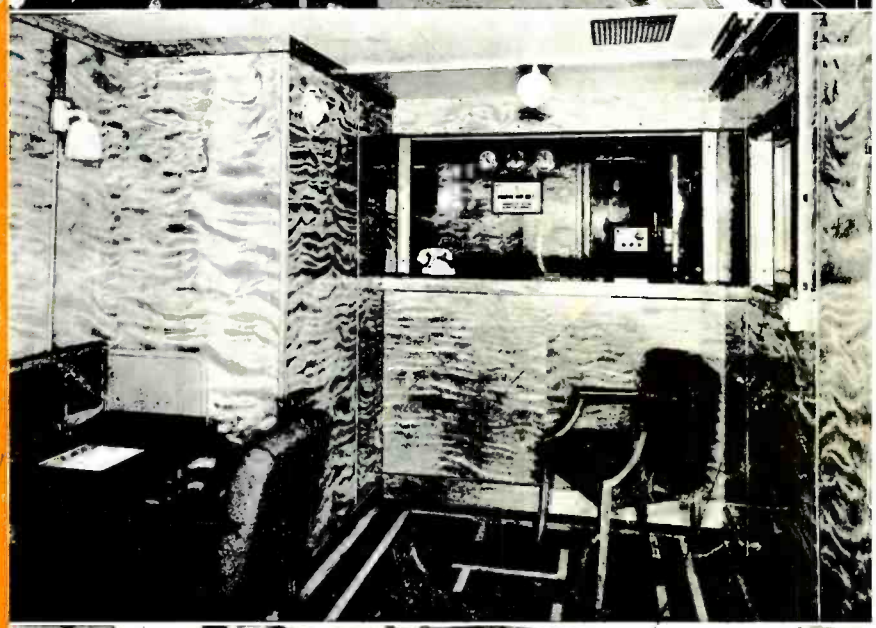
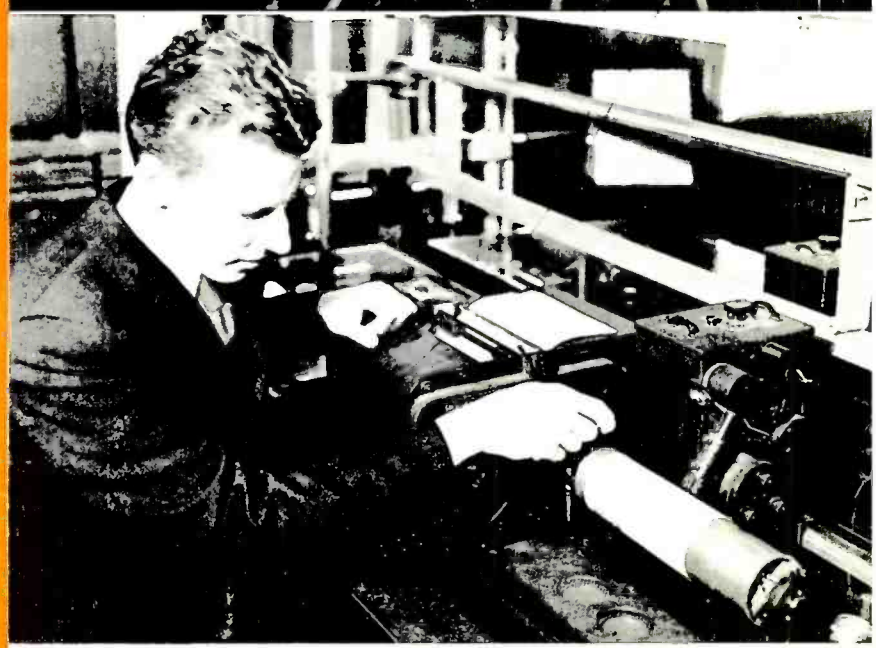
ALL-WAVE RADIO





AUGUST • 1936

FIVE-METER RECEIVER
battery-operated portable

KILOCYCLES TO METERS
a handy conversion chart

SELECTIVE ANTENNA
with direction switch

RADIO FACSIMILE
by 3-meter relay

25c U.S. and CANADA

THE JOURNAL of WORLD RADIO

STEPPING STONES TOWARD
"THAT TICKET"
Published by the American Radio Relay League

Universally recognized as the standard elementary guide for the prospective amateur

The 1936 edition of How to Become a Radio Amateur—features equipment which, although simple in construction, conforms in every detail to 1936 practices. The apparatus is of a thoroughly practical type capable of giving long and satisfactory service—while at the same time it can be built at a minimum of expense. The design is such that a high degree of flexibility is secured, making the various units fit into the more elaborate station layouts which inevitably result as the amateur progresses. Complete operating instructions and references to sources of detailed information on licensing procedure are given, as well as a highly absorbing narrative account of just what amateur radio is and does.

1.

HOW TO BECOME A RADIO AMATEUR

New 1936 Edition

25 cents Post paid.

2.

THE RADIO AMATEUR'S LICENSE MANUAL

Latest Edition

25 Cents Post Paid

A necessity for the beginner—equally indispensable for the already licensed amateur. Going after your first ham "ticket"? You need the manual for its instructions on where to apply, how to go about it in the right way—and, most important of all, for the nearly 200 typical license exam questions and answers. Already got a license? The manual is still necessary—for its dope on renewal and modification procedure, the Class A exam (with questions and answers), portable procedure, etc.

All the dope on every phase of amateur licensing procedure, and, of course, the complete text of the new regulations and pertinent extracts from the basic radio law.

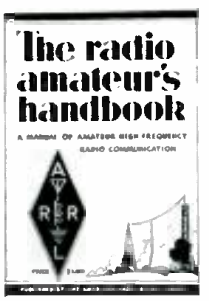
3.

THE RADIO AMATEUR'S HANDBOOK

FOR THOSE WHO WISH TO KNOW ABOUT THE HANDBOOK

It is the standard manual of amateur radio communication. For ten years it has been the practical working guide for all interested in short-wave radio. Published by the official organization of radio amateurs, you can rely upon the technical accuracy of the information in it. It is complete in every respect from theory and construction to operation of a station.

500 illustrations, 480 pages.



FOR THOSE FAMILIAR WITH THE HANDBOOK

Owners of past editions enthuse over the 1936 edition which is nearly twice as big. This was done in order to expand many chapters to give the subjects the treatment they deserved, and to add chapters on dope heretofore not covered. Attention has been given to the new developments in the ultra-high frequency field. We are positive in declaring it to be the most helpful piece of amateur literature that has ever been created.

New 1936 Edition.

PRICE U. S. A. $1.00 — POSTPAID — ELSEWHERE $1.15

ENCLOSE CHECK — MONEY ORDER — STAMPS WITH ORDER AND MAIL TO — BOOK DEPARTMENT —

MANSON PUBLICATIONS CORP., 16 East 43rd St., New York, N. Y.

How I Got My Start in RADIO

And Established My Successful

RADIO SERVICE BUSINESS WITHOUT CAPITAL

E. LAMAR JOHNSTON, Rome, Georgia
Graduated from the National Radio Institute on February 25, 1929. Today Mr. Johnston owns a profitable Radio Sales and Service business. Maybe you too should get into Radio. Read what Johnston says—then find out what Radio offers. Mail the coupon.

Read This True Story By

E. LAMAR JOHNSTON, ROME, GEORGIA

"I WAS an untrained worker, with no regular job—sick and tired of skimping along, working for low wages when I could find work—and going farther in debt. One day I saw an advertisement of the National Radio Institute which said that they would train me at home to make more money in Radio.

"Frankly, at first I was doubtful whether I could learn Radio at home, as I knew nothing about electricity or Radio. But I knew that I needed training to get ahead, and Radio struck me as an industry which offered plenty of opportunity for trained men to make good money.

"So I sent for their Free Book, "Rich Rewards in Radio"—and after reading it and learning about their practical Course, and after reading the letters from N. R. I. men who had made good—I enrolled right away. I have never regretted it since.

"The very first lessons I received showed many ways that I could make money. I could start just as soon as I learned them. In a few weeks, I worked three hours and made one five dollar bill clear profit. Every lesson taught me more ways to make money that I could cash in on just as soon as I learned them.

"Working with the Radio parts and equipment which I received as part of the Course showed me exactly how to do actual Radio work. I actually built the circuits and testing apparatus which were described in the Lessons. This made earning money easier and quicker.

"Since that time I have spent all my time in Radio work. I have married, bought my own home—a nice place valued at $3,500—and have the nicest, most pleasant type of work in the world. My Radio business brings me a good income—and I am my own boss.

"I started my present business—now one of the largest and most profitable Radio firms in Rome, Georgia—with money I made servicing and selling sets. I had to have training to do this—training which goes far beyond the usual sort—training in ALL branches of Radio.

"That is the kind of training the National Radio Institute gives—the kind a man must have to get ahead in Radio. I honestly feel that any man who wants to make more money—and who is willing to spend a little of his spare time, training—will find success in Radio. Find out what Radio offers you. Send for the National Radio Institute's Free Book today."

(Signed) E. LAMAR JOHNSTON.

JOHNSTON'S MODERN SERVICE DEPARTMENT in Rome, Georgia. All equipment was bought from Radio servicing profits. Johnston is on the left—his helper on the right.

Many Make $30, $50, $75 a Week in their Own Business or in Radio Jobs Like These

The world-wide use of Radio sets has made many opportunities for you to have a spare time or full time Radio business of your own. Over 20,000,000 Radio sets are now in use in the U.S. More than $235,000,000 worth of sets and parts were sold in 1934! Millions of sets are going out of date and must be rebuilt or replaced! About $60,000,000 are spent EACH YEAR for repairs, servicing, new tubes, etc. Radio Sales and Servicing is a TREMENDOUS BUSINESS—with many opportunities for well trained Radio Experts!

And Radio offers many job opportunities, too. Broadcasting stations use engineers, operators, station managers and pay up to $5,000 a year. Radio manufacturers use testers, inspectors, foremen, engineers, servicemen and buyers and pay up to $6,000 a year. Radio Dealers and Jobbers employ hundreds of servicemen, salesmen, managers, for jobs up to $75 a week.

Many N. R. I. Men Make $5, $10, $15 a Week in Spare Time While Learning

The day you enroll, N. R. I. starts sending you Extra Money Job Sheets which quickly show you how to do Radio repair jobs. You get plans and ideas that have made good spare time money for hundreds of fellows.

Money Back if not Satisfied

When you enroll, you get an agreement to refund every penny of your tuition if you are not satisfied with N. R. I. Lesson and Instruction Service when you graduate.

64-Page Book of Facts Sent FREE—MAIL COUPON

Mail the coupon for your copy of "Rich Rewards in Radio"—the same book which started E. Lamar Johnston towards success in Radio. It's free to anyone over 16 years of age. It tells you all about Radio's spare time and full time opportunities; about N. R. I. Training; what others who have taken it are doing and earning. Mail the coupon now—in an envelope or paste it on a penny postcard.

National Radio Institute
Dept. 6HS1
Washington, D.C.

J. E. SMITH, President
National Radio Institute, Department 6HS1
Washington, D. C.

Dear Mr. Smith: Without obligation, send me your free book about spare time and full time Radio opportunities, and how I can train for them at home in spare time. (Please write plainly.)

Name ..... Age .....

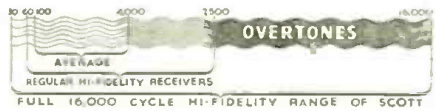
Address .....

City ..... State .....

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



FULL 16,000 CYCLE HI-FIDELITY RANGE OF SCOTT

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.

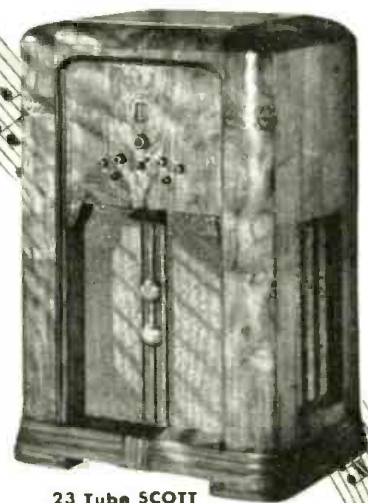
HEAR *ALL* THE PROGRAM!

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 soundboard 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.

HEAR *ALL* THE STORY!

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!

FREE-SEND TODAY FOR DETAILS

E. H. Scott Radio Laboratories, Inc.
4476 Ravenswood Ave. Dept. 31M6, Chicago

I'd like to know more about the new 23-tube SCOTT. Please send me full proofs, and illustrated booklet above.

Name.....

Street.....

City..... State.....

E. H. SCOTT RADIO LABORATORIES, INC.
4440 Ravenswood Avenue, Dept. 5M6, Chicago, Illinois
630 5th Avenue, New York 115 N. Robertson, Los Angeles

Edited by M. L. Muhleman

CONTENTS - AUGUST - 1936

COVER

Top: International Marine radio operators at work in the Radio Control Room on board the R.M.S. Queen Mary. Center: Part of the Radio Accepting Office of the R.M.S. Queen Mary at which passengers can hand in radio messages. Bottom: Facsimile scanner used in RCA's New York-Philadelphia ultra-short wave circuit just recently opened.

FEATURES

DEPARTMENTS

ALL-WAVE RADIO

Reg. U. S. Pat. Off.

VOLUME 2 • NUMBER 7

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.

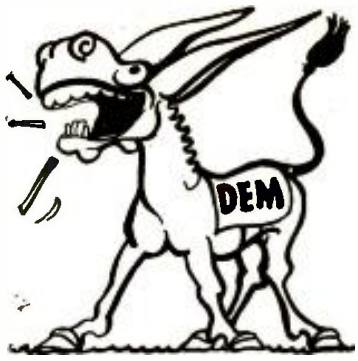
ADVERTISING OFFICES

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, Room 534, 30 N. LaSalle St., Chicago.

CONTRIBUTIONS

MANUSCRIPTS ARE submitted at the author's risk and cannot be returned unless accompanied by postage. Notification of the acceptance or rejection of a manuscript is given within two weeks after receipt.

3rd?



NO PARTY CONNECTIONS!

BUT A. W. R. PRESENTS

A PLATFORM WORTHY OF YOUR SUPPORT

WE PLEDGE OURSELVES to another year of bigger and better:

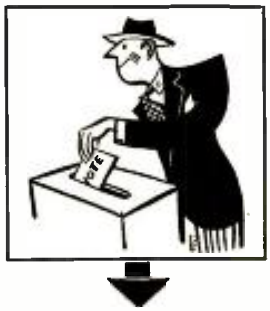
- STATION LISTS
- HAM AND FOREIGN STATION WRITE-UPS
- NEWS SCOOPS—REPORTS ON THE LATEST DISCOVERIES AND DEVELOPMENTS
- INFORMATIVE AND INSTRUCTIVE FEATURES
- "DX" DOPE

BY THE BEST WRITERS IN THE RADIO FIELD

DO WE KEEP CAMPAIGN PROMISES?—JUST LOOK AT THE RECORD!

HOP ON THE "ALL-WAVE BAND" WAGON . . . VOTE EARLY ***AND AS OFTEN AS YOU LIKE!***

WE'LL HELP THE N. R. A. (NEW RADIO AMATEUR), THE S. W. L. AND E. X. P.



Another Term of V. F. B. with A. W. R.! . . . TO QUOTE THE MAESTRO: "*A YEAR OF THE MOSTA OF THE BESTA.*"

QUICK ACTION BALLOT

ALL-WAVE RADIO 16 East 43 Street New York, N. Y. ☒

..... (NAME) of ..... (ADDRESS)

ELECTS TO RECEIVE ALL-WAVE RADIO FOR 1 YEAR STARTING WITH THE ..... ISSUE. ENCLOSED PLEASE FIND $2.50 in ☐ Check ☐ Money Order

I AM A: ☐ S. W. L. ☐ E. X. P. ☐ N. R. A. ☐ O. R. A.

EDITORIAL QUOTES

BY THE EDITOR

WITH the new 1937 crop of radio receivers come new engineering features, new tubes and new trade phrases. Among the latter are G.E's "Focused Tone," RCA's "Magic Voice," and Crosley's "Mystic Hand." We expect a Magic Carpet momentarily.

But in all seriousness, the phrases are far from being idle ones. Behind G.E.'s "Focused Tone" is a system of combined color tuning control, automatic frequency control and silent tuning. With the color tuning control, the illuminated dial scale changes from red to green when the set is tuned to a station. With the automatic frequency control, as the dial pointer nears the frequency of a strong signal, the tuning circuit *automatically* swings into sharp resonance. With the silent tuning control, the loudspeaker may be cut out while the set is being tuned from station to station and silence maintained until the dial scale turns green for the new station.

Behind RCA's "Magic Voice" is a unique arrangement of resonator cylinders mounted on the base of the cabinet in an enclosed space, which prevent boominess in loudspeaker response.

Behind Crosley's "Mystic Hand" is a system of automatic frequency control similar to that used by G.E. It prevents mistuning of the receiver and also compensates for frequency drift in the oscillator circuit, each a notable improvement in itself.

There will be other catch phrases before the year is out, but it is safe to say that the majority of them will really imply something worth while.

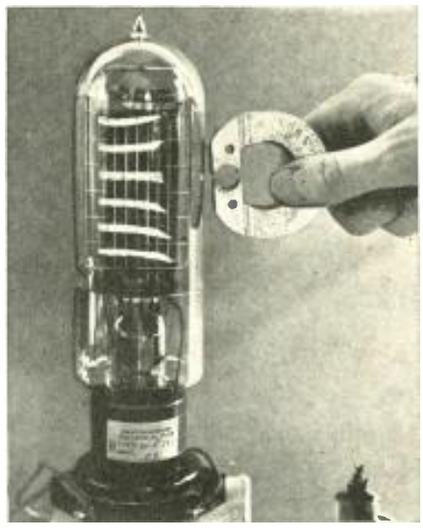
A number of manufacturers have introduced receivers using the new 6L6 super-power audio tubes, just recently announced. This marks the beginning of a new era in high-power, high quality audio amplification.

✦

Visible Electrons

PROGRESS IN THE design of the cathode-ray tube has stimulated interest in other means of electron-operated visual indicators, such as the "electron-ray" tube now used in many radio receivers.

Making electrons "visible" to simplify the study of electronic phenomena is now possible through the use of a new tube developed by Westinghouse. The tube has a fluorescent coating on the plate that "illustrates" electron bombardment for demonstration purposes, such as in laboratories, high schools and colleges.



Electron pattern on plate of new tube, distorted by effects of magnet.

Like the other three-element electronic tubes in fundamental design, the new tube has been especially constructed with a fluorescent coating on the plate. Electrons striking this coating are transformed into visible bands of radiations whose widths depend directly upon the electron beam intensity (illustrated). Thus, the electrons passing through the grid to the plate form a visible pattern which corresponds to the invisible pattern in a more conventional tube.

The effects of grid voltage on this transmission are illustrated by changes produced in the strips of light on the plate. A constant, high negative grid voltage will reduce the bands to fine lines, while a constant positive voltage on the grid will cause the bands to expand to widths sufficient to cover the plate completely. Thus, it is possible to illustrate the fact that a direct relationship exists between the electron flow in a tube and its plate current, namely, that a change in the flow produced by the grid in turn varies the plate current.

The visible display of electrons in tubes of this nature may form the basis of new types of indicating devices for radio use.

✦

The Ham and the SWL

DO AMATEURS welcome reception reports from short-wave listeners? Do the short-wave listeners provide sufficient data to make the reports of value to the amateur? How do amateurs feel about supplying verification cards to short-wave listeners? Is there a possibility of establishing cooperation between amateur and listener, and how may the one group serve the other?

These are questions we put to a well-known amateur, who will give his views on the subject in the September issue. We are sure you will find his opinions both interesting and valuable.

✦

W6XAO Television

THE DON LEE television transmitter W6XAO, at Los Angeles, California, is now on the air daily except Sundays and holidays, from 3:00 to 5:00 P.M., and from 6:30 to 8:30 P.M. Pacific Time, on a frequency of 45 megacycles (6 2/3 meters). Voice anouncements concerning the broadcasts are made at the beginning and end of each transmission.

For receiving the voice announcements over W6XAO, and for preliminary experiments, any type of receiver which will tune to 6 2/3 meters may be used. Receivers designed for 5-meter amateur work are suitable when provided with larger coils. Install coils with 50 percent more turns and remove one turn at a time while tuning for W6XAO.

Data on a receiver suitable for the sight broadcasts from this station will be published in the September issue.

✦

Ten Meters

THE TEN-METER amateur band is beginning to show signs of life. Foreign stations are commencing to break through in good fashion. It may be that the band will be wide open by the time you read this. In any event, if you have ignored ten, it will be well worth your while to watch it from now on. Try it during daylight hours.

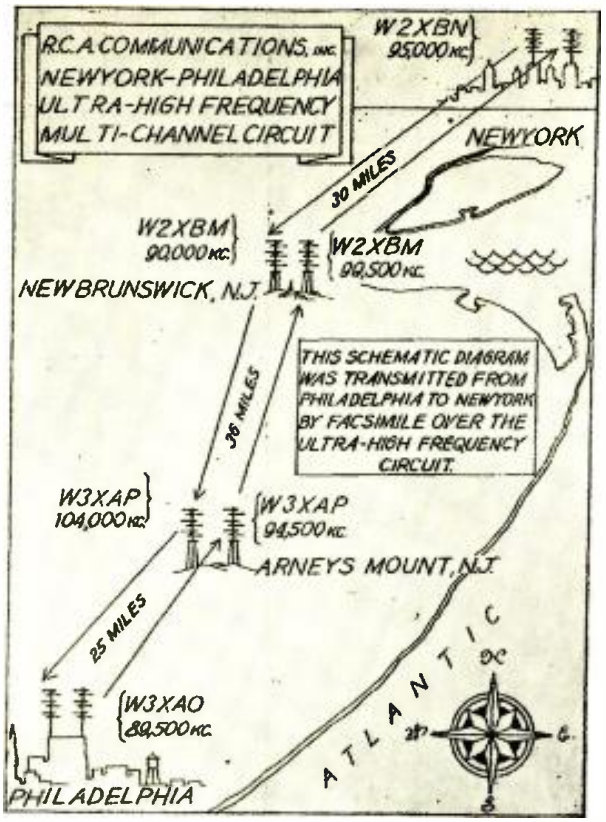
✦

W10XDA

THE SIGNALS FROM W10XDA are again being heard in the 20-meter amateur band. This is the call of Captain Bob Bartlett's schooner *Morrissay,* which left New York on June 23rd for Greenland.

W10XDA has been heard on phone in the vicinity of 14.25 mc. The transmitter has a 100-watt carrier, and is being operated by Clifton F Foss, (W2OJ) who has been on previous expeditions.

3-Meter 91-Mile CONNECTS



A NEW 90-mile multiple ultra-short wave radio circuit connecting New York and Philadelphia was opened for commercial service by RCA on June 10th, at their Broad Street offices. The occasion was the first demonstration of RCA's new system with automatic relay stations which enables the transmission of drawings, type matter, handwriting and other visual material in facsimile, with the tariff computed on a "square inch" rather than a "number of words" basis.

The unit at the right is the transmitter proper. There's a motor blower at the bottom and a "stove-pipe" transmission line at the top of this odd-looking device; it could be taken for a G.E. Oil Burner or an electric hot-water heater—but it's the latest in ultra-short wave signal pumpers.

Repeater Stations

The equipment developed for the new circuit, which operates on a group of frequencies in the vicinity of 3 meters, is a radical departure from standard practice. The automatic repeater stations, which relay the ultra-short waves in both directions between New York and Philadelphia, are located at New Brunswick, New Jersey, and Arney's Mount, near Trenton, New Jersey. Since the range of 3-meter radio waves is virtually limited to line-of-sight, the points of reception and transmission for each of the stations were selected to provide the most distant optical horizon. In New York and Philadelphia, therefore, the antennas are located atop tall office buildings, whereas the intermediate points of New Brunswick and Arney's Mount were chosen for their favorable terrain.

Six Frequencies Used

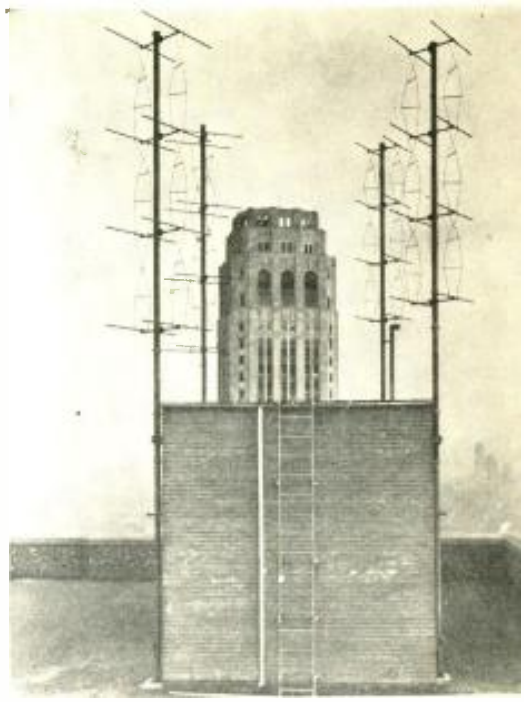
Each of the repeater stations employs two different transmitting frequencies, or one for each direction, as shown in the accompanying reproduction of an actual sketch transmitted over the new circuit. The two terminal stations each use one sending frequency, making a total of six frequencies for the complete circuit. It was explained that, if it should be desired to extend the circuit beyond either terminal point, those six frequencies could be used over and over again in the same sequence. Thus, two frequencies would be generated at points about one hundred miles apart, and would not interfere with each other, because of the line-of-sight limitation to their range.

Automatic Remote Control

One of the most interesting engineering features of the new circuit is the method by which the unattended relay stations may be turned on or off from either one of the terminal stations by radio. The receivers at each of the four stations are always in operation and ready to intercept impulses from the transmitters to which they are tuned. When it is desired to make the circuit ready for traffic, New York or Philadelphia starts up its transmitter and sends an audio tone which is picked up by the receivers. At the unattended receiver at New Brunswick the tone passes through electrical filters and is used to actuate relays which turn on the power for the "south" transmitter, which, when in operation, passes the tone on by radio to the Arney's Mount station. There the operation is repeated.

Facsimile Circuit

NEW YORK and PHILADELPHIA



Pictures take hop, skip and jump through unattended relay stations controlled by tone signal. Six frequencies employed to avoid interference.

The "turnstile" beam antennas used for hurling 3-meter signals to the relay station at New Brunswick. These are connected to the transmitters located in the elevator control room below. The receiving antenna is atop the skyscraper seen in the background.

When the tone signal reaches the Philadelphia station, the transmitter at that city is also automatically turned on, and the tone starts on its return journey, back to New York. Operators in New York know that when the tone comes back to them from the "north" transmitter at New Brunswick the entire circuit is in full operation and ready for traffic. The constant presence of the tone keeps the relays closed, and the circuit in operating condition. When the tone is withdrawn from the circuit, relays click in the same succession over the round trip to Philadelphia, and one by one the transmitters are automatically turned off. Philadelphia has the same control over the circuit as New York.

New Departure in Design

The new circuit is described by RCA officials as an outstanding example of the value of coordinated research and engineering in many special phases of the radio art. There being no precedent for building apparatus for commercial operation on 3 meters, the equipment developed is unique in appearance. Antennas, because of their curious form, are characterized as "Christmas trees" and "turnstiles," which are terms well fitted to the New York aerials shown in an accompanying illustration. Certain parts of the receivers look like small steam engines, and the transmitters might be taken for hot-water boilers. The transmitter shown is one of three in the elevator control room of the Continental Bank Building in lower New York. The lower part of the cylindrical unit—the transmitter proper—is green and the hood is black. There is a motor blower in the base, used for cooling the tubes. A "stove-pipe" transmission line, with elbows and all, protrudes from the rear of the black hood and curves up to the ceiling through which it passes to the antenna on the roof.

Engineers explained that these odd shapes result from the application of the principle of "resonant lines" to both transmitters and receivers. That principle, developed by RCA for this use eliminates crystal control and provides efficient means of maintaining the transmitters and receivers at their exact frequencies, necessary for practical commercial operation.

The heart of the receiver is the Acorn Tube. These are used in preselector and oscillator stages which are matched to an intermediate-frequency amplifier of special design.

Five Services Available

The new ultra-short wave circuit is capable of handling two pictures simultaneously in both directions on the same frequency, as well as two automatic typewriter channels and one telegraph channel, or a total of five services in each direction on a single channel. By the addition of circuits employing the same frequencies in identical sequence, the service could be extended across continent. For that matter, a similar chain of circuits might well be used for the distribution of television services.

David Sarnoff, President of RCA, said of the new system: "Radio communication is today placing in useful public service, a region of the radio spectrum which only yesterday was virtually unexplored and scientifically unconquered territory. Having developed a technique of operation for the 3-meter band of radio wavelengths, we find in that region, a medium of transmission unlike anything that we have ever known.

"The most significant feature of the new communication development is that it marks the attainment of a radio circuit so efficient that we are challenged to take full advantage of it. This is very important, for radio communication has, from its beginning, struggled to provide ever better connecting radio channels between transmitter and receiver. Now we find that the ultra-short wave portion of the radio spectrum gives us a medium of almost unbelievable possibilities. We cannot only send messages in facsimile as fast as present equipment will allow, but we can send two pictures simultaneously, and on the same radio wave we can also add two automatic typewriter channels and a telegraph channel. Of course, this means that we do all those things in both directions at the same time.

"The possibilities of multiple transmission are still not exhausted. Perhaps this single illustration will give some idea of the traffic-handling possibilities of the circuit. If we were concerned only with communication on a word basis, we could, with increased power and filter systems, operate enough automatic typewriters to carry a total of twelve thousand words per minute in both directions."

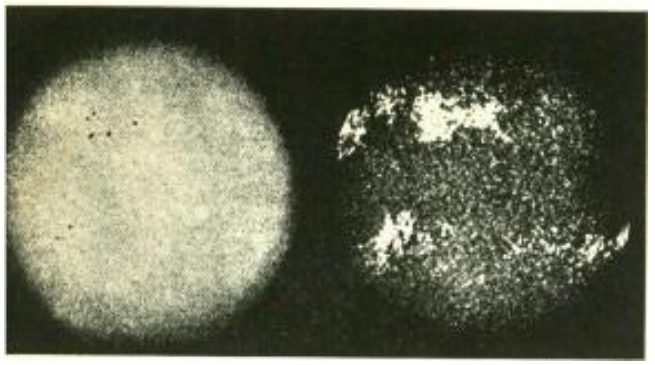


Fig. 3. Photoheliogram and Spectroheliogram of sunspots, K line. (Mount Wilson Observatory.)

RADIO AND THE

By J. L. Richey
CHIEF TECHNICAL OPERATOR,
OVERSEAS SERVICE, A.T.&T.

IN determining the diurnal and seasonal transmission characteristics of any particular wavelength, from a long series of measurements made over an extended period, it has been observed that both periodic and irregular fluctuations take place. Practically all wavelengths are more or less affected at the time of intense aurorae and abnormal variations in terrestrial magnetism.[11] So closely have the latter phenomena been related with radio transmission that it appeared initially to be the cause of changed radio conditions. Further analysis has shown, however, that they are co-existing phenomena—the ultimate cause appears to be in the sun and other probable cosmic factors. Espenchied, Anderson, and Bailey[17] were the first to call attention to the relationship between abnormal radio transmission on long waves and disturbances in the earth's magnetic field. The effect observed was a large decrease in the night-time signal intensity and a slight increase in the daylight values.

The aurorae are seen most frequently during the period of greatest solar activity, i.e., when sunspots are most numerous. The most spectacular auroral displays appear when the region of solar activity is turned toward the earth, and our world becomes an easy target for the disturbing influences leaving the sun.

There is a certain rhythm to solar activity; the changes are generally characterized by regular periods of minimum, increasing, maximum and decreasing number of sunspots and other factors. The solar radiation undergoes changes which synchronize rather closely with solar activity. The period between adjacent maxima and adjacent minima varies from seven to seventeen years (average 11.13 years) recurring about nine times a century. Other variations of both a fortuitous and periodic character have been observed, superposed upon the 11-year cycle. It has been found that during some years spots are in evidence every day—the number observed depends upon the size, quality, and magnifying characteristics of the observing instrument. The majority of these spots have only a short life. Some last for as many as four to six solar rotations and occasionally even longer. Some years there may be as many as 200 days when no spots are seen.

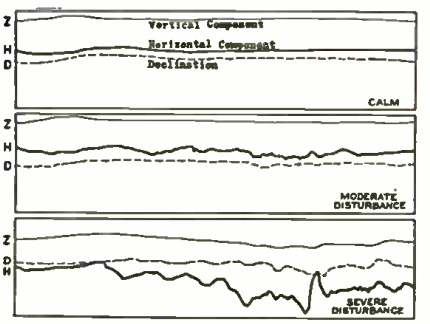


Fig. 2. Magnetograms. (From January, 1933 Proc. I.R.E.; "Transoceanic Reception of Radio Telephone Signals, by R. M. Morris and W.A.R. Brown.)

Sunspots, which are huge whirlpools of gases on the sun's surface, have been found to be regions of reduced temperature in the solar atmosphere, and hence appear dark only by comparison. Since measurements have indicated that a spot is about 1200 to 2000 degrees Centigrade cooler than the undisturbed surface of the sun, Dr. Henry Norris Russell,[4] Director of the Princeton University Observatory, has called them "Incandescent Refrigerators." (The normal photosphere temperature is about 5750 degrees Centigrade). Even though sunspots appear dark against the dazzling solar background, actually the blackest portion of a sunspot is more brilliant than the brightest part of an electric arc light. The whirling motion of a sunspot, involving as it does large numbers of electrified particles, has given rise to the development of a magnetic field within the spot.

Sunspots move across the surface of the sun by virtue of its rotation. By observing the motion of spots it was found that the sun does not rotate like the earth. Its fluid-like mass rotates faster near its equator than it does in higher latitudes. As seen from a fixed point in space the rotation period (si-

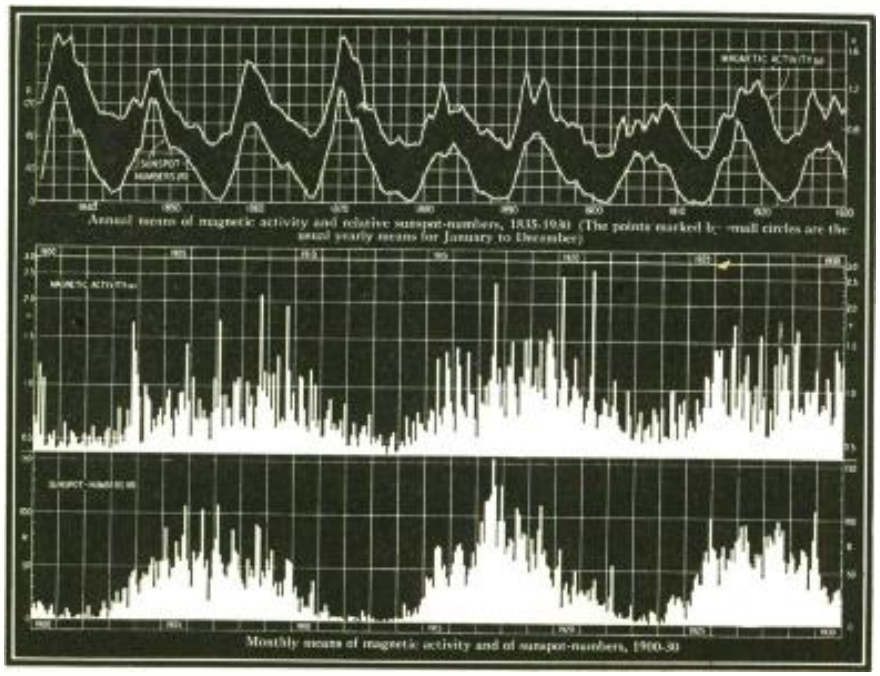


Fig. 1. Magnetic activity and sunspots; J. Bartels, March, 1932. (From "Terrestrial Magnetism and Atmospheric Electricity".)

ATMOSPHERE

PART 4:

Radio Transmission — Terrestrial Magnetism — Solar Activity.

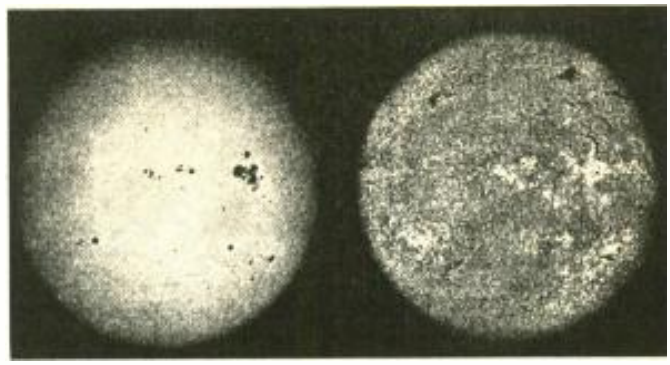


Fig. 4. Photoheliogram and Spectroheliogram of sunspots, H alpha line. (Mount Wilson Observatory.)

dereal period) of the sun is 24.6 days at its equator and 33.3 days at a latitude of 80 degrees.

In addition, the sunspots seem to have a motion of their own. The area of activity which produces the spots appears in two zones ranging from latitudes of about 5 to 30 degrees on both sides of the equator. The seats of activity seem to start in a latitude of 30 degrees and gradually move toward tht equator, reaching their maximum activity at about a latitude of 16 degrees. At the time of the sunspot minimum, there are four well marked belts, two near a latitude of 30 degrees, which is the active region just beginning, and two near the latitude of 5 degrees, which is the active region just dying out.

Magnetic Storms

The needle of the magnetic compass has been observed to periodically swing slowly through a few minutes of arc every day. It was not so long after the discovery of the periodicity of sunspots (Herr Heinrich Schwabe 1843), that a similar cycle was observed in the range of the compass variation and, in the strength of the earth's magnetic field. Often the compass needle would suddenly oscillate through an arc of several degrees within an hour or two, at the same time there would be relatively large fluctuations in the earth's magnetic field. This effect is called a *magnetic storm*. During this period, there would be large current sheets flowing back and forth in the earth's outer crust. Often these would be of sufficient magnitude so as to seriously interfere with telegraph systems that utilize the earth as a return conductor. As in the case with the aurorae, these magnetic storms are most frequent at the time of the greatest number of sunspots, and generally coincide with the appearance of spots and abnormal activity near the center of the sun's disk.

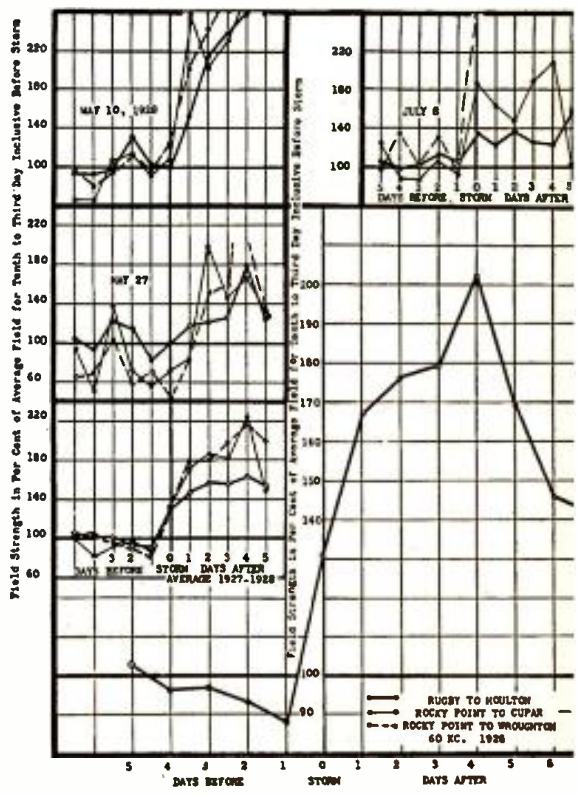
The aurorae are most frequently seen in the polar regions, showing a maximum, near the latitude of about 60 to 70 degrees. Terrestrial magnetism also shows greater variations taking place toward the polar regions. It is evident that the disturbing influence leaving the sun, that is responsible for the terrestrial effects, is of an electrified nature and are more concentrated into the polar regions by the earth's magnetic field.

The changes in radio transmission occurring during magnetic storms are less prominent on the longer wavelengths. On the shorter waves, transmission is generally subject to higher attenuation; in some cases the signals become too weak to be used commercially, and sometimes too weak to be even distinguishable. These periods may last a few hours to possibly as much as two or three days in extreme cases. They are followed by a period of recovery lasting from one to several days, during which time transmission may be subnormal. A very important fact brought out by analyzing disturbed condition phenomena, is that the transmission is most adversely affected along paths which lie near zones surrounding the earth's magnetic poles. This is indicated by the marked effect which these disturbances had on the north Atlantic circuits while showing a much smaller effect on the circuits between North and South America.[29] In fact there were instances where South America had heard both London and New York calling each other during a severely disturbed period, but neither of the latter heard each other.

Generally the effect of solar disturbances is to weaken the strength of the short waves and slightly improve the long waves. During these times the E layer of the ionosphere is denser and the F_1 layer and nighttime F layer are more tenuous. The effect of this is to shift the optimum frequency to a lower value on the short waves.[10] If the disturbance is not too severe, commercial operation can obtain on the lower than optimum frequency. For instance, on the New York-London short-wave channel, 16 meters is the optimum wavelength for summertime operation between approximately 1300 and 1800 GMT. On a day when a moderate magnetic storm occurred, 16 meters would be too weak to be used, and fair operation obtained on 20 to 24 meters. During very severe magnetic storms, when the short waves to Europe are wiped out, communication must be carried on over the very long wavelengths.

Schafer and Goodall[8] have found, during their ionospheric explorations with radio impulses, that there is a definite correlation between the value of ionic density of the F_1 region and magnetic storms; a decrease in ionic density being obtained on magnetically disturbed days. During moderate magnetic storms the virtual height of the lower (E) layer seemed to decrease (indicating higher ionization). During severe magnetic storms the measurements suggested a condition of great turbulence in the up-

Fig. 5. Effect of solar disturbances on 60-kc daylight radio transmission. (C. N. Anderson, Proc. I.R.E., September, 1929.)



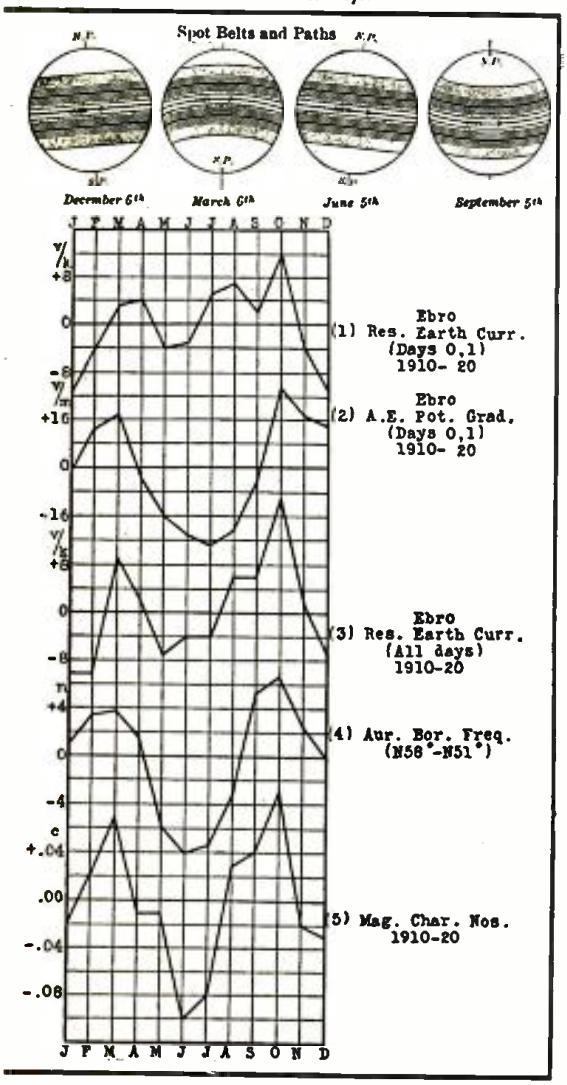
per ionized regions, which undoubtedly was responsible for the greater attenuation of short waves.

Kirby, Berkner, and Stuart[9] found in their studies of the ionospheres on frequencies returned from the F_1 region, that retardation of the pulses were longer (indicating greater height and lesser ionization) and subject to greater absorption during magnetically disturbed periods as compared with undisturbed times.

Professor E. V. Appleton[36] finds that *under normal conditions* the daytime electron density in region E is only about one-quarter to one-fifth of that in region F_1, but under abnormal region E conditions the electron density at the 100 kilometer level may be actually higher than that in the upper region.

No information is available as yet, as to what occurs in the D layer during a magnetic storm, but we know that the very long wave radio transmission is improved during daylight; hence by posteriori reasoning, we may expect it to show an increase in ionic density.

Fig. 10. Annual variations of diurnal range of electric and magnetic phenomena. (Vol. 27, 1922, "Terrestrial Magnetism and Atmospheric Electricity.)



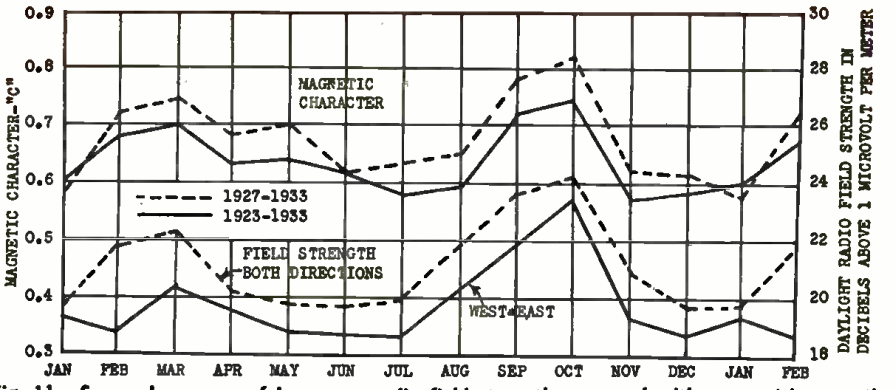


Fig. 11. Seasonal averages of long-wave radio field strength compared with terrestrial magnetic activity. (From Bell System Technical Journal, October, 1935. "Long-Wave Radio Telephone Transmission," by Austin Bailey and H. M. Thomson.)

Referring to Figs. 5, 6 and 7, it can be seen how closely the magnetic storm condition correlates with radio transmission across the North Atlantic. A further analysis of these curves brings out an interesting point. Coming events cast their shadows before. It will be observed in the case of the long waves that the daylight field strength is generally subnormal a few days before the storm, and on the short waves, transmission conditions are abnormal during the same period. So, exceptionally good short-wave conditions across this transmission path may be taken as a portent of something about to happen. A sort of calm before the storm. On the long waves, it may be looked upon as a benign influence. All storms do not show the same characteristics. One may start right on the heels of a preceding one, and the effects will be accordingly modified for both, etc.

Chapman[38] in analyzing magnetic storm data from stations situated in different latitudes, finds that the disturbances in the polar regions are very intense as compared with the disturbances observed in lower latitudes. Even on relatively quiet magnetic days, there remains a certain amount of disturbance, with its associated diurnal variation. In middle and low latitudes this is small compared with the normal quiet day variation, but it is still considerable in high latitudes, sufficient to be able to mask partly or wholly the residual diurnal variation corresponding to an ideally quiet day. Within the auroral zone the normal quiet day variation becomes insignificant compared with the disturbance variation, even in the reduced form of the latter on magnetically quiet days. The auroral zone appears to broaden and move toward the equator during periods of intense disturbance.

Generally the magnetic variations occurring in the polar regions, on what would be considered normally quiet days, are of a magnitude that would be considered a moderate to severe magnetic storm in lower latitudes. This indicates that there is a continual arrival of shoals of charged particles from outer space, being deflected into the polar regions by the earth's magnetic field.

Zones of Difficult Transmission

These prevailing disturbances in the polar regions constitute a serious barrier to commercial short-wave transmission through this area. Fig. 8 shows the zones which, in the present state of the communication art, are considered dead for commercial operation from New York and San Francisco. An example of this situation was encountered several times on the ship-to-shore circuit during round-the-world cruises. Because the path of communication passed right through this difficult area surrounding the northern magnetic pole, it was practically impossible to talk on short waves for any satisfactory period from overseas stations near New York while the ships sailed east from India to about a day out of Japan. During this time, communication was established through the San Francisco station on the west coast. The west coast station experiences similar difficulty for transmission from the Mediterranean and Red Sea, and from most European points. Mr. Henry E. Hallborg[35] outlines similar difficulties on the RCA point-to-point facilities, in an excellent paper delivered before a joint IRE and URSI meeting in Washington, D. C., on April 26, 1935. Trans-

Fig. 8. Map showing commercially dead zones. (From "Long Lines," August, 1935.)

mission to points subtended by this difficult area is accomplished by relaying through other points, that reach the desired destination over paths which lie outside of the dead zone. For example; to reach the Orient from New York, radio transmission is accomplished through the west coast station at San Francisco, and over wire lines from San Francisco to New York for telephony.

The synchronous behavior of the departure from normal of radio transmission on the one hand, and terrestrial magnetism on the other, with the changes in solar activity, led to a study of their correlation, and an investigation of the machinations of the various factors believed responsible therefor. Much information has been gathered, but the answer as yet is not altogether conclusive.

Solar Phenomena

The most conspicuous of the solar phenomena, usually seen coincident with the changed radio conditions, are sunspots. The general disturbance is also evidenced in other solar activity such as: bright patches on its surface, called faculae, clouds of hydrogen and calcium gases called flocculi, regions of sheets of flaming gases called prominences, and increases in the solar corona. All of these belong to a great group of activities and may apparently replace each other, or at least react upon each other in such a way that no one of them is more than a rough indication of the true activity taking place on the sun.

Sunspots and faculae are the only solar phenomena visible to the eye directly. During a total solar eclipse, prominences and the corona, with its streamers, can

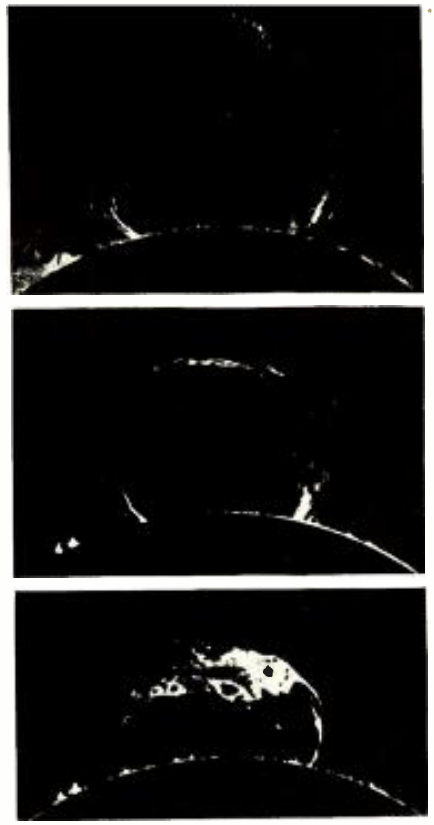


Fig. 9. Great eruptive prominence of July 15, 1919. (Yerkes Observatory.)

be seen projecting beyond the edge of the disk. In order to see the flocculi and prominences when they are on the sun's disk, a device known as the spectrohelioscope must be used. This device permits the sun to be seen or photographed through the radiations of some of the sun's particular chemical elements, i.e., observing the sun through its various spectral lines.

Figs. 3 and 4 show direct photographs of the sun showing sunspots, and spectroheliograms taken through calcium and hydrogen radiations. It will be observed that the bright flocculi, which are the light splotches, appear in greater numbers around sunspots. These bright flocculi lie at a comparatively low level and are brighter than the photosphere because of higher temperature. These do not project above the sun's edge as prominences. The prominences, when viewed on the disk, appear as dark flocculi. These are generally dark because the hydrogen and calcium gas of which they are mostly composed, is comparatively cool at high levels, and thus absorbs the light from the hotter region below. As the sun rotates, the dark flocculi take on the appearance of prominences as they approach the edge of the disk.

The birth of a sunspot is generally preceded by an eruptive prominence. These vast masses of flaming hydrogen, helium, calcium—mixed with gaseous iron, magnesium, sodium and other elements, are shot from the sun's surface to heights ranging from a few thousand to millions of miles, at speeds up to a hundred miles a second and greater. These activities suggest that the influences in operation on the sun are gigantic storms whose fury pales into utter insignificance the most violent of earthly tornadoes. A well developed spot itself stimulates fresh eruptions.

A very interesting theory, called upon to explain how solar activity affects the earth, considers that the forces of solar radiation and this abnormally violent turbulence combine to send streams of electrified particles out into space. These are believed to be projected outward in somewhat the same manner as are jets from a revolving water spray as it sprinkles a lawn. As the sun rotates on

[*Continued on page 362*]

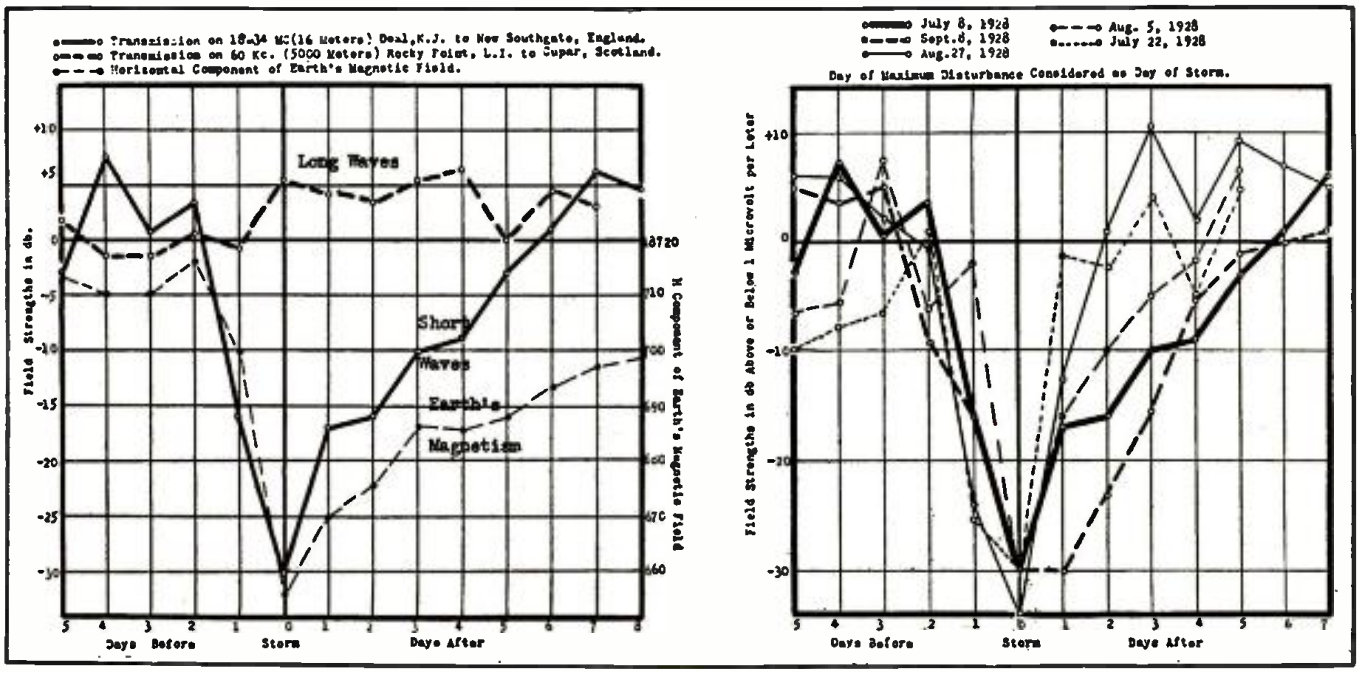


Fig. 6. (left). Variation in radio transmission before and after solar disturbance, July 8, 1928. Fig. 7. (right). Variation in field strength before and after a solar disturbance. (C. N. Anderson, Proc. I.R.E., September, 1929.)

Globe Girdling

By J. B. L. Hinds

true dx'ers . . . soviet broadcasts . . . queen mary frequencies . . . new calls for ethiopia . . . spanish pronunciations . . . amateur phones . . . new stations

IT is said that "DX" signifies distance, which brings to the mind of the writer the word "DXers." Now DXers are made up of many classes, and are determined by the objective, the ambition, and the desire of the individual and therefore represent character and reputation backed only by the conscience of the individual.

"True DXers"

I like to regard DXers as "True DXers," for in that class we find those who seek to add all possible stations to their lists purely for the enjoyment of receiving and verifying them, who tell of their successes solely in the desire to assist others to obtain the same enjoyment, have pride in their character and reputation, and with no inclination or desire at heart to create the impression of superiority over others.

Such a DXer needs no display of verifications to accredit his ability and would derive no pleasure in securing one, other than through honorable means, or would not withhold information with the thought that others might use it for dishonorable ends. The obtaining of verifications therefore is backed by his conscience.

"Superiority" never did mean much to the writer, for where is the DXer who has a verification for every station that broadcasts; and besides you will always find someone who has a verification which you have not, no matter what ability you think you have, for there are many factors other than personal skill involved, such as the hour of the day, the frequency employed, the direction of the beam, the hours you are required to be away from your receiver when following your daily vocation, and your location. All play an important part in the results obtained. It has been said that we are on equal terms only with those in our own locality.

In my contact with the many readers of ALL-WAVE RADIO, I am impressed with the great number who forward information to me with no thought except reporting for the benefit of others and with no idea of publicity to themselves, and I wish all to know that I appreciate deeply the spirit of helpfulness extended and intended. I also appreciate the many expressions of good will and good cheer.

MR. J. B. L. HINDS

Silver lady sporting in blue atmosphere with red planets . . . get one of these.

Soviet Broadcasts

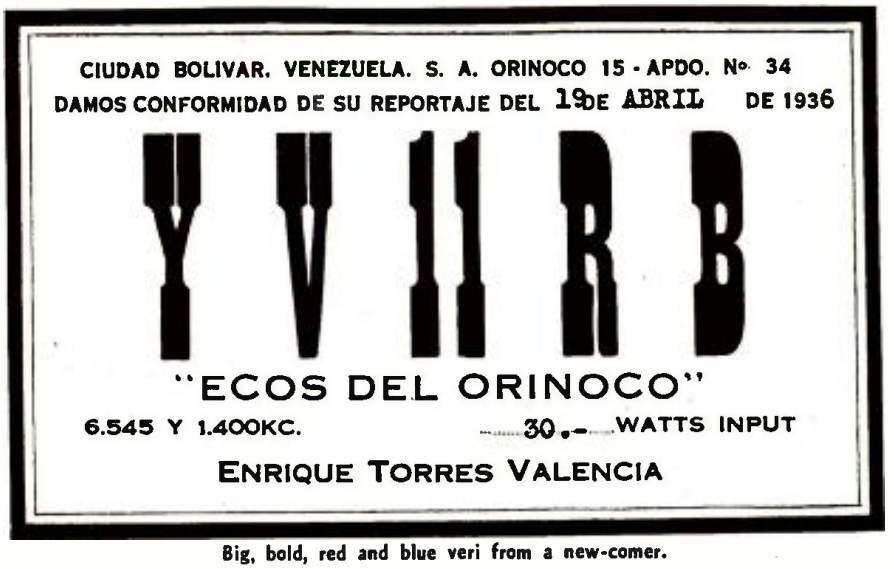
It is learned that VK6ME, the new station at Perth West, Australia, will soon be on the air testing and broadcasting on 9590 kc.

VQG, Nairobi, Kenya Colony, Africa, a new phone station, is said to contact London between 7:00 and 8:00 A.M. on 15280 kc.

The work of rebuilding the transmitter of HC1PM, Quito, Ecuador, on 5725 kc, is about completed and this station will soon be heard with greater power.

It is said that Mr. J. Sanders is now Engineer-in-Charge of Java Wireless stations and stationed at Bandoeng, Java. Mr. H. Van der Veen formerly was in charge.

The striking of the big tower clock in the General Post Office building at Mel-



Big, bold, red and blue veri from a new-comer.

bourne, Australia, is now being heard at each hour on the broadcasts of VK3ME Melbourne, on 9510 kc.

The new broadcasting station with call letters RAN (9520 kc, 31.51 meters) Moscow, U. S. S. R., is being received with good power daily, but interfered with to some extent by its closeness to W2XAF and at occasional times by bursts of code from an unknown source. Miss Inna Marr, Chief Editor, Moscow Radio Centre, advises it is a daily broadcast beginning at 12:00 A.M. G. M. Time (7:00 P.M. E. S. Time). The station has, however, been heard before 7:00 P.M. broadcasting in some other foreign language. The broadcasts between 7:00 and 7:30 P.M. are in English; 7:30 to 8.00 P.M. in German.

RV96 (19.76 meters) Moscow, is reported as being heard and requesting reports sent to Moscow. This station heard by James V. Saxton, New York City, on two occasions of late.

Queen Mary Frequencies

The following frequencies are used by the *Queen Mary* of the Cunard-White Star Line under the call letters GBTT:

kc	*meters*
17800	16.85
16420	18.27
13330	22.50
12340	24.30
8840	33.93
8200	36.58
4420	67.87
4100	73.17

The Venezuelans

Permission to broadcast has been granted two new short-wave stations in Venezuela. YV14RC on 6270 kc is to be operated by Senor V. M. Soto, owner of "Casa Philco" in Caracas. It is Mr. Soto's intention to broadcast original programs and not records. It is expected that the station will be in operation the first or second week in September.

YV15RC, Valencia, the capital of the State of Carabobo, will transmit on 5910 kc. The approximate date of opening is not known at this time.

YV7RNO, Maracaibo, Venezuela, originally assigned to 5810 kc and not reported as being heard on that frequency, is now broadcasting on 6070 kc.

France is now sending verification cards for reception of stations TPA2-3 and 4.

CO9RY, a new experimental station in Cuba, is being heard on 6240 kc broadcasting evenings. Address is Senor Bernabe R. de la Torre, Gral Belancourt 51, Matanzas, Cuba.

It is understood that HJ4ABC, "La Voz de Pereira," is now broadcasting only on long waves.

Two or three reports have been received that HIX was picked up on 12262 kc and HJ3ABD on 12100 kc, although the last reports from the stations indicated that HIX was on 6131 kc and HJ3ABD on 6050 kc. It is probable that the first mentioned are the second harmonics of the latter frequencies.

Senor Antonio Fuentes L, of Station HJ1ABE, Cartagena, Colombia, advises that they have been off the air on short waves since April 7th and broadcasting only on long waves only until completion of the installation of their new 1000-watt transmitting plant to operate on 9500 kc. HJ1ABE sold its old transmitter to Sr. M. Vega A in Sincelejo, Colombia, and is being heard at times on 7200 kc, (41.67 meters) under the call HJ1AVE. This call will be changed. Senor Vega broadcasts on 7200 kc 6:30 to 8:30 P.M. daily. After 8:30 P.M. the transmitter works phone and cw with amateurs.

R. Simpson, Concord West N. S. W., Australia, advises he hears a phone testing on 21.9 meters with call VJZ and announcing, "This is VJZ, Rabaul Territory of N. C. Broadcast. Send reports to Radio Office Rabaul, New Guiana."

Ethiopian Stations

The Ethiopian stations formerly operated by them from Akaki, near Addis Ababa have been rebuilt and will be operated soon under new calls as listed below:

Kc	*Old Call*	*New Call*
18270	ETA	IUD
15450	—	IUG
11955	ETB	IUC
7620	ETD	IUB
6922	—	IUF
5880	ETG	IUA

Stations IUG and IUF on 15450 and 6922 kc are new transmitters.

Thomas Taaffe, Jr., Elmsford, New York, installed a swell new doublet aerial and it worked fine. Lightning recently struck it and Tom says "it sure knocked it for a row of pins." Luckily

Veri-valentine from HC1PM—salmon colored card.

he had a lightning arrestor on both legs of the transmission line. One was burnt crisp and the side of the house blackened over an area a foot square, but the receiver was uninjured and there was no further damage to the house.

YNLF Managua, Nicaragua, now advise that they have changed from 6451 to 9595 kc.

LRX listed at 9580 kc is reported as having changed to 9640 kc.

Mr. R. B. Oxreider, State College, Pa., reports hearing YNLF near 9655 kc. Others report LRX as working 9640 to 9660. As no one seems sure as to the call of either it is difficult to say what is correct.

The report is that HJ1ABB moved from 6447 to 6128 kc but has met with considerable interference there, which is not surprising. There have been no reports received as to its being heard on 6128 kc and it appears absent from its usual frequency.

Station Shifts

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

New	*Call*	*Old Frequency*
16250	FZR	16214
13100	VPD	13075
10530	JIB	10535
9595	YNLF	6451
6545	YV77RB	6570
6410	TIPG	6385
6190	HI1A	6182
6150	YV3RC	6165
6131	HIX	5980
6105	HI3C	6977
6085	HJ5ABD	6490
6025	HJ1ABJ	6006

Spanish Pronunciations

As several requests have been made I am listing below the Spanish pronunciation of letters of the alphabet and of the simple numerals as shown in the Department of Commerce record book of May 15th, 1935.

	Letters		*Numbers*
A	ah	1	uno
B	bay	2	doce
C	say	3	trace
D	day	4	kwah-tro
E	ay	5	sinko
F	effay	6	sase
G	hay	7	sate
H	ah-chay	8	ocho
I	ee	9	noo-a-vay
J	ho-tah	10	de-ais
K	kah	11	on-say
L	ellay	12	do-say
M	emmay	13	trasay
N	ennay	14	katorsay
O	oh	15	keensay
P	pay	16	deesi-sase
Q	coo	17	deesi-sate
R	erray	18	deesi-ocho
S	essay	19	deesi-noovay
T	tay	20	vain-tay
U	oo	30	trayntah
V	vay	40	karentah
W	dooble-vay	50	seen-kentah
X	eckis		
Y	egree-ay-gah		
Z	zed		

New Veries

Verification card from the new Venezuela station YV11RB located at Ciudad, Bolivar, has been received. This station is known as "Ecos del Orinoco" and operates daily from 7:00 to 10:00 P.M. on 6545 kc with but 30 watts power, The veri card is white background, red call and double border with other lettering in black.

Veri card from HI8Q "Emisora Carta Real" is white background and call in Red. Address: Avenida Expana No. 12, Ciudad, Trujillo, R. D.

Card from the League of Nations station, Geneva, bears various call letters with details of service, etc. An ink line is drawn through those frequencies not received. The word "Radionations" is printed cornerwise in red on the white background.

Other veries received are as follows: HI1S, Puerto Plata, R. D.; HAT4, Budapest; PDV, Radio Kootwijk, Netherlands; RKI, Moscow, U. S. S. R.; HJ1ABP, Cartagena, Colombia; COCD Havana, Cuba; HJ1ABG, Barranquilla, Colombia; YV3RC, Caracas, Venezuela; and HI3C, La Romana, R. D.

New Stations

Other new stations listed are as follows:

Kc	*Call*	*Location*
14970	LZA	Sofia, Bulgaria
13410	YSJ	San Salvador, Salvador
11560	CMB	Havana, Cuba
9520	RAN	Moscow, U.S.S.R.
8630	CMA	Havana, Cuba
6070	YV7RMO	Maracaibo, Venezuela

Complaints continue to come in regarding the slowness of some stations in verifying reports and we are still continuing in the list stations HJN, HKV, HJ3ABF, HJ4ABD, HJ4ABB, HJ1ABB and HJ1ABJ, Colombia; HC2CW, HC2ETC, Ecuador; XBJQ, Mexico; HRN, Honduras; TIEP, Costa Rica; CT1AA, Portugal; YNVA, Nicaragua, and CB96O, Chile. If others should be included please send the calls. I have yet to hear from one listener who has heard direct from HRN either by card or letter. CT1AA and HJ1ABJ have recently replied to some, but are still tardy with many.

Amateur Phone Band

From late reports of listeners on the 20 meter amateur phone band it is noted the following stations were received: EA8AL-AT-AO-AF-AA-AS and LW, Canary Islands; SU1CH, SU1RK and SU8MA, Egypt; G5NI, G5VL, G6LK, G5BL, G5JO, G2BY and G6BL, England; HC1RT, Ecuador; TI2RC, TI2AV and TI5JJ, Costa Rica; K6KKP and K6JLV, Hawaii; OA4AV, Peru; VP4PX and VP4TH, Trinidad; CE1AQ and CE1AR, Chile; ON4VK, Belgium; YN1OP, YN1HS and YN1TR, Nicaragua; NY2AE, Canal Zone; PY2CK and PY2ET, Brazil; CO2AN and CO2WZ, Cuba; VP5AQ, Jamaica; HH5PA, Haiti; VO1I and VO1P, Newfoundland; HJ1ABN, HK1BM and HJ1ABM, Colombia; YV4AC, Venezuela; HB9A, Switzerland; EA7AI and EA4BM, Spain; PAO1DW and PAOFB, Holland; LU8AB and LU5PZ, Argentina; VK2NY, VK3AB, MR and EG and VK4JX, Australia; VK7JB

Red and green veri from Hungary, with photo affixed.

and VK7XL, Tasmania; EI2J, Ireland; I1KS, Italy; PK1MX, Java.

All reports were not outlined as suggested in my comment in the July issue, making it impossible to list the calls as proposed.

It might be of interest to readers that reports indicate the Australian amateurs are heard best from 1:00 A.M. to 7:00 A.M., but are heard often as early as 12:00 midnight. The European stations are still coming through best between 4:00 P.M. and midnight. As a rule they are best around dusk. South American stations are being heard up to as late as midnight but appear to be best around 7:00 to 9:00 P.M. Stations in the West Indies, Bahamas, Central America, Barbados, Canal Zone, Newfoundland and Hawaii can be picked up most any time but as a rule best in the late afternoons and evenings.

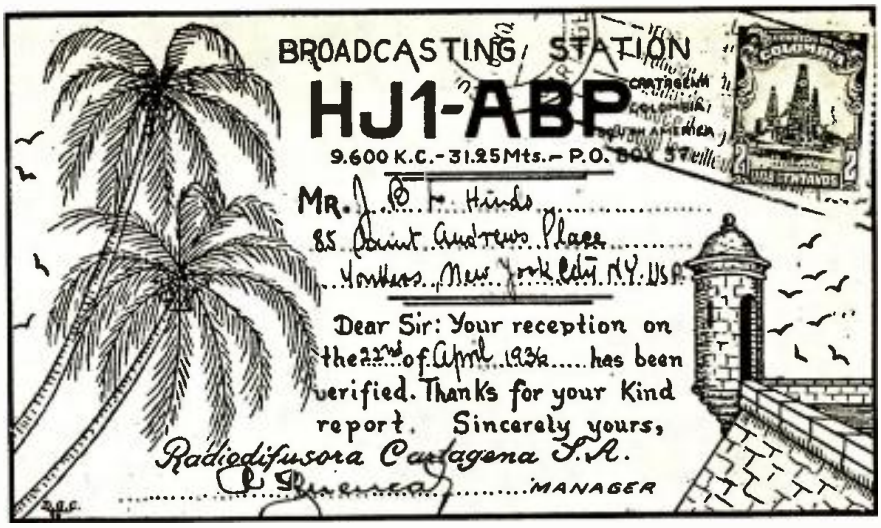
If the individual listeners would be kind enough to make up their reports as suggested in my July article a better digest might be prepared.

Appreciation

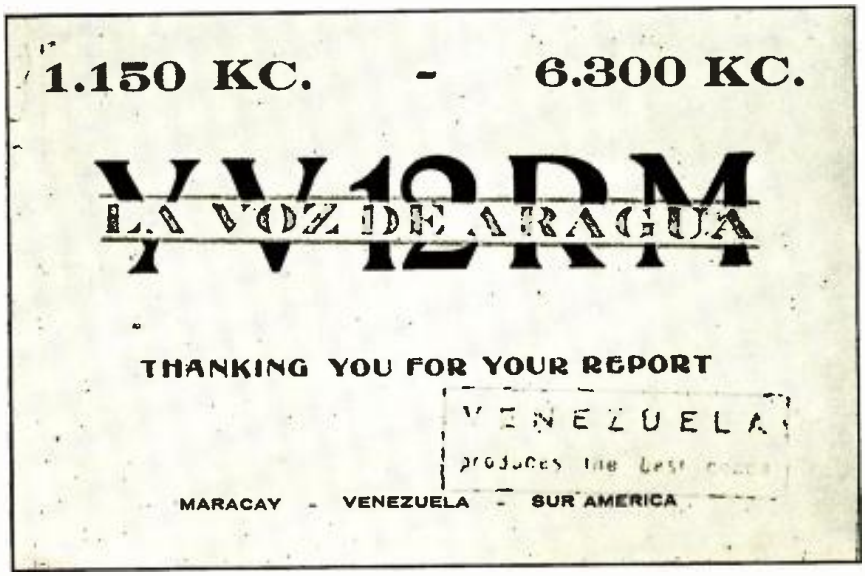
We desire to thank Mr. David H. Stone, Brooklyn, N. Y.; Mills Van Bergen, Syracuse; J. F. Quigley, Council Bluffs, Iowa; Roy Waite, Ballston Spa, N. Y.; Joseph H. Miller, Brooklyn, N. Y.; G. T. Magee, Birmingham, Ala.; Robert L. Weber, West McHenry, Ill.; W. H. Stark, Wauwatosa, Wisc., and Raymond S. Swenson, Rockford, Ill., for their information and assistance.

It is with much pleasure that we acknowledge many fine reports and letters from Mr. Ben Adams, Jr., Brooklyn, N. Y., Vincent Clarke, Montreal, Que., Canada, Miss Ivy E. Fugl, St. Paul, Minn., Mr. William Grote, New York City, N. Y., Miss Eileen Hofmaster, Sandusky, Ohio, Mr. C. D. Kenyon, Cleveland, Ohio, H. E. Mack, New York City, N. Y., J. F. Quigley, Council Bluffs, Iowa, C. F. Russ, Houston, Texas, David H. Stone, Brooklyn, N. Y., J. V. Saxton, New York City, N. Y., Charles R. Steegmuller, Newburgh, New York, Mills Van Bergen, Syracuse, N. Y., Richard Bergrugghe, Jr., Detroit, Mich., J. L. Webb, Joplin, Mo., and Dellner Sopher, Steger, Ill., and to extend to them and many others the thanks of ALL-WAVE RADIO and the writer of this section for their fine letters and reports. My special thanks are extended to Mr. J. Wendell Partner, Tacoma, Washington, R. B. Oxreider, State College, Pa., Lyle Nelson, Yamhill, Oregon, Wilfred T. Siddle, Birmingham, Ala.; L. M. Clark, R. Simpson, Concord West, N. S. Wales, Australia, James Waters, Cleveland, Ohio and Ashley B. Wood, Jr., Bangor, Me., for their able and generous assistance.

All questions regarding unknown stations and station matters in general will be cheerfully answered. Suggestions and criticisms welcome. Address your letters to me at 85 St. Andrews Place, Yonkers, New York, enclosing self addressed stamped envelope if you desire reply. Questions of a technical nature should be forwarded to Queries Editor, ALL-WAVE RADIO, 16 East 43 Street, New York, N. Y.



A nice veri from HJ1ABP, Cartagena.



"Venezuela produces the best cocoa," is stamped on this veri.

BOOK REVIEW

"TELEVISION WITH CATHODE RAYS," by Arthur H. Halloran. $2.75 per copy. Pacific Radio Publishing Co., Inc., San Francisco, Calif.

The operating principles of the cathode-ray tube and its application to television are here explained in terms which can be understood by radio amateur operators and service men. The text constitutes the lecture notes for a course on television given under the auspices of the Extension Division of the University of California. The specific treatment is preceded by a description of the general manner in which television is accomplished and is followed by an appendix telling how to read the mathematical language employed by technical writers.

The main treatment starts with the practical use of the cathode-ray tube as a voltmeter, without regard to its theory, which is later illustrated by means of the patterns on the screen of the instrument. The fundamental theory of electrostatic effects including capacitive reactance, of electromagnetic and high-frequency resistance effects including inductive reactance, and of impedance effects including resonance, is thus gradually developed in terms of electronic motion as a preliminary to a brief account of the use of the ocsillograph in aligning tuned circuits. A novel feature of this treat-

[*Continued on page 361*]

Night-Owl Hoots

By Ray La Rocque

cheating at solitaire . . . bon bons from KIEM . . . no shouting says argentina . . . super-power menace . . . new stations and calls

THE past season has been marked by a great deal of comment on the part of radio clubs and DXers regarding the subject of dishonest DXing. Many have even ventured to say that the number of dishonest DXers is increasing so alarmingly as to seriously threaten the existence of the hobby. Your Chief Night Owl has been associated with DXers and DXing for the past seven years and has yet to have any contact with a DXer who was dishonest.

DXing is a hobby that does not make way for any cheating, for dishonesty usually exists only where something of monetary value is involved. A radio log or a trunk full of verifications have no monetary value whatsoever. If there is such a person as a dishonest DXer, he can cheat no one but himself. A person must be very peculiar indeed to enjoy recording into a log book stations which he has not even heard. In regard to verifications, it is sufficiently difficult to obtain a verification from a foreign station with a correct report—what chance of ever receiving a reply does a fellow have who sends only fake reports or merely asks for a verification without submitting any report? If it were fame and recognition among other DXers of the world that such a person was seeking, he would surely find his efforts very unsuccessful, if not entirely futile.

New Antenna for WIBM

Marking an innovation in antenna construction, WIBM, Jackson, Michigan, has just completed the erection of a new tubular steel tower 218 feet in height. Following a considerable amount of research engineering, this type of antenna is thought to be the nearest thing to an ideal of any tower yet designed, and is expected to be widely used in the future by stations on frequencies above 1200 kilocycles. Being constructed of a tough, yet flexible copper-plated alloy steel, it is able to withstand terrific strains.

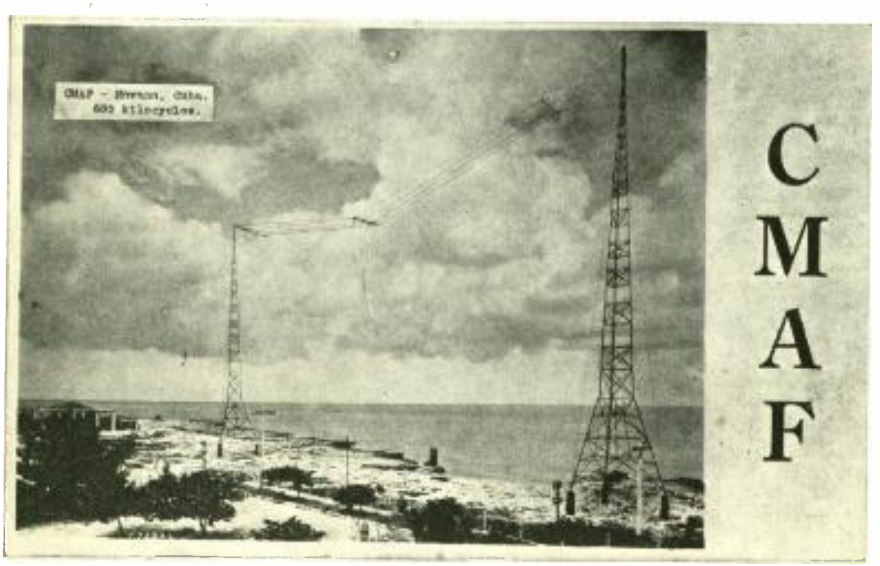
Due to its small cross-section area, illumination is supplied by two 500-watt flood lights, placed a few feet from the base of the pole. These serve not only as illumination of the tower, but are charted on all airway maps as marker beacons for the city of Jackson, and as a warning to the aviators of a high point in the city profile. Field-strength measurements indicate a 104% increase in signal strength as compared to conventional antenna systems.

Super-Power Menace

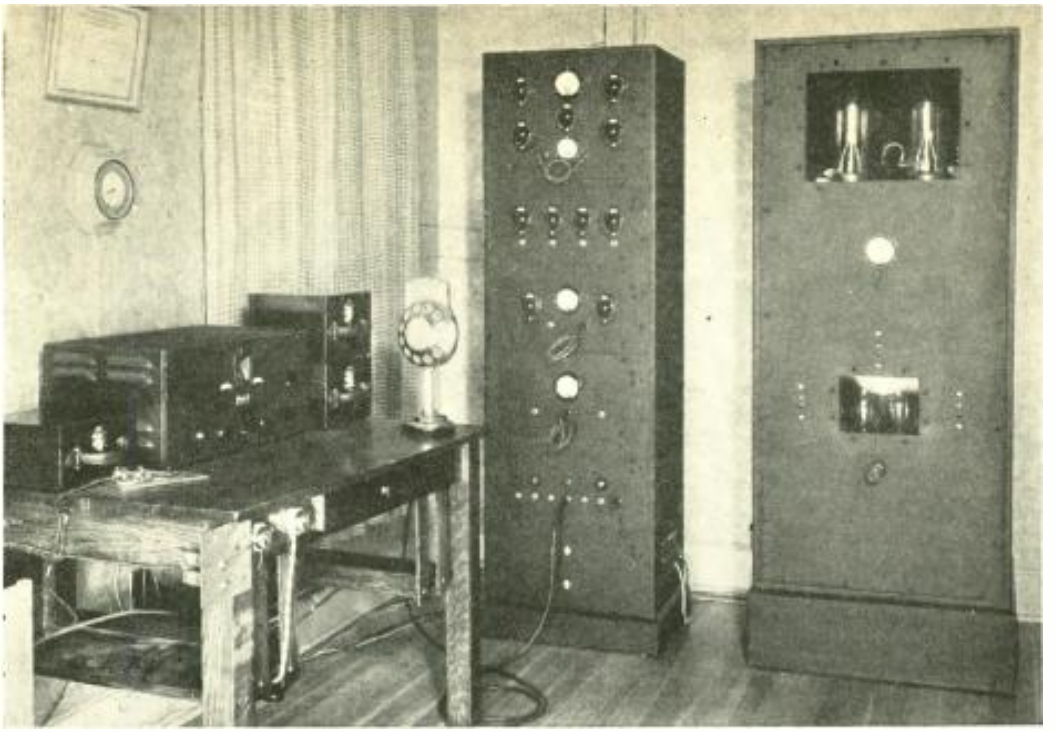
While the all-night stations with their endless supply of phonograph records continue to be a serious barrier for DXers to surmount, another obstacle in the path to smooth DXing arises in the form of super-power transmitters. The only 500-kilowatt station in the country now is WLW on 700 kc, whose signals now blanket the entire country so efficiently that a directional antenna had to be installed to prevent interference to CFRB, on 690 kc, in Toronto, Canada. Lately, however, it seems that a thirst for super power has sprung up among the stations of this country. WHO, WJZ, WGN, and WHAS have applications before the FCC at the present time and it is more than likely that other stations will follow suit.

It is sincerely hoped that the Commission will refrain from granting too many of these requests, especially to those stations in the central part of the country. Increases to such tremendous power will not increase the coverage of these stations in this country, as all of the stations now have a national coverage with their 50 kilowatts. The only people to benefit will be the DXers of Europe and Oceania, and certainly the FCC is not interested in serving the foreign public with its standard broadcast-band stations. The short-wave broadcasting stations are for this purpose and if any power increasing is to be attempted, it should be done on the short-wave bands. If better coverage of the out of the way districts is sought by the FCC, they need only to keep on with their policy of supplying small local sta-

[*Continued on page 364*]



Veri from Havana, Cuba. CMAF broadcasts daily from 5 to 11:30 P.M. and beginning at 1 P.M. on Sundays.



MR. TUCKER'S STATION. THERE ARE TWO TRANSMITTERS: 20 METER PHONE AND 40-METER C.W.

AMATEUR STATION W5VU

Dallas · Texas

AMATEUR Radio Station W5VU is owned and operated by Durward J. Tucker, 5712½ Marquita Avenue, Dallas, the Centennial City of the Lone Star State of Texas.

Many of the older hams will remember Mr. Tucker as an old-timer from way back when spark was in its heyday and absorption-loop modulation was the latest. The call at that time was 5AKX which was maintained until QRM from school work became so heavy that it was necessary to deliberately let the call expire about 1928. Unable to resist the temptation longer, activities were again resumed in 1930 under the call of W5VU. Later the call W5BXF was added, but has since been given up due to the ruling of the Federal Communications Commission that amateur stations can have only one amateur station call.

Experimental Xtal U.H.F.

Besides his amateur work Mr. Tucker has an Experimental Radio Station, W5XM, with which he pioneered crystal control in the ultra-high frequency region. This is one of the few individually owned ultra-high frequency experimental stations in the country.

As can be seen from the picture, the receiver on the operating table is a Hammarlund Comet Pro. A doublet in the attic is used with the receiver with very good results.

The instrument cases seen on the operating table, along with the receiver, contain a vacuum-tube voltmeter and general purpose test equipment.

The loudspeaker missed the picture but is located on a short rack and baffle board located to the left of the operating table.

Transmitters

Two complete transmitters are used at W5VU. The large cabinet houses a 40-meter c-w transmitter and the other cabinet contains the 20-meter 'phone transmitter. The microphone is a double button carbon and is shown on the right edge of the operating table.

The 40-meter transmitter uses a 112 tube as 80-meter crystal oscillator, a 46 doubler and two 212-D in push-pull as an oscillating lock amplifier. The 46 furnishes just enough excitation to the final stage to make the amplifier frequency keep in synchronization with the crystal, thereby giving all the appearance of crystal control. This provides an excellent means of obtaining crystal control with a high-power rig without the cost of expensive exciter or driver stages.

The 20-meter 'phone transmitter is built up of six complete units on standard 19-inch relay rack panels. Reading from the bottom up the stages are power, speech, modulator, oscillator, doubler and buffer, and power amplifier modulated stage.

In the speech amplifier there are three transformer-coupled stages. The first two stages use a 56 in each and the last stage uses two 45's in push-pull.

The 45's drive two 210's in Class B in the modulator stage. All transformers are Acme Delta and the frequency response curve is better than necessary for amateur voice operation.

An 80-meter crystal is used in a 59 tube tri-tet oscillator. The 2nd harmonic or 40-meter frequency appears in the plate circuit of the tri-tet oscillator. This frequency is doubled to 20 meters by the use of a 59 regenerative doubler. Two 46's in parallel are used as a buffer amplifier to excite two 801's in push-pull in the final amplifier.

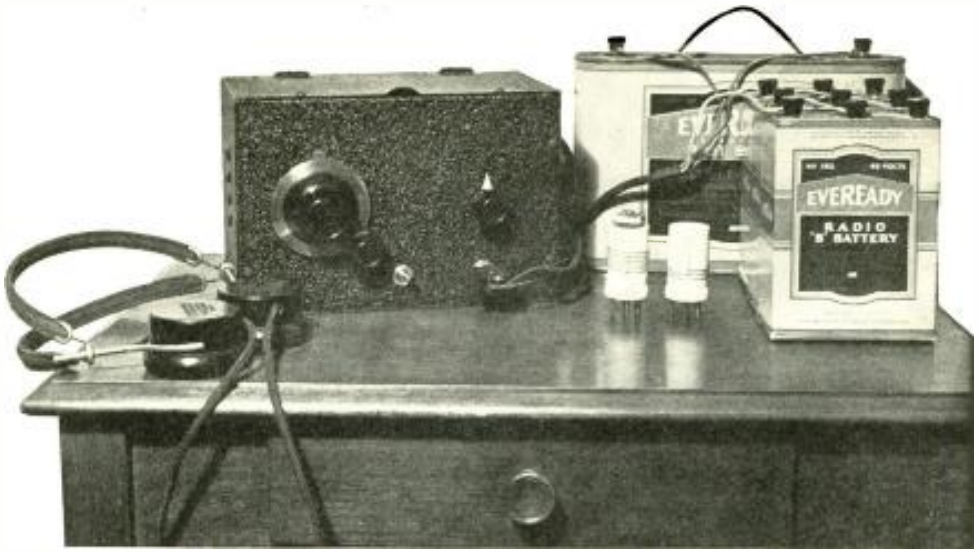
The final amplifier is usually run at 120 watts input and is modulated by the 210 modulator unit.

The Antenna

In order to work both transmitters efficiently off the same antenna, an antenna was put up with a fundamental frequency at 40 meters. The antenna is approximately 66 feet long with 45-foot zeppelin feeders, is 40 feet high, and points north and south. The 40-meter transmitter operates this antenna at its fundamental frequency and the 20-meter transmitter operates the antenna as a full wave on the 2nd harmonic and gives very good low-angle radiation.

Numerous contacts in scattered parts of the world have been made with both transmitters. Best 'phone DX are New Zealand and numerous heard reports from Australia.

The AWR-2



The completed receiver, with extra coils, and the A and B batteries.

PORTABLE 5-10-20-METER RECEIVER

By Willard Bohlen and Chester Watzel

A PORTABLE receiver differs from the standard type of receiver in that size and weight are of paramount importance, rather than sensitivity and selectivity. When carried to the extreme a portable receiver can be built small enough, including batteries, to fit in a coat pocket or two. This particular receiver is a practical compromise between one of this type and the usual 5-meter station receiver.

Interior, chassis view of the completed receiver.

Two of the 6.3-volt heater tubes are used. The 6-volt filament battery necessary for true portable operation is heavier than would be required for the 2-volt tubes, but this disadvantage is offset by the added convenience of being able to run the heaters from either an automobile storage battery or a 110-volt a-c line through a midget filament transformer. The receiver can thus be operated on three different types of filament supply.

The small plate current drain assures long life for the B batteries, so that they may be economically used at all times. A well-filtered power supply, such as that described last month in the article on the AWR-6 Band Spread Super, is quite satisfactory for house or Ham Station use. A bleeder resistor of about 15,000 ohms should be used and the B plus lead of the receiver tapped down at approximately 135 volts. On some supplies it might be advisable to bypass the B plus lead to the B minus through a condenser of several microfarads.

Tubes Used

Two type 76 triode tubes are used, one as a superregenerative detector and the other as an audio amplifier. These require only a low heater and plate current for proper operation. They are also quite inexpensive. For operation from a 110-volt a-c line where 2.5 volts is available for the heaters, either 56's or the older type 27's may be used instead.

Where B batteries must be used, several precautions should be observed. No bleeder network for providing fixed or variable voltage can be used as this would drain the batteries unnecessarily. Also transformer coupling should be used between the tubes as resistance coupling will lower too much an already low plate voltage on the detector. No separate tap is used for the detector plate voltage, making only one B plus lead necessary.

A cathode bias resistor, with accompanying bypass condenser, is used to provide grid bias for the audio amplifier tube, a practice not usual in battery receivers. While this lowers the effective plate voltage on the amplifier tube by the amount of the grid bias voltage, the usual C bias battery is eliminated.

The detector uses a circuit which requires no tap on the coil. This greatly simplifies coil winding. By using the right size of grid leak and correct degree of antenna coupling smooth superregeneration is obtained on 5 meters and straight regeneration on the other bands.

Construction

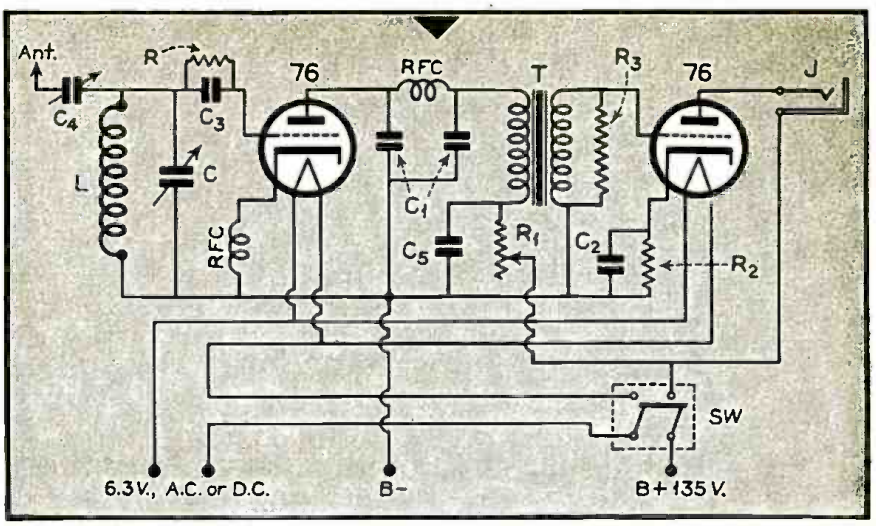
The construction is easy and straightforward. The base is turned upside down so that there is a half-inch space underneath. The binding post strip is made of an odd piece of bakelite or hard rubber. The audio transformer and sockets should be mounted up off the base and the prongs and lugs bent out. The coil and detector tube sockets should be mounted an inch and a half above the base to give short leads to the tuning condenser. Two holes should be drilled in the back of the cabinet, with grommets inserted, for antenna and battery cable.

The actual length and placement of the wiring is unimportant except in the detector circuit. Here it is highly important that short leads be used if proper 5-meter operation is to be secured. In order to duplicate the results of the original receiver the placement of the critical leads will be given. All other wires not mentioned can be placed as suits the convenience of the builder.

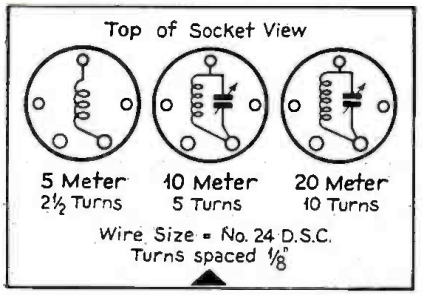
Wiring

The coil and detector tube sockets are mounted with the "filament" prongs to the rear of the set. The grid prong of the detector socket is connected through the grid condenser and leak to the adjacent stator soldering lug of the tuning condenser. The other stator lug of the condenser goes directly to the grid prong of the coil socket. The antenna coupling trimmer condenser fastens to this same prong on the coil socket with a short, stiff wire. The other end of the antenna condenser then goes around to the antenna binding post. A soldering lug is placed under the bolt-head that holds the end of the binding post strip nearest the coil socket. A wire runs from this ground lug to the "ground" prong on the coil socket. A wire goes from this prong directly to the rotor lug of the tuning condenser and another to the filament prong on the detector socket which is adjacent to the plate prong. An r-f choke is placed between the sockets as shown and connected between the "ground" prong on the coil socket and the cathode prong on the tube socket. The .00025-mfd mica plate bypass condenser goes directly between the plate prong on the tube socket and the adjacent filament prong which has already been grounded. The r-f choke in the plate circuit is slung under the detector tube socket with one end connected directly to the plate prong.

On 10 and 20 meters the antenna lead is connected to the antenna binding post and the antenna coupling condenser adjusted until smoothest regeneration control occurs. Too loose coupling on these bands might cause the detector to superregenerate. On 5 meters the easiest method is to take a turn around the upper end of the coil form with the end of the antenna lead. This turn can be slid up and down until smoothest superregeneration occurs.



Schematic diagram of the AWR-2 Portable Receiver.



Connections and winding data for the three coils.

A tuned antenna is usually best on 5 meters. A simple one to use is a half-wave Hertz with single-wire feed. Just cut the antenna 8 feet long, attach a feeder wire three feet from one end of the antenna, and run it to the set. The length of the feeder wire should make no difference. The 5-meter antenna should be as high as possible for best reception. Where possible a ground connection should be made to the cabinet to avoid body capacity in tuning on the 10 and 20-meter bands.

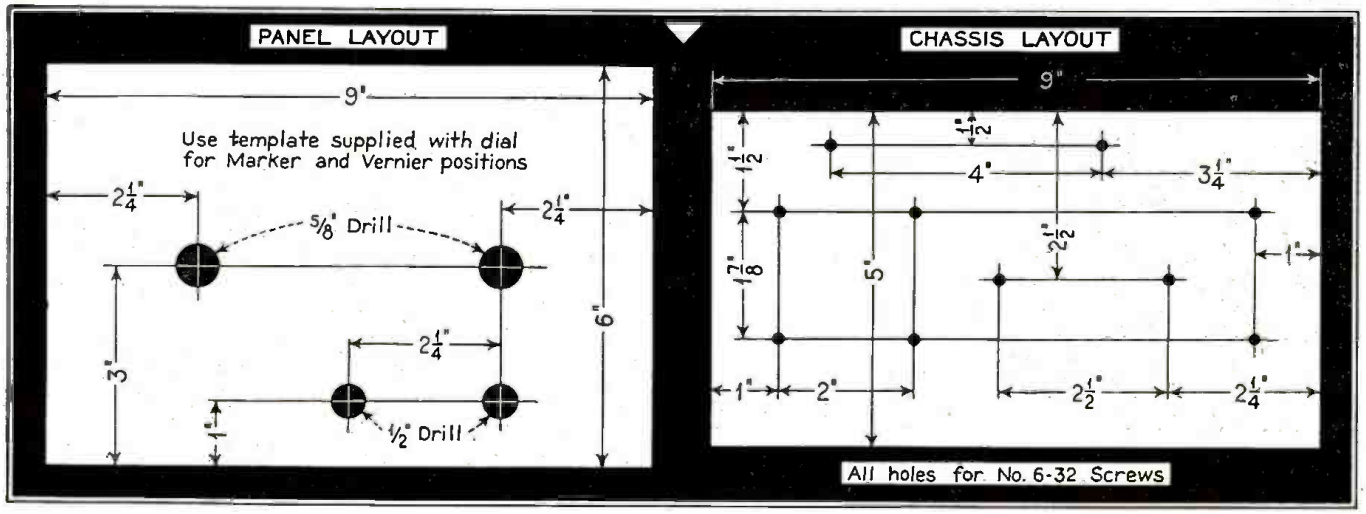
Results

The results to be had with this little receiver depend entirely upon the location. On 5 meters the receiver performed as well as several other 5-meter superregenerative receivers that it was tested against. On 10 meters only a few local stations were heard as the band was dead at the time. Reception on 20 meters was similar to that usually had with a regenerative receiver.

The receiver has been designed as a good 5-meter receiver and as such performs quite well. Coils for 10 and 20 meters were wound up as a sort of after-thought as we intend to take the receiver on a New England trip sometime during the summer.

[*Continued on page 368*]

Construction data on panel and chassis.



"Barb" and "Ernest"—

GRANGER WRITES

From Ernest

Dear Gerald,

Thanks for your latest letter giving us further advice on how to become successful hams. The Boss and I have been devoting the major part of our spare time to perfecting ourselves in code and for a couple of old folks we're doing pretty well, if we do say so ourselves. We're up now to a point where we're taking perilously close to 10 words per minute, which isn't so bad.

Mr. Candler's course helped us in this very materially, but with Mr. Miller's Teleplex we were able to distinguish the correct sound of the letters, something we seemed unable to do by ourselves. I've even gotten so that I can transmit that old debbil "C" properly in line with the way you advised it in your last letter. I have one trouble which Barb doesn't seem to experience and darned if I know how to correct it. Maybe you can tell me.

I preconceive words as I am receiving. Barb will shoot a few letters at me and I think it's going to be a certain word. Then a wrong letter (to me) comes through and I'm up in the air ten feet. By the time I come down I've missed about four or five letters and the word is gone for all time. How do I correct that?

We believe it's about time now that we start studying up for the written examination and I have a few questions to ask on that, so I can get started out on the right foot.

The Radio's Amateur's License Manual put out by the A.R.R.L. has a list of some 161 questions, which they say, if we know the answers to, will be all that we need to know to pass the examination. Have we, for example, any surety that this statement is so? I'd hate to think that we'd put a lot of work on these questions and find that the government may have changed its mind at the last minute and pulled a fast one on us. I imagine the A.R.R.L. must know what they are talking about.

Mr. Candler recommends that the student should join the A.R.R.L. before getting a license. I had intended joining this organization if successful, but am wondering whether it would do me any good to join before that.

To get back to the original subject, on the matter of questions; you have told us to study only the part covering the F.C.C. Regulations first. It would appear to me that anyone with ordinary intelligence could study these easily and as I see them they require practically no explanation.

But the first part covering the technical side of radio; boy—them's the stickers. Even I, who have had a technical education, am slightly nonplussed as to some of them, but Barb, who doesn't know a watt from a filament is going to have a swell time mastering this bunch. If you can teach her even the fundamentals of this side, you're a better man than I, Gunga Din. I've tried for fourteen years to give her some slight knowledge of things electrical, and as an explainer apparently I'm not so hot.

The boss has a lot of questions she wants to ask you, so if you don't mind I'll let her do her own asking.

Will you convey my greatest thanks to both Mr. Candler and Mr. Miller for their kindness to us.

Ernest

From Barb

My dear Gerald,

Ernest tells me that I am really doing very well with my code, and, I admit myself that I can see a great deal of improvement, but I am still a bit worried about my ability to attain any degree of speed. At times I find myself going along like the G.O.P. Convention, turning on all cylinders and all of a sudden I go blotto and can't tell an "L" from an "F". Is this a normal complaint or is it due to senility? Frankly, and confidentially, I think I transmit better than Ernest does —which by the way he loudly disputes, as his transmission is inclined to be jerky —my transmission, if I do say so, is pretty good. My only trouble—and I do wish you could help me in it—is that my arm becomes very tired. I have tried to follow Mr. Candler's instructions as far as I can. Trying to keep a loose wrist with the proper grip of the key, but somehow after a half-hour's work I'm tired.

I find Mr. Candler's course very helpful indeed. Its steps are very gradual and most explicit. The Teleplex has been a wonderful help to me, for had I only Ernest's species of transmission as an example I'm afraid I'd fail to recognize professional transmission entirely. It's been a great help in the matter of rhythm and the fact that the speed can be regulated with no undue pauses.

I would like to know why it is that I can take a tape at a fair speed and yet fail to recognize even slow transmission over the radio.

I feel that with practice and patience I can work my speed in code, but when I think of an examination involving any technical questions I collapse like a balloon. Can that part of the examination be learned in poll-parrot fashion or must grey matter and reasoning be used?

I suppose, like all of my species, I've been a long-winded pest, still I'll be very

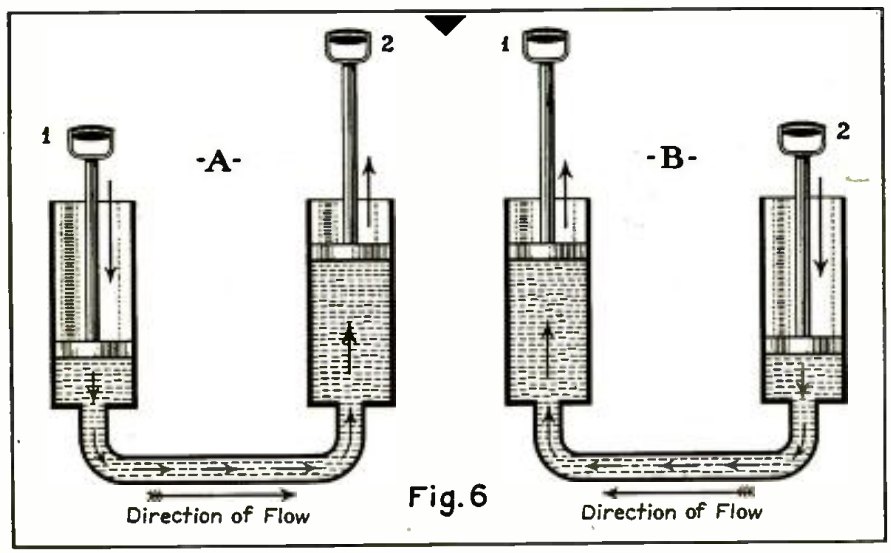


Fig. 6

Interconnected hand pumps employed as illustration of the manner in which an alternating electric current travels in a wire circuit.

Embryo Radio Hams

ON ELECTRICITY

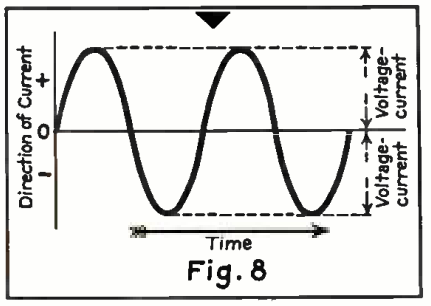


Fig. 8

Illustrating the flow of an alternating electric current in a wire circuit.

grateful for any help you can give me regarding my problems.

Yours in trepidation,
Barb

The Answer

Dear Barb and Ernest:

I'm really very pleased to hear that you two are "perilously close to 10 words per minute," and that you feel sufficiently well advanced in code to start giving thought to a bit of technical instruction. You'll get that, anyway, but I think it is time for the three of us to stage a preliminary code exam. So, you may expect a visit from the old maestro, who will put you through your paces.

As to you, Ernest, your preconception of words is a good sign rather than a bad one. It is an indication of mental agility in code reception, even if it does trip you up occasionally. It is a stage all operators pass through, and many never really break themselves of the habit of attempting to anticipate words. However, try breaking yourself of the habit by copying only that which you hear rather than attempting to reconstruct words in advance. As good a method as any, I believe, is to have Barb send you groups of letters with no meaning rather than actual words. Something like "ecftha qbgwt," etc., containing all the letters of the alphabet, and with a number thrown in here and there for good measure. Be sure Barb copies down the word and number groups beforehand so you can check back afterwards.

Well, Barb, I'm glad to hear that you have a better "fist" than Ernest, even though you may still be a bit worried about code speed. As to the latter, it is quite natural to go through periods of mental "wipe-outs" when certain letters simply fail to register. In your own case it might well be due to mental fatigue caused by too much code practice at one time. In any event, it is no cause for worry.

I am at a loss to know why you are able to take fair speed on the tape and yet fail to recognize even slow transmission over the radio. I have a suspicion, though, that the difficulty is not with you, but rather with the transmissions you intercept. Your radio is not equipped with a beat-frequency oscillator and is, therefore, not properly equipped for the reception of code signals. More than likely the majority of signals you pick up are far from being clear. However, we'll check on this when we get together for the preliminary code exam—real soon.

Tired Fist

I'm not at all surprised that your arm becomes tired after a half-hour's work with the key. As your arm becomes used to this new type of work, and as you develop better form, the aching will disappear, and you will find it possible to send for protracted periods without suffering muscular fatigue. Above all, follow Mr. Chandler's instructions to the letter, even though it may be difficult at the outset. You had to learn how to hold golf clubs, didn't you? And, if you have ever played tennis, you will know that the body muscles have a way of complaining until they are well used to the exercise.

So, you're both frightened to death at the thought of the technical questions? Seems to me you were two frightened puppies not so long ago, whenever you so much as contemplated the code. Now that the code is a friend and an inspiration and no longer the big, bad wolf, you have to transfer your fears to the technical phase of the game! Well, as the dentist might say, let's do a little probing and find out just how painful it is. (If I'm as good as I think I am, it won't hurt you at all!).

But, first, joining the A.R.R.L. now or later is for you to decide. If you're superstitious, possibly you'd rather wait.

And, as to the F.C.C. questions, as listed in the License Manual, if you can reason them out, you will have nothing to fear when exam-time rolls around. But I wouldn't care to vouch for your chances were you to learn the answers by heart without as well learning the why's and wherefore's. Of course, it's up to me to give you the fundamentals in simple form so that you can reason for yourselves. And I'll see to it that you will be able to explain all the questions listed.

Bare Fundamentals

But, before we get into fundamentals, we must have an understanding as to what I intend to do and what I intend *not* to do. I intend to provide you only with such information as you will require to pass the exam, and little more. I do not intend to follow every subject to the bitter end, as is done in most courses, because I am not trying to make technicians out of you two. You can get clever as hell later on, if you wish.

So, we will dispense with the "fuller explanation departments" and stick to broad essentials. We won't get all involved in the precise operation of radio tubes, or go into long explanations of grave engineering functions. Rather than this, we will "develop a series of photographs" of the surface appearance of radio and not worry too much about what's "behind the photo."

One of the odd things about radio is that it is possible to *almost* explain all its phases by analogy, but yet not *fully*

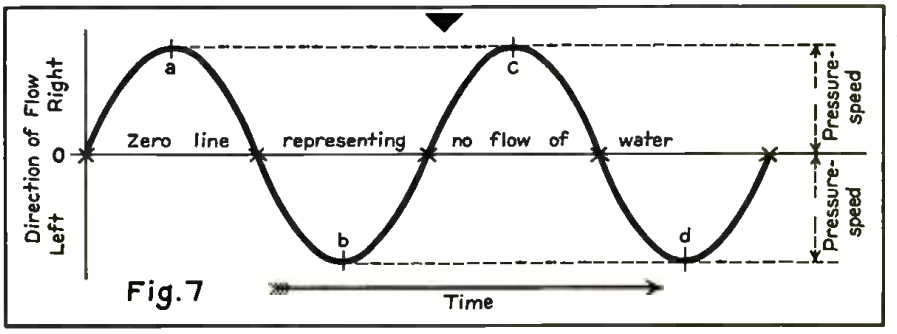


Fig. 7

How the water flows in the "pump circuit" shown in Fig. 6.

explain them. That's where the average instructor commences to become conscience-stricken, for fear that one of his students is going to come back at him some day and say, "Why, you taught me thus and so and it is only half the truth. The analogy you employed doesn't fully cover the function." Which in most cases is the truth. But, take it from me, analogy is good enough for the beginner, and though it is a generalized short-cut, "it sufficeth."

An analogy is just what I am going to use. You're warned!

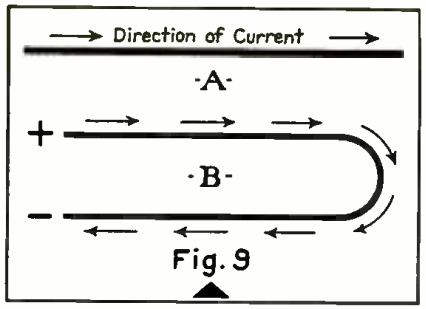
Now, where should we begin? Certainly not with the names and functions of the various components employed in radio transmitters and receivers, nor with the terms designating the properties of the components. For, all of these things will be meaningless until you first have a clear understanding of electricity in its various forms. A radio receiver or transmitter, or any unit of one or the other, is a lifeless thing so long as it is not energized by electricity in one or more of its various forms. So, let us talk first of the "invisible fluid" that is the life blood of radio.

Electricity

There is nothing overly mysterious in the manner in which electricity passes through a wire circuit. It is much like the flow of water through a pipe. And, just like the water in a pipe, the electricity has a definite pressure and a definite rate of flow. The pressure of electricity in a circuit is referred to as its "voltage," and is measured in "volts." The flow of electricity in a wire circuit is referred to as "current" (as the current of a river), and is measured in "amperes."

Actually there is but one type of electricity, but it is made to take various forms by the manner in which it is produced. The electricity produced chemically by a storage battery or a dry cell is of the purest form and is referred to as "pure direct current," because the flow is continuous, with no interruptions, in one direction only. The electricity produced by a dynamo is also a direct current, but contains a ripple, much like the ripple of a brook flowing over stones. But the ripple in the current from a dynamo is caused by actual interruptions in collecting the electricity, so that the current is fed to the wire circuit in broken sequence, like a series of dots. However, due to electrical inertia, the spurts of current join so that the result is somewhat similar to the jerky flow of water from a hand pump.

The electricity produced by an alternator (alternating-current generator) is something quite different. Electricity in this form does not flow continuously in the same direction. Instead, it is made to change its direction of flow in the wire circuit a certain number of times a second. In other words, the electrical current oscillates back and forth.



"Positive" (plus) and "negative" (minus) indicate direction of flow of an electric current.

Alternating Current

You could accomplish much the same thing with water if you had a gadget like the one shown in the attached sketch (Fig. 6). It is composed of two cylinders, each with a hand piston, connected together with a pipe. The cylinders and pipe contain water. Case A shows that if you were to push down on piston No. 1 the water would flow through the pipe in the direction indicated and force up piston No. 2. Then, if you were to immediately reverse the process and push down on piston No. 2, as shown at B, the water would flow in the opposite direction and force up piston No. 1. If you were to grab both piston handles and work them up and down as fast as the inertia of the water flow would permit, you could reverse the direction of flow of the water in the pipe a considerable number of times per minute. Possibly you could do this 30 times per minute, in which case the water would pass through 30 complete alternations, or 15 complete cycles of change in flow.

An alternating electrical current flows the same way in an electrical circuit. In our analogy the two pumps represent the alternating-current generator and the connecting pipe, through which the water flows, the electrical or wire circuit. If the electrical current itself were visible in the wire, it would be seen to change its direction of flow a number of times per second (faster than you could pump!). If it were found to change direction 120 times per second, then it could be said that there were 120 alternations of current flow, or 60 complete cycles. And 60 cycles is the frequency of the average home electric-light line.

Now let's return to the pump analogy so that we may better explain what happens to an alternating electrical current in a wire circuit. In operating this silly pump, you would find that the water would not always flow at the same rate. During the down stroke of either piston it would go through the pipe like the devil, but when the down stroke of one piston was completed, the water would come to a standstill in the pipe before

[*Continued on page 365*]

WAVELENGTH-FREQUENCY TABLE

IT'S NOT THE MOST convenient thing in the world to translate wavelength in meters to frequency in kilocycles—or vice versa—by mathematical computation. Realizing this, the Bureau of Standards, in Washington, D. C., prepared a table some years ago, from which it is possible to determine at a glance either the frequency in kilocycles for a given wavelength, or the wavelength in meters for a given frequency in kilocycles. This table is printed on the opposite page.

The odd and even columns in this table are related to each other; that is, the first column is related to the second, the third column to the fourth, and so on. Fundamentally, the numbers in the odd columns—the first, third, etc.—refer to wavelength in meters. These columns are continuous numerically from 10 meters to 10,000 meters. The numbers in the even columns—the second, fourth, etc.—refer to frequency in kilocycles. These columns are continuous from 29,982 kilocycles to 29.98 kilocycles.

It is obvious from the above, then, that 10 meters is equivalent to a frequency of 29,982 kilocycles, and that 10,000 meters is equivalent to 29.98 kilocycles. Or, that 300 meters is equal to a frequency of 999.4 kilocycles.

The table is also reversible. Thus, the number 10 at the top of the first column may be read in kilocycles, in which case the number opposite it in the second column represents the wavelength, or 29,982 meters. Likewise, if 300 is read as the frequency in kilocycles, then the wavelength is 999.4 meters. This same relation exists throughout the entire table. It is for this reason that the designations for frequency (f) and wavelength (λ) are placed at the top of each column, since any two related columns may be read either way.

From this table it is also possible to determine frequencies and wavelengths above or below the values included. Thus the frequency corresponding to 5 meters may be determined by selecting the number 50 in the first column and reading it as 5.0. The answer is 59960 kilocycles, or 59.96 megacycles. For 2.5 meters, one would select the number 250 in the first column and read it as 2.5. The answer in this case is 119900 kilocycles, or 119.9 megacycles. It is merely a matter of shifting decimal points.

for λ	λ or f	for λ	λ or f	for λ	λ or f	for λ	λ or f	for λ	λ or f	for λ	λ or f	for λ	λ or f	for λ	λ or f	for λ	λ or f	for λ	λ or f
10	29,982	1,010	296.9	2,010	149.2	3,010	99.61	4,010	74.77	5,010	59.84	6,010	49.89	7,010	42.77	8,010	37.43	9,010	33.28
20	14,991	1,020	293.9	2,020	148.4	3,020	99.28	4,020	74.58	5,020	59.73	6,020	49.80	7,020	42.71	8,020	37.38	9,020	33.24
30	9,994	1,030	291.1	2,030	147.7	3,030	98.95	4,030	74.40	5,030	59.61	6,030	49.72	7,030	42.65	8,030	37.34	9,030	33.20
40	7,496	1,040	288.3	2,040	147.0	3,040	98.62	4,040	74.21	5,040	59.49	6,050	49.64	7,040	42.59	8,040	37.29	9,040	33.17
50	5,996	1,050	285.5	2,050	146.3	3,050	98.30	4,050	74.03	5,050	59.37	6,050	49.56	7,050	42.53	8,050	37.24	9,050	33.13
60	4,997	1,060	282.8	2,060	145.5	3,060	97.98	4,060	73.85	5,060	59.25	6,060	49.48	7,060	42.47	8,060	37.20	9,060	33.09
70	4,283	1,070	280.2	2,070	144.8	3,070	97.66	4,070	73.67	5,070	59.13	6,070	49.39	7,070	42.41	8,070	37.15	9,070	33.06
80	3,748	1,080	277.6	2,080	144.1	3,080	97.34	4,080	73.49	5,080	59.02	6,080	49.31	7,080	42.35	8,080	37.11	9,080	33.02
90	3,331	1,090	275.1	2,090	143.5	3,090	97.03	4,090	73.31	5,090	58.90	6,090	49.23	7,090	42.29	8,090	37.06	9,090	32.98
100	2,998	1,100	272.6	2,100	142.8	3,100	96.72	4,100	73.13	5,100	58.79	6,100	49.15	7,100	42.23	8,100	37.01	9,100	32.95
110	2,726	1,110	270.1	2,110	142.1	3,110	96.41	4,110	72.95	5,110	58.67	6,110	49.07	7,110	42.17	8,110	36.97	9,110	32.91
120	2,499	1,120	267.7	2,120	141.4	3,120	96.10	4,120	72.77	5,120	58.56	6,120	48.99	7,120	42.11	8,120	36.92	9,120	32.88
130	2,306	1,130	265.3	2,130	140.8	3,130	95.79	4,130	72.60	5,130	58.44	6,130	48.91	7,130	42.05	8,130	36.88	9,130	32.84
140	2,142	1,140	263.0	2,140	140.1	3,140	95.48	4,140	72.42	5,140	58.33	6,140	48.83	7,140	41.99	8,140	36.83	9,140	32.80
150	1,999	1,150	260.7	2,150	139.5	3,150	95.18	4,150	72.25	5,150	58.22	6,150	48.75	7,150	41.93	8,150	36.79	9,150	32.77
160	1,874	1,160	258.5	2,160	138.8	3,160	94.88	4,160	72.07	5,160	58.10	6,160	48.67	7,160	41.87	8,160	36.74	9,160	32.73
170	1,764	1,170	256.3	2,170	138.1	3,170	94.58	4,170	71.90	5,170	57.99	6,170	48.59	7,170	41.82	8,170	36.70	9,170	32.70
180	1,666	1,180	254.1	2,180	137.5	3,180	94.28	4,180	71.73	5,180	57.88	6,180	48.51	7,180	41.76	8,180	36.65	9,180	32.66
190	1,578	1,190	252.0	2,190	136.9	3,190	93.99	4,190	71.56	5,190	57.77	6,190	48.44	7,190	41.70	8,190	36.61	9,190	32.62
200	1,499	1,200	249.9	2,200	136.3	3,200	93.69	4,200	71.39	5,200	57.66	6,200	48.36	7,200	41.64	8,200	36.56	9,200	32.59
210	1,428	1,210	247.8	2,210	135.7	3,210	93.40	4,210	71.22	5,210	57.55	6,210	48.28	7,210	41.58	8,210	36.52	9,210	32.55
220	1,363	1,220	245.8	2,220	135.1	3,220	93.11	4,220	71.05	5,220	57.44	6,220	48.20	7,220	41.53	8,220	36.47	9,220	32.52
230	1,304	1,230	243.8	2,230	134.4	3,230	92.82	4,230	70.88	5,230	57.33	6,230	48.13	7,230	41.47	8,230	36.43	9,230	32.48
240	1,249	1,240	241.8	2,240	133.8	3,240	92.54	4,240	70.71	5,240	57.22	6,240	48.05	7,240	41.41	8,240	36.39	9,240	32.45
250	1,199	1,250	239.9	2,250	133.3	3,250	92.25	4,250	70.55	5,250	57.11	6,250	47.97	7,250	41.35	8,250	36.34	9,250	32.41
260	1,153	1,260	238.0	2,260	132.7	3,260	91.97	4,260	70.38	5,260	57.00	6,260	47.89	7,260	41.30	8,260	36.30	9,260	32.38
270	1,110	1,270	236.1	2,270	132.1	3,270	91.69	4,270	70.22	5,270	56.89	6,270	47.82	7,270	41.24	8,270	36.25	9,270	32.34
280	1,071	1,280	234.2	2,280	131.5	3,280	91.41	4,280	70.05	5,280	56.78	6,280	47.74	7,280	41.18	8,280	36.21	9,280	32.31
290	1,034	1,290	232.4	2,290	130.9	3,290	91.13	4,290	69.89	5,290	56.68	6,290	47.67	7,290	41.13	8,290	36.17	9,290	32.27
300	999.4	1,300	230.6	2,300	130.4	3,300	90.86	4,300	69.73	5,300	56.57	6,300	47.59	7,300	41.07	8,300	36.12	9,300	32.24
310	967.2	1,310	228.9	2,310	129.8	3,310	90.58	4,310	69.56	5,310	56.46	6,310	47.52	7,310	41.02	8,310	36.08	9,310	32.20
320	936.9	1,320	227.1	2,320	129.2	3,320	90.31	4,320	69.40	5,320	56.36	6,320	47.44	7,320	40.96	8,320	36.04	9,320	32.17
330	908.6	1,330	225.4	2,330	128.7	3,330	90.04	4,330	69.24	5,330	56.25	6,330	47.36	7,330	40.90	8,330	35.99	9,330	32.14
340	881.8	1,340	223.7	2,340	128.1	3,340	89.77	4,340	69.08	5,340	56.15	6,340	47.29	7,340	40.85	8,340	35.95	9,340	32.10
350	856.6	1,350	222.1	2,350	127.6	3,350	89.50	4,350	68.92	5,350	56.04	6,350	47.22	7,350	40.79	8,350	35.91	9,350	32.07
360	832.8	1,360	220.4	2,360	127.0	3,360	89.23	4,360	68.77	5,360	55.94	6,360	47.14	7,360	40.74	8,360	35.86	9,360	32.03
370	810.3	1,370	218.8	2,370	126.5	3,370	88.97	4,370	68.61	5,370	55.83	6,370	47.07	7,370	40.68	8,370	35.82	9,370	32.00
380	789.0	1,380	217.3	2,380	126.0	3,380	88.70	4,380	68.45	5,380	55.73	6,380	46.99	7,380	40.63	8,380	35.78	9,380	31.96
390	768.8	1,390	215.7	2,390	125.4	3,390	88.44	4,390	68.30	5,390	55.63	6,390	46.92	7,390	40.57	8,390	35.74	9,390	31.93
400	749.6	1,400	214.2	2,400	124.9	3,400	88.18	4,400	68.14	5,400	55.52	6,400	46.85	7,400	40.52	8,400	35.69	9,400	31.90
410	731.3	1,410	212.6	2,410	124.4	3,410	87.92	4,410	67.99	5,410	55.42	6,410	46.77	7,410	40.46	8,410	35.65	9,410	31.86
420	713.9	1,420	211.1	2,420	123.9	3,420	87.67	4,420	67.83	5,420	55.32	6,420	46.70	7,420	40.41	8,420	35.61	9,420	31.83
430	697.3	1,430	209.7	2,430	123.4	3,430	87.41	4,430	67.68	5,430	55.22	6,430	46.63	7,430	40.35	8,430	35.57	9,430	31.79
440	681.4	1,440	208.2	2,440	122.9	3,440	87.16	4,440	67.53	5,440	55.11	6,440	46.56	7,440	40.30	8,440	35.52	9,440	31.76
450	666.3	1,450	206.8	2,450	122.4	3,450	86.90	4,450	67.38	5,450	55.01	6,450	46.48	7,450	40.24	8,450	35.48	9,450	31.73
460	651.8	1,460	205.4	2,460	121.9	3,460	86.65	4,460	67.22	5,460	54.91	6,460	46.41	7,460	40.19	8,460	35.44	9,460	31.69
470	637.9	1,470	204.0	2,470	121.4	3,470	86.40	4,470	67.07	5,470	54.81	6,470	46.34	7,470	40.14	8,470	35.40	9,470	31.66
480	624.6	1,480	202.6	2,480	120.9	3,480	86.16	4,480	66.92	5,480	54.71	6,480	46.27	7,480	40.08	8,480	35.36	9,480	31.63
490	611.9	1,490	201.2	2,490	120.4	3,490	85.91	4,490	66.78	5,490	54.61	6,490	46.20	7,490	40.03	8,490	35.31	9,490	31.59
500	599.6	1,500	199.9	2,500	119.9	3,500	85.66	4,500	66.63	5,500	54.51	6,500	46.13	7,500	39.98	8,500	35.27	9,500	31.56
510	587.9	1,510	198.6	2,510	119.5	3,510	85.42	4,510	66.48	5,510	54.41	6,510	46.06	7,510	39.92	8,510	35.23	9,510	31.53
520	576.6	1,520	197.2	2,520	119.0	3,520	85.18	4,520	66.33	5,520	54.32	6,520	45.98	7,520	39.87	8,520	35.19	9,520	31.49
530	565.7	1,530	196.0	2,530	118.5	3,530	84.94	4,530	66.19	5,530	54.22	6,530	45.91	7,530	39.82	8,530	35.15	9,530	31.46
540	555.2	1,540	194.7	2,540	118.0	3,540	84.70	4,540	66.04	5,540	54.12	6,540	45.84	7,540	39.76	8,540	35.11	9,540	31.43
550	545.1	1,550	193.4	2,550	117.6	3,550	84.46	4,550	65.89	5,550	54.02	6,550	45.77	7,550	39.71	8,550	35.07	9,550	31.39
560	535.4	1,560	192.2	2,560	117.1	3,560	84.22	4,560	65.75	5,560	53.92	6,560	45.70	7,560	39.66	8,560	35.03	9,560	31.36
570	526.0	1,570	191.0	2,570	116.7	3,570	83.98	4,570	65.61	5,570	53.83	6,570	45.63	7,570	39.61	8,570	34.98	9,570	31.33
580	516.9	1,580	189.8	2,580	116.2	3,580	83.75	4,580	65.46	5,580	53.73	6,580	45.57	7,580	39.55	8,580	34.94	9,580	31.30
590	508.2	1,590	188.6	2,590	115.8	3,590	83.52	4,590	65.32	5,590	53.64	6,590	45.50	7,590	39.50	8,590	34.90	9,590	31.26
600	499.7	1,600	187.4	2,600	115.3	3,600	83.28	4,600	65.18	5,600	53.54	6,600	45.43	7,600	39.45	8,600	34.86	9,600	31.23
610	491.5	1,610	186.2	2,610	114.9	3,610	83.05	4,610	65.04	5,610	53.44	6,610	45.36	7,610	39.40	8,610	34.82	9,610	31.20
620	483.6	1,620	185.1	2,260	114.4	3,620	82.82	4,620	64.90	5,620	53.35	6,620	45.29	7,620	39.35	8,620	34.78	9,620	31.17
630	475.9	1,630	183.9	2,630	114.0	3,630	82.60	4,630	64.76	5,630	53.25	6,630	45.22	7,630	39.29	8,630	34.74	9,630	31.13
640	468.5	1,640	182.8	2,640	113.6	3,640	82.37	4,640	64.62	5,640	53.16	6,640	45.15	7,640	39.24	8,640	34.70	9,640	31.10
650	461.3	1,650	181.7	2,650	113.1	3,650	82.14	4,650	64.48	5,650	53.07	6,650	45.09	7,650	39.19	8,650	34.66	9,650	31.07
660	454.3	1,660	180.6	2,660	112.7	3,660	81.92	4,660	64.34	5,660	52.97	6,660	45.02	7,660	39.14	8,660	34.62	9,660	31.04
670	447.5	1,670	179.5	2,670	112.3	3,670	81.70	4,670	64.20	5,670	52.88	6,670	44.95	7,670	39.09	8,670	34.58	9,670	31.01
680	440.9	1,680	178.5	2,680	111.9	3,680	81.47	4,680	64.06	5,680	52.79	6,680	44.88	7,680	39.04	8,680	34.54	9,680	30.97
690	434.5	1,690	177.4	2,690	111.5	3,690	81.25	4,690	63.93	5,690	52.69	6,690	44.82	7,690	38.99	8,690	34.50	9,690	30.94
700	428.3	1,700	176.4	2,700	111.0	3,700	81.03	4,700	63.79	5,700	52.60	6,700	44.75	7,700	38.94	8,700	34.46	9,700	30.91
710	422.3	1,710	175.3	2,710	110.6	3,710	80.81	4,710	63.66	5,710	52.51	6,710	44.68	7,710	38.89	8,710	34.42	9,710	30.88
720	416.4	1,720	174.3	2,720	110.2	3,720	80.60	4,720	63.52	5,720	52.42	6,720	44.62	7,720	38.84	8,720	34.38	9,720	30.85
730	410.7	1,730	173.3	2,730	109.8	3,730	80.38	4,730	63.39	5,730	52.32	6,730	44.55	7,730	38.79	8,730	34.34	9,730	30.81
740	405.2	1,740	172.3	2,740	109.4	3,740	80.17	4,740	63.25	5,740	52.23	6,740	44.48	7,740	38.74	8,740	34.30	9,740	30.78
750	399.8	1,750	171.3	2,750	109.0	3,750	79.95	4,750	63.12	5,750	52.14	6,750	44.42	7,750	38.69	8,750	34.27	9,750	30.75
760	394.5	1,760	170.4	2,760	108.6	3,760	79.74	4,760	62.99	5,760	52.05	6,760	44.35	7,760	38.64	8,760	34.23	9,760	30.72
770	389.4	1,770	169.4	2,770	108.2	3,770	79.53	4,770	62.86	5,770	51.96	6,770	44.29	7,770	38.59	8,770	34.19	9,770	30.69
780	384.4	1,780	168.4	2,780	107.8	3,780	79.32	4,780	62.72	5,780	51.87	6,780	44.22	7,780	38.54	8,780	34.15	9,780	30.66
790	379.5	1,790	167.5	2,790	107.5	3,790	79.11	4,790	62.59	5,790	51.78	6,790	44.16	7,790	38.49	8,790	34.11	9,790	30.63
800	374.8	1,800	166.6	2,800	107.1	3,800	78.90	4,800	62.46	5,800	51.69	6,800	44.09	7,800	38.44	8,800	34.07	9,800	30.59
810	370.2	1,810	165.6	2,810	106.7	3,810	78.69	4,810	62.33	5,810	51.60	6,810	44.03	7,810	38.39	8,810	34.03	9,810	30.56
820	365.6	1,820	164.7	2,820	106.3	3,820	78.49	4,820	62.20	5,820	51.52	6,820	43.96	7,820	38.34	8,820	33.99	9,820	30.53
830	361.2	1,830	163.8	2,830	105.9	3,830	78.28	4,830	62.07	5,830	51.43	6,830	43.90	7,830	38.29	8,830	33.95	9,830	30.50
840	356.9	1,840	162.9	2,840	105.6	3,840	78.08	4,840	61.95	5,840	51.34	6,840	43.83	7,840	38.24	8,840	33.92	9,840	30.47
850	352.7	1,850	162.1	2,850	105.2	3,850	77.88	4,850	61.82	5,850	51.25	6,850	43.77	7,850	38.19	8,850	33.88	9,850	30.44
860	348.6	1,860	161.2	2,860	104.8	3,860	77.67	4,860	61.69	5,860	51.16	6,860	43.71	7,860	38.14	8,860	33.84	9,860	30.41
870	344.6	1,870	160.3	2,870	104.5	3,870	77.47	4,870	61.56	5,870	51.08	6,870	43.64	7,870	38.10	8,870	33.80	9,870	30.38
880	340.7	1,880	159.5	2,880	104.1	3,880	77.27	4,880	61.44	5,880	50.99	6,880	43.58	7,880	38.05	8,880	33.76	9,880	30.35
890	336.9	1,890	158.6	2,890	103.7	3,890	77.07	4,890	61.31	5,890	50.90	6,890	43.52	7,890	38.00	8,890	33.73	9,890	30.32
900	333.1	1,900	157.8	2,900	103.4	3,900	76.88	4,900	61.19	5,900	50.82	6,900	43.45	7,900	37.95	8,900	33.69	9,900	30.28
910	329.5	1,910	157.0	2,910	103.0	3,910	76.68	4,910	61.06	5,910	50.73	6,910	43.39	7,910	37.90	8,910	33.65	9,910	30.25
920	325.9	1,920	156.2	2,920	102.7	3,920	76.48	4,920	60.94	5,920	50.65	6,920	43.33	7,920	37.86	8,920	33.61	9,920	30.22
930	322.4	1,930	155.3	2,930	102.3	3,930	76.29	4,930	60.82	5,930	50.56	6,930	43.26	7,930	37.81	8,930	33.57	9,930	30.19
940	319.0	1,940	154.5	2,940	102.0	3,940	76.10	4,940	60.69	5,940	50.47	6,940	43.20	7,940	37.76	8,940	33.54	9,940	30.16
950	315.6	1,950	153.8	2,950	101.6	3,950	75.90	4,950	60.57	5,950	50.39	6,950	43.14	7,950	37.71	8,950	33.50	9,950	30.13
960	312.3	1,960	153.0	2,960	101.3	3,960	75.71	4,960	60.45	5,960	50.31	6,960	43.08	7,960	37.67	8,960	33.46	9,960	30.10
970	309.1	1,970	152.2	2,970	100.9	3,970	75.52	4,970	60.33	5,970	50.22	6,970	43.02	7,970	37.62	8,970	33.42	9,970	30.07
980	303.9	1,980	151.4	2,980	100.6	3,980	75.33	4,980	60.20	5,980	50.14	6,980	42.95	7,980	37.57	8,980	33.39	9,980	30.04
990	302.8	1,990	150.7	2,990	100.3	3,990	75.14	4,990	60.08	5,990	50.05	6,990	42.89	7,990	37.52	8,990	33.35	9,990	30.01
1,000	299.8	2,000	149.9	3,000	99.94	4,000	74.96	5,000	59.96	6,000	49.97	7,000	42.83	8,000	37.48	9,000	33.31	10,000	29.98

Reprinted by permission of Government Printing Office

Channel Echoes

By Zeh Bouck

diversity reception . . . words to the wise . . . vox pop

THAT the picture of Roxy and his gang in our May column was "no teaser," as W. Iger, of Brooklyn, N. Y., puts it, was adequately demonstrated by the number of readers who identified it. The first identification was contributed by William Daly, 130 West 91st Street, New York City; and, thanks to his vigilant eye and your columnist's rashness, he rates a one-year subscription to ALL-WAVE RADIO. We herewith present a harder one this month with another subscription to the reader who gives us the *best* idea (not necessarily the first) of what it is, or was, all about. If the fellow with the cigarette drooling so gracefully from his lips, wins, we'll change the prize to a Lynch antenna kit, to be donated by Arthur H. Lynch, Incorporated. (*Over our dead body.—Ed.*)

The scene, as you may have guessed from the Paragon variometers, two and three control superheterodynes, loop antenna, the last word in loudspeakers and the nifty little pipe in the hands of yours truly, dates back some dozen years. Radio history was made the night this photo was taken. And, believe it or not, the same pipe is on our desk as we write this. We only take it out, these days, after dark. (*Just an old sentimentalist.—Ed.*)

✦

WE ARE HEARING a bit of late about diversity antennas, and of receivers designed to take advantage of diversity reception. The idea is simple—but the receivers are not. Such a receiver is really two sets in one, with a common audio-frequency channel. They are operated from individual antennas, separated as far as possible. The same signal is picked up on each receiver, and the audio outputs mixed in the common a-f amplifier. The theory is that phase relationships and wave-front conditions differ over even very short distances, and that the signal will rarely be fading simultaneously at both antennas. As we have intimated, the receiver is a complicated affair, with a differential automatic-volume-control action. However, diversity results can be enjoyed by anyone who has two receivers and two aerials, by operating them in the same room as independent systems, but tuned to the same station. The effect, on the whole, is excellent, though, without differential avc, the background noise will be somewhat higher than in a properly engineered diversity receiver. Both sets should be operated at only slightly below normal volume for one receiver. Though the sound energy in the room will be practically doubled, there will be scarcely any noticeable increase in volume due to the logarithmic response characteristic of the ear. The wattage will be up about 3 db, and one decibel represents approximately the smallest variation in sound the ear can detect at average sound levels. The effect as a whole is that of improved quality (particularly if the receivers are of different audio-frequency characteristics) and the practical elimination of fading.

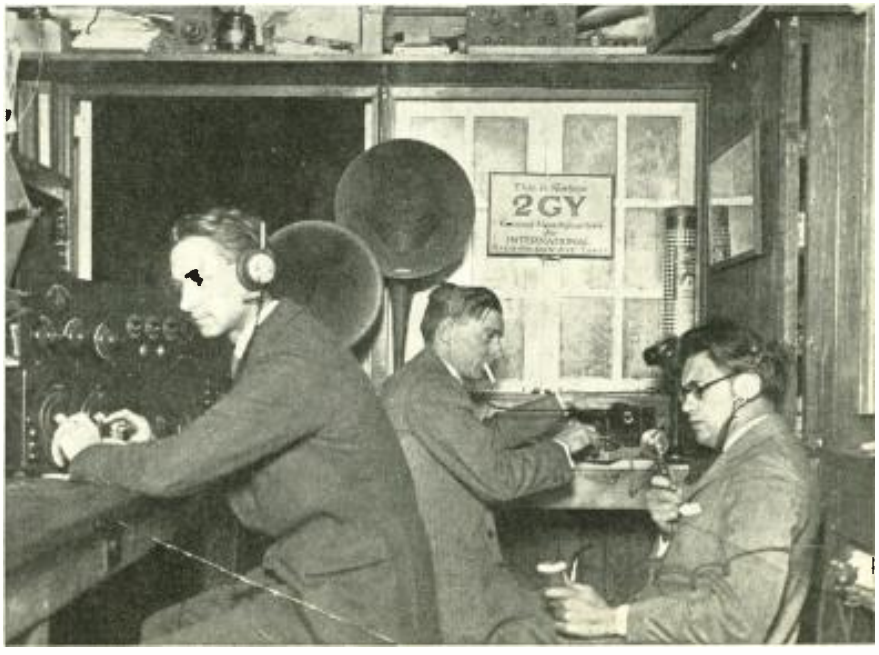
Naturally the diversity effect will be more pronounced the greater the separation of the two antennas. Best results will be secured when the aerials are separated by eight to ten wavelengths, but satisfactory improvement will be noticed when the individual aerials are merely strung in different directions from the same building or pole.

This disadvantage suggested to the writer the system of "frequency diversity"—which has its own disadvantage in being limited as to stations. However, the two antennas can be as close together as convenience dictates, and, in the majority of instances, the two receivers can be operated from the same aerial. We have used this system quite consistently on the Daventry stations—one set being tuned, as a rule, to GSD, 11.75 mc, and the other to GSC, 9.58 mc. The D-string can also often be picked up simultaneously on different frequencies for diversity frequency reception.

We also suggest the system to U. S. program addicts, who are located in poor reception areas for both long and short-wave stations. With one receiver tuned to a long-wave broadcast, and the other to a short-wave channel carrying the same program, a considerable improvement in reception will be noted. (*Re-*

[*Continued on page 367*]

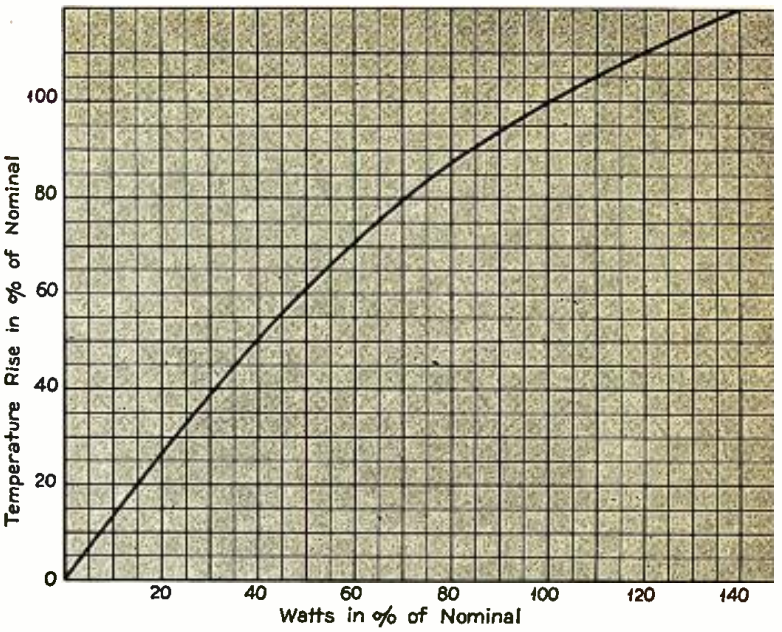
SECOND TEASER CONTEST—NO BOX TOPS



OHM'S LAW HAS NOT BEEN Repealed

By A. A. Berard

Ward Leonard Electric Co.



Nominal ratings based on 250° C rise on resistor with one foot free air space.

MANY man-made laws and alphabetical agencies have been repealed or in other ways discarded and replaced. However, in electrical science and especially in the field of electrical resistors, the discovery in 1827 by Dr. G. S. Ohm of Berlin of the relation between current strength and pressure in electrical circuits gave us a fairly simple formula, now called Ohm's Law. This formula concerns three factors always present in an electrical circuit: resistance measured in ohms, electrical pressure or potential measured in volts, and current measured in amperes. (See the accompanying table.)

Many of the readers of this article are experimenters or builders of short-wave transmitters and receivers. Information contained herein is primarily for your guidance. The wonders of electrical phenomena, and especially radio as we accept it today, make electrical resistors appear a rather insignificant item. Nevertheless, they play an important though hidden part in telephone, telegraph and radio circuits.

Heat Conduction

We now select and accept resistors in a very matter-of-fact manner. The early types of resistors presented many disadvantages consisting mainly of unprotected wires arranged in various ways, dependence being placed chiefly on air convection for the dissipation of the heat generated. It was not until 1896 that Mr. H. Ward Leonard developed a vitreous enamel embedded resistor.

Just a word about the construction of vitreous-enameled wire-wound resistors. In this type of resistor there is no dead air space between the resistive material and the embedding material to interfere with rapid conduction of heat from the wire to the surface of the resistor. The vitreous embedding material also has great heat-conducting ability. As a result heat is rapidly conducted away from the resistive conductor to the surface and then to the surrounding medium.

Watt Dissipation

This brings us to the important matter of watt dissipation limitations. The arbitrary full rating of a vitreous-enameled resistor is the load in watts which will produce 250 degrees C. (450 degrees F.) rise at the hottest spot of a two-terminal resistor when suspended in air at least one foot away from the nearest object. If the temperature of the surrounding air does not exceed 40 degrees C. (104 degrees F.), this temperature rise is the standard of the National Electrical Manufacturers Association, the Radio Manufacturers Association and the National Board of Fire Underwriters.

Heat and Air Space

It is, of course, understood that it would be very uneconomical to have one foot of free air space in all directions from a resistor. which means that the conditions of ventilation cannot be as good as those specified above. The accompanying curve, therefore, may be of considerable value in the selection of a proper resistor. This curve is expressed in percentage of nominal watt rating against percentage of temperature rise. It will be noted that a 50% watt rating reaches a temperature rise of 60% of the permissible temperature rise. Where ventilation is poor, it may be necessary to work at quarter watt ratings.

When several units are mounted together or when one or more units are partially or totally enclosed, the load which will cause the permissible temperature rise is materially decreased. Thus the application limits the load which a unit will dissipate. The apparatus mounted near a resistor, as in many classes of radio equipment, may be injured by a temperature rise, which is much lower than the permissible 250 degrees C.

In Selecting a Resistor

The following are a few of the conditions that should be taken into account in

[*Continued on page 364*]

OHM'S LAW

OHM'S law is concerned with the relation of three factors which are always present in an electrical circuit; the resistance measured in ohms; the electrical potential measured in volts; and the current measured in amperes.

The relation between these factors is expressed by one of the following three formulae:

$$I = \frac{E}{R} \quad \therefore R = \frac{E}{I} \quad \therefore E = I \times R$$

Where I = Current in amperes, E = Potential in volts, and R = Resistance in ohms.

Applying the first formula to a simple problem, for example, to find the resistance value, knowing the circuit voltage to be 6 volts and the current 0.6 amperes:

$$R = \frac{E}{I} = \frac{6}{0.6} = 10 \text{ ohms}$$

Resistors are rated in current carrying capacity and watts. The basic formula for watts is:

$$W = E \times I \quad \therefore E = \frac{W}{I} \quad \therefore I = \frac{W}{E}$$

$$\therefore W = I^2 \times R \quad \therefore I = \sqrt{\frac{W}{R}} \quad \therefore R = \frac{W}{I^2}$$

$$\therefore W = \frac{E^2}{R} \quad \therefore R = \frac{E^2}{W} \quad \therefore E = \sqrt{R \times W}$$

SELECTIVE DIRECTIONAL

FOR TRANSMITTING

By R. J. Hagerty—W6JMI

FEW persons can deny the advantages of directional antenna systems. The gain in signal strength is well worth while, but usually the switching arrangement becomes too complicated, especially when applied to transmitting. It generally necessitates the returning of the final tank circuit—which requires time. And this loss of time often means the loss of a desirable contact.

With this in mind a simple but effective directional system was worked out here that has proven very satisfactory in actual practice. To put it into operation all one has to do is to throw one switch and transmit or receive jn the desired direction.

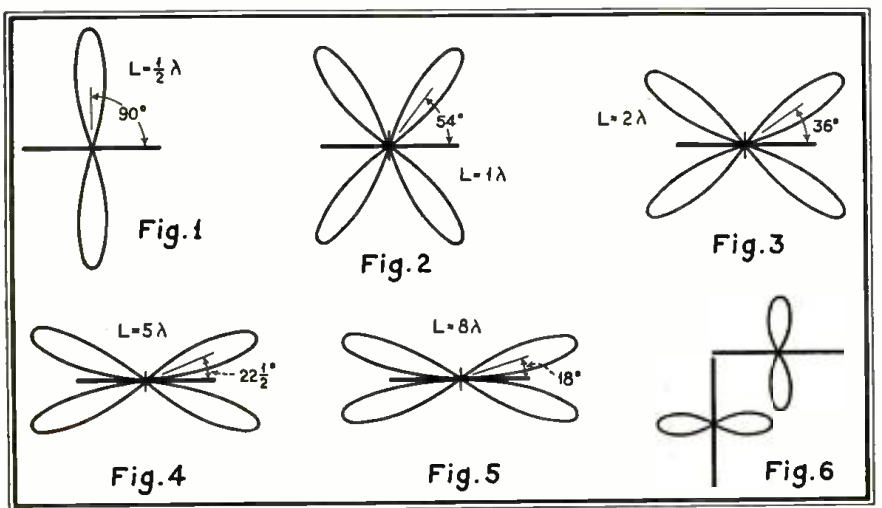
Basis of System

The basis of this system is to use a Fuch or ungrounded Marconi—the simplest of all antennas. While we realize all the fine arguments that can be stated against its use, our experience proves it to be more desirable than any other due to its simplicity; ability to stay tuned regardless of weather conditions; ease of adjustment; ability to operate efficiently on harmonics; and actual contacts have proved its ability to take power and radiate, which, after all is said and done, is the whole purpose of any antenna.

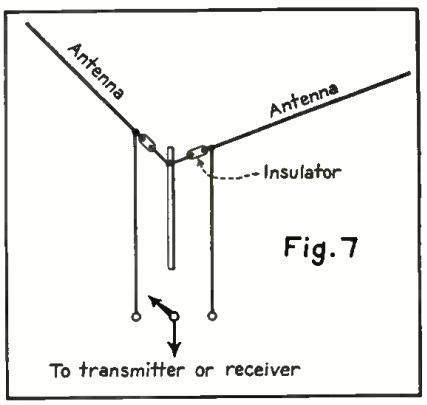
Two Spans Used

To put this directional antenna system into practice it is necessary to use two antenna wires—strung in different directions. First take a globe and determine the directions you desire to cover. Then a study of your particular location will show the space available for erection of antennas.

Now by consulting Figs. 1 to 6 the approximate length of the antennas can be estimated. The formula, Length in feet = 468,000 divided by Frequency in kilocycles, will serve as a starter providing you add 3 or 4 feet for a reason to be stated later on. A wire one-half wavelength long has its maximum radiation at right angles to its length as shown by the lobes in Fig. 1. A wire a full wavelength long has 4 lobes of maximum radiation at an angle of 54 degrees to its length as shown in Fig 2. In Fig. 3 the lobes are at an angle of 36 degrees, etc. It should be stated that these lobes also hold for reception as well as transmission.



Radiation patterns of antennas of various length. These patterns also hold good for reception.



The two directional antennas with switching arrangement.

Ascertaining Directions

An easy method to ascertain the desired directions is to make copies of these illustrations, stick a pin through the center and then tack onto a globe. By rotating the figures the desired directions and antenna lengths can be obtained.

As an example, the system shown in Fig. 6 is used at this station. Notice the field strength pattern of the two separate half-wavelength antennas. One antenna stretches north and south for contacts east and west of this location. And the east and west antenna is used for directions north and south.

Antenna Connections

One end of each antenna is brought into the station and connected to a single pole double throw switch with the knife blade going to the transmitter or receiver, as shown in Fig. 7. An alternative method is shown in Fig. 8. The center or knife blade of the switch is elongated and made into a wide V, with holes drilled at the ends for the attachment of pull cords. The whole thing is fastened on top the pole at the station end and the proper antenna is selected by a pull on the corresponding pull cord.

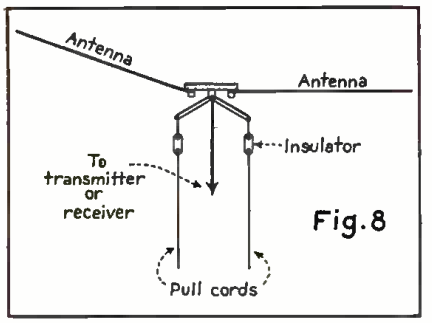
Measuring Lengths

It is well known that for maximum efficiency an antenna should be cut to exact length. While it can be approximated by mathematical formula it is only in rare cases that this is the true length for the frequency used inasmuch as height, surrounding objects and con-

ANTENNA SYSTEM

AND RECEIVING

ditions will vary this to a considerable extent. But in the case of the Fuch antenna it can be cut to the exact length by the following procedure:—Tune the final tank circuit for resonance or maximum dip of the plate milliammeter. Then tap the antenna wire onto the tank bringing it up to the "hot" or plate end until the desired load is obtained. Now retune the final tank condenser for resonance. If a lesser capacity is required for minimum plate current the antenna is too long. If more capacity is required to bring the circuit into resonance the antenna is too short. But, if the resonance setting is the same with or without the antenna attached the antenna is of the exact length; and represents a pure load to the tank circuit which, in turn, means maximum efficiency. It is advisable to start with the antenna wire over-long and then cut by the above procedure. Also a coupling condenser of .002 mfd or so should be used between the tank and the antenna.



Directional antennas with remotely operated switching arrangement made from an ordinary type single pole, double throw switch.

Now by tuning the two directional antennas in the above manner we not only have a condition of maximum efficiency but either one may be instantly used by the simple expedient of throwing a switch and no circuits have to be returned. Thus when a dx CQ comes through it is only necessary to choose the proper antenna and go after him with much more confidence than if an ordinary antenna were used.

As to the question of the proper antenna to use it is only necessary to see on which antenna the signal is received the best and then use the same one for transmitting.

Working Example

A practical working example of this system's effectiveness and desirability can be shown by a recent test transmission with LU4DQ. On the north and south antenna LU4DQ was received R5 and reported my signals the same. Then W8CRA came on R8, making LU4DQ unreadable. By throwing the switch to the east and west antenna LU4DQ was brought up to R7, W8CRA dropped to R5, and my signals were reported R8. What more could any one ask of such a simple directive system?

✦ ✦ ✦

"I want you should meet Mr. Zilch, our vice president in charge of wrapping."

Queries

soldering technique . . . circuit diagrams . . . directional aerials

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

Question No. 9

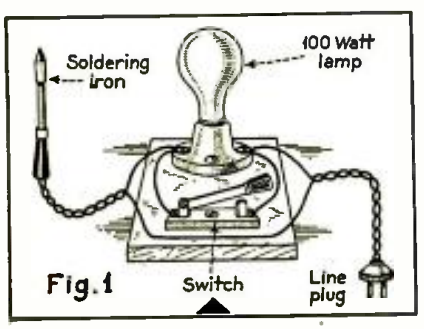
"In the course of experimental work and radio set building, I have occasion to use the soldering iron for fairly long periods of time. If I leave the soldering iron plugged in while at work, I find that it overheats, burns off the tin, and soon becomes pitted, requiring filing and retinning several times in the course of an hour or so. On the other hand, if I turn it off, except when actually in use, it cools quickly, and time is lost waiting for it to get hot enough to solder with again.

"It occurs to me that it might be practical to cut in a series resistor that would maintain the iron at the correct temperature after it was once heated. This resistor would be shorted out, of course, to speed up the preliminary heating. Can you suggest the right ohmage and wattage?—*A. J. H. Portsmouth, Va.*"

Answer

A series resistor will do the trick nicely, and such a device is employed by thousands of radio servicemen. Others are pretty expert at guaging the time, and turn on the iron just the right number of seconds or minutes before the iron will again be used. In any event, they always find something to do while waiting for the iron to get hot. As watched water never boils, similarly a watched iron never flows solder.

But the convenience of A. J. H.'s suggestion must be admitted. About the best and most convenient resistor is a 100-watt lamp. The simple circuit is shown in Fig. 1. With the switch (S) open, the lamp will also remind the operator that the iron is plugged in. However, the switch must be closed not merely for the preliminary heating-up, but also when the iron is being used. Heat is conducted away from an iron very rapidly when soldering, and the amount of heat required to maintain a given temperature when the dissipation is merely into thin air will not suffice for soldering.



Circuit of soldering device.

About the cleverest device along these lines that we have seen is the contrivance of a professional serviceman, and employs a discarded telephone desk-stand. A lamp socket is substituted for the microphone—as shown in Fig. 2—and the 100-watt lamp screwed into this. The rings of the hook have been cut out with a hack-saw to provide a rest for the iron. The circuit is the same as in Fig. 1. When the iron is at rest the switch is opened automatically by the weight of the tool. When the iron is in use, the hook raises, and the switch shorts out the lamp.

Question No. 10

"Some time ago, I purchased and built an All Star, Jr. Receiver. While it works quite well, it does not fit my requirements. I have the following proposed circuit in mind—but do not possess sufficient technical knowledge to design the same:

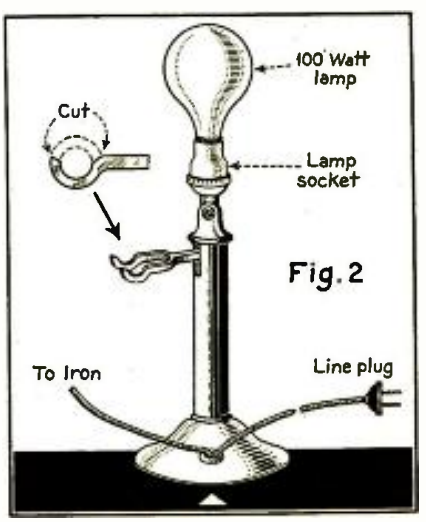
"One stage of regenerative radio-frequency using a 6C6 tube. Combination first detector and oscillator employing a 6A7. A 6A7 tube for intermediate-frequency amplification and beat-frequency oscillator. Second detector and automatic volume control with a type 75. A 6E5 as a tuning indicator. A 76 in the audio and a 42 output tube with an 80 rectifier.

"As I have all the plug-in coils, beat-frequency coil, speaker and tuning condenser from the All Star kit, I wish to use them in this new circuit—*R. V. P., Redsky, Indiana.*"

Answer

The Queries Editor receives many questions similar to the above, and wishes that it were possible to answer them satisfactorily. Of course, a circuit can be designed about any halfway logical collection of parts and tubes. And it would not take long to draw up such a circuit, and indicate approximate resistance and capacity values. But taking a circuit from paper and making it into a successful receiver is an entirely different proposition. The set would first have to be constructed—*and then the bugs worked out of it.* Additional bypass capacity would be needed in this cathode circuit and in that plate circuit. Resistance R_1 would have to be dropped ten thousand ohms and resistor R_2 increased half a million ohms. Such and such a grid circuit would need more shielding, while another grid circuit couldn't stand as much for proper alignment, with a resulting change in mechanical layout. Even more fundamental alterations might logically be in order before the

[*Continued on page 350*]



Automatic switch for soldering iron.

The Ham Bands

By Beat Note

WE WERE SLOUCHED in front of the receiver, stripped to the waist. Beyond our open window trees were etched into the intense radiance of this sweltering afternoon. Only the infra-throb of the sun broke the silence of a world heat-drugged into a deathlike slumber. Moo-Moo, the feline, lay on its back, with feet in mid-air, too lazy to stalk the fly dozing on the wall.

We knocked the receiver into twenty and listened abstractedly to a scattering of 2's and 9's yawning at each other. The air was dead. We dozed a bit.

Dusk rolled in like a damp cloudbank. A bird took wing for its nest; a few leaves fluttered; Moo-Moo stretched, and the fly drew itself up to the ceiling. Twenty rolled over and murmured. The drone of heterodynes issued up from the mud. G's, LU's and VP's were stirring in the slowly gathering froth of QRM. The 9's were commencing to bust up the east coast. The world was rubbing its eyes after a deep siesta.

When the curtain of darkness fell, the heat gave to the evening that queer magic of the tropics that quickens the senses. Anything could happen, we told ourself—anything within reason or without reason. Even a VU could break through the ever-increasing growl of twenty, and it was with this absurd thought in mind that we threw the lever on the automatic electrical bank spreader and plastered twenty over 300 degrees.

We took a 5-kc. slice off the low end and picked out a few insignificant c-w boys a mere 4000 miles out, and an SU on fone. While running over a YN birdie we heard what could have been an audio image, but excessively sharp. A mere touch on the vernier crank gave little more than an indication of the presence of some form of carrier. We increased the spread to 1000 degrees, and after careful retuning were rewarded with a constant unmodulated carrier beating with the double low-frequency oscillator.

We tried audio-frequency heterodyning without success, and finally resorted to doubling the 1000-degree spread through a harmonic amplifier. It was immediately evident upon tuning back into the carrier that, what had at first seemed to have been a single wave was, in truth, a multiple affair. Excitedly we threw in a five-stage push-pull pre-selector

beat note goes off the deep end with a splash

equipped with an inverse silencer and shot balancer, and upon applying a negative resistance to the super-regenerative avc amplifier learned to our complete surprise that not only was each carrier being modulated but, more surprising still, each was without a doubt the carrier of a ham fone station. There was no mistaking the crystal clear ham idioms.

But what modulation! Never had we heard such dulcet tones, such succulent sibilants, such breathless bass response . . . and this, mind you, with nary a trace of interference!

With trembling fingers we moved the micrometer adjustment on the split-frequency control and brought the nearest carrier into zero beat with the double low-frequency oscillator. Then, de-energizing the beat oscillator, we sat with bated breath awaiting the sign-off. It was not long in coming, but the shock we received left us completely unstrung . . . could it have been possible? --but, yes, we had heard it as clearly as our own labored breathing—CO13CZ signing with W12AM!

With a madness born of an indescribable fear of the unknown, we rocked from one station to another . . . ZB-F2, CY27-F1, XL44-F . . . Cold sweat trickled down our back. We wanted to smash our receiver into bits to escape from this nightmare, *because we knew by a chance remark about the war of 1950 that we were listening in on the future!*

Stark, shrieking fear is a mental enema that often leaves the brain in a transcendent stage, and this is undoubtedly the effect it had on our intellect, for with surprising rapidity for one as slothful as ourself, we grasped the immense truth underlying the mode and manner of these future communications. It came as a flash that a sub-harmonic of the third multiple frequency would undoubtedly do the trick. With surprising calm we hooked in an absorption trap and used the output to excite a single-ended doubler. We switched in the transmitter and cautiously called W11SM-F2 whom we had previously heard. We confess to a bit of excitement when we flipped the standby switch on the receiver and kicked up the intermediate r-f gain. As the distant carrier came on, the shot noise balanced out and we heard the clear voice of W11SM-F2 coming back.

"I believe this is our first QSO," he said.

We commenced working duplex, and we said, "It most certainly is, if it is a QSO at all, because I am a fighter and I suspect I will have been killed in the war of 1950 and so, if I am dead, how can I talk to you?"

"You are talking nonsense," he shot back. "Don't you know your FCC regulations regarding coyness in the amateur bands? Coyness has no place in the amateur bands, nor poor modulation for that matter. Yours is terrible. And, by the way, what is your complete assignment? You made no reference to your frequency area, and I am beginning to doubt that you are licensed to operate in region F2. Putting everything together, there is something decidedly queer about your mode of operation."

"There ought to be," I replied. "You may be surprised to learn that I am working from the year 1936."

"By Harry!" he exclaimed, "so your year finally broke through. Let's see, now—QRX just a second—yes, you're working your frequency against the 27th multiple of the terrestrial cycle which clearly places you in the year 1936. Well, congratulations, old man—we talk to lots of the boys in the 1937 to 1949 period, but you're the first '36 to get through. There will be no end of excitement when the A.R.R.L. hears of this and, by the Lord Harry, it means I will get the first WAY Certificate ever issued."

"What," I asked, "is a WAY Certificate?"

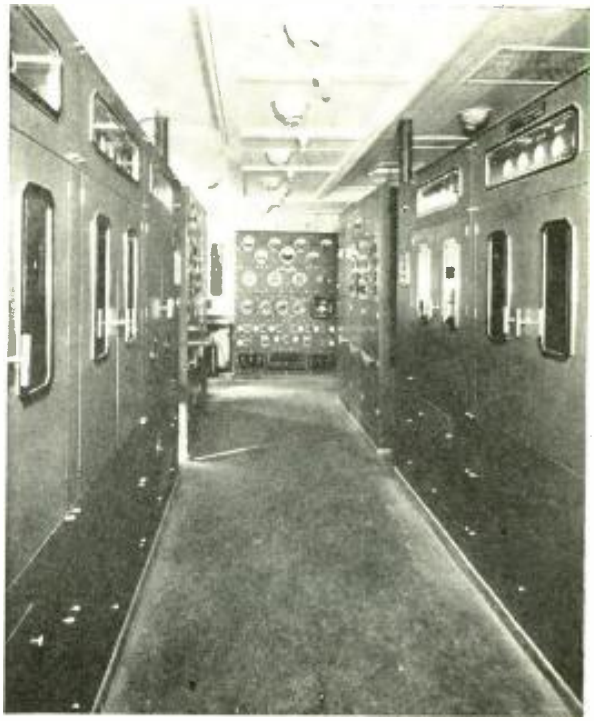
"Worked All Years, of course," he shot back. "You see, due to the lunar variation, no signals previous to the year 1936 can be received; they fall into a complete Dellinger Fadeout. Besides, the earlier years are the more difficult catches, just like the distant stations in your time cycle, so you can see that you're a rare catch for any ham."

"Well, arc my tank condenser, if that isn't the damnedest," I said. "Imagine hunting for years instead of DX. Here in New York we consider ourselves pretty good if we can hook a VU, but wow,

[*Continued on page 366*]

The Footloose Reporter

RADIO ON THE "QUEEN MARY"

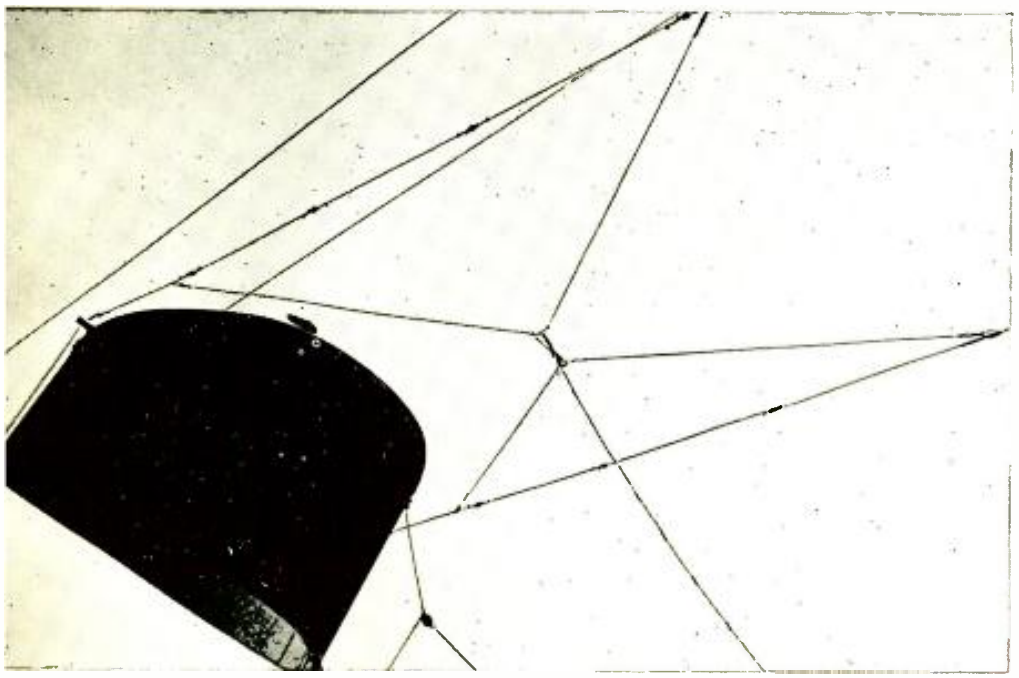


Right: The Transmitter Room on the R.M.S Queen Mary. There are four transmitters in all. Below: One section of the antenna array. There are ten aerial systems altogether, one of which is over 500 feet long.

WE stood in line at Pier 90, in the North River, looking up at the giant steel hull of the R.M.S. *Queen Mary*. We unconsciously fingered the engraved lettering on the invitation card so graciously sent us by the Cunard-White Star Line.

We tried picturing the Superliner in mid-Atlantic, spreading out its radio fingers and touching the coasts of innumerable countries, but it was a hot day and our thoughts kept returning to the problem as to how the devil they had found space for hanging ten separate aerials, even though the ship looked as big as all outdoors.

There were four in our party—two of the boys from *Scientific American* magazine (who were itching to see the engine room), and two of us radio boys (who didn't care so much about the engine room, but were itching to see the "wireless gear").



No sooner had we hit the main promenade deck of the *Queen Mary* than we were taken in tow by a perfect prize of a Deck Steward, who hustled us off toward the interior. Everything went well till we reached the sumptuous Swimming Pool and Turkish Baths. There we lost the Steward, and henceforward it was every man for himself.

We started for the deck, but each time ended back in the Men's Smoking Room. We needed a compass. Finally we saw daylight in the distance, and eventually managed to work our way to freedom. We hit for the boat deck "a-way up yonder" and after much climbing reached the sides of the immense funnels. And there before our eyes was the most colossal array of antennas we had ever seen. Strung between the masts, high above the deck, was a single stretch of wire easily 500 feet long. This we took to be the long-wave antenna. But this was nothing compared to the vast criss-cross of wires stretched from mast to funnel. There seemed to be doublets, verticals, Marconi's and Zepps, but it was really impossible to tell where one aerial ended and another began. And from this web of wires were a series of transmission

[*Continued on page 357*]

Backwash

A PAGE GIVEN OVER TO THE EXPRESSIONS AND OPINIONS OF READERS

Receiver Reports

Editor, ALL-WAVE RADIO:

I must admit that I have enjoyed reading ALL-WAVE RADIO from the beginning. I'm a forester by profession, and due to the nature of my job I must depend on the radio for most of my amusement. Living in the sticks is not so bad if one can occasionally enjoy good musical programs via radio, and also be able to lay his hands on a radio magazine like ALL-WAVE RADIO that is not too technical, yet enough so to be convincing and interesting.

It is encouraging and pleasing to note that you can "take it" as well as give it. Knickerbocker's letter in "Backwash" expresses my opinion of the Proving Post perfectly. There is a place for honest information on new radio models, but there is no place for such a section in a magazine that must depend on advertising for its existence. An honest discussion of the many trick circuits developed by present-day radio engineers would be helpful to one out to buy.

B. R. LEXIN,
FLAGSTAFF, ARIZONA.

(We have given more thought to the "Proving Post" than to any other department in the magazine. An alteration may be expected in the very near future. In the meantime, we will continue to conduct our tests on the same basis and report our findings in the same manner. These reports can be relied upon by our readers.—The Editor).

◆

Razzes and Roses

Editor, ALL-WAVE RADIO:

I am a DXer and a dyed-in-the-wool one at that. What I am most interested in is getting more stations, both on the B. C. and the S. W. bands.

In the first issue of your magazine you had a complete list of Broadcast, Shore Wave and Police Stations. I said to myself, boy, that is just the thing for you! Well, sir, to my big disappointment, you never gave us another standard station list, only short wave.

I do appreciate the S. W. list. It is very good, but it is nearly the same for two or three months at a time. In fact, the last one is almost the same as the first one you published.

I think it would be swell if you changed off. Have a list of short-wave stations one month and a list of standard broadcast stations the next month. If there are any important changes in either list in the month between, you could have a small space in the back of the magazine devoted to recording such changes.

Then, for myself, I would like to see a place in your magazine telling us what stations are putting on special DX programs at certain times during the coming month.

And please don't keep your magazine so strictly East Coast. Every writer you use seems to live on the Atlantic Coast, so the information as to what stations they receive and do not receive does not mean a thing to us here on the Pacific slope. I have friends who feel the same way about this. Please get someone from the West Coast to tell you what stations he receives and how they come in.

That ends the brickbats; now for a few flowers. You sure got a scoop when you got Ray La Rocque. He's swell. And Mr. Hinds is okay, too. These two are worth the subscription price alone. I also like Zeh Bouck and Beat Note. I like the Queries Department and I love Backwash.

HENRY BIESHEUVEL,
BELLINGHAM, WASHINGTON

(Completely revised Standard Broadcast, Police and Aircraft station lists are now in preparation and will be published in the Fall issues. A list of foreign broadcasters will be included.

The Shore-Wave Station List is far from being the same each month. As a matter of fact, there are so many changes in frequencies, schedules, and so many station replacements each month that the list is a headache. However, it is worth the effort, for the reader is provided a complete and accurate list each month from which he may work without having to refer to previous lists of station additions and deletions, and changes in frequencies and schedules. This, we have been assured by many readers, is the preferred type of list. It is certainly convenient and, being up-to-date, it is a time saver.

Articles by West Coast writers have appeared in recent issues. Reception reports from the West Coast are included each month in Mr. Hind's department. We will give thought to the idea of segregating such reports.

The flowers are greatly appreciated. —The Editor).

◆

Flood Victim

Editor, ALL-WAVE RADIO:

I really can't afford to continue my subscription nor can I afford to miss my ALL-WAVE RADIO.

Please note my new address. This is recent and was caused by the recent flood. I lost my house, most of my furniture AND all my first issues of ALL-WAVE RADIO. I feel that I must take advantage of your kind offer and renew my subscription.

I have no criticism either constructive or otherwise to offer at this time. I like your magazine as it is.

F. L. TUXBURY,
OAKMONT, PA.

(We can't tell you how much it means to us to know that in spite of the unpleasantness and loss which you have suffered as a result of the recent flood disaster, you feel that you cannot do without AWR. You have our most sincere sympathy for the loss of your house and belongings. We are restoring your file of ALL-WAVE RADIO *and trust that it will be of value to you in the days to come.—The Editor).*

◆

Receiver Testing

Editor, ALL-WAVE RADIO:

On page 235 of your May number I note the letter from Mr. H. S. Knickerbocker, of Carmel, New York. His letter and your comments certainly hit the nail on the head.

As you undoubtedly know, it is impossible to get an unbiased report on a radio set in sufficient detail and so stripped of technical description as to be understandable by the average person.

[*Continued on page 368*]

RADIO PROVING POST

FIGURE 1

THE HAMMARLUND SUPER PRO

THIS review is based on the results of tests conducted on the Hammarlund Super Pro Receiver, Serial No. 605, shipped to us by the Hammarlund Mfg. Co., Inc.

The receiver consists of three units —the receiver proper, the power supply, and the loudspeaker. There are 14 tubes in the receiver and two tubes in the power-supply unit. The loudspeaker is a Jensen 12-inch high-fidelity type. A 10-wire cable, with terminal strips, is used to connect the receiver to the power supply. The loudspeaker is connected to both the receiver and the power supply by means of similar cables with terminal strips.

Mechanical Points

The panel of the receiver is a solid piece of aluminum, about ⅛-inch thick, with a dull black wrinkle finish. The chassis to which the panel is fastened, is heavy gauge cadmium-plated steel. There are reinforcing brackets between chassis and front panel. There is no possibility of chassis flexure which so often causes alterations in circuit adjustments and consequent instability in operation.

Both the receiver and power-supply chassis are enclosed in strong metal dust covers, with the same black finish as the receiver panel, and these are made secure by series of solid metal thumb screws. The dust covers are removed by removing the thumb screws.

The units mounted on top of the receiver chassis are completely shielded. Even the gang condensers and the Band Selector Switch are enclosed in sheets of metal joined securely together by large machine screws. The battery of 20 r-f coils under the chassis are also completely shielded with heavy metal, and the bottom of the chassis proper has a metal covering.

Fig. 4. One of the r-f antenna transformers with Faraday screen between windings.

Aside from the fact that the receiver is exceptionally solid in construction, it is a superlative example of fine machine work. The excellent workmanship is evident in everything from the intricate band-selector switch to the metal dust cover.

Receiver Controls

There are a total of 14 controls on the front panel of the receiver, but for average home broadcast reception on all bands, only four of the controls need be used—the On-Off Switch, the Band Selector Switch, the Main Tuning Control, and the Volume Control—no greater number than the controls employed on the average receiver. The additional controls are provided so that the receiver would have the necessary degree of control flexibility to meet all reception requirements.

The controls are clearly shown in the illustration of the receiver panel (Fig. 1). At the top center is the Tuning Meter, not included as a control. Di-

rectly below this meter is the Band Selector Switch which has five positions and covers the following ranges: 540 to 1160 kc, 1160 to 2500 kc, 2.5 to 5.0 mc, 5.0 to 10 mc, and 10 to 20 mc. The limits of each band are marked on the scale plate attached to the Band Selector Switch.

To the left of the Band Selector Switch is the main tuning scale. The control knob is below the scale, near the bottom edge of the panel. The main tuning scale is directly calibrated in kilocycles and megacycles and has a shutter arrangement controlled by the Band Selector Switch, as shown in Fig. 2, so that only the frequency scale in use shows up in the window.

The band-spread dial is to the right of the Band Selector Switch. The control knob is below the scale, near the bottom edge of the panel. The Band Spread Control operates only in the frequency bands from 2.5 to 20 mc. The scale has 100 divisions and provides straight-line frequency readings in all three of the high-frequency bands covered by the receiver. It may be used either to spread out any portion of the frequency ranges covered by the main tuning dial or as a vernier for fine tuning in the short-wave bands.

The knob at the left center of the panel is the R-F Gain Control. This knob controls the sensitivity of the radio-frequency or pre-selector amplifiers.

Below this knob is the Selectivity Control which operates a multiple cam arrangement that varies the coupling of three of the intermediate-frequency transformers. The control is continuously variable so that any degree of selectivity within the limits of the receiver may be obtained at will.

To the right of the Selectivity Control are two toggle switches. The upper switch cuts the plate voltage on the r-f and h-f oscillator tubes so that, when the receiver is used for communication work, it will not block. This switch also permits the receiver to be used as a monitor during transmissions.

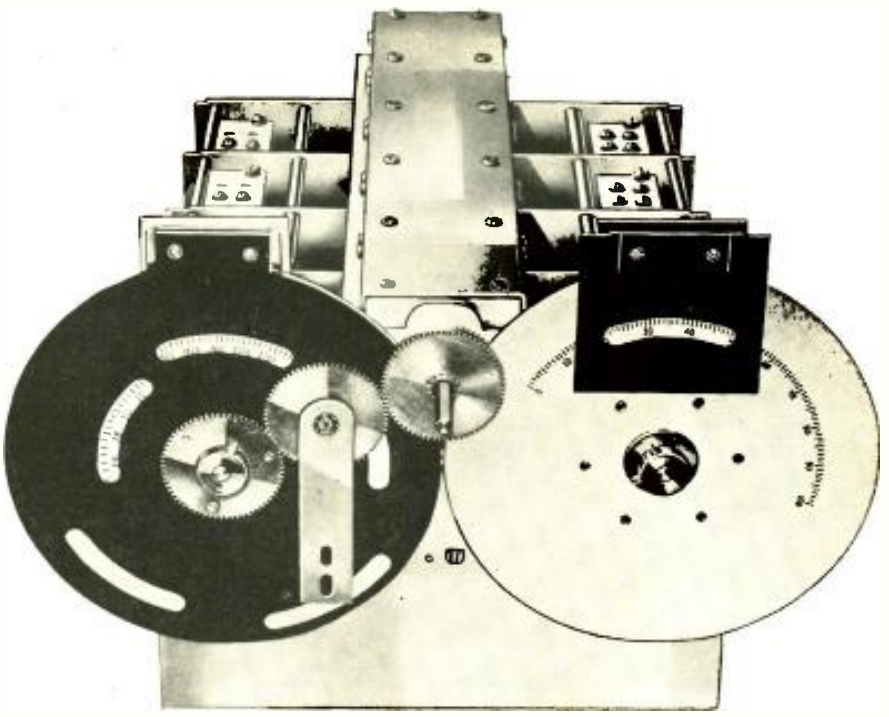


Fig. 2. The main and band-spread tuning dials, showing shutter arrangement geared to band selector switch shaft.

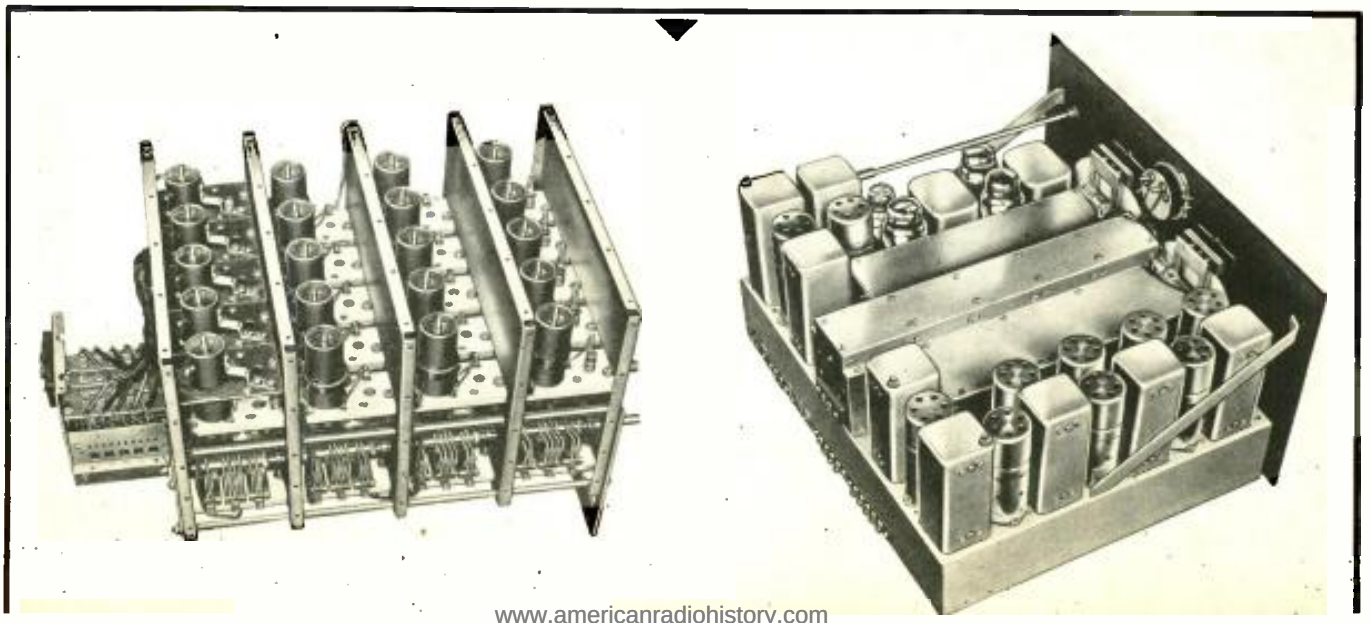
The lower toggle switch throws the receiver from manual to automatic volume control. When in the left position, the gain of the receiver is controlled automatically. When in the right position, the control of gain or sensitivity is accomplished by the R-F Gain Control and/or the I-F Gain Control which is the small knob directly below the On-Off toggle switch at the bottom center of the panel.

To the right of the Band Spread Control Knob are two more toggle switches. The upper one places the receiver in condition for either phone or c-w reception. When in the right position, the receiver is conditioned for the reception of any form of modulated carrier (phone, i.c.w. or broadcasting). When the switch is in the left position, the beat-frequency oscillator plate and screen circuits are energized, and the receiver is conditioned for the reception of c-w code signals. This position of the switch also permits the beat-frequency oscillator to be employed as a station finder.

The lower toggle switch permits reception either through the loudspeaker or through a pair of headphones which can be plugged in to tip jacks located at the rear of the chassis. The headphones may be left plugged in at all times and the output of the receiver switched immediately from either loudspeaker or phones with a flip of the switch.

The knob at the lower right of the receiver panel is the Audio Gain Control,

Fig. 6 (left). The 20 r-f transformers in their compartments and beneath them, the ganged band-spread tuning condensers. Right: The chassis.



which controls the volume to either loudspeaker or phones, depending which is switched into circuit.

Above this knob is the Tone Control, and at the top of the panel the Beat Oscillator Control by which the pitch of a c-w signal may be varied. This knob controls a small variable condenser in shunt with the coil of the beat-frequency oscillator.

The Circuit

The circuit of the receiver is shown in Fig. 3. There are two stages of radio-frequency amplification, using 6D6 tubes, a 6A7 first detector or mixer, 6C6 high-frequency oscillator, three intermediate-frequency amplifier stages employing 6D6's, a fourth i-f stage working through the pentode section of a 6B7 tube, a second detector comprising the diode of the 6B7, a separate intermediate-frequency amplifier used in conjunction with a second 6B7 tube which provides amplified automatic volume control, a 6C6 beat-frequency oscillator for c-w reception, a 76 audio voltage amplifier, a 42 audio driver and an audio power output stage employing two 42 tubes in push-pull, operated Class AB. Fourteen tubes in all in the receiver proper, which provide every service necessary to a wide range of receiver reception conditions.

There are a number of interesting features in the circuit worthy of mention. Note, for instance, that the antenna transformers, A1-A2, B1-B2, etc., have electrostatic shields between their primary and secondary windings so that the transfer of energy from the antenna to the grid of the first r-f tube is limited to pure electro-magnetic coupling. One of these coils with the Faraday screen placed between the windings, is shown in Fig. 4.

The circuits of the Band Selector Switch are also worthy of note. The switch has five sections, SW1-2-3-4-5, each shielded from the next. Each section consists of a two pole, five-position switch. Silver-plated knives, mounted on bakelite panels, sliding in guides are raised and lowered by cams on the switch shaft, as shown in Fig. 5. In the lower position, the knives engage pairs of contacts on the switch base,

Fig. 5. One section of the shielded, cam-operated, band selector switch.

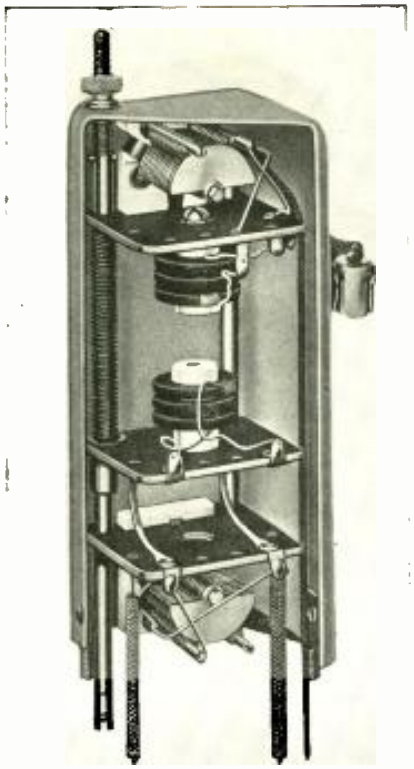


Fig. 7. One of the air trimmed i-f transformers with variable coupling.

thereby closing the circuit. The base contacts are of spring bronze, silver-plated. Each has six separate contact fingers to further insure low-resistance connection. This design eliminates the necessity for pig-tails, wiping rotary contacts and even the pivot of the knife blade. Since the switch knives merely enter and leave the spring base contact, as the circuits are opened and closed, there is no "passing through" action, with its attendant wear. Consequently there is no chance offered of building up a conducting path of metallic particles between contacts. No moving part of the switch carries current to cause noise or to provide stray coupling. Silver-plated short-circuiting springs automatically short the four spring contacts at all times. All five positions are passed through by one revolution of the switch shaft. The five contact points which are 72° apart are definitely located by an accurate detent mechanism. No stop is used, so that the switch can be continuously rotated in either direction. The timing of the cams and arrangements of contacts is such that the circuit through one set of knives is not broken until contact is made with another set. This avoids sparking in the sections which handle plate current and also prevents open grid circuits when the switch is turned.

Band Spreading

The next point of interest in the circuit is the arrangement of the ganged band-spread variable condensers, BS1-2-3-4. It will be noted from Fig. 3 that each section consists of a single rotor and three stators, thus making each section actually three variable condensers in one, or a total of 12 band-spread condensers altogether on a single shaft. The interesting part about this arrangement is that turning the band-spread control knob simultaneously tunes all three of the high-frequency bands extending from 2.5 to 20 megacycles, but the only band effectively tuned is the one to which the band-selector switch is set. This condition is of no advantage in itself; it is only the result of an excellent arrangement which, through the use of separate condensers of proper capacity for each short-wave band, provides automatically the most desirable degree of band spread on the dial scale, and, secondly, an arrangement of multiple condensers permanently connected to their proper coils at all times. This series of band-spread condensers is shown in the illustration of Fig. 6. It will be seen that each set of stator plates in each section is of a different size or number of plates, the ones with the lesser number of plates and less capacity being used in conjunction with the higher frequency bands.

The intermediate frequency transformers will also bear notice. It will be seen that each is of the double-tuned type, and all of them are air trimmed. The first three, AA-BB-CC, have variable coupling and are controlled by cams attached to the shaft of the Selectivity Control on the front panel of the receiver. One of these transformers is illustrated in Fig. 7. With this arrangement, the response characteristic or selectivity of the intermediate amplifier can be varied from a single, sharp peak in the minimum coupling position, to a wide, double-humped peak in the position of maximum coupling.

The fourth i-f transformer DD, has a third winding which provides link coupling between the third i-f stage and the intermediate avc amplifier. The i-f transformer, EE, in the fourth stage, and the i-f output transtormer, HH, in the avc amplifier, are also air trimmed.

There are, altogether, 10 tuned circuits in the signal i-f amplifier, and 3 tuned circuits in the avc amplifier. A high degree of selectivity and gain are therefore provided in both amplifiers.

The diode section of the upper 6B7 tube functions as the signal rectifier. The output of this diode appears across the volume-control potentiometer (94). The signal is thence fed to the 76 a-f voltage amplifier which provides plenty of gain to swing the 42 driver tube. The driver provides the power necessary to drive the push-pull power output amplifier employing type 42 tubes operated as triodes.

Note from the circuit that, with the

exception of the type 42 push-pull tubes, all cathodes are connected directly to ground. All tubes so connected are fixed biased from the power-supply unit. The negative voltage appears across the voltage divider resistors, (72) (73) (74) (75) from which taps are taken to provide the proper initial and steady bias for the various tubes in the receiver circuit.

The AVC Circuit

Automatic control bias is supplied to the grids of the two r-f tubes and to all four i-f tubes, but in different amounts. Maximum control is placed on the first three i-f tubes where it is most needed, and a lesser amount on the r-f tubes and the fourth i-f tube. The circuit is so arranged that both the R-F and I-F Gain Controls are effective irrespective of whether manual or automatic gain control is employed. It is therefore possible to limit the r-f and i-f gain of the receiver even though the avc is in operation. The circuit is also arranged so that avc can be effectively employed during the reception of c-w code signals. This is accomplished by increasing the time constant of the avc circuit by the addition of condenser (30) when the MOD-CW toggle switch is thrown to the CW position.

The circuit of the power-supply unit is not shown as it is standard. The unit employs a type 5Z3 full-wave rectifier with the usual filter system, for supplying plate and screen voltages to the tubes in the receiver, and for exciting the field of the dynamic speaker. The speaker field forms the second section of the filter. A type 1-V half-wave rectifier tube is employed for supplying negative bias voltage. A resistance-capacity filter is used in conjunction with this tube.

Report on Tests

All controls are smooth and precise in operation. The Band Selector Switch is rather stiff in action, but is sure-fire. Though each frequency band is marked on the knob plate, it is just as easy to refer to the dial scales, since only one is visible at a time.

The calibration of each of the five main tuning scales were checked against a crystal-controlled oscillator and against stations of known frequency stability. We found each band to be more accurately calibrated on the dial scales than any receiver so far tested, and found it quite practical to pre-set the receiver to a definite frequency and intercept the desired station. The discrepancy at the most is only a matter of a few hundred cycles.

The frequency drift of the receiver was also checked with a high-precision crystal-controlled oscillator. The oscillator was warmed up for a period of a half hour so that it would be perfectly stabilized. The receiver was then set to 14 megacycles, the exact frequency of the oscillator, and left running for a half hour. The frequency drift of the receiver in this period, from a cold start to temperature stability amounted to only 2.2 kilocycles. An additional half-hour of operation failed to indicate additional drift.

The degree of band spread was then checked. In the 14-mc band, each scale division of the band-spread dial was found to cover 4.5 kc. In the 7-mc band each division covered 4 kc, and in the 3.5-mc band the coverage for each division was found to be 5 kc. This amount of spread in each of the three high-frequency bands was found adequate for all purposes.

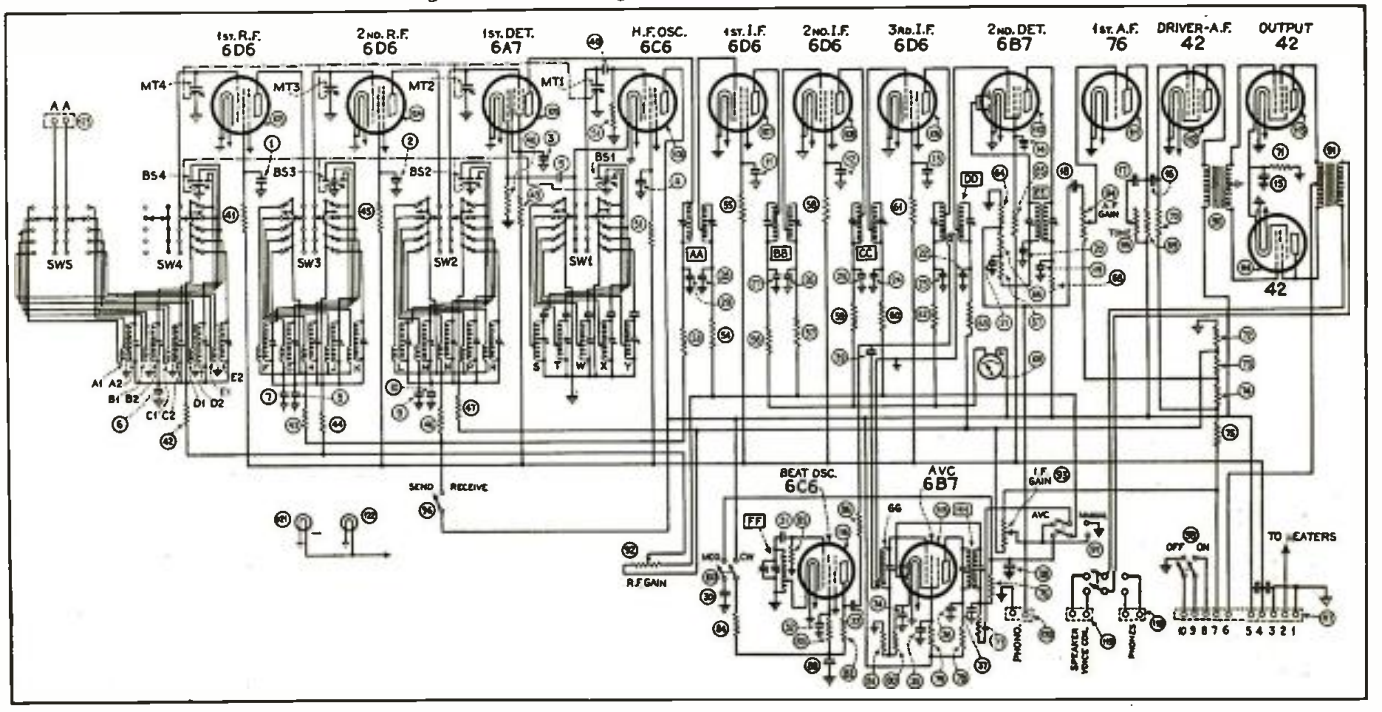
The degree of sensitivity of the receiver is so high that it is necessary to reduce the R-F Gain Control to minimum, and run the I-F Gain Control at the minimum or half-way position during reception from local broadcast stations. Though the avc will ride the gain of the receiver as effectively as any we have tested, it is still not practical to employ full sensitivity in either of the two low-frequency bands except during the reception of extremely weak stations. We found it of use on KFI, which has not been riding through any too well lately, but in the majority of instances we kept the R-F Gain at minimum.

In the three high-frequency bands, however, the high sensitivity of the receiver comes into its own. Both R-F and I-F Gain Controls can be run wide open in the event there is not too much noise background. Under most conditions the full gain of the I-F cannot be used, but it is there, ready for use on extremely weak signals.

The Selectivity Control provides a range of coupling from 1/3 optimum in the narrow position to about three times optimum in the wide position. In practical operation this control reduces by one-half the space occupied by a modulated station carrier of high field strength, when set for maximum selectivity. Thus, with this control the full audio range of a strong station carrier can be passed through, or it can be sliced in half and a station brought in on either of the two adjacent channels. And there

[*Continued on page 361*]

Fig. 3. Schematic diagram of the Hammarlund Super Pro.



Review of World Radio

alps get radio yodle . . . china to smash ether . . . radio horse race close shave . . . news!—short wave bites snake bite . . . televisioniske

Telephony Between Russia And U.S.A.

MOSCOW: The first telephone conversation between Moscow and New York took place recently. The service was made available by an extension of the direct route between Moscow and London, which was opened some time ago.

◆

Farmers' Radio

CHECHOSLOVAKIA: In Chechoslovakia exists a very powerful station called the "Farmers' Radio" which was organized by a farmers' cooperative organization. The first transmissions were broadcast in 1926 at the Praga station and since that time service has not been interrupted. A committee of central editors edits the program material which is simultaneously broadcast on all the transmitters in the country; on the other hand, regional broadcasts are edited locally and complete that part of the program which did not originate at the main studio.

The "Farmers' Radio" proposes to contribute immeasurably to improved agricultural production methods, to elevate the intellectual level of the peasants and to better acquaint city dwellers with farm problems. The major part of the transmissions are occupied by technical questions relative to production of field products, agricultural notices, market reports and meteorological information. The transmissions are dialogued by two actors performing as rubes. Statistical reports reveal that 52 out of every 100 listeners of the "Farmers' Radio" are agriculturists and the remainder are composed of urbanites having little or no farm interest.

◆

Radio for Alpine Climbers

ITALY: The Italian Alpine Club has, it seems, taken a useful decision, which should provide greater safety for alpinists. The principal refuge huts on the Italian Alps will be connected by wireless telephone with the valleys. Thus occupants of the huts will be in a position to transmit and receive urgent news, meteorological reports and requests for information and assistance. Short and ultra-short waves will be used, and, for their power supply, the stations will employ storage batteries. The first posts to be fitted with wireless—viz., the Prince Umberto and Monte Piana huts, which are connected with Misurina—are said to have given excellent results. The experiment is intended to provide a most useful service of weather forecasts, to be organized by the Royal Italian Aeronautic Society and the E.I.A.R. (*World Radio Mar. L936)*

◆

Proposed Reform of Broadcasting Service

CANADA: A Reuter message from Canada states that the reorganization of the administration of the Radio Broadcasting Company of Canada and the replacement of the present radio commission by a public corporation with a board of nine directors and a broadcasting expert as general manager, was suggested to the Dominion House of Commons Radio Committee by the Canadian Radio Relay League recently. The committee is making a thorough study of the radio broadcasting situation in Canada, and will report to the Commons shortly.

◆

Three New Broadcasting Stations

GREECE: Tenders are being invited by the Greek Government for the building of three broadcasting stations at Athens, Salonica and Corfu. The Athens station is to be ready for working in 18 months from the ratification of the contract between the Greek Government and the successful firm, and the Salonica and Corfu stations within 2 years. The total cost of the three stations complete is estimated at drachmae 300,000,000 ($3,000,000). Tenders are to be submitted by July 3rd.

◆

Broadcasting Developments In China

NANKING: The Chinese Broadcasting Administration has recently placed an order with the British Marconi Company for a high-power short-wave broadcasting station which will probably be erected near Nanking to augment the present medium wavelength XGCA station. The new installation reported to be more powerful than the present British Empire Broadcasting Station in Daventry will require two years to manufacture and construct. Chinese radio engineers are being dispatched in the near future to the Marconi College and factory in Chelmsford, Essex, to inspect the plant during manufacture and to acquire additional experience in modern radio technique. By 1938 it is anticipated that with this equipment China will have a broadcasting station capable of giving a world-wide service.

Instructions have recently been given by the National Government to the Ministeries of Finance, Communications and Railways to issue necessary permits granting exemption from import duties and other transportation charges of the above equipment upon its arrival in China.

According to a report credited to the Ministry of Communication, 70,000 radio receiving sets have been registered throughout the country with the Government during the past two years. Thirteen private radio stations operating contrary to radio regulations are claimed to have been abolished while in other areas suspensions for indefinite periods have occurred.

Examination of radio programs is being established, regulations having been drafted by the Ministry to prevent the broadcasting of programs detrimental to public morals. As the majority of broadcasting stations are located in the Shanghai area, the local Bureau of Social Affairs and Education has been instructed to cooperate in the examination of broadcasting programs. Efforts will also be made, states the Kuo Min News Agency, to take over radio stations operated by foreigners, in order to protect the Chinese national interest. (*Comm. A. V. Smith, Shanghai*).

◆

"People's Set": A Misfire

NORWAY: Norway's effort at providing a "People's Receiver" has failed. Four firms submitted tenders for the production of a standard receiver, but all four offers were rejected, partly for price reasons and partly because they did not comply with the technical requirements.

It is understood that a new appeal will be addressed to the industry shortly in an endeavor to emulate the German "Volksempfänger" (people's radio).

◆

Dangerous News Item

NORWAY: In a recent issue of the Swedish *Radio Times* a story is being told of a very unusual happening as the result of a running commentary on a horse race. A barber was about to commence shaving a customer when the commen-

[*Continued on page 367*]

Station Signatures...

IDENTIFICATION SIGNALS OF SHORT-WAVE BROADCAST STATIONS

17775 16.88 PHI	*Call:* In seven languages. *Interval:* Metronome with 80 beats per minute. *Closing:* Netherland's National Anthem.
15370 19.52 HAS3	See 9125 kc.
15244 19.68 TPA2	See 11720 kc.
15220 19.71 PCJ	*Interval:* Metronome, 80 beats per minute. *Closing:* Netherlands National Anthem.
15121 19.84 HVJ	*Call:* "Landetur Jesus Christus." *Interval:* Clock ticking. Station known as "Radio Vaticano."
14100 21.25 HJ5ABE	*Interval:* Bugle calls. "Cia Radiodifusora Colombiana."
13100 22.90 VPD	*Call:* "Radio Suva calling." *Closes:* "God Save The King." Station known as "Radio Suva."
12830 23.38 CNR	See 8035 kc.
12000 25.00 RNE	See 6000 kc.
11880 25.23 TPA3	See 11720 kc.
11810 25.38 2RO4	See 9635 kc.
11800 25.40 HJ4ABA	*Call:* "Ecos de la Montana."
11790 25.43 W1XAL	*Call:* "Station W1XAL, Boston."
11720 25.60 CJRX	*Call:* Station CJRX, Winnipeg, Manitoba."
11720 25.62 TPA4	*Call:* "Allo, ici Paree, station d'etat Radio Coloniale." *Interval:* Three tones ("F" in Morse). Opens and closes with anthem "La Marseillaise."
10740 27.93 JVM	See 10660 kc.
10660 28.14 JVN	*Interval:* Chimes and gongs, irregular. *Closing:* Selection "Kimigayo."
10350 28.98 LSX	*Call:* "*Ellie-Essay-Aixey* B-way-nos-eyeries." *Closing:* "San Lorenzo" March.
10330 29.04 ORK	*Call:* "Ici Bruxelles Post Colonial Belge." *Interval:* Uses a carrillon. *Closing:* "Brabanconne."
9860 30.43 EAQ	*Call:* (Spanish) "Eay-Aye-Coo"; (English) "This is EAQ, Madrid, Spain." *Closing:* Good night greetings in Spanish, French and English, followed by "Himno de Riego" with their own programs. Closing with International Broadcast Club, London: Ted Lewis' "Good Night Melody."
9650 31.09 CT1AA	*Call:* "Aqui Estacoa Radio Coloniale Lisboa." Announcements in Portuguese, French, English; sometimes in Spanish and German. In English: Radio CT1AA (short a) Lishoa. *Interval:* "Cookoo" Signal (2 notes G, E, repeated three times). Station known as "Radio Coloniale Lisboa."
9635 31.23 2RO3	*Call:* "Radio Roma Napoli." *Interval:* Bird Call (singing). *Closing:* Puccini's "Hymn to Rome"; also "Royal March" and "Giovinezza" on American Hour.
9600 31.25 CB960	*Closing:* "Rhapsody In Blue."
9595 31.27 HBL	See 7797 kc.
9590 31.28 VK2ME	*Call:* "You are listening to VK2ME, Sydney, the short-wave experimental station of the Amalgamated Wireless, Australasia." Gives time of day often; clock chimes each quarter hour. Clock strikes at hour. *Interval:* Call of Kookaburra bird. *Closing:* "God Save The King." Known as "The Voice of Australia."
9565 31.36 VUB	*Call:* "This is the Bombay station of the Indian Broadcasting Service," followed by indication of Indian Standard Time. *Interval:* "Bombay Calling." *Closing:* "God Save Tbe King."
9560 31.40 DJA	*Call:* "Hier der Deutscher Kurzwellensender"; English: "Hello dear friends in Nortb America." *Interval:* Notes from a music box. *Closing:* The two German national anthems, "Deutschland"—"Horst Wessellied."
9515 31.53 LKJ1	*Call:* "Hallo On-zlo-her." *Interval:* Six piano notes.
9510 31.55 VK3ME	*Call:* "You are listening to VK3ME Melbourne, the short wave experimental station of the Amalgamated Wireless, Australasia." *Closing:* Chimes; clock strikes hour of 10, "God Save The King."
9501 31.56 PRF5	*Call:* "Pay-air-effie sinko, La Voz do Brazil." English; "PRF5 short-wave station of the Government of Brazil." *Interval:* Three-note gong. *Closing:* Brazillian national anthem.
9428 31.81 COCH	*Call:* "Estacion de Onda Corta C-O-C-Ahchie. Vedado Habana, Cuba." *Interval:* Crowing of rooster.
9125 32.88 HAT4	*Call:* "Hallo Itt Radio Budapest." *Interval:* Musical box melody. Comes on the air with bells ringing. Also announces in English; gives meters and kilocycles. Station known as "Radio Budapest."
8775 34.19 HCJB	Opening selection (record), March "Patria." *Call:* "HCJB 'La Voz de los Andes'." English; HCJB; H as in Harry, C as in Chicago, J as in Jones, and B as in Broadcast. *Interval:* Fournotes on gongs. *Closing:* Ecuadorian National Anthem. Mentions "Westinghouse" quite often in Spanish program.
8750 34.29 ZBW	*Call:* "This is station ZBW, at Hong Kong."
8590 34.92 YNVA	*Closing:* "Bugles and drums. Announcement: "Estacion Ruben Dario."
8035 37.33 CNR	*Call:* "Ici Radio Moroc en Rabat." *Interval:* Metronome, 60 beats per minute.
7797 38.47 HBP	*Call:* "This is the Wireless Station of the League of Nations, Geneva, Swftzerland." Known as "Radio Nations."
7282 41.20 HJ1ABD	Station known as "Ondas de la Heroica." *Closing:* "Stars and Stripes Forever."
6701 44.71 TIEP	*Call:* "La Voz del Tropico."
6635 45.00 HC2RL	*Opens* and *closes* with Ecuadorian National Anthem. Station known as "Quinta Piedad."
6618 45.33 Prado	*Opening:* Station chimes. *Announces:* "Estacion el Prado en Rio-bamba Ecuador."
6520 46.01 YV6RV	Station known as "La Voz de Carabobo." *Intercalls* near closing. Taps and off.
6447 46.51 HJ1ABB	*Announces:* "La Voz de Barranquilla en Columbia Sur America." Three chimes identification like NBC. One chime between advertisements. *Closing:* Selection "La Golondrina."
6410 46.80 TIPG	*Closing:* Selection "Parade of the Wooden Soldiers." Station known as "La Voz de la Victor."
6375 47.10 YV4RC	*Closing:* Record, "Blue Danube March" (Jesse Crawford). Station known as "Ecos del Avila y Andas Populares."
6357 47.19 HRP1	*Call:* "El Eco de Honduras en San Pedro Sula Inla Centro Americano."
6230 48.15 OA4XG	*Closing:* Selection "Good Night Sweetheart."
6190 48.47 H11A	*Call:* "Aqui la Voz del Yaque." *Interval:* gong. *Closing:* Selection "Anchors Aweigh."
6171 48.61 XEXA	*Closing:* Selection "March of the Toys."
6170 48.62 HJ3ABF	*Call:* "Estacion de Radiodifusora 'Hache-Jota-tresbe-efe'." *Closing:* Selection "Good Night Sweetheart." Station known as "La Voz de Bogota."
6150 48.78 YV3RC	*Call:* "Aqui Radiodifusora Venezuela en Caracas." *Interval:* Two chimes, pause, two bells. Station known as "Radiodifusora Venezuela."
6150 48.78 CJRO	*Call:* "Station CJRO. Winnipeg, Manitoba."
6140 48.86 W8XK	*Closing:* Selection "Stars and Stripes Forever."
6131 48.93 HIX	*Call:* "Hache-I-Ekis en Santo Domingo." *Interval:* Bells. Known as Radiodifusora HIX.
6130 48.92 COCD	*Call* (English): "you are listening to COCD, Habana, Cuba, on 6130 kc." "La Voz del Aire, S. A." *Closing:* Selections "Smoke Gets in Your Eyes" and Ted Lewis' "Good Night Melody."
6120 49.02 W2XE	Announces in five languages. *Closing:* "Star Spangled Banner."
6115 49.06 HJ1ABE	*Closing:* "Aloha" on Organ. Station known as "La Voz de los Laboratorios Fuentes."
6110 49.10 HJ4ABB	*Call:* "Hegui radiodifusora HJ4ABB en Manizales." Uses bells.
6080 49.34 CP5	*Opening:* Gong, one stroke and then chimes. Station known as Radio Illimani.
6072 49.41 OER2	*Call:* "Hier Radio Wein." *Interval:* Metronome, 60 beats per minute.
6065 49.45 HJ4ABL	*Announcement:* "Ecos de Occidente." *Closing:* Selection "Himno de Carnaval de Manizales."
6060 49.50 OXY	*Call:* "Kalundborg Kobenhavn og Danmarks Kortbolge sender." *Opens:* One gong stroke. *Closing:* Selection Der er et yndigigt land" "There is a winsome land."

[*Continued on page 350*]

Station Signatures

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

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

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

6040 49.67 W1XAL — *Call:* "Station W1XAL. Boston."

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

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

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

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

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

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

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

6000 50.00 RN59 — *Call:* "This is Moscow calling." Plays "Internationale" at *opening* and *closing.*

5975 50.20 XEWI — *Closing:* Selection "Ah Sweet Mystery of Life." Station known as "My Voice to the World from Mexico."

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

5885 50.98 HCK — *Call:* "Radiodifusora del Estado."

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

5850 51.28 YV5RMO — *Opening:* One stroke of gong. *Call:* "Aqui Estacion YV5RMO Maracaibo Ecos del Caribe." *Interval:* One stroke on gong followed by run of notes C, E, G, C. *Opening and closing:* Extract from "Blue Danube March" (Jesse Crawford).

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

5800 51.72 YV2RC — *Call:* "Aqui Cia Anomonia Venezuela"; also "Radio Caracas." *Interval:* Four chimes; opens and closes programs with station's official "1BB March." It is not the Venezuelan anthem as many believe. Bugle calls and whistles just before closing. Station known as "Radio Caracas."

QUERIES

[*Continued from page 340*]

receiver could be really graduated from paper.

Obviously, it would not be practical for ALL-WAVE RADIO to build and experiment with every receiver suggested or requested by its readers—as much as we would like to have the time, money, staff and facilities to enable us to do just this! The best we can do is to build one or two sets each month to supply the greatest need as recognized from your letters, and describe these receivers, tried and tested, in the magazine.

It may be maintained that there are plenty of readers capable of doing just what our technicians can do—take a logical circuit and make a good receiver of it. Granted! But such readers do not have to come to us for the circuit. If they are as good as all that—as good as our technicians—they can design their own circuits as well as we can do them for them!

The story is told of Mozart at the height of his career. A young and ambitious musician asked the master how to compose a symphony. Mozart, observing his youth, suggested that he start with something more simple. However, the young man was not to be easily dissuaded, and he reminded Mozart that the master himself had written a symphony at the tender age of seventeen.

"True—true," admitted Mozart, nodding slowly. "But I didn't have to ask how."

Sad experience has shown that the request for an original and arbitrary circuit with experimental values is *prima facie* evidence that he who requires it lacks the ability to construct the receiver from such meagre information. It is better for both his sake and ours that we refer such readers to one of the ALL-WAVE RADIO standard circuits, or some commercial and tested kit which best approximates his requirements. We are not lazy—nor are we shirking our responsibility to our readers. Rather, we are living up to it!

Question No. 11

"I have dabbled mildly in ordinary broadcast radio for several years, and have always been under the impression that an aerial received best from the direction in which it was pointed. Your comprehensive discussion of directional effects in the Queries Department of your April issue bears this out. On the other hand, the installation instructions that accompany the antenna outfit sold by RCA states, 'The direction of the antenna wires should be such that the span is at right angles to the line of direction of the location of any particular station whose short-wave signals it is desired to receive.' Unless I am sadly off in my reading, this is a direct contradiction of the principles expressed above. How come?—*G. A. R., Bethlehem, Pa.*"

Answer

As it often happens, everyone is right—and none wrong. G. A. R.'s broadcast experience was doubtless with the familiar L type antenna, which does receive best along the line of span, and from the end at which the lead-in is taken off. The RCA instruction sheet refers to a doublet antenna, which aerial receives better at right angles to the direction of span. In our April discussion of directional effects, we never referred to the *direction of span.* If we said a "north-south" antenna, we meant an aerial signally directional north and south (probably having in mind a doublet antenna strung up east to west). However, it might just as well have been an L antenna, with a north-south span, and the lead-in taken off from the end pointing in the direction of the desired reception—at the north end in the specific case of Japan.

CORRECTION NOTICE

Two errors appeared in the parts list for The AWR-6 Band-Spread Super, on page 278 of the July issue.

Under the heading "Parts for Receiver," there are two resistors designated as R1. The second is correct. The first should read: R—IRC Insulated Metallized 1500 ohm, ½ watt.

Under the heading "Parts for Power Supply," the Sylvania tube listed should be a 5Z3, not a 5Z4.

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.	7 A.M.-9 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. daily.
21420	14.01	WKK	Lawrenceville, N. J.	(P) Phones LSN - PSA daytime; HJY - OCI-OCJ irregular
21160	14.19	LSL	Buenos Aires, Arg.	(P) Phones GAA mornings; DFB-DHO PSE-EHY irreg.
21140	14.19	KBI	Manila, P. I.	(P) Tests and relays P. M. irregular
21080	14.23	PSA	Rio de Janeiro, Brazil	(P) Phones WKK-WLK daytime
21060	14.25	KWN	Dixon, Calif.	(P) Phones afternoon irregular
21020	14.29	LSN	Buenos Aires, Arg.	(P) Phones WKK-WLK daily; EHY, FTM irregular
20860	14.38	EHY	Madrid, Spain	(P) Phones LSM-PPU-LSY mornings
20860	14.38	EDM	Madrid, Spain	(P) Phones LSM-PPU-LSY mornings
20835	14.40	PFF	Kootwijk, Holland	(P) Phones Java days
20830	14.40	PFF	Kootwijk, Holland	(P) Phones Java days
20825	14.41	PFF	Kootwijk, Holland	(P) Phones Java days
20820	14.41	KSS	Bolinas, Calif.	(P) Phones Far EastA.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. 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-WOF 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; 3:40-5:45 P.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	Mon., Thurs., Fri., Sat. 8-10:30 A.M. Sunday 8-11 A.M.; 1-2 P.M.
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.
16250	18.46	FZR	Saigon, Indo-China	(P) Phones FTA-FTK early A.M.
16240	18.47	KTO	Manila, P. I.	(P) Phones JVE-KWU evenings
16140	18.59	GBA	Rugby, England	(P) Phones Argentina & Brazil irreg.
16117	18.62	IRY	Rome, Italy	(P) Phones Cairo, Asmara and others, broadcasts A.M. and early P.M.
16050	18.69	JVC	Nazaki, Japan	(P) Phones Hong Kong early A.M.

KC	Meters	Call	Location	Time
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.-3:40 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	Sun., Wed. 7-11 A.M. Tues. 3-6 A.M.
15210	19.72	W8XK	● Pittsburgh, Pa.	9 A.M.-7 P.M. daily
15200	19.74	DJB	● Zeesen, Germany	3:50-11 A.M.
15140	19.82	GSF	● Daventry, England	9 A.M.-12 noon, 3:40-5:45 P.M., 6-8 P.M. 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
14970	20.04	LZA	● Sofia, Bulgaria	Daily 4:30-5:30 A.M., 12-4 P.M.
14940	20.06	HJB	Bogota, Colombia	(P) Phones WNC-PPU-YVQ days
14935	20.07	PSE	Rio de Janeiro, Brazil	(P) Phones LSL-WLK day irreg.; EDM-EHY 8 A.M.
14920	20.11	KQH	Kahuku, Hawaii	(P) Tests irregularly
14910	20.12	JVG	Nazaki, Japan	(P) Phones Formosa and broadcasts 1-2:30 A.M. irreg.
14845	20.19	OCJ2	Lima, Peru	(P) Phones HJY and others daytime
14800	20.27	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. B.C. music 12-1 A.M. daily & eves. irreg.
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
13410	22.37	YSJ	San Salvador, Salvador	(P) Phones WNC days
13390	22.40	WMA	Lawrenceville, N. J.	(P) Phones GAS-GBS GBU-GBW daily
13380	22.42	IDU	Asmara, Eritrea, Africa	(P) Phones Italy; early A.M. and sends music
13345	22.48	YVQ	Maracay, Venezuela	(P) Phones WNC-HJB days
13285	22.58	CGA3	Drummondville, Que.	(P) Phones England days
13240	22.66	KBJ	Manila, P. I.	(P) Phones nights and early A.M.
13220	22.70	IRJ	Rome, Italy	(P) Phones Japan 5-8 A.M., and works Cairo days
13180	22.76	DGG	Nauen, Germany	(P) Relays to Riverhead days
13100	22.90	VPD	● Suva, Fiji Islands	Week days 12:35-1:35 A.M.
13020	23.04	IZE	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

KC	Meters	Call	Location	Time
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
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.	5-9 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	10:30 A.M.-12 noon, 12:15-3:25 P.M., 9-11 P.M., 11:30 P.M.-1:30 A.M. daily
11720	25.60	CJRX	● Winnipeg, Manitoba	Daily 6 P.M.-12 A.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. Broadcasts irreg. 1-2:30 A.M.
11570	25.93	HH2T	● Port-au-Prince, Haiti	Sp'l programs irreg.
11560	25.95	CMB	Havana, Cuba	(P) Phones New York irreg.
11538	26.00	XGR	Shanghai, China	(P) Tests irregularly
11500	26.09	XAM	Merida, Mexico	(P) Phones XDF-XDM-XDR irreg.
11495	26.10	VIZ3	Rockbank, Australia	(P) Tests CJA4 early A.M.
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. daily and 5-9 P.M. irreg.
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.; 12-1 A.M. daily
10620	28.25	WEF	Rocky Point, N. Y.	(E) Relays program service irregularly
10620	28.25	EHX	Madrid, Spain	(P) Phones CEC and EHZ afternoons
10610	28.28	WEA	Rocky Point, N. Y.	(E) Tests Europe irreg.
10550	28.44	WOK	Lawrenceville, N. J.	(P) Phones LSN - PSF - PSH-PSK nights
10530	28.49	JIB	Tawian, Japan	(P) Phones JVL - JVN early mornings; sp'l bc's 3-4 A.M. Sun.
10520	28.52	VK2ME	Sydney, Australia	(P) Phones GBP - HVJ early A.M.
10520	28.52	VLK	Sydney, Australia	(P) Phones GBP - HVJ early A.M.
10520	28.52	CFA-4	Drummondville, Que.	(P) Phones N. Am. days
10440	28.74	DGH	Nauen, Germany	(P) Phones HSG - HSJ - HSP early A.M.
10430	28.76	YBG	Medan, Sumatra	(P) Phones PLV - PLP early A.M.
10420	28.79	XGW	Shanghai, China	(P) Tests GBP - KAY early A.M. Musical tests 10:45 A.M.-3 P.M.
10420	28.79	PDK	Kootwijk, Holland	(P) Phones PLV A.M., and special programs irreg.
10415	28.80	PDK	Kootwijk, Holland	(P) Phones PLV A.M., and special programs irreg.
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	Tenerife, Canary Islands	(P) Phones EDN 3:30-6 A.M.
10350	28.98	LSX	● Buenos Aires, Arg.	Near 10 P.M. irregular; 6-7:15 P.M. daily
10335	29.03	ZFD	Hamilton, Bermuda	(P) Phones afternoons
10330	29.04	ORK	● Brussels, Belgium	1:30-3 P.M. daily
10310	29.10	PPM	Rio de Janeiro, Brazil	(P) Tests New York and B.A. evenings
10300	29.13	LSQ	Buenos Aires, Arg.	(P) Phones GCA - HJY - PSH afternoons
10300	29.13	LSL	Buenos Aires, Arg.	(P) Phones GCA - HJY - PSH afternoons. Broadcasts irreg.
10290	29.15	DZC	● Zeesen, Germany	Used irregularly
10290	29.15	HPC	Panama City, Panama	(P) Phones C. A. and S. Am. daytime
10260	29.24	PMN	Bandoeng, Java	(P) Tests VLJ early A.M.; broadcasts 4:30-10 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	EDN	Madrid, Spain	(P) Phones YVR afternoons
10055	29.84	ZFB	Hamilton, Bermuda	(P) Phones WNB days
10055	29.84	SUV	Cairo, Egypt	(P) Phones DFC-DGU-GCA-GCB days
10042	29.87	DZB	● Zeesen, Germany	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.

KC	Meters	Call	Location	Time
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.
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.
9595	31.27	YNLF	●Managua, Nicaragua	8-9 A.M., 1-3 P.M., 6:30-10:30 P.M. daily
9590	31.28	W3XAU	●Philadelphia, Pa.	11 A.M.-7 P.M. daily
9590	31.28	VK2ME	●Sydney, Australia	Sunday 12-2 A.M., 4:30-8:30 A.M., 10:30 A.M.-12:30 P.M.
9590	31.28	HP5J	●Panama City, Panama	Week days 12-1:30 P.M., 6-10:30 P.M. Sundays 10:30 A.M.-1:30 P.M., 3-4 P.M., 6-10:30 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.
9520	31.51	RAN	●Moscow, USSR.	English 7-7:30 P.M.; German 7:30-8 P.M. daily
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. 4:00-7:00 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 7 A.M.-12 night. Sun. 8-9 A.M., 11:30 A.M.-1:30 P.M., 6-9 P.M.
9415	31.86	PLV	Bandoeng, Java	(P) Phones PCV-PCK-PDK-VLZ-KWX-KWV early A.M.
9400	31.92	XDR	Mexico City, Mexico	(P) Phones XAM irreg. days
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
8630	34.76	CMA	Havana, Cuba	(P) Phones New York irreg.
8590	34.92	YNVA	●Managua, Nicaragua	1-2:30 P.M., 7:30-10 P.M. daily
8560	35.05	WOO	Ocean Gate, N. J.	(P) Phones ships days
8500	35.29	JZF	Nazaki, Japan	(P) Phones ships irreg.
8470	35.39	DAN	Nordenland, Germany	(P) Phones ships irreg.
8404	35.70	HC2CW	●Guayaquil, Ecuador	Week days 11:15 A.M.-12:15 P.M., 7:15-10:30 P.M. Sundays 3:30-5 P.M.
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.

KC	Meters	Call	Location	Time
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.
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., Thurs., 2-3, 4-5 P.M.
7500	40.00	CFA-6	Drummondville, Que.	(P) Phones N. America days
7470	40.16	JVQ	Nazaki, Japan	(P) Relays and phones early A.M.; broadcasts Mon., Thurs., 2-3, 4-5 P.M.
7470	40.16	HJP	Bogota, Colombia	(P) Phones HJA3-YVQ early evenings
7445	40.30	HBQ	Geneva, Switzerland	(E) Relays special B.C. evenings irreg.
7430	40.38	ZLR	Wellington, N. Z.	(P) Phones VLJ early mornings
7400	40.45	WEM	Rocky Point, N. Y.	(E) Special relays evenings
7390	40.60	ZLT-2	Wellington, N. Z.	(P) Phones Sydney 3-7 A.M.
7385	40.62	OEK	Wein, Austria	(P) Tests early evenings very irreg.
7380	40.65	XECR	●Mexico City, Mexico	Sundays 7-8 P.M.; occasionally later
7370	40.71	KEQ	Kahuku, Hawaii	(P) Relays programs evenings
7345	40.84	GDL	Rugby, England	(P) Phones Japan irreg. A.M.
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
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
6695	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.
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.
6545	45.84	YV11RB	●Ciudad Bolivar, Venez.	7-10 P.M. daily
6520	46.01	YV6RV	●Valencia, Venezuela	10:30 A.M.-1:30 P.M., 4:30-9:30 P.M. daily
6500	46.15	HIL	●Ciudad Trujillo, R.D.	12-2 P.M., 6-8 P.M.
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
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	46.72	HI1S	●Puerto Plata, R.D.	11:40 A.M.-1:40 P.M. 5:40-7:40 P.M.
6420	46.72	W3XL	●Bound Brook, N. J.	No regular schedule
6415	46.77	HJA3	Barranquilla, Colombia	(P) Phones HJA2 evenings
6410	46.80	TIPG	●San Jose, Costa Rica	7:30-9:30 A.M., 12-2 P.M., 6-11:30 P.M.
6400	46.88	YV9RC	●Caracas, Venezuela	7-11 P.M. irreg.
6375	47.10	YV4RC	●Caracas, Venezuela	5:30-9:30 P.M. ex. Sun.
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 10:40 A.M.-1:40 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
6190	48.47	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
6150	48.78	HJ5ABC	●Cali, Colombia	11A.M.-12 noon. 7-10 P.M. Mon. to Fri., 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	6 P.M.-12 A.M. daily
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	YV3RC	●Caracas, Venezuela	10:30 A.M.-1:30 P.M., 3:30-9:30 P.M. daily
6150	48.78	CB615	●Santiago, Chile	12-1 P.M. 8:30-9:30 P.M.
6150	48.78	COKG	●Santiago, Cuba	12-1 P.M., 5-8:45 P.M. daily. Tues., Thurs., Sat., 10-10:30 P.M. Sunday 1-2 A.M.
6150	48.78	CSL	●Lisbon, Portugal	7:30-8:30 A.M. 2:30-7:00 P.M.
6140	48.86	W8XK	●Pittsburgh, Pa.	9 P.M.-1 A.M. daily

KC	Meters	Call	Location	Time
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.
6131	48.93	HIX	Ciudad Trujillo, R. D.	Mon. to Sat., 12:10-1:10 P.M., 4:40-5:40 P.M. Sunday, 7:40-9:40 A. M. Tues. and Fri., 8:10-10:10 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	Daily 11 A.M.-4 P.M., 7:30 P.M.-12 A.M.
6120	49.02	W2XE	Wayne. N. J.	9-10 P.M. daily
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.
6105	49.14	HI3C	LaRomana, R. D.	12:10-2:10 P.M., 4:40-8:40 P.M. daily. Sat., 11:40 P.M.-1:40 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.	Daily 6 P.M.-12 A.M.
6090	49.26	ZTJ	Johannesburg, S. Africa	11:45 P.M.-12:30 A.M. 3:30-7:00 A.M. 9 A.M.-4:45 P.M.
6090	49.26	HJ4ABE	Medellin, Colombia	11 A.M.-12 noon, 6-10:30 P.M. daily
6085	49.30	HJ5ABD	Cali, Colombia	7-10 P.M. ex. Sunday
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	YV7RMO	Maracaibo, Venezuela	Daily 5-10 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	Mon. to Fri. 5:45-6:15 A.M., 11:30 A.M.-2:30 P.M. Tues. and Thurs., 8:30-9:30 A.M. Sat., 11 A.M.-3 P.M. Sun., 11 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	Daily 11 A.M.-11 P.M. Sun., 11 A.M.-8 P.M.
6040	49.67	HI9B	Santiago de los Caballeros. R. D.	Daily 6:10-9:40 P.M.; Sat. 11:40 P.M.-12:40 A.M.
6040	49.67	PRA8	Pernambuco, Brazil	9:30-11:30 A.M., 2:30-8:30 P.M.
6040	49.67	YDA	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.
6025	49.79	HJ1ABJ	Santa Marta, Colombia	11:30 A.M.-2 P.M., 5:30-10:30 P.M. daily
6020	49.83	PGD	Kootwijk, Holland	(P) Phones Java and E. Indies irreg.
6020	49.83	DJC	Zeesen, Germany	11:35 A.M.-4:20 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.
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.	Sat. 11:30 P.M.-1 A.M.
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.
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. 8:15-10 or 10:45 P.M. Also 1st & 3rd Tues. evenings
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	11:15 A.M.-12:45 P.M., 5:15-9:45 P.M. daily
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.	Sun., Wed., Thurs., 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

KC	Meters	Call	Location	Time
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.
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	Lawreneeville, 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 11 P.M.-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.

QUEEN MARY RADIO

[*Continued from page 342*]

lines of various types, all leading to huge feed-through insulators atop a steel lead-in stack over the Radio Control Room. We snapped some photos of this array, so you can see for yourself what an intricate pattern it makes.

Then we went on a hunt for the Radio Room. All we had to do, it seemed, was to hit for the space below the lead-in stack—which we did. We repeated this move three times without finding any semblance of a Radio Room and had almost come to the conclusion that the whole thing was an immense decoy . . . but the fourth time we struck it (we had been hunting on the wrong deck).

The first thing we ran into was a sign reading, "Night Service." This was inside a neat little room with desk and chairs and message blanks, and even a built-in radio with gold-plated airplane dial, where passengers go to send their "love and kisses" and their "buy G.M. at . . . " At one side of the room was a little window (like in a Post Office), through which we had our first glimpse of the radio equipment (see photos on front cover).

This was the Radio Control Room, from and to which all blessings and admonitions are sent. It is the nerve center. We entered and nosed about without benefit of escort.

On one side of this room is a long desk on which we found the radio telegraph tape machines used for automatic high-speed code communication. There are positions for two operators, and on the wall over this desk is a message rack with cubby holes carrying the call letters of the ship and shore stations regularly contacted by the *Queen Mary*. We spied WOO, the Rex, the Bremen, and lots of others.

On the other side of the room are grouped the four main transmitting and receiving control positions, each with separate keys, headphones, typewriters and dual receiver panels. Two of these positions are used exclusively for short- and long-distance radiotelephony between ship and ship, and ship and shore. The third position is used for the reception of press and the fourth position for the handling of manual and automatic radio telegraph traffic.

The receivers employ huge plug-in coils with large, metal handles, that look for all the world like electric flat-irons. Each plug-in coil has engraved on it both the frequency and wavelength range it covers. Though 32 separate fixed frequencies are used for communication purposes, the receivers are capable of responding to other frequencies as well.

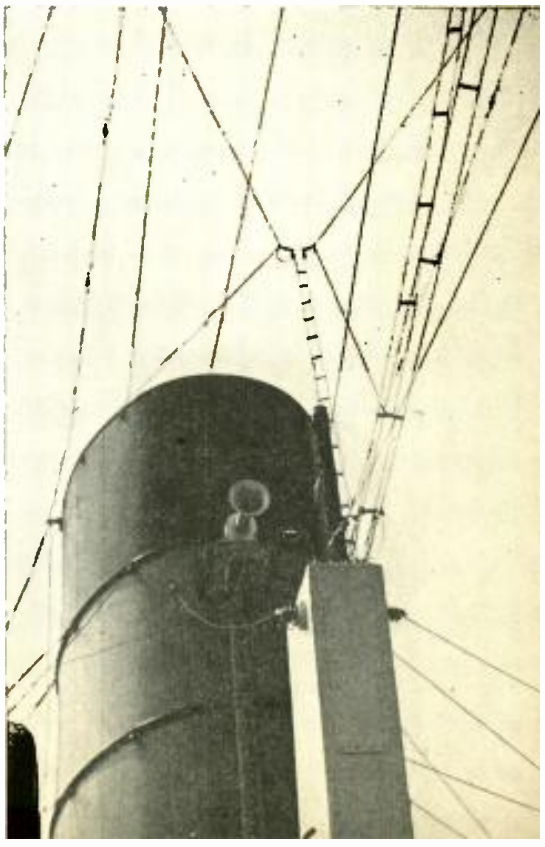
The Transmitter Room is 400 feet away from the Radio Control Room. There are four transmitters, all of which are remotely controlled from the operating positions in the Control Room. There is a long-wave transmitter covering a band of 1875 to 2725 meters, a 600- to 800-meter transmitter, and two short-wave transmitters operating at wavelengths between 17 and 96 meters. All four of these transmitters can be operated simultaneously with the receiving positions, making a total of eight active communication channels that can be utilized at the same time. Thus, with four operators on duty, one might be monitoring radiophone communication with England, another with the United States or some other country, a third operator handling press and a fourth operator handling telegraphic traffic.

All operations are handled from the Control Room. An operator at any one of the positions can turn on or off the transmitter with which he is working and shift its wavelength. He can also switch from radiophone to radio telegraph as the occasion demands. He has the same sort of control over his receiving equipment.

At the far end of the Control Room is an emergency transmitter and receiver which are operated from storage batteries. The transmitter is of comparatively high power and is capable of covering a distance of 500 miles or more

[*Continued on page 367*]

The lead-in stack, with transmission lines running to the array of antennas above.



On the Market

Empire Test-All Servicer

THE TEST-ALL Service Instrument, for a-c or d-c operation, is a product of Empire Radio Corp., 1217 W. Washington Blvd., Chicago, Ill.

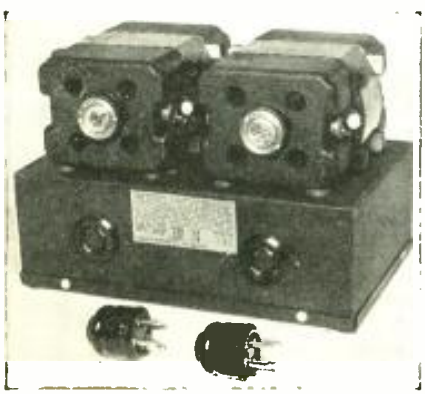
The instrument employs a type 6E5 electron-ray tube in conjunction with a 25Z5 plate-supply rectifier and a 6H6 diode rectifier. It may be used as an output or capacity meter, resistance meter, resonance indicator, bridge indicator and as a high-resistance a-c, d-c and r-f indicator. *All-Wave Radio.*

◆

Carter Communication Genemotors

THE RADIO AMATEUR who may be thinking of installing his transceiver in his car this summer will find an economical and compact "B" power supply in the dual unit Genemotors recently designed by the Carter Motor Company.

Developed for ultra-short wave two-way communication, the 255-351X model illustrated is equipped with a high-frequency filter that does much to cut radiation down to a minimum. Operating from a 6-volt storage battery one of the Genemotors delivers 250 volts at 50 m.a. to run the receiver, with an "A" drain of 4.5 amperes. The other Genemotor delivers 350 volts at 100 m.a. to work the transmitter, and has an "A" drain of 11 amperes. Each unit functions individually, thus insuring longer life to the storage battery.



Sturdy in construction, with the two Genemotors floated on rubber mounts, the power supply will provide long continuous service. Low-loss phenolic sockets and plugs that are provided insure proper input voltage.

Small in physical size, measuring 10" x 7" x 7" and weighing 17 lbs., the outfit is easily portable, and is suitable for use in camps, on boats, in automobiles, airplanes and police cars. The unit is also available without the specially constructed ultra-short wave filter.

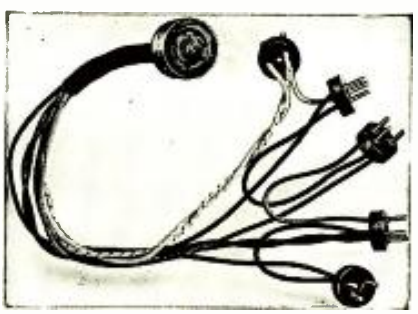
A complete catalog listing the many types of high-voltage Genemotors for use with transmitters, sound trucks, amplifying equipment, home radio, automobile, police and airplane radio can be obtained by writing to the Carter Motor Company, 361 West Superior Street, Chicago, Ill. *All-Wave Radio.*

◆

New Eby "B" and "C" Battery Adapter

ADDED FLEXIBILITY in making "B" and "C" connections to sets of the Philco battery types is now made possible by a new battery adaptor recently announced by Hugh H. Eby, Inc., of Philadelphia.

Consisting of a socket especially made to fit the plug already in the receiving set



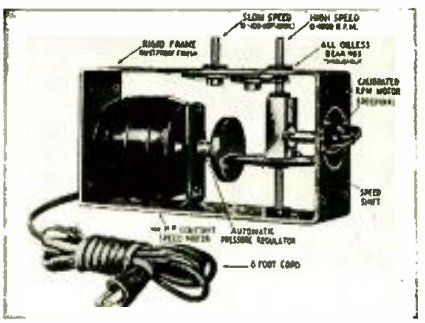
cable proper, the Eby Adaptor supplies a multiple connector ending in several plugs which fit standard "B" and "C" battery sockets. These adaptors come in two types, applicable to a battery combination where a set connector of either 7 or 8 prongs is now required.

The 7-prong Eby Adaptor supplies ready connection where three 45-v "B's" and two 4½-v "C's" are needed; while the 8-prong adaptor makes connection with an added 4½-v "C" battery. These are the "B" and "C" battery values of the two types of Philco power packs.

The Eby Adaptor is fully described in the new Catalog sheet, which may be had by writing H. H. Eby, Inc., 2066 Hunting Park Avenue, Philadelphia. *All-Wave Radio.*

Senco Vari-Speed Motor

CONSTANT SPEEDS with less than 1% drift, variable from 0 to 1000 r.p.m. by turning a small calibrated dial are possible with the new Senco Vari-Speed Drive developed



by the Sundt Engineering Company of Chicago, affiliate of Littelfuse Laboratories.

The unit is powered by a 1/100-h.p. 110-v. shaded induction motor and the speed is changed by means of special wear resistant friction disc clutch. Oilless bearings are used throughout. The average torque is 1.0 inch pounds. A 10-to-1 reduction is available for slow speeds. Attractively finished, the unit measures only 8½ x 3½ x 4½ inches and weighs 10 pounds.

While this unit was designed primarily to provide a synchronous scanning system for use with the Senco Neon Oscilloscope Tube, it has many other shop and laboratory uses; sweeps for cathode-ray tubes, stroboscope systems, timing and control devices, automatic switches, advertising displays and novelties, laboratory life tests, lecture room demonstrations, etc.

A pamphlet is available that describes many applications for this unit. *All-Wave Radio.*

◆

Ultra-High Range Resistors

IN RESPONSE TO many requests from leading physicists and engineers for a stable, ultra-high range, non-inductive, high voltage resistor, the Engineering Department of the International Resistance Company announces satisfactory solution of the unique problems common to high values in two new IRC resistor types, the Metallized "FH-1" and Type "MG."

In general, the new Type FH-1 resembles the well-known IRC Metallized filament resistors, with the addition of special processing which serves to stabilize the unit against the effect of humidity and to reduce surface leakage. Type "MG" units, providing high value resistors for the use at high voltages, are available in 3" to 12" lengths of glass with cast end terminals and special processing to control surface leakage.

The type FH is available in values up to 10,000 megohms for low voltage applications. Types MG 3", 6", and 12" are available in values from 20 megohms to 100,000 megohms and voltages up to 4000-v. Special applications requiring greater voltages may be provided for by IRC engineers upon receipt of complete details of the requirement.

These new Types FH-1 and MG resistors are described in a catalog recently issued, which may be had by writing the International Resistance Company, 401 N. Broad Street, Philadelphia. ALL-WAVE RADIO.

◆

A Visual Null and Tuning Indicator

A VISUAL indicator designed about the 6E5 "electric eye" tube and a suitable amplifier has been announced by the Tobe Deutschmann Corporation, Canton, Mass.

In addition to the electron ray tube, a type 79 is employed in a two-stage resistance-coupled amplifier. Sensitivity is adjustable and is reported as more than adequate for bridge work. The power supply is self-contained and employs an 84 rectifier tube.

While designed primarily as a null indicator with a standard impedance bridge —in place of the inconvenient and cumbersome 'phones—it may be readily adapted to tuning indicating purposes, where its high sensitivity will appeal to the experimenter and short-wave enthusiast—whose pocketbooks have also been considered in the design.

The 6E5 tube is mounted in a hooded socket, which may be swivelled to suit the convenience of the operator. ALL-WAVE RADIO.

◆

1937 Emerson Auto Radio

"HOME TONE on the road" is the catch for the new Emerson Auto Radio. 6 tubes. Dynamic speaker. Automatic volume control. Tone control. All ready to go traveling over the bumpiest roads; it is said that Emerson tests its auto radios on a bump-machine, an ingenious apparatus that simulates the shock and jar of hard driving.

Easy to install, this radio of the road. Three mounting bolts, that's all. And in four of the popular makes of cars only two bolts are needed for they fit exactly into holes provided in the firewall.

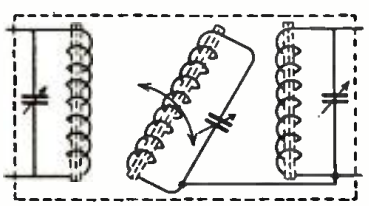
The remote control comes to match the advance styling of all the new autos. And for installation in older cars where dash board installation is not practical, Emerson provides two other choices . . . steering post installation or for the lower edge of the dash. *All-Wave Radio.*

◆

Selective Band Expansion

A THREE-CIRCUIT continuous flat-top band-expansion i-f "transformer" is the latest development of Aladdin Radio Industries, Inc., 466 West Superior Street, Chicago, Illinois. This new coupling device, known as the Type D-101, makes it possible to obtain selective band expansion in an economical and efficient manner.

The new transformer uses Aladdin Polyiron cores in all three coils. The center inductor of this three-circuit transformer may be rotated with respect to the other two inductors, varying the selectivity while retaining a flat-topped steep-sided characteristic through all degrees of band-width expansion with no appreciable loss in gain.



Type D

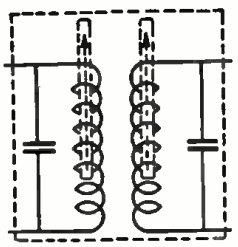
The Type D-101 i-f transformer is contained in an aluminum shield can 2" x 2" x 4". The selectivity may be controlled by a knob on the panel of the receiver, by attaching a suitable link mechanism to the center shaft which projects through the shield can.

While the Type D transformer has three trimmer condensers, the initial adjustment is made in the same manner as in the case of an ordinary transformer, that is, merely by peaking each tuned circuit at the intermediate frequency. The user is then given the option of high fidelity or split-channel selectivity by manipulation of the selectivity control on the panel. So effective is this method of selective band expansion, it is said, that audio tone controls can be dispensed with in receiver designs, since high audio-frequency attenuation may be secured through this means of control of side-band amplification. The accompanying circuit diagram shows schematically this new form of i-f coupling. ALL-WAVE RADIO.

◆

New Aladdin I-F Transformer

ALADDIN RADIO INDUSTRIES, Inc., 466 West Superior Street, Chicago, Illinois, offers a new type of intermediate-frequency transformer as a remedy for the instability of alignment and mechanical shifts of capacitance which have been inherent in many previous designs of condenser-trimmed i-f transformers. The new transformer



Type P

is designated Type P by the manufacturer. The Polyiron cores of the primary and secondary coils of this transformer are adjustable with a screw thread, and the inductance values are not affected by vibration, humidity, or temperature changes, it is said.

Fixed sealed condensers are permanently connected across the inductors. High gain and narrow band width characterize the Type P transformer. The accompanying circuit diagram shows schematically how this transformer is connected. ALL-WAVE RADIO.

◆

New Cornell-Dubilier Catalog

A CATALOG listing of the more important electrolytic condensers recently developed by their laboratories, for the radio servicing field, is announced by the Cornell-Dubilier Corporation. Catalog No. 131A furnished on request to the Cornell-Dubilier Corporation, 4377 Bronx Blvd., New York City. *All-Wave Radio.*

Small Metal-Can Electrolytics for Large Capacities

THE RECOGNIZED lasting quality of the metal-can electrolytic, together with a marked reduction in bulk for a given capacity, is achieved in a new line of dwarf units just announced by Aerovox Corporation, 70 Washington Street, Brooklyn, N. Y.

Known as the GLS series, these new electrolytics are of a uniform 1" diameter but vary in height from 2 3/16" for the 4-mfd units, to 4 3/8" for the 16 mfd. Two voltage ratings are available—the GLS5 or 450 d.c. voltage, 525 surge peak, and the GLS250 or 250 d.c. voltage, 300 surge peak. Capacities of 4, 8, 12 and 16 mfd are offered.

The 1" can electrolytic, heretofore popular for crowded assemblies, is now packed with twice as much capacity for a given height, over formerly available metal-can units. In other words, far better filtering can now be provided in the same condenser bulk. Or, if the user must save on space, the same capacity may be had in half the height of former 1" can units. ALL-WAVE RADIO.

◆

'Shock Absorber' for Microphones

THE MSA-3 MICROPHONE Shock Absorber, manufactured by the American Phenolic Corporation, is now available to amateurs and public-address men through regular trade sources. This unit is quite small, with an overall length and width of 1⅞ and ¾ inches respectively, and is very strongly turned of chrome finished brass. Standard ⅝ inch—27 threading (male at one end and female at the other) permits ready installation between mike and stand. The cushioning element is of live para gum rubber of highest resilience and long life, and the 7/16 inch opening in the entire length of the unit permits the passing through of the microphone cable.

The unit is simply fixed between head and stand for the absorption of vibrations set up in or by the stand and is claimed by the manufacturer to be perfectly efficient in elimination of noise caused by floor and other types of vibration and reproduced electrically in the grid circuit of the first tube. ALL-WAVE RADIO.

Lafayette "Transceptor"

A NEW TYPE portable five-meter instrument, known as the Lafayette "Transceptor" and designed to replace existing "transceivers" for amateur and experimental work, has been brought out by Wholesale Radio Service Co., Inc., of New York, Chicago, Atlanta, Newark and Bronx, N. Y. Separate tubes and tuning controls for the radio-frequency functions of receiving and transmitting are provided, with a common audio system that acts as signal amplifier for receiving and as speech-amplifier and modulator for transmitting. This arrangement eliminates compromises in antenna adjustment, which are a limiting factor in ordinary "transceivers," according to Frank Lester, designer of the new device.

The entire "Transceptor" is completely self-contained in a sturdy metal case measuring only 15 x 15 x 7½ inches—about the size of a portable typewriter. Two type 30 and two type 19 tubes are used, and all necessary batteries are included. A hinged front cover, convertible into a writing surface, protects the controls on the front panel, while a special compartment on the right side of the case houses the handset. When the case is closed for carrying, nothing but the handle on top is in sight. The instrument is intended for portable use and is built to withstand the abuses of this type of service. *All-Wave Radio.*

◆

Amperite External Input Transformer

THE NEW AMPERITE input transformer of the cable type is designed to operate low-impedance microphones directly into amplifiers having high impedance input. It permits the cable of the low inpedance microphone to be any length up to 2,000 feet. Makes high gain amplifiers immediately adaptable to any location. Equal output is obtained by the use of this specially designed transformer and the low impedance velocity mike as is obtainable with high impedance microphones.

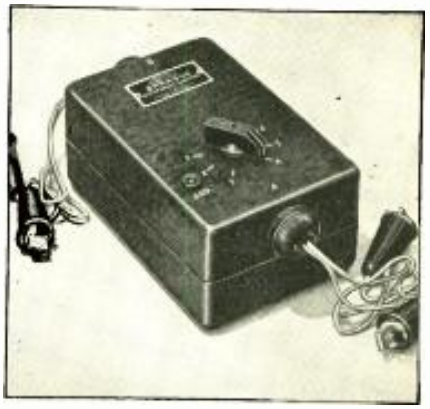
As many as four velocity microphones can be fed into one transformer. Hum pickup is entirely eliminated by the hum neutralization design of the transformer, it is said. An alloy case is used which will withstand a great deal of mechanical abuse.

Only a few seconds are required to connect the input of the transformer to the microphone—and a single conductor shielded cable is supplied for the output. Either a 50- or 200-ohm impedance can be fed into the standard input impedance of 200 ohms. Other impedances obtainable upon request. *All-Wave Radio.*

Sprague Interference Elimination Helps

SERVICEMEN who have not yet fully acquainted themselves with radio interference elimination possibilities in their locality are missing a real bet according to information contained in the 1936 Sprague Condenser Catalog just issued by the Sprague Products Company, North Adams, Mass., and available free upon request.

A pioneer in developing the profitable interference elimination market for servicemen, Sprague has devoted two full catalog pages to helpful information on this important subject. There are available to servicemen a free booklet "How to Eliminate Radio Interference" and a series of clever post cards designed to bring this profitable new business to those who will use them. The cards and printing are supplied free, the only cost to the serviceman being the penny postage. *All-Wave Radio.*



◆

New Brush Crystal Headphones

THE BRUSH DEVELOPMENT Co., East 40th Street at Perkins Ave., Cleveland, Ohio, has just announced the introduction of two new models of Brush crystal headphones to supplement the Brush Type A 2-phone model.

First of these two new developments is a single 'phone instrument with head band and soft rubber pad which holds the 'phone securely in place against the ear of the user. It is ideally suited for use in installations where the preference is for a single 'phone, rather than the double 'phone model, and brings to this service in a very low priced instrument the many advantages that can be secured only with Brush crystal operation.

Second of the new models is also a single 'phone instrument . . . but with the 'phone mounted on a 12-inch lorgnette handle. A five-inch extension—to 17 inches—is provided that enables the user to hold the instrument against the ear from any of several convenient and comfortable positions.

More complete details, including descriptive literature, circuit diagrams, complete installation data and prices can be secured from the company—without obligation. ALL-WAVE RADIO.

THE SUPER PRO

[*Continued from page 347*]

are few instances when this cannot be done.

The beat-frequency oscillator was tested separately on a c-w signal of known stability. During a period of a half hour no drift was discernible. If drift there was, it could have been a matter of only a few cycles.

Listening Tests

The reception of distance on this receiver is almost a foregone conclusion. We got tired of logging stations, and do not see that any purpose will be served by reprinting the logs here. It is enough to say that 98 stations were brought in on the standard broadcast band in slightly over a half hour; that we brought in KFI moderately well when it couldn't be hauled in on other sets; that we purposely tried for KHBC in Hawaii and brought them in the first crack, and that we followed the *Queen Mary* from England to the United States. That we picked up with no difficulty phone and broadcast stations VK2ME, VK3ME, VK3LR, JVM, RNE, ZBW, SPW, PDK, PSK and the usual run of other short-wavers. That on commercial code during daylight we brought in such stations as PLF, PLK, YSL, LCP, LSF, CSL, TMB and a flock of KW's, and after dark LQB-3, LQC, PVH-3, EDZ and so on, through a list two pages long. And in the 20-meter amateur band we had such stations as LU8AB, PY2EJ, CY2EA, EA2BH, ON4PA, SU1CH, CS7AI, EI2J, CE1AR, G5ML, LU5CZ, LU2DJA (we're picking the highlights as we run down the list), SU1PH, EA8LW, VP2CD, VP4PH, VP5AT, VP6YB, VK3UH, VK5HZ, and so on. through a list four pages long.

But the above are stations that anyone might intercept at one time or another. The real excellence of the Super Pro was time and again demonstrated by its ability to bring in and hold amateur phone stations that could not be copied by two local Hams owning fine receivers, and by its ability to intercept short-wave broadcasters that were not audible on switch-over to other receivers. And image reception simply did not exist.

BOOK REVIEW

[*Continued from page 327*]

ment is the interpretation of a resonance curve as the relation between the tangent and cosine of the phase angle, thereby facilitating exact computation of circuit response to any off-resonant frequency. The purpose is to enable the reader to handle the instrument intelligently before introducing the complexities of its adaptation to television.

The preceding theory is finally applied to a simple explanation of the action of standard types of oscillographs and their modifications for the production of television images. The discussion is confined to the systems developed by Zworykin and by Farnsworth, as these are the first to be commercialized in England and America. They suffice for a thorough exposition of fundamentals and will be supplemented by accounts of other methods as they come into commercial use.

This is made feasible by the loose-leaf format, to which supplementary sheets regarding new developments and more advanced phases of the subject may be added as they are issued quarterly during the first year following initial publication, without further charge to the purchaser of the book. The new material will consist of at least a hundred additional pages annually.

RADIO AND THE ATMOSPHERE

[*Continued from page 323*]

its axis, it appears to spray the vast regions of surrounding space. When one of these invisible jets strikes the earth, it is, because of its electrified nature, deflected mostly into the polar regions by the earth's magnetism. Its general movements into our atmosphere brings about the changes in radio transmission and the earth's magnetic field.

The stream of electrified particles ejected from the sun will have a curved path on account of the solar rotation. The stream will lag behind the active area, although each particle of the stream will be traveling outward in practically straight lines. Such a stream is believed to consist of equal number of positive and negative ions. Recombinations will be few on the journey from the sun to the earth, and the normal expansion of this stream will account for the observed duration of the storm. If the particles were of one sign they would immediately disperse, because of mutual repulsion, before they had traveled more than a million miles or so away from the sun.

In investigating the beginnings of magnetic storms, Maunder[37] finds that they start 34 hours before to 86 hours after, or a mean average of 26 hours after the spots pass the sun's central meridian. From this it appears that there are zones on the sun that particularly favor the terrestrial phenomena. There are cases when disturbances started with the appearance of spots on the eastern limb, and remained until the spots disappeared off the western limb. In these instances the severity of the disturbance was of greater magnitude after the spots passed the central meridian. Since the spots and associated activity are most favorably situated to spray the earth when they are near the central meridian, if would seem to follow that the mean figure of 26 hours west of the central meridian, may be the time taken for the disturbing influence leaving the sun to arrive at the earth, or a speed of 1000 miles a second.

A large number of severe magnetic storms and changed radio conditions have been associated with the presence of a large group of sunspots near the center of the sun's disk. Sometimes severe magnetic storms and disturbed radio conditions occur when no large sunspots are visible. Hale and Ellerman at the Mount Wilson Observatory, in investigating sunspots, came upon evidence of invisible sunspots, the calcium and hydrogen flocculi completely covering them. The spots were detected by their inherent magnetic fields. The solar disturbances are not always directed earthward, hence the appearance of sunspots are not always accompanied by terrestrial effects.

In the region of the sun where sunspots are mostly found, the period of rotation is about 27 days. So, a disturbance affecting the earth can be expected to recur after the same region on the sun turns around so that it can again spray the earth. There have been so many cases of this kind that it leaves practically very little doubt as to the solar origin of the disturbance.

From Fig. 10 it becomes immediately apparent that the factors affecting terrestrial magnetism, aurorae, earth currents and atmospheric electricity, etc., are more in evidence during the equinoxes than during the solstices[40]. An inspection of the sunspot belts and paths and the position of the sun with respect to the earth will reveal why this is possible. The sun is inclined at an angle of seven degrees with respect to the plane of the ecliptic; so that, as the earth makes a complete revolution around the sun (in the ecliptic plane), it will be 7 degrees below the solar equator on March 6th, and then 7 degrees above the equator on September 5th. It will cross the solar equator in June and December. The distribution of spots and the active areas on both sides of the solar equator, makes the earth easier to reach with the spraying streamers during the equinoxes (March and September), as compared with the solstices (June and December). An inspection of Fig. 11 shows higher field strengths on the long wavelengths at the time of the equinoxes as compared with the solstitial periods. It is observed that the increase and decrease follow fairly closely the variations in magnetic character. From the fact that the long waves are reflected from the lower ionospheric heights, it appears that the factors affecting terrestrial magnetism are more likely to be found in the lower ionosphere. Short waves, which are reflected from the upper layers, do not appear to show any outstanding characteristic at the time of the solstice or equinox other than the usual seasonal characteristic. A factor worthy of mention in connection with Fig. 11 is a probable meteor shower effect. According to Dr. C. P. Olivier, the Perseid meteor shower is by far the longest annual shower. It extends from July 25th approximately to August 28th, reaching a maximum about August 11th. If the Perseid meteor shower could be credited with having any effect on the long waves, the effect would apparently be an increase in field strength in the daytime. For the period covered in the Fig. 11 the increased daylight field strength in August is not explained by any increase in magnetic activity, and may possibly be ascribed to the Perseid meteors.

Maxima and Minima Characteristics

At the time of the sun-spot maximum, magnetic storms are most numerous, because there are more holes in the solar sprinkler system to spray the vast regions of space. There is also an increase in the general solar temperature, which results in an increase in the amount of solar radiation, and consequently more ultra-violet light. The increased solar radiation increases the ionic density of the ionospheric layers of the earth, and results in a further reaction. When sunspots are fewest it is possible to hear broadcasting and short-wave radio stations over greater distances as compared with the sunspot maximum period. The normal short-wave operation is changed somewhat during the different periods of solar activity, in that during quiet times (no magnetic storm in progress) the longer of the short waves are used more during the minimum sunspot period, and the shorter of these are used more during the maximum period. The very long wave stations, on the other hand, are usually received better during the sunspot maximum than during the sunspot minimum. So there are two general effects; namely, the storm effect and the maxima-minima effect. The storm effect is more noticeably associated with the solar rotation period, and the maxima-minima effect with the 11-year cycle.

Much can be written about solar phenomena and its relationship to radio transmission and other terrestrial phenomena. This treatment is a very sketchy outline of some of the many studies that have been made. It can readily be seen that radio investigations involve not only physical, mathematical and electro-technical elements, but those which are meteorological and astronomical as well.

The transmission of radio waves over long distances depends upon a series of yet unknown factors, which are continually being investigated, and which have apparently to do with the electrical and magnetic forces of the universe. These investigations require explorations into the fields of the infinitely great and the infinitesimally small, and the boundaries of our knowledge are constantly being extended from a study of the information being obtained. Radio is fast becoming an important tool of the Physicist, the Meteorologist, and the Astronomer, in addition to its uses for communication purposes. Its possibilities represent one of the greatest romances in science.

(THE END)

ADDENDA

Figure 7. Page 266 of the July 1936 issue should be marked: From October 1926 Proc. I.R.E. "Some Measurements of Short-Wave Transmission" by R. A. Heising, J. C. Schelleng, and G. C. Southworth.

Fig. 6. Page 267 of the July 1936 issue should be marked: From March 1928 Proc. I.R.E. "Transatlantic Radio Transmission and Solar Activity." by C. N. Anderson.

The designation Signal Intensity and Months should be interchanged.

REFERENCES

26. H. T. Friis, C. B. Feldman, and W. M. Sharpless: "The Determination of the Direction of Arrival of Short Radio Waves." January, 1934, Proc. I.R.E.
27. R. A. Heising, J. C. Schelleng, and G. C. Southworth: "Some measurements of Short-Wave Transmission." October, 1926, Proc. I.R.E.
28. W. H. Nichols and J. C. Schelleng: "Propagation of Electric Waves over the Earth." April, 1926, The Bell System Technical Journal.
29. Lloyd Espenchied and William Wilson: "Overseas Radio Extensions of the Wire Telephone Networks." February, 1931, Proc. I.R.E.
30. C. N. Anderson: "Transatlantic Radio Transmission and Solar Activity." March, 1928, Proc. I.R.E. "Solar Disturbances and Transatlantic Radio Transmission." September 1929, Proc. I.R.E. "Notes on Radio Transmission." July, 1931, Proc. I.R.E.
31. Austin Bailey and H. M. Thomson: "Transatlantic Long Wave Transmissions." October, 1935, The Bell System Technical Journal.
32. G. Breit: "A suggestion of a connection between radio fading and small fluctuations in the Earth's magnetic field." August, 1927, Proc. I.R.E.
33. Greenleaf W. Pickard: "Correlation of Radio reception and Solar Activity." February and September, 1927, Proc. I.R.E. "Short period variations in Radio reception." April, 1924, Proc. I.R.E.
34. L. W. Austin: "Comparisons of Solar Activity with Long Wave Measurements." February, 1928, Proc. I.R.E.
L. W. Austin and Miss I. J. Wymore: "On the influence of Solar Activity on Radio Transmission." February, 1928, Proc. I.R.E.
I. J. Wymore: "The relation of Radio propagation to disturbances in Terrestrial Magnetism." July, 1929, Proc. I.R.E.
35. Karl G. Jansky: "Electrical disturbances apparently of Extraterrestrial origin." October, 1933, Proc. I.R.E. "A note of the source of Interstellar Interference." October, 1935, Proc. I.R.E.
36. E. V. Appleton: August 16, 1935, World-Radio.
37. E. Walter Maunder: "Magnetic Disturbances 1882-1903." November, 1904, Monthly Notices of the Royal Astronomical Society.
38. Henry E. Hallborg: "Terrestrial Magnetism and its relation to World-Wide Short-Wave Communications." March, 1936, Proc. I.R.E.
39. S. Chapman: "On certain characteristics of world wide magnetic disturbances." July 1, 1927, Proc. of the Royal Society. "Outline of a theory on Magnetic Storms." Vol. 95-A Proc. Royal Society.
S. Chapman and V. C. A. Feraro: "A new theory of magnetic storms." June and September, 1931, June and December, 1932, Terrestrial Mag. and Atmos. Electricity.
40. L. A. Bauer: "Some results of Earth Current Observations and relations with Solar Activity, Terrestrial Magnetism, and Atmospheric Electricity." Vol. 27, 1922, Terrestrial Magnetism and Atmospheric Electricity.
41. Ellsworth Huntington: "Earth and Sun." Book by the Yale University Press.
42. Harlan T. Stetson: "Earth, Radio and the Stars." Book by McGraw-Hill Co.
43. G. Abetti: "Solar Physics." Handbuch der Astrophysik das Sonnensystem. Book published by Verlag Von Julius Springer. Berlin, Germany.
44. Henry Norris Russell: "Incandescent Refrigerators." Scientific American May 1931. "Things that happen in sunspots." October 1932 Scientific American.
45. George Ellery Hale: "Solar Research for Amateurs." April 1929, May 1929, October 1931 Scientific American, and numerous other papers in Astronomical Journals.
46. J. Bartels: "Terrestrial Magnetic Activity and Solar Phenomena." March 1932, March 1934, and September 1935. Terr. Mag. and Atmos. Electricity.
47. Joseph L. Richey: "The sun's effects on radio." June, 1934, Electronics. "En el aire." Octubre, 1935, Revista Telefonica Argentina. "Incandescent Refrigerators." Long Lines August 1933. Articles in "Amateur Astronomer" Summer 1934 and 1935, Winter 1935-1936.
48. Extensive bibliography in Proceedings of Institute of Radio Engineers for June 1931.

OHM'S LAW

[*Continued from page 337*]

determining the selection of the proper resistor:

The temperature at which enamel or protective coating deteriorates.

The temperature of the air issuing from the enclosure containing the resistor as allowed by NEMA, RMA, or Underwriters' rules.

The amount of ventilation available to the resistor.

The ambient temperature in which the resistor is located.

The kind of material which encloses the resistor.

The total watts in a certain definite space.

The RMA wire-wound resistor committee selected the following wattage ratings as standard for radio use: 10 watt, 25 watt, 40 watt, 50 watt, 80 watt, 100 watt, 160 watt and 200 watt. It is to the advantage of all of us to follow this expert guidance when selecting resistors.

It is especially recommended that irrespective of watts, not over 500 volts be impressed on any one resistor unit.

Due to the limitation of space, only the broad aspects of this subject have been touched upon.

NIGHT-OWL HOOTS

[*Continued from page 328*]

tions in these districts instead of filling the channels with so many 500 kilowatters that stations on the adjoining frequencies become practically useless, unless fortified by similar power.

More New Stations

After granting construction permits for eight new stations last month, the Federal Communications Commission slackened its pace only slightly this month and the result is six more new stations. They are:

K.C.	*Location*	*Watts*	*Time*
1500	Salt Lake City, Utah	100	unlimited
1420	Chattanooga, Tenn.	100	day only
1370	Champaign, Ill.	100	day only
1210	Lima, Ohio	100	day only
1210	Lewistown, Mont.	100	unlimited
640	Portland, Maine	500	limited

The granting of a Construction Permit to the Portland Broadcasting System for a new station in Portland, Maine, terminates a long dispute over that channel. For many months no less than nine other applicants battled for the right to use the 640-kc channel. The other applicants from Detroit, Michigan; Pittsfield, Mass.; and another in Portland, Me.; along with stations WAIU, KFUO, WORC, WAAB, WFLA-WSUN, and WJAY failed to convince the FCC that it would be worthwhile to allow them to operate on the same channel as the powerful KFI. The new Portland station will be required to operate with a directional antenna. At the same time the Commission granted a renewal of license to WOI of Ames, Iowa, for daytime operation on the disputed channel. Thus ends the long 640-kc battle!

New Calls

Call letters were assigned to the following stations whose CP's were granted last month: WNLC to New London, Conn.; WJRD to Tuscaloosa, Ala.; WFOY to St. Augustine, Fla.; WAYX to Waycross, Ga.; KRBC to Abilene, Tex.; KPLT to Paris, Texas; KBST to Big Springs, Texas; KANS to Wichita, Kans.; and KDNC to Lewistown, Mont.

The Federal Communications Commission recently adopted new rules which affected all broadcast stations except the regular broadcast stations in the band 550 to 1500 kc. Most of the action took place on the short waves, but of interest to the B.C. band fans is the fact that the stations operating on 1530, 1550, and 1570 kc were changed from experimental broadcast stations to special broadcast stations and the band from 1500 to 1600 kc was added to the broadcast band. The FCC states, however, that this does not mean that other frequencies in this band will be assigned to stations at this time. A good place for the all-nighters, say we.

Kilocycling Around

Mexican stations seem to have given up shifting channels, and are now changing call letters. XEWZ is now XEOO and XFX has changed to XEXM . . . The new 100-watt Hawaiian on 1420 kc, (KHBC at Hilo) has been reported by several listeners even on the east coast. In all cases the signal strength is reported stronger than either KGU or KGMB who use much higher power . . . WBZA seeks to separate from WBZ and would like to do some broadcasting of its own on 550 kc . . . WTAR is boosting its power to 1000 watts. Same goes for WBNX . . . CMCG signs off nightly at midnight with the playing of the "Indian Love Call" on the organ . . . CMGH is on the air from 12 to 1 A.M. daily with a program called "Noche Tropical" when the scenic beauties of the city of Matanzas are described to the world . . . WCAC, which has been operating only one hour per day of late has been deleted at the request of the Connecticut State College, owners of the

station . . . From the CDXR we quote: "KIEM is on the air daily except Sunday until 5 A.M. For the best report each day a box of chocolates in a case made of a redwood stump is sent to the writer." . . . In the past many of the Argentine stations have had the custom of broadcasting advertising matter in the form of verse or song. New regulations of the Post Office Department prohibit the singing of such texts whether accompanied by music or not. Furthermore, advertising must not be announced in a voice louder than that used in non-advertising matter, and the frequent repetition of trade-marks or names of business houses is also prohibited . . .

EMBRYO HAMS

[*Continued from page 334*]

you could get the other piston going on its downstroke. And, furthermore, it would take a bit of time, and a bit of extra pushing to overcome the inertia of the still water, before you could get the other piston going at a good rate. Consequently, during one piston stroke, the water would begin flowing slowly from a complete standstill, and increase its rate of flow as you got your wind up, and would cease flowing again when the piston you were pushing came to the end of its stroke.

Pressure, Flow and Direction

I have attached a sketch illustrating all the antics through which the water must go in passing back and forth from one cylinder of the silly pump to the other (See Fig. 7). This is a handy sketch as it shows a whole lot of things at one time. First of all, there is a horizontal arrow at the bottom representing time, which might be half a minute in our case. Above this is another horizontal line which represents zero or no flow of water. To the left of this line, and drawn perpendicular to it, is another line indicating the direction of the flow of water in the pipe. Then, drawn over the horizontal "zero flow" line is a continuous wavy line which shows just what the water does.

This wavy line is marked with an "x" wherever it crosses the "zero flow" line, and these are the points indicating the times when the water in the pipe is at a standtill. If we start with the first "x" and follow through on the wavy line, we see that first of all the water commences flowing through the pipe in the right-hand direction, since the line curves upwards into the "right-hand territory" above the zero line. We also see that the water flows faster and faster as time passes, until it reaches point "a," at which time piston No. 1 is nearing the end of its stroke. From this point on, the water flow decreases in speed until it again comes to a standstill (at the point of the second "x") because piston No. 1 has now reached the end of its stroke. Then piston No. 2 comes into operation and the water slowly commences to flow in the opposite direction—to the left, or below the line of zero flow in Fig. 7—and gains speed until it reaches maximum, of point "b". From then on its rate of flow decreases because piston No. 2 is nearing the end of its stroke, and the water finally comes to rest in the pipe again when piston No. 2 reaches the end of its stroke. This brings us to the third "x". The two following alternations "c" and "d" are merely repetitions of what has just been explained. But it is well

to note that this sketch represents four alternations or two cycles of water flow.

Positive and Negative

Now glance at the third sketch I have enclosed (Fig. 8). This is identical to the one shown in Fig. 7, except that it has different designations. It represents an alternating electrical current, but direction of flow is indicated not by left and right, but rather by "positive" and "negative" which are the electrical terms used for designating direction of flow. The terms are purely relative, and hark from the old days when it was customary to refer to the terminal of a battery or dynamo from which the current emerged as the "positive" terminal, and the terminal to which the current returned as the "negative" terminal. However, it should not be inferred from this that a "negative" electrical current is a "minus quantity" to the extent of having no power. The term "negative" is used only to indicate a difference in the direction of current flow, just as "left" and "right" were applied to the pump analogy to express opposite directions of water flow. For an illustration of the fact that the terms "positive" and "negative" as applied to electrical current are merely relative, glance at the sketch of Fig. 9. "A" shows a wire with an electrical current flowing through it. "B" shows a similar wire that has been bent back on itself—nothing more. In case "B" the current flowing through the lower section of the single piece of wire is, relatively, "negative" with respect to the current flowing through the upper section. This may seem odd since there is but a single piece of wire with the current flowing through it in only one direction. Nevertheless, it is obvious that with the wire bent as shown, the *relative* currents in the two sections are opposite. I will go into this more fully later on as it has a bearing on certain elements of radio design.

Voltage and Current

Now back to the sketch of Fig. 8. Aside from indicating time, and the direction of current flow, the illustration also indicates the pressure and the speed of the electricity, except that these factors are referred to as "voltage" and "current," the electrical designations. Thus, this sketch, as well as the sketch of Fig. 7, would indicate that pressure or voltage, and speed or current, increase and decrease in unison, since both are represented by one wavy line. Under ideal conditions this holds true, but I don't know enough about water pumping to know if it could be true in that case. Let's refer to Fig. 6 again and see what happens.

Suppose the water is at a standstill in the pump circuit and that the water level is the same in both pumps. Then, if you were to push down on either piston handle, you would immediately create pressure on the water in that particular cylinder. But, because of the inertia of the water, and the friction present, it would take a bit of time before the water actually started to flow. It is obvious, then, that the pressure comes first, or to put it another way, the pressure leads the flow.

The same thing can and does happen in an electrical circuit carrying alternating current; the voltage leads the current. But, we have means for making the two coincide or, if desired, of making the current lead the voltage. How this is accomplished will be explained when we have reached the point where you can make use of the information.

So, more anon. In the meantime, your questions. If I have not made all points clear, let me know.

GERALD.

THE HAM BANDS

[*Continued from page 341*]

hooking the years is a new stunt in this game."

W11SM-F2 laughed. "My father was a ham before me, and I recall his speaking of VU's. If I am correct, that was—or is, I should say, the territory known in your time as India. Incidentally, old timer, it may interest you to know that I am a distant descendant of yours. I've just checked you in a '36 call file and find that my great-great-great grandfather is none other than yourself."

"The hell you say," I gasped. "It's incredible. Why, son, you're not even born yet, and still—well, it's beyond me. I'd rather we changed the subject. Tell me, what district is W11 . . . we don't have any such area in '36."

His carrier dropped into a slow fade. "Hold it," I shouted, "you're dropping out of the picture."

He came back about an R7. "Sorry," he said, "we're falling out of synchronism with the time cycle. I'll be out completely in another minute if I can't hold the beat. We'd better sign now while it's still a 100 percent QSO."

Slowly his signals were reaching the shot noise level. I kicked the gain a bit and said, "Okay, son, glad to have met one of my future offspring. Tell your mother I'm going to fight in the war of 1950 to keep up the family traditions . . . and where did you say W11 was?"

I had to put on the cans to get him at all on the comeback, he was so weak, but I squeezed him through. I heard him say very plainly, "Mother is here and says she knows all about you. During the battle of San Antonio you dropped five enemy planes and picked up as many

medals. She has them in front of her now! W11 old man? Why W11 is the U. S. Possession on Mars. Well, cheerio and happy landings. W11SM-F2 signing off and clear and pulling switches . . ."

We awoke with a start. The light was on and Moo-Moo had just scrambled off our lap in hot pursuit of the fly which, we learned from our better half, had landed on our nose.

CHANNEL ECHOES

[*Continued from page 336*]

ports on experiments with these systems will be appreciated.—Ed.)

◆

'Tis said that lending money to a friend costs both friend and kale
Sometimes. *But giving radio advice is never known to fail!*
A hint as to what set to buy, in light and friendly tone
Can do more harm to friendship than a thousand-dollar loan.
No matter what the cost, how good the set, you'll service it for years,
And bear the brunt of open kicks and sundry, subtle sneers.
Static, whistles, weather, tubes—your reputation takes the raps,
Dwindling day by day—until the frazzled cord of friendship snaps!
Oh lend him money, steal his wife, tell him he's no judge of Scotch,
But never on fair friendship's blazon smear that one unfading blotch.
Let him rave with pleading tongue, or in white anger lash—
But lending money to a friend, and losing both the friend and cash
Is just a nice clean job compared with telling him what set to buy.
Someone else can help him. Don't you be the guy!

◆

WE HAVE WONDERED for some years just how intelligent announcers (oh yes, there are a few) and artists feel about the unmitigated tripe which sponsors force them to perpetrate upon the unoffending ether. We put the question up to Annette McCullough the other day—Annette McCullough with the Kate Smith voice and technique, whom most of our readers have probably heard through WGY's short-wave outlets. Mac has been on programs so lousy that even her dulcet tones couldn't lift them out of the sloughs of worse than mediocrity. We asked her if she wasn't positively nauseated by the bilge her sponsors made her spout.

She said, "No—I've never thought of it that way. To me it's just a job, and I'm paid for doing it the way my sponsor wants it done—and to the best of my ability."

MOLLE'S VOX POP program has done men two favors. The excess and type of commercials have undoubtedly sent thousands of stubble-tormented listeners back to the good old soap and brush. We men have also been pleasantly convinced that while the female may be the more dangerous of the species, she is also much the dumber. The prize was taken by a gal who was asked if she thought that Roosevelt's political enemies were justified in calling him a philatelist. She said no (quite indignantly) and thought it was a shame if they got away with it.

But—justice to all—we can't forget the member of our own sex who was asked what state capital had the largest population. He started to answer, "Albany" but caught himself and changed it to Washington, D. C.

"QUEEN MARY" RADIO

[*Continued from page 357*]

under normal conditions. The emergency equipment is placed in the Control Room so that it would be instantly available and under direct supervision in case of an emergency.

The *Queen Mary* also has a receiving panel for broadcast programs which are piped to the Staterooms and to the various Lounges, Smoking Rooms, etc. Moreover, if you want to talk to Aunt Grace in Peoria, you don't have to hang around the Radio Room like a street loafer. When they get Aunt Grace "on the wire", they'll feed her voice right into the privacy of your Stateroom.

By this time some of the engineers from the International Marine Radio Company, the organization that installed the equipment, had breezed in, and it seemed about time for us to go. We decided to strike out for the Turkish Baths again, but ended up in the Main Lounge (which was air-conditioned, and much to our taste). Some of the boys from WOR had just arrived and were setting up their pick-up equipment, getting ready for a special broadcast. We stayed to take this in, but eventually something told us it was about time for dinner. So, taking a last look in odd corners, we strode down the gangplank and back into the United States.

WORLD RADIO

[*Continued from page 348*]

tator's voice coming from a loudspeaker in the shop announced the victory of a certain well-fancied horse. The barber, who had backed it heavily, was so elated that he gave a violent start, with the result that he was unlucky enough to chop off one of his fingers. The customer,

mindful of the bad effects on his throat which might eventuate from the barber's listening to the results of further races, did not wait to be shaved but hurriedly dashed out of the shop. (*WW May 1936*).

◆

Short Waves and Snake-Bites

PARIS: As many people are aware, the venom from snakes has sometimes been used to alleviate certain diseases of the nervous system, and now it appears that in Paris short waves are being employed to cure snake-bite.

The Pasteur Institute is engaged in research work in this direction, and it is said that a considerable measure of success has been attained. No mention is made, however, of any remedy being discovered to counteract the effects of the short waves!

◆

Television in Russia

U. S. S. R.: Television in Russia, although introduced only a short while ago, appears to have made greater strides than in some other countries where successful experimental transmissions have been carried out. In Russia, the State has placed television sets in large factories and in the halls of communal dwellings, and since a number of television transmitters have been installed in Moscow and in other cities the popularizing of television has proceeded at a quicker pace than it has done elsewhere.

So far as program features are concerned, they, too, seem further developed than those in other countries. Quite recently, for instance, a boxing-match was televised. In the near future the Television Department hopes to introduce a new kind of transmission under the heading of "Film-Talks," when Arctic explorers will speak on their explorations, and the transmissions of circus performances are another new television program feature shortly to be introduced. For this purpose an entire circus has been specially engaged. In addition to these innovations, television relays of films, and operetta excerpts from theatres are also announced.

A television transmitter is to be installed in the Arctic during the second half of this year.

◆

Holland-Roumania Wavelength Controversy

THE HAGUE: Inter-continental radio conference at Paris ended without having settled the controversy between Holland and Roumania. Both countries utilize the same 1875-meter wave channel. Provisional talks were rather promising but did not lead to a settlement.

It is the intention to go into this matter shortly again, as both Kingdoms suffer by present conditions. (*Variety*, Mar. 25, 1936.)

BACKWASH

[*Continued from page 343*]

My own experience with an expensive set may be interesting. The most simple tests of this receiver on the broadcast band gave results far from satisfactory in separating a local station nine miles distant from one 500 miles distant 10-kc apart in wavelength. Other simple tests failed and the publicity ballyhoo of this receiver was found to be nothing! These tests were made in comparison with a 9-tube super three years old and the old set won out on broadcast.

I certainly hope you can figure out a simple system of grading commercial receivers as to efficiency, operation, etc.

H. D. BURRAL,
ALBUQUERQUE, NEW MEXICO.

AWR-2 PORTABLE

[*Continued from page 331*]

It would probably be a good idea to knock together a box of some kind to hold the batteries, fones, etc. A small, inexpensive suitcase of the "dollar" variety should prove okay for this purpose. A lot of fun can be had on a vacation with this little receiver.

LEGEND

AEROVOX:
1—Midget mica, 100 mmfd. (C-3)
2—Midget mica, 250 mmfd. (C-1)
CARDWELL:
1—Type ZR-15-AS Trim-Air, 15 mmfd. (C)
CORNELL-DUBILIER:
1—Type DT-4P5 bypass, 0.5 mfd, 400 v. (C-5)
1—Type ED-2050 tubular electrolytic, 5 mfd, 25 v. (C-2)
EBY:
5—Binding posts
ELECTRAD:
1—Potentiometer, 100,000 ohms. (R-1)
EVEREADY:
1—Type 1461 Hot Shot 6-volt battery
3—Type 762 B batteries, 45-volt
GENERAL RADIO:
1—Type 702-A dial, 2¾-inch with vernier
1—Type 637-A knob, 1⅛-inch with pointer
HAMMARLUND:
3—Type S5 Isolantite 5-prong sockets
3—Type CF 5M coil forms (L)
IRC:
1—2 megohm, ½ watt. (R)
1—½ megohm, ½ watt. (R-3)
1—2000-ohm, ½ watt. (R-2)
LEEDS:
1—Type 3825 cabinet with panel
NATIONAL:
3—Type M30 mica trimmers, 3-30 mmfd. (C-4)
2—Type R100 r-f chokes (RFC)
RAYTHEON:
2—Type 76 tubes
THORDARSON:
1—Type 5736 interstage a-f transformer. (T)
YAXLEY:
1—Infant single-circuit fone jack with insulating washer. (J)
MISCELLANEOUS:
1—DPST toggle switch. (SW)
1—4-wire battery cable

Use these McGraw-Hill Books

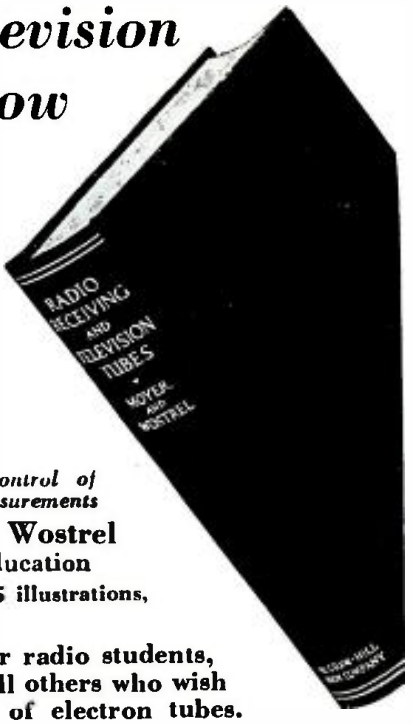
—to answer puzzling questions in practice

—for quick solutions to technical and practical problems

—to advance yourself in radio as a profession or as a hobby

How radio and television tubes work---and how they are used

—Just published—



Radio Receiving and Television Tubes

Including Applications for Distant Control of Industrial Processes and Precision Measurements

by **James F. Moyer** and **John F. Wostrel**
Massachusetts Department of Education

Third edition, 635 pages, 5½ x 8, 485 illustrations, $4.00

HERE is a practical manual for radio students, service men, engineers, and all others who wish a thorough, working knowledge of electron tubes. The book explains the essential principles underlying the construction and operation of the various types of tubes and relates this in a practical manner to the circuits in which the tubes may be used and the various radio and industrial applications to which they may be put. In this edition the book was entirely rewritten, with many important changes such as a new chapter on television systems and tubes, special attention to tubes for ultra short-wave applications, new material on tube testing, a greater number of industrial applications, etc.

Chapter Headings

1. Introduction
2. Construction of Vacuum Tubes.
3. Fundamental Electrical Relations
4. Vacuum-tube Action
5. Radio Meters and Measurements
6. Testing Vacuum Tubes
7. Vacuum-tube Installation
8. Use of Vacuum Tubes as Detector
9. Vacuum Tubes as Rectifiers in Power-supply Devices
10. Use of Vacuum Tubes as Amplifiers
11. Use of Vacuum Tubes as Oscillation Generators
12. Television Tubes
13. Industrial Applications of Vacuum Tubes

Zeh Bouck's MAKING A LIVING IN RADIO

220 pages, 5½ x 8, illustrated, $2.00

A frank, impartial survey of the opportunities in the field of radio today. Covers engineering, operating, servicing, broadcasting, writing, salesmanship, etc., telling what jobs there are, what they pay, how to train for them, how to break into the game, and then get ahead.

New, up-to-date 6th Edition

Nilson and Hornung's

RADIO OPERATING QUESTIONS AND ANSWERS

More than 600 questions, typical of those asked on radio operator license examinations, with full, well-illustrated answers. Covers marine, broadcasting, police, aeronautical, and amateur radio. $2.50.

Nilson and Hornung's

PRACTICAL RADIO COMMUNICATION

754 pages, 6 x 9, 435 illustrations, $5.00

Covers the requirements for all classes of radio operator's license examinations. Treats long, medium, short, and ultra-short-wave radio; principles, systems, equipment, operation; all classes of radio stations; is in general a complete text on practical radio communication suitable for self-instruction and reference use.

Henney's RADIO ENGINEERING HANDBOOK

Keith Henney, Editor, Electronics, Editor-in-Chief, assisted by a staff of 28 specialists. A thorough revision of this authoritative handbook bringing all material up to date, including much new information, additional illustrations, etc. Offers the engineer technical data on all fields and aspects of radio engineering from fundamentals to practical applications. New second edition, 850 pages, 4½ x 7, $5.00.

Send money order or check. Do not send currency through the mail. No books sent C.O.D. All Prices postpaid. Order from

MANSON PUBLICATIONS CORP., 16 East 43 St., New York, N. Y.

The Whole Family Will Thrill to the Glorious Reception of this NEW 1937 AIR-TESTED MIDWEST

Only MIDWEST *gives you* 16 TUBES...5 WAVE BANDS... 9 *to* 2200 METERS...ELECTRIK SAVER...PUSH BUTTON TUNING... AUTOMATIC AERIAL ADAPTION...DUAL AUDIO PROGRAM EXPANDER

and Scores of Other Features for only

$49.95 COMPLETE *WITH* GIANT THEATRE-SONIC SPEAKER (LESS TUBES)

30 DAYS *Free* TRIAL!

TERMS AS LOW AS **10¢ PER DAY**

I AM TREMENDOUSLY IMPRESSED WITH THE REMARKABLE PERFORMANCE OF MY MIDWEST..... *Robert Montgomery*

MUSICIANS EVERYWHERE COMMENT ON THIS.... REMARKABLE INSTRUMENT *Johnny Green*

Electrik-Saver Reduces Wattage Consumption 50% The magical exclusive Electrik-Saver enables Midwest radios to operate on low line voltage—as low as 80 volts! . . . and explains why they consume no more current than ordinary 7-tube sets. It is a real miser begrudging every penny's worth of current that flows through the meter.

SAVE UP TO 50% BY BUYING DIRECT FROM MIDWEST FACTORY

ONCE again, Midwest demonstrates its leadership by offering the world's most powerful ALL-WAVE 16-Tube, 5-Band Radio. A startling achievement, it makes the whole world your playground. Powerful Triple-Twin tubes (two tubes in one!) give 18-tube results! It is a master achievement, a highly perfected, precisely built, radio-musical instrument that will thrill you with its marvelous super performance . . . glorious crystal-clear "concert" realism . . . and magnificent foreign reception. Before you buy, write for the FREE 40-page 1937 catalog. Never before so much radio for so little money. Why pay more?

85 ADVANCED 1937 FEATURES

This Super DeLuxe Midwest is so powerful, so amazingly selective, so delicately sensitive that it brings in distant foreign stations with full loud speaker volume on channels adjacent to powerful locals. Scores of marvelous Midwest features, many of them exclusive, make it easy to parade the nations of the world before you. You can switch instantly from American programs . . . to Canadian, police, amateur, commercial, airplane and ship broadcasts . . . to the finest and most fascinating foreign programs.

No middlemen's profits to pay! Buying direct from the Midwest factory makes your radio dollar go twice as far. See for yourself that Midwest offers you greater radio value—enables you to buy the more economical factory-to-you way that thousands of radio purchasers have preferred since 1920.

You can order your Midwest 1937 radio from the new 40-page catalog with as much certainty of satisfaction as if you were to come yourself, to our great factory. (It pictures the beautiful 1937 Radios . . . in their actual colors!) You save 30% to 50%—you get 30 days free trial—and you pay as little as 10c a day. Satisfaction guaranteed or money back. Write today for FREE catalog.

MAIL COUPON TODAY for *Free* 30-DAY TRIAL OFFER *and* 40-PAGE FOUR-COLOR *Free* CATALOG

MIDWEST RADIO CORPORATION
Dept. C-34 Cincinnati, Ohio

Without obligation on my part, send me your new FREE catalog and complete details of your liberal 30-day FREE trial offer. This is NOT an order.

Special offer and prices prevail only when dealing direct with factory by mail.

Name .....

Address .....

Town ..... State .....

MIDWEST RADIO CORP.

DEPT. C-34, Established 1920 — CINCINNATI, OHIO, U.S.A. Cable Address MIRACO...All Codes