THE RADIO EXPERIMENTER'S MAGAZINE

February

SHORT WAVE CRAFT

Edited by
HUGO GERNSBACK

1933

IN THIS ISSUE

The A.C. "BAND-SPREAD-2" WORKS LOUD-SPEAKER

See Page 592

NOW 25¢
IN CANADA 30¢

NO, YOU'RE WRONG, we're NOT advertising Movies!

Paramount Pictures merely loaned us this photo of glamorous Marlene Dietrich as "The Blonde Venus" to help us make a point about radio reception to you.

You like Marlene because of her dramatic ability, her loveliness of face and form, and the rich warmth of her throaty voice—but even more fascinating is her different, intriguing *foreign-ness.*

If thoughts of foreign lands and foreign tongues lure you—if you would thrill to Grand Opera direct from La Scala Theatre in Milan or a tango Orchestra direct from Madrid—if you would like to send your ears world-roving . . . you can—at the twirl of a dial.

There is no need—NOW—to be bored by the eternal sameness of your local programs—the same orchestras—the "too-well-known" features that sometimes cause you to turn off your set.

For, AT LAST, there is one radio receiver that makes your cozy home a front row seat at the whole world's daily radio performances . . . not just the portion that is broadcast here in the states, but all the fascinating radio entertainment from England, France, Germany, Italy, Spain, and even far-off Australia.

With this one set, that is not merely a promise . . . it is a GUARANTEE of daily world wide radio reception . . . for the SCOTT ALL-WAVE DELUXE alone gives such a warranty. And every part of this precision-built, custom-constructed receiver (except tubes) is guaranteed for five years, instead of the ordinary 90 day period.

The SCOTT ALL-WAVE DELUXE is a combination short wave and long wave receiver. With it you will receive U. S. broadcasts from every State in the Union with a color of tone—a new depth of resonance—that will fill your home with a soul stirring wave of tone realism such as you never before have heard in a radio receiver.

You might think so superbly performing an instrument prohibitively high priced. Not at all! Although its quality is above all other radios—its cost is but little more than that of the ordinary receiver.

The coupon at the right below is for your convenience. Use it to get the whole thrilling story of this, the world's finest radio receiver.

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THE Scott ALL-WAVE Deluxe

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Send me your two new brochures that tell how and why SCOTT ALL-WAVE DELUXE Receivers out-perform all others. This is not to obligate me in any respect.

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Town .... State ....

IN THIS ISSUE: PROMINENT SHORT-WAVE AUTHORS

Whitney • Moller • Shuart • Matthews • Cisin • Dillard • Palmer

HUGO GERNSBACK
Editor

SHORT WAVE CRAFT

H. WINFIELD SECOR
Managing Editor

CONTENTS FOR FEBRUARY, 1933

FEATURES IN NEXT ISSUE

Ultra Short Waves In Medicine, illustrated, by Dr. E. Schliephake (Germany).

A Short-Wave Superhet Using but 4 Tubes—just what you have been looking for, by C. E. Denton.

Method of Coupling to Loud Speakers—the best circuits and how to use them, by M. Harvey Gernsback.

Short-Wave Tuning Inductance Charts—a set of specially drawn graphic curves, whereby the amateur can find the inductance, size of wire, and coil dimensions for any given capacity and wavelength, by Clifford E. Denton.

Improving Your "Keying" with an Audio Oscillator, by A. Hazelton Rice, Jr.

Also, plenty of simple type short-wave sets of interest to the beginner. More data on the "Wunderlich" Tube—and the New "19," by Louis Martin.

Contents for February—Continued

OUR COVER

Two-Tube A.C. "Band-Spreader" Receiver That Works A Loud Speaker, is described in full detail, with drawings and photos, by George W. Shuart, Short-Wave Expert, on page 592

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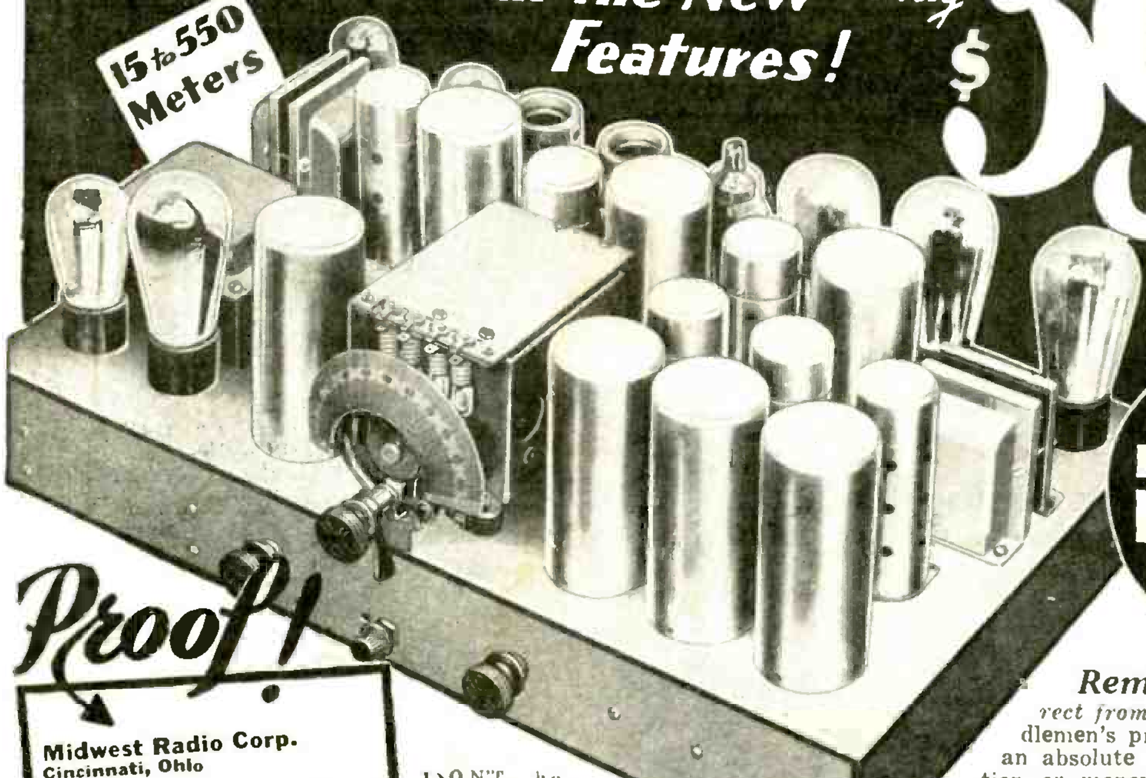

Proof!

Midwest Radio Corp.
Cincinnati, Ohio

Gentlemen:
"Received the 16-tube outfit. At 3:15 P.M. started to go after Rome and in a few minutes playing with the Color-lite dial. I received this station. This afternoon. I picked up Pontoise, France (W8XK), Rome, Italy (12-RO). Mexico City (XDA). Chelmsford, England (G5SW) Have also picked up YVQ, LSN, VK2ME (Sydney, Australia). Sunday morning. Sydney, Australia, Germany, Italy, France and Mexico were all coming in good."

Yours very truly,
Louis Cseh,
13605 Englesmere Ave.,
Cleveland, Ohio, U. S. A.
Member International Short Wave Club.

Note: The above is just part of Mr. Cseh's interesting letter.

DON'T be satisfied with less than a big powerful, 16-tube Midwest ALL-WAVE set. A receiver covering only half the regular broadcast waves is only *half* a set. When you own this latest Midwest marvel, *the whole world of radio* is yours. With a tuning range of 15 to 550 meters, you can hear regular and short wave broadcasts from all over the U. S. and many foreign lands. Midwest users from coast to coast report picking up England, France, Germany, Italy, Africa, South America, Hawaii, Japan, Australia, the Philippine Islands and many other far-away stations.

This powerful, clear-toned, perfectly controlled set opens up new delights of radio to every listener. Such selectivity, such sensitivity, such amazingly faithful tone reproduction will delight the most critical. Don't buy any radio until you get the new 1933 Midwest catalog. Send for it today. Mail the coupon or write us a postal . . . NOW!

Remember, *you buy direct from the makers.* No middlemen's profits to pay. You get an absolute guarantee of satisfaction or money back. You try any Midwest 30 days before you decide to keep it. Then, if you wish, you can pay in small monthly amounts that you'll scarcely miss. Mail coupon for full details, or write us a postal.

COMPLETE LINE OF NEW CONSOLES

The big new Midwest catalog shows gorgeous line of artistic consoles in the new six-leg designs. Mail the coupon now. Get all the facts. Learn how you can save 30% to 50% on a big powerful radio by ordering direct from the factory.

World-Wide Long and Short-Wave Reception

The Midwest 16-tube ALL-WAVE is the last word in radio completeness and efficiency. You hear not only U. S. and foreign broadcasts, but also police calls, airplane signals, ships at sea, amateurs . . . . everything that comes over the air. But it's no wonder, for this latest 1933 sensation incorporates all the worthwhile new features . . . . New type tubes . . . Stat-omit tuning silencer . . . . Color-lite tuning . . . . Full-floating condenser . . . . 18 tuned circuits (Super-heterodyne), 9 in cascade . . . . Dual Power, two separate transformers . . . . Large dual speakers . . . . Duplex Duo-diode detection . . . Class "B" Amplification . . . . and many other sensational new refinements and improvements. You'll be amazed and delighted when you hear one of these wonderful new sets in your own home.

Deal Direct with Factory—SAVE UP TO 50%

TERMS as low as $5.00 DOWN

Why buy the costly old-fashioned way and pay two or three profits? Buy direct from the Midwest factory and keep the middlemen's profits in your own pocket. Investigate! Mail the coupon. Learn how we give you a bigger, better, more powerful, clearer-toned radio at a positive saving of 30% to 50% of usual retail prices. Costs only a stamp to find out. Mail the coupon or write us a postal . . . . NOW!

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Dept. 185 **Cincinnati, Ohio**

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Midwest Radio Corp.
Dept. 185
Cincinnati, Ohio.

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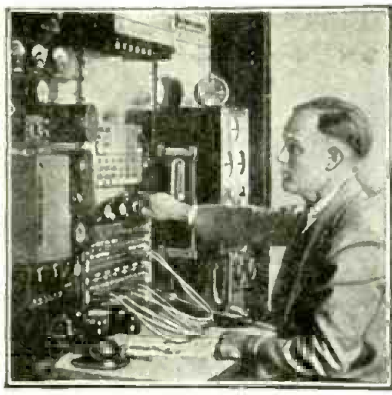
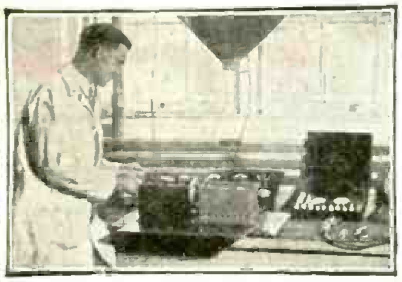
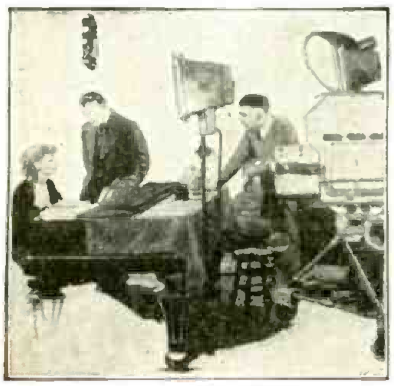
I WILL TRAIN YOU AT HOME

Many Make $50 to $100 a Week in Radio -- *the Field With a Future*


Broadcasting Stations employ trained men continually for jobs paying up to $5,000 a year.


Police Departments are finding Radio a great aid in their work. Many good jobs have been made in this new field.


Spare time set servicing pays many N.R.I. men $200 to $1,000 a year. Full time men make as much as $65, $75, $100 a week.


Talking Movies—an invention made possible by Radio—employs many well trained radio men for jobs paying $75 to $200 a week.


Television—the coming field of many great opportunities—is covered by my course.

My book, "Rich Rewards in Radio," gives you full information on the opportunities in Radio and explains how I can train you quickly to become a Radio Expert through my practical Home Study training. It is free. Clip and mail the coupon NOW. Radio's amazing growth has made hundreds of fine jobs which pay $50, $60, $75, and $100 a week. Many of these jobs may quickly lead to salaries as high as $125, $150, and $200 a week.

Radio—the Field With a Future

Ever so often a new business is started in this country. You have seen how the men and young men who got into the automobile, motion picture, and other industries when they were started had the first chance at the big jobs—the $5,000, $10,000, and $15,000 a year jobs. Radio offers the same chance that made men rich in those businesses. It has already made many men independent and will make many more wealthy in the future. You will be kicking yourself if you pass up this once-in-a-lifetime opportunity for financial independence.

Many Radio Experts Make $50 to $100 a Week

In the short space of a few years 300,000 Radio jobs have been created, and thousands more will be made by its future development. Men with the right training—the kind of training I will give you in the N.R.I. Course—have stepped into Radio at 2 and 3 times their former salaries. Experienced service men as well as beginners praise N.R.I. training for what it has done for them.

Many Make $5, $10, $15 a Week Extra In Spare Time Almost At Once

My Course is world-famous as the one "that pays for itself." The day you enroll I send you instructions, which you should master quickly for doing 28 Radio jobs common in most every neighborhood. Throughout your Course I will show you how to do other repair and service jobs on the side for extra money. I will not only show you how to do the jobs but how to get them. I'll give you the plans and ideas that have made $200 to $1,000 a year for N.R.I. men in their spare time. G. W. Page, 110 Raleigh Apts., Nashville, Tenn., writes: "I made $935 in my spare time while taking your Course." My book, "Rich Rewards in Radio," gives many letters from students who earned four, five, and six times their tuition fees before they graduated.

Get Ready Now for Jobs Like These

Broadcasting stations use engineers, operators, station managers and pay up to $5,000 a year. Radio manufacturers employ testers, inspectors, foremen, engineers, service men, buyers, and managers for jobs paying up to $6,000 a year. Radio dealers and jobbers (there are over 35,000) employ service men, salesmen, buyers, managers and pay up to $100 a week. Talking pictures pay as much as $75 to $200 a week to men with Radio training. There are hundreds of opportunities for you to have a spare time or full time Radio business of your own—to be your own boss. I'll show you how to start your own business with practically no capital—how to do it on money made in spare time while learning. My book tells you of other opportunities. Be sure to get it at once. Just clip and mail the coupon.

I HAVE STARTED MANY IN RADIO AT 2 AND 3 TIMES

$400.00 Each Month

"I spent fifteen years as traveling salesman and was making good money but could see the opportunities in Radio. Believe me, I am not sorry, for I have made more money than ever before. I have made more than $400 each month and it really was your course that brought me to this. I can't say too much for N.R.I."—J. G. Dahlstead, Radio Sta. KYA, San Francisco, Cal.

$800.00 In Spare Time

"Money could not pay for what I got out of your course. I did not know a single thing about Radio before I enrolled, but I have made $800 in my spare time although my work keeps me away from home from 6:00 A.M. to 7:00 P.M. Every word I ever read about your course I have found true."—Milton I. Leiby, Jr., Topton, Pennsylvania.

Chief Engineer Station WOS

"I have a nice position and am getting a good salary as Chief Engineer of Radio Station WOS. Before entering Radio, my salary was barely $1,000.00 a year. It is now $2,400.00 a year. Before entering Radio, my work was, more or less, a drudgery—it is now a pleasure. All of this is the result of the N.R.I. training and study. You got me my first important position." H. H. Lance, Radio Station WOS, Jefferson City, Missouri.

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Act Now --- Mail Coupon Below for Free Book of Facts and Proof

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Hold your job. There is no need for you to leave home. I will train you quickly and inexpensively during your spare time. You don't have to be a high school or college graduate. My Course is written in a clear, interesting style that most anyone can grasp. I give you practical experience under my 50-50 method of training—one-half from lesson books and one-half from practical experiments with equipment given without extra charge. This unique and unequalled method has been called one of the greatest developments in correspondence Radio training. N.R.I. pioneered and developed it. It makes learning at home easy, fascinating, practical.

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I'll give you more training than you need to get a job—I'll give you your choice, and not charge you extra either, of my Advanced Courses on these subjects—(1) Television, (2) Set Servicing and Merchandising, (3) Sound Pictures and Public Address Systems, (4) Broadcasting, Commercial and Ship Radio Stations, (5) Aircraft Radio. Advanced specialized training like this gives you a decided advantage.

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One copy of my valuable 64-page book, "Rich Rewards in Radio," is free to any resident of the U. S. and Canada over 15 years old. It has started hundreds of men and young men on the road to better jobs and a bright future. It has shown hundreds of men who were in blind alley jobs, how to get into easier, more fascinating, better paying work. It tells you where the good Radio jobs are, what they pay, how you can quickly and easily fit yourself to be a Radio Expert. The Coupon will bring you a copy free. Send it at once. Your request does not obligate you in any way. ACT NOW.

J. E. SMITH, President
Dept. 3BB3, National Radio Institute
Washington, D. C.

Special FREE Offer

Act now and receive in addition to my big free book "Rich Rewards in Radio," this Service Manual on D. C., A. C., and Battery Operated sets. Only my students could have this book in the past. Now readers of this magazine will receive it free. Overcoming hum, noises of all kinds, fading signals, broad tuning, howls and oscillations, poor distance reception, distorted or muffled signals, poor Audio and Radio Frequency amplification and other vital service information is contained in it. Get a free copy by mailing the coupon below. ACT NOW.

SPECIAL Radio Equipment for Broad Practical Experience *Given Without Extra Charge*

My Course is not all theory. I'll show you how to use my special Radio equipment for conducting experiments and building circuits which illustrate important principles used in such well-known sets as Westinghouse, General Electric, Philco, R. C. A., Victor, Majestic, and others. You work out with your own hands many of the things you read in our lesson books. This 50-50 method of training makes learning at home easy, interesting, fascinating, intensely practical.

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"Before taking your course, I had worked at Radio for over seven years, doing quite a bit of servicing, but I realized that I was in need of better training. From the first lesson on I began to understand points that had me wondering. The course has taught me what I could not have learned otherwise and I would not take many times the price it has cost me, for the knowledge I have gained. In a period of nine months, I have made at least $3,500."—C. J. Stegner, 28 So. Sandusky St., Delaware, Ohio.

Clip and mail NOW *for* FREE INFORMATION

J. E. SMITH, President,
National Radio Institute, Dept. 3BB3
Washington, D. C.

Dear Mr. Smith: Please send me your manual "Trouble Shooting in D.C., A.C. and Battery Sets" and your book, "Rich Rewards in Radio," which points out the opportunities for spare time and full time jobs in Radio and your famous 50-50 method of training men to become Radio Experts through home study. I understand that this places me under no obligation.

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"M"

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We publish no catalog and ask you to be kind enough to order direct from this page. Prompt shipments will be made to you direct from the publishers. We merely act as a clearing house for a number of radio publishers and OUR PRICES ARE AS LOW OR LOWER THAN WILL BE FOUND ANYWHERE. Remit by money order or certified check. If you send cash, be sure to register it.

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HUGO GERNSBACK, EDITOR H. WINFIELD SECOR, MANAGING EDITOR

SHORT WAVE ACTIVITIES INCREASE

An Editorial by HUGO GERNSBACK

● DURING the past year, all short wave activities have increased at a remarkable rate in this country. I have mentioned this a number of times in the past and also the fact that there were increasing signs of short wave activity apparent all about us. If these remarks seemed perhaps too optimistic, I am now in a position to back it up by actual figures secured from the report of the *Federal Radio Commission* of Washington. These figures are astonishing, in that they are far greater, in many respects, than the most optimistic predictions I could have forecasted. They make, indeed, excellent reading for those who are interested in the continuous growth of short waves in all its different branches.

30% Increase in Licensed Amateurs

First of all, radio amateur activities increased tremendously. On June 30, 1932, there were 30,374 licensed radio amateur stations in the United States alone, according to the report. 12,522 new stations were authorized by the Federal Radio Commission, an increase of more than 30% in a single year. This is a most astonishing figure, and embraces, of course, only those amateurs who have been *licensed*, and who may therefore, be called *transmitting* amateurs. Conservative estimates of other experimenting amateurs and radio experimenters not licensed, but who are interested only in receiving short waves, is certainly not less than 150,000! These figures are based in part on our own estimates, and also on the sworn circulation of SHORT WAVE CRAFT, which under date of February 16, 1932, was 67,740.

In aviation the Federal Radio Commission authorized 177 new stations, the total of June 30th now being 358 aircraft. For aeronautical, aeronautical point to point, and airport, new stations authorized were 92, total stations now 221. Under special experimental stations licensed (most of which are probably on *short waves*) we have several classes, mostly of general experimental, special experimental, experimental relay broadcasting, and experimental visual broadcasting (television). Total new stations authorized 68, total of these stations on June 30th of this year, 211. Of the geophysical stations (for exploring underground, mine and metal deposits, etc.) 3 new stations were authorized; total now in U. S. 116.

Amateur Station Licenses 87% of Total

In addition to this, there were 80 new ship stations added, and there is now a total of 2,011 new stations, but most of these are, of course, not on short waves. The exact number of ship short-wave stations cannot be ascertained, since the Radio Commission does not give this information. The Federal Radio Commission also, under the caption of *Amateur Section*, states that *amateur stations* comprise *87% in number of all radio stations licensed by the Commission.* The records of applications, licenses, call letters, and other details were maintained on cards which aggregate about 100,000.

These are formidable figures, and speak volumes for the activities of the American radio amateurs and experimenters. They show with what avidity the serious radio enthusiasts in this country have taken to *short waves*, and there is no predicting how far the movement will grow. It is certain, however, from what is being observed, that the movement is yet in its infancy, and that it will expand rather than contract during the next few years. The reasoning here is that, if during the depression all short-wave activities have increased, what will happen when times become normal again?

The cause of this great interest, of course, is that *short-wave* radio experimenting cannot be looked upon simply as a hobby, but in a way it is a serious vocation which frequently becomes a profession. I have mentioned many times that, sooner or later, the boy who starts in with the $5.00 short-wave set, invariably graduates into better endeavors and he finds himself climbing upward in the radio profession.

It is significant that practically all the personnel of the radio industry today has been recruited from the radio experimental and amateur fields. It is here that the young men gained their experience, which has stood them well in the later years, because what you learn when you are young you probably will never forget, and indeed, the former hobbies often paid handsome dividends to those young men who stuck it out.

In the meanwhile, *short-wave experimenters* are added to the fold by the thousands every month. They are chiefly attracted to the new endeavor, first by the itch for building their own sets, and second, to listen to the *foreign* short-wave programs. Most of those starting in the game are usually beginners who, for a few dollars, are enabled to build their own sets; and from the large correspondence which we receive from day to day, we know that many of these experimenters have built as many as twenty sets. It is not at all a rarity these days to have experimenters who have three or four sets hooked up permanently at all times; which makes it possible to receive almost *simultaneously*, from four to five distant radio stations on the various loud speakers and thus listen to the multiplicity of foreign lands all at once! It is seldom that all of the foreign station announcements come through at the same moment; so that it is no trick at all for the experimenter to "log" the various foreign stations in one sitting, over a few hours, with little changing of the tuning controls.

Of course, a great many of these builders sooner or later go in for the factory-made sets, after they have obtained sufficient confidence in short waves to make the investment in an expensive set either by themselves or their family an actual possibility.

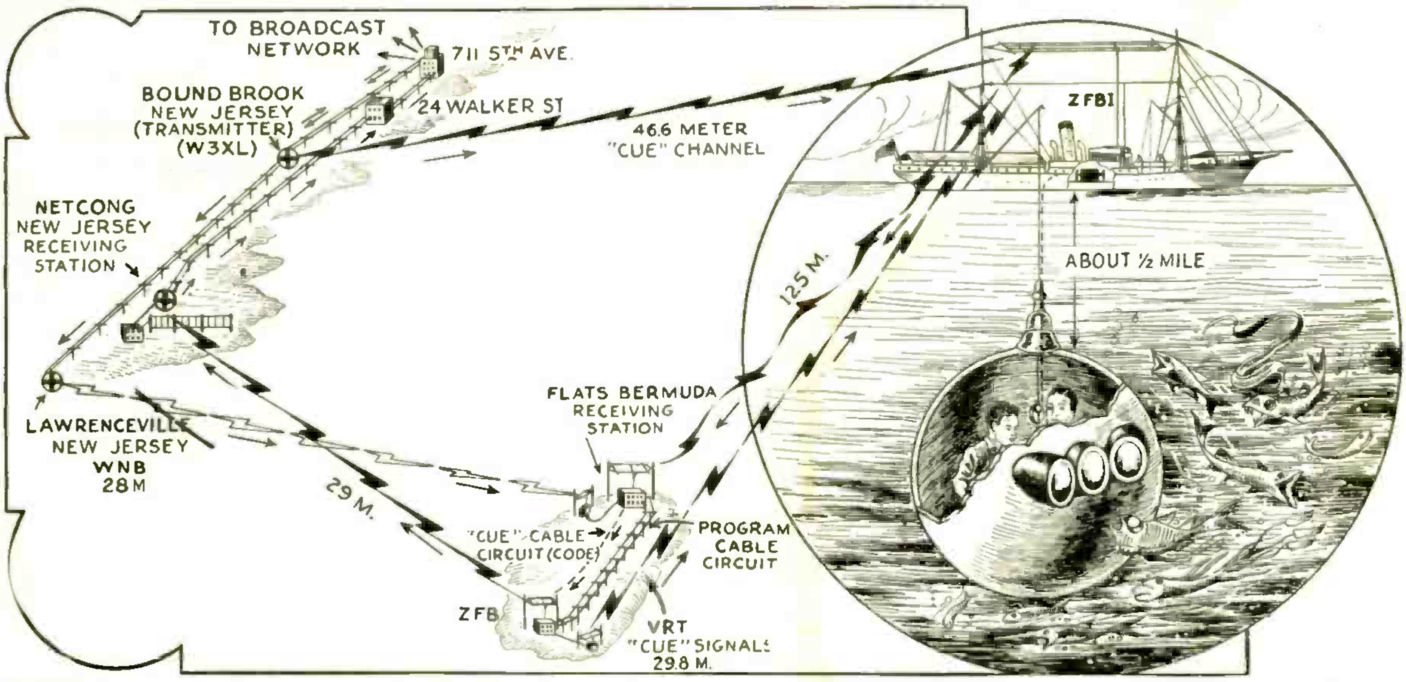
I again repeat, that short waves have by no means reached the crest of their popularity, and the process will go on for a long time to come.

SHORT-WAVE CRAFT IS PUBLISHED ON THE 15th OF EVERY MONTH

This is the February, 1933, Issue - Vol. III, No. 10. The Next Issue Comes Out February 15th

Editorial and Advertising Offices - 96-98 *Park Place, New York City*

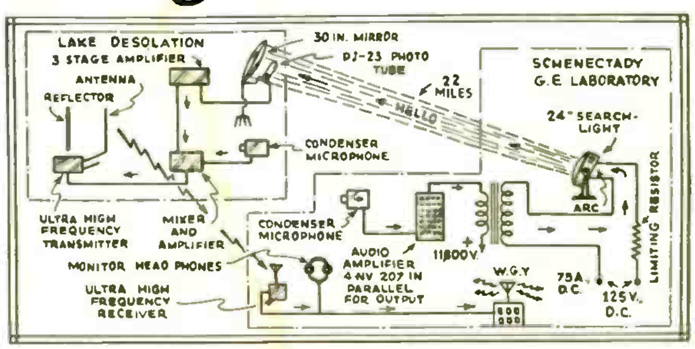
Short Waves Carry Voice from Ocean's Depths



● THE interesting diagram reproduced above shows how the voice of Captain William Beebe was broadcast from a steel ball, known as the "bathysphere," which was lowered approximately one-half mile below the surface of the sea. Captain Beebe and Otis Barton, inventor of the "bathysphere," were lowered over the side of the S. S. *Freedom* anchored off Nonsuch Island, Bermuda. The air conditions and the sub-sea sights they saw were broadcast over a telephone wire to the surface and then radiated on short waves to a land station at Bermuda. Thence the broadcast went on a 29 meter wave to Netcong, N. J.; over a wire circuit to New York City, and out over the N.B.C. network. Other short-wave "cue" channels connecting with the ship and Bermuda stations were also used, as the diagram shows. Note the interesting "long distance" cue circuit extending from New York (711 Fifth Ave.) to Bermuda, thence by radio to the sender ship *Freedom*.

Talks 22 Miles on Light Beam

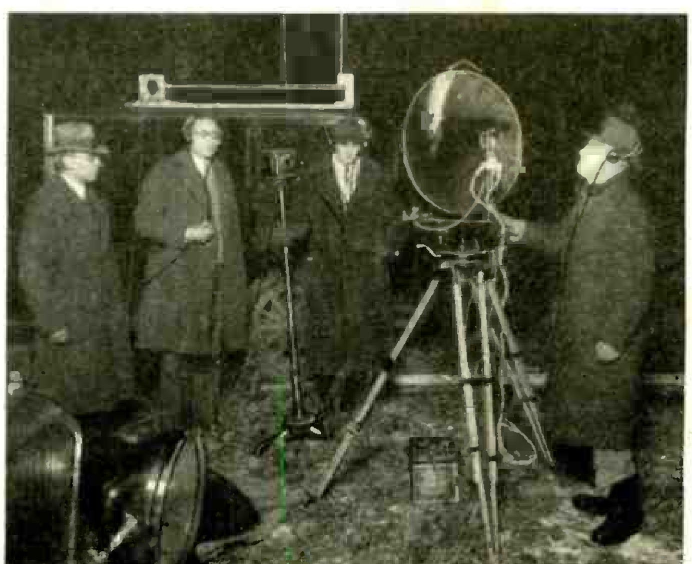
Left: Heywood Broun at the "mike" with light-beam projector beside him. Right: Diagram showing talking light beam and short-wave "relay" link.



● THE human voice has been carried 22 miles on a beam of light; the previous record was about six miles. The successful spanning of the much greater distance was accomplished on the evening of November 22, when Heywood Broun, newspaper columnist and radio speaker, stood before a microphone in one of the buildings of the General Electric Company at Schenectady. Beside him was a 24-inch reflector, concentrating into a narrow beam of light from an electric arc. The light appeared constant, but in reality it was very rapidly varying in intensity, being modulated by the voice of Mr. Broun. Through a closed window the light was pointed northward, to the foothills of the Adirondacks.

High up on a hillside near Lake Desolation, at a crow-flight distance of more than 22 miles, were John Bellamy Taylor and other scientists of the General Electric Company. They had a 36-inch reflector, at the focus of which was mounted a light-sensitive phototube. Accurate adjustments of the beacon and receiver established the contact. The phototube equipment, responding to the

(Continued on page 621)



Left: Talking light-beam receiver set-up at Lake Desolation, 22 miles from Schenectady, N. Y.

Will Short-Wave Heat Effects Cure Human Ills?

Dr. Willis R. Whitney, author of the present article and one of the foremost experts on scientific research in the world.

By DR. WILLIS R. WHITNEY
Vice-President and Director, General Electric Company

Among the interesting physiological effects of short waves are their heating effect on solutions akin to blood; their effect on animals and various other angles, such as the "focusing" of the heating effect.

● VACUUM tubes place in our hands the remarkable power of generating an electromagnetic field traveling through space at high velocity, akin to light, and, like it, composed of radiations of many different wave-lengths, but far more comprehensive in the scope of its spectrum than visible light can possibly be. Tubes of the radio type can be used to produce electromagnetic waves as long as a thousand meters and as short as 5 centimeters (2 inches). It is not difficult to believe that within this range many invisible assets await only further research to disclose them. Radio broadcasting is only one use for the principles involved.

In earlier days, and indeed from its very beginning, the greater part of radio-tube research was carried out along the definite and narrow lines dictated by, as it was then supposed, its greatest application—that of broadcasting. Vacuum-tube phenomena, as they were disclosed, permitted the use of certain types of sending tubes, and the development of other specializations, such as magnifying, rectifying, amplifying, and receiving tubes. In a word, the best talent was expended on the development of the radio tube for radio use, and little thought was given to the broader aspects of the powerful tool in our possession.

One of the important applications of radio tubes quite apart from, and, indeed, tangential to, their use in radio, concerns their employment in biological, and possibly in therapeutic fields. Our interest was early attracted to the heating and destruction of living matter in an intense radio field, and we undertook much investigational work in this connection, for it seemed clear that sooner or later radio fields must find biological use. The form of apparatus which we most commonly used in this work consisted of an oscillating circuit with a condenser and reactance activated through vacuum-tube oscillators.

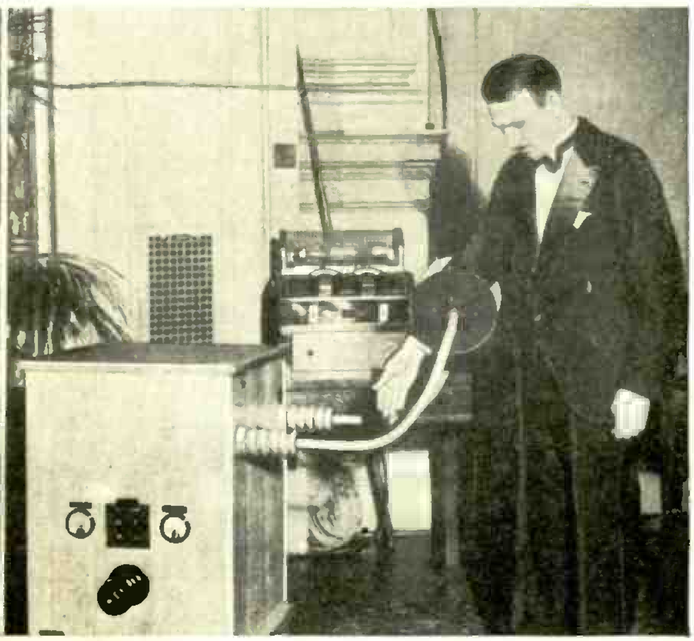
The three-element tube permits the production of undamped sine-wave oscillations, or very high frequency sine-wave alternating currents, by suitably connecting it into a circuit in which an electrical capacity and a reactance are in parallel. This oscillating current charges a second condenser, and it is in the field of this condenser that the heating which we are considering in this article is produced.

The electrical engineer, thinking at first of the dielectric constants of condensers, is apt to confine his thought to what is broadly called dielectric hysteresis, and to use the word to cover the various losses in the space between the condenser plates without reference to their origin. This article is not the place to analyze losses in dielectrics. For our purpose it may be enough to know that we are dealing largely, if not entirely, with a relatively simple case of electrical resistance. We may look at our arrangement as a condenser field in the midst of which a certain resistance is placed. If the ends of that resistance are looked at as connected in any way, as by static induction, to the condenser plates, it is clear that some certain current will flow in the resistance, and so cause corresponding heating.

If electrolytic resistance is commonly looked at as the frictional effect opposing the motion of the ions of the electrolyte, we may still attribute the heating effects to this motion, even though the actual migration which can take place in a ten-millionth of second is very small and the amount of actual electrolysis entirely negligible.

The "influence" of the condenser plates themselves, which we have called

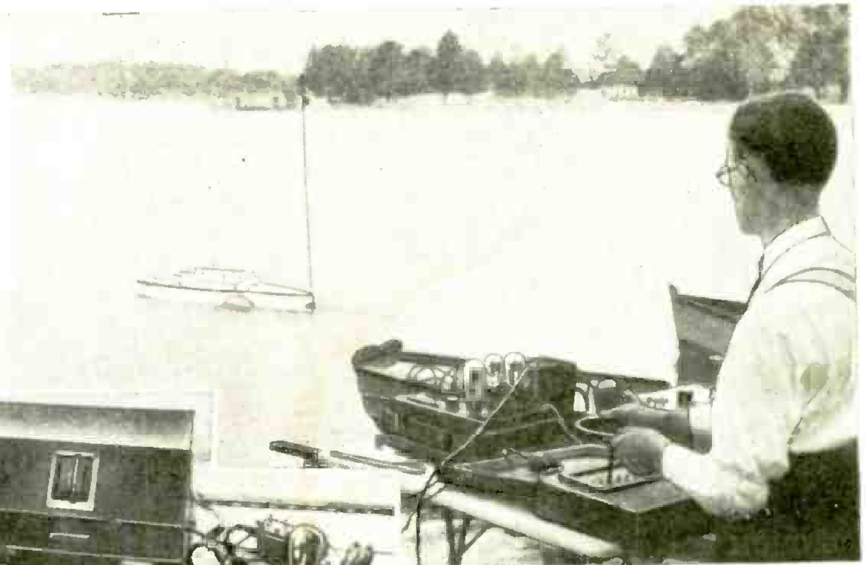
(Continued on page 624)

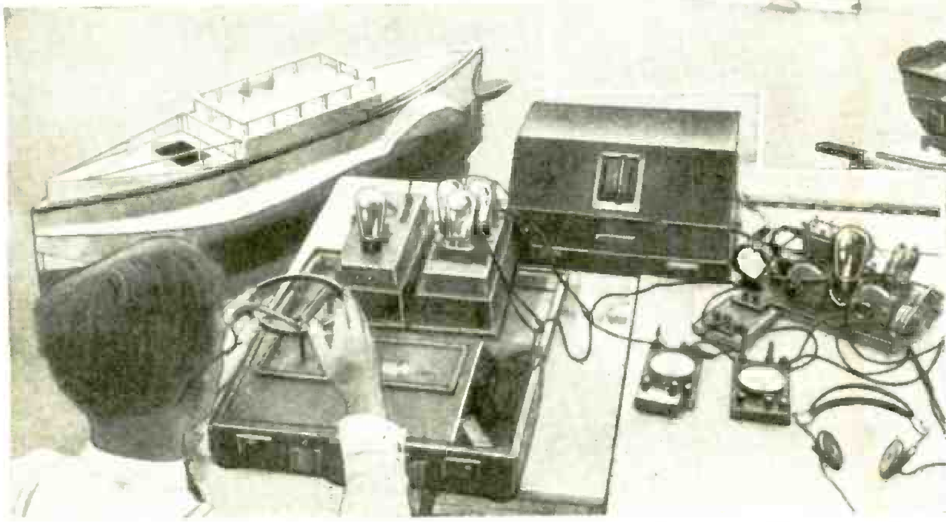


Photos courtesy of the General Electric Company

Photo at left, above, shows experiment with insects exposed to the powerful short-wave field which had a very unusual effect on them. Photo, at right, illustrates how we may treat certain muscular and other ailments tomorrow, by simply subjecting an arm or other part of the body to a powerful high frequency field as shown.

Short Waves Control Model Ship





Above—Rudolph Weber at the short-wave transmitting apparatus and control wheel by means of which he directs the movements of the small boat shown in the picture.

Left a close-up view of Mr. Weber's short-wave radio control apparatus, the waves from which direct the small ship and cause it to stop, start and turn.

● RUDOLPH WEBER, a rising young radio genius of Drossen, Germany, has recently demonstrated his extremely interesting short-wave control apparatus, by means of which he is enabled to cause a model ship or other device to go through a series of movements at a distance. Different frequencies are used for producing the respective movements, such as stopping and starting the miniature ship, causing it to turn one way or the other, etc. Mr. Weber installed a small cannon on the deck of the ship which he could fire at will from the shore. The propelling motor derives its power from a storage battery. Mr. Weber took up the study of radio when he was nine years old. This is a very interesting and prolific field for American experimenters to develop.

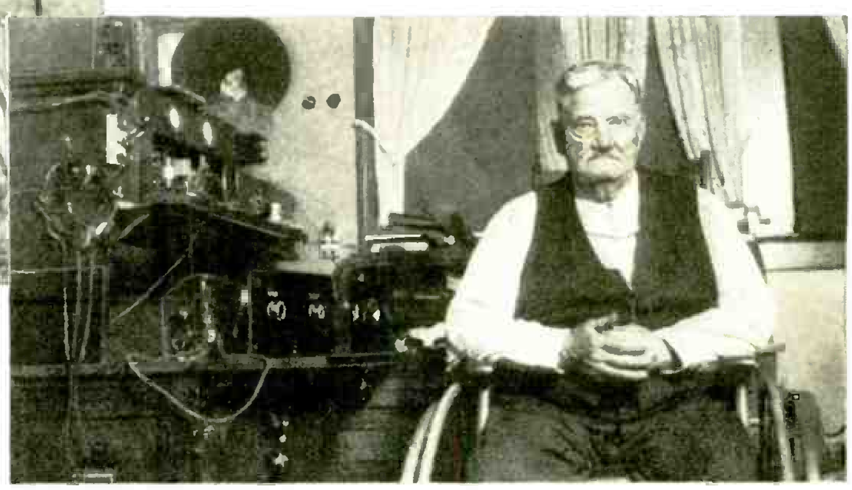
Above—New R. C. A. 5-Meter Transmitter and Receiver. It is "battery-operated" and is thoroughly portable; it can be used in a plane. Its land range is about three miles, but this can be increased by elevating the transmitter.

New 5-Meter Transmitter and Receiver

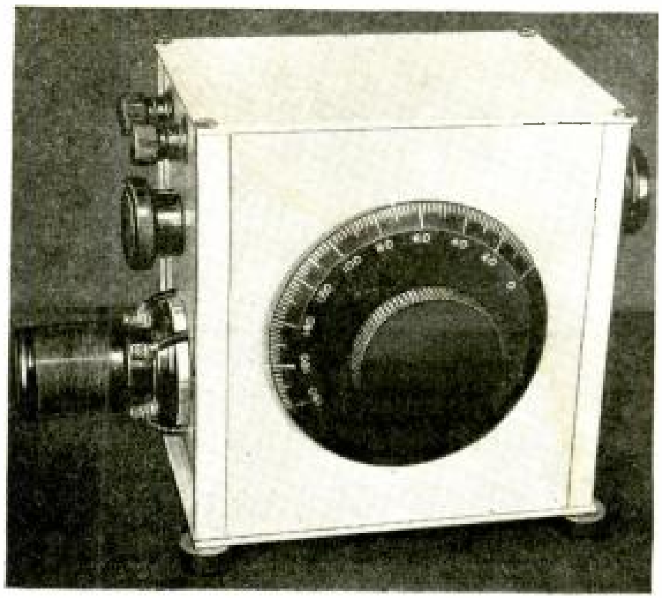
● THE photo at left shows the newest commercial 5-meter transmitter and receiver mounted on a strong tripod. This 5-meter *two-way* radio telephone and telegraph receiver and transmitter is intended for mobile communications over short distances; it is battery operated. It has been perfected by the engineers of the RCA-Victor Company. The apparatus weighs but 22 pounds. The antenna is of the di-pole type; the average range on land is three miles.

Oldest Radio Amateur

● "HATS OFF" to Dr. George W. Kirk, 82 year old "ham" radio operator who dearly loves his short waves. Dr. Kirk was graduated from medical school in 1888. He became interested in radio about ten years ago and received his transmitting license about five years ago. His call is W8ARJ. His transmitter comprises a Hartley oscillator with a '10 tube; the receivers are a Pilot *Super-Wasp* and 3-tube regenerative for *long-wave* weather reports. Dr. Kirk does not care for phone, but prefers to work a few "hams" regularly by "C.W."—*Bernard Comte.*



Right—The OLDEST "ham," Dr. George W. Kirk, 82 years old, who handles a key like a youngster.

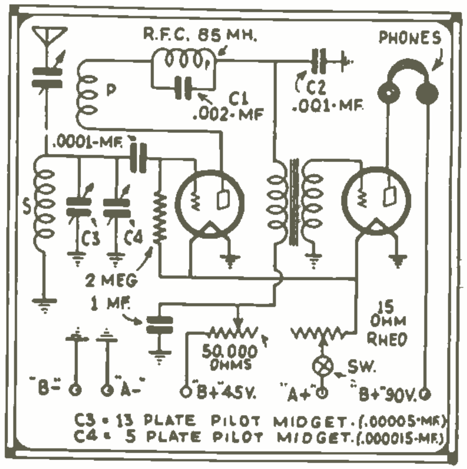


2-TUBE PORTABLE All-Wave Receiver

By CLARK KUNEY, Jr.

Here's a snappy little All-Wave receiver which may be used as a "station" or "general" receiver: Range 20-550 Meters.

Left—One of the most compact, useful All-Wave Receivers that we have seen. Right—hook-up for Mr. Kuney's set.



● This two-tube instrument, operated by batteries, was designed to provide a compact, portable, smoothly operating short wave automobile or station receiver.

The set covers all waves from 20 to 550 meters, and has received, with no external amplifiers, the following stations:

EAQ Madrid, Spain
W6XI California
VE9CL Winnipeg, Manitoba
GBS Rugby, England

and many other stations at a lesser distance than the above, as well as many amateurs in the U.S. and Canada.

When the author operates this set at his home station, a .0005 mf. condenser in parallel with a 25 turn 1½" coil is put in series with the antenna. This not only serves to eliminate "dead spots", but when operated at its correct setting, serves to materially increase the signal-to-noise ratio. However, when the set is used as a portable, this extra piece of equipment is not necessary.

Any type triode tubes may be used in this set, but the author recommends '30's. The case is an aluminum shield can 5x5x6 inches. The antenna is coupled to the set through a small trimmer condenser, fastened directly to the antenna binding post. The coil socket is mounted on a small circular piece of bakelite cut to fit the coil socket base, and the entire assembly is mounted directly over a 1½ inch hole cut with an expansion bit in the left-hand panel of the case. The coil leads are encased in spaghetti tubing where they pass through the panel.

A cut-out is made on the back panel of the set to accommodate a strip of bakelite in which the five binding posts are set. The author found it much more convenient to have separate posts for each wire than to connect two wires to the same post, especially when using a battery cable.

(Continued on page 637)

Novel Short-Wave Coil Ideas

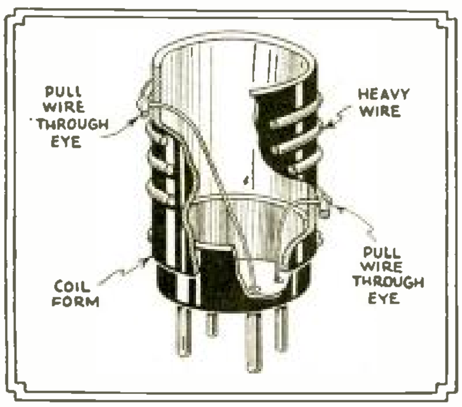
Fastening Heavy Wire

● I am herewith sending a free hand drawing of a method I am using for fastening the ends of large wire on my short-wave coils. Fully realizing that it is a hard matter to wind coils with large wire and secure the ends in such a manner as to have the turns drawn tight, I set about to find a way that would be easy, and this sketch illustrates the result.

Taking two pieces of No. 16 wire, I bent a ring on one end of each wire (scraping the ends and priming with solder before bending the ends into a circle) large enough for No. 12 wire to pass through. Then I measured the wire from the hole in the coil form to the tube prong, allowing about one inch to stick through. I cut off, cleaned and primed this end with solder. The wire was then drawn through the hole in the coil form and passed through the hole in the tube prong, drawn tight and soldered fast. After allowing enough space on the coil form for the required number of turns on the coil, I then bored another hole for the second wire and the same procedure was followed, placing this wire like the first one.

All that is necessary to wind a coil on a form like this is to prime the starting end of the coil wire with solder, place it in the ring and solder fast, wind on the necessary amount of turns and solder the finishing end into the opposite ring from the starting end.

You have a coil that can be changed any number of times with different wire sizes by only applying a soldering iron to the rings.—Chas. Q. Free.

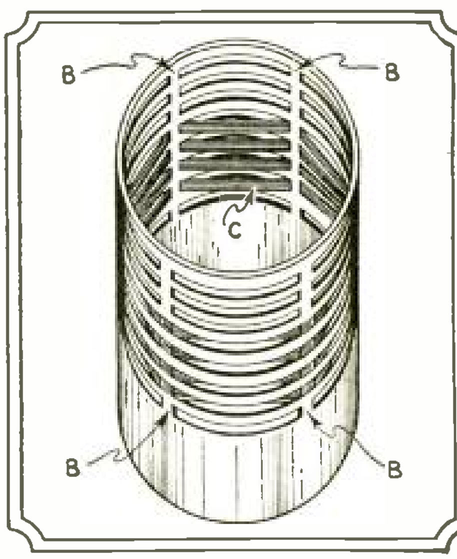


An effective method for anchoring heavy wire on coil forms.

Simplest Low-Loss Coil Form

● Probably one of the simplest and best *low-loss* coil forms is shown in the accompanying illustrations. This particular design was suggested in a recent British patent and appeared in *Experimental Wireless* in London. The coil is wound in sections in the slots formed, the tube or cylinder being made of varnished impregnated paper, or it may be or fiber, bakelite, micarta, etc. The uncut portions, B, serve to

(Continued on page 637)



A clever way in which to make a "low-loss" short-wave coil form.

PENTODES In

By Dr. W. Möller

The transmitter described in this article is intended primarily for demonstration purposes, and should not be used for actual radio transmission, unless it is adjusted to operate in one of the "amateur bands." Of course, a license from the Federal Radio Commission is necessary for radio transmitting of any kind. Experimenters who are interested only in observing the phenomena of resonance, absorption, etc., can use this apparatus in their homes without a license, as long as they do not couple it to an antenna.—*Editor.*

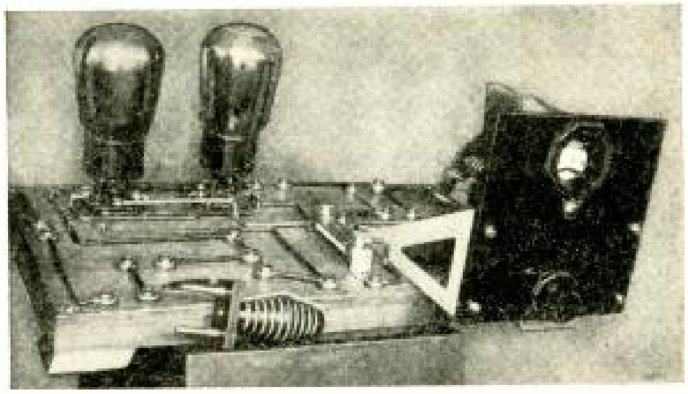


Fig. 2—Photo of the experimental pentode transmitter built by Dr. Möller.

● SMALL transmitters, with which a number of interesting experiments can be performed, may be constructed without difficulty with simple means. At the same time great manual dexterity is absolutely unnecessary. Whoever knows how to construct a *one-tube receiver*, can certainly also build a small experimental transmitter. Special transmitting tubes are not requisite. A great number of loud-speaker (audio amplifier) tubes are suitable.

First, I shall treat small transmitter hook-ups, operating with *pentodes*. In the second section, there follows a selection of suitable experiments, all so chosen that even in the case of the loud speaker (audio frequency) tubes, customary in receiving sets, a sufficiently strong and impressive effect results. These experiments give at the same time a deeper insight into the nature of radio-technological processes and are therefore suitable not merely for one's own studies, but also for the purposes of demonstration.

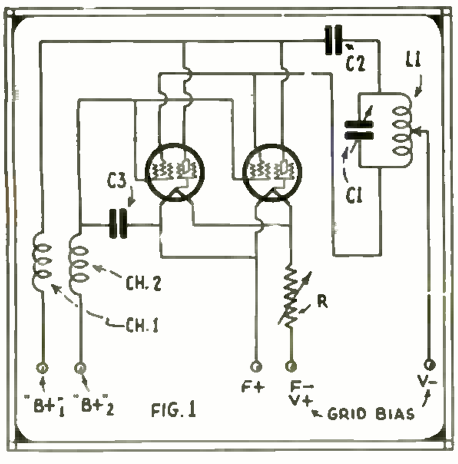


Fig. 1—Hook-up of low-power pentode transmitter.

1—Construction of a Small Transmitter

Transmitting hook-ups for the *single* tubes may also be converted without trouble to the pentode tubes. A modification of the three-point hook-up, suited to the pentode, is shown in Fig. 1. The oscillating circuit, which consists of the coil L1 and the condenser C1, has its poles at the plate and control grid of the tube. On the way from the oscillation circuit to the plate of the tube is the blocking (fixed) condenser C2. Its task is to keep the high plate direct current out of the oscillating circuit and away from the control grid. The grid bias is taken from a special, small grid battery +V—V and connected approximately to the center of the oscillation circuit coil. The plate potential is applied via the high frequency choke CH. 1 and the protective grid potential via the choke CH. 2. The grid and the cathode are by-passed by a (fixed) condenser C3.

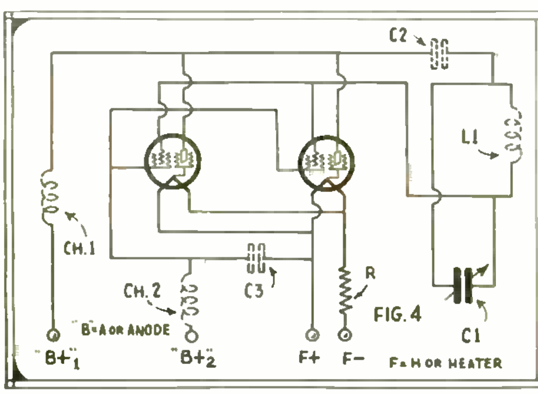
For the experiments described in the second section it is most practical to adjust the frequency approximately to the range between 40 and 100 meters, since the requisite coils can be used in the form of core-less coils, and with their relatively small number of windings these are always convenient to manage. This settles the dimensions of the oscillation circuit. The condenser C1 must be a short wave condenser of 200 mmf. maximum capacity. The coil parallel to it has a diameter of 3 to 4 inches, with 6-8 turns. The blocking condenser C2 must not offer too great a resistance to the high frequency oscillations traveling between tube and oscillation circuit; therefore, it must have at least 2000 mmf. (or .002 mf.) capacity. Its test potential must be about four times the operating potential provided for the plate.

The other blocking condenser C3, which lies in the bridge between protective grid and cathode, has the size of .1 mf. In the hook-up two tubes are in parallel in order to increase the output of the transmitter. Their plates, control grids, shield grids and filaments are connected by means of short wires. The second tube is not absolutely necessary. When it is not available, the hook-up can be made with one tube. The experiments are successful even then. The designated choke coils are ordinary high frequency chokes, such as are used in every receiving set, of about 85 MH. inductance. The plate potentials are taken from a house-current power-pack, just as in receiving sets.

How the set is to be constructed is left to the reader's taste. Where it is a question of performing experiments for personal study, and occasionally also for demonstration purposes, the arrangement in Fig. 2 is recommended. It shows the base-board of the set built by the writer. On it are fastened the tube sockets, the regulating resistance for the heater circuit, and a vertical front-panel for the tuning condenser. There are also on the base-board a number of sockets, which are connected together according to the hook-up.

The individual connections are made with different colored wires, making the whole arrangement very easy to look over and understand. This type of mounting presupposes that the other parts which must still be added, such as condensers, choke coils, etc., are all so arranged that one push puts them in their sockets. This makes experimenting especially simple.

One can easily change one part for another and investigate its influence on the operation of the transmitter, etc. If on the other hand all the parts are in a fixed mounting arrangement with regard to one another, this advantage of easy interchanging is lost. Accordingly, whoever resolves on this kind of mounting must put choke coils and blocking condensers on suitable double-plugs and pay careful attention



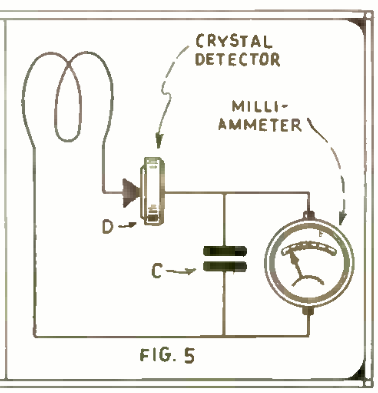


Fig. 4, at left, wiring plan of the pentode transmitter, as used by the author. Fig. 5, at right, shows the detector and receiving circuit.

Low-Power Transmitters

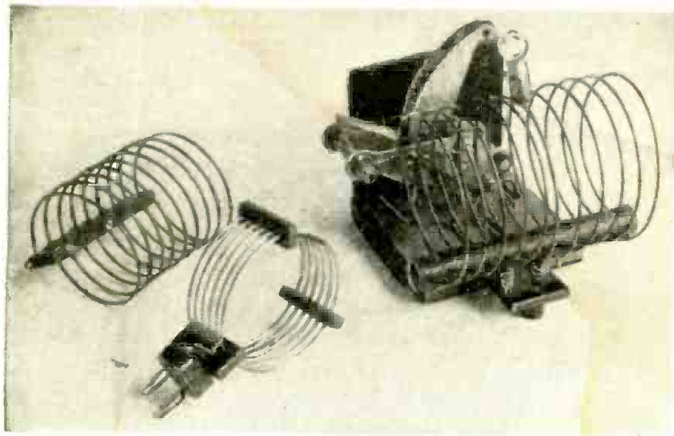


Fig. 6A—Coils used in the transmitter and receiver—two transmitter coils at left; at right—condenser and coil, together with glow lamp used in "test" receiver.

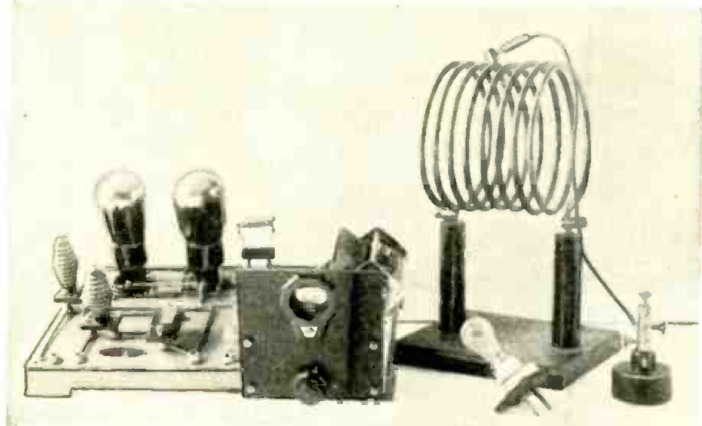


Fig. 3—The experimental, low-power, pentode transmitter with individual parts as constructed by Dr. Möller for his laboratory demonstration work. You will find it very interesting.

to the separation of the sockets on the base-board, so that the prongs will fit properly.

Figure 3 shows the experimental set with which I have had very good results in experimenting, and which I therefore can recommend warmly. At the same time it shows some examples of how the small parts are fastened to the double-plugs. Coil L1 is made in a large form. Its ends rest on two supports, made of insulating material. It is connected by heavy copper wires. Besides this large coil, which is bent out of 5 mm. (.25 inch) copper tubing 10 cm. (4 inch) in diameter, one can of course also operate with smaller coils. In radio-technological instruction courses this form of set has proved excellent. Accordingly there is shown in Fig. 4 the exact wiring plan of the base-board, with the individual parts clearly indicated.

The arrangement just described is only a proposal, so that all roads are open to the reader to choose for his set other forms better suited to him.

Since the writer had to use the transmitter not only in the short wave oscillation field, but also for producing oscillations of acoustic frequency and also for oscillations of very slow periodicity, it was necessary to exchange choke coils and blocking condensers very quickly. In these frequency fields there are needed, aside from much larger blocking condensers, also choke coils of a far higher inductance.

The broad basis for so extensive a purpose of use could be created only by having all the parts in question made easily and quickly interchangeable by means of prongs and sockets. Those who wish to confine their experiments to high frequency oscillations described in the following section can mount the blocking condensers, the coil L1, and also the choke coils solidly on the base-board if desired.

2—Experiments in the Field of High Frequency Oscillations

First Experiment: The Demonstration of Induced Oscillations.

As soon as the transmitter is set in action, a magnetic field arises in the region about the oscillator coil, with high frequency alternating currents flowing through it. Each point of this field is characterized by the fact that the magnetic force in it continually changes its strength and its polarity, in exact time with the oscillation of the transmitter. These fields possess a physical characteristic extremely important for radio work. They induce a potential in all conductors inserted into the field; this again produces a current, the so-called *induction current*, if the circuit of the conductor is closed.

To demonstrate this *field effect* by an extremely clear experiment, we bend a wire loop of about the same diameter as the oscillator coil. The two free ends of this loop are closed across a small 3.5 volt filament lamp. We hold this wire loop in such a way that it is parallel to the loops of the oscillation circuit coil, and bring it toward the transmitter coil. At a distance of 5 to 10 cm. (2 to 4 inches) the lamp begins to glow. The induction current is thereby demonstrated.

We can use this small apparatus with advantage, when we wish quickly and simply to convince ourselves or our audience that the transmitter is operating.

Second Experiment: Sounding the Transmission Field with a Detector Receiver.

The glow lamp shows a visible effect only in the direct proximity of the oscillation circuit coil. It is relatively insensitive. We get a far greater sensitivity if we provide our receiver with a *crystal detector*. The alternating

(Continued on page 627)

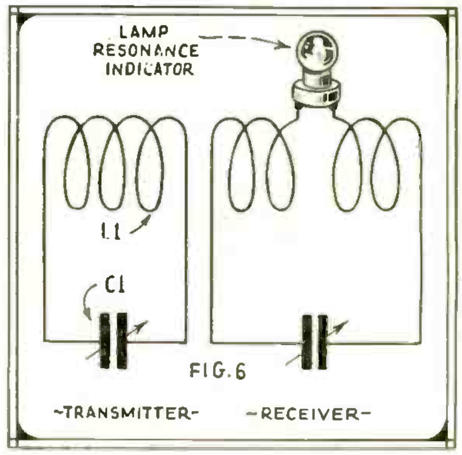
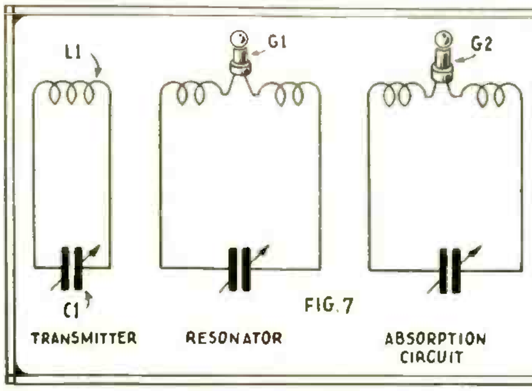


Fig. 6—Experimental receiving circuit employing a small lamp as the resonance indicator.



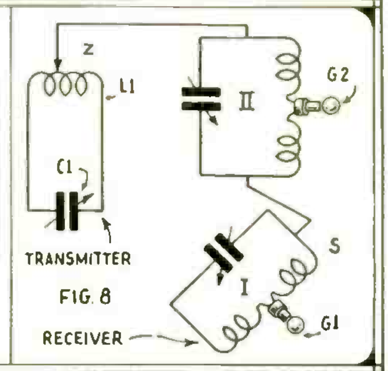
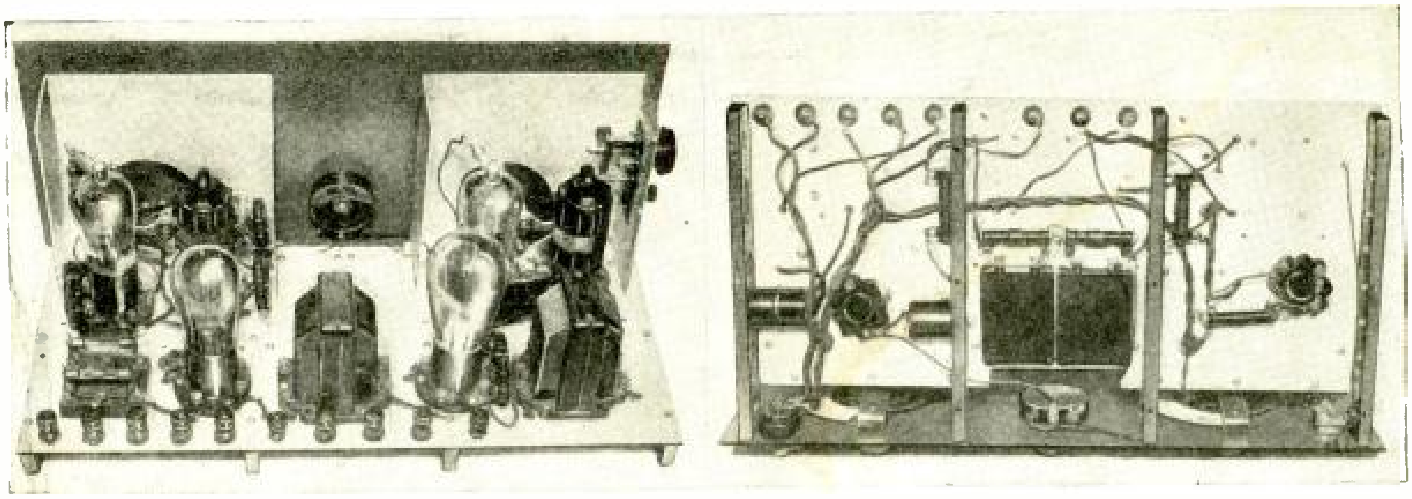


Fig. 7, at left, above, shows experimental set-up of transmitter, resonator and absorption circuit; Fig. 8, at right, shows how to hook up apparatus for demonstrating "blocking circuit" effect.



The two photos above show the A.C. Super-Wasp after being brought up-to-date by adding a screen-grid tube for the detector and a 47 pentode for the output.

The A.C. Super-Wasp Brought Up To Date!

Thousands of short-wave "fans" are the proud owners of the famous A.C. Super-Wasp. Many of these "fans" have often wished undoubtedly for some information describing how to modernize this receiver, so as to use a 47 pentode. This data is here given, also how to use a screen-grid tube for the detector.

By
A. A. DOLID

● ONE of the first A.C. tuned radio frequency short-wave receivers, the Pilot A.C. Super-Wasp, was widely used by short-wave enthusiasts. The combination of screen grid, tuned radio frequency and the regenerative detector made a sensitive and fairly selective receiver but the use of a type '27 output tube prevented satisfactory use of the loud-speaker.

This article will show how to bring the receiver up to date at an extremely low cost.

The major changes consist of replacing the type '27 detector tube with a screen-grid tube and the output tube with a type '47 pentode. In order to keep the cost down to a minimum it was decided to retain the present type '24 as the R. F. tube and to use a similar tube as the detector. If the new type '57 and '58 tubes were used new sockets would be necessary.

The first attempts to use the '24 as detector were failures. It was found that the leakage due to the high voltage across the detector grid condenser made enough noise to drown out any signal. The only remedy was to isolate the detector grid from the R. F. plate.

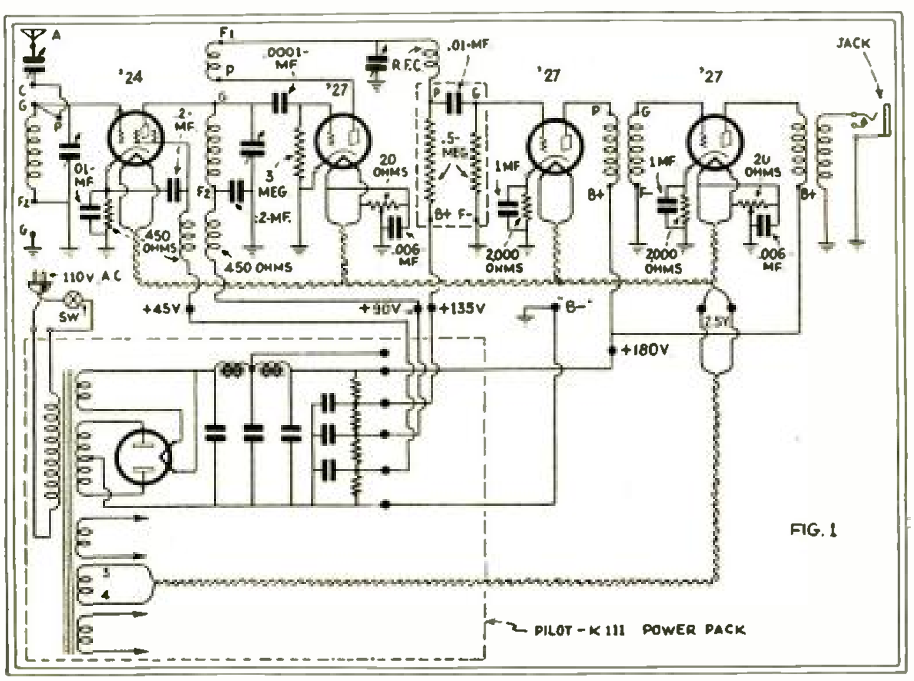


Fig. 1—Wiring diagram of the A.C. Super-Wasp in its original form.

The obvious method of adding a primary winding was ruled out, as this would mean the use of new six-prong coil forms and sockets. A little research disclosed the fact that the Pilot Co., engineers, in designing the Universal Super-Wasp, had used a two-winding coil for coupling the R.F. tube to the detector circuit. This was done by using the "tickler" as a combination primary and oscillating coil.

Figure I shows the original circuit and Fig. 2 the changed circuit. A comparison of the two will show the few additional pieces of apparatus necessary to make the change. The use of the screen-grid for regeneration and oscillation gives the effect of using a separate oscillator and practically eliminates detuning in the detector circuit. The potentiometer in the screen-grid lead controls regeneration very effectively.

The additional apparatus is listed below with the designations shown in Fig. 2:

C-1	.01 mf. mica cond.
C-2	.0001 mf. mica cond.
C-3	.00004 mf. mica cond.
C-4	.01 mf. mica cond.
R-1	50,000 ohm potentiometer
R-2	450 ohm resistor
RF-1	80 milli-henry R.F. Choke

The K-111 power-pack is retained. The 220 volt tap which was not used in the original circuit, is now used to supply the plate voltage for the pentode output tube. Although this voltage drops to about 200 volts under load, the output from the '47 tube is sufficient to operate the loud-speaker on practically all signals.

The .00004 mf. condenser C3, which couples the detector plate to the screen-grid, is mounted directly on the detector tube socket. The .0001 mf. condenser C2 is hung beside the detector coil socket, being held in place by the leads to the tube socket and the coil socket. These are shown clearly in the rear view of the receiver.

The .01 mf. condenser C4 is mounted below the chassis directly between the old R.F. choke and the new choke RF1, which is mounted on the other bracket. The other .01 mf. condenser C1 is mounted on the frame of the detector tuning condenser in place of the old .2 mf. paper condenser.

The 450 ohm resistor R2 replaces the present 2000 ohm bias resistor and the 50,000 ohm potentiometer R1 is mounted on the panel in the place of the present variable condenser used for regeneration control.

Since the grid-leak is now across the grid condenser, the location of both of these must be changed. By using heavy wire (16 gauge) the grid clip which is fastened to the upper end of the condenser will hold them in place.

The lead is removed from the cathode terminal of the output tube socket and connected to the center-tap of the filament resistor. This tap must be disconnected from its present ground. Since there are two *grounded* binding posts on the receiver, G and B minus, one of these posts is removed, the hole reamed out and an insulating bushing put in, so that the post can be used as the 220 volt tap for the pentode circuit. The "B" minus lead from the power-pack is connected to the ground post on the set.

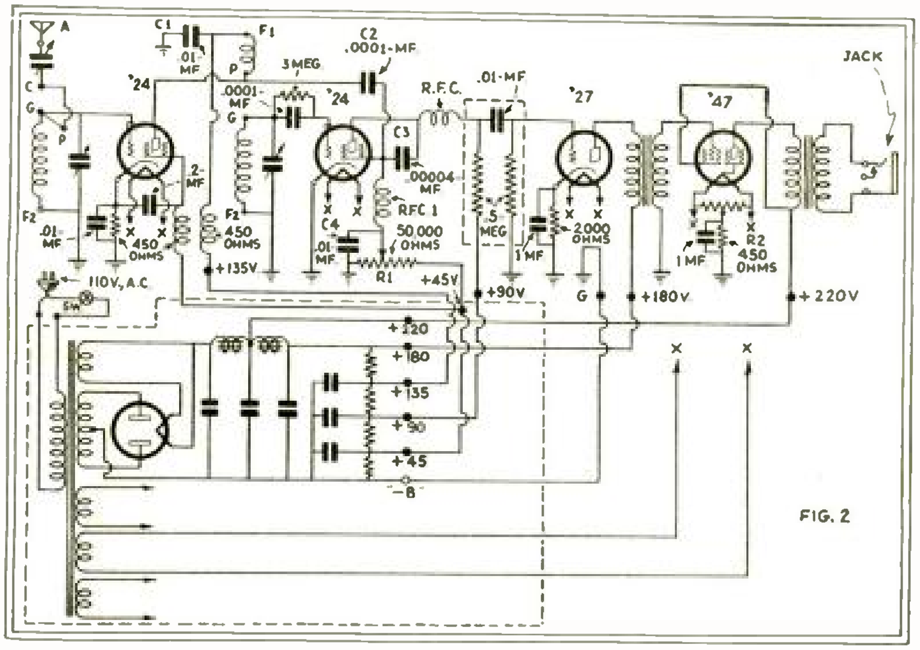


Fig. 2—The A.C. Super-Wasp after modernization, showing screen-grid tube for detector in place of the 27; also, the use of a 47 pentode in the output stage.

As neither the turns on the coils nor the spacing between windings is changed, the wavelength ranges are the same as before.

Short-Wave Receiver in a Cigar Box

● PORTABILITY was the primary objective in the building of this one-tube short-wave receiver submitted. The set shown was designed for use on a trip into northern Michigan. Of course an A.C. set was out of the question and because batteries could not be purchased on the trip, it was necessary to construct a receiver with the least possible drain on the batteries. After a little consideration the straight one-tube regenerative circuit was chosen.

Because of a limited amount of space a cigar box with the dimensions 2⅞"x5¾"x10¼" was used. This was large enough to enclose all parts, including both batteries and aerial.

The set was for the most part, built from old parts out of broadcast receivers. The coil is of the plug-in type, wound on an old tube-base. The grid coil has 24 turns and the tickler 18 with a space of ⅛" between the two. The tube is a UX-199. The tuning condenser is a .00025 mf. cut down to a 50 mmf. and the regeneration condenser is a .0005 mf. cut down to a .00035 mf. The aerial condenser is a 20 mmf. The grid-leak is 8 megohms and the grid condenser is a .0001 mf. The "A" battery consists of two flashlight cells in series and the "B" battery is a small 22½ volt size. The aerial is a copper screen built into the lid of the box. A piece of wood ⅛"x5½"x-2⅝" is used to separate the set from the batteries and also to support the tube socket. The resistance of the earphones is 2,000 ohms.

To operate this little receiver all that is necessary is to plug in the earphones and turn the filament switch on, then adjust the regeneration control until a slight hiss is audible; the tuning condenser is turned slowly until a station is heard. If any "dead spots" are encountered while tuning, they can be shifted by turning the antenna condenser.

This short-wave receiver may also be used as a short-wave adapter on any modern broadcast receiver, by simply running a wire from each of the ear-

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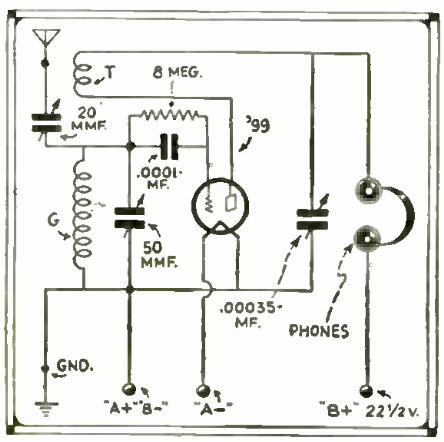
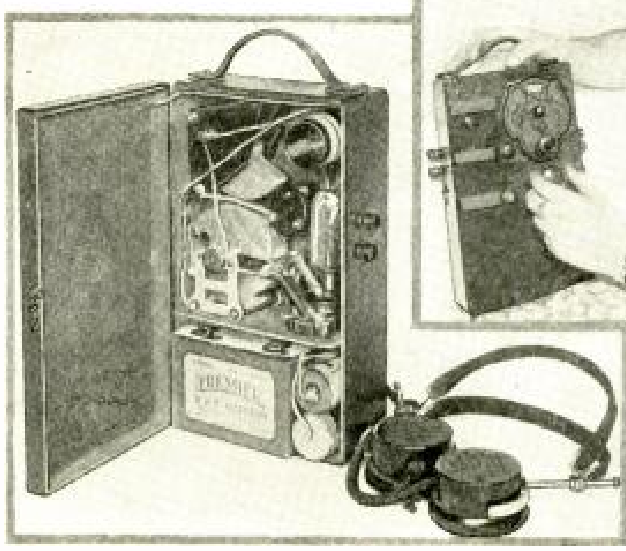


Wiring diagram for the 1-Tube battery-operated S-W Receiver.

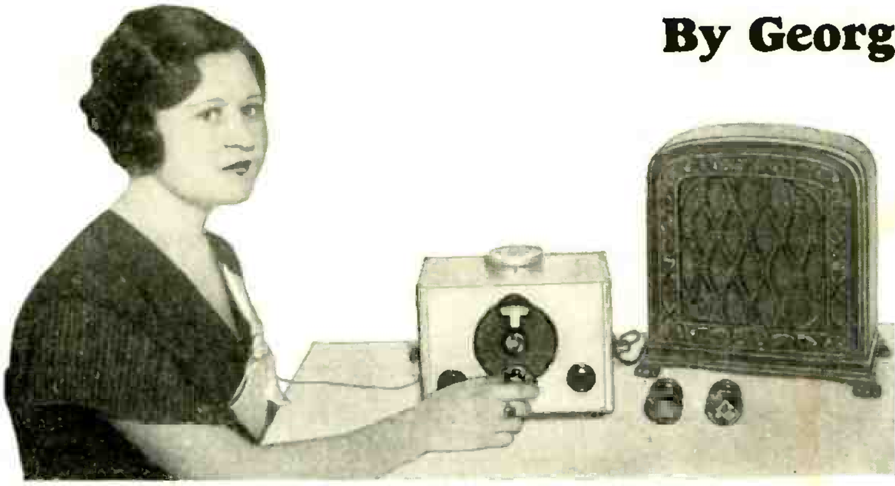


George W. Bunce of Olmsted Falls, Ohio, won honorable mention in the August contest for the best short-wave set submitted to the editors. The editors tried this receiver and it worked very nicely.

Two-Tube A. C. Band-

By George W. Shuart, W2AMN-W2CBC

There has been a wide-spread demand from short-wave fans for an economical short-wave receiver, which would work a loud speaker on but two "working" tubes, and also provide "band-spread" features, besides providing a smooth regeneration control. Mr. Shuart has supplied the "missing link" and the set he here describes embodies these several desirable factors



Mr. Shuart's 2-Tube A.C. "Band Spreader" provides smooth, easy tuning and high economy.

● THE receiver described in this paper was built as a companion to the crystal-controlled transmitter described in the December issue of this magazine.

The requirements were a very sturdy and compact receiver at low cost, and still no sacrifice in sensitivity.

The new type 58 tube provides a very sensitive detector, and is very smooth in operation. The 47 pentode was chosen for the audio amplifier because it had comparatively large audio output, and could be operated from the same filament supply as the 58.

The entire set is built around an aluminum can measuring 5x6x9 inches. These cans can be readily obtained. If one does not wish to cut the hole in the cover himself, any of the dealers supplying these cans will readily supply the can with the hole and a cover to fit. This opening is convenient because otherwise it would be necessary to take out the four screws and remove the cover in order to change coils.

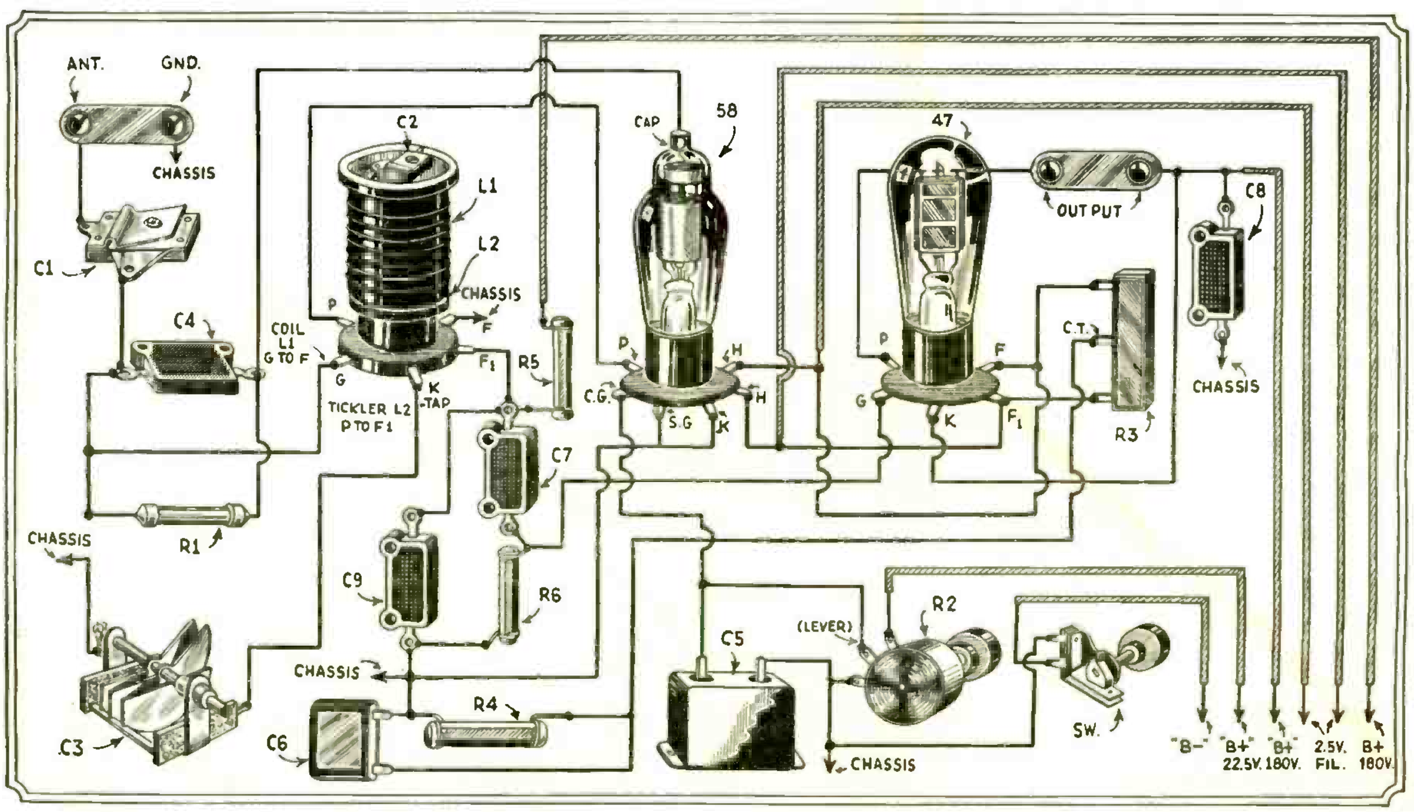
The sub-base mounted inside the can measures 4½x5½x8½ inches, and is fastened to the bottom of the can on brass spacers ⅞ of an inch long. This space provides ample room for the wiring and the mounting of the resistors, condensers and wafer sockets.

All Parts Mounted on Shelf

All parts should be mounted on the shelf, and all wiring be done before it is attached to the bottom of the cabinet. The leads to the various parts mounted on the front and insides of the cabinet should be left long and unattached till all other wiring is done.

The posts supporting the socket for the plug-in coil should be one and one half inches long, if short coil forms, such as National or Silver-Marshall, are used; otherwise it would be difficult to reach the coil from the small hole in the top.

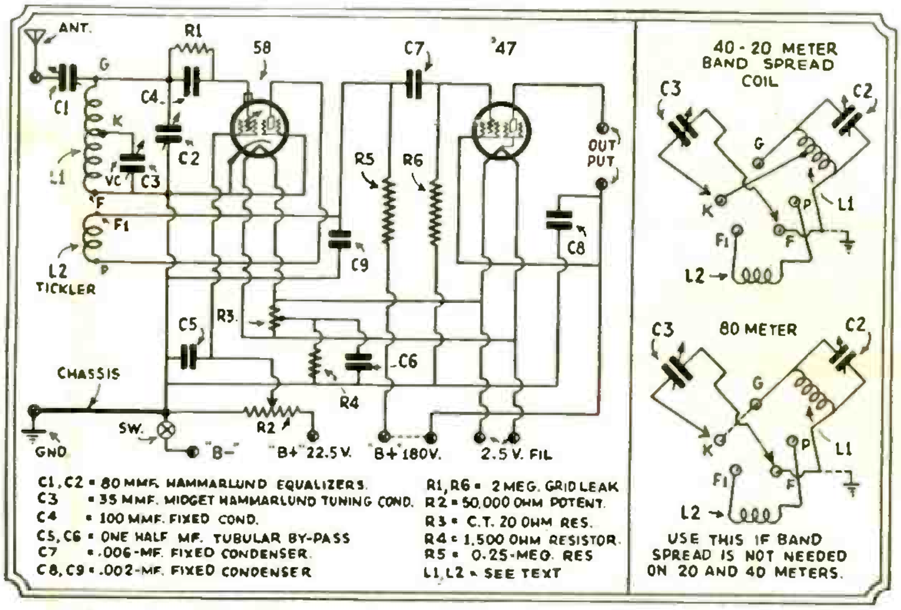
The cable is clamped to the shelf and the leads are attached directly to the



Picture diagram especially suited to the lay reader, who is not so familiar with schematic wiring diagrams. The cost of building this 2-tube receiver is very nominal indeed.

Spreader Works Loud Speaker

Winner of $20.00 Prize in November Contest



Schematic wiring diagram of the A.C. "band spreader" 2-tube receiver.

parts. This eliminates the necessity of a plug or a binding post arrangement.

No specifications for mounting of the parts are given, because anyone building this set may use a somewhat different layout. A general idea of this can be gotten from the photographs.

The grid-leak and condenser are mounted directly on the tuning condenser, with a lead from one end going up to the grid cap on the 58 tube. No tube shield is shown on the detector because the use of one resulted in a noticeable decrease in signal strength, especially around twenty meters. No radio frequency choke coil was found necessary in the plate circuit of the detector. A by-pass condenser C9 was all that was needed. A .002 mf. unit is shown, although any size from .00025 mf. to .002 mf. will serve quite well.

No "Dead-Spots"—Smooth Regeneration

There are absolutely no "dead-spots" in the tuning of this receiver, and there seems to be no limit to the frequency at which the type 58 detector will oscillate. The control of regeneration by varying the screen-voltage on the detector of this type receiver is highly recommended, because it is absolutely the best method so far developed. There is little effect upon tuning, and it is extremely smooth in operation. The one-half mf. condenser shunted across the potentiometer controlling regeneration gives quiet operation and also acts as a by-pass for the screen grid lead.

The audio coupling is done by the condenser-resistor method, because of the small amount of space it requires. Audio amplification can be carried only to a certain degree after which the back ground noise becomes too great for the reception of weak signals. With the method used in this set many signals are too loud for comfortable ear phone reception. The stronger signals come in with sufficient strength to operate a loud speaker, and still the background noise level is extremely low.

It can be seen that even if more audio gain could be obtained by other methods of coupling it would be useless with a 47 as the audio amplifier. If a 27 or 56 were used then there would be reason to use another method. This is why a 47 was used, as it eliminated the larger type of coupling units.

No Output Transformer Used

Of course one must remember that the 47 draws considerable plate current and that this passes directly through the phones, unless an output transformer is used. The author has not used an output transformer and no ill effects have been experienced.

The grid bias for the 47 is obtained through a 1,500 ohm resistor in the grid return to the filament center-tap resistor.

It may be well to mention here that if hum is noticeable, it may be caused by the filament voltage being taken off the plate transformer. A separate filament transformer will undoubtedly cure this trouble.

The specifications for the coils are given in the drawing and hold true only with National or Silver-Marshall coil forms, or with other forms of the same dimensions.

If one does not wish to spread out the twenty and forty meter amateur bands, the tap in the grid coil can be eliminated and the tuning condenser shunted directly across the entire grid

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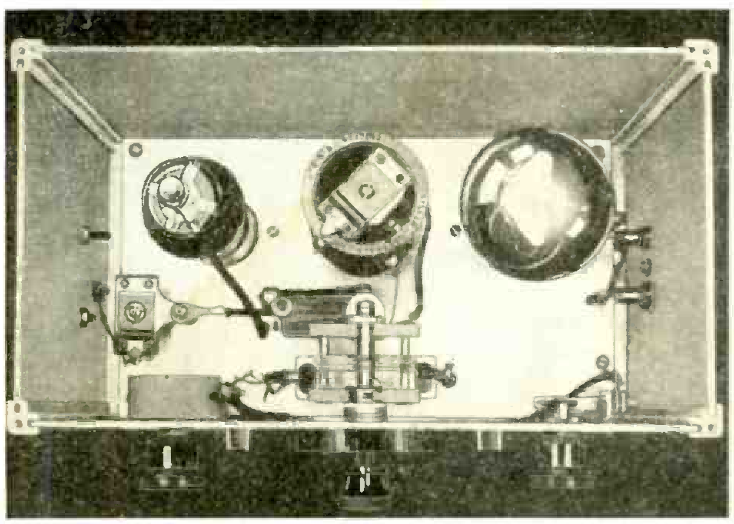

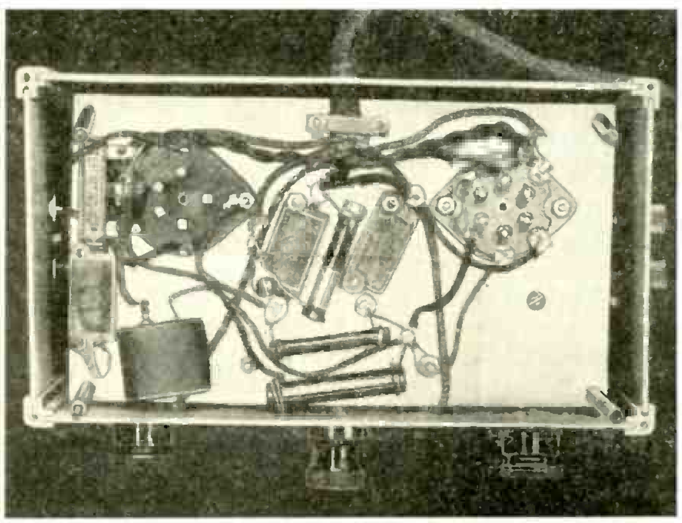

The photos above show interior as well as bottom views of Mr. Shuart's very neat receiver job—a 2-tube "high gain" A.C. operated set, with "band-spread" features. It employs a 58 tube for the detector and a 47 A.F. output tube. The plate supply may be from "B" battery or from a well-filtered "B" eliminator, whichever you have handy.

A 5-Meter S.W.

By A. C. MATTHEWS,

Appearance of Mr. Matthews' 5-meter superheterodyne receiver which employs a single tuning dial; loud speaker appears in the background. The set uses seven tubes in all, including a rectifier.

● WITH the advent of actual broadcasting on the ultra short wave band between 43 and 80 megacycles, intensive receiver development has been taking place. The art has gradually progressed through the regenerative detector, super-regenerator stage, until at present the most satisfactory method is that of the *double-detector* or *superheterodyne*.

Tuned radio frequency amplification at such ultra short wavelengths is practically out of the question, since the low impedances encountered in the ordinary tuned circuit do not permit much amplification. Recent advances in tube design have resulted in decreased inter-electrode capacities. This is conjunction with the addition of an extra grid (R.F. pentode) has made it possible to realize some gain at very high frequencies, if extra precautions are taken in the circuit design. At its best, however, a tuned radio frequency receiver for these frequencies is complicated, due to the necessary design precautions that must be taken.

Superheterodyne

Briefly, the superheterodyne functions in the following manner. (Shown diagrammatically in Fig. 1.) The incoming signal frequency is mixed with a *local oscillator*. The resulting beat frequency, being lower than the original signal frequency, is therefore much easier to handle. The difference between the local oscillator and the signal frequency remains constant over the band for which the set is designed. Since the beat frequency remains constant, the design of a suitable amplifier having the desired characteristics is much easier than before. The choice of the frequency difference between the oscillator and the incoming signal, however, is important and will be discussed further under the intermediate amplifier. Once the incoming signal has been transformed to a relatively low frequency, the design problem becomes simply that of a straight tuned radio frequency receiver with associated audio amplifier.

The development of this circuit for use in the *ultra high frequency* band has been rather slow. This has been due to the almost impossible task of maintaining the beating oscillator at a constant frequency. The success of the superheterodyne depends on the stability of this oscillator.

Having discussed the main difficulties to be experienced in the design of an ultra high frequency superheterodyne, we will now take up its design in a systematic manner.

First Detector—Mixer Circuit

The first detector circuit is tuned to the incoming signal frequency by the inductance L-2 and condenser C-1. The coils are made by winding the necessary number of turns (see table) on a one-half inch form and then removing the form. The wire size is rather large and this will tend to hold the coils in place. Pin jacks are soldered on the coil ends for convenience. This makes it possible to change coils in the event that it is necessary to shift to another frequency band. The oscillator is coupled through the screen-grid circuit of the 58 type tube, although inductive coupling may be used when a stable oscillator is employed. The author prefers the screen-grid method, since this precludes the

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The 5-meter field is rapidly expanding. Many short wave "hams" operating in this field have undoubtedly found that one item badly needed was a good 5-meter receiver—one which would provide high sensitivity, suitable selectivity and sufficient volume to work a loud speaker. Mr. Matthews, author of the present article, is a prominent short-wave and television expert, and he has evolved this very interesting 6-tube superhet for 5-meter work.

1—Two gang variable condenser 100 mmf. cap. (Hammarlund) C1 and C2.
1—Midget variable condenser 18 mmf. cap. (Hammarlund) C3.
1—0.1 mf. 200 volt condenser.
2—Triple section 0.1 mf. 300 volt condensers.
1—0.001 mf. mica dielectric 200 volt condenser.
1—50 mmf. mica dielectric 300 volt condenser.
3—250 mmf. mica dielectric 300 volt condensers.
2—0.01 mf. paper dielectric 200 volt condensers.
1—0.02 mf. paper dielectric 200 volt condenser.
2—1.0 mf. paper dielectric 300 volt condensers.
1—2.0 mf. paper dielectric 200 volt condenser.
2—8.0 mf. dry electrolytic 500 volt condensers.
1—400 ohm ½ watt carbon resistor.
1—1500 ohm 1 watt carbon resistor.
1—5000 ohm ½ watt carbon resistor.
1—14,000 ohm 3 watt carbon resistor.
1—25,000 ohm ½ watt carbon resistor.
1—30,000 ohm ½ watt carbon resistor.
1—100,000 ohm ½ watt carbon resistor.
1—250,000 ohm ½ watt carbon resistor.
1—500,000 ohm ½ watt carbon resistors.
1—25,000 ohm 1 watt variable resistor with power switch.
1—200 turn universal wound coil. ½" form (Auto. Winding Co.)
1—85 mh. choke (Samson).
1—10 henry choke 35 ma. direct current.
1—20 henry choke 50 ma. direct current.
4—Six-prong sockets. Alden
2—Four-prong sockets. Alden
1—Five prong socket. Alden
1—Power cord and plug.
1—Chassis (Blan—The Radio-Man).
1—Power transformer: Sec. Volts—2.5 volts c.t. 7.5 amps, 5.0 volts 2 amps, 700 volts c.t. 70 ma.
4—Tube shields for 58 type tubes.
1—Tube shield for 24 type tube.

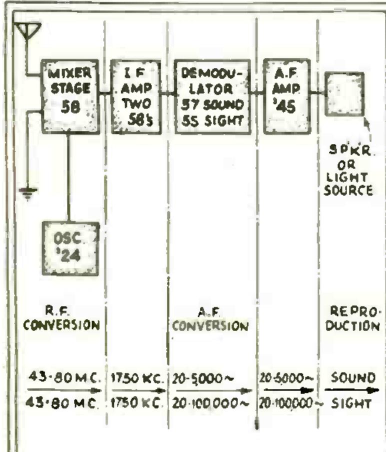


FIG. 1 A

TABLE

RANGE	40-80 MEGACYCLES
L_1	2 TURNS - 1/2" DIA. NO. 14 ENAM.
L_2	4 TURNS - 1/2" DIA. NO. 14 ENAM.
L_3	4 TURNS TAP AT 1 TURN 1/2" DIA. NO. 14 EN.

I.F. TRANS. = F.W. SICKLES CO. SPRINGFIELD MASS. OR
DATA:—
FORM = 1¼" DIA. 2¼" LONG.
PRI. = 50 TURNS NO. 32 D.S.C.
SEC. = 100 TURNS NO. 28 EN.
WINDING = CLOCKWISE 64 T. PER INCH.
COND. = 70 MMF. VAR. ISOLANTITE DIELECTRIC.
FREQ. = 1,750 KC.

FIG. 1 B

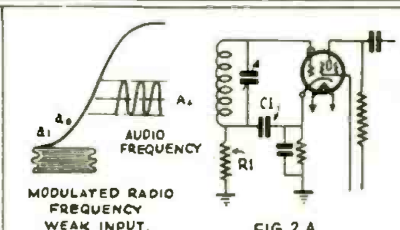
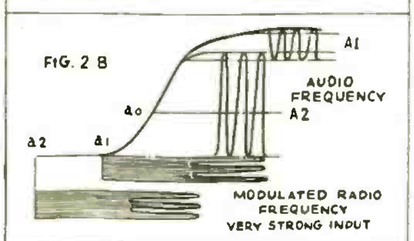
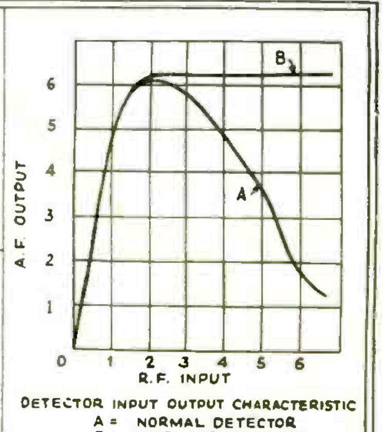


FIG. 2 A

FIG. 2 B





DETECTOR INPUT OUTPUT CHARACTERISTIC
A = NORMAL DETECTOR
B = MODIFIED DETECTOR

FIG. 3

Diagram above shows, at left, successive stages in the reception of signals on a superheterodyne; coil winding data at Fig. 1B, while the graphs shown at Figs. 2 and 3 are used by the author in explaining the action of the receiver.

Superheterodyne

Radio Consultant

possibility of radiation through the antenna.

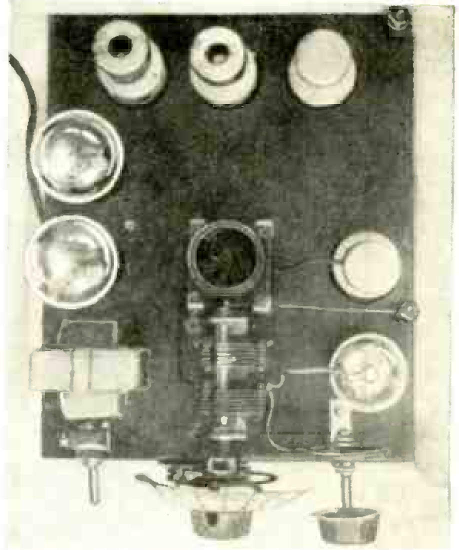
Oscillator

As has been said before, the oscillator is the heart of the ultra high frequency superheterodyne. The ordinary oscillator with inductive coupling, such as employed in the usual receiver, would be a complete failure in ultra high frequency work. The oscillator to be used must not only have a very high order of *frequency stability*, but also be capable of maintaining its intended frequency unaffected by the first detector circuit, with which it is connected. Frequency stability that is relatively impervious to changes in the supply voltage is necessary. The fact that its load circuit is subject to rather severe variations, since the oscillator is required to furnish power of a small order to the first detector, makes the oscillator requirements very severe to say the least. The degree of "pulling in" of the oscillator frequency with the tuning of the first detector unfortunately is greater as the frequency increases. In other words, the frequency stability of the oscillator decreases as the frequency increases. Therefore a combination that would be entirely adequate for broadcast reception would be entirely out of the question for ultra high frequency work. With the performance so dependent on a fixed frequency difference between the oscillator and the incoming signal frequency, it is easily seen that nothing but the most refined circuit design would be tolerable in this application. No doubt it is because of this fact that so much valuable time has been spent trying to improve on the straight regenerative and super-regenerative receivers.

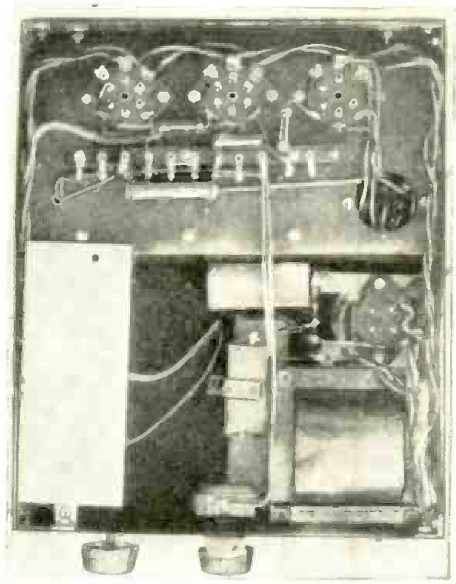
Suppose we take a look at some commercial installation and see what precautions they take to maintain oscillator stability. Probably one of the best installations would be the trans-Atlantic receiver station of the R. C. A., at Rocky Point, L. I. In their diversity telephone receiving system used for picking up foreign broadcasts, they make use of a *buffer* or *coupling tube* between the oscillator output and the grid circuit of the first detector. This provides a high degree of oscillator independence but the additional tube makes for more complicated circuits and although it can be used for frequency doubling or tripling, it is hardly warranted in a receiver for Mr. General Public.

After having tried practically every type of oscillator circuit unsuccessfully, the *electron-coupled* oscillator was adopted. This oscillator, described by Lieutenant J. B. Dow in the December, 1931, *I. R. E. Proceedings*, has as good if not better all around *frequency stability* than the more complex oscillator-amplifier combination. The circuit employs a screen-grid tetrode; the cathode, control-grid and screen-grid forming the frequency generating circuits, while the plate is in the output circuit and is entirely independent of the oscillator frequency, since it is shielded by the screen-grid from the oscillator circuit proper. (The screen-grid is at ground potential, as far as radio frequency is concerned.) The coupling to the load circuit is therefore electronic rather than inductive or capacitive since the plate is effectively isolated by the screen grid. This reduces the interlocking effect between the oscillator and first detector tremendously and in no small measure

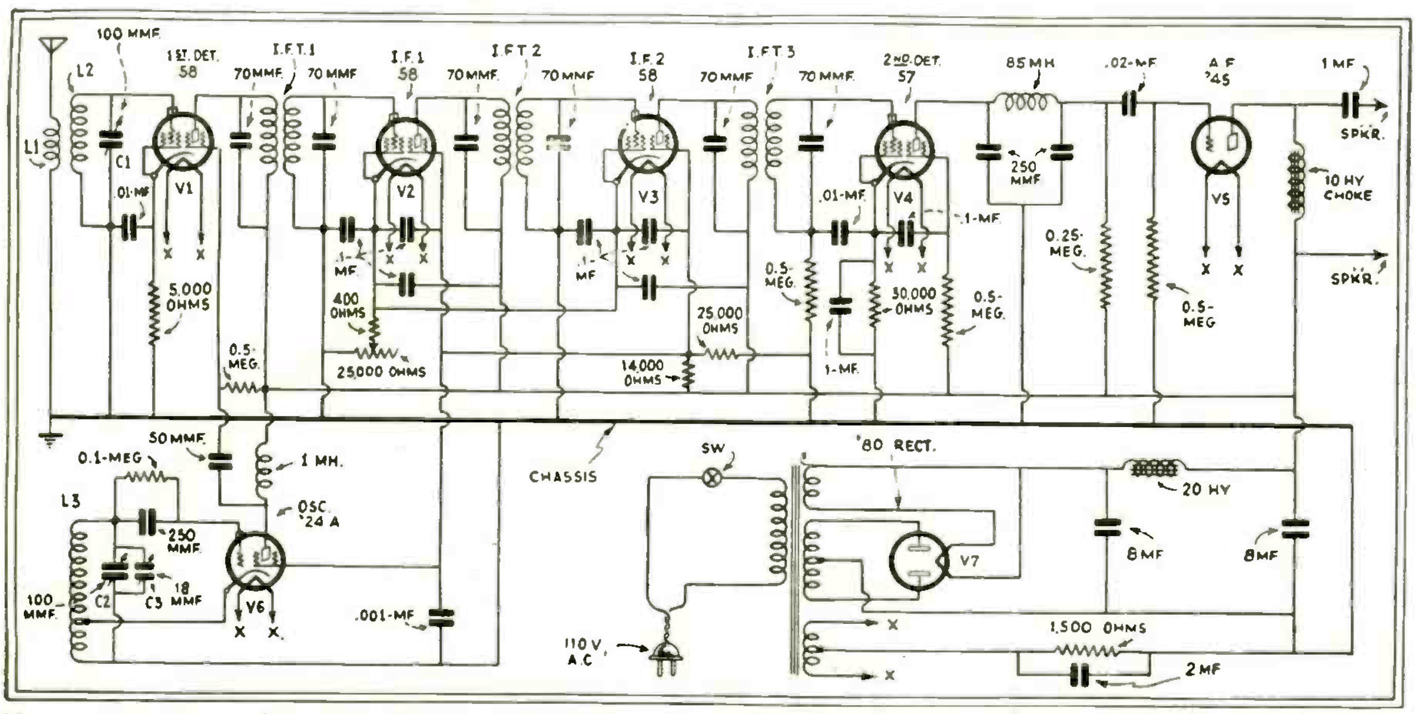
(Continued on page 622)



Top view of the 5-meter superheterodyne.

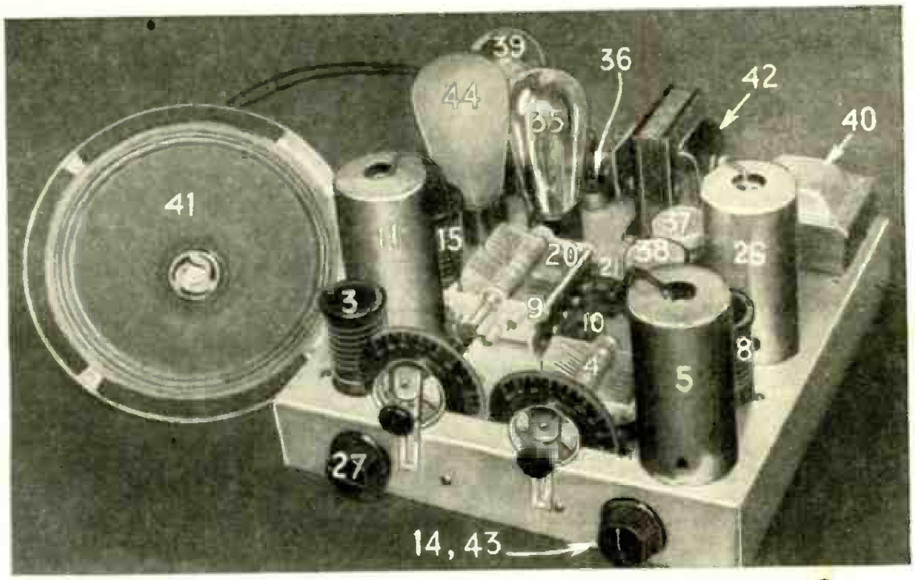


Bottom view of Mr. Matthews' 5-meter "super."

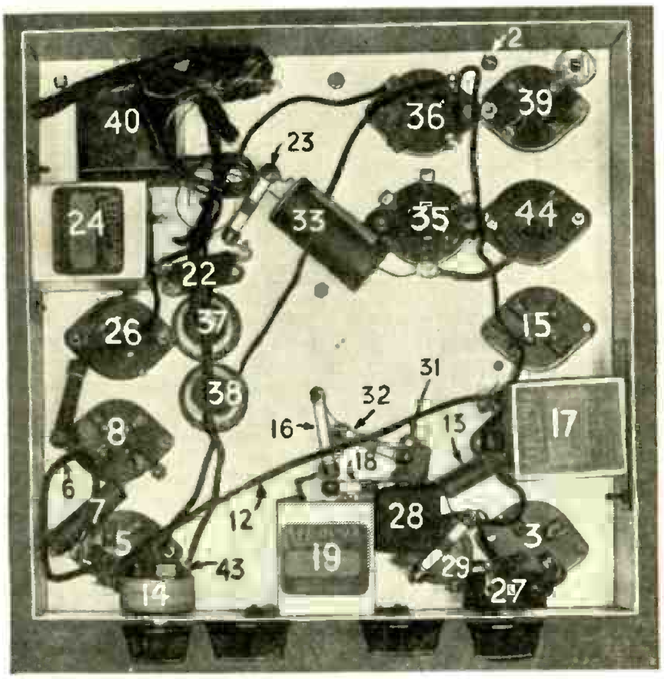


Here we have the complete wiring diagram of Mr. Matthews' superheterodyne designed for 5-meter reception. We believe that this is an ideal receiver for the average short wave fan interested in 5-meter reception, as it uses but seven tubes with rectifier.

CISIN 4-



Above — General view of the newest 4-tube A.C. operated short-wave receiver designed by Mr. Cisin, popular American set designer, and which uses the new 6.3 volt pentodes. The author specifies the best type of loud speaker to use with this receiver.



Bottom view of the Cisin 4-tube pentode receiver. The numbers on the various parts correspond to those on the diagram on the opposite page.

● AS usual, the new radio tubes have been appearing so frequently that even the most up-to-date set manufacturers do not seem to be able to keep abreast of the march of progress.

Experimental set builders, however, can employ the latest developments in tubes just as soon as the tubes are available in the radio stores—provided suitable circuits are furnished from which to work.

Many readers have wished to try out the efficient new 6.3 volt tubes in a short wave A.C. circuit. The receiver presented herewith was especially designed for these fans.

A glance at the schematic diagram reveals the fact that the new tubes are used in a circuit which is fundamentally sound. It is of the tuned radio frequency classification, with two stages of T.R.F., a regenerative power detector and a resistance-coupled output stage. The new super-control 44 type variable-mu pentodes are used in the two R.F. stages.

Plug-in Coil Details

The antenna coupler (3), the R.F. transformer (8) and the coupling coil with tickler (15) are all *plugin* type Alden short-wave coils. Coils (3) and (8) are used in the conventional manner, while coil (15) utilizes the secondary winding as a tuned impedance with the primary winding employed as a *tickler*. The Alden coils are available four to a set, so that when tuned by a .00015 mf. variable condenser, they can be used to cover the entire short wave range from 16 to 200 meters.

In this receiver, three identical sets of these coils are used. The tops of the coil forms are marked with different colors, corresponding to the wavelength range of each particular coil. This prevents confusion, since if a coil with a red marking is used at socket (3), it obviously is necessary to plug in a coil with a similar color marking at (8) and (15). The Alden coils possess unusual low-loss characteristics and they are rugged and efficient.

Accurate, light weight variable condensers are employed. One of these (4), is a single Cardwell "Featherweight" type. The other (9, 20), is a dual condenser of the same type. Trutest trimmer condensers are used in connection with the dual variable in order to permit perfect initial balancing.

2-Dial Control

Two-dial control has been chosen, to give that very desirable extra degree of accuracy, so helpful when one is trying to tune in a difficult distant station. The No. 66 double reduction wedge drive Crowe tuning units are specified. These dials are designed for extremely fine tuning. They have a ratio of 48-to-1 in 180 degrees. Precision tuning units permit one to obtain better results from any set, but in the case of a well-designed short-wave set, they are absolutely indispensable.

The detector is a screen grid tube of the 36 type. Condenser (22) and resistor (23) are a part of the coupling system between the second R.F. stage and the detector. As mentioned above, *power detection* is used. Minimum negative bias is maintained on the two R.F. tubes by means of the voltage drop across individual fixed resistors (6) and (12) in the cathode return circuits. The Electrad tapered potentiometer (14), in series with both these resistors, provides a means of smooth even volume control. The screen grid voltage on the 44's and also on the 36 is dropped to the specified value—90 volts—by means of the voltage divider resistors (18) and (16). The total voltage drop across these two resistors is 250 volts.

A 50,000 ohm resistor is required at (25) to provide the negative bias for the power detector and the resistor at (34) furnishes correct negative bias voltage of 16.5 volts for the output tube. It is interesting to note that the plate voltages of all four tubes are identical—250 volts. Another interesting feature of this circuit is the fact that all four tubes are of the *cathode-heater* type. If the 2½ volt tubes were used, it would be necessary to use a direct heater type tube in the output, such as the 47 or 45. Since indirect heater type tubes are used, this circuit can be adapted readily for direct current or for battery usage.

The tickler coil is shunted by a 50,000 ohm Electrad potentiometer (27) which gives a conventional but efficient means of regeneration control. The short-wave R.F. choke (29), by-passed by the .001 mf. mica condenser, keeps the audio portion of the circuit free from R.F. currents, which otherwise would tend to produce distortion.

The resistance coupling between the detector and the output gives splendid results as regards tone fidelity. The output tube (35) is the latest type 42 power pentode. Although this fact is not generally known, the 42 tube yields 20 per cent more undistorted power output than the 47 type pentode. Specifically, the 42 has a power output of 3000 milliwatts, whereas the 47 has only 2500 milliwatts output.

The 2500 ohm speaker field, by-passed by the two Aerovox dry electrolytic condensers, furnishes ample filtering for the rectified A.C. Full-wave rectification of standard design is used. The

TUBE PENTODE RECEIVER

BY H. G. CISIN, M. E.

"Efficiency plus" marks this latest brain-child of Mr. Cisin's, a 4-tube A.C. operated high-gain receiver using 6.3 volt pentodes in the two R.F. stages and the A.F. stage, and a 6.3 volt screen-grid tube in the detector stage. This set works a loud speaker in dandy shape and possesses unusually high-gain in the R. F. amplifier, thanks to the use of tuned inductances of the plug-in type, thus permitting operation on any wave band.

switch (43) is mounted on the volume control and is operated by the same knob. The amperite (44) is included in the circuit so that the operation of the set will be independent of line voltage fluctuations. This is a very desirable feature. A Trutest power transformer (40) provides all necessary voltages with the exception of filament voltage for the four receiver tubes. The latter voltage is obtained from a separate filament transformer (42).

Constructional Details

It is possible to obtain the aluminum chassis with socket holes and transformer mounting hole already drilled. Where this work is to be done by the experimenter, these holes preferably should be drilled in the flat sheet before the sides are bent.

The sockets are mounted first and at this time the three tubes shield bases are also fastened in place. The binding posts are mounted next, grounding post (2) to the chassis, but carefully insulating post (1). The power supply transformer (40) is mounted, then the single and dual Cardwell variable condensers. The dual condenser is set back about two inches, using a small metallic coupling and extension shaft to line up the two Crowe tuning units. The condenser is set back so that the grid leads to the variable condenser sections will be as short as possible.

The trimmer condensers are fastened to the chassis deck alongside the dual variable unit as shown in the illustration. The two electrolytic condensers (37, 38) and the filament transformer (42) are also mounted on top of the chassis.

The two Electrad potentiometers (14, 27) are mounted on the front chassis wall. As shown in the bottom view illustration, the three large by-pass condensers (17, 19, 24) are fastened to the inside chassis walls. Mica condensers (22) and (31) and the R.F. choke (29) are secured to the underside of the chassis. All other components (fixed condensers, flexible resistors and metallic resistors) are soldered in place while the set is being wired.

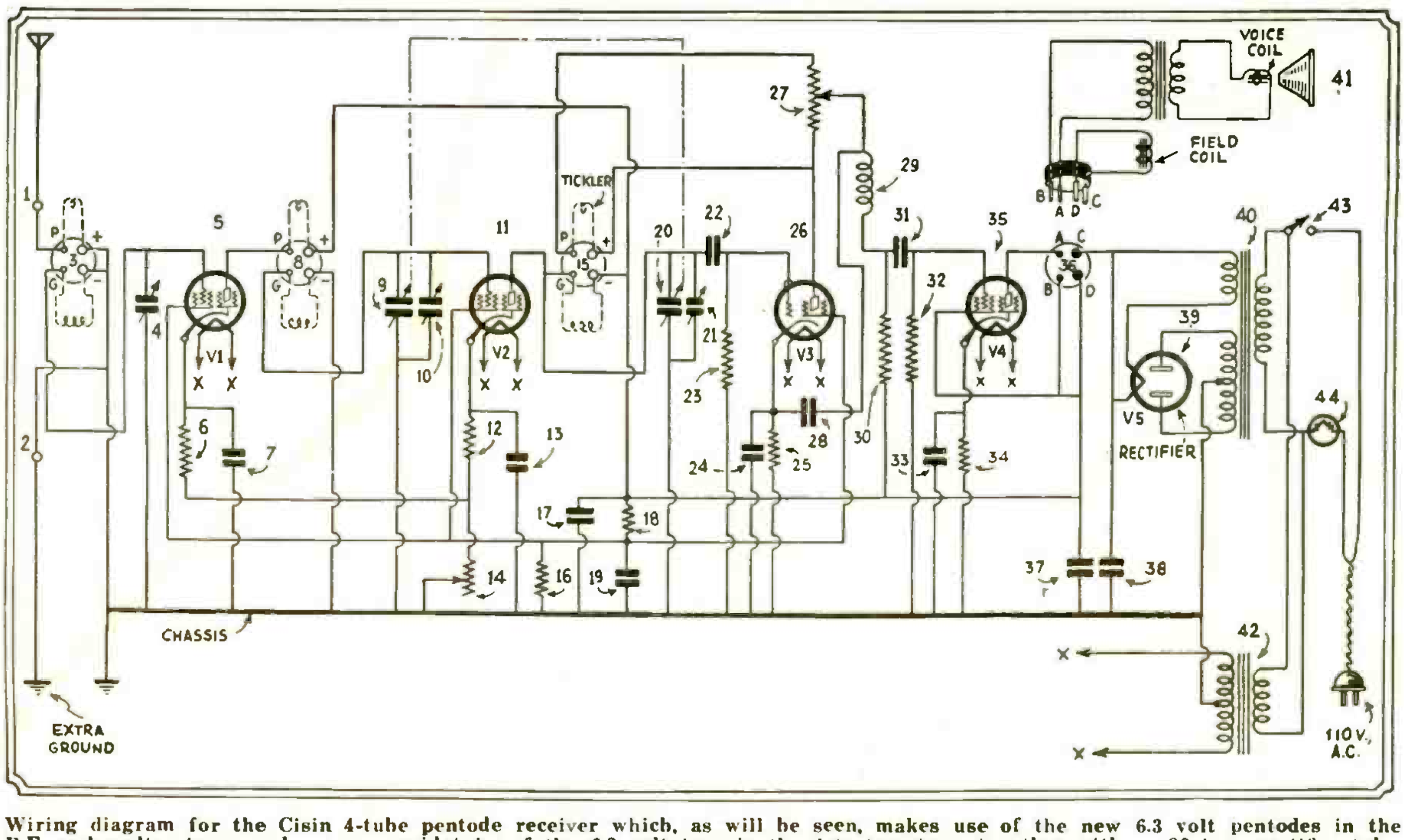
Flexible Corwico Braidite should be used for the wiring. The filament circuits of the four receiver tubes are wired in first. To reduce the filament voltage to 6.3 volts, the exact value specified for these tubes, an .8 ohm, 3 watt resistor should be connected in series between one of the outside filament terminals of the transformer (42) and the line going to the tube sockets.

The method of wiring the sockets for the Alden short-wave coils is clearly shown in the schematic diagram. Before starting to wire the tube sockets, the accompanying socket connection sketches should be carefully studied. The grid circuits are wired in first, making the control grid connections of the first three tubes at the caps, as indicated. It is suggested that shielded Braidite be used for the leads to these caps. Plate circuits are wired next, then cathodes, negative returns, by-pass condensers and filter condensers. The rectifier tube circuits are then completed, as are the primary circuits of the two transformers.

After checking over the wiring, the tubes are inserted in their proper positions with shields placed over tubes (5), (11) and (26), the three short wave coils are put in place, the loud speaker is plugged in, aerial and ground are connected and the set is connected to the 110-volt A.C. source.

The first adjustment is that of the trimmers (10) and (21). If the set does not regenerate properly, this is a

(Continued on page 618)



Wiring diagram for the Cisin 4-tube pentode receiver which, as will be seen, makes use of the new 6.3 volt pentodes in the R.F. and audio stages and a screen-grid tube of the 6.3 volt type in the detector stage, together with an 80 type rectifier tube.

Home-Made Antenna Coupling Condensers

The short-wave fan will find these home-made condensers very efficient and the cost practically nil.

By M. HARVEY GERNSBACK

● ONE of the most important considerations in the design of a short-wave receiver is the method of coupling the set to the antenna system. There are two coupling methods generally in use, as most fans know: inductive coupling and capacitive coupling. For the present we shall confine our attentions to a discussion of simple methods of effecting a suitable coupling medium by use of capacitance. All of the methods discussed here are, of course, only home made "gadgets," but they are all just as effective as the ordinary midget variable condenser seen in a commercial outfit.

The first coupling device serves a double purpose; it acts as a coupling condenser and it is also the answer to what to do with old razor blades. The condenser consists of two safety razor blades mounted on top of each other with an insulating spacer in between. The blades should preferably be of the new type with stampings in them. The stampings can be used for passing screws through. The blades used by the writer were Gillette's, but almost any type will do. The blades should be spaced about 1/16 of an inch apart and one should be free to be rotated in order to vary the capacity of the unit (See Fig. 1).

Another simple condenser can be constructed by taking two pieces of aluminum, brass or copper sheeting and cutting out two pieces ½x2 inches; each piece should be bent to form a right angle bracket. The bend should be at a distance of one inch from each end so that the resulting pieces will be in the form of right angle brackets with each leg one inch long. In one piece drill a hole in one of the legs to pass a screw. The size of the hole may be as desired to fit whatever screw the constructor has on hand. In the other piece a slot ½ inch long with the ends of the slot ¼ inch in from the ends of the leg should be cut. The width of the slot should be sufficient to pass a screw the same size as the screw to be used in the other bracket. The two brackets should be mounted as shown in Fig. 2. The capacity can be varied by sliding one of the brackets back and forth by means of the slot in it. The illustration should be self-explanatory. Do not make the brackets any smaller than specified or the capacity of the condenser will be too small to secure good results.

Another type of condenser is really nothing more than the old "neutrodon," which was a familiar part of the original neutrodyne sets of nine years ago. A bakelite block 5 x ½ x 1/8 inches should be secured; also six inches of bus bar wire, six inches of spaghetti tubing that will fit over the bus bar very snugly, two small screws of half inch length and nuts to fit them, and last of all a 3 inch piece of brass tubing, with an inside diameter slightly larger than the outside diameter of the spaghetti tubing.

Two holes should be drilled in the bakelite block, ¼ inch from each end to pass the two screws. Two pieces of bus bar each 2½ inches long should be cut and two pieces of spaghetti two inches long also. A loop is made in one end of each piece of bus large enough to pass the screws. The spaghetti is then slipped over the bus, completely insulating it with the exception of the loops. The rest of the construction is illustrated in Fig. 3. It is important that the distance between the two pieces of bus is about 1/8 of an inch.

The condenser illustrated in Fig. 4 consists of two right angle brackets of brass with one leg ½ inch long and the other two inches long. The width of the brackets may be ½ inch. In the ½ inch legs a hole should be drilled for passing a mounting screw. In the two inch legs holes should be drilled ¼ inch from the end of the legs. These last holes should be tapped so that brass threaded rods may be screwed through. On the end of each rod a disc of copper or aluminum two inches in diameter is soldered. The two discs form the plate of the condenser and by screwing or unscrewing the brass rods the capacity may be altered.

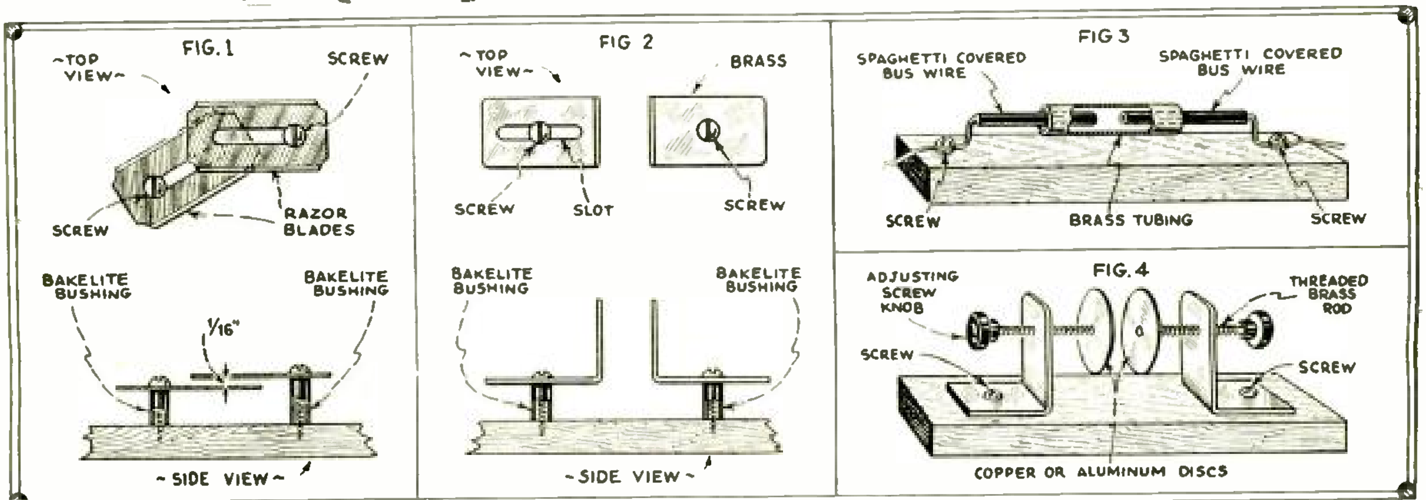


Fig. 1, at left, shows how to make an antenna coupling condenser from old safety-razor blades. Fig. 2—Another simple and practical design involving the use of two right-angle brass or other metal members, one of which is slotted for adjusting the capacity. Fig. 3 shows how to utilize the old neutralizing condenser principle. Fig. 4—Still another simple type which can be made from odds and ends to be found in your "scrap-box". The base should be of first-class insulation.

How Large is the Dead Zone in Ultra Short Waves?

The American Naval Research Laboratory recently undertook the task of determining the extent of the "dead" zone of the waves between 15 and 7.5 meters. In these tests a transmitter with 1 kilowatt capacity was under observation from several receiver stations of varying distances. Emitting on the 15-meter-wave, the transmitting frequency was gradually increased and marked down at these reception ends, at what frequency the signs became inaudible, that is, where the limit of the dead zone was reached. For this purpose, the measurements were made exclusively at a time of intensest ionization, that is, around 1 or 2 hours after noon, inasmuch as ordinarily the dead zone for these waves is infinitely great.

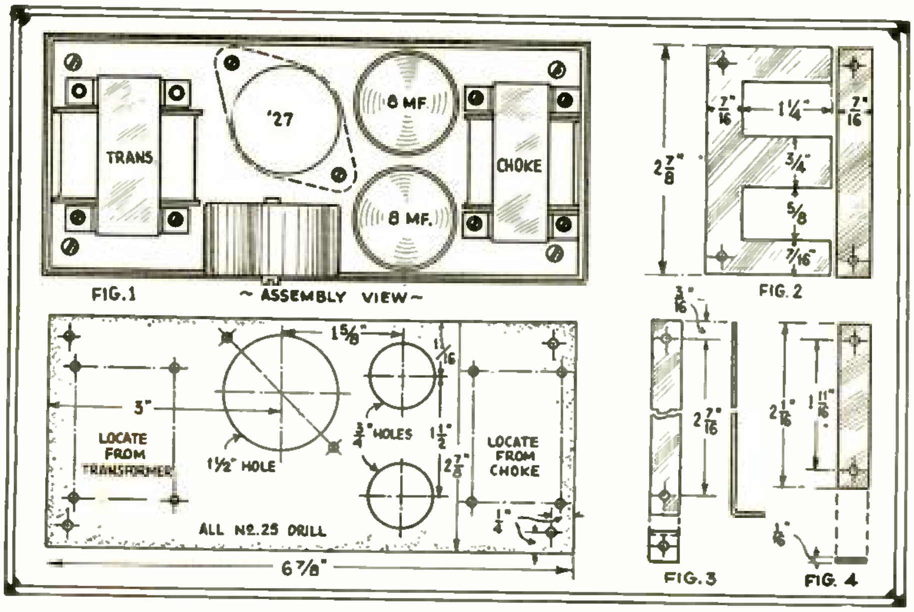
For the dead zone, these waves showed the following values, applicable only for noon time:

Frequency kilocycles	Wavelength in meters	Dead Zone kilometers*
20,000	15.0	1500
22,600	13.2	2000
26,000	11.5	2200
28,000	10.7	2600
32,000	9.4	3300
36,000	8.3	3300
40,000	7.5	3300

*1 kilometer = .6 mile.

—from *Radiowelt.*

Building A Shielded Power Unit for Short Wave Receivers



Drawing above shows details of metal shield, power supply unit and the filter system.

● At least half of the converter failures are due to the makeshift ways by which their power is taken from the receiver to which they are connected. By looking over the diagrams and drawings given on these pages the reader will see that this unit is very staple and inexpensive to make. While the shielding can is not required to make the power unit work it is put on to prevent any disturbances from interfering with the short wave tuning apparatus. Therefore this unit can be placed extremely close to the tuner or converter.

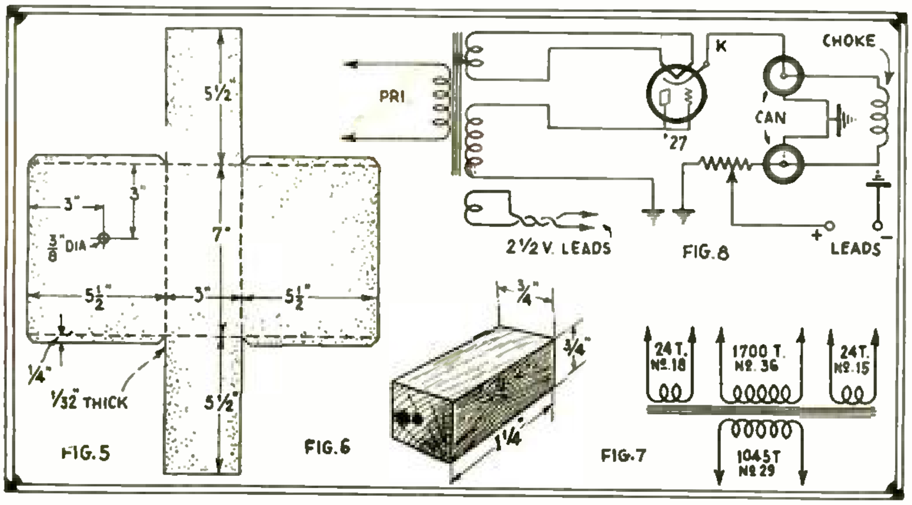
Some of these power packs take the high voltage for the rectifier plate directly from the A. C. line. This limits the rectified voltage to less than line voltage. At the same time this system requires the use of a filament transformer for the heaters. The transformer to be described will be found easy to construct and is properly designed for this job. By looking at the hookup diagram we find a pair of 2.5 volt heater supply leads that will take care of this end of the job. The plus lead will give a range of voltage from zero to 160 volts with plenty of current for all converter and short wave tuner needs. A knob on this voltage regulator is not needed as it will be set once to meet the need of the set and left.

Constructing Transformer

In Figure 6 we have a wood block; this will serve to wind the coil upon. Cut a strip of wrapping paper 1¼ inches wide and wrap this around the block to a thickness of nearly 1-16 inch. Put a machine screw through the hole and fasten it in the hand drill. This drill can now be clamped in the bench vise. Lay a strip of friction tape on each side of the paper form, leaving an inch project beyond each end of the block. Solder a lead wire to the end of the No. 29 B. & S. enameled wire and tape the joint. Twist this around the center screw in the block to anchor it and wind the first layer of wire over the paper and strips of tape. Before it winds to the end start the wire back over the first layer. With this second layer in place cover with a layer of thin waxed paper. Continue with two layers of wire and a layer of paper until 1,045 turns have been wound on. Now fold the ends of the tapes over the coil. They will hold the wire in place. Solder a lead on and cover the primary with three layers of the same paper used under the coil.

Now lay down four more strips of tape for the secondary binding. Solder a lead to the No. 36 B. & S. enameled wire and anchor as at the primary start. Wind about 400 turns on and cover with waxed paper; continue thus for 1,700 turns. Do not try to wind this fine wire in even layers, simply wind back and forth. After the 1,700th turn solder a lead on and fold the tapes over the coil. Put on three layers of the wrapping paper. After which put down the tape strips as before.

> Simple, clear directions for building a quiet plate and heater "supply unit" for satisfactory use with short-wave receivers has been rather scarce. The accompanying article gives details for "winding your own" power transformer; also the method of connecting the transformer, "home made" choke, condensers and rectifier tube. Keep this article for future reference.



Here we see the various parts comprising the S-W "power unit" laid out on the base; also details of the transformer steel laminations.

Coil Is Finished

The No. 18 B. & S. wire is used next, and no leads are needed as the wire is strong enough. Wind on twenty-four turns and bind with the tapes. Cover with paper and wind on twenty-four turns of the No. 15 B. & S. wire. Now the coil is done; remove the block from the center and submerge the coil in melted wax or parafin. Do not have this too hot—just melt it. Figure 2 shows the kind of laminations to use. These are inexpensive to purchase (see note at end for this), or can be cut from lamination iron to the dimensions given. Using fifty of these laminations, place all the "E" pieces in the coil opening. Entering them alternately from one end, then from the other end. With this done, place the straight pieces at the open ends of each "E" lamination.

A solid core is built up in this way.

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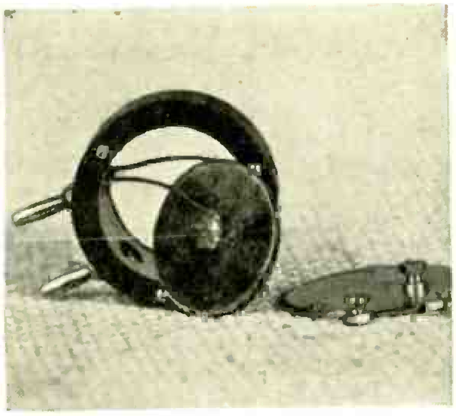
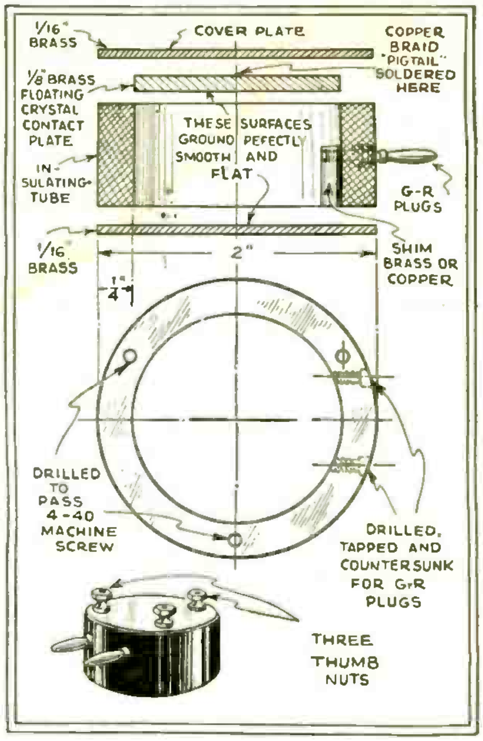


A good crystal holder is very desirable.

Navy type crystal holder here described.



Details of crystal holder as described by Lieut. Pyle.

A Navy Type Crystal Holder

By HOWARD S. PYLE
Lieut. (JG) C-V (S), U. S. N. R.

● WITH the advent of the quartz crystal as a practical, efficient and comparatively inexpensive method of maintaining constant frequency in a radio transmitter, and the increasing popularity of this type of oscillator control among amateur radio enthusiasts, it is time that some thought was given to construction of a suitable holder for such a delicate piece of equipment as a thin quartz plate.

In their enthusiasm to modify their transmitters to use a crystal for frequency control, a large number of amateurs give little thought to the highly important mounting for the quartz plate, and many are content to merely clamp such crystals between two scrap brass plates, holding the whole assembly with a rubber band.

The quartz crystal is coming more and more extensively into use every day in our amateur short-wave transmitting stations. It is one thing to purchase a crystal ground accurately to the proper thickness for the specified frequency, but it is just as important to have an efficient holder for the crystal. We are certain that our readers will be pleased to have this article by Lieut. Howard S. Pyle, in which he gives much valuable information on how to build a professional Navy type "crystal holder."

There are on the market a few crystal holders within the means of the average amateur, and those amateurs who have wished to elaborate on their makeshift mountings have made rough copies of such crystal holders as they may have seen on display in radio stores. There are, however, a number of weak points in these cheaper manufactured holders, and such weaknesses are generally amplified when their construction is attempted in the home workshop. It is accordingly the purpose of the writer in this article to offer a substantial, efficient and practical design for a holder which can, with care, be made almost entirely at home and at a total cost of about $1.00.

The holder described is designed along lines very similar to those of the holders in use in the United States Navy, with suitable modifications to adapt it to average amateur purposes.

It will be noted that the container is circular, rather than square or rectangular, as in the case of the majority of manufactured and home-made holders in general use. From the amateur builder's standpoint this is more desirable, inasmuch as a great deal of patient drilling and filing in a block of heavy insulating material is not necessary in order to provide a suitable recess for the crystal and its contact plates.

The container, accordingly, is formed of a hard rubber, bakelite or fibre insulating tube, 2 inches in outside diameter and 1½ inches inside, leaving a ¼-inch wall. The finished length of this piece of tubing is but ¾ inch, and such tubing can be obtained from stock from any insulating material house for about 20 cents. The edges should be faced off in a lathe so that they are exactly parallel and at a perfect right angle to the side walls. The amateur who is not equipped with a lathe can have this done in a few minutes at any machine shop at a cost of but a few cents.

The base and cover plates for the holder are of 1/16-inch brass stock. Discs 2 inches in diameter, which will require no machining, can be obtained from shop and foundry supply houses for about 5 cents each. At the same time a disc 1½ inches in diameter and ⅛ inch thick should be obtained for the floating contact plate. The balance of the material required is slight: three 4/40 flat head brass machine screws 1 inch long; three small thumb nuts for same; 2-inch piece of fine copper braid, and two General Radio or similar type plugs will complete the list.

The two larger brass discs should be layed out for three holes to pass the 4/40 machine screws, and such holes should be equally spaced about the circumference of the disc, and ⅛ of an inch from the edge. The holes in one plate should be countersunk to receive the heads of the 4/40 screws.

Now, using one of the drilled plates as a template, identical holes should be drilled through the edge of the insulating tube container. These may be smooth holes clear through, or, if the builder desires a particularly well-built job and has the necessary tap, the last ¼ inch of the hole should be drilled with a smaller drill and tapped for the 4/40 machine screws. This will prevent the base plate being loosened every time the cover plate is removed.

In the side wall of the insulating tube two holes should be drilled, ⅜ of an inch from the edge and ¾ of an inch apart. Care should be taken to drill these holes exactly parallel to an imaginary line drawn through the diameter of the tube and bisecting the circle, so that the two plugs mount parallel to one another; otherwise they will not properly fit the jacks. These holes should be slightly countersunk from the outside so that the shoulder on the base of the plugs make a snug fit in the tube. It is better to thread the plugs into these holes than to attempt to use a nut on the inside, although this may be done. Using a nut may make it slightly more awkward to remove the floating contact plate from the crystal, when desired.

(Continued on page 622)

Improving the Short Wave Antenna

By Everett L. Dillard

No one factor in short wave operation is more important than the aerial and the method of making a connection between it and the set proper. Mr. Dillard, well-known for his previous articles on short wave antennas, here provides real sound information which every short wave "fan" should study carefully. The signal energy you waste at the antenna can never be regained at the receiver.

● THE short wave fan, whether he is interested in transmission or reception, encounters at one time or another the problem of how to erect the most efficient antenna for his purpose in the space and surroundings in which it falls his lot to live. This is quite often a problem, especially in certain sections of crowded city territory where space is at a premium and a large unsightly antenna system is out of the question. While it is true that each individual location presents a separate problem in itself, it is also true that certain fundamentals of antenna design along with the proper choice of antenna materials will considerably enhance the prospects for better results.

This applies to both the transmitting and receiving antenna and though quite often the final appearance of the best aerial system for receiving purposes is quite different from that of an antenna system designed for transmitting purposes in the same location, there are, nevertheless, certain inherent factors which remain the same for both types af antennas even though they may differ considerably in appearance in their final form. These fundamentals of design which improve the performance of both the receiving and transmitting antenna are simple and will be taken up at this time.

Most Important Factor

The first and most important factor relative to any short wave antenna is that it should be as much in the clear and as free from any surrounding obstacles as possible to place it. Height is valuable, but if the choice must be made between height and placement of the antenna in the clear, by all means choose the location giving clearance. On the short waves we experience much more loss due to the absorption or shielding effect of surrounding buildings, trees, heavy wiring, and garages than is experienced on the broadcast frequencies. Technically this is known as a high attenuation factor, and about the only solution to the problem is to locate the antenna as free from surrounding objects as practical. Placing the antenna in the clear also tends to reduce pickup by the antenna proper of man-made static—which in itself is a considerable improvement in reception. We can afford to sacrifice some height in preference to clearance of the antenna and still expect reasonably good results, but the moment that our antenna gets too close to other objects which tend to absorb and shield from the antenna, our efficiency immediately begins to drop off rapidly.

Now local conditions and surroundings may be such that, while it is impossible to erect an antenna in the clear near the radio set, fifty or a hundred feet away there is a spot which is reasonably clear and suitable for the erection of the antenna. This may be in the lot next door, on the flat roof of the building across the alley, or on top of the building several stories up. When this condition exists it is possible to take advantage of the spot that is ideal for the location of the antenna by putting it there and making connection either to the transmitting or receiving set by the use of a feeder system.

Use of the Doublet and Transposed Lead-in

This is not unduly complicated and will improve reception very much in localities of this kind. Without going too much into detail, let the writer suggest the use of the doublet antenna with its transposed lead-in, when reception conditions must be bettered and background noises eliminated. For the transmitting antenna, the voltage fed single wire Hertz, the Zepp, the current fed doublet and other practical feeder systems will suggest themselves to the reader. It is safe to say that if a location better than that in which your antenna is now located is within a distance of 100 feet or less, your results will be materially improved if you will transfer the antenna to the better location and then use one of the feeder systems mentioned above. (See page 412, November 1932 issue.)

Many mistakes have been made, and in many instances poor results have been secured simply due to the fact that the wrong kind of antenna wire was used for the antenna. Too often smooth tongued salesmen will force upon the beginner some kind of a "new fangled" antenna wire with promises of results better by 100 to 200% than if ordinary antenna wire is used. After many years of trial the fact remains that the best wire for short waves is still single strand copper wire, running either in the No. 14 or No. 12 gauges—all high sounding sales-talks to the contrary. Except for the antenna used with a transmitting set of 250 watts output or more, No. 14 and No. 12 wire is amply large. The use of No. 10 wire is recommended on all powers in excess of 250 watts up to the limit of 1000

(Continued on page 629)

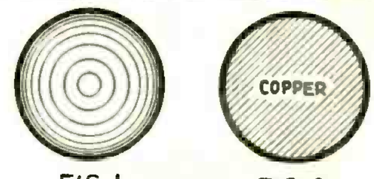


FIG. 1 FIG. 2

Fig. 1, shows "skin effect," most of the radio frequency current traversing the outer surface, as indicated by the black line. Fig. 2, indicates high-resistance oxide coating on weathered bare wire; enameled wire is best.

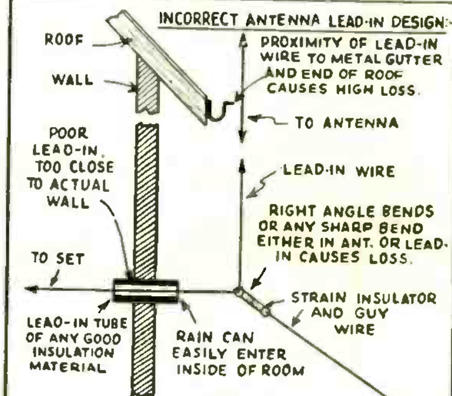


FIG. 3

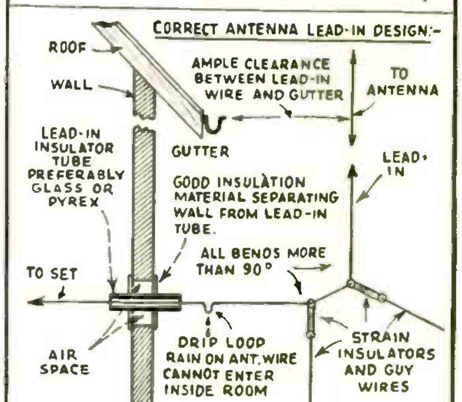


FIG. 4

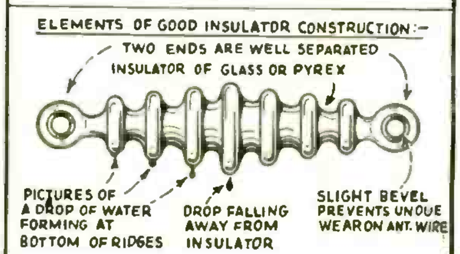


FIG. 5

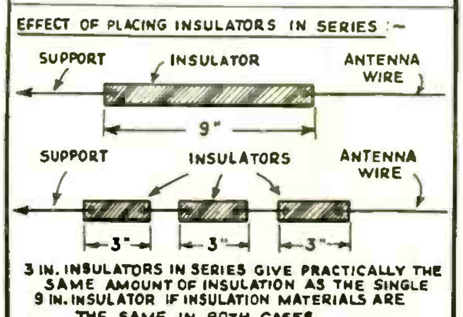
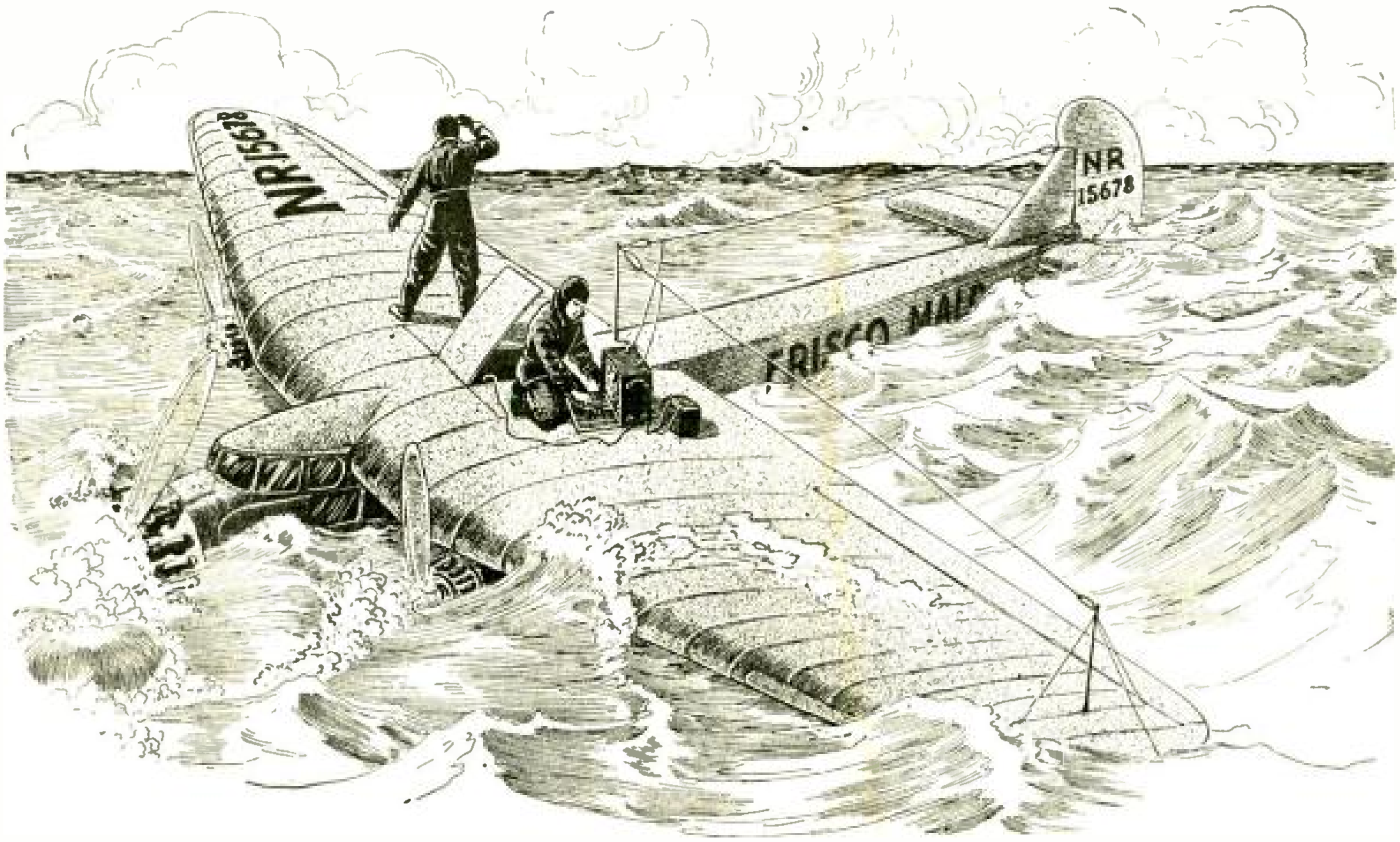


FIG. 6

Diagrams, Figs. 3 to 6, show correct and incorrect antenna lead-in design; the elements of a good insulator and the effect of placing several insulators in series.

"...Picked up and Relayed"

By A. D. MIDDELTON, W8UC



". . . . position 170 west 30 north . . . all's well so far . . . plane sinking lower . . . can hold on a little longer . . . Pete."

SITTING there in his tiny operating room, Jack Miller wiped his forehead, shifted his phones to a more comfortable place on his ears and rolled his wad of gum over to the other jaw. He glanced at his log book and ran his eye down the list of ones, twos, nines and the ever present fives. Not so many were the sixes and only one seven greeted his eye. "But," thought Jack, "this is mid-summer and I can't expect much."

It was only 10:10 P. M., the little ship's clock on the monitor told him. There was plenty of time to get in some real work before hitting the hay.

A sweet whistle broke through the jam calling "CQ CQ CQ de W5DEX." Jack shoved in the switch and as the whistle ceased with a parting "K," called back—"W5DEX W5DEX de W9ZH." A lifted key and the whistle was saying "BK BK." Jack replied and gave the Texas station the desired report: That his crystal-like signals were coming in QSA5 and that they were 'knocking his cans off up in Evanston!" The five gave a couple of laughs and came back with some wise-cracks such as only a Texan thinks of.

Then among the wise-cracks Jack heard "—— did you hear latest news of Transpacific fliers? They are reported half-way from Frisco to Tokio."

To Miller there was only one thing as dear to his heart as Radio—that was aviation.

"No," he replied, "I knew they were well on their way but missed the CQ at 8 p. m."

"Well, old timer," came back the five, "I'll throw a few more CQs out and go to bed CUL 73."

Jack signed off with his customary speed but his mind was not on the dots and dashes that his nimble fingers were flicking out into the air . . . far from it. His thoughts were on a tiny plane, far out over the Pacific and on a pair of men, sitting in a crowded cabin. One with his eyes and hands glued on his flying instruments, the other man twisting a dial and listening with tired and aching ears, to the weather reports and other data sent out by shore and ship stations as the plane flew on towards the goal in Japan.

"Gosh," thought young Miller, "what would I give for a chance to do something like that, sure wish I could try it . . . oh, well, let's see what's doing outside the band."

A twist of the dial and Jack was out of the band used by the States and into that forbidden but widely used space where bootleg stations and expeditions abound. A few faint rotten notes and some good ones greeted his ears.

Jack knew that the good signals were South Americans and that the bad ones were dumb American "lids." Neither held any interest for him. As he turned back into the band a droning note came into his phones.

A Voice From Mid-Ocean

Once before, Jack had heard a note like this, when the ill-fated "Dallas Spirit" had flown its merry but tragic way almost to Hawaii. The "Spirit" had carried a short-wave rig on it and Miller had been one of the numerous amateurs who listened to the steady drone for hours and then heard it rise to a shriek and die out in the midst of a parting wise-crack. There could be no mistake—It must be the Transpacific plane. Yes! It was.

The droning note had stopped and now Jack heard—"CQ de XVMO CQ de XVMO ALLS WELL DOING 105 NOW OVER HALF-WAY LOVE AND KISSES MAC AND PETE."

Jack was not following the smooth sending of "Pete." He was thinking of the time he met this man at a convention in Chicago, where Mark Peterson, a world-famous aviator and radio expert, kept the gang spellbound with his witty comments on the subjects so dear to him. Several thousand miles separated the plane and Evanston, but Miller could feel the pull of the cheerful personality of the man, who was jesting even while on a "crazy and futile journey" as a journalist had put it.

Jack turned away from the plane's signal but its position on the dial was engraved on his memory and he knew that his dial would rest on that point most of the night. He worked several stations, but the amateurs seemed so tame and uninteresting after listening to the far-away "Frisco Maid." Time after time he tuned from the band and onto the steady drone that portrayed the scene going on far out over the Pacific.

As long as the note stayed steady, he knew the plane was in the air and moving along its normal course, but should the note rise and fall, and waver in its pitch, all the world could tell that the plane was in trouble, for the key was down all the time. Pete would lift it only to send messages.

Distress

Jack noted the plane's reported position at times on the wall map and felt elated at the progress the men were making.

But then—even as he listened to an especially funny wise-crack he heard "SOS SOS SOS de XVMO PLANE FALLING POSITION APPROX LAST PLUS FIFTY MILES WEST XVMO."

Jack was thinking very hard. His pencil wrote automatically—"SOS SOS SOS de XVMO PLANE ALMOST ON WATER LAST POSITION IN ERROR WE ARE NOW APPROX—" and the droning note cut off.

Jack closed his eyes and strained his ears, but the signal was gone. There was no mistake about it. He listened, tuned around carefully and listened again. It was no use, there was nothing there!

It couldn't be, thought Miller, that Pete was gone . . . No . . . anything but that . . . But where is the signal? I must be dreaming. It must come back. He reached over and turned on the broadcast receiver.

"———— Broadcasting Company regrets to announce that the Transpacific Plane, 'Frisco Maid,' is down in mid-ocean. The position as last reported was well over half way to Japan

Our readers voted for "more" short-wave fiction—so here goes! We hope you get as great a thrill out of Mr. Middelton's tale as we did.

Jack Miller, our hero, is a typical short-wave "ham," who is liable to be "listening in" at most any old time of the night or day. And, as usual, the unexpected will happen—Jack picks up the distress call from a trans-Pacific plane, forced down in mid-ocean. His "ham" station was located in Evanston, Illinois. How do you think Jack got Naval planes to rescue the distressed fliers far out on the broad Pacific? Read on—it's a great tale!

but the present location of the plane, which is carrying Peterson and MacReady, is unknown as the radio was sending out their corrected position when the plane fell into the water. We will broadcast any further information we receive—through the courtesy of the United Press. Please stand by."

Young Miller turned off the radio. It was true! What an awful ending to such a glorious pair of adventurers. He sat there thinking, helpless in his desire to do something to save the men who were at that moment so near the end of their journey.

Jack thought of the logical events that would take place in the plane. Peterson would try the emergency 600 meter rig that was carried for such an ending as this, a forced landing . . . but if that failed, what would he try next? The generator on the plane only rotated and supplied power to the short wave set while the propeller revolved.

While toying with these dismal facts, Jack's fingers had not been idle. A ceaseless turning of the dial often raised his hopes, only to have them dashed down when the wobbly note signed "YX2A" or some other unimportant call. Out of the night there came no reassuring "CQ CQ de XVMO ALLS WELL."

Downhearted, he listened on in the hope that something would turn up. An hour passed. The broadcast set gave the report that the 600 meter rig had failed to get a message through. No ship had reported any SOS signals. Two hours went by. Jack had talked with several western stations and with an Hawaiian, but they all had similar luck, bad luck. No signals were heard from the "Frisco Maid."

At Last! A Signal From the Wrecked Plane!"

Miller's hand still twisted the dial, hoping to hear that familiar fist calling. Suddenly he straightened up in his chair and turned up the volume.

"—— SOS SOS de XVMO POSITION 170 WEST 30 NORTH PLANE ON WATER CAN HOLD UP FEW

(Continued on page 618)

Short-Wave Operating Hints

By M. Harvey Gernsback

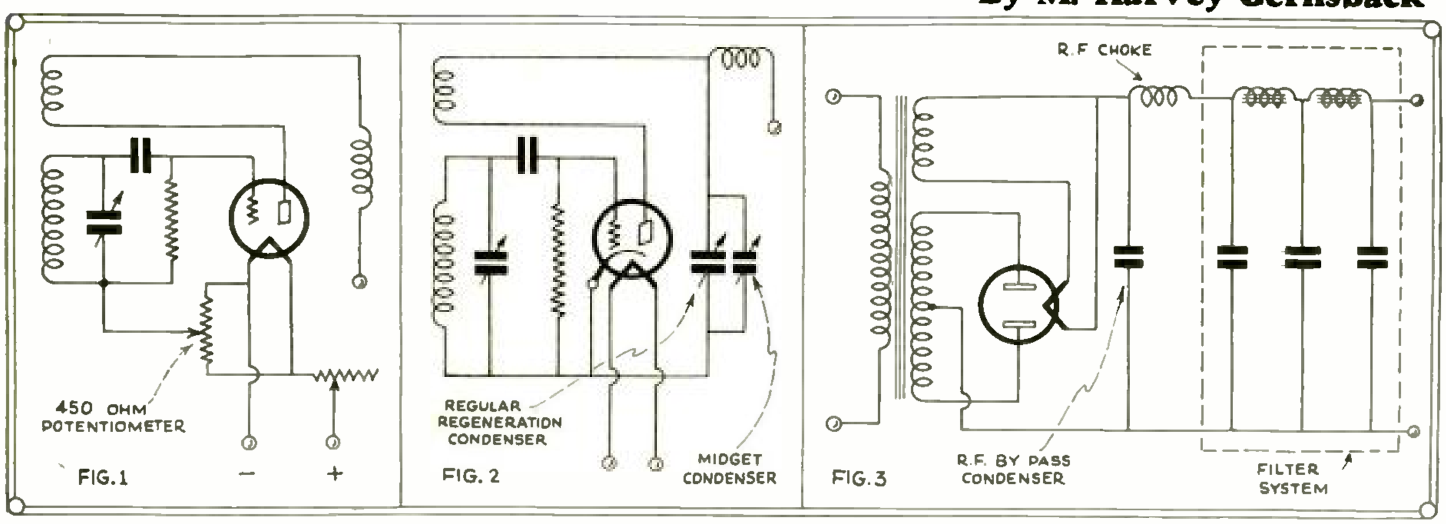


Fig. 1 shows one way to obtain smooth regeneration with a potentiometer; Fig. 2, using a vernier condenser to facilitate regeneration control; Fig. 3, Circuit for reducing "hum" in a short wave receiver.

● 1. MICROPHONIC hum in a short-wave receiver is not always caused by faulty tubes. A defective variable condenser is often the cause of violent microphonic hum. This trouble can sometimes be remedied by re-spacing the plates of the noisy condenser. If this procedure is not possible it will be necessary to replace the condenser.

2. When shielding a short-wave set be sure that the coils are at least one inch away from the shields. If it is possible to have even greater spacing so much the better. When coils are too close to the shields there is sure to be a large loss in efficiency.

3. When using for a detector a filament type tube supplied with pure D.C., it is often possible to obtain smooth regeneration control by connecting a potentiometer across the filament terminals of the tube and bringing the grid return to the slider arm of the potentiometer (see diagram).

4. When using a variable condenser to control regeneration in a short-wave receiver very fine adjustment of regeneration can be secured by shunting the regeneration condenser with a small variable condenser. A midget condenser having 2 or 3 plates should prove very satisfactory (See Diagram).

5. Always make sure that all by-pass condensers used in the R.F. and detector circuits of a short-wave receiver are of non-inductive construction. If they are not they are next to useless.

6. When using a stage of radio-frequency amplification utilizing a screen grid tube, it is worthwhile to try several tubes before making a final installation, as these tubes are less uniform in construction than triodes.

(Continued on page 620)

The COMET

By LEWIS W.

Note the "professional" appearance of the new Comet "Pro" short-wave superheterodyne receiver, developed by the Hammarlund engineers.

● THE Comet "Pro" is a high-frequency superheterodyne receiver designed to meet the exacting demands of professional operators and advanced amateurs interested in the reception of both code and voice radio signals in the frequency range from 20,000 kc to 1200 kc. In addition, it is suitable for various kinds of experimental and research work involving frequencies in that range where high sensitivity, low noise level, and great selectivity are important. The rather unusual tuning system as well as several other interesting features are here described.

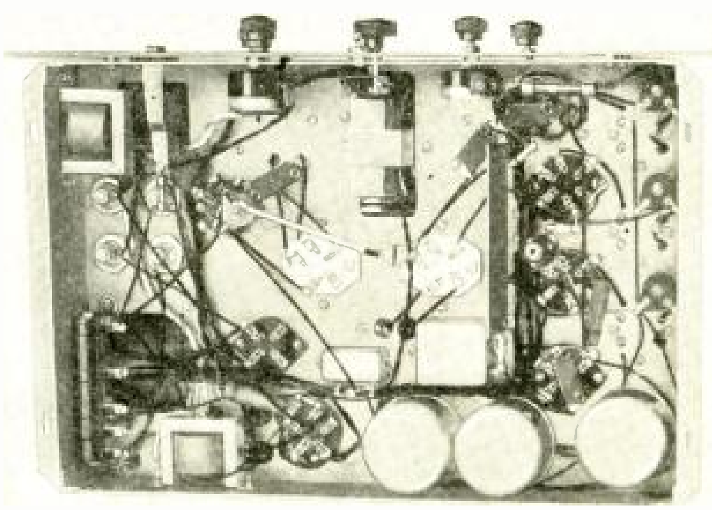
Before taking up the actual description of the receiver it may be interesting to go over some of the more important considerations involved in short-wave receiver design. First of all comes the question of power supply; shall it be batteries or alternating current? Of course this controversy is automatically answered in situations where no alternating current is available, but these relatively few cases were disregarded and complete A.C. operation decided upon. There is really no comparison from the standpoint of convenience; in fact the only argument in favor of battery operation seemed to be from the standpoint of quietness of operation which is unquestionably of paramount importance in the reception of extremely weak signals. After some experimental work even this argument was disproved, as it was found perfectly possible to build an all A.C. receiver just as quiet in operation as the finest battery-operated receivers.

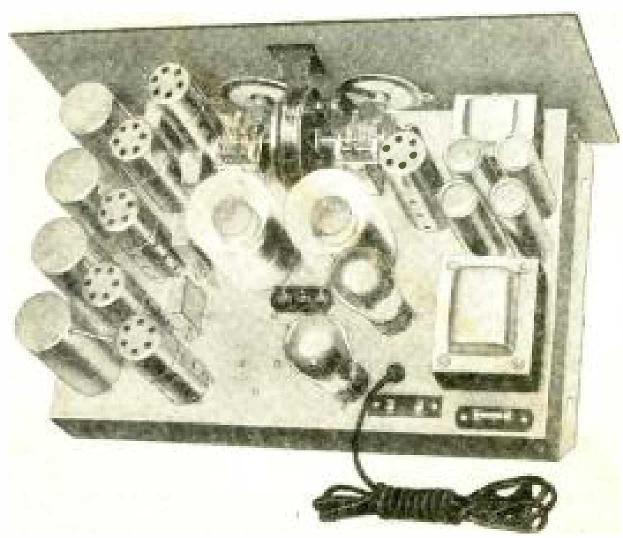
Next come selectivity and sensitivity, which while separate and distinct qualities in themselves, are nevertheless dependent on each other in most practical receiver designs. The superheterodyne, or double detection type of receiver, undoubtedly offers outstanding advantages in the matter of selectivity and sensitivity, especially where such a wide range of signal frequencies must be covered. Then once again the question of noise was raised—all superheterodynes were considered too noisy for satisfactory weak signal reception. But experimental work also disproved this theory and so work was started in earnest on an A.C. operated superheterodyne. An intermediate frequency of 465 kc was chosen as a compromise. It is below the broadcast band, and at the same time is high enough to provide a large spread between a desired signal and its "image" interference. By using Litz wound intermediate coils the selectivity and sensitivity are kept high. This and many other design features are described in more detail in the following paragraphs.

Tests on the final model were exceptionally gratifying. The selectivity is such that the over-all response curve averages only 30 kc wide at 10,000 times input. The sensitivity is so high and the receiver noise level so low that, under test in a prominent laboratory it was found possible to read a C.W. code signal at twenty words per minute (single transmission) when the input to the receiver was only 1/10 micro-volt. The signal was fed from a signal generator through a 200 ohm resistor to the "Ant" and "Gnd" terminals of the receiver. Dividing this figure by four gives a value of 1/40 micro-volt per meter (assuming an effective antenna height of four meters) which is the generally accepted measure of signal field-strength. A complete description of the receiver follows.

General Description

Interchangeable plug-in coils are used to shift from one frequency range to another. Two coils, one OSC and one W.L. constitute a set, and the tuning condensers are of such size that each set of coils covers a frequency range of approximately two to one. To provide ample overlap four sets of coils are used to cover the range from 15 to 250 meters. The coils are wound on extruded Isolantite forms 1½" in diameter. This results in high electrical efficiency and also great mechanical stability, which aids materially in maintaining dial calibrations. The coils plug into special extruded Isolantite sockets with double grip clips which make contact to opposite sides of each coil prong, insuring reliable electrical connection with consequent freedom from noise due to variations in contact resistance. Any variation in resistance at these coil terminals would modulate the incoming signal carrier. Since these coil terminals are really the input to the receiver, any modulation at this point would be amplified by all succeeding stages resulting in serious noise in the output circuit. For this reason all switches or other sources of variable contact resistance





The two photos above show rear and bottom views of the Comet "Pro" high-frequency "superhet." Plug-in coils of the latest type, wound on Isolantite forms, are used. C.W. code reception is provided for, as well as phone.

"PRO" SUPERHETERODYNE

MARTIN*

One of the outstanding high-frequency superheterodyne receivers of the year is the Hammarlund Comet "Pro" here illustrated and described. The editors have been able to obtain the coil data for this set and this is the first time that this has been published. The Comet "Pro" tunes over a frequency range extending from 1.2 to 20 megacycles. This high-class short-wave receiver, intended for commercial, high-class amateur and general S-W listening stations, possesses several outstanding features such as "band-spread" tuning, extreme selectivity, high-power output and a special oscillator for the reception of C. W. signals.

have been avoided in the design of this receiver. Both OSC and W.L. coils are completely shielded in separate shield cans. The covers of these shields are readily removable to facilitate changing from one frequency range to another. The use of these coil shields eliminates all electro-magnetic coupling between OSC and W.L. coils as well as direct pickup from stray fields of any kind.

"Band-Spread" Feature

The arrangement of the tuning condensers is interesting and unique. The fundamental circuit is shown in Fig. 1, and although designed primarily to give a band-spreading action on the four amateur bands of 20, 40, 80, and 160 meters, the same effect is obtainable throughout the entire range from 15-250 meters (20,000 to 1200 kc). Condensers C1, of 138 mmf. each, constitute *tank* condensers and are individually controlled by separate vernier dials, one at left center and one at right center of the panel. By means of these two condensers, together with the appropriate set of coils, the receiver may be tuned to any frequency within its range. After this has been done, the main tuning dial, which controls condensers C2 and C3, will provide substantially true *single control* over a relatively narrow band of frequencies. If the main dial is set at 50 when the adjustment of the two tank condensers is made, approximately half of the spread band will be above and the other half below the mean frequency determined by the choice of coils and the setting of the two tank condensers. If the main dial is at zero when the tank condensers are adjusted the entire spread band will be above that frequency. Conversely, setting the band with the main dial at 100 will throw the spread band on the lower frequency side. The dials on the two tank condensers are finely and accurately calibrated to facilitate precise logging. While calibration curves are furnished with each receiver, the operator should make an accurate calibration of his own receiver by means of standard frequency signals, certain stations known to be well controlled, etc.

This type of band spreading circuit necessarily results in a non-uniform band width at various frequencies, and this fact should be taken into consideration by the operator. At 20 megacycles the band is approximately 1500 kc wide and narrows to 300 kc wide at 10 mega-cycles (using the "AA" coils). With the "BB" coils the band width is 1000 kc at 10 mc. and 150 kc wide at 5 mc. The band spreading on these two ranges is accomplished by the 15 mmf. condensers C2 and C2, Fig. 1, on the main tuning dial. These condensers alone are inadequate for proper band width in the 5 mc. to 1.5 mc. range covered by the "CC" and "DD" coils.

(Continued on page 634)

*Hammarlund-Roberts, Inc.

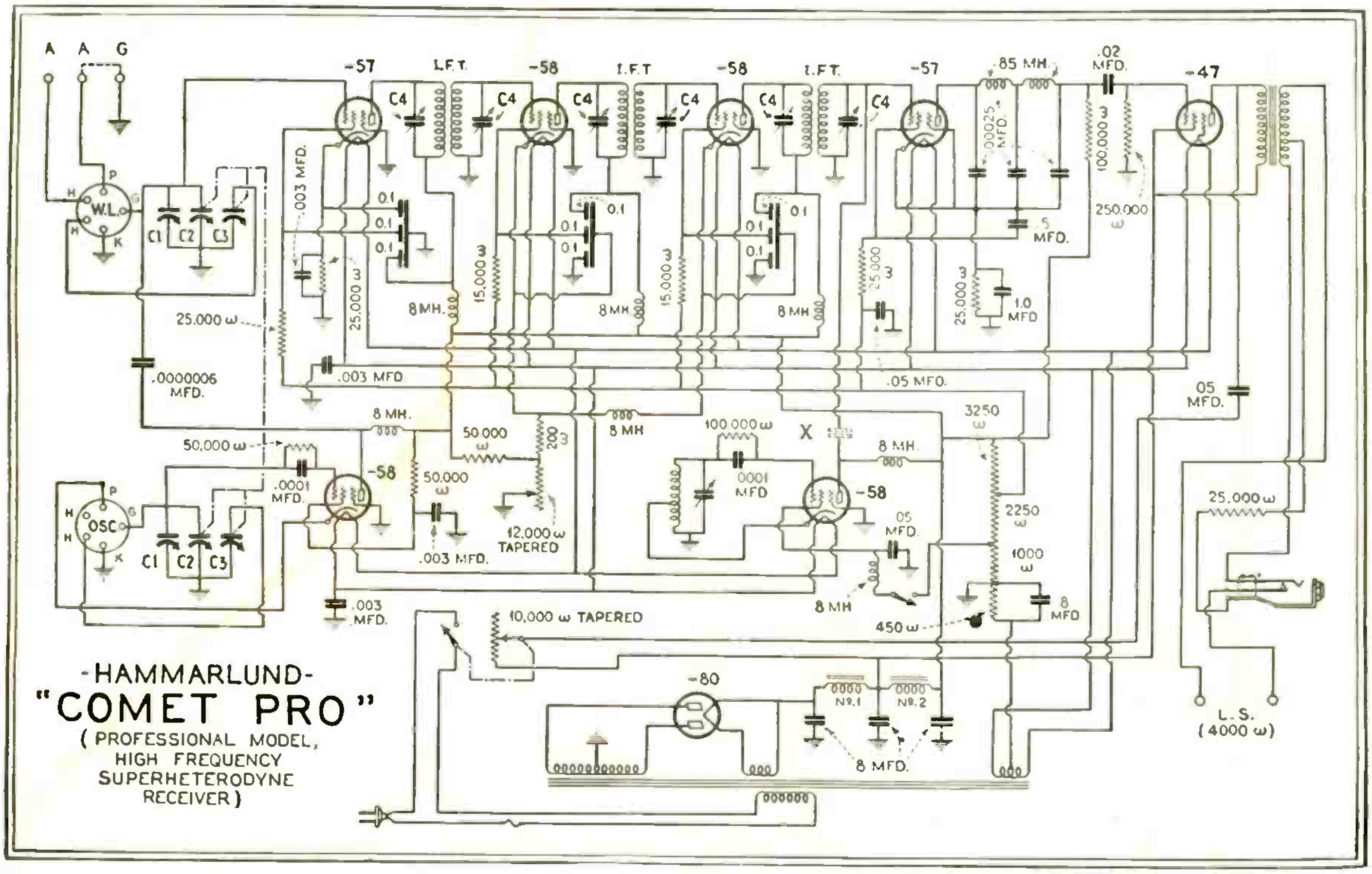


Diagram of connections as used in the latest "revised" model of the Hammarlund Comet "Pro" short-wave superheterodyne receiver. This set uses 8 tubes, including an 80 type rectifier. Fig. 1.

A Revolution in Thermionic Valves?

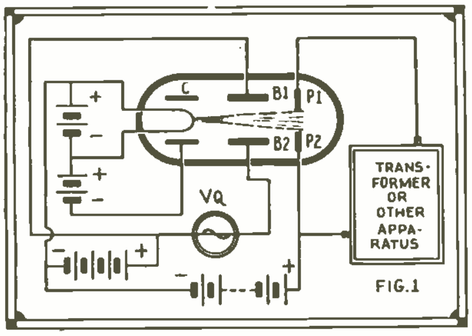


Fig. 1—Hook-up for amplifier. C, filament, enclosed in concentrating cylinder; B1 and B2, deflection plates; P1, principal anode or plate, and P2, the second or polarizing plate.

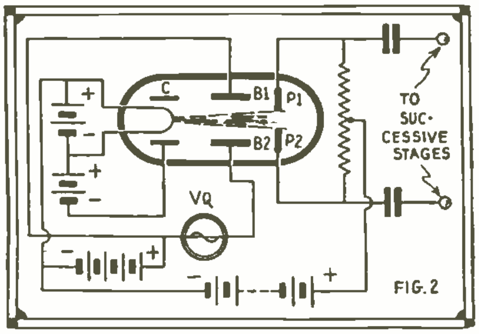


Fig. 2—Showing similar design of tube to that illustrated at the left in Fig. 1, but here capacity coupling is employed to output circuit, instead of a transformer

By GIOVANNI COCCI

● THE thermionic valve in use today represents without doubt an enormous progress with respect to the models first constructed. The considerable increase in the filament efficiency, plus a more rational arrangement of the individual electrodes, has permitted improving in large measure the electrical characteristics of the valve. Other electrodes have been added, making the valve better adapted for certain purposes, and finally the technical manufacture has been so improved as to allow the making of valves perfectly similar to a given model in large quantities. In view of the progress already made, we can hardly hope for further remarkable perfection (except in tubes intended for special purposes, like the multi-mu), unless some new principle can be used.

The tubes now in use still operate according to the principle used by De Forest in the first *triode* devised by him. Between cathode and anode of a two-electrode tube is inserted a control electrode (grid), which, creating an electro-static field, controls the number of electrons which can reach the anode. Considering a single electron emitted by the filament, the action of the grid is of the "all or nothing" type; namely, the useful effect is represented solely by the possibility of the single electron with regard to getting the plate; long before producing this total effect, the electrostatic field of the grid has already commenced to influence the kinematic characteristic of the orbit of the electron, but this effect is not absolutely utilized in the ordinary triode.

Then the idea spontaneously arose of constructing a triode in which is utilized the diverging effect instead of the blocking effect of the electrostatic field of the control (i. e., the grid), which should give a valve more sensitive than those now in use.

The corresponding phenomenon is much used in the cathode oscillograph, and those who have had occasion to use it have reported it as the producer of very weak electrostatic or electromagnetic fields for obtaining notable deflections of the electron pencil.

Its use for the construction of amplifier tubes is for the present hindered by the inconveniences, both theoretical and practical, which we shall indicate below. The basic hook-up for an amplifier is shown in Fig. 1. C is the filament enclosed by the cylinder for concentrating the electron pencil; B1 and B2 are the two deflection plates; P1 is the principal anode (plate), and P2, the second anode. The electron pencil generated by the cathode passes between the two deflection plates and is equally divided between the two anodes.

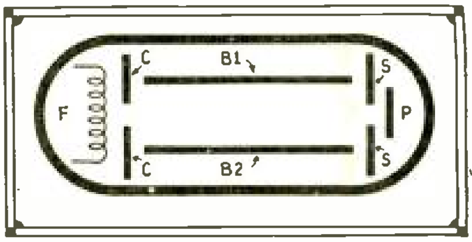


Fig. 3—Showing the arrangement of the vacuum tube devised and used by the author. F is the cathode; C, the concentrating electrode; B1 and B2, the two deflecting plates; S, the screen and polarizing anode, and P, the actual anode.

A rapid calculation based on the elementary formulas of electronic dynamics allows the determination of the variations of current on one of the anodes by means of a meter applied between the deflection plates on the basis of the elements of the electron pencil (velocity and density) and the geometrical dimensions of the whole, introducing plausible values for the various amounts thus obtained for the steepness (perfectly corresponding to the steepness of ordinary triodes), values of the order of 5 to 10 milliamperes; that is, values better than or at least equal to those of the better triodes constructed today.

A number of novel ideas quite revolutionary in character in regard to vacuum tubes for use in radio circuits are here presented by Mr. Cocci. He suggests the use of tubes based on the well-known cathode ray tube, now being experimented with extensively for television reception. The tube we shall use tomorrow may very conceivably have magnetic field control, besides electrostatic control, and provide vastly improved results. A brand new type of tube experimented with by the author is also described.

Tubes of this kind can have many other uses of interest. Keeping the arrangement of Fig. 1, one can note that the variation in current in the two anodes is in perfect opposition of phase; then using both currents one can make a balanced system much more perfect than those known today.

Having disposal over more anodes and a circular deflection field, one can obtain in output a polyphase current with perfect symmetry, ready for many uses without the obstacles caused by the difficulty of obtaining it with triodes.

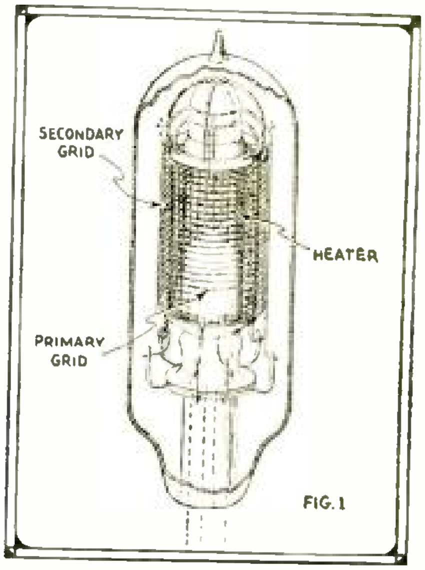
The control with magnetic fields is just as easy as with electrostatic fields and allows great simplification of the parts used for collecting between the various points. Lastly, by opportunity combining magnetic and electrostatic fields one can obtain with extreme ease phenomena of modulation, frequency alteration, etc. Recently James Robinson (the inventor of the *Stenode*) patented a tube of the kind, with combined electrostatic and magnetic control, which permits periodically variable stopping of an oscillating circuit; this phenomenon is utilized by permitting in a circuit a small decrement to follow the modulation of the telephonic signals.

In conclusion, tubes functioning by the bending of a pencil of electrons promise to bring progress and very great simplification in the field of radio technology. We shall now see the difficulty of construction. The first attempts at tubes of this type took place somewhat after the appearance of ordinary triodes; in general the results obtained were rather discouraging. Aside from the difficulty of obtaining an electron pencil sufficiently intense and concentrated, there were marked difficulties in using the variations in current obtained. On the introduction of useful loads in the anode circuit, there is formed on the anode an alternating potential, which influences in an unfavorable manner the course of the pencil; there results a coefficient of amplification so low as to make the tube useless. Only much later was the need comprehended of the accurate screening of the anode and the results attainable with the means of modern technology are set forth in an article in the July issue of the *Zeitschrift für Hochfrequenztechnik*, 1931 (by H. Alf-

(Continued on page 621)

New Vacuum Tube For Generating Ultra Short Waves

One of the newest and most unusual patents, granted recently to Emil Hatt, relates to an improved means for producing electro-magnetic waves of ultra-short length, ranging from one-half meter down to a millimeter or less. The outstanding features of Mr. Hatt's invention are illustrated and described herewith.



The new ultra-short-wave generating tube, which is provided with primary and secondary grids, together with heater and plate elements.

● EMIL HATT of Maywood, Illinois, recently had an interesting patent granted to him by the U. S. Patent Office, disclosing an improved form of vacuum tube for producing ultra-short waves, ranging in length from one-half meter down to a millimeter or less. Mr. Hatt's patent is numbered 1,844,-319. Mr. Hatt claims for his invention a more efficient means of producing ultra-short waves.

One of the goals of Mr. Hatt in working up his invention was the efficient production of ultra-short waves without the necessity of necessarily employing an external oscillating circuit.

Referring to the top sectional view of the tube, Fig. 3, it will be noted that on the inside of the tube and in the center of all the elements there is a glass stem which is made in two sections—a top section and also a bottom or supporting one. The top section, as shown in Fig. 1, has a rounded closed top and a flanged bottom end. In the rounded upper end of the top section there is fused a depending tubular member, in which there is concealed a conductor leading down through the center of the stem. In sealing the top and bottom glass stems together, there is sealed between the flanges a plurality of radially extending arms, having upturned ends, which serve to support the various elements in the tube, as Fig. 1 makes clear. Some of these arms constitute conductor terminals, while others merely act as associated supports for elements mounted on the top section of the stem. The tube is finally exhausted and sealed through the tip at the top as shown in Fig. 1.

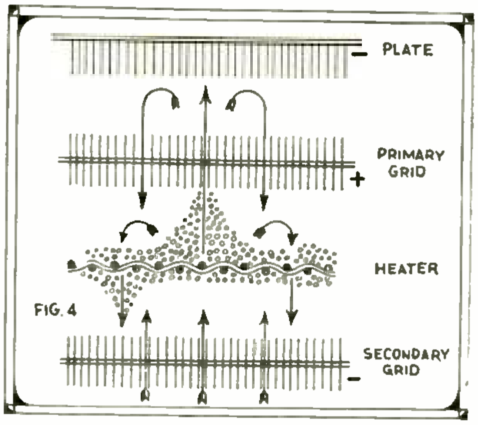


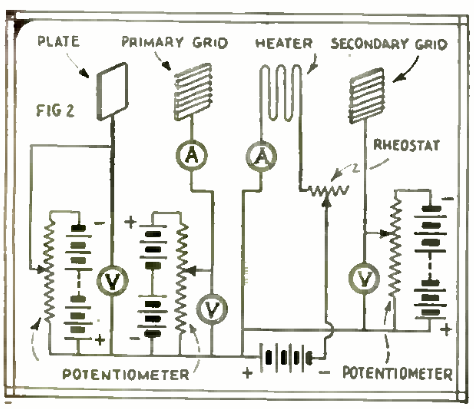
Diagram showing the action between the plate, heater, and the primary and secondary grids.

Supported upon the top section of the stem is an electrode which constitutes the *plate* element of the tube; refer to Fig. 3. This *plate* element, which functions as a negative anode, is tubular in form and has a diameter greater than that of the stem. The ends of this metallic tube or plate member are reduced in diameter so that the bottom end rests upon a shoulder formed at the base of the glass stem, while the top of the plate rests against the stem, as becomes apparent from the study of the drawings. A suitable conductor or lead wire connects to the plate.

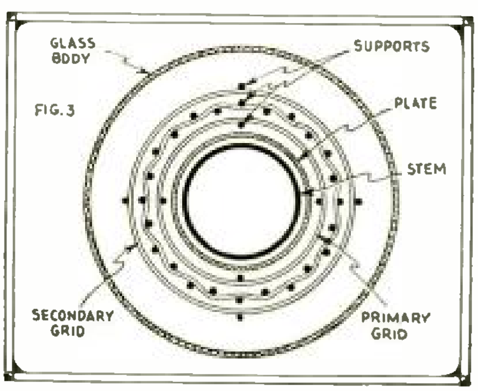
Surrounding the plate, but radially spaced therefrom, is a second electrode which constitutes the inner or *primary grid* of the tube, as shown in Fig. 3. This grid comprises four upright supporting rods upon which is helically wound a wire of any suitable material and gauge. A suitable conductor is connected to this primary grid member. Referring once more to the diagram, Fig. 3, the wavy line just outside the primary grid represents the third or *heating electrode*, which is the *cathode* of the tube. This heating element is radially spaced from the inner or primary grid also. This heating element, in the form of a cylinder, comprises a substantially fine-mesh wire screen made of any suitable filament material, but Mr. Hatt suggests the use of thoriated tungsten. The top and bottom ends of the mesh cylinder are bound and secured in a rigid fashion by rings. Suitable conductor wires are secured to the heating element, so as to provide an electric circuit through the heater in the usual way. A clever arrangement has been worked out by the inventor for the mounting of this heating element, so as to provide for the relative movements of the element due to the expansion and contraction caused by heating and cooling.

Such a heating element with a mesh-like filament is advantageous because it provides a greater filament surface area, which is foraminous for the passage of electrons there-through. Again, such a mesh insures a universal emission of electrons in every conceivable direction because said electrons, when emitted, begin their flight in directions radial to each and every filament wire in the mesh. Instead of employing thoriated tungsten in the wire of the mesh or screen alone, you may employ platinum iridium wire as a base core and coat it with a suitable oxide compound of barium or calcium, etc. Another advantage gained in making the cathode in the form of a wire mesh is that the

(Continued on page 626)



Schematic circuit arrangement for utilizing the new four-element tube devised by Mr. Hatt for generating ultra-short-waves.



View looking down endwise on the ultra-short-wave generator tube, showing double grids and plate; the heater is between the two grids.

SHORT WAVE LEAGUE

HONORARY MEMBERS
Dr. Lee de Forest
John L. Reinartz
D. E. Replogle
Hollis Baird
E. T. Somerset
Baron Manfred von Ardenne
Hugo Gernsback
Executive Secretary

News of Clubs; Readers' Opinions of the 5 Meter "No-Code" Argument

Tri-Cities Short Wave League

I am turning in eleven more memberships to the SHORT WAVE LEAGUE.

We have two meetings a month and have decided to call our chapter *The Tri Cities Short Wave League.*

Please send any notices or instructions to me.

Yours truly,
FRANCIS J. MacBLAIN,
Box 144, Baytown, Tex.

International Amateur Radio Society

Editor, SHORT WAVE CRAFT:

Being interested in radio, especially in short waves, I receive quite a few magazines on radio and among them are SHORT WAVE CRAFT, TELEVISION NEWS and *Radio-Craft*. To give you my true opinion as to what radio magazines I like best, I won't hesitate to say frankly that those published by the Gernsback publications such as *Radio-Craft* and TELEVISION NEWS, and last but not least the one and only short-wave magazine that is making friends all over the globe is SHORT WAVE CRAFT, which is the only magazine of its kind in print that gives the reader the latest and most up-to-date international developments in short waves, in a very simple manner so that any reader can understand.

I am pretty sure that your magazine will be a great success as a monthly publication. Being the vice-president of the "International Amateur Radio Society," which has headquarters at 111 N. Main Street, Three Rivers, Michigan, all of our officers as well as myself recommend the magazine to all of our members all over the world.

Membership in this organization is only 25 cents a year which gives the members the privilege of using all of our technical radio departments free of charge and also we have a club album wherein we allow each member a full page on which we insert the photos of himself as well as of his radio outfits. This also is free of charge to members. The society's album, when completely filled with photos from its members, will be sent around the world so that each of our members can see for himself what other members are like. In addition to all these privileges we also supply our members with the society's organ, which is published each month for the benefit of our members. In this small magazine we have all the news on the development of this society and radio news that is supplied by our members. You really don't have to be a licensed amateur to become a member of our society as we have members in our "IARS" who are not amateurs, but merely interested in short-wave radio.

We are looking now for radio amateurs in the following countries, who would care to be our official representatives in Poland, France, Germany, Russia, Latvia, Burma, Italy, Czechoslovakia and a few others. Those interested in representing our society in their country should write to this address, Stanley J. Yurek, 72 East 21st Street, Bayonne, N. J. Those interested in becoming a member of our society should send in 25 cents to our headquarters, or to me, and we will see that each one sending his membership fee of 25 cents is supplied with our official organ every month, as well as given a full page in our society's album. So please hurry and send in your "two-bits" and enjoy the privilege of being one of the many satisfied members of the good true "IARS."

In closing, let me thank you for your cooperation of the past as well as the present and future, also wishing you all the success and luck in this monthly publication of SHORT WAVE CRAFT, and on behalf of all the officers of the "International Amateur Radio Society."

Cordially and sincerely yours,
STANLEY J. YUREK,
72 East 21st Street,
Bayonne, N. J.

Likes Phone But Not Code Test

Editor, SHORT WAVE CRAFT:

I have just joined the SHORT WAVE LEAGUE and am another in favor of doing away with the "code test" in passing the government license. I have no license, but anyhow I have no desire to "pound brass" as the amateurs say; I am just interested in Radiotelephony or Amateur "Fone." I believe that there are many others like myself who would obtain a license if it were not for the "code" part of the test, and I sure wish that the Radio Commission would do away with it.

GEORGE HIBBELER,
2104 N. Keystone Ave.,
Chicago, Illinois.

Wants Code Test

Editor, SHORT WAVE CRAFT:

I am a new reader of SHORT WAVE CRAFT, having bought my first copy this month, and I want to say that it is the best magazine on short waves.

Again bringing up the subject of "no knowledge of code on or below six meters," I read a letter in the June issue of SHORT WAVE CRAFT written by a certain Mr. V. D. Kinard. I don't see why he should be having such a hard time with the code. It took only two months to master the code and "Q" signals on my part. I think it is much harder to build a transmitter, monitor, frequency meter, and all the other necessary equipment of a station than learning the code. The result would be a lot of inexperienced fellows who have tinkered with radio apparatus, building transmitters without any idea of its operation. Practically all of the fellows would be "off frequency" and the band in which they operate would be a regular inferno of noise, QRM and everything under the same title.

I am not a "ham" yet, but will be in a very short time. I think every operator should have a license, regardless of the frequency or band he works on, for the sake of others on the same band.

Wishing your magazine continued success, I remain,

Yours very truly,
M. R. ROFAJKO,
5417 N. Natoma Ave.,
Norwood Park, Ill.

Arguments for "Code Test"

Editor, SHORT WAVE CRAFT:

In the course of buying your magazine for the interesting articles it admittedly contains, I have found that I bought some printed opinion with which I am not in accord. You will perhaps find it worth while to run this counter-attack on the page you devote to the SHORT WAVE LEAGUE.

Class my remarks as opposition to the issuance of a non-code-requirement license. Since your readers have been so unanimous in the support of such a movement as would delete the test, it is only fair to pass on some of the considerations of the other side.

Radio telegraphy is the older art, but must not presume on seniority in the argument, save in one way, and that in the natural course of development. An amateur operator in the adjustment of his first transmitter learns that the paper advice he has read is not easily put to work. Experience brings the ability to use a transmitter to the best advantage, both for its "DX" ability, and for the good-citizen character of the signal emitted. As the readers know, phone operation is more than a refinement; it requires even more familiarity with the radio frequency end of the "rig," presumably gained in the successful operation of a C.W. transmitter. The complexity is doubled. While a phone transmitter is not an impossible thing to operate without telegraph experience, getting over one part of the problem in the C.W. outfit allows any of the difficulties arising to be more intelligently dealt with. Simple things first is the scientific attitude.

Thus the operation of a C.W. transmitter would seem to improve one's technical insight against the later phone. It is for this reason, in part, that I hold for the code test, and the ability to use a telegraph outfit for all amateurs. Emergency might call for telegraph with simpler apparatus, too.

In addition, the members of the League who are crying for a "codeless" license, nearly all say that the code is too hard for them. The amateur who has had to learn the code is obviously more interested in the art of radio than one who only wants to play with it, unwilling to give himself the code ability. Wave bands are more and more passing on to the limit of capacity, and restriction of their use to people who will work a bit and thus evince

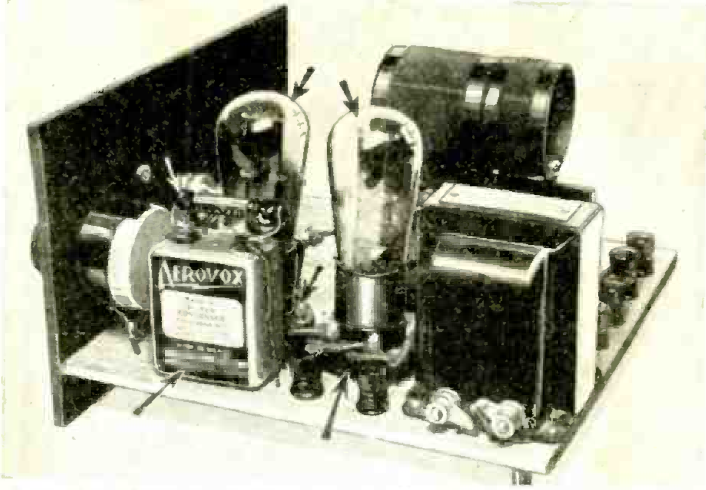
(Continued on page 628)

Get Your Button!

The illustration herewith shows the beautiful design of the "Official" Short Wave League button, which is available to everyone who becomes a member of the Short Wave League.

The requirements for joining the League were explained in the May issue; copies of rules will be mailed upon request. The button measures ¾ inch in diameter and is inlaid in enamel—3 colors—red, white, and blue.

Please note that you can order your button AT ONCE—SHORT WAVE LEAGUE supplies it at cost, the price, including the mailing, being 35 cents. A solid gold button is furnished for $2.00 prepaid. Address all communications to SHORT WAVE LEAGUE, 96-98 Park Place, New York.



How the "Beginners' Receiver" looks when rewired for A.C. Tubes. Arrows indicate "new" parts

The Short-Wave Beginner

By C. W. PALMER

No. 8 in Series: Completing Electrification of Beginners' Receiver

Mr. Palmer describes in a clear manner, intelligible to the layman, just how to convert the "Beginners' Receiver" from battery to A.C. operation.

● WELL, here we are ready to complete the *electrification* of our short wave receiver. We will remember that last month we made the power amplifier and power supply unit, and we have been using the "B" part of this unit to supply the plate curent to our receiver.

However, we are still using the "A" battery to light the filaments of the two tubes in the set, and as it is our purpose to make a completely power-operated set from our original Beginners' receiver, we will make the necessary changes, now.

First, we will not be able to use the type 30 tubes in the electric set, as these tubes are designed for battery operation and cannot be used with alternating current on the filament. The tubes made for the latter purpose are constructed a little differently than the former type. Instead of having a filament to emit the electrons as we learned some time ago, it uses the filament only to heat a small metal tube (called the "cathode") to a red heat. This cathode is covered with a substance that emits electrons similar to a filament. The regular filament is operated from the alternating current, which we have learned is not constant, but is continually changing its direction, back and forth; and of course, the strength of the current also varies from a maximum value to zero, each time it changes direction.

These changes in strength would cause the tube to act differently for each value of current and a very loud humming noise would be heard in the loudspeaker. This is the reason why the "cathode" type tube is used. The cathode holds the heat, so that the changes in the filament current do not affect the operation of the tube. These current changes that we have mentioned are too fast for our eyes to notice, but they are heard in the phones or loudspeaker as a very annoying hum.

Making the Changes

The tube that we will choose, then, is very much like the old ones in appearance, with certain exceptions. It has five prongs on the base, so new sockets are also needed. While this changing from one type of apparatus to another may seem wasteful, it was necessary as we can see by referring back over all the steps made in building our set. Naturally we had to build it simple at first, so that we would not have too much trouble.

The only remaining battery, when we remove the "A" batteries, is the "C" battery. We will remove this by placing a resistance in the current supply for the plates of the tubes, and tapping off enough for the "C" supply, which is only about 10 volts. This is done by inserting a resistance of the correct value in the "cathode" circuit. As the current of the "B" supply passes from the cathode to the plate, this is the most convenient place to make the "C" tap.

The parts needed for these final changes in our receiver are as follows:

2—type 56 Tubes—Arcturus (or R. C. A.)

2—5-prong Tube Sockets—Alden

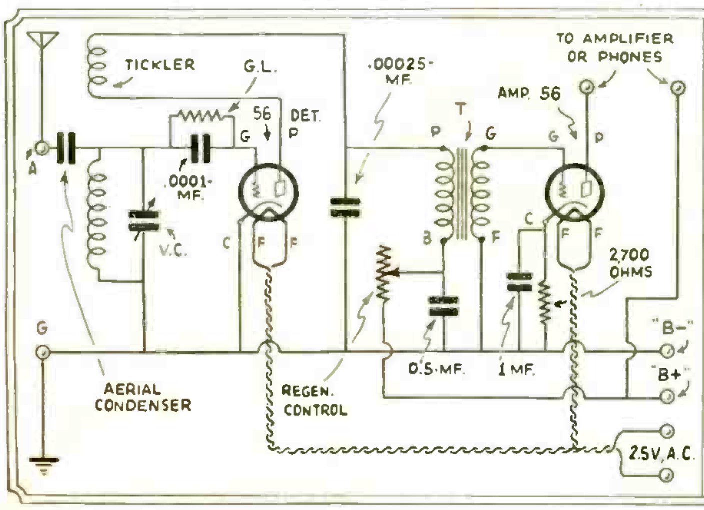
1—Resistor, 2,700 ohms (1 watt size) Aerovox (Lynch)

1—1 mf. by-pass Condenser—Aerovox (Concourse)

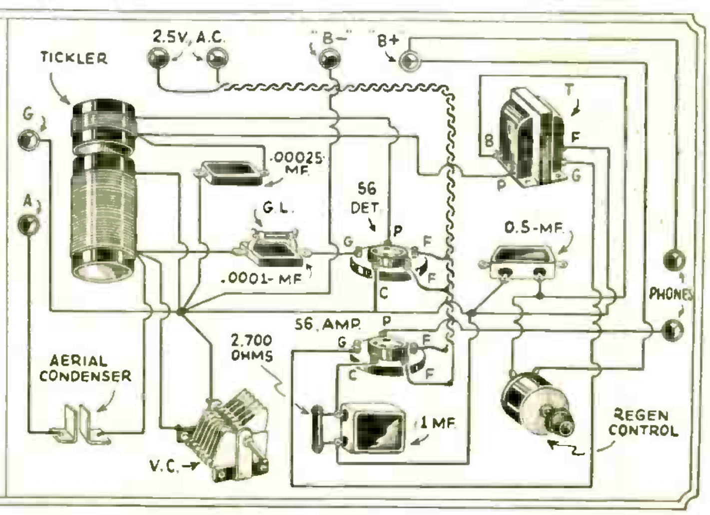
Remove the tube sockets, the filament wires, which includes the wires that connected to the "F" terminals on the two sockets, as well as the wires from ground to the filament rheostat and from the rheostat to the "A—,B—,C." terminal. The wire from the "A." to the tube filaments and the wire from the "F" terminal on the transformer to the "C—" terminal are also removed.

Now mount the five-prong sockets in place of the old ones, with the grid binding post to the left looking from the front. Resolder the wire from the grid leak and condenser to the "G" terminal on the detector socket. Connect the wire from the regeneration coil back on the "P" terminal of this socket. This leaves three terminals

(Continued on page 636)



Wiring diagram showing schematically how the new A.C. heater circuit is applied to the short-wave "Beginners' Receiver," previously described for battery operation.



Physical wiring diagram for the "uninitiated" S-W fan, showing how Mr. Palmer rewired the filament-heater circuit for A.C. operation in the "Beginners' Receiver."

SHORT WAVE STATIONS OF THE WORLD

ALL SCHEDULES EASTERN STANDARD TIME: ADD 5 HOURS FOR GREENWICH MEAN TIME

Short Wave Broadcasting Stations

Wavelength (Meters)	Frequency (Kilocycles)	Call Letters	Address and Schedule
13.93	21,540	W8XK	Westinghouse Electric, East Pittsburgh, Pa. 7:30 a.m.-noon.
13.97	21,470	GSH	Chelmsford, England.
15.93	18,830	PLE	Bandoeng, Java. Wednesdays, 4:00-8:00 a.m.
16.87	17,780	W3XAL	National Broadcasting Co., Bound Brook, N. J.
		W9XF	Downers Grove, Ill.
16.88	17,770	GSG	Chelmsford, England.
19.56	15,330	W2XAD	General Electric Co., Schenectady, N. Y. Broadcasts 3-6 p.m. daily; 1-6 p.m. Sat. and Sunday.
19.65	15,270	W2XE	Wayne, N. J.
19.68	15,210	FYA	"Radio Colonial," Pontoise (Paris), France. Service de la Radiodiffusion, 103 Rue de Grenelle, Paris. Daily 8:30-10:00 a.m.
19.72	15,210	W8XK	Westinghouse Electric & Mfg. Co., East Pittsburgh. 7:30 a. m. to 5 p.m.
		DJB	For address, see listing for DJA. Mondays, 10-11 p.m.
19.81	15,140	GSF	Chelmsford, England.
19.83	15,120	HVJ	Vatican City (Rome, Italy) Daily 5:00 to 5:15 a.m.
		JIAA	Tokio, Japan. Irregular.
19.99	15,000	CM6XJ	Central Tuinucu, Cuba. Irregular.
20.50	11,620	XDA	Trens-News Agency, Mexico City, 2:30-3 p.m.
20.95	11,310	G2NM	Gerald Marcuse, Sonning-on-Thames, England. Sundays, 1:30 p.m.
21.50	13,940	....	University of Bucharest, Bucharest, Roumania, 2-5 p.m., Wed., Sat.
23.35	12,850	W2XO	General Electric Co., Schenectady, N. Y. Antipodal program 9 p.m. Mon. to 3 a.m. Tues. Noon to 5 p.m. on Tues., Thurs. and Sat.
		W2XCU	Ampere, N. J.
		W9XL	Anoka, Minn., and other experimental relay broadcasters.
23.38	12,820	....	Director General, Telegraph and Telephone Stations, Rabat, Morocco. Sun., 7:30-9 a.m. Daily 5-7 a.m. Telephony.
25.16	11,905	FYA	"Radio Colonial," Pontoise (Paris). See listing for 19.68 meters. Daily 1:00-2:00 p.m.
25.21	11,880	W9XF	National Broadcasting Co., Downers Grove (Chicago), Ill. 9-10 p.m. daily.
25.26	11,870	VUC	Calcutta, India. 9:45-10:45 p.m.; 8-9 a.m.
		W8XK	Westinghouse Electric, East Pittsburgh, Pa. 4-10 p.m.
25.28	11,865	GSE	Chelmsford, England.
25.34	11,840	W9XAO	Chicago Federation of Labor, Chicago, Ill. 7-8 a.m., 1-2, 1-5:30, 6-7:30 p.m.
25.36	11,830	W2XE	Wayne, N. J.
25.4	11,810	I2RO	"Radio Roma Napoli," Rome, Italy. Daily, 11:30 a.m. to 12:15 p.m. and 2:00-6:00 p.m. Sunday, 11:00 a.m.-12:15 p.m.
25.42	11,800	VE9GW	W. A. Shane, Chief Engineer, Bowmanville, Canada. Daily, 1-4 p.m.
25.45	11,790	W1XAL	Boston, Mass.
25.47	11,780	VE9DR	Drummondville, Quebec, Canada. Irregular.
25.50	11,760	XDA	Trens-News Agency, Mexico City. 3-4 p.m.
25.53	11,750	GSD	Chelmsford, England.
		VE9JR	Winnipeg, Canada. Weekdays, 5:30-7:30 p.m.
25.6	11,705	FYA	"Radio Colonial," Pontoise (Paris). See listing for 19.68 meters. Daily, 3.00-7:00 p.m.
29.30	10,250	TI4	Amondo Cespedes Marin, Heredia, Costa Rica. Mon. and Wed., 7:30 to 8:30 p.m.; Thurs. and Sat., 9:00 to 10 p.m.
30.4	9,860	EAQ	Transradio Espanola, Alcala 43-Madrid, Spain. (P. O. Box 951). Daily for America, 6:30-8:00 p.m.; for Europe and Canaries on Saturdays only, 1:00-3:00 p.m.
31.10	9,640	HSP2	Broadcasting Service, Post And Telegraph Department, Bangkok, Siam. 9-11 a.m., daily.
31.28	9,590	VK2ME	Amalgamated Wireless, Ltd., Sydney, Australia, Sun., 1-3 a.m., 5-9 a.m., 9:30-11:30 a.m.
31.29	9,585	GSC	Chelmsford, England.
31.30	9,580	W3XAU	Byberry, Pa., relays WCAU daily.
		HBP	League of Nations, Geneva, Switzerland. Sundays, 5:00-5:45 p.m.
31.33	9,570	W1XAZ	Westinghouse Electric & Mfg. Co., Springfield, Mass., 6 a.m.-10 p.m daily.
		SRI	Poznan, Poland, Tues., 1:45-4:45 p.m., Thurs., 1:30-8 p.m.
31.38	9,560	DJA	Reichspostzentralamt, 11-15 Schoeneberger Strasse (Berlin), Konigswusterhausen, Germany. Daily, 8 a.m.-7:30 p.m.
31.48	9,530	W2XAF	General Electric Co., Schenectady, N. Y., 5-11 p.m. Daily.
31.49	9,520	OXY	Skamleboek, Denmark, 2-7 p.m. daily.
31.51	9,510	GSB	Chelmsford, England.
31.55	9,510	VK3ME	Amalgamated Wireless, Ltd., 167-169 Queen St., Melbourne, Australia. Wed. 5:00-6:30 a.m., Sat. 5:00-7:00 a.m.
31.58	9,500	PRBA	Radio Club of Brazil, Rio de Janeiro. 4:30 p.m. to about 8:00 p.m.
31.70	9,460	....	Radio Club of Buenos Aires, Argentina.
32.00	9,375	EH9OC	Berne, Switzerland. 3-5:30 p.m.
32.26	9,290	....	Rabat, Morocco, 3-5 p.m. Sunday, and irregularly weekdays.
35.00	8,570	RV15	Far East Radio Station, Khabarovsk, Siberia, 5-7:30 a.m.
39.80	7,530	....	"El Prado," Riobamba, Ecuador. Thurs., 9-11 p.m.
40.00	7,500	....	"Radio-Touraine," France.
40.20	7,460	YR	Lyons, France. Daily except Sun., 10:30 to 1:30 a.m.
40.50	7,410	....	Eberswalde, Germany. Mon., Thurs., 1-2 p.m.
40.70	7,370	X26A	Nuevo Laredo, Mexico. 9-10 a.m.; 11 a.m.-noon; 1-2; 4-5; 7-8 p.m. Tests after midnight. I.S.W.C. programs 11 p.m. Wed. A.P.31.
40.90	7,320	ZTJ	Johannesburg, So. Africa. 9:30 a.m.-2:30 p. m.
41.46	7,230	DDA	Doeberitz, Germany.
41.50	7,220	HB9D	Zurich, Switzerland. 1st and 3rd Sundays at 7 a.m., 2 p.m.

(NOTE:—This list is compiled from many sources, all of which are not in agreement, and which show greater or less discrepancies; in view of the fact that most schedules and many wavelengths are still in an experimental stage; and that wavelengths are calculated differently in many schedules. In addition to this, one experimental station may operate on any of several wavelengths which are assigned to a group of stations in common. We shall be glad to receive later and more accurate information from broadcasters and other transmitting organizations, and from listeners who have authentic information as to calls, exact wavelengths and schedules. We cannot undertake to answer readers who inquire as to the identity of unknown stations heard, as that is a matter of guesswork; in addition to this, the harmonics of many local long-wave stations can be heard in a short-wave receiver.—EDITOR.)

Wavelength (Meters)	Frequency (Kilocycles)	Call Letters	Address and Schedule
41.67	7,195	VS1AB	Singapore, S. S. Mon., Wed. and Fri., 9:30-11 a.m.
42.00	7,110	HKX	Bogota, Colombia.
42.70	7,020	EAR125	Madrid, Spain. 6-7 p.m.
42.90	6,990	CT1AA	Lisbon, Portugal. Fridays, 5-7 p.m.
43.60	6,875	F8MC	Casablanca, Morocco. Sun., Tues., Wed., Sat.
46.10	6,180	TGW	Guatamala City, Guat. 8-10 p.m.
46.70	6,425	W9XL	Anoka, Minn.
46.70	6,425	W3XL	National Broadcasting Co. Bound Brook, N. J. Relays WJZ. Irregular.
46.72	6,420	RV62	Minsk, U.S.S.R. Irregular.
47.00	6,380	HC1DR	Quito, Ecuador, 8-11 p.m.
47.35	6,335	VE9AP	Drummondville, Canada.
		CN8MC	Casablanca, Morocco. Mon. 3-4 p.m., Tues. 7-8 a.m., 3-4 p. m. Relays Rabat.
47.81	6,270	HKC	Bogota, Colombia. 8:30-11:30 p.m.
48.00	6,250	HKA	Barranquilla, Colombia. 8-10 p.m. ex. Mo., Wed., Fri.
48.62	6,170	HRB	Tegucigalpa, Honduras. Monday, Wednesday, Friday, Saturday 5-6 p.m. and 9-12 p.m.
48.86	6,140	W8XK	Westinghouse Electric and Mfg. Co. East Pittsburgh, Pa. 5 p.m.-midnight.
48.99	6,120	W2XE	Columbia Broadcasting System, 485 Madison Avenue, New York, N. Y. 7:00 a.m. to midnight.
		FL	Eiffel Tower, Paris. 5:30-5:45 a.m., 5:45-12:30, 4:15-4:45 p.m.
49.10	6,110	VE9CG	Calgary, Alta., Canada.
49.15	6,100	W3XAL	National Broadcasting Company, Bound Brook, N.J., Irregular.
		VE9CF	Halifax, N. S., Canada. 6-10 p.m., Tu., Thu., Fri.
49.17	6,095	VE9GW	Bowmanville, Ontario, Canada. 5:00 p.m. to midnight.
49.18	6,100	W9XF	Downers Grove, Ill.
49.31	6,080	W9XAA	Chicago Federation of Labor, Chicago, Ill. 6-7 a.m., 7-8 p.m., 9:30-10:15, 11-12 p.m. Int. S.-W. Club programs. From 10 p.m. Saturday to 6 a.m. Sunday.
49.40	6,070	VE9CS	Vancouver, B. C., Canada. Fridays before 1:30 a.m. Sundays, 2 and 10:30 p.m.
		JB	Johannesburg, South Africa. 10:30 a.m.-3:30 p.m.
49.46	6,065	SAJ	Motala, Sweden. 6:30-7 a.m., 11 a.m. to 4:30 p.m.
49.50	6,060	W8XAL	Crosley Radio Corp., Cincinnati, O. Relays 6:30-10 a.m., 1-3 p.m., 6 p.m. to 2 a.m. daily. Sunday after 1 p. m.
49.50	6,050	VQ7LO	Imperial and International Communications, Ltd., Nairobi, Kenya, Africa. Monday, Wednesday, Friday, 11 a.m.-2:30 p.m.; Tuesday, Thursday, 11:30 a.m.-2:30 p.m.; Saturday, 11:30 a.m.-3:30 p.m.; Sunday, 11 a.m.-1:30 p.m.; Tuesday, 3 a.m.-4 a.m.; Thursday, 8 a.m.-9 a.m.
		W3XAU	Byberry, Pa. Relays WCAU.
49.58	6,050	GSA	Chelmsford, England.
49.59	6,050	VE9CF	Halifax, N. S., Canada. 11 a.m.-noon, 5-6 p.m.. On Wed., 8-9; Sun., 6:30-8:15 p. m.
		HKD	Barranquilla, Columbia.
49.67	6,040	PK3AN	Sourabaya, Java. 6-9 a.m.
		W4XB	Lawrence E. Dutton, care Isle of Dreams Broadcast Corp., Miami Beach, Fla.
49.75	6,030	VE9CA	Calgary, Alta., Canada.
49.96	6,005	VE9DR	Canadian Marconi Co., Drummondville, Quebec. 6-10 p.m. daily.
49.97	6,000	YV2BC	Caracas, Venezuela. 7:45-11 p.m. daily ex. Mon.
		....	Eiffel Tower, Paris, France. Testing, 6:30 to 6:45 a.m.; 1:15 to 1:30, 5:15 to 5:45 p.m., around this wave.
		VE9CU	Calgary, Canada.
49.97	6,000	....	Administration des P. T. T., Tananarive, Madagascar. Tues., Wed., Thurs., Fri., 9:30-11:30 a.m. Sat and Sun., 1-3 p.m.
50.26	5,970	HVJ	Vatican City (Rome), 2-2:15 p.m., daily. Sun., 5-5:30 a.m.
50.80	5,900	HKO	Medellin, Colombia. 8-11 p.m., except Sunday.
51.40	5,835	HKD	Barranquilla, Colombia, 7:15-10:30 p.m., Mon., Wed., 8-10:30 p.m.; Sunday, 7:15-8:30 p.m. Elias J. Pellet.
52.50	5,710	VE9CL	Winnipeg, Canada.
54.02	5,550	W8XJ	Columbus, Ohio.
58.00	5,170	OK1MPT	Prague, Czechoslovakia 1-3:30 p.m., Tues. and Fri.
		PMY	Bandoeng, Java.
		PMB	Sourabaya, Java.
60.30	4,975	W2XV	Radio Engineering Laboratories, Inc., Long Island City, N. Y. Irregular.
62.56	4,795	W9XAM	Elgin, Ill. (Time signals.)
		W3XZ	Washington, D. C.
		W9XL	Chicago, Ill.
67.65	4,430	DOA	Doeberitz, Germany. 6-7 p.m., 2-3 p.m., Mon., Wed., Fri.
70.00	4,280	OHK2	Vienna, Austria. Sun., first 15 minutes of hour from 1 to 7 p.m.

SHORT WAVE STATIONS OF THE WORLD

(Continued from opposite page)

Short Wave Broadcasting Stations

70.20	4.273	RV15	Far East Radio Station, Khabarovsk, Siberia. Daily, 3-9 a.m.
7.05	42.530	....	Berlin, Germany. Tues. and Thurs., 11:30-1:30 p.m. Telefunken Co.
80.00	3.750	F8KR	Constantine, Tunis, Africa. Mon. and Fri.
		I3RO	Prato Smeraldo, Rome, Italy. Daily, 3-5 p.m.
82.90	3,620	DOA	Doeberitz, Germany.
84.24	3.560	OZ7RL	Copenhagen, Denmark. Tues. and Fri. after 6 p.m.
128.09	2.342	W7XAW	Fisher's Blend, Inc., Fourth Ave. and University St., Seattle, Washington.

Experimental and Commercial Radio-Telephone Stations

Wavelength (Meters)	Frequency (Kilocycles)	Call Letters	Address and Schedule
9.68	31,000	W8XI	Pittsburgh, Pa.
10.79	27,800	W6XD	Palo Alto, Calif. M. R. T. Co.
11.55	25,960	G5SW	Chelmsford, England. Experimental.
11.67	25.700	W2XBC	New Brunswick, N. J.
12.18	21,000	W6XQ	San Mateo, Calif.
			Vienna, Austria, Mon., Wed., Sat.
11.00	21,420	W2XDJ	Deal, N. J.
			And other experimental stations.
11.01	21,400	WLD	American Telephone & Telegraph Co., Lawrence, N. J., transatlantic phone.
14.15	21.130	LSM	Monte Grande, Argentina.
11.27	21,020	LSN	(Hurlingham), Buenos Aires, Argentina.
14.28	21.000	OKI	Podebrady, Czechoslovakia.
11.47	20.710	LSY	Monte Grande, Argentina. Daily 3-6 p.m., Sunday, 10 p.m.
14.50	20.680	LSN	Monte Grande, Argentina, after 10:30 p.m. Telephony with Europe.
		LSX	Buenos Aires. Telephony with U. S.
		FSR	Paris-Saigon phone.
14.54	20,620	PMB	Bandoeng, Java. After 4 a.m.
14.89	20,140	DWG	Nauen, Germany. Tests 10 a.m.-3 p.m.
15.03	19.950	LSG	Monte Grande, Argentina. From 7 a.m. to 1 p.m. Telephony to Paris and Nauen (Berlin).
		DIH	Nauen, Germany.
15.07	19.906	LSG	Monte Grande, Argentina. 8-10 a.m.
15.10	19.850	WMI	Deal, N. J.
15.12	19.830	FTD	St. Assise, France.
15.45	19.400	FRO, FRE	St. Assise, France.
15.55	19.300	FTM	St. Assise, France. 10 a.m. to noon.
15.58	19.240	DFA	Nauen, Germany.
15.60	19.220	WNC	Deal, N. J.
15.94	18.820	PLE	Bandoeng, Java. 8:10-10:40 a.m. Phone service to Holland.
16.10	18,620	GBJ	Bodmin, England. Telephony with Montreal.
16.11	18,620	GBU	Rugby, England
16.33	18,370	PMC	Bandoeng, Java.
16.35	18.350	WND	Deal Beach, N. J. Transatlantic telephony.
16.38	18.310	GBS	Rugby, England. Telephony with New York. General Postoffice, London.
		FZS	Saigon, Indo-China. 1 to 3 p.m. Sundays.
16.44	18.210	FRO, FRE	Ste. Assise, France.
16.50	18.170	CGA	Drummondville, Quebec, Canada. Telephony to England.
16.57	18.100	GBK	Bodmin, England.
16.61	18.050	KQJ	Bolinas, Calif.
16.80	17.850	PLF	Bandoeng, Java ("Radio Malabar").
		W2XAO	New Brunswick, N. J.
16.82	17,830	PCV	Kootwijk, Holland. 9:40 a.m. Sat.
16.87	17.780	W8XK	Westinghouse Electric and Mfg. Co., Saxonburg, Pa.
17.00	17,610		Ship. Phones to Shore; WSBN, "Leviathan"; GFWV, "Majestic"; GLSQ, "Olympic"; GOLJ "Homeric"; GMJQ, "Belgenland"; work on this and higher channels.
17.25	17.380	JIAA	Tokio, Japan.
17.31	17,300	W8XL	Dayton, Ohio.
		W6XAJ	Oakland, Calif.
		W9XL	Anoka, Minn., and other experimental stations.
17.52	17,110	WOO	Deal, N. J. Transatlantic phone.
		W2XDO	Ocean Gate, N. J. A. T. & T. Co.
17.55	17,080	GBC	Rugby, England.
18.40	16.300	PCL	Kootwijk, Holland. Works with Bandoeng from 7 a.m.
		WLO	Lawrence, N. J.
18.50	16,200	FZR	Saigon, Indo-China.
18.56	16,150	GBX	Rugby, England.
18.68	16,060	NAA	U. S. Navy, Arlington Va. Time signals. 11:57 to noon.
18.80	15.950	PLG	Bandoeng, Java. Afternoons.
18.90	15.860	FTK	St. Assise, France. Telephony.
18.93	15.760	JIAA	Tokio, Japan. Up to 10 a.m. Beam transmitter.
19.60	15.300	OXY	Lyngby, Denmark. Experimental.
20.65	14,530	LSA	Buenos Aires, Argentina.
20.70	14.180	GGBW	Radio Section, General Post Office, London, E. C. 1. Rugby, England.
		WNC	Deal, N. J.
20.80	14,420	VPD	Suva, Fiji Islands.
21.17	14,150	KKZ	Bolinas, Calif.
22.38	13.400	WND	Deal Beach, N. J. Transatlantic telephony.
23.46	12.780	GBC	Rugby, England.
24.41	12.290	GBU	Rugby, England.
24.46	12.250	FTN	Ste. Assise (Paris), France. Works Buenos Aires, Indo-China and Java. On 9 a.m. to 1 p.m. and other hours.
		GBS	Rugby, England.
		PLM	Bandoeng, Java. 7.45 a.m.
24.68	12.150	GBS	Rugby, England. Transatlantic phone to Deal, N. J. (New York).
		FQO, FQE	Ste. Assise, France.
24.80	12,090	... ...	Tokio, Japan. 5-8 a.m.
24.89	12,045	NAA	Arlington, Va. Time signals, 11:57 to noon.
		NSS	Annapolis, Md. Time signals. 9:57-10 p.m.
24.98	12,000	FZG	Saigon, Indo-China. Time signals, 2-2:05 p.m.
25.10	11.945	KKQ	Bolinas, Calif.
25.65	18,680	YVQ	Maracay, Venezuela. (Also broadcasts occasionally.)
25.68	11.670	KIO	Kahuku, Hawaii.
26.00	11.530	CGA	Drummondville, Canada.
26.10	11,490	GBK	Bodmin, England.
26.15	11,470	IBDK	S.S. "Elettra," Marconi's yacht.
26.22	11.435	DHC	Nauen, Germany.
26.44	11,340	DAN	Nordeich, Germany. Time signals, 7 a.m., 7 p.m. Deutsche Seewarte, Hamburg.
27.30	10.980	ZLW	Wellington, N. Z. Tests 3-8 a.m.
28.20	10.630	PLR	Bandoeng, Java. Works with Holland and France weekdays from 7 a.m.; sometimes after 9:30.
28.44	10.540	WLO	Lawrence, N. J.
		VLK	Sydney, Australia. 1-7 a.m.
28.80	10.410	PDK	Kootwijk, Holland.
		KEZ	Bolinas, Calif.
		LSY	Buenos Aires, Argentina.
28.86	10.390	GBX	Rugby, England.
29.54	10.150	OIS	Nauen, Germany. Press (code) daily; 6 p.m.; Spanish; 7 p.m., English; 7:50 p.m., German; 2:30 p.m., English; 5 p.m., German. Sundays: 6 p.m., Spanish; 7:50 p.m., German; 9:30 p.m., Spanish.
30.15	9.950	GBU	Rugby, England.
30.30	9.890	LSN	Buenos Aires, phone to Europe.
		LSA	Buenos Aires.
30.64	9.790	GBW	Rugby, England.
30.75	9.750	.....	Agen, France. Tues. and Fri., 3 to 4:15 p.m.
		WNC	Deal, N. J.
30.90	9.700	WMI	Deal, N. J.
30.93	9.600	LQA	Buenos Aires.
31.23	9.600	LGN	Bergen, Norway.
32.13	9.330	CGA	Drummondville, Canada.
32.21	9.310	GBC	Rugby, England. Sundays 2:30-5 p.m.
32.40	9.250	GBK	Bodmin, England.
32.50	9.230	FL	Paris, France (Eiffel Tower). Time signals 4:56 a.m. and 4:56 p.m.
32.59	9.200	GBS	Rugby, England. Transatlantic phone.
33.26	9,010	GBS	Rugby, England.
33.81	8.872	NPO	Cavite (Manila), Philippine Islands. Time signals 9:55-10 p.m.
		NAA	Arlington, Va., Time signals 9:57-10 p.m., 2:57-3 p.m.
33.98	8.810	WSBN	S.S. "Leviathan."
34.50	8.690	W2XAC	Schenectady, New York.
34.68	8,650	W2XCU	Ampere, N. J.
34.68	8.650	W3XE	Baltimore, Md. 12:15-1:15 p.m., 10:15-11:15 p.m.
		W2XV	Radio Engineering Lab., Long Island City, N. Y.
		W8XAG	Dayton, Ohio.
		W4XG	Miami, Fla.
		W3XX	Washington, D. C. And other experimental stations.
34.71	8.630	WOO	Deal, N. J.
		W2XDO	Ocean Gate, N. J.
35.02	8.550	WOO	Ocean Gate, N. J.
35.50	8.450	PRAG	Porto Alegre, Brazil. 8:30-9:00 a.m.
36.92	8.120	PLW	Bandoeng, Java.
37.02	8.100	EATH	Vienna, Austria. Mon. and Thurs., 5:30 to 7 p.m.
		JIAA	Tokyo, Japan. Tests 5-8 a.m.
37.80	7.930	DOA	Doeberitz, Germany. 1 to 3 p.m. Reichspostzentralamt, Berlin.
38.00	7.890	VPD	Suva, Fiji Islands.
		JIAA	Tokio, Japan (Testing).
38.30	7.830	POV	Kootwijk, Holland, after 9 a.m.
38.60	7.770	FTF	Ste. Assise, France
		PCK	Kootwijk, Holland. 9 a.m. to 7 p.m.
39.15	7.660	FTL	Ste. Assise.
39.10	7.610	HKF	Bogota, Colombia. 8-10 p.m.
39.74	7.520	CGE	Calgary, Canada. Testing. Tues., Thurs.
43.70	6,860	KEL	Bolinas, Calif.
			Radio Vitus, Paris, France. 4-11 a.m. 3 p.m.

(Continued on next page)

"STAR" SHORT WAVE BROADCASTING STATIONS

The following stations are reported regularly by many listeners, and are known to be on the air during the hours stated. Conditions permitting, you should be able to hear them on your own short-wave receiver. All times E.S.T.

G5SW has been replaced by eight stations operating on various waves between 13.97 and 49.58 meters.

HVJ, Vatican City. Daily 5 to 5:15 a.m. on 19.83 meters; 2 to 2:15 p.m. on 50.26 meters; Sunday 5 to 5:30 a.m. on 50.26 meters.

VK2ME, Sydney, Australia. 31.28 meters. Sunday morning from 1 to 3 a.m.; 5 to 9 a.m.; and 9:30 to 11:30 a.m.

VK3ME, Melbourne, Australia. 31.55 meters. Wednesday 5:00-6:30 a.m.; Saturday 5:00-7:00 a.m.

FYA, "Radio Colonial," Paris. On 19.68 meters, daily 8:30-10:00 a.m.; on 25.16 meters, daily 1:00-2:00 p.m.; on 25.6 meters, daily 3:00-7:00 p.m.

Konigs-Wusterhausen, Germany. On 31.38 meters daily from 8 a.m. to 7:30 p.m.

HKD, Barranquilla, Colombia. On 51.4 meters, Monday, Wednesday and Friday, 8 to 10:30 p.m.; Sunday, 7:45 to 8:30 p.m.

VE9GW, Bowmanville, Ontario, Canada, 25.42 meters, from 1 to 10 p.m.

EAQ, Madrid, Spain, 30.4 meters. 6:30 to 8 p.m. daily; 1 to 3 p.m. Saturday.

RV15, Khavarovsk, Siberia. 70.2 meters. Daily from 2 to 9 a.m.

SHORT WAVE STATIONS OF THE WORLD

(Continued from preceding page)

Experimental and Commercial Radio-Telephone Stations

Wavelength (Meters)	Frequency (Kilocycles)	Call Letters	Address and Schedule
43.80	6,840	CFA	Drummondville, Canada.
44.40	6,753	WND	Deal, N. J.
44.99	6,660	F8KR	Constantine, Algeria. Mon., Fri., 5 p.m.
		HKM	Bogota, Colombia. 9-11 p.m.
45.50	6,560	RFN	Moscow, U.S.S.R. (Russia) 2 a.m.-4 p.m.
46.05	6,515	WOO	Deal, N. J.
62.80	4,770	ZL2XX	Wellington, New Zealand.
63.00	4,760	Radio LL	Paris, France.
63.13	4,750	WOO	Ocean Gate, N. J.
63.79	4,700	WIXAB	Portland, Me.
72.87	4,116	WOO	Deal, N. J.
71.72	4,105	NAA	Arlington, Va. Time signals, 9:57-10 p.m., 11:57 a.m. to noon.
92.50	3,256	W9XL	Chicago, Ill.
95.00	3,156	PK2AG	Samarang, Java.
96.03	3,124	WOO	Deal, N. J.
97.53	3,076	W9XL	Chicago, Ill.
			Motala, Sweden. 11:30 a.m.-noon, 4-10 p.m.
193.5	1,550	W2XCE	Passaic, N. J.
199.35	1,560	WIXAU	Boston, Mass.

Airport Stations

Wavelength (Meters)	Frequency (Kilocycles)	Call Letters	Address
98.95	3,030	VE9AR	Saskatoon, Sask., Canada.
53.25	5,630)	WQDP	Atlanta, Ga.
86.00	3,490(	WSDE	Tuscaloosa, Ala.
		WSDB	Jackson, Miss.
		KGUK	Shreveport, La.
		KGUF	Dallas, Tex.
		KGUC	Fort Worth, Tex.
		KGUL	Abilene, Tex.
		KGUG	Big Springs, Tex.
		KGUA	El Paso, Tex. (Southern Air Transport Lines.)
53.53	5,600)	WQDU	Aurora, Ill.
94.52	3,170(	KQQ	Iowa City, Iowa.
		KQM	Des Moines, Iowa.
		KMP	Omaha, Neb.
		KRF	Lincoln, Neb.
		KMR	North Platte, Neb.
		KQE	Cheyenne, Wyo.
		KQC	Rock Springs, Wyo.
		KQD	Salt Lake City, Utah.
		KKO	Elko, Nevada.
		KJE	Reno, Nevada.
		KFD	Oakland, Calif.
		KRA	Boise, Idaho.
		KDD	Pasco, Wash. (Boeing Air Lines).
54.00	5,560)	WAEF	Newark, N. J.
96.77	3,100(	WAEE	Camden, N. J.
		WAED	Harrisburg, Pa.
		WAEC	Pittsburgh, Pa.
		WAEB	Columbus, Ohio.
		WAEA	Indianapolis, Ind.
		KGTR	St. Louis, Mo.
		KSY	Tulsa, Okla.
		KSW	Amarillo, Tex.
		KSX	Albuquerque, N. M.
		KGPL	Kingman, Ariz.
		KGTJ	Las Vegas, Nev.
		KSI	Los Angeles, Calif.
		KGTD	Wichita, Kan.
		KST	Kansas City, Mo. (Transcontinental Air Transport).

Television Stations

Wavelength (Meters)	Frequency (Kilocycles)	Call Letters	Address and Schedule
3.75 to 5 meters—60 to 80 megacycles.			
5.96 to 6.18 meters—48.5 to 50.3 megacycles.			
6.32 to 7.14 meters—42 to 46 megacycles.			
		W8XF	The Goodwill Station, Pontiac, Mich.
		W3XE	Philco Radio, Philadelphia, Pa.
		W8XL	WGAR Broadcasting Co., Cleveland, Ohio.
6.89	43,500	W9XD	Milwaukee Journal, Milwaukee, Wis.
		W3XAD	Camden, N. J. (Other experimental television permits: 48,500 to 50,300 k.c., 43,000-46,000 k.c.).
101.7 to 105.3 meters—2,850 to 2,950 kc.			
		WIXAV	Short Wave & Television Corp., Boston, Mass. 1-2, 7:30 to 10:30 p.m. daily ex. Sun. Works with WIXAU 10-11 p.m.
		W2XR	Radio Pictures, Inc., Long Island City, N. Y. 4 to 10 p.m. exc. Sundays. Silent 7-7:30 Sat.
105.9	2,833	W6XAN	Los Angeles, Calif.
		W7XAB	Spokane, Wash.
105.3 to 109.1 meters—2,750 to 2,850 kc.			
		W2XAB	Columbia Broadcasting System, 4 8 5 Madison Ave., N. Y. 8:00-10:00 p.m. Sight and Sound Transmission daily except Saturday and Sunday.
		W2XBO	Long Island City, N. Y.
		W3XE	Philco Radio, Philadelphia, Pa.
		W9XAA	Chicago, Ill.
		W9XG	Lafayette, Ind. 60 holes, 1,200 r.p.m. Tuesdays and Thursdays, 2:00 p.m., 7:00 p.m., 10:00 p.m.
108.8	2,758	VE9CI	London, Ont., Canada.
130.4 to 136.4 meters—2,200 to 2,300 kc.			
		W9XAL	First National Television Corp., Kansas City, Mo.
136.4 to 142.9 meters—2,100 to 2,200 kc.			
		W2VBS	National Broadcasting Co., New York, N. Y., 1,200 R.P.M., 60 lines deep, 72 wide. 2-5 p.m., 7-10 p.m. ex. Sundays.
		W2XR	Radio Pictures, Inc., Long Island City, N. Y. 48 and 60 line. 5-7 p.m.
		W3XAD	R. C. A.-Victor Co., Inc., Camden, N. J.
		W2XCW	Schenectady, N. Y.
		W8XAV	Pittsburgh, Pa. 1,200 R. P.M., 60 holes. 1:30-2:30 p.m., Mon., Wed., Fri.
		W9XAP	Chicago, Ill.
		———	Kansas State Agricultural College, Manhattan, Kans.
142.9 to 150 meters—2,000 to 2,100 kc.			
		W2XAP	Jersey City, N. J.
		W2XCR	Jersey City, N. J. 3-5, 6-9 p.m., ex. Sun.
		W3XK	Wheaton, Maryland. 10:30 p.m.-midnight exc. Sun. Works with W3XJ.
		W2XCE	Passaic, N. J. 2-3 p.m. Tues., Thurs., Sat.
		W8XF	The Goodwill Station, Pontiac, Mich.
142.9 to 150 meters—2,000 to 2,100 kc.			
		W9XAO	Western Television Research Co., Chicago, Ill.
		W9XAA	Chicago, Ill.

Police Radio Stations

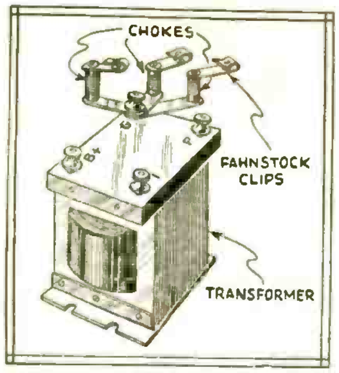
Wave-length (Meters)	Frequency (Kilocycles)	Call Letters	Location
121.5	2,470	KGOZ	Cedar Rapids, Ia.
		KGPN	Davenport, Ia.
		WPDZ	Fort Wayne, Ind.
		WPDT	Kokomo, Ind.
		WPEC	Memphis, Tenn.
		KGPI	Omaha, Neb.
		WPDP	Philadelphia, Pa.
		KGFD	San Francisco, Cal.
		KGPM	San Jose, Cal.
		KGPW	Salt Lake City, U.
		WRDQ	Toledo, Ohio
		....	Klamath Falls, Ore.
122.0	2,458	YPDO	Akron, Ohio
		WPDN	Auburn, N. Y.
		WPDV	Charlotte, N. C.
		WRDH	Cleveland, Ohio
		WPDR	Rochester, N. Y.
		WPEA	Syracuse, N. Y.
122.4	2,450	WPDK	Milwaukee, Wis.
		WPEE	New York, N. Y.
		WPEF	New York, N. Y.
		WPEG	New York, N. Y.
		KGPH	Okla. City, Okla.
		KGPO	Tulsa, Okla.
		KGPZ	Wichita, Kans.
		KGZF	Chanute, Kans.
122.8	2,442	KGPX	Denver, Col.
		WPDF	Flint, Mich.
		WPEB	Grand Rapids, Mich.
		WMDZ	Indianapolis, Ind.
		WPDL	Lansing, Mich.
		WPDE	Louisville, Ky.
		KGPP	Portland, Ore.
		WPDH	Richmond, Ind.
		KGZH	Klamath Falls, Ore.
		....	Muskegon, Mich.
123.4	2,430	WPDI	Columbus, Ohio
		KGPP	Portland, Ore.
		WPDM	Dayton, Ohio
		KGZD	San Diego, Cal.
		....	Highland Park, Ill.
123.8	2,422	KSW	Berkeley, Cal.
		WMJ	Buffalo, N. Y.
		KGPE	Kansas City, Mo.
		KGPG	Vallejo, Cal.
		WPEK	New Orleans, La.
		WPDW	Washington, D. C.
124.1	2,416	KGPB	Minneapolis, Minn.
		WPDS	St. Paul, Minn.
124.2	2,414	WPDY	Atlanta, Ga.
		KGPS	Bakersfield, Cal.
		WCK	Belle Island, Mich.
		WPDX	Detroit, Mich.
		WRDR	Grosse Point Village, Mich.
124.2	2,414	WMO	Highland Park, Mich.
		KGPA	Seattle, Wash.
		WPDA	Tulare, Cal.
		....	El Paso, Tex.
175.15	1,712	KGPJ	Beaumont, Tex.
		WPDB	Chicago, Ill.
		WPDC	Chicago, Ill.
		WPDD	Chicago, Ill.
		WKDU	Cincinnati, Ohio
		KVP	Dallas, Tex.
		KGPL	Los Angeles, Cal.
		KGJX	Pasadena, Cal.
		WPDU	Pittsburgh, Pa.
		KGPC	St. Louis, Mo.
		KGZI	Wichita Falls, Tex.
		....	Newton, Mass.
		....	Shreveport, La.
189.5	1,574	WRDS	E. Lansing, Mich.
		WMP	Fram'gham, Mass.
		KGPY	Shreveport, La.
1123	257	WBR	Butler, Pa.
		WJL	Greensburg, Pa.
		WBA	Harrisburg, Pa.
		WMB	W. Reading, Pa.
		WDX	Wyoming, Pa.

Marine Fire Stations

187.81	1,596	WRDU	Brooklyn, N. Y.
		WKDT	Detroit, Mich.
		WCF	New York, N. Y.
192.4	1,558	WEY	Boston, Mass.
		KGPD	San Francisco, Cal.

$5.00 For Best Short Wave Kink

The Editor will award a five dollar prize each month for the best short-wave kink submitted by our readers. All other kinks accepted and published will be paid for at regular space rates. Look over these "kinks" and they will give you some idea of what the editors are looking for. Send a typewritten or ink description, with sketch, of your favorite short-wave kink to the "Kink" Editor, SHORT WAVE CRAFT.



$5.00 PRIZE VARIABLE R.F. CHOKE

Above is a diagram showing a simple method of quickly changing the value of the radio frequency choke. Fahnestock clips are screwed to the top of half-inch wooden dowel rods and one end of the choke is fastened to the clip. A hole is drilled in each end of a strip of copper or brass. One end of the strip is bolted to the binding post of the transformer. Screw the other end to the dowel rod. The remaining end of the choke is fastened to the strip.—Ivan Ross.

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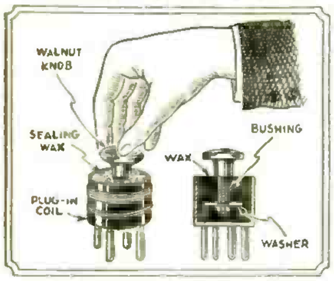
PLUG-IN COIL HANDLES



A very good handle for tube base coils can be made from a common walnut knob, the variety sold in the Five-and-Ten-Cent stores; a fiber washer and a brass bushing. Remove the nut on the knob and slip on the bushing, which should be about ½" long; next, the washer, and finally the nut. Tighten the whole thing and the handle is ready for use.

After the coil is made, fill up form with sealing wax and push the handle into the mass until the bottom of the knob is flush with the surface of the wax. Once the wax solidifies you have an ever-lasting coil "pull."—Thomas A. Blanchard.

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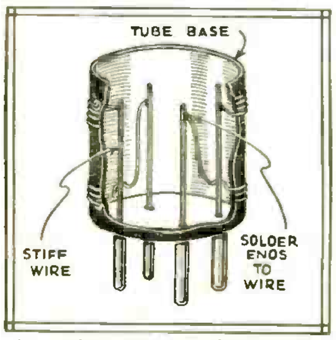
JOINING WIRE TO PRONGS



In making short-wave plug-in coils I have found an easier method of fastening the ends of the coils to the prongs of the coil form or tube base. For UX bases take four pieces of stiff wire (as tall as necessary) just large enough to fit tightly into the prongs of the form and solder the ends of the coils to the wire. For UY use five wires, etc.—Harry F. Sieber.

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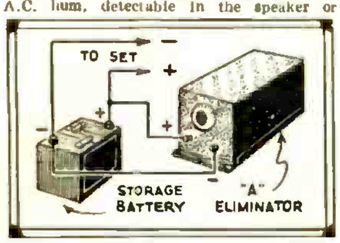
"HUM" REMOVER

Here is a kink that will be very useful to those who use "A" eliminators for their receiver filament supply, which pass an A.C. hum, detectable in the speaker or phones. I have an "A" eliminator which was extremely noisy, so I bought a storage battery, intending to use the eliminator as a charger. This took a lot of time and bother so I shunted the battery across the output of the "A" eliminator. This eliminated the A.C. hum completely. If this hum still persists take out the acids from the battery and fill it with condenser oil instead.—G. Zemanovich.



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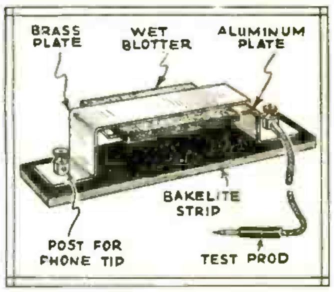
SIMPLE "TEST" BATTERY

To construct this "everlasting battery" you sandwich the blotter between the metal plates. Drill two holes in the bakelite from each end; perform the same operation on the metal plates. The piece of bakelite I used was ⅝" wide and 2½" long. The plates are part of two variable condensers, one brass and the other aluminum. Any size plates of bakelite may be used; the blotter keeps the plates from touching one another. Instead of two clips or binding posts one may be used and a



piece of flexible wire fastened under the head of one of the machine screws; something should be soldered to this end for a prod. The tip of the aforementioned phone cord is used for the other end of the test cord. To charge this battery simply immerse the blotter in water. If the blotter dries before you wish to use it, the process is simply repeated. It is not necessary to remove the blotter from between the plates to wet it. Wet the complete battery, and then wipe excess water from the plates and strip of bakelite, being sure the plates are so placed that they hold the blotter firmly between them.—James Austin.

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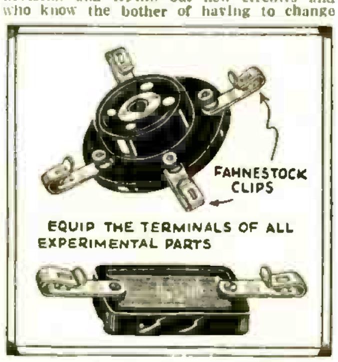
HANDY CONNECTIONS!

To those experimenters who delight in devising and trying out new circuits and who know the bother of having to change



connections from one point to another by screwing and unscrewing thumb-nuts (in the life of an experimenter about every ten seconds) try the following kink: Equip the terminals of all your experimental parts (sockets, coils, rheostats, etc.) with Fahnestock clips. The parts thus equipped may be mounted bread-board fashion and minor circuits or complete circuit changes may be made quickly and without trouble.—M. C. Alexander, Jr.

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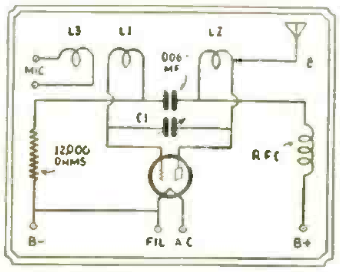
5-METER TRANSMITTER

I believe this to be the simplest and most efficient 5-meter transmitter. In the past six weeks over 200 contacts were made



with 28 different stations. The "DX" was about 15 miles and an "R9" signal was reported from that station. Because position and not power is everything on this band, and the transmitter being located on the west slope of a hill, practically all contacts were with "Western" stations. The quality of modulation was good, although loop was used and the percentage of course was low. An indoor 8-ft. aerial was used and over 6 miles was covered with no antenna at all. The circuit is a variation of the split Colpitts and is as follows:

A '45 with 400 volts of "B" supply was found to work the best. L1 and L2 are one turn, 1¼" diameter of No. 16 wire. L3 is 1 turn of No. 32 wire wound around L1. C1 may be a 5 to 11 plate midget or any condenser of similar capacity.

The aerial is 8 feet long and may be connected to the plate coil directly. A neon bulb will show oscillation by touching it to either end of the antenna or a single turn of wire attached to a flash-light bulb will light within one-half inch of the plate coil. Any RFC (radio frequency choke) will suffice.—David Townsend.

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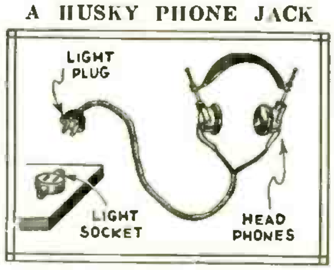
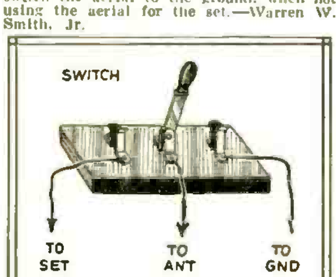
A HUSKY PHONE JACK



Use an electric light plug for a phone jack and a light socket of the prong type. I find it just as good. Solder one end of the lead from the phones to one of the screws of the plug and do the same to the other lead. Using a double-throw, single-pole switch makes a good way to switch the aerial to the ground, when not using the aerial for the set.—Warren W. Smith, Jr.



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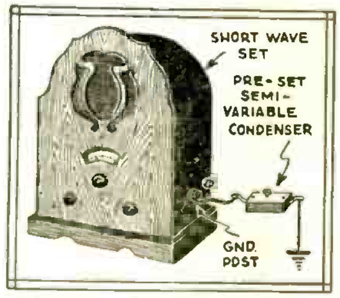
ANTI-CAPACITY DEVICE

This is a method of curing those troublesome "body capacity" effects. It consists merely of "tuning" the earth lead to a point where the effects disappear, by means of a "variodenser," such as XL, of any capacity up to about .0005 mf. maximum; I use a .0003 mf. This will be found absolutely effective, and I have never known it to fail yet. If one moves



up from, say, the 20-meter to the 40-meter band, a slight readjustment may be necessary, but this is the work of a moment.—G. E. Gaunt.

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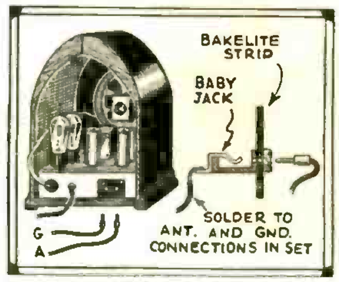
QUICK AERIAL CHANGE

I got tired of removing the antenna and ground leads from one set and placing them on another. Now I use baby phone jacks instead of the binding posts, and



cord tips on the leads instead of the bare wire. The two baby jacks were put onto a small strip of bakelite as shown in sketch above and soldered to the antenna and ground connections in the set. Now it is a simple matter to yank these connections out of one set and plug them into the other.—J. T. Watkins.

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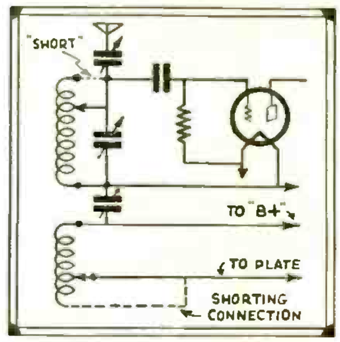
REDUCING "DEAD-END" LOSS



Referring to Mr. Hans' article, "Sliders Do The Trick," in the February-March issue of Short Wave Craft, I found the same trouble as with taps, the "grid" coil showed a loss and the "plate" coil went into oscillation too abruptly on account of the "dead-ends." Then I did for the sliders exactly what I had been doing with the taps, that is, "shorting" with a heavy piece of bus-bar from the pivot of the sliders to the "dead-end" of the coils. Presto! No loss to be noticed from the grid coil and the plate coil could be varied from a whisper to a maximum without oscillation.—W. H. Lord.

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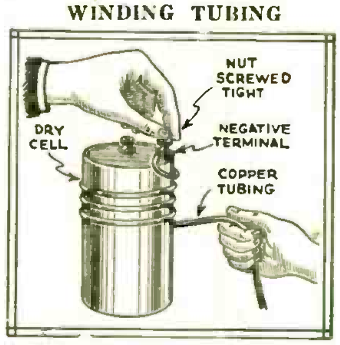
WINDING TUBING



Wind your copper tubing coils on an old dry-cell. First flatten the end of copper tubing, drill a hole through it and slip over binding post. Wind the required turns while the other end is pulled tight in a vise or held by someone.—Floyd Gribben.

LETTERS FROM S-W FANS

200 STATIONS!

Editor, SHORT WAVE CRAFT:

I am glad to give a big cheer to SHORT WAVE CRAFT for its wonderful work. I am a regular reader of your magazine and I appreciate the good it did to me. I can hardly wait for the next issue!

As I am not rich (I'm a "chomeur"), *(French term for unemployed. Ed)* I experiment only with parts scrapped from old sets, and being very patient and courageous I obtain good results.

I've built a "5-tuber" that tunes quite sharp from 200 to 550 meters: 200 stations from Canada, United States and Mexico have been "logged" with it, all on the loud-speaker and with good tone and volume.

And now, you ought to see my S-W set! It is a marvel born from junk! It's an adapter built from "odds and ends." The coils are wound on 3¼" tubing and with model Ford T primary coil wire. The condensers are old .0005 mf. Cardwells, cut down to 5 and 17 plates. The detector is an old tube bearing no name but a number "221D," the prongs are very short. Who made it? I don't know—but it works better than the "01A." I've heard over 25 broadcast stations and a lot of code and (what a thrill) around *20 police stations!* Now that I've the bug, try'n' stop me in my experiments!

I don't know if you'll publish this letter but I am glad to give you once again my appreciation.

Yours truly,
GEORGE LEGARE,
4289 Des Erables,
Montreal, Canada.

(My! My! George—"F. B." and glad to hear from one of our Canadian readers. Why not take a good clear photo of your short-wave receiver and tell the SHORT WAVE CRAFT readers something more about it? What a great many of our contributors fail to do is to tell a little bit more about the "operation" of their sets, when writing an article about them. It's all very well to tell a man to buy six condensers, four plug-in coils, a handful of miscellaneous binding posts, by-pass condensers and resistors and tell him to "go to it." It frequently happens that the enthusiastic builder is a "greenhorn" and if he is not given a few "tips" as to how to tune the set, for example, he may run up against a stone wall temporarily, which may disillusion him before he has really had a fair chance to experience some of the wonderful thrills the short waves really hold in store for him. So "we'll be seeing" you—we hope real soon.—Editor.)

A "BRIEF" FOR THE BRIEF-CASE SET

Editor, SHORT WAVE CRAFT:

In one of the late issues of SHORT WAVE CRAFT you published a hook-up for a *brief-case* short-wave receiver. This I built, except that it was built on a panel instead of in a brief case. I also made plug-in coils for each band.

I believe you stated this receiver would span one-half the U. S. By using 90-volt plate batteries and two 01A tubes I have listened to Rio De Janeiro, South America, on said receiver!

I have before me at this writing, confirmation from station EAQ, Madrid, Spain, for my reception of their station at 8:00 p. m., E. S. T., on June 23, 1932.

I am advised by the owners of EAQ that they broadcast programs to America daily from 23:30 and 1:00 G. M. T., and on Saturdays from 6:00 to 8:00 p. m., G. M. T., a program intended for Europe, Canary Islands and all Spanish possessions. EAQ has 20 KW. power and works on 30.4 meters.

Trusting that the above information will be of interest to you and that through SHORT WAVE CRAFT you will advise other "hams" that they have been receiving broadcast programs from EAQ. I am,

Very truly yours,
P. A. DONALDSON,
101 No. Jefferson St.,
New Castle, Pa.

(Thanks very much for the information, P. A. D., and that's sure a record for the short-wave "brief-case" receiver which we described in the June issue of this magazine. Just shows what a little real patience will do with a small battery-type receiver, such as the "brief-case" design. We have had many testimonials concerning the "brief-case" receiver, but we believe you go to the head of the class for your "DX" results.—Editor.)

COMING, SIR, COMING!

Editor, SHORT WAVE CRAFT:

I like SHORT WAVE CRAFT better than any other publication of its kind that I have found, and I have been buying it for over a year. Mr. Gernsback's editorials and articles are very good, and I have noticed that some of his prophecies of future radio have already come true. I would like to see some *low-powered crystal controlled transmitters* in your publication in the near future.

I wish you would put a few more simpler receivers in your magazine, instead of those "factory-made" receivers.

73's and good luck,
EDWARD MUNDT,
575 Clatsop Ave.,
Portland, Ore.

(We are glad to have your suggestion, Edward, and pleased to know that you like the editorials. In the December issue you will find a low-power crystal-controlled transmitter and we have some more material along this line in store for you. We are sure that you must have noticed the last few issues of SHORT WAVE CRAFT, *which have contained a vast arrangement of the "simpler type" short-wave receivers, including super-regenerators, etc., and that a relatively small space has been devoted to factory-made receivers.—Editor.)*

FROM HOLLAND!

Editor, Short Wave Craft:

About forty days ago I bought for the first time Short Wave Craft and yesterday my second copy (October issue). As a beginner, I find in your fascinating and wonderful publication plenty of theoretical and practical information. I think it is the most valuable radio magazine and the most interesting. Yes, I have found what I was looking for—it was wasting money to buy other magazines.

Encouraged from its plain building descriptions I have assembled and worked my first radio receiver, the short-wave set designed and described by Louis Martin in your September issue. What results! More than twenty European and Transatlantic S-W stations came in the loud-speaker! I am proud of this receiver and thank you so much, dear Editor and Mr. Martin, for having given me the chance to build such a radio masterpiece!

I hope to hear from you soon.

Sincerely yours,
CATELLO MUSCOGINRI,
Pieter de Hoopchstraat, 25B,
Rotterdam, Holland.

("Merci beaucoup," Catello—and undoubtedly you will hear from some of our American fans when they see your letter in this department of SHORT WAVE CRAFT. *We are glad indeed that you had such fine results with Mr. Martin's short-wave receiver and we always try to balance each issue with as much theoretical and practical data as possible.—Editor.)*

ON THE BED-SPRING AERIAL

Editor, SHORT WAVE CRAFT:

I have been a reader of SHORT WAVE CRAFT for some time and have always found it instructive and educational.

I have just finished reading the *"Letters from S-W Fans"* page in the August number and like Mr. Ventura am writing, this, my first letter to any magazine. My attention was attracted by Mr. Ventura's and Mr. Staple's letters with reference to the "two-tube" short-wave receivers. Last spring I built my first S.W. receiver using the then new "dry-cell" tubes. I used a set of Aero short-wave coils (regenerative), a 30 detector tube and a 33 tube in the single audio stage. I know this is not quite a proper place for a pentode tube, *but that's where I put it!* With an inside aerial and a bedspring ground, I was able to listen in on W3XAL and W9XF consistently with headphones. I also heard nearly a hundred "hams" from California to New York and the Carolinas. Well, that was pretty good for a "starter" but my attic became too hot for comfort, so that I haven't listened in for three months or more and now that winter is here, I want to get lined up with a real S.W. set.

I hope I haven't taken up too much of your time and I hope also that SHORT WAVE CRAFT will continue to grow and spread the gospel of short waves.

Yours very truly,
PHILLIP SMITHHISLER,
Portland, Oregon.

(Glad to hear from you, Phillip. It really is astonishing, when one stops to think about it, what some of you fans accomplish on two small dry-cell type tubes! We hope that by this time you are back on the job with the "cans" glued to your ears and from the way all the other fans write you will have to be very hard of hearing to miss Paris, Rome and Rio de Janeiro, with Australia thrown in as a "filip."—Editor.)

FROM VENEZUELA

Editor, SHORT WAVE CRAFT:

I am very glad to write you this, which I would like to have communicated to Mr. Frank McCoy of Kansas City, author of the two-tube 27 circuit, of which a diagram was published in your excellent magazine for Dec.-Jan. 1930-1, page 277, as well as in the June-July 1931 issue, page 56.

While this circuit did not contain the values of the component parts, since I am a radio fan through and through, I managed to construct around this circuit an excellent receiver, which satisfies me splendidly, as well as all my friends who have heard it. Although it has only two tubes, I can hear the strong stations on a magnetic speaker, very smoothly, and others by phones, with surprising fidelity and purity of tone.

Such stations are Schenectady, Pittsburgh, Paris, Cincinnati, New Jersey, London, Rome, Madrid, Boston, and all those in Columbia, Brazil, Argentina, beside others too numerous to mention.

I would like to convey to Mr. McCoy my thanks and congratulations on his marvelous idea. I shall be glad to hear from him, at the editorial offices of *El Universal,* Caracas, Venezuela, South America.

(Between Gradillas and Sociedad)—street address. GUSTAVO A. RIVODO L.

(Fine Business, Gustavo, and we were sure glad to hear from one of our short wave readers in Venezuela. You will undoubtedly hear from many readers of this magazine when they read your letter. We assure you that the editors have endeavored to greatly improve SHORT WAVE CRAFT *since December, 1930, in so far as giving the complete details of constructing various sets are concerned. We try to give all the helpful and constructional data that we can and usually if there is any data missing, it is because it was humanly impossible to obtain it, which sometimes occurs in the case of manufactured sets, etc. Thanks again for your interesting letter.—Editor.)*

(Continued on page 637)

Direct-Reading Ohmmeter

By H. J. DAILEY

● TO anyone who has operated an ohmmeter of the series type, the limitations and drawbacks of its operation very soon appear. Readings of this type of instrument are wide on one side of its scale and so close on the other side that it almost prohibits any degree of accuracy.

To everyone who has had this experience, this article is dedicated, especially to those whose finances are somewhat limited. Following is a list of material that will be required to construct a direct-reading ohmmeter, that is, one on which the readings are distributed evenly across the scale.

1—0-1 milliammeter
1—10,000-ohm fixed resistor
1—*400*-ohm potentiometer
1—12-volt flashlight lamp or 3½ volt lamp and a 30 ohm resistor (approximately)
1—small battery switch
3—4½ volt "C" batteries
1—filament control jack (or)
1—two pole double throw switch

If the filament control jack is used a telephone plug with the terminals shorted together will be required.

This ohmmeter has three ranges: 10-1000 ohms, 1000-10,000 ohms, 10,000-100,000 ohms, so it will cover practically every resistor that the serviceman has trouble with today.

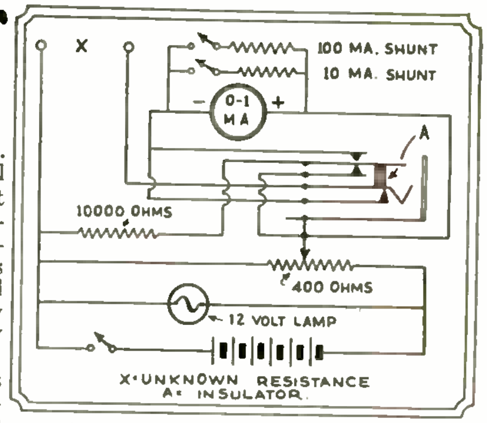
In this case I used a filament control jack, because this is an article that will be found in practically every serviceman's junk-box. The accompanying diagram gives the hook-up of this ohmmeter using the filament control jack. A double-pole, double-throw switch of any style can be used equally as well.

The 10,000 ohm resistor that was used by the writer is a carbon fixed resistor that was originally around 9000 ohms but by scraping and filing this resistance was raised to 10,000 ohms. The proper value was ascertained by comparing the readings of the 0-1 ma. in series with this resistor and a good-quality voltmeter belonging to a friend. Scraping the resistor until the readings of the two meters are identical is a sure way of getting the right result.

The drawing is very nearly self-explanatory. An unknown resistor is connected at X. The battery switch is closed. This connects the unknown resistance in series with the 0-1 meter. If the resistance is between 1-100 ohms close the 100 ma. shunt, insert phone plug and multiply the scale reading by 10. If the resistor is between 100-1000 ohms close the 10 ma. shunt, insert phone plug and multiply the reading by 100. If the resistor is between 100-10,000, leave both shunts open and adjust the 400 ohm potentiometer until the meter gives full scale reading, then insert phone plug and multiply reading by 1000.

If resistor is between 10,000 and 100,000 adjust the potentiometer until the meter reads by one-tenth of its full scale or .0001 ampere or 1/10 or 1 milliampere, insert phone plug and multiply by 10,000. In every reading but

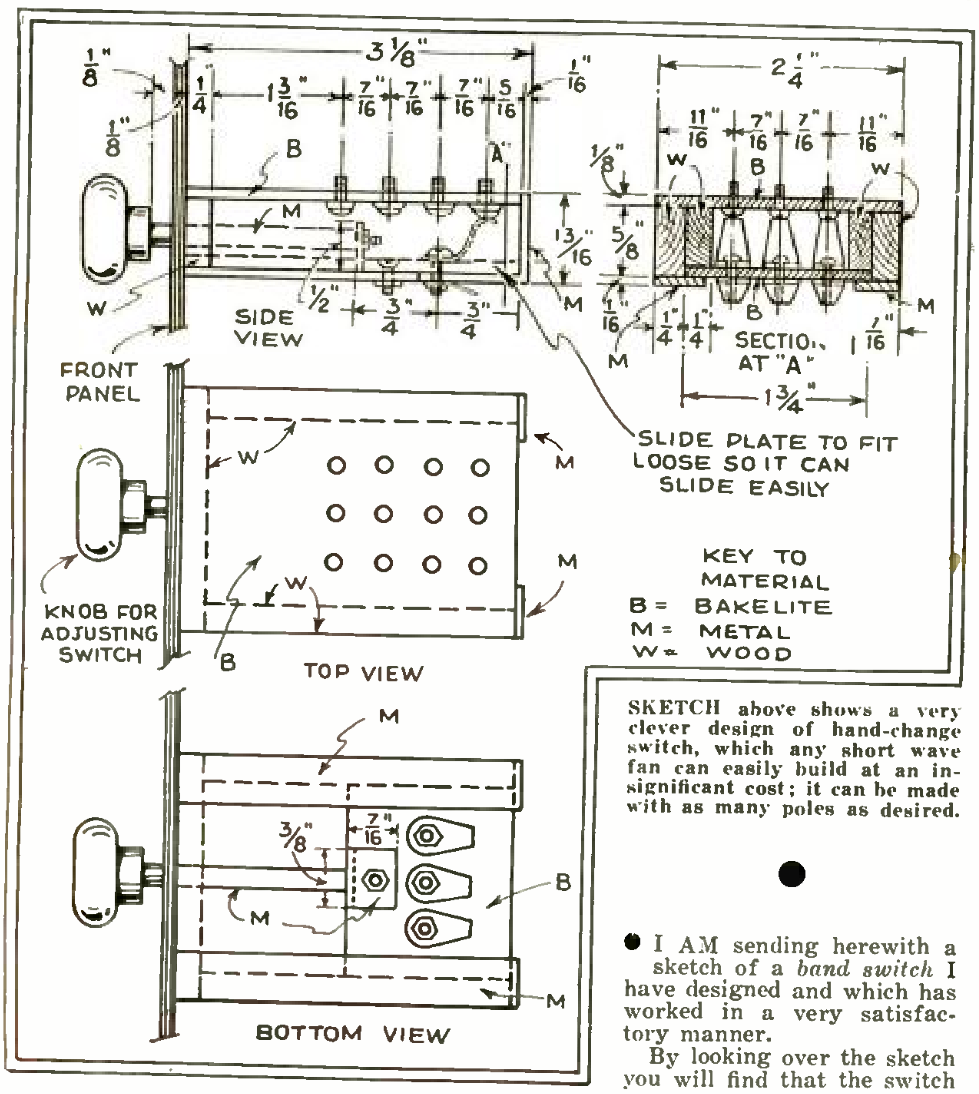
(*Continued on page 634*)



Hook-up suggested by Mr. Dailey for a direct-reading ohmmeter built around a low-scale milliammeter. With the scheme shown it becomes possible to obtain readings which are distributed evenly across the scale.

My Idea of A Band Switch

By ANTHONY HOLTGREFE



SKETCH above shows a very clever design of hand-change switch, which any short wave fan can easily build at an insignificant cost; it can be made with as many poles as desired.

● I AM sending herewith a sketch of a *band switch* I have designed and which has worked in a very satisfactory manner.

By looking over the sketch you will find that the switch can be made very easily, with practically no cost, by simply using all the old material that every radio or short-wave "bug" has on hand.

Now for a few details about the switch. First you will notice that the bolts used for contact points have no nuts on them. By drilling the holes in the bakelite a little smaller, the bolt can be turned in to fit snugly and the wires from the coils can be soldered direct to same. By doing this I have saved on space.

By drilling the front panel for two wood screws, one on each side of the shaft it can be held in place by running these screws through the front panel into the front wood piece on the switch.

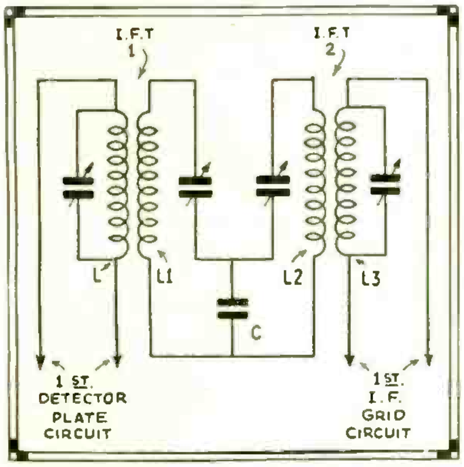
By marking the shaft at each setting with an awl, at the face of the front panel, the correct setting can be determined with ease.

This switch can be used with the "Best" short-wave converter described in the Feb.-Mar. issue of SHORT WAVE CRAFT.

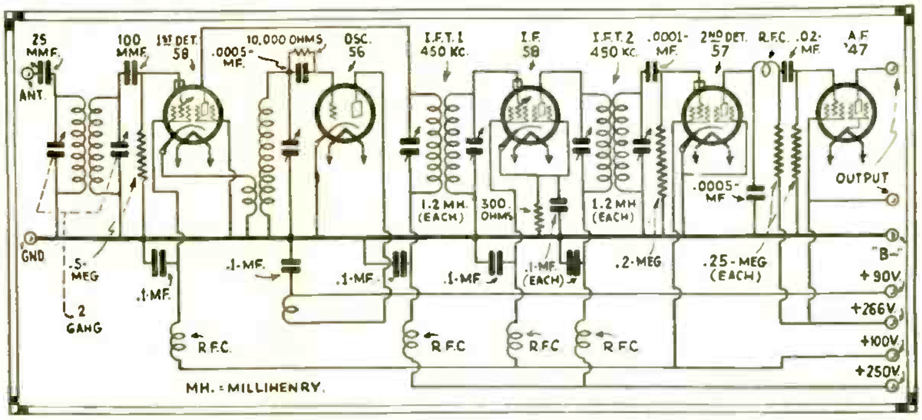
This design of short wave band-change switch has many good points to commend it. For one thing, it is a relatively easy matter to adjust the springs, made of phosphor bronze or German silver, so that they will have even tension at all positions of the switch.

SHORT WAVE QUESTION BOX

Edited by R. WILLIAM TANNER



4-Circuit band-pass filter suitable for connecting the first detector plate and the grid of the first I.F. tube in a "super."



"Super-het" hook-up requested by Mr. Neff and designed to produce good volume and ample selectivity.

Band-Pass Tuning Data

A. G. Getzler, Chicago, Ill.

(Q) I want to build a short wave super but am uncertain as to just what type of second detector and audio to use. Will you advise which of the following combinations would give best volume and tone: 57 pentode detector feeding a 47 audio amplifier, a 55 diode-triode feeding a 47 or a 56 triode feeding a 47?

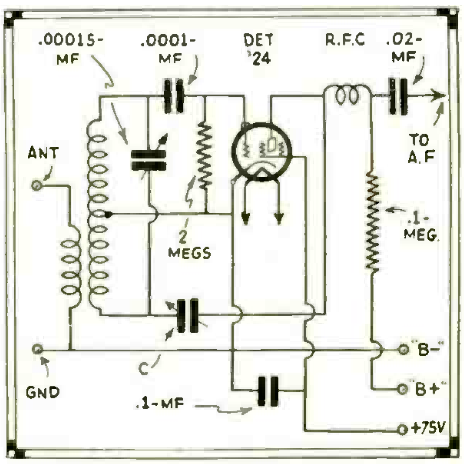
(A) A 57 detector will give greatest volume. The two latter combinations are about equal in sensitivity but better tone is possible with the 55 detector. A combination Carborundum, Zincite-Tellurium or Iron Pyrites crystal detector, followed by a 57 voltage amplifier feeding a 47 power stage, will give greater volume and better tone than any of the above. The Iron Pyrites crystal will, I believe, handle a greater input voltage, although authorities differ.

(Q) While I am quite certain upon an I.F. of 450 kc. and two I.F. stages, would it be better to employ an I.F. of 175 kc.?

(A) I have always obtained better results with a circuit using a first I.F. of about 500 to 700 kc. with one tuned R.F. stage, and a second I.F. of 100 to 200 kc. with one band-pass coupled I.F. stage. This gives less trouble from regenerative feed-back and has practically the same gain as two I.F. stages.

(Q) I want to obtain real knife-blade selectivity, say 5 to 6 kc. separation without losing too much gain. Would a coupling in the I.F. transformers of 1½" provide this?

(A) It is doubtful if this separation would give the degree of selectivity you desire. In these columns you will find a four-circuit band-pass filter to connect between the first detector plate and the grid of the first I.F. tube. The coupling between coils may be quite close, approximately ¾". The condenser C determines the selectivity and may be from .0005 mf. to .5 mf., the larger the value the greater the selectivity. All coils are of the same values, as are the tuning condensers. The common connection to the two "inside" tuning condensers may be grounded.



Improved regeneration control scheme, using tapped grid coil; the condenser "C" has 25 mmf. capacity.

Aligning Super-het I.F. Stages

Charles A. Bingham, Nashville, Tenn.

(Q) What would you recommend as being simple to construct and inexpensive for aligning a superhet I.F. amplifier?

(A) The simplest device I know of is merely a tuned circuit, energized by a small buzzer connected as shown in the diagram in these columns. The output is controlled by a 3000 ohm potentiometer. The coil value will depend upon what frequency band you want to cover. The entire equipment must be placed within a shield can in order to provide a decently sharp output wave. I have used a similar device for years. At present, a double contact buzzer is used which synchronizes with a 2.5 volt 60 cycle supply. Due to a number of new features, the output wave is nearly as sharp as a modulated oscillator.

(Q) I custom build sets for "short-wave listeners" and so far have built all regenerative and T.R.F. sets. The demand is generally for a small number of tubes. Could a superhet do the work with only one I.F. amplifier?

(A) I believe the following arrangement would be very satisfactory: 58 first detector, 56 oscillator, 58 I.F. amplifier, 57 second detector and a 47 power A.F. Regeneration in the first detector through the use of the screen grid would greatly increase sensitivity and image selectivity. Two tuned circuits preceding the first detector would be just as necessary as with a broadcast super even with an I.F. of 400 to 500 kc.

Data on S-W Super-het

Albert Neff, Hollywood, Calif.

(Q) I have about $300.00 worth of radio parts and want to build a short-wave super-het. Have always had trouble with oscillation in I.F. amplifier and poor quality at loud volume. Will you publish a good circuit which is easy to build and that has a high degree of volume?

(A) The circuit appears in these columns. There is not space enough here to give constructional details. However, the important constants are shown. Wind the coils as would be used for any short wave super. The 450 kc. I.F. coils will have to be purchased.

Regeneration Control

Eugene Moore, Kalamazoo, Mich.

(Q) I have a regenerative short wave receiver using a 35 tuned R.F. and 24 regenerative detector and two stages of A.F. This set works like nobody's business but I do not care for continuous control of the regeneration condenser. Can this be made so as to "stay put" over a large portion of any one band?

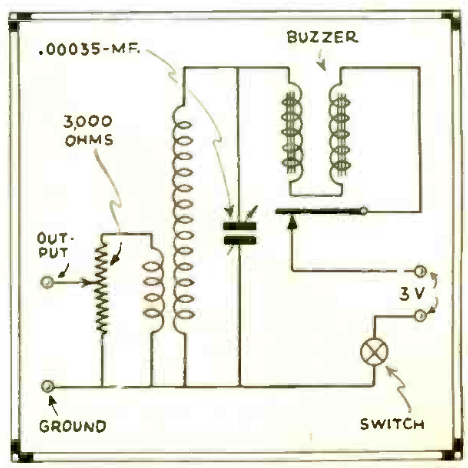
(A) There are two methods which can give fair results. One uses a tuned grid and a tuned plate coil shielded from each other. Regeneration can be controlled by variation of screen grid voltage. The other method is far the be ter. The circuit is given in these columns. The detector coil is tapped in the exact center and the tuning condenser connected across the entire coil. The condenser C is adjusted so that regeneration is at a desired point and is then seldom varied except when shifting bands. C should be a midget of 25 mmf. capacity.

Value of Resistor

Glen Clark, Kansas City, Mo.

(Q) What is the value of the Electrad Truvolt resistor shown in circuit on Page 329 Feb.-March issue?

(A) The value is 2000 ohms variable.



Hook-up of buzzer suitable for use in checking up I.F. amplifier.

Amateurs who made good

R. G. SCELI

● IN 1912 Mr. Sceli became the proud possessor of one of the wireless telegraph outfits advertised in those days as an alleged transmitter and receiver. He says that he has no recollection of ever hearing a signal or of having anyone hear him. However, within a month or two, he had completely dismantled the thing and set it up in accordance with his own ideas.

He naturally graduated from this to the W. B. Duck Catalog, from which concern he purchased numerous Navy type loose couplers, transformers, spark gaps, etc. Mr. Sceli's interest continued unabated up to the time of the war, when he heard rumors that the Government was going to make all amateurs shut down. Therefore he proceeded to sell his outfit and did so about two weeks before the order went into effect.

From 1917 to 1924, his activities were somewhat curtailed but seldom in that time was he without at least some sort of a receiver.

In 1924, he started the Radio Inspection Service Company in a room about ten feet square in a second floor location, with a pair of pliers, a screwdriver and a "lot of nerve." He began to get work from local radio stores as well as servicing sets for friends. Started building custom built superhets, the first of which were his own idea of Lacault's Ultradyne.

Two years later, in 1926, he moved across the street to larger quarters. By this time, he had worked up a very nice business on custom built superhets, of which altogether he sold probably 500 in Hartford (Conn.) and surrounding towns.

In 1926, Mr. Sceli managed to talk Mr. McMurdo Silver into appointing him as service station. Shortly after this, working on the theory that a service station should stock parts, he talked Silver-Marshall into selling him on a jobber's basis. In 1927 and 1928, his firm did a land office business in superhets, kits, and "what have you." And also developed a very good service and repair business.

With the advent of the Majestic electric radio, he started to sell manufactured sets for the first time. Then when Silver-Marshall brought out their model 30, his company really did sell manufactured sets and gave up the custom built sets entirely. In October, 1930, they moved to their present location, which is a store 20 by 60 feet, giving them considerably more room, good show windows, etc.

His company has developed since into a very good parts business supplying local dealers, amateurs and service men and also does very good retail business on sets.

Mr. R. G. Sceli

"Picked Up and Relayed"

(Continued from page 603)

HOURS MAC AND PETE XVMO."

A look at the map and within a flash Jack threw on the power and called "CQ PACIFIC URGENT" for several minutes, signed and then listened—he held his breath. There was a weak but distinct call for him—it signed "K6ZB." It was a Midway Islander, only a few hundred miles from the plane!

"Did you hear the 'Frisco Maid'?"

"No," came back the Islander, "no luck here past four hours *skip-distance* effect."

With flying fingers Jack gave the far-off station the details of the plane's position and plight.

"Please get in touch with Naval base and see what they can do about it," Jack told the Midway Station. The man replied that he would do all he could. Soon K6ZB told him that a pair of seaplanes had left the base and were bound for the spot far out on the ocean where the fliers were reported to be floating.

Jack told the Midway man that he would call him in a half hour and tuned back to the plane's wave. The note was not a drone now, it was a weak 500 cycle wavering thing, so like the plane that was just barely awash, far out on the deep Pacific, a half-hearted carrier.

As Jack listened, he could picture the condition of the men as they were tossed by the steady roll of the waves. He kept the receiver following the shifting wave coming from the "Frisco Maid." He heard snatches of the CQ's that Peterson was sending out on the short wave transmitter like "SAY IF YOU BIRDS DON'T COME QUICK WE CAN'T GET TO JAPAN IN TIME FOR DINNER," or "POSITION 170 WEST 30 NORTH ALLS WELL SO FAR PLANE SINKING LOWER CAN HOLD ON A LITTLE LONGER PETE."

As if in answer to his question, the far-off operator answered Jack's mental query, "SORRY CAN'T USE 600 METER RIG CAN'T GET AT IT COLLAPSED CABIN."

An Emergency Transmitter

This made it apparent that Peterson, a master craftsman, had rigged some kind of a "hand" operated generator and was "working" the low powered short wave transmitter by means of the make-shift power supply.

The signal disappeared at times for long intervals and it seemed that all hope must be gone, but then Jack, ears strained for the weak signals, would hear the welcome high-pitched note and a message would come through.

As time went on and the messages grew shorter and more to the point it seemed that the men on the plane must lose hope but their indomitable will was holding them up.

The Navy men were on the alert and swung into action on receipt of a cable from the K6ZB. They had been waiting anxiously for such a call, reported K6ZB to Jack over the air as the minutes flew by.

Saved!

It seemed to Jack that a month had passed, in reality only a few hours, and then a fragment of a message came through—

"HEAR PLANE'S MOTOR SEEMS TO BE CIRCLING US SURE HOPE WE AREN'T DREAMING THE PLANE IS COMING DOWN THEY SEE US GREAT WORK."

Jack was almost wild with joy. He listened on, "NOW THEY ARE DOWN AND TAXYING UP TO US WILL SINE OFF NOW CUL 73 PETE XVMO."

With a turn of the switch, Jack called the Island station who had done so much to aid in the rescue and told him what he had heard from the plane. The man on the Island flashed out "Mighty glad to help will see them tomorrow please QSL 73."

Jack reached for his "log" book and glanced at the little clock, "Only 5 AM; could it be that all this excitement had happened in so short a time?" But there was the clock and there were the scribbled notes on the pad in front of him. Jack shook his head thoughtfully and turning out the light, went to bed.

That morning, Jack was greeted rather harshly by his father when he came down, sleepily, for breakfast.

A Pleasant Surprise

"Why the Sam Hill can't you go to bed at a decent hour instead of sitting up there and ticking away on that infernal key of yours?" But Jack only smiled and handed his father the *Morning News*, where there on the front page, in two-inch heads, was printed the answer—

PACIFIC FLIERS SAVED BY RADIO

Young Miller pointed to the story below, which read, "Guided by a radio message picked up and relayed by an amateur radio operator named Miller, of Evanston, Illinois, a Navy seaplane . . . ." and smiled as he reached for the ham and eggs.

THE END.

Cisin 4-Tube Pentode Receiver

(Continued from page 597)

sign either *that the tickler winding should be reversed or that this winding is short-circuited.* However, if the above directions have been followed faithfully, no trouble of any kind should be encountered. Anyone desiring additional top and bottom drawings showing exact locations of the various parts may obtain these gratis by writing to the author in care of Short-Wave Craft, enclosing 5c to cover mailing costs.

Data on Alden Plug-in Coils*

(1) 4¾ turns; 6 Pitch No. 22 D.S.C.; Primary 4 turns No. 31 D.S.C.

(2) 10¾ turns; 12 Pitch No. 22 D.S.C.; Primary 6 turns No. 31 D.S.C.

(3) 22¾ turns; 16 Pitch No. 22 D.S.C.; Primary 7 turns No. 31 D.S.C.

(4) 51¾ turns; 40 Pitch No. 22 D.S.C.; Primary 15 turns No. 31 D.S.C.

(5) 68¾ turns; Close wound No. 28 D.S.C.; Primary 28 turns No. 36 D.S.C.

(6) 131¾ turns; Bank wound, 2 layers, No. 32 (Optional Litz); Primary 32 turns No. 36 D.S.C.

WAVE BANDS:

(1) Blue—10 to 20; (2) Red—20 to 40; (3) Yellow—40 to 80; (4) Green—80 to 200; (5) White—200 to 350; (6) Orange—350 to 550.

D.S.C.—double silk covered. Pitch—turns per inch.

*For use with .00015 mf. capacity condensers. Coil forms 1¼" dia. by 1 15/16" long.

Complete List of Parts for Four-Tube Short-Wave Receiver Using the New 6.3 Volt Pentode Tubes

1, 2—Eby Insulated Binding Posts.

3, 8, 15—Alden (Radio Trading Co., No. 1616) short-wave plug-in coil sets (four coils to a set) covering Bands from 16 (15) to 200 (210) meters—Hammarlund "Isolantrite" Four-Prong Sockets, (Trutest, Alden) wafer-type.

4—Cardwell "Featherweight" .00015 mf. variable condenser, type 405-B.

5, 11—Variable-mu R.F. pentode, type 44—Trutest (Alden) 5-prong wafer-type sockets.

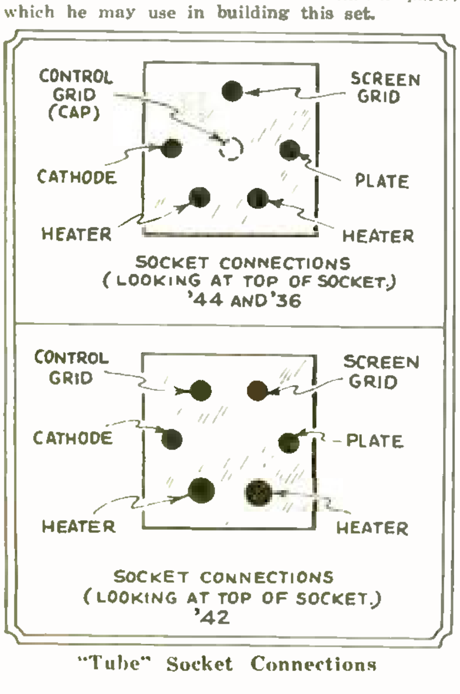
6, 12, 34—Electrad Truvolt flexible resistors, 500 ohms, type 2G-500.

7, 13—Aerovox (Polymet) .01 mf. 200 volt cartridge by-pass condensers, type 281.

9, 20—Cardwell "Featherweight" .00015 mf. dual variable condenser, type 405-B double.

10, 21—Trutest (Hammarlund) trimmer condensers, 2 to 35 (32) mmf.
14—Electrad (Clarostat) Tapered Volume Control, 10,000 ohms, type R1240-P (P-18-10,000 N) with Switch.
16—I.R.C.-Durham (Lynch) 10,000 ohm, 1 watt metallized resistor, type F-1.
17—Aerovox (Concourse) 1 mf. 400 volt by-pass condenser, type 407 (PT-1 400 V).
18—I.R.C.-Durham (Lynch) 20,000 ohm, 1 watt metallized resistor, type F-1.
19, 24—Aerovox (Concourse) 1 mf. 200 volt by-pass condensers, type 207 (PT-1-200 V).
22—Aerovox (Polymet) .00015 mf. mica condenser, type 1460 (MI-1157).
23—I.R.C.-Durham (Lynch) 1 meg. 1 watt metallized resistor, type F-1.
25—I.R.C.-Durham (Lynch) 50,000 ohm, 1 watt metallized resistor, type F-1.
26—'36 type Screen Grid Detector—Trutest (Alden) 5-prong wafer-type socket.
27—Electrad potentiometer, 50,000 ohms, type R1205.
28—Aerovox (Polymet) .001 mf. mica condenser, type 1460.
29—Trutest (Gen-Win; Hammarlund) short-wave type R.F. choke.
30—I.R.C.-Durham (Lynch)—250,000 ohm, 1 watt metallized resistor, type F-1.
31—Aerovox .01 mf. mica cond. type 1450.
32—I.R.C.-Durham (Lynch) 500,000 ohm, 1 watt metallized resistor, type F-1.
33—Aerovox 25 mf., 25 volt tubular dry electrolytic condenser, type PR-25-25.
35—Power output pentode, type '42—Trutest (Alden) 6-Prong wafer type socket.
36—Trutest (Alden) Four Prong wafer-type socket for "Speaker" connections.
37, 38—Aerovox 4 mf. 500 volt dry electrolytic condenser, type G5-4 (TD cans).
39—Full Wave '80 type rectifier tube—Trutest (Alden) 4-Prong wafer-type socket.
40—Trutest flush-mounting power transformer, type 4C-1490.
41—Lafayette (Serge-Smith) dynamic speaker, with 2,500 ohm field and output transformer for single 47, PZ or 42.
42—Trutest $7\frac{1}{2}$ volt filament transformer, type 2C-1967.
43—Switch on 14.
44—Amperite regulating line voltage control, type 5A-5 Trutest (Alden) four-prong wafer-type socket.
Roll Corwico stranded Braidite hook-up wire.
Three Hammarlund aluminum shields for tubes 5, 11 and 26.
Aluminum chassis, 14 to 16 gauge, 11"x11"x2" high—Blan, The Radio-Man.
Two Crowe tuning units, Fan type, No. 66.
Metallic Condenser Coupling—2" extension shaft.

Note 1: "Trutest" Products are marketed by the Wholesale Radio Service Co., New York, N. Y.
Note 2: The other "trade-marked" apparatus listed in brackets are mentioned to give the reader a greater choice of well-known parts, which he may use in building this set.



"Tube" Socket Connections

Crystal Oscillators

By A. Binneweg, Jr.

(Concluded from January Issue)

Use of Crystal Oscillator as Transmitter

A crystal oscillator of this type can be used to control the frequency of a transmitter. A larger tube can be used in the crystal oscillator, such as a type '45, which is cheaper than a type '10. It is advisable not to use over 250 volts on a crystal oscillator for the reason that the crystal may crack. For the higher voltages it will be necessary to increase the voltage of the "C" battery. The condenser, C1, should also have the proper high voltage rating, about twice the plate voltage to be used in the oscillator. Normally, it will not be necessary to use a plate condenser having a greater plate spacing, unless very high voltages are used on the crystal oscillator itself. When using a type '45 tube, the filament will probably be operated from the light socket through a transformer.

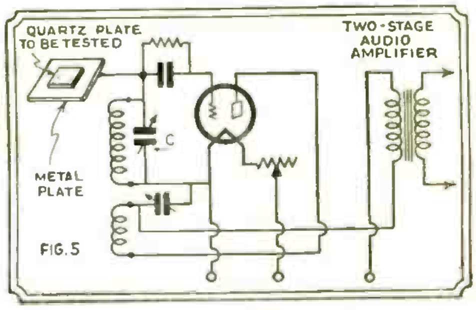
For greater power output, an amplifier must be added to the crystal oscillator. Figure 4 shows a diagram of a crystal oscillator followed by a power amplifier. Normally, the amplifier will employ a higher plate potential, so the resistance R is used to drop the voltage to the crystal tube to the proper value. The antenna is coupled to the plate circuit of the amplifier by any of the usual methods.

Short-wave transmitters operating at the higher frequencies use frequency doublers in order to obtain a constant high frequency output. For transmitting purposes, it is usually best to purchase a crystal having a fundamental as close to the desired operating frequency as possible. The higher the fundamental frequency desired, the more expensive the crystal itself becomes. High-frequency crystals are very thin and fragile. However, there is usually a considerable saving in apparatus if the higher frequency crystals are purchased, since the amplifying apparatus necessary is less complicated.

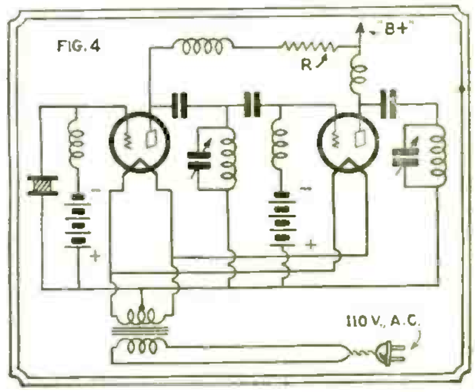
The operation of frequency doublers is explained in the following: Assume a 160-meter crystal. Such a crystal furnishes a 160-meter wave to the grid of the crystal oscillator. The plate circuit of the crystal oscillator is tuned to the same frequency. The first stage of amplification has its grid circuit tuned to 160 meters, but its plate circuit tuned to 80 meters. If one desires to transmit at 80 meters, the antenna is tuned to 80 meters and coupled to the plate circuit of the amplifier. For operation at 40 meters, another stage of amplification is required. The grid circuit of this stage would be tuned to 80 meters and the plate circuit to 40 meters. The aerial would then be tuned to 40 meters and coupled to the output of the second stage of amplification. For higher frequencies, the procedure is similar, other stages of amplification being employed. It is evident that, if a 40-meter crystal were available to start with, much expensive apparatus would be saved, offsetting the increase in cost of the crystal itself. If the output of the 40-meter crystal oscillator were amplified, it would be necessary to neutralize the amplifier, since the plate and grid circuits are tuned to the same frequency, and self-oscillation would result.

Testing Quartz Crystals

A very practical method for testing the operation of quartz plates is shown in Fig. 5. A



Arrangement for testing quartz crystals.



Crystal Oscillator with power amplifier.

metal plate is mounted on a piece of bakelite and the plate connected to the tuned circuit of a short-wave regenerative receiver detector. The detector circuit should be followed by about two stages of audio amplification for best results. The detector should be provided with plug-in coils covering the ranges in which the fundamental and desired harmonics of the crystals fall. To test a quartz crystal, lay it on the metal plate and, with the regenerative receiver kept at the point of oscillation, vary the setting of the tuning condenser C. When the fundamental of the crystal is crossed, a loud "plurp" will be heard in the output of the audio amplifier. By varying C over a large range, the harmonics, and any other frequencies present, can easily be heard. The crystals will give a fine loud musical note, just as the tuning condenser crosses the fundamental frequency of the crystal. If the crystal is being ground to a certain frequency, it is easy to note the progress of the work by using this method. It is not extremely accurate but will find much use where other methods cannot be used.

Short-Wave Operating Hints

(Continued from page 603)

7. A.C. hum in a short-wave receiver using battery substitutes is often difficult to eliminate. Certain types may be cured by placing an R.F. choke with suitable R.F. by pass condensers in the "B" supply unit's filter circuit. This should precede the filter system (see diagram).

8. Always have several grid leaks on hand as there is a great difference in performance between various sizes.

9. When using a set with plug-in coils it may happen that the set is less sensitive over that portion of the tuning range where the variable condenser used for tuning is near maximum capacity. If this is the case it is possible to wind an extra plug in coil with its winding increased 40 to 50 per cent over that of the coil mentioned above. By this method the frequencies which were received when the variable condenser was near maximum using the first plug in coil will be tuned in near the minimum capacity of the variable condenser when the extra plug in coil is used in place of the regular one. The sensitivity of the receiver is better when less condenser capacity is shunted across the tuning coil and therefore better reception will be had. This particular kink was used very successfully on the Pilot "Super Wasp" set.

A Revolution in Thermionic Valves

(Continued from page 606)

ven: *Versuche mit einer Verstärkerrohre nach dem Querfeldprinzip*—i.e., *Experiments with an amplifier tube by the cross-field method*). The hook-up of the tube used by the author is shown in Fig. 3. F is the cathode; C, the concentrating electrode; B1 and B2, the two deflecting plates; S, the screen and rest (polarizing) anode, and P, the actual anode. Given proper voltages to the various electrodes, the characteristics obtained are excellent and are:

coefficient of amplification, 2,000
steepness, 3.5 MA/V

The tube, however, presents various inconveniences.

Even if a strong grid current is put on the two deflection plates (about .2 milliampere), this can be very inconvenient for the use of the tube as amplifier. Luckily the relative steepness is much smaller and in general negative, hence the charge imposed on the input circuit can be made zero by the introduction of a suitable series resistance. There cannot be omitted the possibility of reducing the grid current by a favorable agreement of the electrodes, as has already been done in the case of the cathode oscillograph, and lastly there is the possibility of magnetic control which definitely eliminates that inconvenience.

Much more serious, however, is the difficulty of obtaining a concentrated pencil. In the technology of the low voltage oscillograph it is noted that a sufficient concentration is possible only by leaving in the tube a small quantity of residual gas. In the case now considered the writer used mercury vapor coming from a vacuum pump, the pressure of which regulated the mercury of the pump on opportune cooling. Too low a gas pressure does not allow the attaining of a sufficient concentration of the pencil, while too high a pressure gives a pencil which is not very sensitive to the external fields.

The useful pressure will be critical enough, and that certainly constitutes the gravest inconvenience. The construction of the tube in this way presents great difficulties for manufacture on a large scale, and also the keeping of the requisite degree of vacuum presents great technical difficulties. Another practical difficulty is represented by the large number of electrodes and the need of a precise adjustment of the potentials of the various electrodes.

All these difficulties are not insurmountable. The technology of the cathode oscillograph has recently rapidly progressed, and already today it is possible to get better results than those described by the author. Hence it is very probable that in a very short time the last difficulty will be overcome and tubes operating according to these principles will be introduced into practical use, allowing a great advance in the field of radio technology.—*Radio per Tutti.*

Talks 22 Miles on Light Beam

(Continued from page 584)

light variations, changed the impulses into electrical waves and then into sound.

Also at Lake Desolation was a *short-wave radio transmitter* so that the engineers there could talk with Schenectady—Lake Desolation being without telephone service—and so the light-conducted talk by Mr. Broun could be relayed back to Schenectady for stations WGY and W2XAF.

In connection with the Lake Desolation program it was found that the signals could also be transmitted during daylight hours.

"Essay" Contest Winners

THE essay contest on "What is an Amateur?" conducted by the General Engineering Corp., of Charlotte, Mich., closed Dec. 15. The First Prize was won by J. E. Barrett, W6ABY, Tucson, Ariz.; Second Prize by Chas. E. Winkley, Jr., Plymouth, Mass., and Third Prize to Victor Soens, Iowa City, Iowa. First prize consisted of a fine power-pack; second prize was a 10,000 volt .000175 m. f. variable transmitting condenser; Third prize was a fine 45 henry filter choke with 170 mills capacity and standing 5000 volts.

A Navy Type Crystal Holder

(Continued from page 600)

The smaller disc and the large disc which has the countersunk holes form the contact surfaces which "sandwich" the crystal, and accordingly one side of each must be ground perfectly flat and smooth. This is done by hand, using fine carborundum dust or valve grinding compound on a flat glass surface, and rubbing the plates with the finger tips in a circular motion. The side of the large disc which is NOT countersunk will, of course, be the side to grind.

Upon completion of the grinding, the contact surfaces should be thoroughly cleaned with gasoline, and the holder is then ready for assembly.

First, secure the two jacks in place and tin the ends protruding into the shell. To one, solder a ⅝-inch length of very thin shim brass or copper, about 1/16-inch wide. Bring the free end down the inside of the shell and fold it over the bottom edge of the insulating shell. This will form contact with the bottom contact plate of the holder, which may now be placed in position and the three 4/40 machine screws put through it and the shell. The short piece of copper braid is then soldered to the UNGROUND side of the small disc, about in the center, and the other end of the braid soldered to the remaining plug, inside the shell. Care must be used in soldering to the small disc, in order that the job may be done quickly without overheating the plate, which might cause it to warp slightly and affect the contact with the crystal.

Again wiping off both brass contact surfaces to make sure that no finger grease or other foreign matter has soiled them, the holder is now ready for the crystal, which may be dropped gently on to the bottom plate, with the smaller disc resting on the upper surface of the quartz. It will be found that the weight of a brass disc 1½ x ⅛ inch is approximately 1½ ounces, which is just the correct pressure on the crystal, without additional springs or other mechanisms. Furthermore, crystals of varying frequencies (thickness) may be used in the holder with assurance that the pressure will always be the same on any crystal, which would not be the case with spring tension applied.

The cover plate may now be slipped over the protruding screws in the upper edge, and the thumb nuts run on, and our holder is now complete and ready for use.

Should the holder be used where there would be danger of occasional rough handling, which would cause the upper contact disc to ride up and down in the holder, the space between the upper contact disc and the cover plate may be lightly packed with absorbent cotton.

The accompanying working drawings illustrate the constructional work in detail, and should be closely followed. The writer has made up a number of these holders for the use of himself and others, and all have given perfect satisfaction. Considerable may be added to their appearance by buffing the brass or nickel plating.

A 5-Meter S.W. Superheterodyne

(Continued from page 595)

contributes to the excellent frequency stability of the oscillator. The screen-grid being at ground potential (R.F.) necessitates operating the cathode above ground. This is completely satisfactory and when using uni-potential cathode type tubes having indirectly heated cathodes, no deleterious effects can be detected by having an R.F. potential difference between the cathode and heater. Although it might seem that the cathode-heater capacity might interfere with the satisfactory functioning of the circuit it compensates rather than incapacitates the frequency stability during the warming up period of the tube. A slight varying of the oscillator frequency with detector tuning has been noticed when using the fundamental of the oscillator; however, this can be eliminated by using the second harmonic of the oscillator to heterodyne with the incoming signal frequency to create the intermediate frequency beat.

Careful shielding of course is necessary if the oscillator is to be operated at full efficiency, since any coupling of the oscillator tuning circuit will defeat the excellent qualities of the system.

The coil data are given in table 1. The condenser C-2 determines the approximate frequency while the trimmer condenser C-3 acts as a vernier adjustment. Eventually when ultra high frequency super-heterodynes become as numerous as the regular broadcast variety, the receivers will then be truly *single control*. The vernier, however, is not a serious hardship to endure and without it the performance would surely suffer. The screen-grid voltage should be approximately 67 to 90 volts, the lower value being recommended for stability. The value of the gridleak should be 100,000 ohms for best operation.

Now that the degree of electrical stability far surpasses any other oscillator combination, it behooves the experimenter to exercise particular care in the mechanical construction to insure rigid mounting of the component parts which might affect the frequency stability. If ordinary precautions are taken in the construction of the oscillator, even the dyed-in-the-wool experimenter will witness a thrill at the stability of the electron-coupled oscillator.

Intermediate Frequency Amplifier

The choice of an *intermediate amplifier* is one of all importance, since the main characteristics of the receiver are obtained in this section. The intermediate frequency must be low enough so that sufficient gain can be realized with a good degree of selectivity. The frequency characteristic of course must also be considered, otherwise the quest for selectivity would result in undue attenuation of the high audio frequencies and poor quality would obviously result. However, there is another consideration to be taken into account in ultra high frequency work. Suppose the Intermediate frequency was of the order of 400 kc. and the oscillator tuned to a frequency of 40,000 kc. It can readily be seen that a variation of only 0.01% in frequency would amount to so much that the resulting frequency would not be amplified by the highly selective intermediate stages.

Now, let us suppose an intermediate frequency of 1,750 kc. or thereabouts was chosen. The percentage allowable variation in the oscillator frequency could obviously be much greater, without affecting over-all performance.

The intermediate frequency finally adopted in this application was 1,750 kc. I.F. transformers may be purchased already built, or the experimenter may build his own. In the latter case the coils from a short-wave receiver covering this band will be satisfactory. Small Isolantite dielectric condensers may be substituted for the larger air condensers formerly used for tuning. The I.F. amplifier in reality is a fixed-tune radio-frequency amplifier and its design is not unlike any other R.F. amplifier covering this band. Such circuits are not so selective that the fidelity will be impaired by side-band attenuation. This applies only to sound reception; the requirements for television reception are somewhat more stringent.

Second Detector

The *second detector* for voice reception is of the orthodox *plate detection* variety. A 57 tube is employed in a circuit designed particularly to eliminate detector overloading. This scheme does not entirely eliminate detector overloading in the strict sense of the word, but it does greatly extend the usable range of inputs to the detector, without suffering an appreciable reduction in rectified output. This particularly applies to signals of low percentage modulation which heretofore have given the most trouble in detector circuits.

Figure 2 shows the essential circuit in its simplest form, together with a graphical explanation of the how-and-why of the improvement. C-1 and R-1 are chosen so as to have a time-constant of greater duration than the period of the lowest audio frequency to be reproduced, yet sufficiently short in duration to follow the variations in amplitude of the modulated carrier. C-1 must also be of such a value that it will have no effect upon the tuning.

Figure 2-A shows a typical grid-plate characteristic of a *power detector*. Point a-o represents normal bias with no signal applied. Upon the reception of a modulated signal (50% mod. shown) this point moves to a-1 and rectification takes place, giving the audio frequency component in the plate circuit as shown. Such a signal would result in the same output in either a straight bias detector or the modified circuit used here. Now let us consider a very strong signal which would normally overload the detector. With the normal circuit the effective grid bias is increased from a-o to a-1. This, however, is not sufficient to bring the envelope of the modulated wave on the *straight-line portion* of the tube characteristic, with the result that the audio output A-1 suffers severe distortion. Note also that the amplitude is greatly reduced.

Now consider the modified circuit. When grid current flows a voltage drop occurs across R-1, thus causing the bias point to shift to a-2. This results in a much greater amplitude than before, although with slight distortion. A close examination will show, however, that the distortion is more symmetrical and certainly less severe than that of A-1, without the decrease in amplitude experienced before. The voltage built up across R-1 can be returned to the I.F. grids through de-coupling resistors to effect further limitation on very strong signals.

Typical output curves with and without this circuit refinement are shown in Fig. 3.

Output Stage and Power Supply

The output stage of this receiver is left entirely up to the individual. The author prefers a single '45 tube for ordinary use. This can be used to drive a pair of 46s in push-push (class B) amplification, if the sound output is inadequate. The schematic diagram clearly shows the circuit and constants used, and needs no further explanation.

Part List—Five Meter Superheterodyne—Voice Receiver

Required — *Items*
3—Coils—L-1, L-2, L-3, see table.
3—I.F. Transformers, see table. (F. W. Sickles Co.)

Short Wave Receiver in a Cigar Box

(Continued from page 591)

phone binding posts, to the terminals marked *phonograph* on the broadcast receiver. The aerial and ground are left on the short wave receiver and tuning is done on the same.

As for results this little receiver using a ground for an aerial, a W1-phone station at Hartford, Connecticut, was received QSA 5, R 6-7 and also W4OC: a phone station at Durham, North Carolina, was QSA 4, R 6 at Detroit, Michigan, in the daytime. The copper screen used as an aerial in the lid of the cigar box works very satisfactorily at night.

1—50 mmf. tuning condenser.
1—.00035 mf. regeneration condenser.
1—.0001 mf. fixed grid condenser.
1—20 mmf. antenna condenser.
1—8 megohm grid-leak.
2—tube sockets.
Grid coil, 24 turns on old tube base.
Tickler coil, 18 turns, spaced ⅛" from grid coil.
1—UX-199 tube.
1—filament switch.
4—binding posts.
1—vernier dial.
Cigar box 10¼" x 5½" x 2⅝".
1—piece of copper screen 9⅞" x 5⅞".
1—piece of wood 5½" x 2⅝" x ¼".
1—strip of leather 9" x ⅝" x ⅛" for the handle
Miscellaneous nuts, bolts, wire, etc.
2—flashlight cells for the "A" battery.
1—22½ volt "B" battery.

—*George W. Bauer, Olmsted Falls, Ohio.*

RAW A.C. S-W. Receiver

By Robert Eilenberger, New York City
(Honorable Mention in Set-Builder's Contest)

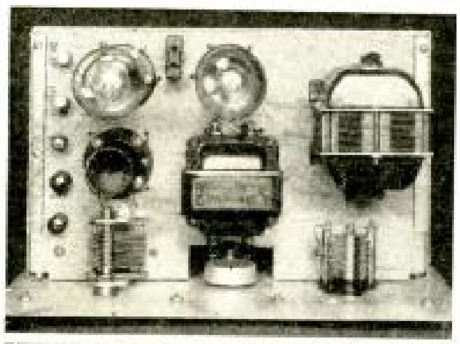
● THE set that I finally constructed after several months of experimenting with various circuits and parts, is a "two-tuber," using *raw* A.C. on the filaments of the '27's and two or three "B" batteries for a *quiet* plate supply. The circuit employed was chosen mainly because of its high selectivity and sensitivity.

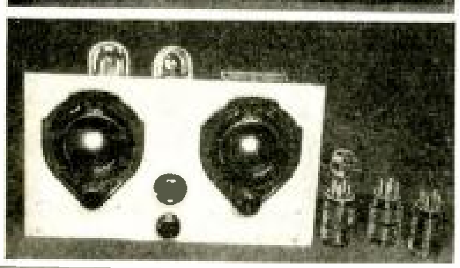
A Hammarlund .00014 mf. "Midline" midget condenser is used for tuning, while a Pilot .0001 mf. midget condenser controls regeneration. The 50,000 ohm resistance is employed as a volume control. For plug-in coils, the Dresner type is recommended, because they are small and the forms are threaded. For an audio transformer, the Thordarson type R76 is used. The filament transformer is home-made, having been rebuilt from the power transformer taken from an Elkon tapering trickle-charger.

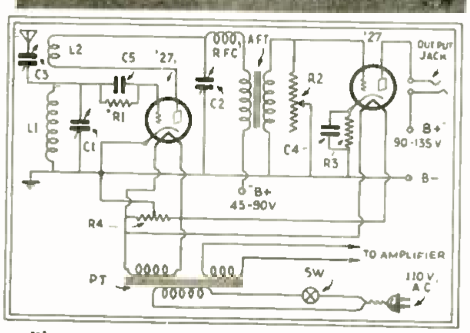
Incidentally, both transformer cases are grounded.

List of Parts

C1—Hammarlund .00014 mf. "Midline" midget condenser
C2—Pilot .0001 mf. midget condenser
R2—Centralab 50,000 ohm resistance
AFT—Thordarson R76 audio frequency transformer.
L1, L2—Dresner plug-in coils (Gen-Win)
PT—Filament transformer, 2½ volt
2—five-prong tube sockets
1—four-prong coil socket
SW—Pilot power switch
R4—Pilot 20 ohm center tapped resistance
C5—Sangamo .00025 mf. mica grid condenser
R1—Aerovox 2 megohm grid-leak
C3—Variable antenna coupling condenser
RFC—Radio frequency choke, 85 mh.
R3—2000 ohm metallized resistor
1 Pilot knob (for volume control)
1—"KK" knob (for power switch)
2—"KK" vernier dials—0-100½ and 100-0
C4—1 mf. bypass condenser
1—aluminum panel 12"x7"
3-ply veneer subpanel, 6¾"x10¾"
2—subpanel brackets, 2"x6¾"
Binding posts, hardware, etc.
1—Carter midget phone jack
1—Pair of Baldwin type "C" earphones







Photos and hook-up of the Eilenberger A.C. S-W. Receiver

Will Short-Wave Heat Effects Cure Human Ills?

(Continued from page 585)

static induction effect, may be as easily interpreted as our experience with radio waves and antennas. We think of the radio antenna as picking up the magnetic field changes, but the two changing magnetic and static fields are closely interlocked. The fact is that the heating of such resistances as those of aqueous solutions in the static field of alternating circuits becomes very considerable when the frequency of alternation reaches the ranges above ten million cycles. The more accurate determinations of relation between frequency and resistance in such cases, and with reference to the significance of the dielectric constants, have been shown by various writers, such as Patzold and McLennan.

Miss Hosmer in 1928 studied the effect of the radio field upon salt solutions contained in glass tubes placed between condenser plates which were connected to the radio power supply. It was found that the salt solutions were heated in the field, and that solutions of equal electrical resistance heated at the same rate, regardless of the salts used. Solutions similar in their constitution to the blood were particularly studied, and it was found that effective heating occurred in a range of alternating frequency of the order of fifty to ten million cycles, or six to thirty meters wave-length. Experiments were also made with solid jellies, to determine the extent of their heating in the field, and also to observe the remarkable phenomenon of orientation between the plates.

This heating effect was found to be much more general than a mere application of the field to salt solutions might indicate. Apparatus of the type described by De Walt and by McLennan was found to permit a variation of the heating effect in the resistor with the variation of oscillation frequency in the circuit. McLennan and Burton, indeed, have shown the mathematical relationships which explain the dependence of the rate of heating of the resistor upon its electrical resistance (for dilute solutions). They have shown that the frequency of the electrical oscillations for maximum heating can be expressed by the formula $\frac{2C}{nK} = 1$ where C is the conductivity and K the dielectric constant of the resistor, and n the frequency. More general mathematical studies of such heating effects have been made by Christie and Loomis, Drake, Pierce, and Dow, Patzold, and a general treatment of the subject by Schliephake was published in Germany in 1929.

When we transferred our attention from salt solutions to living matter, it seemed wisest at first to work with non-human material—insects, mice, rats, rabbits, and other animals. Alternating current of several hundred thousand cycles, to be sure, had already been used therapeutically, contacts of one sort or another being always attached directly to the person or animal treated. In these interesting cases, it seemed probable that the contact resistances and differing specific resistances of various parts of the body produced unevenly distributed heating effects—a condition well delineated by Westermark and by Schliephake. Because of this, and because we were not perfectly certain that internal high-frequency heating might not produce far-reaching, but subtle, ill effects similar to those obtaining in some of the early x-ray exposures, we preferred to approach the subject of human therapeutic treatment with caution.

We soon found that all animals could easily be killed in an intense radio field, but only after evidence of overheating, so that death was apparently due to passage of the thermal limit of viability. Small insects such as fruit-flies, when submitted to fields of a few watts of radio energy, apparently died instantaneously, and the deposition of moisture from their bodies on the walls of the tube near them indicated that death was due to overheating. When the same insects were exposed to the field in the dormant condition produced by a surrounding temperature of zero degrees Centigrade, it was possible by careful manipulation to revive them, and to make them fly about in the zero air exactly as though midsummer temperatures prevailed. A slightly greater energy application killed them. Throughout this work, quartz tubes were used, it being found that glass itself heated in the field—an effect perhaps due in part to absorbed moisture.

At about this stage of the work we became acquainted with the remarkable work of Dr. Wagner-Jauregg, of Vienna, who had made a fundamental clinical research on many cases of paresis by using fevers. He had employed particularly a malarial infection, and thereby had produced at least 30 per cent recessions of the paresis. It naturally seemed desirable to apply the radio fever in place of the infection. Dr. Carpenter took up work on syphilis in rabbits, and later, after it was evident that no danger was involved, extended his work to include humans. In the meantime, the work of other researchers on the physiological and biological changes brought about by radio heating—notably that of Dr. Knudson, of Albany—gave increasing confidence that experiments on humans might be safely carried out. So work on a "fever-machine" was extended, and it has been found possible, with increasing perfection of design, to control rises in human body temperature as great as 8.5 deg. F.

A powerful tool was thus placed in the hands of medical men in the combating of various diseases, such as syphilis, in which excessive body temperature may be an alleviant, or even a cure. Such work, however, can be properly done only by experts in well organized institutions. Several such institutions, having learned of the preliminary researches, requested loan of experimental apparatus. This seemed the best way to carry out the clinical studies. It was logical to attack immediately the identical disease which had yielded to the malarial treatment. The New York State Psychiatric Institute, already using that method, were willing to use the electrical process, and an outfit was loaned to that institution. Some of their results have been published. Other organizations have been loaned other outfits, and the plan has, in general, been one of supporting or assisting the researches of experts already acquainted with the field of paresis or some kindred disease where internal heat might be "indicated." In this way sufficient data have already been obtained to warrant further work along this line.

Arthritis, as mentioned, seeems to lend itself well to this work, and several experts are actively experimenting. Dr. Schliephake has recently published accounts of favorable experiments on surface malformations such as boils and carbuncles, and on such swellings of joints as occur in certain arthritis troubles. Several friends made use of our apparatus in the study of tumor growth under controlled temperature in the mouse and rat. The results here were not promising, however.

It developed through the experiments in hospitals that there were studies of internal body or joint heating which might be made of value without producing a fever for raising the temperature of the whole body above the temperature produced by its normal control mechanism. For this reason a number of smaller short-wave generating outfits have been made by which induced local heating, as within arm and leg joints, is accomplished. Several clinical centers are now operating in this way.

The work also soon raised the interesting question: Can the heating effect be "focussed"? There are at least two ways of localizing, more or less, this energy application. One is by the shape, size and positions of the condenser plates, because the greatest heat effect, other things being equal, is where the field is the most intense. Another way consists in controlling the frequency so as to fit the particular specific resistance of the part concerned. Not much has been done in either field, but it was shown by Hosmer that while aqueous solutions of different salts and equal resistances heated equally, there was for each frequency a particular resistance or salt concentration which heated most rapidly. A tadpole in water which heated but slightly alone caused heating of the water because of the tadpole's rise in temperature when in the water.

Schliephake has made comparisons between the rates of heating of various parts of the body, like fat, bone, muscle, etc., when submitted to diathermy as commonly applied (using contact-electrodes), and when submitted to the radiothermy here described. This selective method has been well illustrated by a recent article by McLennan and Burton, in which the local heating differences in dead flesh in this static field have been disclosed very ingeniously by changes in the colors of thermo-sensitive organic dyes.

In all such work good judgment and careful planning are necessary, and it has been our plan to depend entirely upon the medical organizations using the outfits to report their results, and that without undue haste. As similar devices are also now in use in European hospitals, it is probable that their value for the diseases in question will soon be determined.

The question of action of radio energy, as distinct from simple heating, upon micro-organisms, bacteria, transplanted tissue cells, etc., is very important. A number of workers have undertaken researches with this in mind, but so far as we know the results might be attributable to the specific effects of the rise in temperature of the body or culture medium in which the living matter was planted.

As the methods of production of radiant energy of shorter and shorter wave-lengths in the unexplored "radio" region are extended, such experiments will probably have to be repeated.

(A paper presented at the International Electrical Congress, Paris, France, July 4-12, 1932.)

Building A Shielded Power Unit for S-W Receivers

(Continued from page 599)

Now with small wooden wedges tighten the laminations in the coil opening. Four of the brackets in Figure 3 and four clamping strips Figure 4 are made 1-16 inch thick brass or aluminum strip. Using No. 6-32x1¼ inch screws clamp these to the laminations with the strips on each side of the jointed ends of the core. The long brackets serve to mount the transformer to the base.

Buy or Make the Choke

A very satisfactory choke can be made, one having a high inductance, as the current is relatively small. Using a block of the same length but ¾x⅝ inch instead of ¾ inch square as for the transformer, cover with paper as before; also use the strips of tape for binding the coil. Solder a lead to the No. 36 B. & S. wire and wind at random 7,500 turns of this wire on the block. Put a lead on the end of the wire and bind the coil with the strips of tape. Remove the block and dip into the hot parafin. The core is built up of forty laminations, but all of the "E" laminations are put into the coil from the same end. The straight pieces are stacked up in a pile and clamped to the open end of the core by using four more of the strips shown in Figure 4. Brackets Figure 3 will be added for mounting the choke. Using a bought choke, select one of high inductance—the direct current resistance can be as much as 1,000 ohms.

A mounting base for the parts is shown, with dimensions, in Figure 1. Make this of 1-16-inch thick aluminum. The large hole is for the tube socket. The two ¾-inch holes mount the two electrolytic inverted condensers. Place the transformer and choke in position and mark for the holes from these. Drill holes for bringing the transformer leads and the choke leads under. The connections are very simple and are shown in the hookup diagram. The cathode terminal on the socket supplies the high voltage, rectified current to the choke. Tie both grid and plate terminals to one end of the 1,700-turn winding. Only one connection is to be made to the electrolytic condensers, this being shown as the center on each one. The can is shown grounded; this, as all other such symbols denote that the point is to be connected to the base if not already in assembly of part. Use a rubber-covered hookup wire for all connections. The twenty-four turn winding made up of number 18 wire connects to the heater terminals on the socket. Leave two long, twisted leads from the other heater winding to connect to set.

Shielding the Unit

A sheet of 1-32 inch aluminum 14x18 inch should next be cut as dimensioned in Figure 5. The hole is for mounting the voltage control resistance. Bend along the dotted lines, taking the flap edges first. A straight edge will be very useful if clamped to the bending line, then the aluminum may be easily formed around this edge. With four sides bent up rivet the flaps to the adjacent sides with small rivets or eyelets. Next drill four holes in the bottom to line up with those in the corners of the mounting base. In mounting the assembled and wired unit into the shield use number 6-32x1¼ inch screws with a 1 inch spacer under the base to give clearance to the parts under this base. If the variable resistance has its arm connected to the mounting stud this stud will have to be insulated from the shield by the use of fiber washers. A cover for the unit is made of the same material from which the shield was made. Using a piece 4x8 inch cut one-half inch squares out of the corners and bend the sides up so that the cover will slip over the shield tightly.

Testing

Using a '27 tube a test was made on the completed unit to determine the actual output at various current loads. A milliammeter and a high, variable resistor were placed in the lead of the unit for taking these measurements. The voltmeter was of the high resistance type and was put in circuit from the tap to the minus connection. After setting the external variable resistance so that the current read was 5 milliamperes (mils) the voltmeter gave the voltage as 175 volts. Another setting at 10 mils gave a voltage reading of 165 volts; at 14 mils this had dropped another 5 volts to 160. These readings will go to prove that this little unit is entirely capable of handling most of the converters and short wave tuners. The '27 tube used for rectification is very inexpensive as also are the two electrolytic condensers.

List of Material

Ninety Laminations (Type E-1-3 Allegheny Steel Co., Brackenridge, Pa.).

Two Electrolytic Condensers (8 mf.) Concourse, Aerovox, etc.

One 50,000-ohm variable resistance; wire wound.

One-third pound number 36 B&S enameled magnet wire (for transformer and choke).

One-eighth pound number 29 B&S enameled magnet wire.

Fifteen feet each of number 18 and number 15 enameled magnet wire.

One UY wafer type socket.

One 14x18x1/32 inch aluminum.

One 4x8x1/32 inch aluminum.

One 2⅞x6⅞x1/16 inch aluminum.

Courtesy of N. Y. Sun.

New Vacuum Tube for Generating Ultra Short Waves

(Continued from page 607)

several wires reinforce each other to provide a strong, rigid, lightweight cathode, wherein the wires are secured against mechanical vibration, which induces field disturbances. Again, such a cathode is free to expand equally and will not warp, but will maintain its true and original state.

Surrounding the heating element but radially spaced therefrom is another electrode, which constitutes a *negative* outer or *secondary* grid. This grid, which is substantially of the same structure as the primary grid, comprises a plurality of upright supporting members, upon which is helically wound a wire of any suitable material. The top ends of the supporting members converge inwardly to be fixed to a ring, which engages the stem above the ring of the first mentioned grid.

The *live terminals* pass down through the bottom section of the stem for attachment to suitable pin or other contacts in the insulated base of the tube, which is not illustrated here. When the four elements are mounted on the stem as described, the stem is inserted in a tube blank which is fused at its bottom end to the base and is then exhausted through the tip which is sealed.

In Fig. 2 there are illustrated diagrammatically the various elements of the tube in a circuit and for convenience in illustration there is shown a source of energy or current supply for each element. Thus there are shown batteries respectively associated with the plate, primary grid, heater, and secondary grid in the order mentioned.

The positive and negative conductors for the heating element are connected to the ends of the battery. There is provided a rheostat for controlling the current supply for the heating element. The plate conductor is connected to the negative side of its associated battery by means of a potentiometer interposed between the sides of said battery; the positive side of the battery is connected to the like side of the heating element battery. The conductor leading to the inner or *primary grid* is connected to the positive side of its associated battery by means of potentiometer also, as shown in the diagram Fig. 2; the negative side of the battery is connected to the positive side of the heater battery.

The conductor leading from the outer or *secondary grid* is connected, as shown, to the negative side of its battery, through the medium of a potentiometer. Suitable voltmeters are placed at the positions marked V, and ammeters at the points marked A. The positive side of the secondary grid battery is joined to the positive side of the heater battery.

Action of the Tube

When the heating element is energized it functions as an electronic radiator or emitter. With a positive potential on the primary grid, an effect is produced which draws the electrons emitted by the heating element when energized, through the grid to the plate and thus the electrons are impelled toward the plate, because of the electrostatic field set up by this grid. In this impelled movement or flight of electrons they acquire kinetic energy; as the electrons pass through the grid they approach or enter a negative electrostatic field adjacent to the plate and are repelled.

If the plate be at a sufficiently high positive potential with respect to the heating filament, the kinetic energy of the swiftly moving electrons would be converted into heat by collision with the plate, and this would result merely in heating up the plate with a possible destruction of the same. In this improved tube, wherein a negative potential is impressed upon the plate, the imparted energy of the moving electrons is converted into electromagnetic waves or radiations, by reason of their motion being retarded by the negative electrostatic field, formed by the plate which is opposing or repelling the moving charge of the electrons before they can reach and impinge against the plate, and this action is best illustrated in Fig. 4.

When the electrons are retarded in their motion or flight, they give up part of their kinetic energy in the form of radiation. However, as the electrons are repelled by the electrostatic field adjacent to the plate, the retarded motion of the electrons is transferred to the space charge set up about the heater and in the space between the two grids.

These electrons in this space are thus effected and become disturbed in their motion, acting through the meshes of the heater, where a second opposing electrostatic field is set up by the outer grid acting against them, and the disturbed electrons are thus again retarded and upon repetition sustained radiations or oscillations are produced as the heater gives off a continuous flow or source of electrons.

To further explain the electronic action, it is evident that in order to accelerate an electron, work must be done upon it and if the electron is retarded in its motion, it must give up a part of its kinetic energy. If the inertia of an electron is wholly electromagnetic, the work in accelerating it is work done by lines of force. Supposing, then, a charge of electrons with its lines of force, moves through space with uniform velocity. If this charge is suddenly retarded the ends of the lines of force thereof will be jerked backwards, so to speak. In accordance with the characteristics of lines of force the kinks or reversals created at the end of each line will not be transmitted along the entire line instantaneously, but will be propagated along the line with a finite velocity, substantially that of light. These kinks or reversals in these lines of force are those parts thereof wherein the electrons are retarded and the electro and magnetic forces associated with these lines are more intense than those associated with the straight parts of the lines.

When an electrostatic disturbance passes over an electron, moving with uniform velocity, the electro and magnetic fields associated with it will be modified by the intense fields in the disturbance, and this modification is propagated to the center of the moving electron along lines of force constituting it. The result is a change or reversal in the motion of the electron. It is therefore apparent that the energy of a moving electron is transformed into radiation energy and this transformation takes place when the electron is retarded or accelerated.

Pentodes in Low-Power Transmitters

(Continued from page 589)

currents received by the wire loop (two windings with 8 cm. (3.2 inch) diameter) are rectified by the detector D, and the rectified current impulses are then demonstrated in a D. C. milliammeter. Figure 5 shows the hook-up; D is the detector and C a blocking condenser of 5000 cm. (.005 mf.) capacity. With a good meter we are now in a position to investigate the field at greater distances from the transmitter coil.

Third Experiment: Resonance in the Case of Inductive Coupling.

In the first two experiments we worked with an untuned receiver. The alternating currents induced in the receiver did not follow its natural frequency, but were imposed upon it by the transmitter with the latter's frequency. The induced reception currents become incomparably stronger if the receiver is tuned in resonance to the transmitter frequency.

Resonance phenomena are of basic importance for the technology of radio transmission and reception. For the experimental investigation of this complexity of questions we build a receiver according to the diagram of Fig. 6, whose inductance and capacity approximately correspond to the values of the transmitter. The coil is cut in the middle and there is inserted a connection for a small 3.5 volt filament lamp (F). Then we set up the receiver about 30 cm. (12 inches) away from the transmitter in such a way that the *coils are parallel*. By cautious changing of the capacity of the tuning condenser, we soon find a position in which our little indicator lamp lights up. In this experiment we can either *tune the transmitter to the receiver*, or conversely *tune the receiver to the transmitter*. The characteristic difference between the third experiment and the first lies in the range, or, what amounts to the same thing, the *degree of coupling*.

The lighting of the lamp, which in the first experiment occurred only in the case of close coupling, shows itself in the third already with very loose coupling. In that we have the basis for the nature of *resonance*. For it is only when the natural frequency of the receiver is adjusted to the frequency of the transmitter that such weak effects are sufficient at a relatively great distance to excite the reception system to vigorous response.

When the oscillating circuits are in resonance, we must not bring the receiver too near the transmitter. The induced currents become so strong that the filament comes to a radiant white heat and at the same time is in danger of being burned out.

Our experiment permits the recognition of still another fact of great importance, likewise for the construction of receiving sets. If we change the distance between the two coils, always remaining in the space permissible for the filament of the indicator lamp, we can establish the fact that the tuning becomes sharper the looser the coupling is. A really sharp adjustment is only possible in the case of extremely loose coupling.

Fourth Experiment: Action of the Absorption Circuit.

The electric power arising in the receiver in the experiment just performed came from the transmitter. Once the second oscillation circuit was adjusted to resonance with the transmitter, it withdrew from it the maximum of power.

The ability of taking up power in the resonance position is a common property of all oscillating circuits. To explain it clearly by experiment, we use an experimental arrangement according to Fig. 7. First the resonator is given loose inductive coupling with the transmitter and is tuned to resonance. Its lamp G1 lights. Then we bring toward the resonator a second circuit, in the middle of whose coil is likewise built in a small lamp G2. If we change the capacity of the condenser, we find a very pronounced position at which the glow lamp G1 goes out. The second circuit is now of equal frequency with the resonator and with the transmitter frequency. It withdraws from the resonator so much electric power that the amount remaining is no longer sufficient to keep the filament of the little lamp at the glowing temperature.

The proof that in this method of tuning the second circuit actually is adjusted to the transmitter frequency is easily furnished in the following way. We remove the resonator and put in its place the second circuit. At once its lamp G2 lights.

The experiment at the same time explains the term "absorption circuit." Such circuits are frequently used in receiving hook-ups when it is desired to increase the selectivity of a set and (for example) to prevent a local station from breaking through on others. One then inductively couples the absorption circuit with the antenna and sets the former in resonance with the interfering station. It then absorbs out of the antenna path the alternating (oscillating) currents induced by the interfering station, and thus keeps them away from the grid circuit of the first tube.

Fifth Experiment: The Blocking Circuit Action.

To explain experimentally this property of the oscillating circuit, very important for radiotechnology, we use an experimental arrangement like that in Fig. 8. First the oscillating circuit I (provided with the indicator lamp G1) is directly coupled with the transmitter by a wire Z S. Circuit II is at first not used. The coils are so placed that an inductive effect of the transmitter on the receiver is excluded. We tune I to resonance to the transmitter frequency, so that G1 lights. We convince ourselves that the tightness of coupling becomes the greater, the further the tap Z is moved toward the end of the coil. Then we add to the connection wire Z S, the oscillating circuit II. In this arrangement it is in the blocking circuit hook-up and acts in such a way that, as soon as it is adjusted to the transmitter frequency, it completely blocks the flow of these alternating currents. It always shows the greatest apparent resistance for that frequency to which it is itself tuned. Therefore at the start of our experiment we untune the blocking circuit as much as possible with respect to the transmitter. Then it has no effect on the lighting action of lamp G1. Then we regulate its tuning condenser and observe that in a definite and again fairly sharply limited position, the lamp G1 is extinguished. In this moment the blocking circuit is itself in resonance with the transmitter. A small 3½ volt filament lamp connected at the center of its coil (G2) lights up and thereby demonstrates that now the blocking circuit itself is working. Its resistance toward the alternating current has now become so great that there is no longer any power flowing to circuit I.

Short Wave League

(Continued from page 608)

some degree of their zeal is a protective measure, as well. One of your correspondents writes you that he has "learned the code, but has great trouble in reading it." That means just that he has *not* learned it, or he *could* receive. Will he apply himself any more to theory, and technique? The cry is continually, "none of this useless theory, give us practical articles." Without the theoretical work preceding it, no practice would be brought out except by accident. Brains to one degree or another must be used, and the aimless puttering I have watched and have heard, termed "experimenting," does *not* produce results!

All that is done on the longer short waves applies to 5 meters. Experience in the simpler frequency ranges will show what to expect in new territory.

There is a lot of condemnation of the code operation in general, as being uninteresting, and even as being useless. Contacts of stations at great distance are accomplished by C.W.—seldom by phone. The fact that the "keying" of a carrier is heard with the level way down where a modulated carrier would be heard only as the continuous wave allows this. By all means use code, and to familiarize the amateur with his transmitter and the radio frequency phenomena, have him pass a *code test* so he will want to go C.W. at first. Don't forget that a decent "phone rig" is expensive, too; *don't lose sight of the regulations made to insure that the signals will not interfere with others' rights in the spectrum.* The amateur bands are there for experiment, and who can start in and build a phone outfit immediately and obtain the good results to be expected by *other* amateurs? Broad signals, "hash," and the rest of the QRM must go, and inexperienced operators would not help in that. It's the old idea of apprenticeship, learning the ropes, then taking the "exam."

If you will publish this, I think we will hear some good arguments, or read them, rather. Pick the flaws, you readers, and I'll see what comes then.

TEMPLE NIETER (W1EPL, W8HPF),
54 Garfield St.,
Cambridge, Mass.

P. S. Mr. Gernsback, tell your letter-writers not to say "73's." The signal is just 73, meaning "best wishes." 73's would read "best wishes's," and anyway, is liddish.

Why the "Code Test"?

Editor, SHORT WAVE CRAFT:

I laud your stand for abolishing the code examination for phone below six meters. I never could see the sense of one knowing the code, who had a first-class phone station anyway, except that it keeps quite a number from having phone stations. This also keeps business down, as many would like to have phone stations but cannot pass the code test.

Yours for success,
THOMAS J. P. SHANNON,
6232 S. Alamo Ave.,
Bell, Calif.

Sees Big Future—"Without Code Test"!

Editor, SHORT WAVE CRAFT:

In the first place I sure am in favor of the SHORT WAVE LEAGUE'S platform and I am willing to "do my bit" in making this club what it ought to and can be. Personally, I don't see any reason whatever why it is necessary for a prospective phone "ham" to be made to memorize the code, before he can operate a 5 meter phone transmitter, and I am sure I voice the sentiment of an army of *would-be amateurs* when I say that there are a decent bunch of fellows who would go on the air and instead of causing a lot of interference (as some hams seem to think) would be willing to help do away with it. Further they would be willing to, with intelligent cooperation and research, bring about a spirit which I will leave to the imagination of the intelligent reader.

But allow me to say this, please: Encourage all members and prospective members to acquire at least a knowledge of the *fundamentals of radio.* I do not mean to say this should be imperative, but the idea should be encouraged, at least.

Ignorance in all ages and places has been the prime cause of much misunderstanding that should have been avoided. The same applies to radio. Everybody who expects to derive pleasures from this matchless hobby should understand enough of the mysteries of radio involved, to enable him to get the best results with the least amount of interference to the other fellow. I am a student, who is at present enrolled with one of the pioneer training schools of the United States. But not everyone is so fortunate and still a lot can be learned from the text-books available. I am saying all this with the feeling that it might help inspire some member or would-be member to get the fundamentals, so that the SHORT WAVE LEAGUE will develop into an efficient and well-informed organization that may change short wave radio from its already big status to an even bigger one. Who can tell?

Before closing this letter I wish to say that it is my belief that *phone transmission* will help very materially to *popularize* radio. Right here I want to tell of the enthusiasm exhibited by a friend of mine when he first heard a phone ham. He acted just as a kid would when presented with a toy steam engine that really worked! That boy was thrilled to the core! And he says that now his highest ambition is to become a "ham." But here's the embargo: He doesn't want to memorize the code; he wants to go on *phone* right off! Personally, I don't blame him.

In the near future I am going to organize a radio club. Obviously it shall be a chapter of the SHORT WAVE LEAGUE. So here's wishing the LEAGUE an abundance of success. 73 es CUL.

Yours very truly,
SIMON H. SASSER, Jr.,
P. O. Box 46,
Hawthorne, Fla.

Those Harmonics Again

It seems that we will have to make up a big sign for the benefit of short-wave listeners, something like this: "Warning! Beware of Harmonics!" The other evening we listened for ten minutes on about 29 meters to a fairly strong station that was transmitting a program in German. The announcer was German, the performers were German and the music was mostly heavy Wagner. We thought we had run into a brand new foreign station until a clear American voice replaced the German and announced that the "All German program sponsored by the So and So Furniture House of Yorkville" was now over, and identified the transmitting station as one located only about a mile and a half away! If that announcer could have heard what we said about him, his face would have been plenty red! ? XOM!

Is it "2" or "Q"?

Many new short-wave listeners who have not yet become familiar with "ham" lingo misinterpret amateur call letters very badly. The most common error is in mistaking the number 2 for the letter Q. Thus nearby and easily heard second district amateur phone stations are logged with call letters that do not exist. Remember this: all American amateur stations begin with the letter W, followed by any number from 1 to 9, indicating the geographical district, and further followed by either two or three letters. Canadian stations begin with E, British with G, French with F.—R. H.

Improving the Short Wave Antenna

(Continued from page 601)

watts tube input, which is the maximum power allowed the United States amateur. The small seven-strand copper cable is not recommended for the antenna where short waves are to be dealt with. Its losses on the higher frequencies are such that it should be discarded in favor of a single wire in the gauges mentioned before. Above all beware of any so-called antenna wire made up of tinsel or multiwire copper strip or cable sold under attractive trade-names. Single wire, sufficiently large, will always be better and will give superior results. It should be mentioned in this connection that the "skin" resistance of multiwire cables mounts to a surprisingly high value after the antenna has been subjected to the elements, especially after corrosion and oxidation has set in. This in turn reduces the efficiency of the antenna—a factor which cannot be permitted on short waves, where every loss should be kept to a minimum.

Enameled Wire Valuable

Single wire with enamel insulation is to be preferred for antenna purposes over bare copper wire. While both kinds of wire will give about the same results when first installed, over long periods of time the *enameled wire* will give superior performance. Both enameled copper and bare copper wire will give excellent results when first installed, but the bare copper wire, especially in the city where dense smoke helps to contribute its share of deterioration, will soon lose the "shiny" appearance and the dull copper oxide coating due to the chemical reaction between the surface of the bare copper wire and the oxygen in the air completely covers the wire.

Because of the difference in resistance between the inner copper of the wire just under the oxide coating and the copper oxide coating itself, distributed over the outside of the wire, some loss is introduced in the antenna due to the "skin resistance" effect and results will be found to decrease as the antenna gets older and after it has been used for some time. To those of our readers who do not understand what we mean by the term "skin effect" we can clarify the matter by explaining that radio frequency current does not travel through a wire as D.C., but instead it follows the surface path of the wire, and, since but the mere shell of the surface is used, it has been likened to the skin—the bare outside covering.

Some of our readers may not understand why the enamel coating on enameled wire does not behave in a similar manner to offer a high resistance surface to the radio frequency energy as in the case of the oxide coating. The fact is that the copper oxide coating, while of a higher resistance than the original copper surface, it not so high in resistance that it can be classed as an insulation. The enamel coating, on the other hand, is primarily an insulation and no radio frequency will use it as a path. This being the case, there is but one other possible path for it to follow and that is the surface of the copper wire just under the enamel coating—all of which is exactly what happens. Thus by protecting the surface of copper wire with enamel insulation the surface of the wire remains, as far as resistance to radio frequency is concerned, as though the antenna had just been erected, even after months of exposure to the elements.

What the Insulators Must Do!

So much for the wire in the antenna. This far we have been interested in the lowest resistances possible. In the selection of our insulators, however, the problem is not the lowest resistance, but the highest possible resistance and lowest distributed capacity. Both the internal and outside resistance of an insulator must be as great as possible and these qualifications must not break down even in the most inclement weather. The material of which the insulator is made must be capable of maintaining its resistance value over long periods of time, in all kinds of weather, in all kinds of climatic conditions. These, it can be readily seen, are very rigid and drastic specfications which have not been so easy to attain. To be practical, rain and snow must not change the insulator resistance materially; in other words it must be of such a composition that rain or moisture will not be absorbed and the design of the insulator such that any water striking the insulator will drop off as rapidly as it forms upon it. In addition to these qualifications the insulator material must be such that it will not permit soot and smoke to accumulate on its surface, as this type of accumulation tends to lower the surface resistance of the insulator and thus ruin its effectiveness. These and many other specifications must be adhered to if an insulator is to be trusted on our short wave antennas.

We now know what a good insulator should do—but how are we going to select one which is best for our purpose? With what we have just said kept in mind, this is not an especially difficult task. Insulators made of Pyrex, glass and glazed porcelain are all good, and their relative "goodness" is in the order mentioned, with Pyrex leading all other compositions as the best insulator material commercially obtainable to the layman.

In addition to high resistance, the insulator must have an extremely low capacity between the ends so that no appreciable energy will be lost due to the condenser effect of the two ends. If our insulator is anything over four inches in length and composed only of the insulation material itself, i. e., without fancy metal ends for fastening the wire, etc., it can be depended upon to have a fairly low capacity between its extremities. The longer the insulator for a given thickness, the better it is both in respect to high resistance and low capacity. If one insulator sufficiently long for the purposes desired is not available, the same effect can be secured by placing several short insulators in series until a resistance path the desired length is obtained.

Why Insulators are Ribbed

The better grades of insulators on the market all have a ribbed outside surface. This "bumpy" appearance with its hills and dales serves two important functions in the insulator. First, because of the fact that radio frequency tends to travel on the surface of the insulator rather than through it, these ridges lengthen the surface path from one end of the insulator to the other. Second, they afford an excellent means for disposing of any water which may start to accumulate due to heavy rain by allowing the water to form easily into drops and thus fall away from the insulator. Most of the water will tend to form on the under side of each protruding ridge, which leaves the dales comparatively free from water and betters the insulation qualities of the insulator even with water falling upon it. A good insulator of proper design will dispose of water almost as fast as the rain deposits it upon the insulator.

If porcelain insulators are to be used, use only insulators made of glazed porcelain. See to it in choosing such an insulator that the porcelain glaze is not cracked and that it covers the entire surface of the insulator, except possibly the extreme ends. Glazed porcelain insulators compare favorably in performance with the ordinary glass type familiar to all of our readers.

For best results in either transmitting or receiving antennas do not try to skimp on the use of insulation. At least two of the common four inch variety should be used in series, and better results can be expected if even more are used. It must be remembered that even though the voltage in a transmitting antenna may be hundreds of times more than that in a similar antenna used for receiving purposes it is just as important, and in fact still more important, to keep from losing any of the minute voltages generated in the receiving antenna—for, although the losses may be extremely small, they may seriously impair reception. Good insulators are cheap enough and every one that you add helps to better your insulator when weather conditions are at their worst and reception proportionately so. Insulators must not be put in an antenna on the basis of good weather performance but installation must be made on the basis of good insulation even during the most disagreeable and inclement weather.

Correct Type of Lead-in

Next in our discussion of the better antenna is the problem of correct lead-in and feeder design. When the reader is told that some of the most serious losses of any antenna occur in the seemingly unimportant lead-in, he can begin to see the need for proper design of this portion of the antenna system.

As in the case of the antenna proper, ample clearance is an absolute essential for best results. The lead-in wire should be kept at least three

See Announcement on page 637 on Monthly Prizes for Best Sets.

to four feet from any building walls, cornices, gutters and similar objects which frequently fall in its path. Another important factor is that no sharp bends are permissible as these cause considerable loss and in the case of fairly high powered transmitters they will emit a corona discharge.

One of the most common places where excessive loss is suffered is at the point where the lead-in wire comes through the wall or window of the building into the room in which the set is located. Extreme care must be taken to avoid excessive capacity between the wire and the building for if this exists much valuable energy will be by-passed directly to ground through this capacity and thus be lost. In designing the lead-in through the wall or other parts of the building take care to reduce capacity to the smallest possible amount because at the higher frequencies quite small capacities will cause serious losses. Little need be said of the necessity for the best lead-in insulation it is possible to get. In this connection see to it that the design of the lead-in insulator is such that it will not permit water to accumulate on it or flow through it on the wires into the inside room.

The same precautions just given for the lead-in hold good for the design and placement of any of the so-called feeder systems. While it is true that their fields are restricted and that they do no radiating themselves, nevertheless, major losses will occur in them if the feeders are erected in a haphazard manner with no thought given to proper design. A little care and thought invested in the lead-in or feeder system before building will repay itself in dividends of good consistent performance over a long period of time.

Keep the antenna free from any vibration. Swinging wires in the wind are not only unsightly, but they impair efficiency and give unsteady results. It is a simple matter to pull all antenna wires taut and rectify the above. If an antenna is built in a slipshod, careless manner and allowed to blow in the wind like an old broken down clothes line, the antenna had better be used to dry the family washing, for it will prove far superior for this purpose than for radio transmission or reception!

And You must Do "Good" Soldering!

One more thing remains. We have purposely kept it to the very last because of its importance and because of the fact that it is so often overlooked and forgotten in the hurry to get the antenna up and working. We refer to the matter of GOOD soldered connections—not connections good for only a week or month, but good for many months and even years. The importance of a good soldered joint cannot be overimpressed on the mind of the reader for in the connections and joints of the antenna system lies to a large degree the success or failure of the entire system. See to it that the wire is perfectly clean and shiny before attempting to solder; use either a good heavy iron or blow-torch; wrap the two wire ends well around each other so that too much dependence is not placed on the ability of the solder to overcome the mechanical strain on the joint; allow the solder to flow freely; use a good flux and see to it after the job is completed that every sign of flux left on the surface is wiped off. Some soldering pastes, and acid flux in particular, permit bad corrosion to set in and this corrosion in time entirely destroys the effectiveness of the soldered joint regardless of how good a job it was originally.

The short wave antenna is one of the most important cogs in the machinery comprising our high frequency mechanism. It is not stretching the matter too far to say that results with the best or the poorest equipment will be just as good as the antenna used with it.

If your antenna has been up some time, better take it down and inspect it carefully by checking over the condition of the wire, the insulators and all soldered joints. Such an inspection will be well worth your time and may improve results surprisingly over what you are now experiencing with your present antenna condition.

In closing allow the writer to leave this one thought: while it is true that a small loss here and there in one part of an antenna may not seriously impair its action, if we can, by proper construction and design, effectively eliminate several of these smaller losses at one time we have accomplished the same thing as though we had disposed of a major loss and consequently our performance will show a decided improvement, and, regardless of the set used, results will be bettered. The more of the smaller losses that we can successfully eliminate the more will be this noticeable improvement!

A high quality short-wave receiving set is a fine thing, but don't try to make it work on an antiquated or obsolete antenna. Give the set a chance to show you its real worth by building an antenna built for best results—and then really enjoy the hobby we all like best of all, Short Wave Radio.

A New Short-Wave Switch

● THE H. H. Eby Manufacturing Co., Inc., is now marketing a versatile instrument for switching circuits of almost any nature. This device is commonly called a *Short Wave Switch* but is in general intended for switching all kinds of apparatus wherein the load which is to be carried does not exceed 3 amperes at 110 volts A.C., or 1½ amperes at 110 volts D.C. of non-inductive loads. A single switch of this type actually consists of one or more switches combined into a unit but operated by means of rotating a single shaft. The flexibility of the component parts makes it possible to open or close any number of circuits simultaneously. For example, it might be required to close seven independent circuits at once. The switch would easily accomplish this or could be so arranged so that as it closed these seven circuits, it opened seven others at the same time. In other instances it might be necessary to close, for example, five circuits in sequence; that is, first No. 1, then No. 2 and so forth up to five or more. More complicated arrangements might require that circuit No. 1 in say four different groups be closed simultaneously; then circuits No. 2, No. 3, No. 4, etc., be closed in each group in sequence. Such a seemingly complicated switching of circuits can easily be accomplished with this switch.

The unique manner in which the contacts are fastened to the switch results in an exceedingly low capacitance between the various segments. The advantages of such an arrangement are broadly recognized in all short-wave radio receivers. This prevents the effects of one circuit influencing others nearby and in the case of short-wave receivers makes it possible to clearly detect one station from another. This same feature of low capacitance is invaluable in complicated photo-electric circuits where it is of utmost importance to have negligible effects between the lead wires of various apparatus used with photocells.

The switches are made in any lengths and combinations to meet the specifications of the user, some switches being very small and thus requiring perhaps but one or two segments and two or three positions; while others are longer and may comprise as many as fifteen or twenty segments having four, five or even six positions to suit the individual needs.

The new Eby Short-Wave Switch.

A Little Drama entitled "When To Listen"

or

The "Low Down" on Short Wave Schedules.

By Robert Hertzberg

● FOR several months we have been considering the advisability of making up an hour-by-hour chart showing what short-wave stations are on the air during each particular period. After studying some lists of this type that have already appeared in print, and considering our own extensive short-wave listening experience, as well as the experience of numerous other fans, we have come to the conclusion that such a list, however attractive it might appear, is not really very useful or practical.

It would be very easy to list half a dozen foreign stations as being "on the air" between say 10:00 and 11:00 a. m., but the actual usefulness of the data, in most cases, is negligible. As every short-wave listener has learned, reception of short wave stations depends on several interlocking factors, such as the frequency, the season of the year, the hour of the day and the patience of the operator. The fact that a station is known to be transmitting at any particular time does not mean that you can hear it by merely tuning your receiver to the proper dial setting. In fact, lists of this kind are likely to cause many unnecessary disappointments. A person not familiar with short-wave tuning technique will twist the dials vainly in search of stations that he can't possibly hear because of unfavorable circumstances of one sort or another.

One of the little jokers that ruins the value of hour-by-hour lists is the fickleness of the stations themselves. Almost without exception, short-wave stations that transmit programs are entirely *experimental* in nature, and change their wavelengths and schedules without much advance notice if any at all! The fact that most short wave phone stations carry experimental-class licenses is significant in itself.

During the past five years the writer has been in correspondence with practically every short-wave phone station of importance in the world, has received letters from thousands of individual listeners describing their experiences, and has lost many valuable hours of sleep scanning the short wave channels with every kind of set from a one-tube squealer to a fourteen-tube superheterodyne. As a result of this accumulated experience he has come to the following conclusions, which will undoubtedly be verified by many readers:

1. Except for a few isolated stations, announced schedules, even when taken directly from the stations' own letters, cannot be relied on to any great extent. The more business-like stations state frankly that all schedules are "subject to change without notice," or they refuse *point blank* to commit themselves to any schedules at all.

2. The only way to bring in stations not previously logged is to go up and down the scale patiently, *at the correct time of the day for the particular wavelength*. Hundreds, if not thousands of S.W. set owners waste countless hours on absolutely unproductive wavelengths.

In this connection it is highly appropriate to quote from an instructive little booklet entitled "World Wide Short Wave Reception," written by James Millen, of the National Company. States Mr. Millen:

"It is desirable to reiterate that the listener should time his reception, or tune on certain wavelengths at certain times of the day. From 11 to 20 meters all tuning should be done from daybreak till 3 p. m. local time. From 20 to 33 meters, stations to the east of the listener will be heard best from about 11 a. m. till 10 p. m. Stations to the west of the listener in this band should be heard best from midnight till about two hours after daybreak, when they will fade out. From 33 to 70 meters, distant stations can be heard only after darkness falls. Very little in the way of distance can be heard above 70 meters, although the ships, police, fire, coast guard and aircraft stations are all heard above that wavelength.

"Short wave stations have a habit of changing in volume from time to time, these changes being affected mostly by the amount of daylight between the stations and the listener. For example, European stations are always best for American listeners during the summer months. In reverse, South Americans are best during the winter months. Each year we hear from hundreds of listeners arguing that winter months are best for distant reception and others that summer is best. It depends mostly on the habits of the listener and his location. By habits we mean. the stations he generally tunes for. There is not the least doubt that European stations such as G5SW, I2RO, Zeesen and OXY are best during the summer months."

In other words, the hour-by-hour list looks pretty. but it is useless unless it is qualified according to the information given above. The three-page station list as it has been appearing in SHORT WAVE CRAFT is actually easier to use, because it runs according to wavelength and frequency.

To give an example. Suppose you get up early some morning and decide to give the knobs a twirl. According to the foregoing "dope" you should plug-in the smallest coils and stay in the neighborhood of 20 meters if you are after DX. That's all there's to it. If you hear distant stations, congratulate yourself; if you don't, it's just too bad. but don't worry about it. Short wave reception conditions are known to change to an extraordinary extent from one day to another, and where there was utter silence on the dial on Monday there may be strong signals on Tuesday.

What S.W. fan hasn't had the embarrassing experience of inviting guests to hear those wonderful foreign stations. which tore the speaker apart for two weeks previous to the day of the fateful visit, and then having to twist the dials desperately with no sign of them? Was your face red!

When To Listen In

By ROBERT HERTZBERG

● WE are grateful to the many readers of SHORT WAVE CRAFT who have sent in reports concerning foreign short wave stations. Some of these are reproduced herewith for the benefit of other readers who have not been fortunate enough yet to pick up the stations mentioned.

League of Nations Station

John DeMyer, 545 Baker Street, Lansing, Mich., received a letter of verification from "Radio Nations," the short-wave broadcasting station maintained by the League of Nations at Geneva, Switzerland. This follows:

"From September 25th, 1932, onward, this station broadcasts on the work of the League of Nations every Sunday in English from 11:00 to 11:15 p.m. (5:00 to 5:15 p.m. E.S.T.), in French from 11:15 to 11:30 p.m. (5:15 to 5:30 p.m. E.S.T.) and in Spanish from 11:30 to 11:45 p.m. (5:30 to 5:45 p.m. E.S.T.) on wavelengths of 31.3 and 38.47 meters. We vary our weekly programs on some Sundays, giving talks by statesmen known to audiences all over the world; on others, interviews between a journalist and an official of the League of Nations on current problems.

"These broadcasts are especially intended for overseas countries and will, I hope, interest you. I should also be extremely grateful if you would further our aims by informing your wireless listener friends of our undertaking. Any letters on our programs and their reception will be welcome. Address them to G. Gallarati, Information Section, League of Nations, Geneva, Switzerland."

New British Empire Station

Short-wave enthusiasts should make a note of the new call-signs which have now been alloted to the British Broadcasting Corporation for use in connection with their British Empire short-wave station at Daventry, which is to supersede G5SW.

In order to distinguish between the eight different channels on which transmissions are to take place, a different call-sign has been allocated to each wavelength or frequency that is going to be used for the Empire broadcasts.

Thus, for example, GSA is the call-sign for the 6,050 kilocycle channel; GSB for 9,510 kilocycles; GSC for 9,585; GSD for 11,750; GSE for 11,865; GSF for 15,140; GSG for 17,770; and GSH for 21,470 kilocycles. For those who find it easier to "think in wavelengths," the equivalents in meters are as follows: GSA, 49.58 meters; GSB, 31.54; GSC, 31.29; GSD, 25.53; GSE, 25.28; GSF, 19.81; GSG, 16.88; and GSH, 13.97 meters.

It is possible that slight alterations to these wavelengths or frequencies may be found necessary as a result of experience gained in the course of the experimental transmissions when the station comes "on the air."—*Amateur Wireless* (London).

Cairo-London Phone Circuit

Several radio telephone stations are working from Cairo, Egypt, to England, apparently as a preliminary to a regular radiophone service between the two countries. SUV, SUW, SUX and SUC have been reported on various waves between 25 and 40 meters.

Costa Rica on Low Wave

"The smallest broadcasting station in the world," little TI4NRH, in Heredia, Costa Rica. Central America, is now working on 19.9 meters as well as on 31 meters. This station uses only 7½ watts but has been heard almost everywhere on the face of the globe.

Some time ago the owner, Senor Amondo Cespedes Marin, increased the power to 150 watts, but for some strange and as yet unknown reason the outfit refused to "perk" nearly as well as before. When the old "flea power" transmitter was restored the DX reports started rolling in as before!

Banana!

The name "Banana" now appears on the official list of the world's radio stations. This station is located on the Belgian Congo, and uses telephony between 15 and 20 meters.

Yearly Schedule of VK2ME and VK3ME

Through the kindness of P. M. Farmer of Amalgamated Wireless Ltd., Sydney, Australia, we are able to publish the entire 1933 schedules of both VK2ME, Sydney, on 31.28 meters, and VK3ME, Melbourne, on 31.55 meters. This unusual chart is well worth saving.

VK2ME (Sydney)—Sundays Only

		Sydney	GMT	EST (America)
Jan.	1st	4 p.m.-6 p.m.	0600-0800	1 a.m.-3 a.m.
	2nd & 3rd	8 p.m.-Mdt.	1000-1400	5 a.m.-9 a.m.
	4th	Mdt.-2 a.m.	1400-1600	9 a.m.-11 a.m.
Feb.	1st	4 p.m.-6 p.m.	0600-0800	1 a.m.-3 a.m.
	2nd & 3rd	8 pm.-Mdt.	1000-1400	5 a.m.-9 a.m.
	4th	Mdt.-2 a.m.	1400-1600	9 a.m.-11 a.m.
Mar	1st.	4 p.m.-6 p.m.	0600-0800	1 a.m.-3 a.m.
	2nd & 3rd	8 p.m.-Mdt.	1000-1400	5 a.m.-9 a.m.
	4th	12:30 a.m.-2:30 a.m.	1430-1630	9:30 a.m.-11:30 a.m.
April	1st	4 p.m.-6 p.m.	0600-0800	1 a.m.-3 a.m.
	2nd & 3rd	8 p.m.-Mdt.	1000-1400	5 a.m.-9 a.m.
	4th	12:30 a.m.-2:30 a.m.	1430-1630	9:30 a.m.-11:30 a.m.
May	1st	4 p.m.-6 p.m.	0600-0800	1 a.m.-3 a.m.
	2nd & 3rd	8 p.m.-Mdt.	1000-1400	5 a.m.-9 a.m.
	4th	1:30 a.m.-3:30 a.m.	1530-1730	10.30 a.m.-12:30 p.m
June	1st	3 p.m.-5 p.m.	0500-0700	Mdt.-2 a.m.
	2nd & 3rd	8 p.m.-Mdt.	1000-1400	5 a.m.-9 a.m.
	4th	2:30 a.m.-4:30 a.m.	1630-1830	11:30 a.m.-1:30 p.m.
July	1st	3 p.m.-5 p.m.	0500-0700	Mdt.-2 a.m.
	2nd & 3rd	7:30 p.m.-11:30 p.m.	0930-1330	4:30 a.m.-8:30 a.m.
	4th	2:30 a.m.-4:30 a.m.	1630-1830	11:30 a.m.-1:30 p.m.
Aug.	1st	3 p.m.-5 p.m.	0500-0700	Mdt.-2 a.m.
	2nd & 3rd	7:30 p.m.-11:30 p.m.	0930-1330	4:30 a.m.-8:30 a.m.
	4th	1:30 a.m.-3:30 a.m.	1530-1730	10:30 a.m.-12:30 p.m
Sept.	1st	3:30 p.m.-5:30 p.m.	0530-0730	12:30 a.m.-2:30 a.m.
	2nd & 3rd	7:30 p.m.-11:30 p.m.	0930-1330	4:30 a.m.-8:30 a.m.
	4th	12:30 a.m.-2:30 a.m.	1430-1630	9:30 a.m.-11:30 a.m.
Oct.	1st	3:30 p.m.-5:30 p.m.	0530-0730	12:30 a.m.-2:30 a.m.
	2nd & 3rd	7:30 p.m.-11:30 p.m.	0930-1330	4:30 a.m.-8:30 a.m.
	4th	12:30 a.m.-2:30 a.m.	1430-1630	9:30 a.m.-11:30 a.m.
Nov.	1st	4 p.m.-6 p.m.	0600-0800	1 a.m.-3 a.m.
	2nd & 3rd	7:30 p.m.-11:30 p.m.	0930-1330	4:30 a.m.-8:30 a.m.
	4th	Mdt.-2 a.m.	1400-1600	9 a.m.-11 a.m.
Dec.	1st	4 p.m.-6 p.m.	0600-0800	1 a.m.-3 a.m.
	2nd & 3rd	8 p.m.-Mdt.	1000-1330	5 a.m.-9 a.m.
	4th	Mdt.-2 a.m.	1400-1600	9 a.m.-11 a.m.

VK3ME (Melbourne)

Wednesday	8 p.m.-9:30 p.m.	1000-1130	5 a.m.-6:30 a.m.
Saturday	8 p.m.-10 p.m.	1000-1200	5 a.m.-7 a.m.

BRITISH EMPIRE STATION OPENS

● THE most important news of the month for short wave listeners comes from England. The new Empire station at Daventry began operation on Monday, Dec. 19, 1932. This is one of the largest short wave plants in existence. The new station will supplant G5SW at Chelmsford. The station consists of two transmitters capable of working on any of eight different wavelengths! Each transmitter has a power rating of 20 kw. In addition there is an array of 17 directional antenna systems for directing transmissions to any part of the world. With such a set-up fairly reliable world-wide reception is assured.

For program purposes the transmissions have been divided into five *world zones* with the following calls and frequencies: Zone 1, Australia, New Zealand, etc.: GSD, 11,750 kc., 4:30 a. m. to 6:30 a. m. Zone 2, Indian zone including Malay States: GSG, 17,770 kc., GSB, 9,510 kc., and as a reserve channel, GSD, 11,750 kc. 9:30 a. m. to 11:30 a. m. Zone 3, East Africa, Western Indian Ocean, etc., and Palestine: GSH, 21,470 kc., during daylight and GSC, 9,585 kc. during nighttime, 1:00 p. m. to 3:00 p. m. Zone 4, West African Zone, West Africa, South Atlantic Ocean and probably South America: GSB, 9,510 kc., GSA, 6,050 kc., 3:30 p. m. to 5:30 p. m. Zone 5, Canadian Zone, includes all of North America: GSF, 15,140 kc. (probably won't be used till late spring), GSB, 9,510 kc., GSA, 6,050 kc., 8:00 p. m. to 10:00 p. m. All time is Eastern Standard. These schedules are experimental and may be changed to suit conditions.

As mentioned, directional antenna systems are employed, so it will probably be impossible to hear all of the transmissions in the United States. It should be possible to hear the transmissions to zones 1 and 2 sometimes and certainly to hear those for zone 5 which are directed broadside at the United States and Canada.—M. Harvey Gernsback.

Short Wave Events of the month

A list of Columbia Broadcasting System's short-wave broadcasts for the period Nov. 11 to Dec. 11 follows:

- November 12, 12:30 to 1:00 A. M.—Special program of popular music from Honolulu, Hawaii.
- November 13, 1:00 to 1:30 P. M.—Prince Clumay speaking from Paris on "Why Drink and What?"
- November 14, 4:20 to 4:40 P. M.—Right Honorable Lord Ponsonby speaking from London on "To an Old School Friend."
- November 21, 4:20 to 4:40 P. M.—Lord Peel speaking from London on "To an Old School Friend."
- November 27, 12:30 to 12:45 P. M.—Leon Trotsky speaking from Copenhagen on "The Meaning of the Russian Revolution."
- December 4, 12:30 to 1:30 P. M.—Speeches by Dr. Yen and Dr. Matsuoka of the Japanese and Chinese Delegations of the League of Nations—from Geneva.

PRESENT "NBC" SHORT WAVE SCHEDULE

3XAL—Boundbrook—WJZ 8:00 a. m. to 4:00 p. m. daily except Sunday. 4:30 p. m. to 1:00 a. m. each Saturday night.
2XAD—Schenectady—WEAF 1:00 p. m. to 3:00 p. m. daily except Sat. and Sun. 1:00 p. m. to 4:00 p. m. each Sat. and Sun.
2XAF—Schenectady—WEAF 5:15 p. m. to 11:00 p. m. daily except Sat. and Sun. 4:00 to 11:00 p. m. each Sat. and Sun.
W1XAZ—Springfield—WJZ 7:00 a. m. to 1:00 a. m. daily. All time is E.S.T.

The Comet "Pro" Superheterodyne

(Continued from page 605)

In this range, the 26 mmf. condensers E and F (Fig. 1) are connected into the circuit also. However, no switch is necessary, as this additional connection is automatically made when the "CC" and "DD" coils are inserted in their sockets. The fifth coil prong (which is not used in Coils "AA" and "BB") is used for this purpose in Coils "CC" and "DD." In this frequency range the band width varies from approximately 1200 kc. at 4.5 mc. to 225 kc. at 1.5 mc.

Screen Grid Pentodes as Detectors and I.F. Amplifiers

The first detector is a "57" screen grid pentode. Its high detector sensitivity and high output impedance make it highly suitable to work into the high impedance primary of the first I.F. transformer.

The two intermediate amplifying stages employ "58" variable-mu pentodes, and the intermediate coupling transformers are of the twin-coil tuned plate tuned grid type. Since the intermediate amplifier provides most of the receiver's sensitivity and selectivity, no effort has been spared in the design and construction of the intermediate transformers. The transformer coils are wound with 10/41 Litz wire and have an inductance of 1.2 millihenries. At 465 kc., these coils have a power factor of .01 or a Q of 100. They are tuned by adjustable condensers with mica dielectric and Isolantite bases. Inasmuch as six of these low loss tuned circuits are used in the three I.F. Transformers, it is not difficult to account for the extreme selectivity shown by the overall performance curves of the receiver.

The second, or I.F. detector, is also a "57" screen grid pentode operated as a plate rectifier. Since its plate circuit contains a large I.F. component in addition to the desired audio frequencies a filter is necessary to remove it, otherwise undesirable feed back would result.

High-Power Output

The output tube is a "47," resistance capacity coupled to the second or intermediate frequency detector. An output transformer as mounted underneath the chassis with its secondary connected to the speaker terminal block at the rear edge of the chassis, and is designed to operate any speaker, either magnetic or dynamic (or permanent magnet dynamic), having an input impedance of the order of 4000 ohms. A tap on the secondary of the output transformer is connected through a resistor to the jack on the front panel, thus providing head-phone reception at reduced volume and with a minimum of hum.

WINDING DATA ON COILS FOR NEW COMET "PRO"

W.L. Coils (to be wound on standard forms)

Coil No.	Wavelength Range	Primary Turns	Primary Wire Size	Secondary Turns	Secondary Wire Size	T.P.I
AA W.L.	15-31	3	No. 30 DSC	7	No. 20 DSC	6
BB W.L.	28-61	3	" "	16	" "	12
CC W.L.	56-120	4	" "	29	" "	24
DD W.L.	115-250	5	" "	55	10/41 Silk Litz	56
EE W.L.	250-550	8	" "	136*	10/41-two bank, Silk Litz	

TPI equals Turns per Inch.

*The turns given are a guide only—the inductance should be 1½ or 2% greater than our present No. 5-W.L. coil.

OSC Coils (to be wound on new forms with holes for tap—these coils have no primaries).

Coil No.	Wavelength Range	Turns	Wire Size	T.P.I	
AA—OSC	15-31	7	No. 20-DSC	6	Tap at 1 2/3 turns from bottom
BB—OSC	28-61	14	" "	12	Tap at 2 2/3 turns from bottom
CC—OSC	56-120	23	" "	24	Tap at 4 2/3 turns from bottom
DD—OSC	115-250	39	28-SSC	56	Tap at 9 2/3 turns from bottom
EE—OSC	250-550	80	28-SSC	60	Tap at 16 2/3 turns from bottom

All taps to be soldered to the "P" terminal of coils CC-W.L., DD-W.L., CC-OSC and DD-OSC; coils also to have jumpers between the "G" terminal and the "H" terminal next to the "K" terminal.

Forms 1 and 7 sixteenths inch diameter

A very important feature of the Comet "Pro" is the intermediate oscillator, which can be started and stopped by the toggle switch on the panel. It consists of a "58" tube and associated circuits permanently adjusted to oscillate at the intermediate frequency of 465 kc. Like the high-frequency oscillator, it is also of the "electronic coupled" type.

This feature was designed primarily for the reception of pure C.W. code signals.

Comet "Pro" Tuning Condenser Data: Referring to the diagram, the tuning and oscillator variable capacitors have the following values: C1—138 mmf., C2—15 mmf., C3—26 mmf.

The trimmers across the two coils in each I.F. transformer each has 140 mmf. (max.) Each coil in the I.F. transformers has 1.2 millihenries inductance (1,200 microhenries) and are especially wound on a machine, the coils being about ⅜"x⅜" in cross-section.

The plate rectifier chokes (iron core) have about 30 henries inductance each.

The capacity X is an infinitely small capacity, equivalent to the capacity between lead wires or that between the edges of two small lugs fastened near together on the tube base.

Direct Reading Ohmmeter

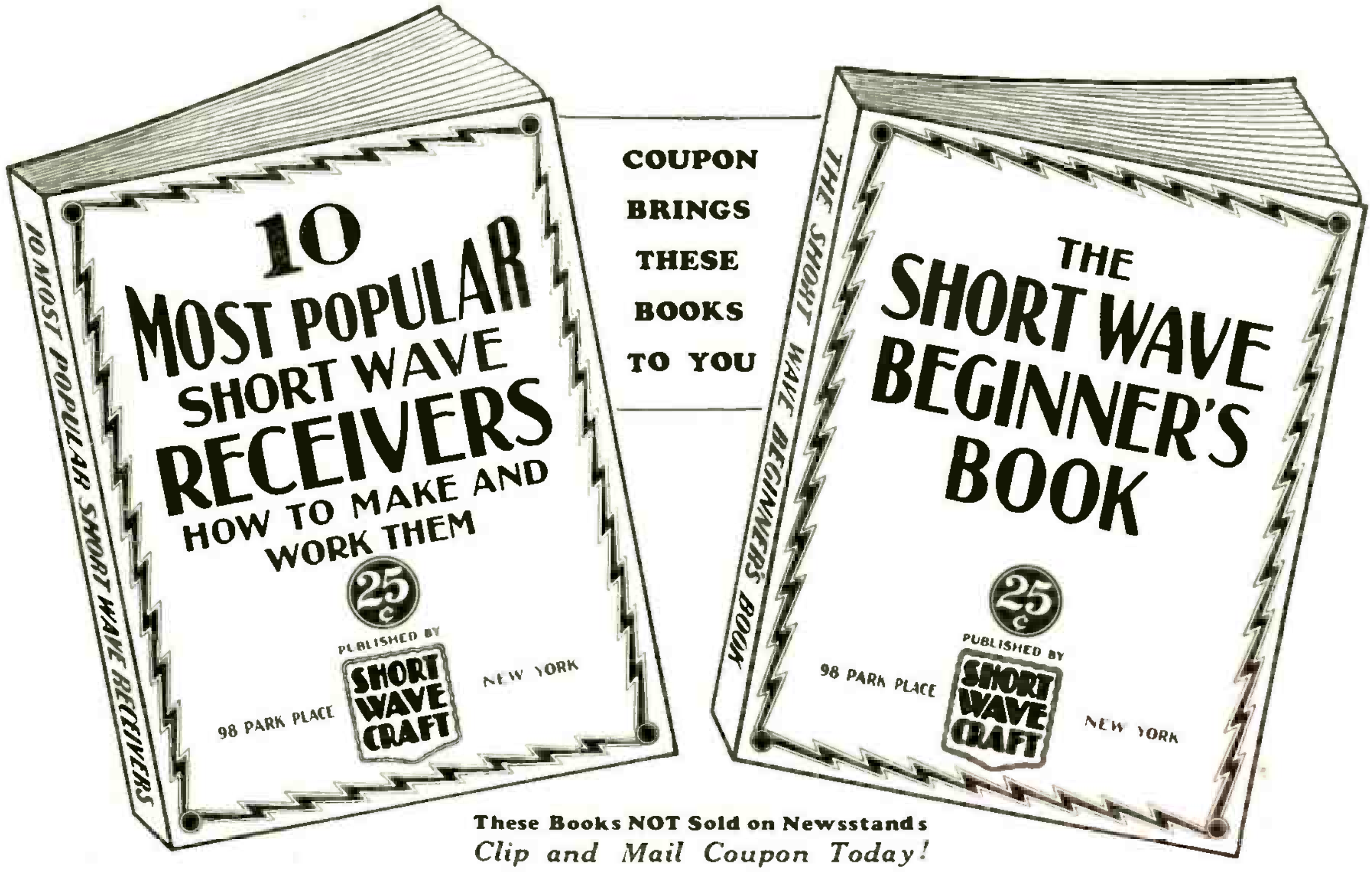
(Continued from page 615)

the 10,000 to 100,000 the milliammeter is adjusted to full scale. These readings are an adaptation of Ohm's Law, which states that R equals E over I.

One thing had best be kept in mind. If the approximate value of the resistance is unknown, it is safest to have one of the shunts on when first turning the battery switch on, as a low resistance under test might cause damage to the meter.

New! New!! New!!!

TWO NEW 25c SHORT WAVE BOOKS



These Books NOT Sold on Newsstands
Clip and Mail Coupon Today!

HERE IS GREAT NEWS

PURSUANT to many requests from our readers, we have decided to publish two new popular short wave books, for which there is a persistent demand at this time.

These new books contain everything on the subjects worth knowing and both books will be welcomed by all short wave experimenters, short wave fans and short wave enthusiasts, the same as our former two books HOW TO BUILD AND OPERATE SHORT WAVE RECEIVERS, and HOW TO BECOME AN AMATEUR RADIO OPERATOR were welcomed by thousands of our short wave friends.

In conformity with the times these books have been priced at 25c instead of 50c, which is the price of our other books. Yet the two new 25c volumes that we are offering now contain a tremendous amount of information and the type and illustrations have been chosen in such a manner as to give you almost as much for your 25c as you received for your 50c before. Only by increasing the press run enormously and making other printing economies has it been possible to price these books at such a low, popular price.

You will make no mistake in getting either or both of these new and popular books and we know in advance from our many years of experience with short wave enthusiasts that you will thank us for having made these books possible.

Ten Most Popular Short Wave Receivers. How to Make and Work Them

This new volume will be a revelation to all those who wish to build their own short wave receivers. The editors of SHORT WAVE CRAFT over a period of years have learned to know exactly what short wave experimenters and short wave set builders want to get. For that reason they have selected ten outstanding short wave receivers and these are described in the new volume. Everything worthwhile about every one of the ten receivers is described in the text. Each receiver is fully illustrated and each receiver has a complete layout, pictorial representation, photographs of the set complete, hookup and all worthwhile specifications, so there is *nothing left to your imagination* when it comes to building any one of these ten popular receivers. Everything from the simplest one tube set to a six tube superheterodyne is presented. Complete lists of parts are given to make each set as complete as it is humanly possible to do. You can select any or all receivers and know beforehand that you will be able to successfully build and operate such a receiver and not waste your money in building some theorist's dream-child. You will also be shown how to operate the receiver to its maximum efficiency.

IMPORTANT

THERE IS NO DUPLICATION WHATSOEVER BETWEEN THIS BOOK AND OUR OTHER VOLUME —"HOW TO BUILD AND OPERATE SHORT WAVE RECEIVERS." ALL THE MATERIAL PUBLISHED IN THE NEW BOOK HAS NEVER APPEARED IN ANY BOOK BEFORE.

This book has been edited by the editors of SHORT WAVE CRAFT, which alone is a guarantee that you will get satisfaction and that nothing has been left undone to give you between two covers the greatest selection of short wave receivers ever published.

PRICE 25c PREPAID 40 PAGES
OVER 75 ILLUSTRATIONS

A Short Wave Beginners Book

Here is a book that will solve your problems if you are new to the short wave game. It contains positively everything that you would wish to know in connection with short waves, leading you in easy stages from the simplest fundamentals to the present stage of the art in short waves as it is known today. It is the only low-priced reference book on short waves for the beginner, whether he be a short wave enthusiast, short wave listener or short wave amateur.

The book is profusely illustrated with all sorts of illustrations, explanations and everything worthwhile knowing about short waves in this interesting and growing field. Yet withal, the book is not "technical." It has no mathematics, no "highfaluting" language and no technical jargon which would only serve to frighten you away. *The entire book is kept in popular language throughout.* Wherever technical words are used, explanations are given, leaving nothing to the imagination. You are shown how to interpret a diagram and a few simple sets are also given to show you how to go about it in making them. Yet everything has been done to make it possible to give you a complete understanding of short waves from the ground up.

After reading this book, you will never be at a loss for short wave terms and you will not have to consult other text-books or dictionaries. The editors of SHORT WAVE CRAFT who have edited this book have seen to it that everything has been done to make this volume an important one that will be used as reference for years to come by all those who wish to break into the short wave art. The book covers everything, "from soup to nuts" and will be of tremendous importance to everyone.

It abounds with many illustrations, photographs, simple charts, hookups, etc., all in simple language. It also gives you a tremendous amount of very important information which you usually do not find in other books, such as time conversion tables, all about aerials, noise eliminating, how to get verification cards from foreign stations, all about radio tubes, data on coil winding and dozens of other subjects.

The book is just chock full of information and you will never regret having gotten this important volume. You will keep referring to it every day in your work.

PRICE 25c PREPAID 40 PAGES
OVER 75 ILLUSTRATIONS

SHORT WAVE CRAFT, #SW-233
96-98 Park Place, New York City.

Gentlemen:

☐ I enclose herewith 25c, for which please send me as soon as published, prepaid, a copy of your new book **"Ten Most Popular Short Wave Receivers. How to Make and Work Them."** The book to be sent to me immediately upon publication.

☐ I enclose herewith 25c for which please send me as soon as published, prepaid, a copy of your new book **"The Short Wave Beginners Book."** The book to be sent to me immediately upon publication.

☐ I enclose 60c for which please send me, prepaid, as soon as published, your two books, **"Ten Most Popular Short Wave Receivers. How to Make and Work Them,"** and **"The Short Wave Beginner's Book."** The books to be sent to me immediately upon publication.

(Send money order, check, cash or new U. S. stamps. Register letter if it contains currency or stamps).

Name ....

Address ....

City .... State ....

Two-Tube AC Band-Spreader Works Loud Speaker

(Continued from page 593)

coil. For band spread tuning, a Hammarlund 80 mmf. equalizing condenser is mounted in the top of the coil form, and is shunted directly across the grid coil. The method of tapping the coils to obtain band spread is shown in the diagram.

No switch is provided to turn off the whole receiver, as this would necessitate the running of the A.C. leads into the receiver. The only switch used is in series with the plate supply "B" negative lead, which is useful to transmitting amateurs as one does not have to wait for filament heating.

Antenna To Use

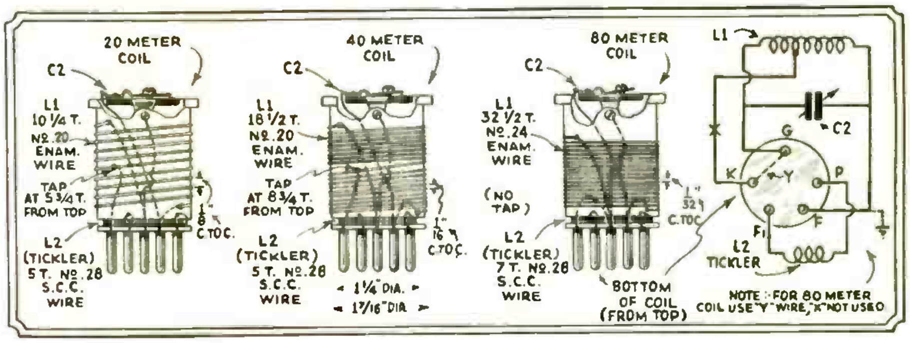
The antenna that was found best for this receiver was a long low wire. This type gives considerably less background noise. However, this receiver will pull in foreign stations with an antenna only ten feet long and the coupling condenser adjusted closer.

All negative leads are connected to the aluminum can, and the whole thing is "grounded."

For reception on the 100 to 200 meter band, the coil needs 42 turns in the grid coil and 11 turns in the plate coil; also an increase in the grid condenser tuning capacity, which should now be 100 mmf. instead of 35 mmf.

List of Parts

1—Blan 7x6x9 inch shield box
1—National type B dial
1—Eby antenna and ground unit
1—Eby phone tip unit
1—Yaxley switch
1—35 mmf. Hammarlund condenser
1—50,000 ohm (Clarostat) potentiometer
1—6 prong wafer socket Eby (Alden)
1—5 prong wafer socket Eby (Alden)
1—5 prong bakelite socket Eby (Alden)
4—80 mmf. Hammarlund equalizing condensers
2—2 meg. grid leaks, Lynch
1—250,000 ohm resistor, Lynch
1—1500 ohm resistor, Lynch
2—.002 mf. Aerovox condensers
1—.006 mf. Aerovox condensers
2—.5 mf. tubular Aerovox (Concourse) condensers
3—5 prong coil forms (National or Silver Marshall)



Coil details for Band-Spread Receiver.

The Short-Wave Beginner

(Continued from page 609)

without wires on the detector. The "C" (cathode) terminal is connected with a wire to the common ground terminal on the under side of the baseboard.

The filament wires must be quite heavy. The best thing for this purpose is twisted lamp cord. Solder one wire on each of the "F" terminals of the detector socket and solder the other ends of these wires to the two binding posts on the left in the rear of the set (the two that were formerly used for the "C−" and "A+" battery terminals).

Connect the wire from the "G" terminal on the transformer to the "G" terminal on the new audio tube socket. Resolder the "P" socket terminal to the front "phone" binding post. Connect another piece of the twisted lamp cord to the two "F" terminals and wire them to the "F" terminals on the detector socket, so that the two are connected together.

We have two new pieces of apparatus that have not yet been connected in the set. They are the 2,700 ohm resistor and the 1 mf. condenser. These are mounted on the baseboard near the "C" terminal on the amplifier socket as shown. Take a piece of wire and solder it to the latter terminal and connect the other end to one terminal on both the resistor and the condenser. Then with another piece of wire, connect the other terminal on each of these two parts to the common ground wiring. The last wire in the set is the one connecting between the "F" terminal on the transformer which also connects to the common ground wiring.

This completes the changes in the set wiring. You will notice by looking at the wiring diagram that the binding posts at the back of the set have been redesignated. The two left terminals are connected with a piece of twisted lamp cord to the A and B binding posts on the amplifier and power unit. The third from the left is the "B−", which connects to the H post on the amplifier and the last connection is the "B+" which connects to the G binding post.

We are now ready to try the set. Turn the power switch on the amplifier to the ON position—this turns on the entire set. The filament rheostat of the set is left without any connections, although, if a really neat job is desired, the power switch on the amplifier can be transferred to the set panel, in the position occupied by the rheostat.

Operating the Set

When the power switch is turned on, the filaments on all the tubes, both in the set and the amplifier, should light. It is best to connect the phones to the binding posts on the set, to try it. Tune the set in the usual way, using the volume control to control the regeneration. If the set oscillates too freely, move the position of the "G" contact on the voltage divider resistor to a lower position (R3 in the amplifier last month). If the set will not oscillate over the complete band, move the band higher.

Letters from Short Wave Fans

(Continued from page 614)

WE HANG OUR HEADS

Editor, SHORT WAVE CRAFT:

I have been a reader of your magazine, SHORT WAVE CRAFT, for several years. Am also an ardent radio enthusiast and have operated Amateur Radio Station W8AKF very consistently, using both "fone" and "C.W." I am sure this call is very familiar to many of your readers.

If you will go over the issues of SHORT WAVE CRAFT for the past year you can find retarding articles in each issue. The one in particular which has caused so much concern among the "fone" operators, is in the February-March, 1932, issue and features an "Inexpensive Fone Transmitter." You have informed your readers in the December-January issue that an oscillator could not be successfully modulated and directly in the next issue reverse your opinion and tell them how satisfactory it is to modulate an oscillator by the absorption principle. I hope this article was not taken to heart by our younger brothers and put to use, as conditions on the "fone" bands do not warrant such antique equipment.

I suppose you realize the "amateur fraternity" depends on your publication as a source of advanced information concerning radio transmitting and receiving, with better operating conditions and practices as their objective. I trust in the future you will give this your deepest consideration and publish and feature articles which will be forward and constructive and thereby impress on the minds of your readers who, in most cases, are amateur operators of today or tomorrow, modern ideals of the fraternity.

I believe in so doing SHORT WAVE CRAFT and all the amateur operators and short wave listeners will be greatly benefited. I sincerely believe this note has expressed the ideals of thousands and if I may be of service to regarding any radio activities I will be glad to do so to the best of my ability.

Yours for cooperation,
MARVIN W. SHELLHAMER,
Amateur Radio tation W8AKF,
The Voice of the Anthracite Coal Region,
258 Brown St., Tamaqua,
Schuylkill County, Pa.

(Thanks a lot, Marvin, and we will bear in mind what you have to say regarding future articles on 'phone transmitters. We should have labeled the article you speak of with a blurb stating that the loop transmitters are of particular interest to students of the subject and that they are not desirable for everyday use by amateurs. We understand that the loop absorption modulators are used in some of the portable army radiophone transmitters.

The editors had the thought in mind that the principle involved would be of interest to new students of short waves, but as you suggest, the loop absorption method might be taken too strongly to heart by some of them. Thanks again for the suggestion.—Editor.)

2-Tube Portable All Wave Receiver

(Continued from page 587)

The regeneration control, a 50,000 ohm Carter variable resistor, is mounted on the right-hand panel. The ear phones are connected to the set by an Eby phone post strip mounted next to the regeneration control. The grid-leak leads are soldered directly to the leak to conserve space.

The tube sockets selected were spring suspension sockets, selected not because of size, but because it was thought they would be useful when set was to be used in portable auto receiving.

The rheostat, switch and binding posts are all mounted on the rear panel. The left panel supports the 13 plate Pilot midget "band spread" condenser, the antenna and ground binding posts and the coil socket.

In order to wire the set, it was found necessary to have the front panel, as well as the top of the shield can removed most of the time, and for this reason it was decided to mount only the main tuning condenser on the front and have this panel readily removable. This was accomplished by having the stator connection on the condenser made by a "free" wire with a forked clip soldered on the end and fastened to the condenser by a nut provided for that purpose.

The use of such a small condenser as a pilot 5 plate midget for a main tuning condenser provides good band spreading and eliminates the need for a vernier dial, which is always hard to mount on an aluminum panel.

Rubber feet are provided to eliminate noises when the set is operated on a metal surface. Another precaution necessary to prevent noise is to tighten the upper corners of the corner posts by squeezing with pliers and then forcing the sides into them, otherwise the corners and corner posts will create excess noises and at times the set will refuse to operate altogether when this condition is present.

The only really novel part of the circuit is the extra by-pass condenser C2. This was found a great aid to smooth regeneration and also to prevent *fringe howl*, and while not necessary in ordinary two-tube regeneratives, it is necessary here probably because of the close placement of parts and the resultant intercoupling and need for extra by-passing. This condenser and also condenser C1 are both mounted on top of the 85 millihenry R. F. C. by means of friction tape.

The 1 mf. regeneration control resistor is mounted on the lower left of the rear panel.

The coils are all wound on UX tube bases and the tickler coils are wound on the finger tips, tied with thread, and mounted simply by inserting the wires in the prongs and soldering. The coils are wound as follows:

	Secondary	Primary
20 meters	7 turns No. 22 D. C. C.	6 turns No. 32 D. C. C.
20 "	9 " ditto	7 " ditto
40 "	17 " ditto	8 " ditto
80 "	21 " ditto	7 " ditto
80 "	28 " ditto	7 " ditto
Broadcast	90 turns No. 36 S. S. C.	10 turns No. 22 D. C. C.

Reinartz Next Month!

● Due to unavoidable circumstances this month's installment of John L. Reinartz's series—"How to Become A Radio Amateur"—had to be postponed till next issue.

Novel Short-Wave Coil Ideas

(Continued from page 587)

support the coil sections, while each unit is permanently held in place by the slot walls. By marking off the slots on the surface of the tube, they can be cut by a hacksaw into which two or three blades can be fitted at the some time, so as to cut a slot of the desired width. If access is had to a milling machine or a lathe then a saw or milling cutter can be used to cut the slots in the tube. The ridges, B, may be sunk to the depth of the inner tube surface by placing one tight-fitting tube within another and allowing the ridges B to be formed on the second tube.

$20.00 Prize Monthly For Best Set

● THE editors offer a $20.00 monthly prize for the best short-wave receiver submitted.

If your set does not receive the monthly prize you still have a chance to win cash money, as the editors will be glad to pay space rates for any articles accepted and published in SHORT WAVE CRAFT.

You had better write the "S-W Contest Editor," giving him a short description of the set and a diagram, BEFORE SHIPPING THE ACTUAL SET, as it will save time and expense all around. A $20.00 prize will be paid each month for an article describing the best short-wave receiver, converter, or adapter. Sets should not have more than five tubes and those adapted to the wants of the average beginner are much in demand.

Sets must be sent PREPAID and should be CAREFULLY PACKED in a WOODEN box!

The closing date for each contest is sixty days preceding date of issue (January 1 for the March issue, etc.)

The judges will be the editors of SHORT WAVE CRAFT, and Robert Hertzberg and Clifford E. Denton, who will also serve on the examining board. Their findings will be final.

Articles with complete coil, resistor and condenser values, together with diagram, must accompany each entry. All sets will be returned prepaid after publication.

REQUIREMENTS: Good workmanship always commands prize-winning attention on the part of the judges; neat wiring is practically imperative. Other important features the judges will note are: COMPACTNESS, NEW CIRCUIT FEATURES, and PORTABILITY. The sets may be A.C. or battery-operated, Straight Short-Wave Receivers, Short-Wave Converters, or Short-Wave Adapters. No manufactured sets will be considered: EVERY SET MUST BE BUILT BY THE ENTRANT. Tubes, batteries, etc., may be submitted with the set if desired, but this is not essential. NO THEORETICAL DESIGNS WILL BE CONSIDERED! The set must be actually built and in working order. Employees and their families of SHORT WAVE CRAFT are excluded. Address letters and packages to the SHORT WAVE CONTEST EDITOR, care of SHORT WAVE CRAFT Magazine, 96-98 Park Place, New York, N. Y.

See page 635 for
IMPORTANT
Announcement on
NEW BOOKS

DOERLE WORLD-WIDE Receivers

Official Doerle Receivers

THERE have never been produced short-wave receivers which have taken the whole country by storm as much as the now famous DOERLE Receivers. Mr. Doerle described his first receiver, the now famous TWO TUBE 12,500 MILE RECEIVER in the December-January issue of SHORT WAVE CRAFT. You have seen the many letters published in SHORT WAVE CRAFT lauding this receiver to the skies, and for a good reason. It is a low-priced receiver, yet, pulls in short-wave stations from all over the world, REGULARLY, in practically any location, not only in this country, but anywhere. Thousands of experimenters have built their own, and have obtained miraculous results, as hundreds of glowing testimonial letters from radio fans testify.

Recently, Mr. Doerle brought out another receiver, the THREE TUBE SIGNAL GRIPPER, which already has started to make history. There is no question that the three tube job will also make its triumphant tour all over the world.

We repeat that we do not believe that there are two more efficient and practical low-priced short-wave receivers in existence today at the present stage of the art than the Doerle TWO TUBE 12,500 MILE RECEIVER and THREE TUBE SIGNAL GRIPPER.

In the course of the year, we have received many requests for these receivers, and we have sold a great many parts for both receivers, but not until recently have we concluded our tests which now places us in a position to supply the two complete receivers so that you can either buy them completely wired or in kit form.

By special arrangement with the publishers of SHORT WAVE CRAFT, we are now in a position to sell you these official receivers so that all short wave enthusiasts who ever wished to own either of these fine sets can now be sure to buy them without a question in their minds that they will perform 100%.

It took a lot of labor, and much ingenuity to collect the correct parts to make sure that each receiver would work under all circumstances. This means that all the usual "bugs" have been ironed out by us in such a way that you may order every receiver with full confidence, that in practically every location, anywhere, "they will do their stuff."

ONLY FIRST CLASS PARTS USED

It may be possible to buy the parts of the completed sets at a lower price. We admit this at once. But if you will look over our parts list, you will find that *only first class material is used*. We have done away with all losses. There is no *"hand capacity."* IN THESE TWO SETS ONLY THE BEST CONDENSERS—AND THAT MEANS HAMMARLUND—ARE USED. The sets could be produced for a considerabl less amount if we used cheaper condensers. We have refrained from doing so because w wanted a first class product. And this goes for everything else in the sets. They are low i price, yet the quality is excellent considering the low price. Thus, for instance, we are using Kurtz-Kasch dials because we found them excellent for their purpose, and as everyone knows, they are really first class verniers. The baseboards are of laminated well-seasoned veneer wood, that will not warp. Panels are polished aluminum, on which the condensers and other parts are mounted. These panels do away with hand capacity. The plug-in coils are of Bakelite, wound with enamel wire for low losses. In short, despite the exceedingly low price of these sets, we give you quality. Bakelite sockets only are used. Even the aerial condensers are of the Micamold Equalizing type. We have even included pin-tip jacks, rheostats with switch and binding post strips of Bakelite to keep down losses.

In short, you will be pleased not only with the business-like appearance, but with the performance as well.

WHAT THEY SAY!

"Does All You Say"

I have built the *Doerle* short wave receiver and I want to say it does all you say it will.

J. Joseph Whalley, 401 Springdale Street, Cumberland, Md.

Some List!

Have just completed your *Doerle* two-tuber. I received the following on the loudspeaker: XDA, LQA, GMB, VE9DR, VE9GW, KKQ, W1XAZ, W2XAF, W3XAL, W3XAU, W2XAB, W8XK, W8XAL, W9XF, W9XAA, Bermuda, Honolulu, Budapest, Hungary, and "hams" in 38 states.

Maurice Krasy, R. F. D. 1, Hammond, Ind.

This Is Going Some!

Today is my third day for working the *Doerle* set, and to date I have received over fifty stations. Some of the more distant ones I shall list. From my home in Maplewood, N. J., I received the following: WVR, Atlanta, Ga.; WGK, Ohio; W9BHM, Ft. Wayne, Ind.; W9AYS, Elgin, Ill.; W8ERK, Girard, Ohio; and, best of all, XDA, Mexico, PZA, Surinam, South America; TIR, Cartago, Costa Rica; G2WM, Leicester, England. I have also received stations WDC and PJQ, which I have not found listed in the call book.

That's not a bad record for three days on a two-tube job, is it? I will answer any questions concerning the *Doerle* set.

Jack Prior, 9 Mosswood Terrace, Maplewood, N. J.

A Good Word for the Doerle

I would like to put a word in for the *Doerle* 12,500 mile receiver. I recommend this set to all "set wreckers" in a big way! Hoping that this set "perks" for all "hams" in a big way.

H. J. Keilholtz, 1508 Belt Street, Baltimore, Md.

A Doerle Enthusiast

I have just completed my two-tube *Doerle*, and it surely is a great receiver! It works fine on all the wavebands. Nobody could wish for any better job than this one. I can get W8XK and W9XAA to work on the loudspeaker at night, and the code stations come in with a wallop behind them.

Samuel E. Smith, Lock Box 241, Grayling, Mich.

Only by making these sets in quantities can we afford to sell them at the extremely low prices quoted.

Note the testimonials printed on this page. They will give you an idea what can be expected from these great sets.

HOW DO THE TWO SETS DIFFER?

The TWO TUBE 12,500 MILE SHORT-WAVE SET is intended to be used with headphones, although it is bringing in, right along, stations on the loudspeaker. We, however, do not make such a claim. For instance, stations 5,000 and 10,000 miles away come in only on headphones. This set uses two 230 two-volt battery type tubes.

The THREE TUBE SIGNAL GRIPPER, as its name indicates, is a three tube set. It also uses the 230 type battery tubes. It is a great deal more powerful than the smaller set, and will bring in stations from great distances on the loudspeaker. A good magnetic loudspeaker should be used. Thus, for instance, stations from all over the country come in on the loudspeaker, but, of course, stations 12,000 miles distant require the use of earphones.

The price of the two sets include a set of plug-in coils. Both sets are operated from ordinary dry cells. The "B" battery supply can be either 90 volts or 135 volts for the THREE TUBE SIGNAL GRIPPER. For the TWO TUBE SET, 90 volts is sufficient.

Both sets tune exceedingly easy, and the oscillation control is always under full control of the operator. The vernier dials are accurate so that stations can be logged and found in their allotted positions every time you use the set.

OUR OWN TESTS

Both sets have been tested by us, and we found that they do all and more claimed by Mr. Doerle, and other enthusiasts who built the sets. We refrain from giving you the astonishing list of stations which we ourselves have logged because we do not wish to let our enthusiasm run away with us, and because you might not believe the actual results accomplished with this set. We much rather have others talk about the results.

Incidentally, we have, as yet, to receive a single complaint on these sets, although we sold a large quantity of parts for both of them.

Two Tube 12,500 Mile Doerle Receiver

$8.90

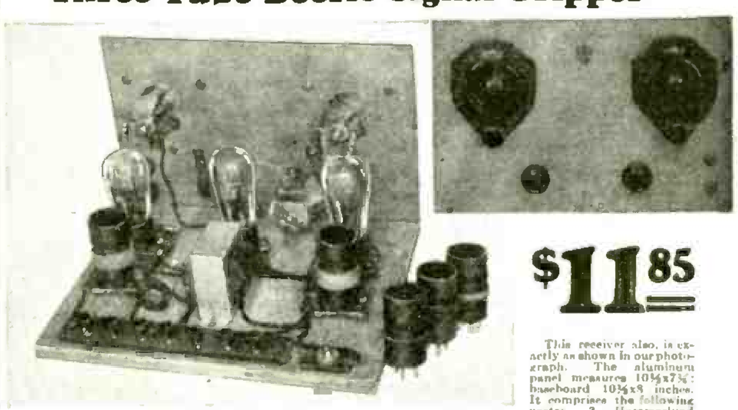
This receiver is exactly as illustrated in our photographs. Size of aluminum panel is 9x6¼ inches; base 9x5½ inches. List of material used: 2 Hammarlund .00014 Condensers; 1 Carter 20 ohm Rheostat and Switch; 1 Peerless Audio Transformer; 2 Kurtz-Kasch Vernier Dials; 3 Bakelite Low Loss Sockets; 1 Micamold Equalizer Antenna Condenser; 1-.0001 Aerovox Fixed Condenser; 1-5 megohm Carborundum Grid Leak; 2 Telephone Pin Jacks; 1 Aluminum Panel; 1 Veneer Baseboard; 1 Bakelite Rheostat Knob; 1 Bakelite Binding Post Strip; 1 set of 4 Bakelite Short Wave Plug-In Coils; Instructions for Operation; 1 Set of Hardware, Wire, etc. Complete shipping weight 5 lbs.

No. 2140. TWO TUBE 12,500 MILE DOERLE SHORT WAVE RECEIVER, completely wired and tested as per above specifications YOUR PRICE **$8.90**

No. 2141. TWO TUBE 12,500 MILE DOERLE SHORT WAVE RECEIVER KIT, with all parts as specified above, *but not wired*, with blueprint connections and instructions for operation. Complete shipping weight 5 lbs. YOUR PRICE **$7.70**

No. 2142. Complete set of accessories, including the following: 2 six months guaranteed Neontron type No. 230 tubes; one set of No. 1678 Brandes Matched Headphones; 2 No. 6 standard dry cells; 2 standard 45-volt "B" batteries, complete, shipping weight 22 lbs. YOUR PRICE **$5.40**

Three Tube Doerle Signal Gripper



$11.85

This receiver also, is exactly as shown in our photograph. The aluminum panel measures 10⅝x7⅜; baseboard 10⅝x8 inches. It comprises the following parts: 3 Hammarlund .00014 Tuning Condensers; 1 Carter 20 ohm Rheostat and Switch; 1 Peerless Audio Transformer; 2 Kurtz-Kasch Vernier Dials; 2 Sets of Short Wave Coils; 1-5 Megohm Carborundum Grid Leak; 2 RTC r.f. Chokes; 5 Bakelite Low Loss Sockets; 2 Micamold Equalizer Aerial Condensers; 1 Bakelite Binding Post Strip; 2 Telephone Pin Jacks; 2 Bakelite Knobs; 1 Aluminum Panel; 1 Veneer Baseboard, One Set of Directions and Instructions for Operation; 1 Set of Hardware, Wire, etc. Shipping weight 7 lbs.

No. 2143. THREE TUBE DOERLE SIGNAL GRIPPER, completely wired, ready to use. YOUR PRICE **$11.85**

No. 2144. THREE TUBE DOERLE SIGNAL GRIPPER KIT, with all parts as specified above, *but not wired* with blueprint connections and instructions for operation, complete. Shipping weight 7 lbs. YOUR PRICE **$10.50**

No. 2145. Complete set of accessories, including the following: 3 six months guaranteed Neontron type No. 230 tubes; one set of Brandes Matched Headphones; 2 No. 6 standard dry cells; 3 standard 45-volt "B" batteries, 1 B.B.L. 9 inch Cone Magnetic Loudspeaker, complete. Shipping weight 32 lbs. **$11.00**

GUARANTEE

We guarantee and warrant that all material furnished in the two sets described in this advertisement, whether in the completed set or in the kit form, is first class, in every respect; that the complete sets have been tested before shipping, and that we will stand back of these sets and kits in every way. We will replace any parts, with the exception of accidentally blown out vacuum tubes within three months, if parts are returned to us within that time.

PLEASE NOTE

We are short wave specialists. Please understand that the two sets here described are not the only ones which we produce. We can furnish parts, in kit form of practically any short wave receiver described in SHORT WAVE CRAFT or other radio magazines. Get our prices first. We will save you money.

ORDER FROM THIS PAGE — Send money order or certified check. C.O.D. only if 20% remittance accompanies all orders. Order NOW—TODAY

FREE 100-page Radio and Short Wave Treatise; 100 hook-ups, 1,000 illustrations. Enclose 4c for postage. Treatise sent by return mail.

RADIO TRADING COMPANY, 100A Park Place, New York City

SWAPPERS

SWAPPERS are swappers of correspondence. During the past few years we have noted that Short-Wave enthusiasts love to get acquainted with each other by mail in order to swap experiences.

Use a postcard only. Never write a letter. Address postcard as follows:

SWAPPERS, c/o SHORT WAVE CRAFT, 96-98 PARK PLACE, NEW YORK, N. Y.

On the blank side of the postal PRINT clearly your name, address, city and State; nothing else! No charge for this service.—EDITOR.

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In their own secluded laboratory, these engineers, with slide rule, meter and microscope are always making improvements and double checking Certified Triad production.

PROTECTION

Hundreds of skilled young ladies find interesting and profitable employment, making "small parts" for Certified Triads.

for SERVICEMEN

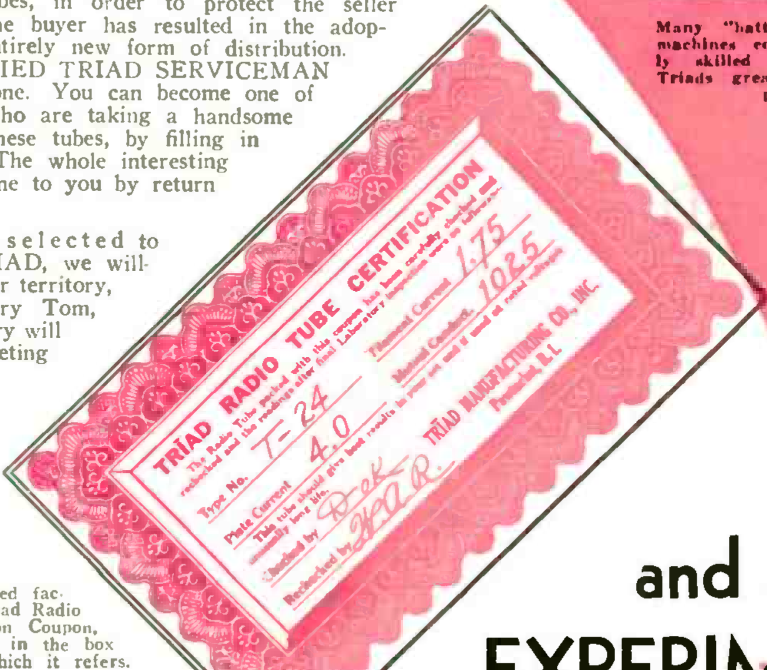
CERTIFIED TRIAD TUBES are the result of many years' experience. All the guesswork has been eliminated. They are designed, manufactured and tested by the most modern machinery. They are produced by skilled operators. No better tubes can be bought.

A complete study of the proper method of merchandising tubes, in order to protect the seller as well as the buyer has resulted in the adoption of an entirely new form of distribution. The CERTIFIED TRIAD SERVICEMAN is the key stone. You can become one of the agents, who are taking a handsome profit from these tubes, by filling in the coupon. The whole interesting story will come to you by return mail.

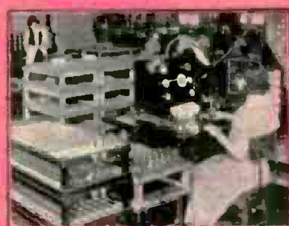
If you are selected to represent TRIAD, we will protect your territory, for you. Every Tom, Dick and Harry will not be competing with you.

Write for full information

Many "batteries" of sealing machines controlled by highly skilled co-workers make Triads great production possible.



This is a reduced facsimile of the Triad Radio Tube Certification Coupon, which is sealed in the box with tube to which it refers.



At the end of every production line, the tubes are given their first check. Ten characteristics are checked here. Even this is more than is done with the average tube, but it is not enough for "Double-Checked," Certified Triads.

and EXPERIMENTERS

Even a good radio receiver will sound like "nothing at all" if it is equipped with poor tubes. Most people realize that the radio tube is the heart of their receiver. Ordinary tubes can be bought for a song, but you usually get what you pay for. No one expects to get Cadillac or Lincoln service from an Austin. No one looks for custom-made shoes for three dollars. Those who expect the very best performance from inferior tubes are not logical and they are sure to be disappointed. No form of entertainment is as inexpensive as radio. Isn't it good business to keep it working at its best? You can be sure of doing so by insisting on CERTIFIED TRIAD TUBES. *A line to us will enable us to send you the CERTIFIED TRIAD SERVICEMAN, we have selected to serve your vicinity.*

The TRIAD LINE is complete. It includes all types of standard Tubes as well as Photo-Electric Cells and Television Tubes

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Please send me full information and prices on the complete line of Certified Triad tubes. Check shows my field of interest in Short Waves and Television.

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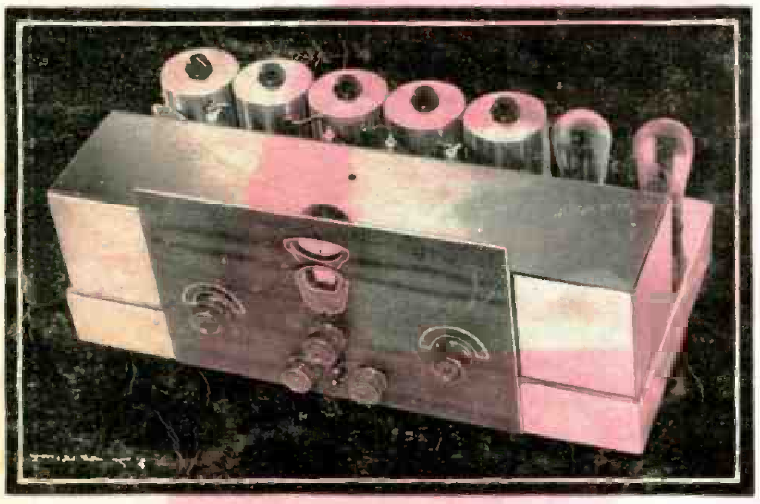

Lincoln De Luxe
All Wave Superheterodyne

15 TO 550 METERS

With undistorted amplification made possible thru Lincoln's foresight in development of new triple push pull detector and audio system.

Automatic Volume Control
Signal Indicator
Four High Gain I. F. Stages

BRING THE WORLD RIGHT INTO YOUR HOME

with proven equipment used by the MacMillan Polar Expedition, Commercial Experts and Individuals the world over.

SUPER POWER of the New Twelve-Tube Lincoln DeLuxe SW-33, coupled with the new Lincoln developments, guarantees to you real radio reception of unlimited distance.

If you have never tuned the new Lincoln you have missed the treat of your life.

Just tune to a European station which ordinarily fades completely out at times, and note how the Lincoln new automatic volume control holds the signal at a perfect level.

Watch the signal indicator register the weakest signal, and then tune to the exact center of the carrier wave with absolute precision.

When you wish to tune late at night, open up the sensitivity control wide, and reduce volume control to whisper.

Throw in the 53 to 1 ratio on the dial for ease in tuning high frequencies.

Open up the volume control to the limit and shake the floor with the tremendous amplification, without distortion.

Listen to the heavy bass vibratory notes produced by the use of the push-pull detector followed by two stages of push-pull audio and reproduced in the finest auditorium type speaker we can procure.

Note the high sensitivity provided by four tuned stages of intermediate amplification—just tune in a foreign station—you will want the volume control opened only a few degrees.

Just note what a recent Lincoln owner in Java (a country with extremely bad weather conditions, and mineral deposits, making high noise intereference) says about the new Lincoln: "Foreign stations come in very loudly. Paris, Rome, Zeesen, Konigswusterhausen, Chelmsford and a score of other European stations come in clearly. Sydney, Queensland and Melbourne from Australia can be received with great volume; JIAA from Japan is consistently heard, while Pittsburgh and Schenectady have been received. Also on the broadcast band daily reception can be had from several European stations, Japan, Manila and China. I have heard of no other set that can equal your Lincoln."

Owners of the first Lincoln models are still proud of their performance.

BATTERY RECEIVER uses eleven (11) two-volt tubes, and can be used in connection with the Air Cell or storage batteries.

Mail the coupon for Laboratory information and price. New York City territory write Valentine G. Hush, Division Drive, Dobbs Ferry, N. Y.

LINCOLN RADIO CORPORATION
Dept. SWC-16, 329 S. Wood St., Chicago, Ill.
Please send information on ☐ A.C. ☐ D.C. receivers.

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