ALL-WAVE RADIO

SEPTEMBER • 1936

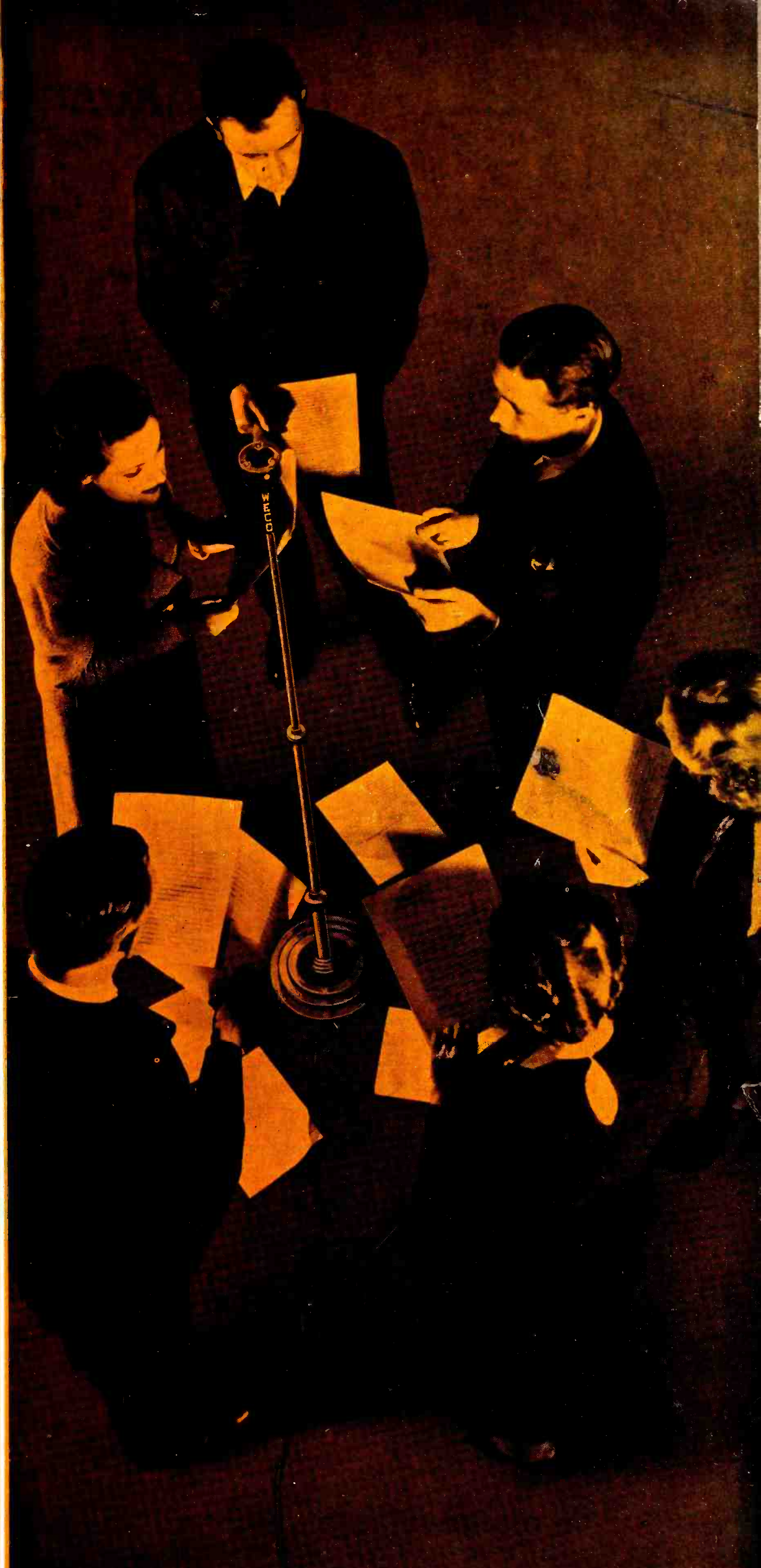
FALL DX NUMBER

NEW STATION LISTS
broadcast and short wave

RECEIVER CONDITIONING
for best fall DX reception

A DX PRESELECTOR
with parallel regeneration

25c U.S. and CANADA



THE JOURNAL of WORLD RADIO

STEPPING STONES TOWARD "THAT TICKET"

Published by the American Radio Relay League

1.

HOW TO BECOME A RADIO AMATEUR

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.

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.

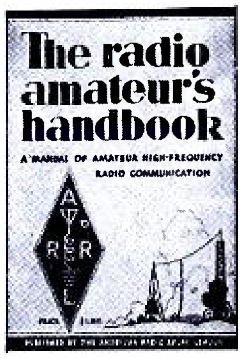
3.

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.

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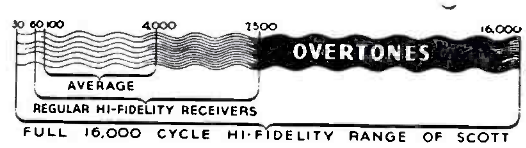
ALL THE BEAUTY OF THE OVERTONES

ALL THE MAGIC OF DISTANT LANDS



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.

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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?

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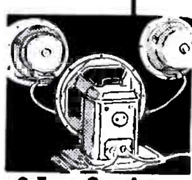
Put your finger up to one ear. Shut off the sound. What you hear doesn't sound complete—you say "there's something missing." Look through a screen. Hold a sieve up to the light. Everything beyond is just the same—but colors are not so pleasing, faces are dimmer. It is the same with your radio. Every 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.



3 True Speakers

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

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*Name of station upon request.

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Edited by M. L. Muhleman

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COVER

ON THE AIR—A typical shot of a play being broadcast from a studio.
(Photo courtesy Western Electric Co.)

FEATURES

DEPARTMENTS

ALL-WAVE RADIO

Reg. U. S. Pat. Off.

VOLUME 2 • NUMBER 8

GENERAL

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EDITORIAL QUOTES

BY THE EDITOR

THE cathode-ray oscilloscope is the X-ray machine of radio. This remarkable device has long been employed for the visual study of the behavior of waveforms in radio circuits, aside from its many other uses.

The radio amateur has come to learn the value of the oscilloscope as an adjunct to his station equipment. Why shouldn't the serious-minded radio listener consider the use of this instrument, coupled to his receiver, for the purpose of collecting pertinent data on the characteristics of received signals, and as a means of maintaining a constant check on the operating conditions of his set?

Oscillography is a fascinating subject in itself, but nowhere near as fascinating as the beautiful and the weird patterns the controlled beam of electrons "paints" on the fluorescent screen of the cathode-ray tube. They are immensely interesting to watch as they change shape, and with a bit of study it is comparatively easy to determine what the various patterns imply in relation to signal and receiver characteristics.

We have long been of the opinion that listeners would find radio a far more enjoyable hobby if they took a more active part in surveying receiving conditions and signal characteristics. The average listening post could be made to offer up a wealth of important data which, if properly coordinated, would be of great value to broadcasters and amateurs alike.

It is true, of course, that amateur operators are able to gather valuable material with regard to their signals through the stations which they contact, but in many instances the only means by which an amateur can determine his field pattern and his coverage is through reports received from listeners throughout the world. We know of one case in particular of an amateur who has never succeeded in contacting a British amateur, but who keeps trying because he knows from reports he has received from British listeners that he is putting in a good signal over there. It was through this knowledge, as a matter of fact, that he was given sufficient confidence in his signal to keep after a station in Spain—which station he eventually contacted. Without the support of the data from listeners, more than likely this amateur would have given up the Spanish station after the first call or two.

The amateur is much too involved in his own work to bother with the gathering of data on broadcast station signals. The listener is in a much better position to take care of this. For that matter, the listener has it within his power to be of distinct value to the broadcaster and the amateur, to say nothing of his value to brother listeners.

Though the cathode-ray oscilloscope is of great assistance in the amassing of reliable and valuable data on station signals, it does not hold that it is necessary to use one. Such data as signal level, degree of fading, distortion, etc., can be determined with the ordinary receiver. But we have little doubt that many listeners would like to put the oscilloscope to use. In any event, we have in preparation an article that will cover the use of this instrument in conjunction with a receiver, for the purpose of making signal measurements. The same article will cover pointers on how to use a receiver most effectively in the determination of signal characteristics.

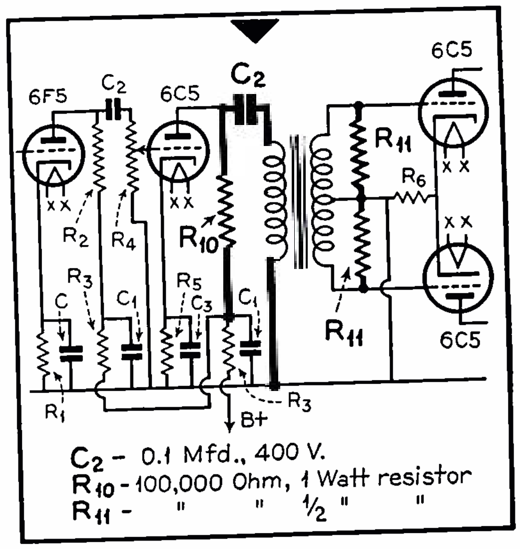
We are now working on a plan whereby reports on station signals can be coordinated for the convenience of listeners, broadcasters and amateurs. The success of the plan will depend entirely on the support and cooperation we are able to receive from our readers. The full plan will be announced next month. Watch for it.

✦

Improving the Modulator

FURTHER RESEARCH on the AWR 2-3 Low Power Modulator, described in the July issue, has brought about improvements that are readily obtainable at low cost.

Two alterations have been made, as shown in the accompanying schematic diagram. First, shunt feed was instituted in the plate circuit of the second audio tube, which improved bass response appreciably. In this instance, voltage is fed to the plate of the 6C5 tube through the additional resistor R10, and the primary of the push-pull input transformer is isolated by means of the additional condenser C2. Thus the primary inductance of the transformer is not affected by the flow of direct plate current.



The frequency response of the modulator has been evened out by the addition of two resistors, R11, shunted across the center-tapped secondary winding of the push pull input transformer.

Those who have constructed the modulator will find these simple changes well worth making. The actual changes are indicated in the accompanying schematic diagram by the heavy lines.

✦

Amateur Television?

THE AMATEUR bands from 1715 to 2000 kilocycles and from 56 to 60 megacycles are open for experimentation in television, facsimile and picture transmission. So far the bands have not been used for this purpose.

Many amateurs are interested in television and would like to go in for it if sufficient technical data and experimental equipment were available. Sadly enough, such information on television as is available to the "outsider" is distressingly vague, and as far as equipment is concerned, many of the necessary components are not on the market. Moreover, even if satisfactory equipment for practical television were available, the receiver components, and more particularly the transmitter components, would be out of reach of the pocketbook of all but a very few well-to-do amateurs.

The answer to the problem rests not in television with the degree of refinement of some of the modern commercial systems on trial, but rather in simplified systems embracing the transmission of material such as handwriting, line

[*Continued on page 392*]

WHAT'S IN A STATION'S CALL?

The Authoress Investigated—The Results Will Surprise and Amuse You

WHAT lies behind those three little letters that roll so glibly from announcers' tongues? Like WOR, for instance, or WOW or WOV? Or those four little letters like WIND and WAVE? And WOOD and WASH and WILL and WHAM? (And who knows somewhere there may be lurking a WARP and even a WOOF?)

Reasons Behind Calls

Roughly speaking, the reasons behind the call letters of your favorite station may be found under six general classifications:

- Civic Pride
- Universities
- Newspapers
- Purely Personal
- No Significance
- Miscellaneous

And the miscellaneous takes in anything from old ship call letters, a church and a joke, all the way to slang and an incubator manufacturer's memory.

Many and varied are the reasons given, but none so frank as that offered by Station WSAZ—the *Worst Station from A to Z!*

"About twelve years ago an ambitious young fellow by the name of Glenn E. Chase applied for a license from one Hon. Herbert Hoover, then Secretary of Commerce, to operate a radio station in his home town of Pomeroy, Ohio," writes Fred Burns, Program Director at Huntington, W. Va.

"In his application Mr. Chase jokingly stated that due to the fact that he was

By Madeleine Moschenross

Information Department

WESTERN ELECTRIC CO.

•

making most of the equipment himself, it would probably be the Worst Station from A to Z and asked that appropriate call letters be assigned."

His request was granted promptly.

Some years later when the station changed hands and new equipment was installed, the call letters remained the same but not so the significance. Station WSAZ became *With Service from A to Z*. After all, there's that new equipment.

In Alabama there is a strip of fertile land running through the center of the state known as the Black Belt. In the center of the Black Belt is the city of Selma. And in the center of the city of Selma is Station WHBB. Upon the occasion of its initial broadcast, Judge Samuel Hobbs, Congressman for that district, referred to the station as the *Whole Heart of the Black Belt* . . . and that's how slogans are born.

The letter W preceding call letter combinations is a government prefix which indicates that generally such stations are located in the east, while stations in the west are usually identified by the government prefix K. Therefore, often as not, civic-prideful stations find the W a wonderful help. So we find a *Wonderful Charleston, S. C.* (WCSC) . . . a *Wonderful City of Asbury Park, N. J.* (WCAP) . . . *Wonderful Dynamo of Dixie* (WDOD) which is in Chattanooga, Tenn. . . . WCOA is Pensacola, Florida's *Wonderful City of Advantages* . . . and typically topical is the *Wonderful Isle of Dreams* (WIOD), whose transmitter is located on an enchanting tropical island in Biscayne Bay directly off Miami Beach.

"Why Stay Up North?"

Station WEBR says *"We Extend Buffalo's Regards,"* but *"Why Stay Up North?"* asks WSUN in the Sunshine City of St. Petersburg, Florida. Its more staid sister station is content merely to give its geographic position, which happens to be West Florida. Thus, we have Station WFLA.

WFLA is the result of an early dream of a Florida real estate developer—one George H. Bowles. In 1925 he got the broadcast fever, purchased a second hand 500 watt transmitter and opened a station bearing his initials, in Clearwater. Later he sold the whole business and it became WFLA.

The old 500 watter (W. E. 1-A), now replaced by the present 5,000 watt 105-C transmitter, occupies a place of honor in the Smithsonian Institute at Washington.

We are advised to *Watch Akron Develop Commercially* by Station WADC, and to *KUM TO HOT SPRINGS!* by KTHS, the famous Arkansas resort's station. KTHS were originally ship call letters, but so potent has been the success of the slogan that it is said to be one of the most shining examples of cogent slogans on or off the air.

With true Southern hospitality, Station WTOC, in Savannah, Ga., flashes *Welcome To Our City* at regular intervals during their daily broadcasts, while WIL cries *Watch It Lead!* in St. Louis, Mo. Its favorite slogan "The Biggest Little Station in the Nation" however, has considerably more appeal. Who wouldn't listen in?

Aptly identified is the *World's Play Ground* through Station WPG in Atlantic City.

"We Listen We Learn"

And in the uptown section of New York City WLWL broadcasts over a limited area on a *We Listen We Learn* basis . . . a short distance away WFAB goes over the ether via the Fifth Avenue Broadcasting Corporation . . . while WNEW is identified in a three-fold manner: stations are maintained in NEWark, N. J. and NEW York and the combination is NEW on the air. This does cover the whole thing pretty thoroughly.

But what WNEW does not bring out is the fact that this particular station is the milkman's delight. It broadcasts twenty-four hours a day!

WTNJ is located in the state capital of New Jersey and simply indicates Trenton, N. J. . . . while fiery little Mayor Fiorello LaGuardia's pet, Station WNYC (and are those police quartettes honeys!) means just what it says.

Although sloganless, Station WRR of Dallas, Texas, has long cherished a compliment paid by a blind listener who stated WRR, as far as he was concerned (and that went for other shut-ins, too) meant *"Worries' Ready Relief."*

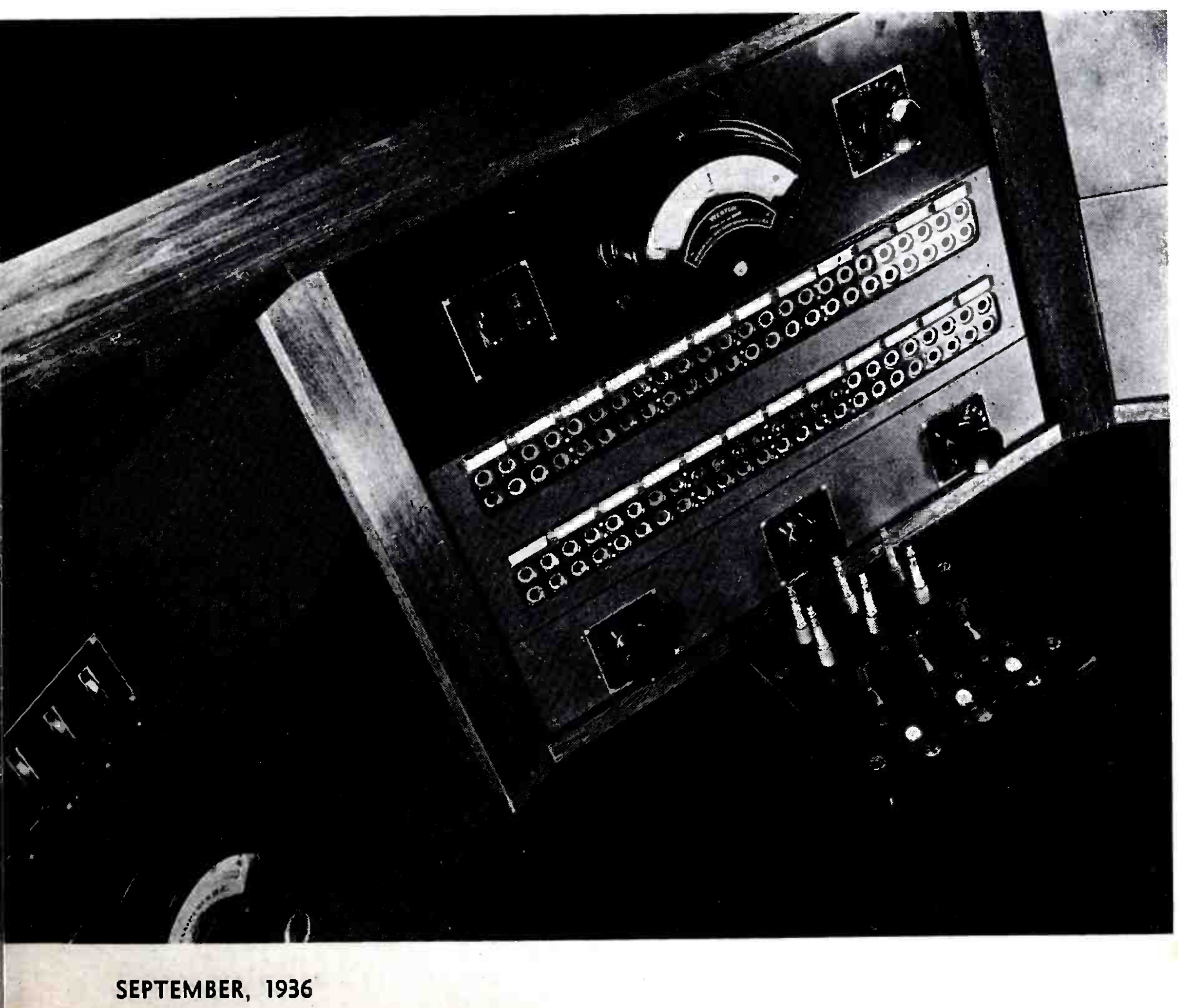
Two popular Maryland stations are WBAL for Baltimore (what? no Wonderful?) and WFBR, Maryland's pioneer radio station. WFBR is unique in that it was formerly owned by the Fifth Regiment Maryland National Guard, the first radio station in the country so owned. The call letters stand for *World's First Broadcasting Regiment.*

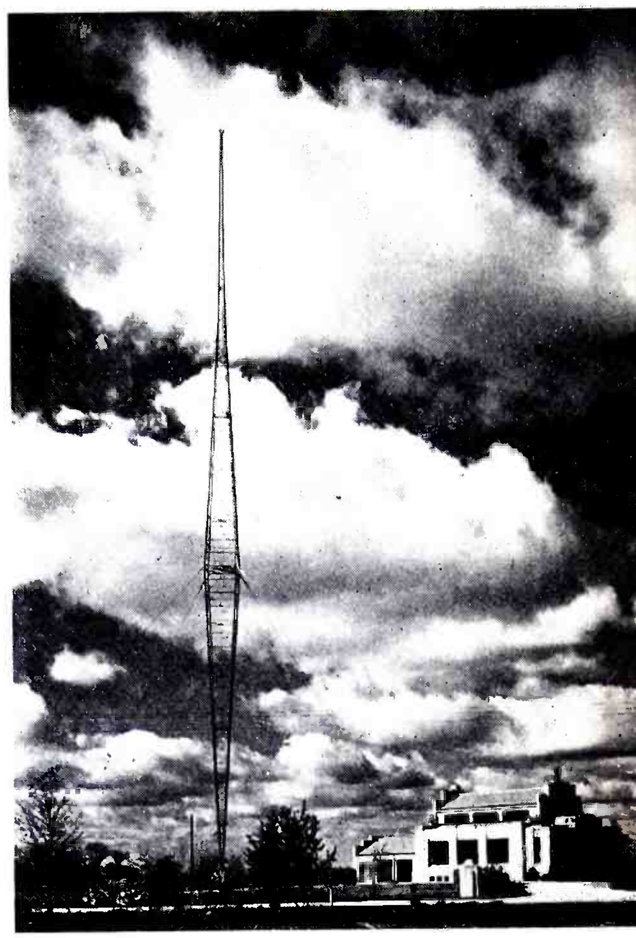
A sort of Tale of Two Cities story involves Station KSFO, in San Francisco. It maintains complete studio facilities in both metropolises—San Francisco and Oakland.

Is there a station in the audience yearning for increased power? Then let it take heed of the words of Paul Oury, General Manager of the Cherry & Webb Broadcasting Co., Providence, R. I., in connection with WPRO.

"In our early efforts in merchandising the station, we used this fact to back up our contention that WPRO was designed to render a service to the people of Providence and we made every effort to tie up all activities, civic, educational, charitable, etc., which would bring out the significance of this service. Through these efforts, we collected enough data, such as letters of appreciation from our listeners, from civic, educational, religious and charitable bodies, to enable us to present a formidable case to the Federal Communications Commission for increased power, which was granted."

CONTROL POSITION AT STATION WJR, DETROIT.





VERTICAL RADIATOR, WJR, DETROIT.

Sex Appeal

An incident where pretty women rated higher than civic pride can now be told about Station WRVA, in Richmond, Va., and again we come face to face with the chivalry of the Old South.

In the early days, Station WRVA was just another Wonderful — Wonderful Richmond, Va. It wasn't long after that, volunteered Walter R. Bishop, Studio Director, when someone suggested the rather regal title "We Rule Virginia's Air." Before they had a chance to become haughty, however, some wag countered with "We Ruin Virginia's Air." So a contest was held—and when a slogan was submitted to the effect that *Women (of) Richmond Very Attractive* it appealed to the studio director, who is, or was at the time this goes to press, a bachelor.

From beautiful women to spinach is a broad jump but we take it in our stride and bring to your attention the Spinach Station, or rather, WIS. There's spinach in South Carolina, and there's iodine in them thar spinach. Likewise, there's lettuce, celery, cabbage, squash, etc., to say nothing of shell fish, all of which are plentiful and all of which contain oodles of iodine.

It was when an analysis of the natural iodine content of these vegetables was made, that the State Agricultural Department decided to promote the uses of such products, as particularly helpful in supplying the normal iodine require-

[*Continued on page 422*]

GETTING SET FOR

Your Aerial and Receiver

IT is as good an idea for the farmer to make hay while the sun shines as it is for the squirrels to store nuts while the gathering is good. And, it is also a good idea for the dyed-in-the-wool radio listener to whip his receiving equipment into shape before the real DX commences to break through from the four corners of the earth.

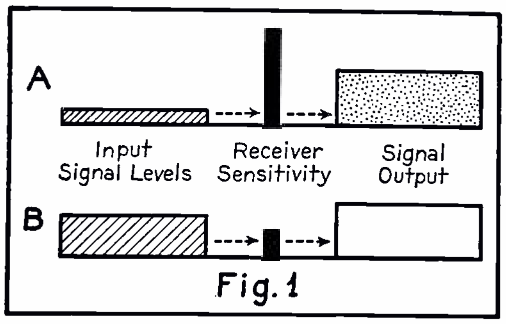
Whip the receiving equipment into shape? Possibly that's a new idea to some listeners, but there's nothing foolish about it. An aerial system can drop its efficiency as rapidly as can an auto storage battery left to its own devices, and a receiver can commence misfiring as readily as an auto engine if it isn't given the once-over occasionally.

In other words, you can't expect an aerial or a receiver to continue functioning perfectly unless you give them a bit of attention. Neither the aerial nor the receiver are foolproof, and you're mistaken if you think they are.

What About Aerials?

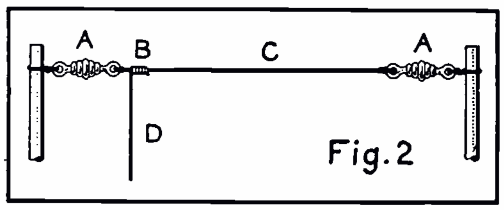
Take the aerial, for instance. When did you last examine it? Ten to one any soldered connections (if they *are* soldered) have become corroded. If they aren't soldered, and you haven't bothered with them, the chances are a hundred to one that the connections are oxidized. If you've ignored the aerial completely, it's at least an even chance that all the insulators are coated with a film of carbon, or other substances, left there by wind and rain and snow and sleet and smoke and what have you.

A terminal of a storage battery in a car can become so thoroughly corroded that no current can pass. When that happens, your car is completely out of commission—but usually you don't let it happen. But, there are many radio listeners who will disregard corrosion and oxidation in the aerial system because it has never occurred to them that corrosion and oxidation are particularly harmful, to say nothing of insulator film. Yet the aerial is called upon to pass electrical currents so infinitesimal as to be almost negligible. When these minute currents reach a corroded terminal, they're up against a veritable stone wall.



If signal at receiver input is low (A), receiver sensitivity must be increased to obtain adequate output. Result is noise. With high signal input (B), much less sensitivity is required to obtain same output, but minus noise.

The trouble is, of course, that the listener still receives signals—and possibly fairly good ones at that—and assumes that the old aerial is still what she should be when she isn't at all. If the aerial is of the single lead-in L or T type, the lead-in may be doing all the real pick-up work, in which case the receiver is called upon to operate at greater sensitivity. The result is increased noise background. Some aerials are probably so bad that they provide no real signal pick-up at all and the listener would be just as well off using a piece of bell wire thrown on the floor.

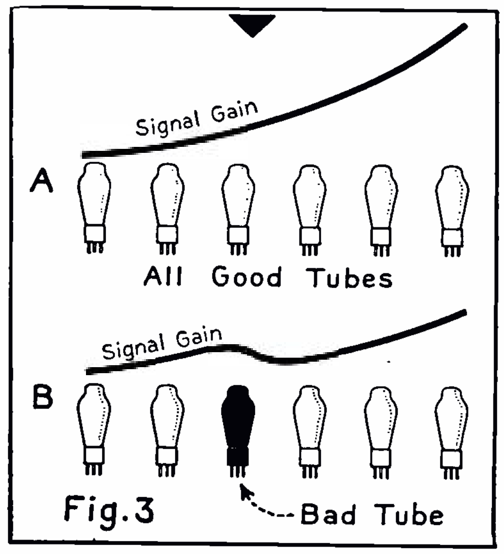


Danger points. A, insulator film; B, corrosion or oxidation; C, oxidation. If point B is corroded, signal pickup may be in lead-in D only.

Receiver Takes the Rap

It would be nice if there were some simple way of determining whether or not an aerial was working right, but there is no simple way. If the aerial has dropped off in efficiency, the receiver will make up for the difference, in increased amplification of the input signal voltage (See Fig. 1). That's a nice thing about modern receivers, but unfortunately, there is a limit as to what receivers can do, and if the aerial is in poor shape the real DX signals just aren't going to show up at all. There won't be enough signal voltage to even cause a ripple in the receiver. But you'll get plenty of noise, no fear of that.

Look at it sensibly; corrosion and oxidation block the flow of the minute electrical currents, because corrosion and oxidation form a very effective insulation. On the other hand, the film that forms on the aerial insulators is more often than not a darn good conductor of electricity. So, to begin with, the radio-frequency currents in the aerial wire are obstructed when they attempt to flow into the down-lead, and, to make matters even worse, are permitted to leak off to ground across the film on the insulators (See Fig. 2). And currents that leak off to ground have no part in exciting the radio receiver.



One bad tube can cut receiver sensitivity appreciably.

Cleaning Up

So, before the balmy weather leaves us, take a look at your antenna system. Clean all unsoldered connections as well as you would clean the family silver. Start with a knife and end up with fine sandpaper. After you have re-made the splice, solder it by all means, then you needn't worry about losses for at least a year. It may save you a trip to the roof or a tree climb when it is below zero out of doors.

Then clean the insulators. You can use gasoline or alcohol or whatever you happen to have handy—but get the film off. We prefer brushing with soap and water if the film isn't too hard, followed by a clear water rinse.

You needn't worry too much about the oxide that forms on bare copper aerial wire. It does introduce losses, but these are not particularly serious. Nevertheless, if your a stickler, clean off the oxide with fine sandpaper, or re-

THE DX SEASON

Should Be Put Into Shape

By G. S. GRANGER

place with enamel covered wire. The enamel does no harm and it cannot oxidize.

And while you're examining the aerial, make sure it is still clear of all obstructions and that it has not come in contact with another aerial or some such conductor as a vent pipe or a rain gutter.

If a new building, a steel transmission line tower, telephone or electric wires, or any other such large or conducting objects, have come into creation since you first erected your aerial, they may have a pronounced effect on radio reception, particularly from certain directions. In such an instance it might be highly advantageous to string the aerial in another direction or increase its height.

Aerial Pointers

If your aerial seems to be pretty well shot, and not worth rehabilitation, by all means erect a new one. And should you go about this, keep the following points in mind:

1). The higher the aerial above ground, the better the reception.

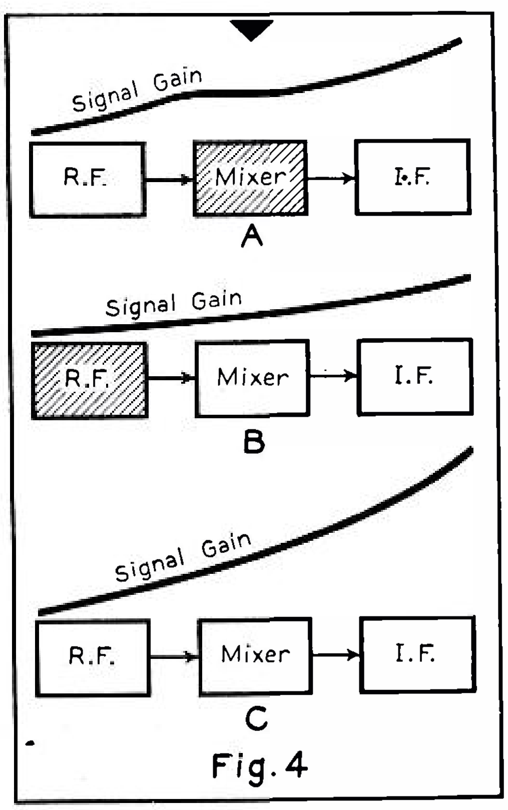
2). The higher a noise-reducing type of aerial is above ground the less chance there will be of intercepting man-made interference.

3). The ideal aerial is one strung in free space. Come as close to this ideal as possible.

4). String your aerial at right angles to known noise sources such as electric power lines, trolley lines, electrified railways, roads frequented by autos, etc.

5). An aerial 100 feet or more in length is still the best type for good reception in the standard broadcast band, unless there is considerable noise interference, in which case a noise-reducing antenna will give more consistent results.

6). An all-wave doublet-type antenna is best for short-wave reception, unless reception is desired in one band only, in which case the aerial wire should be of the correct length to resonate in the desired band.



Approximation of what may happen to signal amplification in a receiver with misaligned mixer (A), misaligned r-f stage (B). Note high gain in receiver properly aligned, (C).

The Receiver

Now, what about your receiver? First of all, your receiver is only as good as the tubes it has to work with. The fact that the tubes still "give forth" is no indication that all things are as they should be.

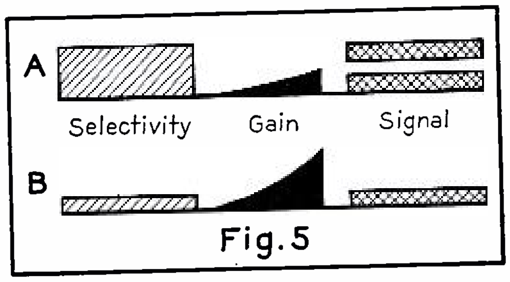
Tubes wear out with use, just as human beings do. One worn-out factory worker can hold up an entire production line; one worn-out tube in a receiver can undo most of the good accomplished by the other tubes. (See Fig. 3).

A tube goes sour gradually, so you don't notice the change. If it happens to be a radio-frequency amplifier tube, it may not have sufficient life left to amplify a real weak signal, although it may still do a good job on strong signals. Moreover, as the tube life or emission drops off, the entire receiver is affected.

Your receiver depends on good tubes to work properly; give your receiver its due and have your tubes tested. Discard any that do not come up to snuff. If your pocketbook permits, be on the safe side and get a whole new set of tubes for the receiver, for there is no telling when one of the old ones may decide to wither and die on you. It is always preferable to have a complete complement of tubes of the same age.

Receiver Alignment

Now, as to the receiver proper—no



Receiver minus preselector has low weak-signal gain and poor image frequency ratio (A). Receiver with preselector is sensitive to weak signals and has good image frequency ratio (B).

set, with the exception of the regenerative receiver without benefit of an r-f stage, remains properly adjusted forever. Most receivers of the tuned r-f or superheterodyne type actually require re-alignment every six months if they are to be of use for DX reception.

In this respect a receiver is like an auto with valves or ignition system out of whack—only the receiver will act up worse than the auto under conditions of improper adjustment. There is nothing more disastrous than an r-f or i-f stage out of alignment, unless it be an oscillator improperly trimmed and padded. Just one little stage off a bit on the resonant frequency is enough to cut the receiver sensitivity and selectivity almost in half (See Fig. 4).

Radio receivers (with the exception of a few of the 1937 models) are adjusted to the proper frequencies by small condensers. The plates of the condensers are made of metal and this metal expands and contracts with a change in temperature. After a while the small pieces of metal alter their position slightly. Or in their periodic expansion and contraction brought about by changes in the internal temperature of the set every time it is turned on and off, the little adjusting screws loosen a bit. The vibrations set up by the loudspeaker, or even vibrations set up in the room, are sufficient to loosen the adjusting screws and throw one or more circuits out of alignment. I know of a case where vibration set up by trucks and buses passing a house was sufficient to throw a receiver out of whack in two months' time.

There are other things that can throw a receiver out of alignment, including tubes which have become old, but the point is that receiver alignment shouldn't be taken for granted. If you haven't

[*Continued on page 422*]

Globe Girdling

By J. B. L. Hinds

quick-reference listings . . . sectional reception reports . . . moscow frequencies . . . new belgrade station . . . new canadian station list

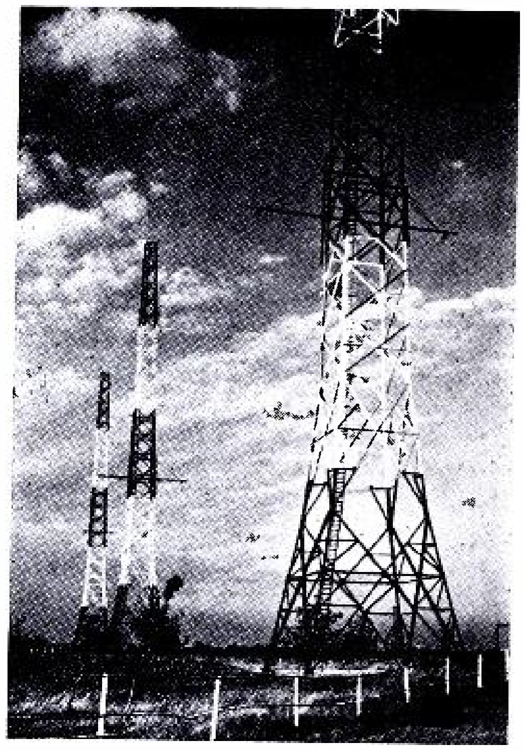
IN ORDER that our readers may know what stations are being received in different sections of the country, I am listing from reports available some of the stations being heard on the West Coast and similar information for the East Coast.

WEST COAST

LRX, LRU, Argentina; HJ1ABG, HJU, HJ1ABP, HJ3ABD, Colombia; CQN, XGW, ZBW, China; COCH, Cuba; GSD, GSF, GSH, England; FYA, France; VPD, Fiji Islands; DJB, Germany; KIO, Hawaii; TFJ, Iceland; PLQ, (new 6720 kc.), Java; JVH, JVD, JVB, JIB, Japan; YNLF, Nicaragua; LKJ1, Norway; HS8PJ, Siam; EAQ, Spain; RAN, U. S. S. R.; YV7RMO, Venezuela.

EAST COAST

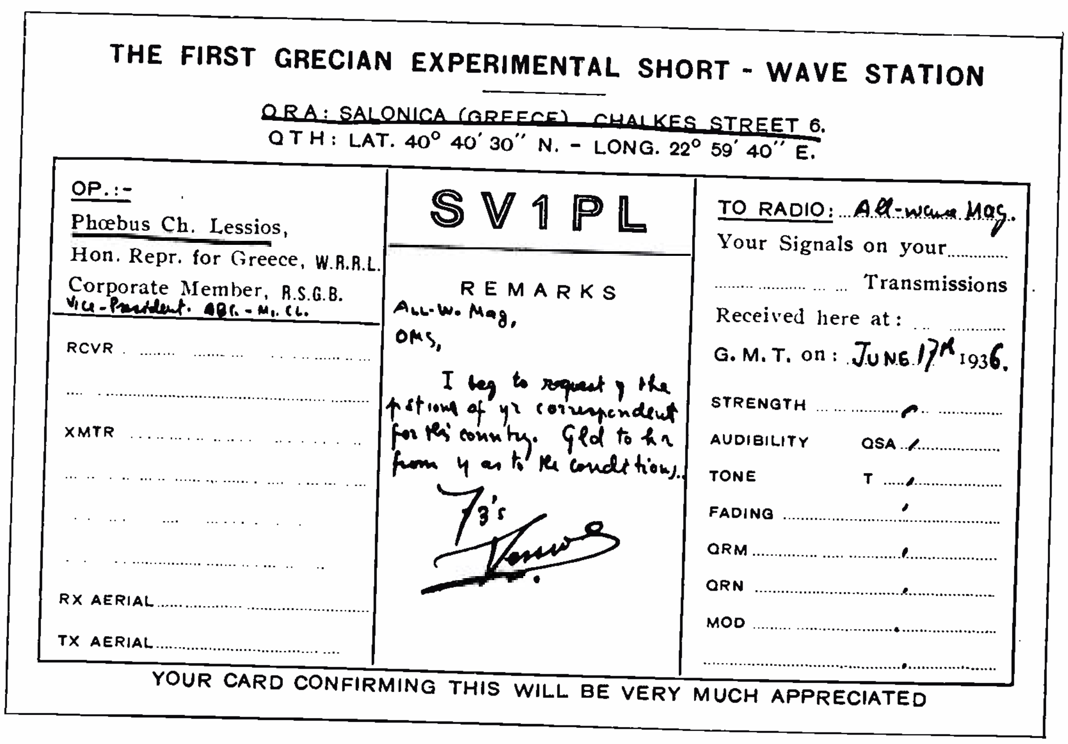
LRU, LRX, Argentina; VK2ME, VK3ME, VK3LR, Australia; ORK, Belgium; VP3BG, VP3MR, British Guiana; PRF5, Brazil; CEC, Chile; HJ1ABP, HJU, HJ3ABX, HJ4ABD, HJ4ABB, HJ4ABE, HJ5ABD, HJ1-



The antenna towers of stations HAS-HAT, Hungary.

ABG, HJ3ABD, Colombia; COCD, COCO, COKG, COCH, CO9JQ, CO9WR, Cuba; TIEP, TIPGH, TIPG, TIRCC, Costa Rica; HI2D, HIH, HIT, HI1S, HIZ, HIG, HI8Q, HI1A, HIX, HI9B, HI1J, Dominican Republic; GSB, GSC, GSD, GSF, GSH, GSP, England; HC2RL, Ecuador; TPA2-3-4, France; VPD, Fiji Islands; DJA, DJB, DJN, DJQ, Germany; TG2X, TGWA, Guatemala; HH3W, Haiti; HAS3, HAT4, Hungary; PHI, PCJ, Holland; HRD, HRN, Honduras; TFJ, Iceland; 2RO3, 2RO4, Italy; JVM, Japan; XEXA, XECR, XEBT, XEWI, Mexico; CT1AA, Portugal; HP5J, HB5B, Panama; EAQ, Spain; HBL, HBP Switzerland; RNE, RAN, U.S.S.R.; YV2RC, YV3RC, YV4RC, YV5RMO, YV6RV, YV7RMO, YV9RC, YV12RM, Venezuela.

The above lists were made up from the few reports available. We did not have sufficient information from the Middle West to provide a worthwhile report.



THE FIRST GRECIAN EXPERIMENTAL SHORT - WAVE STATION

QRA: SALONICA (GREECE) - CHALKES STREET 6.
QTH: LAT. 40° 40' 30" N. - LONG. 22° 59' 40" E.

OP.:-
Phœbus Ch. Lessios,
Hon. Repr. for Greece, W.R.R.L.
Corporate Member, R.S.G.B.
Vice-President. ABC.-M. Cl.

RCVR
XMTR
RX AERIAL
TX AERIAL

SV1PL

REMARKS
All-W. Mag,
OMs,
I beg to request y the position of yr correspondent for this country. Glad to hr from y as to the conditions.
73's

TO RADIO: All-wave Mag.
Your Signals on your
Transmissions
Received here at:
G. M. T. on: June 17th 1936.
STRENGTH
AUDIBILITY QSA
TONE T
FADING
QRM
QRN
MOD

YOUR CARD CONFIRMING THIS WILL BE VERY MUCH APPRECIATED

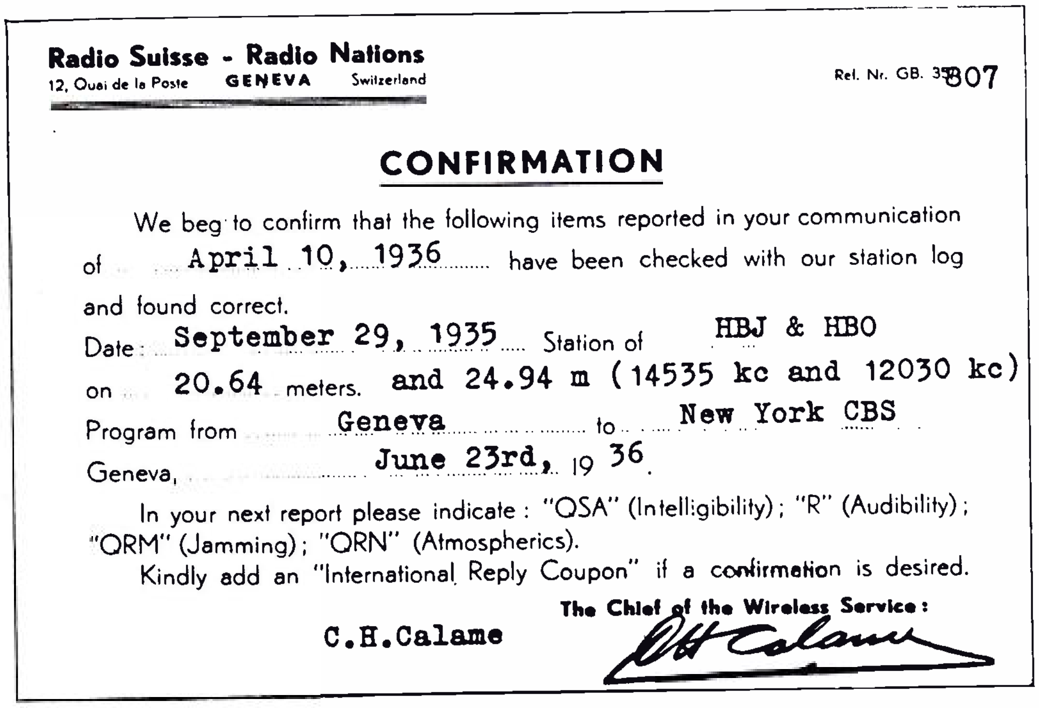
Veri card from the first Grecian experimental short-wave station.

Sectional Reports

It is our thought that information of this nature would be valuable to the listeners and we have in mind gathering such data and presenting it in this section monthly. With this end in view, we would be pleased to receive logs for 30-day periods from different sections so that they will be in my hands by the 5th of each month. While we have not worked out the plan in connection with the reporting, it would be well to note in your reports the signal strength, quality and extent of fading of each station received. The call letters and frequencies, of course, should be shown.

This rough outline will give you the idea. Such data should be of distinct value to all short-wave listeners. Your assistance and suggestions would be greatly appreciated.

In order that listeners may know what changes have been made in the current


Radio Suisse - Radio Nations
12, Quai de la Poste GENEVA Switzerland

Ref. Nr. GB. 35807

CONFIRMATION

We beg to confirm that the following items reported in your communication of April 10, 1936 have been checked with our station log and found correct.

Date: September 29, 1935 Station of HBJ & HBO
on 20.64 meters. and 24.94 m (14535 kc and 12030 kc)
Program from Geneva to New York CBS
Geneva, June 23rd, 1936.

In your next report please indicate: "QSA" (Intelligibility); "R" (Audibility); "QRM" (Jamming); "QRN" (Atmospherics).
Kindly add an "International Reply Coupon" if a confirmation is desired.

The Chief of the Wireless Service:
C.H.Calame

Veri from "Radio Nations," at Geneva, Switzerland.

station list, I am listing such changes in order of frequencies and classifying by new stations added, changes in frequencies, calls, etc., which, it is believed, will be of material assistance, and eliminate to a great extent the necessity of comparisons of the monthly list. It will be appreciated, however, that it will not be possible to note the many changes in time schedules of stations on the air, and that reference to the list will be necessary as heretofore. It will be our constant endeavor to maintain the schedules as near correct as is possible.

I have in mind extending this service by inclusion of non-authenticated stations, under a special caption, and including therein such stations reported but not listed. The changes in this issue are as follows:

NEW STATIONS

Kc	Meters	Call	Location
55500	5.41	W3XKA	Philadelphia. Pa.
17260	17.37	CMA5	Havana. Cuba
15450	19.42	IUG	Addis Ababa. Ethiopia
15183	19.76	RV96	Moscow. USSR.
15180	19.76	GSO	Daventry. England
14985	20.02	YSL	San Salvador. Salvador
10955	27.38	HS8PJ	Bangkok. Siam
7220	41.55	VP3BG	Georgetown. Br. Guiana
6922	34.34	IUF	Addis Ababa. Ethiopia
6135	48.90	HH3NW	Port-au-Prince. Haiti
6100	49.18	Belgrade	Belgrade. Yugoslavia

STATIONS DELETED

Kc	Meters	Call	Reason
15260	19.66	GSI	not assigned
12035	24.93	HBO	not assigned
6150	48.78	CSL	not in service
6000	50.00	RV59	not in service

STATION CHANGES

New Frequency	Call	Old Frequency	New Call
18450	HBF	18950	
18270	ETA	18270	IUD
15145	RKI	15040	
14535	HBJ	14550	
11402	HBO	11385	
11955	ETB	11955	IUC
9660	LRX	9580	
7620	ETD	7620	IUB
6710	TIEP	6701	
6182	XEXA	6171	
6090	CRCX	6095	
6005	VE9DR	6005	CFCX
5880	ETG	5880	IUA

Indeterminate COCQ

There is a new station with call COCQ, in Havana, Cuba, which is endeavoring to find an open spot from which to broadcast and so far has camped in several places between 9750 and 9900 kc. At last hearing it was near 9760 kc. and maintaining a good consistent signal and talking mostly in the Cuban language. It appears to have designs toward a monopoly of identification signals, as it uses chimes, bells, train whistles, moving trains, siren whistles, bugle calls, and other imitations and employs a gentleman to laugh most heartily at stated intervals which is usually followed by the healthy roar of a lion, if the writer can tell one when he hears it.

If this station maintains all these identification signals in future broadcasts, it will be no trick to determine the station you are hearing. They apparently advertise a little for the General Electric, Victor, Westinghouse and Fleischmann companies, but as yet I have not secured their street address.

LSN3, Buenos Aires, Argentina, on 9890 kc. has been on the air several times of late with some fine program material and with announcements in English to the effect that reports would be greatly appreciated and giving assurance that they would be duly acknowledged. Their signals have been a good QSA4, R8. It is not known if it is their intention to institute a broadcast service or not.

Although the authorities of Dominica state that the frequency of HIX, Ciudad, Trujillo, is 6131 kc. and is being heard on that frequency, it is also being heard on 12,262 kc. And what's more, the writer has inspected a verification given by the station for reception on the latter frequency. It will be our endeavor to straighten this one out for the benefit of our readers.

HJ1ABB, Barranquilla, Colombia, listed in the station list at 6447 kc., is still shown there as no definite word has been received of a permanent assignment. It was reported that this station would broadcast on 6128 kc. and it is understood that it tested there for a short time, but on account of the extreme congestion at that point, gave it up as a location. This station is now reported as being heard on or about 9560 kc., but with a slight heterodyne, presumably caused by DJA.

Referring to the comment in the July issue on XEWI, Mexico, a recent letter

Interesting card from TIEP, San Jose, Costa Rica.

from this station advises that it is their intention to operate from now on on exactly 6000 and 11900 kc., which are the frequencies assigned to them by the Mexican government. We have been listing this station at 5975 and 11900 kc., as they reported using those frequencies. Since receiving the first above mentioned advice, however, a listener reports receiving a letter from them, which appears to have been dated since, saying they were on 5890 and 11950 kc., so no change will yet be made in the station list until definite advice is received.

According to reports received, JVH, Nazaki, Japan, is being heard from 5:00 to 9:00 P. M., E. S. Time with irregular thirty-minute broadcasts relaying long-wave station JOAK.

YV7RMO, Maracaibo, Venezuela, is now being reported as heard by quite a number on 6070 kc. Their address is P. O. Box 100. This station was mentioned as YV7RNO in error in "Globe Girdling" for August.

The address of the new Westinghouse station W3XKA (55,500 kc.) is 1622 Chestnut Street, Philadelphia, Pa.

Moscow Frequencies

Radio Centre, Moscow, U.S.S.R. advises that the following frequencies are now used on English broadcasts and are listed in the station list in this issue: RNE, 12000; RAN, 9520; RKI, 15,145; and RV96, 15183 kc. The broadcasts from RAN and RV96 are for thirty minutes and those from RNE and RKI of one hour duration, although the carriers may be found on the air at other hours than those shown in the list, broadcasting in other languages.

One or two late reports say that 2RO4, Rome, is broadcasting on 11810 kc. from 2:45 to 4:45 P. M. although no advice has been as yet received from the station as to a change in its frequencies. The American hours still remain on 9635 kc.

Mr. J. Wendell Partner, Tacoma, Washington and Hugh Compton, San Diego, California, each have received a verification from HS8PJ, 10955 kc., 27.38 meters. It is a white card with call letters printed in red and other printing in black and gives time on the air as Mondays, 8:00 to 10:00 A. M., E. S. Time. HS8PJ is an experimental broadcast station located at Saladeng, Bangkok, Siam. Siamese and foreign music and news events are broadcast. The signal radiated is a fairly strong one and should be heard on the east coast.

YV5RMO, Maracaibo, Venezuela, 5850 kc., has been sold by Senor S. M. Vegas to Messrs. L. Garcia Nebot and Juan Suarez Castro. The slogan of the station has been changed from "Ecos del Caribe" to "Ecos del Zulia." The new owners will continue to operate on the same frequency, it is understood.

As stated in the August issue, YNLF, Managua, Nicaragua, is supposed to be operating on 9595 kc. according to the last report received from that station. Although the writer has not heard this station for some time during the reporting of these changes from one frequency to another, one or two listeners report it 9645 kc. If this station operates with 1000 watts power as claimed, no matter where it may light, it should be heard.

New Belgrade Station

Short-wave broadcasting station "Belgrade," Yugoslavia, is listed in this issue at 6100 kc. This station has 1000 watts power and may possibly be heard when 6100 kc. is not being used by W9XF, Chicago, or W3XAL, Bound Brook.

The call letters VE9DR (6005 kc.) relaying the programs of longwave station CFCF, Montreal, Quebec, Canada, have been discontinued in favor of the new call CFCX on the same frequency. CFCX has been in use only since May 6, 1936 and operates with 75 watts power. Short-wave station VE9DN (6005 kc.) is used irregularly for broadcasts to far northern Canada and is on the air on Saturday nights at 11:30 P. M. during the Fall, Winter and Spring months.

Short-wave relay broadcast station W4XB, Miami, Florida (6040 kc.) has been off the air for some two months in order that some changes in equipment might be effected. It is expected to resume operations normally within a few week's time and advance notice will be forwarded this department.

Reports from the west coast indicate that CQN, Macao, (Portuguese) China, has moved again from 9553 to 9680 kc. and is now broadcasting beginning at 5:00 A. M. E. S. Time. The writer is hoping that it was this Chinese station to which he was recently listening.

The writer is informed by Mr. C. P. Edwards, Director of the Radio Service of the Canadian Government, that the new edition of the Official List of Radio Stations in Canada is again on sale and may be purchased for twenty-five cents from the Department of Marine, Radio Branch, Ottawa, Ontario, Canada.

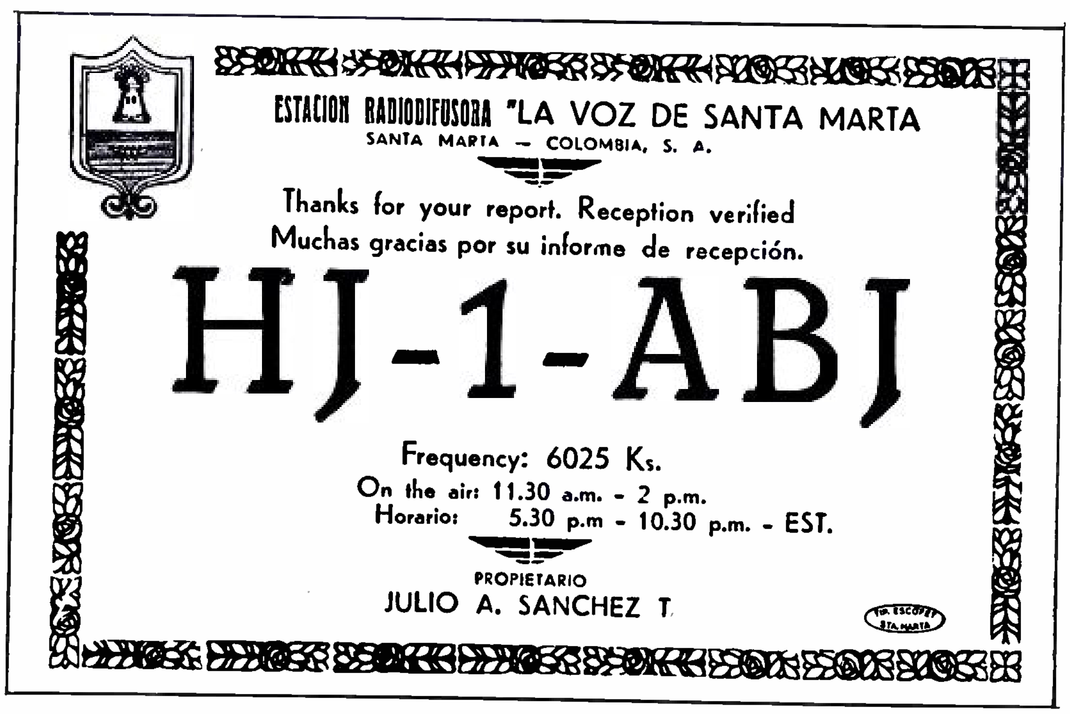
One listener reports hearing YV2RC on 11600 kc. No advice has been received from the station that it has changed frequency or that it operates on any other than 5800 kc.

HH3W Stepping Out

Senor G. Ricardo Widmaier, operator and owner of Station HH3W on 9595 kc. advises he has received 25 reports from listeners in England, and also received reports from Belgium, Italy, India and Japan, which speaks well for the efficiency of his 30-watt transmitter. Senor Widemaier is also now operating a second transmitter, HH3NW, on 6135 kc. which is listed in this issue. He would appreciate reports from those hearing the station.

LZA, Sofia, Bulgaria, on 14970 kc., broadcasts with 2000 watts power according to information from a reliable source.

Some comments have been made about the time schedules in our station lists for W2XAD, 15330 kc., and W2XAF, 9530 kc. The General Electric Company at Schenectady, New York, advises that W2XAD is scheduled on the air daily from 10:00 A. M. to 3:45 P. M. and W2XAF from 4:00 P. M. to 12:00 A. M., both E. S. Time. The above are the regularly assigned hours on the air. Both stations, however, are also on the air at various times for special events, tests, operas, baseball games, relays etc.



Red, green and blue veri from Santa Marta, Colombia.

Yellow card with red letters—from HI3C, the little town of La Romana, R.D.

It is hoped that this will explain why the time of such special events cannot be shown in a schedule.

VK3LR, Melbourne, Australia, is now broadcasting on 9580 kc. daily and remaining on the air until 8:30 A. M. E. S. Time instead of 7:30 A. M. as heretofore.

LRX, Buenos Aires, Argentina, has changed to 9660 kc. and operates only in the evening. LRU carries the day program on 15290 kc.

Station W8XWJ (31600 kc., 9.49 meters) the ultra-high-frequency station of the *Detroit News,* advise that they broadcast code practice sessions every night from 7:30 to 8:30 P. M. E. S. Time.

Georgetown Stations

The new broadcaster VP3BG on 7220 kc., located at Georgetown, British Guiana, is getting out with a fairly consistent signal through the mess of cw which abounds there. A similar condition exists with VP3MR on 7080 kc., the other British Guiana station at Georgetown, and which appears to be getting out better than heretofore. These two spots are good places to test your tuning ability and to determine the extent of your patience. The programs of both stations are quite enjoyable ones.

The frequency of CRCX, Bowmanville, Ontario, Canada, has been changed to 6090 kc. Mr. W. A. Shane, Chief Engineer, states that the exact assigned frequency is 6090 kc., but that the actual frequency deviation from this frequency is plus or minus 40 cycles. The power in the antenna is approximately 500 watts or slightly more.

Late advice from Mr. R. Simpson, Concord West, N. S. W. Australia, states that the latest and largest of the interstate passenger fleet, the motor ship *Kanimbla* in North Queensland passenger service is the first passenger ship to own a regular broadcasting station. Its call is VK9MI which is operating on 6000 kc. or 50 meters. Mr. Simpson heard the station 2000 miles out of Sydney on a recent trip from Belfast. They broadcast regular programs and employ a lady announcer who gives the call "9MI." The ship is owned by McIlwraith and McEacharn, Bridge Street, Sydney, Australia, where reports should be sent.

The following stations are slow in verifying reports: — HJN, HKV, HJ3ABF, HJ4ABD, HJ4ABB, HJ1-ABB, Colombia; HC2CW, HC2ETC, Ecuador; XBJQ, Mexico; HRN, Honduras; YNVA, Nicaragua; CB96O, Chile; HI7P, HI9B, HI4V, HI2D and HI5N, Dominican Republic.

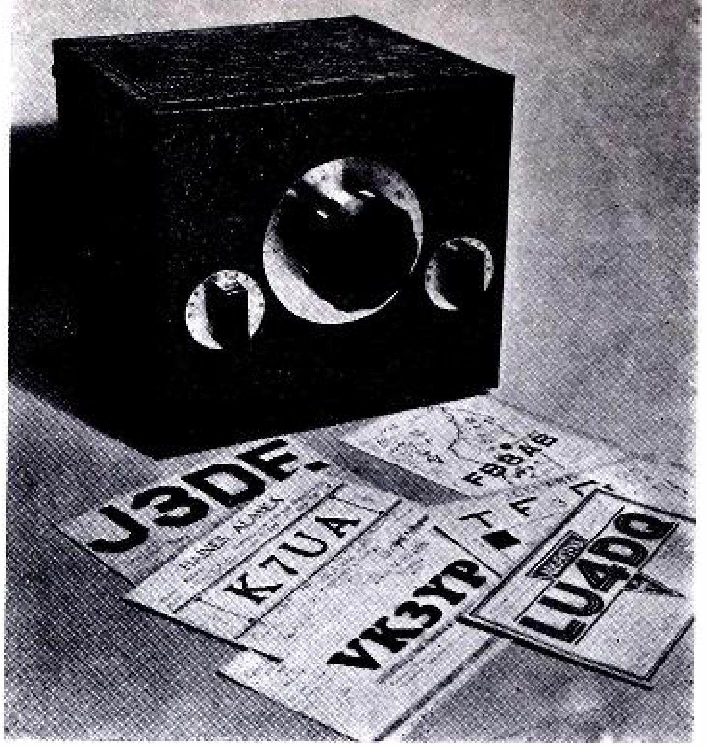
Amateur Phone Stations

The following 20-meter amateur phone stations are reported as being received:—G2BH and NO, G5ML-VL-XG-JO-BJ-NI, G6WU-XR-GO-LK, England; F8MG, France; HI4F and HI1W, Dominican Republic; TI5JJ and TI5CV, Costa Rica; LU1BJ, LU2AP, LU4BH, LU6AP and LU8AB Argentina; PY2CK, PY2ET, and PY1DK Brazil; EA2BT, EA2BH, EA3BT, EA4AO, EA4BM, EA3DQ, EA5BC, EA5BE, Spain; CE1AR and CE1BC, Chile; YV4AA and YV4AC, Venezuela; XE3AG, Mexico; OA4AK, OA4AA and OA4B, Peru; EA8AT, Canary Islands; K6LJB-KKP, Hawaii; NY2AC, Canal Zone; ON4VK, Belgium; PAOIDW and PAOFB, Holland; OZ4H, Denmark; CT1BY and CT1BV, Portugal; VP2CD, Antigua; SU1CH, Egypt; LI1J, Lithuania; VP4TH, Trinidad; SM5SX, Sweden; VK2RB and VK2AP, Australia.

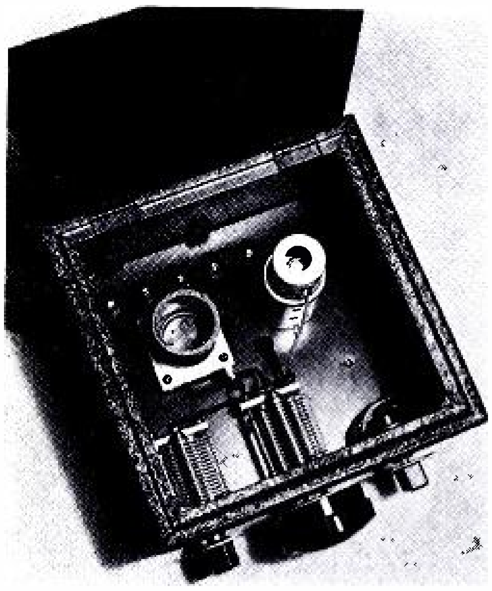
The majority of stations reported are received between 5:00 and 9:00 P. M. with the exception of those in Hawaii, Australia and Trinidad which were contacted after 12:00 midnight. Lithuania was picked up around 10:00 P. M. and Sweden at 7:15 P. M. For the information we are grateful to Mr. R. S. Swenson, Rockford, Ill., David H. Stone, Brooklyn, N. Y., L. R. McPherson, Chicago, Ill., E. H. Clark, Hollister, Calif., Bernard L. Ahman, Jr., Baltimore, Md., Roy Waite, Ballaston Spa, N. Y., John Carothers, Lincoln, Neb., and S. P. Herren, Jr., Haskell, Tex. Reports from others of out-of-the-ordinary stations on this band would be appreciated, giving the calls, location, time of receiving and the approximate frequency. It is known, however, that it is not always possible to furnish the latter in every case. It is hoped that the information being furnished is of benefit to many, and comments and suggestions will be gratefully received.

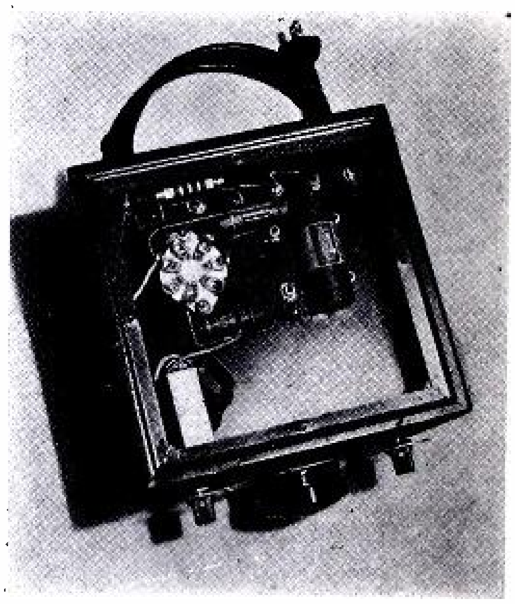
[*Continued on page 420*]

Veri from HI8Q—presumably the "Voice of Carta Real Brandy."



THE AWR Regenerative Preselector

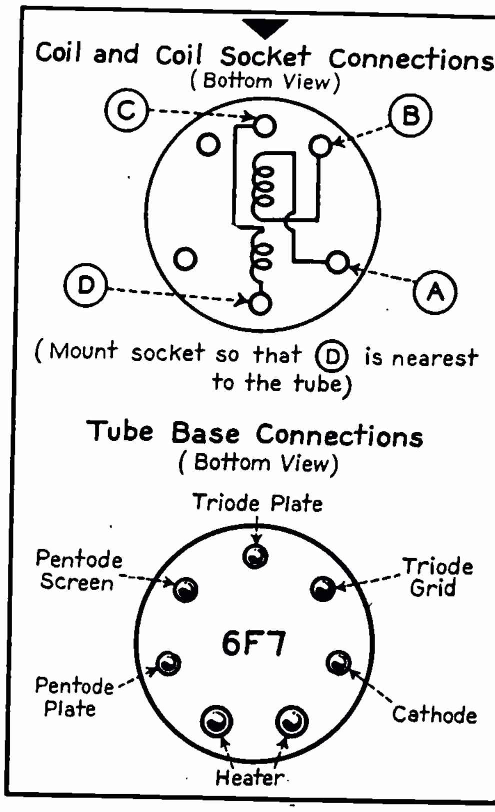




By
Willard Bohlen • W2CPA
and
Chester Watzel • W2AIF

A SUPERHETERODYNE receiver should have, for best signal-to-noise ratio, the highest possible gain in the signal circuits (before the first detector), with a corresponding reduction in gain in the i-f amplifier circuits. It is also important in this respect to have high gain in the first tube of the superheterodyne, to overcome the inherent noise produced in this tube itself. These principles of reducing noise in a superheterodyne in relation to the signal being received, are more fully explained in the articles on the AWR-13 and AWR-6 Receivers in previous issues of ALL-WAVE RADIO, and will not be repeated here.

A new receiver can be properly designed and built so as to include one or two r-f stages ahead of the first detector. But it is difficult, if not impossible, to do this in an existing receiver which has no r-f stage. It therefore becomes necessary to include the desired r-f stage or stages in a separate unit which can be attached to the receiver with a few wires. The use of an additional preselector or r-f stage of this type is not limited to an existing superheterodyne which has no r-f stages at all, but can be used to advantage with supers already incorporating an r-f stage or two.



Coil socket and tube base connections.

Use of Regeneration

The use of regeneration in a separate preselector stage is desirable for highest possible gain. The 6F7 circuit used in the first detector stage of the AWR-6 Receiver is used with a change in bias voltage from the original circuit so as to make an r-f amplifier of the 6F7 instead of a detector. The pentode section of the 6F7 is used as the r-f amplifier tube, with optimum voltages on all elements regardless of the regeneration control setting. Regeneration is produced by the triode section of the tube. This makes the 6F7 equivalent to two separate tubes, one for amplification and one for regeneration, so that no compromise is necessary between optimum conditions for each function as would be necessary if a tube of the ordinary type were used.

The circuit is quite simple, there being only three controls. The center dial is, of course, the tuning control. The small right-hand dial operates the regeneration control, this being secured by varying the plate voltage of the triode section of the 6F7. The left-hand control represents a departure in preselector design. As will be seen from the diagram, this operates condenser C-1. This condenser, in conjunction with the plate winding of the coil, forms a single "pi" antenna-matching network. Proper adjustment of this condenser will provide highest gain of the preselector as the circuit can be matched nearer to the antenna impedance than otherwise possible with the ordinary preselector circuits used.

Construction and Wiring

Construction and wiring of this preselector is easy and simple. No particular precautions need be taken when wiring, other than to see that the leads between the coil socket and tuning condensers C and C-1 are short and direct. After the unit is completely assembled it is a good idea to take the chassis out of the cabinet and wire up as much as possible before placing it back in the cabinet. Several grommets should be mounted in the back wall of the cabinet near the binding posts for connection to them.

The coils specified will give complete coverage from 10 meters through to 150 meters. One of the coils covers both the 20- and 40- meter ham bands and another covers both the 40- and 80-meter bands. The 10- to 19-meter coil will actually cover the 20-meter ham band, but due to the high C (tuning capacity, used to hit 20 meters with this coil, the gain is considerably lowered. For 20 meters the 19- to 40-meter coil should be used.

The preselector has its own filament supply so that it may be used with receivers using 2.5-volt type tubes.

Preselector Connections

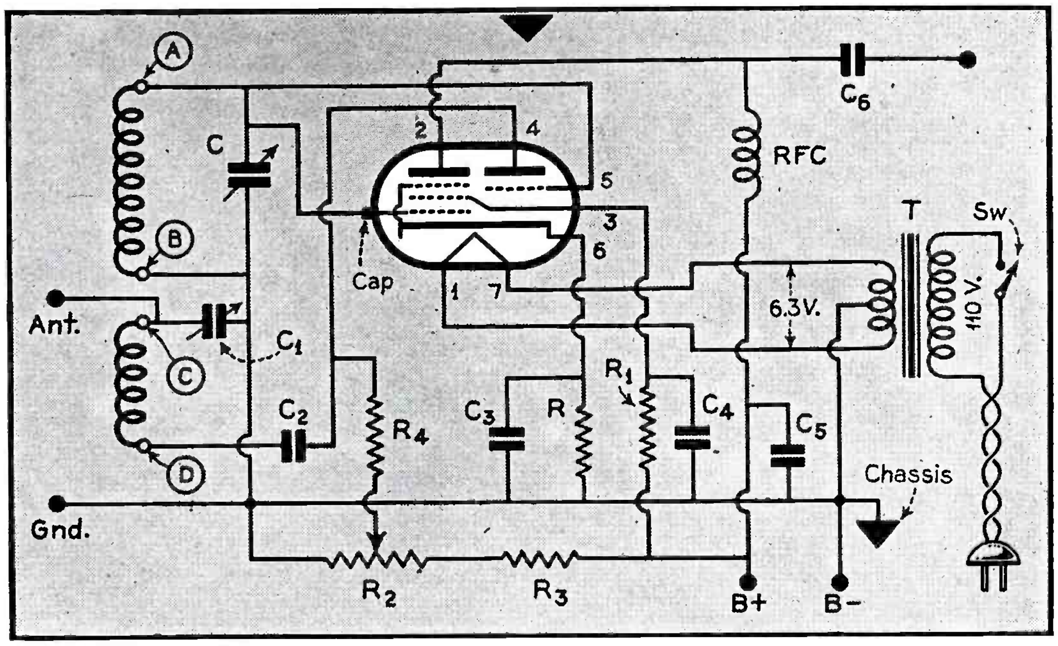
In connecting the preselector to a receiver it is only necessary to connect the minus B post to the chassis of the receiver. The plus B post is connected to the plus B of the receiver (B side of the speaker or fones will do), and the output post to the antenna post of the receiver. The antenna and ground connections are then made to the proper posts on the preselector instead of to the receiver. On those receivers having two antenna posts, one should be connected to the output post of the preselector and the other to the chassis of the receiver. A reversal in connection to these two antenna posts will show quickly which way gives the best signal gain.

Operation of Preselector

Operation of the preselector only entails placing the proper coil in the socket and tuning the main dial until the desired signal is loudest. This should be done with the regeneration control turned to the minimum position. The antenna matching dial at the left should then be turned slowly from one end to the other while the tuning dial is swung back and forth through resonance until the best setting for the antenna control is found. The regeneration control should then be slowly advanced while the tuning dial is again swung back and forth through resonance until the greatest gain (just before the preselector begins to oscillate) is had. It should be remembered that adjusting the antenna condenser affects slightly the settings of both the tuning and regeneration controls.

As the highest gain is had just before the 6F7 reaches the oscillation point, it is desirable that this oscillation can be secured on all frequencies. If oscillation can not be obtained, more turns should be put on the plate winding of the coil being used. Changing the number of turns on this plate winding will not affect the frequency range of the coil. Too great an antenna load will also prevent oscillation, and this can be reduced by putting a small condenser, such as one

[*Continued on page 419*]

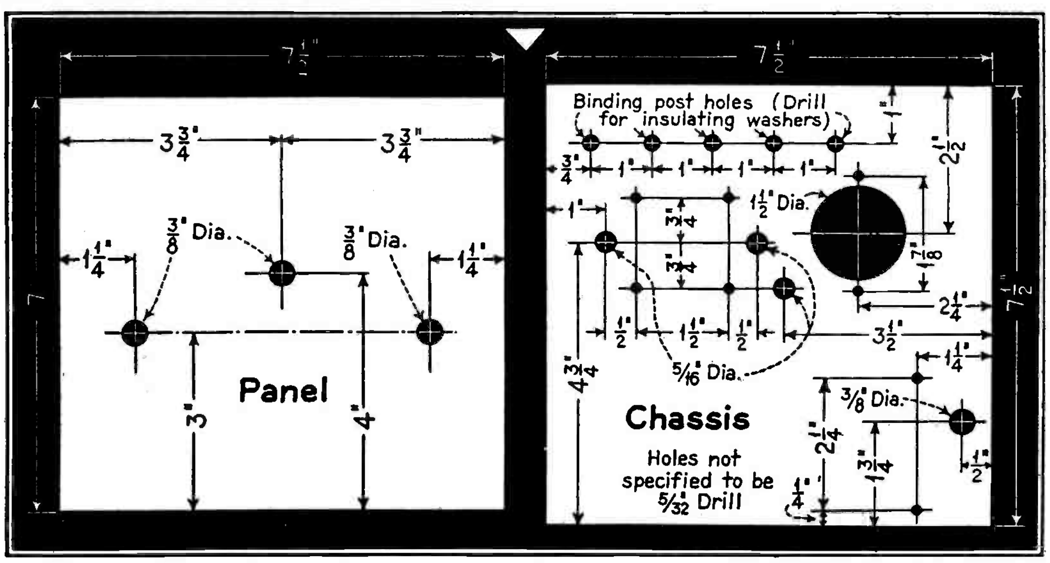


Complete circuit of the AWR Regenerative Preselector. Parts values are given in Legend.

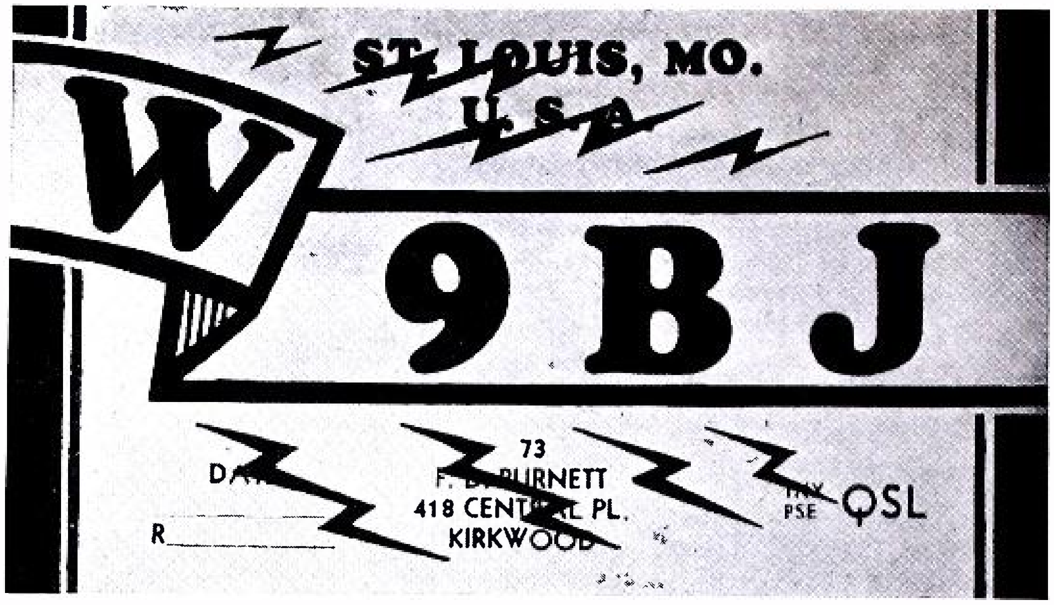
Coil Winding Data

Range in Meters	10 to 19	19 to 40	40 to 85	85 to 150
Grid Winding Number of Turns	$2\frac{3}{4}$	$6\frac{3}{4}$	$15\frac{3}{4}$	$39\frac{3}{4}$
Length of Winding	3/8"	1/2"	Close wound	Close wound
Wire Size	No. 24 DSC	No. 24 DSC	No. 24 DSC	No. 24 DSC
Plate Winding Number of Turns	$4\frac{1}{2}$	$6\frac{1}{2}$	$9\frac{1}{2}$	$20\frac{1}{2}$
Length of Winding	Close wound	Close wound	Close wound	Close wound
Wire Size	No. 24 DSC	No. 24 DSC	No. 24 DSC	No. 30 DSC
Note: - All grid and plate windings spaced 1/8"				

Above: Winding data on the Preselector coils.
Below: Details of Preselector panel and chassis.



THE HAM AND THE SWL



Typical amateur QSL card, often used as "wall paper."

Read What a Well Known Amateur Has To Say About Reception Reports

By Richard M. Purinton—W2ICU

THE practice of exchanging QSL cards must go back to the very early days of amateur radio. Then, as is sometimes the case now, there may have been a tendency to wonder if a QSO really did take place or if the whole performance was a dream. The arrival of a QSL card a few days later settled the question and proved that the amateur is not a dreamer—at least about QSO's.

The QSL card, while confirming a QSO, provides to the amateur a written confirmation of the information he writes into his log book. In addition, it may bring to him more detailed information than was given during the contact over the air. By far the greatest number of QSL cards pass between the operators of c-w stations. The card in this case brings to each amateur a better picture of his friend made in a contact over the air. In any case, it is a safe conclusion that the exchange of QSL cards between amateurs is productive of pleasure over and above the fun of the contact itself.

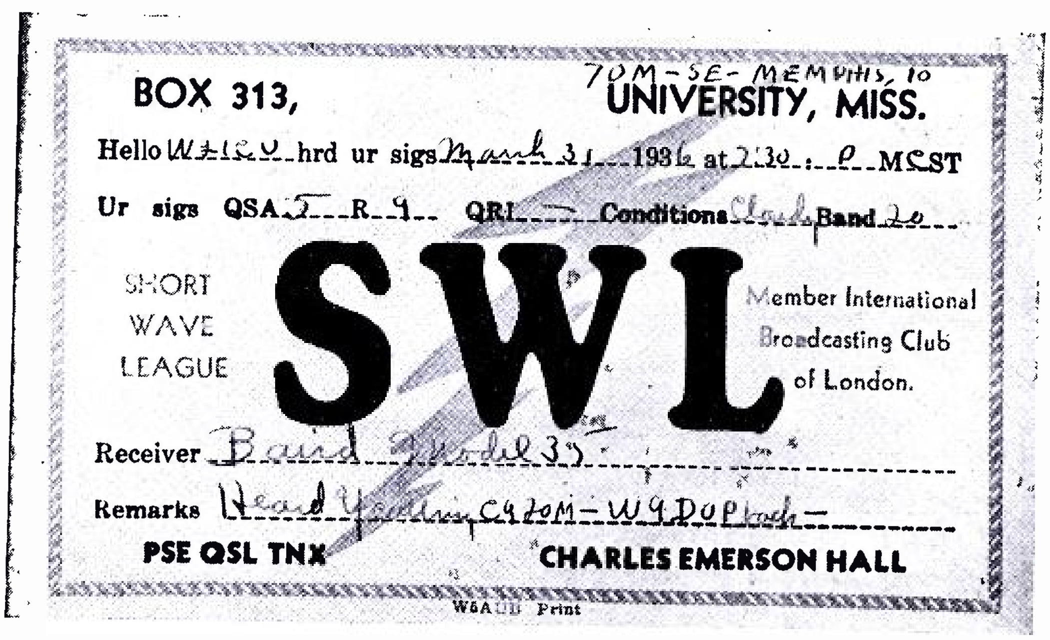
QSL Card Problem

In the last few years, the introduction of short-wave receivers or rather "all-wave" receivers for the broadcast listener has added a new element to the QSL card problem of every amateur. To speak of this new development as a problem is a reasonably accurate way to describe it. Anything costing money is likely to be a problem when it applies to a hobby whether that hobby happens to be amateur radio, photography or any other diversion.

A direct QSL card exchange between two amateurs provides certain definite, wanted information. A QSL card volunteered by a listener can provide as much, although there is an excellent chance that this will not be the case. While the listener may be in the "wall paper" stage, it is likely that the amateur is not. In the last few years, amateurs have had a sufficient number of DX contacts to provide cards from foreign countries for the wall decoration. Cards from amateurs within the country are filed carefully or are kept in a neat bundle at the front of a desk drawer where they are always accessible but never on display. To the amateur, then, the urge to display is a thing that is of passing interest unless the card represents real DX, or unless it comes from another amateur who is an old friend over the air. Unless the listener card is more than a request for "wall paper," it will seldom draw a QSL card in reply.

Before going farther, it may be well to point out that not every amateur on c-w or phone has QSL cards to mail. The cost of one or two hundred cards is very often balanced against the purchase of some piece of transmitting equipment which may be essential. The short-wave listener has only a receiver, which may stand unchanged for years. The amateur has a receiver, too, but his transmitter may be changed every few months to keep pace with new developments. The transmitter takes the "spare change" and sometimes there isn't enough left to satisfy a printer. In such a case, the finest kind of a short-wave listener report may not bring the

[*Continued on page 423*]



This sort of short-wave listener's card is of value to the amateur. Note that aside from a report on signals, the location of the town is given.

Channel Echoes

By Zeh Bouck

the brown bombardment . . . radio locations . . . anne boleyn's neck

BEYOND shadow of doubt, the cleanest, most inoffensive and palatable bit of radio advertising we have ever heard was on the occasion of the recent Schmeling-salts-Joe Louis brownbarding. It was a perfect exemplification of our fondest dreams, the epitome of what we have been writing and haranguing for in fifteen years of radio program criticism—a brief dignified courtesy line at the beginning of the program, and a credit at the end in equally concise good taste!

Those simple unassuming words will echo in our ears through a thousand plugs to come. At the beginning of the program—"Ladies and gentlemen—the Studebaker Corporation has postponed its program, the Studebaker Champions, usually heard at this hour, in order that we may bring you a blow-by-blow description of the Louis-Schmeling fight." And then something to the same effect after it was all over. Congratulations to Studebaker!

Unfortunately, cabbages, not orchids, must be tossed to Buick, the actual sponsor of the program. The publicity was of the rankest variety—on two counts. First, time was taken out for Buick to explain that there wasn't going to be much Buick publicity, because Buick wanted to bring the radio audience the fight, not Buick publicity, and therefore Buick would keep the Buick publicity short and sweet (!), and therefore there wouldn't be any Buick publicity to slow up the fight which was being brought to the radio audience by Buick. Second, throughout the melee, Clem McCarthy would interpolate something like this—"That was a lightning blow—like the lightning in Buick's pickup!"—or perhaps—"That was fast—very fast—but not as fast as Buick!" A member of our speaker-side audience groaned, "Phewick!"

As for the broadcast itself—shades of J. Andrew White! Edwin C. Hill succeeded marvelously in dispelling the illusion at the very beginning by jabbering non-consequentials while millions were straining their ears to pick up the words of the announcer in the ring. In radio parlance it was the most nonsensical bit of QRM we have ever heard. Clem McCarthy, in his blow-by-blow description spent so much time in correcting his statements as to who hit whom that few were certain who was knocked out in that memorable twelfth round until they read the morning papers.

Why doesn't some wise sponsor bring back to the ringside J. Andrew White—Andy, first and among the best fistianannouncers? Or Graham McNamee? As Mac himself might tell you, we have never been what is called a McNamee fan. But Mac is aces at the ring—better by far than any sports announcer recruited from the press box!

To sum it all up, a friend remarked as we were mixing the last highball of the evening—"It was a damn good fight. I'm going to sell my Buick and buy a Studebaker."

◆

IT IS JUST about this time of year that thousands of migratory citizens are looking forward to the first of October as moving day. Tentative excursions are made to preferred locations—occasionally a deposit is placed down.

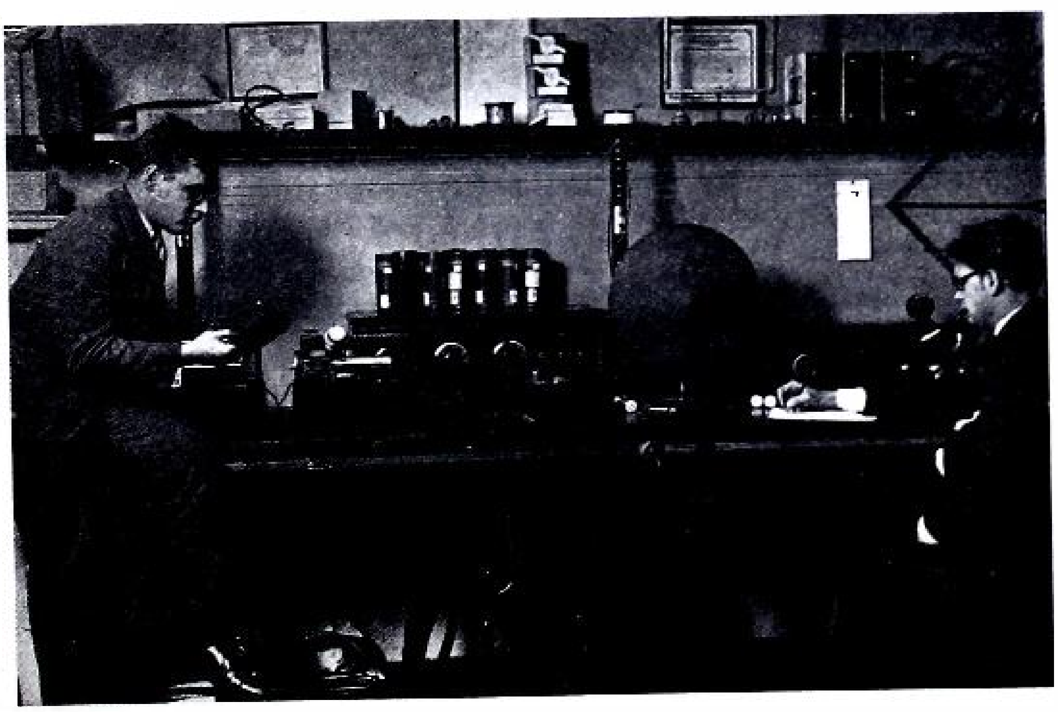
A few years back it was pretty much a matter of finding a home comfortably located and convenient to schools, railroad stations, subway, church or speakeasy. Today, for the serious radio fan which includes practically all readers of ALL-WAVE RADIO, the matter of a good radio location must receive considerable thought. Aside from the consideration of noise, location has more to do with good reception than any other factors, including the excellence of the set, type and length of antenna, etc. (Always within reason, of course.) The difference of a few miles—in some instances, only a thousand feet or so—will make all the difference between phenomenal and mediocre reception.

When cruising about, an automobile radio will often provide a fairly good determination of receiving conditions in general. Of course, broadcast-wave reception cannot be used consistently as a criterion for short-wave results. There are locations where long-wave reception is excellent and the high-frequency fields way down and distorted. Also, vice versa.

The fan to whom all-wave reception is a major hobby should make at least

[*Continued on page 420*]

BEGINNING OF A BEAUTIFUL ECLIPSE



"Barb" and "Ernest"—

THEY CRACK

MRS. ROWLAND AT CODE PRACTICE

Says Ernest

Dear Gerald:

We got your past letter, the boss and I, and I appreciate your explanation of the analyses of electricity for the boss's sake. It was, of course, rather fundamental to me, having passed my alternating current in technical school a good many years ago with pretty high marks. When it comes to 60-cycle stuff I claims to know it pretty well, as I'm messing around with it daily. But brother, when you get talking about high frequencies and their actions, then I'm over my head plenty.

Take, for example, the reading of the Handbook, which you suggested. The first two chapters were swell, and repeated what you and Mr. Candler and Mr. Miller have been saying right along. But Chapter 3 on Fundamental Electrical Principles busts right out with a picture (Fig. 302) showing "Conduction by Thermionic Emission of Electrons in a Vacuum Tube." So right away I'm stopped. When it comes to a wire circuit I'm not so dumb, but electrons mean very little to this man's son.

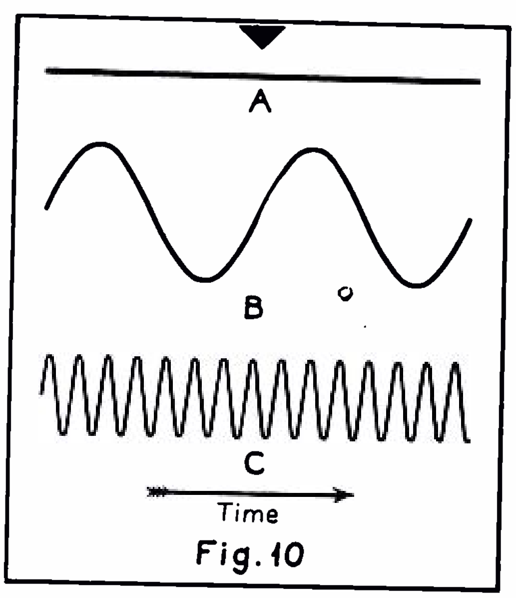
So then I turn to the questions and answers in the A.R.R.L. License Manual. I've gone over the first 17 questions in this book rather carefully, and I don't question that I'd be able to pass an examination on these all right, though I must admit that I don't know how a filter is made, and I think I should know it if I'm going to be able to pass an examination.

However, I'd hate right now to have to take an examination on frequency measurements, or transmitter theory and practice. The terms used are way over my head, and as far as I can see the Manual doesn't define terms so that an absolute "amateur" like myself can understand them. If I were going to school where I had more time to study these terms it would be easy, but I have to do my studying at odd times at night and I don't get very far. And poor Barb, who knows absolutely nothing about electricity is going to have a swell time when it comes to "High Q", "Impedance" and a lot of terms that won't mean a thing to her. Take, for example, the simple term "Push-pull". I've read this for years and it still means nothing to me.

As to code, we're getting along as well as can be expected. Mr. Miller paid us a visit, and we are very much encouraged by his remarks on our code-copying ability.

I'm going to let Barb tell you her tale of woe now. I wish you could hear her remarks as she tries to wade through the technical end. It would be swell reading, but I'm afraid the government would take your book off the stands!

Ernest



A, direct current; B, low-frequency oscillation; C, high-frequency oscillation.

Says Barb

Dear Gerald:

Ernest has just told me that I should write you and tell you what I know about the technical end of radio. That's easy. I know that I don't know anything and I wonder if I ever will know anything.

I'm doing pretty well at the code, if I do say so myself. Mr. Miller thinks so, too. I'm not so hot taking it off the tape but when Ernest transmits I get it pretty fast. But I can't get it on the radio. Ernest tells me that that is due to the small band spread on our set, which causes interference, or should I say QRM?

But to get back to the technical end. Honest to goodness, Gerald, I'm just so dumb that I don't suppose I'll ever learn. Your explanation of the difference between a.c. and d.c. helped a whole lot, and I think I get what it's all about, but if I must tell you the honest truth I still don't know what makes the wheels go round.

I went over a few questions in the first part of the examination for Class B and C licenses, and while I could memorize them, right now I still don't know even the barest terms. After your explanation I know the difference between a.c. and d.c but the terms which they use have me stumped.

Take question number one alone. I'm just going to give you a list of what I don't know even after I read it. 1. Plate Power Supply. 2. Filtered Direct Current. 3. Frequency Modulation. (Hurray, I know what "Broad Signals" means). 4. Oscillator.

I think maybe I could understand question 2 after a while. Question 3 doesn't seem so hard. Question 4, I give up entirely. What is a filter? I guess I haven't got sense enough to find it in the Handbook. Question 5 the same. I know about ripples in a stream of water, but these ripples are different.

Have I asked enough to show my absolute ignorance or shall I go further? I'm afraid I'm going to be forever dumb but you've told me you could help me learn, so I lay the job at your doorstep

Embryo Radio Hams

THE CODE

in a big way. I envy the OM's technical knowledge. Maybe I'd better take the code examination and let him take the technical side!

I'm hoping you'll be able to help me, but I doubt it. We just got a letter from Mr. Candler who says he's sending us a copy of The Beginner's Story of Radio, and maybe this will help me. Both Mr. Candler and Mr. Miller have been more than kind to us, and they certainly help us a great deal.

Barb

Says Gerald

Dear Barb and Ernest:

You two are like a young medical student slowly going mad trying to memorize the Latin terms used to cloak human ailments in a veil of mystery. Well, be mystified if you want, but don't let the terms used in radio get you down. They're not as tough as you might suppose, and many of them, such as *resistance* and *impedance,* carry the same definitions when applied to radio as they do in their more common applications.

Now that you are spending more time with the technical aspects of radio, you will naturally run into many words entirely new to you—words that you will become well acquainted with as time passes—but do not make the mistake of assuming that such words as *resistance* and *impedance* have different meanings when applied to radio.

And another thing—Question No. 1 in the License Manual is not necessarily an easy one because it is the first. The ability to answer any or all of the questions in this book is predicated upon a complete understanding of radio fundamentals. Therefore it is quite useless to attempt to comprehend the questions before you have become well grounded in radio fundamentals, as you have in the code. By the same token, there is no reason why you should know what an oscillator or a filter is before you have run into them in your studies.

What's a Filter?

And, by the way, Barb, the filter that has you worried does just what the word implies, and the ripples it filters out *are* quite similar to the ripples, in, say, a brook. Though this is getting ahead of the game somewhat, suppose you were handed the problem of smoothing out the ripples in a brook because their noise disturbed a hypochondriac living nearby. One way you could do this would be by feeding the water of the brook into a large tank, where it would be stilled, and then feeding it out the bottom of the tank minus the ripples.

The voltage from the power line in a house has ripples in it, and if we don't smooth out these ripples they will impress themselves on the radio wave and become audible at the receiving end. So, we filter them out. And, to do this we use, well, of course, a filter, which is composed of one or more "chokes" and "condensers." Both chokes and condensers have the ability of momentarily storing up electrical energy, and at certain intervals releasing this energy. So, in this respect, they play much the same role as the hypothetical tank you purposely built into the brook to still the water ripples. Or did you?

MR. ROWLAND AT DOT DASH DITTO

That, as you may guess, is only a part of the story, but it is enough to give you at least a partial idea as to what an electrical filter is and what it does. There are other types of filters, too—selective filters that will pass currents of only certain frequencies. We'll be around to these things soon.

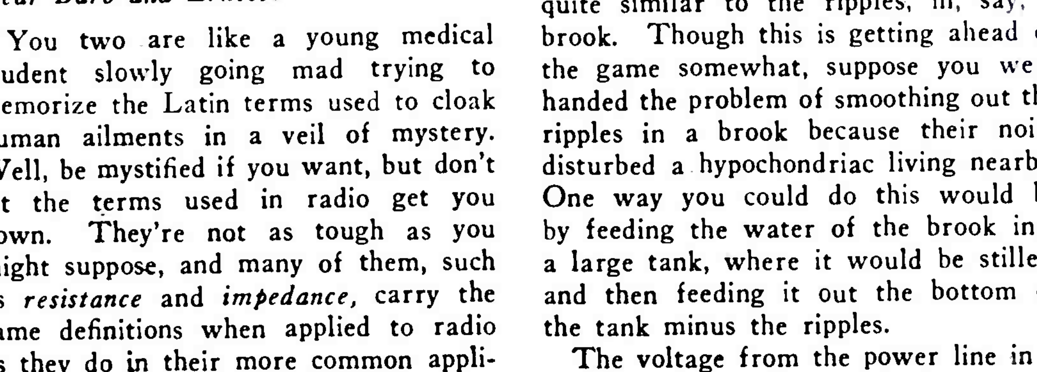
I had intended covering radio frequencies in this letter, but since the days are so hot, and the two of you are off for a vacation, I'm not going to get too deep into this subject. Just the groundwork . . . so, here goes—

Frequency, Radio and Audio

In my last letter I explained the difference between a direct and an alternating current, and pointed out that the former is a current flowing continuously in one direction only, whereas the latter reverses its flow periodically. I am sure you have found it obvious that there is quite a difference between the two. However, the difference between the common variety of 60-cycle alternating current used in most homes, and a radio-frequency current, is but a matter of degree.

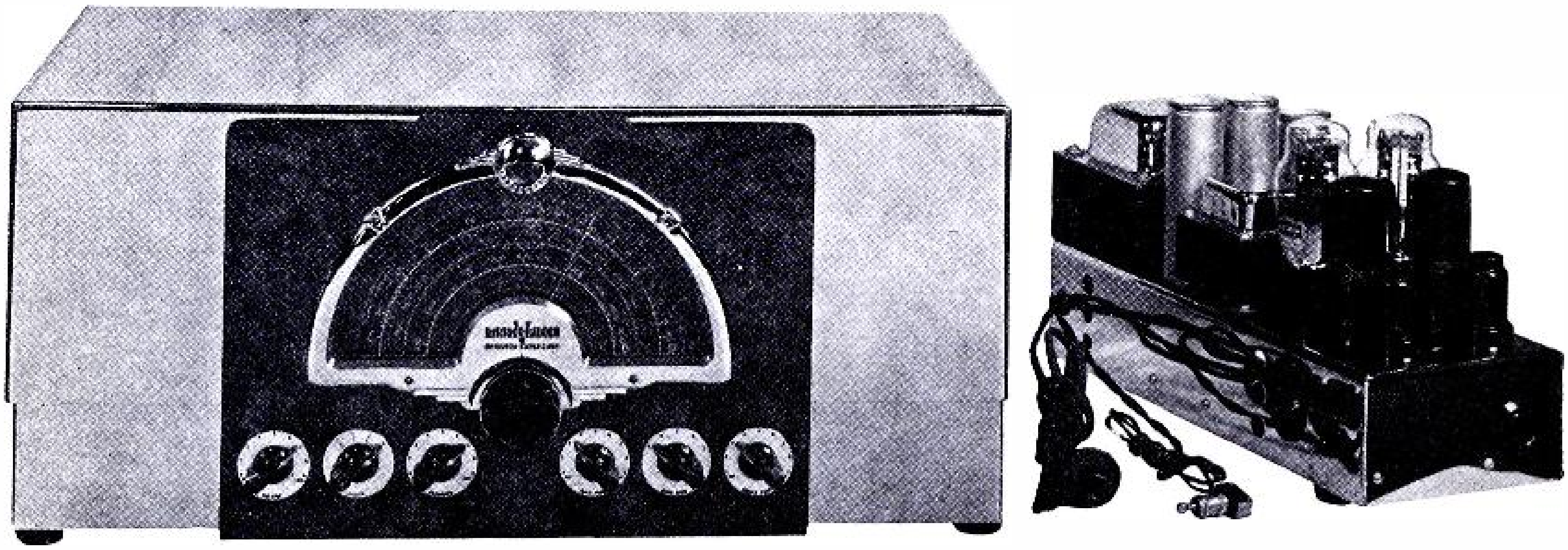
Let's review the whole matter by drawing pictures. In Fig. 10 I have shown a pure direct current at A and an alternating current at B. At C, I have shown what may well be a radio-frequency current—I am asking you to believe that it is—and you will note that

[*Continued on page 417*]



The frequency spectrum employed in radio communication.

THE SILVER



The new Silver Masterpiece V receiver with combined power supply and beam-power audio amplifier.

A 20-Tube High-Fidelity Receiver With Range of 140 to 70,000 K. C.

IT is an impossibility to fully describe in a short article a new all-wave receiver which introduces an unusually large number of new engineering developments. What follows is therefore only the briefest sort of "high-spotting" of the new 20 tube Masterpiece V. The photos indicate that it consists of the 14-tube completely shielded tuner, the six-tube electron beam-power amplifier and power supply and the new 18-inch 68 lb. Super-Giant speaker, seven times more efficient and sensitive than existing speakers.

4 to 2140 Meters

The five tuning ranges of the Masterpiece V are accurately calibrated on the 9 inch dial, and are 140 to 430 kc for long waves and Europe, and 535 to 70,000 kilocycles without a gap. This is 2140 to 700 and 560 to 4.287 meters, which covers every broadcast service on the air from long-wave Europeans down to below the 5-meter amateur band, and includes the rapidly developing ultra-high-frequency "apex" bands of 26 and 31 to 40 megacycles. The new "lance" dial makes tuning surprisingly easy for it sensibly enlarges tuning scale size for successive short-wave bands, the 49 to 16-meter dial band 7 inches in diameter and the 16 to 4.3-meter dial being 8 inches in diameter.

The dial is so large that it is "spread-band" in that it can be read to 10 kc even at 25 meters. This accurate reading is made possible by the "lance" pointer, a knife edge that effectively eliminates the parallax reading error of ordinary flat pointers spaced appreciably away from the dial scale itself.

Separate band-spread tuning is no longer necessary, so close can the dial be read. For the confirmed DXer it is nevertheless provided by a new micrometer dial behind the tuning knob, upon which main dial station spread and separation is amplified ten times for precise reading. This method of band-spreading eliminates the old confusion of a second whirling pointer on the main dial to distract attention. Accurately relogging of the band-spread dial is assured through a new single positively meshed gear link between tuning condenser and automatic two-speed dial shafts.

Two tuning speeds are provided through the single tuning knob, a fine 50:1 ratio for one knob turn (in either direction) which then automatically shifts to 10:1 fast or broadcast-band ratio. Accurate tuning is made easy, and mandatory, by this "free wheeling" dial, and the "Magic Eye" on the dial, calibrated to measure signal strength, fading and over-modulation of stations as weak as 1 microvolt.

Radio-Frequency Stages

The two stages of air-tuned radio-frequency amplification pioneered in all-wave broadcast receivers by the Masterpiece IV are retained in the new set. These are in circuit on four bands, from 140 kilocycles to 19 megacycles, and account for the complete absence of "repeat points" on short waves, and the phenomenally low inherent circuit noise. These two stages of t.r.f. introduce some new and unique methods of noise compensation and need a story in themselves, for they completely eliminate usual oscillator-first-detector noise of conventional radios and set the limit of inherent noise down at that low level of free electron agitation in the antenna r-f transformer only! Inherent noise is not over 15 milliwatts at maximum sensitivity or from 10 to 100 times less than that of even approximately equally sensitive receivers using only one r-f stage, in which usual oscillator-detector noise swamps very weak signals.

From 140 to 19,000 kc, sensitivity is set at one-half microvolt absolute or greater, as desired, and is actually greater than 2/10 microvolts absolute, due to the seven times greater Super-Giant speaker efficiency. Circuit and tube noise are substantially zero at sensitivities of 5.0 microvolts or greater.

Automatic Sensitivity Control

Automatic regulation of sensitivity is had by the new automatic sensitivity control (called for simplicity A.V.C.) and by a sensitivity switch on the expander knob which drops sensitivity 20 db, or down to 5 microvolts at will, for local reception. This new A.V.C. system uses two tubes, a tuned A.V.C. amplifier and a rectifier and through its circuit position and constants gives the final perfection of A.V.C. (A.S.C.) that has heretofore been only a theoretical concept. It holds all signals above 20 microvolts at the same apparent ear volume, and has the theoretically perfect sharp "knee" at the leveling-off point.

MASTERPIECE V

By McMurdo Silver

Chief Engineer, McMurdo Silver Corp.

No longer is selectivity the conventional V-shaped side-band cutting curve, but at last the long sought U-shaped true band-pass ideal of every engineer. The fidelity knob gives initial choices of 18 kc or 8 kc band-pass selectivity (corresponding to 9000-cycle high fidelity and 4000-cycle sharp DX-getting audio modulation bands.) This true band-pass selectivity eliminates not only quality-impairing side-band cutting, but coupled with non-microphonic tuning and trimmer condensers and wiring, plus unusually thorough cushioning, completely eliminates that ever-present short-wave bugaboo, microphonic howling.

Continuous variability of the two initial selectivity choices is effected by the treble tone control, and by the new high-fidelity filter, to give anything from 2 to 18 kc selectivity at the will of the user. Through the fidelity knob, a choice of three 465-kc dual air-tuned (all r-f and i-f trimmers are hermetically sealed non-microphonic air dielectric condensers) i-f amplifier stages for extreme dx, or one stage for local high-fidelity reception.

The unusual diode second detector is operated at the very low level of 1.0 to 1.5 volts, thus decreasing second-detector distortion and preventing the possible overloading of customary high-level diode detectors. The triode portion of this 6Q7 tube is the best oscillator, unique in that it operates at its second harmonic to completely eliminate spurious "tweets" not indicating actual stations.

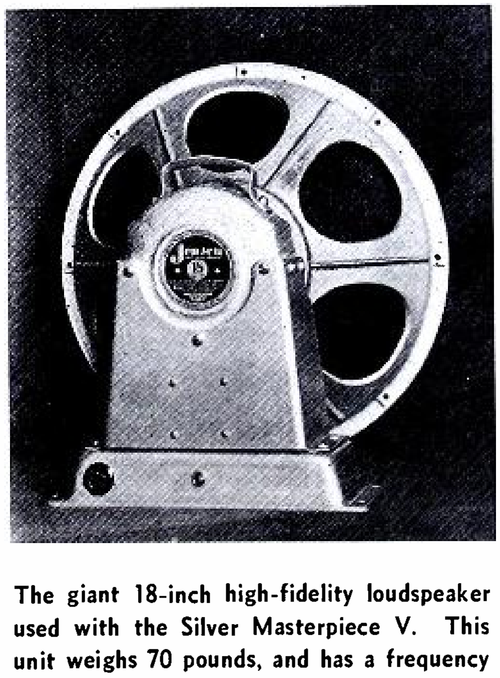
Beam-Power Amplifier

The totally new three-stage audio amplifier follows the second detector with the first built-in electronic volume expander radio has yet seen and the first use of the new 6L6 electron beam-power tubes which have long been awaited. The volume expander knob first drops average volume 20 db, and then adds it back into reproduction by expansion or the loudening to original naturalness of studio-compressed music. It is impossible to describe the effect on the listener of this expansion, so new and thrilling are its effects on music. The writer recalls in July, 1935, being one of over 100 engineers at the I.R.E. Convention demonstration of the first expanders. Being hard boiled we came to scoff—and remained to shout and stomp with enthusiasm when we heard it. Since that first revelation, expander adaptors have been made which do a fair job but it has taken a year to design and perfect the built-in expander which alone can give the full benefit of perfect expansion. This is because the expander cannot be satisfactorily "jacked into" an ordinary audio amplifier, for its problems necessitate thorough and complete design of a new audio amplifier with properly matched and adapted volume expander built right into it—if full expander performance is to be had.

Resistance coupling is used throughout the audio amplifier to eliminate the last traces of the hysteretic distortion of audio transformers. This has hardly been worth while previously since this was only a small portion of total unavoidable distortion. Today it is fully worth while, for the new 6L6 electron beam-power tubes practically completely eliminate the unavoidable distortion of all previous tubes. Total distortion of all types is only 2% at full 32-watt output, while at ordinary home play levels of one to five watts, it is so low as to be practically unmeasureable.

Tone Controls

Tone of really unimaginable purity is the net result of all this—tone so clear that the last small trace of scratch and "marbles" of previous fine amplifiers is completely eliminated. This tone is controllable, (in addition to automatic aural tone compensation) to be anything desired. By two tone knobs it can be set "flat" from 20 to 9000 cycles, or its treble range can be boosted 10 db to make up for treble tone absorption in particular rooms, or smoothly cut down so there are no treble tones left above 1500 cycles. Bass can similarly be cut completely out for noise reduction in DXing, or it can be boosted a total of 18 db to the point where deep organ notes actually cause walls to shake. This new and complete control of tone makes the tone of the Masterpiece V instantaneously anything desired at the will of the user—all things to all men.



The giant 18-inch high-fidelity loudspeaker used with the Silver Masterpiece V. This unit weighs 70 pounds, and has a frequency range from 20 to 9000 cycles.

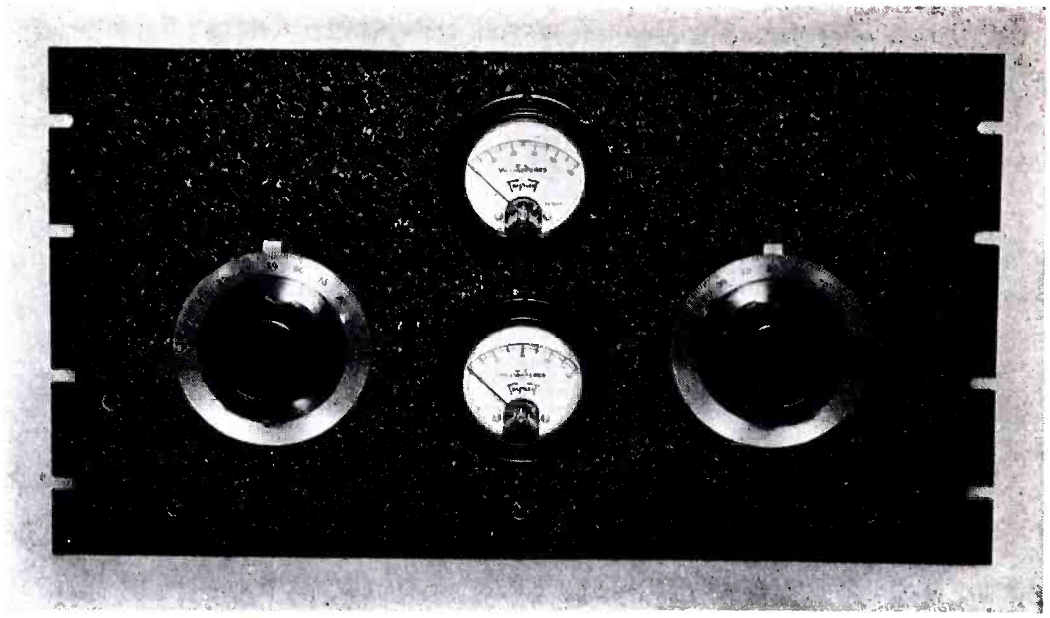
Conservative operation of the push-pull 6L6's dictates an undistorted power output of 30 to 32 watts. Intelligent design says that to put 30 watts into any ordinary loudspeaker of 5% efficiency is to get only 1.5 acoustic or sound watts —obvious inefficiency. So for the Masterpiece V a totally new speaker was developed of 35% efficiency. Compared with any other radio its seven times great efficiency results in this 30 watts equaling 210 watts fed to any ordinary radio set loudspeaker! This more than takes care of crescendos in music and does it without the least trace of blasting or distortion.

New Type Speaker

The new Super-Giant speaker is both a bass and "tweeter" speaker in one unit. It is the first loudspeaker to cover the range of 20 (note the 1 to 2 bass octaves added) to 9000 cycles. It does this by virtue of a new dual cone invention of Major Glen. The inner cone is stiff and small for "tweeter" operation, while the outer 16-inch cone is large and relatively softer, as it should be for bass tone.

As this 9000-cycle range is higher than is needed for 6000-cycle chain network programs or for any but the very best studio originated programs, a three-section "high-fidelity" filter in the speaker is cut in or out by a switch on the speaker base. This at last permits clearing up of distortion due to prevalent station overmodulation (indicated by "Magic Eye" flicker) and the elimination of noise during the 90% of listening time that only 6000-cycle chain program tone range is needed.

The AWR 2-3 FINAL AMPLIFIER

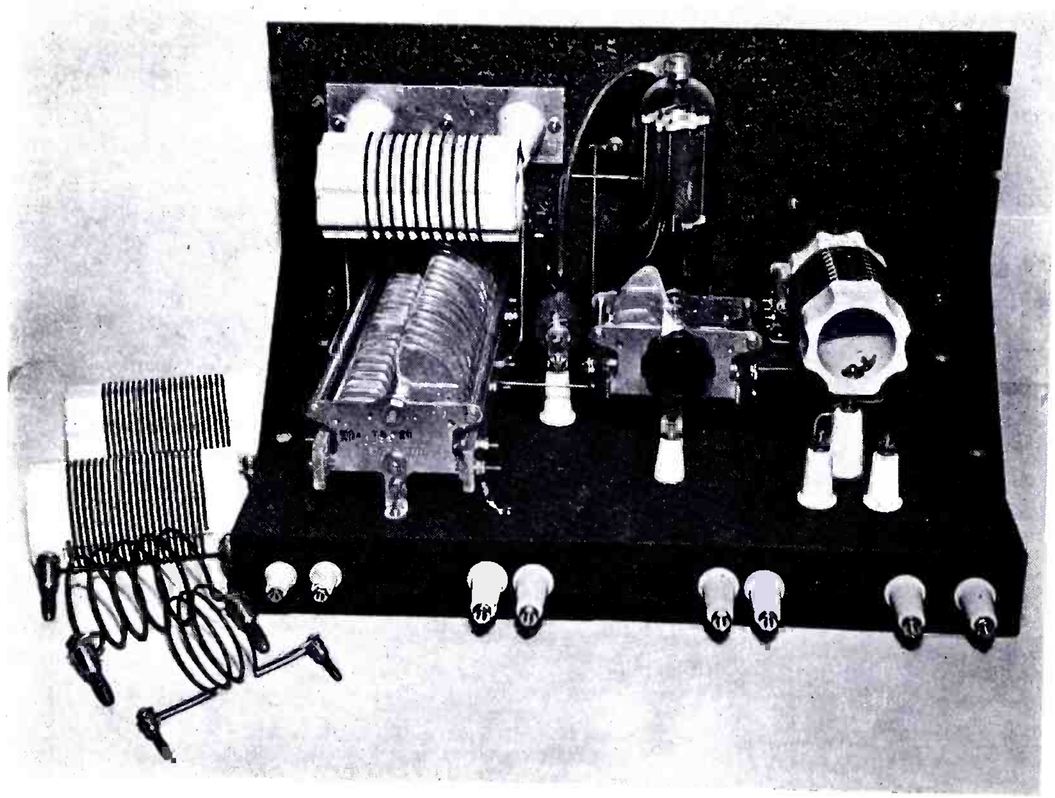


Panel view of the completed Final Amplifier.

By Willard Bohlen, W2CPA, and Chester Watzel, W2AIF

THE design of a high-power amplifier for the AWR 2-3 Transmitter is not the simple task it may seem at first thought. There are many factors which must be taken into account and balanced one against the other before the design is completed. But the design is only half of the job. The other half involves making the amplifier work in the manner originally intended.

The several factors involved are the tube type to be used, amount of excitation available, voltage and current rating of the power supply, and the frequencies the stage is to be used on. The advantages of push-pull over single-ended, and vice-versa, as well as whether or not the stage is to be modulated, must also be taken into account. The transmitter was originally designed to produce a fone carrier of 90 or 100 watts from the final stage, but it was discovered that a few dollars extra would increase the fone power to 140 or 150 watts, so that the latter design was chosen.



Chassis view of the completed Final Amplifier using a type 805 tube.

Type 805 Used

A single-ended amplifier, rather than push-pull, was decided on for the sake of simplicity. In order to avoid high potentials of 2000 volts or over, and the attendant increased expense, plate potentials of the order of 1000 volts or so were thought to offer the most desirable compromise. The supply used gives 1200 volts at a maximum current rating of 400 ma continuous. The available excitation is that from the AWR 2-3 Transmitter Unit, which has an output of up to 25 watts.

These conditions dictated the use of a tube which will take an input, for fone work, of at least 1200 volts at 175 ma. The tube must furthermore be capable of working on 10 meters with a reasonable output power. Such a tube is the new RCA type 805. Others of a higher power rating that could be used are the Amperex HF-200, the Eimac 150T, or the Taylor 814, 122, T-200 or T-155. These will all fit the standard 50-watt type socket provided, although the larger size and different filament voltage of several of these types will make necessary moving the socket further to the rear and using a different filament transformer. The 814 or 822 may be used without further changes instead of the 805, if desired.

In order to prevent capacity loading of the RK-25 tube, which in this case is employed as the driver stage, link coupling is used. Capacity coupling on 10 meters is difficult or impossible to get working properly, if maximum grid drive to the 805 is desired. The grid input circuit is tuned by the left-hand dial on the amplifier panel, the other dial tuning the plate tank. This plate tank is of the split stator type, which gives best results in a single-ended amplifier circuit.

Two milliammeters are used, the top one being the plate meter and the bottom the grid meter. As in the RK-25 exciter unit, these meters are kept at ground

LEGEND

RCA

1—Type 805 transmitting tube

BIRNBACH

6—Type 396 giant plugs
6—Type 401 small plugs
11—Type 4125 feed-thru insulators
2—Type 458 feed-thru insulators
1—Type 430 feed-thru insulators
2—Type 432J jack type Steatite stand-off insulators
2—Type 433J jack type Steatite stand-off insulators

NATIONAL

1—Type XM50 tube socket

HAMMARLUND

1—Type CH500 heavy-duty transmitting r-f choke (RFC1)
1—Type CHX r-f choke (RFC)

CARDWELL

1—Type XC-75-XD split-stator tuning condenser (C7)
1—Type MT-50-GS tuning condenser (C)
1—Type NA-14-NS neutralizing condenser (C5)

WARD LEONARD

1—3000-ohm, 50-watt resistor (R)
1—100-ohm center-tapped filament resistor (R1)

CORNELL-DUBILIER

1—Type 9-25D2 mica condenser .002 mfd, 2500 v. working (C6)
2—Type 9-12D2 mica condenser .002 mfd, 1200 v. working (C1, C2)
2—Type 9-6D2 mica condenser .002 mfd, 600 v. working C3, C4)

TRIPLETT

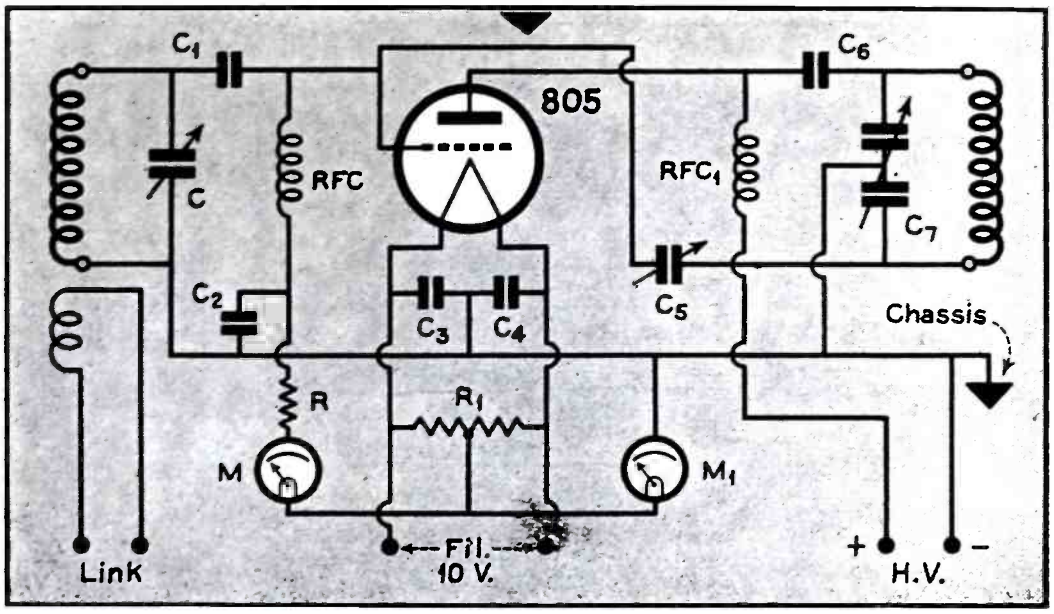
1—Type 321 d-c milliammeter 0-150 ma (M)
1—Type 321 d-c milliammeter 0-300 ma (M1)

GENERAL RADIO

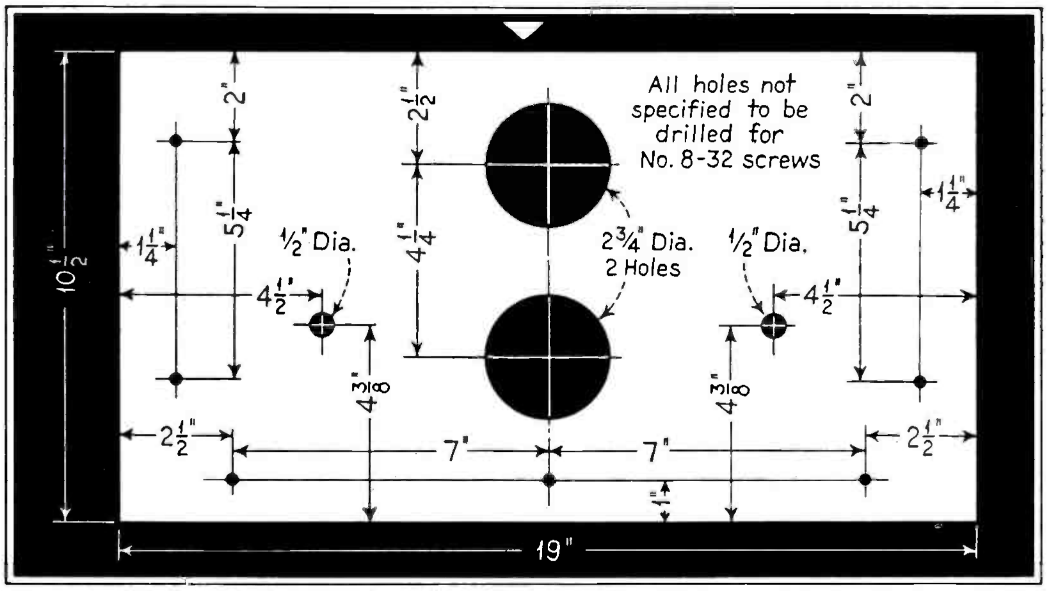
2—Type 717A dials, 4"
6—Type 677U coil forms

LEEDS

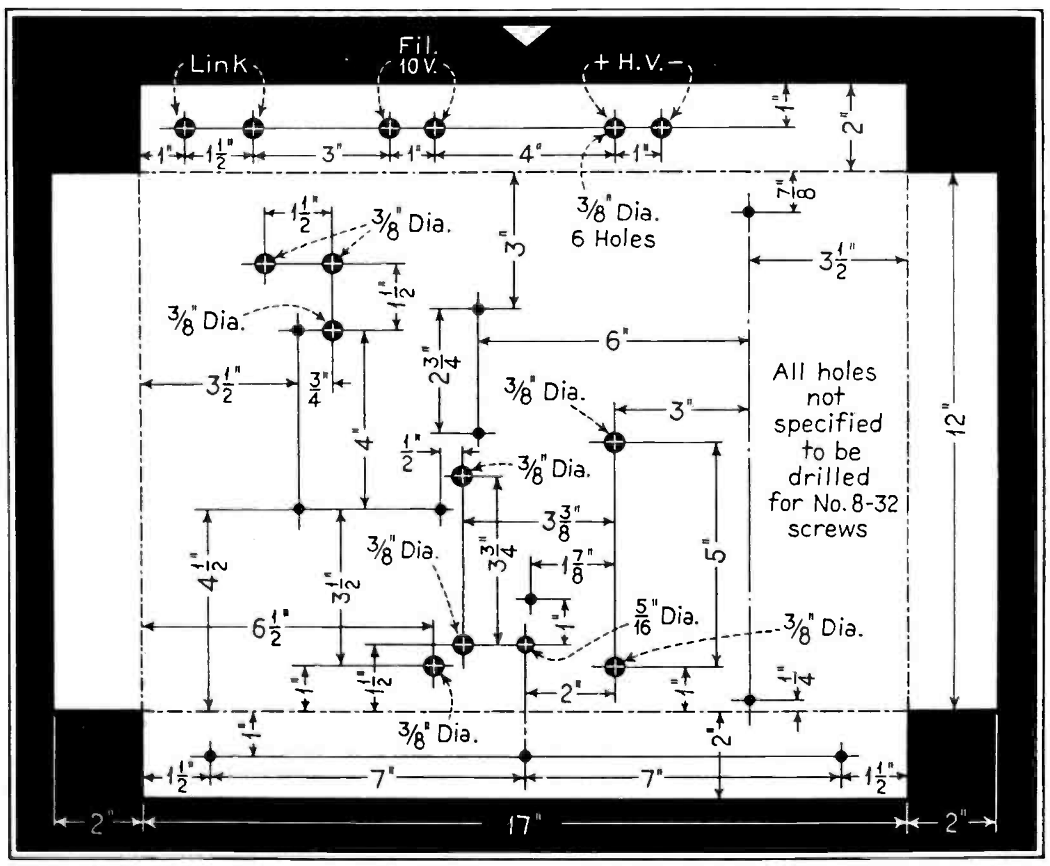
1—17" x 12" x 2" black crackle finish chassis
1—8¾" x 19" black crackle finish aluminum panel
1—pair 7½" x 9½" black crackle finish brackets

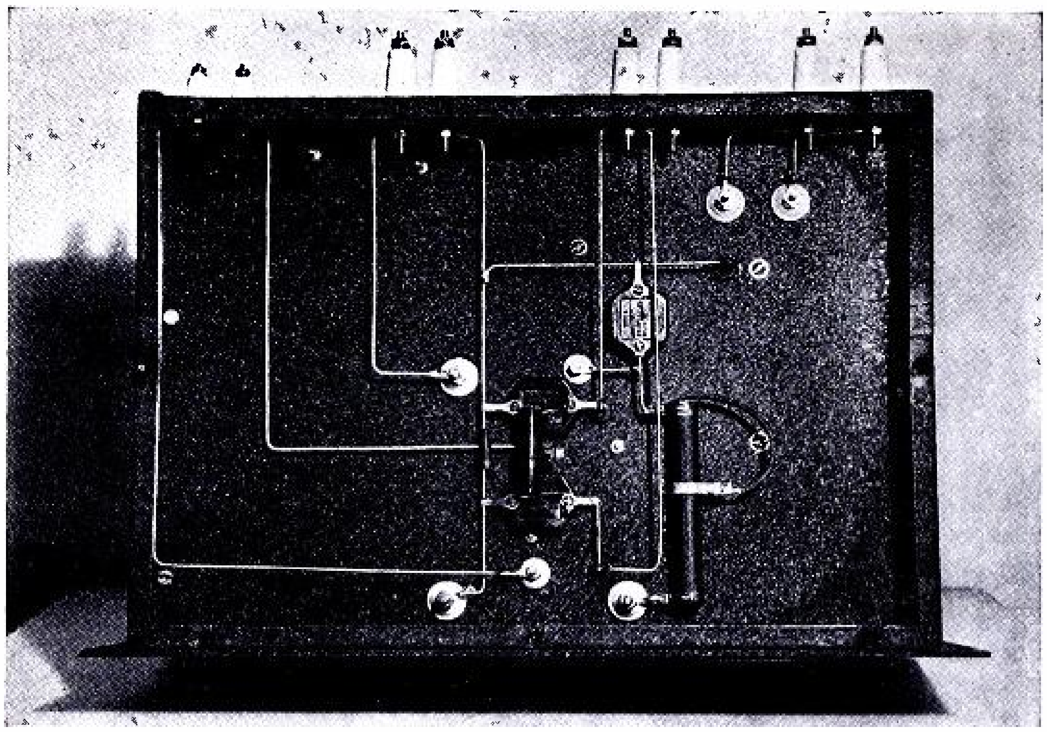


The schematic diagram of the Final Amplifier for the AWR 2-3 Transmitter. Note that link coupling is employed. The values of the parts are given in the Legend on this page.



Above: Details of the front panel for the Final Amplifier. Below: The chassis details. All necessary dimensions and construction data for both the panel and chassis are given.





Under-chassis view of Final Amplifier.

potential so that there is no possibility of either the meters breaking down to the panel or of the operator getting a kick when he touches them. By hooking the meters in as shown in the circuit, the grid meter will read only grid current and the plate meter only plate current.

The feedthru insulators on the back edge of the chassis are so placed that they will line up perfectly in position with corresponding posts on the other units of the transmitter. These units have all been mounted in a standard 6-foot rack and the connections on the back edges of all units have been laid out so as to match up. The final article on this transmitter will show the interconnections in detail.

Placement and Wiring

It is extremely important that this unit be copied as closely as possible in parts values used, placement of parts, and wiring. After the amplifier was completed it took two days of experimenting with parts values and wiring changes before the amplifier perked right. For instance, changing the grid blocking condenser, which has a value of .0001 mfd, to a larger capacity, will load the grid circuit so that the specified coils will not hit the bands. Changing this condenser from the original value of .00025 mfd to the present value of .0001 mfd, and moving the grid choke from below the chassis to its present position permitted the use of an 8-turn grid coil on 20 meters instead of a 6-turn coil.

The 20- and 40-meter coils are wound on General Radio forms. The 40-meter coils fill all notches on the coil forms, while the turns of the 20-meter coils are spaced every other notch. For 10 meters the coils are air-wound, since the comparatively large diameter of the G.R. coil forms do not permit of a sufficiently small variation in coil inductance for 10-meter work. The 10-meter coils are small enough to be self supporting.

The link coils for both the RK-25 plate coils and the 805 grid coils should have 2 turns each, wound in the same direction as the corresponding coils they couple to. In operation they should be bent back and forth, nearer and further from the other coils until the RK-25 is loaded to approximately 100 ma on its meter and the grid current on the 805 is 25 to 40 ma.

Tuning Up

In tuning up, the plate voltage should be turned off the final stage and the grid tank tuned for maximum grid current on the 805. The plate tank should then be tuned to resonance. If the stage is not neutralized a small neon bulb will show a glow when touched to the tube plate cap. The neutralizing condenser should be adjusted for minimum glow. This process should be repeated several times, tuning first the grid tank, the plate tank, and then the neutralizing condenser until, the neon bulb shows minimum glow or goes out altogether.

The nominal rated output of the 805 at 1250 plate volts is 170 watts. As the voltage from the power supply is somewhat higher than this at the 200-ma current used for c-w operation, the output will be in the neighborhood of 200 watts for this class of operation. For c-w work the plate current should never exceed the rated maximum value of 210 ma.

Antenna Coupling

No antenna coupling arrangement is shown on this amplifier. This is taken care of by the antenna tuning panel, to be described later. The antenna panel mounts above the amplifier in the rack and has a coupling coil which will be in a position over the amplifier tank coil. A simple arrangement will permit the antenna coupling coil to swing up and down, varying the distance between the two coils by several inches.

AMATEUR TELEVISION?

[*Continued from page 373*]

sketches and the printed word. This is something the amateur should be able to do without getting in over his head technically and financially for the reason that such transmissions do not call for the rigid requirements of the pick-up, transmission, and reception of scenes, pictures, etc., involving light shadings.

The transmission and reception of material involving only lines can be resolved into a comparatively simple procedure, and who is there to doubt that the technically-minded amateur wouldn't work out his own simple systems of visual communication? At least, such a system of visual communication is reasonably well within the capabilities of amateur radio. True television would follow as a natural course.

Who will be the first amateur to fire the opening shot by transmitting simple block letters to a fellow ham across the railroad tracks? Whoever he may be, his name will go down in the history of amateur radio.

Coil Winding Data

Band	10 Meters	20 Meters	40 Meters
GRID COILS			
Spacing between turns	5/16"	2 Notches	1 Notch
Coil diameter	2"	2½"	2½"
Number of turns	3	8	17
Coil form used	Air wound, no form	General Radio No. 677U	General Radio No. 677U
PLATE COILS			
Spacing between turns	½"	2 Notches	1 Notch
Coil diameter	2"	2½"	2½"
Number of turns	5	10	22
Coil form used	Air wound, no form	General Radio No. 677U	General Radio No. 677U

Night-Owl Hoots

By Ray La Rocque

dx season approaches . . . europeans on up side . . . post-card reporters . . . annual cdxr convention . . . new stations

IT won't be long now! Though the little red strip of mercury may still be threatening to fly out through the top of your thermometer, less than a month actually remains before the new DX season is ushered in. The Chief Night Owl sincerely wishes for a better break from Old Man Static during the season to come, and no doubt there are thousands of DXers throughout the country who also look forward to the coming of a new season with a great deal of hope that reception conditions will show some improvement over the season of 1935-36. If the summer reception of the Argentines is any criterion, the season should prove to be a very fruitful one for everybody.

Europeans next year ought to be as easy as the proverbial pie for most DXers, because of a very decided trend toward super-power broadcasting. France, especially, is planning increases in power to practically all of its stations, and in every case except one or two the increase will be to a power greater than 100 kilowatts. Germany, Italy, Great Britain, and Holland also will have stations of 100 kilowatts or over. All of these power increases will take place within the next month or two, so that the stations should be hurling fairly strong signals across the Big Pond by midwinter when trans-Atlantic reception reaches its peak. SOoooo, Night Owls, stick a couple of extra pages into your log for the TA's next season.

Post-Card Reporters

One of the real evils of the DX hobby is the "chiseling" DXer who expects to receive a verification from a station after sending the station a mere post card report with no return postage. In the first place a post card report very seldom contains enough information to be of use to the station, and secondly it certainly is a poor exchange for the usually courteous verifications sent out by most stations.

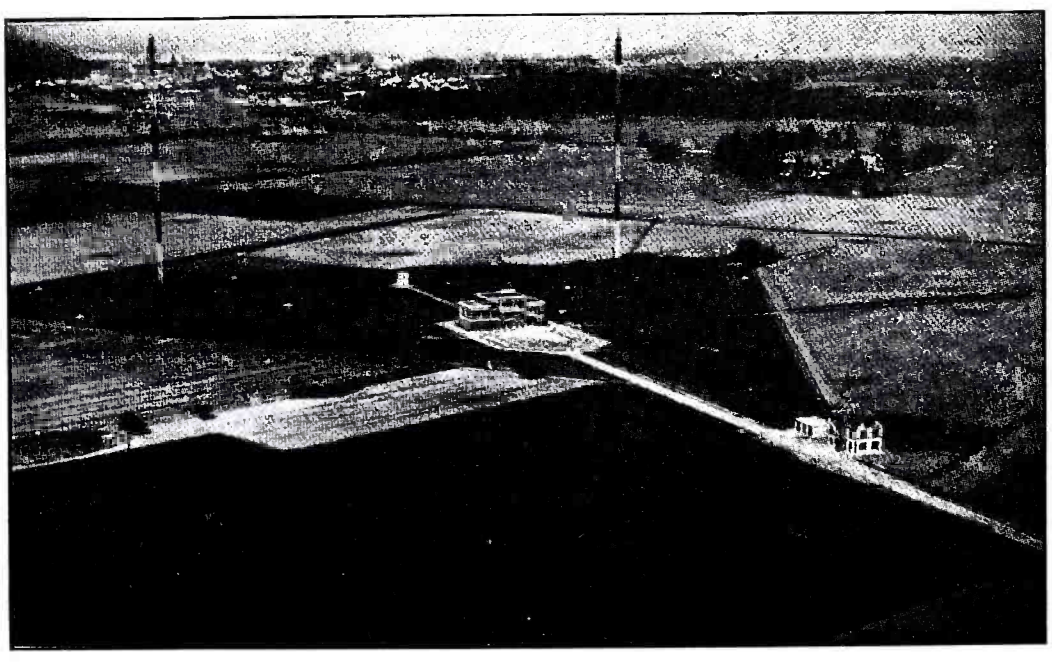
Radio stations are not obliged to verify reception, but fortunately most of them are courteous enough to do so. If the stations attempted to stand the expense of replying to all letters they would find that at the end of a year, their profits would suffer greatly. Besides the cost of postage there is the stationery, printing and the salary of the help hired for this purpose. If a DXer who receives a verification after sending only a post card to a station does not feel that he has not cheated the station, he must admit that he has at least taken advantage of their generosity.

Perhaps the stations themselves are more to blame for the situation which has arisen, than anyone else. If they refused to answer post card reports, the writers would soon realize the necessity of enclosing postage. There are still many stations who complain of the exceedingly great number of post card reports, but proceed to answer each and every one of them with the same courtesy afforded those who have enclosed return postage. The solution of the problem of what to do with the post-card reporters lies with the stations. They alone have the power to do away with such reports.

Greece to Have Station

The establishment of a radio broadcasting station in Greece has been under consideration since 1928, but for various reasons the project has never materialized. At the present time the situation assumes a rosier aspect as the Government has decided to call for bids in an international competition for the erection and operation of a radio broadcasting system in Greece. The concession will be granted for a period of 27 years, but the government will have the right to buy the entire system on twelve months' notice after it has been in operation for five years. The concession provides for the installation of three medium-wave stations and one short-wave station, and for the construction of three fully equipped studios and office buildings. The transmitters are to be located as follows:

[*Continued on page 421*]



View of the station "Poste Parisien," which pushes 60 kilowatts into the 914-kc channel.

The complete 5-meter station described in the accompanying article.

COMPLETE 56-M.C. STATION

Construction Data On 5-Meter Transmitter and Converter-Receiver

By George B. Hart—W8GCR

WE were never one to boast about the cards we received or the fish we almost caught (except the time we worked Wellington, New Zealand, with a '99 and 45 volts on the plate—or maybe you have heard that one), but the little suppressor-grid phone transmitter which we evolved from a variety of parts, circuits, and cuss words certainly warrants the praise of any constructor. Built around the much-used 59, the outfit is one to gladden the heart of any Ham.

Suppressor Modulation

Inspired to heights of noble thought and ignoble endeavor by sundry articles on the use of suppressor-grid modulation, we pursued the fleeting electron until we finally achieved our ambition—practical suppressor-grid modulation at 56 megacycles. And it is both practical and efficient as evidenced by many QSO's.

Designed primarily for military purposes within the National Guard, it was decided from the outset that here was one outfit that would not "wobbulate" from 56 to 60 mc during a single transmission. But how to obtain the desired results without resorting to crystal control and a multitude of stages with their attendant sins! Obviously, tourmaline crystal control would achieve the end desired, but none was available. So after many slips with the slip-stick and the usual amount of cut-and-try we decided that a slightly modified electron-coupled Tri-Tet would give us the greatest amount of amplification at the desired frequency with the minimum of equipment. This arrangement gives a signal of about the same characteristics, and handles in about the same way as crystal control.

E-C Oscillator

An electron-coupled oscillator can be made quite simple and at the same time obtain the general effect of operation as with an oscillator and buffer stage through the buffer action of the plate circuit of the Tri-Tet. This characteristic makes the circuit shown in Fig. 1 highly desirable for operation at the ultra-high frequencies since it mimimizes frequency shift and permits of high signal stability.

Military operation required that the equipment be not only efficient but pleasing in appearance, so all of the r-f apparatus was mounted on a 5" x 9" x 2" steel chassis drilled for the various outlets and then enamelled black to give a very smart appearance. The three tuning condensers were mounted on the edge of the chassis so as to allow ample space for mounting the entire unit within a black crystalline cabinet of steel. The grid tuning condenser C-3 was mounted at the front of the chassis for ready access and appearance, but the two plate tuning condensers, C-1 and C-2, were mounted in the rear so that once set they would not be as subject to prying hands. This requirement is particularly important where many persons are likely to come in contact with equipment with which they are not familiar. The grid and plate inductances, L-1 and L-2, are mounted on black porcelain stand-off insulators located directly behind their respective tuning condensers. The coils should be mounted at right angles to each other.

The Coils

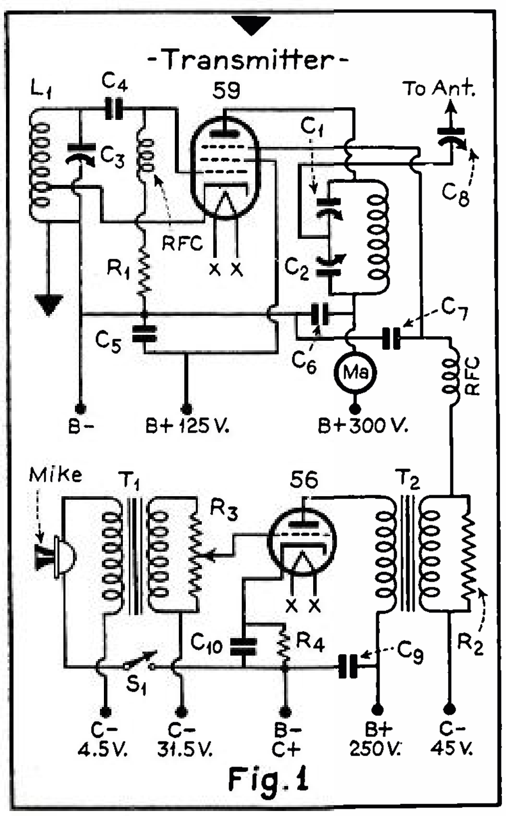
The coils are wound on high-efficiency inductance forms, or a piece of celluloid of the sort used for automobile window repairing is wound tightly about a standard cardboard mailing tube 1⅝ inches in diameter. Over this is wound 5 turns of No. 16 enamelled wire spaced the diameter of the wire. The winding is then given two coats of MRL solution or clear lacquer which should be allowed to dry thoroughly. The celluloid form may then be removed from the cardboard tube and the form mounted on the insulators already referred to. These make excellent 56-mc inductances as they are both rigid and efficient. Do not try to cheapen your coils!

The wiring is conventional except that the leads should be as short as possible, and rigid. Obviously the least vibration in the wiring or parts of the equipment will cause momentary frequency shifts, or modulation, to an intolerable degree.

Power-supply leads are brought to an ordinary terminal strip at the back of the cabinet; this facilitates connecting the battery cable to the unit. Incidentally, we used battery plate supply rather than the usual a-c power supply in order to insure freedom from hum modulation. Many 56-mc experimenters use full a-c operation, but we still prefer the use of batteries for plate operation, although a-c is used on the filaments.

Antenna Coupling

Before describing the speech amplifier, it would be well to mention the method of coupling the transmitter to the transmission line. Condensers C-1 and C-2 are in series, with the antenna feed-line coupled through C-8 to their mid-point. By this method, rather than by attempting to take a tap off of the plate coil, we are enabled to get a much finer impedence match between the modulated driver and the antenna. It is only necessary to experiment around a little with the condensers to get optimum results from this auto-transformer. Much greater efficiency was obtained through



Circuit diagram of the 5-meter transmitter with its single tube modulator. Note that electron coupling is used.

the use of this method of coupling to our 8′ 4″ antenna mounted on the roof than from any other method of coupling.

The Modulator

Returning to the modulator, we find nothing but a single 56 with 250 volts on the plate. This tube is capable of delivering the requisite audio power and has high enough power sensitivity to permit operating its grid circuit directly from a single-button microphone.

A chassis and cabinet similar to that employed with the r-f portion of the transmitter is used to obtain uniform appearance and make for a commercial looking rig. The microphone and output transformers are mounted on top of the chassis so that a view into the cabinet reveals only the two transformers and the 56 modulator. A 1:1 output transformer loaded with a 25,000-ohm, 1 watt, resistor provides the load stability necessary for intelligible speech. R-3, of course, enables the operator to ride gain on himself (from the modulation heard on this and other bands we think that most hams have neglected this piece of apparatus entirely).

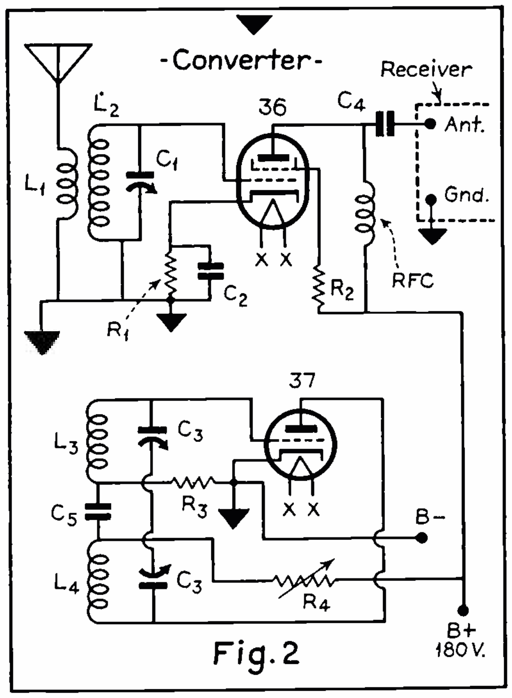
Operation

To get this little phone set in operation, couple the antenna to the oscillator and adjust C-1 and C-2 for maximum output with minimum plate current as shown by the milliammeter in the plate circuit. When optimum settings for operation at the desired frequency have been reached, place a small one-turn loop of No. 14 wire in series with a neon lamp in such a position as to indicate r-f current in the plate coil. Now swing C-1 and C-2 in various combinations so as to obtain the same frequency with different condenser relations. The light in the loop should be watched for resonance between the antenna and the plate circuit, since the neon bulb will go out when resonance has been reached. At the same time that the neon bulb goes out there will be a dip in the plate current; when this dip is just perceptible and the neon bulb goes out then the driver and the antenna are in resonance.

The Receiver

The receiver used in conjunction with this transmitter consists of a two-tube high-frequency converter coupled to a six-tube superheterodyne. Such an arrangement is ideally suited for modern 56-mc work, although it is too selective for operation with some of the less efficient 5-meter phone jobs whose signals run from pillar to post and then back.

With the rapid development of stable 56-megacycle oscillating systems, such as



Circuit of the 2-tube, 5-meter converter designed for use with a standard receiver.

the electron-coupled circuit described here, there is little doubt that the superheterodyne will become as preeminent here as it has on the lower frequencies. Such a receiver gives added sensitivity improved signal-to-noise ratio, and greater selectivity. To the average amateur, however, the superheterodyne is out because of its additional original cost. To this man the converter offers an opportunity for increased sensitivity and greater flexibility than is offered by the super-regenerator. Such a device is highly satisfactory and can be used in conjunction with any broadcast receiver with excellent results. It is only necessary that the b.c. set selected be capable of tuning to 1550 kc, the intermediate frequency best suited for reception between 56 and 60 megacycles.

The circuit diagram of our converter is shown in Fig. 2, and is seen to consist of a detector and an oscillator. Although three tuning condensers are shown, actually only one enters the picture. C-3, the oscillator tuning condenser, is a Hammarlund 100-mmfd plit-stator condenser. It is important only so far as oscillation is concerned and tracks fairly well with the 50-mmfd tuning condenser C-1. In so far as actual operation is concerned it will be found necessary to change its position about once every 10 degrees of a 180-degree dial.

In order to maintain a symmetrical appearance the converter was also mounted in a black can of the same type as used in the construction of the transmitter and modulator. The jack shown in the photograph is a reminder of a time when a super-regenerator, which has been discarded in favor of the more efficient converter, was housed in the same cabinet.

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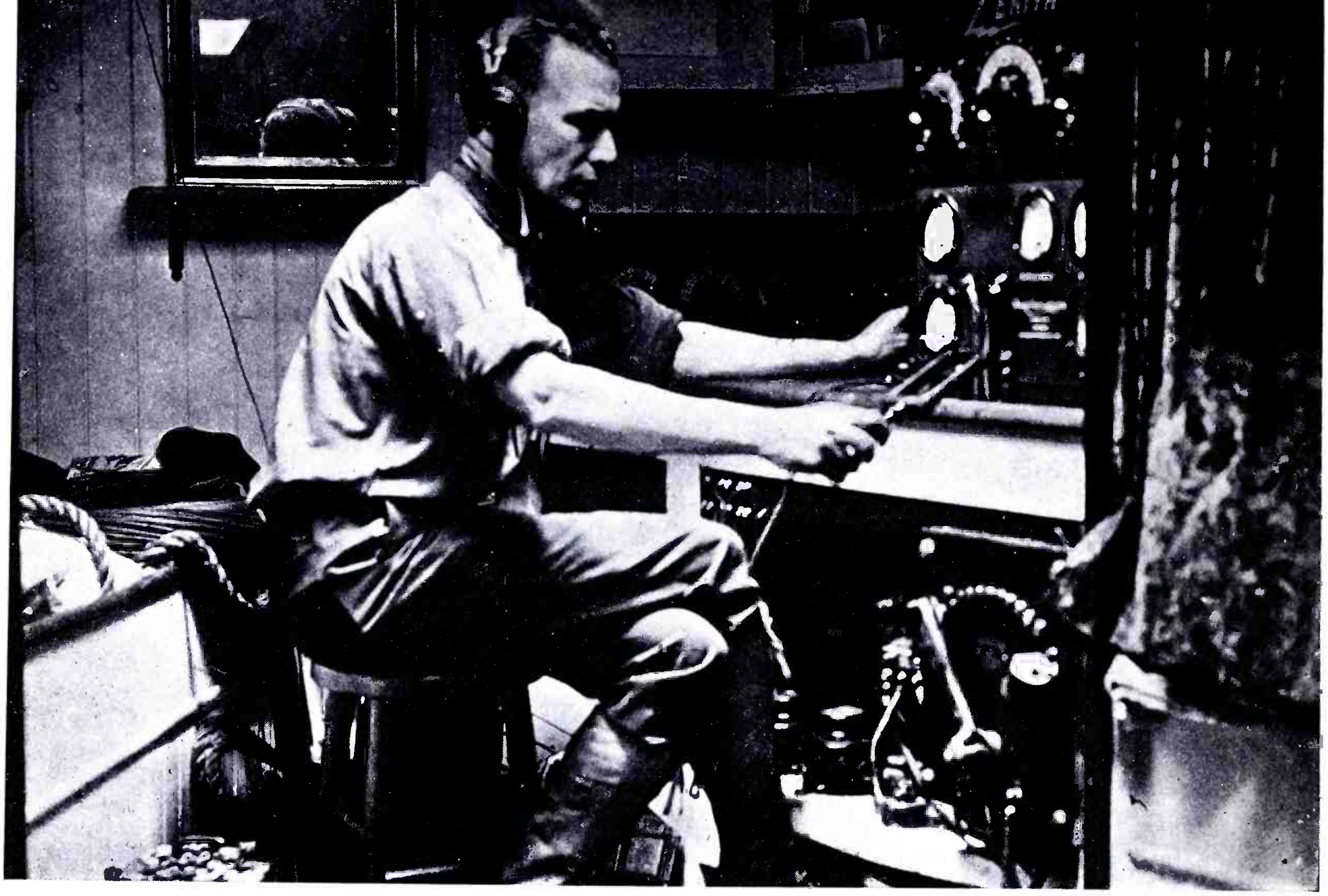


Commander McDonald, of the Zenith Radio Corp., operating the radio equipment aboard the Bowdoin. The call was WNP. How many remember?

Amateur Radio in the Arctic

Another Chapter From the Early History of Amateur Radio

"COMMANDER E. F. McDONALD stated to me that he met Commander Donald B. MacMillan through Commander U. J. ("Sport") Herrmann, who formerly ran the New York and Chicago radio shows. Herrmann is one of our best known yachtsmen in the country and it seems that he met MacMillan through having his last yacht built at East Booth Bay, Me., where MacMillan's *Bowdoin* was being built at the same time.

F. H. Schnell, K. B. Warner, and the late Hiram Percy Maxim, using a Zenith receiver for communication with the Bowdoin as she left Wiscasset, Maine. The receiver was made to oscillate and the code sent by tapping the antenna lead with the finger.

Commander MacMillan in the summer of 1922 came on to Chicago to visit Commander Herrmann and it was at that time that MacMillan was introduced to McDonald. They took a long auto ride during this visit and showed MacMillan the sights of Chicago. They finally landed on the deck of the *Santa Maria,* a replica of Columbus' original *Santa Maria* that was presented to the United States by the Spanish Government.

"It was while sitting on the deck of the old *Santa Maria* that McDonald started discussing with MacMillan the subject of MacMillan's taking radio into the Arctic with him on his next trip north which was to be in June 1923. MacMillan said, 'I rather hesitate to take radio with me because in all my trips into the far north I have carefully selected my men and I have been able to maintain happiness among them and I am just wondering if radio would not possibly make the men homesick if they heard the American stations.'

"McDonald, who is a yachtsman and explorer himself, pointed out to MacMillan that the great difficulty when away from civilization is that men get talked out. They tell each other all the stories they know and pretty soon each man on the trip knows everyone else's and everything that every other man does, and he said, 'Would not radio be the means of bringing new subjects which would be material for conversation and discussion and thereby breed more happiness rather than discontent?'

"MacMillan thought for a long time on this subject and finally agreed to take radio north with him. McDonald then ordered the engineers of the Zenith Radio Corporation to construct what they believed would be the last word in that period of the art in a transmitter and a receiver to be placed on the Mac-

THE series of articles on "The Story of Amateur Radio," published in recent issues of ALL-WAVE RADIO, *created widespread interest among newcomers and oldtimers alike. We regret that the series was not more extensive.*

No one, to our knowledge, has ever undertaken the task of completely recording the history of amateur radio—a task that most certainly should be fulfilled. Such an history would be replete with the account of outstanding accomplishments, packed with thrills and colored by human interest.

Some day such an history may be recorded in its entirety in a single volume. It will require painstaking work on the part of an amateur of the old school with a well developed perspective. Until that day arrives we must be content with scattered accounts of the brilliant history of amateur radio that come our way.

Such an account has reached us. It deals with heretofore unpublished data on the part Amateur Radio played in the 1923 MacMillan expedition into the far north. The idea of carrying radio into the Arctic originated with Commander E. F. McDonald, of the Zenith Radio Corporation. Mr. F. H. Schnell, an early pioneer in amateur radio, obtained the "unwritten story" from Commander McDonald, and we are presenting it here in its original form, untouched by the conventional editorial blue pencil, just as it was written by Mr. Schnell. The photographs were loaned us from Commander McDonald's collection.—THE EDITOR.

Millan schooner *Bowdoin.* The engineers who designed and constructed this apparatus were Messrs. G. E. Gustafson, Karl E. Hassel, M. B. West, and R. G. H. Matthews, all members of the American Radio Relay League.

"On the suggestion of these engineers, Commander McDonald and his attorney Irving Herriott went east early in 1923 and called on Mr. Hiram Percy Maxim to obtain the co-operation of the American Radio Relay League, not only with a view to having the members of the A.R.R.L. keep in contact with the *Bowdoin* during the expedition, but also to have the A.R.R.L. select from among its members a radio operator to go north with MacMillan.

"Mr. Maxim immediately saw the value of this expedition to the A.R.R.L. and agreed to give the fullest co-operation, and sent both Messrs. Herriott and McDonald to the office of the A.R.R.L. to confer with Mr. K. B. Warner and me. I was at that time Traffic Manager of the American Radio Relay League. This was my first meeting with McDonald.

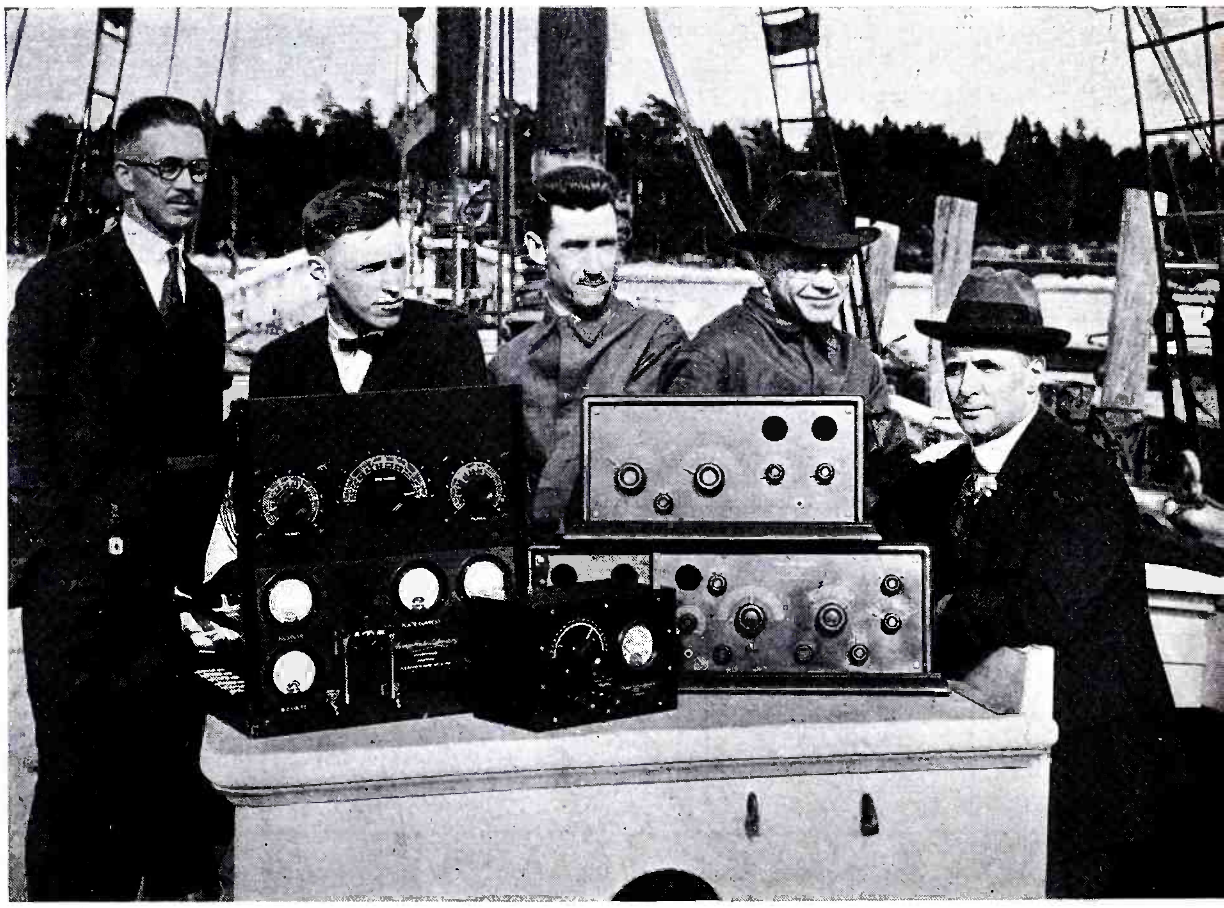
"Under instructions from Mr. Maxim it became my job to scour the United States and select a capable amateur for this expedition and I was told that he not only had to have ability but that personality and physique came even ahead of that. These seemed funny instructions but it was what MacMillan wanted and I was able to find in Donald Mix a man that had all three qualifications. After placing proper insurance on his life, Mix decided to go with the expedition as operator.

"In June of 1923 just before the *Bowdoin* sailed, Mr. K. B. Warner and I took Mix to Wiscasset to introduce him to Commander MacMillan. We went on board the *Bowdoin* and examined the equipment, all of which had been installed by Zenith engineers and which consisted of a 32-volt bank of batteries, and a charging outfit; a 500-watt generator, a transmitter having two 50-watt tubes, and a receiver that was capable of getting down to 115 meters which at that day was extremely short wave. While on board the *Bowdoin,* we introduced Mix to Commander MacMillan. We went aboard the *Bowdoin* and Mix shook hands with Commander MacMillan. As I recall it, not more than five words passed between Commander MacMillan and Mix and MacMillan left all of us standing on the after deck of the *Bowdoin* as he went forward. We must have waited more than two hours, during which time MacMillan, as far as we could observe, paid no attention to Mix at all. That evening at the hotel I explained to MacMillan that we had to get back to Hartford and I wondered how long it would be before he could make a decision on accepting Mix as an operator, and he replied, 'Mix will do.' It struck me as being a hasty decision, especially in accepting a man to do a job which carried with it the responsibility that Mix had. Of course the whole world knows that Mix did his job thoroughly and competently in every respect. Radio communication was handled by the American Radio Relay League.

"The expedition in the foregoing should not in any way be confused with the 1925 MacMillan-National Geographic Expedition with which the A.R.R.L. also co-operated. For this expedition, Zenith Radio Corporation equipped both the steamship *Peary* and the schooner *Bowdoin* with what in those days was the last word in short wave. The transmitters and receivers for both of the ships were capable of going down to about 15 meters. As a matter of fact, considerable traffic was handled on 17 meters.

"The *Peary* was equipped with voice as well as code. John Reinartz was selected as the A.R.R.L. man to go on the *Bowdoin* and Paul Magee and Harold Gray were the operators on the *Peary.* It was while they were on this expedition that I established communication with them nearly half-way around the world."

F. H. Schnell, Donald Mix, K. B. Warner, M. B. West and Commander Donald B. MacMillan, grouped around the Bowdoin's transmitting and receiving equipment.



Methods of Phase Inversion

Coupling Circuits For Resistance-Coupled Push-Pull Amplifiers

By Engineering Staff, Aerovox Corp.

PHASE inversion consists of obtaining the input for a push-pull stage from a single-ended stage by resistance coupled circuits and without the use of a push-pull input-transformer. The chief reason for existence of the phase inverter is the fact that a relatively simple and inexpensive arrangement may yield results which could not be equalled unless a transformer of excellent quality and consequently high price were used. When properly designed a phase inverter can be made to deliver two signal voltages exactly 180 degrees out of phase and of equal amplitude. Moreover, there need not be any frequency distortion, and phase shifts can be reduced to a negligible amount.

Illustrative Circuit

First let us consider a circuit which has been used in the past but which is now more or less out of date. Fig. 1 shows the output stage of an amplifier where the inversion is accomplished by the output tube A. The signal voltage in the plate circuit of a tube is opposite in phase to that in the grid circuit. If the grid voltage becomes positive (rather, less negative) the plate current increases, and the voltage drop across the plate load increases making the plate voltage lower. This is so when the load is a resistor but when the load contains reactance as in the case of Fig. 1, the voltage drop across the load is not in phase with the current through it and consequently, the plate and grid circuits do not have signal voltages in exact opposite phase.

The second requirement, that of equal amplitudes can be met by employing a voltage divider with the proper ratio so as to supply to tube B the same voltage as was applied to tube A.

The system of Fig. 1 thus suffers from a phase shift which results in some distortion and in the inability to obtain full output.

European Circuit

The next step obviously leads to a circuit with a resistance load which would remove the above objection. There are several variations of this but they are really all the same. Fig. 2 illustrates a system widely used in Europe. It accomplishes the same thing as Fig. 1 but the load is resistive, therefore, the signal voltages in plate and grid circuits are opposite in phase. The voltage divider must be adjusted carefully so as to make the voltage across R1 equal to the voltage *e* of the input.

The condenser is necessary in order to prevent the plate voltage from reaching the grid of the following tube. This condenser causes a small phase shift which varies with frequency. Usually the shift is of the order of a fraction of a degree for average values used. The idea is to make the resistors of a high value and the condenser of a high value. The reactance will then be so low as to have negligible effect.

There is another drawback to this system. For the convenience of having R1 and R2 standard resistance values, symmetry is often sacrificed. The two sides are then not exactly the same. Moreover, suppose that the divider has been perfectly adjusted for a symmetrical output, any variation in line voltage or in the characteristics of the tube with age will unbalance the circuit. These effects are generally not very large and the system has become quite popular.

There is of course no gain provided by the tube. It delivers a voltage equal to *e* and in opposite phase but there is no amplification. Some consider that the gain equals 2.

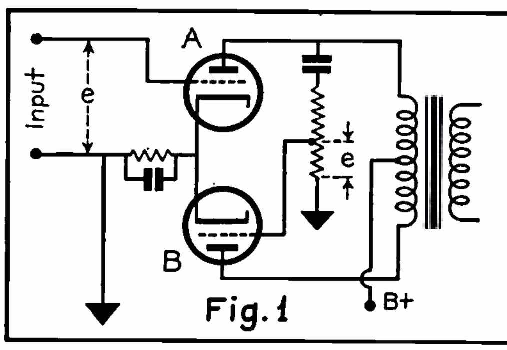


Fig. 1

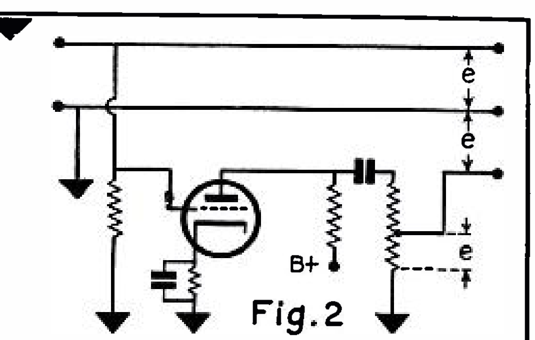


Fig. 2

Fig. 1: Early type of phase inversion circuit. Fig. 2: A phase inversion circuit developed in Europe.

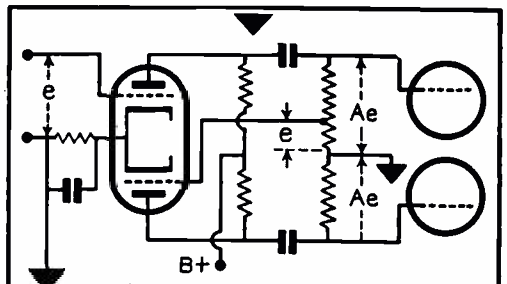


Fig. 3

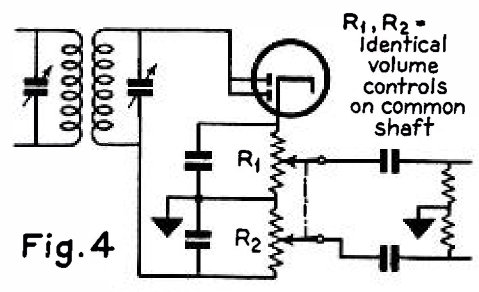


Fig. 4

American version of phase reversal circuit, and phase inversion in circuit of a diode.

American Version

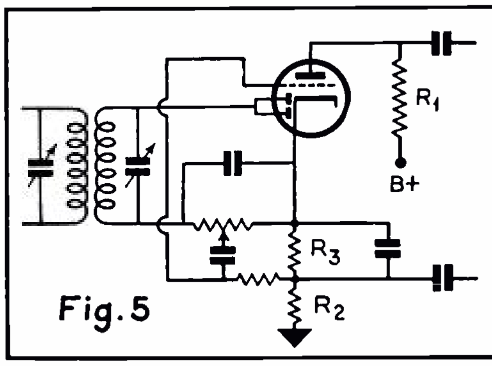
In Fig. 3 is shown the American version of the same idea. Really it is exactly the same as Fig. 2 but with a resistance coupled stage ahead of it. A double triode is often used but there is no objection to employing two different triodes. The gain of the two tubes may be considered as twice the gain of one, in other words, the phase inversion tube again has a gain of 2. Otherwise this circuit has the same characteristics and drawbacks as the one in Fig. 2.

In a radio receiver employing a diode detector it is possible to obtain perfect inversion in the detector circuit. This arrangement is illustrated in Fig. 4. The load resistor of the diode circuit is simply divided into two equal parts and the center is grounded. Each of the sections has to be filtered individually. The circuit delivers two signals which are exactly 180 degrees out of phase and which are equal if the resistors are equal. There are no changing tube characteristics which may upset the balance later. However, if it is necessary to control volume in the same circuit a tandem control must be used; it will be very difficult to find two volume controls which will always be equivalent at all positions of the moving arm.

Improved Inversion

This difficultv is overcome in the circuit of Fig. 5. The inversion in this case is not done in the diode circuit but in the first audio stage. It depends on the following principle: The signal voltage across a resistor in the plate circuit of a tube is out of phase with the signal in the grid circuit as previously explained. If the plate load is placed in the cathode circuit, the voltage drop across it will be in phase with the input signal. Then, if it is possible to divide the plate load equally between the plate circuit and the cathode circuit, the two sides of the push-pull signal can be obtained. The two signals must be equal when the resistors are equal and they are exactly opposite in phase because both sides will have the same number of coupling condensers.

The fly in the ointment is that such an arrangement requires the input circuit to be insulated from ground because the grid return is not at zero potential; it goes up and down with the signal. This is no objection in the case of the diode detector of a superheterodyne since the secondary can be completely isolated from ground. Fig. 5 shows how it is connected. The bias can be obtained by means of a small battery or it may be supplied by the voltage drop across a portion of the cathode resistor. This portion must then be bypassed by a high-capacity electrolytic condenser. It does not count as a part of the plate load. R1 and R2 should be equal (Fig. 5) but R3 is determined by the required bias and it is not a part of the cathode load. The volume control in this case can be at the same time the load of the diode tube.



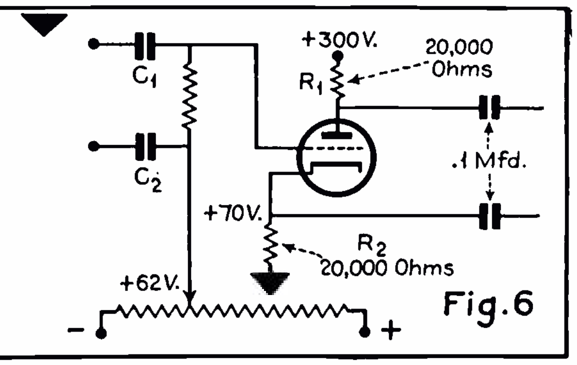


Fig. 5: Phase inversion in the first audio circuit. Fig. 6: Improved phase inversion circuit.

Working Example

Many an experimenter has burned the midnight oil trying to make the circuit of Fig. 5 suitable for an input device which has one terminal grounded. There are several solutions but they are really all the same. The secret consists of establishing a suitable grid-return point which is being held at a fixed potential above the chassis, so that the proper bias can be applied to the tube. If this point remains fixed, the signal can be applied between ground and grid through the usual condensers.

The circuit of Fig. 6 is due to Richter (*Electronics* for October 1935). The tube is a 76, R1 and R2 are the two equal load resistances. When the tube is operated properly there will be a voltage drop of 70 volts across the cathode resistor R2. The required bias is 8 volts. The grid circuit now returns to a point on the voltage divider which is 8 volts negative with respect to the cathode. This point is 62 volts positive with respect to ground. The voltage divider must be bypassed with a large condenser. C1 might be .1 mfd. paper but C2 should be a high capacity electrolytic condenser.

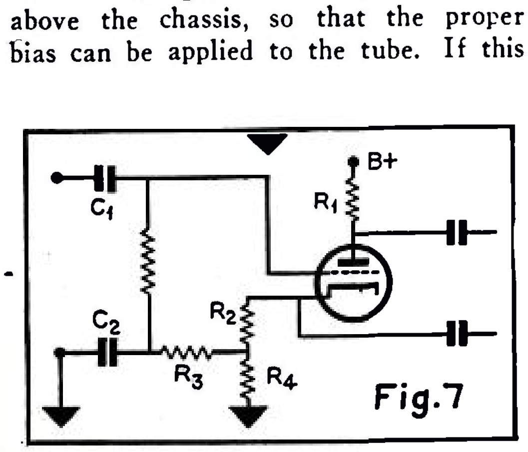
It was explained before that this arrangement insures the two halves of the signal to be equal and exactly opposite in phase. It is not affected by changes in the plate voltage nor by changes in the characteristics of the tube.

The total gain obtainable from a stage like this is less than 2. It is obvious that any voltage, *e*, applied to the grid circuit appears amplified in the cathode circuit and would have a value of *Ae* volts. Another signal of *Ae* volts is developed across the plate load R1. The total is then *2A*. The next question is how large is *A*. Whatever voltage is developed across the cathode resistor, R2, is again applied to the grid in a direction so as to oppose the original voltage, *e*. Then *Ae* must be less than *e* if there is going to be something left over; then *A* is less then unity and *2A* must be less than 2. The actual value of *A* is somewhere around .8 or .9 depending on the mu of the tube and the design of the circuit. The fact that the tube does not deliver any gain is really not serious; the whole circuit might be considered as a replacement for a push-pull transformer. Since there is no reactance in the plate load or in the grid circuit there is no frequency discrimination.

Alternative Method

Another way of accomplishing the same result is shown in Fig. 7. The equal load resistances are R1 in the plate circuit and the combination of R2, R3 and R4 in the cathode circuit. These have been so selected that their combined effect is equal to R1. R2 is of the proper size to obtain the required bias. R3, in parallel with R4 as far as the signal is concerned, is very much larger than R4. The equivalent resistance of R3 and R4 in parallel added to R2 should equal R1. The condenser C2 is again very large so that its impedance is nearly zero for alternating currents. It will be seen that the grid is at the same potential as the junction of R2, R3 and R4 and that it is being kept constant due to the resistance-capacity filter R3-C2. The circuit has the same degeneration effects as the one in Fig. 6; the gain is less than 2.

It is recommended to use triodes only for the purpose of inversion since the screen supply of tetrodes or pentodes would offer another problem.



Another simple but effective system of phase inversion.

✦ ✦ ✦

PRACTICAL HINTS ON VOLUME CONTROL INSTALLATION

VOLUME CONTROLS, points out the engineering department of Clarostat Mfg. Co., Inc., are furnished with three terminals permitting their use as rheostats or potentiometers. When used as potentiometers, all three terminals are employed. When used as rheostats, the center or contact terminal, and either the right or left terminal, are employed, depending on whether resistance is to increase or decrease with clockwise rotation of knob.

It is highly important when using tapered controls that terminals be connected into the circuits as shown in wiring diagrams. Otherwise, due to characteristics of taper recommended, efficient control will not be obtained.

The accepted method of connecting volume controls is such as to provide minimum volume at extreme counter-clockwise rotation of the moving arm, and when rotating in clockwise direction the signal is increased smoothly.

Type Control to Use

Use wire-wound controls only in circuits where current load is too great

[*Continued on page 404*]

THE NATIONAL NC-100

FIGURE 1

A Rationalized Professional-Type All-Wave Receiver

THE new NC-100 receiver, a product of the National Company, Inc., is a distinct departure from the design practice characteristic of the company's FB7, AGS and HRO series. For instance, the NC-100 employs metal tubes, has a built-in power supply, an integral wave-range selector, and has facilities for the excitation of the field of a dynamic speaker which is a component of the receiver though not contained in the same housing. Moreover, the NC-100 has a power output of 10 watts, far in excess of the output of the company's previous receivers which were designed for specialized services.

Uncompromised Design

Actually, the NC-100 is a much closer approach to the composite receiver in that it meets the general requirements of both amateur and listener, and fulfills the diverse requirements of the two groups without resorting to a compromise.

Assurance that the design is uncompromised may be had from a study of the services that have been built into the receiver. Nothing that is essential has been dispensed with.

The NC-100 employs 12 tubes in all; a 6K7 r-f preselector used on all wave ranges, a 6J7 first detector, a 6K7 high-frequency oscillator, 6K7's in the two air-trimmed i-f stages, a 6C5 power detector, two 6F6's in the push-pull output stage, 6J7 beat-frequency oscillator, 6J7 amplified avc with delay action, a 6E5 tuning indicator and a type 80 power-supply rectifier. The receiver covers all frequencies from 540 to 30,000 kilocycles (10 to 550 meters), in five ranges.

Receiver Controls

A panel view of the receiver is shown in Fig. 1. The main tuning dial is located near the center of the panel and operates a three-gang tuning condenser mounted at right angles to the receiver front, rather than parallel to it, as in the HRO. The dial is of the multi-revolution type operating through a spring-loaded gear train having a step-down ratio of 20 to 1. In tuning across any one coil range, the dial makes ten complete revolutions and since its diameter is four inches, the equivalent scale length is approximately twelve feet. There are fifty divisions about one-quarter inch apart around the circumference of the dial and the index numbers are changed automatically as the dial is rotated by means of an epicyclic gearing, so that the calibration is numbered consecutively from 0 to 500. The index numbers are actually changing continuously, the shift occurring at the bottom of the dial where it is not ordinarily visible.

Through this mechanism it is thus possible to obtain a continuous dial reading from 0 to 500, with the result that all signals are well spread out on the scale, making tuning and logging both convenient and precise. Calibration curves for each of the five frequency ranges are provided so that dial scale readings may be translated into frequency readings.

Band Spread Ample

As examples of the degree of band spread afforded by the dial, five complete revolutions of the dial are required to tune from one end of the standard broadcast band to the other—a spread of five feet. The 160-meter amateur band covers 1½ revolutions of the dial or approximately 23 inches of dial space. The 80-meter band covers 1¼ revolutions or 21 inches, and the 40-meter band two-fifths of a single revolution or six inches. The 20-meter band covers three-fifths of a revolution or 8¾ inches, while the 10-meter band covers four-fifths of a revolution or 10 inches of dial space. The 13, 19, and 25-meter short-wave broadcast bands each occupy 2½ inches of dial space, while the 16-meter band occupies 2 inches, the 31-meter band 6¼ inches and the 49-meter band 27½ inches.

Immediately below the tuning dial is the wave-range selector knob which actuates the coil-changing mechanism. The five coil ranges are marked on the front panel in a horizontal line directly over the range selector knob. Each of the range markings has a small window in back of which an indicator appears when that particular coil assembly is plugged into the circuit.

Automatic Plug-In Coil Mechanism

The movable-coil tuning unit is a feature in itself, in that it dispenses with the necessity of using a switch with numerous contacts and coil leads, and yet provides all the advantages of plug-in

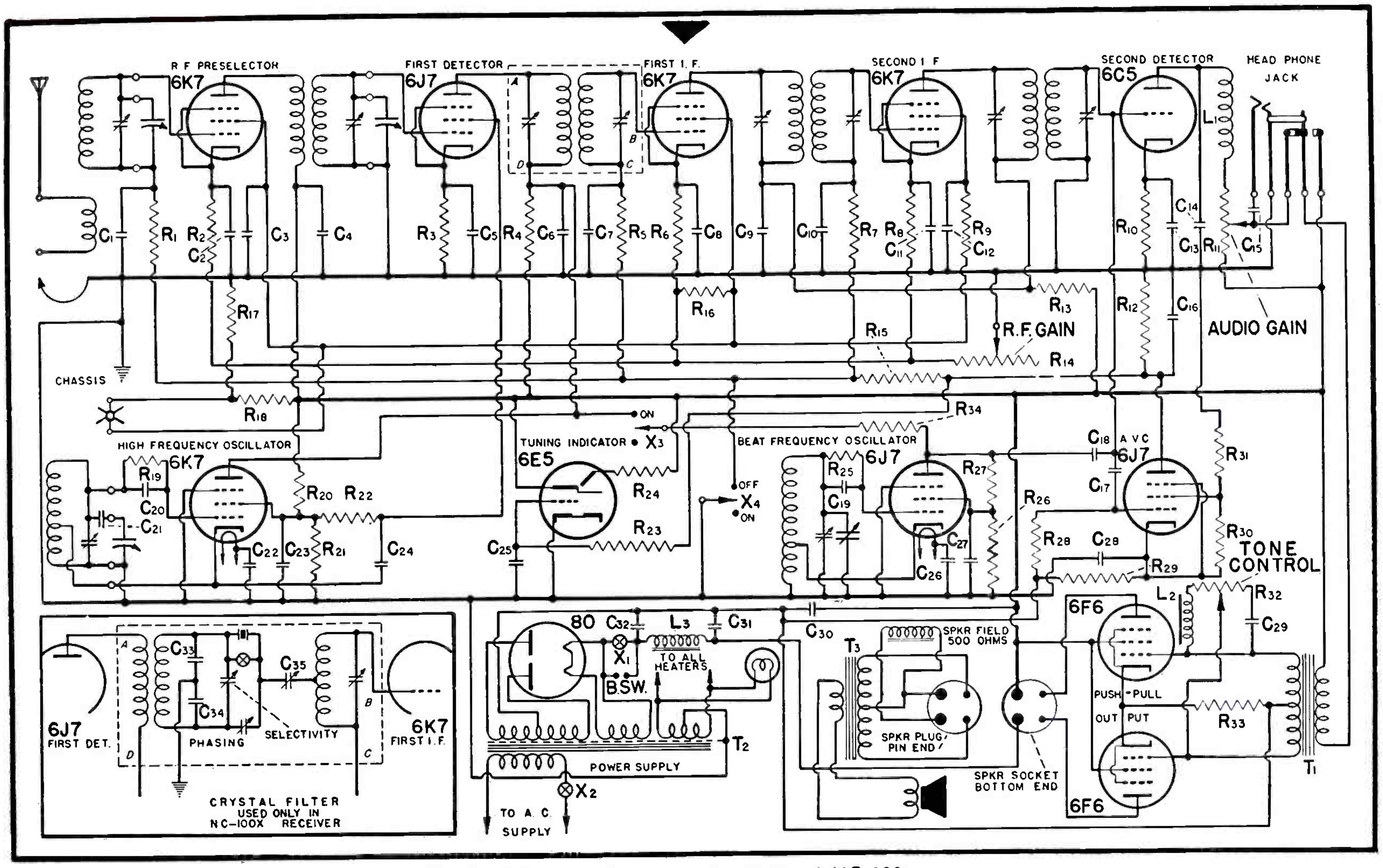


Fig. 2. Schematic diagram of the National NC-100 receiver.

coils minus their inconvenience in handling.

The 15 high-frequency coils are mounted in a heavy cast aluminum frame having two sections which are clamped together. Each coil and its air-type trimming condenser is mounted in a separate compartment in the frame so that each individual coil is completely shielded from all others. The coil prongs extend through insulated openings in the frame and the prongs for the three coils for each of the five ranges are situated in a parallel line so that when the frame is moved on its track by the gear action on the wave selector knob, only the coils actually in use are in any way connected in the circuit. The relatively large movement of the coils, when changing from one range to another, has made possible the use of rugged, silver-plated side-wipe contacts. The desired range is locked in position directly below the three-gang tuning condenser to which the contactors are attached.

This arrangement of automatic plug-in coil switching with its sliding shield frame, does away with switch wiring and provides direct connection between the set of coils in use and the variable gang condensers directly above them. Because of this and the short connecting paths, losses are kept at a minimum.

Starting at the left-hand side of the front panel the uppermost knob is the tone control for varying the frequency characteristic of the audio amplifier. When the control is rotated to the extreme counter-clockwise position, high-frequency cut-off occurs at about 1500 cycles. In the mid-position (zero) the characteristic is flat from 50 to 10,000 cycles. At the extreme clockwise position, low-frequency cut-off starts at 300 cycles, and the characteristic rises (about 6 db) between 1000 and 5000 cycles.

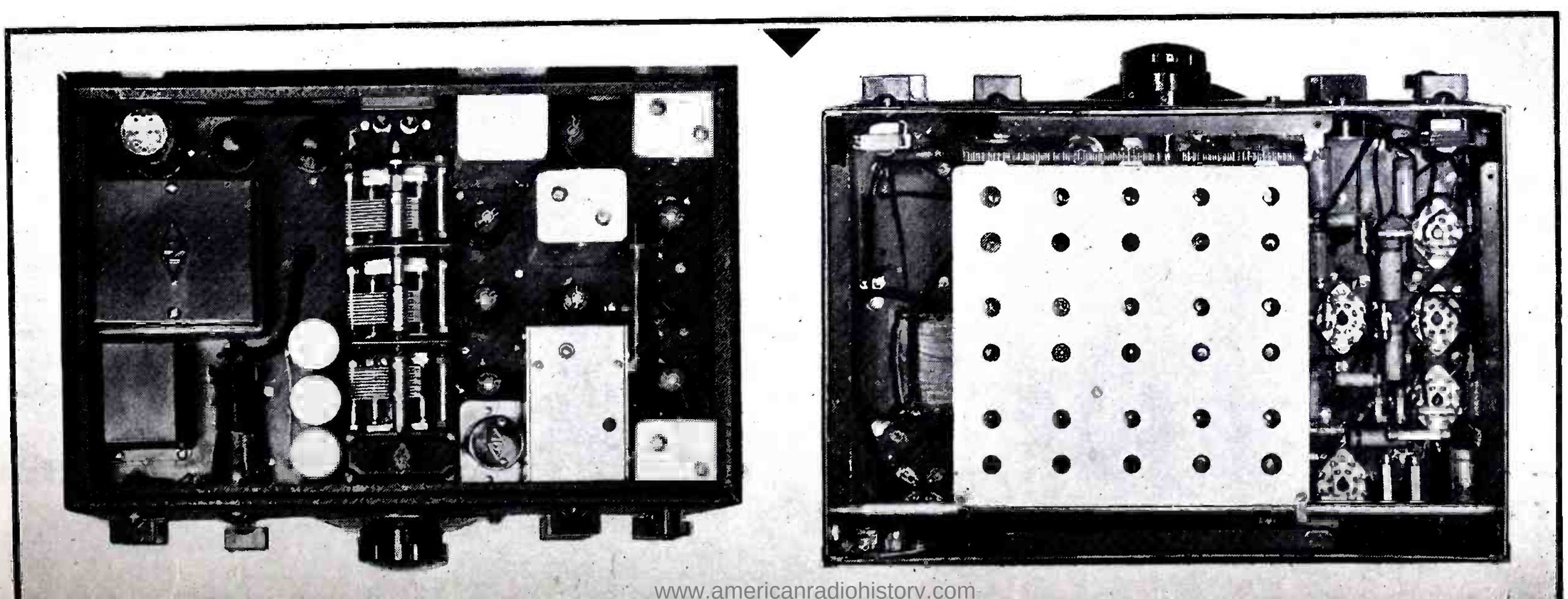
Control Switches

Below the tone control is a combination switch. In the extreme counter-clockwise position the receiver is turned off; in the mid-position all heater circuits and the rectifier are turned on but no B voltage is applied; in the clockwise position the B voltage is turned on to place the receiver in operation.

There are two insulated terminals at the back of the receiver chassis, which are connected in parallel with the B plus switch. They are intended to serve as a means for connecting a relay for automatically turning the receiver on and off during communication.

Continued on page 421

Top and bottom chassis views of the NC-100. Travelling plug-in coil frame is shown in photo at right.



Queries

Question Number 12

receiver hum . . . antenna problems . . . floating primaries

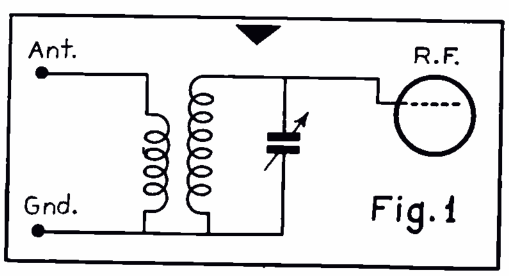
"I am dissatisfied with the short-wave reception I am experiencing with my 8-tube (metal) General Electric Type A-87. To top it all, the set has a hum that is very annoying—particularly on speech. I spoke to an amateur who immediately blamed poor reception and hum on my antenna. My antenna is a 40-foot doublet, about 20 feet high at one end and 10 feet high at the other. The two wires of the lead-in are connected to the antenna and ground posts of the receiver. My amateur friend says that I should disconnect the wire from the ground post and use a ground. If I do this, what should I do with the second wire from the doublet?—*J. R., Woodhaven, L. I.*"

Answer

To start off—there is no good reason why J. R. shouldn't enjoy thoroughly satisfactory reception from his G. E. A-87 receiver. This is an excellent set, and showed up well in the AWR laboratories.

It is always a good idea, if you know a neighboring amateur, to take your radio troubles to him. In this instance, however, we are not altogether in accord with his diagnosis and recommended treatment — though a better antenna might improve reception. Hum is rarely—very rarely—to be blamed on the aerial. Fifty percent of hum is caused by a faulty receiver. Forty percent of hum can be traced to bad tubes, and incorrect operation is responsible for approximately ten percent of hum troubles. We are inclined to suspect the last in the present instance.

A hum will be present in many receivers when operated without a ground, and the first check in case of hum is the ground circuit. *Reversing the plug in the 110-volt socket* will often eliminate hum, and we suggest that J.R. try this before anything else.



Receiver input circuit with grounded primary.

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.

Connecting a ground wire to the ground post will probably do a lot in the way of hum reduction, as his amateur friend suggests. The second wire can be left connected to the ground post —or disconnected—or (and probably the best arrangement) connected to the antenna post along with the other wire. In any case, the noise reduction properties of the antenna system will be adversely affected. If the lead-in remains connected to the ground post, the aerial will be operating as a combination doublet and L type. The transmission line will be unbalanced, and noise will be picked up by the down lead connected to the antenna post. If the receiver is operated with the ground connected and the one wire free, only half the aerial will be in use, and will function as an open L type. With both wires connected to the antenna post, the two halves of the doublet are employed, and the aerial becomes a type T.

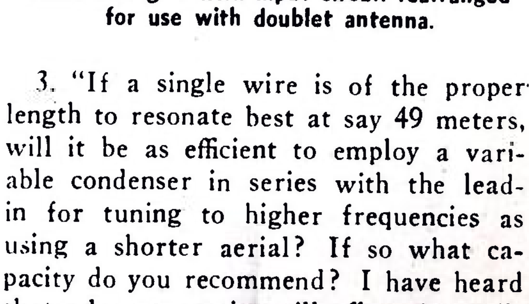
While your antenna could be a bit higher, there is nothing fundamentally wrong with it, and it should give you satisfactory reception—*if you are in a good location.* It is quite possible that noise is not too bad in your neighborhood, and such being the case you may find the solution to your troubles in connecting both lead-ins to the antenna post (which will take advantage of lead-in pick-up) and operating the receiver with a *good* ground. Try reversing the 110-volt plug for lowest hum level.

The G. E. A-87 is not suited for operation with a doublet type antenna having the lead-ins connected directly to the antenna and ground posts. A coupler should be employed between the lead-ins and the set, and the receiver grounded. If the direct arrangement is to be used, the primary circuit of each input coil will have to be changed. Any serviceman —or perhaps J. R.'s amateur friend—can do this. Another binding-post should be mounted on the chassis and insulated from the chassis. The ground connection to each primary coil should be broken and connected to a common lead running to this post. The lead-ins are connected to the antenna and new posts, and a ground to the ground post. This change is shown schematically in Figs. 1 and 2 on one of the four primary circuits, Fig. 2 indicating the preferred doublet arrangement.

Question Number 13

1. "Is it necessary that the two legs of a doublet be the same length in order to secure best noise reduction results?

2. "I have heard of using a twisted lead with a single wire (open) antenna for noise reduction. Is this practical?



Same as Fig. 1 with input circuit rearranged for use with doublet antenna.

3. "If a single wire is of the proper length to resonate best at say 49 meters, will it be as efficient to employ a variable condenser in series with the lead-in for tuning to higher frequencies as using a shorter aerial? If so what capacity do you recommend? I have heard that a large capacity will affect the oscillation of the detector.

4. "What is the directional effect, if

[*Continued on page 418*]

In Writing For Veries...

ADDRESSES OF PRINCIPAL SHORT-WAVE STATIONS BY COUNTRY

AFRICA

CNR	Director General des Postes, Rabat, Morocco.
CR6AA	Estacao Radio Difusora, Caixa Postal 103, Lobito, Angelo, Portuguese West Africa.
CR7AA	Radio Station CR7AA, P. O. Box 594, Lourenco Marques, Africa.
ETA-ETB ETD-ETG	Thore Bostrom, Chief Engr., Ministere Postes Intercontinental Radio Station, P. O. Box 283, Addis Ababa, Empire D'Ethiopia.
OPL-OPM	Radio Leopoldville, Congo Belge, Africa.
SUV-SUX	P. O. Box 795, Cairo, Egypt.
VQ7LO	P. O. Box 777, Nairobi, Kenya Colony, Africa.
ZSS	Overseas Communications, Kodak House, Shortmarket St., P. O. Box 962, Capetown, So. Africa.
ZTJ	African Broadcasting Co., Ltd., P. O. Box 4559, Johannesburg, Transvaal, South Africa.

ASIA, OCEANIA AND FAR EAST

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

CANADA

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

CUBA, MEXICO, CENTRAL AMERICA AND WEST INDIES

CMA-3 CMB-2	Cuba Transatlantic Radio Corp., Apartado No. 65, Havana, Cuba.
COKG	Laboratorio Radio-Electrico, Grau y Caminero, Apartado 137, Santiago, Cuba.
CO9JQ	Estacion Experimental de Onda Corta-CO9JQ, Calle del General Gomez, No. 4, Camaguey, Cuba.
CO9WR	P. O. Box 85, Sancti-Spiritus, Santa Clara, Cuba.
COCO	P. O. Box 98, Havana, Cuba.
COCD	"La Vox del Aire, S. A.," P. O. Box 2294, 25 y. g. Vedado, Havana, Cuba.
COCH	Estacion COCH, Calle B, No. 2 Vedado, Havana, Cuba.
HI1A	Radiodifusora HI1A, P. O. Box 423, Santiago de los Caballeros, R. D.
HI2D	Radiodifusora HI2D, Association C'ca Dominicana, Ciudad, Trujillo, R. D.
HI3C	Radiodifusora HI3C, Sr. Roberto Bernado, Prop., La Ramona, R.D.
HI3U	Radiodifusora HI3U, Apartado 23, Santiago de los Caballeros, R. D.
HI4D	Radiodifusora HI4D, "La Voz de Quisqueya," Ciudad Trujillo, R. D.
HI4V	Radio HI4V, La Voz de la Marina, P. O. Box 824, Ciudad Trujillo, R. D.
HI5E	Radiodifusora Ozama, Ciudad Trujillo, R. D.
HI5N	Radio HI5N, La Voz del Almacen Dominicano, Santiago de los Caballeros, R. D.
HI7P	Sr. J. M. Roques, R. Director, Ciudad Trujillo, R. D.
HI8A	Mayor E. Valverde, Director, Ciudad Trujillo, R. D.
HI8Q	Abbes and Garcia, Owners, Ciudad Trujillo, R. D.
HI9B	Sr. J. L. Sanchez, Director, Apartado 95, Santiago de los Caballeros, R. D.
HH2T HH2S	Societe Haitienne de Radiodiffusion, P. O. Box 103, Port-au-Prince, Haiti.
HH3W	Radiodifusora HH3W, P. O. Box A117, Port-au-Prince, Haiti.
HIG	Sr. A. Cordero, P. Director, Radiodifusora HIG, Ciudad Trujillo, R.D.
HIH	Radio HIH, "Las Voz del Higuamo," San Pedro de Macoris, R. D.
HIL	Radio HIL, Apartado 623, Ciudad Trujillo, R. D.
HIX	Radio HIX, J. R. Saladin, Director of Radio Communication, Ciudad Trujillo, R. D.
HI1J	Radiodifusora HI1J, Apartado 204, San Pedro de Macoris, R. D.
HIT	La Voz de la RCA-Victor, Apartado 1105, Ciudad Trujillo, R. D.
HIZ	Radiodifusora HIZ, Calle Duarte No. 68, Ciudad Trujillo, R. D.
HP5B	Radio HP5B, P. O. Box 910, Panama City, Panama.
HP5F	La Voz de Colon, Hotel Carlton, Colon, Panama.
HP5J	La Voz de Panama, Apartado 867, Panama City, Panama.
HP5K	Radiodifusora HP5K, La Voz de la Victor, P. O. Box 33, Colon, Panama.
TGS	Radio TGS, Casa de Presidencial, Guatemala City, Guatemala.
TGX	Radiodifusora TGX, Director M. A. Mejicano Novales, 11 Avenue N. 45, Guatemala City, Guatemala.
TGW-TGWA	Radiodifusora Nacional TGW, Republic de Guatemala.
TG2X	Direccion general de la Polica Nacional, Guatemala City, Guatemala.
TIPG	Radio TIPG, Perry Girton, Prop., Apartado 225, San Jose, Costa Rica, C. A.
TI8WS	Radio TI8WS, "Ecos de Pacifico," Sr. Abel Salazar F, Apartado 75, Puntarenas, Costa Rica.
TIEP	"La Voz del Tropico," Apartado 257, San Jose, Costa Rica, C. A.
TIGPH	Radiodifusora TIGPH, "Alma Tica," Apartado 800, San Jose, Costa Rica.
TIRCC	Radioemisora Catolica Costaricense, Apartado 1064, San Jose, Costa Rica, C. A.
HRD	Radiodifusora HRD, La Voz de Atlantida, La Ceiba, Honduras, C. A.
HRN	Radio HRN, La Voz de Honduras, Tegucigalpa, Honduras.
HRP1	Manuel Escota, Director y Gerente, San Pedro, Sula, Honduras.
VPN	Station VPN, Nassau, Bahama Islands.
WTDV-WTDX	Donald S. Boreham, Supt. of Public Works, St. Thomas, Virgin Islands.
WTDW	H. N. McKenzie, Supt. of Public Works, Christiansted. St. Croix, Virgin Islands.
ZFB-ZFD	Engineer-In-Charge, Wireless Receiving Station, Devonshire, Bermuda.
XAM	Director General de Correos, Merida, Yucatan, Mexico.
XBJQ	Radiodifusora XBJQ, P. O. Box 2825, Mexico D. F., Mexico.
XDA-XDC	Secretaria de Communicaciones, Mexico, D. F.
XEBT	El Buen Tono, S. A., Apartado 79-44, Mexico, D. F.
XECR	Estacion Difusora XEVI, P. O. laciones Exteriories, Mexico, D. F.
XEFT	Radio XEFT, La Voz de Vera Cruz, Av. Independencia 28, Vera Cruz, Mexico.
XEUW	Radiodifusora XEUW, Av. Independencia 98, Vera Cruz, Mexico.
XEME	Radiodifusora XEME, Calle 59, Num. 517, Merida, Yucatan, Mexico.
XEWI	Estacion Difusora XEWI, P. O. Box 2874, Mexico, D. F.
XEXA	Secretaria de Educacion Publica, Mexico, D. F.
YNA	Tropical Radio Telegraph, Managua, Nicaragua, C. A.
YNLF	Radiodifusora YNLF, c/o Ing. Moises Le Franc Calle 15 de Set No. 206, Managua, Nicaragua.
YNVA	Radiodifusora YNVA, Managua, Nicaragua.

EUROPE

2RO	6 Via Montello, Rome, Italy.
CSL	Radio CSL, Emissora National, Lisbon, Portugal.
CT1AA	Antonio Augusto de Aguair, 144, Lisbon, Portugal.
CT1CT	Oscar G. Lomelino, Rua Gomez Freire 79-2 D, Lisbon, Portugal.
CT1GO	Portuguese Radio Club, Parede, Portugal.
SPW	Polskie Radio, 5, Mazowiecka St., Warsaw, Poland.
DAN	Hauptfunkstelle Nordeich, Norden-Land, Germany.
DJA, et al.	German Short Wave Station, Broadcasting House, Berlin, Ger.
Dutch Phones	Parkstaat 29, S'Gravenhage, Holland.
EAQ	Estacion EAQ, P. O. Box 951, Madrid, Spain.
EA8AB	Radio Club Tenerefe, Alvarez de Lugo 1, Apartado 225, Santa Cruz de Tenerife, Canary Islands.

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In Writing For Veries

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EHY-EDM	Piy Margall 2, Madrid, Spain.
English Phones	Engineer-in-Chief's Office (Radio Branch), G.P.O. Armour House, London, E. C. 1.
English Ships	Connaught House, 63, Aldwych, London, W. C. 2. England.
TFJ	Icelandic State Broadcasting Service, P. O. Box 547, Reykjavik, Iceland.
French Phones	166 Rue de Montmartre, Paris, France.
G6RX	Rugby Radio, Hillmorton, Warwickshire, England.
GSA-GSH, et al.	British Broadcasting Corporation, Broadcasting House, London, W. 1, England.
HAS-HAT	Director Radio, Hungarian Post, Gyali St. 22, Budapest, Hungary.
HB9B	Radio Club, Box 1, Basle, Switzerland.
HBL-HBP et al.	Information Section, League of Nations, Geneva, Switzerland.
HVJ	Radio HVJ, Castine, Pio IV, Vatican City, Vatican.
IAC	Coltano Radio, Piza, Italy.
IRM-IRW IRG-IQA	Italo Radio, Via Calabria N. 46/48, Rome, Italy.
LKJ1	Ministere Du Commerce, Administrator des Telegraphes, Oslo, Norway.
OER2	Radio OER2, Vienna, Austria.
ORK-ORG	Director de Communications, Bruxelles, Belgium.
OXY	Statsradiofonien Heibergsgade 7. Copenhagen, Denmark.
PCJ	Philips Radio PCJ, Eindhoven, Holland.
PHI	Phillips Radio PHI, Huizen, Holland.
PI1J	Radio Station PI1J, Dr. M. Hellingman, Owner and Operator, Dordrecht, Holland.
TPA2-3-4	Minister des Postes, Boulevard Haussman, 98 Bis., Paris, France.
RNE-RV59	Radio Centre, Solianka 12, Moscow, USSR.

SOUTH AMERICA

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

UNITED STATES

Dixon Stations	140 Montgomery St., San Francisco, Cal.
W1XAL	World-Wide Broadcasting Corp., University Club, Boston, Mass.
W1XK	Westinghouse Electric & Mfg. Co., Springfield, Mass.
W2XAD-W2XAF	General Electric Co., Schenectady, N. Y.
W2XE	485 Madison Ave., New York, N. Y.
W3XAU	1622 Chestnut St., Philadelphia, Pa.
W3XL-W3XAL	30 Rockefeller Plaza, New York, N. Y.
W4XB	Isle of Dreams Broadcasting Corp., Radio W4XB, Herald Bldg., Miami, Florida.
W8XAL	Crosley Radio Corp., Cincinnati, Ohio.
W8XK	Grant Bldg., Pittsburgh, Pa.
W9XAA	Navy Pier, Chicago, Ill.
W9XF-	20 N Wacker Drive, Chicago, Ill.
W9XBS.	Radio WVD, 517 Federal Office
WVD	Bldg., Seattle, Wash.

VOLUME CONTROLS

[*Continued from page 399*]

for composition or carbon element control. The composition control is most used in antenna, cathode and audio shunt circuits where current is light. It provides a far greater flexibility in high resistance ranges and in complicated taper curves.

It is well to test the operation of a volume or tone control before mounting and soldering the connections. When soldering, especially the composition type, never allow flux or solder to run down terminals into the case, since such materials coming into contact with the resistance element will cause the control to become noisy. Also, never solder any connection to metal cover, for the extreme heat dissipated through contact with a hot soldering iron will tend to damage the control.

Never open a volume control in an attempt to improve upon its internal construction, since the element and contact member are delicate and must not be touched, scraped or tinkered with. Also, never apply oil to surface of resistance element because this will ruin the resistance and the control will no longer function properly.

When using a replacement wire-wound control in antenna cathode circuit which requires minimum resistance to be left in circuit at full volume, use an external resistor of between 200 and 400 ohms such as the flexible type. Stock type controls do not have such minimum resistance incorporated in the control itself, and therefore due precaution must be exercised in seeing that the control is provided with external resistance if wiring diagram or original control has such internal bias resistance. Otherwise the control element may be ruined.

Although volume controls are inexpensive, they are precision devices, carefully made, adjusted and tested by the manufacturer to provide satisfactory service if properly chosen and installed.

U. S. BROADCAST STATION LIST

POWERS IN ITALICS INDICATE STATION IS LICENSED TO OPERATE DAYTIME ONLY

550 KC

KFUO	St. Louis, Mo.	500
KFYR	Bismark, N. D.	1000
KOAC	Corvalis, Ore.	1000
KSD	St. Louis, Mo.	1000
KTSA	San Antonio, Texas	1000
WDEV	Waterbury, Vt.	*500*
WGR	Buffalo, N. Y.	1000
WKRC	Cincinnati, Ohio	1000
WSVA	Harrisonburg, Va.	*500*

560 KC

KFDM	Beaumont, Tex.	500
KLZ	Denver, Colo.	1000
KSFO	San Francisco, Cal.	1000
KWTO	Springfield, Mo.	*5000*
WFIL	Philadelphia, Penna.	1000
WIND	Gary, Ind.	1000
WIS	Columbia, S. C.	1000
WQAM	Miami, Fla.	1000

570 KC

KGKO	Wichita Falls, Tex.	250
KMTR	Hollywood, Calif.	1000
KVI	Tacoma, Wash.	1000
WKBN	Youngstown, Ohio	500
WMCA	New York, N. Y.	500
WNAX	Yankton, S. D.	1000
WOSU	Columbus, Ohio	750
WSYR	Syracuse, N. Y.	250
WWNC	Asheville, N. C.	1000

580 KC

KMJ	Fresno, Calif.	1000
KSAC	Manhattan, Kans.	500
WCHS	Charleston, W. Va.	500
WDBO	Orlando, Fla.	1000
WIBW	Topeka, Kans.	1000
WTAG	Worcester, Mass.	500

590 KC

KHQ	Spokane, Wash.	1000
WEEI	Boston, Mass.	1000
WKZO	Kalamazoo, Mich.	*1000*
WOW	Omaha, Nebr.	5000

600 KC

KFSD	San Diego, Calif.	1000
WCAO	Baltimore, Md.	500
WICC	Bridgeport, Conn.	500
WMT	Waterloo, Iowa	1000
WREC	Memphis, Tenn.	1000

610 KC

KFRC	San Francisco, Calif.	1000
WDAF	Kansas City, Kans.	1000
WIP	Philadelphia, Penna.	1000
WJAY	Cleveland, Ohio	*500*

620 KC

KGW	Portland, Ore.	1000
KTAR	Phoenix, Ariz.	1000
WFLA	Clearwater, Fla.	1000
WHJB	Greensburg, Penna.	*250*
WLBZ	Bangor, Me.	*500*
WSUN	St. Petersburg, Fla.	1000

630 KC

WTMJ	Milwaukee, Wis.	1000
KFRU	Columbia, Mo.	500
KGFX	Pierre, S. D.	*200*
WGBF	Evansville, Ind.	500
WMAL	Washington, D. C.	250
WPRO	Providence, R. I.	250

640 KC

KFI	Los Angeles, Calif.	50000
WAIU	Columbus, Ohio	500
WOI	Ames, Iowa	*5000*
WSPG	Portland, Me.	500

650 KC

WSM	Nashville, Tenn.	50000

660 KC

WAAW	Omaha, Nebr.	*500*
WEAF	New York, N. Y.	50000

670 KC

WMAQ	Chicago, Ill.	50000

680 KC

KFEQ	St. Joseph, Mo.	*2500*
KPO	San Francisco, Calif.	50000
WPTF	Raleigh, N. C.	5000

700 KC

WLW	Cincinnati, Ohio	500000

710 KC

KIRO	Seattle, Wash.	1000
KMPC	Beverly Hills, Calif.	500
WOR	Newark, N. J.	50000

720 KC

WGN	Chicago, Ill.	50000

740 KC

KMMJ	Clay Center, Nebr.	*1000*
KTRB	Modesto, Calif.	*250*
WHEB	Portsmouth, N. H.	*250*
WSB	Atlanta, Ga.	50000

750 KC

KGU	Honolulu, Hawaii	2500
WJR	Detroit, Mich.	50000

760 KC

KXA	Seattle, Wash.	250
WBAL	Baltimore, Md.	2500
WEW	St. Louis, Mo.	*1000*
WJZ	New York, N. Y.	50000

770 KC

KFAB	Lincoln, Nebr.	10000
WBBM	Chicago, Ill.	50000

780 KC

KEHE	Los Angeles, Calif.	500
KFDY	Brookings, S. D.	*1000*
KFQD	Anchorage, Alaska	250
KGHL	Billings, Mont.	1000
WEAN	Providence, R. I.	500
WMC	Memphis, Tenn.	1000
WTAR	Norfolk, Va.	1000

790 KC

KGO	San Francisco, Calif.	7500
WGY	Schenectady, N. Y.	50000

800 KC

WBAP	Fort Worth, Tex.	50000
WFAA	Dallas, Tex.	50000
WTBO	Cumberland, Md.	*250*

810 KC

WCCO	Minneapolis, Minn.	50000
WNYC	New York, N. Y.	*1000*

820 KC

WHAS	Louisville, Ky.	50000

830 KC

KOA	Denver, Colo.	50000
WEEU	Reading, Penna.	*1000*
WHDH	Boston, Mass.	*1000*
WRUF	Gainesville, Fla.	*5000*

850 KC

WESG	Elmira, N. Y.	1000
WKAR	East Lansing, Mich.	*1000*
WWL	New Orleans, La.	10000

860 KC

WABC	New York, N. Y.	50000
WHB	Kansas City, Mo.	*1000*

870 KC

WENR	Chicago, Ill.	50000
WLS	Chicago, Ill.	50000

880 KC

KFKA	Greeley, Colo.	1000
KLX	Oakland, Calif.	1000
KPOF	Denver, Colo.	500
WCOC	Meridian, Miss.	500
WGBI	Scanton, Penna.	500
WPHR	Petersburg, Va.	*500*
WQAN	Scranton, Penna.	250
WSUI	Iowa City, Iowa	500

890 KC

KARK	Little Rock, Ark.	250
KFNF	Shenandoah, Iowa	500
KFPY	Spokane, Wash.	1000
KUSD	Vermilion, S. D.	500
WBAA	West Lafayette, Ind.	*1000*
WGST	Atlanta, Ga.	1000
WILL	Urbana, Ill.	250
WJAR	Providence, R. I.	500
WMMN	Fairmount, W. Va.	500

900 KC

KGBU	Ketchikan, Alaska	500
KHJ	Los Angeles, Calif.	1000
KSEI	Pocatello, Idaho	250
WBEN	Buffalo, N. Y.	1000
WELI	New Haven, Conn.	*500*
WFMD	Frederick, Md.	*500*
WJAX	Jacksonville, Fla.	1000
WKY	Oklahoma City, Okla.	1000
WLBL	Stevens Point, Wis.	*2500*
WTAD	Quincy, Ill.	*500*

920 KC

KFEL	Denver, Colo.	500
KOMO	Seattle, Wash.	1000
KPRC	Houston, Texas	1000
KVOD	Denver, Colo.	500
WAAF	Chicago, Ill.	1000
WORL	Boston, Mass.	500
WPEN	Philadelphia, Penna.	250
WRAX	Philadelphia, Penna.	250
WSPA	Spartansburg, S. C.	1000
WWJ	Detroit, Mich.	1000

930 KC

KMA	Shenandoah, Iowa	1000
KROW	Oakland, Calif.	1000
WBRC	Birmingham, Ala.	1000
WDBJ	Roanoke, Va.	5000

940 KC

KOIN	Portland, Ore.	1000
WAAT	Jersey City ,N. J.	500
WAVE	Louisville, Ky.	1000
WCSH	Portland, Me.	1000
WDAY	Fargo, N. D.	1000
WHA	Madison, Wis.	2500

950 KC

KFWB	Hollywood, Calif.	1000
KHSL	Chico, Calif.	250
KMBC	Kansas City, Mo.	1000
WRC	Washington, D. C.	500

970 KC

KJR	Seattle, Wash.	5000
WCFL	Chicago, Ill.	5000
WIBG	Glenside, Penna.	100

980 KC

KDKA	Pittsburgh, Penna.	50000

990 KC

WBZ	Boston, Mass.	50000
WBZA	Springfield, Mass	1000

1000 KC

KFVD	Los Angeles, Calif.	250
WHO	Des Moines, Iowa	50000

1010 KC

KGGF	Coffeyville, Kansas	1000
KQW	San Jose, Calif.	1000
WHN	New York, N. Y.	1000
WNAD	Norman, Okla.	1000
WNOX	Knoxville, Tenn.	1000

1020 KC

KYW	Philadelphia, Penna.	10000
WDZ	Tuscola, Ill.	250

1040 KC

KRLD	Dallas, Texas	10000
KWJJ	Portland, Ore.	500
WTIC	Hartford, Conn.	50000

1050 KC

KFBI	Abilene, Kans.	5000
KNX	Hollywood, Calif.	50000

1060 KC

KTHS	Hot Springs, Ark.	10000
WBAL	Baltimore, Md.	10000
WJAG	Norfolk, Nebr.	1000

1070 KC

KJBS	San Francisco, Calif.	500
WCAZ	Carthage, Ill.	100
WTAM	Cleveland, Ohio	50000

1080 KC

WBT	Charlotte, N. C.	50000
WCBD	Waukegan, Ill.	5000
WMBI	Chicago, Ill.	5000

1090 KC

KMOX	St. Louis, Mo.	50000

1100 KC

KGDM	Stockton, Calif.	1000
KWKH	Shreveport, La.	10000
WLWL	New York, N. Y.	5000
WPG	Atlantic City, N. J.	5000

1110 KC

KSOO	Sioux Falls, S. D.	2500
WRVA	Richmond, Va.	5000

1120 KC

KFIO	Spokane, Wash.	100
KFSG	Los Angeles, Calif.	500
KRKD	Los Angeles, Calif.	500
KRSC	Seattle, Wash.	250
WCOP	Boston, Mass.	500
WDEL	Wilmington, Del.	250
WISN	Milwaukee, Wis.	250
WTAW	College Station, Tex.	500

1130 KC

KSL	Salt Lake City, Utah	50000
WJJD	Chicago, Ill.	20000
WOV	New York, N. Y.	1000

1140 KC

KVOO	Tulsa, Okla.	25000
WAPI	Birmingham, Ala.	5000
WSPR	Springfield, Mass.	500

1150 KC

WHAM	Rochester, N. Y.	50000

1160 KC

WOWO	Fort Wayne, Ind.	10000
WWVA	Wheeling, W. Va.	5000

1170 KC

WCAU	Philadelphia, Penna.	50000

1180 KC

KEX	Portland, Ore.	5000
KOB	Albuquerque, N. M.	10000
WDGY	Minneapolis, Minn.	1000
WINS	New York, N. Y.	1000
WMAZ	Macon, Ga.	1000

1190 KC

WATR	Waterbury, Conn.	100
WOAI	San Antonio, Texas	50000
WSAZ	Huntington, W. Va.	1000

1200 KC

KADA	Ada, Okla.	100
KBTM	Jonesboro, Ark.	100
KDNC	Lewistown, Mont.	100
KFJB	Marshalltown, Iowa	100
KFXD	Nampa, Idaho	100
KFXJ	Grand Junction, Colo.	100
KGDE	Fergus Falls. Minn.	100
KGEK	Sterling, Colo.	100
KGFJ	Los Angeles, Calif.	100
KGHI	Little Rock, Ark.	100
KMLB	Monroe, La.	100
KSUN	Lowell, Ariz.	100
KVCV	Redding, Calif.	100
KVOS	Bellingham, Wash.	100
KWG	Stockton, Calif.	100
WABI	Bangor, Me.	100
WAIM	Anderson, S. C.	100
WAYX	Waycross, Ga.	100
WBBZ	Ponca City, Okla.	100
WBNO	New Orleans, La.	100
WCAT	Rapid City, S. D.	100
WCAX	Burlington, Vt.	100
WCLO	Janesville, Wis.	100
WCPO	Cincinnati, Ohio	100
WEST	Easton, Penna.	100
WFAM	South Bend, Ind.	100
WHBC	Canton, Ohio	100
WHBY	Green Bay, Wis.	100
WIBX	Utica, N. Y.	100
WIL	St. Louis, Mo.	100
WJBC	Bloomington, Ill.	100
WJBL	Decatur, Ill.	100
WJBW	New Orleans, La.	100
WJNO	West Palm Beach, Fla.	100
WJRD	Tuscaloosa, Ala.	100
WKBO	Harrisburg, Penna.	100
WLVA	Lynchburg, Va.	100
WMFR	High Point, N. C.	100
WMPC	Lapeer, Mich.	100
WNRI	Newport, R. I.	100
WRBL	Columbus, Ga.	100
WTHT	Hartford, Conn.	100
WWAE	Hammond, Ind.	100

1210 KC

KANS	Wichita, Kans.	100
KASA	Elk City, Okla.	100
KDLR	Devils Lake, N. D.	100
KDON	Del Monte, Calif.	100
KFJI	Klamath Falls, Ore.	100
KFOR	Lincoln, Nebr.	100
KFPW	Fort Smith, Ark.	100
KFVS	Cape Girardeau, Mo.	100
KFXM	San Bernardino, Calif.	100
KGY	Olympia, Wash.	100
KIUL	Garden City, Kans.	100
KPPC	Pasadena, Calif.	100
KVSO	Ardmore, Okla.	100
KWTN	Watertown, S. D.	100
WALR	Zanesville, Ohio	100
WBAX	Wilkes-Barre, Penna.	100
WBBL	Richmond, Va.	100
WBLY	Lima, Ohio	100
WBRB	Red Bank, N. J.	100
WCOL	Columbus, Ohio	100
WCRW	Chicago, Ill.	100
WEBQ	Harrisburg, Ill.	100
WEDC	Chicago, Ill.	100
WFAS	White Plains, N. Y.	100
WFOY	St. Augustine, Fla.	100
WGBB	Freeport, N. Y.	100
WGCM	Gulfport, Miss.	100
WGNY	Chester Township, N. Y.	100
WHBF	Rock Island, Ill.	100
WHBU	Anderson, Ind.	100
WIBU	Poynette, Wis.	100
WJBY	Gadsden, Ala.	100
WJEJ	Hagerstown, Md.	100
WJIM	Lansing, Mich.	100
WJW	Akron, Ohio	100
WKOK	Sunbury, Penna.	100
WMBG	Richmond, Va.	100
WMFG	Hibbing, Minn.	100
WMFN	Clarksdale, Miss.	100
WOCL	Jamestown, N. Y.	50
WOMT	Manitowoc, Wis.	100
WPAX	Thomasville, Ga.	250
WSAY	Rochester, N. Y.	100
WSBC	Chicago, Ill.	100
WSIX	Springfield, Tenn.	100
WSOC	Charlotte, N. C.	100
WTAX	Springfield, Ill.	100
....	Middlesboro, Ky.	100

1220 KC

KFKU	Lawrence, Kans.	1000
KTW	Seattle, Wash.	1000
KWSC	Pullman, Wash.	1000
WCAD	Canton, N. Y.	500
WCAE	Pittsburgh, Penna.	1000
WDAE	Tampa, Fla.	1000
WREN	Lawrence, Kans.	1000

1230 KC

KGBX	Springfield, Mo.	500
KGGM	Albuquerque, N. M.	250
KYA	San Francisco, Calif.	1000
WFBM	Indianapolis, Ind.	1000
WNAC	Boston, Mass.	1000

1240 KC

KLPM	Minot, N. D.	250
KTAT	Fort Worth, Texas	1000
KTFI	Twin Falls, Idaho	1000
WKAQ	San Juan, Porto Rico	1000
WXYZ	Detroit, Mich.	1000

1250 KC

KFOX	Long Beach, Calif.	1000
WCAL	Northfield, Minn.	1000
WDSU	New Orleans, La.	1000
WHBI	Newark, N. J.	1000
WLB	Minneapolis, Minn.	1000
WNEW	Newark, N. J.	1000
WTCN	Minneapolis, Minn.	1000

1260 KC

KGVO	Missoula, Mont.	1000
KOIL	Council Bluffs, Iowa	1000
KPAC	Port Arthur, Texas	500
KRGV	Welasco, Texas	500
KUOA	Fayetteville, Ark.	1000
KVOA	Tucson, Ariz.	500
WHIO	Dayton, Ohio	1000
WNBX	Springfield, Vt.	1000
WTOC	Savannah, Ga.	1000

1270 KC

KGCA	Decorah, Iowa	100
KOL	Seattle, Wash.	1000
KVOR	Colorado Springs, Colo.	1000
KWLC	Decorah, Iowa	100
WASH	Grand Rapids, Mich.	500
WFBR	Baltimore, Md.	500
WJDX	Jackson, Miss.	1000
WOOD	Grand Rapids, Mich.	500

1280 KC

KFBB	Great Falls, Mont.	1000
WCAM	Camden, N. J.	500
WCAP	Asbury Park, N. J.	500
WDOD	Chattanooga, Tenn.	1000
WIBA	Madison, Wis.	1000
WORC	Worcester, Mass.	500
WRR	Dallas, Texas	500
WTNJ	Trenton, N. J.	500

1290 KC

KDYL	Salt Lake City, Utah	1000
KLCN	Blytheville, Ark.	100
KTRH	Houston, Texas	1000
WEBC	Superior, Wis.	1000
WJAS	Pittsburgh, Penna.	1000
WNBZ	Saranac Lake, N. Y.	100
WNEL	San Juan, Porto Rico	1000

1300 KC

KALE	Portland, Ore.	500
KFAC	Los Angeles, Calif.	1000
KFH	Wichita, Kans.	1000
KFJR	Portland, Ore.	500
WBBR	Brooklyn, N. Y.	1000
WEVD	New York, N. Y.	1000
WFAB	New York, N. Y.	1000
WFBC	Greenville, S. C.	1000
WHAZ	Troy, N. Y.	500
WHBL	Sheboygan, Wis.	500
WIOD	Miami, Fla.	1000

1310 KC

KCRJ	Jerome, Ariz.	100
KFPL	Dublin, Texas	100
KFXR	Oklahoma City, Okla.	100
KFYO	Lubbock, Texas	100
KGCX	Wolf Point, Mont.	100
KGEZ	Kalispell, Mont.	100
KGFW	Kearney, Nebr.	100
KINY	Juneau, Alaska	100
KIT	Yakima, Wash.	100
KIUJ	Santa Fe, N. M.	100
KPDN	Pampa, Texas	100
KRKV	Sherman, Texas	100
KRMD	Shreveport, La.	100
KROC	Rochester, Minn.	100
KTSM	El Paso, Texas	100
KVOL	Lafayette, La.	100
KXRO	Aberdeen, Wash.	100
WAML	Laurel, Miss.	100
WBEO	Marquette, Mich.	100
WBOW	Terre Haute, Ind.	100
WBRE	Wilkes-Barre, Penna.	100
WCLS	Joliet, Ill.	100
WCMI	Ashland, Ky.	100
WDAH	El Paso, Texas	100
WEBR	Buffalo, N. Y.	100
WEMP	Milwaukee, Wis.	100
WEXL	Royal Oak, Mich.	50
WFBG	Altoona, Penna.	100
WFDF	Flint, Mich.	100
WGH	Newport News, Va.	100
WHAT	Philadelphia, Penna.	100
WJAC	Johnstown, Penna.	100
WLAK	Lakeland, Fla.	100
WLBC	Muncie, Ind.	100
WLNH	Laconia, N. H.	100
WMBO	Auburn, N. Y.	100
WMFF	Plattsburg, N. Y.	250
WNBH	New Bedford, Mass.	100
WOL	Washington, D. C.	100
WRAW	Reading, Penna.	100
WROL	Knoxville, Tenn.	100
WSAJ	Grove City, Penna.	100
WSGN	Birmingham, Ala.	100
WSJS	Winston-Salem, N. C.	100
WTAL	Tallahassee, Fla.	100
WTEL	Philadelphia, Penna.	100
WTJS	Jackson, Tenn.	100
WTRC	Elkhart, Ind.	100

1320 KC

KGHF	Pueblo, Colo.	500
KGMB	Honolulu, Hawaii	1000
KID	Idaho Falls, Idaho	500
KRNT	Des Moines, Iowa	500
WADC	Akron, Ohio	1000
WORK	York, Penna.	1000
WSMB	New Orleans, La.	500

1330 KC

KGB	San Diego, Calif.	1000
KMO	Tacoma, Wash.	250
KSCJ	Sioux City, Iowa	1000
WDRC	Hartford, Conn.	1000
WSAI	Cincinnati, Ohio	1000
WTAQ	Green Bay, Wis.	1000

1340 KC

KGDY	Huron, S. D.	250
KGIR	Butte, Mont.	1000
KGNO	Dodge City, Kans.	250
WCOA	Pensacola, Fla.	500
WFEA	Manchester, N. H.	500
WSPD	Toledo, Ohio	1000

1350 KC

KIDO	Boise, Idaho	1000
KWK	St. Louis, Mo.	1000
WAWZ	Zarephath, N. J.	500
WBNX	New York, N. Y.	1000

1360 KC

KCRC	Enid, Okla.	250
KGER	Long Beach, Calif.	1000
WCSC	Charleston, S. C.	500
WFBL	Syracuse, N. Y.	1000
WGES	Chicago, Ill.	500
WQBC	Vicksburg, Miss.	1000
WSBT	South Bend, Ind.	500

1370 KC

KAST	Astoria, Ore.	100
KCMO	Kansas City, Mo.	100
KELD	El Dorado, Ark.	100
KERN	Bakersfield, Calif.	100
KFGQ	Boone, Iowa	100
KFJM	Grand Forks, N. D.	100
KFJZ	Fort Worth, Texas	100
KFRO	Longview, Texas	100
KGAR	Tucson, Ariz.	100
KGFG	Oklahoma City, Okla.	100
KGFL	Roswell, N. M.	100
KGKL	San Angelo, Texas	100
KICA	Clovis, N. M.	100
KIUP	Durango, Colo.	100
KLUF	Galveston, Texas	100
KMAC	San Antonio, Texas	100
KONO	San Antonio, Texas	100
KRE	Berkeley, Calif.	100
KRKO	Everett, Wash.	50
KSLM	Salem, Ore.	100
KUJ	Walla Walla, Wash.	100
KVL	Seattle, Wash.	100
KWYO	Sheridan, Wyo.	100
WABY	Albany, N. Y.	100
WAGF	Dothan, Ala.	250
WATL	Atlanta, Ga.	100
WBNY	Buffalo, N. Y.	100
WBTM	Danville, Va.	100
WCBM	Baltimore, Md.	100
WDAS	Philadelphia, Pa.	100
WDNS	Champaign, Ill.	100
WEOA	Evansville, Ind.	100
WGL	Fort Wayne, Ind.	100
WGRC	New Albany, Ind.	250
WHBQ	Memphis, Tenn.	100
WHDF	Calumet, Mich.	100
WHLB	Virginia, Minn.	100
WIBM	Jackson, Mich.	100
WLLH	Lowell, Mass.	100
WMBR	Jacksonville, Fla.	100
WMFD	Wilmington, N. C.	100
WMFO	Decatur, Ill.	100
WMIN	St. Paul, Minn.	100
WOC	Davenport, Iowa	100
WPAY	Portsmouth, Ohio	100
WPFB	Hattiesburg, Miss.	100
WQDM	St. Albans, Vt.	100
WRAK	Williamsport, Penna.	100
WRDO	Augusta, Ga.	100
WRJN	Racine, Wis.	100
WSVS	Buffalo, N. Y.	50

1380 KC

KOH	Reno, Nev.	500
KQV	Pittsburgh, Penna.	500
WALA	Mobile, Ala.	500
WKBH	La Crosse, Wis.	1000
WNBC	New Britain, Conn.	250
WSMK	Dayton, Ohio	200

1390 KC

KLRA	Little Rock, Ark.	1000
KOOS	Marshfield, Ore.	250
KOY	Phoenix, Ariz.	500
WHK	Cleveland, Ohio	1000

(Continued on page 414)

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	W3XKA	● Philadelphia, Pa.	Weekdays 11 A.M.-11 P.M. Sun. 9 A.M.-11 P.M.
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., 9 A.M.-12 noon daily
21420	14.01	WKK	Lawrenceville, N. J.	(P) Phones LSN - PSA daytime; HJY-OCI-OCJ irregular
21160	14.19	LSL	Buenos Aires, Arg.	(P) Phones GAA mornings; DFB-DHO PSE-EHY irreg.
21140	14.19	KBI	Manila, P. I.	(P) Tests and relays P. M. irregular
21080	14.23	PSA	Rio de Janeiro, Brazil	(P) Phones WKK-WLK daytime
21060	14.25	KWN	Dixon, Calif.	(P) Phones afternoon irregular
21020	14.29	LSN	Buenos Aires, Arg.	(P) Phones WKK-WLK daily; EHY, FTM irregular
20860	14.38	EHY	Madrid, Spain	(P) Phones LSM-PPU-LSY mornings
20860	14.38	EDM	Madrid, Spain	(P) Phones LSM-PPU-LSY mornings
20835	14.40	PFF	Kootwijk, Holland	(P) Phones Java days
20830	14.40	PFF	Kootwijk, Holland	(P) Phones Java days
20825	14.41	PFF	Kootwijk, Holland	(P) Phones Java days
20820	14.41	KSS	Bolinas, Calif.	(P) Phones Far 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.
18920	15.85	WQE	Rocky Point, N. Y.	(E) Programs, irreg.
18910	15.86	JVA	Nazaki, Japan	(P) Phones and tests irregularly with Europe
18890	15.88	ZSS	Klipheuvel, So. Africa	(P) Phones GAQ-GAU mornings
18830	15.93	PLE	Bandoeng, Java	(P) Phones PCV mornings early; KWU evenings
18680	16.06	OCI	Lima, Peru	(P) Phones CEC-HJY days; WKK-WOP noon
18620	16.11	GAU	Rugby, England	(P) Phones VWY-ZSS early A.M.; Lawrenceville, daytime
18545	16.18	PCM	Kootwijk, Holland	(P) Relays and phones Java early A.M.

KC	Meters	Call	Location	Time
18540	16.19	PCM	Kootwijk, Holland	(P) Relays and phones Java early A.M.
18535	16.20	PCM	Kootwijk, Holland	(P) Relays and phones Java early A.M.
18480	16.23	HBH	Geneva, Switzerland	(E) Relays to N. Y. mornings irreg.
18450	16.26	HBF	Geneva, Switzerland	(E) Commercial; irreg.
18440	16.25	HJY	Bogota, Colombia	(P) Phones CEC-OCI noon; music irreg.
18410	16.29	PCK	Kootwijk, Holland	(P) Phones PLE-PMC early A.M.
18405	16.30	PCK	Kootwijk, Holland	(P) Phones PLE-PMC early A.M.
18400	16.31	PCK	Kootwijk, Holland	(P) Phones PLE-PMC early A.M.
18388	16.31	FZS	Saigon, Indo-China	(P) Phones FTK early mornings
18340	16.36	WLA	Lawrenceville, N. J.	(P) Phones GAS A.M.
18310	16.38	GAS	Rugby, England	(P) Phones WLA-WMN mornings
18295	16.39	YVR	Maracay, Venezuela	(P) Phones DFB-EHY-FTM mornings
18270	16.42	IUD	● Addis Ababa, Ethiopia	Irregular
18250	16.43	FTO	St. Assise, France	(P) 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, U. S. eves.
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; 12:15-5:45 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	8-11 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	CMA5	Havana, Cuba	(P) Phones and tests evenings
17260	17.37	DAN	Nordenland, Germany	(P) Phones ships A.M.
17120	17.52	WOO	Ocean Gate, N. J.	(P) Phones ships daytime
17120	17.52	WOY	Lawrenceville, N. J.	(P) Phones England irregularly
17080	17.56	GBC	Rugby, England	(P) Phones ships daytime
16910	17.74	JZD	Nazaki, Japan	(P) Phones ships irreg.
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.

KC	Meters	Call	Location	Time
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.
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.; U. S. eves.
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
15450	19.42	IUG	Addis Ababa, Ethiopia	(P) Phones irregular
15430	19.44	KWE	Bolinas, Calif.	(P) Tests JYK - JYT - PLE evenings
15415	19.46	KWO	Dixon, Calif.	(P) Phones JVF evenings
15370	19.52	HAS3	● Budapest, Hungary	Sunday 9-10 A.M.
15360	19.53	DJT	● Zeesen, Germany	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.-3:45 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.	7 A.M.-4:45 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
15252	19.67	RIM	Tashkent, USSR.	(P) Phones RKI early mornings
15243	19.68	TPA2	● Pontoise, France	4:55-10 A.M. Daily
15220	19.71	PCJ	● Eindhoven, Holland	Sun., Wed. 7-11 A.M. Tues. 4-6 A.M.
15210	19.72	W8XK	● Pittsburgh, Pa.	9 A.M.-7 P.M. daily
15183	19.76	RV96	● Moscow, USSR.	1:30-2 P.M. Sunday
15180	19.76	GSO	● Daventry, England	12:15-3:40 P.M. daily
15145	19.81	RKI	● Moscow, USSR.	Phones RIM early A.M. Broadcasts Sun. 6-7 A.M., 10-11 A.M., Wed. 6-7 A.M.
15200	19.74	DJB	● Zeesen, Germany	3:50-11 A.M., 4:45-10:45 P.M. daily
15140	19.82	GSF	● Daventry, England	9 A.M.-12 noon, 12:15-5:45 P.M., 6-8 P.M., 9-11 P.M. daily
15121	19.84	HVJ	● Vatican City, Vatican	10:30-10:45 A.M. weekdays
15110	19.85	DJL	● Zeesen, Germany	5:45-7:30 A.M. daily
15055	19.92	WNC	Hialeah, Fla.	(P) Phones daytime
15040	19.95	HIR	Ciudad Trujillo, R. D.	(P) Phones WNC days
14985	20.02	YSL	San Salvador, Salvador	(P) Phones days irreg.
14980	20.03	KAY	Manila, P. I.	(P) Phones DFC-DFD-GCJ early A.M.; KWU evenings
14970	20.04	LZA	● Sofia, Bulgaria	Sunday 12:30 A.M.-8 A.M., 10 A.M.-4 P.M.; Mon., Wed., Fri., Sat., 5-7 A.M.; Tues., Thu., 1-3 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. 5-9 P.M.
14590	20.56	WMN	Lawrenceville, N. J.	(P) Phones England days
14535	20.64	HBJ	Geneva, Switzerland	(E) Relays to Riverhead daytime
14530	20.65	LSN	Buenos Aires, Arg.	(P) Phones PSF-WLK-WOK irreg.
14485	20.71	TIR	Cartago, Costa Rica	(P) Phones WNC days
14485	20.71	TIU	Cartago, Costa Rica	(P) Phones WNC days
14485	20.71	YNA	Managua, Nicaragua	(P) Phones WNC days
14485	20.71	HPF	Panama City, Panama	(P) Phones daytime
14485	20.71	HRM	Tela, Honduras	(P) Phones WNC days
14485	20.71	TGF	Guatemala City, Guatemala	(P) Phones WNC days
14480	20.72	PLX	Bandoeng, Java	(P) Phones Europe 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.
14250	21.00	W10XDA	Schooner Morrissey	(P) Irregular
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	WOP	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 12:30-1:30 A.M.
13020	23.04	JZE	Nazaki, Japan	(P) Phones ships irreg.
13000	23.08	FYC	Paris, France	(P) Phones CNR A.M.
12985	23.11	DFC	Nauen, Germany	(P) Phones KAY-SUV-SUZ early A.M.
12865	23.32	IAC	Pisa, Italy	(P) Phones ships irreg.
12860	23.33	RKR	Novosibirsk, USSR.	(P) Daily, 7 A.M.
12840	23.36	WOO	Ocean Gate, N. J.	(P) Phones ships days
12830	23.37	HJC	Barranquilla, Colombia	(P) Phones HJB-HPF WNC days
12830	23.38	HJA-3	Barranquilla, Colombia	(P) Phones HJB HPF-WNC days
12830	23.38	CNR	● Rabat, Morocco	Special broadcasts irreg
12830	23.38	CNR	Rabat, Morocco	(P) Phones FYB TYB FTA irreg. days
12800	23.44	IAC	Pisa, Italy	(P) Phones ships and tests Tripoli, irreg.
12780	23.47	GBC	Rugby, England	(P) Phones VWY early A.M.
12394	24.21	DAN	Nordenland, Germany	(P) Phones ships irreg. mornings

KC	Meters	Call	Location	Time
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, 1:40-2:15 P. M. and later
12220	24.55	FLJ	Paris, France	(P) Phones ships irreg.
12215	24.56	TYA	Paris, France	(P) Algeria days
12150	24.69	GBS	Rugby, England	(P) Phones Lawrenceville days
12130	24.73	DZE	● Zeesen, Germany	7-9 P.M.
12100	24.79	CJA	Drummondville, Que.	(P) Tests VIY early A. M. and evenings
12060	24.88	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12055	24.89	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12050	24.90	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12020	24.95	VIY	Rockbank, Australia	(P) Tests CJA6 early A.M. and evenings
12000	25.00	RNE	● Moscow, USSR.	Sundays 6-7 A.M., 10-11 A.M., 4-5 P.M.; Mon. 4-5 P.M.; Wed. 6-7 A.M., 4-5 P.M.; Friday 4-5 P.M.
11991	25.02	FZS	Saigon, Indo-China	(P) Phones FTA - FTK early A.M.
11955	25.09	IUC	● 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.
11885	25.25	TPA3	● Pontoise, France	1-4 A.M., 11:15 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.	Daily 8:30 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.	5 P.M. News Items—Mon. to Fri. inc.
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	12:15-2:25 A.M., 12:15 P.M.-3:25 P.M.
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.
11402	26.31	HBO	Geneva, Switzerland	(E) Broadcasts Sundays 11:30 P.M.; commercial, irreg.
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
10955	27.38	HS8PJ	● Bangkok, Siam	Mondays 8-10 A.M.
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 to 8 A.M.; 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	Bangkok, 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	7-9 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

KC	Meters	Call	Location	Time
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 1-3 P.M.; daily 5:15 to 9:30 P.M.
9840	30.47	JYS	Kemikawa-Cho, Japan	(E) Tests irregular
9830	30.50	IRM	Rome, Italy	(P) Phones JVP-JZT-LSX-WEL A.M.
9810	30.58	DFE	Nauen, Germany	(P) Relays and tests afternoons irreg.
9800	30.59	GCW	Rugby, England	(P) Phones Lawrenceville eve. and nights
9800	30.59	LSI	Buenos Aires, Arg.	(P) Relays very irreg.
9760	30.74	VLJ	Sydney, Australia	(P) Phones PLV-ZLT early A.M.
9760	30.74	VLZ	Sydney, Australia	(P) Phones PLV-ZLT early A.M.
9750	30.77	WOF	Lawrenceville, N. J.	(P) Phones GCU irreg.
9710	30.88	GCA	Rugby, England	(P) Phones LSL afternoons
9700	30.93	LQA	Buenos Aires, Arg.	(P) Tests and relays early evenings
9675	31.00	DZA	● Zeesen, Germany	5-7 P.M.
9660	31.06	LRX	● Buenos Aires, Arg.	5-9 P.M. daily
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. First Monday each month 6-7 P.M.
9595	31.27	HH3W	● Port-au-Prince, Haiti	1-2 P.M., 7-8:30 P.M.; 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 12:30-2:30 A.M., 4:30-8:30 A.M., 9:30-11:30 A.M.
9590	31.28	HP5J	● Panama City, Panama	Week days 12-1:30 P.M., 6-10:30 P.M. Sundays 10:30 A.M.-1:30 P.M., 3-4 P.M., 6-10:30 P.M.
9590	31.28	PCJ	● Eindhoven, Holland	Sundays 7-8 P.M.; Wed. or Thurs. 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	Daily 3:30-8:30 A.M.; Sat. 10 P.M.-2 A.M.
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., 8-11 A.M., 4:50-10:45 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., 8-11 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	12:15-2:25 A.M., 12:15 P.M.-5:45 P.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

KC	Meters	Call	Location	Time
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	● Asuncion, Paraguay	8:00-10:00 P.M.
8075	37.15	WEZ	Rocky Point, N. Y.	(E) Program service P. M.; irregular
8035	37.33	CNR	Rabat, Morocco	(P) Phones France nights
8035	37.33	CNR	● Rabat, Morocco	Special broadcasts irreg.
7970	37.64	XGL	Shanghai, China	(P) Tests early mornings
7968	37.65	HSJ	Bangkok, 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

KC	Meters	Call	Location	Time
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. First Mon. each month 6-7 P.M.
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	IUB	●Addis Ababa, Ethiopia	Irregular
7610	39.42	KWX	Dixon, Calif.	(P) Phones KKH nights; KAZ-KTP-PLV JVT-JVM A.M.
7565	39.66	KWY	Dixon, Calif.	(P) Phones Shanghai early mornings
7550	39.74	TI8WS	●Puntarenas, Costa Rica	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.
7220	41.55	VP3BG	●Georgetown, Brit. Guiana	6-8:45 P.M. daily
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.
6922	43.34	IUF	Addis Ababa, Ethiopia	(E) Irregular
6905	43.45	GDS	Rugby, England	(P) Phones WOA-WNA-WCN evenings
6900	43.48	HI2D	●Ciudad Trujillo, R. D.	Daily 6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
6895	43.51	HCETC	●Quito, Ecuador	8:15-10:30 P.M. ex. Sun.
6890	43.54	KEB	Bolinas, Calif.	(P) Tests KAZ-PLV early A.M.
6880	43.60	CGA-7	Drummondville, Que.	(P) Phones Europe days
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	WOO	Rocky Point, N. Y.	(E) Tests evenings irreg.
6720	44.64	YVQ	Maracay, Venezuela	(P) Phones and relays N. Y. evenings
6720	44:64	YVQ	●Maracay, Venezuela	8-9 P.M. Saturdays
6718	44.66	KBK	Manila, P. I.	(P) Phones A. M. seasonally
6710	44.71	TIEP	●San Jose, Costa Rica	7:00-10:30 P.M. daily
6690	44.84	CGA-6	Drummondville, Que.	(P) Phones Europe irregularly
6680	44.91	DGK	Nauen, Germany	(P) Relays to Riverhead evenings irreg.
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., 5:40-8:40 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; 3-6 P. M. Sun.
6520	46.01	YV6RV	●Valencia, Venezuela	10:30 A.M.-1:30 P.M., 4:30-9:30 P.M. daily
6500	46.15	HIL	●Ciudad Trujillo, R.D.	12-2 P.M., 6-8 P.M.
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
6182	48.53	XEXA	●Mexico City, Mex.	8-11:30 A.M., 3-5 P.M. ex. Sun., 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.

KC	Meters	Call	Location	Time
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.
6140	48.86	W8XK	● Pittsburgh, Pa.	9 P.M.-1 A.M. daily
6137	48.88	CR7AA	● Lourenco Marques, Africa	12:45-3 P.M. daily; 8-10:30 A.M. Sundays
6135	48.90	HH3NW	● Port-au-Prince, Haiti	1-2 P.M., 7-8:30 P.M. daily
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	Belgrade	● Belgrade, Yugoslavia	2 A.M.-12 midnight daily
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.
6090	49.26	CRCX	● Bowmansville, Ont.	Week days 5-11 P.M.; Sundays 2-11 P.M.
6090	49.26	ZTJ	● Johannesburg, S. Africa	11:45 P.M.-12:30 A.M. 3:30-7:00 A.M. 9 A.M.-4:45 P.M.
6890	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.	6:30-8:30 A.M., 5 P.M.-12 A.M. daily
6080	49.34	ZHJ	● Penang, S.S.	6:40-8:40 A.M.
6080	49.34	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 8 P.M.-12 A.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	Temporarily off the air. Undergoing repairs.
6040	49.67	W1XAL	● Boston, Mass.	Sun. 3-9 P.M.; Mon. to Fri. inc., 7-9 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
5020	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. 12-2 P.M., 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	CFCX	● Montreal, Que.	Week days 6:45 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. Fall, Winter & Spring
6000	50.00	XEBT	● Mexico City, Mexico	10 A.M.-1:45 A.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	IUA	● 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.

Short-Wave Station List

KC	Meters	Call	Location	Time
5670	52.91	DAN	Nordenland, Germany	(P) Phones ships irreg.
5500	54.55	TI5HH	● San Ramon, Costa Rica	3:30-5 P.M., 8-9:30 P.M. daily
5445	55.10	CJA7	Drummondville, Que.	(P) Phones Australia early A.M.
5435	55.20	LSH	Buenos Aires, Arg.	(P) Relays LR4 and tests evenings
5410	55.45	ZBW	● Hong Kong, China	1:30-3:15 A.M., 6 A.M.-12 N.
5400	55.56	HJA7	Cucuta, Colombia	(P) Phones irreg.; broadcasts music in evening at times
5400	55.56	HJA7	● Cucuta, Colombia	Monday 4-8 P.M.
5395	55.61	CFA7	Drummondville, Que.	(P) Phones No. America irregular
5260	57.03	WQN	Rocky Point, N. Y.	(E) Program service; irregular
5140	58.37	PMY	● Bandoeng, Java	Daily 4:45-10:45 A.M., 5:45 P.M.-2:15 A.M.
5110	58.71	KEG	Bolinas, Calif.	(P) Phones irregularly evenings
5080	59.08	WCN	Lawrenceville, N. J.	(P) Phones GDW evenings seasonally
5025	59.76	ZFA	Hamilton, Bermuda	(P) Phones WOB evenings
5040	59.25	RIR	Tiflis, USSR.	(P) Phones afternoons irregular
5015	59.82	KUF	Manila, P. I.	(P) Phones Bolinas; irregular
4975	60.30	GBC	Rugby, England	(P) Phones ships afternoon and nights
4905	61.16	CGA8	Drummondville, Que.	(P) Phones GDB - GCB afternoons
4820	62.20	GDW	Rugby, England	(P) Phones WCN-WOA evenings
4810	62.37	YDE2	● Solo, D. E. I.	5:30-11:30 A.M., 5:45-6:45 P.M., 10:30 P.M.-1:30 A.M.
4795	62.56	VE9BK	● Vancouver, Canada	Week days 11:30-11:45 A.M., 3-3:15 P.M., 8-8:15 P.M.; Sat. 7:30-7:45 P.M.
4752	63.13	WOY	Lawrenceville, N. J.	(P) Tests irregularly
4752	63.13	WOO	Ocean Gate, N. J.	(P) Phones ships irreg.
4752	63.13	WOG	Lawrenceville, N. J.	(P) Phones Rugby irreg.
4600	65.22	HC2ET	● Guayaquil, Ecuador	9:15-10:45 P.M. Wed. & Sat.
4555	65.95	WDN	Rocky Point, N. Y.	(P) Tests Rome and Berlin evenings
4550	65.93	KEH	Bolinas, Calif.	(P) Phone; irreg.
4510	66.52	ZFS	Nassau, Bahamas	(P) Phones WND daily; tests GYD - ZSV irregular
4465	67.19	CFA2	Drummondville, Que.	(P) Phones No. Amer.; irregular days
4348	69.00	CGA9	Drummondville, Que.	(P) Phones ships and Rugby evenings
4320	69.40	GDB	Rugby, England	(P) Phones CGA8 and tests evenings
4295	69.90	WTDV	St. Thomas, Virgin Is.	(E) Weather reports, 8 A.M.-12 Noon; 3-6 P.M.
4295	69.90	WTDW	St. Croix, Virgin Is.	(E) Weather reports, 8 A.M.-12 Noon; 3-6 P.M.
4295	69.90	WTDX	St. John, Virgin Is.	(E) Weather reports, 8 A.M.-12 Noon; 3-6 P.M.
4273	70.21	RV15	● Khabarovsk, USSR.	Daily 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.

U. S. Broadcast Station List

(Continued from page 407)

1400 KC

KLO	Ogden, Utah	500
KTUL	Tulsa, Okla.	500
WARD	Brooklyn, N. Y.	500
WBBC	Brooklyn, N. Y.	500
WEGL	Brooklyn, N. Y.	500
WIRE	Indianapolis, Ind.	500
WLTH	Brooklyn, N. Y.	500
WVFW	Brooklyn, N. Y.	500

1410 KC

KGNC	Amarillo, Texas	1000
KMED	Medford, Ore.	250
WAAB	Boston, Mass.	500
WBCM	Bay City, Mich.	500
WHIS	Bluefield, W. Va.	250
WROK	Rockford, Ill.	500
WSFA	Montgomery, Ala.	500

1420 KC

KABC	San Antonio, Texas	100
KABR	Aberdeen, S. D.	100
KALB	Alexandria, La.	100
KBPS	Portland, Ore.	100
KCMC	Texarkana, Ark.	100
KEUB	Price, Utah	100
KFIZ	Fond du Lac, Wis.	100
KGFF	Shawnee, Okla.	100
KGGC	San Francisco, Calif.	100
KGIW	Alamosa, Colo.	100
KHBC	Hilo, Hawaii	100
KIDW	Lamar, Colo.	100
KIUN	Pecos, Texas	100
KNET	Palestine, Texas	100
KORE	Eugene, Ore.	100
KRBC	Abilene, Texas	100
KRLC	Lewiston, Idaho	100
KRLH	Midland, Texas	100
KUMA	Yuma, Ariz.	100
KWBG	Hutchinson, Kans.	100
KXL	Portland, Ore.	100
WACO	Waco, Texas	100
WAGM	Presque Isle, Maine	100
WAPO	Chattanooga, Tenn.	100
WAZL	Hazleton, Pa.	100
WCBS	Springfield, Ill.	100
WCHV	Charlotteville, Va.	100
WEED	Rocky Mount, N. C.	100
WEHS	Cicero, Ill.	100
WELL	Battle Creek, Mich.	100
WGPC	Albany, Ga.	100
WHDL	Olean, N. Y.	100
WHFC	Cicero, Ill.	100
WILM	Wilmington, N. C.	100
WJBO	Baton Rouge, La.	100
WJBR	Gastonia, N. C.	100
WJMS	Ironwood, Mich.	100
WKBI	Cicero, Ill.	100
WLAP	Lexington, Ky.	100
WLBF	Kansas City, Kans.	100
WLEU	Erie, Pa.	100
WMAS	Springfield, Mass.	100
WMBC	Detroit, Mich.	100
WMBH	Joplin, Mo.	100
WMFJ	Daytona Beach, Fla.	100
WMSD	Sheffield, Ala.	100
WPAD	Paducah, Ky.	100
WPAR	Parkersburg, W. Va.	100
WPRP	Ponce, Porto Rico	100

1430 KC

KECA	Los Angeles, Calif.	1000
KGNF	North Platte, Nebr.	1000
KSO	Des Moines, Iowa	500
WBNS	Columbus, Ohio	500
WHEC	Rochester, N. Y.	500
WHP	Harrisburg, Penna.	500
WNBR	Memphis, Tenn.	500
WOKO	Albany, N. Y.	500

1440 KC

KDFN	Casper, Wyo.	500
KLS	Oakland, Calif.	250
KXYZ	Houston, Texas	1000
WBIG	Greensboro, N. C.	500
WCBA	Allentown, Penna.	500
WMBD	Peoria, Ill.	500
WSAN	Allentown, Penna.	500

1450 KC

KIEM	Eureka, Calif.	500
KTBS	Shreveport, La.	1000
WGAR	Cleveland, Ohio	500
WHOM	Jersey City, N. J.	250
WSAR	Fall River, Mass.	1000
WTFI	Athens, Ga.	500

1460 KC

KSTP	St. Paul, Minn.	25000
WJSV	Washington, D. C.	10000

1470 KC

KGA	Spokane, Wash.	5000
WLAC	Nashville, Tenn.	5000

1480 KC

KOMA	Oklahoma City, Okla.	5000
WKBW	Buffalo, N. Y.	5000

1490 KC

KFBK	Sacramento, Calif.	5000
WCKY	Covington, Ky.	5000

1500 KC

KBIX	Muskogee, Okla.	100
KBST	Big Springs, Texas	100
KDB	Santa Barbara, Calif.	100
KGFI	Corpus Christi, Texas	100
KGFK	Moorhead, Minn.	100
KGKB	Tyler, Texas	100
KGKY	Scottsbluff, Nebr.	100
KNEL	Brady, Texas	100
KNOW	Austin, Texas	100
KOTN	Pine Bluff, Ark.	100
KPLC	Lake Charles, La.	100
KPLT	Paris, Texas	100
KPQ	Wenatchee, Wash.	100
KRNR	Roseburg, Ore.	100
KTEP	El Paso, Texas	100
KUTA	Salt Lake City, Utah	100
KVOE	Santa Ana, Calif.	100
KXO	El Centro, Calif.	100
WCNW	Brooklyn, N. Y.	100
WDNC	Durham, N. C.	100
WGAL	Lancaster, Penna.	100
WHBB	Selma, Ala.	100
WHEF	Kosciusko, Miss.	100
WJBK	Detroit, Mich.	100
WKBB	East Dubuque, Ill.	100
WKBV	Richmond, Ind.	100
WKBZ	Muskegon, Mich.	100
WKEU	Griffin, Ga.	100
WMBQ	Brooklyn, N. Y.	100
WMEX	Boston, Mass.	100
WNBF	Binghamton, N. Y.	100
WNLC	New London, Conn.	100
WOPI	Bristol, Tenn.	100
WRDW	Augusta, Ga.	100
WRGA	Rome, Ga.	100
WSYB	Rutland, Vt.	100
WTMV	East St. Louis, Ill.	100
WWRL	Woodside, N. Y.	100
WWSW	Pittsburgh, Penna.	100

1530 KC

W1XBS	Waterbury, Conn.	1000
W9XBY	Kansas City, Mo.	1000

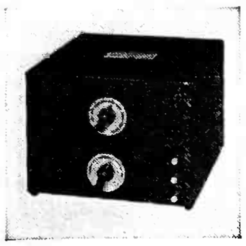
1550 KC

W2XR	Long Island City, N. Y.	1000
W6XAI	Bakersfield, Calif.	1000

On the Market

C. I. Audio Oscillator

THE AUDIO OSCILLATOR, Type VFF, manufactured by Communication Instruments, Inc., 125 West 40th Street, New York City, employs a resistance stabilized circuit that assures an excellent waveform and stability of the output. An amplifier stage isolates the oscillator circuit from the load and so permits the oscillator to be operated at a low output level, at the same time preventing the load from affecting the frequency or otherwise reacting on the oscillator.



The main dial is calibrated in ten marked steps at the following frequencies: 50 — 100 — 400 — 1,000 — 2,500 — 5,000 —7,500—10,000—14,000 and 20,000 cycles per second. The second dial controls the output and on-off switch.

The compact and portable unit is operated from batteries, the filament drain being only 60 ma and the plate current drain being but 2.5 ma for the two type 30 tubes. All possibilities of hum originating in the source of a-f voltage and feedback are eliminated because of battery operation, which also contributes to the inherent frequency stability of the oscillator.

In addition to the high-impedance output, which delivers a maximum of 5 volts, an output transformer is included to match a 500-ohm load, across the terminals of which is delivered a maximum of 0.5 volt. The harmonic content is about 6% at 50 c.p.s. and lower at all other frequencies. ALL-WAVE RADIO.

◆

Taco Self-Selecting Antenna

THE NEW self-selecting antenna system offered by Technical Appliance Corporation, 17 E. 16th St., New York, is intended for use in locations where the noise problem

is not too severe, thereby making a more elaborate and costlier system unnecessary.

Among the quality features is the armored aerial wire. This comprises a special high-tension core, carefully weatherproofed, around which copper conductors are grouped. Without adding much weight, this armored type is capable of being stretched exceedingly taut for neatness and maximum average height. Also, it withstands heavy sleet and high winds.

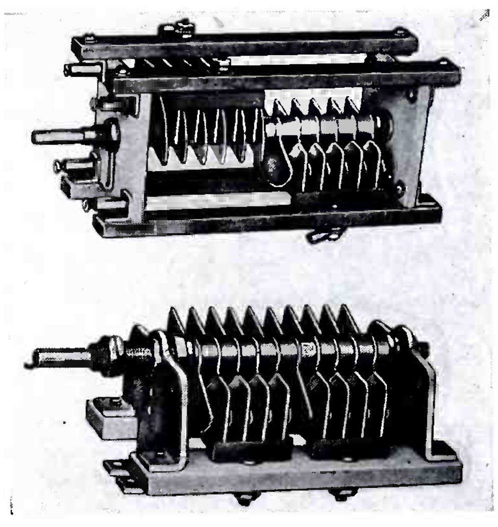
This system also has the Taco self-selecting feature, or separate transformers for standard broadcast and short-wave bands, electrically interconnected and always in circuit, so that signals are automatically routed through proper transformer windings for maximum transfer of energy between aerial and set. Manual switching is thus eliminated. Also a no-loss cross bar separates the two halves of the doublet aerial.

Matched components and factory-prewired assembly permit installation in an hour or less. All necessary insulators are included. ALL-WAVE RADIO.

◆

New Cardwell High-Frequency Condensers

IN STEP WITH the rapid progress being made in the field of high and ultra-high frequency, both with reference to radio trans-



mission and physio-therapy, The Allen D. Cardwell Mfg. Corporation of Brooklyn, N. Y., has developed two types of variable air condensers which excel in combining all of the essential features of design which must distinguish a unit capable of efficient performance at frequencies of the order of 30 megacycles up. *Both Types have the following features*: No metallic closed loop circuits to absorb energy or encourage parasitics. Maximum leakage path between elements. Best high-frequency insulation, having the required mechanical strength—mycalex and isolantite.

The JD-28-GD (upper photo) balanced type of "all insulation" frame high-frequency variable air capacitor, has following specifications:

Maximum capacity per section	—28 mmfd
Minimum capacity per section	—5 mmfd
Airgap	—.125"
Voltage rating	—4600 V. peak flashover
Plates	—.040"-buffed and polished
Insulation	—isolantite end plates, mycalex tie rods—stator supports
Mounting	—front panel

The NP-35-GD (lower photo) is destined to become very popular for amateur high-frequency transmitters of moderate power, and is widely used in the therapy field, for resonating the output or patient-pad circuit. Specifications are as follows:

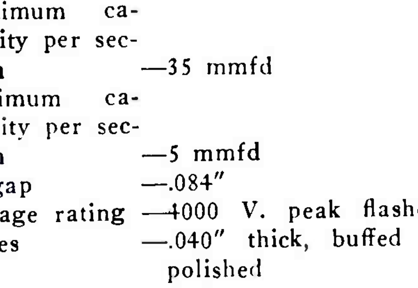
Maximum capacity per section	—35 mmfd
Minimum capacity per section	—5 mmfd
Airgap	—.084"
Voltage rating	—4000 V. peak flashover
Plates	—.040" thick, buffed and polished
Insulation	—isolantite
Mounting	—single hole, or can be mounted by three (3) hexagonal posts. Also feet are provided for sub-base mounting

◆

New IRC Insulated Resistors

AN ECONOMICAL, completely insulated wire wound ½ and 1-watt resistor, altogether similar in size and appearance to the well-known IRC Insulated Metallized units, has just been announced by the International Resistance Company, of Philadelphia.

Thus an alternative to the usual carbon or Metallized filament type resistor is now



available in power ratings of ½ and 1-watt, and in resistance values of 0.25 to 500 ohms, and 0.5 to 2,000 ohms respectively, with respective lengths of ⅝" and

1½". Completely insulated against short circuits or grounds and against the effects of humidity, Type "BW" consists of wire wound on a textile core of small diameter, to which wire leads are clamped under pressure for permanent contact, molded at high pressure in a special phenolic compound of excellent properties.

This method of assembly insures low noise levels and permanent contact. The result, the manufacturers state, is a stable, conservatively-rated, small, insulated wire-wound resistor, having all the electric characteristics and stability of its type, together with compactness and complete protection against abnormal atmospheric conditions.

This new "BW" resistor is fully described in a resistor catalog recently issued, which may be had by writing the International Resistance Company, 401 N. Broad Street, Philadelphia. *All-Wave Radio.*

✦

New RCA Beat Oscillator

A NEW VARIABLE audio oscillator, operating on the beat-frequency principle, and weighing only 10¾ lbs., has just been announced by RCA Parts Distributors. This oscillator, which is completely self contained includes such features as a direct-reading dial and a center-tapped output transformer having impedances of 250, 500 and 5000 ohms.

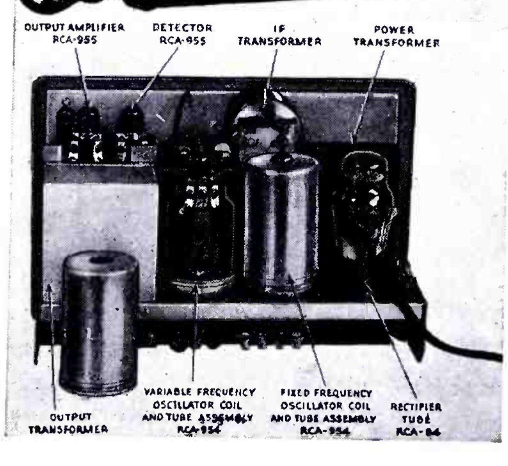
Applications of the new RCA Beat Frequency Oscillator includes measuring receiver fidelity, and audio amplifier fidelity, testing speakers and cabinets for howl and using its output as a sweep frequency on the RCA Cathode-ray oscillograph for checking unknown frequencies.

The operation of a beat-frequency audio oscillator is based on the beat or difference frequency produced when two r-f oscillators are operated near the same frequency and their outputs combined. By making one of these oscillators fixed in frequency and the other variable over a small range, the difference or beat frequency may be adjusted to any desired value, by shifting the variable oscillator.

In the RCA Beat Oscillator, the fixed frequency oscillator consists of an Acorn type tube, RCA-954, operated in an electron-coupled circuit at 350 kc. The variable-frequency oscillator is also an RCA-954, operated in an electron-coupled circuit and operated over the frequency range from 335 to 350 kc., the variation accomplished by a tuning capacitor attached to the main dial.

The output of each oscillator stage is combined and fed into a self-biased RCA-955 detector which extracts the audio or difference frequency and rejects any r-f frequencies present. The output from the detector is fed into the output amplifier which is an RCA-955 fixed-bias amplifier having the output control in the grid circuit and a statically shielded output transformer in the plate circuit. This transformer is designed to operate into center-tapped loads of 250, 500 and 5000 ohms impedance.

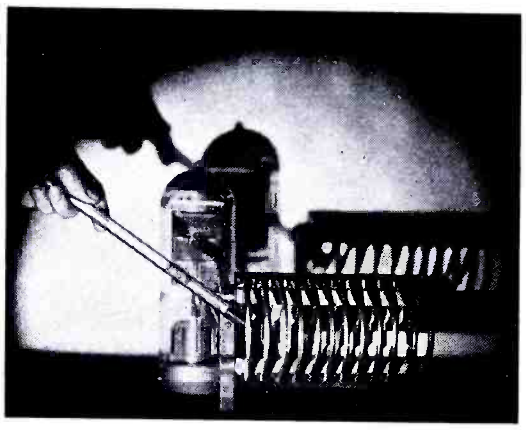
The circuit design of this instrument is such that a high degree of stability together with low distortion is obtained. The use of a center-tapped output transformer is a necessity for accurately matching the output to the various loads that may be encountered in practice. ALL-WAVE RADIO.



✦

Neon Tuning Wand

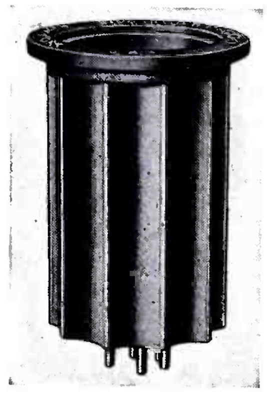
BY A WAVE of the hand the inductance of a radio coil is either raised or lowered as desired by the operator using the magic Neon Tuning Wand as illustrated. For example, the Wand indicates whether a capacitor should be increased or decreased to correct the tuning. The 10-inch tube is filled with sensitive neon gas and gives a very brilliant light when brought into the r-f field of a transmitter; it is perfectly safe because the caps are made of heavy molded bakelite thus insuring protection against shock or burns.



The Wand is manufactured by Sundt Engineering Co., 4238 Lincoln Ave., Chicago, Ill., for the primary purpose of aiding in tuning transmitters, indicating oscillation, resonance, and neutralization. However, it may also be used in aligning receivers. ALL-WAVE RADIO.

Hammarlund Transmitting Coil Form

A NEW JUMBO coil form, designed expressly for use in amateur transmitters or wherever a coil of large dimensions is required, has been announced by the Hammarlund Manufacturing Co., 438 West 33rd St., New York, N. Y.



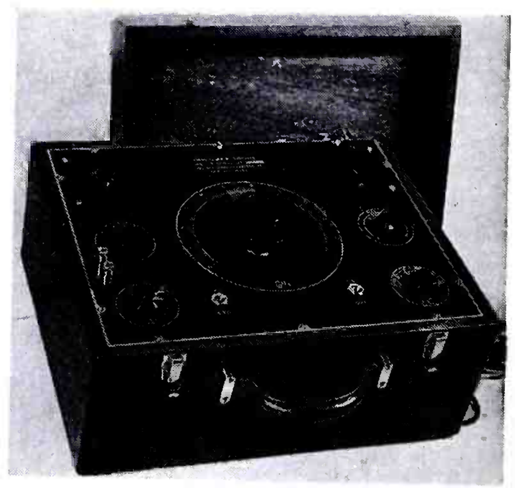
The form itself is molded from XP-53 low-loss dielectric. The diameter of the form is 2¼" and the length 3⅞". Threaded mounting holes are provided for base mountings if socket mounting is not desired.

The new coil form is obtainable in either 4- or 5-prong types. ALL-WAVE RADIO.

✦

New Solar Analyzer

TEN OUTSTANDING advantages are claimed for the newest Analyzer unit from Solar Mfg. Corp., 599 Broadway, New York City. This is a Capacitor-Analyzer and Resistance-Bridge, planned to suit the needs of amateurs as well as radio experimenters . . . a refined and extended Wien bridge built into instantly useful form for laboratory, shop and field work. All readings are secured direct from a color-coded panel . . . saving time and trouble formerly required in cross-referring to charts and graphs.



This unit may be had in two models, both attractively housed in wood cabinets with detachable hinged covers. Compact, light yet sturdy and thoroughly scientific.

[*Continued on page 424*]

EMBRYO HAMS

[*Continued from page 387*]

the only difference between this and the alternating current, B, is that there are more wiggley lines or cycles compressed in the same amount of space.In other words, there are more cycles per second to a radio-frequency current than there are to a good, old household alternating current. One is a low-frequency and the other a high-frequency current.

There have to be distinguishing features between these currents so that there will be no mixup when one attempts to pass a technical *mot juste* over on a fellow enthusiast — so a dividing line has been created so that the other fellow will know what sort of a current you are talking about. You'll get the idea from Fig. 11.

The first group are those currents, such as the 60-cycle house supply or the currents that actuate the loudspeaker of a receiver, whose frequencies are within the range of audibility. These are known as *audio frequencies*. The second group are those currents whose frequencies are beyond the average range of audibility. These are known as *radio frequencies*, and are used for broadcast and communication purposes.

From Fig. 11 it will be seen that the audible frequencies extend from 16 to 16,000 cycles, although the range of audible frequencies broadcast is usually from about 30 to 5000 cycles. The lowest radio frequency employed is seen to be 10,000 cycles, or 10 kilocycles, which corresponds to a wavelength of 30,000 meters. Radio frequencies beyond 60,000,000 cycles, or 60 megacycles, which corresponds to a wavelength of 5 meters, are used but are not shown as their use is uncommon.

Oscillations

Now the audio- and radio-frequency currents that are employed in radio work are "oscillating" audio or radio currents, that is, they oscillate to and fro in an electrical circuit much in the same manner as the pendulum of a clock oscillates back and forth in space. There, Barb, is your word "oscillate," and, as you have suspected by this time, an "oscillator" is a device that creates or generates an oscillating power. In radio, the power is electrical, and the device we use to generate the oscillations is the well-known vacuum tube. An "audio oscillator" is a generator of audio frequencies (such as the vacuum-tube audio oscillator in your Teleplex machine). A "radio oscillator" or "radio-frequency oscillator" is a generator of radio frequencies.

Frequency

This word "frequency" we have been using is employed to express the number of times an electrical current oscillates, or, to put it more specifically, the number of cycles of reversal a current passes through *per second* (we measure these things in seconds in radio—never in minutes.) Thus, the alternating house current "oscillates at a frequency of 60 cycles" which is much less "frequent" than a radio-frequency current which, even at a wavelength of 300 meters, oscillates at the tremendous rate or frequency of 1,000,000 cycles per second. At a wavelength of 5 meters, the lowest wavelength commonly used by amateurs, the rate of oscillation is 60,000,000 cycles per second.

Such figures as 1,000,000 cycles and 60,000,00 cycles are a nuisance to use, so we go in for a bit of abbreviation. For a figure the size of 1,000,000 we add "kilo"—denoting 1000—to the word cycles, and thus shave down the expression to "1000 kilocycles." Then, of course, the figure 60,000,000 cycles could be expressed as "56,000 kilocycles," but human nature being what it is, it is easier to use the term denoting 1,000,000 in place of "kilo," and so we express such an immense figure as "56 megacycles."

You will observe the more you study that at any time an engineer is forced to revert to a decimal or a comma, he will use the terms "cycle," "kilocycle," or "megacycle," as the instance dictates. He will write "1 kilocycle" before he will write 1,000 cycles, and he will write, as likely as not, "1 megacycle" before he will refer to it as 1,000 kilocycles—and if for no other reason than to avert a possible error, he will write "600 kilocycles" before he will write ".6 megacycle." And for an abbreviation of kilocycles he will use K.C., k.c., KC or kc, and for megacycles, M.C., m.c., MC or mc. Take your choice. They all appear to be in vogue.

Behavior of Oscillations

Now the next step would be an explanation of the behavior of oscillating currents in a radio circuit, and particularly radio-frequency currents. But, as I promised, I shall leave that for my next letter. Just let me say, though, that alternating or oscillating currents have the knack of transporting themselves through space with the greatest of ease, whether the space be the distance between a transmitter and a receiver, or merely the space between two coils or the plates of a condenser. Nothing, you might say, can stay these couriers in their appointed tasks. The job we have is keeping them from running all over the lot.

The above should lead you to the conclusion that audio-frequency and radio-frequency currents behave alike, which is true. Both are generated and controlled in the same manner, but the higher or radio-frequency currents are more difficult to keep in hand. But we manage to make both do our biddings through the use of vacuum tubes, coils of wire, condensers and resistors, and little else.

More when you return from your vacation. Have a good time.

Gerald.

QUERIES

[*Continued from page 402*]

any, with a single wire—lead-in taken off one end?—*C. B., Baldwin, L. I.*"

Answer

1. No. The relative lengths of the doublet sections have nothing to do with the noise pick-up by the transmission line.

2. Yes. The two wires are connected to the receiver in the usual doublet fashion, as shown in Fig. 2. One lead is connected to the open antenna, while the other is not connected to anything on the aerial end. Twisted leads have also been tried by connecting the lead-in wire to the antenna post and the open wire to the ground post—with the ground connected—the idea being that the open wire will shield the lead-in wire. This is not effective, unless proper couplers are employed at both antenna and set terminals. If straight shielding is good enough to reduce noise, it will "bypass" the signal current to ground without couplers. However, a twisted pair affords very little shielding, and, excepting for the doublet transmission line arrangement first considered, it is not to be recommended as a lead-in.

3. A 100-mmfd. condenser may be used. This will be more efficient than a shorter aerial, as greater pick-up will be secured. (By connecting this condenser across antenna and ground, rather than in series with the lead-in, the antenna system can be tuned to lower frequencies.) This condenser will affect the detector circuit only when no r-f is used—and in any case its effects can be immediately counteracted by other controls.

4. The directional effect of an L antenna is in line with its span, and in the direction of the end from which the lead-in is taken. In other words, an L aerial, running north and south, and with the lead-in taken off the north end, will be most favorable to signals coming from the north.

On the other hand, a doublet antenna is directional at right angles to the direction of span.

AWR PRESELECTOR

[*Continued from page 383*]

of the 3-30 mmfd trimmer type, in series with the antenna lead and adjusting it until oscillation is secured.

Coupling to Doublet

Coupling to a doublet antenna can be done in two different ways. One is to wind an entirely separate antenna coil of a few turns on the coil form (between the grid and plate windings) and connecting it to the two vacant connections on the coil socket. This can be done more easily by just twisting several turns around the center of the coil and connecting them directly to the antenna. If it is desired to match the doublet in through the regular antenna-matching system provided in the preselector, it will be necessary to provide more capacity in the antenna condenser than the present 150 mmfd unit, due to the low impedance of this type of antenna. One side of the doublet should be connected to the ground post and the other to the antenna post. The extra capacity can be placed directly across the doublet leads by using the proper size of mica fixed condenser (from 100 mmfd to 500 mmfd should be tried while readjusting the antenna tuning condenser), or by using a broadcast-type of variable condenser of about 350 or 500 mmfd maximum capacity.

Results

A preselector of this type will increase the gain and decrease the noise for any given signal with any type of super, whether or not it has an r-f stage or two. However, the most noticeable increase in results will be had when it is used with a superheterodyne receiver which has no preselection at all. The image frequency stations heard on such receivers can be practically eliminated. The AWR-6 Band-Spread Super, with regeneration turned off, was used to simulate this type of receiver, although the AWR-6 is actually quieter in reception than most sets without preselection, whether or not regeneration is used in the first detector. The sensitivity was greatly increased. Even when the AWR-6 was used with maximum regeneration in the first detector, a high increase in gain could be secured. This test was made on weak European amateur signals. Room volume could be secured on most of these foreign ham signals without using the audio tube.

This preselector is not limited to use with a superheterodyne type of receiver; it can be used to advantage with any ordinary regenerative or t.r.f. receiver.

This preselector should never be allowed to oscillate more than momentarily during adjustment, since it will radiate an interfering heterodyne to nearby receivers.

LEGEND

NATIONAL

1—Type O dial
2—Type HRO dials
1—Type T78 tube shield
1—Small 7-prong tube socket
4—Type XR6 coil forms
1—Square coil socket
1—Type C-SRR plain cabinet
1—Type R-100 radio-frequency choke (RFC)
1—Type 24 grid clip
2—Type ST-150 tuning condensers (C, C1)

SYLVANIA

1—Type 6F7 tube

EBY

5—Plain binding posts with insulating washers

UTC

1—Type FT-2 filament transformer 6.3V (T)

AEROVOX

1—Midget mica condenser .00005 mfd (C2)
1—Midget mica condenser .0001 mfd (C6)

CORNELL-DUBILIER

2—Tubular bypass condensers .1 mfd, 400V (C3, C4)
1—Tubular bypass condenser 1. mfd, 400V (C5)

IRC

1—½ watt 400-ohm insulated metallized resistor (R)
1—½ watt 100,000-ohm insulated metallized resistor (R1)
1—1 watt 100,000-ohm insulated metallized resistor (R3)
1—½ watt 50,000-ohm insulated metallized resistor (R4)

CENTRALAB

1—50,000-ohm potentiometer with switch (R2-SW)

5-METER STATION

[*Continued from page 395*]

The Converter Coils

The circuit diagram is self-explanatory with the exception of the coils which are wound on the same ½-inch form. All coils are wound of No. 16 enamelled wire, each coil having four turns spaced the diameter of the wire. The spacing between the coils L-2 and L-3 is about two inches. This provides sufficient coupling between the oscillator and the detector, yet oscillation is easily controlled by the variable plate resistance R-4. Spacing between L-1 and L-2, and L-3 and L-4 should be about ½ inch. The r.f.c. in the output of the detector circuit should be one designed for broadcast operation; we used a Hammarlund b.c. choke with excellent results.

Tuning

Tuning this converter is very simple; connect the converter to the broadcast receiver as usual and adjust the b.c. set to about 1550 kc. Now adjust R-4 and C-3 for maximum oscillation; slowly tune C-1 until a signal is heard. Bring the signal in by adjusting the oscillator condenser and plate resistance for maximum signal intelligibility. With a little experience no difficulty will be experienced in the operation of the converter.

A small 10- or 15-foot antenna will give best results when used with this converter.

Parts For Transmitter and Modulator

C1 —Cardwell 50 mmfd Trim-Air
C2 —Cardwell 50 mmfd Trim-Air
C3 —Cardwell 25 mmfd Trim-Air
C4 —Sangamo 250 mmfd fixed
C5 —Sangamo 5000 mmfd fixed
C6 —Sangamo 5000 mmfd fixed
C7 —Sangamo 1000 mmfd fixed
C8 —Cardwell 25 mmfd Trim-Air
C9 —Aerovox 1.0 mfd fixed
C10 —Aerovox 1.0 mfd fixed
R1 —Electrad 50,000 ohm, 2 watt
R2 —Electrad, 25,000 ohm, 1 watt
R3 —Centralab 50,000 ohm volume control
R4 —Electrad 2700 ohm, 1 watt
S —Yaxley toggle switch
T1 —Thordarson microphone transformer
T2 —Thordarson 1:1 output transformer
1 —Readrite 0-50 ma milliammeter
2 —R-f chokes, 30 turns No. 24 d.c.c. on ½" form.
C1 —Cardwell 50 mmfd Trim-Air
C2 —Aerovox .01 mfd fixed
C3 —Hammarlund 100 mmfd split-stator
C4 —Sangamo 250 mmfd fixed
C5 —Sangamo 150 mmfd fixed

Parts For Converter

R1 —IRC Metallized 5000 ohm, 1 watt
R2 —IRC Metallized 250,000 ohm, 1 watt
R3 —IRC Metallized 15,000 ohm, 1 watt
R4 —Centralab 25,000-ohm volume control

RFC—Hammarlund B.C. choke

GLOBE GIRDLING

[*Continued from page 381*]

In Appreciation

It affords the writer much pleasure to again acknowledge many reports and letters from Mr. Robert Behm, Philadelphia, Pa., John Blecha, Long Island City, N. Y., Galen Balfe, Lowell, Mass., E. H. Clark, Hollister, Calif., John Carothers, Lincoln, Neb., Hugh Compton, San Diego, Calif., David H. McKinley, Cleveland, Ohio, Bob Morrison, Vancouver, B. C., Canada, Norman L. MacLeod, Jr., Pasadena, Calif., Charles J. Neff, Yonkers, N. Y., Donald Walter, Aurora, Ill., and S. P. Herren, Jr., Haskell, Tex., and to extend to them and many others the thanks of ALL-WAVE RADIO and the writer of this section for their assistance and kindly comments. Your suggestions and criticisms are welcomed. Information as to changes in time schedules, or of other notes of interest to readers, are gratefully received.

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

CHANNEL ECHOES

[*Continued from page 385*]

six tests (three day and three night-time) on a short and long-wave receiver at the contemplated location—the tests being made several days apart from each other.

Very often a local serviceman can be of considerable assistance, and will usually co-operate with a prospective customer in loaning him a receiver for test purposes as well as supplying first-hand information on year-round reception conditions.

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THERE IS NO offer of a free subscription this month for identification of our rogues gallery. It is extremely doubtful if anyone other than the two individuals in the picture could identify the place or occasion. The gentleman on the left doesn't give a hang about radio—and we're on the free-list.

The picture was taken in the writer's lab somewhere around the 24th of January, 1924—on the occasion of supposedly recording variations in radio signals during the total eclipse of the sun which made New York City murky for about a full minute on that date.

As we recall it, we started in ambitiously about a half hour before totality, fortified with an indominitable will to do right by science. About a quarter of an hour before totality we smoked up a piece of glass—just in case something went haywire with the equipment. Five minutes before the moon gobbled up the sun, we said the hell with this, and, grabbing the piece of smoked glass, we joined the rest of the neighborhood on the roof of our apartment house.

Just what happened after it was all over, we're not quite certain. But the chances are we got the data from someone else, who had stuck to the job, and wrote up a comprehensive article on "The Recent Eclipse and Radio Signal Variations"—for such an article appeared under our signature and accompanied with the photograph appearing in this department!

✦

THE G-STRING—Daventry, Merrie England—recently broadcast a delightful little skit entitled "This Little Neck," which, according to one newspaper report, "celebrated" the four-hundredth anniversary of the beheading of Anne Boleyn at London.

Alternative titles: Necked Twice by Henry VIII. Getting Ahead by Anne Boleyn. Axe me Another. Annie Doesn't Live Here Anymore.

NIGHT-OWL HOOTS

[*Continued from page 393*]

Athens, 601 kc. using 100,000 watts and a short-wave station of 10,000 watts power, both stations to use the same studio and office building. Salonica will have a 10,000-watt station operating on 804 kc. The third station will be at Corfu and will use 5000 watts on 1285 kc. The station at Athens must be completed within eighteen months and the other two stations within two years.

Second Annual CDXR Convention

The CDXR will hold its annual convention in Goderich, Ontario this year on September 5 or 6. We had the pleasure of attending last year's affair in the beautiful Garden City of Canada —St. Catherines, Ont., and had the time of our lives, climaxed by an ever-to-be-remembered studio party in the form of a DX broadcast by "The Silver Spire," CKTB in the Welland House. Those who attended last year "will no doubt plan to be there again this year if it is humanly possible. DXers are a friendly lot of people, and most of them carry on correspondence with their fellow DXers, but it is not often that there is an opportunity to meet so many of them personally. If you'd like to be there, write to the Canadian DX Relay headquarters at Goderich, Ontario, immediately. We'll be seeing you in Goderich!

Night Owl Joe Miller of Brooklyn says that he has a veri from HSH in which Phra Aram Rouajit, Chief Engineer reveals the following information of interest to DXers: "HSP1, 'National Broadcast Station' 350 mtrs. (856 kc/s.) 2500 watts broadcasts daily from 7 to 10 A.M. E.S.T. On Wednesday and Saturday sign-off is one hour earlier. HS7PJ, 400 mtrs. (750 kc/s.) 10,000 watts broadcasts on Wednesday and Saturday from 9 to 11 A.M."

Both stations are in Bangkok, Siam. Joe says that Phra Aram would like reports. It's a safe guess that he will not be swamped with the letters with this schedule in effect.

Kilocycling Around

The F.C.C. applied the pressure during the past month and only one applicant for a new station was successful in obtaining a construction permit. The fortunate applicant, George B. Bairey, receives a C. P. for a new station in Valley City, N. D. to operate on 1500 kc with 100 watts unlimited time. . . WSPR, the new Springfield, Mass., station is now operating. Ditto WJNO in West Palm Beach, Fla. . . . The catch that every DXer someday hoped to hook is no more! The little unlicensed WUMS, whose 2-watt transmitter in Proctorville, Ohio, has caused much loss of sleep during the past few seasons was sold to an amateur in Trenton, Ohio, who will use it on the 80- and 160-meter bands. This from the Hot Spot of the GCDXR . . . Maybe you're wondering why CRCT has been coming in so well of late. The reason: Doc Brinkley has decided to put his XERA into moth balls for the rest of the summer and struggle along with XEAW. . . . KUTA are the call letters assigned to the new station at Salt Lake City. . . . KRSC granted increase in power to 250 watts and will also operate unlimited time instead of daytime only. . . . "CRCV is installing equipment to increase power to 5000 watts."—CDXR. . . . CMGC sends out a postcard veri printed in English and Spanish with the call letters prominently shown in ¾" bright green letters. . . . TGW sends out a whole library of information about Guatemala.

The Chief Night Owl welcomes correspondence from all fellow Night Owls, especially letters containing information of value to other DXers. Address material for this column to Ray La Rocque, 135 Highland St., Worcester, Mass.

NATIONAL NC-100

[*Continued from page 401*]

To the right of this switch is the manual r-f gain control which controls the gain of the r-f and i-f stages. The action of this control is limited when the avc system is in operation, and in this instance it is used for adjusting the maximum gain of the receiver.

To the right of the range selector knob is the audio gain control which is used for controlling volume with either the loudspeaker or headphones in use.

The knob at the lower right-hand corner of the panel is a combination switch having three positions. In the counterclockwise position the avc circuits are in operation; in mid-position the avc is turned off; and in the clockwise position the c-w beat-frequency oscillator is turned on, the avc still being off.

Near the tuning dial is mounted a pilot light, and also the electron-ray tuning indicator. Aside from denoting a condition of circuit resonance for a given signal, the tuning indicator also provides a means for the measurement of signal strength in conjunction with the r-f gain control whose readings are calibrated on a chart provided with the receiver.

To the right of the tuning dial are the crystal-filter controls (on NC-100X receivers only). The uppermost knob is the selectivity control of the crystal filter, and below it is the phasing control and crystal filter switch.

The Circuit

The circuit of the NC-100 receiver is shown in Fig. 2. It will be observed that the primary of the antenna r-f transformer may be floated, for use with a doublet antenna, or grounded to the chassis when used in conjunction with a Marconi type antenna.

There is a switch shown above and to the left of the 6K7 high-frequency oscillator tube. This operates in conjunction with the band selector mechanism and automatically disconnects the B supply from the screen circuits of the r-f tubes during coil switching. The switch X3 makes and breaks the plate supply to the beat-frequency oscillator. Switch X4 cuts in and out the avc circuit which provides automatic bias voltage to the r-f and i-f tubes. The loudspeaker circuit is so arranged that the B-supply voltage is disconnected from the receiver if the speaker is not plugged into its socket. The headphone jack has additional contacts so that the speaker is silenced when headphones are in use.

The volume control is in the plate circuit of the 6C5 power detector. Incidentally, diode detection is dispensed with in this receiver in favor of the power-type detector which is capable of driving the power-output tubes without intermediate a-f amplification. Since avc action is delegated to a separate tube, the use of a power detector is not only permissible but highly advantageous.

The tone control is in shunt with the control grids of the 6F6 audio power tubes, and consists of the choke L2, the potentiometer R32 and the condenser C29.

All trimmers and padders in the receiver are of the air-dielectric type. Both the high-frequency and beat-frequency oscillators are electron coupled. By these facts, and the fact that the sliding coil frame is mounted below deck where it is unaffected by heat from tubes and heavy-duty units (remember that heat rises), it holds that the NC-100 should have exceptionally good frequency stability and negligible frequency drift.

STATION CALLS

[*Continued from page 375*]

ments for the human body. This quality, according to the broadcasting station's vice president, was first noticed when statistics indicated the unusually low number of goiter cases among women of the state.

The S in WIS, however, does not stand for spinach. The call letters mean *Wonderful Iodine State.*

Historical Note

A quaint historical note is sounded by Station KDON in colorful Monterey, Calif. Most of the early settlers of California were Spaniards. They were either churchmen or fighters. Then came the wealthy land-owners, the Dons. Monterey, situated on a peninsula, is one of the earliest Spanish settlements. It is fitting and proper, therefore, to identify the station in such an interesting manner.

For years it has been the custom of all salesmen out of Jacksonville, Florida, to register in hotels as, for instance, "John Doe, Jax." Every room clerk was familiar with the meaning of Jax. It could mean nothing but Jacksonville, Fla. Consequently, when the station was first licensed, Commissioner Imeson requested these call letters—WJAX—which means *Wonderful Jacksonville.*

DX SEASON

[*Continued from page 377*]

done so already, have a good serviceman—one who comes well recommended —realign your set before the Fall DX season sets in. But don't waste money on realignment until you have had the tubes tested. If new tubes are placed in the receiver, it should be realigned anyway, for no two tubes are exactly the same. After the new tubes have been placed in the receiver and the receiver is properly aligned, do not make the mistake of switching tubes around to see if you can obtain better results. The correct alignment can be maintained only if the tubes are left where they were when the receiver was aligned.

Call a Serviceman

Now for an excellent bit of advice:

Some manufacturers have the habit of including the circuit diagram and the servicing data with the receivers they sell, which might lead you to believe that you can tackle an alignment job yourself. Don't, unless you hanker after a headache. The superheterodyne receiver, and the modern ones in particular, are highly complicated devices—more complicated than you probably realize. Though there is a general method of going about alignment, each receiver has some little kink of its own that requires at least one deviation from common alignment practice. Unless you know your eggs, and have an accurate all-wave signal generator, output meter or cathode-ray oscilloscope, alignment tools at your disposal, and *complete* servicing data on your own model receiver, leave the job for the serviceman or a local radio amateur who is known to have done this type of work.

Adding a Preselector

If you are not satisfied with the results you have been getting from your set, you might give thought to adding a preselector. This is nothing more than a separate stage of tuned radio-frequency amplification that can be hitched on to the receiver input.

A good preselector has numerous advantages (See Fig. 5). First, it will increase the sensitivity and improve the signal-to-noise ratio of any superheterodyne, but particularly the superheterodyne having no pre-amplifier. Second, it will increase selectivity, and with better selectivity it is quite possible that most if not all image and second channel interference will disappear. This means that the stations you have been receiving at two different points on the dial will come in at only one point, and that much of the phone and code interference that has come in on top of desired signals will have also disappeared. Not all of it, probably, but a good part of it.

Of course, there is one more tuning control to manipulate when you use a preselector, but since the tuning is rather broad to begin with, and need not be too precise, the additional control is really no inconvenience. Once you get used to the handling, it's quite simple.

So, how about primping up the old receiving post so that it will be in readiness for the real DX in the offing? It will be worth your while.

THE HAM AND SWL

[*Continued from page 384*]

desired covering "for that hole in the plaster."

The writer has received all types of listener reports from listeners within the United States. Most of these reports give useful information and serve to supplement the reports on signal strength and other transmitter characteristics furnished by amateurs during QSO's. These have been answered and a genuine effort made to show some appreciation for the reports. A very few cards received stress the "wall paper" angle and infer failure to reply will stamp the amateur recipient as a poor sport. These few cards reveal an unfortunate attitude and a failure to understand both amateur radio and human psychology.

Data Hams Want

Failure to understand what the amateur would like cannot be fairly criticized unless some mention or outline of a desired report be given at the same time. There are only two fundamental kinds of information a listener needs to incorporate in a report. These are:

First, full and complete information on the readability, audibility and quality of the signal, with further information on the tone if the signal is c.w., or modulation if the signal is from a phone station. The report should be accurate. If the signal was R6, it is grossly unfair to the amateur to tell him it was R9. The time and date of reception should be given, of course.

Second, accurate information on the location of the listening point unless the listener happens to be located in a large and well-known city. If the listener is in a small city or town, the distance and direction from a large city should be given.

The amateur who receives a large number of accurate listener reports is in a much better position to analyze his transmitter performance than would be possible through direct amateur contacts alone. If he has any cards at all, he is perfectly willing to exchange one of his own for the listener's report which tells him *not* that his signal is R9, say in Minneapolis, but that it just barely gets there. Perhaps he wants to work an amateur in Minneapolis. The listener's card helps to confirm the amateur's suspicion that the antenna should be changed and that confirmation is worth a great deal more than the reply card.

Postage

Comment has already been made that many amateurs desire to place the money they have available in equipment rather than in accessories which include QSL cards. To go further, it can be safely said that the average amateur's financial statement would show a pretty small figure opposite the Spare Change item. This brings us to the question of postage. The listener, if he can afford it, should send a penny stamp along with his request for a card. If he can't afford it, he'll just have to hope that the amateur will reply. The writer's personal opinion is that postage will not provide any problem if the listener's report is carefully made.

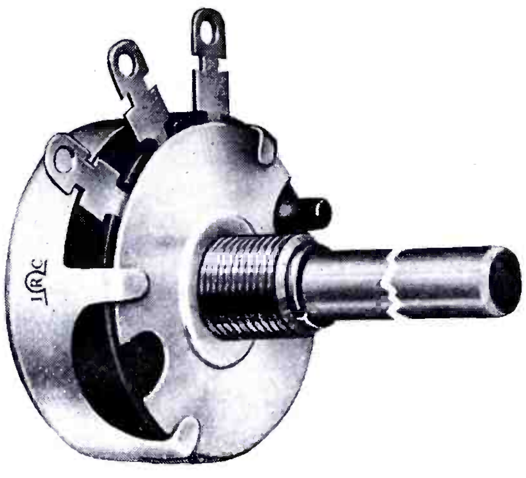
ON THE MARKET

[*Continued from page 416*]

New IRC Volume Controls

AN UNUSUALLY compact and modern volume control has just been made available to the radio industry with the introduction of the IRC Type "C" Volume Control by the International Resistance Company of Philadelphia.

Among the outstanding features of the new control are the famous Metallized type resistance coating permanently bonded to a moisture-proof bakelite base; multi-finger, silver plated contacts; exceptional stability and many others.



Unexcelled for use under even the most severe atmospheric conditions, Type "C" Controls undergo no appreciable change at 90% relative humidity, while immersion of the element in water does not affect the coating nor alter resistance values perceptibly, the makers assert.

Mechanical principles of interest include an extremely hard coating as well as the "5-finger Spring Contactor," a combination which reduces wear of the element to a minimum. Each silver plated contact finger operates independently, gliding smoothly over the element making contact in exactly the same track with each rotation, the effect being that of "knee action" contact. Operation is unusually quiet.

IRC Volume Controls are available without switch or equipped with a low internal resistance switch, making them suitable for automobile radios as well as for general use.

Provision has been made for two taps, which may be brought out anywhere on the element by a special method which eliminates obstructions in the path of the multi-finger slide contactor.

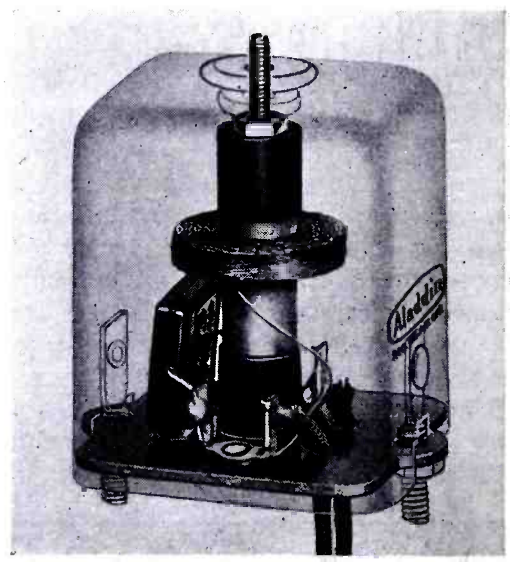
A detailed description of this Type "C" Volume Control is found in the IRC 1936 Catalog, which may be had by writing the International Resistance Company, 401 N. Broad Street, Philadelphia. ALL-WAVE RADIO.

Brush Data Sheet

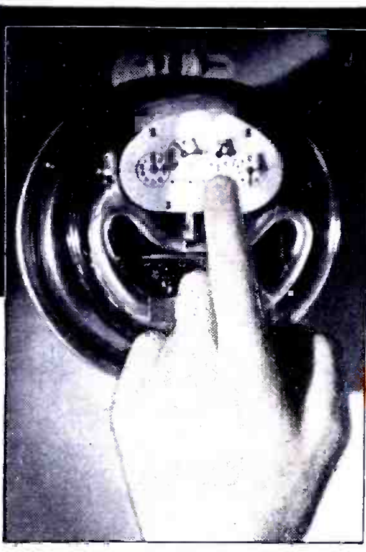
THE BRUSH Development Company, East 40th Street at Perkins Avenue, Cleveland, Ohio, is distributing its newly revised Data Sheet No. 10. This is a two page circular on Brush crystal operated Type A Head Phones. It gives a very clear and complete description of the construction of the head phone—is complete with prices, etc., of Brush Type A 2-phone head set, single phone head set and Brush lorgnette handle ear phone for use by the hard of hearing. Copies will be sent postpaid upon request. ALL-WAVE RADIO.

Polyiron Wave Trap

TO PREVENT code interference from commercial ship-to-shore stations, a unique new type of wave trap has been placed on the market by Aladdin Radio Industries, Inc., 466 West Superior Street, Chicago, Illinois. This wave trap differs from ordinary interference filters in that it is tuned by the movement of a magnetic core of patented Aladdin Polyiron. The movable core varies the inductance of the coil which in combination with a fixed capacitor tunes to the frequency of the undesired code signals. The rejection ratio of the Polyiron wave trap is so much greater than that of the conventional air-core device that it effectively



suppresses interference from code signals before it reaches the first tube of the receiver, without interfering in any way with normal reception of desired signals. The new wave trap is particularly effective on five- and six-tube superheterodyne receivers which do not have a radio-frequency stage preceding the converter tube. ALL-WAVE RADIO.



Exclusive New MIDWEST ELECTRIK-SAVER

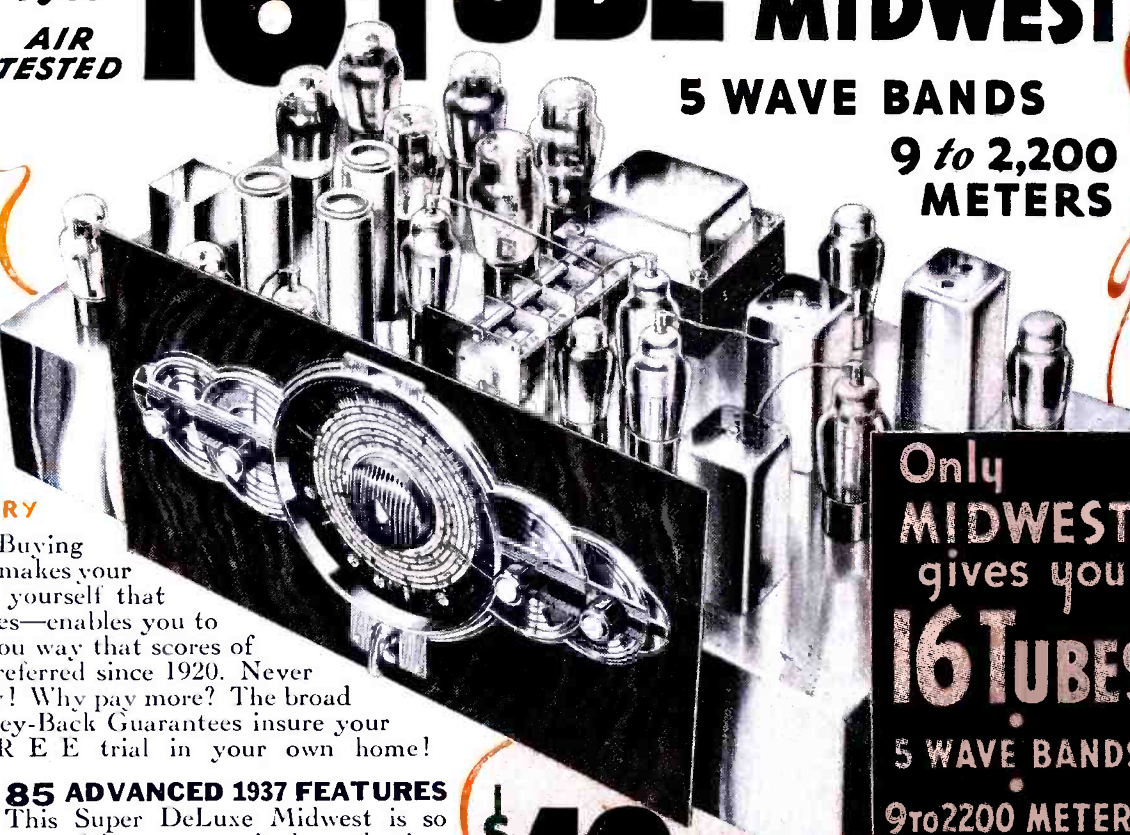
Slashes Radio Current Bills IN HALF!

The Electrik-Saver is today's most sensational radio feature. It cuts radio wattage consumption as much as 50% and results in Midwest 16 and 18-tube radios consuming no more current than an ordinary 7 or 8-tube set. This feature enables the "Air Tested" Midwest to operate on low line voltages—as low as 80 volts! In addition, the Electrik-Saver increases tube life, reduces strain on the set, eliminates repair bills and makes for more consistent and gloriously realistic reception.

NEW 1937 *AIR TESTED* 16-TUBE MIDWEST

5 WAVE BANDS

9 *to* 2,200 METERS



SAVE UP TO 50%

DIRECT FROM MIDWEST FACTORY

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 values—enables you to buy the more economical factory-to-you way that scores of thousands of radio purchasers have preferred since 1920. Never before so much radio for so little money! Why pay more? The broad Midwest Foreign Reception and Money-Back Guarantees insure your satisfaction. You get 30 days F R E E trial in your own home!

Once again, Midwest demonstrates its leadership by offering the world's most powerful and most beautiful 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. This advanced radio 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. The Dual Audio Program Expander gives a living, vital realistic quality to voice and musical reproduction. Before you buy, write for the F R E E 40-page four color 1937 catalog TODAY.

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 M i d w e s t 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. The new Midwest Tuning System, for example, shows you exactly where to tune for foreign stations . . . while Automatic Aerial Adaption triples the number of foreign stations that can be secured and doubles the excitement and joy of short wave tuning.

MIDWEST USES LESS CURRENT THAN AN ORDINARY LIGHT BULB

With a Midwest, the finest entertainment the world has to offer is at your command. It is preferred by famous orchestra leaders, musicians, movie stars and discriminating radio purchasers everywhere. It enjoys an increasing world-wide sale because it outperforms ordinary receivers costing twice as much. You can order your Midwest "Air-Tested" 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 pay as little as 10c a day. Three iron-clad guarantees protect you: (1) A Foreign Reception Guarantee—(2) Absolute Guarantee of Satisfaction — (3) One-Year Warranty. Fill in and mail the coupon N O W!

$49.95 COMPLETE *WITH* GIANT THEATRE-SONIC SPEAKER

(LESS TUBES)

TERMS AS LOW AS 10¢ A DAY

MY MIDWEST HAS UNEQUALLED BEAUTY OF TONE AND SHARPNESS OF SELECTIVITY. *Glen Gray*

CONGRATULATIONS FOR CREATING THE MIDWEST. IT BRINGS IN WONDERFUL FOREIGN RECEPTION. *Rubinoff*

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
- 30 DAYS FREE TRIAL

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

QUALITY RADIOS SINCE 1920

MIDWEST RADIO CORPORATION
Dept. B-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 ....

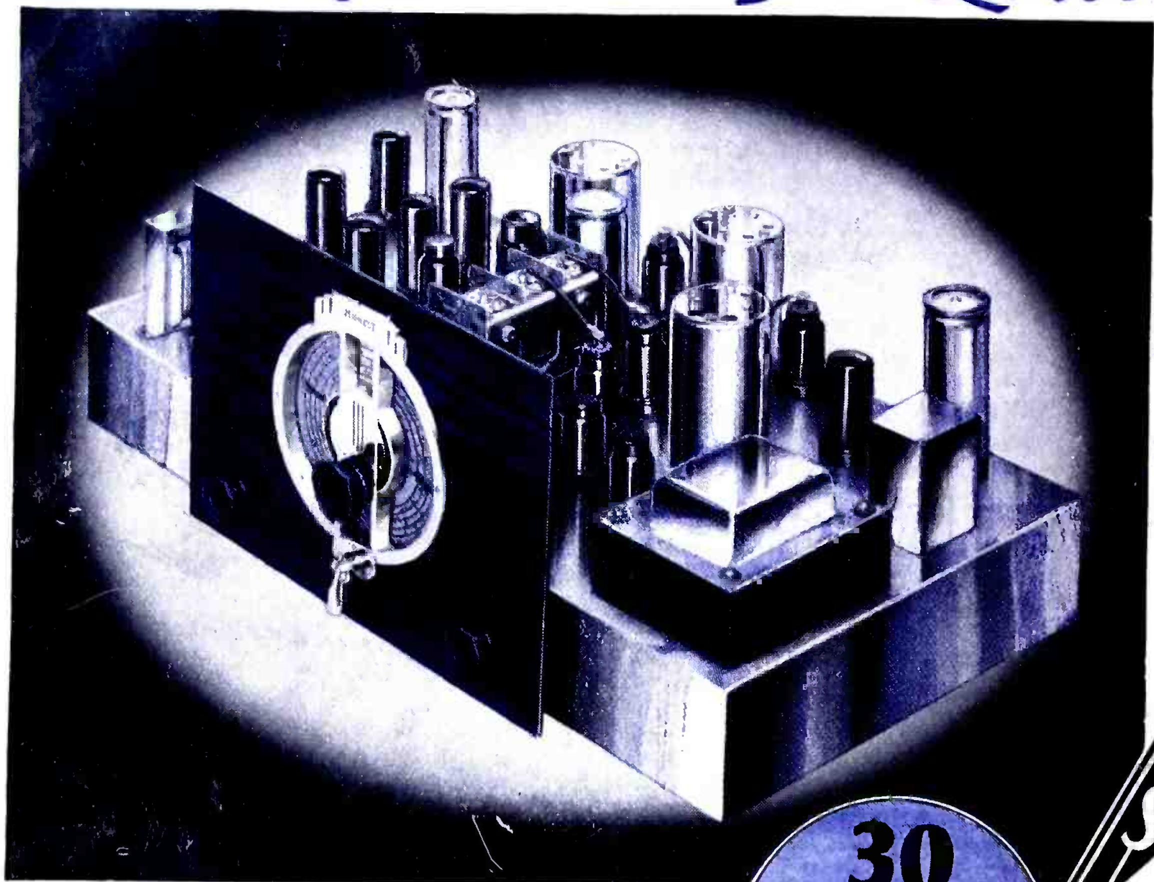
Town .... State ....

MIDWEST RADIO CORP.

DEPT. B-34 · Established 1920 · QUALITY RADIOS SINCE 1920

CINCINNATI, OHIO, U.S.A. · Cable Address MIRACO...All Codes

Again... MIDWEST RADIO *Proves Its Leadership!*



with a MARVELOUS *NEW*

14-Tube

FIVE WAVE BAND, WORLD WIDE SET 9 TO 2400 METERS

30 DAYS FREE TRIAL

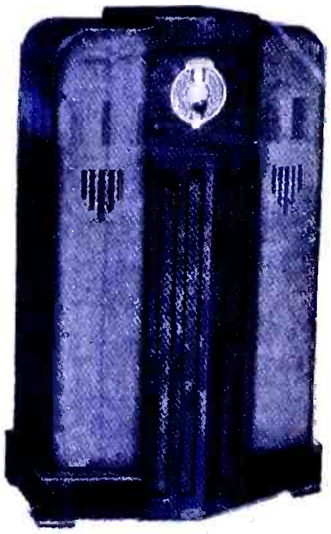
$49.50 with New AUDITORIUM TYPE SPEAKER (LESS TUBES)

EASY PAYMENT TERMS

DEAL DIRECT WITH LABORATORIES

SAVE UP TO 50%

ONCE again, Midwest demonstrates its leadership by offering the world's most powerful Super DeLuxe 14-METAL Tube 5-band radio. It is a master achievement... today's most highly perfected, precisely built, laboratory adjusted set. It is a radio-musical instrument that will thrill you with its marvelous super performance... glorious new acousti-tone... crystal-clear "concert" realism... and magnificent foreign reception. Before you buy any radio, write for FREE 40-page 1936 catalog. Learn about the successful Midwest Laboratory-To-You policy that saves you 30% to 50%... that gives you 30 days FREE trial. This super radio will out-perform $100 and $200 sets on a side by side test. It 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. The 14 tubes permit of advanced circuits, make it possible to use the tremendous reserve power, and to exert the sustained maximum output of the powerful new tubes.



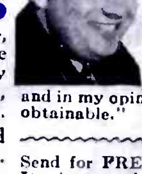
50 SENSATIONAL ADVANCEMENTS

Scores of marvelous Midwest features, many of them exclusive, explain Midwest glorious tone realism, super performance and thrilling world-wide 5-band reception. They prove why nationally known orchestra leaders like Fred Waring, George Olsen, Jack Denny, etc., use a Midwest in preference to more costly makes. Five tuning ranges 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 programs from Europe, Africa, Asia, Australia South America... 12,000 miles away.

Acousti-Tone V-Spread Design (U. S. Design Patent No. 96750)

The V-Front Dispersing Vanes established a new radio style overnight. They spread the beautiful lace-work of the "highs" throughout the room in a scientific manner... directing the High Fidelity waves uniformly to the ear. Now, get complete range of audible frequencies... achieving glorious new acousti-tone... assuring life-like crystal-clear "concert" realism.

No middlemen's profits to pay. You buy at wholesale prices, direct from Laboratories... saving 30% to 50%. You can order your 1936 Midwest radio from the new 40-page catalog with as much certainty of satisfaction as if you were to come yourself to our great laboratories. You save 30% to 50%... you get 30 days' FREE trial... as little as $5.00 down puts a Midwest radio in your home. Your are triply protected with a One-Year Guarantee, Foreign Reception Guarantee, Money-back Guarantee.



Ted Weems Enthuses Over Foreign Reception

"After comparing many radios, I can truthfully say that my Midwest out-performs other sets costing almost twice as much. In all my experience, I have never heard such life-like reproduction. My Midwest surpasses all my expectations, and in my opinion, is the finest radio receiver obtainable." TED WEEMS.

Send for FREE 40-page four-color catalog. It pictures the complete line of beautiful 1936 Midwest Acousti-Tone V-Spread consoles and chassis... in their natural colors.

MIDWEST RADIO CORP.
DEPT. 128-T CINCINNATI, OHIO U.S.A.
Established 1920 Cable Address MIRACO All Codes

QUALITY RADIOS SINCE 1920

***Free* 30-DAY TRIAL OFFER *and* 40-PAGE FOUR-COLOR *Free* CATALOG**

MIDWEST RADIO CORPORATION
Dept. 128T 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.

User-Agents Make Easy Extra Money Check Here ☐ for details.

Name ....
Address ....
Town .... State ....

Check ☐ if interested in a Midwest All-Wave Battery Radio