P.M.
5853	51.20	WOB	Lawrenceville, N. J.	(P) Phones ZFA P.M.
5850	51.28	YV5RMO	Maracaibo, Venezuela	11:30 A.M.-1 P.M. 5:30 to 10 P.M.
5845	51.30	KRO	Kahuku, Hawaii	(P) Tests early mornings
5825	51.50	HJA2	Bogota, Colombia	(P) Phones HJA3 afternoons irreg.
5820	51.50	TIGPH	San Jose, Costa Rica	7 P.M.-12 Midnight
5800	51.72	KZGF	Manila, P. I.	(P) Tests mornings irregularly
5800	51.72	YV2RC	Caracas, Venezuela	Sundays 9 A.M.-10:30 P.M. Week days 11:30 A.M.-2 P.M. 4:30-10 P.M.

KC	Meters	Call	Location	Time
5790	51.81	JVU	Nazaki, Japan	(P) Phones JZC early mornings
5780	51.90	CMB-2	Havana, Cuba	(P) Phones and tests irregularly
5780	51.90	OAX4D	Lima, Peru	9-11:30 P.M. Wed. Sat.
5760	52.08	HJ4ABD	Medellin, Colombia	10:30 A.M.-1 P.M. 6-11 P.M.
5750	52.17	XAM	Merida, Mexico	(P) Phones XDR-XDF early evenings
5730	52.36	JVV	Nazaki, Japan	(P) Phones JZC early A. M.
5720	52.45	YV10RSC	San Cristobal, Venezuela	8:00-11:00 P.M.
5713	52.51	TGS	Guatemala City, Guatemala	6-9 P.M.
5712	52.54	CFU	Rossland, Canada	(P) Phones CFO and CFN evenings
5670	52.91	DAN	Nordenland, Germany	(P) Phones ships irreg.
5500	54.55	TI5HH	San Ramon, Costa Rica	3:30-5 P.M. 8-9:30 P.M. Daily.
5445	55.10	CJA7	Drummondville, Que.	(P) Phones Australia early A. M.
5435	55.20	LSH	Buenos Aires, Arg.	(P) Relays LR4 and tests evenings
5400	55.56	HJA7	Cucuta, Colombia	Phones irregularly; broadcasts music in eveing at times
5400	55.56	HJA7	Cucuta, Colombia	Monday 4-8 P.M.
5395	55.61	CFA7	Drummondville, Que.	(P) Phones: No Am.; irregular
5265	57.00	KEC	Bolinas, Calif.	(P) Phones Honolulu irregularly
5170	58.50	PMY	Bandoeng, Java	(E) Phones and relays programs early mornings
5110	58.71	KEG	Bolinas, Calif.	(P) Phones irregularly evenings
5080	59.08	WCN	Lawrenceville, N. J.	(P) Phones GDW evenings seasonally
5025	59.76	ZFA	Hamilton, Bermuda	(P) Phones WOB evenings
5040	59.25	RIR	Tiflis, U. S. S. R.	(P) Phones afternoons irregular
4975	60.30	GBC	Rugby, England	(P) Phones ships afternoon and nights
4905	61.16	CGA8	Drummondville, Que.	(P) Phones GDB-GCB afternoons
4820	62.20	GDW	Rugby, England	(P) Phones WCN-WOA evenings
4810	62.37	YDE2	Solo, D.E.I.	4-8:15 A.M. Irregular.
4790	62.63	VE9BK	Vancouver, Canada	Week days 11:30-11:45 A.M. 3-3:15 P.M. 8:00-8:15 P.M. Sat. 7:30-7:45 P.M.
4752	63.13	WOY	Lawrenceville, N. J.	(P) Tests very irregular
4752	63.13	WOO	Ocean Gate, N. J.	(P) Phones ships irreg.
4752	63.13	WOG	Lawrenceville, N. J.	(P) Phones Rugby irregular
4600	65.22	HC2ET	Guayaquil, Ecuador	9:15-10:45 P.M. Wed. and Sat.
4555	65.95	WDN	Rocky Point, N. Y.	(P) Tests Rome and Berlin evenings
4510	66.52	ZFS	Nassau, Bahamas	(P) Phones WND daily; Tests GYD-ZSV irregular
4470	67.11	YDB	Soerabaja, D.E.I.	Broadcasts early mornings.
4465	67.19	CFA2	Drummondville, Que.	(P) Phones: No Am.; irregular days
4348	69.00	CGA9	Drummondville, Que.	(P) Phones ships and Rugby evenings
4320	69.40	GDB	Rugby, England	(P) Phones CGA8 and tests evenings
4295	69.90	WTDV	St. Thomas, Virgin Is.	(E) Weather reports 2-3 P.M.
4295	69.90	WTDW	St. Croix, Virgin Is.	(E) Weather reports 2-3 P.M.
4295	69.90	WTDX	St. John, Virgin Is.	(E) Weather reports 2-3 P.M.
4272	70.20	WOO	Ocean Gate, N. J.	(P) Phones ships afternoons and eve.
4272	70.20	WOY	Lawrenceville, N. J.	(P) Tests evenings
4250	70.65	RV15	Khabarovsk, U.S.S.R.	1:30-9:00 A.M.
4002	75.00	CT2AJ	Ponta Delgada, Azores	Wed. and Sat. 5-7 P.M.
3770	79.60	HB9B	Basle, Switzerland	Mon. Thurs. Fri. 4-6 P.M.
3310	90.63	CJA8	Drummondville, Que.	(P) Phones Australia, A.M.
3027	99.10	CFA8	Drummondville, Que.	(P) Phones: No Am.

"VOX POP"

(Continued from page 71)

York influence shows in the spats they both wear. Parks' are pearl gray, but Jerry has gone sissy and is wearing black ones.

"How long is it since you boys have been back home?" I asked.

"Oh, we can't go back home," I was told.

"But why not?"

"Well, you see it's like this—back in our part of Texas there are only two kinds of people, the quick and the dead. If we appeared on the streets wearing spats, on the first block the folks would look at us and whisper. On the second block they'd start shooting. So, you see, we can't go home and live—at least not for long."

In spite of this, both boys own dirt farms back home, to which they will retire when there is no longer a demand for Vox Pop—if ever. That won't be soon if the following letter taken from their files is any indication. By the way, it is no more extravagant in tone than many others I saw. I shall omit the signature although I doubt whether the writer would mind, as he used his business stationery, name, address, everything.

Jan. 9, 1936.

Mollé Shaving Cream Co.,
c/o Vox Pop, Station WEAF,
New York, N. Y.

Gentlemen:

I would consider it a special favor if you started your Sunday broadcasting period at 3:30 P. M. instead of 2:30 P. M. as you now have it. My reason for this unusual request is as follows:

At 2:30 P. M. each Sunday, my wife

(Turn to page 92)

"VOX POP"

(Continued from page 91)

is in the midst of making dinner for us. About three Sundays ago, I was listening to your program and asked my wife, who was in the kitchen, to listen with me. Much to my sorrow, she did, and before we knew it, our main course, which was a roasted tongue, was entirely burnt.

The above incident was practically minor as to what occurred the past Sunday. Sure enough, I was again listening to your program and my wife was busy in the kitchen. She was watching the french fried potatoes that were being fried with fat. At my request, she came in to listen with me. A few moments later, the odor of something burning presented itself, and my wife ran into the kitchen to investigate. The fat in the french fryer caught afire. Of course, she yelled for me to come in, but I remained listening to the radio, thinking that some more meat burned, which I was sort of used to by now. When I did not come in she started to scream. I quickly got up and ran into the kitchen. Upon entering it, I noticed flames of fire shooting from the pot. By this time. the cupboard, which is adjoining the stove, and the walls, were starting to catch fire. I grabbed a towel, caught hold of the handle of the pot, and threw it on the back porch, but not till after singeing my right arm.

While on the porch, the pot continued to burn, and the flames started to go higher and higher. Not having any experience with extinguishing fires, I filled a dish with water and threw it on the flame. The moment the water came in contact with the flame, there was heard an explosion, and only by some quick footwork did I manage to stop my clothing from setting afire. Needless to say, we did not have potatoes for dinner that day.

For these reasons, I earnestly request that you change your broadcasting period to one that both my wife and I can enjoy our dinner and your program.

Very truly yours,

A. D. M.,
Lambertville, N. J.

He'll get his wish starting Tuesday, January 28, when the program will be on from 9:00 to 9:30 P. M.

WILLIAM R. HYNES.

◆

QUERIES

(Continued from page 78)

transmitting station beamed for Madrid, from Buenos Aires, with the plane flying some ten miles on the B. A. side of the beam. So effective was the "reflecting" system behind the beam, that practically no signal at all could be picked up on the ground at the flying field on the Buenos Aires side. As the plane gained altitude, the signal became stronger, the signal leaking out "backwards" over the reflector. At ten thousand feet it was quite good, but nowhere near as strong as on the ground five hundred miles on the Madrid side of the beam.

The idea of the beam can be gathered from Figure 1 reproduced from the November, 1935, issue of ALL-WAVE RADIO. The dark, heart-shaped line, connects points of equal signal strength—and is the characteristic shape of a beamed signal. As the concentric circles become larger,

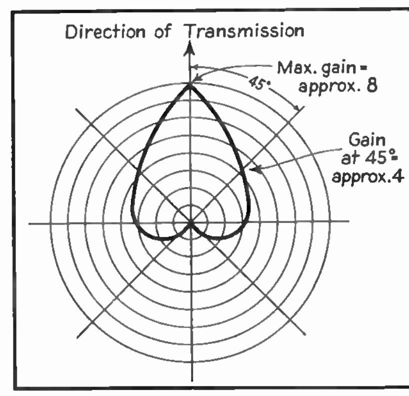

Fig. 1. Field pattern of typical beam antenna.

let us assume that the radii increase one hundred miles for each circle, that the arrow points north (up) and that west and east and left and right respectively. The curve therefore shows that eight hundred miles north of the transmitter as powerful a signal will be received as would be heard under the same conditions three hundred miles west or east.

There are two beneficial effects of beamed signals. The first is the equivalent increase in transmitting power, without increase in consumption or cost of major equipment. In other words, if a 50-watt transmitter is working into a beam antenna having a gain of say four in the desired direction, it is the equivalent of 200 watts on an ordinary aerial. After all, in point-to-point work, it is desired to contact only one station, as a rule, in a given direction. (As a matter of fact, broadcasting stations often take advantage of beam effects to concentrate the signal in the direction of densely poulated areas.) Secondly, such concentration reduces interference in other directions.

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CHANNEL ECHOES

(Continued from page 75)

France. Tried WOR again at 9:35, and discovered the gal friend still talking—this time on what size earrings to wear. At 9:45 WEAF featured "The Banjoliers." Excellent playing, variety in selections and no advertising. On England's channel, a ghost story.

Where is the preponderance of drivel? You tell us.

New Year's morning we tuned in WGY for one of these "musical clock" programs—canned music and long plugs for a furniture company after each selection. We were unable to log just how Europe was celebrating the first of the year, due to the fact that our son, three years old, likes the musical clock. Our physician assures us that he will outgrow this in another year.

In conclusion, we wonder just what Europe thought of the short-wave broadcasts of the opening of Congress. An edifying spectacle. Following the prayer and invocation for "greater understanding," "co-operation," "peace on earth—good will to men," and what have you, a bedlam broke forth of bickering, carping, caviling, crimination and recrimination, dissent and such general discord as would have furnished another chapter to the late Clarence Day's "This Simian World."

ROSES

(Continued from page 65)

trol of the station to which we were listening.

We can quite understand that this was probably the case, but we should like to know if it was a Republican or a Democrat that got stuck in the mixer.

◆

James Lamb
Is a Ham what am;
He built a rig
To take out the damn
NOISE!

◆

IT'S A SMALL world. It turns out that a prominent executive and equally as prominent an amateur, was in the port of Yokohama, Japan, on a converted German ship at the same time "Sparks" was there. The story in the last issue of ALL-WAVE RADIO brought it to light, and since then the two men have met and exchanged experiences.

"Sparks," it turns out, remembers quite well the day the German ship limped into port with her smoke stack full of shell holes, obligingly punched therein by a gunboat off Vladivostock.

The prominent executive also remembers quite well the fire outside the harbor, as reported in the story.

The only thing "Sparks" cannot seem to remember is what the devil he did with the one dozen sandwiches he ordered (and paid for) in the Astor House, in Shanghai. Hardly seems possible he could have eaten them all.

No doubt this will remain one of the world's major mysteries—unless the world is *so* small or the circulation of ALL-WAVE RADIO *so* large, that we will eventually hear from the Room Service Clerk in the Astor House. Possibly *he* knows.

◆

EVERY ONCE and so often some sort of flamdoodle takes place in one of the amateur 'phone bands that provides our imagination with a queer twist.

For instance, two amateurs were running a QSO into the ground one evening, when the fellow talking was interrupted by the ringing of the telephone. Presumably the phone was on the table right close to the mike, because the voice of the person on the wire was clearly understandable.

It turned out that the person had the wrong number.

What we were thinking was, what a jolt that person would have received had he known that an innocent little wrong number led to his question, "Is Annie there?" being flung to the far corners of the earth.

That man will die never knowing that the name "Annie" on his lips shook God's ether like so much jelly. He will die never knowing that he inadvertently provided thousands of listeners with Annie's phone number.

The day may come when, through this ironic error of science, he will learn that Annie doesn't live there any more.

PHI-PCJ

(Continued from page 61)

victim to these internal dissensions. Putting the PHOHI on a level with the other broadcasting stations seemed somehow an impossibility and it was decided to close the station down.

Upon its re-opening in 1932, the transmitter, originally destined for a wavelength of 16.88 meters, was also built for a second wavelength of 25.57 meters. These wavelengths are being used in summer and winter respectively. Practice had shown that such an interchange of wavelengths was necessary if good receptions at suitable times were to be guaranteed in the East and West Indies. In order to increase this certainty and to eliminate interference of telegraph transmitters especially in North Sumatra, transmissions are now made simultaneously on 16.88 and 19.71 meters, or on 25.57 and 19.71 meters.

Details of Transmitter

The PHOHI-transmitter is crystal controlled. By the application in this stage of an ordinary receiving tube the crystal is slightly loaded which greatly adds to the regular functioning of the transmitter. The frequency of the vibrations generated in the crystal stage are in the following stage doubled and redoubled a number of times, in order to obtain the right wavelength. For instance, on the 16.88-meter wavelength the crystal stage is tuned to 135 meters. Before the frequency of the 67.5 meter wavelength is doubled, the vibrations are amplified by two parallel connected 10-watt tubes. The doubling takes place afterwards up to 33.75 meters. The highest voltage used in these stages is 400 volts. However, the amplifying tubes following work under a plate potential of 2000 volts. The final doubling takes place in two 1500-watt tubes up to 16.88 meters. When the high-frequency energy has once more been amplified by two parallel connected 1500-watt tubes, it is fed into the last amplifier stage consisting of two 10-kilowatt water-cooled tubes. The potential for this stage is 10,000 volts.

The power of the transmitter is thus 60 kw. The output of the transmitter is 20 kw. at 97% modulation.

The Modulator

The modulation equipment is in another part of the building. The high voltage is obtained from two rectifiers supplying respectively 8000 volts (3-phase rectification) and 14,000 volts (6-phase rectification). The total input attains 130 kw. The control desk is mounted in a central position with regard to the transmitter.

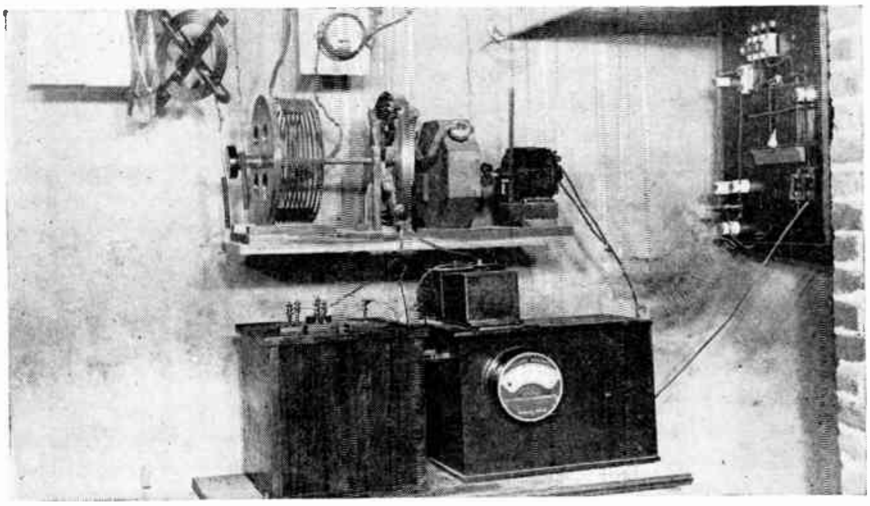
The aerial system is of the beam type, in other words, the aerial radiates only in two directions: i.e., to the East and to the West. This system guarantees both for the East and for the West Indies a much better reception than would be the case were a non-directional system applied.

The Studios

The chief studios of the PHOHI are in Hilversum where the majority of transmissions are being broadcast. Moreover, a special studio is installed in Amsterdam for the spoken word and a large music-studio in the Hague, used for the concerts of the local "Residentie" orchestra.

The Philips station PCJ, is an experimental transmitter and is situated at Eindhoven. It broadcast on a wavelength of 19.71 meters, but has also the disposal of 31.28 meters. For the present it does not make use of the latter wavelength.

"And now, gentlemen, shelving television for the moment — who ordered liverwurst on rye?"



This station was the rather elaborate ham outfit, owned by Lester Spangenberg and was known on the air, at that time, as 2ZM. Lester is now W2MB. This station comprised a half-kilowatt home-made transformer, shown in the large case with the eclipse ammeter on the front. To the left is the home-made bank of glass-plate condensers. On the shelf, above these units, the motor to the right was used to turn over the nonsynchronous rotary gap which was installed in the hexagonal housing. The gap circuit fed into the primary of the oscillation transformer.

STORY OF HAM RADIO

(Continued from page 60)

the first person in this country to intercept signals from Europe. The equipment was unlike anything that had been used previously. There were, for instance, twin sets of large coils set on top of the receiver cabinet. It was said that one of the coils was connected in the grid circuit of the vacuum tube and the other in the plate circuit. No one was quite clear as to the effect of this arrangement, but it was enough to visit Dr. Goldhorn's home and listen to the clear, clean-cut whistle of signals from the transmitter at Nauen, Germany, and to pick up what scraps of information one could gain from the doctor.

What the youngsters in the neighborhood had unknowingly cast their eyes upon was the first or one of the first receivers using an oscillating detector . . . autodyne reception at a time when the naval and commercial stations were using choppers or crude forms of heterodyne systems for the reception of continuous-wave signals.

The Regenerative Receiver

But the genial Dr. Goldhorn could not keep his secret nor Armstrong's secret—the amateur was to have his regenerative receiver with which he could amplify a signal one hundred times or more with a single tube. And immediately upon the introduction of this circuit, every other type of receiving system became obsolete. The regenerative receiver opened up new horizons to the amateur; he worked stations he had never even heard before. Without having increased the power of his transmitter, he had had its range doubled or tripled merely because of the remarkable sensitivity of the regenerative set.

But little did these fellows suspect that on the table before them, contained in a small cabinet with knobs and dials, was the essence and the principle that would constitute the CW and 'phone transmitters they would use in later years.

(To be continued)

NOISE SILENCER

(Continued from page 57)

voltage, which is negative in value, that is fed to Grid No. 3 of the 6L7 silencer tube in the lower channel. The impression of a negative voltage on this grid materially reduces the gain or amplification of the tube. The reduction in gain, of course, depends upon the value of the applied negative voltage and this in turn is dependent upon the amplitude of the noise impulse. Consequently, the greater the amplitude of the noise impulse, the greater the silencing action in the 6L7 silencer tube.

It is essential that the time constant of the automatic silencing circuit be small; the negative silencing voltage developed in the diode load circuit should have as short a duration as possible so that the silencer tube may be released as soon as the original noise impulse has ceased. The time constant is dependent upon the values of R and C in the diode load circuit. If these are properly proportioned, there will be no appreciable lag in the functioning of the system.

Circuit of Adapter

Fig. 6 is the circuit of an adapter unit that may be applied to the average superheterodyne receiver. Only three tubes are necessary.

When using the adapter, the 6L7 tube takes the place of the second intermediate-frequency amplifier tube in the receiver. The tube is removed and the tube-base plug inserted in its place. The control grid of the 6L7 is connected to the secondary of the i-f transformer by means of the tube cap. This is inserted into the i-f transformer grid clip.

The noise-silencer system is not readily adaptable to a superheterodyne having less than two stages of intermediate-frequency amplification. Moreover, the receiver should preferably have a stage of r-f amplification ahead of the first detector.

In conclusion, we wish to state that the system has already been tested. It works—and there are no two ways about it. It is effective on all bands, but obviously shows up to best advantage at the short wave lengths where man-made interference is particularly obnoxious.

FOREIGN NEWS

(Continued from page 79)

respect. They have been presenting experimental 60-line, 25-frame mechanically-scanned transmissions on 175-meters approximately once each week since last April. Reports by the American Commercial Attache in Paris state that a 10-kw, 180-line transmitter is being constructed for the Eiffel Tower and will be ready for service in March.

On December 8th of last year, 10,000 Parisians viewed the first public showing of television on two-foot screens. To accommodate the crowds 10 receivers were set up in various parts of the city. Televiewers admitted the demonstration was of excellent quality.

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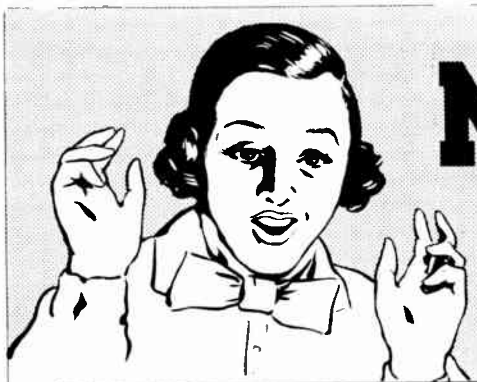
VERI LIST

(Continued from page 85)

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

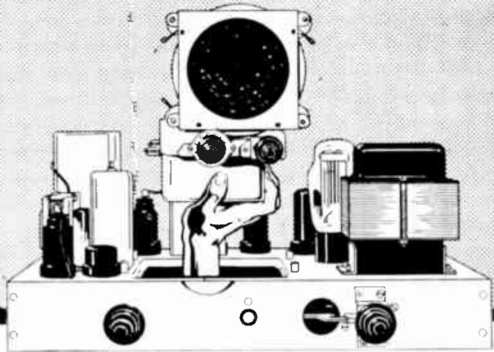
NEW *and* STARTLING



METAL TUBES *plus the* **CENTROMATIC UNIT** *in the* **NEW 1936 AMERICAN-BOSCH RADIO**

hand you all these definite advances

- More long and short wave stations to enjoy.
- Better, clearer, purified tone.
- Greater freedom from noise—BETWEEN stations and ON stations.
- Tuning made easier on both long and short wave.
- Surpassing dependability resulting from 90% less wiring—104 fewer soldered connections.
- Extra performance from new metal tubes.



SO MANY good radios! But the CentrOmatic Unit in the new American-Bosch helps you choose the best!

You not only can hear the difference which CentrOmatic Engineering introduces. You can actually *see* the difference! The chassis—as you can see—has a separate unit on which are centralized all the sensitive radio elments; armored and insulated from internal set noises.

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

UNITED AMERICAN BOSCH CORPORATION

Springfield Massachusetts

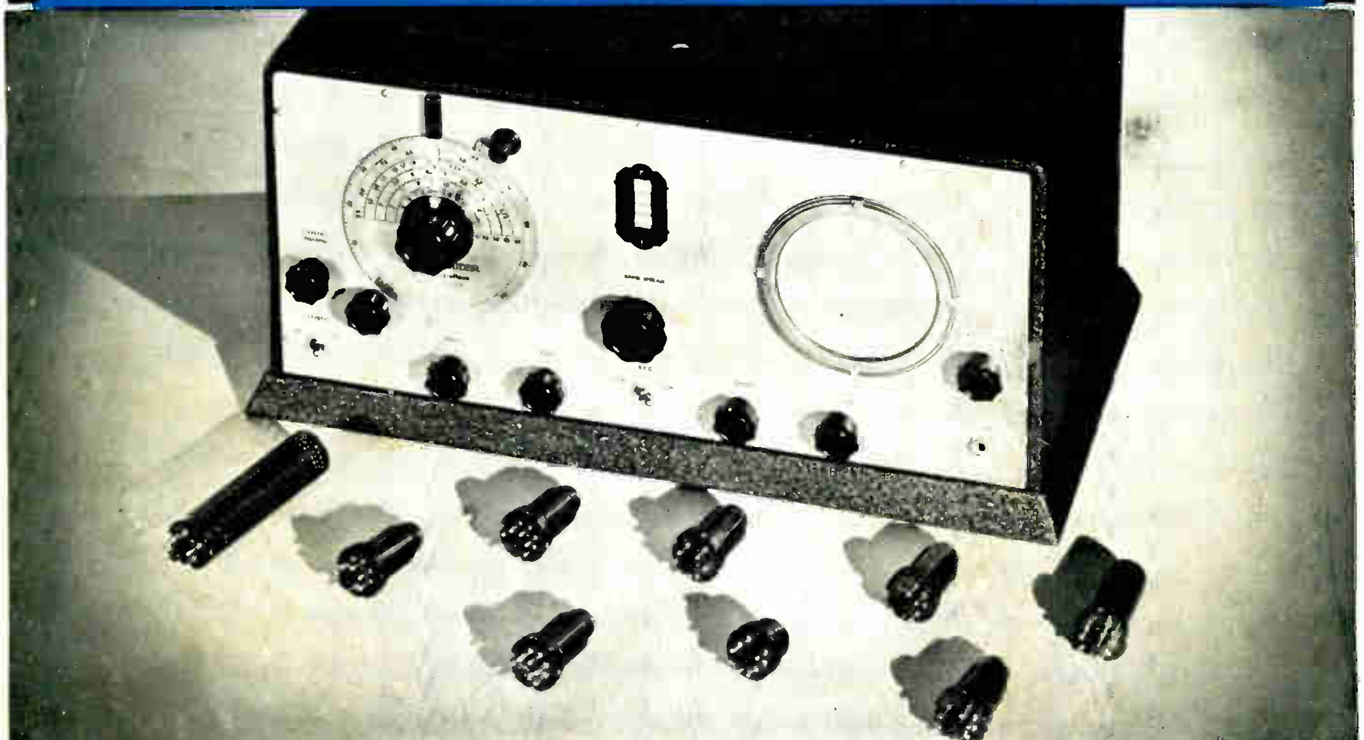
Model 595M — High Fidelity 10 tube, 11 tube performance, American, police and foreign, plus U. S. weather band, superheterodyne Console radio, with exclusive combination of new metal tubes and American-Bosch CentrOmatic construction. Range 540 to 18,500 Kilocycles and long wave U. S. weather band 150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

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

American-Bosch Radio is licensed under patents and applications of R. C. A. and Hazeltine Corp.

AMERICAN-BOSCH CentrOmatic RADIO

The SUPER SKYRIDER is MODERN *



- 9 Metal Tubes—Dovetail perfectly with our efforts to improve signal to noise ratio—eliminate noisy tube shields—reduced interelectrode capacities and shorter leads afford greater gain.
- Iron Core I. F. system—greatly increased sensitivity and a signal to noise ratio unattainable with an air core system.
- Duo-Micro-Vernier Band Spread—provide improved logging accuracy—provides electrical band spreading and micro-vernier tuning in an exclusive and distinctive dial.
- More efficient C[illegible]stal Filter Circuit, controlled by vari[illegible] knob on front of set gives one signa[illegible] selectivity—without reducing sensitiv[illegible].
- Beat Oscillator with con[illegible]inuous range.
- Modern Band Changing System—any desired bands in the short-wave spectrum with the turn of an exa[illegible] positive switch—no cumbersome plu[illegible]ils.
- Compact—all complet[illegible]d in one convenient and effic[illegible]t 19½" x 10" x 10".

*

When you install the Super Skyrider you have every modern feature known to radio, plus the progressive engineering that keeps pace with the latest developments and trends in short wave reception.

Examine the marvelous 1936 Super Skyrider. Compact, convenient, efficient, it's the embodiment of today's trends in radio engineering, and incorporates, too, the brilliant Hallicrafters engineering developments. It's orderly and workmanlike, different from the old-fashioned, loosely wired, separate parts that constitute the receiver of the past. Amateurs today want the compact convenience of the Super Skyrider.

There are no cumbersome, inconvenient, plug-in coils used in the Super Skyrider—modern receiver design and layout permit the use of a simple band switch that tunes in any band with a twist of the finger, while the Automatic Band Indicator shows it on the dial. Here's convenience to the Nth degree, obtained without sacrifice but with actual gain in efficiency.

The Super Skyrider is engineered for the New Metal Tubes, radio's great advance for 1936. Completely shielded, with short leads and small interelectrode capacities, they provide the last link in Hallicrafters' efforts to build a stable, high gain set.

Sensitivity is brought to a still higher level with the new Iron Core I. F. Transformers, first [illegible]sed in the Super Skyrider and now rapidly being adop[illegible] by the more progressive manufacturers.

It's modern features like these and a d[illegible]en others on the Super Skyrider that make it what it is [illegible]ca's outstanding short wave receiver.

But with all the advantages the S[illegible]kyrider is extremely reasonable in price, making it [illegible]n value as well as efficiency. Don't delay, see it at [illegible] dealer's today, you won't be satisfied until you own th[illegible] MODERN short wave receiver.

the hallicrafters

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