SHORT WAVE RADIO

July
1934

Edited by
obert Hertzberg and Louis Martin

IN THIS ISSUE:

The Ten Best Foreign S. W. Stations
By J. B. L. Hinds

New World List of Stations in Handy Form

The Truth About "Noise Reducing" Aerials

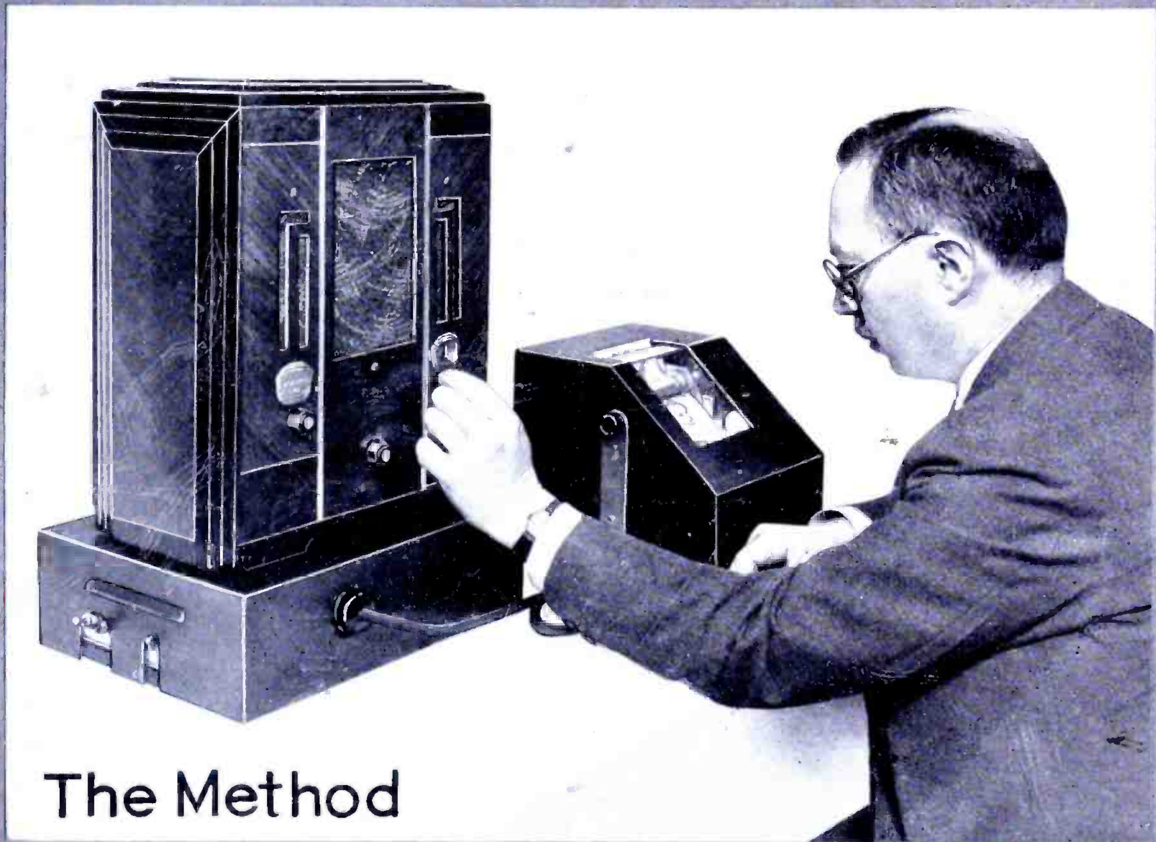
Amateurs Rescue Flood Victims
By Lewis Winner

Making Superhets Work
By Robert S Kruse

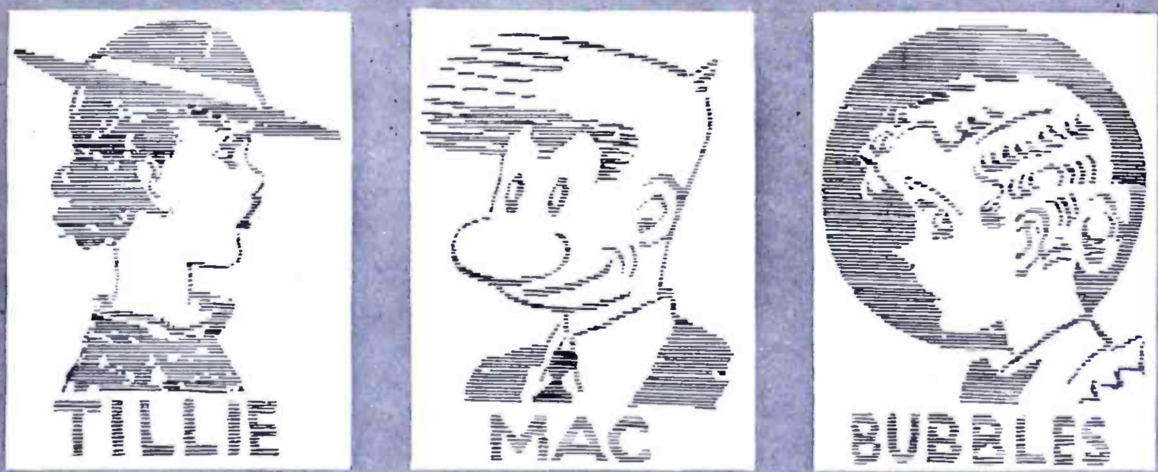
Clifford E. Denton's Latest Receiver

25¢
IN CANADA 30¢

Pictures by Radio



The Method



The Result

July, 1934 Vol. 1, No. 9

SHORT WAVE RADIO

devoted to short-wave transmission and reception in all their phases

Robert Hertzberg, *Editor* Louis Martin, B. S., *Technical Director*

IN THIS ISSUE

Of General Interest:

Of Explanatory Nature:

For the Constructor:

IN FUTURE ISSUES:

LOUDSPEAKERS FOR S.W. USE—Although it is an extremely important part of every short-wave receiver, the loudspeaker has received comparatively little attention from users of these popular receivers. Our Technical Director has prepared an excellent article on the subject, dealing particularly with the proper methods of field excitation.

PORTABLE RECEIVERS—At least one portable receiver of excellent design and construction will be described in the forthcoming August issue. We had expected to run this set in the current number, but a number of little "bugs" developed in it and we decided to exterminate them before presenting the set to our readers.

ADVANCE DATA ON THE NEW SETS—Without revealing any confidences, we are able to say at this time that a number of new and different ideas will appear in forthcoming short-wave and all-wave receivers that will appear this Fall. We can state definitely that the superheterodyne circuit is here to stay and that it will be a whole lot quieter than heretofore. Multi-stage pre-selectors, improved automatic volume control, freedom from acoustic feedback and extremely high ratio tuning controls will be among the dishes served to the buying public.

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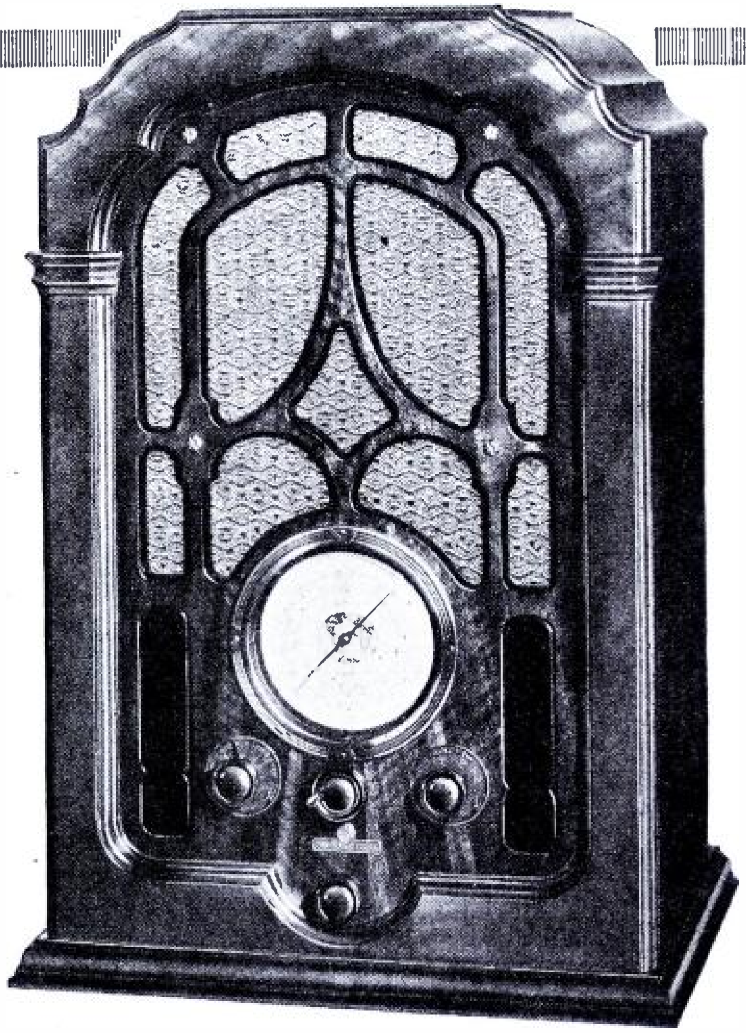
READY TO "Go places"

THE INSTANT IT'S INSTALLED



General Electric All-purpose receiver, Model K-80. Price $92.50. Prices slightly higher in West, Mid-west and South. Subject to change without notice.

These features are "standard equipment" with the G-E K-80 All-wave Radio.

- Range (540 to 18,000 kc.)
- Speaker (high-grade dynamic)
- Power pack (humless)
- Pre-selector (image-erasing cascade type)
- Doublet-antenna provision
- Super-vernier tuning
- Full set of tubes

. . .

The K-80 receiver is 100 per cent complete for

—amateur phone
—broadcast
—S. W. broadcast

. . .

For C. W.?

You bet!—adapted without cutting a wire.

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"Now is the time to buy"

GENERAL ELECTRIC RADIO

GENERAL ELECTRIC COMPANY
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Kindly send me, without charge, full technical details of the K-80 receiver. My special interests are checked below.

☐ New Receiver antenna data ☐ Using the K-80 for C. W.
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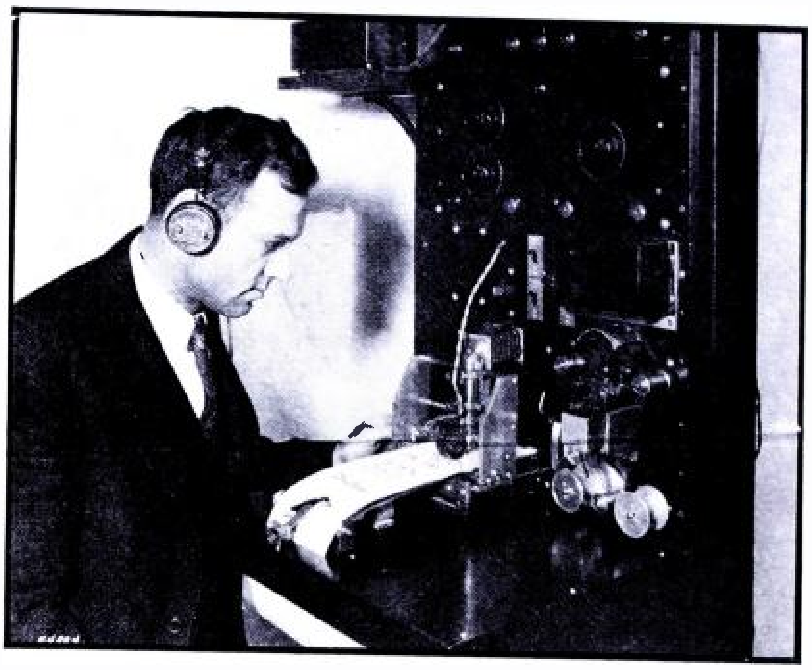
Pictures by Radio

WHILE television continues to lurk around that hidden corner, much research effort is being spent on facsimile transmission. Transmission of this kind does not possess the popular romantic appeal of television, which has been plagued by excessive and premature publicity, but it nevertheless holds some very interesting possibilities. Realizing this, Mr. John V. L. Hogan, well-known radio engineer and inventor, who is responsible for single dial tuning, has been busy developing what now appears to be the simplest facsimile system so far presented to the radio art.

Demonstrations of the Hogan system given recently in New York and Milwaukee, Wis., leave little doubt as to its practicability. At the transmitting end, images in the form of black and white drawings, typewritten matter, maps, sketches, etc., or clear, contrasty photographs, are scanned by a simple viewing mechanism. The sketches or other subject matter to be transmitted are printed or sketched by hand on a continuous paper roll about 4" wide. This feeds through the transmitter and the images are scanned continuously. Scenes may also be photographed on regular 35 millimeter cinema film and scanned for easy transmission.

At the radio-picture transmitting station: how hand drawn images on a continuous paper tape are presented to the "scanning" mechanism for broadcasting. To the right is a cinema-film scanning arrangement, with a short loop of film in place. The simplicity and compactness of the apparatus are evident.



Narrow Frequency Range

In the New York experiments, Mr. Hogan's experimental transmitter, W2XAR on 1594 kilocycles, was used. In Milwaukee the experimental stations W9XAG on 1652 kilocycles and W9XAF between 40 and 60 megacycles will be used for regular experimental service. This facsimile transmission presents no particular problems insofar as the radio transmitter itself is concerned, as the signal frequency is only about 2400 or 2500 cycles—only half the width of an ordinary broadcast signal.

At the receiving end, any high-grade receiver equipped with a suitable coupling device for the transcriber may be used. The actual picture producing machine is about half the size of a midget receiver. The images are produced on a continuous roll of paper by means of a vibrating needle or stylus fed with ink. The images produced are thus immediately available for observation or cutting, no chemical or photographic processing being involved. In fact, the user of the equipment can watch the image as it is reproduced line by line. The received record is permanent, dry and easily handled.

At the present time, detail in the reception is limited to 40 lines per inch. While this does not permit any fine gradations of tone, the reproduction of cartoons, maps, stock quotations and the like is really excellent and more than fulfills the requirements of many special services.

No details of the actual transmitting and receiving mechanisms have as yet been released, but SHORT WAVE RADIO expects to publish further information on the apparatus in future issues.

The paper tape at the receiving end is four inches wide, and the image is reproduced on it at the linear paper speed of two and one-half inches per minute.

The Hogan apparatus is not available commercially at the present time, although even now Mr. Hogan believes that machines can be built in mass production for as little as $10. Mr. Hogan himself is not in the manufacturing business, but the likelihood is that radio manufacturers will be licensed by him and that the radio "pens" will appear on the market as soon as a number of transmitting stations install suitable transmitting equipment.

Short-wave set owners and experimenters will undoubtedly find the Hogan facsimile apparatus a source of considerable interest. The possibilities of the system are obvious, and many uses can easily be devised for it.

The Milwaukee experiments are sponsored by the *Milwaukee Journal*, a daily newspaper, which also operates station WTMJ on the regular broadcast band. The Hogan apparatus will be installed in the Hotel Schroeder of that city. The test programs will run about three hours daily, according to Walter Damm, manager of the *Milwaukee Journal's* stations and chairman of the Television and Facsimile Committee of the National Association of Broadcasters.

Foreign Station Notes of Interest

By Robert W. Mitchell
132 Forest Street
Winchester, Mass.

A letter from Oslo states the following: "The short-wave station LCL, Jeloy, is an experimental station erected in order to find a high frequency channel suited for relay transmission to the new Finnmark broadcasting transmitter. The time of operation is in the near future likely to be irregular, and probably the wavelength will be altered from 42.9 to 48.9 m. or more. Presently the station is transmitting the complete ordinary evening program from Oslo."

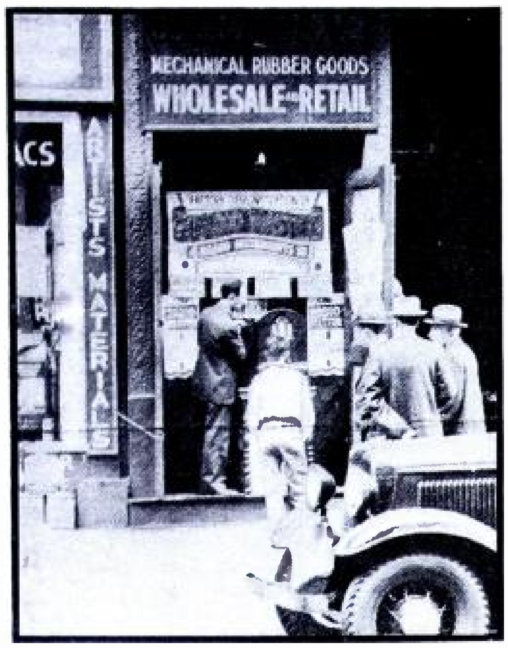
The summer schedule of the Deutschen Kurzwellensender (German short-wave station) to North America will be on DJC (49.83 m.) and on DJD (25.51 m.) from 9:30 P.M. to 12:00 M. Eastern Daylight Saving Time.

The Radio Club of Tenerife sends the following: "—Most probably we will stop working with our station EA8AB for some time (former EAR58) as we intend building it up again with more power. If it closes down it will be for about 4 to 5 months.

"Nevertheless we will continue to broadcast with our station EAJ43 (201 m. 1492 kc.), 200 w. power."

Station CJRO, 6150 kc., at Winnepeg, Man., is again working in synchronization with CJRX, 11,720 kc., also of Winnepeg, using the Canadian Radio Commission programs from 9 P.M. to midnight E. D. T. CJRO was revamped during the winter months.

Beware of the Fake Noise Eliminator!



An actual demonstration in lower downtown New York. The demonstrator is just starting to collect an audience

WITH extraneous noise the bane of short-wave reception, certain small and unscrupulous manufacturers are attempting to cash in on the situation by exploiting a number of fake "noise eliminators." These devices are altogether different from legitimate line filters and interference eliminators that are intended for connection directly to the terminals of noise-creating electrical machines. These pseudo eliminators are connected directly in series with the aerial wire and are supposed to exercise a magical effect in quieting the receiver without affecting the reception of actual radio signals.

As comparatively few radio dealers care to jeopardize their reputation and business by selling these fakes, their manufacturers have adopted the plan of selling them through roadside demonstrators. These men travel from place to place and are rarely, if ever, seen twice in the same spot. They know darn well that a return visit is not always safe for them!

Demonstrations Convincing

The demonstrations staged by these roadside sharpers are really very convincing. The usual arrangement is to have one of the front mudguards of an ordinary passenger car fitted up with a small wooden table, on which rests a midget receiver of conventional appearance. The board is also decorated with one or two small electric motors. Leading out of the back of the set is a flexible aerial wire, the other end of which is attached to one of the door hinges or to a small aerial supported above the roof of the car by a couple of short sticks.

The demonstrator dons a scientific looking laboratory coat, sets up his apparatus, and draws a crowd very quickly by merely turning on the set.

The sales spiel and the demonstration are pretty much standardized. The man turns on the motors, with the aerial connected directly to the receiver. The latter gives a pretty good imitation of a coffee grinder with a loose bearing. Then the demonstrator disconnects the lead-in three or four feet from the set itself, and inserts one of his "eliminators." As if by magic, the noise disappears and the music comes through loud and clear. Sales of three, four, and even ten eliminators are not unusual after this demonstration, at prices ranging from 35c to $1.00 each.

The eliminator itself usually takes the form of a small cardboard cylinder about an inch or an inch and one-quarter in diameter and possibly two and one-half inches long, with a wire protruding from each end. The contents of the cylinder vary from plain, ordinary sealing wax in the out-and-out fakes, to tiny fixed condensers in some of the more expensive units. In one eliminator purchased by a short-wave fan in New York, the two wires sticking out from the ends of the box were actually one piece of wire! One eliminator, when cracked open with a cold chisel, was found to contain cement, which accounted for its unusual weight.

Some Use Condensers

The devices containing condensers will, of course, have some slight effect on reception. Any small condenser connected in series with the antenna circuit of most small broadcast receivers will make the tuning a little sharper than before, although the volume may also drop noticeably. How then, you ask, are these demonstrations worked?

We are indebted to a small parts manufacturer of New York, whose identity we will keep a secret to protect him from reprisals, for an explanation of these ingenious demonstrations. This man knows the "inside" because he was approached by some of these fakers and asked to supply the special switches that are the basis of the whole stunt.

It seems that the flexible wire that connects to the radio set itself does not terminate at a binding post at the back of the chassis, but instead goes through a small hole in the latter. The free end of the wire is hooked to the lead-in from the car aerial. A slight tension is maintained on this wire by means of an inconspicuous rubber band tied around the latter lead-in. With the two wires hooked together, so that the aerial connects directly to the receiver, the tension on the wire is such that a small switch is operated inside the chassis. When this switch closes, a connection is made between the little motors and the receiver, and, of course, the set becomes terrifically noisy. The regular aerial connection to the receiver remains, the switch merely being tied to the wire mechanically.

How It Works

Now, when the demonstrator unhooks the two sections of the lead-in and inserts the "interference eliminator," the tension on the lead-in is reduced and the switch inside the set opens. The noise, of course, then disappears. The demonstration is convincing because the demonstrator leaves the set running and does nothing but hook in the so-called eliminator.

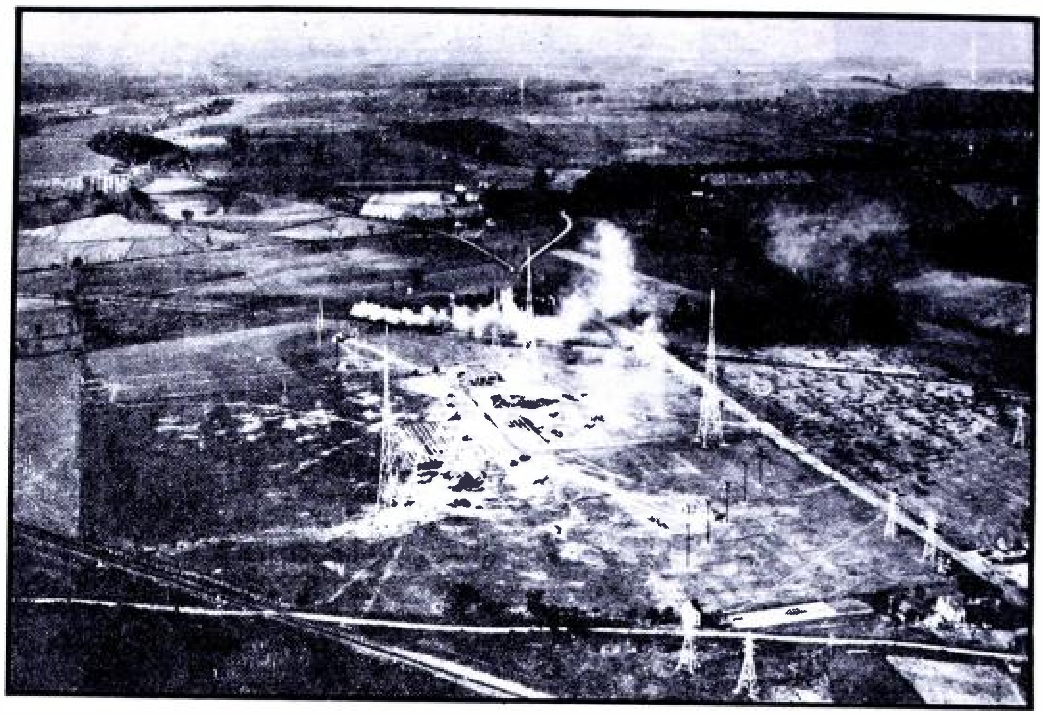
It can be pretty definitely stated that any noise picked up by a radio aerial can be eliminated only at the expense of the desired radio signals. Any device connected in the aerial circuit alone that is supposed to reduce or eliminate noise will also reduce or eliminate the signal. This is a very definite statement and is absolutely the truth.

Demonstrations of these fake noise eliminators are not confined to automobiles—in New York a number of demonstrators go around with large pushcarts! Small stands set up in the doorways of empty stores are also a favored means of exploitation.

The existence of the set control switch inside the chassis is not evident to the onlooker. The demonstrators do not hesitate to turn the sets around so that the backs are fully visible. The switch tension is very carefully adjusted so that the contacts make or break if the lead-in is disturbed in the slightest degree.

The editors of SHORT WAVE RADIO are making a collection of these noise fakes and expect to publish a photograph of a bunch of them in a forthcoming issue. We will take them apart and show exactly what is inside. We invite readers to send any samples that they have picked up themselves.

The Technical Director of this magazine had the privilege of testing at least one "static eliminator" a month for a period of two years while engaged with a large radio company. All of these so-called eliminators were pretty much alike: they reduced the noise all right, but they reduced the signal at the same time, and in the same proportion. It is interesting, though, to listen to the really remarkable explanations of the sources of noise—speaking time, two minutes!



An airplane view of the South Schenectady radio plant.

Progress of the Short-Wave Art

By P. C. Sowersby*

THE new all-wave radio sets have made short-wave broadcasting an activity of international importance. Relegated to the background as useless when broadcasting first became popular, short-wave activity was confined to amateur and commercial use. The entertainment field took full possession of that portion of the radio spectrum from 550 to 1500 kilocycles, known as the broadcast band. Listeners were equipped with sets capable of receiving only local stations, or perhaps the higher-powered regional transmitters. Rarely did one search outside the limits of his own country for radio entertainment.

But short-wave broadcasting could not be held down forever. In the great laboratories, scientists and research engineers were making investigations into the little-known field of high-frequency circuits. The General Electric Company has pioneered in the development of short-wave radio, and today, with its famous stations W2XAF and W2XAD, occupies an enviable position in the broadcasting world.

The company maintains two short-wave experimental relay stations, W2XAF and W2XAD, at Schenectady, New York. Station W2XAF is perhaps the more widely known at present, because of its excellent service in maintaining contact with Rear Admiral Richard E. Byrd's second expedition to Little America and the South Pole. Station W2XAF, licensed to use 40 kilowatts on a frequency of 9,530 kilocycles (31.48 meters), uses a directional antenna designed by Dr. E. F. W. Alexanderson.

The special beam antenna, so successfully used for these programs, has the effect of concentrating the radio waves and reflecting them in one direction. The effective signal strength is increased two and one-half times at the receiving point. This, in turn, has the effect of increasing the antenna power more than six times, putting station W2XAF truly in the super-power class.

While our friends at the southern end of the world are exploring new lands at great personal risk, they are able to keep in touch with their homeland through daily short-wave broadcasts. In even the stormiest of Antarctic weather, when the expedition's transmitters are unable to penetrate through the storm to civilization, W2XAF comes pounding through to let them know that they are not forgotten.

Now, another step is being taken in short-wave accomplishment. Both W2XAD and W2XAF have been heard in practically every country in the world at various times of the day or night. A simultaneous broadcast has been tried, with announcements in nine different languages, so that almost everyone who hears the program will understand what is said. Robert L. "Believe-it-or-not" Ripley, internationally known traveler, was a recent speaker on the program and offered a special cartoon to each person outside of the United States who verified reception of the program. (See the June, 1934, issue of SHORT WAVE RADIO—*Ed.*)

For several years after the radio broadcasting industry was born, short-wave activities were in the background, put there as being of little commercial use. It was not until 1923 that G. E. thought seriously of using higher frequencies for voice transmission. One hundred meters, then definitely in the short-wave class, was selected as the wavelength to be used for this development.

Preliminary work was begun with the development of oscillator and modulator units for the newly designed 20-kilowatt, water-cooled tube. Intense high-frequency pick-up from this short-wave oscillator caused serious interference with other important work nearby. So the little-thought-of short-wave apparatus was moved to other quarters. From the radio engineering laboratories, the engineers moved their equipment to an abandoned "potato shack" on Van Slyck Island in the Mohawk River, opposite the G. E. plant.

The development and investigations were well under way when instructions came to have a short-wave transmitter, designed to operate on 100 meters and capable of relaying WGY programs, ready to go on the air by a certain date. The high-power rectifier, oscillator, modulator unit, and large air capacitor were hastily assembled and installed. Such was the need for speed that some of the transformers were not even removed from their packing cases. But the transmitter went on the air—to be heard by a few amateurs and foreign listeners who immediately wrote to Schenectady to warn of the "terrific 100-meter harmonic of WGY."

Once established, short-wave broadcasting grew and developed rapidly. With the assistance of G. E. engineers, the Radio Corporation of America set up a plant at Tuckerton, New Jersey, and carried on

*General Electric Co.

conversations with England on short-waves. Other nations were beginning to take notice of the possibilities of higher frequencies.

Spring floods in the Mohawk River made broadcasting from Van Slyck Island difficult. Programs were continued nightly, but high water marooned the operators and engineers on more than one occasion; rescue was effected by row-boat and canoe.

Necessity for facilities for expansion, as well as the need for more commercial quarters, resulted in the establishment of the radio experimental laboratory at South Schenectady. Under new licenses issued by the Department of Commerce, the projects grew rapidly. Developmental work, which had begun in the 100- to 109-meter band, progressed until the frequencies of 4610 kc. (65 meters), 7140 kc. (42 meters), 9150 kc. (32.77 meters), 11,550 kc. (26 meters), and 13,660 kc. (21.96 meters) were used.

Problems of Frequency Shift

Many difficult problems were encountered as the power was increased in short-wave circuits. In the original self-excited oscillator circuits, large shifts in frequency resulted from the natural vibrations of capacitors, from body capacity effects when operators moved near the transmitters, and from various mechanical vibrations. Such frequency fluctuations made the carrier wave unsuitable for speech modulation. Vibration was minimized by rigid construction, and later the use of harmonic amplifiers made possible a much steadier carrier through the use of temperature-regulated crystal control.

Vacuum-tube construction became an increasingly difficult problem with the introduction of high-frequency circuits. Greater power at high frequency resulted in failure of grid leads within the tubes. Continued difficulties of this nature finally brought about the development of new tubes having low grid capacities, capable of withstanding high frequencies.

Short-waves also resulted in new methods of radio insulation. Porcelain, bakelite, and other similar insulating materials were unsatisfactory. Glass had to be used in many cases, and, finally, an entirely new insulating material—Mycalex—was developed.

Valuable information was obtained as the short-wave tests progressed, by simultaneous transmissions on several frequencies. The coöperation of the American Radio Relay League, and many amateurs, in addition to the company's own observers, made it possible to determine the more favorable frequencies for short-wave broadcasting. Reports from Europe, Africa, South America, and Australia, representing widely different time zones, were of great assistance in determining the success of the tests.

Accordingly, two frequencies were selected to give the greatest possible coverage from Schenectady, and early in 1927, W2XAF and W2XAD began operating on alternate nights, transmitting the regular programs of WGY. W2XAF used a frequency of 9,150 kc. (32.77 meters), and K2XAD used 13,660 kc. (21.96 meters).

The advent of broadcasting networks brought many events of national and international importance within the reach of short-wave audiences. Through these short-wave stations, many historical happenings were broadcast. Among them were:

New York's reception to Colonel Lindbergh.

The Prince of Wales' speech at the opening of the Peace Bridge in Buffalo.

The Pan-American Conference at Havana.

President Coolidge's address to the Pan-American Conference at Washington.

New York's reception to the crew of the "Bremen."

Time signals and messages to the Gow-Smith expedition in Brazil.

Important American football games.

World's Series baseball games.

Heavyweight-championship boxing matches.

King George's speech to the Arms Conference.

The inaugurations of Presidents Hoover and Roosevelt.

Opening of Congress and important Congressional legislation.

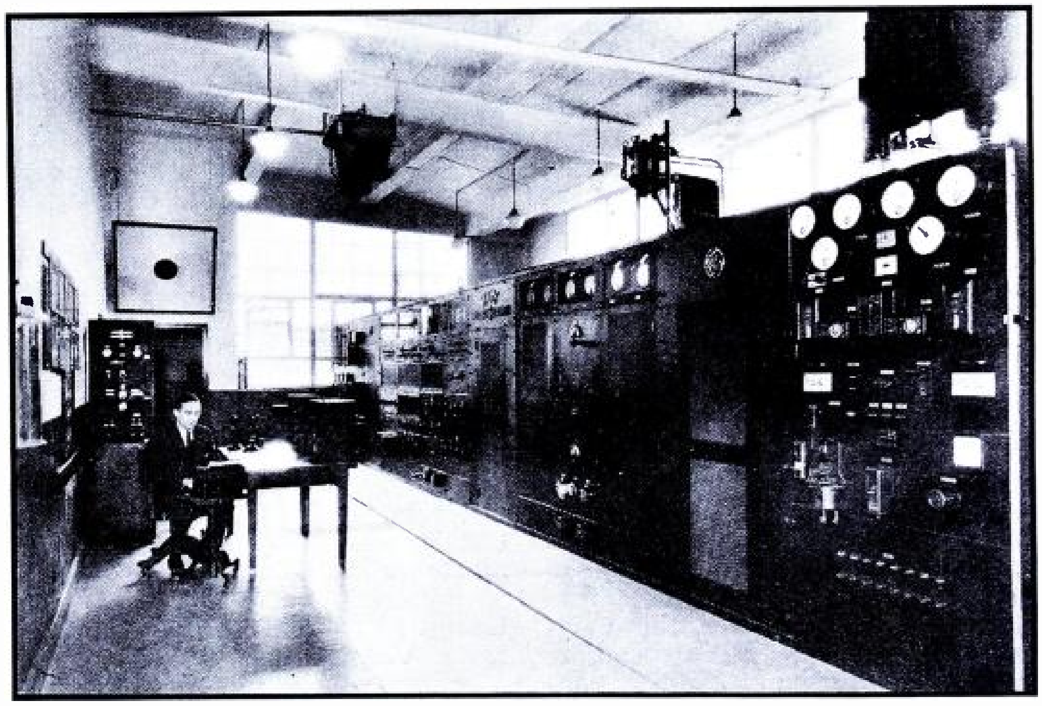
To make the coverage more nearly complete, programs of W2XAF and W2XAD have been rebroadcast from such distant points as England, South Africa, Spain, France, Australia, New Zealand, Mexico, Cuba, Argentine, Brazil, and Chile. So much interest has been shown by foreign listeners in American short-wave schedules that many of the programs of W2XAF and W2XAD have been listed in foreign periodicals. The present use of all-wave sets has made the interchange of program material of great real value.

Not only has short-wave broadcasting been of value internationally, but it has brought increasing response from listeners in many southern states of the United States, indicating a large field of reception. High static levels in the summer months make long-wave reception difficult, and, in many cases, impossible. Short-wave transmissions necessarily have been used in tropical and semi-tropical countries, where electric disturbances are particularly severe in the middle and lower frequencies.

Success Recognized

The success of American short-wave broadcasting, we believe, has done much to popularize it in other lands. The British Broadcasting Corporation, after a series of tests on station G5SW at Chelmsford (which included many two-way conversations with W2XAD and other American stations interested in long-distance transmissions), adopted it for Empire communication. Today, the Corporation transmits to remote parts of the Empire through regular short-wave schedules.

Schenectady transmissions have become so popular that many daily newspapers in England, in Central and South America, and in Australia carry the 19- and 31-meter schedules. BBC's "World Radio Magazine" syndicates the G. E. short-wave programs to both English and continental newspapers. Continental reports of Schenectady programs prove that the stations have regular listeners on the far side of the Atlantic.



These business-like panels represent stations WGY, W2XAF and W2XAD.

Three of the operators of W7BEV, one of the key stations in the rescue work. The operators, from left to right, are Nelson Colett, Roland Smith and Wilbur Miller.

Amateur Radio to the Rescue in the Northwest

By Lewis Winner

STREWN shreds of clothing over bodies battered by swirling, swollen waters; countless disheveled, homeless, wandering children and adults, shrieking, sobbing, staring at their treasured symbols of life suddenly swept away. A piercing tragedy, and this but briefly portrays the scene of a pitiful flood-stricken area.

A sudden roar, an airplane, and almost magically, aid is at hand. A few dots and dashes from this isolated section torn apart by a prank of nature, and the world begins to help.

A more stirring scene could not be painted. Short-wave radio and the zealousness which radio amateurs have shown in this work are the answer. Operating a perfectly harmonious keyed system, they demonstrated the vital value of this means of communication in the recent floods in the Coeur D' Alenes area, which cut off the towns of Wallace and Kellogg, Idaho.

Every means of communication suddenly impaired, the entire flooded district was shrouded in walls of silence. Swift radio messages, however, soon cracked through the ether, bringing prompt assistance.

Without compensation, working tirelessly day and night, repairing transmitting antennas in darkness and storm, tramping hip deep in mud, carrying heavy equipment into the storm ridden district, these soldiers of short-wave radio stood by for one hundred and twenty consecutive hours.

When the first report of conditions at Wallace and Kellogg reached station W7AMA, Spokane, Washington, owned by Henry Sturtevant, his transmitting antenna was out of order. The area was pitched in darkness and a high wind was blowing. Sturtevant, however, realized that an emergency existed. With only a single flashlight to guide him, he climbed two fifty-foot trees on which the antenna was suspended, untangled the wires, brought them down to earth, and made the proper repairs. Almost immediately, he and station W7BEV contacted W7BDX at Wallace, and W7AQK at Kellogg. Operators were thereafter on the air practically every minute. Tired, and so worn that he could not possibly keep awake, Dunkin McLean, operator of station W7BDX, was finally relieved by Carl Johnson, a short-wave operator who flew to the Osborn Flying Field near Wallace with Major R. G. Breen in an Army plane.

Johnson and his assistant were obliged to carry the heavy transmitting and receiving equipment, which they had brought along for a second short-wave station at Wallace, from the flying field to town.

They walked four miles in mud and water to Wallace, where a station was set up in a garage, with the call letters W7BUZ. Several other amateurs in Kellogg and Wallace soon came in on the scene with pertinent messages. These were stations W7AQK and W7BCU.

More than a thousand messages were handled by the Spokane short-wave operators. They consisted of personal, business, and emergency messages. Even such special messages as required by stock brokers and telegraph companies were flashed through the air. Airway traffic was also handled. Associated Press news and press dispatches addressed to the newspapers, totalling over 11,000 words, were sent through.

News regarding the United States Mail was handled. Weather reports were given to the North-West Airways every morning. Food, clothing, even furniture, was ordered by way of short-wave radio and transported by plane and boat.

So accurate were the weather reports from these amateur stations that many planes flying in to the stricken area were prevented from serious injury by proper landing condition warnings.

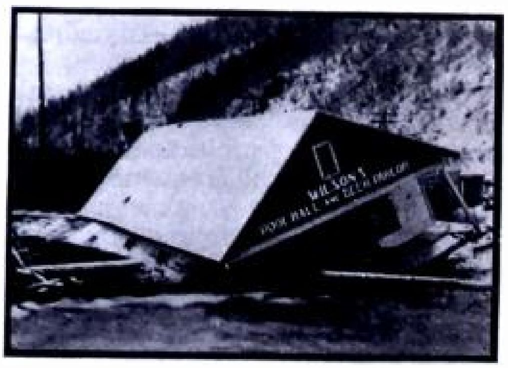
The key stations, W7AMA and W7BEV, at Spokane, operating on 1,976 kc. and 3,956 kc., employed specially constructed transmitting equipment and a professional short-wave receiver, the Hammerlund Comet "Pro."

The equipment was kept going continuously. Consequently, exceptional consistency of transmission and reception was an important factor. The success with which this work was done is evident. The newspapers of this vicinity lauded the remarkable work of these amateurs and their steadfast instruments.

Without the heroic, ceaseless, vigil of these "hams," as they are popularly known, thousands would not have been saved, and millions of dollars would have been also lost. Even after the actual flood had receded, constant watch was kept by these amateurs until all indications pointed to safety. These watches had to be kept since the water-soaked earth, which had frozen, presented new hazards to the stricken residents.

Amateurs went about the town keeping close watch and sending word to those at the transmitter, "warning information." Although communication was established at some points, those living at the lower part of the country or in the valley were still without assistance. Fuel, fruits, vegetables, fresh foods, had to be sent them. Rapid messages swept through describing

(*Continued on page* 47)



One of the floating derelicts resulting from the storm. Amateur radio played a big part in the rescue work.

"Radio Row" Goes Short Wave

CORTLANDT STREET, the most famous radio shopping center in the world, has gone solidly short wave. The windows are full of the latest short-wave and all-wave receivers and the sidewalks during lunch hour and on Saturday afternoons are again crowded with little knots of fans who discuss their international DX accomplishments and swap circuit "dope," station verifications, etc.

These 1934 scenes are really history repeating itself. During the early days of the broadcast boom, it was the lure of distance just as much as the miracle of radio reception itself that produced so much business, and today the dealers are thankful that the old DX fever has again afflicted the listening public.

A view of Cortlandt Street, looking west, taken from the 9th Avenue "L" station at the corner of Cortlandt and Greenwich Streets, New York.

The Boundaries

It is difficult for a person who has never visited this part of New York to appreciate Cortlandt Street's "Radio Row." The district is an institution by itself and is really worth investigating. The main axis of Radio Row is Cortlandt Street, which is an important cross street in lower Manhattan, running directly into a whole row of ferry slips on the Hudson River shore. Thousands of commuters from New Jersey stream by each day. The district is bounded on the west by West Street, which actually is the waterfront, and on the east by Greenwich Street, two blocks away. The southern boundary is Liberty Street and the northern limit Telegram Square. These limits are not very definite, as numerous important radio stores are also found farther east and north.

The Cortlandt Street stores vary considerably in appearance. There are many attractively decorated salons (and also a couple of saloons!), while some of the shops are merely holes-in-the-wall, perhaps four or five feet wide and six or eight feet deep.

While, of course, practically every known make of standard receiver is on display along the street, Radio Row is most attractive for its huge stocks of surplus and obsolete equipment. The short-wave experimenter will find it a veritable paradise, because there he can obtain every conceivable part or accessory. The variety of merchandise on display in some stores is amazing. You can get everything from crystal detectors to crystal oscillators, from single slide tuning coils to sixteen-tube superheterodynes, from picture moulding aerials to the latest doublets, from dry cells to ten-kilowatt motor generators!

One of the outdoor parts counters on Washington Street, where you can buy soldering lugs or a dynamotor!

If you have ever wondered what becomes of old broadcast receivers that have been turned in as part payment on new sets, you will find the answer on some of the side streets off Radio Row. For as little as 25c you can buy, "as is," receivers that once gladdened dealers' hearts to the tune of $200.00. Many radio fans who have gotten wise to this part of the business go shopping on Saturday afternoons and for a couple of dollars buy whole automobile loads of ancient receivers that yield numerous parts in good working order.

For 50 cents or a dollar you can walk away with massive old Fadas, Stromberg-Carlsons, Grebes, Atwater Kents, or practically any other set produced since 1921. A single part is usually worth that much, even if the rest of the obsolete sockets, dials, transformers, etc., is discarded.

Washington Street, between Cortlandt Street and Telegram Square, is the cabinet mart. The sidewalks are lined and piled high with all sorts of woodenware, ranging from 7 x 18 inch pine boxes to massive five-feet high monstrosities. The business is conducted on a strictly cash-and-carry basis, the final sales price of any particular item depending on your ability to out-argue the demon salesmen.

The sales policies and business methods of certain of the Cortlandt Street gentry in years past have given Radio Row something of a sinister reputation, which the present tenants are trying to live down. During the boom years, the lure of easy money attracted some pretty bad characters, who sold misrepresented, misbranded and defective merchandise without giving any thought whatsoever to their own future or the future of the industry. The depression scattered most of these "gyps" (to be called a Cortlandt Street gyp artist was the worst reprobation that could be heaped on a radio merchant), and today the street is honored by the presence of some high-grade stores of established honesty.

There are still plenty of sharpers lurking in the alleys, but only the most naïve customers fall victim to them. It seems that many of the people now getting into the short-wave game are ex-broadcast fans of the 1921-27 era, and they fall back on their previous experience when they go shopping for apparatus. The whole spirit of Radio Row is different now. The cheap carnival atmosphere has more or less disappeared, and respectable sales methods have replaced the former hit-'em-over-the-head tactics.

Visit Cortlandt Street. You will find it an interesting and instructive experience!—*R. H.*

J. B. L. Hinds Picks the Ten Best

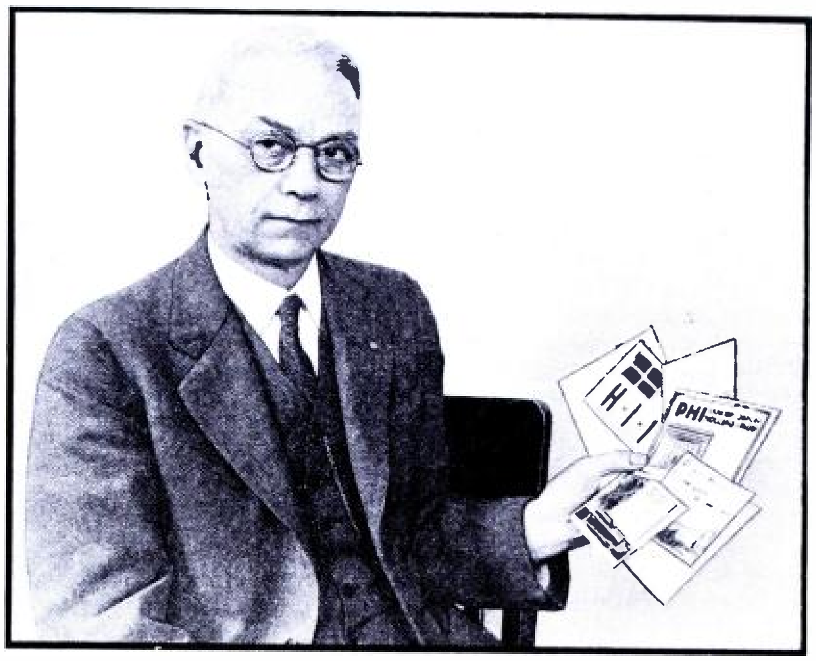
AS an experienced listener of radio programs from all parts of the world, I have been asked to name the ten best foreign stations now on the air and broadcasting regular programs.

In making such a selection, consideration must be given to many things, such as class of programs presented, strength and evenness of signal, consistency of output, whether enjoyable and understandable to the majority of listeners, etc.

In the opinion of the writer the stations listed below will furnish the greatest enjoyment and entertainment, as a varied class of entertainment, consisting of concert and symphony orchestras, typical native music and songs will emanate from them and their programs will also furnish considerable information on the current topics of the day.

Where time of day or night is given, Eastern Standard time is intended, as all reliable radio programs published in the U. S. of foreign broadcast stations show that time.

For convenience, the ten stations will be listed in alphabetical order according to the countries in which they are operating, it being impossible to list the order in which they come on the air, as some operate the majority of the time, while others operate on certain days only. It is not the intention of the writer to indicate which stations are superior to others, and the assignment made should have no bearing on the selections made.



J. B. L. Hinds

whom we take pleasure in introducing to our readers as the new conductor of our Short Wave Station Department, is an experienced and conservative radio fan who never counts a station as heard until he receives a verification from it. He does not merely guess at the identity of stations, but listens very carefully, keeps a complete and very accurate record of his results, and double checks on each new catch by attempting to duplicate the reception at least a second time. We feel that his advice and suggestions will be interesting and helpful because he spends only a nominal amount of time at his receivers, and therefore, he is in the same position as most other short-wave listeners. By profession an accountant with the New York Central Railroad in its New York office, he is at his regular job during the day and listens to the short waves after he gets home. He does not have to stay up all day and all night and have relief operators for his receivers in order to build up an impressive log of stations. We believe his understanding of the average short-wave fan's problems and habits will do much to make his articles valuable.

Mr. Hinds acquired his first short-wave receiver, an a.c. Super-Wasp, in the Spring of 1930. Late last year, before entering the Denton Trophy Contest, he acquired a more modern receiver, a Hammarlund Pro. He has received phone or broadcast stations from more than 40 countries and has a really marvelous and highly prized collection of almost 200 verification cards, letters and certificates.

Mr. Hinds lives in Yonkers, N. Y., a suburb bordering on the northern end of New York City. He will be very glad to correspond with readers of SHORT WAVE RADIO and to receive their reports on their own receiving experiences. Reports from other sections of the country are especially desired and will be studied and abstracted by Mr. Hinds in these columns for the benefit of other listeners. Letters should be addressed to Mr. J. B. L. Hinds, c/o SHORT WAVE RADIO, 1123 Broadway, New York, N. Y. If you want a personal reply, be sure to enclose a stamped and self-addressed envelope.

Mr. Hinds is not a radio technician, being interested primarily in international DX reception. You can ask him all the questions you want about foreign stations, but if you want technical advice on receivers, circuits, parts, etc., address your letter to Mr. Louis Martin, technical director of this magazine.

Do not hesitate to write to Mr. Hinds regularly. A steady exchange of station "dope" will be to everybody's benefit.

Australia

VK2ME, Sydney, Australia, transmits programs only on Sunday of each week on 31.28 meters and is on the air from 1 to 3, 4:30 to 8:30 and 9:00 to 11 A.M. and is known as the "Voice of Australia." Electrical recordings are mostly used, but many news items of interest are given and each broadcast contains a very instructive fifteen-minute talk on some section of Australia, which covers an area of 2,974,581 square miles and has a population of 6,600,000. The laughing notes of the Australian Kookaburra bird open and close the programs as a rule, and they also precede and follow the fifteen-minute talk mentioned. The time of day is given over this station, as are the chimes from the clock atop to G.P.O. building in Sydney.

Its sister station, VK3ME, Melbourne, Australia, broadcasts on Wednesday from 5 to 6:30 A.M. and on Saturday from 5:00 to 7:00 A.M. on 31.55 meters, and is a welcome visitor in many American homes with its varied program of recordings, news items, etc.

I recently had the pleasure of listening to our own Eddie Cantor singing "Look What You Got" from this station; to me, his voice sounded as real as when singing the song in a New York studio on Sunday night. Both Australian stations have pleasant voiced English announcers who often tell you the exact time of night in Melbourne or Sydney and inform you promptly before and after rendition the title of the selection played or sang. If you happen to be listening to VK3ME on Saturday morning, when the announcer gives the time in Melbourne as 10 P.M. Saturday night, you may note from your watch beside you that it is exactly 7:00 o'clock Saturday morning Eastern Standard time, and you may go to your breakfast table as Melbourne says "Goodnight everybody" and plays "God Save the King" and closes down.

The signals of VK2ME and VK3ME come into America strong, steady and clear. The first station broadcasts with 2 kw. and the latter with 20 kw. of power. Both stations are owned and operated by the Amalgamated Wireless (Australasia), Limited, and both are used for overseas broadcasting and also beam wireless services to Great Britain, the continents of Europe, North and South America as well as coastal stations and ship wireless.

Foreign Short Wave Stations

VK2ME is the largest broadcasting station in the Southern Hemisphere. The transmitting plant for both stations is located at A.W.A. Radio Center, Pennant Hills, near Sydney, Australia.

If the listeners of these stations will bear in mind that, in Australia, *spring* is September, October and November; *summer* is December, January, February; *autumn* is March, April, May; and *winter* is June, July, and August, they may account for the changes in signal volume from this part of the world.

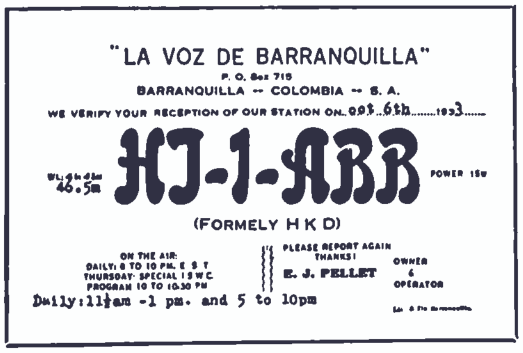
Colombia

HJIABB, which you find regularly on 46.51 meters, is operated from Barranquilla, that quaint city on the northern coast of Colombia, situated just off the Caribbean Sea. This station operates with 300 watts of power and transmits each week day from 7:00 P.M. to 9:30 P.M. and on Sunday from 4:00 to 6:00 P.M. Its typical Spanish numbers are much enjoyed by many listeners. The station is operated by Mr. Elias J. Pellet, who is the proud owner and operator. Mr. Pellet was educated in the United States and is well equipped with a knowledge of electricity and radio. He first began broadcasting over a 7-watt home-made transmitter under the call letters of HKD. Mr. Pellet makes his announcements both in Spanish and English and his programs are greatly enjoyed in the United States, where he has many warm friends.

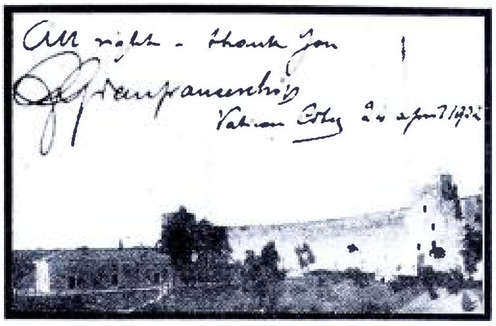
England

The British Broadcasting Corporation broadcasts with eight transmitters GSA, GSB, GSC, GSD, GSE, GSF, GSG, and GSH, seven of the eight being used usually in the daily broadcast. Two transmitters are used simultaneously on each broadcast. Thus, if reception is poor from one, it may be good from the other.

The striking of Big Ben and the Westminster Chimes is radiated often over the network from the Parliament building in London. Big Ben is one of the important landmarks in London. It was built in 1858 and is considered the most powerful striking clock in the world.



This simple but well prepared card verifies reception very specifically.



A picture post-card view of the Vatican City radio station was Mr. Hinds' reward for his report on HVJ.

Its hour hand is nine feet long and its minute hand fourteen feet long. The bell weighs thirteen and one-half tons and its hammer four hundred pounds. The first note denotes the correct time. The chimes follow, set to the following lines:

"All through this hour, Lord, be my guide, and by
Thy Power no foot shall slide"

When Big Ben is silent for repairs, the toll of "Big Tom" from St. Paul's Cathedral is radiated instead.

The transmitting plant of this network is located at Daventry, where eighteen immense aerials direct the signals to the vast British Empire. There are five transmission zones and five groups of directional aerials consisting of twelve aerials, which, with the six omni-directional aerials, make a total of eighteen aerials in use. The B.B.C. broadcasts daily to five zones, Australian, Indian, African, West Africa and Canadian.

Germany

The German Broadcasting Company, which they please to term the "German-Round-The-World-Sender," operates daily on regular set times of service with four transmitters, usually with two transmitters simultaneously, with the call letters DJA, DJB, DJC, and DJD. They radiate their powerful, clear signals from early morning until late at night, closing at 11:30 P.M. The studios are in Berlin and the transmitting plant at Zessen. They broadcast enjoyable programs and are known in America as a friendly station, and direct their programs to us, with their familiar "Hello, America, we hope you have good reception tonight." Many gems of music and song emanate from these transmitters.

Holland

The programs of PHI, that fine station owned and operated by Philips Radio, come to us with fine signal strength from their transmitting plant at Huizen. Studios are maintained at Hilversum. They are on the air Monday, Wednesday and Friday 7:30 to 9:30 A.M. and Saturday and Sunday 7:30 to 10 and 11 A.M. They operate on 25.57 meters and 16.88 meters, according to season.

The new station PHI replaced the famous PCJ, which operated for many years from Eindhoven and closed down in October, 1931. The call letters PHI are well known to all old-time short-wave listeners as they were used for many years on 16.88 meters.

The friendly greetings of Edward Startz, the famous announcer of PCJ, are still heard by his many friends throughout the world. He announces in seven languages, Dutch, Malay, French, German, English, Spanish and Portuguese.

While all the broadcasts are principally meant for the Dutch East and West Indies, the announcements are made as stated to give friends and listeners an opportunity to identify the station and enjoy the programs.

Italy

I2RO, Rome, on 25.40 meters, rebroadcasts the daily programs of long-wave station IRO, Rome. As the season advances, their signals are coming in to America with fine strength. The transmitting equipment and antennas are located just outside of Rome. Studios are maintained in Rome, but programs are picked up at Naples and other cities in Italy. Many famous personalities have been heard by listeners of this station. The voice of Signora Buoncompagni, the young lady announcer, is probably known by as many listeners as any voice on the air, and is immediately recognized by her "Radio Roma-Napoli" station announcements. Of late, occasional afternoon programs of I2RO have been coming to us either over IRM or IRW simultaneously with I2RO. IRM is on 30.52 meters and IRW on 15.37 meters and are operated by Italo Radio, Rome (125) Calabria N 46-48. The address of I2RO is Ente Italiano Andizone Radiofoniche, Rome, Italy.

Spain

EAQ, Madrid, Spain, broadcasts

You don't have to know much Spanish to be able to understand this fancy two-color card from LSX.

daily from 5:00 to 7:00 P.M. and on Saturday from noon to 2:00 P.M. on 30.43 meters. It has as consistent a signal as any station coming into America, where its musical, literary and news programs are received very nicely. Its broadcast on Saturdays is mainly intended for Europe, Canary Islands, and other Spanish possessions. Studios are maintained in Madrid and its fine transmitting equipment at Aranjuez, a suburb of Madrid. Its 20kw. transmitter is a Marconi Beam and is used additionally for telephone work to all parts of the world when not being used for broadcasting purposes. EAQ is owned and operated by Transradio Espanola, P.O. Box 951 Madrid.

On stated evenings each week, an additional hour broadcast is radiated over EAQ for the International Broadcasting Club of London, a listeners' club banded together for the purpose of bringing all listeners into closer relationship. They rebroadcast the long-wave programs of Athlone, Normandy, British Broadcasting Corp., Paris, Spain, Italy, etc.

Switzerland

HBL on 31.27 meters and HBP, 38.47, simultaneously broadcast each Saturday from 5:30 to 6:15 P.M. the programs of the League of Nations at Geneva. These 20kw. transmitters, with several others, are operated from Praguins, some 20 miles from Geneva, and are also used to transmit messages to the world by radio telegraph.

The League of Nations maintains these stations to broadcast the various questions coming before its tribunals and more especially to build up good will among the nations of the world. Their forty-five minute programs are made up of fifteen-minute talks on the various questions arising, the broadcast being fifteen minutes in English and repeated later in French and Spanish. Wonderful signal strength is maintained. They should be addressed, Information Section, League of Nations, Geneva, Switzerland. A prompt and courteous reply will be received and any information desired by the listener will be gladly given free of expense.

Rewards of Reception


INTERNATIONAL SHORT WAVE CLUB

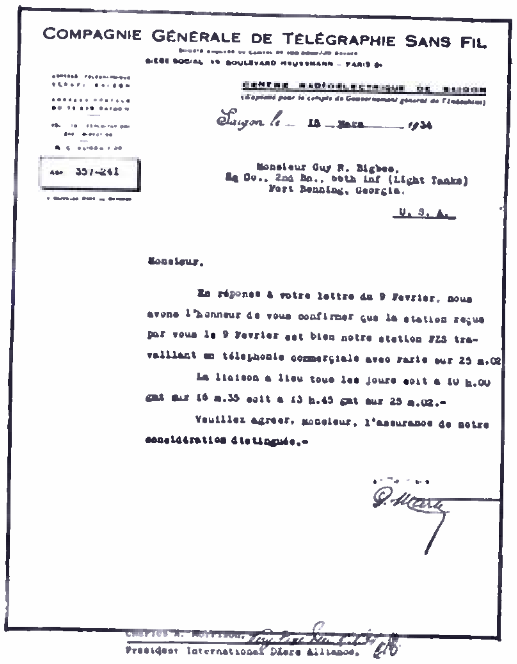
Heard-All-Continents CLUB

THIS IS TO CERTIFY THAT Mr. J. B. S. Hinds HAS SUBMITTED PROOF OF HIS RECEPTION of SHORT WAVE RADIO STATIONS from ALL THE CONTINENTS AND HAS BEEN ACCEPTED AS A MEMBER OF THE "HEARD-ALL-CONTINENTS CLUB" OF THE INTERNATIONAL SHORT WAVE CLUB

NUMBER 17

ARTHUR J. GREEN, President

Above: Mr. Hinds was among the first to qualify for membership in the rather exclusive "Heard-All-Continents" Club, as his certificate No. 17 shows. Below: The "dope" on station FZS, as received by Guy R. Bigbee, Fort Benning, Ga.


COMPAGNIE GÉNÉRALE DE TÉLÉGRAPHIE SANS FIL

SIÈGE SOCIAL 79 BOULEVARD HAUSSMANN – PARIS 8e

CENTRE RADIOÉLECTRIQUE DE SAIGON

Saigon le 15 Mars 1934

No. 357-241

Monsieur Guy R. Bigbee,
Hq Co., 2nd Bn., 66th Inf (Light Tanks)
Fort Benning, Georgia.

U. S. A.

Monsieur,

En réponse à votre lettre du 9 Fevrier, nous avons l'honneur de vous confirmer que la station reçue par vous le 9 Fevrier est bien notre station FZS travaillant en téléphonie commerçiale avec Paris sur 25 m.02

La liaison a lieu tous les jours soit a 10 h.00 gmt sur 16 m.35 soit a 13 h.45 gmt sur 25 m.02.-

Veuillez agreer, Monsieur, l'assurance de notre considération distinguée.-

President International DXers Alliance.

Venezuela

Two of the ten stations selected broadcast from this beautiful country.

YV3BC operates daily on 48.78 meters from 10:30 A.M. to 1:30 P.M. and 4:30 to 10:30 P.M. and YV5BMO on 49.39 meters from 6:00 to 9:30 and 10 P.M.

Both stations are low powered but heard consistently in America, where their varied musical, marimbas, tangos, rumbas, songs, etc., are received with much enjoyment. YV3BC is located at Caracas, the capital of the Republic of Venezuela, most northern country in South America, and located in a valley among the mountains 3,000 feet above sea level. Caracas is the birthplace of Simon Bolivar, the great Liberator and founder of Gran Colombia, now divided into Venezuela, Colombia, Ecuador, Peru, and Bolivia. YV3BC should be addressed Radiodefusora Venezuela, Caracas.

YV5BMO is a newcomer in radio, having been on the air but a short time. It is located at Maracaibo in the northwestern part of Venezuela and is known as "Ecos Del Caribe," address, Apartado de Correos 214 Caracas. The station is owned and operated by Senor Santiago M. Vegas, a young man of sterling qualities who formerly operated amateur station YV2AM on 40 and 41 meters.

In being limited to ten stations naturally some worthy stations are not included. Among those would surely be placed Pontoise, France; HC2RL, Guayaquil, Ecuador; PSK, Rio de Janeiro, Brazil; COC, Havana, Cuba; and our friendly station VE9GW, located across the border in Bowmanville, Ontario, Canada. The writer may at a later date outline some interesting facts in relation to them and also dwell upon the unusual stations whose signals are intercepted only on rare occasions, etc.

Crystals for Reception and Transmission

MANY people who remember or played with early radio receivers using crystal detectors are confused by present day use of crystals in some of the more advanced types of short-wave superheterodynes. It should be emphasized that these two kinds of crystals are altogether different. In elementary receivers, the crystal was usually a piece of lead sulphide, more popularly known as galena, and functioned as a rectifier. The crystals used in modern receivers are usually slabs of quartz and have the peculiar property of vibrating or oscillating at a frequency determined by their thickness. In receivers of the "single signal type," which are intended primarily for code reception, the crystals are connected in the intermediate frequency amplifier circuit in such a manner that they increase the sharpness of tuning almost to the proverbial razor's edge width.

These same quartz crystals are used in short-wave transmitters for stabilizing the frequency of oscillation. Amateur phone operators refer to these crystals quite frequently over the air.

Use Phones for Weak Signals

A GREAT many short-wave listeners who are anxious to tune in the whole world do not seem to appreciate the help that a good pair of earphones can give them. More and more all-wave and straight short-wave receivers are being equipped with earphone jacks, which should be made use of. Signals that are completely lost in a jumble of noise in a loudspeaker can sometimes be brought in with uncomfortably loud volume in the earphones and can be identified very definitely. Radio earphones are among the most sensitive of all electrical indicating devices and will register on the most minute currents.

NATURAL static, which is produced by periodic discharges of static electricity between clouds or between clouds and the ground, is usually of rather a long wavelength (low frequency). Short-wave reception is affected only to a comparatively slight degree. In fact, it is quite possible to listen right through severe local thunder storms with only an occasional click or thump in the loudspeaker to indicate that lightning is flashing in the vicinity.

Best Short Wave Stations

The list below has been compiled from various sources, which have been checked up as closely as the difficulties of international correspondence permit. While it is not 100% accurate (no s.w. station lists of any kind are!), it will be found very useful as a foreign station tuning guide.

The figures at the extreme left are wavelength in meters; next month, for the convenience of all-wave set owners, we will convert these into magacycles. Readers are invited to send in additions or corrections based on their own reception experiences.

World wide stations that send programs, B, Broadcast; E, Experimental; P, Telephone stations.

Europe

16.30, P, PCK, Kootwijk, Holland, about 6.30 a.m.
16.86, B, GSG, Daventry, England, 7.30 to 8.45 a.m.
16.88, B, PHI, Hilversum, Holland. Daily except Tuesday and Wednesday, 8.00-10.30 a.m.
19.55, B, CTIAA, Lisbon, Portugal. Tuesday and Friday, 4.30 to 7 p.m.
19.68, B, Pontoise, France, 8 to 11 a.m.
19.73, B, DJB, Berlin, Germany, 10.00 a.m. to 4.30 p.m.
19.82, B, GSF, Daventry, England, 3 to 5 a.m.
19.84, B, HVJ, Vatican City, Italy, 5 to 5.30 a.m.
25.00, B, RNE, Moscow, U.S.S.R., 8.30 to 10.00 a.m. Saturday.
25.20, B, Pontoise, France, 11.15 to 2.15 p.m., 3 to 6 p.m.
25.28, B, GSE, Daventry, England, 7.30 to 8.45 a.m. and 4 to 6 p.m.
25.40, B, I2RO, Rome, Italy. 11.30 a.m. to 6.00 p.m. daily. Woman announcer.
25.51, B, DJD, Berlin, Germany, 1.30 to 7.30 p.m.
25.53, B, GSD, Daventry, England, 3 to 5 a.m., and 1.15 to 2.45 p.m.
25.57, B, PHI, Huizen, Holland.
25.63, B, Pontoise, France, 3 to 6 and 6.15 to Midnight.
29.04, Ruysselede, Belgium, 1 p.m. on.
30.00, B, EAQ, Madrid, Spain, 5.15 to 7 p.m.
30.52, B, IRM, Rome, Italy, 2 to 6 p.m.
31.27, B, HBL, Geneva, Switzerland, Sat. 5.30 to 6.15 p.m.
31.30, B, GSC, Daventry, England, 6 to 8 p.m.
31.38, B, DJA, Berlin, Germany, 5.00 to 9.00 p.m.
31.55, B, GSB, Daventry, England, 11.30 a.m. to 12 p.m., 1.00 to 5.30 and 6.00 to 8.00 p.m. daily.
43.86, HAT2, Budapest, Hungary, irregular. No time schedule.
45.38, B, RNE, Moscow, Russia, 2 to 6 p.m.
49.50, B, OXY, Skamleback, Denmark, 2 to 6 p.m.
49.59, B, GSA, Daventry, England, 2.45 to 5.45 p.m., 6 to 8 p.m.
49.83, B, DJC, Zeesen, Germany. 8 to 11 p.m.
50.00, B, RV59-RKF, U.S.S.R., 2.00 to 5.00 p.m. daily.
50.26, B, HVJ, Vatican City, Italy, 2 to 2.15 p.m.
60.30, E, G6RX, Rugby, England, 8 to 10 p.m., irregular.
69.44, E, G6RX, Rugby, England. 9 to 11 p.m., irregular.

Asia

16.50, P, PMC, Bandoeng, Java, 3 to 5 p.m., irregular.
19.03, E, JIAA, Kemikawa, Japan, 4.30 a.m., irregular.
20.03, P, KAY, Manila, Philippine Isl., 5 to 8 a.m.
30.40, E, JIAA, Kemikawa, Japan, 5 to 7 a.m.
48.90, B, ZGE, Zula Lumper, Malayan States, Sun., Tues., Fri., 6.30 to 8.30 p.m.
49.10, B, VUC, Calcutta, India, 9 to 12 a.m. and 2 p.m. to 3 a.m.

Africa

23.38, B, CNR, Rabat, Morocco, Sun., 7.30 to 9 a.m.
29.58, P, OPM, Leopoldville, Belgian Congo, 9 to 10 a.m.
37.33, B, CNR, Rabat, Morocco, Sun., 3 to 5 p.m.
41.60, B, EAR58, Teneriffe, Canary Isl., 5 to 6 p.m.
48.99, B, Johannesburg, South Africa, 4 to 5 a.m., 12 to 3 p.m., and 8 to 10 a.m.
49.50, B, VQ7LO, Nairobi, Kenya. 11 a.m. to 2 p.m.

North America

16.87, B, W3XAL, Bound Brook, N. J., 10 a.m. to 4 p.m., irregular.
19.56, B, W2XAD, Schenectady, N. Y., Mon., Wed., Fri. and Sun., 4 to 5 p.m.
19.64, B, W2XE, Wayne, N. J., 11 a.m. to 1 p.m.
19.67, B, W1XAL, Boston, Mass., 11 a.m. to 3 p.m., Sun.
19.72, B, W8XK, Pittsburgh, Pa., 10 a.m to 4 p.m., irregular.
25.27, B, W8XK, Pittsburgh, Pa., 4.30 to 10 p.m., irregular.
25.36, B, W2XE, Wayne, N. J., 3 to 5 p.m.
25.45, B, W1XAL, Boston, Mass., Sat., 5 to 11 p.m., and Sun. 6 to 8 p.m.
31.28, B, W3XAU, Philadelphia, Pa., 1 to 6 p.m.
31.36, B, W1XAZ, Springfield, Mass., 7 p.m. to 1 a.m.
31.48, B, W2XAF, Schenectady, N. Y., 8 to 11 p.m.
46.69, B, W3XL, Bound Brook, N. J., irregular.
48.86, B, W8XK, Pittsburgh, Pa., 4.30 p.m. to 1 a.m.
49.02, B, W2XE, Wayne, N. J., 6 to 11 p.m.
49.18, B, W3XAL, Bound Brook, N. J., Sat. 4.30 to 12 p.m.
49.18, B, W9XF, Chicago, Ill., 8 to 9.30 p.m.
49.34, B, W9ZAA, Chicago, Ill., 3 to 6 p.m.
49.50, B, W3XAU, Philadelphia, Pa., 8 to 12 p.m., irregular.
49.50, B, W8XAL, Cincinnati, Ohio, 9 to 10 p.m.

South America

19.19, P, OCJ, Lima, Peru, 2 p.m. irregular.
25.73, E, PPQ, Rio de Janeiro, Brazil, 7 p.m., irregular.
27.35, P, OCI, Lima, Peru, 10 p.m., irregular.
28.98, E, LSX, Buenos Aires, Argentina, 8 to 9.30 p.m., irregular.
30.03, E, LSN, Buenos Aires, Argentina. 9 to 10 p.m., irregular.
32.00, B, Ti4NRH, Costa-Rica, 7 to 8 p.m.
32.8, B, CP5, Bolivia, 7.30 to 10.30 p.m.
36.65, E, PSK, Rio de Janeiro, Brazil. 8 p.m., irregular.
40.55, E, HJ3ABD, Bogota, Colombia, 9 to 11 p.m.
41.55, B, HKE, Bogota, Colombia, Mon. 6 to 7 p.m. and Tues. 8 to 9 p.m.
41.60, B, HJ4ABB, Manizales, Colombia, 9 to 10 p.m.
45.00, B, HC2RL, Quito, Ecuador, Sun. 5 to 7 and Tues. 9 to 11 p.m.
45.31, B, PRADO, Riobamba, Ecuador, Thurs. 9 to 11 p.m.
45.60, B, HJ1ABB, Barranquilla, Colombia, 6 to 10 p.m.
47.00, B, HJ5ABD, Colombia, Thurs., Sat. and Sun., 7 to 9.30 p.m.
48.00, B, HJ3ABF, Bogota, Colombia, 7 to 10.30 p.m.
48.50, B, TGW Guatemala, 6-12 p.m.
48.78, B, YV3BC, Caracas, Venezuela. Evening, irregular.
48.95, B, YV11BMO, Maracaibo, Venezuela, 8 to 11 p.m.
49.39, B, YV5 BMO, Maracaibo, Venezuela, 5 to 9 p.m.
50.20, B, YV1BC, Caracas, Venezuela, 5 to 10 p.m., irregular.
50.20, B, HJ4ABE, Tunga, Colombia, 9 to 10.30 p.m.
73.00, B, HCJB, Quito, Ecuador, Evening, irregular.

Mexico, West Indies, and Yucatan

25.50, P, XDM, Mexico City, Mexico, 8 to 9 p.m., irregular.
26.00, E, XAM, Merida, Yucatan, 6 to 7 p.m. irregular.
32.09, E, XDC, Mexico City, Mexico, 5 to 7 p.m., irregular.
47.50, B, HIZ, Santo Domingo, 5 to 6 p.m.
47.80, B, HI1A, Dominican Republic, Mon., Wed. and Fri. 12 to 1.30 p.m. Tues., Thurs. and Sat. 7.30 to 9.30 p.m.
B, HIX, Santo Domingo, Tues. 8 to 10 p.m.
50.2, B, COC, Havana, Cuba, 5 to 6 p.m.
50.2, B, YV4 BAG, Caracas, Venezuela, 12.50 to 1.05 a.m.

Oceania

31.28, B, VK2ME, Sydney, Australia, Sun. 1 to 3 a.m., 5 to 8.30 a.m., and 9 to 11 a.m.
31.55, B, VK3ME, Melbourne, Australia Wed. 5 to 6.30, Sat. 5 to 7 a.m.

Canada

25.60, B, VE9JR, Winnipeg, Canada, 6 to 10 p.m., irregular.
49.10, B, VE9HX, Halifax, N.S., Evening, irregular.
49.22, B, VE9GW, Bowmanville, Canada. 3 to 6 p.m. daily.
49.29, B, VE9BJ, St. John, N. B., 5 to 10 p.m.
49.42, B, VE9CS, Vancouver, B.C., Fri. 12 to 1.30 p.m.
49.96, B, VE9DR, Montreal, Canada, 8 to 10 a.m., Sun 1 to 10 p.m.

NOTE: All times given are Eastern Standard.

Reception Reports From Readers

BECAUSE the United States is a big country, reception conditions on the short waves are bound to be different in different sections. For this reason, we ask readers to send in detailed reports of their experiences. Extremely interesting data have been brought to light in some of the letters we have published. This department has caused many short-wave listeners to start corresponding with each other, and some fine friendships have been built up.

If you have been keeping a log of your results (and every listener should), by all means send us a sort of review of it for a period of, say, a month. Don't fail to mention your receiver and to describe your aerial. Use a typewriter if you have one; otherwise, please write clearly in ink on one side of the paper.

Oklahoma

Editor, SHORT WAVE RADIO:

Some of the stations I receive regularly are the Daventry stations, all Berlin stations, I2RO, EAQ, VK3ME, VK2ME, VK3LR, PHI, CT1AA, J1AA, VE9GW, VE9JR, VE9DN, HC2RL, COC, YV3BC, YV1BC, HJ4ABE, HJ5ABD, HJ1ABB, PRADO, Pontoise, HJ3ABF, YV5BMO, CP5, HJ2ABA, KNRA, KFZ, etc.

KFZ has been coming in lately with fairly good volume on number 9 with best reception on Number 5, (near 34 meters). KNRA has also been coming in on this frequency during the last part of the week during the tests preceeding the Sunday night broadcasts.

J1AA, 38.07 meters, is received here every morning between 3:30 and 6:35 A.M. C.S.T. The signals are usually received with fair volume. News reports are given in English during part of the first hour of broadcasting. Oriental music and speaking in Japanese take up the remainder of the program. The sign-off at 6:35 is preceded at 6:30 by a system of gongs and bells. Some mornings they use 4, 3, 1 gong strokes and one chime. Other mornings they vary the number of strokes on the gong.

VK3LR, 31.3 meters, is received from about 1:30 to 6:45 A.M., C.S.T. every morning except Sunday. They broadcast the programs of some long wave station in Australia and carry the programs of the national network. Their signal comes through fairly well with some distortion, making announcements hard to understand.

The two Daventry stations on 31 meters, GSB and GSC, have been coming in extra well during the past two months. At times their signals are better than any others on the band.

DJB, 19.73 meters, comes in every morning with excellent volume between 6:45 and 8 A.M., C.S.T. This station is also used irregularly to transmit programs for rebroadcasting over the NBC.

EAQ, 30.43 meters, has dropped the IBC programs except on Saturdays and Sundays from 6 to 6:30 P.M., C.S.T.

XETE, 31.25 meters, is on the air daily now, rebroadcasting the programs of XEAL, long wave station of the Pan-American Radio Co. XETE sends a phonograph record verification to all reporting reception of their station. The record is of typical Mexican selections.

HJ1ABB will send a set of photographs of the city of Barranquilla to any one sending in ten reports of reception from their station.

I recently received a verification from JYT, 15.76 megacycles, which tests occasionally with San Francisco. On the occasion I heard them they were testing in preparation for a rebroadcast over the NBC.

Although the transmission was for commercial purposes, I wrote for, and received, a verification from Toshitada Matsuyuki at the Japanese station, who enclosed a photograph of the station. The verification is written in English on a multigraph form. The surface of the paper is covered with a light purple ink which makes it very attractive.

My receivers are an 11-Tube Philco 16B All-Wave, and a Pilot A.C. Super-Wasp short-wave receiver.

Hoping this information might be of some use to you, I am,

Sincerely yours,
ROBERT WOODS,
14 West Broadway,
Sand Springs, Oklahoma.

Colorado

Editor, SHORT WAVE RADIO:

I am writing in response to your call for listeners from the West to send in reports.

I use an RCA-Victor eight tube all-wave and a three-tuber that I built myself. Both of my sets are downtown and, therefore, I have a lot of QRM, but I have made some catches which I consider pretty good.

I haven't done much above 49 meters, except for hams and police calls, although the first night I had the set I got the police station in N.Y.C. I have received hams all over the States and one from Canada.

The only Canadian broadcast station which I have received is VE9GW, Bowmanville, this on the three-tuber.

The 49-meter band is not very good here except for locals, such as W8XAL, W9XF, W2XE, and W8XK.

Likewise the 31-meter band is not very good. I have pulled in W2XAF, W1XAZ, W3XAU and for my foreigns I have heard GSC, Daventry, but they weren't very good; also XETE, Mexico City and VK2ME, Sydney. I get HJ1ABB, Barranquilla, South America, just like a local every night between 5 and 6 P.M. mountain time. But the funny part is I don't receive them on the frequency that everyone lists them. I get them on about 46 meters.

The 25-meter band is really the best band out here. I have tuned in FYA, Paris; GSD, Daventry; 2RO, Rome; W2XE, N. Y. C.; and W8XK, Pittsburgh. On the 19-meter band, I have heard GSF, DJB, FYA, and W8XK.

I have gotten only one station in the 16-meter band and that is W3XAL.

I have done all this during the day. Most of the DX is in the morning about eight o'clock, mountain time. Then European stations come through again about noon. South Americans from five on, and VK2ME was at one A.M.

I am working right now to get my ham ticket and my only drawback is code receiving. I expect to take my exam in a few months, and then it's the air for me.

Better DX and 73,
F. L. HOPPER,
Lamar, Colo.

Montreal, Canada

Editor, SHORT WAVE RADIO:

In reference to your recent letter, we are listing below full particulars with regard to our short-wave station VE9DR.

Call Letters—VE9DR

Wavelength—49.96 meters, 6005 kilocycles.

Power—50 watts.

Schedule—Daily except Sunday, 8 A.M. to 12:00 Midnight; Sundays, 12:30 P.M.—11:00 P.M.

We would advise, however, that VE9DR has not been on the air for some time, and we do not expect to go into commission again before two or three months. As soon as we are on the air again regularly we will be glad to advise you.

Yours very truly,
CANADIAN MARCONI COMPANY,
Montreal, Canada,

Allegheny Mt. Foothills

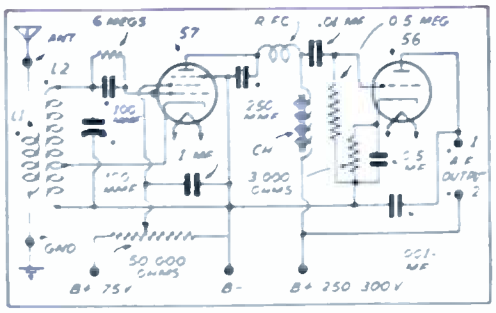
Editor, SHORT WAVE RADIO:

Here is my report from twenty miles north of Pittsburgh, Pa., (New Kensington) on the Allegheny River, known as the Allegheny Mts. Foothills. Built a two-tube receiver in February and heard HJ1ABB testing at 1:30 A.M. and got the "bug" bad. Built a four-tube outfit and listened in about March 1st and very first thing heard was GSC giving press reports, this with good volume on loud speaker. This was about 5 P.M. and about one hour later tuned in EAQ also with good volume. Have heard 2RO Rome loud enough to be a "local."

I cannot listen in very much as I work from 3 P.M. to 11 P.M. and have only one evening each week to listen to DX short wave.

Expect to be a "ham" as soon as I can read 10 w.p.m. and get a license. Enjoy every bit of SHORT WAVE RADIO and wish you lots of good luck, I am

Yours truly,
S. J. FLICK,
534 Ridge Ave.,
New Kensington, Pa.



Schematic diagram of Mr. Talbert's receiver.

	L1	L2	Tap from Bottom
15—28 m.	3	6	½
27—43 m.	6	11	1
42—86 m.	10	25	2
110—200 m.	15	60	3

Vary distance between coils until best results are obtained. Use No. 20 or 24 wire for the first three coils, No. 24 for the fourth. Forms are 1¼ inches in diameter.

Chicago, Ill.

Editor, SHORT WAVE RADIO:

In response to your request for reports on s.w. reception in the Middle West, I wish to say that it is very good. During the month of March I received stations from over 40 countries. This number could be greatly enlarged, no doubt, if I had more time to listen in. As it is, I listen in only between 1:00 P.M. and 10 P.M. C.S.T., and only a few hours a day at that. I have heard stations from the countries listed in the chart at the right.

I have listed only commercial stations. The number before the country indicates the number of stations heard from each country. The star above certain calls indicates phone stations. This list also does not contain any of the several hundred amateur phones or many foreign amateur s.w. stations. As you see, the best reception is had between 6:00 and 9:00 A.M. C.S.T.

It may be interesting to note that all this reception has been done on a two tube a.c. receiver which I will describe.

I do not have verifications from all these stations because I could not afford it in the first place, secondly they do not all answer; only ten out of 15 have QSLed me. I wrote to HJ1ABB about a month ago enclosing I.R.C. and giving a whole hour's program because I understand Spanish and have not received an answer. LSX, Argentina, W2XAF, New York; KNRA, FYA Paris, and several others do not answer either. LSX hasn't been heard from and I wrote to them one year ago.

I am enclosing a diagram of my set and I wish you could publish it, as I have found after much investigation among amateurs that this type of set is used in practically 98 per cent of all ham stations. After much personal experimenting I find that the present model is the most efficient possible to build. It is not particularly suited for ham work because of the large tuning capacity. However, the circuit is heartily recommended. It can be made into a ham receiver by employing any one of the several band spread methods known, viz: condenser across part of coil, a padding condenser to set band and a smaller one to tune, etc.

Although this circuit appears to be very easy to build, several important constructional details are worth mentioning. The circuit is common enough but if certain things aren't watched for, no decent results will be obtained.

The most important detail of the entire set has to do with the grid leak and grid condenser. Usually one builds a set using the regular cartridge type grid leak mounted on clips on the grid condenser. This is fastened to the subpanel or panel, and forgotten. When the set is completed a loud annoying hum is usually noticed. To get rid of the hum we cut down on the audio grid leak, reducing it to about .1 megohm. This cuts out some of the hum and most of the signal, but does not eliminate the squeal and feedback. The set is very unstable and unsatisfactory.

I had this trouble and so did a lot of my friends. I finally found a cure for it. I noticed that when I held my hand near the grid condenser and then grabbed hold of something that was grounded, the hum disappeared. It was found impractical to construct a shield for the usual type of grid condenser-leak, so I bought one of the mica postage stamp type condensers and a pig-tail midget grid leak. I assembled these around the control grid cap of the detector tube.

By placing this arrangement on the control grid cap on the tube you will find the usual tube shield will fit over it easily without shorting. When the set is then turned on no hum is perceptible and the set is very stable, no squealing or feedback. It is very stable and the audio grid leak can be increased in value until you reach a point just below the value where blocking occurs on strong signals.

It will be noticed that the tap on the secondary of the coils is much

(*Continued on page 45*)

Country	*Stations*	*M. or Kc.*	*How often*	*Time*
9 Argentina	LSX*	28 m.	Occasionally	7.00–8.00 P.M.
3 Belgium	ORK	29 m.	Occasionally	6.00–7.00 P.M.
2 Bolivia	CPAY	38 m.	Occasionally	6.00–7.00 P.M.
6 Brazil	PRBA*	6900 kc.	Occasionally	6.00–7.00 P.M.
	PSY	6900 kc.	Daily	8.00–9.00 P.M.
10 Canada	VE9GW*	49 m.	All day daily	
1 Chile	CEA	37.8 m.	Almost daily	9.00 P.M.
5 Colombia	HJ1ABB*	45 m.	Daily	8.00–9.00
	HJP	44 m.		8.00–9.00
2 Costa Rica	TIR	35 m.	Occasionally	8.00–9.00
5 Cuba	CMA	33 m.	Frequently	8.00–9.00
3 Czecho-Slovakia	OKH*	44.6 m.	Occasionally	8.00–9.00
1 Denmark	OXL	52.4 m.	Occasionally	8.00–9.00
1 Egypt	SUX	39 m.	Rarely	9.00 P.M.
8 England	GSD*	25 m.	Daily	About 2.00 P.M.
1 Ecuador	HCJB*	73 m.	Occasionally	
5 France	FYA*	25 m.	Daily	2.00 P.M.
1 French West Africa	FZH	30 m.	Occasionally	3.00 P.M.
8 Germany	OFT	38.4 m.	Daily	8.00–9.00
5 Hawaii	*KEJ-KEQ	30–40 m.	Daily	8.00–9.00
3 Hungary	HATZ	44 m.	Daily	8.00–9.00
4 Italy	2RO*	25 m.	Daily	2.00
3 Japan	JAN	43 m.	Occasionally	
1 Java	PLV	31 m.	Daily	5.00–6.00 P.M.
10 Mexico	XETE*	31 m.	3 Times a week	8.00 P.M.
1 New Hebrides	YHL	38 m.	Once at	8.00 P.M.
3 Norway	LCI	51 m.	Frequently	8.00–9.00 P.M.
4 Netherlands	PGA	30.5 m.	Frequently	8.00–9.00 P.M.
1 Morocco	CNR*	37.3 m.	Frequently	
1 Panama	RXC	44 m.	Occasionally	8.00–9.00 P.M.
3 Puerto Rico	WGU*	44.6 m.	Daily	
1 Madagascar	FTZ	60 m.	Occasionally	8.00–9.00 P.M.
3 San Domingo	HIR	40 m.	Daily	8.00–9.00 P.M.
10 Spain	EAQ*	30 m.	Daily	4.30–6.00 P.M.
3 Surinam	P2B	31 m.	Daily	4.00–5.00 P.M.
6 Switzerland	HBL*	32 m.	Daily	3.00–5.00 P.M.
6 Venezuela	YV3BC*	48 m.	Daily	7.00–9.00 P.M.
1 Syria	FXC	37.5 m.	Rarely	9.00–10.00 P.M.
2 Portugal	CUT	38 m.	Occasionally	8.00–9.00 P.M.

New World List of Stations

WE are presenting this month another station list, which, together with the lists previously published in SHORT WAVE RADIO, gives readers what is probably the most complete compilation of station data available. This new list is arranged numerically according to frequency in megacycles and wavelength in meters, with only the call letters and location included. No operating hours are given, as short-wave station schedules are notoriously undependable. However, space is left for dial readings, so the list will be found very useful as a record of reception, and as a means of drawing up calibration curves.

The frequencies are given in megacycles rather than in kilocycles because the present trend is toward the use of the former unit. Readers accustomed to working with kilocycles can readily swing from kilocycles to megacycles, or vice versa, as the difference between the two units is merely a matter of the decimal point's position. Thus, 15.12 megacycles is the same as 15,120 kilocycles. The corresponding wavelengths in meters are given in all cases, as there are still many people, particularly "old timers" just getting back into the short-wave game, who still find it easier to think in terms of meters than in kilocycles or megacycles.

For the benefit of new readers, we might mention that the following lists appeared in past issues of SHORT WAVE RADIO:

New Police Frequencies, arranged alphabetically by names of cities, page 11, June, 1934 issue.

World List of S. W. Broadcast Stations, arranged numerically according to frequency, page 12, May, 1934 issue.

Grand List of the S. W. Stations of the World, arranged alphabetically according to call letters, page 12, April, 1934 issue.

Back copies of these issues are obtainable directly from SHORT WAVE RADIO at the regular price of 25 cents each, in stamps or coin.

Megacycles	Meters	Call	Location	Dial	Dial
60.20	4.98	W3XAY	Philadelphia, Pa.		
60.00	5.0	W3XE	Philadelphia, Pa.		
		W6XAO	Los Angeles, Calif.		
		W8XAN	Jackson, Mich.		
		W8XF	Pontiac, Mich.		
		W8XL	Cuyahoga Hts., Ohio		
		W9XE	Marion, Ind.		
		W1XW	Milton, Mass.		
		W2XAK	New York, N. Y.		
		W2XF	New York, N. Y.		
		W2XR	Rocky Point, N. Y.		
		W3XAD	Camden, N. J.		
		W6XAQ	Phoenix, Ariz.		
54.20	5.53	W3XAY	Philadelphia, Pa.		
53.80	5.57	W3XAY	Philadelphia, Pa.		
51.40	5.83	W6XAQ	Phoenix, Ariz.		
		W6XC	San Francisco, Cal.		
		W8XAC	Lincoln Park, Mich.		
		W1XW	Milton, Mass.		
48.50	6.18	W3XE	Philadelphia, Pa.		
		W6XAO	Los Angeles, Cal.		
		W8XAN	Jackson, Mich.		
		W8XF	Pontiac, Mich.		
		W8XL	Cuyahoga Hts., Mich		
		W9XE	Marion, Ind.		
		W2XAK	New York, N. Y.		
		W2XF	New York, N. Y.		
		W2XR	Rocky Point, N. Y.		
		W3XAD	Camden, N. J.		
48.20	6.22	W3XAY	Philadelphia, Pa.		
47.80	6.27	W3XAY	Philadelphia, Pa.		
43.00	6.97	W3XE	Philadelphia, Pa.		
		W6XAO	Los Angeles, Calif.		
		W8XAN	Jackson, Mich.		
		W8XF	Pontiac, Mich.		
		W8XL	Cuyahoga Hts., Ohio		
		W9XE	Marion, Ind.		
		W1XG	Boston, Mass.		
		W2XAK	New York, N. Y.		
		W2XF	New York, N. Y.		
		W2XR	Rocky Point, N. Y.		
		W3XAD	Camden, N. J.		
42.20	7.10	W3XAY	Philadelphia, Pa.		
41.80	7.17	W3XAY	Philadelphia, Pa.		
41.00	7.32	W1XW	Milton, Mass.		
		W2XV	Clifton, N. J.		
		W6XC	San Francisco, Cal.		
		W8XAC	Lincoln Park, Mich.		
40.60	7.38	W2XV	Clifton, N. J.		
40.10	7.48	W2XV	Clifton, N. J.		
38.60	7.77	W2XV	Clifton, N. J.		
37.60	7.98	W2XV	Clifton, N. J.		
37.10	8.09	W2XV	Clifton, N. J.		
35.80	8.38	W3XAY	Philadelphia, Pa.		
35.60	8.43	W2XV	Clifton, N. J.		
34.60	8.67	W2XV	Clifton, N. J.		
		W3XAR	Haverford, Pa.		
		W2XAC	Lincoln Park, Mich.		
		W2XES	Englewood, N. J.		
33.10	9.06	W2XV	Clifton, N. J.		
31.60	9.49	W2XV	Clifton, N. J.		
31.10	9.65	W2XV	Clifton, N. J.		
30.20	9.93	W3XAY	Philadelphia, Pa.		
30.10	9.97	W2XV	Clifton, N. J.		
27.80	10.79	W6XD	Palo Alto, Cal.		
25.70	11.67	W2XBC	New Brunswick, N. J.		
24.00	12.50	W6XQ	San Francisco, Cal.		
22.30	13.45	GBU	Rugby, England		
21.54	13.93	W8XK	Pittsburgh, Pa.		

Megacycles	Meters	Call	Location	Dial	Dial
21.47	13.97	GSH	Daventry, England		
21.46	13.98	W1XAL	Boston, Mass.		
21.42	14.0	W2XDJ	Deal, N. J.		
21.41	14.01	WKK	Lawrenceville, N. J.		
21.40	14.02	WLO	Lawrenceville, N. J.		
21.16	14.17	LSL	Buenos Aires, Argen.		
21.13	14.19	LSM	Buenos Aires, Argen.		
21.08	14.23	PSA	Rio de Janeiro, Brazil		
21.06	14.24	KWN	Dixon, Cal.		
		WKA	Lawrenceville, N. J.		
21.02	14.27	LSN	Buenos Aires, Argen.		
21.00	14.28	OKO	Podebrady, Czechoslavakia		
20.73	14.47	LSY	Buenos Aires, Argen.		
20.68	14.5	FSR	Paris, France		
		LSN	Buenos Aires, Argen.		
20.67	14.54	PMB	Bandoeng, Java		
20.38	14.72	GAA	Rugby, England		
20.04	14.97	OPL	Leopoldsville, Belgian Congo		
		DHO	Nauen, Germany		
19.95	15.03	LSG	Buenos Aires, Argen.		
		DIH	Nauen, Germany		
19.90	15.07	LSG	Buenos Aires, Argen.		
19.85	15.11	WMI	Deal, N. J.		
19.83	15.12	FTD	St. Assise, France		
19.69	15.24	CEC	Santiago, Chile		
19.54	15.25	IRW	Rome, Italy		
19.38	15.48	WOP	Ocean Gate, N. J.		
		WKN	Lawrenceville, N. J.		
19.27	15.57	PPU	Rio de Janeiro, Brazil		
19.22	15.61	WKF	Lawrenceville, N. J.		
19.24	15.59	DFA	Nauen, Germany		
19.21	15.61	ORG	Brussels, Belgium		
19.20	15.62	WNC	Deal, N. J.		
19.02	15.77	WKW	Rocky Point, N. Y.		
18.97	15.81	GAG	Rugby, England		
18.96	15.82	LSR	Buenos Aires, Argen.		
18.90	15.78	HBF	Pragins, Switzerland		
18.68	16.06	OCI	Lima, Peru		
18.62	16.11	GBU	Rugby, England		
		GAU	Rugby, England		
		GBJ	Bodmin, England		
18.54	16.18	VWY	Poona, India		
18.52	16.19	DFB	Nauen, Germany		
18.46	16.25	HJY	Bogota, Colombia		
18.41	16.29	GAS	Rugby, England		
18.40	16.30	PCK	Kootwijk, Holland		
18.37	16.33	PMC	Bandoeng, Java		
18.35	16.35	WLA	Lawrenceville, N. J.		
18.31	16.38	FZS	Saigon, Indo-China		
		GBS	Rugby, England		
18.30	16.39	YVR	Maracay, Venezuela		
18.24	16.44	FRE	St. Assise, France		
		FRO	St. Assise, France		
18.20	16.48	PLE	Bandoeng, Java		
18.17	16.51	CGA	Quebec, Canada		
18.13	16.55	LSY	Buenos Aires, Argen.		
18.05	16.62	KQJ	Bolinas, Cal.		
17.85	16.80	W2XAO	Long Island City, N.Y.		
		PLF	Bandoeng, Java		
17.83	16.82	PCV	Kootwijk, Holland		
17.78	16.87	W3XAL	Bound Brook, N. J.		
		W8XK	E. Pittsburgh, Pa.		
		W9XAA	Chicago, Ill.		
		W9XF	Chicago, Ill.		
17.77	16.88	PHI	Huizen, Holland		
		GSG	Daventry, England		
17.76	16.89	DJE	Zeesen, Germany		

Mega-cycles	Meters	Call	Location	Dial	Dial
17.75	16.92	HSP	Bangkok, Siam		
17.31	17.33	W3XL	Bound Brook, N. J.		
17.30	17.34	W9XL	Anoka, Minn.		
		W8XL	Dayton, Ohio		
17.27	17.37	DAF	Norden, Germany		
17.11	17.52	W2XDO	Ocean Gate, N. J.		
		WOO	Ocean Gate, N. J.		
17.08	17.56	GBC	Rugby, England		
16.33	18.37	WLK	Lawrenceville, N. J.		
16.30	18.4	PCL	Kootwijk, Holland		
		WLO	Lawrenceville, N. J.		
16.20	18.5	FZR	Saigon, Indo-China		
16.15	18.56	GBX	Rugby, England		
16.10	16.57	GBK	Bodmin, England		
16.06	18.68	NAA	Arlington, Va.		
16.04	18.71	KKP	Kauhuku, T. H.		
15.95	18.8	PLG	Bandoeng, Java		
15.86	18.91	FTK	St. Assise, France		
	18.91	CEC	Santiago, Chile		
15.69	19.12	FTK	St. Assise, France		
15.62	19.19	OCJ	Lima, Peru		
15.49	19.36	J1AA	Tokio, Japan		
15.42	19.46	KWO	Dixon, Cal.		
15.35	19.54	KWU	Dixon, Cal.		
15.34	19.55	W2XAD	Schenectady, N. Y.		
15.33	19.56	W2XAD	Schenectady, N. Y.		
15.30	19.6	OXY	Lyngby, Denmark		
15.27	19.64	W2XE	Wayne, N. J.		
15.25	19.67	W1XAL	Boston, Mass.		
15.24	19.68	FYA	Pontoise, (Paris) Fr.		
15.21	19.72	W8XK	E. Pittsburgh, Pa.		
15.20	19.74	DJB	Zeesen, Germany		
15.14	19.81	GSF	Daventry, England		
15.12	19.83	HVJ	Vatican City, Italy		
15.11	19.84	HVJ	Vatican City, Italy		
15.00	19.99	CM6XJ	Central Tuinucu, Cuba		
14.70	20.27	WKU	Rocky Point, N. Y.		
		W2XBJ	Rocky Point, N. Y.		
14.62	20.5	XDA	Mexico City, Mex.		
14.56	20.6	HBJ	Pragins, Switzerland		
14.53	20.65	LSA	Buenos Aires, Argen.		
		LSN	Buenos Aires, Argen.		
14.50	20.69	YNA	Managua, Nicaragua		
		TGA	Guatemala City, C.A.		
		TIR	Cartago, Costa Rica		
14.48	20.7	GBW	Rugby, England		
		WNC	Deal, N. J.		
14.47	20.73	WMF	Lawrenceville, N. J.		
14.15	21.17	KKZ	Bolinas, Calif.		
14.11	21.26	YV2AM	Maracaibo, Venezuela		
13.87	21.63	W1Y	Rocky Point, N. Y.		
13.78	21.77	KKW	Bolinas, Cal.		
13.75	21.82	CGA	Quebec, Canada		
13.58	22.09	GBB	Rugby, England		
13.50	22.48	YVQ	Maracay, Venezuela		
13.48	22.26	WAJ	Rocky Point, N. Y.		
13.40	22.38	WND	Deal, N. J.		
13.39	22.4	WMA	Lawrenceville, N. J.		
13.34	22.55	CGA	Quebec, Canada		
13.09	22.93	J1AA	Tokio, Japan		
12.85	23.35	W9XL	Anoka, Minn.		
		W2XO	Schenectady, N. Y.		
		W2XCU	Rocky Point, N. Y.		
12.83	23.38	RABAT	Rabat, Morocco		
12.825	23.39	CNR	Rabat, Morocco		
12.80	23.45	IAC	Pisa, Italy		
12.78	23.46	GBC	Rugby, England		
12.40	24.19	DAF	Norden, Germany		
12.29	24.41	GBU	Rugby, England		
12.25	24.46	GBS	Rugby, England		
		PLM	Bandoeng, Java		
12.229	24.53	CT1AA	Lisbon, Portugal		
12.15	24.68	FQO	St. Assise, France		
		FQE	St. Assise, France		
		GBS	Rugby, England		
12.06	24.88	PDU	Kootwijk, Holland		
12.045	24.89	NAA	Arlington, Va.		
		NSS	Annapolis, Md.		
12.00	25.0	FZG	Saigon, Indo-China		
		RNE	Moscow, U. S. S. R.		
11.95	25.10	FTA	St. Assise, France		
11.945	25.13	KKQ	Bolinas, Calif.		
11.905	25.2	FYA	Pontoise (Paris) Fr.		
11.90	25.21	FZS	Saigon, Indo-China		
11.88	25.25	FYA	Paris, France		
		W9XF	Chicago, Ill.		
11.87	25.27	W8XK	E. Pittsburgh, Pa.		
11.865	25.28	GSE	Daventry, England		
11.84	25.34	W9XAO	Chicago, Ill.		
11.83	25.36	W2XE	Wayne, N. J.		
		W9XAA	Chicago, Ill.		
11.81	25.4	12RO	Rome, Italy		
11.80	25.42	VE9GW	Ontario, Canada		
11.79	25.45	W1XAL	Boston, Mass.		
11.78	25.47	VE9DR	Quebec, Canada		
11.76	25.51	DJD	Zeesen, Germany		
		XDA	Mexico City, Mex.		
11.75	25.53	GSD	Daventry, England		
11.73	25.57	PHI	Huizen, Holland		
11.72	25.58	VE9JR	Winnipeg, Canada		
11.705	25.63	FYA	Paris, France		

Mega-cycles	Meters	Call	Location	Dial	Dial
11.69	25.65	YVQ	Maracay, Venezuela		
11.67	25.68	KIO	Kauhuku, T. H.		
11.66	27.73	PPG	Rio de Janeiro, Brazil		
11.54	26.0	XAM	Merida, Yucatan		
11.49	26.1	GBK	Bodmin, England		
11.47	26.15	IBDK	S. S. Elettra		
11.435	26.22	DHC	Nauen, Germany		
11.34	26.44	DAN	Nordreich, Germany		
11.18	26.83	CT3AQ	Funchal, Madeira		
10.84	27.67	KWV	Dixon, Cal.		
10.77	28.04	GBP	Rugby, England		
10.68	28.09	WNB	Lawrenceville, N. J.		
10.67	28.12	CEC	Santiago, Chile		
10.63	28.2	PLR	Bandoeng, Java		
10.61	28.28	WEA	Rocky Point, N. Y.		
10.578	28.36	FYB	Paris, France		
10.55	28.44	WOK	Lawrenceville, N. J.		
10.54	28.46	WLO	Lawrenceville, N. J.		
10.52	28.51	VK2ME	Sydney, Australia		
		VLK	Sydney, Australia		
10.41	28.8	PDK	Kootwijk, Holland		
10.41	28.82	LSY	Buenos Aires, Argen.		
		KES	Bolinas, Cal.		
		KEZ	Bolinas, Cal.		
10.40	28.85	KWZ	Dixon, Cal.		
10.39	28.87	GBX	Rugby, England		
10.36	28.96	PMN	Bandoeng, Java		
10.35	28.98	LSX	Buenos Aires, Argen.		
10.33	29.04	ORK	Brussels, Belgium		
10.30	29.12	LSL	Buenos Aires, Argen.		
10.29	29.15	DIQ	Nauen, Germany		
10.22	29.35	PSH	Rio de Janeiro, Brazil		
10.15	29.54	DIS	Nauen, Germany		
10.14	29.58	OPM	Leopoldeville, Belgian Congo		
10.10	29.7	EHY	Madrid, Spain		
10.07	29.79	VRT	Hamilton, Bermuda		
10.05	29.83	SUV	Cairo, Egypt		
10.00	30.00	EAQ	Madrid, Spain		
9.98	27.59	VLJ	Sydney, Australia		
9.97	30.09	KAZ	Manila, P. I.		
9.95	30.15	GBU	Rugby, England		
		GCU	Rugby, England		
9.93	30.2	HJY	Bogota, Colombia		
9.89	30.3	LSA	Buenos Aires, Argen.		
9.87	30.4	J1AA	Tokio, Japan		
		WON	Lawrenceville, N. J.		
9.86	30.43	EAQ	Madrid, Spain		
9.80	30.6	GCW	Rugby, England		
9.79	30.64	GBW	Rugby, England		
9.76	30.74	VK2ME	Sydney, Australia		
		VLK	Sydney, Australia		
9.75	30.77	WOF	Lawrenceville, N. J.		
		WNC	Deal, N. J.		
9.71	30.9	GCA	Rugby, England		
9.70	30.9	VMI	Deal, N. J.		
9.675	31.0	TI4NRH	Costa Rica, C. A.		
9.64	31.12	HSP2	Bangkok, Siam		
9.62	31.19	DGU	Nauen, Germany		
9.60	31.25	CT1AA	Lisbon, Portugal		
		XETE	Mexico City, Mex.		
		LGN	Bergen, Norway		
		LQA	Buenos Aires, Argen.		
9.595	31.27	HBL	Geneva, Switzerland		
9.59	31.28	W3XAU	Philadelphia, Pa.		
		VK2ME	Sydney, Australia		
		HBL	Geneva, Switzerland		
		WEF	Rocky Point, N. Y.		
		WKJ	Rocky Point, N. Y.		
9.585	31.3	GSC	Daventry, England		
9.58	31.32	W3XAU	Philadelphia, Pa.		
		W3XE	Philadelphia, Pa.		
9.57	31.35	W1XAZ	Springfield, Mass.		
		SRI	Poznan, Poland		
		W8XK	E. Pittsburgh, Pa.		
9.56	31.38	DJA	Zeesen, Germany		
9.53	31.48	W2XAF	Schenectady, N. Y.		
9.52	31.51	OXY	Skamlebaek, Denmark		
9.51	31.55	YV3BC	Caracas, Venezuela		
		GSB	Daventry, England		
		VK3ME	Melbourne, Australia		
		VK3LR	Melbourne, Australia		
9.493	31.6	OXY	Skamlebaek, Denmark		
		SRI	Posnan, Poland		
9.48	31.63	PLW	Bandoeng, Java		
9.45	31.74	WES	Rocky Point, N. Y.		
9.42	31.86	PLV	Bandoeng, Java		
9.40	31.9	XDC	Mexico City, Mex.		
9.33	32.15	CGA	Quebec, Canada		
9.31	32.22	GBC	Rugby, England		
9.30	32.26	CNR	Rabat, Morrocco		
9.28	32.33	GCB	Rugby, England		
9.25	32.4	GBK	Bodmin, England		
9.23	32.5	FLJ	Paris, France		
9.17	32.72	WNA	Lawrenceville, N. J.		
9.02	33.26	GCS	Rugby, England		
9.02	33.26	KEJ	Kaukuku, T. H.		
8.95	33.52	WEC	Rocky Point, N. Y.		
8.93	33.59	WEC	Rocky Point, N. Y.		
8.872	33.81	NPO	Cavite, P. I.		
8.79	34.13	TIR	Cartago, Costa Rica		
8.69	34.35	W2XAC	Schenectady, N. Y.		

Megacycles	Meters	Call	Location	Dial	Dial
8.68	34.56	GBC	Rugby, England		
8.65	34.68	W4XG	Miami, Fla.		
		W3XX	Washington, D. C.		
		W3XE	Baltimore, Md.		
8.65	34.68	VE9BY	London, Ont., Canada		
		W2XCU	Rocky Point, N. Y.		
		W8XAG	Dayton, Ohio		
8.63	34.74	W2XDO	Ocean Gate, N. J.		
		WOO	Ocean Gate, N. J.		
8.55	35.09	WOO	Ocean Gate, N. J.		
8.47	35.42	DAF	Norden, Germany		
8.45	35.5	PRAG	Porto Alegre, Brazil		
8.38	35.8	IAC	Pisa, Italy		
8.19	36.63	PSK	Rio de Janeiro, Brazil		
8.186	36.65	PRA3	Rio de Janeiro, Brazil		
8.12	36.92	PLW	Bandoeng, Java		
8.11	37.0	HCJB	Quito, Ecuador		
8.035	37.33	CNR	Rabat, Morocco		
7.89	38.0	UPD	Suva, Fiji Islands		
7.88	38.07	J1AA	Tokio, Japan		
7.83	38.3	PDU	Kootwijk, Holland		
7.797	38.47	HBP	Switzerland		
7.77	38.6	FTF	St. Assise, France		
		PCK	Kootwijk, Holland		
7.612	39.41	X2GA	Nuevo Laredo, Mexico		
		HKF	Bogota, Colombia		
7.61	39.42	KWX	Dixon, Calif.		
7.56	39.65	KWY	Dixon, Calif.		
7.556	39.70	HKF	Bogota, Colombia		
7.52	39.89	KDK	Kauhuku, T. H.		
7.52	39.89	KKH	Kauhuku, T. H.		
7.47	40.16	HJB	Bogota, Colombia		
7.444	40.3	HPB	Geneva, Switzerland		
7.40	40.55	HJ3ABD	Bogota, Colombia		
		WEM	Rocky Point, N. Y.		
7.39	37.8	DOA	Doeberitz, Germany		
7.23	41.5	DOA	Doeberitz, Germany		
7.22	41.55	HKE	Bogota, Colombia		
7.20	41.67	HB9D	Zurich, Swtizerland		
7.195	41.7	USIAB	Singapore, S. S.		
7.15	41.9	HJ4ABB	Manizales, Colombia		
7.14	42.02	HKX	Bogota, Colombia		
6.99	42.92	LCL	Jelov, Norway		
		CT1AA	Lisbon, Portugal		
6.977	43.0	EAR	Madrid, Spain		
6.94	43.23	WEB	Rocky Point, N. Y.		
6.90	43.48	GDS	Rugby, England		
6.88	43.6	LCL	Oslo, Norway		
6.86	43.73	KEL	Bolinas, Cal.		
6.84	43.86	HAT2	Budapest, Hungary		
		CFA	Drummondville, Quebec, Canada		
6.753	44.4	WHD	Deal, N. J.		
6.75	44.41	WOA	Lawrenceville, N. J.		
6.68	44.91	DGK	Nauen, Germany		
6.667	45	TGW	Guatemala City, Central America		
		F8KR	Constantine, Algeria		
6.66	45.05	TGW	Guatemala City, C.A.		
		HKM	Bogota, Colombia		
6.65	45.1	IAC	Pisa, Italy		
6.62	45.31	PRADO	Rio Bamba, Ecuador		
6.61	45.38	RW72	Moscow, U. S. S. R.		
6.61	45.38	REN	Moscow, U. S. S. R.		
6.60	45.45	F8KR	Constantine, Algeria		
6.515	46.05	WOO	Ocean Gate, N. J.		
6.447	46.53	HJ1ABB	Barranquilla, Col.		
6.425	46.69	VE9BY	London, Ont., Canada		
6.425	46.69	W3XL	Bound Brook, N. J.		
		W9XC	Anoka, Minn.		
6.38	47.02	HC1DR	Quito, Ecuador		
		HJ5ABD	Cali, Colombia		
6.335	47.35	VE9AP	Drummondville, Can.		
6.27	47.81	HKC	Bogota, Colombia		
6.25	48.0	HJ3ABF	Bogota, Colombia		
		CN8MC	Casa Blanca, Morocco		
6.243	48.05	HKD	Bogota, Colombia		
6.18	48.5	TGW	Guatemala City, C. A		
6.17	48.6	HJ3ABI	Bogota, Colombia		
6.167	48.65	XIF	Mexico City, Mex.		
6.15	48.78	YV3BC	Caracas, Venezuela		
6.147	48.80	VE9CL	Winnipeg, Canada		
6.14	48.86	W8XK	Pittsburgh, Pa.		
6.13	48.94	ZGE	Kuala Lumpur, Fed. Malay States		
		YV11BMO	Caracas, Venezuela		
		YV3BC	Caracas, Venezuela		
6.127	48.95	HJ4ABE	Bogota, Colombia		
6.125	48.98	VE9HX	Halifax, N. S., Canada		
6.122	49.0	ZTJ	Johannesburg, S. Africa		
6.12	49.02	W2XE	Wayne, N. J.		
		VE9HK	Halifax, N. S., Can.		
		YV1BC	Caracas, Venezuela		
6.112	49.08	YV1BC	Caracas, Venezuela		
6.11	49.09	VE9HX	Halifax, N. S., Can.		
		VE9CG	Calgary Alt., Canada		
		VUC	Calcutta, India		
		YNA	Managua, Nicaragua		
6.10	49.18	W3XAL	Bound Brook, N. J.		
		W9XF	Chicago, Ill.		
		VE9CF	Halifax, N. S., Can.		
6.095	49.22	VE9GW	Bowmanville, Can.		
6.09	49.26	VE9BJ	St. John, N. Bruns'k		
6.085	49.3	CP5	La Paz, Bolivia		
6.08	49.34	W9XAA	Chicago, Ill.		
6.074	49.39	YV5BMO	Maracaibo, Venezuela		
6.073	49.4	OXY	Skamlebaek, Denmark		
6.072	49.4	OER2	Vienna, Austria		
		YV2AM	Maracaibo, Venezuela		
6.07	49.4	VE9CS	Vancouver, B. C., Can		
6.069	49.43	VE9CS	Vancouver, B. C.		
		JB	Johannesburg, S. Africa		
6.065	49.46	SAJ	Motola, Sweden		
6.06	49.5	W8XAL	Cincinnati, Ohio		
		VQ7LO	Nairobi, Kenya		
		W3XAU	Philadelphia, Pa.		
		OXY	Skamlebaek, Denmark		
		W3XAV	Philadelphia, Pa.		
		CP5	La Paz, Bolivia		
		CMC1	Havana, Cuba		
6.05	49.59	GSA	Daventry, England		
		VE9CF	Halifax, N. S., Can.		
6.04	49.67	W1XAL	Boston, Mass.		
		W4XB	Miami Beach, Fla.		
		PK3AN	Sourabaya, Java		
		W1XL	Boston, Mass.		
6.03	49.75	VE9CA	Calgary, Alta., Can.		
6.023	49.2	XEW	Mexico City, Mex.		
6.02	49.83	DJC	Zeesen, Germany		
6.01	49.92	COC	Havana, Cuba		
6.005	49.96	VE9DR	Montreal, Canada		
		VE9CU	Calgary, Alta, Can.		
6.00	50.0	FIGA	Tananarive, Madag.		
		EAJ25	Barcelona, Spain		
		RW59	Moscow, U. S. S. R.		
		VQ7LO	Nairobi, Kenya, Af.		
		ZGE	Kuala, Lumpur, Malay States		
5.969	50.26	HVJ	Vatican City, Italy		
5.94	50.5	TGX	Guatemala City, C. A		
5.93	50.59	HJ4ABG	Medellin, Colombia		
5.90	50.85	HKO	Medellin, Colombia		
5.88	51.02	HJ2ABA	Tunja, Colombia		
5.857	51.22	XDA	Mexico City, Mex.		
5.85	51.26	WOB	Lawrenceville, N. J.		
5.80	51.75	HJ1ABB	Barranquilla, Col.		
5.71	52.5	VE9CL	Winnipeg, Canada		
5.692	52.7	FIQA	Tananarive, Madag.		
5.68	52.8	VK3LR	Melbourne, Australia		
5.26	57.03	WGN	Rocky Point, N. Y.		
5.17	58.03	PMY	Bandoeng, Java		
5.145	58.31	OK1MPT	Prague, Czechoslavakia		
5.07	59.08	WON	Lawrenceville, N. J.		
5.05	59.42	VRT	Hamilton, Bermuda		
4.98	60.24	GBC	Rugby, England		
4.84	61.98	GDW	Rugby, England		
4.795	62.56	W9XAM	Elgin Ill.		
		VE9BY	London, Ont., Can.		
		W3XZ	Washington, D. C.		
4.78	62.7	CGA	Quebec, Canada		
4.75	63.16	WOO	Ocean Gate, N. J.		
4.75	63.16	WKF	Lawrenceville, N. J.		
4.70	63.79	W1XAB	Portland, Me.		
4.51	66.5	VPN	Nassau, Bahamas		
4.43	67.5	DOA	Doeberitz, Germany		
4.40	68.17	DFA	Nauen, Germany		
4.32	69.44	G6RX	Rugby, England		
4.273	70.2	RV15	Khabarovsk, Siberia, U. S. S. R.		
4.116	72.8	WOO	Ocean Gate, N. J.		
4.11	73.0	HCJB	Quito, Ecuador		
4.105	74.72	HAA	Arlington, Va.		
3.75	80.0	13RO	Rome, Italy		
3.75	80.0	CT1CT	Lisbon, Portugal		
		FGKR	Constantine, Algeria		

THE foregoing list has been restricted as much as possible to stations that use radio telephony in one form or another. Among these are regular relay broadcasting stations, commercial point-to-point radiophones, and numerous experimental stations that use voice as well as code transmission, and are, therefore, understandable to any short-wave or all-wave set owner regardless of whether or not he knows the code.

This list has been compiled from many sources, which are not always in complete agreement. The licensing regulations in some countries are rather lax and influential station owners are known to pick their own call letters and operating frequencies, sometimes in defiance of international assignments. It is not unusual to receive two different letters from the same Central or South American station during the one week, the letters giving altogether conflicting information!

List of International Call Assignments

The international call letter assignments underwent some extensive changes early this year, when the acts of the Madrid Radio Convention of 1932 went into effect. For the most part the changes affect the smaller countries, but one really important shift gives all the R and U calls to the Union of the Socialist Soviet Republics, ("Russia"). The list as given below incorporates the official changes.

Block of Calls	Country	Amateur Prefix
CAA-CEZ	Chile	CE
CFA-CKZ	Canada	VE
CLA-CMZ	Cuba	CM
CNA-CNZ	Morocco	CN
COA-COZ	Cuba	
CPA-CPZ	Bolivia	CP
CQA-CRZ	Portuguese colonies:	
	Cape Verde Ids.	CR4
	Portuguese Guinea	CR5
	Angola	CR6
	Mozambique	CR7
	Portuguese India	CR8
	Macao	CR9
	Timor	CR10
CSA-CUZ	Portugal:	
	Portugal proper	CT1
	Azores	CT2
	Madeira	CT3
CVA-CXZ	Uruguay	CX
CYA-CZZ	Canada	
D	Germany	D
EAA-EHZ	Spain	EAR
EIA-EIZ	Irish Free State	EI
ELA-ELZ	Liberia	EL
EPA-EQZ	Persia	
ESA-ESZ	Esthonia	ES
ETA-ETZ	Ethiopia (Abyssinia)	ET
EZA-EZZ	Sarre Territory	
F	France (including colonies):	
	France proper	F
	French Indo-China	F1
	Tunis	FM4
	Algeria	FM8
G	United Kingdom:	
	Great Britain except Ireland	G
	Northern Ireland	GI
HAA-HAZ	Hungary	HA
HBA-HBZ	Switzerland	HB
HCA-HCZ	Ecuador	HC
HHA-HHZ	Haiti	HH
HIA-HIZ	Dominican Republic	HI
HJA-HKZ	Colombia	HJ
HPA-HPZ	Republic of Panama	
HRA-HRZ	Honduras	HR
HSA-HSZ	Siam	HS
HVA-HVZ	Vatican City State	
HZA-HZZ	Hedjaz	
I	Italy and colonies	I
J	Japan	J
K	United States of America:	
	Continental United States	W
	Philippine Ids.	KA
	Porto Rico and Virgin Ids.	K4
	Territory of Hawaii	K6
	Territory of Alaska	K7
LAA-LNZ	Norway	LA
LOA-LWZ	Argentine Republic	LU
LXA-LXZ	Luxemburg	
LYA-LYZ	Lithuania	
LZA-LZZ	Bulgaria	LZ
M	Great Britain	G
N	United States of America	W
OAA-OCZ	Peru	OA
OEA-OEZ	Austria	
OFA-OHZ	Finland	OH
OKA-OKZ	Czechoslovakia	OK
ONA-OTZ	Belgium and colonies	ON
OUA-OZZ	Denmark	OZ
PAA-PIZ	The Netherlands	PA
PJA-PJZ	Curacao	PJ
PKA-POZ	Dutch East Indies	PK
PPA-PYZ	Brazil	PY
PZA-PZZ	Surinam	PZ
R	Union of the Socialist Soviet Republics	
SAA-SMZ	Sweden	SM
SOA-SRZ	Poland	SP
STA-SUZ	Egypt:	
	Sudan	ST
	Egypt proper	SU
SVA-SZZ	Greece	SV
TAA-TCZ	Turkey	TA
TFA-TFZ	Iceland	TF
TGA-TGZ	Guatemala	TG
TIA-TIZ	Costa Rica	TI
TKA-TZZ	France and Colonies and Protectorates	
U	U.S.S.R.	
VAA-VGZ	Canada	VE
VHA-VMZ	Australia	VK
VOA-VOZ	Newfoundland	VO
VPA-VSZ	British colonies and protectorates	
	British Guiana	VP
	Fiji, Ellice Ids., Zanzibar	VP1
	Bahamas, Barbados, Jamaica	VP2
	Bermuda	VP9
	Fanning Id.	VQ1
	Northern Rhodesia	VQ2
	Tanganyika	VQ3
	Kenya Colony	VQ4
	Uganda	VQ5
	Malaya (including Straits Settlements)	VS1-2-3
	Hongkong	VS6
	Ceylon	VS7
VTA-VWZ	British India	VU
VXA-VYZ	Canada	
W	United States of America:	
	Continental United States (for others, see under K.)	W
XAA-XFZ	Mexico	X
XGA-XUZ	China	AC
XYA-XZZ	British India	
YAA-YAZ	Afghanistan	YA
YBA-YHZ	Dutch East Indies	
YIA-YIZ	Iraq	YI
YJA-YJZ	New Hebrides	
YLA-YLZ	Latvia	YL
YMA-YMZ	Danzig	YM
YNA-YNZ	Nicaragua	YN
YOA-YRZ	Rumania	
YSA-YSZ	Republic of El Salvador	YS
YTA-YUZ	Yugoslavia	
YVA-YWZ	Venezuela	YV
ZAA-ZAZ	Albania	ZA
ZBA-ZJZ	British colonies and protectorates	
	Transjordania	ZC1
	Palestine	ZC6
	Nigeria	ZD
	Southern Rhodesia	ZE1
ZKA-ZMZ	New Zealand:	
	Cook Ids.	ZK
	New Zealand proper	ZL
	British Samoa	ZM
ZPA-ZPZ	Paraguay	ZP
ZSA-ZUZ	Union of South Africa	ZS ZT ZU

Book Review

PHYSICS OF ELECTRON TUBES, by L. R. Koller, published by the McGraw-Hill Book Co., Inc., New York, N. Y., 6 by 9 inches; 200 pages; well illustrated. Price $3.00.

With the appearance of so many books on vacuum tubes, it is a bit refreshing to read one that does not repeat the wealth of stereotyped information so common in many texts on the subject. *Physics of Electron Tubes* is exactly what the name implies: a treatment of vacuum tubes from the standpoint of the physicist. You need know nothing about the operation of vacuum tubes to be able to read and appreciate this book. The chapters deal with the characteristics of different types of filaments, the calculation of the emission current obtainable therefrom, the advantages and disadvantages of the different types of filaments, etc.

A chapter on the effect of gas is very well presented in a manner somewhat unusual to a radio engineer. The calculation of the mean free path, thickness of ion sheaths, etc., is clearly indicated.

The last half of the book is devoted to photoelectricity and allied fields, an important and well-deserved set of chapters.

The style of the book is very pleasing. Written by a man who knows his work thoroughly, the topics are presented in a very concise manner, the only formulas shown being those which are actually used in the determination of tube constants. Not a single mention is made of the operation of the tube, this part of the theory being left to other books on the subject.

A very valuable feature of the book is the numerical problems at the end of each chapter, together with the answers. Your reviewer feels that more texts on radio should incorporate problems, as they afford one of the few means whereby the reader can check his knowledge of a particular chapter.

Only a few typographical errors were found, and they were of negligible importance. Also, discrepancies exist between several of the answers given in the text and those calculated by your reviewer. However, most of the discrepancies occur in the location of the decimal point, and so should not be detrimental in any respect to those who wish to do the problems.

This is a much needed treatment of what takes place inside the much used vacuum tube.

—*L. M.*.

* * *

ELEMENTS OF RADIO COMMUNICATION, by John H. Morecroft, published by John Wiley and Sons, New York, N. Y., 6 by 9 inches, 286 pages, well illustrated. Price, $3.00.

This is the second edition of the now famous *Elements* of Morecroft, and it is just as difficult to outline the virtues of this book as it is to properly treat the more detailed *Principles*.

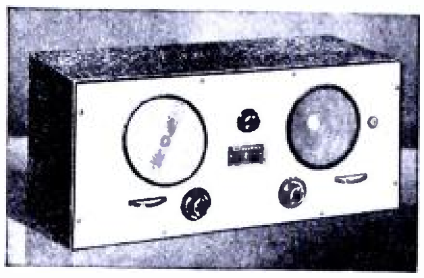
In brief, this book takes the reader from the very fundamentals of radio communication to the more detailed treatment of vacuum-tube theory and operation. It really contains much more information than its modest name implies, and the subject is treated in a manner that can only be attained by a teacher of long standing. It is lucid, accurate and profusely illustrated with numerical problems—an important combination to the man with a mass of un-corelated facts about radio.

(*Continued on page* 41)

•• S. W. Receiver Review ••

To assist prospective purchasers of short-wave receivers in selecting equipment most suitable for their own needs, we have established this regular monthly department, in which factory-built sets will be described honestly, accurately, and completely after having been tested thoroughly by us. Readers are invited to suggest particular sets in which they are interested, and we will endeavor to obtain stock samples for test and write-up. Please do not ask us to make comparisons between different receivers.

The "Skyrider"



MAKE: The Skyrider; manufacturer, Silver-Marshall Mfg. Co., Chicago, Ill.

MECHANICAL DETAILS: 17" x 7½" x 7½". Weight, 24 lbs., packed. Black crackle steel cabinet, light front panel.

REQUIRED ACCESSORIES: This receiver is sold complete with tubes and built-in loudspeaker. Earphones optional. Price complete, about $40, net.

GENERAL DESCRIPTION: This receiver is a four-tube plus rectifier all a.c. operated short-wave set, equipped with a four-position wave changing switch and fixed coils, of which there are four pairs (eight all together). It is essentially a short-wave receiver, tuning from 12 to 200 meters (25 to 1.5 megacycles) in four steps as follows: 12 to 29 meters, (25 to 10.35 megacycles); 27 to 50 meters, (11.1 to 6 megacycles); 48 to 100 meters, (6.25 to 3. megacycles); and 97 to 200 meters (3.1 to 1.5 megacycles). It thus covers the entire usable short-wave spectrum with the exception of the ultra high frequency channels in the neighborhood of 60 megacycles, which, of course, require special receivers.

Unlike practically all of the other new short-wave receivers recently placed on the market, the Skyrider is of the t.r.f. regenerative type. The manufacturers feel, probably rightfully, that a set of this type has peculiar advantages of its own and is preferred by many people to superhets. The circuit employs a 6D6 as the tuned r.f. amplifier, another 6D6 as a regenerative detector, a 6C6 as first audio amplifier and a 42 output tube, the latter feeding into a five-inch electric dynamic speaker.

The arrangement of the r.f. and detector circuits is more or less conventional. The reliable series tickler method of feedback is employed, control of regeneration being exercised by a 25,000-ohm potentiometer connected in the screen circuit of the 6D6 detector tube. A separate audio volume control connected in the grid circuit of the 6C6 a.f. amplifier stage functions independently of the regeneration control.

The power supply unit, which is built right on to the receiver chassis, employs the usual high voltage step-up transformer, a type 80 rectifier tube and a double section filter. The field winding of the loudspeaker functions as the first choke coil. Individual little r.f. choke coils are connected in the high voltage leads to the plates of the rectifier tube to suppress parasitic r.f. oscillations or impulses.

Adequate ventilation for the entire receiver is provided by an iron grille back. As there are no removable coils to shift, the cabinet is not hinged. However, the top may be removed easily for replacement of tubes, being held in place with four self-tapping screws.

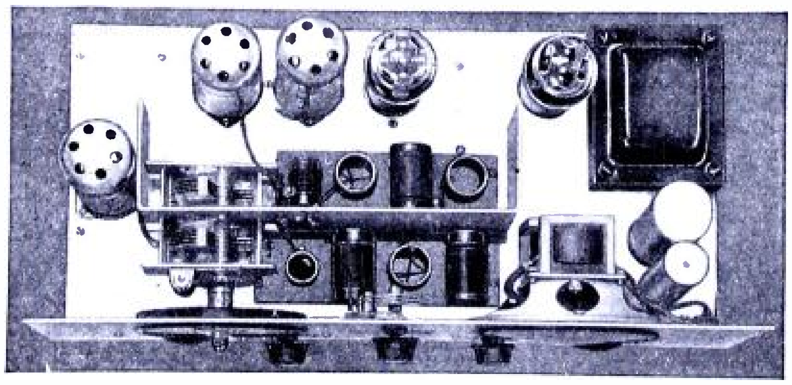
The appearance and construction of this receiver are decidedly unusual and striking. At the left is a large 18 to 1 vernier action dial, operated by a little thumb-wheel which protrudes through a slot in the panel just under the scale. The face of the dial is a printed paper mask, the upper half marked in megacycles and the lower in meters. The moving pointer is a rectangular, transparent strip of celluloid engraved with a guideline and punched with pencil point holes so that particular stations or frequencies may be marked in accurately.

While the printed scale furnished with the receiver is intended as a rough tuning guide, it was found to check pretty closely with stations of known frequency. It is a simple matter to mark in or erase call letters of important key stations.

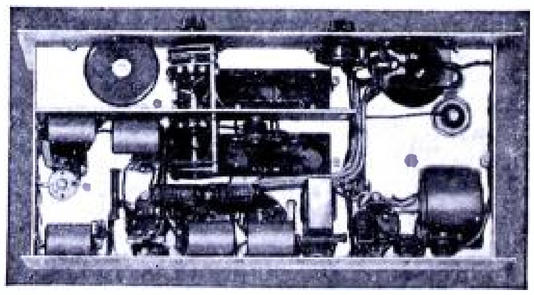
The four-position band selector switch is under and slightly to the right of the dial. Directly next to the latter is a five-plate midget condenser, which acts as r.f. stage trimmer.

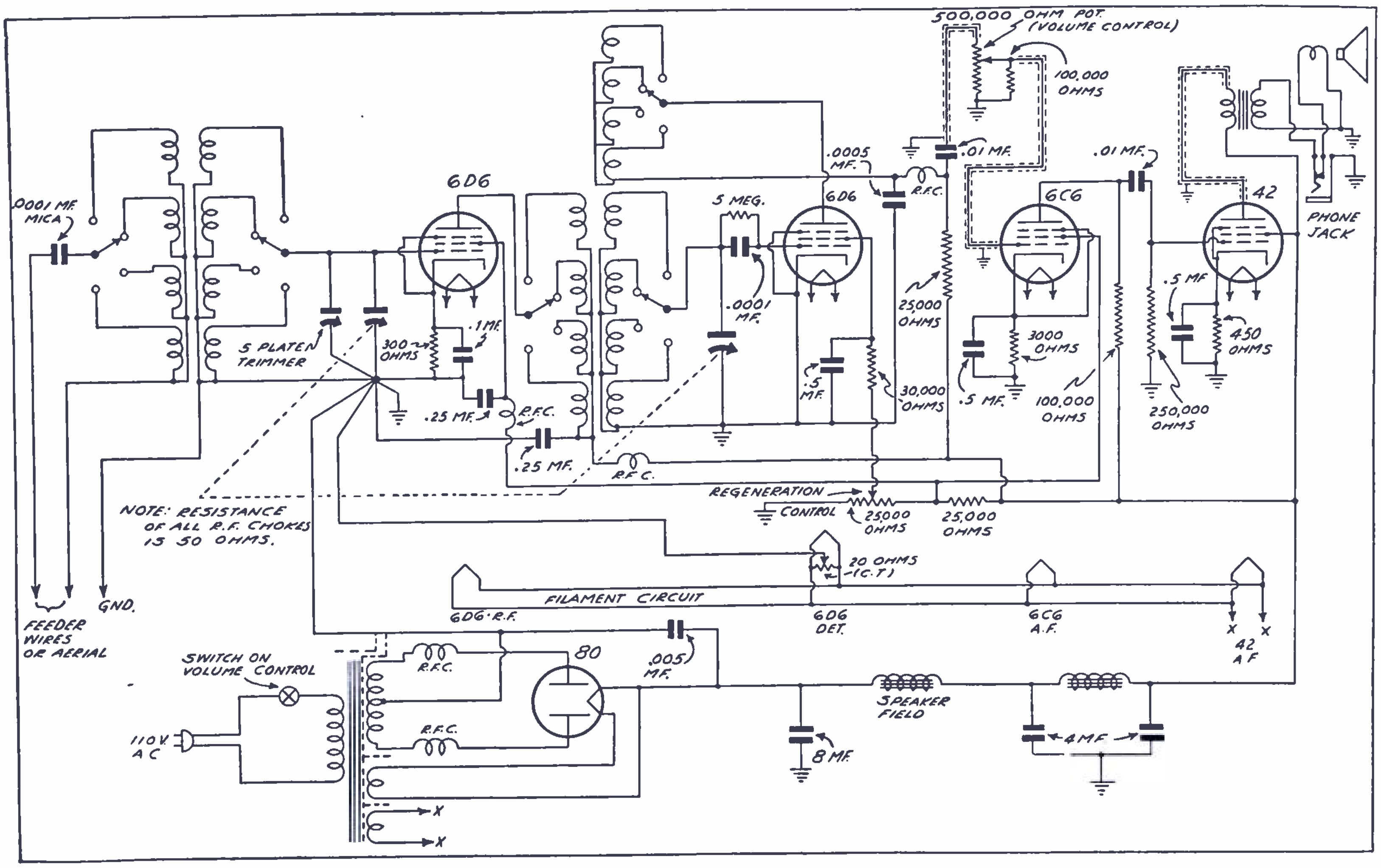
In the right-hand section of this set is the dynamic speaker, which balances the dial on the left. The speaker opening is covered by a wire grille. The knob under and to the left of the speaker is a combined line switch and audio volume control. The second thumb-wheel is the regeneration control. The jack to the extreme right is for earphone connection. In using this receiver the operator simply opens his hands and places them over the right and left edges of the panel. His two thumbs will then naturally fall on the thumb-wheels which control tuning and regeneration. This method of control is a little different from the conventional system using knobs, but it is quite comfortable once the operator becomes accustomed to it.

As may be observed from the inside view of the receiver, the four pairs of coils are arranged on either side of a "U" shaped shield partition. Intercoil coupling is kept at a minimum by the right angle arrangement shown. For any particular wave range, a coil on one side of the partition is connected into the r.f. stage and the adjacent coil on the other side of the partition into the detector stage. The shield partition also separates the two halves



Left: Top view of the Skyrider chassis, showing the coils and the U-shaped shield particularly. Right: under view of the chassis.





Complete schematic diagram of the Skyriders.

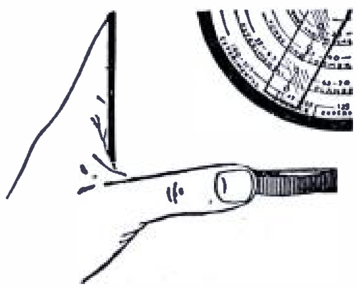
of the dual tuning condenser and the two sections of the wave changing switch.

Provisions are made for the connection of a transposed or twisted wire transmission line for use with a doublet antenna.

OPERATION: The general operation of the Skyrider was found to be very satisfactory, the regenerative action being especially smooth and gradual. This is an important feature from the standpoint of voice and music reception. In the sample tested by the editors of SHORT WAVE RADIO, there was a suspicion of a dead spot in two of the tuning ranges, due probably, to coil absorption, but otherwise the set proved extremely sensitive and quite selective. The volume control could not be opened up full on such foreign stations as London, Berlin, Rome and Madrid. At high volume levels the set tends to become microphonic and breaks into a howl due to acoustic feedback between the loudspeaker and the circuit components. This is not serious or objectionable, as the signals become too loud for comfort before this point is reached and the operator will naturally reduce the volume anyway.

The Skyrider should appeal to short-wave DX fans. It makes an ideal supplementary set for the man who already has an excellent broadcast receiver and who therefore does not care to buy one of the new all-wave sets.

A special model for amateur communication purposes is also available. This is identical in appearance with the set illustrated but has complete band spreading to open up the crowded amateur channels.



Correct method of operating the thumb wheels of the Skyrider receiver.

Names of Antenna Parts Clarified

A GOOD many short-wave set owners seem to be confused over the names of the various parts of the now popular types of noise reducing antennas. The general term "doublet" is being applied to the entire installation, whereas actually a "doublet" is a specific kind of aerial and has nothing to do with the transposed wire or twisted wire lead-in, which is actually the part of the system that rejects both noise and radio impulses along its own length. Contrary to the general belief, the aerial itself does not reject the noise. It must continue to pick up all radio impulses that strike it if it is to function as an antenna at all.

A "doublet" is merely a split antenna with an insulator at the exact center, its maximum operating effectiveness taking place on a wavelength double the overall length in meters; hence the name doublet. The wires that connect this antenna with the receiver are known as the transmission line or feeders. Exactly the same transmission lines or feeders may be connected to one extreme end of an aerial wire. The best operating wavelength of an end-fed antenna of this kind is again double its length in meters, so the name doublet may be applied to an end-fed aerial just as well as to a center-fed aerial.

AUTOMATIC volume control, as now employed very successfully in many short-wave superheterodynes, overcomes fading of short-wave stations to a large degree. However, the a.v.c. action cannot do the impossible; it will not restore or create a signal if fading is so bad that the impulses die out of the receiving antenna altogether. If a station is tuned in and heard quite loudly and then starts to disappear, there is nothing the listener can do about it, except wait for the signals to reappear. Of course, in some sets "fading" is not signal fading at all, but is due to drift in the tuning circuits. This can be overcome only by a very slight readjustment of the dial. Frequency shift at the transmitter may also take place if the latter is not of the crystal controlled type. In this case, any receiver will require slight retuning.

Some Questions and Answers on Noise Reducing Aerial Systems

THE problem of antennas seems to be universal among all short-wave set owners, regardless of the class they fall in. They may be set constructors or merely set operators, but they all have to use aerials. Fully 75% of all the questions asked at the Winter meetings of the Short Wave Club of New York were on this subject. There evidently is a great deal of wrong information floating around, for some of the people attending these meetings expressed some queer notions about antennas.

In order to clarify the situation a little, we have asked Mr. Arthur H. Lynch, well known exponent of short-wave noise reducing antennas, to answer a number of typical questions asked by short-wave set owners. The questions and the answers follow and contain a great deal of useful information. If you have any further questions that you want answered, do not hesitate to send them in to us. We feel that the subject of short-wave antennas is extremely important and we want to make certain that every reader understands the characteristics and limitations of the popular types now available.

(1) *In what direction is an ordinary straight end-fed aerial directional?*

(1) A straight end-fed antenna is directional in the direction opposite the free end; that is, if the antenna runs North and South and the lead is taken off the North end, the receiver will receive best from stations to the North. If the lead is taken off the South end, the receiver will perform best with stations to the south.

The directional properties of such an antenna are not very marked, when used in the broadcast band or when the length of the antenna is rather short. The directional properties of such an aerial depend, to a degree, upon the length of the flat portion of the antenna as compared to the length of the lead-in itself. When a transposed transmission line replaces the ordinary lead-in, the directional effect of the antenna is slightly improved.

Directional Effect

(2) *In what direction is the popular doublet (center-fed) aerial directional?*

(2) Just the opposite directional properties are noted, in connection with the so-called "doublet" antenna. An antenna running North and South will receive best in the directions East and West. The directional properties of the doublet are more marked than those of the single wire type of antenna.

(3) *Why does transposing the wires of the lead-in prevent the lead-in itself from picking up noise or radio energy, or rather why does not this energy get down into the radio receiver by way of the lead-in?*

(3) The reason that a transposed line does not pick up interference is rather simple to understand. Consider that a transposed line is passing in a vertical plane from any antenna to any receiver. At some distance below the antenna and before the line reaches the receiver, consider that we have a source of interference. The interference strikes the two wires of the transposed transmission line with equal intensity. The transposition in the line makes the two sides of the line 180 degrees out of phase. Therefore the interference striking the line is neutralized because it strikes one wire and creates a voltage in that wire with the same intensity that it strikes the other wire and creates a voltage in it.

(4) *Is a transposed wire feeder of any appreciable advantage, enough advantage to warrant its cost, in locations altogether free from extraneous noise?*

(4) Yes. In some locations, even where no noise exists, there is a noticeable fading on regular broadcast stations from 20 to 100 miles distant. This results from the out of phase mixing of the ground and the air waves. Using the doublet antenna with a transposed transmission line eliminates the ground wave altogether. This results, in many instances, in the reception of very satisfactory programs, which, under other conditions, would not be worth hearing. This is a comparatively new application of the doublet antenna and one which is becoming increasingly popular with broadcast listeners who desire to receive over long distances, especially at night.

(5) *A transposed lead-in terminates at the outside of a window. The radio receiver is several rooms removed inside the house. What is the best method of connecting the lead-in to the receiver?*

(5) The easiest way to run a transmission line from the point where the transposed line enters the house to the radio receiver itself is by using ordinary No. 14-2 wire BX cable. This is the same wire used for electric house wiring. Wire of this nature is looked upon by many experts to be entirely unsuitable for transmission-line work. However, we have run lines of this character several hundred feet without any noticeable loss in signal strength.

Lines of this nature are very desirable for running the leads from an antenna to the receiver when the receiver is located in an apartment house, where the use of a regular transposed transmission line would be difficult. The ideal arrangement on apartment houses is to run the transposed transmission line to the level of the roof and BX from the roof level to the receiver. In suburban locations, it is desirable to run the transposed transmission line to the window nearest the location of the receiver, and a short length of BX from there.

Length of Wire

(6) *How critical or important is the length of an end-fed aerial? A doublet aerial?*

(6) The answer to this question depends to a large degree upon whether the antenna is to be used for reception on all waves or on a particular frequency. If the antenna is to be used on a particular frequency, such as for communication purposes on 20, 40, 80 or 160 meters, as used by amateurs, the choice of the length of the antenna is rather important. In most instances the most suitable length is one half of the actual wavelength on which the amateur desires to transmit and receive.

For use in connection with all-wave receivers, the most desirable procedure is the use of an antenna one-half the length of the shortest wavelength we desire to receive. This holds true whether the antenna be a singlet or doublet type. In the latter case, the two wires form doublet, one half the wavelength of the shortest wave received, while, with the single type of antenna, the single wire is one half the wavelength.

The determination of this length of antenna wire has been determined on the following basis. The average all-wave receiver has a sensitivity of approximately 20 microvolts per meter at 15 meters, and a sensitivity of 2 microvolts at 550 meters. Therefore, the best procedure is to make the antenna most efficient where the receiver is least efficient. As we go up in wavelength, the antenna becomes less efficient and therefore, the improved efficiency of the receiver itself more than compensates for the lack of efficiency of the antenna, and we have a desirable balance.

The above holds true whether we are considering a single wire a half wavelength in length, or a doublet which has a total length of one half the shortest wavelength we desire to receive.

(7) *What are the limits on the length of the transposed wire feeder itself?*

(7) We have used transposed transmission lines up to more than a quarter of a mile in length. Lines of this nature, from 300 to 400 feet in length, are becoming increasingly common. At 429 Penn Avenue, Pittsburgh, Pa., the local representative of the Howard Radio Corporation uses a cage doublet antenna with a 290-foot transmission line. Before this installation was made, it was impossible to demonstrate all-wave receivers at that location. Now, no difficulty is experienced in bringing all of the foreign stations into the demonstration room, without interference at any hour of the day or night.

Theoretically, a transmission line with suitable impedance matching devices at each end can be run for a long distance without any noticeable loss. For all practical purposes, as far as the owner of an all-wave receiver is concerned, a good receiver and a good antenna will provide sufficient signals to offset any of the losses which might occur in the transmission line to a degree which makes the final results preferable to the use of the same receiver and a poor antenna which would be subject to local interference.

(8) *Must the feeder be in a straight line or may it be twisted here and there as the construction of particular buildings require?*

(8) The transmission line can be either in a straight line or can be run at various angles. It should not be run parallel to building structures, unless separated from them by at least 2 feet.

(9) *What is the simplest and most practical method of connecting the feeder to an ordinary receiver that has only one aerial post?*

(9) The most simple method of coupling a transmission line to an all-wave receiver is to connect one side of the transmission line to the antenna post and the other side of the transmission line to the ground post. In some instances it is desirable to connect a ground to the receiver and in others the ground may be left off. This is a matter of experiment.

In any case, improved reception results from the application of a suitable coupling device between the transmission line and the receiver itself. The better the coupling, the better the results.

(10) *With the aerial and ground completely disconnected, a certain receiver picks up many stations and also considerable noise. Both the stations and the noise get louder when the aerial is connected. Would a noise reducing antenna of the Lynch type do this set any good? In other words, if the shielding of a set is defective, is it worthwhile spending money for a transposed feeder when the set itself will continue to pick up noise regardless of the aerial?*

(10) At first glance it would seem as though there would be little use in using a good antenna sys-

Answers by

Arthur H. Lynch

who knows aerials

tem where the receiver itself is picking up local noise. Indeed, in locations where this type of noise is picked up by the receiver, when the volume control is not turned on more than a quarter of its range, it is doubtful if any antenna would help. On the other hand, if a good antenna is used, even in a noisy location, it is sometimes possible to bring in a signal which will override the local noise. A certain amount of experience is required to determine whether or not the signals we are likely to pick up by such an antenna would override the volume of the local noise. In most locations of this nature, it is desirable to make some provision for shielding the entire receiver. This is commonly done by removing the chassis from the cabinet and lining the inside of the cabinet with copper screen, making sure that the copper screening is soldered on all sides of the cabinet and then replacing the chassis. After the chassis has been replaced, another copper screen is soldered over the back of the cabinet, so that the receiver itself is entirely encased in the copper screen.

(11) *Is it important to have both sides of a doublet of exactly the same length? If conditions do not permit the erection of a uniform doublet, what should the man do?*

(11) Yes, the two sides of the doublet should be of identical length. In cases where this is impossible, it is sometimes more desirable to take the transposed transmission line from one end of the antenna.

Since the total length of the doublet recommended for all-wave use is 41′ overall, it is hard to visualize circumstances under which such an antenna cannot be used.

(12) *What is the greatest allowable spacing between transposition blocks? From the standpoint of economy, this question is extremely important to people who must erect very long feeders.*

(12) The distance between transposition blocks depends entirely upon the intensity of the local interference in relation to the signal.

In some locations, where the local interference is comparatively light, it is possible to place the blocks as much as three feet apart. There are some locations where they should be placed as close as 12″. When a transmission line is used to connect a doublet antenna, which is located some 200 or 300 feet from a main highway in order to avoid automobile ignition interference, the blocks should be placed 15″ apart for the first 100′, 24″ apart for the next 100′ and 36″ apart for the remainder of the transmission line. This, of course, presupposes that the antenna itself is located in a noise-free area.

(13) *How far from the side of buildings of various kinds should the feeder be kept? (Brick, wood, stucco steel, frame, etc.)*

(13) It is good practice to keep a transposed transmission line at least 2′ from the side of any kind of a building. This is particularly true where the transmission line parallels a portion of the building. If the line crosses at right angles to the edge of a roof it can come within one foot of the building without any noticeable disadvantage. Where BX cable is employed it can be run right down to the side of the building itself. Usually, brick apartment houses are provided with small crevices on the outside, and they make ideal places for hiding the BX, which may be applied to the building by using regular BX clamps.

(14) *What is the best type of general purpose noise reducing antenna for all-wave receivers?*

(14) The most suitable arrangement for any all-wave receiver is a cage doublet with a transposed transmission running to a point as near the receiver as possible, and coupled to the receiver by means of a suitable coupling device. There are some locations in which this ideal cannot be met.

In such circumstances, it is necessary to replace the cages by a single heavy wire, and it is sometimes necessary to run the transposed transmission line to the level of the roof only. The remainder of the transmission line is then made with standard No. 14, 2 conductor BX.

In the design of any antenna and any transmission line, it should always be borne in mind that the best possible results, for a given location, can only be obtained when the antenna resistance is low and the insulating material used to suspend the antenna and to make the transmission line is of the highest quality. Of course, there is always the compromise which must be made with cost. If this was not true and we had all of the land we needed at our disposal, we would all provide ourselves with a whole group of arrays, of the type employed by the transatlantic service of the telephone company. Having to make compromises, as we do, a certain amount of discussion is required.

The Double Doublet—

A New Noise Reducing Antenna System

SUMMARY: *Noise reducing antennas have been in use for quite a time now with very encouraging success. The main failure of present systems is that they do not operate with the same efficiency over the entire short-wave band; the new system described here overcomes this objection to a remarkable extent. Furthermore, the lead-in is balanced, and is designed to match the coupling device and antenna system in the radio set.*

A NEW type of noise reducing antenna system designed for use with all-wave and short-wave receivers has just been announced by RCA-Victor. This system, called "The World Wide Antenna System," has been scientifically designed to produce substantially constant output over the entire bands in use—from 15 to 500 meters (20,000 to 550 kilocycles).

The construction of this system involves the use of a "double doublet" (to be explained shortly), a transmission line from the aerial to the receiver of predetermined length, and a special coupling coil. The instructions for the installation of this system are so specific and answer such a wide variety of questions that a detailed description of the system will be given.

The Installation

By a study of Fig 1 it will be seen that there are installed between the two supporting masts two distinct doublet antennas: one doublet has a length of 29 feet for each half section (A to B and C to D); the second doublet has a length of $16\frac{1}{2}$ feet for each half section (E to B and F to C).

The purpose of this arrangement—the double doublet—is to approach an ideal antenna system for all the short-wave broadcast bands. Theoretically, it would be best to have a separate doublet designed and installed for each band, namely, one for each of the 16, 19, 25, 31 and 49 meter bands. Such an installation would require five doublets, each one being sufficiently separated from its neighbor to prevent interaction. Obviously, such a system would present quite an installation problem, aside from economic difficulties. For this reason, the arrangement shown in Fig. 1 has been decided upon as the happy solution to the problem.

The 29-foot sections tend to tune or match the system toward the low frequency (high wavelength) end of the short-wave band, in the neighborhood of 49 meters; the $16\frac{1}{2}$-foot sections tend to tune or match the system down toward the 16-meter end of the broadcast band. A composite of the two—therefore called the "double doublet"—gives a smooth match throughout the range from 3.5 to 20 megacycles.

Corresponding halves of each doublet are composed of one piece of wire: the length A to B and C to F is one length of wire $46\frac{1}{2}$ feet long (6 inches being allowed for each antenna strain insulator tie). In a similar manner, the halves D to C and B to E are composed of one length of wire. These are connected to the transmission line at the center insulator. When installing the antenna wires, the following considerations should be kept in mind: (1) height above earth ground; (2) clearance from wires, buildings, highways, trolley lines, etc.; (3) direction of span.

Height Above Earth

The first consideration, that of height above earth ground, is extremely important with the antenna system described here. Height above ground should be considered as the distance of the 29 feet horizontal sections to ground. If the installation is on top of a frame dwelling with no grounded metal roof, or if the aerial is stretched from a building to a nearby pole or tree, then the term "ground" means the actual earth. On the other hand, if the span A to D is installed on top of a steel framework building, or on any building with a grounded roof, the earth ground is considered the roof. For good aerials, a minimum of 30 feet above ground is recommended. It should be borne in mind, however, that the signal strength received varies with the height of the antenna above earth ground.

Clearance from wires and buildings is necessary so as to prevent these objects from casting radio shadows on the antenna system with consequent reduction in signal strength pickup. It is interesting to note that the apparent direction of a radio wave may be considerably altered by grounded objects such as steel buildings, trolley lines, etc. These grounded objects defeat the very purpose of making an antenna directional, so that, aside from considerations of signal strength, it is wise to take pains in erecting an antenna as high and as free from grounded objects as possible. Furthermore, a clear antenna is bound to result in less man-made interference.

Since the lead-in of this antenna system is of the balanced type, antennas may be erected as far away as 500 feet from the radio set with

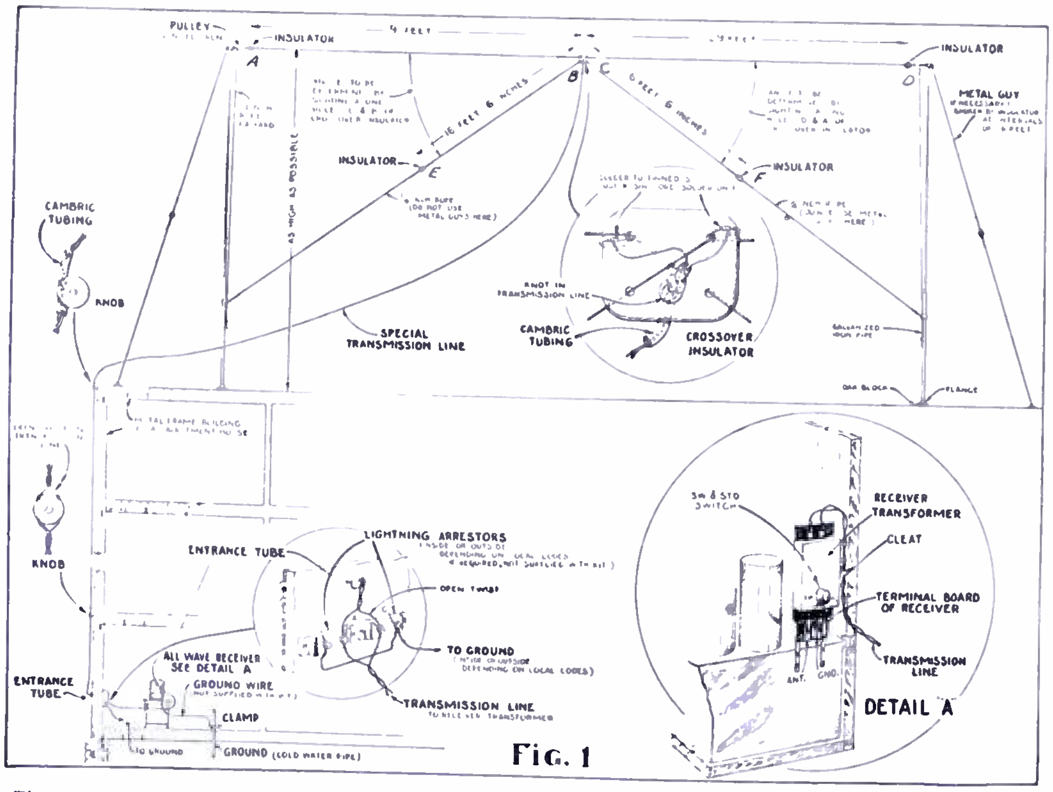


Fig. 1

The new RCA "World Wide Antenna System" described in this article. The drawings in the circles are details.

negligible loss of power. However, a minimum length must be maintained. This point will be discussed a little later. The direction of the span, for best results, is that direction having the double doublet placed *broadside* to the direction from which it is desired to receive. This direction is indicated in Fig. 2. If the antenna is placed in an E-W direction, then reception will be best when signals originate from either the north or the south.

In localities with a noise level that is extremely high, it might be wise to install the antenna so that it points to the interference. The antenna may then not be placed in the best position as far as signal strength is concerned, but in these locations sacrificing signal strength for decreased noise is well worth while.

Horizontal Doublet

Theoretically, the doublet should be stretched out fully—each half making an angle of 180 degrees with the other as shown in Figs. 2 and 3. If this angle is reduced because of constructional difficulties, let us say, to 90 degrees, as shown in Fig. 3, the signal strength will he reduced about 30 per cent from the signal received when the doublets are in a straight line. The diagram of Fig. 3 is a top view of the antenna system. Hence, the insulators for both the 16½ foot doublet and the 29-foot doublet are shown, since they are both in the same plane.

The total length of lead-in supply must always be used regardless of the distance of the receiver from the double doublet. If, for instance, this distance is 60 feet, the balance of 50 feet (the minimum lead-in supply must always be used regardless of the distance of the receiver from the double doublet.) If, for instance, this distance is 60 feet, the balance of 50 feet (the minimum lead-in length is 110 feet) may be coiled up at the receiver end. This precaution must be taken because the entire system is matched as far as impedances are concerned for maximum output, and any lead-in lengths shorter than the minimum of 110 feet will unbalance the system.

For distances between the receiver and double doublets greater than 110 feet, additional length of line must be added in multiples up to two times, or up to 220 feet. After this distance, additional lengths can be added up to 500 feet and can be cut anywhere convenient for connection to the receiver. The following table will clarify this condition.

Line Run to Receiver from Doublet In Feet	Line Length Used In Feet	Number of Lengths of 110 Feet	Length to be Coiled In Feet
95	110	1	15
150	220	2	70
210	220	2	10
300	300	3	No coil necessary. Cut off unused portion if desired.
500	500	5	

The matching transformer used is mounted on the receiver proper as shown by detail A of Fig. 1. The purpose of this coupling unit is to couple the transmission line to the receiver and balance out the transmission line with respect to ground. It is important to note that the length of the ground connection from the transformer to the post on the receiver is critical to insure maximum noise reduction this distance should be as short as possible—not over one inch from the chassis ground.

The transmission line is twisted flexible rubber covered wire, almost identical with ordinary lamp cord. The length of the antenna connection of the transformer is not as critical as that of the ground insofar as noise reduction is concerned. However, it is wise to keep it as short as possible.

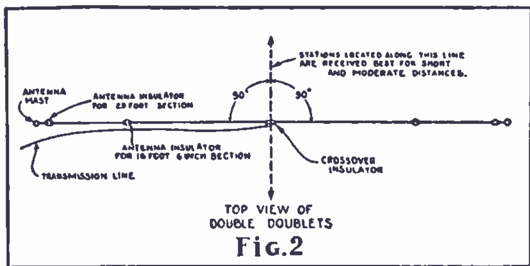
It should be noted that because of constructional difficulties, it may not be possible to secure the full span of 60 feet required for best reception without decreasing the angle from 180 degrees. This situation may be taken care of by the use of specially developed loading coils to permit a reduction of the antenna span from 60 feet to about 34 feet. The connection of these loading coils is indicated in Fig 4.

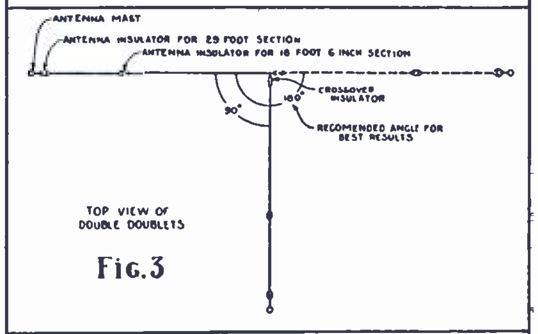
Vertical Doublet

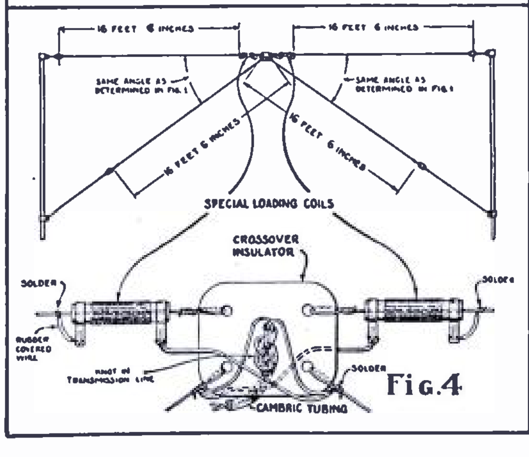
The non-directional properties of the vertical doublet are preferred, by some people, to the horizontal doublet illustrated previously. This is offset, on the other hand, by the better signal-to-noise ratio obtained by the horizontal doublets. For those who wish a non-directional antenna, therefore, with the dimensions given in Fig. 1, a wooden pole or frame house at least 60 feet above the ground is recommended. Such a support is not readily found and is expensive to construct. For those who have some vertical facilities, however, the sketches of Fig. 5 are intended. Note the use of the loading coils in order to effectively reduce the vertical height required from about 60 feet to about 34 feet. Two constructions are shown in this figure: that at A being suitable when a 34-foot pole is available, and that at B when a 20-foot pole is available. Either type of construction will give about the same results.

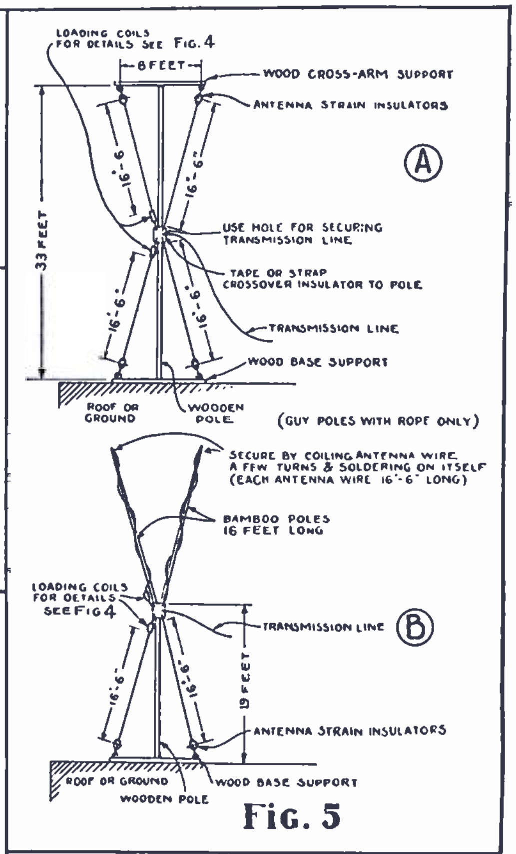
Due to a most efficient match of the double doublet to the receiver for the shorter waves, there is an inevitable loss introduced for the frequencies assigned to broadcasting, police calls, etc., in the range from 550 to 3500 kilocycles (545 to 85.7 meters). To compensate for this antenna loss, a switch is provided on the coupler for improving the reception of signals in this range. Of course, good signal strength can still be obtained in most cases with the switch in the short-wave receiving position.

It is interesting to note that this is the first antenna system of the noise reducing type that attempts to compensate for the changing efficiency of the system with changes in frequency. It is also interesting to note that the system depends upon the variation in sensitivity of the receiver to compensate for the variation in the efficiency of the antenna system.









Several diagrams illustrating the operation of the new antenna system. The effect of keeping the antenna at less than 180° is shown. Vertical doublets are shown in Fig. 5.

Must Supers Be Noisy?

SUMMARY: *Even a good super is noisy—but not any more so than it should be. The noise level output depends upon the gain of the set: the more sensitive the set, the more noise you will hear—t.r.f. or super. This article gives you the "low-down" on the whole situation. If you want a quiet set, get an insensitive one; if you want sensitivity, get a good super.*

GRAPEVINE telegraphy is a very efficient means of communication. Once it gets under way, it can seldom be checked until long after it has taken its toll. Some years ago, someone started the notion that superheterodynes—especially short-wave superheterodynes—are noisy, and that they are noisy simply because they are supers. Furthermore, no distinction was made as to the type of noise, probably because the one who started the fool idea had a brainstorm, which spent itself before any qualifications to the original statement could be made.

Now, s.w. supers are not nearly as noisy as some people lead themselves to believe. Of course, poor design, bad alignment and cheap parts are bad enough; but, when they are combined into a mess that is colloquially known as a "receiver," it's a wonder the contraption works at all. In fact, many "receivers" function in spite of their parts rather than because of them.

Classification of Noises

We can eliminate, first of all, noises picked up from external sources such as power lines, aerial, etc.; for, regardless of what kind of a set you have, they will be heard. The only other kind of noise is that generated in the receiver itself, and it is with this phase of the problem that we will confine ourselves.

Leaky condensers, rosin joints, poor insulation and defective tubes are the major causes of noise; but, even these can be eliminated by the application of some elbow grease on a hot iron and by the use of high quality parts. When all this has been taken care of, receivers—especially supers—are said to be noisy. If so, then where does the noise come from?

It may be news for some people to know that the limit of amplification that is obtainable from any receiver using vacuum tubes is determined by the permissible noise level. In other words, as more and more amplification is added to a receiver, the noise level increases and increases until the noise may become louder than the signal to be heard. This noise—the selfsame noise that causes all the trouble—is generated in the tube itself, and cannot be eliminated by any amount of elbow grease and money when standard parts are used. (It may not be amiss to mention, in passing, that the General Electric Company has designed a special "low noise" tube that resembles the 01A in appearance, but which costs much more!)

It is beyond the scope of this discussion to give the theory of noise generation, although the reader is referred to the March, 1934, issue of this magazine for additional information on tube noises. However, suffice it to say that the noise voltage is a function of the materials used in the construction of the tube, the plate current, gas content, etc. Furthermore, the greater portion of this noise arises from the fact that the electrons from the filament or cathode are not emitted in a smooth, uniform motion; rather, their motions are random, and the plate current as measured by a milliammeter is a measure of the average of the random velocities. It is the motions that deviate from the average that generate the tube noise voltage.

This voltage appears in the plate circuit of any particular tube, is amplified in exactly the same manner that a signal is amplified, and is heard in the output as hisses, scratches, rasps, etc., the exact noun depending upon the vocabulary of the individual.

T.R.F. vs. Super Noise

Here, then, is the crux of the whole situation. If a good super seems more noisy than a t.r.f. set, then the additional noise is present simply because the amplification of the super is many more times that of the t.r.f. set. A little reflection will clear up this point. We all know—or should know—that the amount of amplification obtainable from a tube varies with the frequency of the voltage to be amplified; the higher the frequency, the less the amplification. That is why supers are used in the first place. Because of the comparatively low frequency of the i.f., a great deal more amplification can be obtained from a single i.f. stage than could be obtained from a t.r.f. stage. The tuned r.f. stage or stages is used merely for the purpose of developing enough signal to work the first detector properly and to give the receiver some selectivity.

Stage for stage, then, the super is better, and since it has more amplification, the noise is amplified more. This is a general statement and therefore should be qualified a bit. If we have high gain in the preselector stage of a super, then the point of linearity of the second detector is reached at a corresponding lower value of noise voltage, so that the set will be quieter than with a low-gain preselector stage. This point is more fully discussed in the article referred to previously.

This situation may be summed up in a simple statement: take any t.r.f. set and add stages of amplification to it until the gain of the receiver equals that of a *good* superheterodyne. Under these conditions, the amount of noise heard in the output will be about the same for the two receivers.

Possibility of Noise

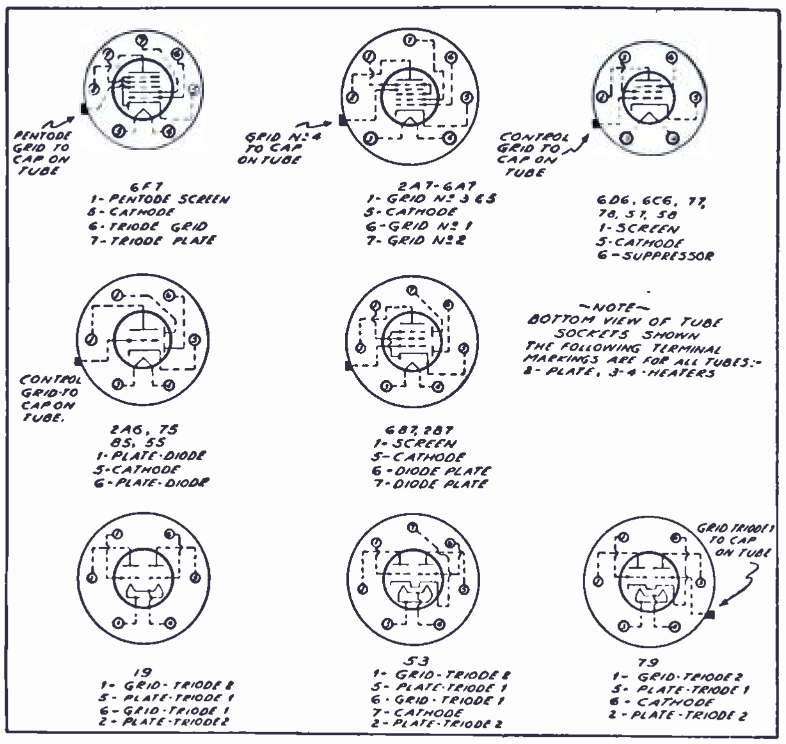
We do not mean to infer from these statements that the *possibility* of noise generation is the same in the super as in any t.r.f. set. On the contrary, there are more places where noise can be generated in a super than in, perhaps, any other type of receiver. With the proper precautions, though, this noise can be eliminated.

First of all, too many supers use oscillators that work too violently. Some of them are so bad that the grid of the first detector goes positive with no signal. A positive voltage on the grid of some of the tubes used for first detectors gives rise to electron emission *from* the grid, with the result that operation is erratic and the super is noisy. As pointed out in the April issue, page 44, there is no need for the oscillator voltage at the grid of the first detector to be greater than the signal voltage, as too much oscillator voltage can start more trouble than a convention of old maids.

The plate circuit of the mixer tube (first detector) is a hotbed of different frequencies. Besides the signal carrier, oscillator carrier, and the sum and difference of the two, there exist sums and differences of the modulation frequency (audio signal) and oscillator and signal, alone and in combination! All the i.f. amplifier cares about is the difference fre-

(*Continued on page* 40)

Some Suggestions for Using the New Multi-element Tubes



Symbols and socket connections for some of the new multi-element tubes now available in the market. Some good suggestions for their use are given in this article.

VACUUM tubes designed for broadcast-band receivers have been adapted to work in conjunction with a great variety of circuits. Broadcast-band design engineers have provided for every possible use of the characteristics of vacuum tubes, while, for some unaccountable reason, short-wave engineers have been content with the old standard modes of connection which have been exploited time and time again.

Of course, there are many reasons for this apparent lack of originality. For one thing, the requirements for short-wave operation are different from those for broadcast band operation, so that many of the unique broadcast circuit arrangements employed are not justified in short-wave practice. Then again, the number of short-wave receivers sold at this writing is considerably less than the number of straight broadcast-band sets, so that it would be natural for the engineering department of set manufacturers to concentrate on that phase of radio which has the greatest pecuniary remuneration.

This commercial viewpoint should not prevent the dyed-in-the-wool experimenter from trying a few circuits of his own, all of which leads us to the purpose of this article—to give, concisely, a few pointers on the "trick" circuits which may be employed with some of the complex tubes available today.

The 2A7 Pentagrid Converter

This tube is one of the latest that has puzzled the non-technical radio man. It consists of a heater, cathode, five grids and a plate; its socket connections and internal arrangement are shown in the diagram. The primary purpose of this tube is to act as a combination first-detector and oscillator in superheterodyne circuits. The first two grids, in combination with the common cathode, serve as a triode oscillator, while the remaining three grids and output plate serve as a first detector. A unique characteristic of this tube is that no external coupling between the oscillator and first detector coils is required—the variation in plate current in the output section depends upon the signal voltage and the oscillator voltage, the coupling taking place *in the tube* itself.

Although this is the primary function of this tube, there is no reason why it cannot be adapted to other purposes. For instance, in a superheterodyne, the pentode section may be used as one of the i.f. amplifiers, and the triode portion as the beat-frequency oscillator; although the characteristic of the tube changes slightly when the oscillator is shut off, nevertheless, the change in characteristics is not very great, and is certainly warranted, especially in view of the fact that a tube is saved.

The 6A7 is the 6.3 volt equivalent of the 2A7.

The 6F7 Triode Pentode

The socket connections for this tube are identical with those of the 2A7 shown in the diagram, although the tube construction and application are different. For one thing, the triode and pentode sections are entirely isolated. The triode section may, theoretically, be worked independently of the pentode part of the tube—in short, this is really two separate and distinct tubes in one envelope; the only thing that is common is the cathode.

The original purpose of this tube, which was announced at about the same time that the 2A7 was announced, is to serve as a combination first detector and oscillator. Although this is also the primary purpose of the 2A7, nevertheless the fact that the coupling between the mixer and oscillator circuits must be made external to the tube itself allows it to be used in more numerous circuit arrangements.

For instance, the November, 1933 issue of SHORT WAVE RADIO contained a description of the "Triflex," which is a one-tube receiver acting as an r.f. amplifier, regenerative detector and a.f. amplifier connected in a reflex arrangement. In this receiver, the r.f. from the antenna feeds into the pentode section, which, in turn, is coupled into the triode portion, where it is detected and regenerated; finally, the audio from this triode portion is reflexed back into the pentode part of the tube. The audio is removed and fed into a pair of earphones.

This three-in-one combination, although economical from a circuit standpoint, may be a bit tricky for the inexperienced experimenter, so we would recommend, as a starter, the use of this tube as merely an r.f. amplifier-detector or as a detector-audio amplifier. In any case, a tube would be saved, inasmuch as the 6F7 actually consists of two tubes in one envelope.

There is one point here that should be cleared up. The fact that this single tube is used for two purposes does not detract from the efficiency of any one of the purposes. In other words, the pentode section acts as if a separate pentode were used and the triode section acts with the same efficiency as if a separate triode were used.

Of course, this tube may also be used as a combination i.f. amplifier and beat oscillator in exactly the same manner as would two separate and distinct tubes. The main difficulty here is to keep the triode section from oscillating too strongly and so overload the pentode section.

The 6F7 is a very stable tube, has a rather low noise level, and should be an excellent starter for the experimenter. When the pentode is used as a regenerative detector, then control of regeneration may easily be effected by variation of the screen voltage. This method of regeneration control, as is well known, produces a minimum change in tuning with change in regeneration.

Miscellaneous Diode Detector Tubes

There is almost an infinite variety of combination of diode-triode-pentode tubes such as the 75, 2A6, 85, 2B7, etc., which may be applied in circuit arrangements that are slightly different from conventional arrangements. The usual procedure

(*Continued on page* 38)

Some Applications of New Type Electrolytic Condensers

THE only purpose of an electrolytic condenser is to provide, at low cost, a high capacity condenser in a small volume. This duty has been more than fulfilled by the electrolytic condenser. This does not necessarily mean that development work must stop, or that the limitations to the physical size of such units have been reached. On the contrary, there has been developed recently a new type of unit known as the concentrically-wound electrolytic condenser. This unit is made by winding two or more condensers in a single roll with either a common positive or common negative terminal.

If there is a common negative terminal for two or more condenser sections composing the concentric unit, then the condenser is referred to as being "concentrically wound—commonly negative." If there is a common-positive terminal for the sections composing the concentric unit, then the resulting condenser is referred to as being "concentrically wound — common - positive." Our purpose here is to show some of the circuit arrangements which make it possible to use to advantage these concentrically-wound combinations.

Fundamental Circuits

It should be appreciated that an infinite number of combinations is possible, using such constructions, and it is, therefore, not possible to describe other than some of the more generally used types and the circuit arrangements to which they are adapted. From the following descriptions of some of the more widely used types of concentrically-wound units, the reader will appreciate the underlying factors of design and be able to work out for himself other combinations to fit special requirements. There is no question that the future is to see even wider use of concentric combinations to bring about reductions in the space requirements for filter and bypass condensers in a radio receiver.

Before discussing circuit arrangements, it will be advisable first to establish clearly in mind the fundamental characteristics of the two general types of concentrically-wound units.

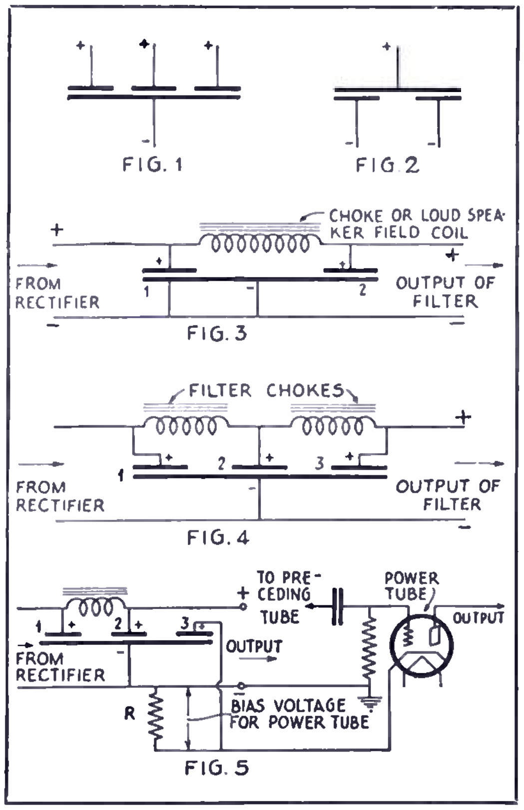
As shown in Fig 1, the concentrically-wound common-negative condenser consists of two or more "positives" wound into a single roll with a single negative foil common to all the anode foils. The figure shows three "positives," but, theoretically, there may be any number of these anodes. Generally, however, not more than three anodes are used.

As shown in Fig. 2, the concentrically-wound common-negative condenser consists of two or more "negatives" wound into a single roll with a single positive foil common to all the negative foils. Again there is no limit theoretically as to the number of "negatives" but usually there are not more than two.

Circuit Arrangements

Now, let us discuss some of the circuit arrangements using these types of condensers. One of the simplest is shown in Fig. 3 where we have a concentric common-negative unit consisting of two high-voltage sections marked 1 and 2, these two sections composing, in combination with a choke coil, the main filter system of a power supply device. The choke coil is in the positive side of the circuit and the positive terminals of the condenser are connected either side of this choke coil. The negative foil common to both sections of the condensers is connected to the negative side of the filter circuit.

In the case of a filter system using two choke coils (in the modern radio receiver one of the chokes is usually the field coil of the loudspeaker) we can make use of a triple-section, concentrically-wound, common-negative condenser. Such a filter circuit is shown in Fig. 4. It is similar to the circuit of Fig. 3 with the exception of the addition of another section to the condenser and another choke in the positive side of the filter system. The first types of concentric units to come into general use were the two- and three-section types illustrated in Figs. 3 and 4 and the success of these circuits has brought about the use of the more special types of concentric units now being manufactured.



Fundamental circuits of common positive and common negative electrolytics.

One of these more special cases is illustrated in Fig. 5. Here we have combined in one unit two filter condensers marked 1 and 2 and, in addition, a low-voltage bypass electrolytic section marked 3, which serves as a bypass unit across a resistor R from which is obtained the C-bias voltage for a power tube. Again, as in the condenser shown in Fig. 4, all three sections are concentrically wound, but instead of having three high-voltage sections, as in the case of Fig. 4, we have in Fig. 5 two high-voltage sections, rated, probably, for a working voltage of 450 volts, and a third section, 3, rated probably at only 25 or 50 volts. The first two sections are placed directly across the filter system and hence must withstand the full voltage of the filter; the third section is connected across the resistor and the voltage drop across this resistor may be less than 25 volts. Consequently, section 3 need only be designed to operate at a similarly low voltage. In Fig. 5, to clarify the circuit arrangement, we have shown very roughly the manner in which the filter system and the condenser tie into the circuit of the power tube. There is, of course, no reason why three high-voltage sections might not be combined with a low-voltage section and thereby permit the use of a two-section filter of the type shown in Fig. 4 and the low-voltage section could again be used for bypass purposes.

"Common-Positive" Circuits

Now let us consider some circuit arrangements for concentrically-wound common-positive units. The simplest arrangement is that shown in Fig. 6 using a two-section high-voltage condenser with one positive and two negative terminals and the choke coil in the negative side of the filter circuit.

In Fig. 7 we show a combination of a concentric common-negative unit with another *separate* condenser in a two-section filter with the first choke in the positive side of the circuit and the second choke in the negative side of the circuit. In many cases, all or part of the voltage drop across the second choke is used, also, as the bias voltage for the power output tubes.

In all cases, when concentric common-negative combinations are used,

SUMMARY: *Electrolytic condensers have undergone many changes since they were first made available to the general public. One of the latest changes involves the combination of two or more units in a single container, with either a common-positive or a common-negative terminal.*

The purpose of this article is to explain, in a practical manner, the connections of these condensers and to outline some of the precautions to follow in using them. This article should be of value to every user of electrolytic condensers.

consideration *must* be given to the voltage between the two "negatives" due to the voltage drop across the choke or other apparatus connected between the two "negatives." The polarity of this voltage drop is shown in Figs. 6 and 7 by the small polarity marks (plus and minus) near the chokes connected in the negative sides of the circuits. This voltage drop is due to the current flowing through the choke coil and the direction of this current is such that the polarity of the side of the choke nearest the output of the filter is positive and the polarity of the side of the choke nearest the input to the filter is negative. The amount of voltage drop across the chokes (and hence the voltage drop between the two "negatives") will be determined by the resistance of the choke and the current, and will be equal to the product of the resistance in ohms and the current in amperes.

Leakage in "Negatives"

This voltage drop between the two "negatives" will cause a high leakage current to flow between the two "negatives," and very adversely affect the effectiveness of the entire filter system unless one of the "negatives" of the condenser has a film formed on it to limit the current flow. In the case of Fig. 6 the "negative" of section 2 will be of positive polarity with respect to the "negative" of section 1 by the amount of the voltage drop across the filter choke. Hence the negative foil of section 2 must have a film on it capable of limiting the current flowing between the "negatives" to a very small value. If the voltage drop is 100 volts, then the film must be such as to limit the current to a small value at 100 volts. If we were to use a condenser in this circuit which did not have such a film on one of the "negatives," the receiver would hum very badly due to excess leakage current across the choke coil.

Similarly in the case of Fig. 7, the "negative" of section 3 is of positive polarity with respect to the "negative" of section 2. Again the "negative" of section 3 must have a film on its surface such as to limit the current flow.

Design Factors

In the case of common-positive concentric units all the positive foils have a film on their surfaces, and we therefore do not have to consider leakage paths between "positives." In the case of common-negative concentric units, leakage must be considered and failure to take this factor into account undoubtedly will result in unsatisfactory operation of the receiver. The importance of this point cannot be overemphasized.

In many circuits use is made of a combination of common-positive and common-negative constructions in a single unit. Such combinations may bring about some reduction in the physical size of the unit, but there is frequently no advantage from a cost standpoint, and, naturally, the more complicated the arrangement the greater are the possibilities of field trouble.

For example, instead of using a single-section condenser and a two-section, common-negative condenser, we can combine them into one unit, as shown in Fig. 7, with, as indicated above, a slight reduction in physical size. This latter arrangement is shown in Fig. 8. From the standpoint of sections 1 and 2 we have a concentric common-negative because both of the sections are connected to a common-negative foil, A. However, from the standpoint of sections 2 and 3 we have a common-positive construction because both sections have a common-positive foil, B. The complete unit is therefore a mixture of common "positives" and the common "negatives," but the resulting arrangement is electrically equivalent, at least, to the filter circuit of Fig. 7.

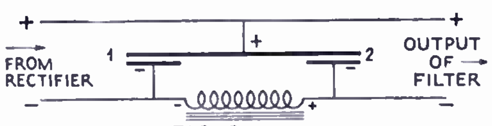


FIG. 6

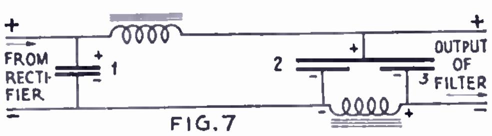


FIG. 7

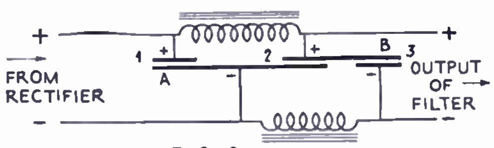


FIG. 8

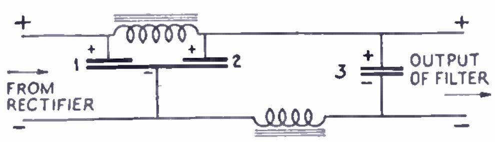


FIG. 9

Some additional uses to which the new electrolytics may be put.

The following points may furthermore serve to indicate the desirability of giving serious consideration to the filter circuit arrangement. In both Figs. 7 and 8 there is present a common-positive concentric unit and hence formation of one of the negative foils will have to be resorted to in order that there shall not be excessive leakage between "negatives." By slightly rearranging the circuit of Fig. 7 this disadvantage can be eliminated.

In Fig. 9 we show the same filter circuit but we have combined sections 1 and 2, thereby making them a concentric common-negative and section 3 is a separate unit. In other words, by simply rearranging the connections we can change from the common-positive, plus one separate section arrangement of Fig. 7 to the common-negative, plus one separate section arrangement of Fig. 9—and it is always preferable to use a common-negative unit if this can be accomplished without unwarranted increase in cost of the complete radio receiver.

Conclusion

It will be obvious to the reader that, although we have only covered in this article concentric combinations with respect to their application to filter systems, similar concentric combinations can also be applied generally to the bypass circuits of radio receivers. There are many points in the receiver, for example, where two 5 or 10 mf. low voltage sections (25 or 50 volts) can be wound concentrically and used to bypass certain audio circuits. Almost invariably, where low voltage bypass condensers are wound concentrically, they are of the common-negative type; it is seldom that such condensers are wound with common-positives.

The preceding discussion will serve to indicate some of the fundamental factors underlying the design and use of concentrically wound electrolytic condensers of various types. It has, of course, been impossible to cover all phases of the subject, but the essential point will, we hope, be apparent from the foregoing. There is no question but that the general use of concentrically wound units in radio receivers of today has somewhat complicated the problem of design and servicing in the sense that reasonable care must be exercised to make certain that all factors have been considered.—*Aerovox Corporation.*

(Readers familiar with the design of standard broadcast receivers will recall the time when all electrolytics were of the wet type. They were bulky, had to be handled carefully, and, in general, were a nuisance. The clean-cut units now available are a pleasure to use—once installed, you can forget about them. It will be interesting to watch the development of the electrolytic condenser art.—*Tech. Dir.*)

Making the Super Work

SUMMARY: *Mounting the parts and putting in the wires constitute but a small part of the job of making a superheterodyne work. Time and time again we have had requests from constructors who want more information on getting the super to work properly. We are fortunate, indeed, to be able to present this highly practical article by Mr. Kruse on this subject. "Making the Super Work" should answer a lot of questions about this type of receiver that have puzzled the experimenter.*

By Robert S. Kruse*

SUPERHETERODYNE troubles are much more easily found if we begin by putting the oscillator and first detector out of business as far as frequency-conversion goes. We then have left a tuned r.f. receiver, a comparatively simple thing to adjust. (Fig. 1.) Usually, it is not too good an idea to take the oscillator tube out of its socket. Instead, short circuit one of the oscillator coils by means of a .1 mf. condenser, perhaps by connecting the condenser from rotor to stator of that section of the tuning condenser which controlls the oscillator frequency. The oscillator will stop—no two ways about that.

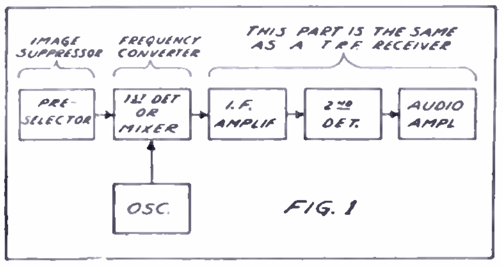
The Test Oscillator

Now we need a signal to work with. It cannot be an ordinary short- or medium-wave signal, but must be an intermediate-frequency signal. Depending upon the set, that may mean almost anything from 175 kc. to 1575 kc.; but, fortunately, we need not cover the whole range so suggested. It suffices if we cover a small strip including the frequency of our i.f. system. Manufactured oscillators take care of all i.f.'s, either by a switching arrangement or by using an oscillator around 175 to 525 kc. and letting its harmonics cover the rest.

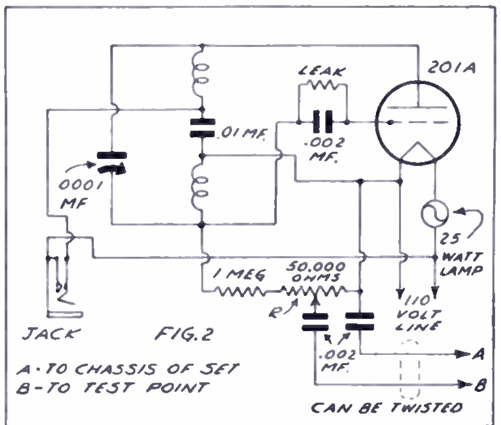
A home-made oscillator can use the circuit of Fig. 2 or that of Fig. 3. In both cases the coils are simply another i.f. transformer like that used in the set, and the tuning condensers, have a capacity of about .0001 mf. of the midget type. The Fig. 2 circuit will carry a heavy growl if used on a.c. Either Fig. 2 or Fig. 3 can be made to have a high-pitched audio squeal by trying a number of grid-leak values. Depending upon the tube and the coils, the right leak may lie almost anywhere between 1 megohm and 10,000 ohms—try a fistful. The presence of the squeal may be determined easily enough by tying the oscillator to the input grid of the 2nd detector as in Fig 4—unless that detector or the following audio system is altogether dead. Try it on another set to make sure. Having attained a squeal that does not die out anywhere in the tuning range, we are ready to start.

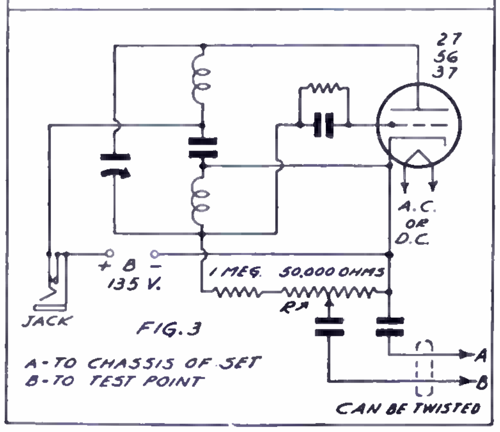
Adjustment

Tie the squealing oscillator to the 2nd detector grid and make sure that something comes out of the headset or speaker. Turn R up and and down to see if the volume changes as it should. In sets having automatic volume control, we usually find that the *hand* volume control works on the audio system. Try turning it up and down to see if it works normally. Naturally, the oscillator input must not be so great as to choke the set to death. Before moving from this part of the set, make sure that the detector and audio system seem to be working well.



Block diagram of a typical super showing how the parts are interconnected.





Schematic circuits of two types of oscillators suitable for lining up the i.f.'s.

Now we can proceed to the i.f. amplifier, which is simply an r.f. amplifier that is tuned to one wavelength and left there. Several things can be wrong here:

A—Mistuning of the i.f. transformers.

B—A tube or circuit defect making amplification low or absent.

C—Instability in the amplifier proper.

D—Instability or bad action in special devices.

E—Unsatisfactory action of automatic volume control.

On point A we are somewhat up a tree unless the oscillator is a commercial one with a calibration. If it is home-made and has been calibrated, you probably need none of the advice given in this paper.

Unless a reliably calibrated oscillator is being used, be *very* reluctant to change the i.f. tuning adjustments—there being no surer way to ruin the tracking of the tuning, thereby *assuring* bad reception. If you feel that you must check up on this point, use a screwdriver that fits the condenser-screws well, watch exactly where the screw stands at the start and then *count* any turns you make so that you can get back to the same place. Use a weak input from the oscillator and don't depend on your ear—connect across the output of the set a simple home-made output meter like that shown in Fig. 5, R having any value needed to get the thing to stay on the scale of the meter.

Using the Oscillator

Run the oscillator tuning back and forth, making sure that you are actually in tune with the i.f. (In the case of a calibrated i.f. oscillator you are *dead sure* of, set it at the proper i.f.—being sure you first know what that should be for the particular set.) Now, test one adjustment at a time. If a metal screwdriver is being used, the setting will almost certainly be made wrong because of the extra capacity which the driver adds—and which leaves when the screwdriver leaves. Use a bakelite one, or a bakelite one with an extremely short metal

*Consulting Engineer.

edge—not over ¼". A ¼" bakelite rod and a coarse file will do the job.

In running through the i.f. transformers in this way, we have encountered a queer effect—the set may seem to go through a performance like that of Fig. 6. This is because the automatic volume control has "taken hold." Either use a weaker signal or put the a.v.c. out of commission temporarily. This can be done in some systems by removing the separate a.v.c. tube or its grid-cap clip—whatever makes the least change in a very *weak* signal. In some systems, you may need to put a *capacity* short circuit (.1 mf. non-inductive) across the input of the a.v.c. tube. When the set uses some of the recent mongrel tubes where parts of 2 or 3 tubes are huddled together in one bottle, it is more of a puzzle, but a little guessing and testing with the .1 mf. condenser will locate a place where the a.v.c. can be put out of order without danger. This permits the trimming to be completed. Then watch the output meter while running the oscillator gain-control up and down, now take the muzzle off of the a.v.c. system and go through the same performance. If all is well, the output should follow the input up a little ways and then "flatten off." If the set is very sensitive, the original rise may be hard or impossible to find, though it could be located with a shielded oscillator whose leakage was so low that we really could get a very weak signal from it.

Instability

If the i.f. amplifier is unstable with the oscillator stopped, it *may* become stable when the oscillator is started—try it. If not, look for a neutralizing device—oh yes, some fairly recent supers have them in the i.f. system. The adjustment of such a device is so old that nothing needs to be said. In addition to that, look for open bypass condensers—bridge each temporarily with your standby .1 mf. unit and, with a high-resistance voltmeter, check the voltages about the set to see if there is anything suspicious here. If everything else fails—throw one of the i.f. transformers a trifle out of tune.

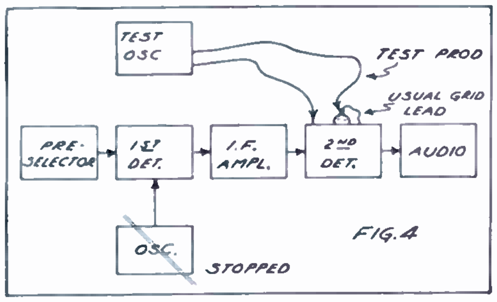
Special Attachments

If the a.v.c. does not work well, do not be too much concerned until later tests show that it is bad on received signals also. Your present bad results may be due to the fact that we are detouring the front end of the set and using a large signal. If actual reception later shows bad a.v.c., or if reception in the manner of Fig. 7 shows such an effect, it is time to look for bad tubes or resistors. Recollect that the currents in an a.v.c. system are very small and the resistances high. Meters will tell you little; try replacing tubes and resistors instead.

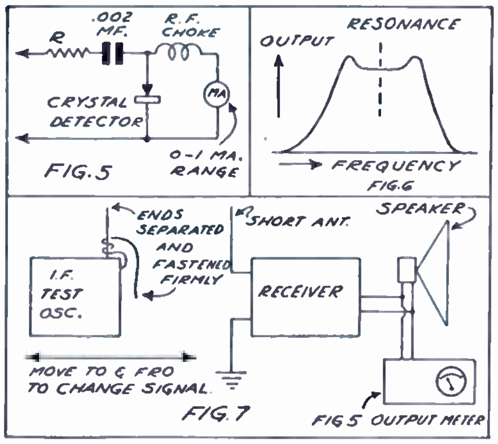
If the "super" is of a type intended for amateur-band work, it may have some attachment for making the i.f. very sharp, for the sake of pulling one c.w. signal or a slice of one voice signal out of the tangle. These devices are of two sorts: (A) ways of making the i.f. amplifier regenerative to a degree which sharpens it up without making it oscillate. (B) Robinson "stenode" filters, based on the use of a Cady quartz crystal resonator as a tuned circuit.

Device "A" may fail to work because of low voltage, and tubes or other things which would cause an ordinary regenerative device to fail. If we keep right on regarding the set as a t.r.f. device and use the i.f. oscillator, the cause can be run down.

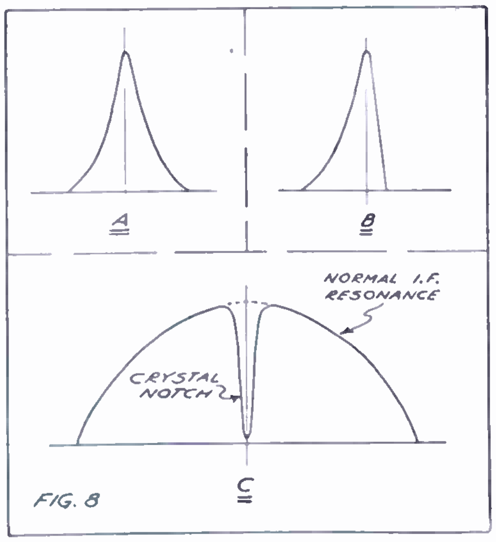
Device "B" can mis-fire for a variety of causes. First, one should be certain that it actually *is* misfiring. Crystal tuning is quite sharp, and if the i.f. system has been tinkered with, or has drifted, the crystal tune may be missed—or one may miss it through not realizing how closely one must tune. Also, remember that there are *two* ways of connecting the crystal; make sure which is being used. In the arrangement usually used by Robinson, the crystal acts as a sort of series bandpass filter and lets a narrow band *through*, somewhat as in Fig 8A. In this arrangement the crystal is used as a small condenser in a Wheatstone bridge circuit which balances out the signals *except* at crystal-resonance. There, the crystal stops being a condenser and becomes a series-tuned circuit—so that signals fall through it into the next tube. The crystal tuning being extremely sharp, the band passed is very narrow.



Using the oscillator—with the set oscillator disconnected—to test the audio.



An output meter, a typical response curve, and details of using the oscillator.



What the crystal does in the i.f. circuit.

Furthermore, Robinson observed that by mis-adjusting the bridge a trifle, the action became lop-sided (assymetrical if you wish to be high-hat), so as to give somewhat the effect of Fig. 8B. Mr. Ralph Batcher has shown the mathematical justification for this in *electronics*. Its usefulness is that in voice reception one can virtually knock out one sideband, and an interference beatnote on that side. Somewhat similarily, in c.w. reception, where a second oscillator is used to beat with the intermediate-frequency signal at the 2nd detector, it is possible to eliminate or greatly reduce the beat note of a signal after tuning through zero beat—so that each station turns up once instead of twice as with a normal oscillating-detector receiver.

The Crystal in Parallel

Finally, if the crystal be connected across the i.f. system in the manner described by the W. S. Barden patent 376, 175, we get still another effect, somewhat as in Fig. 8C. The crystal acts as a very high impedance except at resonance, where its effect is to short-circuit the system as shown by the "notch" in 8C. This notch can be used, if desired, to take out a carrier without damage to the sidebands—nearly. The possibility of destroying beat notes is apparent.

This rather complex picture shows why a Cady-Robinson crystal-filter should not be too soon condemned. If it is not working, one may start by removing the crystal and examining it carefully, and cleaning with carbon-tetrachloride (pyrene or carbona) or some other grease solvent. If marks of mechancal injury are found, take the matter up with the crystal grinder. The trimmers associated with the crystal in its bridge circuit probably need no adjustment.

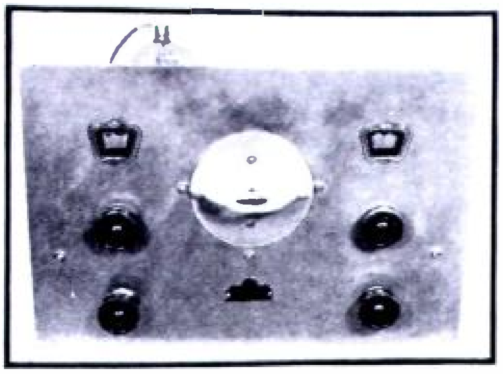
The Translator

Having gotten through with the i.f. system, we can abandon the t.r.f. idea and go back to a superheterodyne. Unmuzzle the oscillator and

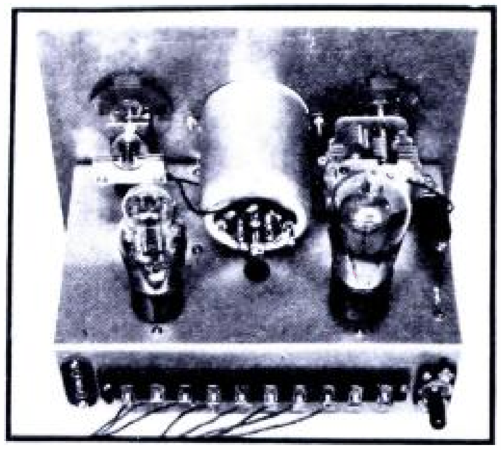
(*Continued on page* 39)

The Mascot 2

a 2-tube receiver of unique design



Panel view of the Mascot showing how the coils plug in through the panel of the set.



Rear view illustrating how the coil shield mounts. Note the socket at its base.

NOVELTY itself is not sufficient to warrant the announcement of a new receiver, but when the novelty results in better performance at lower cost, then it *is* something to talk about. Consider the two-tube receiver described here: it uses but two tubes in a regenerative-amplifier combination; one of the tubes, though, is a two-stage audio amplifier that is perfectly stable in every respect. Its connection should not be confused with the "trick" circuits that sometimes work and sometimes don't.

This receiver has several features not usually found in simple sets. The coil plugs into a shield can from the front of the panel. A socket mounted on the bottom of the can (which is mounted horizontally) facilitates connection to the coil prongs. This arrangement, together with the use of a zinc alloy panel and chassis, minimizes hand capacity effects and enhances the appearance of the set. Furthermore, the complete shielding afforded by this mode of construction makes for stability and consistency of operation. The coils plug in from the front of the panel by means of a commercial type ring holder.

Band spreading is also a feature of the set. The band-spread condenser is the .00005 mf. variable affair, mounted on the right-hand side of the front panel. In using the band-spread feature, set the large tuning condenser to approximately the setting desired, and then do the tuning with the small condenser. Stations that would otherwise be hopelessly crowded are separated with comparative ease.

As may be noted from the diagram, a new circuit for regenerative control is incorporated in this set. A non-inductive resistor and a fixed capacity are employed. This combination makes the control of regeneration smooth and reduces the sputtering and erratic control often experienced when the regeneration control is carrying current.

Note, also, that a resistance-capacity filter is used in lieu of the more conventional choke-condenser arrangement. This has the one advantage of uniform choking action over the entire band, something that cannot quite be attained by the use of chokes.

The output of the 32, which is the screen-grid detector, is resistance coupled into one of the triode portions of the 19, a double-triode tube intended for class B operation. It is interesting to note that each of the triodes may be operated as a class A amplifier by itself, exactly as any other triode. The output of the first triode is again resistance-coupled into the second triode of the same tube. Thus, this single tube acts as a two-stage audio amplifier. Its operation is stable in every respect, so that the constructor need not worry about changing this and that after the set is once wired and ready for operation.

A filament rheostat on the panel enables the set to be operated from either an Air Cell or two No. 6 dry cells in series. In either case, the rheostat is adjusted for a voltage of 2 on the filament of the tubes. With the Air Cell, further readjustment of the rheostat is unnecessary; with 3-volt dry batteries, readjustment is necessary as the batteries die out.

The coil data are given in the table herewith. They are wound on standard 1½" forms, and are space wound according to the data supplied by the table.

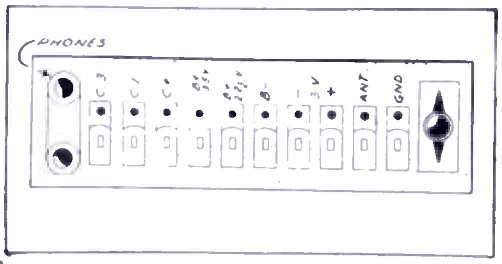
Looking at the deck of the set

(*Continued on page 46*)

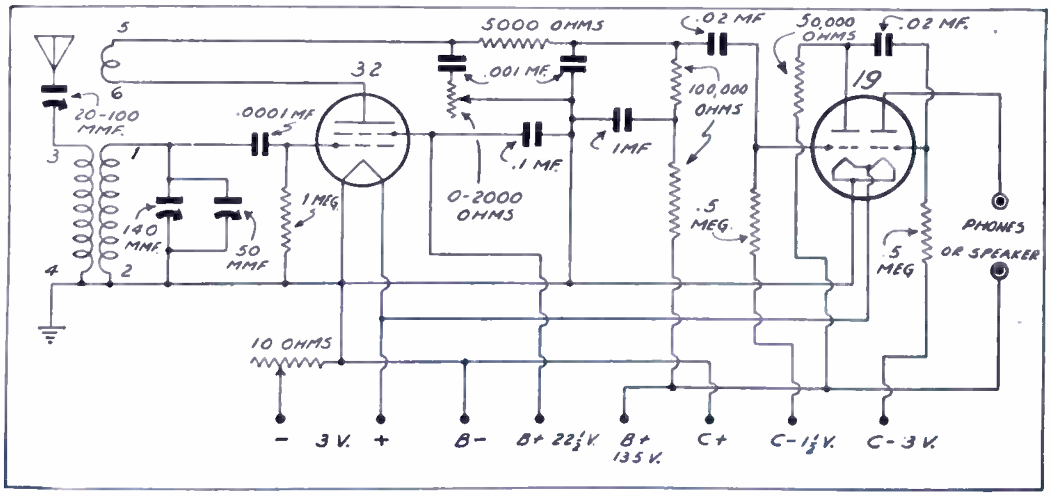
TABLE OF WINDING INFORMATION*

Wave Band (meters)	*Secondary* *No. Turns*	*Secondary* *Length*	*Primary* *No. Turns*	*Primary* *Length*	*Interwound No. Turns*
16–38	7½	1"	9	Close Wound	4¾
35–75	18	1¼"	12	Close Wound	7¾
73–137	28½	1"	13	Close Wound	11¾
135–200	49	1½"	16	Close Wound	16

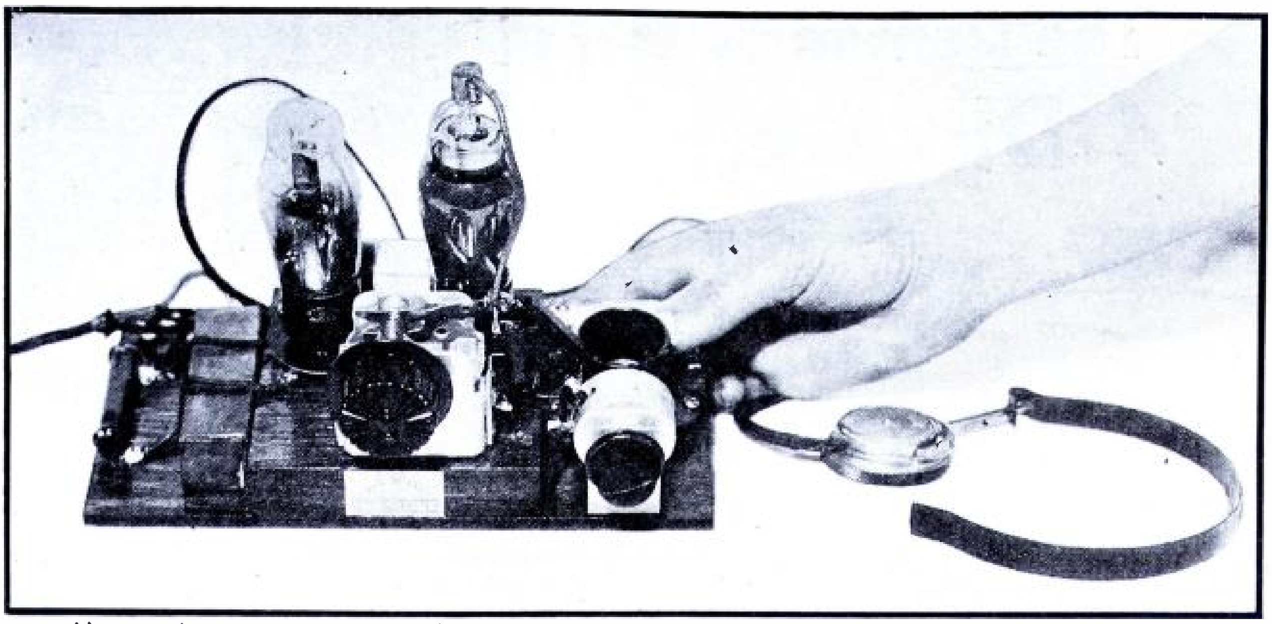
*Form is 1½" in diameter. All wire No. 26 enam.



Above: the arrangement of the binding post strip at the rear of the set. The knob to the extreme right is for the antenna trimmer condenser.



Right: schematic circuit of the receiver. The unique connection of the type 19 tube is shown. See the text for details.



Here is the Air Scout completely wired. Its size may be estimated by comparison with the hand.

The A. C.—D. C. Air Scout Set

By Harold Mitchell*

THE Air Scout is a low-priced all electric set which covers all the bands from 10 to 550 meters. It accomplishes this by means of small plug-in coils, five coils in all being used. The broadcast coil is plugged into the coil socket, permitting one to listen to all the regular broadcast stations. It takes but an instant to remove it and replace it with other coils, covering the short-wave bands.

The Air Scout circuit is characterized by extreme simplicity. The "heart" of the circuit is the new 6C6 pentode tube. The antenna is connected to the control grid, with an antenna trimmer interposed in series to prevent broad tuning and to provide for the use of different length aerials. The longer winding of the plug-in coil is tuned by a .00015 mf. variable condenser; the smaller winding is connected in the plate circuit of the 6C6, serving as a tickler and providing the exact degree of regeneration required to make the set sensitive and selective.

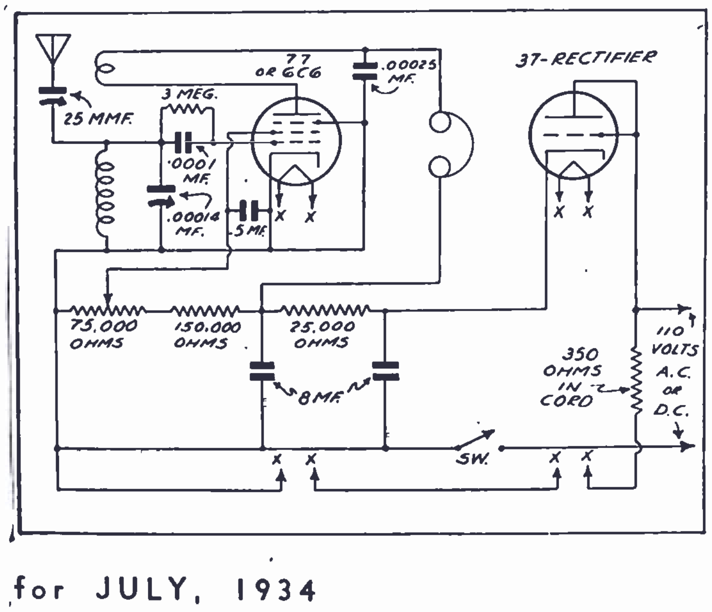
Grid-leak, grid-condenser detection is employed. While this is quite conventional, it is used because it is the best possible for this particular arrangement of components. Regeneration is controlled by varying the screen voltage, using a 75,000 ohm potentiometer, which in this set is combined with the "on-off" switch. The control is smooth and easy to handle.

*Allied Engineering Inst.

The rectifier is a 37 tube, with plate and grid connected together. The filaments of both tubes are connected in series, the line voltage being reduced to the proper value by means of a limiting resistor in series with the filaments. This resistor is contained within the line cord, thus saving space and dissipating the heat far away from the electrolytic condensers and other parts of the receiver. The filtering of this circuit is very good, and little or no hum can be heard.

The set requires no ground, and, for local reception, a short wire thrown on the floor will serve as an aerial. A glance at the illustration will reveal the utter simplicity of the entire receiver.

The conventional metal chassis is not used. Instead, the Air Scout employs a wood base, surmounted by a wood pedestal. The base is made of three-ply veneer which will not warp, and both base and pedestal are stained walnut to bring out the natural grain if the wood, and then finished with a shiny shellac coating. An attractive modernistic effect is thus attained, and the result is that the Air Scout actually looks like a radio set, instead of like a cigar box. Incidentally, this type of construction has many advantages. It eliminates the expense of a cabinet and also permits the coils to be changed quickly without fuss or trouble. The wood base prevents short circuits, a common trouble where metal chassis construction is employed.



Schematic circuit of the a.c.-d.c. Air Scout receiver. The universal power circuit is used; that is, the set may be operated from either a.c. or d.c. without any circuit changes. Plug-in coils are used. It is possible, of course, to use additional coils and tune into the broadcast band. The antenna trimmer, of 25 mmf., is adjusted once and then left alone.

Easy to Operate

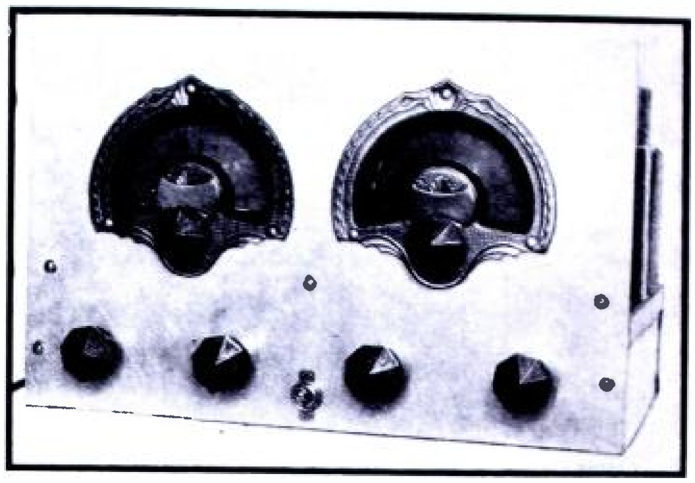
This all electric set is very easy to operate. The first step is to place the tubes in the sockets in the positions shown in the photograph. The screen-grid clip is placed on the cap of the 6C6 tube. One of the plug-in coils is then laced in the coil socket. In making initial tests, it is preferable to start with the broadcast coil.

The aerial is connected to the antenna clip provided for it; a ground should never be used with this set. The earphone, or as many earphones as are desired, is connected and the line cord is then plugged into any house-lighting circuit. Since the line cord contains the voltage limiting resistor, it will get quite warm while the set is in use. This heating is normal and should be disregarded. The set is switched on by turning the knob at the right. It is necessary to wait about 30 seconds for the tubes to warm up. The set should then bring in stations when the station selector at the center is turned. If the set is used on direct current, it may be necessary to reverse the plug before the set will operate. On direct current, the Air Scout will operate with the plug inserted one way only. It is not necessary to reverse the plug when the set is used on alternating current, unless a hum is noticeable. In this case, it will perform better with the plug reversed.

(*Continued on page* 46)

The Denton 1934 Discoverer

SUMMARY: *Short-wave receivers designed by Denton have been built by the thousand and have given more than satisfactory service. For this reason we are pleased to present this article describing his latest superheterodyne. The panel view is shown to the right.*



By Clifford E. Denton*

ALTHOUGH there are many short-wave receivers on the market which are sold wired and in kit form, very few are as complete in operating detail as the receiver described in this article. The "1934 Discoverer" is a short-wave superheterodyne designed for hams and for real short-wave DX fans. One of the main features of this receiver is the adjustable band-spread tuning condensers with separate dials, which are in the circuit at all times. A study of the photographs shows the two main tuning sections, the tuning dial on the right being used for conventional tuning and the dial on the left providing the band-spread feature. The small trimmers which, it will be noted, are mounted on top of the tuning condensers, serve to balance the band spread circuit for tracking purposes, and they work exceptionally well.

One of the most interesting points in regard to this band-spread feature is that the band-spread tuning can be obtained over any or all parts of the entire wavelength range, which is governed by the coils available.

The tubes used in the "Discoverer" have proven their worth in short-wave receiver operation. The modulator tube is of the 2A7 type and combines the functions of detector and oscillator in the one tube. The intermediate-frequency amplifier consists of four tuned circuits with a 58 i.f. amplifier tube. The second detector is a 57 working at a high gain with a 56 first audio feeding the 2A5 power tube. A type 80 rectifier tube supplies the necessary B current and completes the tube requirements.

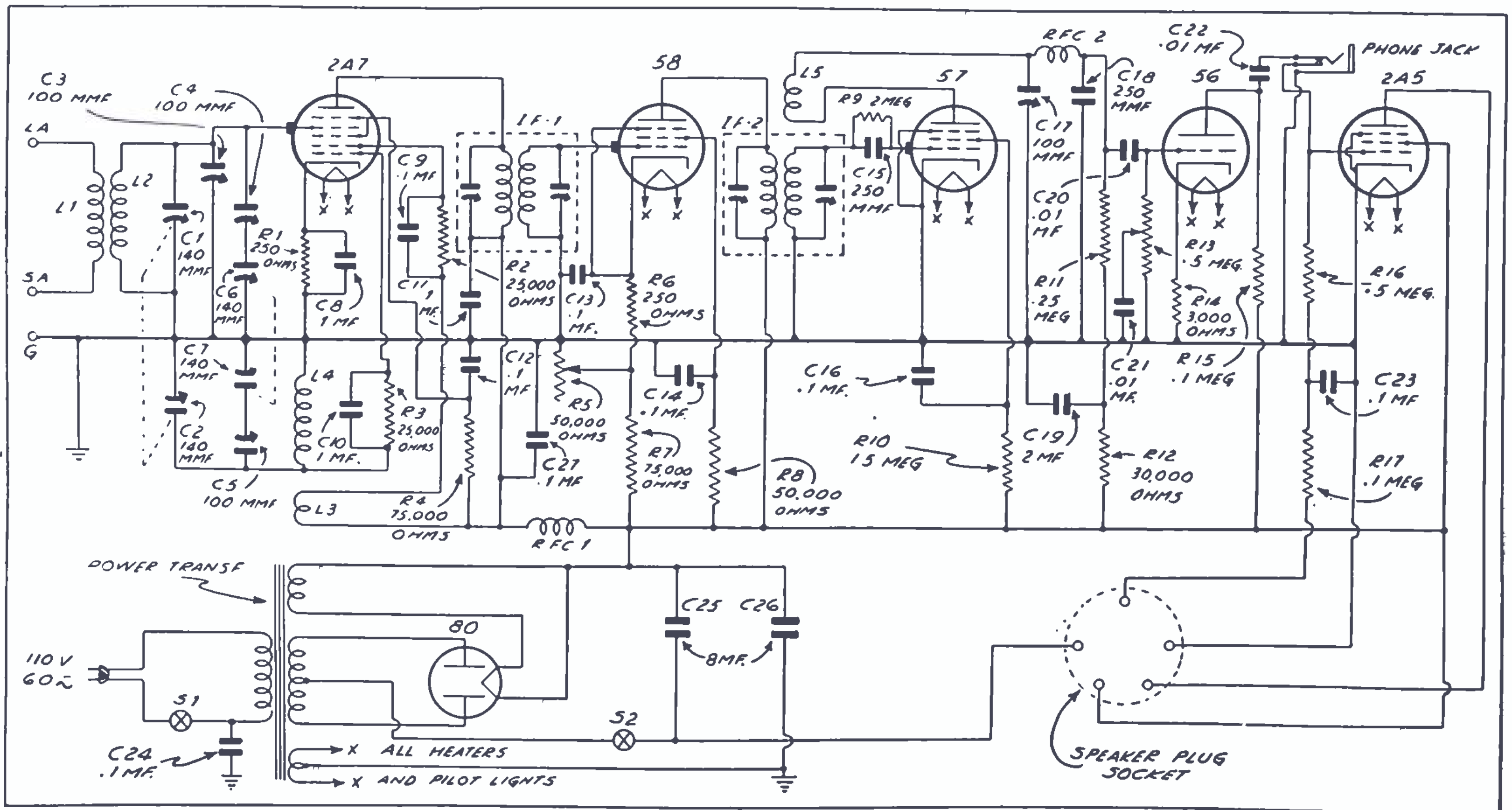
Another interesting feature of this receiver is the regeneration control for c.w. reception, which is incorporated in the second-detector circuit. Here, an additional small winding is placed on the grid end of the second i.f. transformer in such a manner that coupling can be obtained from the plate circuit of the 57 type tube back to the grid. A condenser is used for regeneration control and has no noticeable effect on the tuning of the second i.f. transformer.

The effect of this regeneration control here is unusual: it gives a single signal tuning effect without a crystal, besides increasing the total amplification available from the radio frequency portion of the receiver to a great extent. The antenna input circuit is so laid out that it will permit the use of standard antennas or the more popular doublet antennas in use today. A tone control is also included so that the background noise can be reduced by cutting off the higher audio-frequencies from the receiver. This is very satisfactory, especially in noisy locations, as it makes it possible to enjoy a program even though the noise level may be rather high.

A jack is provided for earphone operation. This is placed in the grid circuit of the 2A5 tube and provides sufficient audio-frequency amplification so that the earphones can be used if desired.

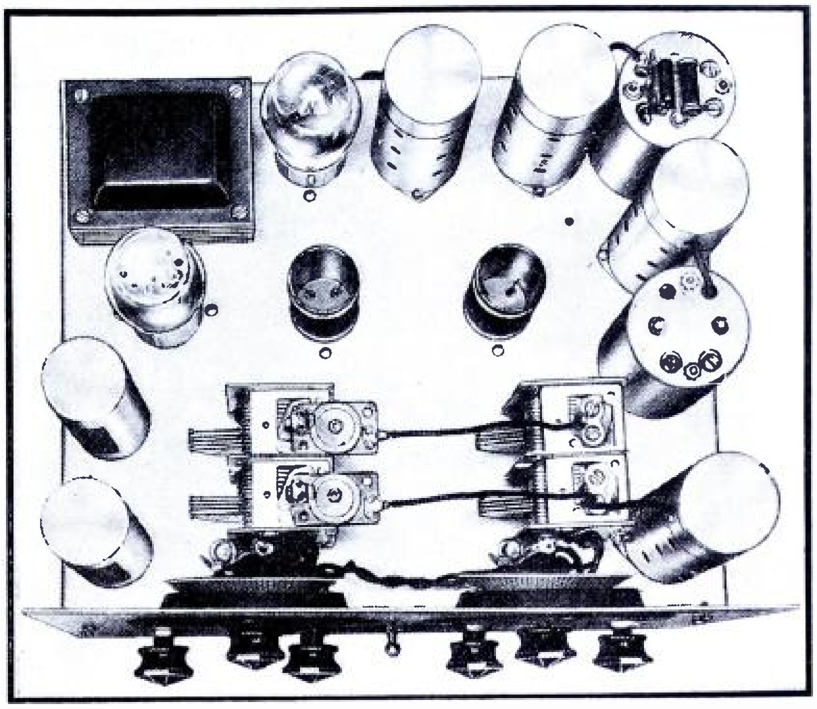
One of the features, while primarily designed for the short-wave

* Chief Engineer, Federated Purchaser, Inc.



Schematic circuit with all values marked on the diagram for reference. The photographs show the location of the parts.

transmitting amateur, is very satisfactory for the short wave listener. This is the on-off switch for killing the B supply. The purpose of this switch, as far as the transmitting ham is concerned, is to kill the receiver while he is transmitting. However, the short-wave listener will find this switch a very excellent feature, as it permits the set to be turned off without changing volume contról setting, tone control setting, etc., when he desires to leave the set for a few minutes. The simple act of closing the switch completes the "B" supply circuit and, as the tubes are heating all the time, he will have immediate reception whenever desired. Of course, there is a main power switch. on the manual tone control, which connects or disconnects the set from the power line.

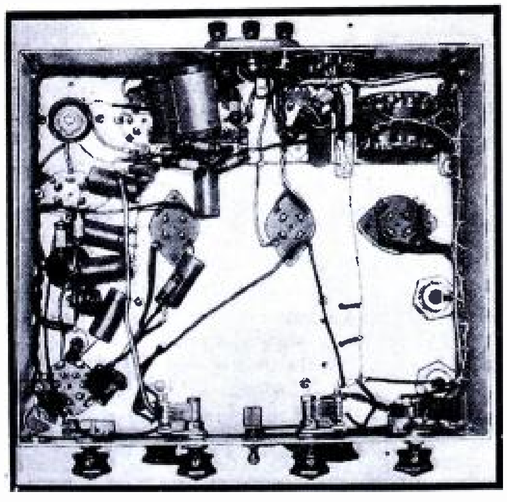


Top view of the deck showing the location of the major parts. The two-gang band-spread condenser is on the left, and the tank condenser on the right. Note the two trimmers, C4 and C5, mounted atop the band-spread condensers. The grid leak and grid condenser for the second detector are mounted on the i.f. transformer in the extreme rear right-hand corner of the chassis. The power transformer is in the rear left-hand corner.

The Circuit Diagram

The study of the circuit diagram shows the inductively coupled antenna coil, LI-L2, which is of the plug-in type. with its associated condensers, C1, C2, and the trimming condenser C3 in the grid of the pentode portion of the 2A7. Condensers C4-C5 and C6-C7 are in the band spreading tuning section and consist of the two gang .00014 mf. condenser, C6-C7, and the two 100 mmf. semi-variable condensers, C4-C5, used as trimmers. The combination modulator-oscillator circuit of the 2A7 is conventional in every respect, except that the plate-voltage dropping resistor R2, with its associated bypass condenser C9, is directly in the screen, and serves as the plate for the triode portion of the tube, which is used as the oscillator section of the 2A7. The volume control is incorporated in the cathode section of the 58 type tube with resistor R7 furnishing additional bleeder current, resulting in smoother control of volume.

In the second-detector circuit there is the additional choke or feedback coil, which is mounted, as shown in the diagram, near the grid coil of the second i.f. transformer, the regeneration being controlled by the 100 mmf. condenser C17. Grid leak and condenser rectification is used in this second detector, with a greater sensitivity and smoother regeneration control than could be obtained if the tube were used in a bias detector circuit arrangement. Resistance coupling is used in the plate circuit of the detector, with a resistance capacity filter, C19 and R12, which reduces the possibilities of motor-boating or any additional hum effects being generated in this circuit. The tone control consists of condenser C21 and resistor R13, a potentiometer. This resistor also serves as the grid loading resistor in the input of the 56, first audio stage.



Under-view of the chassis showing the location of the small parts used.

Earphones Can Be Used

Passing along, we find the jack, which is used for earphone operation. Because of its placement in the circuit, there is no danger of shock, as coupling capacity C22 effectively blocks any D.C. plate voltage from reaching the jack. The 2A5 tube looks into the primary of the speaker voice coil transformer. The speaker plugs into the receiver by means of a five-prong plug, and the speaker field is used in the filter circuit instead of a choke. A resistance-capacity filter is also used in the grid circuit of the 2A5, which reduces the degenerative effects obtained from single-ended output amplifiers, and consists of condenser C23 and resistor R17. The power supply unit is very conventional, and should not require any further description.

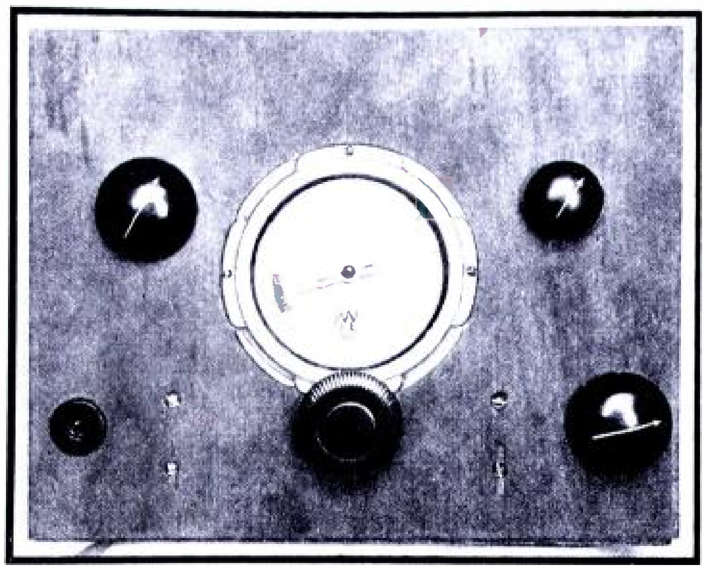
A study of the photographs showing the top and bottom views will enable anyone to assemble the various components properly in a very short time. As each part is placed on the chassis, make sure that it is solidly in place, so that there will be no play, or movement, of the part at any time. If parts are placed on a steel chassis of this type improperly, and if the parts are made of metal, you will find that noises will develop when working the receiver at very high volume levels.

Most of the resistors and small tubular condensers are held in position by the wiring, as indicated in the photograph showing the underneath view of the chassis. Improper placement of these bypass and coupling condensers will result, in many instances, in unsatisfactory operation, and the photographs should be studied very carefully at the time of assembly. It would be wise to place all of the tube sockets, the intermediate frequency transformers, the electrolytic condensers and the power transformer on the chassis first. Then place the phone jack, speaker cable, plug, and the antenna-ground strip on the rear of the chassis. When assembling the units to the chassis, do not fail to bring out the grid lead, which is the yellow wire, from the top of the intermediate-frequency transformer can. It is necessary to bring this lead up in the second detector circuit so that the grid condenser, C15, and the grid resistor, R9, may be mounted on top of the transformer, making the lead to the grid of the 57 about an inch and a quarter long, at the most.

Chassis Assembly

Examination of the chassis will show that the front panel is a separate unit and has considerable equipment mounted on it. All of this equipment can be assembled before the front panel is put into place on the chassis, and it will be wise to fasten the two dial escutcheon plates to this front panel along with the 100 mmf. condensers, one of which is the antenna compensating condenser and the other the second detector regeneration condenser. The single-pole single-throw toggle switch mounted in the center is used in the B negative line as an on-off switch for the B supply. The tone control goes on the left hand side of the front panel, and is

(*Continued on page* 44)



The Double Duplex

SUMMARY: *The "Double Duplex" is a two-tube, battery-operated receiver that gives four-tube performance. This four-tube performance is obtained by virtue of the fact that each of the two tubes in use is really two tubes in one; thus, the two tubes are the equivalent of four tubes.*

The circuit is not in the least "tricky." The connections to each of the tubes are perfectly standard in every respect, and no trouble should be experienced in making the set work. It consists, essentially, of a tuned r.f. amplifier, regenerative detector, and two-stage audio amplifier. The tuned r.f. stage results in excellent selectivity and good signal strength.

By Louis Martin

TRICK circuits almost always result in trickier operation, and it is even doubtful whether some of the trick receivers give any better results that the straightforward circuits of standard design. The "Double Duplex" is not a trick receiver; it is merely an adaptation of two standard circuits to two of the new tubes now available. There are at least two receivers now in general use which employ part of the circuit used in the "Double Duplex"; the writer merely took the outstanding features of each of these receivers and combined them into a single set.

The name "Double Duplex" is derived from the fact that the set uses but two tubes, and each of the tubes—a 6F7 and a 79—is really two tubes in one. Thus, it is possible to secure perfectly stable four-tube operation from two tubes. The writer does not like to state that this is the best two-tube set that can be built, for the simple and obvious reason that he has not heard all the two-tube sets now in use. Suffice it to say, however, that it is the best two-tuber that he has had the pleasure of tuning.

Let us start the description of this set by first talking about the circuit, then the precautions to be taken in making it work properly, and, finally, about the construction. By following this precedure, you will have all the facts in mind before actual construction is started.

The Circuit

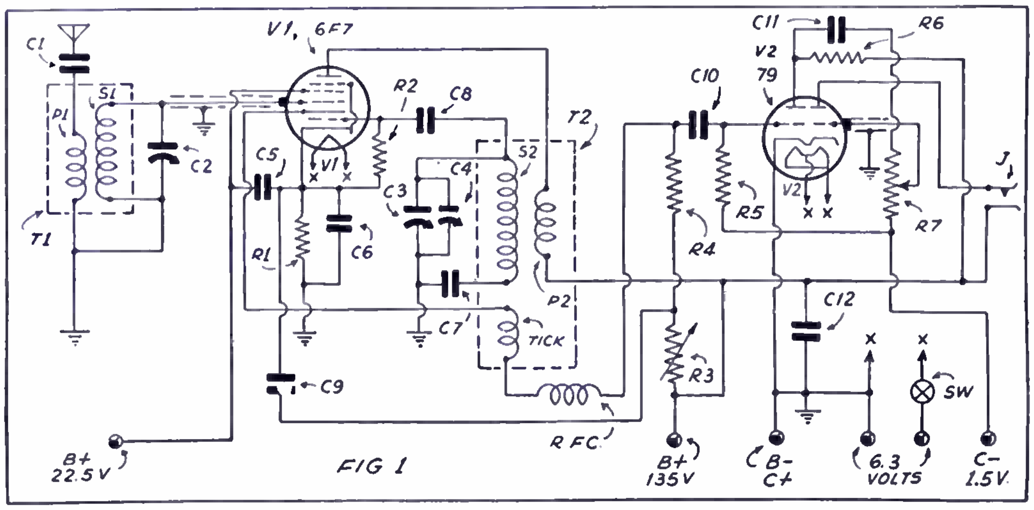
Figure 1 is the schematic circuit of the set. It consists, essentially, of a 6F7 used as a tuned r.f. amplifier and regenerative detector, and a 79 used as a two-stage audio amplifier. The r.f. amplifier, being tuned, minimizes interference on the crowded broadcast channels. The regenerative detector permits the reception of c.w. (telegraph signals) and increases the overall sensitivity of the set. The two-stage audio amplifier permits the use of a loudspeaker on the majority of stations, although it is best to tune the set using phones and switch to the speaker later.

The 6F7 tube is a combination pentode and triode in a single tube. The triode portion is separate from the pentode section except for the common cathode; therefore, the tube may be thought of as two separate and distinct tubes in one.

The 79, on the other hand, consists of two triodes in one envelope. These triodes are also separate and distinct except for the common cathode; hence, this tube, too, may be considered as two tubes in one. It is clear that by the simple process of combining both tubes in one set, a four-tube receiver of novel yet perfectly simple design results.

The antenna and ground connect through a fixed condenser C1, of .0001 mf., to the antenna primary P1 of transformer T1. The secondary of this transformer is tuned by C2, of .00014 mf.; this circuit then feeds into the pentode section of the 6F7. The plate of the pentode section then connects to the conventional primary of r.f. transformer T2. The secondary S2 of this transformer is tuned by C3 through a .01 mf. condenser C7. This circuit feeds the triode portion, the plate circuit of which is regenerated by the tickler. This completes the r.f. and detector parts.

The tickler, through the r.f. choke R.F.C., connects to the coupling resistor R4, and thence to one triode grid of the 79. Note here that the Gr (grid right) is the one used in this position. The other may also be used as the first audio stage, but wiring is more convenient when the socket-connection grid is employed as shown. This point will be con-



Schematic circuit and list of parts for the "Double Duplex."

C1—.0001 mf. fixed condenser, mica.
C2, C3—two gang .00014 mf. condenser, Federal Instrument.
C4—.000025 mf. variable midget condenser, 5 plate.
C5, C9, C12—.1 mf. tubular bypass condensers.
C6, C7, C10, C11—.01 mf. mica condensers.
C8—.0001 mf. mica condenser.
R1—300-ohm, 1/2-watt resistor.
R2—1 or 2 megohm grid leak, 1/2 watt.
R3—.1 megohm potentiometer, used as rheostat.
R4—.1 megohm fixed resistor.
R5—.5 megohm resistor, 1 watt.
R6—50,000-ohm fixed resistor, 1 watt.
R7—.5 megohm potentiometer, with switch S.W.
One four-prong socket for T1.
One seven prong socket for the 6F7.
Two six-prong sockets for the 79 and T2.
One phone jack, single circuit.
One plug and cable, male and female (male on set end), six wires.
One Wireless Egert airplane type dial.
One 6F7, Raytheon.
One 79, Raytheon.
Wire solder, etc.
Coils as per specifications, or standard Alden 4- and 6-prong coils.

sidered further later on. The triode plate corresponding to the grid used, Pr., is resistance coupled into the second triode section through the plate resistor R6, the grid resistor (also volume control) R7, and coupling condenser C11. The arm of R7 connects to the second triode grid (cap on tube), and the corresponding plate, Pl, feeds the loudspeaker.

Some Intimate Details

Now for the intimate details. Condensers C2 and C3 are ganged and do the tuning. C2 is the one nearest the panel and C3 the other, as shown in the photograph. Resistor R1 supplies the bias required for the pentode section as an amplifier; C6 merely bypasses it in the usual fashion. The triode in this tube is a regenerative detector, and, therefore, uses a grid leak and grid condenser (R2-C8); the leak must return directly to the cathode, and it does. Here is an important point. C2 and C3 are shown separate; physically, the rotors of both are one unit. If the bottom of secondary S2 were connected right to the rotor, the grid potential would be disturbed; hence the use of the blocking condenser C7.

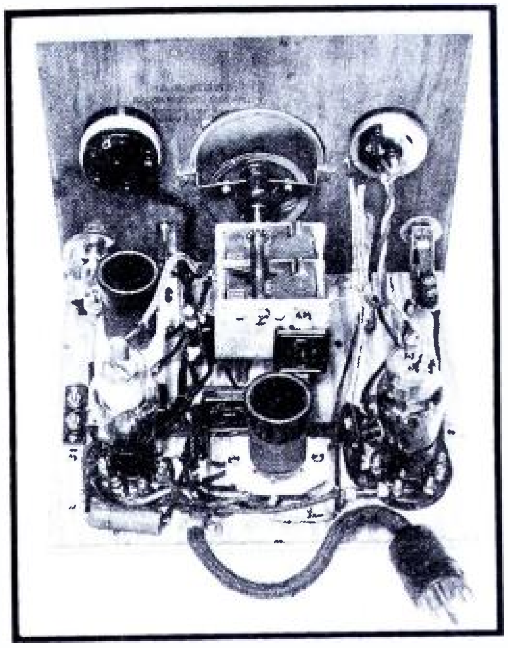
Control of regeneration is effected by rheostat R3. Practically every known method was tried, but the method shown proved the best. Condenser C4 is used as a trimmer across C3. The setting of this is critical, and it affects both the volume and regeneration. The need for this unit becomes clear when it is realized that the grid lead to the pentode section is shielded to avoid feedback and hand capacity effects; the shielding also adds capacity to the tuned circuit. Hence the need for C4. It cannot be fixed, as the amount needed to compensate for the shielding varies with the setting of the main tuning condensers.

No condensers from either side of the choke to B— are required because the set oscillates strongly enough without them. The use of these condensers will be discussed when "precautions" are considered. The remaining part of the circuit is standard in every respect. The only thing to watch is that you do not mix up the grid of one triode with the plate of the other.

Some Precautions

The size of C1 depends upon the length and location of the aerial. The writer used this set with an aerial about 150 feet long, and no trouble was experienced at all—the .0001 mf. used worked very nicely. In general, though, the shorter the aerial, the larger you may make C1. Its value is not critical; in fact, almost any small size used works well. You can tell when you are using the proper size by starting with a small value and increasing it until you use the largest size that allows the receiver to oscillate smoothly over every part of the dial.

Condenser C4 is the next thing to watch. It is merely a 5 plate midget, but it is very sharp. If the first stage is too far out of resonance with the second, the familiar whistle when a station is tuned in cannot be heard; in fact, you cannot tell whether or not the set is oscillating. Don't underestimate the value of this unit simply because it is small.



Rear view showing the location of the coils and tubes.

It may be found during testing that the receiver does not oscillate evenly over the entire scale. This may not be due to any faults in the set itself, but to the manner in which it is wired. With the wires placed in the model shown, no plate condensers were needed; in your receiver, it may be necessary to plate a .0001 mf. fixed condenser from the B plus end of the tickler to the cathode of the 6F7. This connection will increase the intensity of oscillation.

The screen voltage on the 6F7 is next in importance. If it is made too great, the r.f. stage breaks into oscillation, and a station can never be tuned in properly. A voltage of 22½ was found satisfactory: the volume is excellent and the pentode section does not oscillate.

The determination of the proper C bias for the audio amplifier tube yielded some interesting results. Different biases ranging from 0 to 7 volts were tried, but best results were obtained with a bias of close to 1.5 volts. Increasing this bias to 4½ volts made the set completely inoperative. Lowering it to zero volts gave good signals but poor quality. Be sure to use the value stated in the diagram of Fig. 1.

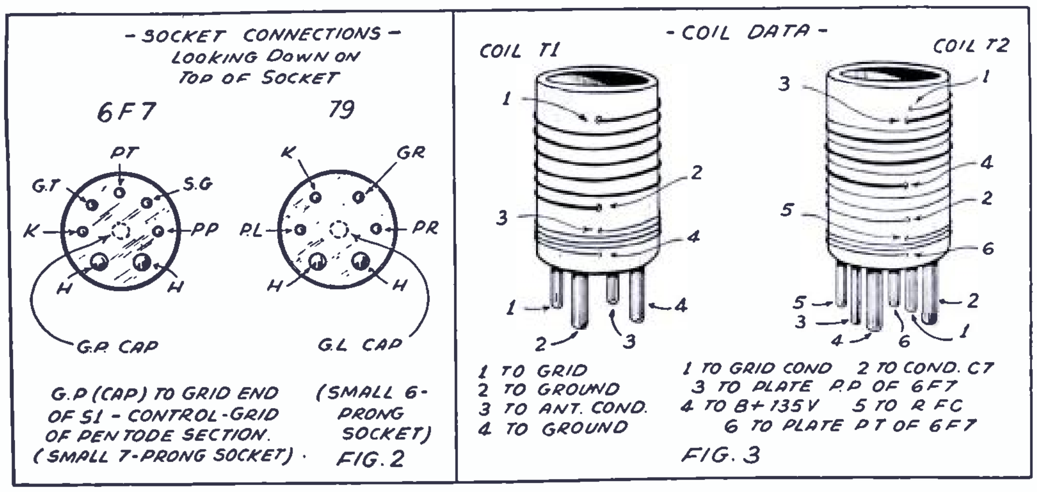
These are the only items that need special attention, as the other components are purely conventional.

TABLE I—COIL DATA

Wavelength Range (meters)	*For Transformer T1*		*For Transformer T2*		
	Primary	*Secondary*	*Primary*	*Secondary*	*Tickler*
10-20	4	4¾	4	4¾	4
20-40	6	10¾	8	10¾	6
40-80	7	22¾	14	22¾	7
80-200	15	52¾	32	52¾	15

T1: the first coil is space wound twice the diameter of the wire, the second coil space wound equal to the wire diameter, and the third and fourth coils are close wound.

T2: same as T1; the primary is interwound with the secondary. All coil forms are 1¼ inches in diameter. No. 26 D.C.C. wire used. Four prong forms for T1; six prong for T2 throughout.



Socket connections and coil data for the receiver. The winding data are in Table I.

Construction

The set was built on a baseboard with a wood panel. This was done in order to cut down the cost of construction to a minimum. Another reason was to facilitate the determination of the values of all the parts so that if an all a.c. operated set

(*Continued on page* 41)

Suggestions for Using the New Tubes

(*Continued from page 27*)

with these tubes is to use the diode as a detector and the output section as the first audio amplifier. Unfortunately, try as we might, we can think of no legitimate use for the two diode plates other than that of detector. The output section, however, may be used as an r.f. or i.f. amplifier in exactly the same manner as any other separate tube. In this case, the output of the detector may be fed directly to a low-powered output tube.

The 19, 53, 79 Twin Amplifier Tubes

These tubes were originally designed for use as a combination of two triodes in one envelope for a complete class B amplifier. The general internal construction of these three tubes is the same, regardless of the fact that the 79 and 53 have a heater, while the 19 has the usual filament.

It is interesting to note that, although these tubes were originally designed for class B operation, each of the triode units may be used separately as a class A amplifier. Thus, just by way of a suggestion, one additional tube such as the 34, 57, or 78 may be employed as an r.f. amplifier which may feed into one triode section of the 19, 53, or 79 connected as a regenerative detector, the output of which may feed into the other triode section of the 19, 53, 79 connected as an audio amplifier. Because the plate impedance of each triode section is relatively low, audio transformers may be employed to advantage. For economical operation, it is recommended that as high a plate voltage as possible be employed—at least 135 on either tube—with the corresponding value of grid bias on the amplifier, about –3 volts. Furthermore, one of the triode units, when as a detector, should be of the grid-leak and grid-condenser type, as the characteristics of each section are not suitable for operation as biased detectors.

Other circuit combinations are quite obvious. One triode section may be used as an i.f. amplifier and the second as a second detector. Then again, one section may be employed as an r.f. amplifier and the other as a detector. A glance at the socket connections in the diagram will show that the only thing that is common between the two sections is the heater or cathode.

A simple two-tube set using the 19 in two separate connections gave results that were easily comparable with any three-tube receiver of more conventional design.

Pentode Tubes

The types 77 and 78, and the 57 and 58 in the 2.5 volt field, lend themselves to a variety of applications which are most interesting. Although the usual application is such that the suppressor grid is connected directly to the cathode or chassis, nevertheless variation of its voltage should be a most interesting means of regeneration control. For instance, a type 77 tube with 180 volts on the plate and 100 volts on the screen, when used with the bias of -5 volts, is able to cause a variation in resistance from 600,000 to several magohms by variation of the suppressor grid voltage.

Making the voltage more negative has an opposite reaction to making the screen- or control-grid more negative. In the latter case, an increase in negative voltage produces an increase in plate resistance, while in the former an increase in negative voltage causes a decrease in plate resistance. Furthermore, the variation is linear with voltage change, so that it is not impossible to use the variation of suppressor-grid voltage for control of volume or regeneration. Furthermore, in view of the fact that the suppressor-grid is interposed between the plate and the screen grid, both of which are at substantially constant potentials, variation of suppressor-grid voltage should not result in an appreciable change in tuning dial settings.

Conclusion

While all of the suggestions given above may be employed singly, there is no reason why they cannot be employed in combination. For instance, a very fine four-tube set without reflexing may be made by using the 6F7 as an r.f. amplifier and regenerative detector, which may be made to feed into a 79 connected as a two-stage amplifier. Here, then, is a four-tube receiver which is not in the least "tricky" and which should be capable of giving four-tube volume. Then, again, the same 6F7 may be used as a two-stage r.f. amplifier and a 79 as a detector and output tube.

Of course, other combinations will suggest themselves to the wide-awake experimenter who is looking for simple circuits that will work without the mystical assistance of a magician's wand.—*L. M.*

* * *

There is only one official short-wave broadcasting station in Poland, according to a letter received by Joseph A. Hopfenberg, 729 Seventh Avenue, New York. This is conducted under the auspices of Marszalka Pilsudski First Cadet Corps in the city of Lvov. The call letters are SP1SI, and the power of the transmitter is ½ kilowatt. Transmissions are made on 47.8 meters during the following hours: weekdays, 8 to 9.30 A.M.; Sundays and holidays 4 to 5.30 A.M., E.S.T.

Making the Super Work

(*Continued from page 31*)

the pre-amplifiers (if any), and use a harmonic of the i.f. oscillator as a signal to work with. Tune it in, align the r.f. tuned circuits with the precautions customary to that job, and somewhat suggested in connection with i.f. alignment, and check back on the a.v.c. action. Probably any direct connection from the oscillator will now give far too much signal. The battery-driven oscillator is best for this job, as it can be carried to and from the set to adjust the input. It should be possible again to make the output meter—and the output noise—climb a little ways and then flatten off. Set the audio gain control at some place which will avoid blowing meters and eardrums.

"Shush"

The perennial curse of superheterodynes is "shush" or "superheterodyne hiss." It seems to have several sources, but one might as well start out by suspecting the first detector—especially in sets so unfortunate as to have no preselector. Other things being equal, there appears to be more of this in sets which concentrate their amplification in the i.f. system—a statement likely to bring the roof down on me, since sets have been designed which used such a combination and gave good performance. Certainly, move number 1 is to get the "shush" down in the first detector by adjusting the oscillator input voltage, which can be done (among other ways) by changing the plate voltage of the oscillator. If the set has several tuning ranges, it would be an accident if this worked out in all of them. It then depends on the oscillator coils and the pickup coils (if any) whether one can get a good combination in all. Our present notion is that the r.f. voltage fed into the detector from the oscillator should be about a volt less than the detector bias—and notice that the detector (so-called) is not biased in the customary detector manner. The data book will show proper values and had better be checked if a set is noisy.

Watch the I.F.

In some sets "shush" seems to start in the i.f. system and can be toned down a great deal by decoupling and bypassing—probably because it was microphonic-regenerative noise in the first place. By "decoupling" we mean placing 2000 ohms or so in the plate supply leads, perhaps 100,000 in the bias-supply leads, and bypassing between the resistors and the tube—or rather on the "tube side" of the resistors. Where a.v.c. is concerned, we must be careful lest this slows down the a.v.c. too much or causes motor-boating.

Then again, "shush" may originate in a tube ahead of the mixer. Variable-mu tubes have reduced this difficulty a good bit. One has not much choice with the older tubes, as the range of operating voltages is such that silence and good gain do not run together. It is worth while to consider grafting a vari-mu tube into the set as a preselector; but not if it previously had a.v.c., as the control-range will suffer.

External Pickup

Maybe it isn't genuine "shush" anyway, but just plain noise from the antenna. In a set with a resistance-coupling at the input, everything from groans to megacycles gets into the first tube, and a lot of it overloads the poor thing. But anyone in 1934 who uses a set without tuned input deserves trouble.

In some of the recent combination-tubes, representing an oscillator electron-coupled to a "mixer"—but all in the same bottle—one may encounter a tendency to mis-fire if the voltage is a little low, especially if the set is attempting to work at a wavelength below 40 meters. Not all makes of these tubes were sufficiently uniform at first either. Better check voltage and trade tubes. Some also become noisy after short use, though quiet at first. Sometimes the noise stops or becomes less if the tube is temporarily turned off. New tube!

New DX Club

Radio set owners interested in long-distance reception should know about the KDKA-W8XK DX Club, which was started last December. Its purpose is to inform DX'ers of news and tips over the air. No formal membership is involved; individual listeners simply send in reports and suggestions which are read over the air through the powerful Westinghouse stations in East Pittsburgh. Joe Stokes has charge of the broadcast band and Edward C. Lips the short-wave bands.

The Club is on the air every Monday morning at 12:30 A.M. over KDKA on 980 kilocycles and W8XK on 6140 kilocycles and sometimes 11870 kilocycles. Suggestions and comments from listeners everywhere are welcome. So far, reports have been received from listeners in Canada, England and New Zealand.

Attention Clubs!

SHORT WAVE RADIO is interested in obtaining descriptions of short-wave clubs for write-up. We particularly desire pictures of the club rooms (if any) and some idea of the discussions that take place during the meetings. Do not fail to include the names and addresses of the officers, especially the secretary. Address all letters to SHORT WAVE RADIO, 1123 Broadway, New York, N. Y.

Must Supers Be Noisy?

(*Continued from page 26*)

quency, so that some means must be taken to weed out all the rest.

Too many supers depend upon the good nature of the first i.f. trimmer condenser to get rid of the undesirable company, and too few supers try and help things along by a simple filter. Why a man will take every pain to place a filter in the plate circuit of a second detector and in the plate circuit of the detector of a t.r.f. set and not do exactly the same thing in the first detector is a mystery. It is an axiom that every detector circuit should have a filter to keep out the r.f.; why does this not apply to the first detector? It is just as much a detector as any other. True, its requirements may be slightly different, but its fundamental purpose is the same. The main difficulty here lies in the fact that present-day receivers work all the way from 1500 to 20,000 kc., and it is a bit difficult to design a filter that will discriminate between the signal and i.f. However, this does not alter the fact that such filters are required. Even without an adequate filter system in the first detector, there are other factors which tend to make supers noisier than they ought to be for good results.

Misalignment of the i.f. transformers is another major cause of too much noise. If the i.f. transformers are aligned at a frequency other than that determined by the oscillator condenser, then maximum amplification is not obtained. Moreover, any noise that is generated in the i.f. is amplified the maximum amount, and the result is a low signal-to-noise ratio. Never use your ear in aligning an i.f. transformer; use a good oscillator and an output meter.

Must supers be noisy? No, not at all. They *can* be noisy, but that doesn't mean that they *must* be. Just keep a few of the pointers outlined here in mind when listening to a super, and do *not* compare a t.r.f. set with a super unless both have the same amount of gain. Another way of looking at the same thing is to compare the noise voltage per unit of gain.

An interesting example of an attempt to produce a super with a very low noise level is the super described by J. A. Worcester, Jr., in the June, 1934, issue of SHORT WAVE RADIO.

—*Louis Martin.*

Official Daily Broadcast Schedule of Naval Stations NAA, Arlington, Va., and NSS, Annapolis, Md.

(*All times are Eastern Standard*)

TIME SIGNALS HOUR	FREQUENCY IN KILOCYCLES	WAVELENGTH IN METERS	POWER
2:55- 3.00 A.M.	17.8 (arc) 113 9050	16,850 2655 33.15	350 kw. 5 kw. 25 kw.
11.55-12.00 Noon	17.8 (arc) 113 690 (voice 8410) 12,615) 16,820)	16,850 2655 435 35.67 23.78 17.83	350 kw. 5 kw. 1 k.w. 10 kw.
3:55- 4:00 P.M.	17.8 (arc) 113 9050	16,850 2655 33.15	350 kw. 5 kw. 25 kw.
6:55- 7:00 P.M.	113 9050	2655 33.15	5 kw. 25 kw.
9:55-10:00 P.M.	17.8 (arc) 113 690 (voice) 9050	16,850 2655 435 33.15	350 kw. 5 kw. 1 kw. 25 kw.
11:55-12:00 Midnight	17.8 (arc) 113 4525	16,850 2655 66.30	350 kw. 5 kw. 1 kw.

WEATHER REPORTS All on 690 kilocycles (435 meters), voice transmission
10:10 A.M.
3:45 P.M. (Except Sundays and Holidays)
10:00 P.M.

The Double Duplex

(*Continued from page* 37)

is constructed, the details of the circuit will be final.

A good dial is as essential as careful tuning. An airplane type was finally selected, not only because it enhances the appearance of the receiver, but because the graduations on these dials are spread sufficiently to permit easy reading.

As may be seen from the front view of the set, the panel contains four knobs and a phone jack. The lower center knob is the main tuning control; the knob immediately to the right varies the trimmer C4; the upper right-hand knob controls the regeneration; and the upper left-hand knob controls the off-on switch and volume control.

The rear view of the set show the layout of the parts. Looking toward the panel from the rear, the 6F7 is seen directly in front of the antenna coil T1. Immediately to the right of the 6F7 is the r.f. transformer T2. The 79 is located at the extreme right, in front of the phone jack. The six-prong socket for the 79 is so placed that the heater prongs (large holes) are to the rear; the six-prong socket for T2 is placed so that the large holes are to the right; the seven-prong socket for the 6F7 has its heater holes to the left, although slightly more to the front than to the rear; the antenna coil has its large holes facing the panel.

The gang condenser C2-C3 is not mounted directly on the baseboard. The construction of the dial is such that C2-C3 must be raised sufficiently to permit the shaft of the condenser to line up with the hole in the dial. The correct height is easily determined by experiment. The face of the dial takes a hole 3⅛ inches in diameter. If a fly cutter is not available, then a series of small holes drilled close to the circumference of a circle of the correct diameter will do the trick. A half-round file to finish off is all that is needed.

Several leads are shielded: the lead to the cap of the 6F7, the lead to the cap of the 79, and the lead from R7 to C11. They are also placed high above the chassis to prevent any feedback from one triode section to the other. All heater leads, the two leads from R3, and the two leads from the switch SW are twisted to neutralize any field they may generate.

A plug and cable arrangement is used to facilitate connection to the batteries. It so happens that the phono jack, antenna-ground posts, and the plug and cable were all obtained from an old Brunswick phonograph combination cable. These cables may be obtained in the market for practically nothing. The connections from the cable to the receiver proper were made directly to the points involved—no special strip to which cables usually terminate was used. All coil data are given in Table I and in Fig. 3.

Results

The proof of the pudding is in the eating, and the proof of a radio set is in the hearing. The writer is not given to exaggerated or ambiguous claims. All he wishes to emphasize is that this little receiver will give about the same results that any reasonably good four-tube receiver will give—and at a small cost. The tuned stage preceding the first detector minimizes interference and adds to the gain of the receiver. Regeneration also adds its bit.

As stated previously, a loudspeaker may be used, and when the writer says that a loudspeaker may be used, he does not mean that a soundproof room and holding of the breath are necessary in order to hear a station. Although opinions differ as to what exactly, a "loudspeaker set" consists of, the writer feels that this Double Duplex easily falls into that class.

Book Review

(*Continued from page* 19)

Much of the material, especially the illustrations, has been taken directly from his *Principles*, and has been rewritten in a style suitable for the beginner. All mathematics, with rare exceptions, has been reduced to simple algebra; comprehensive discussions as to the relative merits of this and that cannot be found—only the results of the discussions are presented.

—*R. H. O.*

* * *

HANDBOOK OF CHEMISTRY AND PHYSICS, edited by Charles D. Hodgman, published by The Chemical Rubber Co., Cleveland, Ohio, 4½ by 7 inches, 1818 pages. Price, $6.00.

Nearly two thousand pages of tables with practically no explanatory material! Every conceivable type of table, logarithms, resistance, temperature corrections, electron constants, radio vacuum-tube characteristics, etc., etc., is printed in this book.

To be able to turn to a certain page and find the constant you want without wading through a mass of undesirable explanatory material is a pleasurable feeling that can only be appreciated after it has been done. Explanatory material is for text books, and a handbook should have facts, and nothing but facts.

Anyone interested in radio, photography, astronomy, chemistry, physics, and other scientific hobbies will be able to keep this book on the work table, not in the library.

It is the eighteenth edition, and represents the cumulative effort of twenty years of compilation.

The B. B. S. W. C.

THE Before Breakfast Short Wave Club, which was first described in the November, 1933, issue of SHORT WAVE RADIO, is a unique organization open to all short-wave listeners. There are no dues, meetings, minutes or other parliamentary nuisances. It is merely a friendly, fraternal and not too serious organization of early birds who believe in the old adage about catching the worm. The only requirement for membership is two verifications from short-wave phone stations one thousands miles or more from the applicant's location, received any time after 5:00 A.M. and before 9:00 A.M. any day of the week.

Verifications sent in to the B. B. S. W. C., are returned promptly to their senders along with a certificate of membership suitable for framing. This certificate measures 8½ in. by 11½ in. and is printed on high grade paper.

We do not make any distinction between short-wave relay broadcasting stations, commercial radiophones, amateur phones, experimental stations, and ship stations. Any station that operates below 200 meters and uses voice transmission is a legitimate catch for the short-wave listener, who is interested only in the feat of reception itself and not in the musical programs, political propaganda and private conversations that fill the air. It is really much more of an accomplishment to bring in an amateur station using perhaps only ten or fifteen watts of power than a powerful broadcasting station using ten or fifteen kw.

Address your verifications and applications for membership to the Before Breakfast S. W. Club, care of SHORT WAVE RADIO, 1123 Broadway, New York, N. Y., and be sure to enclose a large stamped and addressed envelope for their safe return.

A reduced reproduction of the diploma issued, free of all charges, to all those who can qualify. See text.

Correcting Operating Conditions

ALTHOUGH vacuum tubes are generally operated with the "typical" electrode voltages recommended by the manufacturer, special circumstances sometimes make it necessary to use tubes at other voltages. In such cases, new operating conditions which will give the best results must be obtained. The new conditions can be readily obtained for pentodes by means of the accompanying chart.

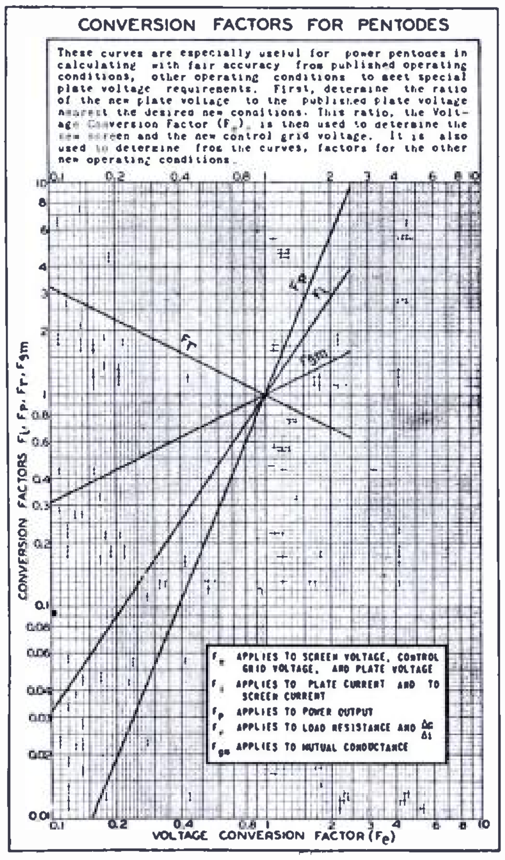
If, for example, the 89 with pentode connection is to be used with a plate voltage of 200 volts, what will be the correct operating conditions? The "typical" values given by the manufacturers are for plate voltages of 250, 180, 135, and 100 volts, none of which quite fits the case. The ratio of the new plate voltage to a known voltage (250 volts) is 200 ÷ 250 = 0.8. This is called the voltage conversion factor and is identified as F_e. Multiplying all voltages by F_e gives the new voltages shown in Table I.

By means of the accompanying curves and the voltage conversion factor (F_e), the new values of the screen and the control grid voltage, the plate and the screen current, mutual conductance, power output, and load resistance can readily be determined. The factors F_l, F_p, F_r and F_{gm} are the ordinates read from the curves at the abscissa value of 0.8. The following table gives the calculated values for a plate voltage of 200 volts.

In the same manner, operating conditions can be determined for other voltage ratios. This method is particularly adaptable to output pentodes where the plate and the screen current are fairly high and vary according to the 3/2 power law, and where the voltage conversion factor is not over two to three or less than one-half to one-third.

—RCA-Radiotron Co., Inc.

(This article is particularly pertinent to short-wave receiver constructors because of the fact that many of the tubes available are rated for voltages which differ considerably from those used by short-wave constructors. This article tells



The conversion chart referred to in this article.

TABLE I

	Condition 250-Volt	*Factor*		*200-Volt Condition*
Plate Volts	250	F_e	= 0.80	200
Screen Volts	250	F_e	= 0.80	200
Control Grid Volts	—25	F_e	= 0.80	—20
Plate Milliamperes	32	F_l	= 0.71	22.7
Screen Milliamperes	5.5	F_l	= 0.71	3.9
Mutual Conductance (Micromhos)	1800	F_{gm}	= 0.90	1620
Load Resistance (Ohms)	6750	F_r	= 1.12	7550
Power Output (Watts)	3.4	F_p	= 0.58	1.98

Subscribe?

See Page 48.

The 1934 Discoverer

(*Continued from page 35*)

equipped with the line switch. The control on the right-hand side, facing the front panel, is the manual volume control, which is, of course, in the cathode circuit of the 58 i. f. stage. There is one shielded lead used in this receiver, and that lead runs from the plate of the second detector to condenser C17, which is mounted on the front panel. This condenser, as previously mentioned, is the regeneration-control unit for the second detector circuit, and, unless this wire is shielded, it will be difficult to keep this circuit out of oscillation because of feedback through other portions of the wiring.

The first thing to be done after the receiver has been completely wired is to check the wiring against the circuit diagram before placing any of the tubes in the sockets. If this check is satisfactory, place the tubes in their respective sockets and plug the receiver into the a. c. line. Allow time for the tubes to heat, and you are now ready to tune the two intermediate frequency transformers to 465 kilocycles. If a local oscillator is obtainable, set the oscillator to 465 kc. and adjust the small tuning screws on top of the i. f. transformers for a maximum response in the loud-speaker or in the output meter, if the latter is available. After this alignment is accomplished, connect the antenna and ground and short circuit post SA to ground if the standard antenna is used. Slowly rotate the main tuning dial and condenser C3, which is the antenna compensating condenser, until a signal is heard. The establishment of resonance between condenser C1 in the modulator circuit and C2 in the oscillator circuit will manifest itself by a rushing sound, and in many cases a mushy signal will be picked up immediately, which can be cleared up by readjustment of C3.

Be sure and have the volume control, R5, moved to the full-on position when making the first test on this receiver, and have condenser C17, the regeneration control, at zero setting—minimum feedback. After a signal has been tuned in, check the action of the volume control R5 and advance the regeneration control C17 until the maximum signal strength is obtained. If it is desired, of course, to tune in c. w. signals, it will be necessary to advance C17 until the 57 tube is in oscillation. In general, the most satisfactory and most sensitive conditions will be obtained just at the point below oscillation for phone reception.

Set the moving arm of the potentiometer R13, the tone control, for the most pleasing tone value; in most cases this unit can be adjusted once and left alone. However, there are times when it will be necessary to cut out more of the higher frequencies; a readjustment of the tone control is then necessary.

When it comes to using the band-spread section, set the main tuning dial, C1-C2, to approximately the band desired and adjust the condensers C4 and C5 until resonance is obtained over that portion of the band desired; then tune the condensers C6-C7.

Sufficient resistance-capacity filtering has been included in all the important circuits of this receiver to insure smooth operation, and there should be no real difficulty in obtaining results in a receiver of this kind. So many features which are usable and practical have been incorporated in this receiver that it will surely prove of interest to all short-wave hams and listeners. A speaker having a field coil of 1800 ohms tapped at 300 ohms provides the plate supply filtering and the bias voltage for the 2A5, second audio stage.

Reception Reports from Readers

(*Continued from page* 15)

lower than that recommended by C. E. Denton in his Handbook. I have found that if a larger amount of coil is tapped, the set oscillates too easily and a drop in signal strength is noted. As it is, the set oscillates very easily and the sensitivity is very high.

The antenna is coupled to the set through an antenna coil. This is superior to condenser coupling because no dead spots are noticeable, and the antenna capacity has little or no effect on the tuning of the signal, adding more to the stability of the set.

Electron coupling is used because it is the most stable form of oscillator known. Variations of supply voltage have no effect on the receiver whatsoever. A station can be tuned in just on the edge of oscillation and it will stay that way, no matter how many irons, toasters, etc., are plugged in on the same line.

The r.f. choke in the detector plate lead is very important. Make sure it is of the best obtainable. If you can't afford the best, construct one from a piece of ½-inch rubber tubing. Wind 600 turns total in four sections about ½ inch apart.

The detector plate choke consists of the primary and secondary of a 5—1 audio transformer in series. This method of coupling gives from two to three times as much volume as resistance coupling.

Sincerely,
ROBERT J. TALBERT,
7823 Colfax Ave.,
Chicago, Ill.

R.M.A. Identifies New Sets

TO inform the radio buying public as well as the trade, means to establish identification of "all wave" and other receiving sets have been adopted by the Radio Manufacturers' Association. The object is to definitely classify the new and improved receivers, to avoid misrepresentation and to facilitate merchandising of sets.

Nomenclature and frequency ranges for a standard broadcast receiving set, the "all wave" receiver and the "standard and short wave," or "dual wave" receiver, were adopted by the Radio Manufacturers' Association board of directors April 18 at Chicago, following recommendations from the Association's Engineering Division.

The "Standard Broadcast" receiver is defined to include sets having the regular frequency range from 540 to 1500 kilocycles.

The definition of the "all wave" receiver applies to sets with frequency ranges from 540 kilocycles to at least 18,000 kilocycles.

The "standard" and "short wave"

or "dual wave" receiver as defined by the R. M. A. will apply to sets having frequencies between 4,000 and 20,000 kilocycles, with a short wave range covering a ratio of maximum to minimum frequencies of at least two and one-half to one.

The definitions outlined above were adopted by the R. M. A. board as the simplest possible to correctly advise the buying public and the trade. Detailed standards defining the nomenclature and frequency ranges of the three types of receivers will be issued soon by the R. M. A. Engineering Division.

The Mascot 2

(*Continued from page* 32)

from the rear, the tube to the right is the 32, screen-grid detector, that to the left is the double triode type 19 tube. The tuning condenser to the right is the main .00014 mf. tank, and the other, smaller unit at the extreme left is the band-spread unit. The large shield can in the center houses the plug-in coil, which is further illustrated in the front-panel view. The grid leak and the grid condenser are mounted above the deck, at the extreme right, to keep the leads as short as possible.

The chassis is 10″ wide, 7″ high, and 6″ deep; it weighs but 3½ pounds, complete with tubes and coil, less batteries.

The entire set may be obtained in kit form, ready for assembly and wiring with two additional coils for the broadcast band and an additional coil for the 9.3 to 21 meter band.

The Air Scout

(*Continued from page* 33)

The Air Scout can be used not only on 105 to 120 volt lines, but also on any 220 volt source of power, either a.c. or d.c., through the use of a voltage reducing resistor.

There are three controls available. At the right is the combined switch and regeneration control. Turning this knob in a clockwise direction turns the switch to the "on" position. As the knob is turned further, it operates the regeneration control. The knob at the center turns the station selector. The third control is the one on the trimmer condenser at the right rear.

No special directions are required for tuning in broadcast stations on the orange-colored coil. If the set tunes too broadly, a shorter aerial should be used or else the adjusting screw on the antenna trimmer condenser should be loosened. In many locations, the Air Scout will operate with a short indoor aerial if local stations only are desired. Tune in the station wanted by means of the station selector knob at the center. Then turn the knob on the regeneration control until satisfactory volume is obtained.

A little practice will soon make

the average person skillful enough to tune in distant short-wave stations. The first step is to place one of the short-wave coils in the coil socket. These coils are color coded according to their wavelength range. Thus, the green coil covers the band from 70 to 200 meters; the yellow coil from 40 to 80 meters; the red coil from 15 to 45 meters; and the blue coil from 10 to 20 meters. The broadcast—orange coil—covers the band from 200 to 550 meters.

Getting back to the best method for tuning in short-wave stations, the station selector knob is turned until a whistle is heard. It may be necessary to loosen the antenna trimmer condenser to get the whistles. As a station whistle is tuned in with the left hand, the regeneration control knob is turned in a clockwise direction with the right hand until the set "spills over," or a distinct hiss is heard. The antenna trimmer should now be adjusted, either tightened or loosened, for the loudest hiss. The station selector knob is turned until a continual whistle is heard and it should be left at the point where the squeal is loudest. The squeal can now be cleared by turning back the regeneration control knob until the set stops oscillating. The signal will then be received clear and loud. A slight further readjustment of the station selector may be necessary. The trimmer adjustment is not critical and need only be set for each coil, except for the reception of very weak signals, which often require careful adjustment all around for best reception. On such stations readjustment of the station selector may be necessary, following the movement of either of the other two controls.

Ham Rescue Work

(Continued from page 8)

these plights, and soon trucks were on the way to help all.

Notification to tent manufacturers and collapsible home producers brought assistance to the homeless whose roofs had been washed away.

I have also been informed that important messages were transmitted by way of voice, so that the short-wave listeners not understanding code could also lend a hand to their stricken neighbors with the important information they had at hand. In other words, every possible effort, every known channel, was used to help.

Some radio concerns in outlying sections, fortunately missed by the flood, loaned receivers and transmitters to amateurs whose equipment had been washed away.

The advantages of short-wave radio, if ever, were definitely evident during this disastrous period. Here is truly a tribute to the courage and intelligence of the American radio amateur.

INDEX TO ADVERTISERS

SPECIMEN PAGE FROM GHIRARDI'S "RADIO PHYSICS COURSE"

less some further movement of the band is desired at a later date. In other words, the trimmer condenser permits the operator to select the particular portion of the band to be included within the tuning range.

One consideration involved in shunting a tuning condenser across only a part of a coil is that when the condenser is adjusted for minimum capacity, the coil is tuned close to its natural period. Unfortunately, the circuit resistance increases rapidly as

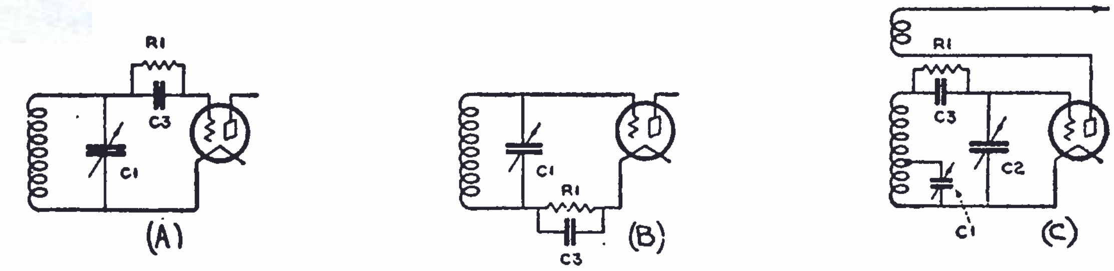
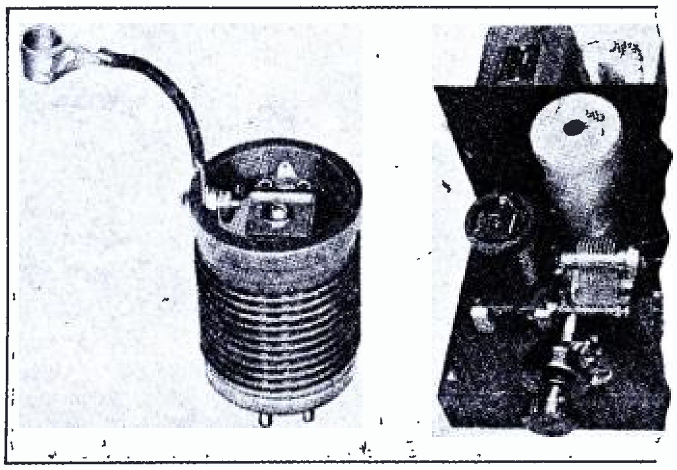


Fig. 423—Band-spread coil arrangement. (Left) The conventional detector circuit with grid-leak and condenser at the top of the coil between it and the grid of the tube. (Center) Here the grid-leak is located in the grid-return to filament line, providing the same results as at the left. (Right) The band-spread circuit showing the grid-leak and condenser in a new position.

the frequency approaches the natural period of the c
spread coils the shunt capacity furnished by the tri
of the tube itself keeps the circuit well below the na
Inside the band-spread type coil is a small grid
as an adjustable low-capacity trimmer condenser. T
rangement, let us refer to Fig. 423. At (A) is sho
for a detector stage. Here, a coil is shunted by a v
end of the coil connecting to the grid of the tube thr



Fgi. 424—A band-spread type s.w. coil is shown at the
shown at its center, are the grid-condenser
typical s.w. receiver with the band-spread coi

by a grid condenser, while the lower end of the coil
A variation of this circuit is shown at (B) where the
nected in the grid-filament return lead. (C) shows
the regular variable tuning condenser of about .000
of the total inductance, while the grid leak R_1, and

GHIRARDI'S

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Here's just one page from Ghirardi's "monumental" RADIO PHYSICS COURSE, a reference book of nearly 1000 pages with 508 diagrams and illustrations.

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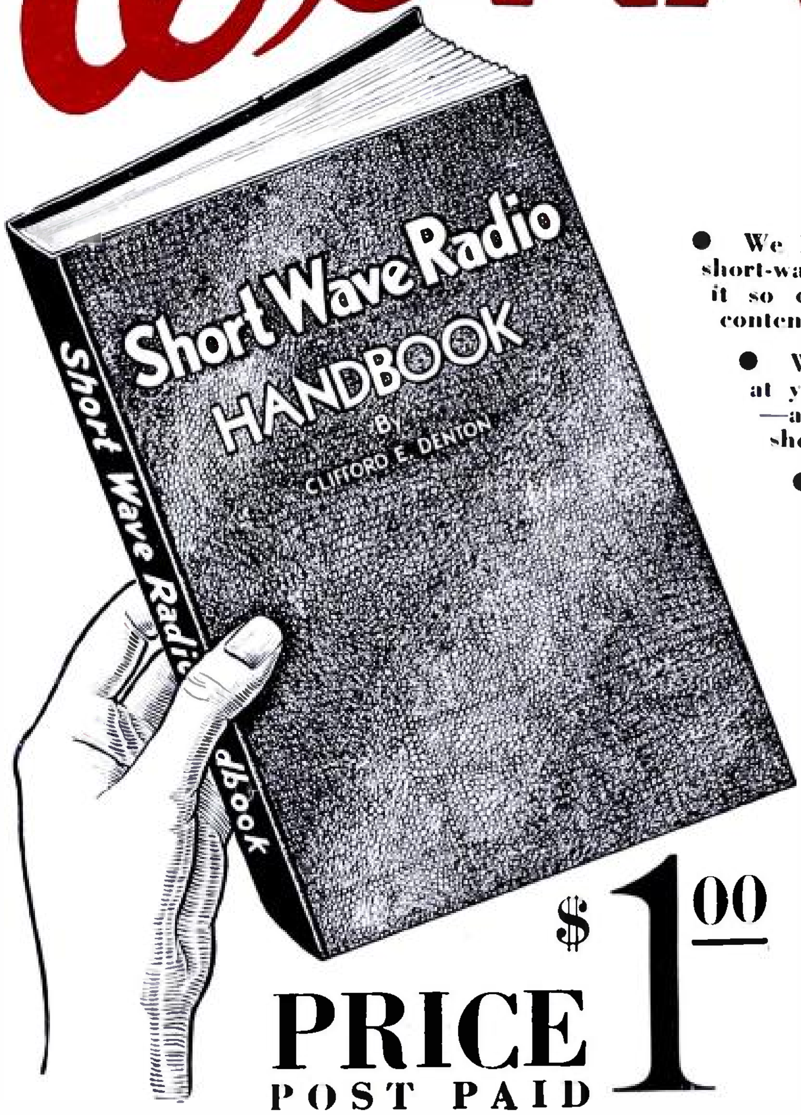

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