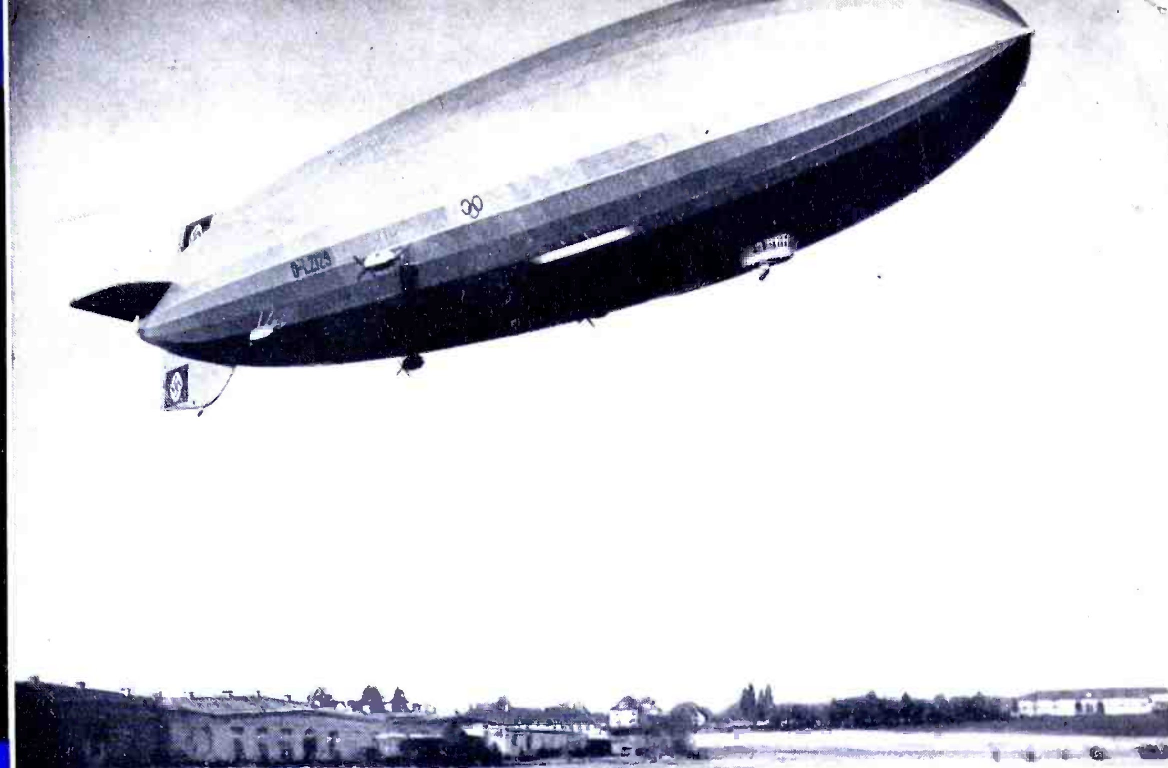
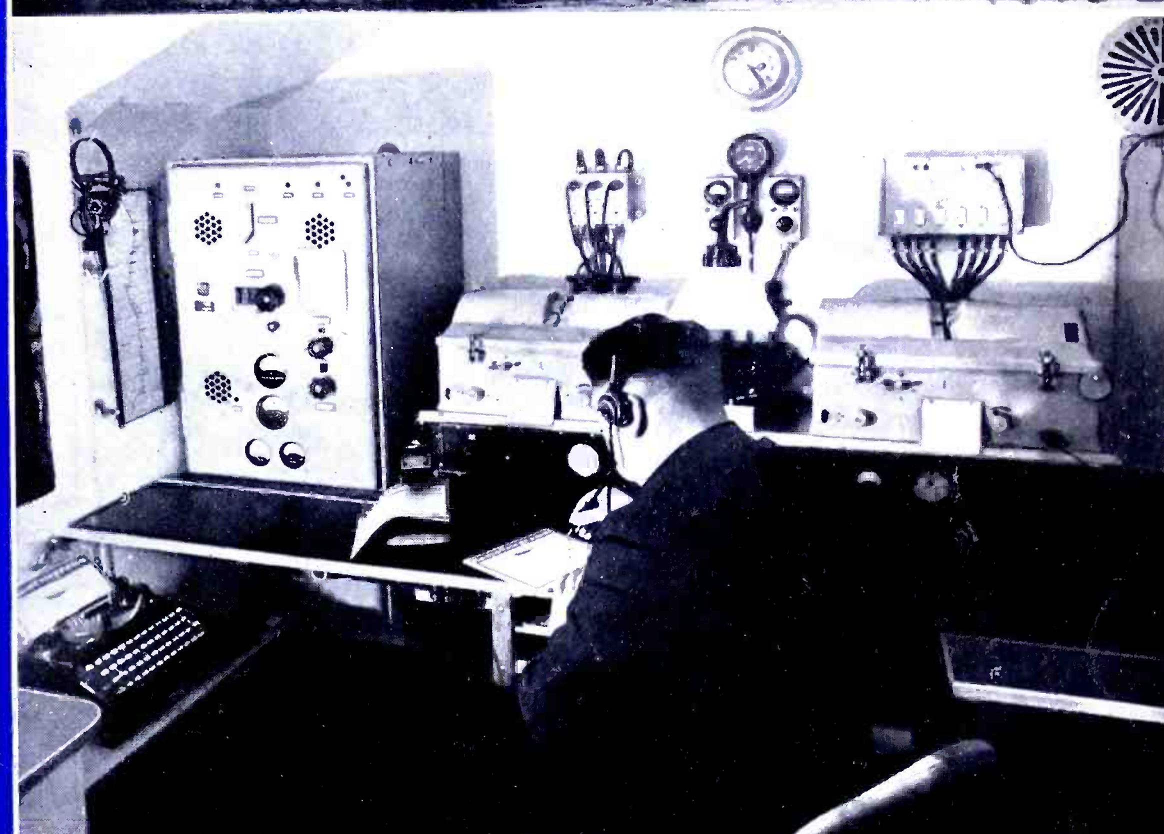
ALL-WAVE RADIO



JULY • 1936



MOOSE RIVER TRAGEDY
the part radio played

BAND-SPREAD SUPER
with regenerative mixer

THE ACOUSTIC SLIDE
in home-built speaker cabinet

RADIO IN JAPAN
when and where to listen

25c U.S. and CANADA

THE JOURNAL of WORLD RADIO

High Fidelity Station tests them all!— Chooses the SCOTT for Truest Tone Beauty!

ALL THE BEAUTY OF THE OVERTONES | **ALL THE MAGIC OF DISTANT LANDS**

PROOF and MORE PROOF—

Proof-every day that when you own a SCOTT you have at your command the finest performance in the world—regardless of price! Tested by celebrated musicians and opera stars! Tested in almost every country in the world! And NOW—tested in *one of the country's leading radio stations**—the SCOTT is *again chosen as the peer of all receivers*. WHY? Ask yourself this vital question when considering your new radio receiver! WHY did SCOTT tone have the most magnificent realism of all the one hundred and fifty receivers?

There under the impartial scrutiny of those engineers in the most gruelling comparison test yet devised, the SCOTT alone—of all receivers tested—captured all the marvelous beauty of the overtones which were broadcast—all the overtones audible to the human ear.

HEAR *ALL* THE PROGRAM!

When your receiver misses the overtones you miss half the beauty of the program—all instruments tend to sound alike. Science shows that *fundamental* notes from voice, violin, trombone, oboe, etc., are all identical—it's the *overtones alone*, or secondary tones, which enable you to tell one instrument from another.

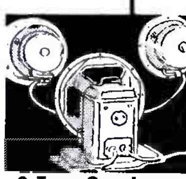
Put your finger up to one ear. Shut off the sound. What you hear doesn't sound complete—you say "there's something missing." Look through a screen. Hold a sieve up to the light. Everything beyond is just the same—but colors are not so pleasing, faces are dimmer. It is the same with your radio. Every day you turn it on for entertainment—for local programs, programs a thousand miles away, programs from Europe, Asia, South America! These programs are for *you*! The stations have been designed for *you*! Get the *full* beauty they have to offer you! More and more stations are raising the fidelity of their broadcasts—and more and more are going "High Fidelity"—*broadcasting the music as it is being played and as it was meant to be heard*—with all the ephemeral and powerful expression that was written into it—with all the enthralling 16,000 cycle overtone range, wherein lies the most sublime beauty of all music.

The SCOTT 16,000 cycle overtone range now offers you and your family the full enjoyment of popular music with all its original sparkle—offers you the world's really great music with all the inspirational beauty the composer himself meant for you to hear. The SCOTT does not overload *one* speaker with this full tonal range. In addition to the *bass and medium tone speaker* (using the sensational bass reinforcing filter) the SCOTT offers *two special true loudspeakers for the higher tones* (these additional speakers receive direct electrical impulses through the regular circuit). Be sure that any extra "loudspeakers" in the set you are considering are not merely "resonators" screwed to the sound-board and "vibrating" with regular tones received by the single real speaker.

*Name of station upon request.

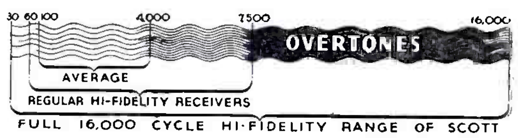
23 Tube SCOTT with Warrington Console

Volume Range Expander—restores expression necessarily cut in broadcasting and recording. Continuously Variable Selectivity—2 to 16 K.C. True Separate Bass and Treble Controls. 19 exclusive cabinets. Highest Useable Sensitivity—for clearest reception at prevailing noise level.



3 True Speakers

Each amplifying its full portion of the complete tone and overtone range.



Average speakers with less than 10 watts power "go to pieces", "rattle" or distort the tone when the full volume of concert music is played through them. With SCOTT 35 Watt Power you may listen to the full glory of symphonic or popular music without any distortion to the ear.

With its Highest Signal-to-Noise Ratio, its remarkable Continuously Variable Selectivity, with its exclusive Rotary Coil System and many other exclusive features, the SCOTT has made probably more verified world distance records than any other receiver in the world.

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This is only a fraction of the magnificent story of the SCOTT. You can own a SCOTT for no more than you would pay for an ordinary good radio. A side by side comparison test is invited. Try it in your own home for 30 days. If you are not then *completely satisfied* that its tone is more beautifully *clear*, that its realism is more strikingly *life-like* than any other receiver, then return it—and there will be no obligation of any kind. Send — TODAY — for complete details of this extraordinary story, every word backed by page upon page of printed PROOF—PROOF of definite, vital superiorities—PROOF of unparalleled tone and distance performance in every quarter of the world—in every state in the Union! Send NOW for full facts!

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COVER

Top: The Zeppelin Hindenburg *flying over Germany. Center: The Radio Room aboard the* Hindenburg, *with transmitter at left and the receivers in front of operator. Bottom: CHNS Remote Control Crew starting off for Moose River. Left to right: J. Frank Willis, Commission Announcer; Louis Murphey, Volunteer Chauffeur; C. A. Landry, Senior Operator; L. A. Canning; W. C. Borrett, Station Director.*

ALL-WAVE RADIO

Reg. U. S. Pat. Off.

VOLUME 2 • NUMBER 6

FEATURES

DEPARTMENTS

GENERAL

PUBLISHED MONTHLY by the Manson Publications Corporation, 16 East 43rd Street, New York, N. Y. Entered as second-class matter August 27, 1935, at the Post Office, New York, New York, under the Act of March 3, 1879. Clarence W. Emerson, President; M. L. Muhleman, Secretary; Edwin W. Lederman, Treasurer.

SUBSCRIPTIONS

YEARLY SUBSCRIPTION rate: $2.50 in the United States and Canada; $3.00 in foreign countries. Single copy price, 25 cents. Notice of change of address required two weeks prior to publication date, or the 15th day of the month. Notifications received after this date will become effective with second issue.

ADVERTISING OFFICES

EASTERN ADVERTISING Manager, Clarence W. Emerson, All-Wave Radio, 16 East 43rd St., New York, N. Y.
Midwest Advertising Manager, William C. Shaughnessy, All-Wave Radio, 1357 Greenwood Ave., Wilmet, Ill.

CONTRIBUTIONS

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EDITORIAL QUOTES

BY THE EDITOR

STREAMLINING has become an intimate part of American life. There are streamlined refrigerators and streamlined Kiddie Kars. But we have yet to see a streamlined magazine.

Nevertheless, we are borrowing the term for our own use, and wish to announce that henceforth ALL-WAVE RADIO will be streamlined.

For months we have been receiving complaints from readers that AWR is one month behind contemporary publications (even though in its contents it is one month ahead), so, beginning with this month we will post-date each issue rather than continue the practice of dating copies the month of issue.

Thus, in June you get the July issue containing August material . . . that's streamlining!

✦

Note on AWR-13

THOUGH THE AWR-13 receiver is "washed up" insofar as its description is concerned, we have continued tests on this set with the purpose in mind of determining if silencing action could be improved in any way.

It has been found that better threshold action on the noise peak suppressor can be obtained by connecting a resistor directly from the cathode to the screen of the 6L7 second i-f tube. A resistor of 100,000 ohms is suitable, if used, although experiment with several values may be desirable.

✦

Tracy Once Removed

WHEN YOU HEAR Lee Tracy's voice via the silver screen, he is twice removed from your presence. Now, if you're sufficiently interested to hear his voice only once removed from your presence to go in for a bit of dial twisting, you may have the opportunity of picking him up direct from his auxiliary schooner, the *Adore*.

The accompanying photo shows Lee Tracy at the dials of his radio equipment aboard the *Adore*. The transmitter, a 100-watt, 100-percent modulated rig, is reputed to be the most complete transmitter on a private boat on the Pacific Coast. On 'phone, Tracy can cover a distance of 3000 miles under average conditions with this equipment, and about 6000 miles on c.w.

TRACY OFF-SCREEN

The station's call is WIFW and it operates on frequencies of 1622, 2060, 2159 and 2790 kilocycles.

From the photo, one would gain the impression that Tracy was using the transmitter as a receiver—but we will give him the benefit of the doubt and assume that he is tuning up the rig.

✦

Long and Short of It

RADIO ON THE short waves has a form of romance peculiar to itself. It also harbors the drama of the unexpected.

Witness the droll circumstances surrounding the tragic plight of the American Legation in Addis Ababa when, in order to communicate with the radio station at the British Legation no more than five miles distant, it was necessary to relay the message to Washington, D. C., from where it was transmitted to London and thence to the British Legation in Addis Ababa.

To the uninitiated, it must have seemed incredible in the first place that two fairly powerful stations only 5 miles apart could not establish contact, and downright astounding in the second place that the semi-portable transmitter at the American Legation could have flashed a message to Washington, D. C.

Witness also the recent broadcast from the Zeppelin *Hindenberg*. With the giant ship off Nova Scotia, the special transmission for the United States had to be intercepted by DJC in Berlin and rebroadcast to this country, then to be rebroadcast again in the standard broadcast band.

There are many instances of this nature when wavelength or skip distance are not suitable for communication between desired points. In such instances, the longest distance is the shortest . . . which may interest Ripley.

✦

Holdover

WE REGRET that it has been necessary to hold over some material scheduled for this issue. There was not sufficient space for all the articles.

The article on receiver operation, and more on the history of amateur radio, will appear in the August issue.

✦

Fun On Five

YOU ARE MISSING a great deal if you fail to listen in on the five-meter amateur band. No matter where you are located, the chances are that you will find little difficulty in intercepting signals from Ham stations operating in this band.

Thirty miles is no longer DX in the five-meter band—the point has been reached where east coast stations communicate quite regularly with stations in the middle west. It has been reported that an English and a French station have been heard in the United States on this wavelength, so there is no telling what the future will bring. One thing is sure . . . this is not a band to be overlooked, and though few all-wave receivers cover five meters, a five-meter receiver is easy to construct and quite inexpensive.

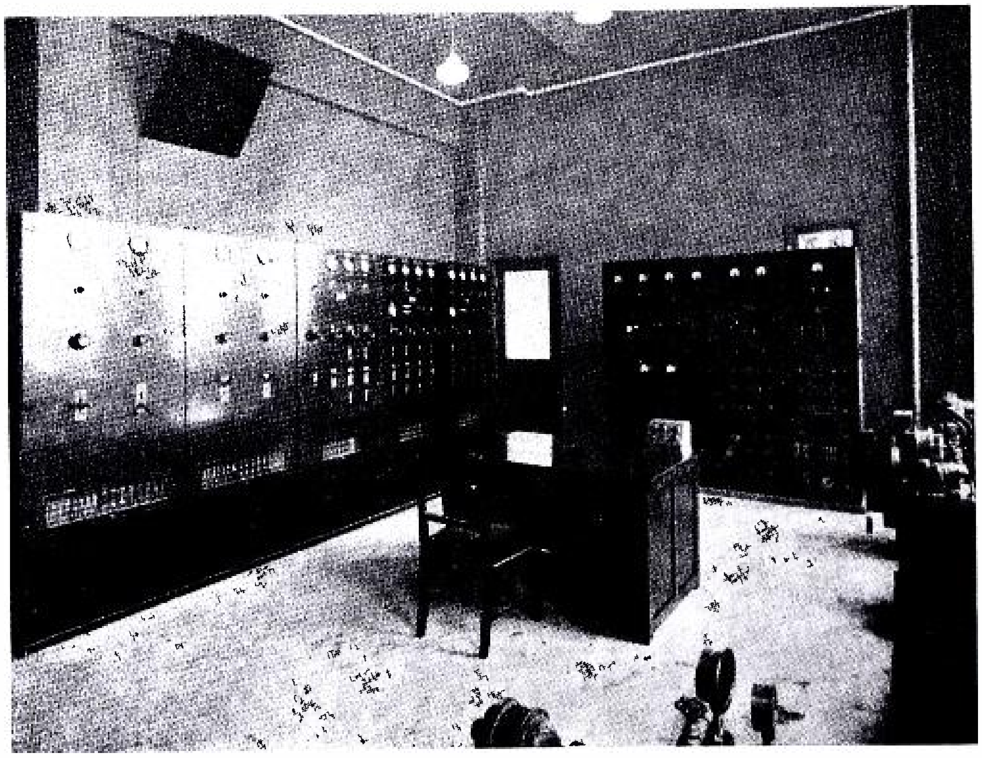
The August issue will carry the dope on a portable, battery-operated five-meter super-regenerative receiver capable of doing a real job in the high-frequency bands. You will find it an interesting diversion.

Identification Signal, "Overseas Broadcast"—First four bars of the Japanese National Anthem (the "Kimigayo") played over and over on chimes.

BROADCASTING

In the Land of the Rising Sun

By George Sholin
PACIFIC LISTENING POST
International DX'ers Alliance



Power room in the transmitter building of Station JOHG, Kagoshima, Japan.

RADIO broadcasting in Japan was established in 1925 with the erection ot the Tokyo, Osaka, and Nagoya Broadcast Stations. They were later taken over by the Nippon Hoso Kyokai (Broadcasting Corporation of Japan) in August 1926. This is now the only organization authorized by the Japanese Ministry of Communications to operate radio broadcast stations in that country.

Broadcasting Set-Up

Japan prides itself on the efficient, modern and comprehensive radio broadcast system which has been built up within a few short years. Large central broadcast stations are located in the principal metropolitan centers of Tokyo, Osaka, Nagoya, Hiroshima, Kumamoto, Sendai and Sapporo. To supplement these main stations, 20 others have been established at important points throughout the nation.

Another indication of the phenomenal development of radio broadcasting in Japan is the fact that, at the present time, the Corporation has a total of over 2,000,000 officially listed "subscribers." This total has been reached after gradual but steady growth, which bids fair to continue into the future.

The fee charged for each receiving set is 50 sen (about 25 cents) a month. This constitutes a major part of the revenue of the Corporation, as broadcast time is not sold and no advertising of any kind is permitted over the radio in Japan.

Expansion on a sound basis has always been the guiding thought behind the development of Japan's present broadcast system. Therefore, the two transmitters of the main Tokyo station are being increased in power—from 10 to 150 kilowatts. Some of the other 10-kilowatt stations may be increased to 100 kilowatts in the near future. The Jap-

Japanese scene—a Nipponese wrestler before a microphone.

anese transmitters will thus rival in range the world's largest stations. At the present time, of the 27 stations, seven are rated at 10 kilowatts, one at 3 kilowatts, one at 1 kilowatt, fourteen at 500 watts and four at 300 watts. In addition, five other stations of 500 watts power are now under construction and may be in operation by the time this appears in print.

Construction on the two new 150 kilowatt transmitters of the Tokyo station is progressing satisfactorily and they will be in operation very soon. The present JOAK station at Shingo will be abolished when the new transmitters of JOAK-1 at Kawaguchi, and JOAK-2 at Hatogaya, are completed. Cantilever antennae, each nearly 1000 feet in height, will be utilized.

The extension program also includes the construction of a large building for each of the studios in Tokyo and Osaka, which will incorporate the latest type of broadcast equipment selected after extensive research and which will equal any such similar installations in any part of the world. These two cities will thus continue to be the broadcasting centers of the Japanese Empire.

New Stations

To make room for the new stations and provide listeners with better service and less interference, the Japanese Government has made a wholesale revision of frequency assignments. The new allocations, to be in effect in the near future, are as follows:

K.C.	Call	Location	Watts	Relay of:
590	JOAK-1	Tokyo	150000	.....
600	JONG	Miyazaki	500	JOGK
610	JOJK	Kanazawa	3000	JOCK
630	JOKK	Okayama	500	JOBK
640	JODG	Hamamatsu	500	JOCK
650	JOUK	Akita	300	JOHK
670	JOTK	Matsue	500	JOFK
680	JOVK	Hakodate	500	JOIK
690	JOBK-1	Osaka	10000	.....
700	JOCG	Asahigawa	300	JOIK
720	JORK	Kochi	500	JOFK
730	JOCK-1	Nagoya	10000	.....
740	JOSK	Kokura	1000	JOGK
770	JOHK	Sendai	10000	.....
780	JOPK	Shizuoka	500	JOAK
790	JOGK	Kumamoto	10000	.....
800	JOKG	Kofu	500	JOAK
810	JOIK	Sapporo	10000	.....
830	JOFK	Hiroshima	10000	.....
870	JOAK-2	Tokyo	150000	.....
890	JOLG	Tottori	500	JOFK
910	JOLK	Fukuoka	500	JOGK
920	JOQK	Niigata	500	JOAK
930	JOAG	Nagasaki	500	JOGK
940	JOBK-2	Osaka	10000	.....
950	JONK	Nagano	500	JOAK
980	JOXK	Tokushima	500	JOBK
990	JOCK-2	Nagoya	10000	.....
1000	JOBG	Maebashi	500	JOAK
1020	JOFG	Fukui	300	JOCK
1040	JOJG	Yamagata	500	JOHK
1050	JOHG	Kagoshima	500	JOGK
1060	JOIG	Toyama	500	JOCK
1070	JOOK	Kyoto	300	JOBK
1080	JOOG	Obihiro	500	JOIK

Taiwan Stations

In addition there are the following stations owned by the Taiwan Hoso Kyokai (Broadcasting Corporation of Taiwan): Taiwan—also called Formosa—is an island possession of Japan situated just off the coast of China, north of the Philippines.

K.C.	Call	Location	Watts
580	JFCK	Taichu	1000
720	JFBK	Tainan	1000
750	JFAK	Taihoku	10000

Korean Stations

Two broadcasting stations are located in Chosen—a part of the Asiatic mainland. This country—also known as Korea—was annexed by Japan in 1910. Its stations are owned and operated by the Chosen Hoso Kyokai (Broadcasting Corporation of Chosen). The main station, JODK, at Keijo has two transmitters.

K.C.	Call	Location	Watts
710	JODK-1	Keijo	10000
970	JODK-2	Keijo	10000
1030	JBAK	Fusan	150

Manchuokuo Stations

The Manchuokuo stations are also listed here as they relay quite a number of the Japanese programs. The main station, MTCY, uses a one-kilowatt transmitter during the daylight hours, but after 6 P. M. Japanese Time (4 A. M. Eastern Standard Time) a 100-kilowatt transmitter is employed.

K.C.	Call	Location	Watts
560	MTCY	Shinkyo (Hsinking)	100000*
674	MTFY	Harbin	3000
760	JQAK	Dairen	1000
890	MTBY	Hoten (Mukden)	1000

* 1000 watts daytime.

Chain Stations

All broadcast stations in Japan, Taiwan, Chosen and Manchuokuo, except JOAK-2, JOBK-2, JOCK-2, and JODK-2, are chained for the main programs. JOAK-2, JOBK-2 and JOCK-2 comprise a second chain for broadcasts of an educational nature, while JODK-2 is a station for the Korean language only.

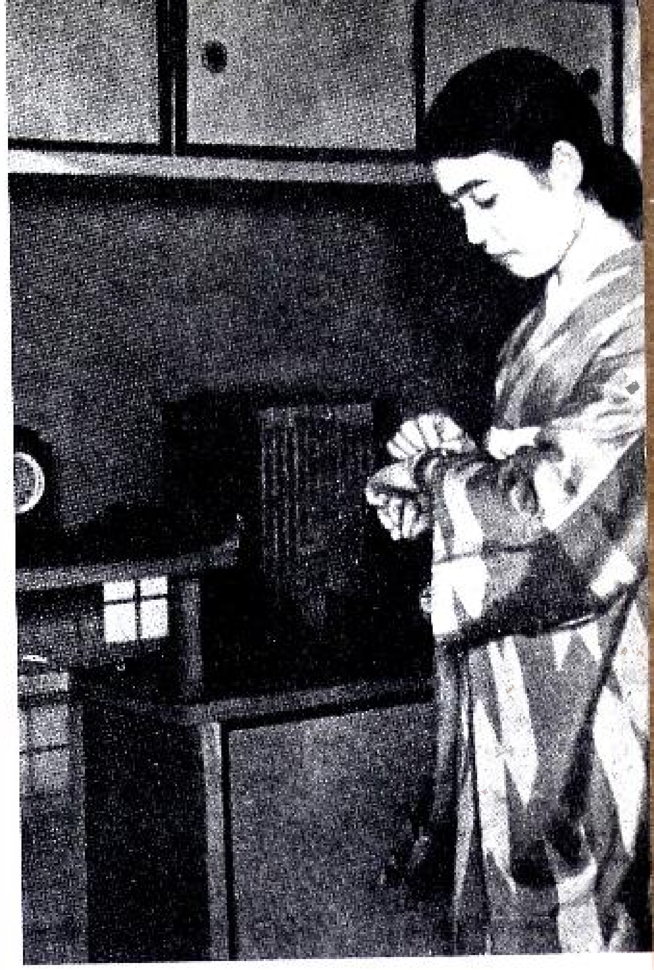
The evening programs of the Japanese stations are often received with excellent volume in America during the early morning hours—especially on the Pacific Coast. These programs start at 6 P. M. Japanese Time (4 A. M.—the same day—Eastern Standard Time) and are scheduled somewhat as follows: *(Time is given in Eastern Standard for the benefit of DX'ers.)*

4:00 a.m.	25 min.	Children's Program
4:25 a.m.	30 min.	Talks in Japanese
4:55 a.m.	5 min.	News in English
5:00 a.m.	30 min.	News in Japanese
5:30 a.m.	2 hrs.	Talks, Music, Drama, etc.
7:30 a.m.	......	Time Signal

The time signal actually starts about a half-minute before 7:30 A. M. E.S.T., and is transmitted in the following manner: 3 gongs, 2 gongs, 1 gong, followed by one chime—all spaced about 10 seconds.

Immediately following the time signal we hear news in Japanese, topics of next day, weather report and forecast, time of sunrise and sunset of next day, time of ebb and flow of the tide for next day, etc.

[*Continued on page 304*]



Checking with time signals.

Japanese "Children's Hour"

Housewives listening-in

Fig. 3. The Great Bolide of August 13, 1928 —a typical meteor train—photographed by M. de Kerolyr at Astrophysics Station of Haute-Provence.

RADIO AND THE

PART 3:

Atmospheric Effects—Seasonal Characteristics of Radio Waves—The Right Wave for the Right Time.

By J. L. Richey

CHIEF TECHNICAL OPERATOR, OVERSEAS SERVICE, A.T.&T.

INVESTIGATIONS of conditions prevailing in the ionosphere are made possible by two general methods:

The first is optical, and must be undertaken by two or more observers at different locations. It has been found that the visibility of aurorae and meteor trains, is for a large part due to ionization resulting from impacts of particles coming from outer space, with the upper atmosphere. These impacts produce an excited and ionized state in the atmospheric gases, mostly at ionospheric heights, resulting in the observed luminosity. By observing the light of meteors and aurorae and comparing their location against the background of fixed stars, from different locations, a parallax is obtained, from which it is possible to compute the height of this phenomenon. The results of measurements made thus far indicate that aurorae and meteor trains exist for the most part in the E region of the ionosphere. The big disadvantage of this method is that aurorae and meteor trains of sufficient visible magnitude are not always available, and seeing conditions (visibility of the starry heavens) are not always good.

The Aurorae

Spectral photographs of aurorae have given some indication of the composition of the atmospheric gases at ionospheric levels. According to Professor L. Vegard, of the University of Oslo, the spectral lines of ionized nitrogen increase in intensity toward the upper part of the aurora, which he interprets as being indicative of an increase in the predominance of nitrogen in the upper atmosphere, as compared with the lower levels.

The afterglow of meteors[7], which persists after the passage of the train, are believed to be due to active nitrogen—a condition brought about by the intense prior ionization caused by the impact of the meteor with the atmospheric gases, and the volatilized ions from the meteor itself. The peculiar shapes taken by the afterglow, up to the time it becomes too faint to be observed further, indicate movements of the ionospheric gases.

In addition, the ordinary light of the night sky contains the green aurora line, and a faint continuous spectrum. This green line is believed to be due to metastable atomic oxygen. During exceptionally bright night sky conditions spectral lines of ionized oxygen have been identified. The night sky is brighter at the times when aurora is very evident. The fact that this light is produced in the earth's atmosphere is apparent, because it is brighter near the horizon than it is toward the zenith. When we are observing straight overhead, we are looking through less atmosphere than near the horizon, and consequently see less light.

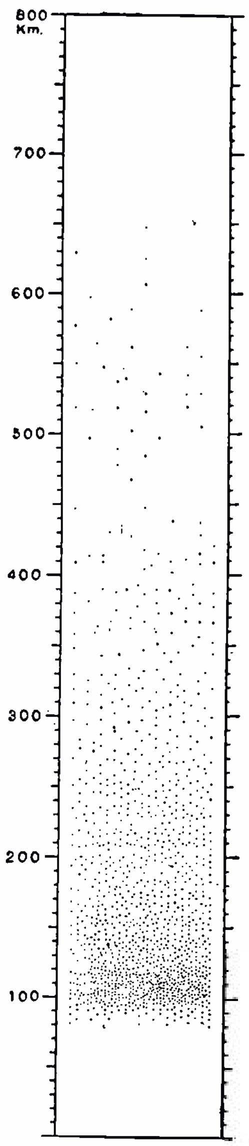


Fig. 2. Showing auroral height, southern Norway, 1911-22.

From "Terrestrial Magnetism and Atmospheric Electricity," by Stormer.

It has generally been supposed that the upper atmosphere consisted mostly of the lighter gases, such as hydrogen and helium, but the spectral photographs indicate the existence of nitrogen and oxygen out to the very limits of our atmosphere. These also show what would be expected from collisions of electrons with our atmospheric gases. These electrons coming from outer space (mostly from the sun) are deflected into the dark regions around the sunset side by the earth's magnetic field.

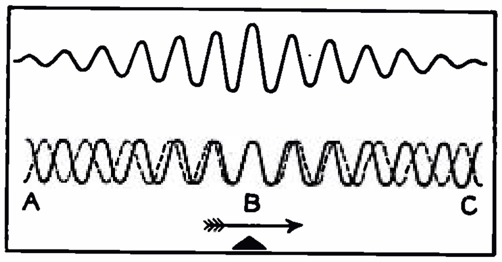


Fig. 5. Illustrating group and phase velocities.

From Wood's "Physical Optics," courtesy The Macmillan Co.

Soundings With Radio Impulses

The second method of investigating the ionosphere is by sending radio impulses straight up and measuring the time taken for an impulse to go up and come down. Since the speed of radio impulses is about 186,000 miles a second; by dividing this figure by one-half of the time measured for a signal to return (one-half of the time is spent in going up, and the other half in coming

ATMOSPHERE

down) gives the virtual height of the reflecting medium. Since the index of refraction changes for different levels, resulting in a continual change in speed, the actual height will be somewhat different from the virtual height. The refractive index changes also for the different frequencies; thus by using different frequencies, we are provided with a means for determining conditions at different levels. Using the cathode-ray tube, with a timing wave on the horizontal plates and the radio receiver output on the vertical plates[8], Schafer and Goodall et al, have obtained some very interesting results in exploring the ionosphere with transmitted pulse signals. These investigations have revealed the electron density at different levels for different times of day and seasons, and indicated the existence of the various layers. In addition to the E region at a height of 100-120 km, and the F region 190 to 300 km, they have found[8] that there is an intermediate reflection region, which they call the M region. Their measurements show it to have an average height of approximately 150 km. Some days it may be as high as 180 km, while on others it may be as low as 130 km. In order to observe this M region, the frequency used must be great enough to permit penetration of the E region, but small enough to give reflections from the M region. The M region can only be observed when its maximum density exceeds that of the E region below it.

They have found that the ionization in the F region does not increase uniformly with height, but has often been found to have a step-like structure. This indicates that there is a tendency for the formation of several ionization maximum in the F region. During the daylight hours two and more maxima have been observed. At times these maxima take on a step-like structure, the treads being strikingly level, indicating abrupt ionic density gradients at heights near 200, 240 and 280 km. The fact that these are only observed in the daylight suggests that they depend upon the ionizing activity of the sun.

Group and Phase Velocity

In the ionosphere the velocity of a particular radio wave (called phase velocity) changes with the wavelength. This is brought about by the change in the dielectric constant with frequency (due to the presence of electrons), resulting in the dispersion observed. Radio impulses consist of groups of waves containing a number of different frequencies

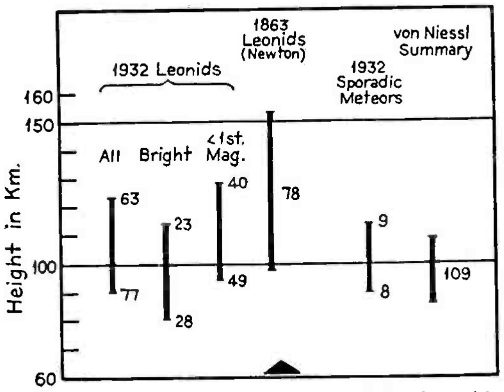


Fig. 4. Meteor heights, 1932 Leonid Epoch, and comparative data, by Olivier.

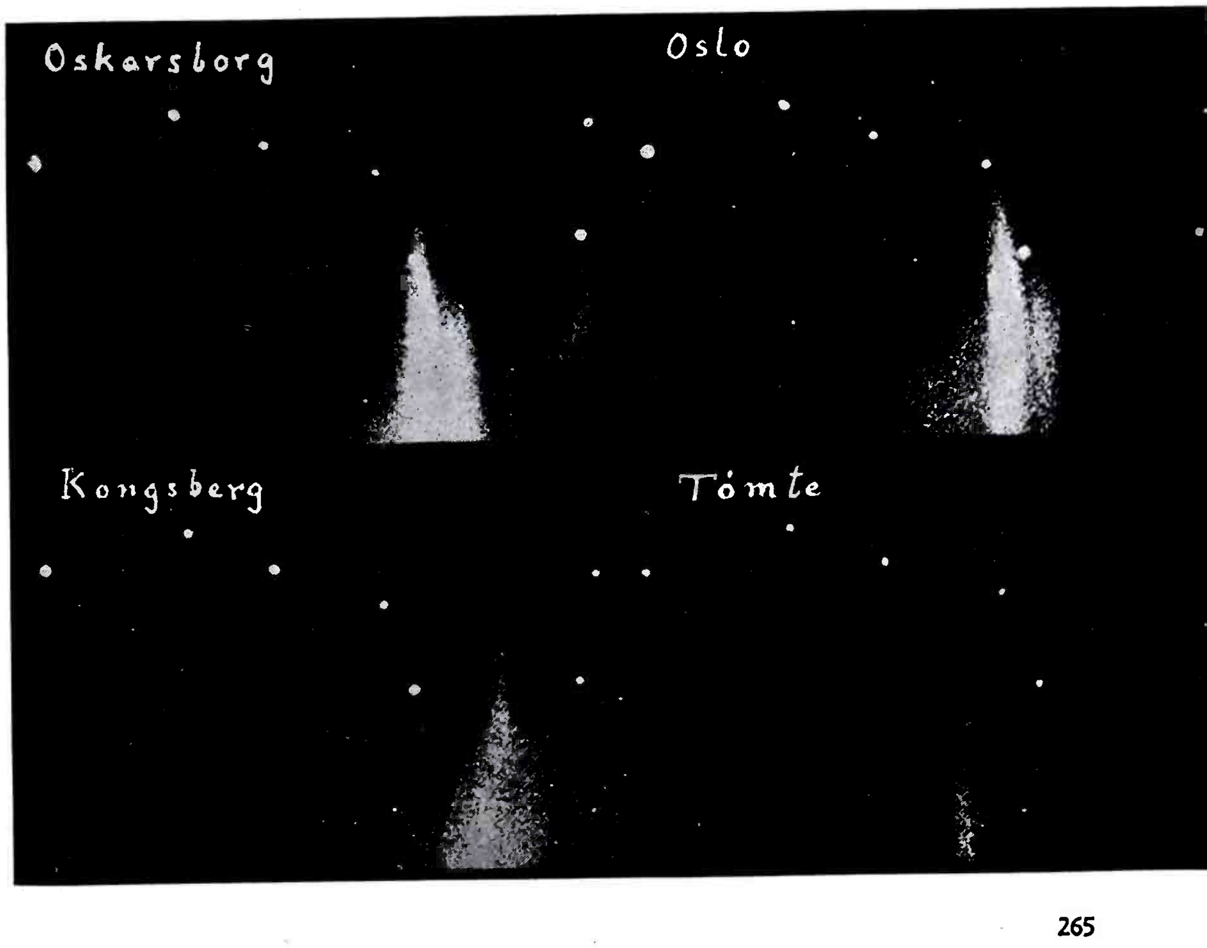
relatively close together. This is the case for both radio telegraphy and radio telephony. It has been found that the velocity of the waves as a group (group velocity), i.e., by analyzing the action of a single impulse group. will be different from the phase velocity (velocity at a particular frequency). This phenomenon is possible only in a medium where dispersion obtains. An interesting illustration of this is discussed in Wood's[16] "Physical Optics":

"An important distinction exists between the velocity of a group of waves and the velocity of a single wave. We can get a very good idea of what is meant by group velocity by throwing a stone into a quiet pond, and watching the circular waves which spread out. If the attention be fixed on a single wavecrest at the center of the group, it will be seen presently to lead the group, the waves ahead of it appearing to die out, and in a few seconds its amplitude will become so small that the eye can no longer be kept on it. There are just as many waves in the group, however, as there were before, and a little further observation will reveal the fact that, as the waves in front die out, new ones appear in the rear. The group is obviously moving forward with a velocity less than that of the individual waves. The velocity of the individual waves is known as the phase velocity.

"The explanation of the phenomenon was first given by Stökes, who regarded the group as formed by the superposition of two infinite trains of waves, of slightly different wavelength, which advanced in the same direction but with different velocities.

"Lord Rayleigh was the first to draw attention to the bearing of group velocity upon optical problems. In his article on "The Velocity of Light" (Nature, 1881), he called attention to the fact that, in all experiments made for the purpose of determining the velocity of light, it is the group-velocity, and not the phase velocity, which is actually measured. What is actually determined is the velocity with which some peculiar-

Fig. 1. Simultaneous photos of auroral rays at four stations, with Ursa Major in the background.
(From "Terrestrial Magnetism and Atmospheric Electricity," by Stormer.)



ity impressed upon the wave-train moves forward. Since it is impossible in the case of light to pick out and watch a single wave, the best that we can do is to measure the speed with which a block, cut out of a wave-train advances. If the medium is free from dispersion, i.e., if waves of all possible length are propagated with the same velocity, the group-velocity and phase-velocity will be the same, the group being propagated without alteration.

"This will be made clear by reference to Fig. 5. In the lower diagram we have two superposed trains of waves, moving in the direction of the arrow. The resultant disturbance is indicated in the upper diagram. The longer waves (dotted line) are out of step with the shorter (solid line) at A and C, and the resultant is zero at these points. At B, where there is agreement of phase, the resultant amplitude is double that of the single waves. If now the velocities of the two sets of waves are equal, it is evident that the group shown in the upper diagram will move forward without alteration with the phase-velocity. If, however, the shorter waves move at a higher speed, it is evident that they will presently get out of the step at B, and into step at C, which now becomes the center of the group. The group thus advances with a velocity greater than that of the individual waves. If the reverse is the case, the amplitude to the left of B increases as the group advances, the amplitude to the right of B diminishing, A becoming eventually the center of the group. In this case the group-velocity is less than the phase-velocity."

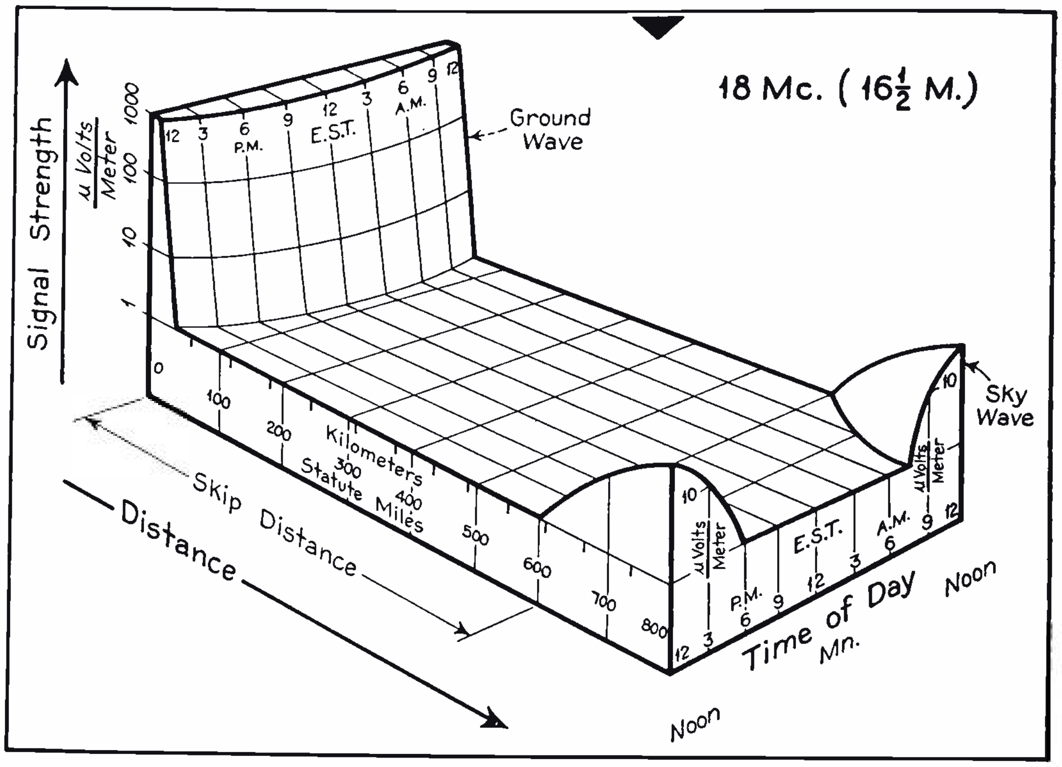


Fig. 7. Short-wave idealized surfaces, showing field intensity, versus distance and time of day. Note the ground-wave and sky-wave projections, and the flat "skip distance" area.

In the case of light and radio waves the group velocity and phase velocity are very simply related, in that the product of the group velocity and the phase velocity is equal to the velocity of light in vacuo, squared. So U, the group velocity is equal to C^2/V, where C is the velocity of light in vacuo, and V is the phase velocity.

"The real evidence that the waves of all lengths travel with the same velocity in free space, is furnished by the variable star Algol, which shows no color sequence when increasing in brightness, as would be the case if waves of different length traveled with different velocities."

Ionospheric Conditions

Measurements of ionospheric conditions by soundings with radio impulses must be considered on the basis of group-velocity. As the ionization in the layer changes for the different times of day, a critical condition is found for which the virtual height varies rapidly with time for a group of frequencies close together, while it is practically constant for other frequencies on either side of them. At such times the measured virtual heights for the critical frequency may be several times the actual height of penetration due to slow group-velocity of the waves in the medium. Similarly for any given set of conditions, if waves of gradually increasing frequency—or gradually shorter wavelength, are projected upwards, it is found that a certain critical frequency is reached that will just penetrate the layer, and show a much higher virtual height. Beyond the critical frequency, reflections take place from the higher layer. The contiguous higher frequencies show a lower virtual height as compared with the critical frequency, but continues to show a higher virtual height as the frequency increases, showing a continuously greater depth of penetration. The critical frequency may be regarded as the lowest frequency that can penetrate through the layer being investigated. The change in the critical frequency for the different times of day is an index of the change in the ionic density of the region, and a knowledge of its value permits a ready estimate of the electron density of the layer.

The electron density per cubic centimeter N is equal to $f_c^2/8.16\times10^7$ where f_c is the critical frequency in

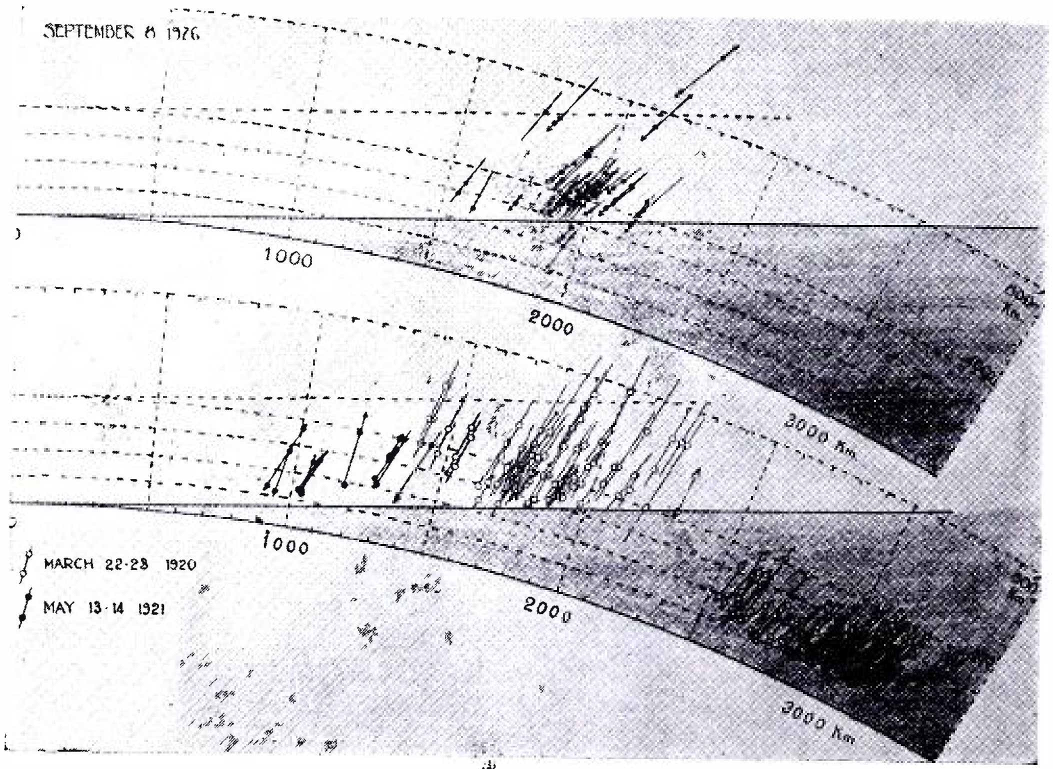


Fig. 8. Auroral diagram showing heights at time of sunset and darkness.
From "Terrestrial Magnetism and Atmospheric Electricity," by Stormer.

cycles per second that just penetrates the layer under investigation. From the many measurements that have been made it has been found that certain wavelengths will change from E layer or E and F layer reflections to F layer reflections only, while others found to be F layer reflections will also undergo change. Frequencies higher than a certain value will no longer regularly return to earth. The Bureau of Standards[9] have found in their ionospheric investigations that the E layer critical frequency shows a regular diurnal variation and a slight seasonal variation in noon maximum, indicating that the sun is the chief source of ionizing forces in the day. In addition sporadic increases of E layer ionization to abnormally high values occur at random, and most frequent at night from some ionizing force apparently independent of direct radiations from the sun (probably meteors).

They find the F region to be composed of two definite strata or layers in the daytime as evidenced by *two other critical frequencies.* The critical frequency F_1 is approximately 1000 kilocycles higher than E critical frequency, and is found to vary diurnally and seasonally in phase with the E critical frequency. Heights for the F_1 layer are estimated by them to be around 185-190 kilometers. The boundary between the F_1 (lower F) and F_2 (higher F) becomes indistinct in midwinter and at night. Certain changes near the F_1 critical frequency correlate with the existence of magnetic storms.

The F_2 region is found to be composed of one or more irregular and changing strata up to 400 km. without regular seasonal or diurnal characteristics.

The F_2 critical frequency is found to have less regular characteristics than the E or F_1 critical frequency, but shows definite diurnal characteristics which change with season, the maximum occurring near noon in the winter and after the sunset in the summer. The maximum value of this critical frequency is higher during the winter noon than during the summer noon, indicating denser ionization at that time.

Dr. Mitra P. Syam of the Wireless Laboratory, University College of Science, Calcutta, India, finds another layer below the E region, which has been named the D layer and which locates at a height of about 50 kilometers. This places it in the ozonosphere. This layer is believed to reflect only the very long radio waves. It appears from these findings as though it will be desirable to extend the lower limit of the ionosphere so as to include the "D" layer.

Dr. Henry Rowe Mimno[21], of Harvard University, in his radio ionospheric explorations finds the existence of what is designated G and H layers, which are above the F region. The G layer locates about 375 miles high, and the H layer seems to be at a height of about 725 miles.

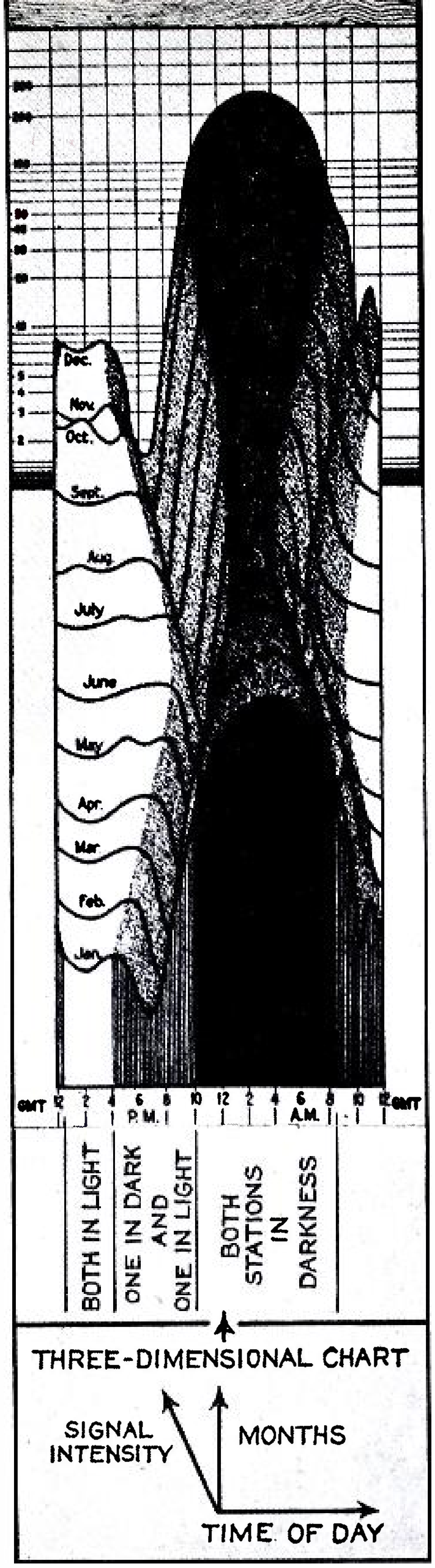


Fig. 6. Long-wave diurnal and seasonal chart, showing variations in transmitter field strength.

Diurnal and Seasonal Characteristics

The variations in the density of electrons in the ionosphere from day to night and for the various times of day, cause the transmission characteristics of radio waves to show a definite recurrent diurnal behavior. On transmission of wavelengths longer than 5000 meters across the north Atlantic, the following conditions have been observed[17]:

(1) Relatively constant signal strengths prevail during the daylight period.

(2) A temporary reduction of signal strength (sunset dip) accompanies the occurrence of sunset in the transmission path between the two terminals.

(3) The advent of darkness over the path causes a rise in signal intensity, which is maintained until daylight approaches.

(4) The approach of daylight over the eastern terminal causes a temporary drop in signal strength. After this, relatively steady daylight signal strengths again obtain.

These characteristics are also subject to seasonal change, the outstanding features being:

(1) The continuation of high nighttime values throughout the year.

(2) The persistence of high nighttime values for a longer period in the winter months than in the summer months.

(3) The time at which the sunset dip occurs changes with the time of sunset, and similarly the time at which the morning drop occurs changes with the time of sunrise.

The sunrise and sunset dips are of a different character for the different wavelengths. An interesting phenomenon associated with the sunset is observed in the case of the aurorae. Dr. Carl Stormer[15] in investigating auroral heights, finds the greatest elevations obtained in the area just beyond the sunset region. sometimes reaching as high as 1000 kilometers. In the darkness the auroral heights usually range normally from 100 to 400 kilometers, with the maximum near 100 km. According to Dr. Stormer, this effect is caused by the action of sunlight, which seems to be a pressure on the upper atmosphere, driving it away tongentially to the earth, (making the earth's atmosphere extend out in space somewhat like the tail of a comet). See sketch in Fig. 8. When the corpuscular rays from the sun hit this tail they produce the aurora rays, the height of which increases with their distance from the sunset point. The sunlit aurora rays situated in this tail seem to be confined to it, and do not descend beyond the frontier line between the sunlit and dark atmosphere. In the space between the tail and the earth, up to a distance of 2500 kilometers from the sunset point, no aurora rays are seen. From 2500 km and further, reckoning from the sunset point, the action of the tail seems to have ceased, so that aurora rays here occur with the usual night altitude from 100 to 400 kilometers.

It is probable that the radiation pressure of sunlight increases the atmospheric density in the region of the upper atmosphere just beyond the sunset point, and increases the collision rate between electron and molecule at the elevation (D layer) where long waves are usually

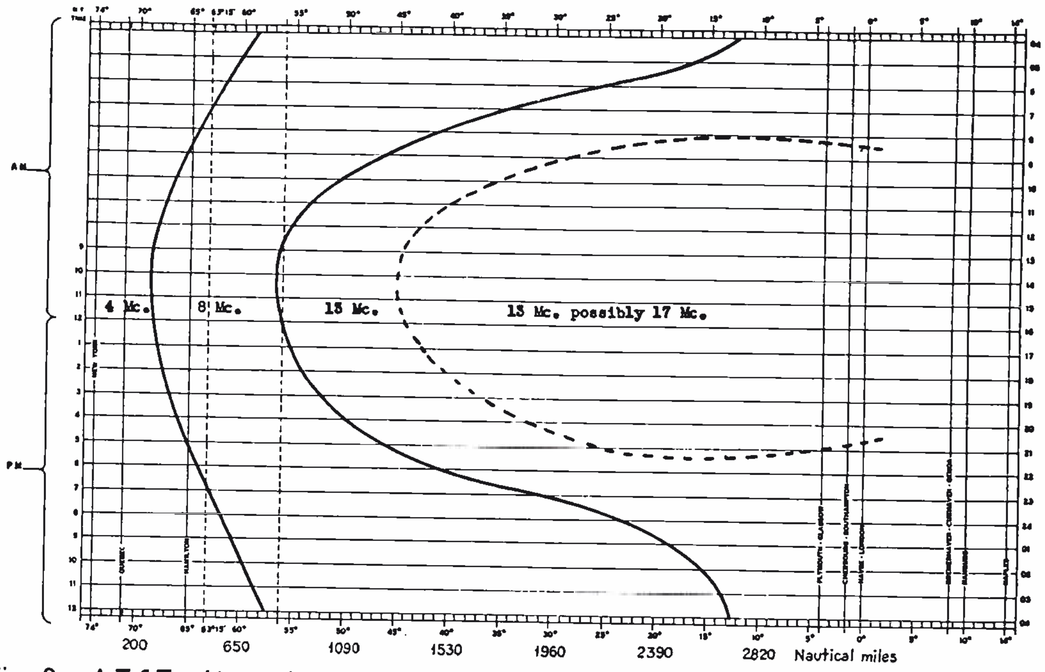


Fig. 9. A.T.&T. ship-to-shore distance-time chart for summer of 1935, showing estimated optimum frequencies for communication in various areas of Atlantic ocean.

reflected from, thereby increasing the attenuation during this period.

Daylight intensities of the signal field for equal radiated powers are higher, the longer the wavelength, while their maximum night time values are very nearly alike.

Wavelength and Distance

The ratio of the night-to-day radio signal intensities for long distances becomes greater as the wavelength is made shorter. This characteristic is obtained all the way down to 200 meters, beyond which the characteristic changes in the reverse direction, so that the ratio of the night-to-day signal strengths decreases as the wavelength is progressively made shorter, and finally the day signal becomes the stronger. At distances of 2000 to 6000 miles, wavelengths below 25 meters are usually stronger in the daytime. and their strength at night depends upon the season, transmission direction, and prevailing transmission conditions.

The short waves also undergo interesting diurnal characteristics. On the longer of the short waves, the average normal night intensity is fairly constant, and the day intensity has a minimum around noon at the center of the path. For example, signal intensity measurements of wavelengths near 160 meters show weaker signals than 80 meters, and 80 meters are weaker than 40 meters, etc. The closer the wavelength is to 200 meters the greater is the daytime attenuation. The *maximum* night signal strengths of 40, 80 and 160 meters have been found to be fairly close, even though the daytime values are very much different. These effects depend very much upon the distance covered. For distances greater than a few hundred miles the signals are usually stronger in the night hours, for wavelengths longer than 30 meters; reflection of the sky-waves usually taking place at a higher elevation in the ionosphere, where the collision frequency is smaller, the signals decrease in strength very rapidly when sunrise occurs at either end of the transmission path—in this case reflection takes place at a lower level of the ionosphere where the greater atmospheric density increases the collision frequency, and consequently the attenuation. At these distances sunlight appears to offer difficulties to waves longer than 30 meters. At night-time the electron density is usually insufficient to bend the shorter waves back to the earth; hence, they probably penetrate through the ionosphere and go out into inter-stellar space. The shorter waves require a greater electron density and gradient to obtain sufficient refraction to bend them back to the earth, as compared with the longer waves, and this is generally obtained in the daytime.

Seasonal variations also occur, in that all of the usable short waves reach out to greater distances in winter as compared with summer. In summer, more use is made of shorter wavelength to reach long distances as compared with winter, and on account of the greater length of daylight, they remain usable for a longer time.

In the discussion on the lower and upper atmosphere in Part I, it was brought out that the temperature of the upper atmosphere increases for a certain distance upward and that this increase was greater during a summer day, and least during a winter night. It is desired to bring out here, predicated on observed absorption of the solar energy by the ozonosphere, that there is a diurnal temperature change in the upper atmosphere. Calculations show that during the daytime, temperatures at heights above 25 miles may exceed that of boiling water[18], and drop to as low as 68° Fahrenheit below zero, and lower at night, depending upon the latitude and season. At the high temperature, the motion of the atmospheric particles will be much greater and consequently collisions will be more numerous. At night-time the motion of the particles will be much reduced, with the concomitant reduction in the collisions. It is suggested that this action may be an appreciable contributing factor affecting the change in attenuation from day to night.

Fading

Rapid variations in the ionic density of the ionosphere at different levels will change the attenuation characteristics, and cause fluctuations in the strength of the signals at the receiving point. These fluctuations are more numerous at the higher levels, hence the shorter waves that reach these levels

[*Continued on page 306*]

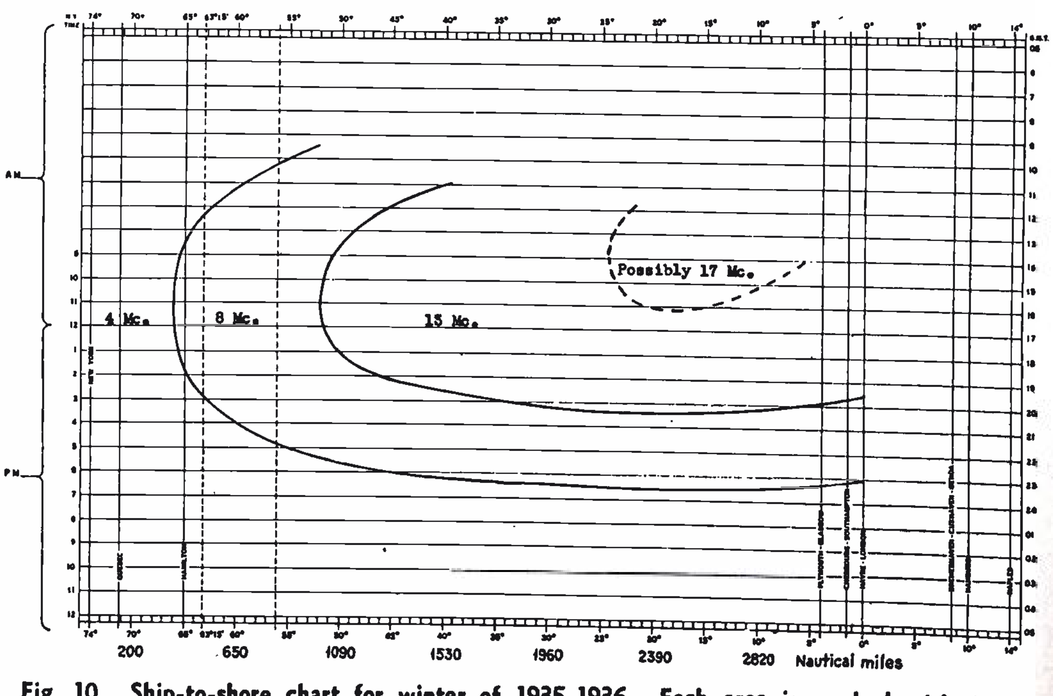
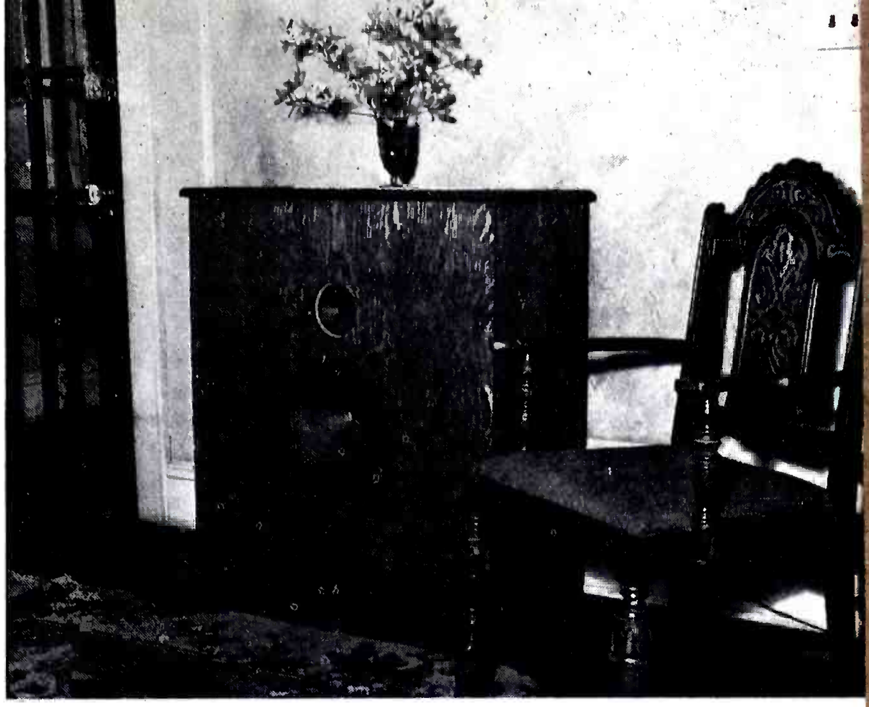


Fig. 10. Ship-to-shore chart for winter of 1935-1936. Each area is marked with frequency best used for reliable communication between ship and shore stations.

Sound-Treated SPEAKER CABINET

With "Acoustic Slide"



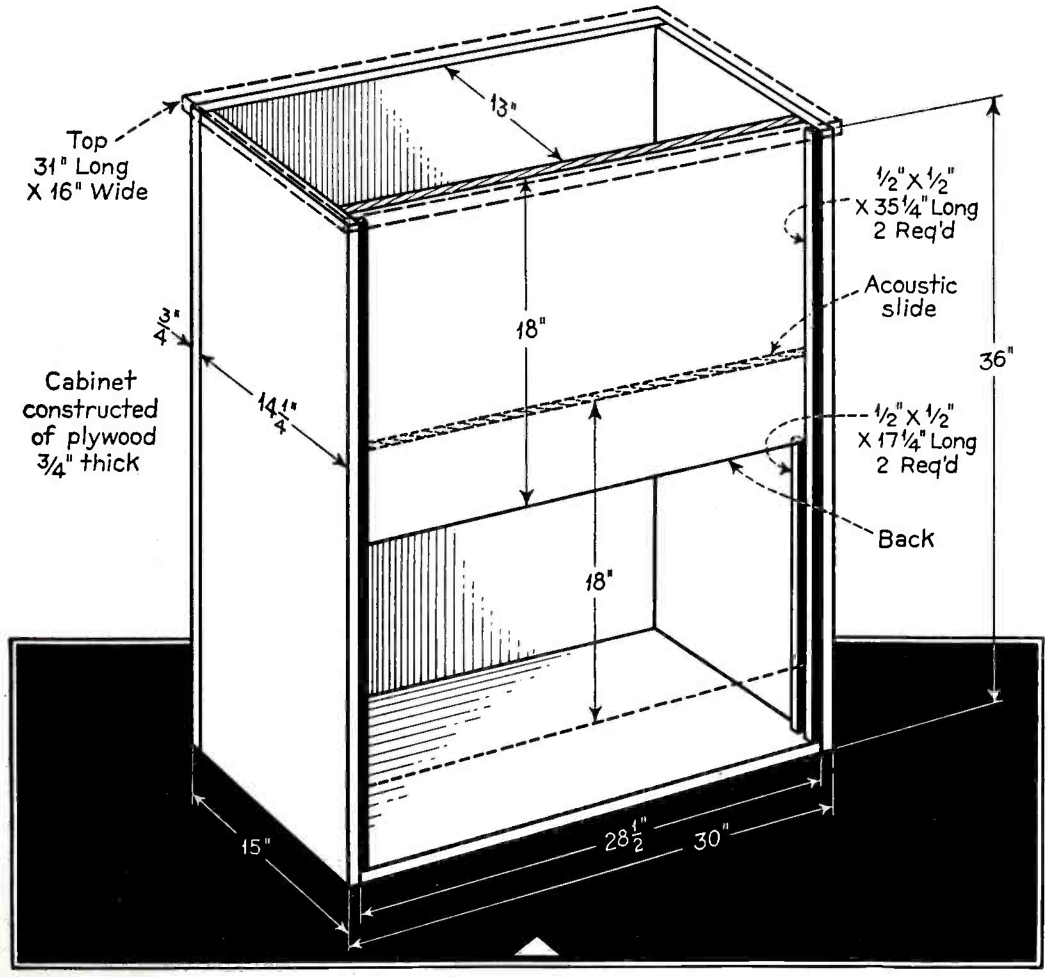
By C. F. Mullen

A SPEAKER operating by itself is merely a means of reproducing intelligible noise. It must be mounted in a properly designed baffle or cabinet before proper reproduction can be secured. A baffle consists simply of a large surface of non-resonant material, such as Celotex, with the speaker mounted at or near the center. This provides the necessary long path for the air waves between the front and the back of the speaker cone. The lower the frequencies desired to be heard the longer this path should be, since low frequencies are of a longer wavelength than high frequencies.

The Problem

The difficulty with using the simple but highly effective baffle is that the baffle board, which must be several feet across, upsets the decorative scheme of the room it is placed in unless it is especially built-in so as to match the other fittings of the room. Usually this cannot be done, particularly in the living room. It then becomes necessary to use some sort of enclosed cabinet, pushed up close to one of the walls. But as soon as a dynamic speaker is mounted in a small enclosed space the reproduction becomes muffled and boomy. Cabinet resonance, vibration of the cabinet surfaces, etc., contribute to poor response and quality.

Details of cabinet construction. Sound-absorbing material not shown.



The Solution

The cabinet to be described was designed to minimize to a negligible degree these difficulties. The air column in an enclosed cabinet must be large enough to provide free movement. It will naturally resonate at some frequency but if large enough this frequency will be well down into the bass range and the resonant peak very broad. This gives quite a desirable increase in bass response without the "boomy" effect improperly designed cabinets have. No shelf or large apparatus should be so mounted as to impede the free movement of the air column in the cabinet. When used with the AWR-13 receiver, the power supply can rest on the bottom of the cabinet out of the way. The speaker can be mounted at any place on the front as this is an enclosed cabinet. The speaker can be dismounted from the chassis if desired and the interconnecting wires lengthened.

The interior surfaces of the cabinet must be dampened with some sound-absorbing material. The best material to use is heavy felt one-half to one inch thick, tacked or glued to *all* the inside surfaces. A good substitute is rock wool, such as is used for insulating the walls of houses. This should be placed in cloth pads about an inch thick, sewed so as to keep flat, and fastened to the inside surfaces.

"Acoustic Slide"

In order to vary the bass frequency response to suit the taste of the listener, an "acoustic slide" is provided on the back. This is merely a ply-wood board, of the same size as the back piece, which slides down into the groove shown in the rear view sketch of the cabinet. When all the way down, the back and the acoustic slide overlap a bit, providing complete enclosure, which gives maximum response in the bass range. As the slide is raised the bass response is lowered, giving more the effect of a straight

[*Continued on page 310*]

Globe Girdling

By J. B. L. Hinds

how to make out station reports . . . international reply coupons . . . new stations on air . . . the costa rican group . . . the mexicans . . .

NUMEROUS letters are being received from readers requesting information as to the method to be followed in obtaining verifications, the manner of making reports of reception to stations, and other details pertaining to these reports.

In order to clearly present this subject to the reader, I am reproducing the form used by the writer in making reports of reception, which are necessary in order to obtain a verification from the station heard.

Report Form

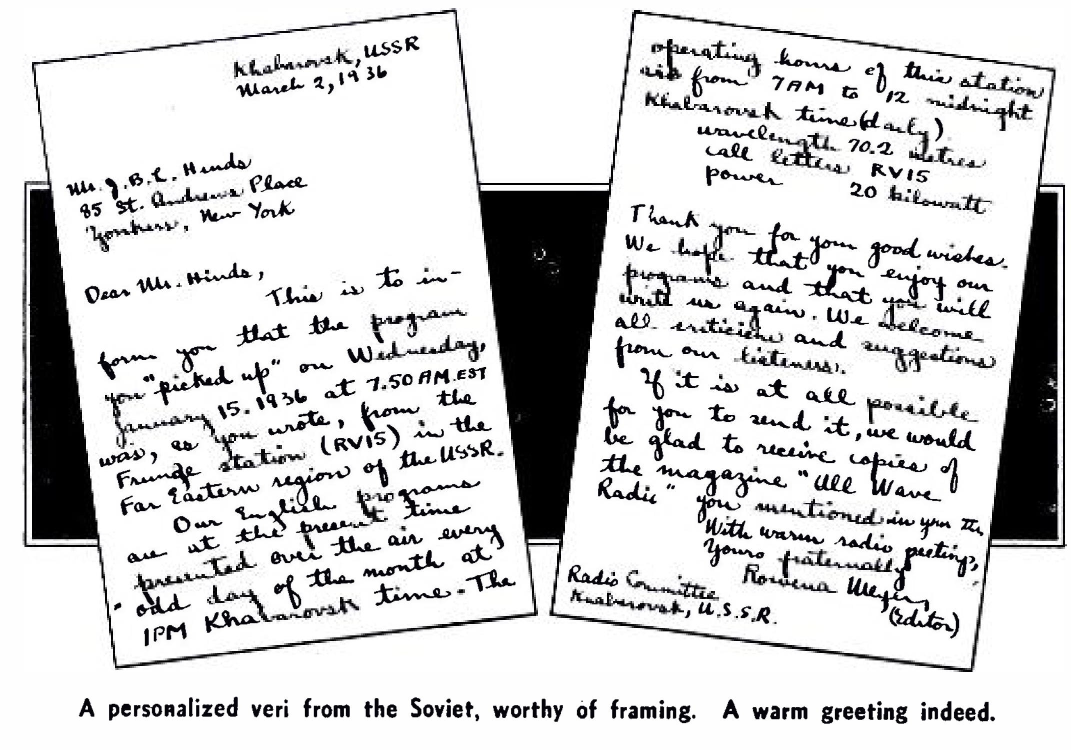
While the form is self-explanatory there are many things of importance to be given consideration in making up the report and the filing of it, which I will cover as I proceed.

After plainly dating the report, the address can be taken from the address list as furnished by ALL-WAVE RADIO alternate months and which gives the correct addresses of the majority of the stations of the world. The station call, frequency and date heard are next given. If reports are made promptly, which of course should be the case, the date of the report should be the same as the date heard, as a great many stations use the date of the report as the date of reception when making out the verification card or letter.

The next part of the form conveys to the station the information, which, to my mind, is most important, as from it their engineering forces learn how you received them as to volume, clarity and stability and whether the signal was interfered with by other stations or natural causes. It will be noted that the form is so arranged that the reporting of these conditions may be shown according to the desire or the particular system used by the individual listener.

The log of reception follows. This should be a picture, if you please, of what you heard and when you heard it, and if more listeners would pay more attention to this point and make a short log of what they did hear, there would be a better chance of the station being able to compare and check with their own log, and know that you had heard them, when sending the verification card which you delight in receiving.

MR. J. B. L. HINDS



Khabarovsk, USSR
March 2, 1936

Mr. J. B. L. Hinds
85 St. Andrews Place
Yonkers, New York

Dear Mr. Hinds,

This is to inform you that the program you "picked up" on Wednesday, January 15, 1936 at 7.50 AM. EST was, as you wrote, from the Frunze station (RV15) in the Far Eastern region of the USSR.

Our English programs are at the present time presented over the air every odd day of the month at 1PM Khabarovsk time. The operating hours of this station are from 7AM to 12 midnight Khabarovsk time (daily).

wavelength 70.2 metres
call letters RV15
power 20 kilowatt

Thank you for your good wishes. We hope that you enjoy our programs and that you will write us again. We welcome all criticism and suggestions from our listeners.

If it is at all possible for you to send it, we would be glad to receive copies of the magazine "All Wave Radio" you mentioned in your [illegible]

With warm radio greetings,
Yours fraternally,
Rowena Meyer (Editor)

Radio Committee
Khabarovsk, U.S.S.R.

A personalized veri from the Soviet, worthy of framing. A warm greeting indeed.

Program Report

Twenty to thirty minutes running time is sufficient time to cover in your report, but be sure and give all you heard and the exact time each selection, song or announcement was made. If orchestra, with tenor, soprano, baritone, or bass solo; if station gongs, chimes, etc., tell how many and when. If you hear the title of the selection rendered, or know the title, be sure to give it in the report. If orchestra playing, state if rhumba, tango, waltz or fox-trot. Be sure and state if piano accompanies the orchestra; if piano solo; if violin solo with piano accompaniment; if male or female or mixed quartet or chorus.

If report is hand-written, write plainly. If you can operate a typewriter, by all means use it, but sign the report in your own handwriting, with your name spelled out below on machine along with your address. Do not use paper with other addresses appearing thereon besides your own. Use the same care in addressing the envelope using the address from report, and showing your return address in the upper left hand corner of envelope. Be sure and place sufficient postage on the envelope before mailing. Europe, Australia, Asia, Africa, Japan, and all British possessions (excepting Canada) require five cents letter postage, with the one exception of Spain and its possessions, (Canary Islands, etc.) which require only three cents postage per letter ounce. North, South, and Central America, Cuba, Mexico and West Indies, require three cents per letter ounce, excepting British possessions (Bermuda, etc.) which are five cents.

Before sealing the envelope and mailing, see that you have enclosed International Reply Coupon, if necessary. These coupons may be purchased at any post-office for nine cents each. When purchased they are stamped as to date and location by the issuing office.

International Reply Coupons

The International Reply Coupon is valid in all countries belonging to the Universal Postal Union, which includes practically every country in the world except the Laccadive and Maldive Islands and the Government of Latakia. A reply coupon, upon presentation at a post office in any of the countries of the Union above named, will entitle the person presenting the coupon to receive (without charge) a postage stamp or postage stamps of that country of sufficient value to prepay a letter of the first unit of weight from the country in which the coupon is exchanged to the country which issued it. It may be added that, under the provisions of the Universal Postal Union Convention, the right is reserved for any country to require that the reply coupons and the articles of correspondence for the prepayment of which they are to be exchanged be presented at the same time.

Modernistic, in black, red and blue, from Santiago (of which there are many), Dominica (of which there is but one).

The above is the plan, although difficulties of a local character have arisen in making exchange in Ecuador and Nicaragua. Short-wave stations in these particular countries request that United States postage stamps be sent (preferably three one-cent stamps).

Although the information as to the arrangement was furnished me by the U. S. Government, the U.S.S.R. usually return to the writer coupons sent them. Moscow, however, does send verifications for correct reports without coupon or postage. Coupons sent by the writer to Moscow were returned on one or two occasions with advice that the U.S.S.R. does not belong to the Union.

Do not send U. S. coins or stamps to foreign countries to pay postage. The International Reply Coupon should be used or the postage of the particular country may be purchased through certain sources and forwarded.

Please bear in mind that you cannot compel stations to verify your reports. This is a courtesy extended you, so be polite and courteous in your requests and your tracers for reply. Be patient—it takes time to secure some reports. All stations do not have forces sufficient

REPORT FORM

......................, 1936

....,
....,
....,
....

It affords me pleasure to furnish below a report of reception of your station. Please be so kind as to check with your station log and send me verification if correct.

Station .... Frequency .... Date Heard ....
Interference (by other stations) ....
Atmospherics (natural static) ....
Signal Strength (volume) ....
Quality (clarity of tone) ....
Fading (stability) ....
Overall Merit ....

Log of Reception follows:

Time given is Eastern Standard

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Signed ....

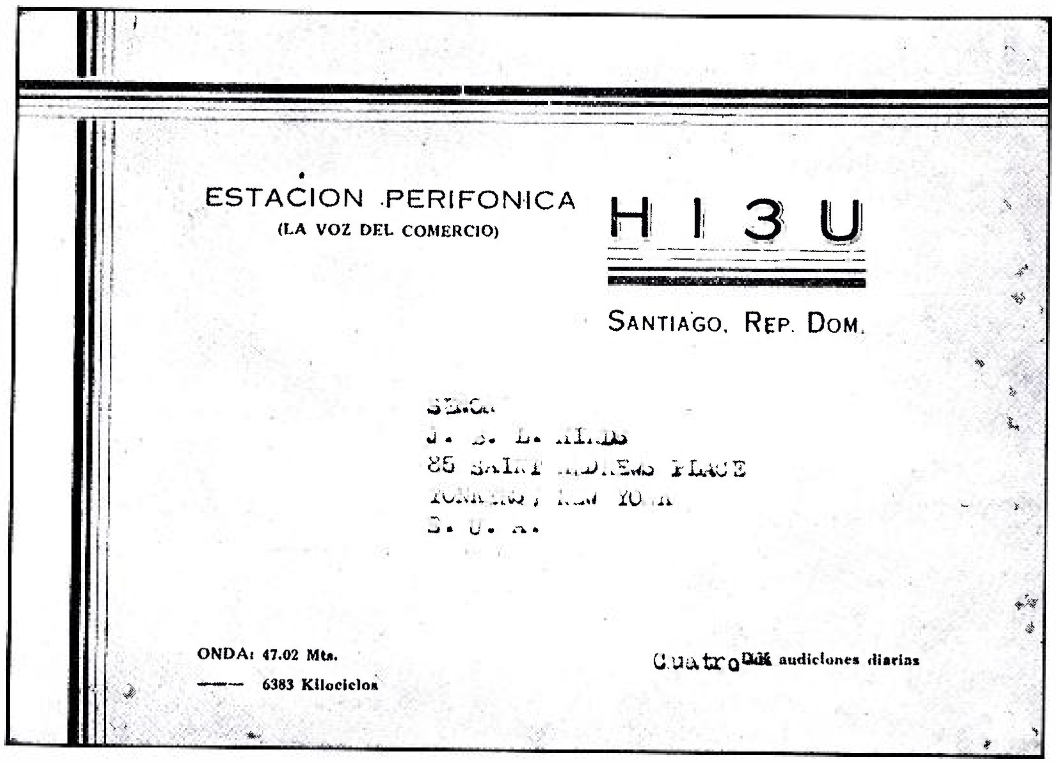
From Mr. J. B. L. Hinds,
85 St. Andrews Place,
Yonkers, New York, U.S.A.

to cope with the great many reports received, and delays will naturally result. Also do not lose sight of the fact that English is not a universal language and that translation of your poorly written report may take time and patience, which also speaks in favor of a short, concise, correct, informative report as I have mentioned in this and previous issues.

What Are Veries?

And speaking of verifications, there are many opinions as to just what *is* a verification. Many collectors of veries

form in which the station may choose to acknowledge to you is a matter for the station to decide. Stations value the good-will of the listeners and most acknowledge, and whatever the form, it should be acceptable as a verification. If you decide to be real technical, however, in your interpretation of what you think is a veri and arrive at the conclusion to secure one from each station which meets with your viewpoint, you are at liberty to do so, but possibly you may find that you have added to your expense, exhausted your patience and not achieved your end.



Red and blue, HI2U, also Santiago (many), Republic Dominica (one).

insist that a verification is not a verification unless it meets with their approval. For illustration; some think that you have not a verification unless you have the cancelled stamp on the envelope and with the post marked date of the sending station. In the opinion of the writer, this is stretching the point considerably. I recall being in the Denton DX Contest some time ago where the same rule was in effect, but none of my verifications were thrown out by the judges on account of their inability to check the date on the post mark, as many were not stamped thereon, or could not be read. My recollection is that you could not determine the post date mark on one quarter of the envelopes received. I could define what I consider a verification but I prefer to use my own judgment as to which I consider verifications, and I have an idea that most of our readers will do the same and not worry about these technicalities. It is entirely a question for each individual to decide.

It should be the endeavor of each to lend encouragement to the station through his report to the station. The

Most Stations Verify

Generally speaking, however, on the subject of verifications, there appears to be a willingness on the part of owners and operators of all stations to be fair with the listeners and speaking personally I believe that we have very little cause for complaint when all things are given consideration. While they cannot be expected to verify the personal conversations of their patrons, most countries do acknowledge reports of tests, exchange programs, etc., and while they do not always verify, the great majority express a pleasure that we heard them and courteously thank us for the information furnished. And while it is to be regretted that a few stations in the United States and Canada have refused to verify reports from listeners at home, yet possibly from the fact that they now know how we receive them, and on account of the volume of reports they must receive, they may be justified in the stand they have taken.

Short-Wave Shorts

Late reports are that a new short-wave broadcaster at Belgrade, Servia, is transmitting programs on 6090 kc or 49.26 meters. Reports indicate that the station has a female announcer.

The Short Wave Reporter of Hendersonville, N. C., reports that a new short-wave station is to be erected at Homs, northeast of Beyrouth, in the French mandated territories of the Levant, in order that the programs from the homeland may be broadcast overseas.

Permission has been granted to Ricardo A. Morales to install a new short-wave broadcasting station with call letters HP5Z and operating on a frequency of 6120 kilocycles (49.02 meters) at a maximum power of 200 watts, and located at Panama City, Panama.

Another report is that "Radio Saigon" F3ICD at Saigon, French Indo-China, is again testing daily on 9520 kc and will shortly resume regular broadcasting. As so many reports of a like nature have been circulated since this famous station closed down in 1931, "hearing" is believing in this case.

A station with call W2XGB, Hicksville, L. I., and owned by Press Wireless, Inc., has been testing with musical programs and requesting reports. They state in their announcements that tests are being conducted for the purpose of ascertaining the practicability and possibility of radio telephonic dissemination of public information and press items on short waves.

Further light is thrown on the Siam transmissions mentioned heretofore by Mr. J. Wendell Partner, of Tacoma, Washington, who informs me that these programs radiate from 8:00 to 10.30 A.M., E. S. Time on Monday only, usually one week on HSH on 10190 kc and the next on HSE on 10950 kc, but occasionally on both frequencies simultaneously. Mr. Partner says the signal on 10190 kc is the stronger, rating R5 and almost an R6, which should be heard on the East coast. Mr. Lyle Nelson, of Yamhill, Oregon, practically is in agreement with Mr. Partner with reference to these transmissions, although some confusion exists by both as to the exact call letters used. The calls HS8PJ and HS1PJ reported by others possibly may be experimental calls. Further reports welcome.

HJ1ABE, 6115 kc is still testing around 9550 kc. It is understood, however, that the new 1000-watt transmitter for regular service on the 31-meter band has not yet been installed, and no advice as yet of its receipt.

Again commenting on COKG, 6150 kc, Santiago, Cuba, COKG is the regular call. CO9GC is the experimental call. Power is being increased to 2400 watts. Schedule now is 12:00 to 1:00 P.M. and 5:00 to 8:45 P.M. daily; Sundays 1:00 to 2:00 A.M. and later on, on Tuesdays, Thursdays and Saturdays

10:00 to 10:30 P.M. in addition to the above time on the air—all E. S. Time.

The German short-wave station at Berlin informs us that the DZ transmitters are those engaged in the International Point-to-Point Program Exchange Service.

Baseball enthusiasts might be rewarded by tuning in JVM, Japan, on 10740 kc on Saturdays and Sundays at 4:30 P.M. for reports on the Tokyo games. (See article in this issue.—Ed.).

This is a beautiful card, with call and flag in light blue. The reverse side is printed in script type. Hook TGS and get one of these.

Costa Rican Stations

In a recent bulletin from the Department of Commerce is noted the following stations which are licensed to broadcast in Costa Rica:

Call	*Frequency*	*Location*
TI2RT	14200-7100	San Jose
TI2RA	14050-7300	San Jose
TI2EA	14015-7015	San Jose
TI3WD	7180-7024	Cartago
TI2RC	7151	San Jose
TI5AF	7150	Tacares
TI2OF	7000	San Jose
TI6OW	6800	Port Limon

These stations are low powered and run from 7½ to 75 watts, and while the majority are not located as to the best receiving conditions, it is thought the information may be of assistance. None mentioned are at present listed.

KAZ 9990 kc and KBD 8710 kc, Manila, P. I., have been heard broadcasting music quite often of late simultaneously with long-wave station KZRM on 618 kc. These programs have been heard in the early mornings up to 7:00 A.M. E. S. Time. It is also said that KZEG on 6130 kc has been quite active up to 7:00 A.M. in broadcast work. Reports from listeners would be appreciated. It is doubtful if veries could be obtained as Manila usually does not make reply.

Notwithstanding reports of YNLF, Managua, Nicaragua, being heard around 5950 kc recently, it is on 6451 kc as reported in the May article, the frequency being changed from 5960 to 6451 kc in the station list of that issue. The advice was received direct from the station.

Iceland Back

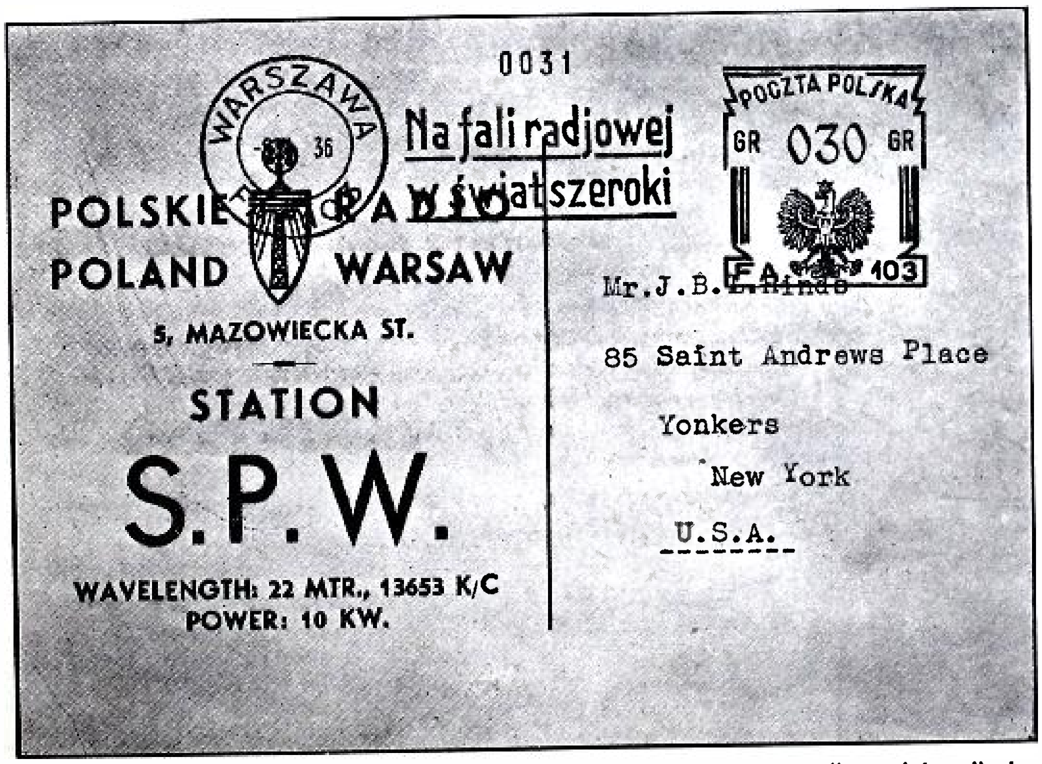
TFJ, Reykjavik, Iceland, 12235 kc, is again back on its Sunday broadcast from 1:40 to 2:00 P.M. E. S. Time, according to several reports received.

VE9DR Montreal, Quebec, Canada has a new card with yellow background, call in red and other printing in black.

TGS, Guatemala, is sending out their colorful veries which are a credit to the station. Other new cards received are: TIGPH, Costa Rica; HI5N, HI8A and HI3U, Dominican Republic; SPW, Poland; HJ1ABP and HJ3ABD, Colombia, and VIZ3, Australia.

Radio El Mundo, Buenos Aires, Argentina, mentioned in the April article has overcome the situation cited by typing in the call of the frequency received on its verification card, which cares for the condition nicely.

HC2AT, Guayaquil, Ecuador, 8400 kc. some time ago informed us that they had sold their transmitter to station HC2CW, but that they would soon be back on the air with a new transmitter. As nothing further has been learned and the new station has not been heard, HC2AT has been dropped from the list.



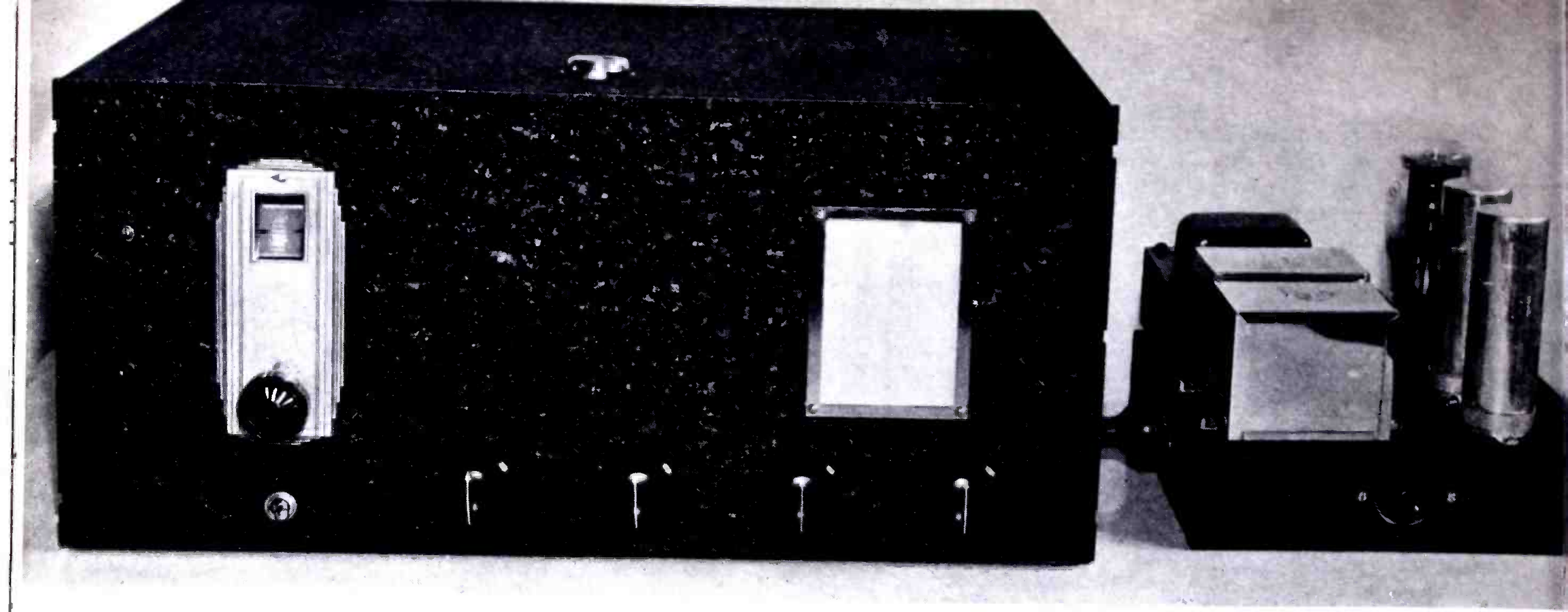
A veri from SPW, Babice (near Warsaw), which is a code station, but "goes 'phone" three times a week on 13653 kc, with 10 kw.

Mexican Stations

The latest official list of stations from the Republic of Mexico shows XEFT, Mexico City as assigned to 6120 and 9600 kc, although apparently working at present on about 9505 kc. A verification for reception on the last named frequency has just been received by the writer from Mr. W. H. Stark, Wauwatosa, Wis. and card shows 9505 and 6120 kc which indicates assignment has been changed. Schedule on 9505 kc as follows: Daily 11:00 A.M. to 4:00 P.M. and 7:30 P.M. to 12:00 A.M.

The call of XEVI, Mexico City, has

[*Continued on page 308*]



The AWR-6 Band-Spread Super. Power supply at right.

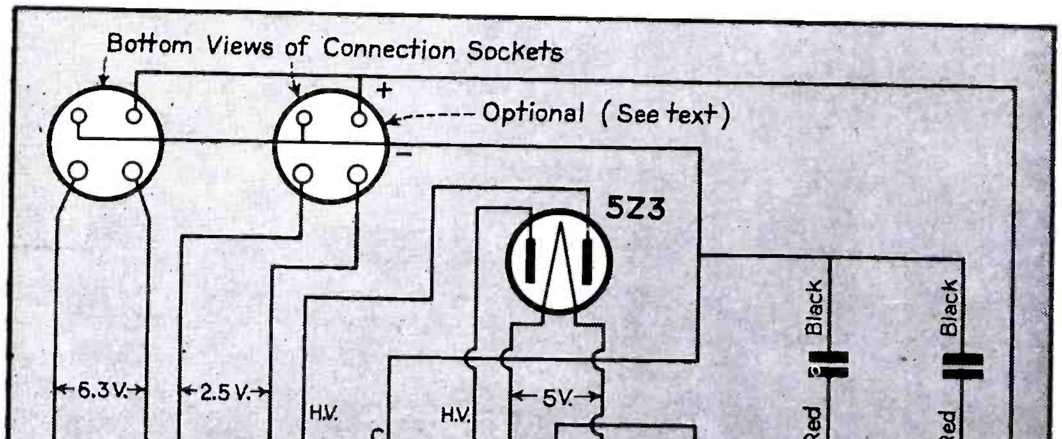
The AWR-6 Band-Spread Super

WITH REGENERATIVE FIRST DETECTOR

By Chester Watzel and Willard Bohlen

In making a grand rush from the t.r.f. type of short-wave receiver to the superhet type, the manufacturers seem to have forgotten that there is still such a thing as a "depression" hovering near the door of the radio shack. Most hams and short-wave listeners have to keep below about fifty dollars when they buy a new receiver, but the "bigger and better" superhets think nothing at all of parking around the hundred to two hundred dollar sales figure.

These prices apply to the really good receivers. There are, of course, quite a few short-wave supers, of both the "all-wave" and "ham communication" type, selling at low prices. But these types of receivers achieve their low price not by some feat of clever engineering design which results in a low cost, high quality short-wave super, but rather by the substitution of cheap, unreliable parts in place of the quality parts used in the good supers. To the uninitiated purchaser these receivers may seem as good as their higher priced brothers, since just as many features are advertised, but he soon finds the difference after owning and operating one for a time.



Circuit diagram of power supply for the AWR-6. See Legend for parts data.

Reliability Stressed

There is a sufficient number of intelligent hams who realize the difference between actual performance and "special features," but who, unfortunately, haven't the money to spend on an expensive receiver. They realize that neither the t.r.f. receiver, with its almost complete lack of selectivity, or the cheaply manufactured super, with its greater selectivity but much less reliability, will solve the present problem of successful communication in the crowded ham-bands. For such a ham the only course is to build his own super—stripped down for action, but completely dependable.

The receiver described here is our personal idea of what such a receiver should be, after the experience gained in building everything from five to fifteen-tube ham supers.

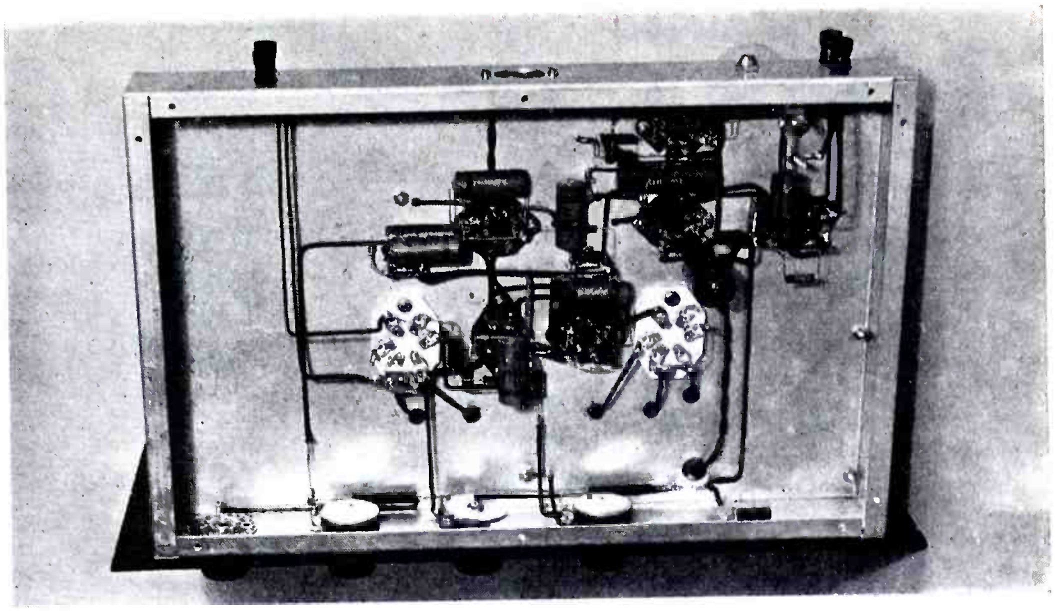
But, first, a word about short-wave broadcast reception. When we proposed this receiver to the editor he said, "how about a set like that for the short-wave listeners?" So we wound up some coils to cover the short-wave broadcast bands also.

Broadcast Reception

Broadcast reception has one requirement that is more stringent than for purely ham work—that of good quality. To take care of this, a Class A audio system is used which has about three watts of undistorted output. As no audio transformers are used in the receiver itself the reproduction will be just as good as the speaker used permits. A good permanent-magnet dynamic will be best suited for broadcast work. For straight ham work a cheap magnetic speaker will be satisfactory—in fact, much better for c.w. work. Did you ever hear key clicks bang a dynamic speaker cone around? By dropping most of the low notes the small magnetic speaker also cuts key clicks to a minimum.

In cutting down on the number of stages and corresponding parts in order to reduce cost, a workable super can be built using only one to four tubes. However, while still a super in principle, such a receiver is usually tricky and difficult to operate, a condition which cannot be tolerated in either communication work or short-wave listening. Our choice is a total of six tubes. With this number no tube or stage is asked to do double or triple duty, which is the chief cause of trouble in the smaller supers, yet all non-essentials for high performance are eliminated. For broadcast and fone reception alone the beat oscillator, although handy in locating stations, may be left out, leaving only five tubes. However, the beat oscillator is quite essential for code reception.

In covering the design of this receiver we are going to be a bit unorthodox and



Under-chassis view of AWR-6, showing location of parts.

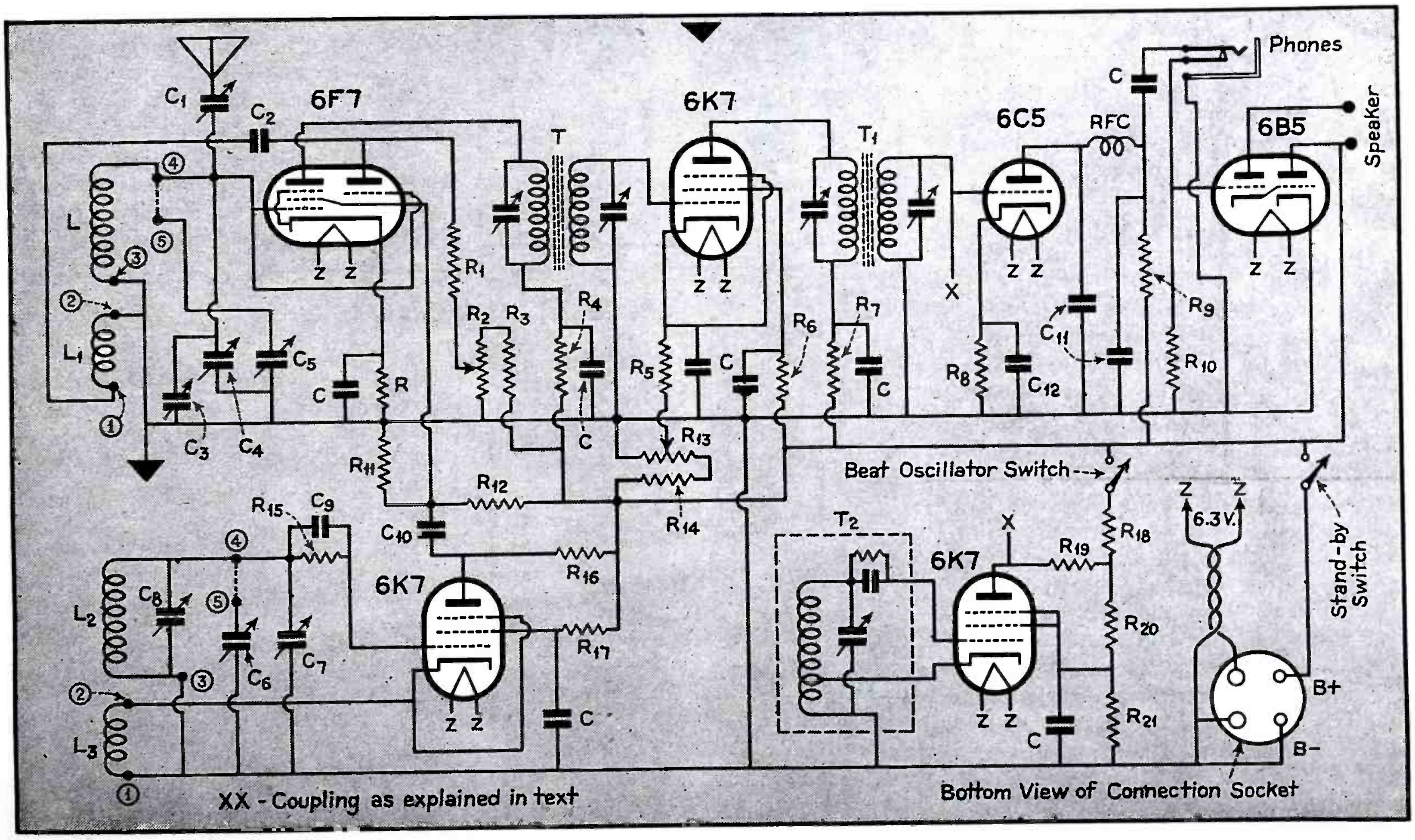
start with the i-f amplifier, leaving the high-frequency section till last. This is because the hardest part of the design work centered in the first detector and first oscillator, and we like to get the easiest part of the design out of the way first.

The I-F Amplifier

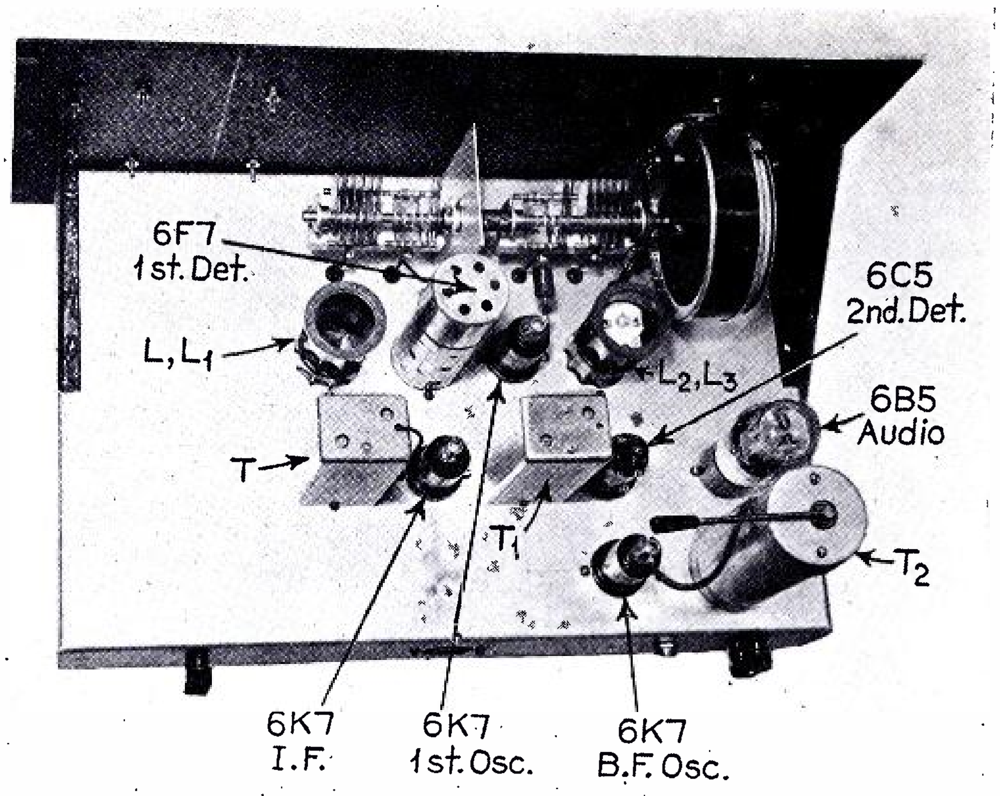
The i-f amplifier consists of only a single stage. However, it will be seen that iron core i-f transformers are used. A single stage using iron core i-f's is approximately equal in both gain and selectivity to two stages using standard type air-core i-f's, and two stages using air-core transformers provide all the gain that can be used if the rest of the super is properly designed. Furthermore, the noise level with the single iron-core stage is considerably less. The better shielding of the 6K7 metal tube used in this stage is also of assistance. The iron-core i-f transformers are, of course, tuned by air trimmers. This feature of using air trimmers in all tuned circuits is adhered to throughout the receiver.

The Second Detector

The second detector is the next stage to be considered. The functions of a second detector in a super are rather



Circuit diagram of the AWR-6 receiver. See Legend for parts values.



Above: Chassis view of AWR-6, showing placement of units. Center: Connections for the band-spread coil forms and, bottom, the coil-winding data.

complex. This stage must provide additional i-f selectivity through its input transformer, it must provide detection and audio amplification, and for c-w reception mix in the beat oscillator output so as to provide an audio note of desired pitch. For this purpose the metal tube type 6C5 detector-amplifier triode was chosen. The better shielding is again of benefit and the low output impedance permits of good matching to earphones. On the other hand the high input impedance of the 6C5 allows the tuned input circuit to tune sharply. The r-f filter in the plate circuit of the tube keeps the r-f out of the fones and audio power stage.

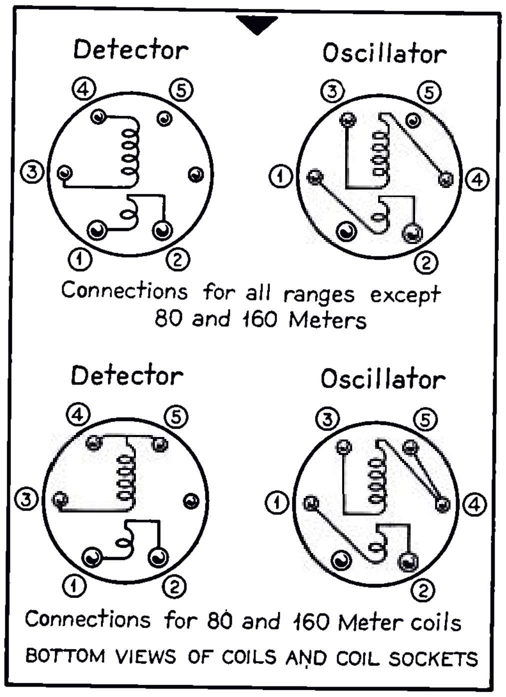
The beat oscillator stage uses the standard electron-coupled circuit, providing the greatest isolation between the tuned circuits of the beat oscillator and second detector. This is necessary as these two circuits are tuned only about one kilocycle apart and any "pulling-in" effect will result in blocking or chirping on strong c-w signals. The two stages are coupled by running parallel for an inch or two a pair of insulated wires connected to the plate of the oscillator and the grid of the second detector. The spacing can be varied for optimum coupling. Loose coupling is desirable for the reception of weak c-w signals.

The audio power tube is a 6B5. This tube is a high-gain dual Class A power tube with the two triode sections directly coupled internally. No bias resistor and by-pass condenser are required. The tube has a 7000-ohm output impedance, the same as the pentode power tube, such as the 2A5 or 42, but is not critical of load impedance. An ordinary magnetic speaker works nicely connected directly into the output circuit.

The High-Frequency Circuits

It is the high-frequency circuits, in both their electrical and mechanical arrangements, which present the greatest problem to the set builder. When there are three or four tuned circuits to handle, each one of which must have several coil sets to be either switched or plugged in —and the corresponding coil sets for each tuning range must be perfectly tracked together—and the tuning condensers for each circuit must be ganged to a single control—and, in addition, each of these tuned circuits must be completely isolated from the others, the problem then becomes quite complex. However, if these tuned circuits can be reduced to just two, one for the oscillator and one for the signal frequency, the job becomes considerably simplified. Plug-in coils can be used instead of the more complex coil-switching arrangements, since only two coils must be changed at a time. By leaving off the coil shields, which have been found unnecessary in this layout, and using each hand for one coil, band changing can be easily accomplished in a very few seconds.

But before we go into this simplified two tuned-circuit arrangement, using only a first detector and high-frequency oscillator, let us look into both its advantages and disadvantages. There must be a reason why almost every super uses one, and sometimes two, stages of r.f. ahead of the first detector. There are actually two very good reasons. The h-f oscillator will, for any given setting, heterodyne two signal frequencies into the i-f amplifier. One is 465 kc lower in frequency than the oscillator, the other



COIL-WINDING DATA

DETECTOR Grid	DETECTOR Plate		OSCILLATOR Grid	OSCILLATOR Cathode
6	5	19 and 25 meter broadcasts	5¾	2¼
9	6	25 and 31 meter broadcasts	9	4
15	7	Air and 49 meter broadcasts	15	5
3	2½	10 meter ham band	3	1½
6¾	6	20 meter ham band	7¾	4¼
15	7	40 meter ham band	15	5¼
30	10	80 meter ham band	30	10
61	20	160 meter ham band	49	20

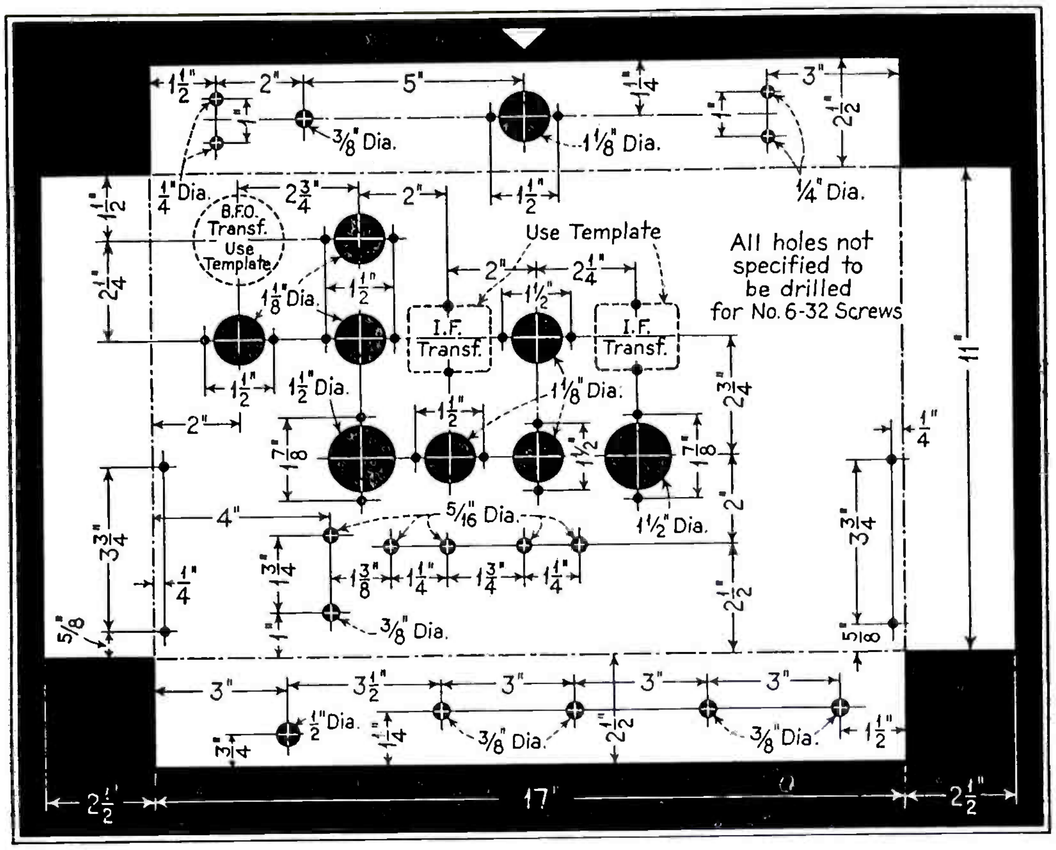
Plate winding of 160-meter detector coil and cathode winding of 160-meter oscillator coil wound with No. 30 DSC—all other windings with No. 24 DSC. Grid windings of 10 and 20-meter coils and 19-25 and 25-31 coils space-wound twice diameter of wire—all others close wound. Space grid and plate windings of all detector coils ⅛ inch—oscillator coils 1/16 inch. Remove all but three plates on cut condenser sections for ham bands. For broadcast bands use both sections with all plates in. Use Hammarlund APC100 (100 mmfd) trimmer in 160-meter oscillator coil. All others, APC25 trimmers.

465 kc higher (assuming the standard 465-kc i-f frequency). The signal circuits (first detector, and r-f stages if any) are tuned to one of these frequencies, usually the lower one. The other frequency, called the "image frequency", must be eliminated by making the signal circuit, or circuits, sufficiently selective. The stronger the signal on the image frequency is, as compared to the signal on the desired frequency, the more difficult this becomes. High-frequency circuits are not rejective to a strong signal off resonance, even if as far as 930 kc off. A single tuned circuit at the signal frequency, such as is had when only a first detector is used with no pre-selection, is ordinarily not very much help in eliminating the image frequency.

The second reason for using high gain at the signal frequency is to reduce set noise as far as possible. A first detector-oscillator combination produces a certain amount of inherent noise which is amplified by the i-f and a-f stages. To reduce this noise to a negligible value, the received signal output from the first detector must be of a considerably higher order than the noise output. Another prolific source of noise is in the first tube of the receiver. Every tube produces a certain amount of inherent noise, no matter in what stage of a receiver it may be located. This noise cannot be usually heard unless amplified by one or more succeeding stages. Thus the noise produced by the first tube of any receiver is amplified and heard in the fones, or speaker output, to a much greater extent than the noise produced by any succeeding tube. The first tube of a receiver must, therefore, show as high a signal-to-noise ratio as possible. Once the signal-to-noise ratio becomes poor in any one stage the following stages can do little about improving it.

Regenerative First Detector

Although only a first detector stage is used in this receiver, and only one tuned circuit is available at the signal frequency, these two problems are nicely handled by the simple expedient of using regeneration in the first detector. This increases both the signal-frequency gain and selectivity tremendously. A regenerative first detector will be found to have higher gain and selectivity than the usual non-regenerative single r-f stage and detector combination which is used in most supers. The signal-to-noise ratio will also be found to be better, because the first tube of the receiver is made regenerative. This gives the desirable higher first-stage gain.

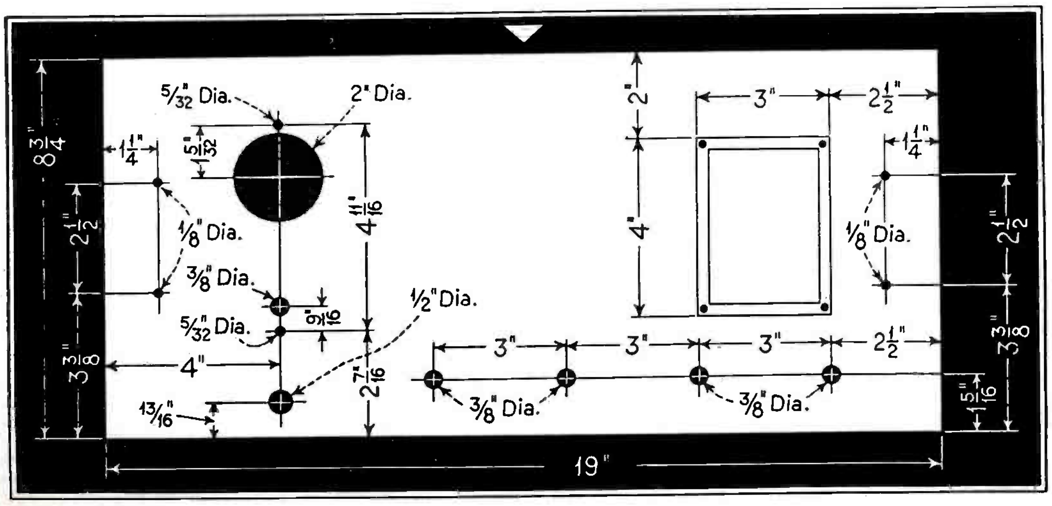


AWR-6 chassis construction details.

Making the first detector regenerative, however, presents several additional problems. These may be appreciated by anyone who has tried to get smooth and quiet control in the detector of the usual regenerative receiver with which most hams and listeners have started their radio career. If regeneration control is to be had by varying the voltage on one of the tube elements, then the detection efficiency, or conversion gain, is also varied at the same time. If this is avoided by placing the control somewhere in the tuned circuits, the resonance frequency of the first detector is then varied with the regeneration, resulting in detuning. Also, since the plate circuit is working at the i-f frequency, the regeneration must be kept in the grid circuit. The usual method is to use cathode regeneration, controlling it by varying the screen-grid voltage. If the oscillation point on the regeneration control can be kept at the optimum point for higher conversion gain at all times this method is not so bad. But, because of different antenna loading of the tuned circuit, and changing impedance as the frequency is varied in tuning, this ideal condition cannot be met. At one time the regeneration screen voltage control will be set so low to keep the detector from oscillating that the conversion gain will be cut far too much, and at another time optimum voltage conditions will be obtained, but conversion gain will still be low because the oscillation point cannot be approached so as to obtain maximum regeneration.

The solution is to go back to practices of quite a few years ago and use a separate tube for obtaining regeneration, leaving the detector voltages at the optimum point at all times. This is not as complex as it sounds. It is only necessary to use a separate triode tube, which will employ the same tuned grid circuit as the first detector, with a separate untuned plate coil coupled to it. The usual first detector tuned circuits will, when properly proportioned, take care of both tubes and both purposes.

The advantage of this system is in the use of the extra tube, which compli-



AWR-6 front panel construction details.

cates somewhat our "boiled down" superhet. However, this has been overcome by using a dual-purpose tube for regeneration and detection. Ordinarily we do not care to use dual-purpose tubes, as was mentioned before, but in this case no particular advantage can be gained by using separate tubes instead of a dual-purpose tube, as both use the same tuned circuits in common. The tube chosen for this job is the 6F7. This tube contains a variable-mu pentode, similar in characteristics to the 6D6 or more familiar 58, and a small triode somewhat similar to the 56 or 76. The two sections are isolated electrically except for the use of a common cathode. This is just what is wanted for the job. As will be noticed in the diagram, the cathode connections for each section have to be paralleled anyway, as do the grids. This leaves only the plate of the triode free which then goes to one end of the plate winding through a condenser.

The control of regeneration is obtained most readily by varying the plate voltage of the triode section, as shown. This has no effect on either the tuning or proper voltages of the detector section. The actual voltage of the triode plate is of no importance as long as the triode can be made to oscillate at some point on the regeneration-plate voltage control. The maximum attainable voltage is kept to the rated 100 volts by using the proper resistors.

The first oscillator circuit is standard. An electron-coupled oscillator is used with the plate capacitatively coupled to the screen of the first detector. This provides sufficient isolation between the two high-frequency tuned circuits so that there is absolutely no pulling-in or detuning effect on the oscillator as the detector trimmer condenser on the panel is varied. A metal tube is used in this position, as in the beat oscillator, to avoid the necessity of a tube shield. Any slight movement of a shield on an oscillator tube, such as is unavoidable at times when changing coils, throws off the calibration. The 6K7 type is used for the oscillators instead of the 6J7 to reduce the number of tube types necessary in the receiver.

Mechanical Details

The actual mechanical arrangement of tuning dial, condensers, coils, controls, panel, chassis and general layout is also of importance. The chassis is of heavy steel, cadmium plated, and is the only commercially available chassis we know of that is strong enough in construction not to need bracing to avoid detuning effects from chassis distortion. It is also quite accurately made. The use of brackets to hold the panel firmly to the chassis makes the receiver construction as solid as a rock. The black crackle finished panel is of aluminum to permit easy drilling of the large dial mounting hole. It will be noticed that the panel is held an eighth of an inch from the chassis by the side brackets. This permits the dial to be dropped lower for easier handling of the tuning knob. The controls are fastened to the chassis before the panel is mounted, which puts the nuts between the panel and chassis.

The tuning dial is the National Type H, which is prefectly smooth in operation and free from backlash, a most important consideration in a tuning control for communication work. It is mounted on the left of the panel for convenience in tuning as most tuning is done with the left hand. Although the photo shows the small knob that comes with the dial, a more convenient one to use is the knob that is employed on the National Type A or N dials, as it is larger and easier to handle.

Coil-Condenser Combinations

The tuning condenser and coil combinations were designed to give good band spread and tracking on the ham bands with a minimum effort in coil winding and adjusting. All taps on the windings, for either cathode or tuning condenser, were avoided. Such coils are very difficult to adjust. Two-section

[*Continued on page 310*]

Parts for Receiver

T —Aladdin G101M iron core i-f transformer
T1 —Aladdin G201M iron-core i-f transformer
T2 —Hammarlund ATO beat oscillator transformer
RFC—National RF201 r-f choke
C —Aerovox 0.1 mfd, 400 volt tubular condenser (8 required)
C1 —National 3-30 mfd mica trimmer condenser
C2 —Aerovox .00025 mfd midget mica condenser
C3 —Hammarlund .000025 mfd Star midget condenser
C4 —Hammarlund MCD-35-MX dual tuning condenser, .000035 mfd per section
C5 —Same as C4
C6 —Same as C4
C7 —Same as C4
C8 —Hammarlund APC25 air trimmer condenser (one for each oscillator coil except 160-meter coil which requires an APC100 trimmer)
C9 —Aerovax .0001 mfd midget mica
C10—Same as C9
C11—Aerovox .00025 midget mica condenser (two required)
C12—Aerovox 5.0 mfd, 100 volt electrolytic condenser
R1 —IRC Insulated Metallized 350 ohm, ½ watt
R1 —IRC Insulated Metallized 5000 ohm, ½ watt
R2 —Centralab 50,000 ohm potentiometer
R3 —IRC Insulated Metallized 50,000 ohm, ½ watt
R4 —IRC Insulated Metallized 2000 ohm, ½ watt
R5 —IRC Insulated Metallized 350 ohm, ½ watt
R6 —IRC Insulated Metallized 100,000 ohm, ½ watt
R7 —IRC Insulated Metallized 2000 ohms, ½ watt
R8 —IRC Insulated Metallized 100,000 ohms, ½ watt
R9 —IRC Insulated Metallized 100,000 ohms, ½ watt
R10—IRC Insulated 500,000 ohms, ½ watt
R11—IRC Insulated Metallized 50,000 ohms, ½ watt
R12—IRC Insulated Metallized 100,000 ohms, 1 watt
R13—Centralab 50,000 ohm potentiometer
R14—IRC Insulated Metallized 100,000 ohms, 1 watt
R15—IRC Insulated Metallized 50,000 ohms, ½ watt
R16—IRC Insulated Metallized 10,000 ohms, 1 watt
R17—IRC Insulated Metallized 100,000 ohms, ½ watt
R18—IRC Insulated Metallized 100,000 ohms, 1 watt
R19—IRC Insulated Metallized 100,000 ohms, ½ watt
R20—IRC Insulated Metallized 100,000 ohms, ½ watt
R21—IRC Insulated Metallized 50,000 ohms, ½ watt
1 —Sylvania type 6F7
3 —Sylvania type 6K7
1 —Sylvania type 6C5
1 —Sylvania type 6B5
4 —Franklin octal type wafer sockets
1 —Franklin small 7-prong socket
1 —Franklin 6-prong socket
1 —Franklin 4-prong socket
1 —National type H drum dial with scale 3
1 —National type 11B calibration chart frame
3 —National grid clips for metal tubes
1 —Hammarlund tube shield for 6F7
10 —Hammarlund type SWF 6 coil forms
2 —Hammarlund isolantite 6-prong sockets
1 —Wholesale Radio Service crackle finish aluminum panel No. YY22204
1 —Wholesale Radio Service cadmium plated chassis No. YY22157
2 —Leeds Radio Co. crackle finish brackets 4" x 5½"
4 —Knobs
1 —Rotary toggle switch
1 —Plain toggle switch for B voltage
4 —Binding posts with insulated bushings
1 —Shaft coupling—flexible if necessary
1 —Closed circuit phone jack

Parts for Power Supply

T3 —United Transformer Co. UH3 power transformer
CH1—United Transformer Co. CS39 filter choke
CH2—United Transformer Co. CS39 filter choke
2 —Cornell Dubilier EA9080 8 mfd, 500 volt filter condensers
3 —Franklin 4-prong wafer sockets
1 —Sylvania type 5Z4
1 —Leeds crackle finish chassis, 8" x 8½" x 2"

Channel Echoes

By Zeh Bouck

a cure for broadcast advertising . . . police television . . .

IT was recently our pleasure to broadcast over W1XAL, of the World Wide Broadcasting Foundation, Boston, Mass. Prior and subsequent to our own appearance on the air, we were, naturally enough, interested in the programs offered by this station, and spent a bit of time on their 6.04-megacycle frequency. With the possible exception of our own broadcast, we were particularly impressed by the quality of the programs, which are non-commercial and non-sponsored.

It is to be hoped that W1XAL is the forerunner of other non-commercial stations. Aside from giving direct relief from stupid advertising, such competition with the commercial broadcasters would force the sponsors to cleanse the Augean Stable of our present broadcasting system, the program output of which is characterized by John C. Futrall, President of the University of Arkansas, as "ninety precent worthless trash."

However, such things are for the future. For the present the listener who objects to our domestic broadcast fare can find respite and solace in the short-wave offerings of many countries. Or, if he insists on local programs, he can help matters considerably by applying a pound of cure in the way of an improved listening technique.

Our own procedure is quite simple, and universally applicable by those who, like ourself, sit close to the radio. We merely turn down the volume control, and refuse to listen to every excessive blurb. We write "excessive" blurb, because, on occasion, we have been afflicted to a painful degree with a sense of fair play. If the program is an excellent one, and the advertising within reason, we'll listen to it. But usually it is a case of thumbs down—or rather volume control down. This maneuver is quite effective. Obviously, it eliminates the objectionable matter. Secondly, one is embued with a feeling of intense satisfaction. You have put one over on the sponsor. You've made him waste his money, you've made faces or stuck your tongue out at him, and thumbed your nose. Also, you have worked off on the sponsor a bit of meanness that might otherwise have been dissipated upon some innocent member of your family.

ZEH BOUCK

For those who do not sit near the radio, or who are too lazy to reach for the volume control knob, there exists a psychological bulwark that can be raised against obnoxious advertising, that renders it not merely innocuous, but actually pleasing! It operates on one's superiority complex.

When next some sponsor inflicts upon you a long argument to the effect that such and such a product is used by all the Hollywood stars, that it cannot hurt the hands or injure the daintiest undies, that it is good for children and that it is recommended by leading physicians, that it keeps you cooler in the summer and warmer in the winter, and do not fail, the moment the program is concluded, to dash around to the nearest gas station for a full supply, and be sure to save the box tops—when you hear all this, just say to yourself: "This program has been prepared by experts for the average listener. It is firmly believed by those responsible, and who should really know, that it will appeal to the average person, and that they will be asses enough to place credence in what the announcer has just said. Well, the whole thing merely nauseates *me*—I find it positively disgusting, puerile and smelling to the high heavens. Moreover, I do not believe the statements of the announcer, and am quite well aware of the fact that the chances are that this sponsor's product is no better than the next. With all this in mind, *it becomes quite evident that I must be above the average in intelligence and discernment!"* After this psychological pat on your own back, continue the argument thusly: "I am even superior to many people who are supposed to be above average intelligence—those responsible for the program, i.e., the president and other executives in the sponsoring company, executives and experts in his advertising agency, and a host of other highly paid persons associated with the creation of this program who have no more sense of the fitness of things than to break up a symphony concert with advertising—to sandwich such drivel between the andante cantabile from Tschaikovsky's Fifth and the magic fire music from Die Valkurie. Verily, I must be a pretty smart guy, and really I should be grateful to the sponsor of this program for demonstrating my own excellence to myself!"

✦

ONE CAN hardly hope for amelioration in broadcast advertising, when advertising itself is in such a sorry state. After all, our broadcast burps are no worse than the printed ads laudatory of that panacea, the cigarette, that is kinder to the throat, or less acid, or gives you a lift, or is easier on the nerves, or aids digestion—ad nauseam. Coming from the same source, what can you expect of broadcasting?

✦

EVER SINCE the fire department cooperated with the RCA at Camden in the outdoor television experiment, their brothers in blue, the police department, have been interested in the possibilities of television for the rapid identification of criminals. This is a great idea, and here's hoping they put it into effect before television turns that corner. We'll all make a lot of money suing for false arrest.

"Barb" and "Ernest"—

The Code Becomes

PROGRESS

Dear Gerald:

Both Barb and I want to thank you very much for your letter giving us the details of how to start the procedure necessary to get ourselves a Ham license. We received the equipment from Mr. Hertzberg, of Wholesale Radio Service Co., Inc., and also the start of the course from Mr. Candler, and we have been working on the code constantly ever since.

As you say in your letter, it is extremely difficult, but we are gradually emerging from the darkness and can now distinguish a few sounds when we listen to the "commercials" calling. We know what "V" sounds like and we recognize "de", and we have gotten so that on account of the constant repetition that we can recognize a few letters by their rhythm.

Rhythm of "C"

Naturally there are plenty of questions that have come up, and we would like to get some answers if it is possible to explain them in writing. First is the matter of rhythm. Most of the letters seem to be comparatively easy, but the one that is used the most in amateur work is the letter "C', and both Barb and I find it very difficult to get a proper rhythm with the *"dah-dit-dah-dit."* Is there any easy method of overcoming this trouble except practice?

In transmitting between ourselves, of course, neither one of us is by any manner of means expert, and we would like to know whether it is better in the beginning to write each letter down as it comes over, or should we wait to make a word? You suggested in your letter that we should listen in to some of the code messages that are being transmitted. Naturally they go too fast for us to do anything but pick up a letter now and then. Would you recommend this method of distinguishing letters, or would you advise us to wait until we are faster in picking up code?

We wonder in your next letter if you will provide us with the frequencies of some stations that send slowly so that we can tune in on these and better get the sound of the letters over the radio rather than through the buzzer and earphones, as there is a distinct difference in the sound. We would also like to know whether it is better first to transmit just words, going over them two or three times, or making complete sentences? Also, as a matter of curiosity, why do these commercial stations use the letter "V" instead of "CQ" and why do they continue the call so long? We have heard some of them on at least ten minutes and it would certainly seem that this would be too long to do any good.

What Are Harmonics?

Now for a few general questions, as we haven't gone very far in our various books which you so kindly provided us. We are interested in knowing what harmonics actually are, and what causes them. Are they always the same distance apart? How is it possible for Hams to change the frequency of their transmitters? We wonder whether you would explain to us just why meter designations were used originally in preference to kilocycles? We realize, of course, that "meters" refer to the length of a wave, but don't understand why it was used.

We understand that the code examination is given to us over a tape. Would you recommend renting a tape machine before the examination so that we would be accustomed to the sound of it? In our reading of the book, we get the impression that it is necessary to wait 60 days after obtaining the license before one's own station can be operated. Is this true?

We are now using a Philco 16-V All-Wave Receiver and find that the band spread is so small that there is a great deal of crowding. Could you suggest another receiver, or possibly a converter that would operate with the Philco set? While this Philco is an excellent receiver, it was not designed for amateur reception. We believe that there is a considerable amount of slow sending on 40 and 160 meters, but we cannot get it on account of the crowding.

There are plenty more questions that we will ask you as we get along in our studies, but these should be enough for a start.

Ernest.

P. S. I hope no one else as old as we are tries learning the code, because as you get older you are either very dumb, or slow to catch new sounds. However, you might be interested in knowing that Barb is now convinced that she will get it, and her original skepticism is gone. She is getting more interested in it daily.

ANSWER

Dear Barb and Ernest:

I am pleased to know that you got off with a good start. No Ham or commercial operator would expect the two of you to knock off the code in a couple of weeks. It's the one thing that takes time, and plenty of it. From what you say, and from your report to Mr. Candler, I should say that you are progressing very nicely.

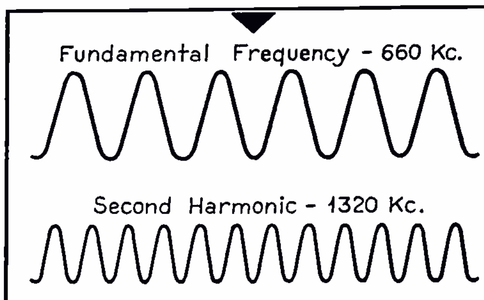


Fig. 4

The second harmonic of a radio wave is double the fundamental frequency, the third harmonic triple the fundamental frequency, and so on.

So you're having a tough time with the letter "C". It has rhythm all right, and you'll pick it up soon enough. If sent properly, it sounds like "ke" tied closely together. The dashes are accented, or appear to be accented, so that it sounds like *DAH-de-DAH-dit*. I would follow the advice Mr. Candler gave, and practice with words containing the letter "C"—and, of course, listen for it on the air.

In alternately transmitting to each other, I certainly wouldn't suggest that you copy down words at a time until you have picked up a bit of speed. After all, in the beginning, the idea is to pick up the rhythm of the letters so that in time you will be able to recognize them instantaneously upon hearing them. The principle, if you would call it that, is exactly the same as the principle applied in learning to operate a typewriter or play a piano—one practices until the time arrives when the manipulation of the keys, and the process of the fingers in automatically finding and hitting the right keys, becomes a subconscious action.

Reaction to Sounds

What you are doing in your practices, is storing up definite rhythmic sounds in the subconscious mind. Once the subconscious has knowledge of the rhythm for each and every letter, number and punctuation mark, you will find that it will instantaneously impart the information to the conscious mind. You will find, for example, that when you have reached

Embryo Radio Hams

Sweet Swing Music

this stage, the sound *di-dah* will *instantaneously* react in your mind as the letter "A", with no thought about it on your part. As you continue practicing, these "paths of knowledge" between the subconscious and conscious mind will become more clearly defined, until the point is reached when you will be able to read whole words at a time in much the same way. From then on, the speed of copying you will attain will depend entirely upon how fast your brain is capable of reacting to the stimulus of the sounds on the subconscious. This speed varies with individuals, as indicated by the fact that thousands of people are able to copy at the rate of 30 words per minute (based on five letters to a word), but few are able to reach the almost unbelievable speed of 56.5 words a minute that T. R. McElroy, the World's Champion, can take on a "mill." Nor are there a great number of operators who can "copy behind," which is a way some operators have of letting the transmitted material get a number of words ahead of them before they commence taking it down.

But, unless Barb or yourself have a yen to match McElroy, you can forget about such things—15 words a minute is going to be *plenty* for both of you insofar as the exams are concerned. You can worry about higher speeds afterwards, if you want.

And you don't have to wait 60 days before going on the air. You can start the day you get your license.

Code Practice Schedules

You ask if it is advisable to listen to the commercial code stations. I think so. Of course you can't expect to copy much of what they send—if you could, we wouldn't be chinning about code—but I think it is very good practice to listen to these signals and pick out letters where you can. It will assist you in getting the rhythm and in developing speed. However, you might prefer to listen to the code practice transmissions sponsored by the American Radio Relay League. Certain key amateur stations operate on regular schedules and at various frequencies. Since these schedules are altered from time to time, I am not going to give them here, but offer the suggestion that you communicate with the Communications Department, American Radio Relay League, West Hartford, Conn., and request that they send you the latest list of Code Practice Schedules.

Why do the commercial stations send the "V" instead of "CQ"?—because they are not calling. The V's, the de's and the station call letters give the automatic sender something to do between actual transmissions of traffic. "Cold" transmitters shift frequency or wavelength, so it is the custom to leave them "on the air," warmed up for instant use. There is also a point about regulations as applied to active channels that I will skip, as it is beside the point.

Harmonics

What is a harmonic? In music harmonics are overtones which bear an arithmatical relationship to the fundamental tones. In radio harmonics are really the same things, but the frequencies involved are much higher.

A fundamental frequency has numerous harmonics; they are referred to as the 1st, 2nd, 3rd and 4th harmonic, and so on. Thus, WEAF operates on a frequency of 660 kilocycles. This is the first, or fundamental frequency. The 2nd harmonic is just twice this frequency, or 1320 kilocycles; the 3rd harmonic is three times the fundamental frequency, or 1980 kilocycles, etc. (see Fig. 4). Each succeeding harmonic is weaker than the preceding one, so there is a limit to the number that can be heard. In radio work, it is not uncommon to hear the second harmonic of a fundamental frequency, and in some cases even the third harmonic can be heard. Thus, if WEAF radiated the second harmonic of its fundamental frequency of 660 kilocycles, which it does not, you could hear the program from WEAF not only at 660 kc, but also at twice the frequency, or 1320 kc, merely by tuning your receiver to the latter frequency. You could hear the program again at 1980 kc if the third harmonic was radiated.

These are means of preventing the radiation of harmonics, but I'll let them ride for the present as I will wish to take this up later in conjunction with some technical explanations of station operations. But this is a good time to point out that all the amateur bands are harmonically related to each other, so that if an amateur station radiates a second harmonic, it will not, in most instances, interfere with a commercial station. If you will look over the attached sketch (Fig. 5) you will see how this works out. For instance, if you had a Ham transmitter working in the 160-meter band, and the frequency in this band upon which you operated your transmitter was 2000 kilocycles, the second harmonic would be 4000 kilocycles, which falls in the tail end of the 80-meter amateur band. The third harmonic would fall in the 6-mc short-wave broadcast band, which wouldn't be so hot, but there is no excuse for a third harmonic, and little for a second. Now, if your transmitter was operated in the 80-meter band instead of 160, and the fundamental frequency was, say, 3500 kilocycles, the second harmonic would

[*Continued on page 294*]

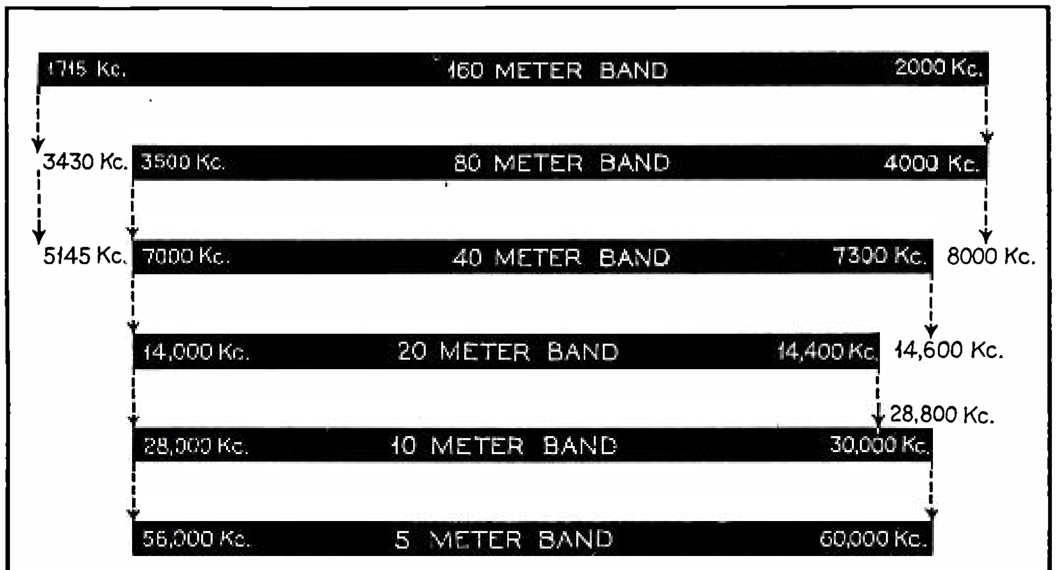


Fig. 5

Illustrating the harmonic relationship of the amateur bands. With but few exceptions, second harmonics produced in one band will fall within the limits of the next higher frequency band. A few exceptions are shown. Third harmonics fall into commercial bands, and therefore cannot be tolerated.

THE AWR 2-3

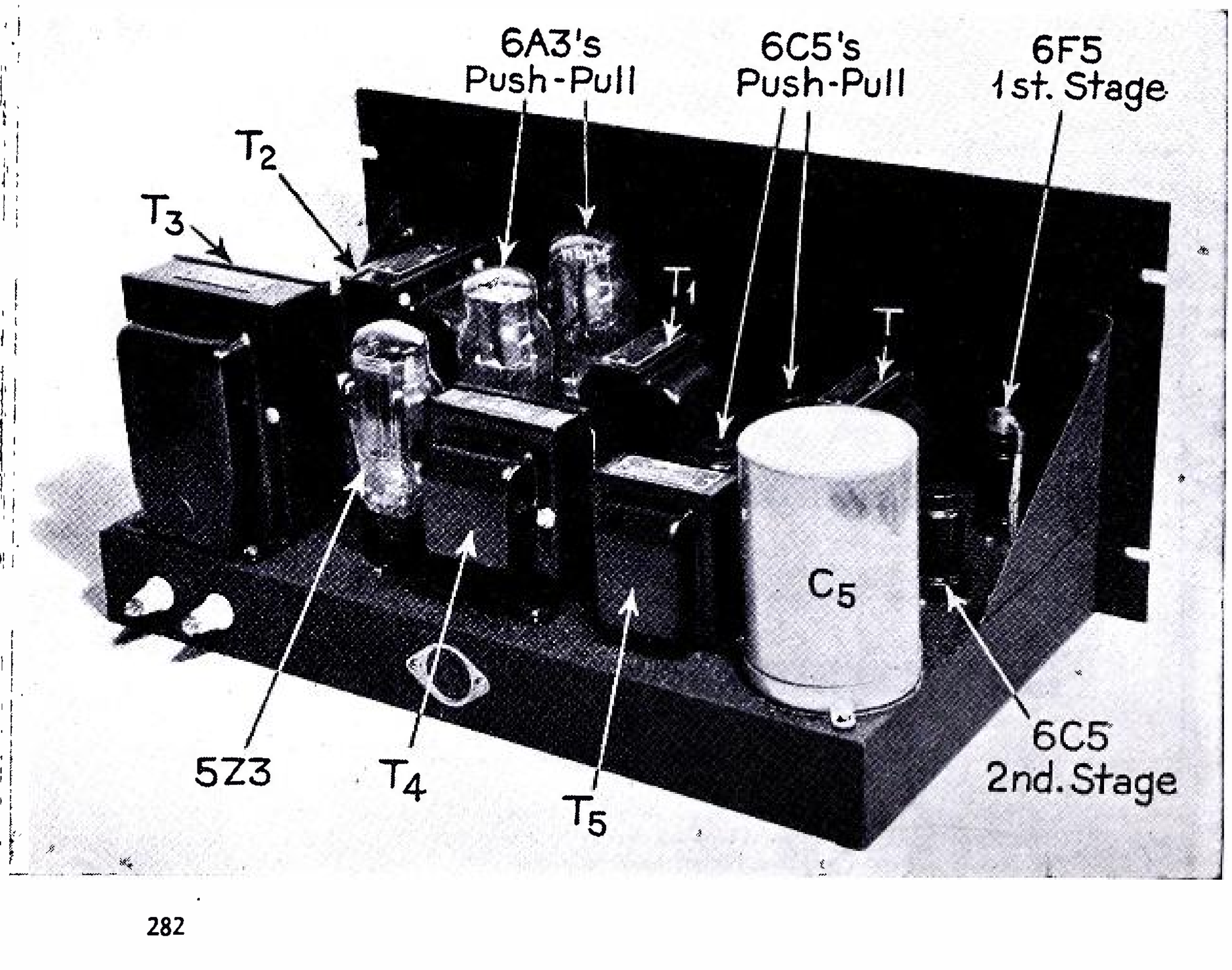
Completed AWR 2-3 Modulator with Turner crystal mike.

15-Watt Modulator With Crystal Mike

MANY fone men, with only a limited amount of cash to work with, spend more of their money on increasing the power of their fone transmitters rather than on improving their speech quality. Every ham, of course, would like to have high power available when necessary to overcome bad transmission conditions, but the highest power fone station isn't going to produce many QSO's if it's quality is poor. Mere loudness does not necessarily mean intelligibility. Besides, most of the fone gang do not care to work another fone station which has poor quality even if it is 100% understandable, any more than the average person cares to talk to another person whose speech is difficult to understand for some reason.

The modulator for the AWR 2-3 transmitter has therefore been designed for good frequency response and low hum level. A crystal mike is used and enough gain is provided so that the crystal mike can work directly into the modulator without a pre-amplifier. This all costs a little more money than a cheap job with a carbon mike, but, as pointed out, it is better to spend what money is available on better speech than on higher power. Increased power can come later.

Rear view of modulator showing location of units. See Legend for values.



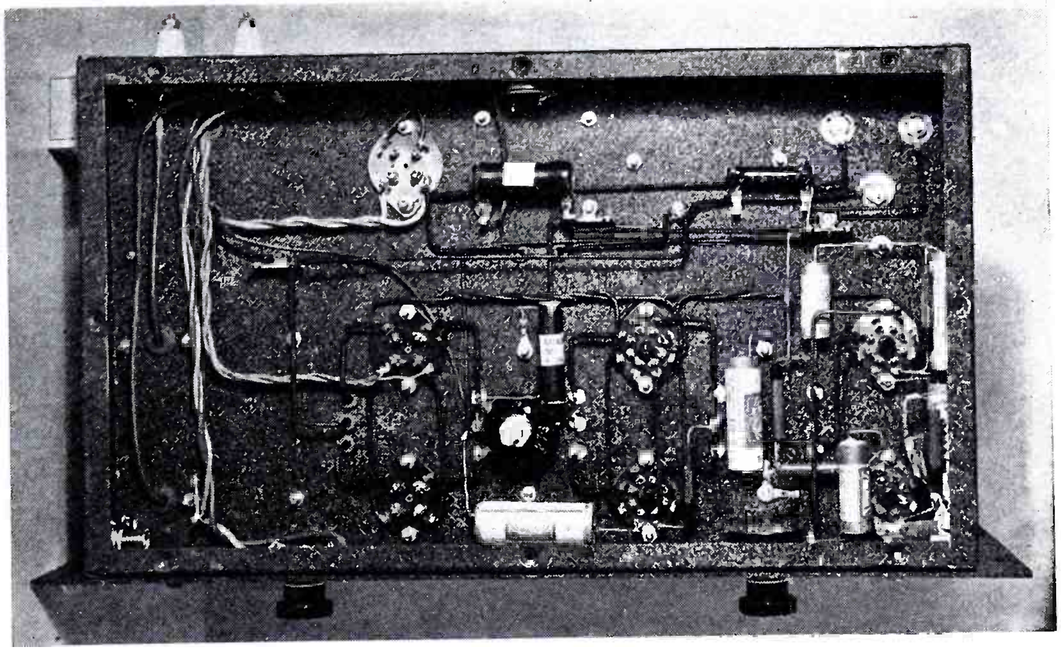
Thirteen-Watt Carrier

According to the RK-25 data sheet, a total audio power of 14.5 watts is required for combined plate and screen modulation. The carrier output under these conditions is rated at 13 watts. A high quality 13-watt carrier is enough on ten meters to go places—also on twenty, when there aren't too many of the high power boys on the air.

This audio power of approximately 15 watts which is required by the RK-25 for modulation, can be supplied by a number of power tube combinations. However, there are not many output transformers available which will work from the output of these tubes to an r-f load. The power tubes finally chosen were a pair of 6A3's in push-pull. These tubes are identical to the familiar 2A3's except for a difference in heater voltage. The 6A3 is rated at 15 watts output (for two tubes in p-p) at only 2½% distortion. This should answer our requirements both as to the audio power and speech quality desired.

The audio stages between the mike input and the grids of the 6A3's, besides providing sufficient gain so that the output of the crystal mike will adequately drive the 6A3's, should be designed so as to minimize any possibility of feedback. This is done by using the smallest number of stages that will provide the requisite gain, and dividing the interstage

By
Willard Bohlen • W2CPA
and
Chester Watzel • W2AIF



Under-chassis view of modulator. Variable and fixed resistor at center were replaced with a single unit (R-8).

coupling between resistance and transformer coupling. Too many stages of either type of coupling provide trouble in the form of feedback and motorboating. The elimination of any single-ended audio transformers aids considerably. The only transformers used are push-pull, which cancel out most feedback tendencies. It is also important that audio transformers be eliminated from the input and low-level stages where possible as these transformers give the most feedback trouble. The use of a crystal mike, which needs no input transformer, and resistance coupling between the first and second audio stages, obviates their use.

Shielding

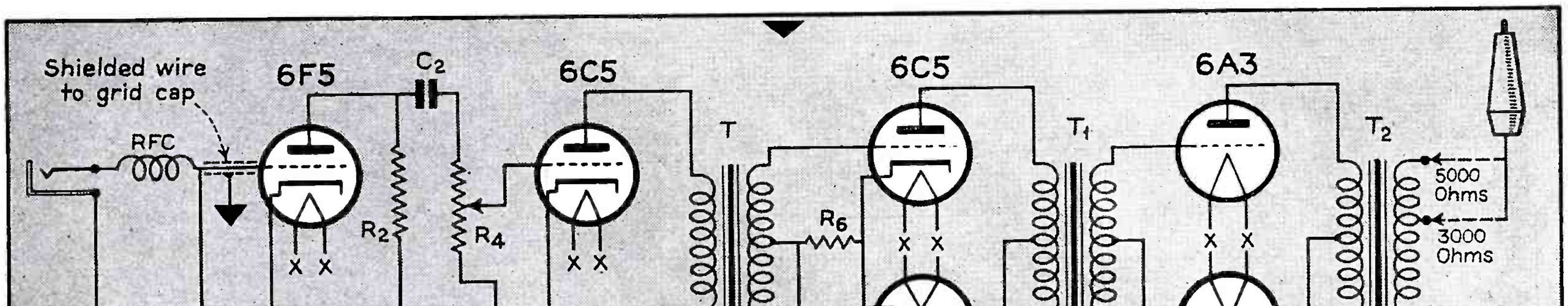
Good shielding is also important. The use of shielded transformers and metal tubes in the first three stages take care of this requirement. It will be noticed that the 6F5 in the first audio stage has the grid input at the top of the tube in the form of the usual grid cap. This is quite desirable as this grid lead is the one from the crystal mike and, having the lowest audio level of any circuit in the entire modulator, is most sensitive to pick-up of a-c hum from the power transformers or r-f pick-up from the transmitter. Running this lead to the top of the tube avoids having it near the 6.3-volt a-c heater circuit in the base of the tube, which is inevitable in other types of tubes with no grid cap. The mike cord is completely shielded as is the mike plug. This is very important if r-f pick-up is to be avoided. The metal chassis with its bottom plate to shield the leads and apparatus underneath, plus the metal tubes and shielded transformers, eliminates any direct r-f pick-up by the modulator.

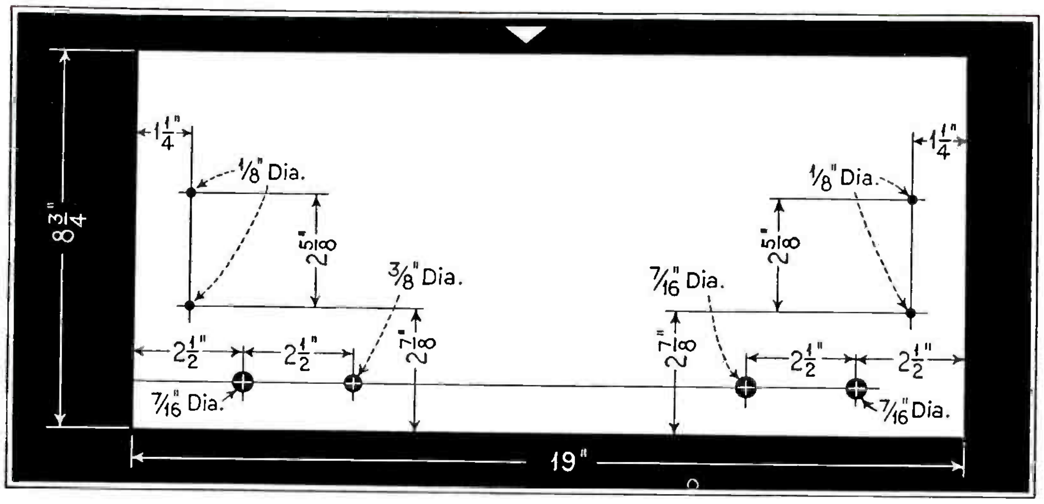
A 600-ohm variable resistor, R-8, is mounted underneath the chassis. This is for the purpose of adjusting the bias on the 6A3's to the correct value. To adjust this bias temporarily, insert a milliammeter with a maximum scale reading of 100 mils or more (the one in the transmitter will do nicely), in the lead from high voltage to the center tap of the output transformer primary. Set the 600-ohm bias resistor so that the 6A3 tubes draw exactly 80 mils (for both tubes). The slider on the resistor can then be left at this position.

Changes For Phone Operation

A few minor changes are necessary in the wiring of the AWR 2-3 transmitter in order to connect it to the modulator. The voltage from the power supply for the transmitter should be reduced to

Circuit diagram of AWR 2-3 Modulator.

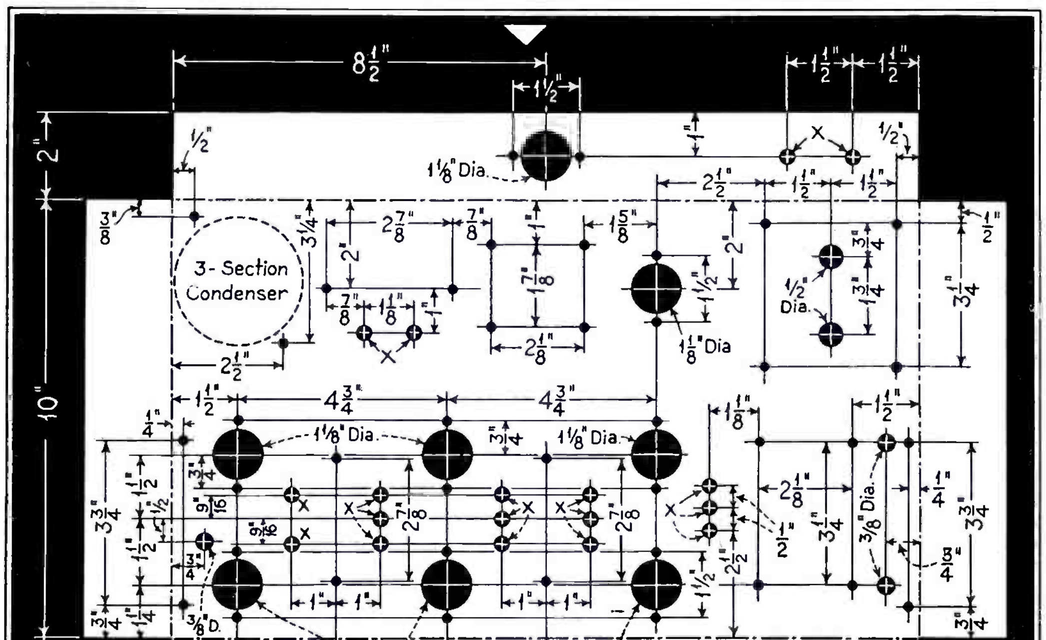




Above: Modulator front panel. Below: Modulator chassis.

C —Cornell-Dubilier ED-3050 electrolytic, 5 mfd, 50 volt
C1—Cornell-Dubilier ED-8020 electrolytic, 2 mfd, 300 volt
C2—Cornell-Dubilier DT-4P1 paper, 0.1 mfd, 400 volt
C3—Cornell-Dubilier ED-3050 electrolytic, 5 mfd, 50 volt
C4—Cornell-Dubilier ED-5100 electrolytic, 10 mfd, 100 volt
C5—Cornell-Dubilier EA-8880 can type electrolytic, triple 8 mfd, 500 volt
R —IRC Insulated Metallized 5 megohms, 1 watt
R1—IRC Insulated Metallized 5000 ohms, 1 watt
R2—IRC Insulated Metallized 500,000 ohms, 1 watt
R3—IRC Insulated Metallized 50,000 ohms, 1 watt
R4—Electrad 500,000-ohm potentiometer
R5—IRC Insulated Metallized 5000 ohms, 1 watt
R6—IRC Insulated Metallized 1000 ohms, 1 watt
R7—Ward Leonard 15,000 ohms, 20 watts, wire-wound
R8—Ward Leonard 600 ohms, 50 watts, wire wound, with slider
R9—Ward Leonard 600 ohms, 10 watts, wire-wound

1 —Sylvania type 6F5
3 —Sylvania type 6C5
2 —Sylvania type 6A3
1 —Sylvania type 5Z3
T —Thordarson type T-5741 transformer
T1—Thordarson type T-7201 transformer
T2—Thordarson type T-7202 transformer
T3—Thordarson type T-7062 transformer
T4—Thordarson type T-1700 filter choke
T5—Thordarson type T-5754 filter choke
4 —Franklin octal sockets
3 —Franklin 4-prong sockets
1 —Yaxley single circuit phone jack, for mike
2 —Birnbach small feedthru insulators
1 —Hammarlund CHX r-f choke
1 —A-C input receptacle
2 —General Radio knobs, small size
1 —Amber pilot light
1 —Rotary toggle switch
1 —Leeds Radio Co. crackle finish steel panel, 8¾" x 19"
1 —Leeds Radio Co. crackle finish chassis, 17" x 10" x 2"
1 —Turner type 24 crystal mike
1 —Turner crystal mike stand
1 —Yaxley shielded mike plug
Rubber grommets
Shielded wire



400 volts. Next remove resistors R1 and R2 in the transmitter (see page 169, April issue) and connect the suppressor grid of the RK-25 directly back to ground. Then disconnect the lead running from high voltage to the screen-dropping resistor, R3, and plate tank of the RK-25 and run it instead to the terminal on a feedthru insulator, which can be mounted on the back edge of the chassis. Another feedthru insulator should also be mounted on the back edge and its terminal connected to resistor R3 and the RK-25 plate tank. In other words, the high-voltage lead going to the screen resistor and plate tank is broken by a pair of new feedthru insulators mounted on the back of the transmitter chassis. These can be conveniently mounted on the opposite end from the antenna insulators so as to correspond in position with the insulators on the back of the modulator when the different units are mounted in a rack or cabinet.

After these changes are made, it is only necessary to connect together the corresponding terminals of feedthru insulators on the modulator and transmitter. The entire transmitter is then ready to go on fone.

In order to prevent overmodulation, the gain control on the modulator should be reduced far enough so that the meter in the RK-25 circuit on the transmitter *never* moves during modulation. Any movement of this meter at all indicates either carrier shift or overmodulation. The antenna coupling should be adjusted so that the total current on the RK-25, as shown when the meter is switched into this circuit, is approximately 75 mils. A flashlight bulb connected to a one-turn loop of wire and held near the RK-25 plate coil, should increase brilliancy under modulation.

There are two terminals on the secondary of the output transformer which are marked 3000 ohms and 5000 ohms. For modulating the AWR 2-3, the terminals marked "0" and "5000 ohms" should be connected to the output feedthru insulators. This is the correct impedance to match the r-f load from the RK-25 to the modulator output.

Modulator Characteristics

This 15-watt modulator also makes a very fine speech amplifier for driving a pair of high-power Class B modulator tubes and can also be used as a 15-watt amplifier for public-address work if so desired, by merely substituting the proper output transformer. The frequency response range and quality of this amplifier is quite sufficient for either speech or music reproduction. A similar amplifier built by the Thordarson Laboratories (Thordarson push-pull type 2A3 tube output Class Amplifier has a measured

[*Continued on page 307*]

Night-Owl Hoots

By Ray La Rocque

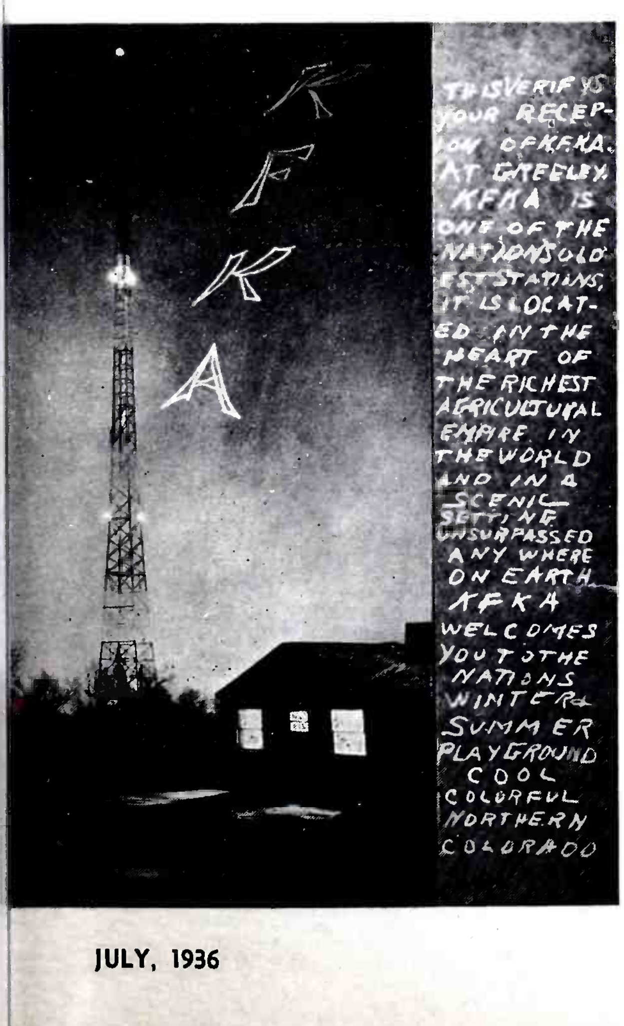
guatemalan courtesy . . . six more broadcasters . . . argentina can't be downed . . . cubans on even frequencies . . . new calls of the month.

THE vast possibilities of DX on the broadcast band were brought out when station TGW in Guatemala, down in the tropics, discontinued broadcasting for one hour during one of their Sunday morning programs on 1210 kc, so that DXers could hear a special DX program from station CJCU in Aklavik, *North West Territory* on the same channel with only 50 watts. Sad to relate, is the fact that the Chief Night Owl did not hear CJCU and has yet to hear of anyone who did. Incidentally, thanks anyhow to TGW for standing by.

Eight New Stations

The FCC have been having a rather busy time of it down in Washington. A countless number of applications for new stations were received and considered during the past month and as a result eight of the applications were granted—*six* of them in *one week!*

Impressive veri from KFKA, in sepia.



Wichita, Kansas is slated for a new station to operate on 1210 kc with unlimited time. Big Springs, Texas, will have a station on 1500 kc, also unlimited time. Paris, Texas, is the second of the three cities in the "Lone Star State" to be granted licenses. The Paris station will operate daytime only on 1500 kc. Another unlimited time station goes to Waycross, Georgia, transmissions to be on 1200 kc. Just so the South would not have all the new stations, the FCC granted permission to the Thames Broadcasting Co., of New London, Connecticut, for a new daytime station on 1500 kc. St. Augustine, Florida, also gets a new unlimited time station on 1210 kc. The owner is listed as *Fountain of Youth Properties, Inc.* Abilene, Texas, will soon have a new broadcaster on 1420 kc with unlimited time. Even good old Tuscaloosa, Alabama, was not left out of the picture, for the FCC has authorized a new station there on 1200 kc, daytime only.

Station KFKA, in Greeley, Colorado, recently celebrated the inaugural of their new 1000-watt crystal-controlled transmitter with a special all-night program, and those fortunate DXers who reported reception of the program received an attractive picture of the transmitter as a verification card. Station KFKA is one of the oldest stations in the country. It was first licensed to operate in May, 1922. Their schedule is from 5 A.M. to midnight (MST) 365 days in the year.

Argentines Strong!

Despite the warm weather and general decrease in signal strength, the Argentine stations keep increasing in signal strength. On one occasion LR6, "Radio La Nacion," on 870 kc, was heard for 2½ hours in the evening without any interference from WENR! Other regulars are LR1, "Radio La Nacion," on 1070 kc; LR3, "Radio Belgrano," on 950 kc; and LR5, "Radio Excelsior" on 830 kc. Listen to them any evening until midnight.

RAY LA ROCQUE

"The new frequency of 910 kc on which CKY is now operating is satisfactory to listeners. Officials of the station, after nine days of testing of the new frequency, reported recently that over the province at large the new frequency was more satisfactory than the old one of 960 kc. Reports from rural Manitoba are that interference from Mexican stations has been cleared up. A few more weeks of testing will be tried before any permanent change is made."—This from the "Hot Spot" of the Globe Circlers DX Club.

Frequency Reallocations

Regarding the proposed reallocation of frequencies, the Federal Communications Commission approved the recommenda-

[*Continued on page 310*]

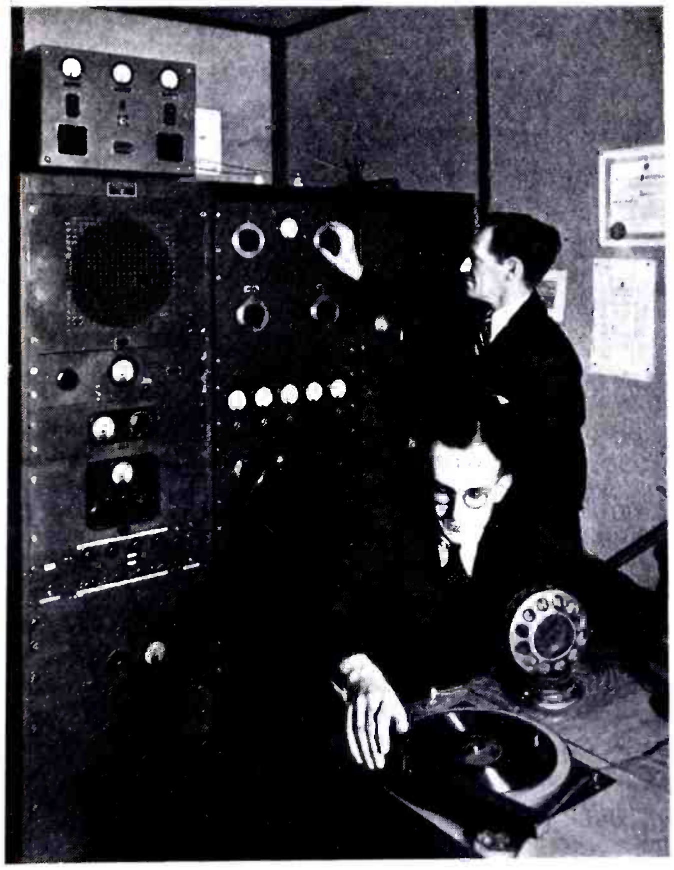
The Footloose Reporter

The MOOSE RIVER Disaster

Two miners and C. A. Landry, Senior Operator at CHNS. Note the beard—grown on the job.

By William C. Borrett, VE1DD
Director, Station CHNS, Halifax

THE Moose River mining disaster which lasted from Easter Sunday night until ten minutes to one Thursday morning, April 23, gave radio broadcasting in Nova Scotia the opportunity of serving the public not only in the Province and in the Dominion, but in the United States and other parts of the world.



Operators of the main transmitter CHNS, at short-wave VE9HX: Wm. C. L. Bauld (standing) and John Clare.

The heroic work of the miners in the rescue of Dr. Robertson and Alfred Scadding, the two surviving members who entered the mine on Sunday before the collapse underground, has already been written up most eloquently by the press from all over the Continent, and there is no need to further elaborate on the fact that to them alone is due all the credit of saving the lives of Dr. Robertson and Mr. Scadding.

Lone Station to Network

Now that the whole matter has come to a conclusion, listeners everywhere, many of whom sat by their loudspeakers without hardly any sleep, to get the details, are asking all kinds of questions as to how this modern wing of scientific communication accomplished its part. It is the purpose of this article to explain how this tremendous network of communication all over the Continent grew from a mere local broadcast with remarkable speed and success, under most trying conditions.

CHNS, at Halifax, had the honor of being the "Key Station" for this tremendous network that eventually embraced not only all the stations of the Canadian Radio Commission, but also those of the Columbia Broadcasting System, the National Broadcasting Company, and the Mutual Broadcasting System in the United States. The average listener is apt to concentrate on only what he hears from the originating microphone or on reading his newspaper without the least thought of how all this information is brought to him.

The Moose River Gold Mine is located about 70 miles from Halifax and is at the end of a branch country telephone circuit containing 15 parties on the line. With the newspaper correspondents eagerly trying to serve their separate newspapers this telephone circuit was inadequate to meet the demands, so the Canadian Press, whose responsibility it is to serve all newspapers in Canada, had to think of ways and means to get the news out of this isolated spot to meet the demand.

Amateurs Meet Emergency

Here it was that radio first got into the picture. Local members of the Halifax Amateur Radio Club, which is associated with the American Radio Relay League, an organization that has covered itself with glory on many occasions in the United States, and which only recently did noble work during the Eastern United States floods, stepped right into the picture. A small group of amateurs set out for Moose River and there established a small battery-operated transmitter of very low power, under the leadership of Mr. Arthur Crowell. In Halifax, at the home of Mr. Clifford Short, a receiver and relay transmitting station, connecting through with the Canadian press, was established with another group who worked in relays, and during the whole time they hardly knew what sleep meant. Owing to the distance and the low power used at Moose River, these boys had to find extra means of communication, as newspapers all over the continent were becoming interested. So they established a Relay Station at Musquodoboit. It was over this network that the great majority of the Canadian Press stories published in newspapers all over the Continent were handled.

It is impossible to mention the names of all of those men who assisted in maintaining communication with the outside, but it is to this group that a great amount of credit is due for the reliable newspaper information that came from the Mine. Individual correspondents of newspapers, of course, were also sending out their own stories, over this one available telephone circuit and through other means. The American Radio Relay League stayed on the job not only until the men were rescued but for many hours afterwards until the full details of the rescue could be transmitted to the Press.

In the meantime the Maritime Telephone and Telegraph Company, which was faced with a tremendous problem, was not asleep by any means.

CHNS Takes Hold

For the first seven days after the cave in, the *Halifax Herald,* with which Radio Station CHNS is associated, were broadcasting daily reports from the *Herald's* own correspondents and on Canadian Press Information on the progress of the work, but shortly after midnight on Saturday, April 18th, when word was flashed through that contact had been established with the entombed men, things of unusual intensity began to happen in the broadcasting field. The Station staff at that time had just closed down after making their usual frequency tests, when they were all summoned back to their posts to be in readiness for regular broadcasts by the newspaper correspondents who had been at the mine. Frank Doyle, of the *Halifax Herald,* rushed in by automobile to tell the story to the public, and the Station remained on the air without a break for thirty hours, giving the only radio broadcasts available up to the conclusion of this first dramatic Sunday, when communication had been established with the entombed men.

Right here the writer feels that due

Bill Horne, VE1GL; Art. Crowell, VE1DQ; and Trevor Burton, VE1CP, and the emergency transmitter these amateurs used at Moose River.

credit should be given to the Engineer, whose name has not been divulged as yet, who, by his precise skill, figured out the exact angle that the diamond drill should work to strike the seven-foot-wide passage which was over one hundred and fifty feet below ground, and in which the men were entombed. If he had miscalculated, the men would probably have been down there much longer, as the establishment of the fact that they were alive marked the turning point in the rescue work. This unknown Engineer certainly deserves every praise for his part in the rescue.

Remote Control Men on Job

The broadcasts from the station and the news despatches going out created such wide-spread interest that it was no surprise to the Station Management when the Canadian Radio Commission called upon them to supply remote control apparatus and to send remote control men to the mine. This, in itself, added to the problems of the Maritime Telephone Co., whose single line was already overloaded. Mr. Landry, Senior Operator at CHNS, gathered up his remote control equipment, and owing to the fact that no power was available at Moose River, had to get a d-c amplifier and a supply of batteries. On Monday, April 20th, at noon, he started off by auto with J. Frank Willis of the Canadian Radio Commission, L. A. Canning, and Lewis Murphy. On these remote control men depended the responsibility of assembling the equipment as soon as possible, keeping it in order, co-operating with the Telephone officials, and seeing that everything was in working order for the Commission's announcer every half hour from the first broadcast at 6:00 o'clock on Monday night, April 20th, right through without any break, until 2:00 o'clock (A.M.) Thursday, April 23. If their apparatus had gone out on them it would have been "just too bad," so far as the broadcasts were concerned.

In addition to this, W. C. L. Bauld, and John Clare, the operators at the transmitter in Bedford, were continually on the job from Sunday night until 2:00 o'clock Thursday morning, at the long and short-wave transmitters. At the

Mine Manager Henderson broadcasting from the pit head.

main control room in the Lord Nelson, R. L. Fry, along with the Station Director, worked under similar conditions. Gordon Arthur, Lionel Shatford, and other members of the Staff also worked many extra hours assisting in the many demands, not only of the general public, but the broadcasting systems.

Feed Lines Installed

The success which was obtained on these broadcasts, however, could not have possibly been achieved without the assistance of other men, particularly the broadcasting engineers of the Maritime Telephone and Telegraph Company, at the Lorne Exchange, under the Direction of Mr. Mumford, and the Canadian Pacific Telegraphs network control men A. E. Emery and M. I. Pelham. These men were notified by the Station at noon on April 20th when the remote control operators at CHNS with the announcer of the Canadian Radio Commission, were leaving for Moose River to put on a National network of Bulletin Service from the scene of the disaster. They had to immediately set to work to arrange for lines and equipment to feed these programs over the necessary circuits. From 6:00 o'clock Monday evening until 2:00 A.M. Thursday these men were under a heavy strain maintaining uninterrupted service. Their lines had to be monitored and watched carefully for programs from Upper Canadan outlets, and the realization of the tremendous interest centered in connection with rescue work added to the anxiety. They had to be ready at all times, when the announcers were talking, to be prepared to switch circuits, if the line was taken from the announcer for an emergency call. These men experienced practically no sleep from start to finish, but they found consolation in the thought that if their job was a tough one they had nothing on the miners.

Telephone communication wih Moose River from Halifax travels this route—first northerly 42 miles to Scuhenacadie over a toll route amply supplied with the best copper circuits, thence easterly 17½ miles to Middle Musquodoboit over a group of 3 circuits, then southerly 15 miles over a local circuit of iron wire serving some 15 subscribers.

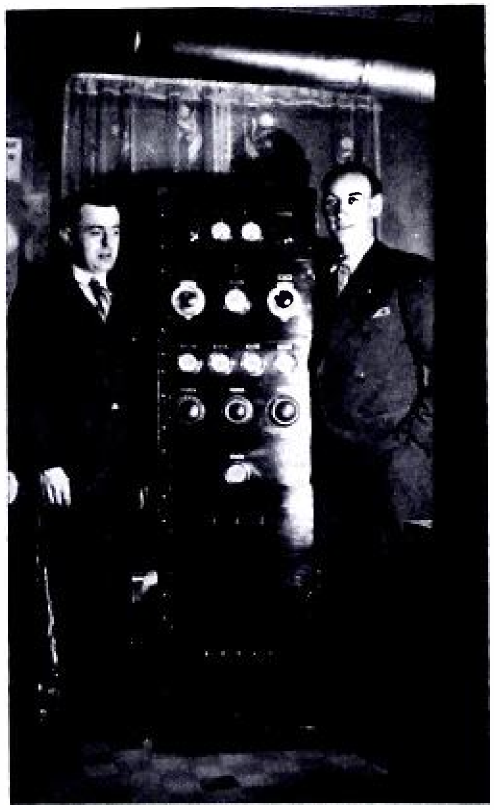
Phone Circuits Doubled

This was the only outlet when the news that the entombed men were alive and the rescue efforts began. It became apparent at once that it was entirely inadequate and steps were taken to double it. Men, under J. A. Bowman, and F. H. Pond, at once set about clearing this iron circuit of grounds and cutting out the worst obstructions to transmission. Repeating coils were placed and a grounded phantom circuit developed, thus giving two circuits where one had existed before. Had this particular part of the country been furnished with electrical transmission lines, this work would have been impossible. Telephones were placed on these circuits as close to the mine as was possible and F. H. Pinfold of the Maritime Tel. and Tel. Co.'s Traffic Department was put in charge of these telephones, his job being to see that emergency calls were given immediate attention and that order was kept in the placing and receiving of other calls. The transcribing of incoming telephone calls was in itself a full job for one man.

These two channels were no sooner working than the demand for broadcasting facilities was received. At first it was felt that these should be refused as it might interfere with the urgent need of the circuit by the rescue authorities, but finally it was agreed to furnish one circuit each half hour to the Canadian Broadcasting Commission for the purpose of keeping the public advised of the progress being made. This complicated infinitely the work of alloting circuit time and threw additional work on the staff in the long-distance terminal room in Lorne Exchange in Halifax.

Special Mike Built

Early on Sunday the Telephone Company considered the supply of a telephone instrument that could be sent down to the imprisoned men through the three-quarter inch pipe which was supposed to be the size of the drill hole. This was an article which did not exist and had to be specially designed and built. Working all day Sunday, Equipment Engineer W. E. Jefferson and Repair Shop Foreman W. Boak built a special telephone microphone in a fountain pen flashlight case and despatched it to Moose River. It was impossible at that time to make a receiver and none could be found about town. In fact as far as Montreal was searched with no results. However, on Monday it was found that the drill hole was 1¼ inches and a receiver was discovered here in Halifax and sent to the scene of the disaster. The Telephone microphone was successfully lowered to the entombed men and worked to perfection, but when the receiver arrived at Moose River and was let down to the drill hole, the imprisoned men could not, because of dripping water, get near enough the drill hole to make use of it. To ensure that the miniature telephone microphone and receiver would reach the prisoners in working condition, it was necessary to take every precaution against dampness in the drill hole. The job of waterproofing was supervised by F. H. Pond, Supervisor of Maintenance, and though done under the most adverse conditions was perfect.



Cliff Shortt, VE1AW, and his transmitter. At right; Walt Wooding, VE1ET, who did the bulk of copying "portable" VE1DQ's signals.

At the same time a telephone was made for the use of the rescue crews in the shaft, thus enabling the men at the working face to communicate with the authorities at the shaft head.

When it was found that Dr. Robertson and Mr. Scadding would not take the receiver sent down to them and that they were unable to hear what was shouted down the hole, it was suggested that public address system amplifiers be tried. These too were sent to Moose River and tried but were found to be altogether useless.

In all there were 10 telephone men, under General Manager W. A. Winfield on the job at Moose River. Many of them worked throughout the rescue without rest.

The tremendous traffic load thrown on the Company was felt by everyone, but particularly by the operating staff. Musquodoboit, an office with a single employee, became like a metropolitan long-distance office. In Halifax the operators sat at the board for hours. Meals were brought in and the girls took a bite when they could get a spare minute. The maintenance crew, always alert, doubled their vigilance to make certain that there would be no failures in the lines.

The event brought out the ingeniousness and determination of everyone. Most of the demands were for materials or facilities out of the regular line of work and in no instance was there a failure.

Offers of Assistance

Offers of assistance came to Station CHNS from Radio Amateurs all over the district. Listeners phoned in from

[*Continued on page 304*]

Review of World Radio

television telephone packs 'em in . . . light by radio . . . england boosts power . . . kaiser falls for radio . . . england to france on five meters.

Seeing by Telephone

BERLIN: The Minister of Posts, Herr von Rubenach, on March 1, 1936, opened the German Post Office's two-way telephone-television service between Berlin and Liepzig (roughly 100 miles by cable), and he afterwards saw and spoke to the Chief Burgomaster of Leipzig, Herr Goerdoler. This is the first service of its kind in the world. It will remain open during the Leipzig Fair and will be continued later for tests.

At present seeing by Telephone in Germany is limited to persons who go to public offices, two of which have been opened in each town. In Berlin these are situated at the Potsdamerplatz and at a busy corner in the West End. In Leipzig one is at the Fair and the other at the central post office. A three minutes' communication costs 3 marks 50 pfennigs, which includes notification of a specified person in the town at the other end of the line.

Public interest is very great. Bookings are nearly always taken well in advance.

The quality of the picture is remarkable; the 180-line definition and 25 frames a second are ample to produce head-and-shoulder image of a person in all details, and the effect is comparable to a small-size projection of the 16-mm film. The cabins have been fitted with comfortable arm chairs, and it is of importance for each person to be exactly in focus. This is obtained by comfortably leaning back in the chair and resting one's head on the cushion; the attendant can then lower or raise the chair at will to bring the person's head into line with the scanning apparatus. The image of the correspondent in the other town appears above the bright line of the scanner, but this is not disturbing. The hands of a wrist watch can be recognized, and even the ring on the hand holding the telephone receiver.

✦

Micro-Waves and Neon Tubes

TOKYO: A new method of lighting neon tubes by means of micro-waves was recently described to the Imperial Academy by Dr. H. Nagaoka, well-known physicist. Micro-waves having a wavelength of 20 centimeters are employed. Neither transformers nor conductors to the tubes are needed to illminate it. On aeroplanes the tube will be illuminated by waves from the airport and will serve as a guiding device. Neon signs in streets may also be lighted without wires by this means.

✦

World Short-Wave Plan

BRUSSELS: The Brussels Control Center of the International Broadcasting Union has been officially empowered to collect short-wave broadcasting data from all over the world. This is the outcome of the recent inter-Continental conference in Paris, when first steps were taken to unify short-wave practice on an international scale.

It is probable that the next year or two may see the formation of a world short-wave plan on the same lines as the Lucerne Plan of Europe. *(WW. 866-No. 14)*

✦

Eiffel Tower to Be Abandoned

PARIS: The Eiffel transmitting tower, the oldest of all French broadcasting stations, is about to be abandoned. With the close of the 1937 World Exposition the famous landmark will lose its voice and the event will bring to a close the last transmitter located inside the French capital.

✦

More Power for B.B.C. Stations

LONDON: The B.B.C. has raised the power of certain transmitters, and intends to take similar steps with others. The potential power of all the regional stations is 70 kw, but until now the power actually used has not been more than 50 kw. With the increasing strength of foreign stations it has been evident for some time that defensive action would have to be taken in this country.

A start has been made by raising West and Midland Regionals to 70 kw, and in the course of a few weeks the North, London, and Scottish Regionals will also be raised to that figure. This increase will not produce remarkable results, but it will nevertheless improve reception, especially on the fringe of service areas.

It has also been decided that the new station for Northern Lisburn, which will be opened on or about March 20, as well as the Burghead, now being built in Scotland, and the North-eastern transmitter in Northumberland, shall have a power of 100 kw. It is expected that Lisburn will make use of its full power, though this is not certain in the case of the other transmitters named.

Lisburn will thus be the most powerful medium-wave station owned by the B.B.C., and more powerful than Athlone's 60 kw.

Reports of proposed Continental transmitters of a power of several hundred kw are heard from time to time but these are not regarded too seriously by technical opinion at Broadcasting House. *(Manchester Guardian—London)*

✦

Television Research in Italy

ROME: The International Center of Television, created last year after the Nizzo Congress of the International Institute of Educative Motion Pictures, said recently at its seat in Rome—"the support of the Italian National Institute of Electro-acoustics has at its disposal the greatest television technicians who have the finest laboratory equipment and facilities to experimentally demonstrate the latest inventions in the field of television so that only the most meritable and practical developments will be released to the great Italian public."

With such facilities and contacts between persons, it is certain that the peninsula country will endeavor to keep abreast of the rapid advance of electrical ingenuity.

✦

Kaiser as Radio Listener

DOORN, HOLLAND: The ex-Kaiser Wilhelm II is reported to have become "a convert to radio." Until two months ago the ex-Kaiser is understood to have been strongly prejudiced against broadcast reception, but in order to follow the funeral ceremonies of the late King George V he ordered the installation of a receiver at Doorn.

So impressed was he at the beauty and dignity of the broadcast that, it is reported, his prejudice against broadcast ception has "completely disappeared."

✦

Coaxial Cable on German Television Circuit

BERLIN: Notes of interest on the new Berlin-Leipzig circuit have been eagerly awaited by short-wave enthusiasts throughout the world. Some of the salient points are as follows: Inner copper wire of 5-mm. diameter following the

[*Continued on page 304*]

RADIO PROVING POST

THE GRUNOW MODEL 1241
Hi-Fidelity Superheterodyne

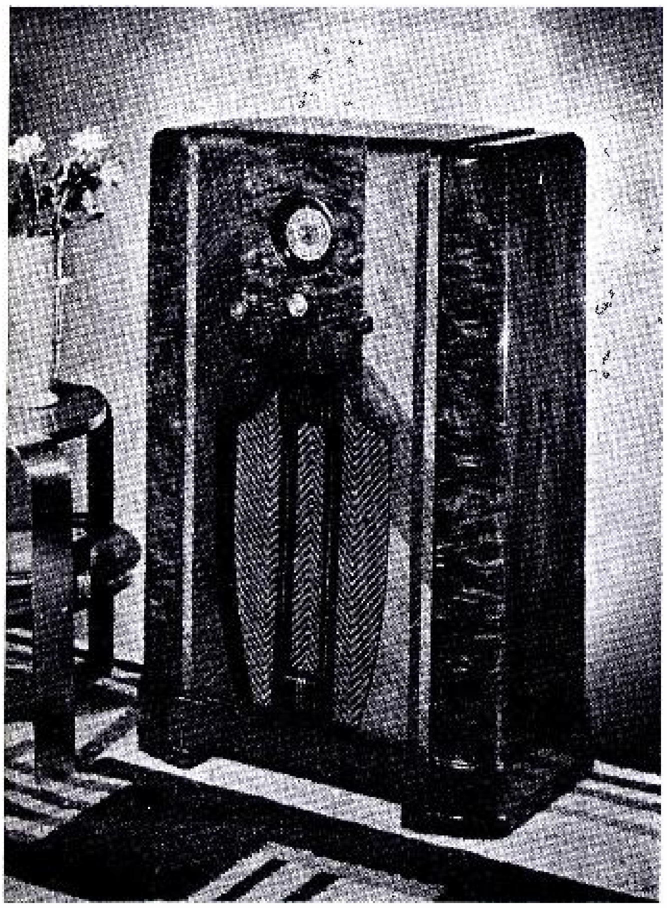
THE Grunow Model 1241 Hi-Fidelity Superheterodyne Receiver combines the features of the all-wave set and the qualities of an instrument of wide-range sound reproduction. Sufficient circuit flexibility has been provided to meet the requirements of both classes of reception.

The receiver is of the console type and employs two small dynamic speakers for the reproduction of high audio frequencies, and one large dynamic speaker for the reproduction of low audio frequencies. All three speakers remain in circuit at all times and the range of audio reproduction is controlled by a knob on the front panel.

Receiver Controls

The receiver has four waveband ranges, each with a separate scale on the airplane-type dial. The range to which the Band Selector Switch is set is indicated by a colored light focused on a portion of the frequency scale in use. The bands, and their respective colors are: 550 to 1750 kc (Green); 17000 to 5680 kc (Orange); 5.4 to 18 mc (Amber), and 150 to 410 kc (Red).

GRUNOW MODEL 1241



The complete dial is indirectly lighted, from the sides, and this method of illumination is easy on the eyes. The outer area of the dial carries the numerals 1 to 12, and these are arranged like the face of a clock. Both the "Minute" and "Hour" pointers traverse this scale so that it is easy to log stations without reference to the smaller frequency scale divisions. Thus, in the "Orange Band", a station at approximately 4000 kc on the frequency scale, as read by the slow-speed pointer, is 4:30 o'clock on the outer scale. This method is easy, rapid, and more accurate than reference to the frequency scale, but is of value in locating stations of known frequency only in the event that the clock scale has been previously calibrated against stations received.

There are five controls on the front panel. To the left of the dial is the Volume Control; to the right of the dial is the Station Selector. The latter control has two ratios, the slow speed motion of the dial pointers being made available when the Station Selector knob is pushed in.

The Range Switch is directly below the dial. This has four positions, one for each of the four separate frequency ranges.

To the left of the Range Switch is the Hi-fidelity Control. This control has six positions, each successive position up from the left increasing the width of range of the audio-frequency band. The last three of these positions are used for high-fidelity reception from local stations. When in any one of these positions the i-f amplifier is expanded and the selectivity is such that the higher audible frequencies are passed through to the audio amplifiers and loudspeakers. With the control in "normal" position, or in one of the two lower positions where the higher audio frequencies are attenuated, the i-f amplifier is automatically adjusted to a condition of high selectivity. Aside from adjusting the selectivity of the i-f amplifier, the Hi-fidelity Control also functions as a tone control of the step type.

To the right of the Range Switch is the combined On-Off Switch and Signal Beacon. This knob has three positions. When turned full to the left, the receiver is turned off; when moved up one point the receiver is turned on; when moved full to the right, the Signal Beacon or beat oscillator is brought into play. This oscillator is used for the reception of c-w signals and as a station finder.

All five controls are smooth and easy of operation. The station selector has no play and the speed ratios are about right for the frequency spread on each scale.

The Circuit

The receiver employs 12 tubes, used as follows: 6K7 r-f amplifier, 6A8 first detector and oscillator, 6K7 first i-f amplifier, 6K7 second i-f amplifier, 6H6 second detector and avc, 6F5 first audio amplifier, 6C5 audio driver, 6F6 high-frequency audio channel power output, 6C5 signal beacon beat oscillator, 2-6F6 push-pull low-frequency audio channel power output, and a 5Z4 high-voltage power supply rectifier.

The circuit of the receiver is shown on the opposite page. This shows that separate r-f, first detector and oscillator coils are used for each of the four frequency bands. There are multiple arms on the band selector switch which short out the idle coils. A rejection filter is included in the antenna circuit. The purpose of this filter is to eliminate signals from commercial code stations operating at or near the intermediate frequency of the receiver.

The first two i-f transformers are arranged so that their mutual inductance may be altered to either increase or decrease the overall selectivity of the i-f amplifier. This variable selectivity is controlled by the Hi-fidelity Control knob on the front panel.

The 6H6 second detector provides variable grid bias to the r-f, first detector and first i-f tubes. The audio-frequency component of the rectified signal appears across the resistance of the volume control and is picked off and fed to the grid of the 6F5 first audio tube through the volume control arm. The 6F5 audio tube provides sufficient voltage amplification to swing the 6C5 driver tube. This tube in turn feeds both the high and low-frequency audio channels. The plate circuit of the 6C5 driver is resistance coupled to the 6F6 high-frequency audio power tube which feeds the two small high-frequency loudspeakers. The plate circuit of the 6C5 driver is also transformer coupled to the low-frequency power tubes connected in push-pull. These 6F6 tubes feed the large low-frequency loudspeaker.

The tone control, which is also coupled to the variable selectivity i-f transformers, is located in the grid circuits of the 6F5 and 6C5 tubes. This control is composed of two separate adjustable audio filter circuits. An acoustic filter is connected in the plate circuit of the 6F5 first audio tube to prevent the passage of noises due to station interference and atmospheric disturbances above 10,000 cycles when the receiver is operated under high-fidelity conditions.

Receiver Tests

The frequency drift of the receiver from a cold start was found to be approximately 30 kc, which is not bad for this type of set. Once temperature stability was reached, no further drift took place. The beat oscillator was found to be subject to slight frequency wandering, but not of a sufficient degree to even be objectionable in the reception of c-w signals.

The frequency scales are well calibrated. Image-frequency response was noticeable in the 5.4 to 18 mc range, but only on a few exceptionally strong signals . . . in other words, no more interference of this sort than is usually encountered in receivers with the same complement of r-f and i-f stages.

A hum of about R1 was noticeable from the large low-frequency loudspeaker, which is not surprising, since this speaker is capable of very low response. The hum could not, of course, be heard during actual reception of signals.

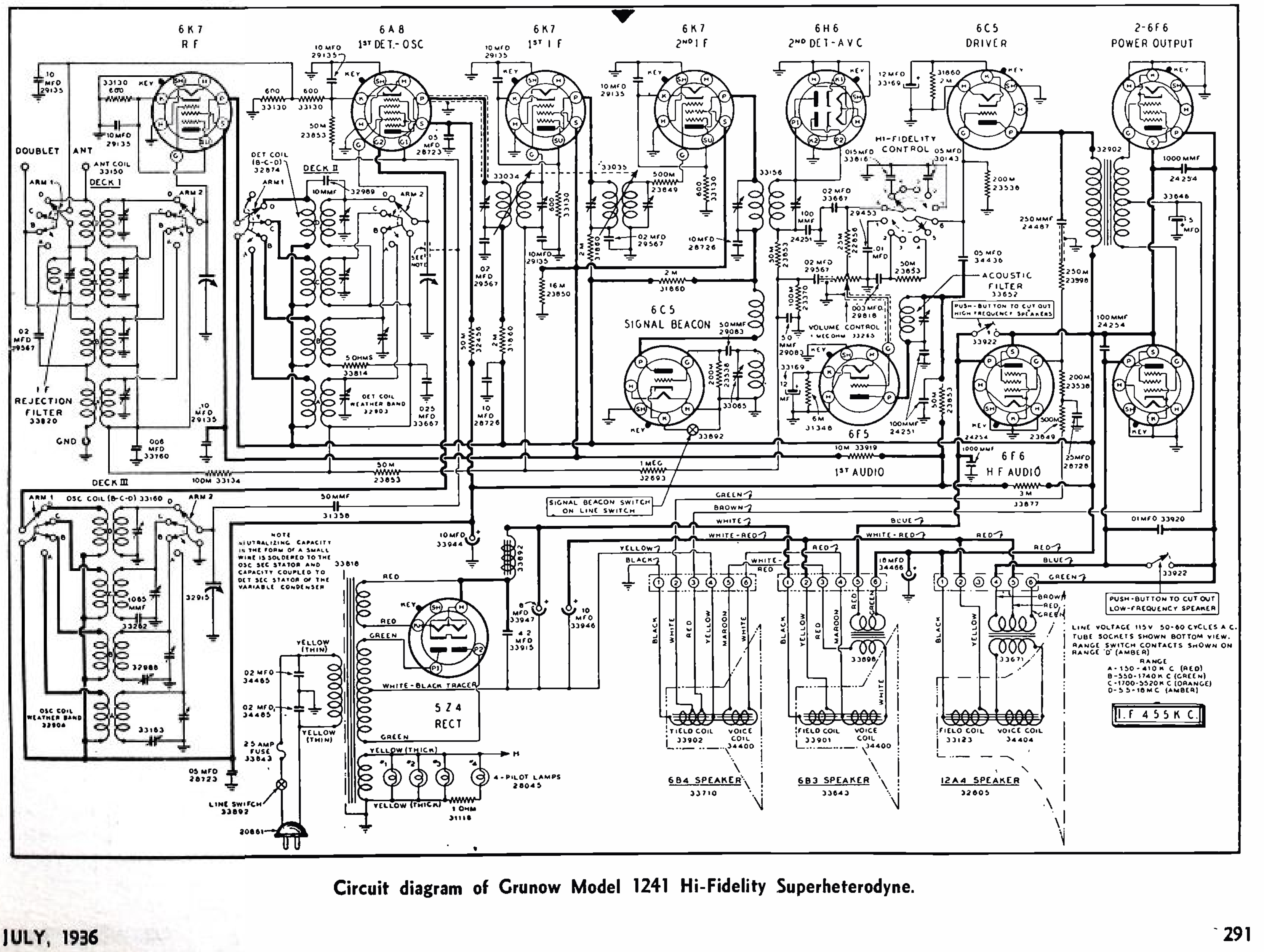
Frequency response was checked with a modulated carrier in order to determine the characteristics of the variable selectivity i-f amplifier as well as the audio system. It was found to be very good in the range from 90 to 6000 cycles and fair above and below this range. Test by ear seemed to indicate a resonance point in the low-frequency speaker somewhere in the vicinity of 90 to 100 cycles, plus a few minor humps at higher points. Such rising characteristics as were noted are all to the good, as a receiver with a flat frequency response is not a desirable instrument. The response of the ear is not flat, and reproduced tones do not sound natural unless properly compensated.

Under such conditions, listening tests are more reliable than the measurement of frequency response. The Model 1241 is equipped with two push-buttons on the rear of the chassis by which either the low-frequency or high-frequency speakers can be silenced. Manipulation of these buttons provides a fine demonstration of the actual response of each of the audio-frequency channels. Pressing one button eliminates a considerable amount of the higher frequencies when the receiver is being operated with the i-f amplifier expanded. Pressing the other button drops out most of the low frequencies.

High-Fidelity Characteristics

The most conclusive demonstration of

[*Continued on page 305*]



Circuit diagram of Grunow Model 1241 Hi-Fidelity Superheterodyne.

Backwash

A PAGE GIVEN OVER TO THE EXPRESSIONS AND OPINIONS OF READERS

The Woman's Angle

Editor, ALL-WAVE RADIO:

I have a copy of every issue of ALL-WAVE RADIO, and am very glad to hear that it is going to be enlarged because it is a very interesting radio magazine.

However, please do not shorten or omit the interesting article "Globe Girdling" by J. B. L. Hinds. ALL-WAVE RADIO is the only radio magazine that has a generous monthly article on verification collecting and it would certainly be a shame to omit or push this entertaining article in the background!

I claim to take as much interest in DXing as any man. I know that you have to have articles to please everyone and I am not technically-minded, but perhaps you would like to know what a reader of my type enjoys in ALL-WAVE RADIO: "Globe Girdling" by J. B. L. Hinds, articles and pictures of foreign shortwave stations, foreign news. "The Story of Amateur Radio," Short-Wave Station List, "In Writing For Veries," Data sheet for radio scrap books (like in December, 1935), a page for reader's comments (not necessarily criticisms) and various other short-wave articles.

Of course I know that there must also be deeper articles for the more technical-minded readers. I hope that my opinion may be of some assistance.

MISS EILEEN HOFMASTER
SANDUSKY, OHIO.

Many thanks for your comments. We wouldn't think of putting Mr. Hind's department in the background. As for data sheets, there will be lots of them in the very near future. You can count on that. Any time we fall short, give us a good, stern reminder. By the way—how do you like this issue?—THE EDITOR.

◆

Seventy Years Young

Editor, ALL-WAVE RADIO:

I am taking time out to make a word of comment on the "Two Embryo Radio Hams" stunt. This is something I have wished for. It has been more or less unsuccessfully staggered at several times in various magazines. So I am enthusiastically joining these two would-be-hams. However, they have much the best of me. I am a retired and fairly worn our physician 70 years old, but I am hobbying on learning the code and getting a ticket to go on the air.

I hope one thing, and that is that Mr. Granger will take the mystery out of theory and practice and simplify the requirements outside of learning the code, a thing which I am sure we can learn. But the bug-a-boo of theory and practice looms before me like an unscalable mountain peak; but step at a time, and it may not be a hard task, but we (or at least I) need some one of experience. Some joker perhaps, owning the great number of hams, and the limited bands for amateur operation, has spread the "news" that the great number of hams has led to increasing the stiffness of the examination so that fewer and fewer will be able to pass. Of course it may all be a joke, but it stings a little bit just the same.

I have all the books suggested in this article and sincerely hope that all the questions of Barb and Ernest will be printed for the benefit of those who wish to play along the side lines for every little item they can pick up. I am sure they will find Mr. Candler's course a very wonderful and simple explanation of How to Learn Code.

A friend gave me a code (tape) machine and told me where I could get tapes. He said he learned the musical rhythm on it of the code language.

Recently I have picked up an amateur code transmission intended especially for beginners, Pacific Standard Time, 7:30 to 8:30 P.M. Mondays and Fridays, that's going to be a wonderful help to me. He begins at the beginning in the most simplified way. He is in the 160-meter band.

With all good wishes for success, I am
GEO. B. THOMPSON, M. D.
LOS ANGELES, CALIF.

Radio is not quite so difficult as it appears on the surface. All subjects appear difficult if we are not on speaking terms with them, and we are sure that Mr. Granger will be able to present the answers to the "riddles" in a manner that all will be able to comprehend.

The character of the examination has not changed. Once you are able to grasp the fundamentals, and answer the questions intelligently, you need have no fear. But don't attempt to learn the answers to the technical questions in the License Manual verbatim. Make sure you understand the answers as well as the questions.

If you run into a few stickers, send them in to Mr. Granger, and he will answer them for the benefit of all.—THE EDITOR.

◆

Prize Winner

Editor, ALL-WAVE RADIO:

I received your letter informing me that I won the one year prize subscription to ALL-WAVE RADIO. I am glad to know that I was the first person to identify the photograph of Roxy and his Gang that appeared in the May issue of your magazine.

I thank you for the kind consideration that was given my letter and assure you that I am grateful to receive a free one year subscription to your magazine.

I have purchased your magazine since it was first published and I believe it is the finest of its kind. It is interesting and contains a great deal of useful information about radio. The cover on the May issue was excellent and made it stand out from other radio publications that were on sale at newsstands. I am sure that the future editions of ALL-WAVE RADIO will be as worthwhile as those in the past.

WILLIAM DALY
NEW YORK, N. Y.

Set Builder Plus

Editor, ALL-WAVE RADIO:

I am building the Pre-tuned High-Fidelity as shown in the January issue of ALL WAVE RADIO. This is the third of your sets I have made since last September. If this one works as well as the others, I shall be most pleased.

Your April issue was a "quality" number—far above the general run of so-called Radio Mag's. So many others are just outlets for distressed merchandise!

HAROLD W. MCCARTHY
GERMANTOWN, PHILA., PA.

Swell. Hope you make out as well with the Pre-tuned job. Some new dope is on the way which you should be able to apply to this job without much difficulty.
—THE EDITOR.

Queries

Amplified AVC . . . Microphone Pickup for Receivers.

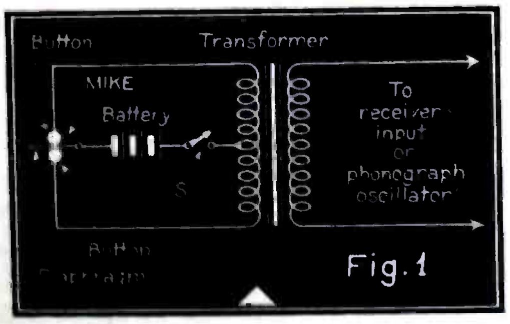
Question Number 7

"The higher priced models of the present all-wave receivers seem generally to use amplified automatic volume control, instead of the old diode detector unamplified a.v.c. which is still employed in the low and medium priced sets. Is this amplified automatic volume control noticeably superior to the more simple system? Is it worth the difference in price? Specifically, some manufacturers have two lines of sets, one with the diode avc, and the other with several tubes working in the avc circuit, and the price some $25 to $30 higher.—*W.H.W.C., Portsmouth, Va.*"

Answer

Any improvement is worth the difference in price if one can afford it—and the converse is equally true. The relatively slight difference in automobile between a 1936 Plymouth and a Cadillac may be worth $3000 to Mr. Goldrocks, but not to Mr. Jones who is having a hard enough time scraping together $25 a month to pay for his Plymouth. A question of this type can be answered intelligently only by ignoring the personal factor.

The more elaborate systems of automatic volume control are definitely superior to the elementary arrangements. It is theoretically impossible, in a diode second detector system, to secure *perfect* automatic volume control over even a favorable range of inputs. The reason for this is that, as the avc effect tends to bring up the signal, this increase in signal, through the diode circuit, acts to nullify the avc action. The result is a compromise—often a very satisfactory one—in which, while the effects of variations in carrier strength are not altogether eliminated, they are, to a very appreciable degree, lessened.



Circuit for connecting microphone to radio receiver.

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

On the other hand, with a properly designed system of amplified automatic volume control, it is theoretically possible to attain *perfect* avc action over a wide range of input levels.

It may be stated that in actual practice the more expensive receivers employ superior systems of securing automatic volume control. However, this is not the only feature in their favor. Usually there is an additional stage of radio-frequency amplification and one or more extra stages of i-f amplification. The former greatly reduces image frequency interference, contributes to sensitivity and selectivity, and often improves the signal-to-noise ratio. Additional intermediate-frequency amplification still further increases sensitivity and selectivity, and facilitates the use of noise eliminating circuits. Improved tonal quality is also to be expected with the more expensive receivers—for electrical and acoustical reasons.

All in all, it sums up to the general statement that, if you can afford to spend $150 to $200 for a receiver, it is the sensible and logical thing to do. If, on the other hand, the exchequer would be strained, there are plenty of very good sets to be had for half the price.

◆

Question Number 8

"I have a 1936 model 18-tube Midwest. I should like to connect a small microphone to the receiver, so that my voice would come through the speaker. —*J. P., New York City.*"

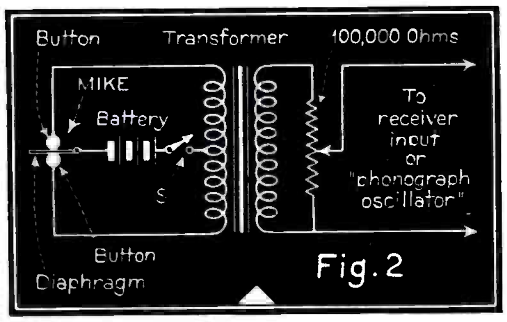
Answer

We have had numerous requests for this information. While the procedure will vary in different sets, in all instances it will be necessary to purchase an inexpensive two-button microphone, a microphone transformer, a small battery and a switch. The current mail-order house prices for this equipment are—microphone, $2.95 to $4.35; transformer, $1.15; a 4.5-volt "C" battery, 30 cents; and a toggle switch (single pole, single throw), 19 cents. A desk-stand for the microphone will probably be desired, and these run from $1.18 to $1.45. The battery specified is for use with the average 200-ohm per button microphone in conjunction with the correct type of transformer, which is the combination that you will probably, but not necessarily, purchase.

Connect the microphone, battery, switch and transformer as shown in Figure 1. In the case of the Midwest 1936 model receiver, the leads marked "receiver input" should be connected across the contacts of the "silent tuning" push-button.

In receivers providing pin jacks or other means of connecting a phonograph pick-up, the receiver input leads should be substituted for the pick-up. In instances where no provision is made for such connections, good results will usually be secured by connecting the input across the grid leak of a first resistance-coupled audio-frequency stage, or across grid and ground in a transformer-coupled

[*Continued on page 312*]



Same as Fig. 1, but including separate volume control.

"BARB" AND "ERNEST"
Two Embryo Radio Hams

fall in the 40-meter amateur band, at 7000 kilocycles. And so it is right down the line from 160, through 80, 40, 20, 10 and 5 meters—that no matter which band you work in the second harmonic of the fundamental frequency will, in most cases, fall right in another amateur band. Such interference is not nice for the amateurs, of course, but this convenient arrangement saves wear and tear on the commercial services, and at the same time puts it up to the amateur to keep his own channels clean. But note from the sketch that third harmonics fall *outside* the amateur bands.

You have asked what causes harmonics, and if they are always the same distance apart. Harmonics are caused by a natural phenomenon, and it may be said that they are arithmetic divisions of the power of the fundamental frequency. Numerically, they are always the same distance apart, as I have outlined in the previous paragraphs. There are such things as even and odd harmonics—the second, fourth, etc., being even, and the third, fifth, etc., being odd harmonics. More on this later.

Changing Transmitter Frequency

How does a Ham change the frequency of his transmitter? He tunes it, just the way you alter the frequency of your receiver when you tune it from one station to another. The difference is that the Ham usually changes the coils in the transmitter when he wishes to shift from one band to another. If the transmitter is tuned to operate in the 160-meter band, and the Ham wishes to shift to the 80-meter band, he takes out the 160-meter coils and replaces them with coils having the correct number of turns (correct inductance) to tune or resonate at some frequency within the 80-meter band. After the 80-meter coils are inserted, they are tuned by means of the same variable condensers used to tune the 160-meter coils. You perform a similar operation when you switch your all-wave receiver from one wave band range to another . . . when you turn the switch from one point to another, you automatically disconnect one set of coils and connect in another set. Each set is wound with just the right number of turns of wire to cover a given frequency range with the same variable gang tuning condenser.

Just why were meter designations used originally in preference to kilocycles? There is no good reason for this. The

They Learn to Transmit

[*Continued from page 281*]

field got off to a wrong start when it selected the length of a radio wave rather than its frequency, as the means of measurement. It would have been better for everyone if the length of a radio wave had never been aired in public.

In radio work, we deal with oscillating currents. What we wish to know is the frequency of oscillation in a given circuit, not the length of the wave it will produce or the wavelength it will respond to. Certain factors are not easily translated into wavelength in meters, and for another thing, knowing the wavelength at which a circuit will resonate is not sufficient data by which to draw conclusions regarding the functioning of the parts of the circuit. We must know the frequency in any event, and since the wavelength in meters contributes little in itself, it is best dispensed with. Practically all calculations are based on frequency, so the use of the term has become universal.

Frequency refers to the number of cycles produced per second. Since the frequencies of radio waves are very high with respect to sound waves, they are expressed in kilocycles and megacycles. A kilocycle is 1000 cycles, a megacycle 1000 kilocycles. Thus the frequency of WEAF is 660,000 cycles, or 660 kilocycles, or 0.66 megacycle. The term megacycle comes in handy when the kilocycle figures become bulky; thus 30,000 kilocycles is more easily expressed as 30 megacycles.

More than likely you could obtain fairly good c-w reception on your Philco receiver if you employed a beat-frequency oscillator to make the signals audible. The code signals you hear are those beating with a 'phone station carrier, and are difficult to copy at best. They disappear when the 'phone carrier is taken off the air. There is a beat-frequency oscillator on the market that can be easily attached to any type of *superheterodyne* receiver for the reception of c-w signals.

Automatic Tape Transmitter

Yes, the code examination is given over a tape. It is nice, clean stuff and much easier to copy than a straight fist, but I agree with you that a bit of experience with one of these machines prior to the exam would be a good thing. These machines are excellent for learning the code once the rhythm of the letters have been mastered, and since I note from your recent report to Mr. Candler, and his reply to the effect that you are progressing in fine shape, I think it is about time you commenced using one of these machines. It will be of great assistance to both Barb and yourself in not only speeding up your copying, but also in improving your transmission.

As it happens, Mr. Miller, of the Teleplex Company, the manufacturer of the automatic tape transmitter, has also taken a keen interest in the efforts of Barb and yourself to become full-fledged Hams, and has kindly offered to contribute a machine towards the good cause. Make good use of it and you will master the "15 or 20 w.p.m." sooner than you expect.

You will find that the Teleplex machine uses tape rolls in which the dots and dashes are punched. The tape is run through the machine, at any desired speed, and the automatic key transmits the letter groups and words on the tape. You can use one tape over and over again, and as your speed picks up, you can correspondingly increase the speed of the tape which increases the transmission. Since the Teleplex incorporates an audio oscillator, the "copy" that comes off the tape will sound like the copy from a commercial code transmitter. Thus, once you have this machine, you need not worry about picking up code transmissions on your Philco.

There are a series of tape rolls, each roll being a lesson in itself. Moreover, the Teleplex has a key, so that you can practice sending as well as receiving. The idea is to run a bit of the tape through the machine, listen to the letter formations, stop the tape, and then transmit the same letters yourself with the hand key and see how near you can come to duplicating the swing and the rhythm of the letters as reproduced in code by the tape. This is an excellent way of checking up on your own fist and eliminating faults in sending. Try it.

That's all for the present. With my next letter I'll start you off on some radio fundamentals. But, in the meantime, shoot along what questions you have, and I'll tackle them, too.

Gerald

In Writing For Veries...

ADDRESSES OF PRINCIPAL SHORT-WAVE STATIONS BY COUNTRY

AFRICA

CNR	Director General des Postes, Rabat, Morocco.
CR6AA	Estacao Radio Difusora, Caixa Postal 103, Lobito, Angelo, Portuguese West Africa.
CR7AA	Radio Station CR7AA, P. O. Box 594, Lourenco Marques, 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	P. O. Box 795, Cairo, Egypt.
VQ7LO	P. O. Box 777, Nairobi, Kenya Colony, Africa.
ZSS	Overseas Communications, Kodak House, Shortmarket St., P. O. Box 962, Capetown, So. Africa.
ZTJ	African Broadcasting Co., Ltd., P. O. Box 4559, Johannesburg, Transvaal, South Africa.

ASIA, OCEANIA AND FAR EAST

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

CANADA

CGA-CJA, et al.	Marconi Station, Drummondville, Quebec, Canada.
CJRX-CJRO	Royal Alexander Hotel, Winnipeg, Manitoba, Canada.
VE9BK	780 Beatty St., A. M. Jagoe, Mng'r, Vancouver, B. C., Canada.
VE9CS	743 Davie St., Vancouver, B. C., Canada.
VE9DN-VE9DR	Canadian Marconi Co., Box 1690, Montreal, Quebec, Can.
VE9CA	Toronto General Trusts Building, Calgary. Alberta, Canada.
CRCX	Rural Route No. 4, Bowmanville, Ontario, Canada.
VE9HX	P. O. Box 998, Halifax, N. S., Canada.
CFU	Radio Station CFU, Rossland, B.C., Canada.

CUBA, MEXICO, CENTRAL AMERICA AND WEST INDIES

CMA-3 CMB-2	Cuba Transatlantic Radio Corp., Apartado No. 65, Havana, Cuba.
COKG	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	P. O. Box 98, Havana, Cuba.
COCD	"La Vox 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, P. O. Box 423, Santiago de los Caballeros, R. D.
HI2D	Radiodifusora HI2D, Association C'ca Dominicana, Ciudad, Trujillo, R. D.
HI3C	Radiodifusora HI3C, Sr. Roberto Bernado, Prop., La Ramona, R.D.
HI3U	Radiodifusora HI3U, Apartado 23, Santiago de los Caballeros, R. D.
HI4D	Radiodifusora HI4D, "La Voz de Quisqueya," Ciudad Trujillo, R. D.
HI4V	Radio HI4V, La Voz de la Marina, P. O. Box 824, Ciudad Trujillo, R. D.
HI5E	Radiodifusora Ozama, Ciudad Trujillo, R. D.
HI5N	Radio HI5N, La Voz del Almacen Dominicano, Santiago de los Caballeros, R. D.
HI7P	Sr. J. M. Roques, R. Director, Ciudad Trujillo, R. D.
HI8A	Mayor E. Valverde, Director, Ciudad Trujillo, R. D.
HI8Q	Abbes and Garcia, Owners, Ciudad Trujillo, R. D.
HI9B	Sr. J. L. Sanchez, Director, Apartado 95, Santiago de los Caballeros, R. D.
HH2T HH2S	Societe Haitienne de Radiodiffusion, P. O. Box 103, Port-au-Prince, Haiti.
HH3W	Radiodifusora HH3W, P. O. Box A117, Port-au-Prince, Haiti.
HIG	Sr. A. Cordero, P. Director, Radiodifusora HIG, Ciudad Trujillo, R.D.
HIH	Radio HIH, "Las Voz del Higuamo," San Pedro de Macoris, R. D.
HIL	Radio HIL, Apartado 623, Ciudad Trujillo, R. D.
HIX	Radio HIX, J. R. Saladin, Director of Radio Communication, Ciudad Trujillo, R. D.
HI1J	Radiodifusora HI1J, Apartado 204, San Pedro de Macoris, R. D.
HIT	La Voz de la RCA-Victor, Apartado 1105, Ciudad Trujillo, R. D.
HIZ	Radiodifusora HIZ, Calle Duarte No. 68, Ciudad Trujillo, R. D.
HP5B	Radio HP5B, P. O. Box 910, Panama City, Panama.
HP5F	La Voz de Colon, Hotel Carlton, Colon, Panama.
HP5J	La Voz de Panama, Apartado 867, Panama City, Panama.
HP5K	Radiodifusora HP5K, La Voz de la Victor, P. O. Box 33, Colon, 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-TGWA	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 800, San Jose, Costa Rica.
TIRCC	Radioemisora Catolica Costaricense, Apartado 1064, San Jose, Costa Rica, C. A.
HRD	Radiodifusora HRD, La Voz de Atlantida, La Ceiba, Honduras, C. A.
HRN	Radio HRN, La Voz de Honduras, Tegucigalpa, Honduras.
HRP1	Manuel Escota, Director y Gerente, San Pedro, Sula, Honduras.
VPN	Station VPN, Nassau, Bahama Islands.
WTDV-WTDX	Donald S. Boreham, Supt. of Public Works, St. Thomas, Virgin Islands.
WTDW	H. N. McKenzie, Supt. of Public Works, Christiansted, St. Croix, Virgin Islands.
ZFB-ZFD	Engineer-In-Charge, Wireless Receiving Station, Devonshire, Bermuda.
XAM	Director General de Correos, Merida, Yucatan, Mexico.
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	Estacion Difusora XEVI, P. O. laciones Exteriories, Mexico, D. F.
XEFT	Radio XEFT, La Voz de Vera Cruz, Av. Independencia 28, Vera Cruz, Mexico.
XEUW	Radiodifusora XEUW, Av. Independencia 98, Vera Cruz, Mexico.
XEME	Radiodifusora XEME, Calle 59, Num. 517, Merida, Yucatan, Mexico.
XEWI	Estacion Difusora XEWI, P. O. Box 2874, Mexico, D. F.
XEXA	Secretaria de Educacion Publica, Mexico, D. F.
YNA	Tropical Radio Telegraph, Managua, Nicaragua, C. A.
YNLF	Radiodifusora YNLF, c/o Ing. Moises Le Franc Calle 15 de Set No. 206, Managua, Nicaragua.
YNVA	Radiodifusora YNVA, Managua, Nicaragua.

EUROPE

2RO	5 Via Montello, Rome, Italy.
CSL	Radio CSL, Emissora National, Lisbon, Portugal.
CT1AA	Antonio Augusto de Aguair, 144, Lisbon, Portugal.
CT1CT	Oscar G. Lomelino, Rua Gomez Freire 79-2 D, Lisbon, Portugal.
CT1GO	Portuguese Radio Club, Parede, Portugal.
SPW	Polskie Radio, 5, Mazowiecka St., Warsaw, Poland.
DAN	Hauptfunkstelle Nordeich, Norden-Land, Germany.
DJA, et al.	German Short Wave Station, Broadcasting House, Berlin, Ger.
Dutch Phones	Parkstaat 29, S'Gravenhage, Holland.
EAQ	Estacion EAQ, P. O. Box 951, Madrid, Spain.
EA8AB	Radio Club Tenerefe, Alvarez de Lugo 1, Apartado 225, Santa Cruz de Tenerife, Canary Islands.

(Continued on page 302)

SHORT-WAVE STATION LIST

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

KC	Meters	Call	Location	Time
55500	5.41	W8XKA	● Pittsburgh, Pa.	2-10 P.M. daily
55500	5.41	W1XKA	● Boston, Mass.	Sunday 7-11 A.M., 4 P.M.-12 A.M. Daily 11 A.M.-9 P.M.
31600	9.4	W8XWJ	● Detroit, Mich.	Sunday 2:30-7:30 P.M. Daily 6:15 A.M.-12:30 P.M., 2-5 P.M., 7-10 P.M.
24380	12.3	CRCX	● Bowmanville, Ont.	Experimental
21540	13.92	W8XK	● Pittsburgh, Pa.	6 A.M.-8 A.M. Daily
21520	13.94	W2XE	● Wayne, N. J.	6:30 A.M.-12 noon Daily
21500	13.95	NAA	Washington, D. C.	(E) Time signals
21470	13.97	GSH	● Daventry, England	6-8:45 A.M. Sundays 3:25-8:45 A.M.
21420	14.01	WKK	Lawrenceville, N. J.	(P) Phones LSN - PSA daytime; HJY-OCI-OCJ irregular
21160	14.19	LSL	Buenos Aires, Arg.	(P) Phones GAA mornings; DFB-DHO PSE-EHY irreg.
21140	14.19	KBI	Manila, P. I.	(P) Tests and relays P. M. irregular
21080	14.23	PSA	Rio de Janeiro, Brazil	(P) Phones WKK-WLK daytime
21060	14.25	KWN	Dixon, Calif.	(P) Phones afternoon irregular
21020	14.29	LSN	Buenos Aires, Arg.	(P) Phones WKK-WLK daily; EHY, FTM irregular
20860	14.38	EHY	Madrid, Spain	(P) Phones LSM-PPU-LSY mornings
20860	14.38	EDM	Madrid, Spain	(P) Phones LSM-PPU-LSY mornings
20835	14.40	PFF	Kootwijk, Holland	(P) Phones Java days
20830	14.40	PFF	Kootwijk, Holland	(P) Phones Java days
20825	14.41	PFF	Kootwijk, Holland	(P) Phones Java days
20820	14.41	KSS	Bolinas, Calif.	(P) Phones Far East A.M.
20380	14.72	GAA	Rugby, England	(P) Phones LSL mornings; LSY-LSM-PPU irregular
20040	14.97	OPL	Leopoldville, Belgian Congo, Africa	(P) Tests with ORG mornings and noon
20020	14.99	DHO	Nauen, Germany	(P) Phones PPU-LSM-PSA-LSL-YVR A.M.
19987	15.01	CFA	Drummondville, Que.	(P) Phones North America irregular
19980	15.02	KAX	Manila, P. I.	(P) Phones KWU evenings; DFC-JVE A.M.; early A.M.
19820	15.14	WKN	Lawrenceville, N. J.	(P) Phones GAU A.M.
19720	15.21	EAQ	Madrid, Spain	(P) Relays & tests A.M.
19680	15.24	CEC	Santiago, Chile	(P) Phones OCI-HJY afternoons
19600	15.31	LSF	Buenos Aires, Arg.	(P) Phones and tests irregularly
19530	15.36	EDR2	Madrid, Spain	(P) Phones LSM-PPU-YVR mornings
19530	15.36	EDX	Madrid, Spain	(P) Phones LSM-PPU-YVR mornings
19520	15.37	IRW	Rome, Italy	(P) Phones LSM-PPU mornings. Broadcasts irregularly
19500	15.40	LSQ	Buenos Aires, Arg.	(P) Phones daytime irregularly
19355	15.50	FTM	St. Assisse, France	(P) Phones LSM-PPU-YVR mornings
19345	15.52	PMA	Bandoeng, Java	(P) Phones PCK-PDK early mornings
19270	15.57	PPU	Rio de Janeiro, Brazil	(P) Phones DFB-EHY-FTM mornings
19235	15.60	DFA	Nauen, Germany	(P) Phones HSP-KAX early mornings
19220	15.61	WKF	Lawrenceville, N. J.	(P) Phones GAS-GAU mornings
19200	15.62	ORG	Brussels, Belgium	(P) Phones OPL A.M.
19160	15.66	GAP	Rugby, England	(P) Phones Australia A.M.
19140	15.68	LSM	Buenos Aires, Arg.	(P) Phones DFB-FTM-GAA-GAB A.M.
18970	15.81	GAQ	Rugby, England	(P) Phones ZSS A.M.
18960	15.82	WQD	Rocky Point, N. Y.	(E) Tests LSY irreg.
18950	15.83	HBF	Geneva, Switzerland	(E) Phones So. A. M.
18920	15.85	WQE	Rocky Point, N. Y.	(E) Programs, irreg.
18910	15.86	JVA	Nazaki, Japan	(P) Phones and tests irregularly with Europe
18890	15.88	ZSS	Klipheuvel, So. Africa	(P) Phones GAQ-GAU mornings
18830	15.93	PLE	Bandoeng, Java	(P) Phones PCV mornings early; KWU evenings
18680	16.06	OCI	Lima, Peru	(P) Phones CEC-HJY days; WKK-WOP noon
18620	16.11	GAU	Rugby, England	(P) Phones VWY-ZSS early A.M.; Lawrenceville, daytime
18545	16.18	PCM	Kootwijk, Holland	(P) Relays and phones Java early A.M.
18540	16.19	PCM	Kootwijk, Holland	(P) Relays and phones Java early A.M.
18535	16.20	PCM	Kootwijk, Holland	(P) Relays and phones Java early A.M.
18480	16.23	HBH	Geneva, Switzerland	(E) Relays to N. Y. mornings irreg.
18440	16.25	HJY	Bogota, Colombia	(P) Phones CEC-OCI noon; music irreg.
18410	16.29	PCK	Kootwijk, Holland	(P) Phones PLE-PMC early A.M.
18405	16.30	PCK	Kootwijk, Holland	(P) Phones PLE-PMC early A.M.
18400	16.31	PCK	Kootwijk, Holland	(P) Phones PLE-PMC early A.M.
18388	16.31	FZS	Saigon, Indo-China	(P) Phones FTK early mornings
18340	16.36	WLA	Lawrenceville, N. J.	(P) Phones GAS A.M.
18310	16.38	GAS	Rugby, England	(P) Phones WLA-WMN mornings
18295	16.39	YVR	Maracay, Venezuela	(P) Phones DFB-EHY-FTM mornings
18270	16.42	ETA	● Addis Ababa, Ethiopia	Irregular
18250	16.43	FTO	St. Assise, France	(P) Phones LSM-LSY mornings
18220	16.46	KUS	Manila, P. I.	(P) Phones Bolinas nights
18200	16.48	GAW	Rugby, England	(P) Relays and phones N. Y. irreg.
18190	16.49	JVB	Nazaki, Japan	(P) Phones Java early mornings
18180	16.51	CGA	Drummondville, Que.	(P) Phones GBB A.M.
18135	16.54	PMC	Bandoeng, Java	(P) Phones PCK-PCV early A.M.
18115	16.56	LSY3	Buenos Aires, Arg.	(E) Phones DFB-FTM-GAA-PPU A.M.; evening broadcasts occasionally
18075	16.59	PCV	Kootwijk, Holland	(P) Phones PLE early mornings
18070	16.60	PCV	Kootwijk, Holland	(P) Phones PLE early mornings
18065	16.61	PCV	Kootwijk, Holland	(P) Phones PLE early mornings
18060	16.61	KUN	Bolinas, Calif.	(P) Phones Manila afternoons and nights
18040	16.63	GAB	Rugby, England	(P) Phones LSM noon
18020	16.65	KQJ	Bolinas, Calif.	(P) Phones afternoons; irregular
17980	16.69	KQZ	Bolinas, Calif.	(E) Tests and relays to LSY irreg.
17940	16.72	WQB	Rocky Point, N. Y.	(E) Tests with LSY A.M.
17920	16.74	WQF	Rocky Point, N. Y.	(P) Phones Ethiopia irregular
17900	16.76	WLL	Rocky Point, N. Y.	(E) Relays to Geneva and Germany, A.M.
17850	16.81	LSN	Buenos Aires, Arg.	(P) Phones S. A. irreg.
17790	16.86	GSG	● Daventry, England	Daily 6-8:45 A.M., 9 A.M.-12 noon. Sundays 3:25-8:45 A.M.
17780	16.87	W3XAL	● Bound Brook, N. J.	8 A.M.-4 P.M. Daily
17780	16.87	W9XAA	● Chicago, Ill.	Irreg. Before 8 A.M., 4-6 P.M. or special
17775	16.88	PHI	● Huizen, Holland	8-10:30 A.M. ex. Tues. and Wed.
17760	16.89	DJE	● Zeesen, Germany	6:30-11:00 A.M. and exp.
17750	16.91	IAC	Pisa, Italy	(P) Phones and tests to ships A.M.
17740	16.91	HSP	Bangkok, Siam	(P) Phones DFA-DGH-KAY early A.M.
17710	16.94	CJA-3	Drummondville, Que.	(P) Phones Australia and Far East early A.M.
17699	16.95	IAC	Pisa, Italy	(P) Phones and tests to ships A.M.
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	DAN	Nordenland, Germany	(P) Phones ships A.M.
17120	17.52	WOO	Ocean Gate, N. J.	(P) Phones ships daytime
17120	17.52	WOY	Lawrenceville, N. J.	(P) Phones England irregularly
17080	17.56	GBC	Rugby, England	(P) Phones ships daytime
16910	17.74	JZD	Nazaki, Japan	(P) Phones ships irreg.
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.
16140	18.59	GBA	Rugby, England	(P) Phones Argentina & Brazil irreg.
16117	18.62	IRY	Rome, Italy	(P) Phones Cairo, Asmara and others, broadcasts A.M. and early P.M.

KC	Meters	Call	Location	Time
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 A.M.
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 days
15620	19.21	JVF	Nazaki, Japan	(P) Phones KWO-KWU after 4 P.M.
15595	19.24	DFR	Nauen, Germany	(E) Tests and relays mornings irreg.
15505	19.36	CMA-3	Havana, Cuba	(P) Phones and tests irregularly
15490	19.37	KEM	Bolinas, Calif.	(P) Phones Java and China; irregular
15475	19.39	KKL	Bolinas, Calif.	(P) Phones Manila and Japan; irregular
15460	19.41	KKR	Bolinas, Calif.	(P) Phones Manila and Japan; irregular
15430	19.44	KWE	Bolinas, Calif.	(P) Tests JYK-JYT-PLE evenings
15415	19.46	KWO	Dixon, Calif.	(P) Phones JVF evenings
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.	10 A.M.-2 P.M. daily
15310	19.60	GSP	● Daventry, England	6-8 P.M. daily
15305	19.60	CP7	La Paz, Bolivia	(E) Relays CP4 tests daytimes
15290	19.62	LRU	● Buenos Aires, Arg.	6 A.M.-10 P.M. Daily
15280	19.63	DJQ	● Zeesen, Germany	12:30 A.M.-7 A.M. daily
15270	19.64	W2XE	● Wayne, N. J.	12 noon-4 P.M. Daily
15260	19.66	GSI	● Daventry, England	12:15 P.M.-5:45 P.M.
15252	19.67	RIM	Tashkent, USSR.	(P) Phones RKI early mornings
15244	19.68	TPA2	● Pontoise, France	4:55-10 A.M. Daily
15220	1971	PCJ	● Eindhoven, Holland	Tuesday and Wednesday 8-10:30 A.M.
15210	19.72	W8XK	● Pittsburgh, Pa.	8 A.M.-6 P.M. Daily
15200	19.74	DJB	● Zeesen, Germany	3:50-11 A.M.
15180	19.76	GSO	● Daventry, England	12:15-5:45 P.M. Daily
15140	19.82	GSF	● Daventry, England	9 A.M.-12 noon Daily
15121	19.84	HVJ	● Vatican City, Vatican	10:30-10:45 A.M. weekdays
15110	19.85	DJL	● Zeesen, Germany	5:45-7:30 A.M. daily
15055	19.92	WNC	Hialeah, Fla.	(P) Phones daytime
15040	19.95	RKI	Moscow, USSR.	(P) Phones RIM early A.M.; broadcasts irreg.
15040	19.95	HIR	Ciudad Trujillo, R. D.	(P) Phones WNC days
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.
14790	20.28	RIZ	Irkutsk, USSR.	(P) Calls RKI 9:30 A.M.
14770	20.31	WEB	Rocky Point, N. Y.	(E) Tests with Europe; irregular
14730	20.37	IQA	Rome, Italy	(P) Phones Japan and Egypt; sends music at times
14690	20.42	PSF	Rio de Janeiro, Brazil	(P) Phones LSL-WLK-WOK daytime
14653	20.47	GBL	Rugby, England	(P) Phones Nazaki early A.M.
14620	20.52	EHY	Madrid, Spain	(P) Phones LSM mornings irreg.
14620	20.52	EDM	Madrid, Spain	(P) Phones PPU-PSA-PSE mornings
14600	20.55	JVH	Nazaki, Japan	(E) Phones DFB-GTJ-PCJ-TYB early mornings and B.C. music
14590	20.56	WMN	Lawrenceville, N. J.	(P) Phones England days
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 days
14485	20.71	TIU	Cartago, Costa Rica	(P) Phones WNC days
14485	20.71	YNA	Managua, Nicaragua	(P) Phones WNC days
14485	20.71	HPF	Panama City, Panama	(P) Phones daytime
14485	20.71	HRM	Tela, Honduras	(P) Phones WNC days
14485	20.71	TGF	Guatemala City, Guatemala	(P) Phones WNC days
14480	20.72	PLX	Bandoeng, Java	(P) Phones Europe irreg.
14470	20.73	WMF	Lawrenceville, N. J.	(P) Phones England daytime
14460	20.75	DZH	● Zeesen, Germany	12-2 P.M.
14440	20.78	GBW	Rugby, England	(P) Phones Lawrenceville daytime
14410	20.80	DIP	Zeesen, Germany	(E) Experimental; 12-4:30 P.M.
14236	21.07	HB9B	● Basle, Switzerland	Monday, Thursday, Friday 4-6 P.M.
14100	21.25	HJ5ABE	● Cali, Colombia	11:00 A.M.-12 noon daily Sun. 6:00-10:30 P.M.
13990	21.44	GBA2	Rugby, England	(P) Phones Argentina & Brazil irreg.
13900	21.58	WQP	Rocky Point, N. Y.	(E) Test daytime
13820	21.70	SUZ	Cairo, Egypt	(P) Phones DFC-DGU-GBB daytime
13780	21.77	KKW	Bolinas, Calif.	(P) Special relays; tests afternoon and evening
13745	21.83	CGA-2	Drummondville, Que.	(P) Phones Europe irreg.
13738	21.82	RIS	Tiflis, USSR.	(P) Tests with Moscow irregular
13720	21.87	KLL	Bolinas, Calif.	(P) Special relays; tests afternoon and evening
13690	21.91	KKZ	Bolinas, Calif.	(P) Tests Japan and Java early A.M.; days Honolulu
13667	21.98	HJY	Bogota, Colombia	(P) Phones CEC afternoons
13653	21.97	SPW	● Warsaw, Poland	11:30 A.M.-12:30 P.M. Mon., Wed., Fri.
13610	22.04	JYK	Kemikawa-Cho, Japan	(E) Tests irregular A.M.
13595	22.07	GBB2	Rugby, England	(P) Phones Canada days
13585	22.08	GBB	Rugby, England	(P) Phones CGA3-SUV-SUZ daytime
13560	22.12	JVI	Nazaki, Japan	(P) Phones Manchukuo irregularly
13465	22.28	WKC	Rocky Point, N. Y.	(E) Tests and relays; irregular
13435	22.33	WKD	Rocky Point, N. Y.	(E) Tests and relays; irregular
13415	22.36	GCJ	Rugby, England	(P) Tests with JVH afternoons
13390	22.40	WMA	Lawrenceville, N. J.	(P) Phones GAS-GBS-GBU-GBW daily
13380	22.42	IDU	Asmara, Eritrea, Africa	(P) Phones Italy; early A.M. and sends music
13345	22.48	YVQ	Maracay, Venezuela	(P) Phones WNC-HJB days
13285	22.58	CGA3	Drummondville, Que.	(P) Phones England days
13240	22.66	KBJ	Manila, P. I.	(P) Phones nights and early A.M.
13220	22.70	IRJ	Rome, Italy	(P) Phones Japan 5-8 A.M., and works Cairo days
13180	22.76	DGG	Nauen, Germany	(P) Relays to Riverhead days
13075	22.95	VPD	● Suva, Fiji Islands	Mon. to Fri. inc. 12:30-1:30 A.M.
13020	23.04	JZE	Nazaki, Japan	(P) Phones ships irreg.
13000	23.08	FYC	Paris, France	(P) Phones CNR A.M.
12985	23.11	DFC	Nauen, Germany	(P) Phones KAY-SUV SUZ early A.M.
12865	23.32	IAC	Pisa, Italy	(P) Phones ships irreg.
12860	23.33	RKR	Novosibirsk, USSR.	(P) Daily, 7 A.M.
12840	23.36	WOO	Ocean Gate, N. J.	(P) Phones ships days
12830	23.37	HJC	Barranquilla, Colombia	(P) Phones HJB-HPF WNC days
12830	23.38	HJA-3	Barranquilla, Colombia	(P) Phones HJB-HPF-WNC days
12830	23.38	CNR	● Rabat, Morocco	Special broadcasts irreg.
12830	23.38	CNR	Rabat, Morocco	(P) Phones FYB-TYB-FTA irreg. days
12800	23.44	IAC	Pisa, Italy	(P) Phones ships and tests Tripoli, irreg.
12780	23.47	GBC	Rugby, England	(P) Phones VWY early A.M.
12394	24.21	DAN	Nordenland, Germany	(P) Phones ships irreg. mornings
12300	24.39	PLM	Bandoeng, Java	(P) Phones 2ME near 6:30 A.M.
12295	24.40	ZLU	Wellington, N. Z.	(P) Phones ZLJ early A.M.
12290	24.41	GBU	Rugby, England	(P) Phones Lawrenceville days
12280	24.43	KUV	Manila, P. I.	(P) Phones early A.M.
12250	24.49	TYB	Paris, France	(P) Phones JVH-XGR and ships irreg.
12235	24.52	TFJ	Reykjavik, Iceland	(P) Phones England days
12235	24.52	TFJ	● Reykjavik, Iceland	English broadcast each 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
12150	24.69	GBS	Rugby, England	(P) Phones Lawrenceville days
12130	24.73	DZE	● Zeesen, Germany	7-9 P.M.
12100	24.79	CJA	Drummondville, Que.	(P) Tests VIY early A.M. and evenings
12060	24.88	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings

KC	Meters	Call	Location	Time
12055	24.89	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12050	24.90	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12035	24.93	HBO	Geneva, Switzerland	(E) Relays programs & phones irreg.
12020	24.95	VIY	Rockbank, Australia	(P) Tests CJA6 early A.M. and evenings
12000	25.00	RNE	● Moscow, USSR.	Sundays 6-7 A.M., 10-11 A.M., 4-5 P.M.; Mon. 4-5 P.M.; Wed. 6-7 A.M., 4-5 P.M.; Friday 4-5 P.M.
11991	25.02	FZS	Saigon, Indo-China	(P) Phones FTA - FTK early A.M.
11955	25.09	ETB	● Addis Ababa, Ethiopia	Sunday 4:30-4:50 P.M.
11950	25.11	KKQ	Bolinas, Calif.	(P) Relays programs to Hawaii eve.
11940	25.13	FTA	St. Assise, France	(P) Phones FZS - FZR early A.M.
11935	25.14	YNA	Managua, Nicaragua	(P) Cent. and S. A. stations, days
11900	25.21	XEWI	● Mexico City, Mexico	Same as 5975 K.C.
11880	25.23	TPA3	● Pontoise, France	1-4 A.M., 10:15 A.M.-5 P.M. daily
11875	25.26	YDB	● Soerabaja, Java	5:30-11:30 A.M.; 5:45-6:45 P.M.; 10:30 P.M.-1:30 A.M.
11870	25.26	W8XK	● Pittsburgh, Pa.	4-8 P.M. daily
11855	25.31	DJP	● Zeesen, Germany	12-2 P.M. daily
11830	25.36	W2XE	● Wayne, N. J.	4-9 P.M. daily
11830	25.36	W9XAA	● Chicago, Ill.	Week days 6:30 A.M.-5 P.M. Sunday 8 A.M.-5 P.M.
11810	25.40	2RO4	● Rome, Italy	8:15-10:30 A.M., 11:30 A.M.-12:15 P.M. daily. Weekdays, News 1:20-1:35 P.M.
11800	25.40	HJ4ABA	● Medellin, Colombia	11:30 A.M.-1 P.M.; 6:30-10:30 P.M.
11795	25.43	DJO	● Zeesen, Germany	3-4:20 P.M. daily
11790	25.43	W1XAL	● Boston, Mass.	Sunday 2:30-3:45 P.M.; Mon. to Fri. inc. 4-5:15 P.M.
11770	25.49	DJD	● Zeesen, Germany	11:35 A. M.-4:20 P.M.-4:50-10:45 P.M.
11750	25.53	GSD	● Daventry, England	9 A.M.-12 noon; 12:15-5:45 P.M., 6-8 P.M., 9-11 P.M., 11:30 P.M.-1:30 A.M. daily
11720	25.60	CJRX	● Winnipeg, Manitoba	Week days 6-12 M.; Sun. 3-10 P.M.
11720	25.60	TPA4	● Pontoise, France	5:15 P.M.-12 A.M. daily
11630	25.68	KIO	Kahuku, Hawaii	(P) Phones Far East early A.M.
11670	25.62	PPQ	Rio de Janeiro, Brazil	(P) Phones WCG-WET-LSX evenings
11660	25.73	JVL	Nazaki, Japan	(P) Phones Taiwan eve.
11570	25.93	HH2T	● Port-au-Prince, Haiti	Sp'l programs irreg.
11538	26.00	XGR	Shanghai, China	(P) Tests irregularly
11500	26.09	XAM	Merida, Mexico	(P) Phones XDF-XDM-XDR irreg.
11495	26.10	VIZ3	Rockbank, Australia	(P) Tests CJA4 early A.M.
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
11050	27.15	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	8:15-10:30 P.M. irreg.
10975	27.35	OCI	Lima, Peru	(P) Phones CEC - HJY days
10975	27.35	OCP	Lima, Peru	(P) Phones HKB early evenings
10940	27.43	TTH	St. Assise, France	(P) Phones So. America irreg.
10910	27.50	KTR	Manila, P. I.	(P) Phones DFC early A.M. irreg.
10850	27.63	DFL	Nauen, Germany	(P) Relays programs afternoons irreg.
10840	27.68	KWV	Dixon, Calif.	(P) Phones Japan, Manila, Hawaii, A.M.
10795	27.79	GCL	Rugby, England	(P) Phones Japan days
10790	27.80	YNA	Managua, Nicaragua	(P) Phones So. America days, irreg.
10770	27.86	GBP	Rugby, England	(P) JYS and XGR irreg.; Phones VLK early A.M. & P.M.
10740	27.93	JVM	● Nazaki, Japan	4-7:30 A.M. irregular
10675	28.10	WNB	Lawrenceville, N. J.	(P) Phones ZFB daytime
10670	28.12	CEC	Santiago, Chile	(P) Phones HJY - OCI daytime
10670	28.12	CEC	● Santiago, Chile	Daily except Thurs. and Sat. 7-7:20 P.M.; Thur. & Sun. 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. irreg.; Mon. & Thurs. 4-5 P.M.
10620	28.25	WEF	Rocky Point, N. Y.	(E) Relays program service irregularly
10620	28.25	EHX	Madrid, Spain	(P) Phones CEC and EHZ afternoons
10610	28.28	WEA	Rocky Point, N. Y.	(E) Tests Europe irreg.
10550	28.44	WOK	Lawrenceville, N. J.	(P) Phones LSN - PSF - PSH-PSK nights
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 N. Am. 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 A.M., and special programs irreg.
10410	28.82	PDK	Kootwijk, Holland	(P) Phones PLV 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) Programs, irreg.
10375	28.92	JVO	Nazaki, Japan	(P) Manchuria and Dairen early A.M.
10370	28.93	EHZ	Madrid, Spain	(P) Phones EHX days
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 B.A. evenings
10300	29.13	LSQ	Buenos Aires, Arg.	(P) Phones GCA - HJY - PSH afternoons
10300	29.13	LSL	Buenos Aires, Arg.	(P) Phones GCA - HJY - PSH afternoons. Broadcasts irreg.
10290	29.15	DZC	● Zeesen, Germany	Used irregularly
10290	29.15	HPC	Panama City, Panama	(P) Phones C. A. and S. Am. daytime
10260	29.24	PMN	Bandoeng, Java	(P) Tests VLJ early A.M.; broadcasts 6:30-10 A.M.
10250	29.27	LSK3	Buenos Aires, Arg.	(P) Afternoons
10220	29.35	PSH	Rio de Janeiro, Brazil	(P) Phones LSL-WOK evenings; special pgm. service irreg.
10169	29.50	HSG	Bankok, Siam	(P) Phones DGH early A.M.
10160	29.53	RIO	Bakou, USSR.	(P) Phones RIR-RNE irreg. A.M.; News irreg. 11 P.M.-3 A.M.
10140	29.59	OPM	Leopoldville, Belg-Congo	(P) Phones ORK afternoons
10080	29.76	RIR	Tiflis, USSR.	(P) Phones RIM-RKI 7-11 A.M.
10070	29.79	EHY	Madrid, Spain	(P) Phones YVR afternoons
10055	29.84	ZFB	Hamilton, Bermuda	(P) Phones WNB days
10055	29.84	SUV	Cairo, Egypt	(P) Phones DFC-DGU-GCA-GCB days
10042	29.87	DZB	● Zeesen, Germany	2-4 P.M.
10040	29.88	HJA3	Barranquilla, Colombia	(P) Tests early evenings irreg.
9990	30.03	KAZ	Manila, P. I.	(P) Phones JVQ-KWX-PLV early A.M.
9966	30.08	IRS	Rome, Italy	(P) Tests irregularly
9950	30.13	GBU	Rugby, England	(P) Phones WNA evenings
9930	30.21	HKB	Bogota, Colombia	(P) Phones CEC - OCP - PSH - PSK afternoons
9930	30.21	HJY	Bogota, Colombia	(P) Phones LSQ afternoons
9890	30.33	LSN3	Buenos Aires, Arg.	(P) Phones WOK-WLK; broadcasts evenings irregular
9870	30.40	WON	Lawrenceville, N. J.	(P) Phones and tests; England irreg.
9870	30.40	JYS	● Kemikawa-Cho, Japan	4-7 A.M. irregular
9860	30.43	EAQ	● Madrid, Spain	Saturday 12-2 P.M.; daily 5:15 to 9:30 P.M.
9840	30.47	JYS	Kemikawa-Cho, Japan	(E) Tests irregular
9830	30.50	IRM	Rome, Italy	(P) Phones JVP - JZT - LSX-WEL A.M.
9810	30.58	DFE	Nauen, Germany	(P) Relays and tests afternoons irreg.
9800	30.59	GCW	Rugby, England	(P) Phones Lawrenceville eve. and nights
9800	30.59	LSI	Buenos Aires, Arg.	(P) Relays very irreg.
9760	30.74	VLJ	Sydney, Australia	(P) Phones PLV - ZLT early A.M.
9760	30.74	VLZ	Sydney, Australia	(P) Phones PLV - ZLT early A.M.
9750	30.77	WOF	Lawrenceville, N. J.	(P) Phones GCU irreg.
9710	30.88	GCA	Rugby, England	(P) Phones LSL afternoons
9700	30.93	LQA	Buenos Aires, Arg.	(P) Tests and relays early evenings
9675	31.00	DZA	● Zeesen, Germany	5-7 P.M.
9650	31.09	CT1AA	● Lisbon, Portugal	Tues., Thurs., Sat.. 3:30-6 P.M.

KC	Meters	Call	Location	Time
9650	31.09	YDB	●Soerabaja, Java	5:30-11:30 A.M.; 5:45-6:45 P.M.; 10:30 P.M. to 1:30 A.M.
9635	31.13	2RO3	●Rome, Italy	Daily 1-5 P.M.; Mon., Wed., Fri., American Hour, 6-7:30 P.M.; Tues., Thurs., Sat., South Am. Hour, 6-7:45 P.M.
9630	31.15	CFA5	Drummondville, Que.	(P) Phones No. America days
9620	31.17	DGU	Nauen, Germany	(P) Phones SUV A.M. Relays irreg.
9620	31.17	FZR	Saigon, Indo-China	(P) Phones Paris early A.M.
9600	31.25	HJ1ABP	●Cartagena, Colombia	Daily 6-11 P.M.
9600	31.25	CB960	●Santiago, Chile	7-10 P.M. week days
9595	31.27	HBL	●Geneva, Switzerland	Saturday 5:30-6:15 P.M.
9595	31.27	HH3W	●Port-au-Prince, Haiti	1-2 P.M., 7-8:30 P.M.; Sunday 12-1 P.M.
9590	31.28	W3XAU	●Philadelphia, Pa.	11 A.M.-7 P.M. daily
9590	31.28	VK2ME	●Sydney, Australia	Sunday 12-2 A.M., 5-9 A.M., 11:30 A.M.-1:30 P.M.
9590	31.28	HP5J	●Panama City, Panama	11:30 A.M.-1 P.M., 7:00-10 P.M.; Sundays 6:30-10:30 P.M.
9590	31.28	PCJ	●Eindhoven, Holland	Sun. 1-2 P.M., 7-8 P.M.; Mon. 7-8 P.M.; Wed. 7-10 P.M.
9580	31.31	GSC	●Daventry, England	6-8 P.M., 9-11 P.M. daily
9580	31.31	VK3LR	●Melbourne, Australia	Mon., Tues., Wed., Thur., 3:15-7:30 A.M.; Fri., 10:30 P.M.-2 A.M.; Sat., 5-7:30 A.M.
9580	31.31	LRX	●Buenos Aires, Arg.	6 A.M.-10 P.M. daily
9570	31.33	W1XK	●Boston, Mass.	Week days 6 A.M.-12 midnight; Sunday 7 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	31.38	DJA	●Zeesen, Germany	12:30 A.M.-3:00 A.M., 8:05 A.M.-11 A.M., 4:50 P.M.-10:45 P.M.
9553	31.40	CQN	●Macao, China	Mon. & Fri. 7-8:30 A.M.
9545	31.44	HH2R	●Port-au-Prince, Haiti	Sp'l programs irreg.
9540	31.45	DJN	●Zeesen, Germany	12:30 A.M.-3:50 A.M. 3:50-11 A.M., 4:50-10:45 P.M.
9530	31.48	W2XAF	●Schenectady, N. Y.	4 P.M.-12 A.M. daily
9520	31.51	XEME	●Merida, Yucatan, Mex.	10 A.M.-3:30 P.M., 5:30-11 P.M.
9515	31.53	LKJ1	●Jeloy, Norway	5-8 A.M., 11 A.M.-6 P.M. daily
9510	31.55	GSB	●Daventry, England	12:15-5:45 P.M., 11:30 P.M.-1:30 A.M. daily
9510	31.55	VK3ME	●Melbourne, Australia	Mon.-Sat. 4:30-7:00 A.M.
9510	31.55	HJU	●Buenaventura, Colombia	12-2 P.M., 8-11 P.M., Mon., Wed., Fri.
9505	31.56	XEFT	●Vera Cruz, Mexico	Same as 6120 KC.
9501	31.56	PRF5	●Rio de Janeiro, Brazil	4:45-5:45 P.M. daily; 9-10:45 P.M. irreg.
9500	31.58	XGOX	●Nanking, China	Week days 6:30-8:40 A.M.; Sundays, 7:30-9:30 A.M.
9500	31.58	HI5E	●Ciudad Trujillo, R. D.	6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
9490	31.61	KEI	Bolinas, Calif.	(P) Phones Indo-China and China A.M.
9480	31.65	PLW	Bandoeng, Java	(P) Phones Australia early A.M.
9480	31.65	KET	Bolinas, Calif.	(P) Phones WEL evenings & nights
9470	31.68	WET	Rocky Point, N. Y.	(E) Tests LSX-PPM-ZFD evenings
9460	31.71	ICK	Tripoli, Africa	(P) Phones Italy A.M.
9450	31.75	TGWA	●Guatemala City, Guate.	Daily ex. Sun. 12-2 P.M., 8-9 P.M., 10 P.M.-12 A.M.; Sun., 12 noon-2 P.M., 12 A.M.-6 A.M.
9430	31.80	YVR	Maracay, Venezuela	(P) Tests mornings
9428	31.81	COCH	●Havana, Cuba	Week days 8 A.M.-12 midnight; Sundays 12-1 P.M., 8-10 P.M.
9415	31.86	PLV	Bandoeng, Java	(P) Phones PCV-PCK-PDK-VLZ-KWX-KWV early A.M.
9400	31.92	XDR	Mexico City, Mexico	(P) Phones XAM irreg. days
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 reasonally
9170	32.72	WNA	Lawrenceville, N. J.	(P) Phones GBS-GCU-GCS afternoons
9147	32.79	YVR	Maracay, Venezuela	(P) Phones EHY afternoons
9125	32.88	HAT4	●Budapest, Hungary	600-7:00 P.M. Sundays
9110	32.93	KUW	Manila, P. I.	(P) Tests and phones early A.M.
9091	33.00	CGA-5	Drummondville, Que.	(P) Phones Europe days
9020	33.26	GCS	Rugby, England	(P) Phones Lawrenceville afternoons
9010	33.30	KEJ	Bolinas, Calif.	(P) Relays programs to Hawaii eve.
8975	33.42	CJA5	Drummondville, Que.	(P) Phones Australia nights, early A.M.
8975	33.43	VWY	Poona, 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 New York early evenings
8790	34.13	HKV	Bogota, Colombia	(E) Tests early evenings and nights
8790	34.13	TIR	Cartago, Costa Rica	(P) Phones Cent. America daytime
8790	34.13	HKV	●Bogota, Colombia	6:00-11:00 P.M. irregular
8775	34.19	HCJB	●Quito, Ecuador	Sunday 4-10:45 P.M.; Tues. to Sat., inc., 7-10 P.M. or later
8775	34.19	PNI	Makasser, D. E. I.	(P) Phones PLV early mornings
8760	34.35	GCQ	Rugby, England	(P) Phones ZSR afternoons
8750	34.29	ZBW	●Hong Kong, China	130-3:15 A.M., 6 A.M.-12 noon
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	●Camaguey, Cuba	7:45-9:00 P.M. weekdays. Sundays irreg.
8650	34.68	WVD	Seattle, Wash.	(P) Tests irregularly
8590	34.92	YNVA	●Managua, Nicaragua	1-2:30 P.M., 7:30-10 P.M. daily
8560	35.05	WOO	Ocean Gate, N. J.	(P) Phones ships days
8500	35.29	JZF	Nazaki, Japan	(P) Phones ships irreg.
8470	35.39	DAN	Nordenland, Germany	(P) Phones ships irreg.
8404	35.70	HC2CW	●Guayaquil, Ecuador	7:30-11 P.M. ex. Sunday
8380	35.80	IAC	Pisa, Italy	(P) Phones ships irreg.
8190	36.65	PSK	Rio de Janeiro, 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 A.M.
8110	37.00	ZP10	●Ascunsion, Paraguay	8:00-10:00 P.M.
8075	37.15	WEZ	Rocky Point, N. Y.	(E) Program service P.M.; irregular
8035	37.33	CNR	Rabat, Morocco	(P) Phones France nights
8035	37.33	CNR	●Rabat, Morocco	Special broadcasts irreg.
7970	37.64	XGL	Shanghai, China	(P) Tests early mornings
7968	37.65	HSJ	Bankok, Siam	(P) Tests early A.M.
7960	37.69	VLZ	Sydney, Australia	(P) Phones ZLT early A.M.
7920	37.88	GCP	Rugby, England	(P) Phones VLK irreg.
7900	37.97	LSL	Buenos Aires, Arg.	(P) Phones PSK-PSH evenings
7890	38.02	CJA-2	Drummondville, Que.	(P) Phones Australia nights
7880	38.05	JYR	Kemikawa-Cho, Japan	(E) Tests and relays irregularly
7860	38.17	SUX	Cairo, Egypt	(P) Phones GCB afternoons
7855	38.19	LQP	Buenos Aires, Arg.	(P) Tests evening irreg.
7854	38.19	HC2JSB	●Guayaquil, Ecuador	9 A.M.-1:30 P.M., 6-11:15 P.M.
7840	38.27	PGA	Kootwijk, Holland	(P) Phones Java irreg.
7835	38.29	PGA	Kootwijk, Holland	(P) Phones Java irreg.
7830	38.31	PGA	Kootwijk, Holland	(P) Phones Java irreg.
7797	38.47	HBP	●Geneva, Switzerland	5:30-6:15 P.M. Saturdays.
7790	38.49	YNA	Managua, Nicaragua	(P) Phones Cent. & So. America daytime
7780	38.56	PSZ	Rio de Janeiro, Brazil	(P) Tests LSX early evenings
7770	38.61	PDM	Kootwijk, Holland	(P) Special relays to E. Indies
7765	38.63	PDM	Kootwijk, Holland	(P) Special relays to Dutch Indies
7760	38.66	PDM	Kootwijk, Holland	(P) Special relays to E. Indies
7740	38.76	CEC	Santiago, Chile	(P) Phones evenings to 8:30 P.M.
7735	38.78	PDL	Kootwijk, Holland	(P) Special relays to E. Indies
7730	38.81	PDL	Kootwijk, Holland	(P) Special relays to E. Indies
7715	38.39	KEE	Bolinas, Calif.	(P) Relays programs to Hawaii seasonally
7669	39.11	TGF	Guatemala City, Guat.	(P) Phones TIU-HPF daytime
7626	39.31	RIM	Tashkent, USSR.	(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 A.M.

KC	Meters	Call	Location	Time
7565	39.66	KWY	Dixon, Calif.	(P) Phones Shanghai early mornings
7550	39.74	TI8WS	●Puntarenas, Costa Rica	5:30-6:30, 7:30-9:30 P.M.
7520	39.89	KKH	Kahuku, Hawaii	(P) Tests KEE evenings; Phones KWX-KWV nights
7518	39.90	RKI	Moscow, USSR.	(P) Phones RIM early mornings
7510	39.95	JVP	●Nazaki, Japan	(P) Tests Point Reyes early A.M.; broadcasts Mon. and Thurs. 4-5 P.M.
7500	40.00	CFA-6	Drummondville, Que.	(P) Phones N. America days
7470	40.16	JVQ	Nazaki, Japan	(P) Relays and phones early A.M.; broadcasts Monday and Thursday 4-5 P.M.
7470	40.16	HJP	Bogota, Colombia	(P) Phones HJA3-YVQ early evenings
7445	40.30	HBQ	Geneva, Switzerland	(E) Relays special B.C. evenings irreg.
7430	40.38	ZLR	Wellington, N. Z.	(P) Phones VLJ early mornings
7400	40.45	WEM	Rocky Point, N. Y.	(E) Special relays evenings
7390	40.60	ZLT-2	Wellington, N. Z.	(P) Phones Sydney 3-7 A.M.
7385	40.62	OEK	Wein, Austria	(P) Tests early evenings very irreg.
7380	40.65	XECR	●Mexico City, Mexico	Sundays 7-8 P.M.; occasionally later
7370	40.71	KEQ	Kahuku, Hawaii	(P) Relays programs evenings
7345	40.84	GDL	Rugby, England	(P) Phones Japan irreg. A.M.
7282	41.20	HJ1ABD	●Cartagena, Colombia	11:15 A.M.-1:15 P.M., Sun. Weekdays 7:15-9:15 P.M.
7245	41.41	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	Sat. 10:10-11:10 A.M.
7080	42.37	VP3MR	●Georgetown, Br. Guiana	Sun. 7:45-10:15 A.M.; Weekdays 4:45-8:45 P.M.
7074	42.48	HJ1ABK	●Barranquilla, Colombia	3-6 P.M. Sunday
7000	42.86	PZH	●Paramaribo, D. Guiana	S. A. Sun. 9:45-11:45 A.M.; Mon. & Fri. 5:45-9:45 P.M.; Tues. and Thurs. 2:45-4:45 P.M., 8:45-10:45 P.M.; Wed. 3:45-4:45, 5:45-9:45 P.M.; Sat. 2:45-4:45 P.M.
6990	42.92	JVS	Nazaki, Japan	(P) Phones China mornings early
6977	43.00	HI3C	●La Ramona, R. D.	11:40 A.M.-1:40 P.M., 4:40-8:40 P.M.; Sat. 11:40 P.M.-1:40 A.M.
6950	43.17	WKP	Rocky Point, N. Y.	(E) Relays programs evenings
6950	43.17	GBY	Rugby, England	(P) Phones U.S.A. irreg.
6905	43.45	GDS	Rugby, England	(P) Phones WOA-WNA-WCN evenings
6900	43.48	HI2D	●Ciudad Trujillo, R. D.	Daily 6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
6895	43.51	HCETC	●Quito, Ecuador	8:15-10:30 P.M. ex. Sun.
6890	43.54	KEB	Bolinas, Calif.	(P) Tests KAZ-PLV early A.M.
6880	43.60	CGA-7	Drummondville, Que.	(P) Phones Europe days
6860	43.73	KEL	Bolinas, Calif.	(P) Tests KAZ-PLV early A.M.
6845	43.83	KEN	Bolinas, Calif.	(P) Used irregularly
6830	43.92	CFA	Drummondville, Que.	(P) Phones N. Amer. nights
6814	44.03	HIH	●San Pedro de Macoris, R. D.	Sunday 3-4 A.M. 12:30-3 P.M. 4-5 P.M. Week days 12:15-2 P.M. 7-8:30 P.M.
6800	44.12	HI7P	●Ciudad Trujillo, R. D.	Daily 6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
6795	44.15	GAB	Rugby, England	(P) Phones Canada irreg.
6760	44.38	CJA-6	Drummondville, Que.	(P) Phones Australia early A. M.
6755	44.41	WOA	Lawrenceville, N. J.	(P) Phones GDW-GDS-GCS evenings
6750	44.44	JVT	Nazaki, Japan	(P) Phones JOAK irregular; Phones Point Reyes at times
6750	44.44	JVT	●Nazaki, Japan	1:45-2:15 A.M. 4-7:45 A.M. 5-5:20 P.M. 7-7:15 P.M. 9:45 P.M. 11:45 P.M.
6725	44.60	WQO	Rocky Point, N. Y.	(E) Tests evenings irreg.
6720	44.64	YVQ	Maracay, Venezuela	(P) Phones and relays N. Y. evenings
6720	44:64	YVQ	●Maracay, Venezuela	8-9 P.M. Saturdays
6718	44.66	KBK	Manila, P. I.	(P) Phones A. M. seasonally
6701	44.71	TIEP	●San Jose, Costa Rica	7:00-10:00 P.M. daily
6690	44.84	CGA-6	Drummondville, Que.	(P) Phones Europe irregularly
6680	44.91	DGK	Nauen, Germany	(P) Relays to Riverhead evenings irreg.
6650	45.11	GBY	Rugby, England	(P) Phones U.S.A. irreg.
6650	45.11	IAC	Pisa, Italy	(P) Phones ships irreg.
6635	45.00	HC2RL	●Guayaquil, Ecuador	5:45-7:45 P.M. Sunday, 9:15-11:15 P.M. Tues.
6630	45.25	HIT	●Ciudad Trujillo, R.D.	12:10-1:40 P.M., 6:10-8:40 P.M. ex. Sun. Sat. DX 11:40 P.M.-12:40 A.M.
6618	45.33	Prado	●Riobamba, Ecuador	Thursday 9:00-11:15 P.M.
6570	45.66	YV11RB	●Ciudad de Bolivar, Venez.	7-11 P.M. irreg.
6555	45.75	HI4D	●Ciudad Trujillo, R.D.	12:15-2:00 P.M., 5:00-8:00 P.M. except Sun.
6550	45.81	TIRCC	●San Jose, Costa Rica	Daily 12-2 P.M. 6-7 P.M. Thurs. Extra 7-10 or 11 P.M. Sunday 11 A.M.-1 P.M. 8-10 P.M.
6520	46.01	YV6RV	●Valencia, Venezuela	10:30 A.M.-1:30 P.M., 5:30-9:30 P.M. daily
6500	46.15	HIL	●Ciudad Trujillo, R.D.	12-2 P.M., 6-8 P.M.
6490	46.30	HJ5ABD	●Cali, Colombia	7:00-10:00 P.M. ex. Sun.
6480	46.30	HI8A	●Ciudad Trujillo, R. D.	Daily ex. Sunday 8:40-10:40 A.M., 2:40-4:40 P.M.
6451	46.50	HJ4ABC	●Ibague, Colombia	7-10 P.M. ex. Sunday
6451	46.50	YNLF	●Managua, Nicaragua	8-9 A.M., 1-3 P.M., 6:30-10:30 P.M. daily
6450	46.51	HI4V	●Ciudad Trujillo, R.D.	11:40 A.M.-1:40 P.M., 5:10-6:40 P.M. daily
6447	46.51	HJ1ABB	●Barranquilla, Colombia	1145 A.M.-1:00 P.M., 5:30-10:00 P.M. daily
6425	46.69	W9XBS	●Chicago, Ill.	Not regular. Usually Tuesday and Thursday 1:00-5:00 P.M.
6420	46.70	HI1S	●Puerto Plata, R.D.	11:40 A.M.-1:40 P.M. 5:40-7:40 P.M.
6420	46.70	W3XL	●Bound Brook, N. J.	No regular schedule
6415	46.77	HJA3	Barranquilla, Colombia	(P) Phones HJA2 evenings
6400	46.88	YV9RC	●Caracas, Venezuela	7-11 P.M. irreg.
6385	46.99	TIPG	●San Jose, Costa Rica	6:00-11 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
6316	47.50	HIZ	●Ciudad Trujillo, R.D.	Daily 11:30 A.M.-2:45 P.M., 5:30 P.M.-9 P.M. Sat. to 10 & 11 P.M.
6300	47.62	YV12RM	●Maracay, Venezuela	6:30-9:30 P.M. ex. Sun.
6280	47.69	CO9WR	●Sancti-Spiritus, Cuba	9-10 A.M., 12-1 P.M., 4-6 P.M., 9-11 P.M. daily
6280	47.77	HIG	●Ciudad Trujillo, R.D.	7:10-8:40 A.M., 12:40-2:10 P.M., 8:10-9:40 P.M.
6275	47.81	HJ1ABH	●Cienaga, Colombia	Broadcasts and phones. Irregular evenings
6240	48.08	HI8Q	●Ciudad Trujillo, R. D.	Daily 6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
6235	48.10	OCM	Lima, Peru	(P) Phones afternoons
6235	48.00	HRD	●La Ceiba, Honduras	8-11 P.M. daily; Saturday to 12 A.M.
6230	48.15	HJ4ABJ	●Ibague, Colombia	8:00-11 P.M.
6230	48.15	OAX4G	●Lima, Peru	7-11 P.M. daily
6182	48.53	HI1A	●Santiago de Caballeros, R. D.	Daily 11:40 A.M.-1:40 P.M., 7:40-9:40 P.M.
6171	48.61	XEXA	●Mexico City, Mex.	8-11:30 A.M., 3-6 P.M., 7-11 P.M. daily
6170	48.62	HJ3ABF	●Bogota, Colombia	11 A.M.-2 P.M. 6-11 P.M.
6165	48.66	YV3RC	●Caracas, Venezuela	10:30 A.M.-1:30 P.M. 4:30-10:00 P.M.
6150	48.78	HJ5ABC	●Cali, Colombia	Daily 11:00 A.M.-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	Week days 6 P.M.-12 A. M. Sundays 3-10 P.M.
6150	48.78	GBT	Rugby, England	(P) Phones U.S.A. days
6150	48.78	HI5N	●Santiago de los Caballeros, R. D.	Daily 6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
6150	48.78	CB615	●Santiago, Chile	12-1 P.M. 8:30-9:30 P.M.
6150	48.78	COKG	●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.	8 P.M.-12 A.M. daily
6137	48.88	CR7AA	●Lourenco Marques, Africa	12:45-3 P.M. daily; 8-10:30 A.M. Sundays
6135	48.90	HJ4ABP	●Medellin, Colombia	6-10:30 P.M.
6130	48.94	ZGE	●Kuala Lumpur, S.S.	Sun., Tues. Fri. 6:40-8:40 A.M.
6130	48.94	TGX	●Guatemala City, Guat.	Irreg.
6130	48.94	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	48.94	VE9HX	●Halifax, Nova Scotia	9 A.M.-11 P.M. daily
6130	48.94	LKJ1	●Jeloy, Norway	10:00 A.M.-6:00 P.M.
6122	49.00	HJ3ABX	●Bogota, Colombia	11 A.M.-2 P.M., 7-11 P.M.
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.	9-10 P.M. daily

KC	Meters	Call	Location	Time
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.
6100	49.18	W9XF	● Chicago, Illinois	Sun., Tues., Thurs., Fri. 8 P.M.-1 A.M. Mon., Wed., Sat. 12 -1 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.	Week day 4:30-10:30 P. M. Sundays 12 noon-8 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.
6090	49.26	HJ4ABE	● Medellin, Colombia	11 A.M.-12 noon, 6-10:30 P.M. daily
6080	49.34	W9XAA	● Chicago, Ill.	Daily 5 P.M.-12 A.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. 6:30-9:30 P.M. daily
6080	49.34	CP5	● LaPaz, Bolivia	11:30 A.M.-1 P.M., 6-7:45 P.M., 8:30-11 P.M. weekdays; Sunday 3:30-6:00 P.M.
6080	49.34	HP5F	● Colon, Panama	Daily ex. Sunday 11:45 A.M.-1 P.M.: 7:45-10 P.M.; Sun. 10:45 A.M.-11:30 A.M.; 4-6 P.M.
6079	49.35	DJM	● Zeesen, Germany	7:30-9:30 P.M.
6072	49.41	OER2	● Vienna, Austria	Weekdays 9 A.M.-5 P.M. Saturdays to 6 P.M.
6070	49.42	VE9CS	● Vancouver, B.C.	6:00-7:00 P.M. Sunday 1:45 P.M.-1:00 A.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. Sun. 6:30 A. M.-7 P.M., 10 P.M.-1:30 A.M. Sundays, 7 A.M.-7 P.M., 10 P. M.-12:30 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.	7-10 P.M. daily
6060	49.50	VQ7LO	● Nairobi, Kenya Colony, Africa	5:45-6:15 A.M., 11 A.M.-2 P.M.
6060	49.50	OXY	● Skamleback, Denmark	1-6:30 P.M. Sunday 10 A.M.-6:30 P.M.
6050	49.59	HJ3ABD	● Bogota, Colombia	Daily 9-11 A.M., 12-2 P. M., 6-11 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	HI9B	● Santiago de los Caballeros. R. D.	Daily 6:10-9:40 P.M.; Sat. 11:40 P.M.-12:40 A.M.
6040	49.67	PRA8	● Pernambuco, Brazil	9:30-11:30 A.M., 2:30-8:30 P.M.
6040	49.67	YDA	● Tandjonprick, Java	5:30-11:30 A.M., 5:45-6:45 P.M., 10:30 P.M.-1:30 A.M.
6040	49.67	W4XB	● Miami, Florida	Daily 12-2:30 P.M.; Mon.. Wed.. Fri., Sat., 8:30-10:30 P.M.; Sun., Tues., Thurs., 9:15-10:30 P.M.
6040	49.67	W1XAL	● Boston, Mass.	Sun., 4-6 P.M.; Mon., Tues., Thurs., 6-8 P.M.
6030	49.75	HP5B	● Panama City, Panama	12 noon-1 P.M., 8-10:30 P.M.
6030	49.75	PGD	Kootwijk, Holland	(P) Phones Java and E. Indies irreg.
6030	49.75	VE9CA	● Calgary, Alberta, Canada	7 P.M.-1 A.M.
6025	49.79	PGD	Kootwijk, Holland	(P) Phones Java and E. Indies irreg.
6020	49.83	PGD	Kootwijk, Holland	(P) Phones Java and E. Indies irreg.
6020	49.83	DJC	● Zeesen, Germany	11:35 A.M.-4:20 P.M.,
6020	49.83	XEUW	● Vera Cruz, Mexico	10 P.M.-1 A.M. daily
6015	49.88	HI3U	● Santiago de los Caballeros, R.D.	Week days 7:10-8:40 A. M., 10:40 A.M.-1:40 P.M., 4:40-9:40 P.M. Sundays 10:40 A.M.-1:40 P.M. only.
6012	49.90	HJ3ABH	● Bogota, Colombia	11:30 A.M.-2 P.M., 6-11 P.M., Sun. 4-11 P.M.
6011	49.91	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., 7-10:30 P.M.; Sun., 1-2 A.M.
6005	49.96	HP5K	● Colon, Panama	7:30-9 A.M., 12-1 P.M., 6-9 P.M.
6005	49.96	VE9DR	● Montreal, Que.	Week days 7 A.M.-12 A. M. Sunday 8 A.M.-10:15 P.M.
6005	49.96	VE9DN	● Montreal, Que.	Used irregularly
6000	50.00	XEBT	● Mexico City, Mexico	10 A.M.-1:45 A.M.
6000	50.00	RV59	● Moscow, USSR.	Sun., Mon., Wed., Fri., 4-6 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	● Ciudad Trujillo, R. D.	Mon. to Sat., 12:10-1:10 P.M., 4:40-5:40 P.M.; Tues. & Fri also 8:10-10:10 P.M.; Sunday 7:40-9:40 A.M.
5975	50.20	XEWI	● 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 M.; Fri. 3-4 P.M., 9 P.M.-12 M.; Sat. 9-10 P.M.
5970	50.25	HJ2ABC	● Cucuta, Colombia	11 A.M.-12 noon, 6:30-9:00 P.M.
5969	50.26	HVJ	● Vatican City, Vatican	2-2:15 P.M., Sunday 5-5:30 A.M.
5950	50.42	HJN	● Bogota, Colombia	8-10:45 P.M. irregular
5940	50.51	TG2X	● Guatemala City, Guat.	Daily 4-6 P.M., 10 P.M.-12 A.M.
5910	50.76	HH2S	● Port-au-Prince, Haiti	7-10 P.M.
5900	50.85	YV8RB	● Barquisimeto, Venezuela	12-1 P.M., 6-10 P.M.
5885	50.98	HCK	● Quito, Ecuador	Mon. & Fri. 9-11 P.M.
5880	51.02	ETG	● Addis Ababa, Ethiopia	Used irregularly
5875	51.11	HRN	● Tegucigalpa, Honduras	Week Days 12-1:30 P.M., 6-7:30 P.M., 8-11:15 P.M.; Sun., 3-5 P.M., 6-7:30 P.M., 8-11:15 P.M. and later
5865	51.15	HI1J	● San Pedro de Macoris, R. D.	Daily 6:25-7:40 A.M., 11:40 A.M.-1:40 P.M., 4:40-9:40 P.M.
5853	51.20	WOB	Lawrenceville, N. J.	(P) Phones ZFA P.M.
5850	51.28	YV5RMO	● Maracaibo, Venezuela	11:30 A.M.-1 P.M., 5:30-10:00 P.M.
5850	51.28	GBT	Rugby, England	(P) Phones U.S.A. irreg.
5845	51.33	KRO	Kahuku, Hawaii	(P) Tests early mornings
5830	51.46	TIPGH	● San Jose, Costa Rica	8-11 P.M. daily ex. Sun.
5825	51.50	HJA2	Bogota, Colombia	(P) Phones HJA3 afternoons irreg.
5800	51.72	KZGF	Manila, P. I.	(P) Tests A.M. irreg.
5800	51.72	YV2RC	● Caracas, Venezuela	8:30 A.M.-9:30 P.M. Sundays; 10:45 A.M.-1:30 P.M., 4:30-9:30 P.M. week days
5790	51.81	JVU	Nazaki, Japan	(P) Phones JZC early mornings
5780	51.90	CMB-2	Havana, Cuba	(P) Phones and tests irregularly
5780	51.90	OAX4D	● Lima, Peru	9-11:30 P.M. Wed., Sat.
5760	52.08	HJ4ABD	● Medellin, Colombia	10:30 A.M.-1 P.M., 6-11 P.M.
5750	52.17	XAM	Merida, Mexico	(P) Phones XDR - XDF early evenings
5730	52.36	JVV	Nazaki, Japan	(P) Phones JZC early A.M.
5725	52.40	HC1PM	● Quito, Ecuador	Tuesdays 9-11 P.M.
5720	52.45	YV10RSC	● San Cristobal, Venez.	11 A.M.-12 N., 6-8:30 P.M.
5713	52.51	TGS	● Guatemala City, Guat.	6-9 P.M. irreg.; Sun. 6-8 P.M.
5705	52.59	CFU	Rossland, Canada	(P) Phones CFO and CFN evenings; news 8:30-8:45 P. M.
5670	52.91	DAN	Nordenland, Germany	(P) Phones ships irreg.
5500	54.55	TI5HH	● San Ramon, Costa Rica	3:30-5 P.M., 8-9:30 P.M. daily
5445	55.10	CJA7	Drummondville, Que.	(P) Phones Australia early A.M.
5435	55.20	LSH	Buenos Aires, Arg.	(P) Relays LR4 and tests evenings
5410	55.45	ZBW	● Hong Kong, China	1:30-3:15 A.M., 6 A.M.-12 N.
5400	55.56	HJA7	Cucuta, Colombia	(P) Phones irreg.; broadcasts music in evening at times
5400	55.56	HJA7	● Cucuta, Colombia	Monday 4-8 P.M.
5395	55.61	CFA7	Drummondville, Que.	(P) Phones No. America irregular
5260	57.03	WQN	Rocky Point, N. Y.	(E) Program service; irregular
5140	58.37	PMY	● Bandoeng, Java	Daily 4:45-10:45 A.M., 5:45 P.M.-2:15 A.M.
5110	58.71	KEG	Bolinas, Calif.	(P) Phones irregularly evenings
5080	59.08	WCN	Lawrenceville, N. J.	(P) Phones GDW evenings seasonally
5025	59.76	ZFA	Hamilton, Bermuda	(P) Phones WOB evenings
5040	59.25	RIR	Tiflis, USSR.	(P) Phones afternoons irregular
5015	59.82	KUF	Manila, P. I.	(P) Phones Bolinas; irregular
4975	60.30	GBC	Rugby, England	(P) Phones ships afternoon and nights
4905	61.16	CGA8	Drummondville, Que.	(P) Phones GDB - GCB afternoons
4820	62.20	GDW	Rugby, England	(P) Phones WCN-WOA evenings
4810	62.37	YDE2	● Solo, D. E. I.	5:30-11:30 A.M., 5:45-6:45 P.M., 10:30 P.M.-1:30 A.M.

In Writing For Veries

[*Continued from page 295*]

EHY-EDM	Piy Margall 2, Madrid, Spain.
English Phones	Engineer-in-Chief's Office (Radio Branch), G.P.O. Armour House, London, E. C. 1.
English Ships	Connaught House, 63, Aldwych, London, W. C. 2, England.
TFJ	Icelandic State Broadcasting Service, P. O. Box 547, Reykjavik, Iceland.
French Phones	166 Rue de Montmartre, Paris, France.
G6RX	Rugby Radio, Hillmorton, Warwickshire, England.
GSA-GSH, et al.	British Broadcasting Corporation, Broadcasting House, London, W. 1, England.
HAS-HAT	Director Radio, Hungarian Post, Gyali St. 22, Budapest, Hungary.
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 IRG-IQA	Italo Radio, Via Calabria N. 46/48, Rome, Italy.
LKJ1	Ministere Du Commerce, Administrator des Telegraphes, Oslo, Norway.
OER2	Radio OER2, Vienna, Austria.
ORK-ORG	Director de Communications, Bruxelles, Belgium.
OXY	Statsradiofonien Heibergsgade 7, Copenhagen, Denmark.
PCJ	Philips Radio PCJ, Eindhoven, Holland.
PHI	Phillips Radio PHI, Huizen, Holland.
PIIJ	Radio Station PI1J, Dr. M. Hellingman, Owner and Operator, Dordrecht, Holland.
TPA2-3-4	Minister des Postes, Boulevard Haussman, 98 Bis., Paris, France.
RNE-RV59	Radio Centre, Solianka 12, Moscow, USSR.

SOUTH AMERICA

CEC	Cia Internacional de Radio, Casilla 16-D, Santiago, Chile.
CB960	Radiodifusora CB960, Casilla 1342, Santiago, Chile.
CP5	Radio CP5, Casilla 637, La Paz, Bolivia.
El Prado	Apartado 98, Riobamba, Ecuador.
HC1PM	Estacion "El Palomar" HC1PM, P. O. Box 664, Quito, Ecuador.
HC2ET	Estacion Radiodifusora del Diario El Telegrafo HC2ET, P. O. Box 824, Guayaquil, Ecuador.
HC2CW	Radiodifusora HC2CW, Casilla 1166, Guayaquil, Ecuador.
HC2JSB	Ecuador Radio Station HC2JSB, Juan S. Behr, Prop., Guayaquil, Ecuador.
HC2RL	Estacion HC2RL, P. O. Box 759, Guayaquil, Ecuador.
HCJB	Estacion HCJB, Casilla 691, Quito, Ecuador.
HCK	Radiodifusora Del Estado, HCK, Quito, Ecuador.
HJA7	Radio HJA7, Cucuta, Colombia.
HJ1ABB	Radio HJ1ABB, Apartado 715, Barranquilla, Colombia.
HJ1ABC	Radiodifusora HJ1ABC, La Voz de Quibdo, Quibdo, Colombia.
HJ1ABD	Estacion HJ1ABD, Cartagena, Colombia.
HJ1ABE	Radio HJ1ABE, Apartado 31, Cartagena, Colombia.
HJ1ABG	Radio HJ1ABG, Apartado 674, Barranquilla, Colombia.
HJ1ABJ	"La Voz de Santa Marta," Radio HJ1ABJ, Santa Marta, Colombia.
HJ1ABK	Radiodifusora HJ1ABK, Apartado 580, Barranquilla, Colombia.
HJ1ABP	Radiodifusora Cartagena, P. O. Box 37, Cartagena, Colombia.
HJ2ABA	"La Voz Del Paiz," Tunja, Boyaca, Colombia.
HJ2ABC	Pompilio Sanchez, Cucuta, Colombia.
HJ2ABD	Hector McCormick, Prop., Radiodifusora HJ2ABD, Calle 2A, No. 1205, Bucaramanga, Colombia.
HJ3ABD	Colombia Broadcasting, Apartado 509, Bogota, Colombia.
HJ3ABF	Radio HJ3ABF, Apartado 317, Bogota, Colombia.
HJ3ABH	"La Voz de La Victor," Apartado 565, Bogota, Colombia.
HJ3ABX	La Voz de Colombia, Radiodifusora HJ3ABX, Bogota, Colombia.
HJ4ABA	Emisora HJ4ABA, "Ecos de la Montana," Medellin, Colombia.
HJ4ABB	Radio Manizales, Apartado 175, Manizales, Colombia.
HJ4ABC	Radiodifusora HJ4ABC, "La Voz de Pereira," Pereira-Caldas, Colombia.
HJ4ABD	Radiodifusora HJ4ABD, La Voz de Citia, Medellin, Colombia.
HJ4ABE	Radiodifusora de Medellin, Medellin, Colombia.
HJ4ABC	Radiodifusora HJ4ABC, Ecos del Combeina, Apartado 39, Ibague, Colombia.
HJ4ABL	"Ecos de Occidente," P. O. Box 50, Manizales, Colombia.
HJ5ABC	"La Voz de Colombia," Radiodifusora HJ5ABC, Cali, Colombia.
HJ5ABD	"La Voz del Valle," Cali, Colombia.
HJ5ABE	Radiodifusora HJ5ABE, Apartado 50, Cali, Colombia.
HJB	Marconi Telegraph Co., Apartado 1591, Bogota, Colombia.
HJN	Ministero de Correos y Telegraph, Bogota, Colombia.
HJU	La Voz del Pacifico, Buenaventura, Colombia.
HJY	All-American Cables, Inc., Bogota, Colombia.
HKE	Observatoria Nacional de San Bartolome, Bogota, Colombia.
HKV	Radiodifusora HKV, Radio Dept.—War Ministry, Government of Colombia, Bogota, Colombia.
LSN-LSL, et al.	Compania Internacional, 143 Defensa, Buenos Aires, Argentina.
LSX	Transradio Internacional, San Martin 329, Buenos Aires, Argentina.
LRU-LRX	Radio El Mundo, Calle Maipu 555, Buenos Aires, Argentina.
OAX4D	Radiodifusora OAX4D, All-American Cables, Inc. (L. N. Anderson, Mgr.), Calle de San Antonio 677; Casilla 2336, Lima, Peru.
OAX4G	Radiodifusora OAX4G, Roberto Grellaud, Avda. Abancay 915-923, Lima, Peru.
OCI-OCJ	All-America Cables, Inc., Lima, Peru.
PPU-PPQ, et al.	Companhia Radiotelegraphica Brasileira, Caixa Postal 500, Rio de Janeiro, Brazil.
PRA8	Radio Station PRA8, Radio Club of Pernambuco; "The Voice of the North," Pernambuco, Brazil.
PRF5-PSK	Comp. Radio Internacional Do Brazil, P. O. Box 709, Rio de Janeiro, Brazil.
VP3MR	Radio Station VP3MR, No. 1 Wellington St., Georgetown, British Guiana.
YV2RC	Radio Caracas, P. O. Box 2009, Caracas, Venezuela.
YV3RC	Radiodifusora Venezuela YV3RC, Caracas, Venezuela.
YV4RC	Estacion S.A.R., Apartado 983, Caracas, Venezuela.
YV5RMO	Radio YV5RMO, Box 214, Maracaibo, Venezuela.
YV6RV	"La Voz de Carabobo," Radio YV6RV, Valencia, Venezuela.
YV8RB	Radiodifusora YV8RB, "La Voz de Lara," Barquisimeto, Venezuela.
YV10RSC	Radiodifusora YV10RSC, "La Voz del Tachira," San Cristobal, Venezuela.
YV12RM	Radiodifusora YV12RM, La Voz de Aragua, Maracay, Venezuela.
YVQ-YVR	Servicio Radiotelegraphico, Maracay, Venezuela.
ZP10	Radio Prieto ZP10, Asuncion, Paraguay.

UNITED STATES

Dixon Stations	140 Montgomery St., San Francisco, Cal.
W1XAL	World-Wide Broadcasting Corp., University Club, Boston, Mass.
W1XK	Westinghouse Electric & Mfg. Co., Springfield, 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 Bldg., Miami, Florida.
W8XAL	Crosley Radio Corp., Cincinnati, Ohio.
W8XK	Grant Bldg., Pittsburgh, Pa.
W9XAA	Navy Pier, Chicago, Ill.
W9XF-	20 N Wacker Drive, Chicago, Ill.
W9XBS-	Radio WVD, 517 Federal Office
WVD	Bldg., Seattle, Wash.

SHORT-WAVE STATION LIST

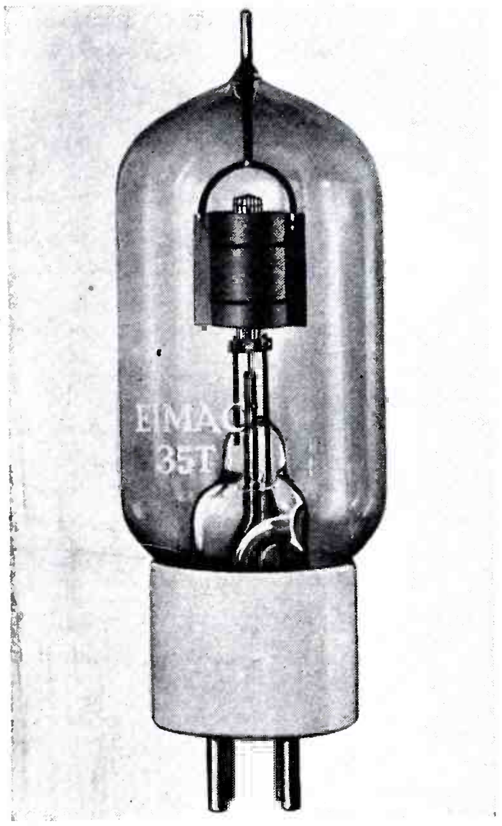
[*Continued from page 301*]

4795	62.56	VE9BK	● Vancouver, Canada	Week days 11:30-11:45 A.M., 3-3:15 P.M., 8-8:15 P.M.; Sat. 7:30-7:45 P.M.
4752	63.13	WOY	Lawrenceville, N. J.	(P) Tests irregularly
4752	63.13	WOO	Ocean Gate, N. J.	(P) Phones ships irreg.
4752	63.13	WOG	Lawrenceville, N. J.	(P) Phones Rugby irreg.
4600	65.22	HC2ET	● Guayaquil, Ecuador	9:15-10:45 P.M. Wed. & Sat.
4555	65.95	WDN	Rocky Point, N. Y.	(P) Tests Rome and Berlin evenings
4550	65.93	KEH	Bolinas, Calif.	(P) Phone; irreg.
4510	66.52	ZFS	Nassau, Bahamas	(P) Phones WND daily; tests GYD-ZSV irregular
4465	67.19	CFA2	Drummondville, Que.	(P) Phones No. Amer.; irregular days
4348	69.00	CGA9	Drummondville, Que.	(P) Phones ships and Rugby evenings
4320	69.40	GDB	Rugby, England	(P) Phones CGA8 and tests evenings
4295	69.90	WTDV	St. Thomas, Virgin Is.	(E) Weather reports, 8 A.M.-12 Noon; 3-6 P.M.
4295	69.90	WTDW	St. Croix, Virgin Is.	(E) Weather reports, 8 A.M.-12 Noon; 3-6 P.M.
4295	69.90	WTDX	St. John, Virgin Is.	(E) Weather reports, 8 A.M.-12 Noon; 3-6 P.M.
4273	70.21	RV15	● Khabarovsk, USSR.	Daily 12-10 A.M.
4272	70.22	WOO	Ocean Gate, N. J.	(P) Phones ships afternoons and eve.
4272	70.22	WOY	Lawrenceville, N. J.	(P) Tests evenings
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.

On the Market

Eimac 35T High-Mu Triode

THE EIMAC 35T High-Mu Low-Capacity General Purpose Triode was designed particularly for use in amateur transmitters. It is applicable to the following services: Class B audio, Class C final or doubler, crystal oscillator, and high-frequency oscillator.



The plate and grid of the 35T are fabcated from tantalum. The plate terminal is at the top of the glass envelope, as shown in the accompanying illustration. There are no internal insulators or spacers, the elements being both suspended and insulated by the glass press and envelope. The grid-plate capacity is only 2 mmfd.

A unique design of the grid, which is composed of vertical bars, permits definite savings in grid power. The filament is thoriated tungsten. The hard "Nonex" glass envelope permits maximum safe heat dissipation making possible the small physical size of the 35T, which is only 5½ inches high and 1¾ inches in diameter.

The filament draws 4 amperes at 5 volts. The amplification factor is 30. Plate dissipation is 35 watts. With 1500 volts plate, Class C r-f, 75% efficiency, the output is 112 watts, and two tubes Class B audio, 140 watts. With 500 volts plate, the respective Class C r.f. and Class B a.f. are 38 and 50 watts.

The 35T is manufactured by Eitel-McCullough, Inc., San Bruno, Calif. *All-Wave Radio.*

Cinaudagraph Dynamic Cone Speakers

THE CINAUDAGRAPH Corporation, Stamford, Conn., has developed a new type of self-powered or permanent-magnet dynamic speaker having a number of unique features which contribute to the frequency characteristics and overall efficiency of the units. For instance, the voice coil is made from a special quartz silicate ribbon on which is wound aluminum wire. The coil form has a wall thickness of only .002" and an overall thickness, including the voice coil, of .006" and weighs only a fraction of the conventional voice coil, it is said. The cone diaphragm has no voice coil orifice, thereby preventing air circulation or "breathing" around the voice coil at low notes, and also improves its efficiency at both the extreme high and low frequencies.

The contour of the cone surface is an ever-changing plane, made to conform to an exponential curve. This form contributes toward the prevention of parasitic vibrations.

In order to provide suitable motion of the diaphragm during the passage of very low frequencies, an improved type of suspension was developed. This suspension allows the diaphragm to float freely as well as keeping the voice coil in perfect alignment. This is accomplished by the use of an interlaced centering net instead of the usual spider support.

The Cinaudagraph speaker requires no electro-magnetic excitation. High magnetic densities, with small light-weight field structures are attained with the new permanent magnet alloy "Nipermag."

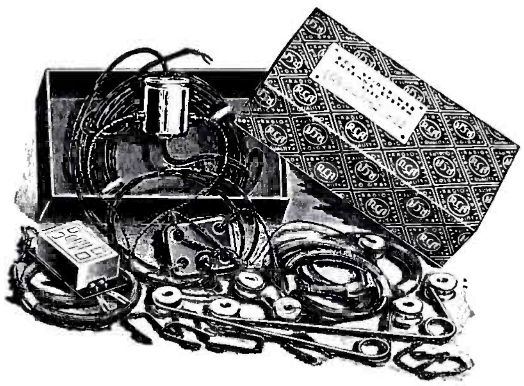
The flux densities of "Nipermag" vary with each speaker size. The 8-inch model, illustrated herewith, has a flux density of 7000 lines of force per square centimeter, and 13,000 lines for the largest, 18-inch speaker.

The Cinaudagraph speakers are manufactured in four sizes, namely, 8", 10", 12" and 18". Special models are available with "infinite baffles"—a type of housing of small dimensions which is said to provide the same frequency response and efficiency of a large baffle six or more feet square. *All-Wave Radio.*

RCA Spider-Web Antenna System

THE RCA Spider-Web Antenna consists of a series of doublet antennas and an improved transmission line to the receiver. It is so constructed that additional doublets may be added to increase the frequency range to 70,000 kc, or 4 meters.

The standard Spider-Web Antenna System covers the range from 140 to 23,000 kc with full noise reduction.



The antenna is completely assembled and soldered at the factory, which makes it possible to erect the antenna in a few minutes after providing supports. A span of 38 feet and a vertical clearance of 12 feet are the entire space requirements. Because double supports are eliminated, it is easier to install than the former double-doublet antenna systems, it is said. *All-Wave Radio.*

RCA Special Purpose Oscillographs

TO MEET THE demand from certain territories and for special applications, the RCA Parts Division has announced the addition of two new types of oscillograph instruments to its standard line of test equipment. These are a model operating on 25-cycle alternating current and a special "sweep" model.

Both are identical to the standard RCA Oscillograph except that one operates on the 25-cycle alternating current in use in some areas, and the other has a special sweep oscillator which extends from 4 cycles to 18,000 cycles. *All-Wave Radio.*

WORLD RADIO

[*Continued from page 289*]

longitudinal axis ot the cable, is kept in place by "styroflex" spiral; around both is a "styroflex" sleeve; then a sleeve of spiral wound flat copper bands held together with copper foil, then a linen sleeve and finally a lead jacket. How "styroflex" is made is not known. It is transparent, flexible and thin as paper. Cable will handle 4,000 kc. now occupied as follows: 100 talking bands, up to 1,000 kc.; television band from 1000 to 1500 kc., now used to produce 40,000 point pictures, or the equivalent of 180 lines 25-frame per second.

✦

Amateur International Link

FOLKESTONE, ENGLAND: Radio amateurs in this town have effected what is believed to be the first international two-way communication by non-professionals on 5 meters, their station G2FA, having established regular contacts with the French stations, F8NN and F8WY, of Boulogne.

MOOSE RIVER

[*Continued from page 288*]

different parts of the United States, giving suggestions which were well meant—it not always practical. Telegrams were received of encouragement and thanks for the service. Assistance in every way in keeping the world informed was given by The Canadian Radio Commission, the Canadian National, Canadian Pacific, Department of Marine, and Maritime Telephone officials, and never before in the history of the Station has such a wonderful demonstration of co-operation of all modern means of communication been shown.

In concluding the broadcast at 2:00 A.M. on Thursday, the 23rd, the Director of CHNS expressed his pleasure at the wonderful spirit and co-operation of all concerned, and paid tribute to the Station Operators and Remote Control Men, the different line Companys' broadcasting Engineers and Communication men whose names the public never hear, as well as the Announcers and Office Staff, who all worked together and ably assisted in making this a most successful effort from the broadcasting viewpoint.

In the days when the Moose River Gold Mine was the scene of much activity, Halifax was two days distant, no faster communication of any type was possible. How greatly all this has been changed by modern inventions—telephone and radio. Newspapers all over the world picked up their telephone receivers and called Moose River. No matter where they were—across the Atlantic or on this side, their voices were carried to that little village in Nova Scotia instantaneously.

CHNS and the Canadan Radio Commission in their half hour bulletins, which were carried on for several days through remote control apparatus and the local station, were able to notify the entire North American Continent direct from the scene of activity, and were able to send out messages of hope and comfort to their relatives and friends and explain the different rescue work and the heroic efforts being made by the miners. Millions of people who perhaps never heard of Moose River and probably even Nova Scotia, stayed up hour after hour to hear the radio accounts. In fact so great was the interest that at times the network included all the affiliated stations of the Canadian Radio Commission, the Columbia Broadcasting System, the National Broadcasting Company and the Mutual Broadcasting System, so that the announcer's voice covered the entire Continent and his words were available to 130,000,000 people at least.

Pictures Sent By Phone

In addition to the broadcasting and the work of the amateurs in supplying the Canadian Press, other press services were being served by radio, by the Canadian Marconi Company, and for the first time in the history of the Province pictures were being sent from Halifax to New York by telephone, from a room in the Lord Nelson Hotel alongside of the offices of CHNS. It is indeed a long way from the old method of communication, these scientific marvels of today, and it is gratifying to know that the broadcasting and communication men of Nova Scotia and all over the North American Continent were able to measure up to the demands of the waiting world and of bringing comfort and reassurance to the relatives most concerned, and of singing praises of the never-to-be-forgotten Nova Scotian Miners.

Appreciation

In closing, a word of thanks must be given to the general radio listening public, who all through this most trying time, sent messages of commendation for the service given, and refrained with very few exceptions, from calling up and asking unnecessary questions.

We are particularly grateful for the many letters already received from all over, and feel fully compensated for any extra work, by the expressions of appreciation from so many listeners. The spirit of cooperation shown by everyone, is indeed a matter to be proud of.

RADIO IN JAPAN

[*Continued from page 263*]

The time of signing-off varies daily according to the length of the above-mentioned items, but usually all "JO" and "JB" stations leave the air before 10 P. M. Japanese Time (8 A. M. Eastern Standard Time). "JF" stations sign-off at approximately 11 P. M. Japanese Time, while "JQ" and "MT" stations may remain on the air until 11:30 P. M.

Call-letters are announced at 6 A. M., 9 A. M., 6 P. M., and at sign-off (Japanese Time. "*Kochira wa Tokyo Chuo Hoso Kyoku de arimasu JOAK*" is a typical announcement, and, when translated into English, means "This is Tokyo Central Broadcast Station JOAK."

Best Listening Periods

Incidentally, it might be well to mention here that, from the writer's personal experience, Sundays and Holidays are the best days for logging Japanese stations as their programs are then quite varied and many stations can be heard operating independently of the chain.

Chain programs are relayed to the Taiwan, Chosen and Manchuokuo stations by short wave. The station used for these relays is located at Nazaki, Ibaraki Prefecture, and is owned and operated by the Kokusai-Denwa Kaisha, Ltd. (International Wireless Telephone Company of Japan, Ltd.). Transmitters used for this purpose have a power of 20 kilowatts and operate on the following frequencies: JVH (14.6 mc), JVM (10.74 mc), JVN (10.66 mc), JVP (7.51 mc), JVT (6.75 mc), and occasionally JZG (6.33 mc). The actual frequency used depends upon the time of day, season of year, etc. The daily service hours in G.M.T. for relaying JOAK follow:

0000-0010	Weather Forecast, Market Quotations
0240-0245	Market Quotations
0340-0410	News, Market Quotations
0650-0720	Market Quotations, News
0900-1300	Evening Program (previously listed)
2220-2240	Physical Exercise

Special Broadcasts

Baseball ranks very high among the popular sports of Japan. In Tokyo there are six 'versity teams which hold official matches in the spring and autumn months. All these games are relayed by JOAK from the Meiji Shrine ground. The broadcasts usually take place between 1:30 and 4 P. M.—or even as late at 5:30 P. M. Tokyo Time (11:30 P. M. to 2 or 3:30 A. M. Eastern Standard Time). The Nazaki stations, JVH, JVM or JVN, also relay the games. Although all announcing is in the Nipponese language, it is possible for an American listener to follow the games as many familiar baseball terms, such as "two strikes," "one ball," 'foul ball," "home-run," etc., can be distinctly heard. Color is added by the siren signals, cheering sections, and the excited voices of announcers.

Another short-wave program, known as the "Overseas Broadcast," is transmitted daily, over JVH or JVN, from 2 to 3 P. M. Japanese Time (12-Midnight to 1 A. M. Eastern Standard Time). These programs are designed especially for reception by Japanese subjects abroad, as well as for others interested in developments in the Far East and Japan in particular.

At the beginning and conclusion of each broadcast, and also during the intervals between various items on the program, suitable brief announcements in English and Japanese are made. Following a resume of the next day's program, the Japanese National Anthem or "Kimigayo" is played—concluding the broadcast. An identification signal is also used and consists of the first four bars of the "Kimigayo" played over and over on chimes.

The Broadcasting Corporation believes that, by means of these short-wave programs, they will be able to present a true and interesting glimpse of the real Japan to all listeners abroad. It is hoped that this introduction of Nipponese culture will tend to create a better understanding of Japan throughout the world.

Overseas Broadcasts

Items of the Overseas Broadcasts include music, lectures, relays from leading theatres and centers of amusement, news in Japanese and English, and various other forms of entertainment.

Whenever a ceremony or event of national or international importance takes place in Japan, the Broadcasting Corporation always makes it a point to put such happenings on the air in a nationwide hook-up. Such special events will also be broadcast abroad over the short-wave transmitters and announcements will be made in advance of these outstanding occurrences during the course of the regular daily programs.

Another "Overseas Broadcast," designed especially for reception in the eastern part of America, is transmitted each Tuesday and Friday, from 6 to 7 A. M. Japanese Time (4 to 5 P. M. Eastern Standard Time on Monday and Thursday). At present, this is being radiated simultaneously over JVN and JVP but, due to the experimental nature of the transmission, other frequencies may be used. It is quite likely that JVH and JVM will carry the broadcasts from time to time. This twice-weekly transmission may be put on a daily schedule in the future if tests prove satisfactory.

The Broadcasting Corporation is very anxious to hear from its overseas audience and welcomes any suggestions in regard to the program material and technical observations. Programs for the Overseas Broadcasts will be selected with care, designed to appeal to the greatest number of listeners. Reports of reception will be verified with beautiful cards and should be addressed to: Overseas Section, The Broadcasting Corporation of Japan, Hibiya Park, Tokyo, Japan.

'Phone Stations

The International Telephone Company also operates a short-wave station at Tyureki, Taiwan, to handle telephone traffic with Tokyo. According to a letter from Mr. Tokujiro Seki, operator of the station, the power output is about 6 kilowatts and the frequencies are JIA (15.74 mc), JIB (10.535 mc), and JIC (5.89 mc). This station may also be used occasionally to relay programs of the Formosan stations on occasions of special interest. The writer is quite pleased to possess the first verification of reception issued to an American listener by the Tyureki station.

A short-wave telephone station is located at Kanjoshi, Manchuokuo, but it is used only for traffic between Tokyo and Shinkyo (Hshinking). The station is owned and operated by the Manchuokuo Telegraph and Telephone Company, Ltd., and transmits with a power of 20 kilowatts on either TDD (5.83 mc) or TDE (10.065 mc).

In conclusion, the writer wishes to thank Mr. Akifusa Saito, operator of JOGK, Kumamoto; Mr. Atsushi Yamamoto, of Shinagawa-ku, Tokyo; Mr. S. Kuramochi, of the Kokusai-Denwa Kaisha, Ltd.; the Nippon Hoso Kyokai; and Mr. Tokujiro Seki, of the Tyureki station, for their kindness in supplying much of the above information.

GRUNOW MODEL 1241

[*Continued from page 291*]

the capabilities of the set as a high-fidelity instrument was had the evening of May 9th during the playing of Rimsky-Korsakow's *Capriccio Espagnaole*, by the Boston Symphony Orchestra. This work is particularly rich in tone values and the bells, cymbols, castinets and kettle drums were reproduced with surprising naturalness. The bells could not be heard in an average broadcast receiver in operation at the same time as the Grunow 1241. Moreover, each distinct tone of the kettle drums was reproduced through the 1241 with no apparent audio-frequency pull-in or lock with the low-frequency resonant point of the large loudspeaker. At one time only was such a condition noticeable and that was during the playing of a bass violin. In this instance. the few notes played were so close to the resonant frequency of the large loudspeaker that a note of one tone only was heard . . . the resonant frequency of the speaker itself. This is far from being an unusual effect in receivers or electrical sound-reproducing systems employing large cone speakers.

The power output of the 1241 is in excess of that from most receivers of a similar type, in that there are two audio channels, one with an output of about 5 watts and the other with an output of about 15 watts. This is more than enough for most requirements. Moreover, a high volume level is not necessary for the reproduction of low tones as the volume control is compensated so as to maintain a good balance at low volume levels.

It was interesting to observe that on many occasions high-fidelity reception could be enjoyed from foreign short-wave stations, particularly the German string. So long as noise level is down and signal level is up, and fading is not serious, the full audio range of the receiver can be effectively employed.

All-Wave Reception

Aside from its high-fidelity feature, the receiver showed up well as an all-around all-wave receiver. Sensitivity and selectivity proved to be good in all four ranges. A total of 39 broadcast stations were brought in during one run through the band during daylight, and 60 after dark. The latter is slightly better than one station per scale division, or 0.6 station per channel. These figures do not include stations that were too weak to provide entertainment, nor stations seriously heterodyned by other carriers.

A total of 32 stations were picked up in the 2500-kc police band in approximately 45 minutes. In the 49-meter band 36 cleared stations were brought in during a trial run one evening, and at another time, 10 cleared stations in the 31-meter band, and 15 in the 25-meter band. A few of the stations heard at various times were: the D's and G's, with England particularly good in the 19-meter band; Radio Colonial; PCJ; Zeppelin *Hindenburg;* VK2ME; JVM; HI2D; CJRX; YDB; 2RO4; RNE; HP5J; EAQ. A few of the stations picked up in the 20-meter amateur 'phone band were: *PY2GJ;* XE2AH; *K5AY;* YV4AT; VP3BG; VP7NC; CO7CX; EA8AW and LU8AB.

RADIO AND THE ATMOSPHERE

[*Continued from page 268*]

will be affected most. This effect is more noticeable during twilight and darkness.

Radio waves in going from the transmitter to the receiver via ionospheric route, will most frequently follow more than one path. This has been verified in measuring the angles in the vertical plane, at which the radio waves arrive at the receiving point. Sometimes reception from many angles simultaneously are evident, indicating a number of paths followed. When they arrive at the receiver they combine in and out of phase in a random sort of way, causing variations in the signal intensity. This type of fading is caused by what is known as *wave interference.*

On voice communication and broadcasting channels, particularly short waves, it is observed that changes in the audio-frequency characteristics occur, in that certain frequencies will be accentuated or reduced. Also the quality will be impaired by muffled and extraneous sound effects. This is called *selective fading,* and is the result of wave interence.

The twinkling of stars[19] is in effect the same kind of fading phenomenon, and is caused by variations in light attenuation through our atmosphere and optical wave interference. Pencils of light from a star reach the observer's eye by slightly different paths and are just in a condition to interfere. The result is the temporary destruction of certain rays of certain wavelengths and the reinforcement of others. Accordingly the light of the star appears to vary in both brightness and in color. This can very easily be seen by looking at a bright star with a field glass and giving the glass a rapid rotary motion, so that the star appears drawn out into a circle of light. This will appear beaded with brilliant colors. The variation in color is the same as selective fading. The variation in brightness is the same type of fading as that which causes the radio signal to vary in intensity.

Variations in received signal intensity are also caused by changes in the plane of polarization, which may be caused by fluctuations in the earth's magnetic field and the characteristics of the ionosphere.

Optimum Frequency Use for *Normal Conditions*

In connection with radio telephony operations with the ships at sea, particularly those plying the trans-Atlantic steamship lanes, it is found that best results obtain by using the 25-meter wavelength in the middle of the day for distances more than 700 miles, (17 meters is also effective at distances over 1500 miles), 35 meters for 250 to 700 miles, and 63 meters for distances up to 250 miles from New York. As evening approaches, 35 and 63 meters become more effective for longer distances, and after darkness their range is further increased. This can be seen by referring to Fig. 9, which shows summer conditions for 1935. Winter conditions are shown on Fig. 10. Spring and fall will be intermediate between the two. In comparing summer and winter charts, it will be observed that 35 and 63-meter waves reach out further in winter as compared with summer. Because of longer daylight and greater ionic density of the lower ionosphere, in summer, 25 and 17 meters are used for longer periods at that time.

For commercial service between New York and Europe, and New York and South America, in summer, wavelengths of 14 to 16 meters are used for a few hours before and after noon in the middle of the path, 20 to 24 meters during daylight and twilight, 30 to 33 meters during early darkness, 44 and 62 meters are used during the late dark and sunrise period to London. During the winter time, use is made of the next longer wave in the available selection. For instance, 14 to 16 meters are used for a relatively shorter period, 20 to 24 meters are used more during the daylight hours, and 30 to 33 meters during twilight and part of the early darkness; 44 and 63 meters also come into use earlier. There is also a long-wave channel of 5000 meters used between New York and London, whose performance is best in the winter-time, and is of considerable help during subnormal transmission conditions on the short waves.

For consistent long-distance work, short waves from 15 to 80 meters in length and waves longer than 1000 meters are found to be more economical. Short waves in general are more economical to use than the long waves, although there are periods in the wintertime when it is possible to operate long waves at a cost that compares favorably with short waves.

Short-wave antennae systems are easier to construct, and it is also easier for the short waves to radiate. Where nearly 550 kilowatts of input power is used to send the long waves on the New York-London channel, virtually the same thing is accomplished under normal conditions on the short waves, with their directive and more efficient antennae systems, with about 105 kilowatts input.

When Long Paths Are Best

An interesting feature in connection with the operation of the radio facility between London, England, and Sydney. Australia, is that the British Post Office finds it expedient to operate the facility when the transmission path is in daylight for the most part. When it is daylight over eastern Europe and western Asia, the British arrange their antennae directivity so that the waves go over Europe and Asia to reach Australia—a distance of 10,600 miles. When daylight is over the Americas, the British interchange the reflector and projector of their antennae systems, and direct the waves across the Atlantic, over Central America, then over the Pacific to Australia—a distance of 14,400 miles. Using a wavelength of about 28 meters, they find the daylight path for these long distances giving the best performance.

(Concluded next month)

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AWR 2-3 MODULATOR

[*Continued from page 283*]

output of 15 watts at only 2½% distortion and a frequency response range that is flat from 60 to 7000 cycles within a fraction of a decibel). Although not measured as yet, this ALL-WAVE RADIO amplifier-modulator seems to be as good as far as an ear test goes. We have in the laboratory a Thordarson 2A3 amplifier which was used for ear tests on both voice and music. Lack of time prevented further tests for quality.

If it is desired to use this modulator as a speech amplifier, a Thordarson type T-6754 output transformer should be substituted for the present one. This transformer has an output to a 500-ohm line as well as to 4, 8, or 15 ohms for direct connection to the voice coil of a dynamic speaker. Appropriate input transformers to match the 500-ohm line output to the grids of any desired Class B tubes can be had. If it is desired to save the cost of an extra transformer, various transformers that will match the 6A3 tubes directly to the grids of Class B tubes are available. When choosing the output transformer required, look for those listed under "2A3 output" as the tubes are, as mentioned before, identical except for heater voltage, and only the 2A3 types are usually listed.

Filter Condenser Connections

In constructing the modulator it will be found that, since the common negative of the triple 8-mfd filter condenser cannot go to ground (chassis), that the entire condenser must be insulated from the chassis. To do this, drill the two condenser mounting holes larger, to a diameter of ¼ inch, and put a pair of insulating bushings (such as are used for the binding posts) in the holes with plain insulating washers on the opposite side so as to insulate the mounting bolts and bracket from the chassis. The filter condenser can should then be raised in its bracket slightly to clear the chassis. One of the mounting bolts, extending below the chassis, can then be used for the common negative terminal.

Probably a simpler way to do the job is to use three separate 8-mfd filter condensers instead of the common one. For this, use the type that has separate negative and positive leads coming from the bottom. The condenser cans can then be mounted directly to the chassis as the cans are insulated from the inside leads. The Cornell-Dubilier type EB-9080 is suitable.

(An r-f power amplifier for the AWR 2-3 Transmitter will be described in the August issue.—Editor).

GLOBE GIRDLING

[*Continued from page 273*]

been changed to XEWI. The assigned official frequencies of this station are 6000 and 11900 kc. When working on the 50-meter band they advised they were transmitting on 5975 kc. They have been recently heard and reported on or about 11950 or less.

Veri card from SPW, Warsaw, Poland, shows frequency of station 13653 instead of 13635 kc heretofore listed.

The Dominican Republic stations are still shifting around. Late advice from the Director of Communications reports the following changes:

HIX from 5980 to 6131 kc
HI9B from 6050 to 6040 kc
HI3C from 6977 to 6105 kc
HI5E 9500 kc is under construction
HI8A is on 6480 kc although its veri card shows 6600 kc—a former assignment.
HIH is on 6814 kc from last official report, although some report it on 6780 kc.
HI8Q is working on 6240 kc with new 300-watt RCA transmitter and announcing its call HI8Q—"H" for Halifax, "I" for Indiana, "8", and "Q" for Queens.

Changes in List

Other changes in frequencies as shown in station lists are as follows:

New Frequency	*Call*	*Old Frequency*
15244	TPA2	15243
11880	TPA3	11885
11720	TPA4	11720
9553	CQN	9490
6130	VE9HX	6110
6090	HJ4ABE	5930
6015	HI3U	6383
5830	TIPGH	5820

YV9RC (6400 kc) Caracas, and YV11RB (6570 kc) Cindad de Bolivar, are two new stations in Venezuela and shown in station list under these frequencies, although some doubt exists as to the correct calls and frequencies as numerous reports have been received of new stations with calls YV8RV, YV11-RMO and YV7RMO and some confusion prevails on account of the inability to determine correctly due to the serious interference reported in connection with the transmissions. It is understood that YV7RMO, Maracaibo, was licensed some time ago to operate on 5810 kc but no reports received of its being heard on this frequency.

New Listings

Other new stations listed follow:—

kc	*Call*	*Location*
55500	W8XKA	Pittsburgh, Pa.
55500	W1XKA	Boston, Mass.
24380	CRCX	Bowmanville, Ont.
17780	W9XAA	Chicago, Ill.
11900	XEWI	Mexico, D. F.
6570	YV11RB	Bolivar, Venezuela
6400	YV9RC	Caracas, Venezuela

Complaints are still being received of the backwardness of certain stations in forwarding verifications. The following are listed:—HJN, HKV, HJ3ABF, HJ4ABD, HJ4ABB, HJ1ABJ, HJ1-ABB Colombia; HC2CW, HCETC Ecuador; XBJQ, Mexico; HRN, Honduras; TIEP, Costa Rica; CT1AA, Portugal; YNVA; Nicaragua, and CB960 Chile. In justice to these stations it should not be understood that they do not verify reports, but rather they are negligent, as no doubt some may have received reports from all or part of the stations mentioned.

The lists of addresses of short-wave stations shown in this issue have been revised to date. Certain changes and additions in the identification signal section have been made and more will appear in the coming issue. The forwarding to the writer of additional information or changes noted to make these lists of greater value to listeners will be much appreciated.

Amateur 'Phones

From the reports of listeners on the 20-meter amateur band it is noted the following stations were received recently: VK2AZ-2RH-2JA-2MA-2HE-2AP-2AX-2OC-2BQ-2RB; VK3BD-3KK-3AFB-3JA-3KX-3OC; VK4BB, VK5HS-5JC and 5DI-Australia; K6KKP-6-FKN and 6JLV-Hawaii; EA8LW-8AF-8AJ-8AT and 8AO Canary Islands; F8DR, France; OA4PA and ON4VK, Belgium; EI2J Irish Free State; PAOI-DW and PAOFB, Netherlands; OA4-AA and OA4R, Peru; VP4TH and VP4TA, Trinidad; PK1MX-DEI-SU1CH and SU8MA, Egypt; YV6YB, Barbados; JE1JR, South Rhodesia, Africa; G6LK-G5NI and G5KG England; TI2AV, Costa Rica; HI5X and H1C Dom. Rep.; and VP1ZR, Zanzibar.

A similar listing was included in April ALL-WAVE RADIO. It is the thought of the writer that quite a number of short-wave listeners are interested in the reception of these phone stations and the procuring of verifications. We have in mind running a list of out-of-the-ordinary stations received. We would therefore welcome reports of such stations. In reporting please show call, approximate frequency location and time heard so that they may be compiled and listed accordingly. While it must be appreciated that it will not be possible to print the complete lists of stations received by each individual, it is thought that a digest of such stations, and the best time to receive them, might be of assistance to others interested. Your comments and suggestions would be appreciated.

In this particular listing we wish to thank Mr. R. S. Swenson, of Rockford, Ill., G. T. Magee, Birmingham, Ala., Robert L. Weber, West McHenry, Ill., Roy Waite, Ballston Spa, N. Y. and Warren H. Stark, Wauwatosa, Wis., for information furnished.

In Appreciation

It again affords pleasure to acknowledge many fine reports and letters from Mr. Bernard L. Ahman Jr., Baltimore, Md., Fred Baines, Sydney Mines, Cape Breton, N. S., Canada, Henry Biesheuvel, Bellingham, Wash., John B. Darrow, Cambridge, Mass., Eden W. Hollon, Royal Oak, Mich. Julian Hirsch, New Rochelle, N. Y., S. C. Kellenberger, Riverdale, Ill., Lyle Nelson, Yamhill, Oregon, George Norris Jr., Hagerstown Md., W. H. Proctor, Toronto, Ont., Canada, Robert Simonds, Larchmont, N. Y., H. D. Todd, Billings, Montana, Howard Wilson Jr., Bath, N. Y., L. R. Wilson, Bellingham, Wash., Li Chi Chiang, St. Johns, Quebec, Canada, M. T. Cooke, Philadelphia, Pa., Ralph S. Healy Jr., Garden City, N. Y., Gordon R. Willard, Minneapolis, Minn., F. H. Scattergood, Quebec, Que., Canada, P. H. Crago, New York City, N. Y., and to extend the thanks of ALL-WAVE RADIO and the writer of this department to these and many others for their kindly interest and informative reports which so materially assist in perfecting our lists and magazine.

It is always a pleasure to answer your questions regarding unknown stations, and station matters in general. Address your letters to me at 85 St. Andrews Place, Yonkers, N. Y. Please enclose self-addressed stamped enevolpe if you desire reply. Questions of a technical nature should be forwarded to Queries Editor, ALL-WAVE RADIO, 16 East 43 Street, New York City, N. Y.

SPEAKER CABINET

[*Continued from page 269*]

baffle. The slide should be held tightly in place so that it cannot rattle. Access to the interior of the cabinet can be obtained through this rear opening. When the slide is part or all the way open the cabinet should be moved away from the wall a bit.

The top piece is fastened on so that a half-inch overhang is had on all sides. The edges of the top can be beveled if desired. No size is given for the opening for mounting the speaker. This will vary with the individual speaker used. In the photograph a high frequency-tweeter is shown mounted above the large speaker which is a Jensen Orthodynamic type. The use of the new Jensen high-fidelity dynamic speaker, as used with the AWR-13, obviates the use of this tweeter. The high-fidelity speaker goes up to 8000 cycles, which is as high as can be used with present broadcasting conditions.

Construction Inexpensive

Although this speaker cabinet can be built by the home constructor it is almost as cheap to have a carpenter do the woodwork. The cabinet completely built except for the lining cost approximately seven dollars of which only two dollars was the labor charge. Similar prices should prevail in other localities. If a carpenter builds it, don't forget to have him cut the speaker mounting hole also—it's easier. Probably the carpenter will have his own ideas about joining the pieces, which is perfectly okay as long as the inside dimensions are kept the same.

The photograph shows the cabinet standing alone with just some flowers for decoration, to give an idea of the appearance it will make in the living room. The receiver can of course be mounted either on top of the speaker cabinet or at some other convenient location, as desired. The plywood can be finished so as to best match the other furniture in the room and a speaker grill used to hide the speaker cone from view.

NIGHT-OWL HOOTS

[*Continued from page 285*]

tion of the Chief Engineer for an informal engineering hearing before the Commission en banc on June 15 for the general purpose of obtaining information concerning the problems involved in the allocation of frequencies to the various classes of service. Among the technical problems mentioned as requiring the attention of the commission was the improvement of frequency allocations to the existing broadcast structure—550 to 1600 kc. One of the more important specific recommendations of the Engineering Department was, "In new allocations or in reallocations of radio frequencies to services or to stations within services, proceed on the basis of 'evolution, experimentation and voluntary action' rather than by radical and enforced costly changes.

Kilocycling Around

WOS in Jefferson City, Missouri, is no more. Their time on the air will be taken over by KFRU and WGBF . . . . CMCG, now on 680 kc, as a result of another complete change in frequencies in Cuba, can be heard nightly from 11-12 o'clock after the sign-off of WPTF . . . . The change, incidentally, placed all Cubans on even frequencies. No more split frequencies! . . . . One of the cleverest slogans is that of the new YV9RC on 1010 and 6400 kc, in Caracas, Venezuela. The slogan is "Ondas Populares" which translated means "Popular Wavelengths." . . . . Another request received by the FCC for 500 kilowatts! This time it is NBC's WJZ. . . . KMED will change to 1410 kc and increase power to 250 watts. . . . WTAQ will move from Eau Claire to Green Bay, Wisconsin. . . . From the CDXR bulletin: "CHNC changed to 960 kc and comes in with a sock." . . . . KIRO to increase power from 500 to 1000 watts. . . . WORL to move into Boston from Needham. . . . KGBZ was refused renewal of their license and KMA takes over their time on the air. . . . KGHL will change from 950 to 780 kc. . . . Here's another station that doesn't like the sound of Doctor Brinkley's voice mingled with its programs—KMBC applied for an increase in power to overcome interference from XEAW! The FCC refused to sympathize and did not grant KMBC's request. The reason being, perhaps, that there are 10 kilocycles separating XEAW from KMBC. . . . Call letters assigned during the month: KPDN to the Pampas, Texas station; KVCV to the new one in Reading, California; and WGRC to the station in New Albany, Indiana. . . . KIEM, "The Voice of the Redwoods?" sends a picture postcard showing one of the Giant Redwood Trees with verification material printed on the reverse side of the card. . . . CMCD on 950 kc is often on the air until 1:00 A.M., and CMCW on 750 kc also can be heard until the same hour.

(All time mentioned above is Eastern Standard, unless otherwise stated.)

AWR-6 SUPER

[*Continued from page 278*]

condensers are used for both the detector and oscillator circuits. One section is used alone for good band spread on the higher frequency ham bands. For the other bands the second section is added in. This is done automatically when these coils are plugged in, by means of the jumper in each coil between the prongs going to the two sections of each condenser.

It is very important for accurate logging of the dial that no other control, either on the panel or in the set, can affect the calibration of the tuning dial by even a hair. The band-setting condensers for the oscillator stage are contained in their respective oscillator coils for each band. These condensers are of the air-tuned type, assuring permanent calibration. In this way the various bands are automatically set at the proper place on the tuning dial when the coils for the desired band are plugged in.

The trimmer for the detector stage is mounted on the panel. Adjusting this condenser does not, of course, affect the tuning or logging of a station as shown on the dial. By having the detector trimmer on the panel any compensation necessary when changing antennas, or for any inequalities in tracking when tuning, can be made easily by a slight adjustment without having to dig into the interior of the receiver with a screw-driver. Capacity coupling to the antenna is through the small mica trimmer shown. The use of a mica trimmer at this point is permissible because the detector trimmer on the panel takes care of any variation.

The mounting for the detector tuning condenser can be made from any piece of metal that can be bent up into a bracket. A small piece of aluminum mounted on an aluminum angle is used. No flexible coupling was necessary between the two tuning condensers although in another receiver it might be a good idea to include it for smoothest running of the dial. The small bracket that comes with the dial is used to keep the oscillator condenser from turning.

Plates are removed from the tuning condensers, as shown in the coil table, to obtain best band spread. This is easily done by gently bending the plate it is desired to remove back and forth with a small pair of pliers until it comes out. To take out a rotor plate, first cut the center ring of the plate with the cutters, then twist gently out.

The construction of the rest of the receiver, and the wiring, is simple and is clearly shown in the sketches and photos. Watch the wiring between the coil sockets and tuning condensers so that it is as near like that as shown as possible. Also keep the sockets turned as shown, and the parts in the same relative positions.

Aligning I-F Stage

Lining up the i-f amplifier after completion is very simple. Plug in one of the coil sets and tune in one of the louder stations. The design of the coils is such that stations should be heard upon first trial. Then adjust the four trimmer screws on top of the i-f transformers for the loudest signal, readjusting the tuning dial if necessary. Then turn on the beat oscillator and adjust the trimmer screw on the bottom of the beat oscillator transformer with a screw-driver until the beat oscillator tunes to resonance with the i-f stage. This will be audibly detected by maximum oscillator hiss. The oscillator trimmer on top of the beat oscillator transformer can be adjusted with the extension handle for vernier tuning of the oscillator. The oscillator coupling to the second detector, adjustable by changing the spacing between the wires from the oscillator plate and the detector, should be made rather loose for best results on weak c-w signals. Too much coupling will possibly cause the i-f amplifier to motor-boat.

The coils, if wound as specified, should cover the desired bands. When first trying a coil set, the detector trimmer should be first set to resonance, while adjusting the regeneration control for greatest regeneration. Next check the band setting on the dial. The band can be set as desired with the APC trimmer mounted in the oscillator coil, readjusting the detector trimmer after each change. If, on the higher frequency coils, two points are found on the oscillator trimmer for the same station, the higher frequency, at lowest capacity setting, should be used. The antenna coupling condenser should be set at about two-thirds of maximum capacity. Experiment will determine the correct setting. A considerable change in antenna length may make necessary a different setting of this condenser.

Tracking of Circuits

After a band is correctly set on the dial the tracking of the detector and oscillator circuits may be checked. Perfect tracking is indicated when the detector trimmer does not have to be changed when tuning from one end of the scale to the other. Perfect tracking is not necessary unless you are finicky about such things, as a slight adjustment of the detector trimmer after a station is tuned in will take care of the situation. However, exact tracking can be obtained by the following process:

First tune in a station on the low-capacity end of the tuning range and adjust the detector trimmers for resonance, using regeneration for sharpest setting. Now tune to another station on the high-capacity end, without touching the detector trimmer. Next retune this trimmer to resonance, noting whether it must be changed to a higher or lower capacity. If it must be changed to a higher capacity the detector is not covering enough range and either more turns are needed on the detector coil or fewer on the oscillator coil. If, on the other hand, the detector trimmer must be changed to a lower capacity, the detector is covering too much range and either fewer turns on the detector coil or more turns on the oscillator coil are indicated. On the higher frequency coils where the turns on the grid windings are spaced the same result may be obtained by sliding the turns closer together or further apart. Moving the turns closer together gives the same effect as adding more turns, and vice-versa. It may be necessary to change the number of detector plate turns for proper regeneration.

Another set might require a slight change in the number of turns on all windings, due to unavoidable differences in wiring length.

While some of the tuning condenser plates were removed for better band-spread on the ham bands, as indicated in the coil table, for the broadcast bands both sections of each condenser were used with all plates left in. This gives a maximum tuning capacity of 70 mmfd for each condenser. If full coverage is desired it might be a good idea to use higher capacity condensers so that fewer coil sets will be required. A convenient size is the Hammarlund 140 mmfd single spaced type. With the tuning arrangement shown the set builder can use any condenser combination convenient to the ranges he wishes to cover and the degree of band-spread desired, as long as the capacities used are the same for both the detector and the oscillator. Coils for other ranges can easily be made up without any particular difficulty. Just use the desired number of turns to hit any particular range on both the detector and oscillator grid windings. Then use about two-thirds this number of turns for the detector plate winding and about one-third for the oscillator cathode winding. If the detector plate winding is too large a turn at a time may be taken off until oscillation occurs at the desired point on the regeneration control.

Characteristics of Set

The results obtained with this little six-tube super were quite gratifying. The r-f gain obtained compares favorably with that of the familiar super layout using one non-regenerative r-f stage and two i-f stages with air-core transformers, as does the degree of selectivity obtained. This selectivity is enough to obtain a noticeable single-signal effect when the beat oscillator vernier handle is properly set.

The outstanding feature is the very excellent signal-to-noise ratio obtained in actual operation. This can be better appreciated when the receiver is compared with the usual run of short-wave supers. As predicted in the first part of this article, this is probably due to the improvement obtained in first tube gain, conversion gain, and the better signal-to-noise ratio resulting from substituting a single iron-core coupled i-f stage for the usual two air-core coupled stages. With the regeneration peaked up, the i-f gain control set at maximum, and the beat oscillator turned off, the set noise level is barely audible—if you look for it. This means better reception of weak DX signals.

The audio gain is sufficient for good room volume. The volume is uncomfortable on the louder signals and still quite enough on the weaker ones. As mentioned before, the quality for fone or broadcast signals is as good as the speaker will permit. The stability is excellent. A c-w station can be tuned in and will stay at the same audio pitch as long as desired, depending of course, as to whether the transmitting station itself is steady as to frequency. For some unknown reason the isolation between the second detector and the beat oscillator seems to be better than heretofore obtained. The pitch of a c-w signal can be run so low that the beats can be almost counted. This receiver should prove excellent for DX reception, since easy tuning, stability, and low noise level are the prime essentials for this work.

The calibration chart on the panel can be used for calibration curves for each band, facilitating logging. The dial numbers can be placed horizontally and the frequencies vertically, using standard squared paper.

The panel does not have standard slotting. This is intentional as the cabinet, panel and chassis were designed to go together as a unit for building a receiver—or other piece of equipment. To mount the set in the cabinet, just slide it in and fasten the panel on with the six screws provided.

The Power Supply

The power supply needs little comment, as the parts can be mounted and wired in any convenient way as long as the diagram is followed. It will be noticed in the power-supply diagram that two connection sockets are provided. The one with the 6.3 volt filament winding connected to it is the proper one to use for this receiver as all the tubes have 6.3-volt heaters. The other connection socket can be used for any receiver using 2.5-volt tubes as long as not more than 4 amperes are required for the heaters or filaments. For a 2.5-volt receiver requiring higher filament current, a separate 2.5-volt transformer can be used, either in parallel to the present 2.5-volt winding or separately. The d-c output from this supply is about 250 volts at 90 milliamperes when connected choke input as shown.

QUERIES

[*Continued from page 293*]

stage, after first breaking the grid side of the transformer secondary.

Probably the most simple method of using the microphone combination shown in Figure 1, with almost any receiver, and without necessitating set changes or tapping in, is by means of an RCA, RK-24 Phonograph Oscillator. These can be picked up at the various mail-order houses, or from a dealer, and are designed to operate with either 6.3 or 2.5 volt tubes. The instrument is accompanied with full directions. While originally designed for use with a phonograph pick-up, it can be used in conjunction with Figure 1 by substituting the receiver input leads for the leads from the phonograph pick-up.

In many instances volume control will be desirable, and a 100,000-ohm potentiometer may be connected as suggested in Figure 2. The switch, S, should always be open when the pick-up is not in use.

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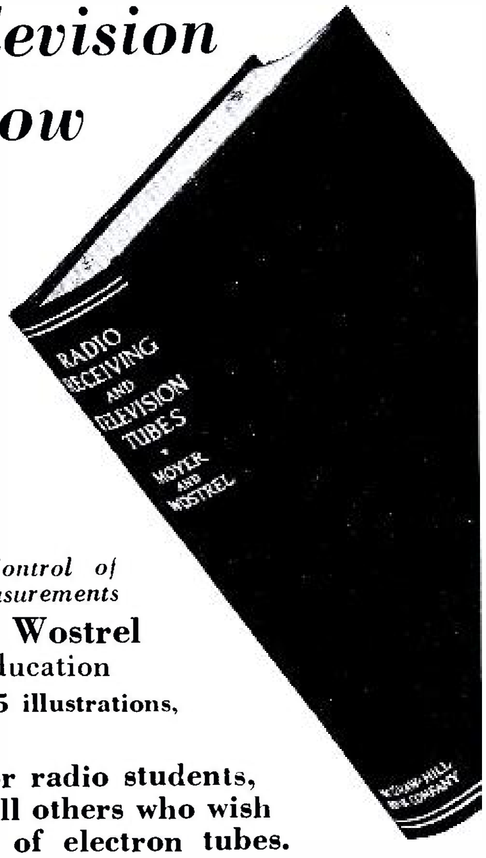

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