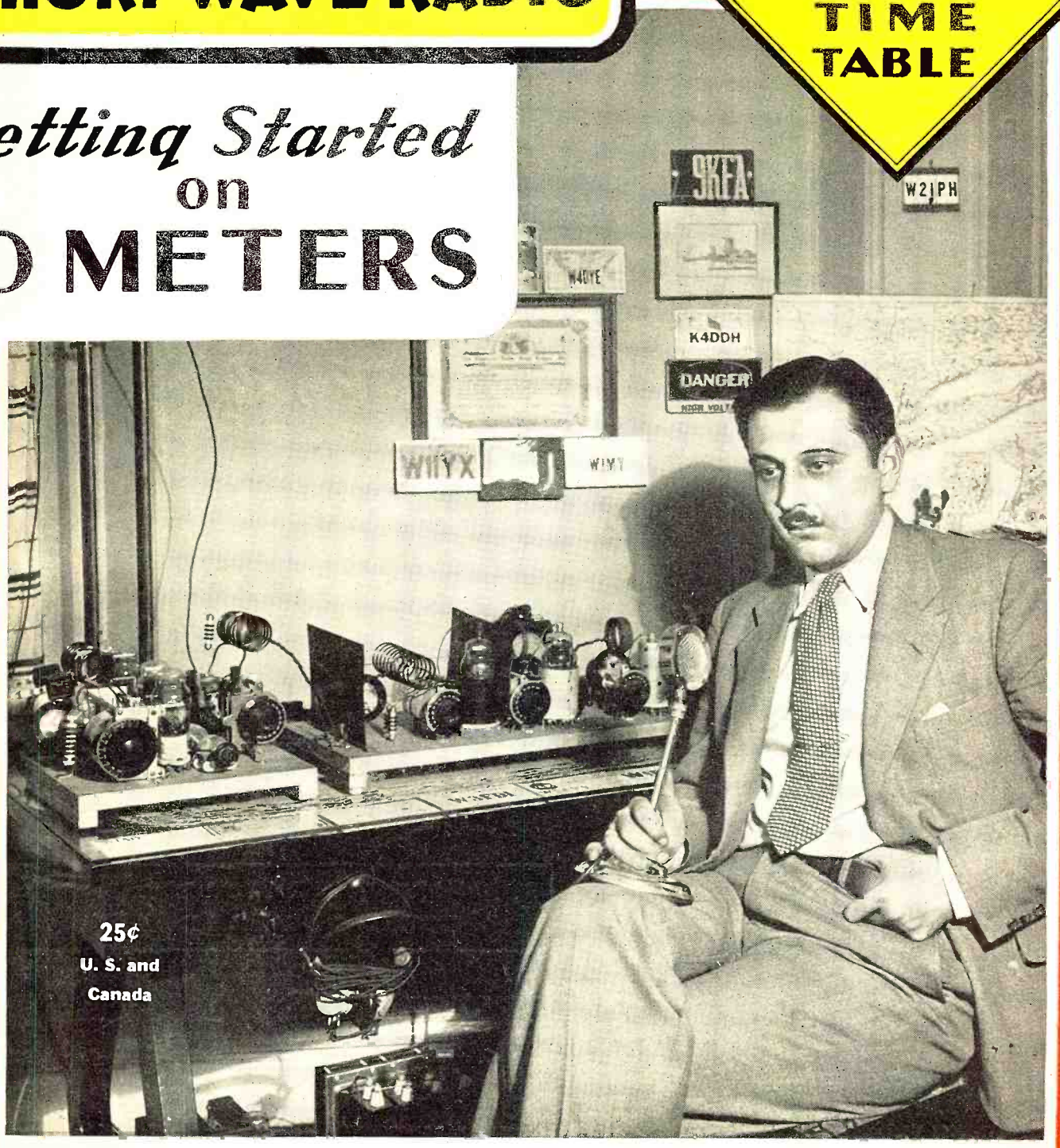
NEW SERVICE INSTRUMENTS

RADIO NEWS AND SHORT WAVE RADIO

SEPTEMBER

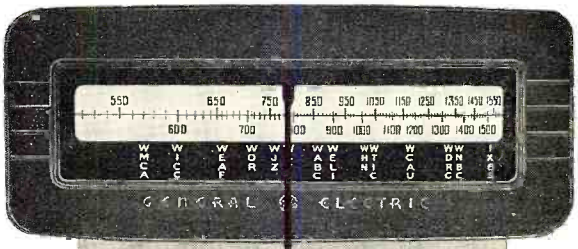
SHORT WAVE TIME TABLE

Getting Started on O METERS



25¢
U. S. and Canada

RESEARCH KEEPS GENERAL ELECTRIC YEARS AHEAD



AUTOMATICALLY! VISIBLY! INSTANTLY!

RADIO'S NEWEST MARVEL

Focused Tone

So packed with sensational improvements that you'll always be glad you bought a General Electric Radio.

WHAT IS FOCUSED TONE?

It is G.E.'s new radio circuit that AUTOMATICALLY and VISIBLY shifts itself into hair-line tuning — perfect tone. It is the new G-E Colorama Dial that changes from red to green to tell you that your program is perfectly tuned.

It is the Personalized Radio with the custom-tailored dial — your own local station letters flash on when you tune in.

It is Silent Tuning — you can switch from one program to another without a single squeal, squawk, or screech.

It is the combination of all the new and revolutionary G-E Radio inventions and developments — G-E Metal Tubes; G-E Sentry Box; G-E Stabilized Dynamic Speaker; G-E Sliding-rule Tuning Scale; G-E "V-doublet" All-wave Antenna — which give you the finest, truest tone of any radio ever built — that's Focused Tone! Only the new G-E gives it to you — AUTOMATICALLY! — VISIBLY! — INSTANTLY! — every time you tune in.

WATCH FOR YOUR LOCAL
G-E RADIO DEALER'S DISPLAY

GENERAL ELECTRIC

Focused Tone Radio

APPLIANCE AND MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONN.

J. E. SMITH
President
National Radio Institute

The man who has directed the home study training of more men for the Radio Industry than any other man in America.

I WILL TRAIN YOU TO START A SPARE TIME OR FULL TIME RADIO SERVICE BUSINESS WITHOUT CAPITAL

Do you want to make more money? The world-wide use of Radio has made many opportunities for you to have a spare time or full time Radio service business of your own. Three out of every four homes in the United States have Radio sets which regularly require repairs, servicing, new tubes, etc. Many sets are old and will soon be replaced by new models. I will train you at home in your spare time to sell, install, service, all types of Radio sets—to start your own Radio business and build it up on money you make in your spare time while learning. Mail coupon for my 64-page book. It's Free—it shows what I have done for others.

Many Make $5, $10, $15 a Week Extra In Spare Time While Learning

Practically every neighborhood needs a good spare time serviceman. The day you enroll I start sending you Extra Money Job Sheets. They show you how to do Radio repair jobs that you can cash in on quickly. Throughout your training I send you plans and ideas that have made good spare time money—from $200 to $500 a year—for hundreds of fellows. My Training is famous as "the Course that pays for itself."

There's a Real Future in Radio for Well Trained Men

Radio already gives jobs to more than 300,000 people. In 1935 over $300,000,000 worth of sets, tubes and parts were sold—an increase of 20% over 1934! Over 1,100,000 auto Radios were sold in 1935, 25% more than in 1934! 22,000,000 homes are today equipped with Radios, and every year millions of these sets go out of date and are replaced with newer models. Millions more need servicing, new tubes, repairs, etc. Broadcasting stations pay their employees (exclusive of artists) more than $23,000,000 a year! And Radio is a new industry, still growing fast! A few hundred $30, $50, $75-a-week jobs have grown to thousands in less than 20 years.

Get Ready Now for Your Own Radio Business and for Jobs Like These

Radio broadcasting stations employ engineers, operators, station managers and pay up to $5,000 a year. Spare time Radio set servicing pays as much as $200 to $500 a year—full time jobs with Radio jobbers, manufacturers and dealers, as much as $30, $50, $75 a week. Many Radio Experts own and operate their own full time or part time Radio sales and service businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, paying up to $6,000 a year. Radio operators on ships get good pay and see the world besides. Automobile, police, aviation, commercial Radio, and loud speaker systems are newer fields offering good opportunities now and for the future. Television promises to open many good jobs soon. Men I have trained are holding good jobs in these branches of Radio. Read their statements in my 64-page book. Mail the coupon.

I Send You Special Radio Equipment To Give You Practical Experience

My Course is not all book training. I send you special Radio equipment and show you how to conduct experiments and build circuits which illustrate important principles used in modern Radio receivers, broadcast stations and loud speaker installations. I show you how to build testing apparatus for use in spare time work from this equipment. You work out with your hands the things you read in the lesson books. My Free Book tells you about this 50-50 method of training—how it makes learning at home interesting, quick, fascinating, practical. Mail coupon.

Save Money—Learn At Home Money Back Agreement Protects You

I am so sure that I can train you at home successfully that I agree in writing to refund every penny you pay me if you are not satisfied with my Lessons and Instruction Service when you finish my Course. I'll send you a copy of this agreement with my Book.

Find Out What Radio Offers You Get My 64 Page Book Free Now

Act Today. Mail the coupon now for my Free Lesson and my book, "Rich Rewards in Radio." Both are free to anyone over 16 years old. My book describes Radio's spare time and full time opportunities and those coming in Television; tells about my Training in Radio and Television; shows you actual letters from men I have trained, telling what they are doing and earning. Find out what Radio offers YOU! MAIL THE COUPON in an envelope, or paste it on a penny post card—NOW!

HERE ARE A FEW EXAMPLES OF THE KIND OF MONEY I TRAIN MY MEN TO MAKE

EARNED $50 FIRST MONTH IN SPARE TIME

"I knew nothing about Radio. After four lessons I began servicing Radios, earning $50 the first month. Last winter I made as high as $100 a month in spare time."—G. F. WALTON, 808 West Olney Road, Norfolk, Va.

OWN BUSINESS PAYS $300 A MONTH

"I now have my own Radio business which shows three hundred dollars a month profit—thanks again to National Radio."—FRANK T. REESE, 39 N. Felton St., Philadelphia, Penna.

CHIEF OPERATOR BROADCASTING STATION

"When I completed 20 lessons, I obtained my Radio Broadcast Operator's license and immediately joined Station WMPC, where I am now Chief Operator."—HOLLIS F. HAYES, 85 Madison St., Lapeer, Mich.

Get My LESSON on Radio Servicing Tips FREE

I'll prove that my Training gives practical, money-making information, that it is easy to understand—that it is just *what you need* to master Radio. My sample lesson text, "Radio Receiver Troubles—their Cause and Remedy" covers a long list of Radio receiver troubles in A.C., D.C., battery, universal, auto, T. R. F., super-heterodyne, all-wave, and other types of sets. And a cross reference system gives you the probable cause and a quick way to locate and remedy these set troubles. A special section is devoted to receiver check-up, alignment, balancing, neutralizing and testing. Get this lesson *Free*. No obligation.

MAIL COUPON NOW

The Tested WAY to BETTER PAY

J. E. SMITH, President
National Radio Institute,
Dept. 6JR,
Washington, D. C.

GOOD FOR BOTH 64 PAGE BOOK SAMPLE LESSON FREE

J. E. Smith, President, Dept. 6JR
National Radio Institute, Washington, D. C.

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

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

Address.....

City..... State.....14x1

RADIO NEWS

Edited by Laurence Marsham Cockaday

S. Gordon Taylor, *Managing Editor* — William C. Dorf, *Associate Editor*

John M. Borst, *Technical Editor* — John H. Potts, *Assoc. Tech. Editor*

Joseph F. Odenbach, *Art Editor*

Vol. XVIII September, 1936 No. 3

Reading Guide to this Issue—

AMATEURS—4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 19, 23, 24, 26, 30, 31

BROADCAST FANS—4, 5, 6, 22, 23, 26, 31

DEALERS—1, 2, 4, 6, 8, 14, 15, 17, 18, 20, 22, 26, 28, 30, 31

DESIGNERS—3, 4, 8, 14, 16, 18, 20, 21, 30, 31

DX FANS—4, 6, 10, 22, 26, 30, 31, 34

ENGINEERS—4, 7, 16, 18, 19, 20, 21, 30, 31

EXPERIMENTERS—4, 5, 6, 7, 8, 13, 14, 16, 19, 20, 21, 22, 24, 30, 31

MANUFACTURERS—3, 14, 18, 30

OPERATORS—30, 31, 32

SERVICEMEN—1, 2, 3, 4, 6, 8, 14, 15, 16, 17, 18, 19, 20, 21, 24, 30, 31

SET BUILDERS—4, 5, 6, 8, 14, 16, 18, 19, 20, 21, 22, 24, 30, 31

SHORT-WAVE FANS—3, 4, 6, 10, 11, 14, 23, 25, 26, 27, 28, 30, 31, 33

STUDENTS—3, 4, 6, 7, 8, 14, 15, 16, 17, 19, 20 22, 24, 29, 30, 31

TECHNICIANS—1, 3, 4, 5, 6, 8, 14, 15, 16, 17, 18, 19, 20, 21, 24, 30, 31

Coming Next Month

Once in a "blue moon" a receiver that is fundamentally different comes along. Such a circuit will be described with full construction details next month. It is a "ham" receiver for operation on the 5, 10, and 20-meter bands and includes every refinement of modern design. Its outstanding feature is the use of a crystal, signal-frequency oscillator and a tunable i.f. amplifier to provide absolute stability of tuning and calibration. The design is by Frank H. Jones who is known the world over, for his amateur station CO6OM at Tuinucu, Cuba.

Published Monthly by Teck Publications, Inc., *Washington and South Avenues, Dunellen, N. J.*

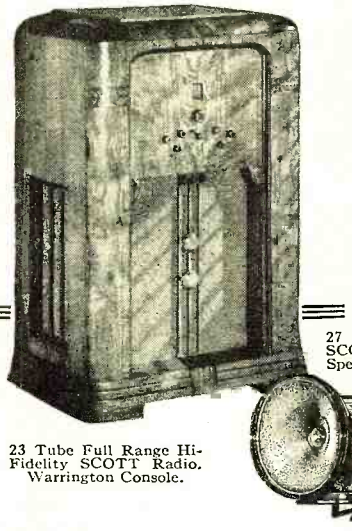
EDITORIAL AND EXECUTIVE OFFICES
461 EIGHTH AVENUE, NEW YORK CITY, N. Y.

Lee Ellmaker, *President and Treas.*
B. Holcepl, *Secretary*
H. D. Crippen W. P. Jeffery, *Advertising Management*
Virgil Malcher, 205 W. Wacker Dr., Chicago, *Western Representative*

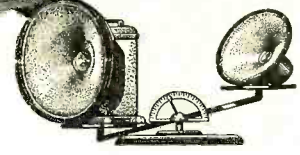
25 a copy. Subscriptions: $2.50 a year, $4.00 for two years. In Canada and Foreign Countries $3.00 a year, $5.00 for two years. Subscribers are notified that change of address must reach us five weeks in advance of the next date of issue.

Not WHAT Your Radio gets — But HOW WELL Your Radio gets it!

Why the 23 tube SCOTT Full Range Hi-Fidelity Radio EXCELS

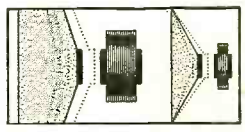


23 Tube Full Range Hi-Fidelity SCOTT Radio. Warrington Console.



27 lb. SCOTT Speaker — 6 lb. Production Speaker

27-lb. SCOTT Speaker (left side of scales) in true comparative size with regular 6-lb. production type speaker (right side of scales).



LEFT
GREATER-DEPTH Vibrations of SCOTT speaker. Gives lower notes of greater "timbre" and high notes of greater beauty.

RIGHT
SHORT-DEPTH Restricted Cone Vibration of production speaker. Prevents perfect reproduction of high and low notes.

LEFT
SCOTT SPEAKER Coil and Magnet 4 times larger. Gives clear, perfectly defined tone.

RIGHT
SMALL Coil and Magnet of mass production speaker—less power to vibrate cone. Result: Weakly defined tone.

LEFT
SCOTT CURVILINEAR Cone holds perfect circular shape when playing strongest concert passages.

RIGHT
STRAIGHT SIDE CONE does not vibrate uniformly when playing strong passages.

A RADIO can be only as good as its speaker! Utterly useless is the engineering genius of the finest chassis and amplifier—*without a speaker capable of bringing out to the full extent all the glorious beauty of the music captured and amplified.*

A giant in strength and power—engineered with the precision of a microscope—this is the 27-lb. loudspeaker used in the 23-tube Full Fidelity SCOTT Radio.

A NEW WORLD OF RADIO

The finest Beethoven symphonies — the latest Gershwin creations — excitement of national elections—challenge of foreign dictatorships — Old World folk music — the amateur band—airplane calls—police calls —every service on the air is yours with a SCOTT!—with a complete absence of distortion at the most magnificent concert volume!

Now—national high fidelity radio station* tests 150 receivers—discovers SCOTT the *only* receiver capturing all the high fidelity tones broadcast—every singing silver overtone from 30 to 16,000—every tone the human ear can hear! But don't expect to hear them without a SCOTT!

High fidelity broadcasting is here! And when you own a SCOTT you may share all its glorious beauty! Dozens of the nation's stations are "going higher fidelity"—broadcasting all the magnificent tones and overtones of instruments and voice! There are gorgeous high fidelity overtone harmonies of voice and orchestra on the air day and night —but you never hear them, even when listening to your favorite stations — unless you own a SCOTT.

Another unparalleled feature of the SCOTT is the SCOTT type Volume Range Expander. The SCOTT is the only radio that completely, and without distortion, restores the vibrant original musical expression played into studio microphone but "cut" by broadcasting engineers.

Put the SCOTT to a side by side comparison test for 30 days in your own home—with *any* receiver at *any* price. If it does not bring in more domestic and foreign stations—with more gloriously true beauty of tone—and with greater freedom from noise, then you may return it for full refund of its purchase price. Nation-wide installation service.

HEAR IT FOR YOURSELF

Simply mail the coupon. Discover for yourself this utterly new world of radio enjoyment—a world so thrilling that the great Toscanini himself exclaimed: "Never would I have believed it possible to attain such marvelous reproduction!" And the astonishing thing about the Custombuilt SCOTT is this—it costs less than many regular production type radios.

Mail the coupon today! No obligation.

*Name upon request.

FREE—SEND TODAY FOR DETAILS

E. H. Scott Radio Laboratories, Inc., 4440 Ravenswood Ave., Dept. 5P6, Chicago.

Am interested in full details of the new 23-tube SCOTT.

Name.....

Street.....

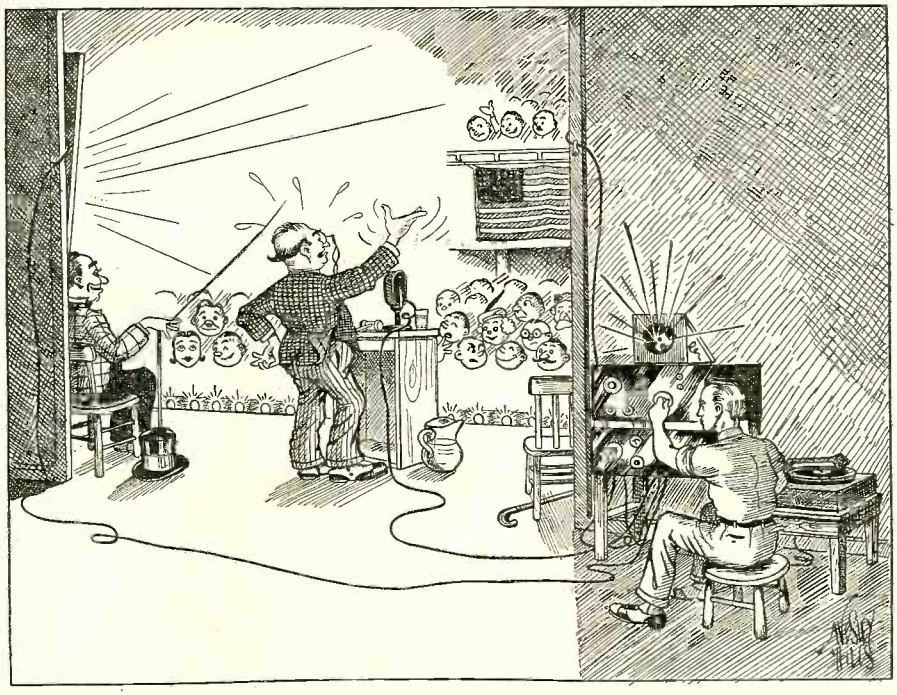
City.....State.....

E. H. SCOTT RADIO LABORATORIES, INC.

4440 Ravenswood Avenue, Dept. 5P6, Chicago, Illinois

630 Fifth Avenue, New York City — 115 N. Robertson Blvd., Los Angeles

Pages From A Serviceman's DIARY



P. A. RENTALS WILL BE "HEAVY" DURING POLITICAL CAMPAIGN

The progressive serviceman should get busy now with the local political headquarters or clubs in his town for the installation of public-address equipment on a rental or permanent sales basis, for rallies, speeches, etc.

ARRIVED at the station in the midst of a sudden downpour. Stepped outside where the raindrops spattered viciously against the sidewalk and formed into wavy rivulets which gushed along the curb and gurgled into the sewer. My raincoat, as usual, was at the store so I resolved to try and hitch-hike the rest of the way.

Saw a few chauffeurs dumping off their employers at the downtown side and managed to hail a big Belgian who pulled up when he recognized me as the one who had fixed his radio. Jumped in and he immediately started to get his troubles off his chest. Told me how his mistress always spoke to him in miserable French (learned at the wrong boarding-school) and informed every visitor that he could understand no other language. "You know, my dear, he is simply marvelous. He has been engaged by Royalty on the Continent where he acquired the niceties of service so lacking in our American ruffians. And he harmonizes with the car so well—just the proper bearing and his hair matches the upholstery." He bathes the pomeranians, too (The Admirable Crichton). "And do you have to sit up and bark for your pay-check?" says I, dodging a left hook to the jaw.

Hopped off at the store, hoping there would be no calls until the storm had subsided. No such luck. "You're elected," Jerry says, handing me a ticket, "lights out, sick baby, can't warm the milk bottles, can't wait for the lighting company. Here are some fuses and a flashlight. Step on it!" Noted the address, within a hundred feet of the interurban railroad high-power lines, and the name, a new customer, so took a few folders on noise-reducing antenna systems and rushed over in the radio truck.

"Shorts" and "Grounds"

Pulled up alongside a large frame house. Took in the fuses, flashlight, and also a tube checker, on general principles. "So nice of you to come so quickly," the lady said. "I really hated to call during such weather." Most people wouldn't have cared. Went upstairs, cocking an eye on the way at a big Majestic in the living room. Found the electric bottle heater plugged in a wall socket. Pulled it out and checked the cord and plug carefully. Found one lead pulled off the plug terminal and short-circuiting internally. Repaired it, then went to the fuse box and replaced the blown fuses in the different circuits where she had tried to use the heater. OK! "And how's the radio?" reaching into my pocket for the noise-reducing antenna pamphlets, "I suppose you are having some trouble from the electric trains across the way." "Oh, no," she said, "it's just dandy. No noise at all. My husband is very handy and he cured that himself. He figured most people have aerials high up in the air—and get noise—so he puts ours down on the ground. Buried it in a ditch the whole length of the backyard." Checked over the installation—a swell job. All No. 12 rubber-insulated wire with porcelain bushings through the window casement and down split knobs to the ground. Tried the set. No trouble on any locals. Looks like we still have lots to learn about aerials but I do hope I don't have to go in for a course in ditch-digging. Climbing trees and scaling perpendicular walls are bad enough. (Anyhow, they are planning to trade in this receiver on an all-wave job so eventually we may get some profitable business here.)

Country Club P. A.

Returned to the shop and loaded up the public-address system, the 20-watt rack-and-panel job, with two mikes and two speakers on 4-foot baffles, and a record-changer. Ran it over to the country club and set it up, putting the amplifier and small monitor speaker behind the stage with the two large speakers on opposite sides of the hall facing away from the stage. Set the gain control on the amplifier well up and turned the speakers at angles until acoustic feedback was a minimum. Tried the record-changer, running off a few brisk march tunes which always go over good, then some popular dance music all set for the evening's political speaker. I have to be on deck again at 7 p. m.

THESE records from an anonymous serviceman's diary should be of decided interest to veteran servicemen, as well as to those whose experience in the service field is more limited. Written by a man who "knows his stuff," and shot with an occasional outcropping of humor, these items provide many hints not found in text books. More of these pages will appear from time to time.

Dropped off for lunch then out on calls. Two simple tube replacement jobs, each customer trying to find out how I intended to vote. (I always steer clear of any political discussions with customers. Politics and business don't mix in this locality.) Returned to the shop and spent the rest of the afternoon modernizing a Westinghouse grandfather-clock type receiver (using an .80 chassis). Installed a.v.c., using a 55 tube, and a Magic Eye resonance indicator. Too bad this model was discontinued. We get lots of calls for them now and it is an ideal instrument for modernization work since those who already own a set like this can find nothing in a new model which will fit into the same scheme of interior decoration. On all other types of receivers, extensive modernization work seldom pays. It is far better for all concerned for the customer to trade in the old receiver on a new model which has been adequately engineered.

Finished up and went to dinner then back to the country club. Went over the schedule for the evening's program with the master of ceremonies and showed him where to stand for best results from the mike.

Asked him to have a heart when he used the gavel. Speakers often don't look when they start pounding and are quite likely to swat the mike. Told him to tell the speaker where to stand. (He probably won't and if he does the speaker will promptly forget.) Fortunately, however, everything went over smoothly and we managed to pack up and get back by midnight.

Better Profits for Trained Servicemen

By R. L. Triplett

Each succeeding year points out the increasing importance of radio in modern life. Besides the ever-increasing number of uses for radio products, set sales continue to reach higher figures and the so-called saturation point is yet to come.

It's Ready! YOUR NEW 1937 ALLIED RADIO CATALOG

DEALERS
SERVICE MEN
AMATEURS
SET BUILDERS
SOUND-MEN
GET YOUR FREE COPY

A Complete Supply Guide to
EVERYTHING IN RADIO
FREE

152 BIG PAGES
MORE THAN 10,000 ITEMS
AT LOWEST PRICES

A Time-saving, Money-saving Catalog Covering Your Every Radio Need. Whether You Are an Amateur, Serviceman, Dealer, Set-builder, Sound Man, or Experimenter, YOU NEED THIS BOOK!

Here it is—the new 1937 ALLIED Radio Catalog—152 pages packed with Everything in Radio. 10,000 duplicate and replacement parts—latest types of amateur transmitting and receiving gear—newest test instruments and service equipment—1937's finest metal-tube, all-wave radio receivers—pages of new kits for set-builders—complete lines of advanced public address equipment—tools, books, etc. Everything for everyone in Radio at the lowest prices!

SERVICEMEN—Page after page of the leading lines of test equipment. Newest developments in tube-checkers, set-testers, analyzers, oscillographs, meters—as well as complete stocks of high-grade standard lines. Thousands of replacement parts, tools, books.

AMATEURS AND EXPERIMENTERS—A complete amateur section loaded with a tremendous assortment of transmitters, receivers, transceivers to meet every Ham requirement. Dozens of new kits for set-builders—new metal tube DX'er, Knight Super-Gainer, new 6-volt all-wave set, 5-meter transceivers and many others.

SOUND MEN—An elaborate display of high quality Public Address equipment for every sound need. 8-60 watts; permanent, mobile and portable, for 110 volts AC, 6 volts DC, and universal operation. Efficiently designed; ruggedly built; powerful in performance, and low in price.

RADIOS—Newest 1937 models. The finest line ever offered. All-Wave, Dual-Wave and Short Wave sets from 4 to 17 tubes. 6 volt, 32 volt, AC-DC, battery and auto sets. Astounding new features, perfected circuits, beautifully designed cabinets. And—special—Farmpower units and Windchargers.

Your Dollar Buys More at ALLIED

We buy in vast quantities, get lower prices, and pass the savings on to you. No matter what you need, we have it at the lowest prices in radio. Page by page, throughout the new ALLIED Catalog, you'll find greater values for your money.

HIGHEST QUALITY

We handle only the highest-grade new, clean merchandise in first-class condition. Every item in the ALLIED Catalog must come up to our exacting standards. You're always assured of highest quality when you buy from ALLIED.

FASTEST SERVICE

Everything under one great roof—our vast stocks, offices, laboratories, technical departments, and shipping rooms are conveniently located in one great building. Our complete stocks mean that you get your order when you want it; our central location means faster shipping; our efficient organization gives you better personal service.

WRITE NOW!

Send for your FREE copy of the new 1937 ALLIED Radio Catalog. No matter what your radio requirements are, you'll find them answered at money-saving prices. For greater values, faster service, and lower prices—order from the new ALLIED Catalog. Write today!

"I FIND EVERYTHING I NEED IN THE NEW 1937 ALLIED CATALOG. IT'S THE FINEST, MOST COMPLETE RADIO SUPPLY GUIDE I HAVE EVER SEEN."

ALLIED RADIO
CORPORATION
833 W. JACKSON BLVD. CHICAGO, ILL.

ALLIED RADIO CORP.,
833 W. Jackson Blvd.,
Chicago, Illinois, Dept. 1-J

☐ Rush me a copy of your big, new 152-page 1937 Catalog absolutely Free. I am particularly interested in:

☐ Servicing sets ☐ Building sets ☐ Selling sets
☐ Operating an amateur station ☐ Installing P.A. Systems

Name.....

Address.....

Making the Most of a SERVICE SIDE LINE

How a serviceman can boost his sales of lamps and modern fixtures with this ingenious new light meter

By Zeh Bouck

DEMONSTRATE CORRECT LIGHTING TO YOUR CUSTOMERS

With this instrument the serviceman can actually measure whether a lamp is giving the correct amount of light where it is needed and the proper size lamp is thus automatically selected.

LAMPS and lighting fixtures are a logical sideline for the radio serviceman. This fact has always been appreciated by the radio expert who happens also to be an electrician and a specialist in house wiring—or who has had a show room where such items might be displayed. However, heretofore, there has been little in it for the serviceman functioning purely in the radio field, and operating from a shop with no display facilities. The situation has altered with the development of light intensity measuring instruments, and with one of these in his service kit, there is no good reason why such a serviceman cannot build up a profitable trade in lamps and lamp accessories, while servicemen already handling this sideline can increase their sales.

How It Works

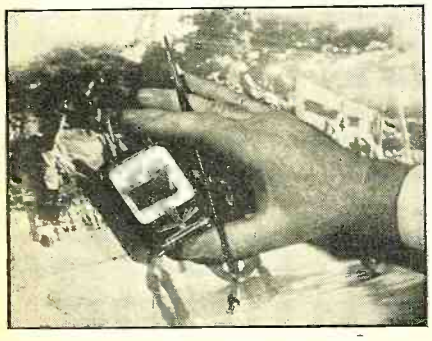
The light intensity indicator consists of a photo-voltaic cell—usually the Weston Photronic cell—and a highly sensitive microammeter, reading either directly in foot-candles or in interpreted terms of the suitability of the light for different tasks. A foot-candle is the light intensity of one candle at a distance of one foot. An intensity of from 10 to 20 foot-candles should be available for reading ordinary print.

Considerable publicity has been given to these devices by the lighting companies throughout the country in recognition of the inadequate lighting facilities in the large majority of homes, offices and factories, and, naturally enough, with the ulterior motive of selling larger lamps and more electricity. Patrons of the lighting companies were offered the free services of an expert who would call with a light measuring instrument and demonstrate to the customer the exact lighting conditions existing in his or her home. Advertisements offering this service have appeared in practically every paper of consequence, from coast to coast, and are being repeated from time to time.

The radio serviceman should *cash in* on this publicity and advertising. *He has the advantage of an entree with every service call.* Based on a survey recently made by the author, only *one out of every ten* average homes is adequately lighted. This means potential sales of larger lamps and additional fixtures in nine out of every ten radio service calls. No sales argument is required. The instrument itself provides that! There is no questioning its simple, scientific truth, that the lighting is—in nine cases out of ten—inadequate.

HOW THE INSTRUMENT WORKS

A light-sensitive cell and a meter are incorporated in this tiny unit which registers the amount of light, falling on the object, by a deflection of the needle. One look at the instrument tells the story. (Figure 1).



What It Is

Probably the most convenient and "eloquent" instrument for the radio serviceman is the "Sight Light Indicator", made by the Sight Light Corporation, New York City, and illustrated in Figure 1. The instrument is entirely self-contained, and requires no batteries or connections. While it reads from zero to 250 foot-candles, it is so calibrated, in red, orange, yellow, green and blue sectors, that the house wife may make her own demonstration. It will be recognized that these are the primary spectrum colors. Arranged in the order given with increasing foot-candles, red is conveniently a warning that the light is inadequate for most tasks, orange and yellow, caution, and green or blue, okay. Red, or from zero to 10 foot-candles, is inadequate for critical seeing. From 10 to 20 foot-candles, or orange, is sufficient for the occasional reading of large print, moderate office, factory or kitchen tasks, and for sewing on light goods. Yellow covers from 20 to 50 light units, and is adequate for reading newspapers, clerical work and average sewing. From 50 to 100 foot-candles—on the green section of the scale—is satisfactory for proof-reading, drafting, prolonged reading and study. Above 100 foot-candles, or in the blue section, the light is sufficient for the most severe tasks, such as engraving, fine assembly work, and sewing on dark goods. The scales are self-explanatory, and quite comprehensible to the layman.

How to "Sell" It

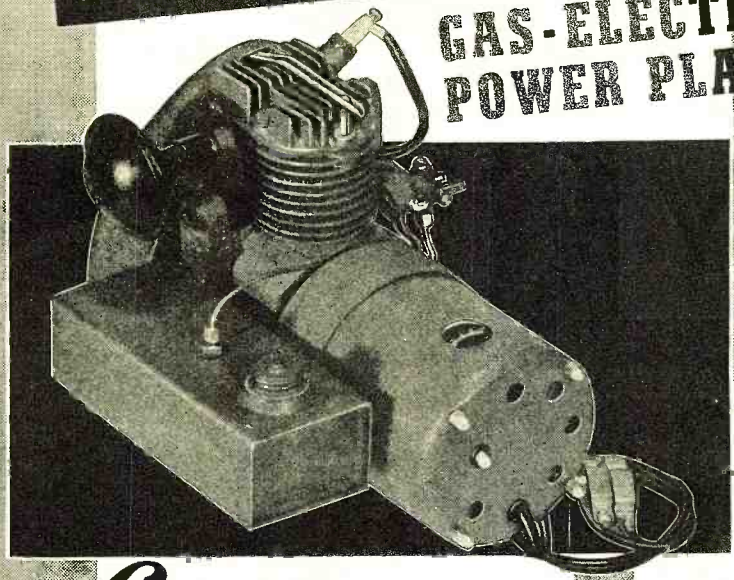
The technique is simple. The attractive and modernistic Light Sight Indicator is removed from your service kit and placed on the radio. The serviceman explains, with a smile, that he is "just checking up on your light." The set owner immediately becomes intrigued by the device, and will carry it around to different rooms. The serviceman should help matters along a little bit, by asking him where he reads, or some similar question, and by demonstrating that (in all probability) the light is inadequate for the given purpose at that spot. (In Figure 1 the test is being made on an artist's easel. The light, as will be observed is entirely adequate—as it had to be for photographic purposes.) Then let him play with the indicator while you inspect the radio.

The instrument (*Turn to page* 169)

ANNOUNCING

200 WATT 6 or 12 Volt

GAS-ELECTRIC POWER PLANT



$44.95 LIST

THE PIONEER 'Cub

Here's a NEW way to BIG profits! Sell *the lowest priced gas electric plant* ever offered!

200 watts, 6 or 12 volts—the new PIONEER "Cub" is a *REAL VALUE!* And every farmer wants electricity on his farm! It will operate a lighting system—charge radio, auto and truck batteries. It will drive small machinery mechanically! The first *practical* LOW COST FARM LIGHT PLANT!

POWERED by "SMOOTHFLO" LAUSON ENGINE

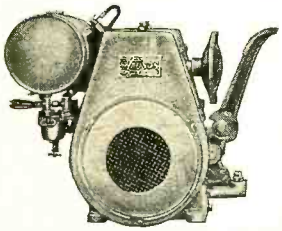
FOR 45 YEARS, A LEADER IN THE QUALITY GAS ENGINE FIELD

Portable, light weight—sturdily built—furnishes compact, reliable power or gas-electric plants, washers, water systems, power lawn mowers. 5/8 H.P. engine operates 16 hours on one gallon of gas. Counter balanced crankshaft—air cooled—ball bearings—quality construction throughout!

Wherever *dependable, economical, portable* power is required—specify the *LAUSON* gas engine.

OTHER PIONEER PRODUCTS

"Baby Jumbo" Gas-Electric Plants with magneto ignition; 6, 12 volts—150 watts DC; 6 volts—200 watts DC; 12, 32, 110 volts—250 watts DC. "Blue Diamond" 300 watts 110 volts AC. "Gold-Crown" 32 volts 800 watts DC; 110 volts AC 600 watts, 1000 or 1500 watts AC or DC. Complete line of PIONEER Dynamotors, converters, and Gen-E-Motors.



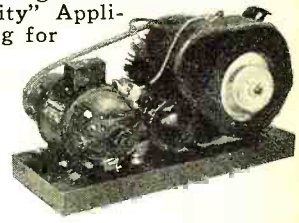
LAUSON ENGINES ARE IDEAL PRIME MOVERS

There's a myriad of uses for these unique Lauson Engines. They're made in a variety of sizes and types—an efficient design for every need! Air cooled models from 1/2 to 3 H.P.; Radiator cooled models from 2 1/2 to 5 H.P. (all vertical) and the horizontal types ranging from 1 1/2 to 18 H.P. All of them are efficient and economical to operate and have a LOW FIRST COST! Write for full information TODAY! Send in the coupon NOW!

300 WATT 110 VOLT AC PIONEER 'Blue Diamond' GAS-ELECTRIC PLANT

$79.95 LIST

The Lowest Priced "City" Light Plant *ever offered.* Operates standard AC "City" Appliances. Also has DC winding for charging 6 volt batteries. Amazing economy — rock bottom price—yet a big profit for dealers! Write for full information TODAY!



Cable Address
"Simontrice" New York

THE LAUSON COMPANY
No. 8 Monroe St., New Holstein, Wis.
Send me complete information on the LAUSON Gas Engine Line.
Name.....
Address.....
City.....State.....

MAIL THIS COUPON TODAY

MAIL THIS COUPON TODAY

PIONEER GEN-E-MOTOR CORP.
464-P West Superior St., Chicago, Ill.
RUSH FULL INFORMATION ON PIONEER "CUB" AT ONCE!
Name.....
Address.....
City.....State.....

Don't worry about HUMIDITY!

MALLORY

Replacement Condensers are HUMIDITY Proof...

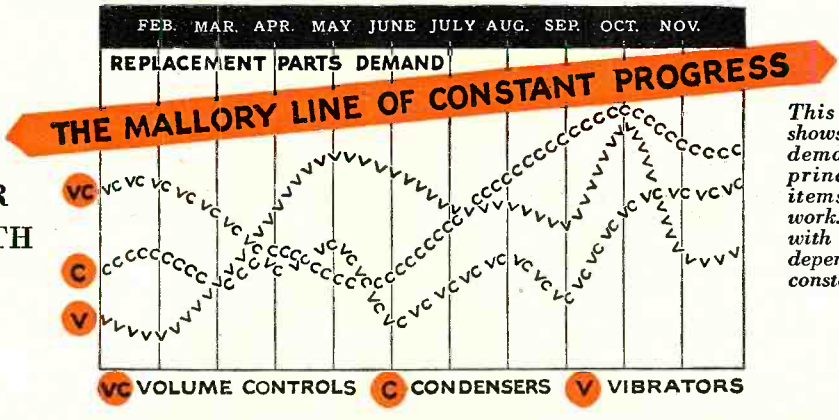
Steamy summer days may play havoc with ordinary condensers. But they do not affect Mallory Replacement Condensers because *humidity doesn't get to them!*

Mallory provides a heavy metal seal around the actual condenser unit *inside* the carton. This protection—plus a *final sealing* of the carton itself—so completely safeguards the condenser that its characteristics remain unchanged despite increasing or decreasing humidity.

The humidity proof feature of Mallory Replacement Condensers is one big point of superiority. There are many others. Mallory provides smaller sizes with greater efficiency. Mallory presents the first universal mounting features for both carton type and round can condensers. The Mallory Terminal Connector eliminates the necessity for splicing leads. And 69 Mallory Replacement Condensers provide universal application to meet the needs which heretofore have required literally thousands of condensers.

If you are not using them you are missing a real bet. Ask your distributor about Mallory Replacement Condensers—now!

BUILD YOUR BUSINESS WITH MALLORY



This composite graph shows the trend of service demand for the three principal replacement items in daily service work. Check your needs with the demand — and depend on Mallory for constant progress.

MALLORY

P. R. MALLORY & CO., Inc.
INDIANAPOLIS INDIANA
Cable Address—PELMALLO

YAXLEY

Radio News

September, 1936

RADIO in the FOREST SERVICE

How the United States Government is employing ultra-short waves and short waves for communication purposes in our National Forests and how this service operates in times of emergencies, such as forest fires, hurricanes, floods, is told in this interesting article.

By **S. R. Winters**

DEFEATING hurricanes, torrential rains, and the wilds of the jungles—common enemies of conventional communication systems—high-frequencies are now to be employed in weaving together the scattered units of the Puerto Rico National Forests. The use of radio on this island off the southeast coast of the United States will unify the scattered areas of the Puerto Rican Forests, where other methods of communication are either impractical or too costly. A. Gail Simson, technical expert in charge of radio for the Forest Service, who has recently returned from an experimental tour of Puerto Rico, says: "The use of radio in the Caribbean National Forests in Puerto Rico is feasible, and from the point of view of emergency communication it is necessary. Frequent hurricanes and heavy rainfall increase the need for reliable communication in the protection of the forests. Radio is much more practical on the island than the costlier land-line telephone service, which is subject to wet, rainy season and hurricane damage."

In Puerto Rico

Mr. Simson says that static in the Puerto Rican area is not as terrific as had been feared, and the regular Forest Service radio equipment, which is in use in about 1200 stations in the National Forests of the United States and Alaska, will be employed there immediately. Existing sets will be modified to meet the conditions set up by the dampness and salt in the air.

In the forests, communication in emergencies is of the utmost importance—whether it is fire patrol or fire suppression, rescuing lost persons or building roads, there is always the need to communicate with key persons. Against the forests' greatest enemy—the dreaded forest fire—immediate communication to headquarters on detection, and the consequent saving of valuable time in getting men and equipment to the scene at once, are of grave importance. In such emergencies, radio communication, instead of the old-time primitive methods, has already proved an invaluable asset.

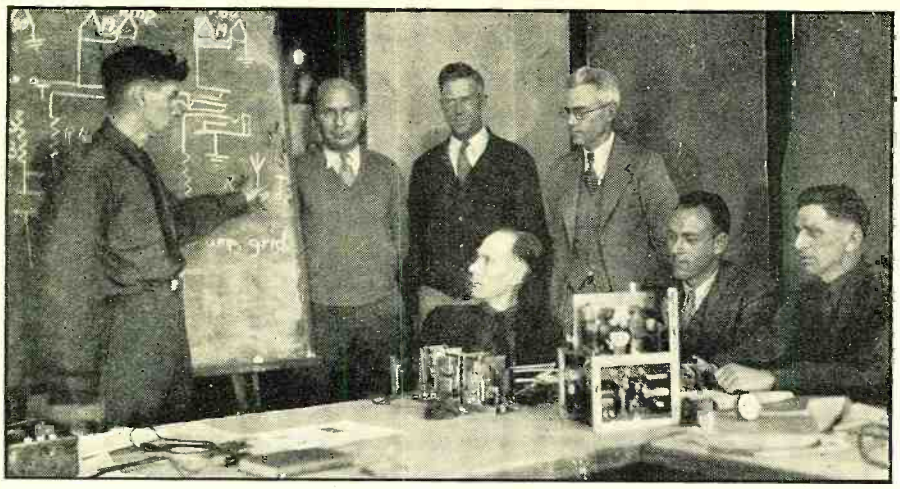
There are about 150 National Forests, with a total area of approximately 170,000,000 acres. Only a part of this area lies within convenient reach of telephone lines. Prior to radio communication, the lookout man, or "smoke-chaser," on detecting smoke had to go to the scene of the fire and then get to the nearest telephone line to summon aid and to give his report of the fire's proportions, how many men were needed, etc. Or, if there were no telephone lines near, he had to rely upon a messenger for getting in touch with headquarters.

SHORT-WAVE STATION "ON GUARD"

This is the radio operating room at the Forest Service Radio Laboratory at Portland, Oregon, where a radio operator is always on duty contacting other fixed and portable stations of the Forest Service.

New Method

During actual fighting of the fire itself, the necessity for communication is ever present. Formerly, this was accomplished by stringing, temporarily, insulated emergency telephone lines. This was not satisfactory because it was a slow, expensive process. It requires a crew of men a number of days to reach the fire-camp with an emergency line and often the need for it was past before the line was completed. Too, it supplied connections only to the base and not to the rapidly changing fire-front, where it was most generally needed.



FORESTRY MEN RECEIVING RADIO INSTRUCTION

An instructor of the Forest Service explaining the circuit and operation of a portable radiophone transmitter and receiver and pointing out the essential parts of the actual transmitter on the apparatus itself.

Now, each forest has its own radio set-up, operating on an individual frequency. There is a net control for each forest in the supervisor's headquarters. On the outbreak of a fire, the patrolman carries with him to the scene his compact portable radio equipment, which weighs only 15 pounds, and may be carried in his pack. On arrival at the scene, he takes stock of the situation, sets up his outfit and makes his report to headquarters, all within the space of a few minutes. The number of men needed are then rushed to the scene, a fire-camp established and small portable radio outfits set up at strategic points.

Radio Is Reliable

The object of Forest Service radio is to provide: reliable communication over certain minimum distances—the distance is rarely over 20 miles—light weight and compactness; and simplicity of design. The last-named factor is important because frequently inexperienced men have to use the sets. Although a brief training course in radio is given the men, the majority of them are not radio experts. For this reason the sets are constructed as nearly fool-proof as possible.

There are two general types of radio equipment in use in the National Forests—the short-wave and the ultra-short-wave types. The former may be built to operate on any frequency between 2000 and 20,000 kilocycles, but usually functions in the band of 3000 kilocycles. The ultra-short-wave apparatus uses a frequency of 32 megacycles (3200 kilocycles).

At present, the major activity of the Forest Service Radio Laboratory at Portland, Oregon, is centered in the development of the ultra-high-frequency equipment, which has a number of advantages over ordinary short-wave outfits. However, the ultra-high frequencies may be used advantageously over short ranges. There is practically no static, nor fading; the equipment can be made quite light and compact and the antenna is short, being only a few feet long, as contrasted to the 130-foot length of the short-wave aerials. The receiver battery-drain is so small that "standby" operation by battery receivers is possible, and by using one frequency for transmitting and another for receiving a pair of stations may be operated "duplex," that is, transmit and receive simultaneously. Two-way communication with moving vehicles is possible.

U. S. W. Sets Used

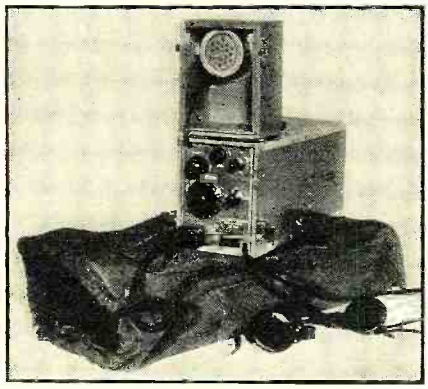
The Forest Service has developed two types of ultra-short-wave radio apparatus. These models are being refined in compliance with the knowledge gained during the past fire-fighting season. One of these sets, designated by the Forest Service as a T radiophone transmitter-receiver, has a rated working range of 50 miles. With it, it is possible to transmit and receive simultaneously when working with another type T radiophone. This set, which weighs between 50 and 100 pounds, is designed for standby operation and has a built-in loud-speaker. It transmits and receives voice only.

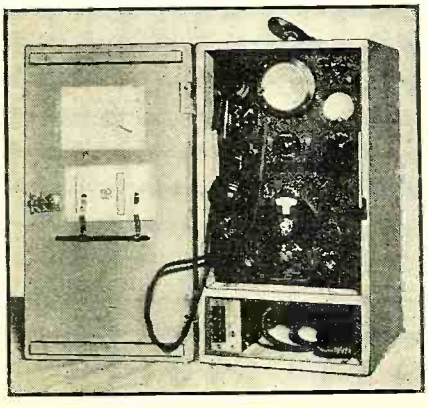
The other set, called the S radiophone transceiver, also has a working range of 50 miles, and transmits and receives voice only, but it will not function as a duplex outfit. Its chief advantages are its portability—it weighs only 10 pounds—and the brief time interval required to put it in operation. The aerial is only 15 feet long and the whole set may be installed in less than two minutes.

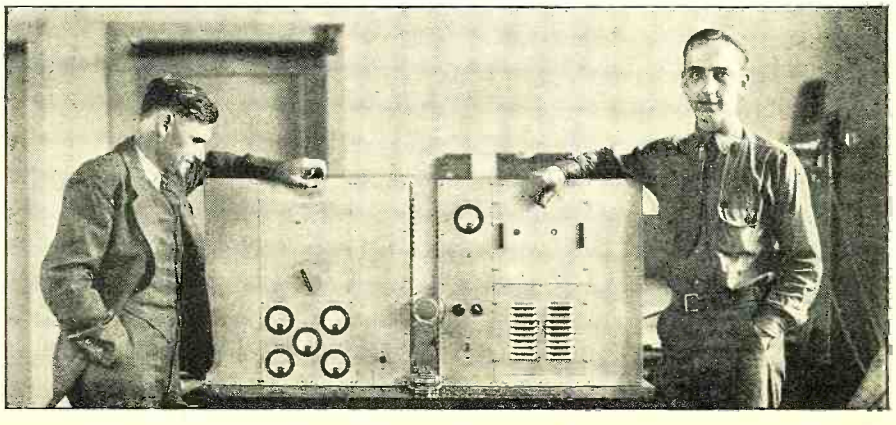
The short-wave equipment used by the Forest Service is standardized. It includes the following types, designated by the Forest Service as:

(1) Type PF Radiophone
(2) Type PF Kitbox
(3) Type SP Radiophone
(4) Type M Radiophone

Type PF is the most frequently used by the Forest Service. It weighs only 15 pounds and transmits and receives both voice and code. It has a working range of 10 miles on voice and 20 miles when code is employed. This 3-watt outfit was designed primarily for use by "smoke- (*Turn to page* 183)







SOME EQUIPMENT TYPES

At the left is pictured the type PF Forest Service Radiophone. The corner photograph shows the ultra-high-frequency radiophone, type T. Below is shown a type B Radiophone built for use in Alaska with A. G. Simson and W. S. Claypool left and right.

WHAT'S NEW in RADIO

By W. C. Dorf

Types 6E5, 6G5

The original versions of the visual indicator tubes, the 6E5 and 6G5, were designed for a plate supply of 250 volts. Many designers wished to use these tubes in a.c.-d.c. receivers but found it impractical due to the low plate voltage.

The Ken-Rad Corporation has now developed an improved model of these tubes which will work on 100 volts. They are available in both the type 6E5 and 6G5. Those wishing to use the tubes in a.c.-d.c. sets will now be able to do so.

A New Development in the Speaker Field

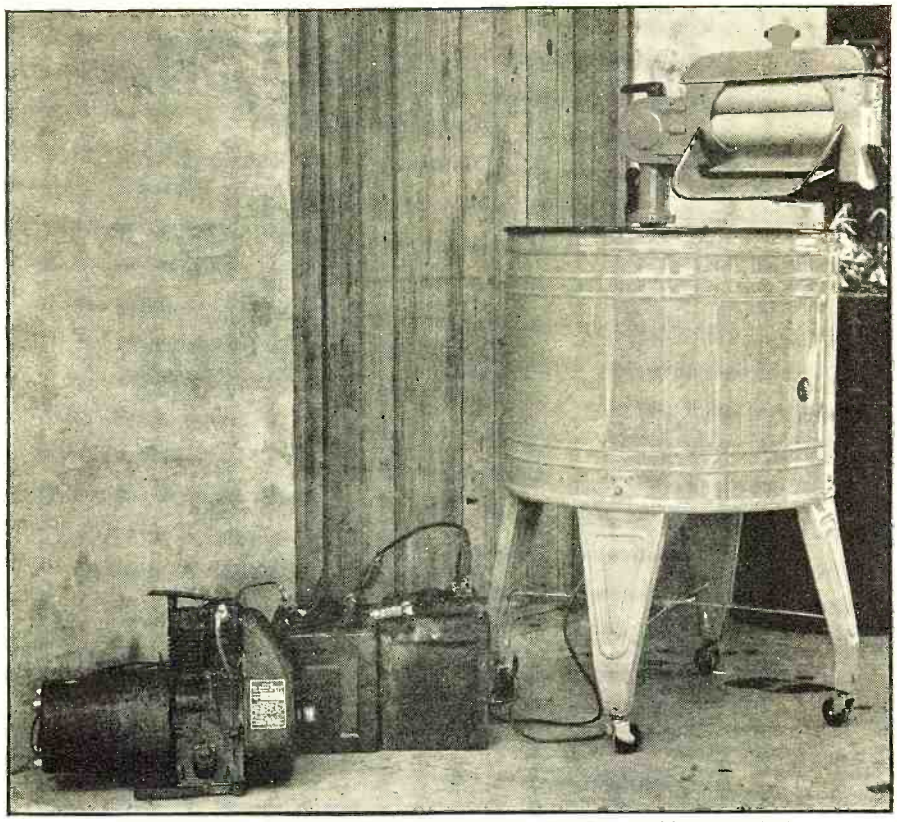
The Continental Motors Corp. announces a new permanent-magnet dynamic type speaker known as the "Perm-O-Flux." Their statement reads that the unusual sensitivity and tone quality provided by the speaker, is made possible by the use of a new magnetic material developed in their laboratories. As no field current is required for this type speaker, installation is simplified and the unit is particularly suitable for automobile and boat installation and for use in farm receivers, call systems, etc.

1937 Line with Many New Features

"Focused Tone," which provides fidelity of reproduction and peak performance in the new 1937 line of General Electric radios, is made possible by a combination of a new simplified color tuning method, automatic frequency control, silent tuning and other new developments. With the new "Colorama" tuning the dial changes from red to green to tell you that your program is perfectly tuned. The new line includes many striking table models, consoles, and radio-phonograph combinations, all sets are equipped for both standard broadcast and short-wave reception and several have extended tuning ranges for the ultra-short waves. The model E105, illustrated, employs 10 metal-type tubes as follows: three 6K7's, one 6A8, one 6H6, one 6F5, one 6L6, one 6J7, one 6C5 and one 5Z4.

Automatic Station Tuning

The outstanding feature of the 1937 Grunow receiver line is the "Teledial" which operates with a regular dial telephone except that only a single flick of the operator's finger is needed to tune in any one of his favorite 15 stations. This does not mean that tuning is confined to only 15 stations, as other stations are tuned in by means of the tuning dial in the usual way. The model 1541, illustrated, employs 15 tubes, is equipped with triple speakers and has a tuning range of 550 to 70,000 kilocycles. Other attractive console and table type sets are available with a large 6-inch clock-type dial. (*See page* 191)



WHAT HAS A WASHING MACHINE TO DO WITH RADIO?

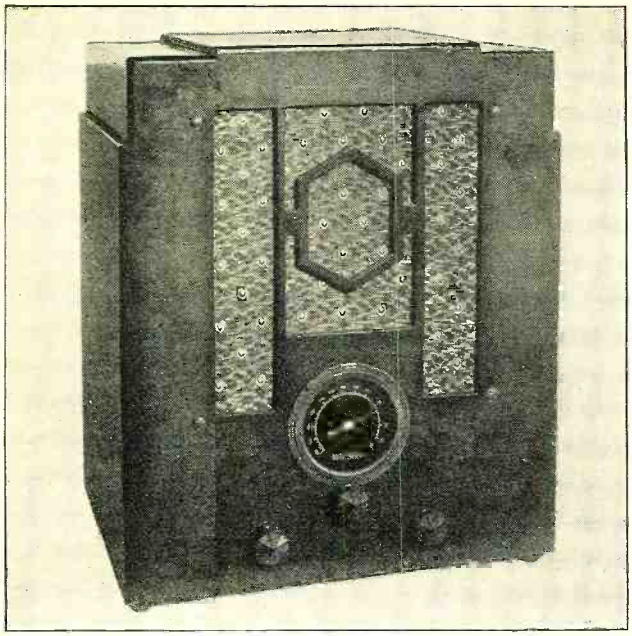
Some of our readers may wonder why we have published this picture as a lead article in the New Products Section. The answer is this: Look down in the lower left-hand corner of the photograph and you will see a compact generator, charging storage batteries. And herein lies the secret. The Serviceman can make considerable additional profit by selling this unit for unwired farm use in lighting the home and furnishing power for the farm machinery and battery-operated sets. It makes the automobile radio type of receiver an excellent one for farm use. Servicemen, get busy! Here is a new opportunity for you.

New Sideline For The Serviceman And Dealer

The Pioneer Gen-E-Motor Co., makers of well-known radio-power equipment, and the Lauson Co., one of the first gasoline-engine manufacturers, have joined hands in producing the Pioneer "Cub", 200 watt, 6 or 12 volt gas-electric power plant.

There is a very definite need for a portable, low-cost power unit in the many thousands of farm homes, summer cottages, camps, etc., that are without benefit of wired lighting supply, and the rural radio market will welcome this compact power-plant because of the many sales opportunities it will offer the serviceman and dealer. Already many servicemen are cashing in on these new midget electric power plants.

In the illustration, the power unit is shown charging two 6-volt batteries connected in series which in turn are supplying the necessary 12 volts for operating the Holland electric farm washer. This is only one of the many applications to which the power plant can be applied: it can operate a 6 or 12-volt electric lighting system, is a readily available charging source for battery-operated radio receivers, can be used to keep the automobile, truck and tractor battery fully charged and a big feature of the power unit is the pulley-drive to which any small piece of machinery such as a cream separator or churn, etc., can be driven by a belt. It is designed to operate 15 hours on a gallon of gasoline. Models are available with a push-button starter.



SHIP-SHAPE IN APPEARANCE AND OPERATION

The chassis may be fitted into a standard cabinet, giving it the appearance of a commercial product.

A Home-Built, RURAL

THIS receiver was developed to meet the insistent demand of rural users for an inexpensive radio that would compare in performance and operating cost with the average five tube a.c. set. The design includes the following features:

1. Low current drain. (3.2 watts with 135 volts B battery.)
2. No C battery is used.
3. Ability to play with run-down B batteries until the total voltage drops below 60 volts.
4. Full automatic volume control without any sacrifice of signal strength on weak stations, or the use of any extra tubes.
5. Quiet operation—no power unit noise.
6. A high degree of selectivity. Most stations operating with a frequency difference of 10 kilocycles can be separated without objectionable cross-talk or interference.
7. The sensitivity is sufficient to bring signals in with loudspeaker volume from most 50 kilowatt broadcast stations within a radius of 500 miles, in daylight, without the use of any antenna, but with a good ground connection made to the antenna post, and chassis left ungrounded.
8. The battery connections are simple and easy to make.

This set is quite easy to construct. The suggested procedure is as follows: Cut a piece of aluminum alloy or similar chassis metal to the exact dimensions (12¾ inches by 12½ inches) for the base, and drill or punch holes for mounting the various parts in the correct locations as shown in the photographs and diagram of chassis layout (see Figure 2). All the parts may be mounted on the chassis before beginning the wiring, and as much of the wiring as possible should then be done before adding the resistors and condensers. Figure 1 shows the complete wiring diagram.

Wiring the Set

The r.f. and intermediate transformers are color-coded and are to be connected as follows: Red to "B" plus; Blue to plate; Green to grid; and Black to ground or a.v.c. return. In mounting and wiring these transformers, care should be used to keep the grid and plate leads as short as possible to avoid unwanted coupling and oscillation. Connect all bypass condensers directly to the coil or tube socket where bypass is to occur and make ground returns to a common point whenever possible. Trouble due to oscillation may be frequently traced to a neglect of the above precaution.

One side of the dial lamp assembly should be grounded and the other side connected to "A" plus at one of the tube sockets. A special 2-volt dial bulb is available for use in sets of this type—the drain is the same as for a 30 tube. However, a dial bulb should not be used unless the set is operated from a 2 volt storage battery or "Air Cell."

After the wiring is completed, check over the work very carefully for mistakes and check the plate voltage connections to make sure that the B batteries are not shorted, grounded, or connected in any way to the filaments of the tubes. Note also that B— is *not grounded*. A little careful checking may save ruining a set of tubes.

Unique Design

Notice the method of obtaining bias voltages. The grid of the 33 tube is returned to B—, however, B— is grounded through 1000 ohms resistance and the voltage drop across this resistance affords bias for the tube. The 10 mfd. electrolytic condenser is to bypass the lower audio frequencies and also to prevent motorboating. A larger capacity may be used if necessary. The grids of all the other tubes are returned to a common point of a.v.c. voltage source and from there through 500,000 ohms to a point 200 ohms from ground. The voltage drop across this resistance is sufficient to maintain minimum bias on the rest of the tubes, for maximum sensitivity of the r.f. and detector circuits. The ½ megohm resistor in the circuit allows a higher voltage to be built up in the rest of the a.v.c. network.

The type 32 second detector circuit

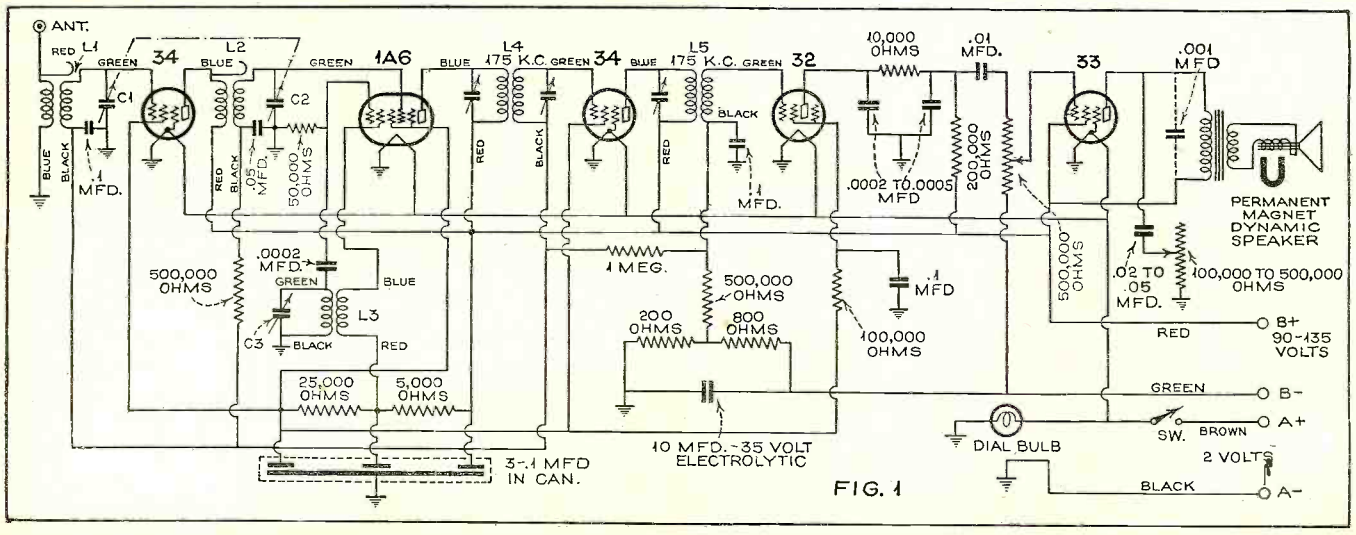
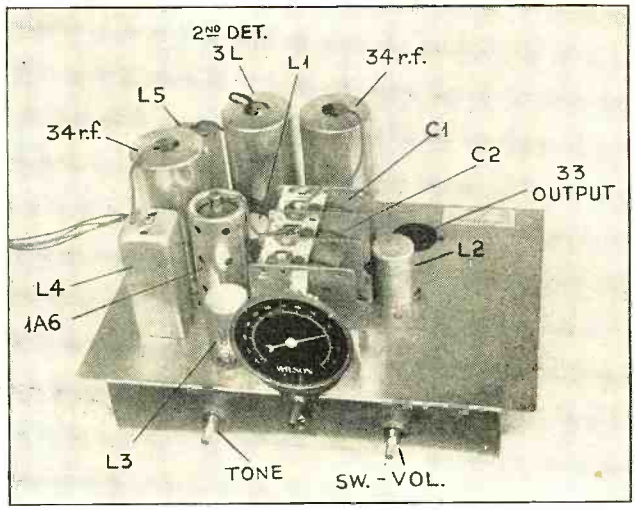


FIG. 1

Battery-Operated SUPER

By Lyman E. Greenlee



THE CHASSIS

A compact assembly on a metal chassis the front and rear edges of which are bent down to form the walls.

is standard with the exception that the grid return is connected to the a.v.c. network just as it would be for diode detection. When connected in this way, the tube acts as a diode rectifier as far as the a.v.c. circuit is concerned, and when a strong signal comes through the i.f., we get a proportional d.c. voltage in the a.v.c. circuit which is due to this rectifying action.

The tubes are not operated with the bias recommended by the manufacturers. They are all slightly overbiased to reduce the drain on the B batteries. Under these conditions, the 33 operates just about as economically as a type 19 tube, if we take into account the current required by the extra 30 driver required with the 19. Very satisfactory operation may be had with a total plate current drain of 10 or 12 milliamperes for all five tubes, notwithstanding the fact that this is less than the normal current drain for the 33 tube alone. This condition is secured by operating the set with two B batteries. Since some 33 tubes draw more plate current than others, a check should always be made of the total plate current drain, using 135 volts on the plates of the tubes, and if it exceeds 18 milliamperes, either change the tube or increase the value of the 800 ohm bias resistor to 1000 ohms or more.

Curing Troubles

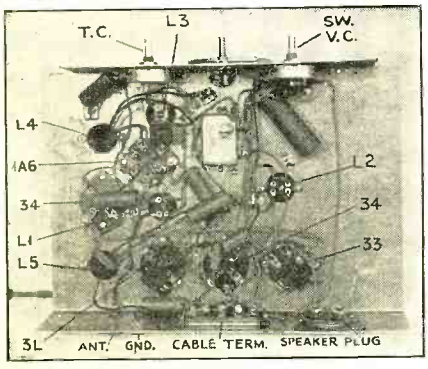
The most frequently encountered troubles with this circuit are due to various types of oscillation, including motorboating, which is usually caused by defective or rundown B batteries. In case trouble of this sort is encountered, try different B batteries, change tubes, and finally (as a last resort) change by-pass condensers and increase the value of the electrolytic condenser used across the bias resistors to 25 mfd.

Alignment

With batteries and speaker connected, and an outside antenna and ground, the set should receive some signals as soon as it is turned on if all connections have been properly made. It is desirable to have a good calibrated service oscillator in order to properly adjust the various tuned circuits. However, temporary adjustments can be made without it. Find a broadcast station you can easily identify at about 1400 kilocycles, and reset the dial so that it reads the frequency of this station you are going to use as a basis for calibration. Retune the set to this station by varying the trimmer on the oscillator section of the variable condenser (C_3) until it comes in at the correct place on the dial. Now adjust the r.f. and detector trimmers for maximum response without making any change in the dial setting. The i.f. transformers may next be adjusted for maximum response by making slight movements of the trimmer screws. Find a station around 600 kilocycles, and if it does not come in at the proper place on the dial, bend the rotor plates of the oscillator section of (*Turn to page* 189)

"DOWN BELOW"

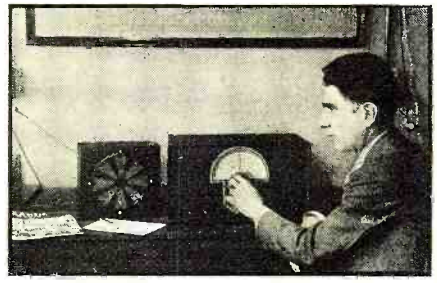
This view provides an excellent idea of both assembly and wiring.

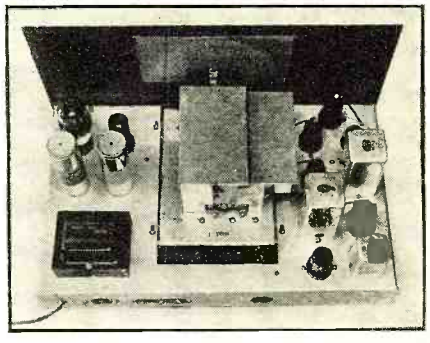


Metal Tubes in the

BROWNING Receiver

By Glenn Browning





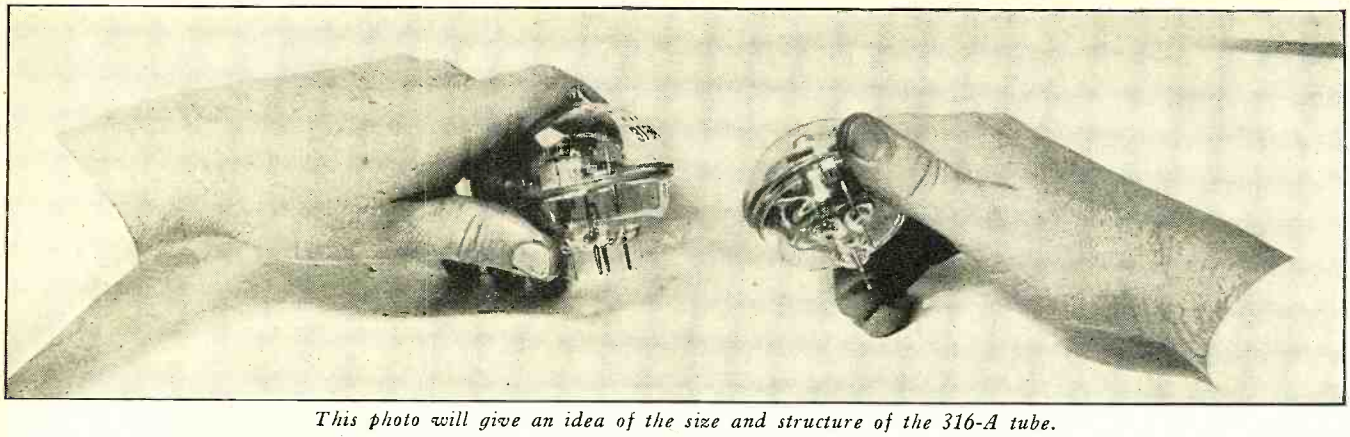
SINCE the "Browning 35" all-wave receiver was described in RADIO NEWS, hundreds of these highly efficient DX receivers have been put in service all over the world. The many enthusiastic letters of praise received by us from its users, have only confirmed our experience with this set in tests at the Westchester Listening Post. Many users have asked if metal tubes can be used in this set. The answer is "yes."

When metal tubes are used, eight tubes are employed instead of seven, as the diode, which is used for second detector, is a separate tube in the metal type (6H6), whereas in the glass tube model the diode and first audio amplifier are combined (2A6 or 75).

The schematic diagram of Figure 1 shows the circuit for the eight metal tubes. The new circuit diagram, when glass tubes are used, is identical except that the diode elements and first audio amplifier are contained in the same tube.

The most important change in the circuit is in the beat oscillator circuit. The oscillator coupler itself has been redesigned and now utilizes its fundamental frequency instead of a harmonic as previously. A knob is provided which gives manual vernier control of the beat-note by varying a small air-dielectric tuning condenser. It will also be noted that this beat frequency is no longer fed into the i.f. amplifier, but is rectified by one of the diode elements before being mixed with the received signal. This results in a very worthwhile improvement as it helps to reduce oscillator hiss and gives a smooth, steady beat note.

A new vernier drive is provided for the main tuning control. The small pointer on (*Turn to page* 184)



This photo will give an idea of the size and structure of the 316-A tube.

Two New Ultra-H. F. Tubes

By Laurence M. Cockaday

WITH the increasing activity on the ultra-short wave-bands, especially the higher-frequency ranges, there should be a great deal of interest in two new tubes recently announced by the Western Electric Company. These are the type 316-A tube and also the 304-B tube which is described elsewhere on this page.

The 316-A vacuum tube is an air-cooled-triode, using thoriated tungsten filament and may be used as a power oscillator or amplifier for ultra-high-frequency, used especially from 100 down to an outside limit of 750 megacycles. The tube has no base and the grid, plate, and filament leads are of tungsten rods ⅜-inch long projecting from the under side flat surface of the tube. The tube itself is designed to be used in this manner without a base and supported by the leads themselves. The maker recommends that connections be made to the tube terminals by means of brass or copper sleeves equipped with set screws. Soldering to the leads should not be attempted. The filament rating of this tube is:

Filament voltage	2 volts
Filament current	3.65 amperes
Thermionic emission	0.4 amperes

The tube has an extremely low inter-electrode capacitance as follows:

Grid to plate	1.6 mmfd.
Grid to filament	1.2 mmfd.
Plate to filament	0.8 mmfd.

The maximum rating for the tubes are as follows:

Maximum direct plate voltage	450 volts
Maximum direct plate current	0.08 ampere
Maximum plate dissipation	30 watts
Maximum direct grid current	0.01 ampere

As an unmodulated oscillator or amplifier the maximum direct plate voltage is 450 volts at 0.08 amperes with a nominal power out-put at 500 megacycles of 7.5 watts.

Oscillator and Amplifier

As a plate-modulated oscillator or amplifier the maximum direct plate voltage is 400 volts at 0.08 ampere with a nominal carrier power at 500 megacycles of 6.5 watts in both cases the grid bias or leak should be adjusted for optimum for the particular tubes used.

When using this power on frequencies higher than 300 megacycles it is necessary to tune the filament-to-ground circuit to get full efficiency and the use of adjustable concentric lines of about ¼ wavelength for each filament lead is believed the best. The average characteristics of the tube, with a plate voltage of 450 volts and a plate current of 67 milliammeters are as follows:

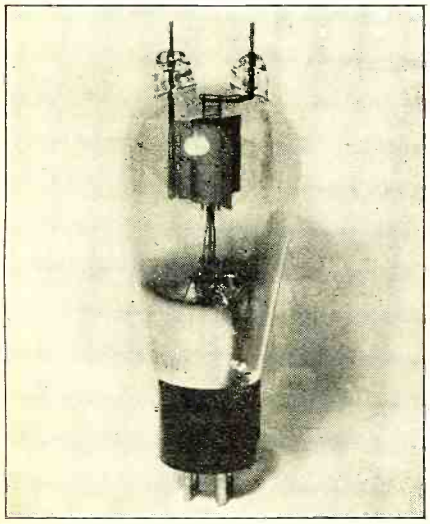
Amplification factor	6.5
Grid-plate transconductance	2400 micromhos
Plate resistance	2700 ohms

As an indication of the power output, in watts, it can be shown that this tube operates as an unmodulated oscillator with an input of 400 volts and 0.08 amperes d.c. and with an output of 8.5 watts, at 300 megacycles, 8 watts at 400 megacycles, 6.5

(*Turn to page* 160)

The 304-B

ANOTHER exceptionally fine new transmitting tube for higher-frequency use is the 304-B Western Electric. It may be used as a radio-frequency oscillator or power amplifier, at full ratings, at frequencies up to 100 megacycles and at somewhat reduced ratings up to 300 megacycles. It can also be used at audio-frequencies, in Class B amplifiers or modulators. It is an air-cooled triode, using a thoriated-tungsten filament, the ratings of which are as follows:



Filament voltage	7.5 volts a.c. or d.c.
Filament current	3.25 amperes
Thermonic emission	1 ampere

The tube's interelectrode capacitances are as follows:

Grid to plate	2.5 mmfd.
Grid to filament	2 mmfd.
Plate to filament	0.7 mmfd.

The maximum rating for the tube is as follows:

Maximum direct plate voltage	1250 volts
Maximum direct plate current	100 milliamperes
Maximum plate dissipation	50 watts
Maximum direct grid current	25 milliamperes
Maximum r.f. grid current	6 amperes
Maximum frequency of above ratings	100 megacycles
Maximum plate voltage for upper frequency limit of 300 megacycles	750 volts

Maximum plate voltage for frequency between 100 and 300 megacycles are in proportion.

As an unmodulated oscillator or amplifier the maximum d.c. plate voltage is 1250 volts at 0.1 amperes, with a continuous plate dissipation of 50 watts and a maximum d.c. grid current of .02 amperes.

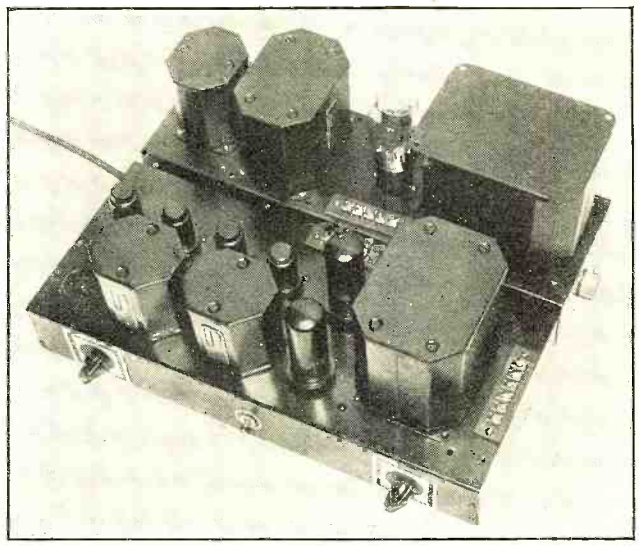
Operating Characteristics

Under operating conditions on 1250 volts the d.c. the grid bias should be —180 to —250 volts, with a plate current of 0.1 amperes, a power output of 85 watts and 40-watts plate dissipation. At a plate voltage of 1000 volts the grid bias is —135 to

(*Turn to page* 183)

Ideal Beam Power AMPLIFIER

By I. A. Mitchell



THE advent of the 6L6 tube has naturally caused a considerable interest in the application of this tube to high power audio amplifiers. The writer has received numerous requests regarding the design of an amplifier incorporating these tubes. The amplifier described below has been designed to take care of every possible requirement and contingency mentioned in these requests. An analysis of the many universal features of this amplifier would indicate the following:

1. High power (35-55 watts).
2. High gain, 118 DB, with provision for immediate change-over to 95 DB.
3. Separate power supply and audio decks for minimum hum pickup.
4. Circuit arrangement suitable for self or fixed-bias operation of the 6L6 tubes.
5. Output circuit with stabilized feedback to increase available output power and reduce distortion.
6. Self-contained equalizer circuits to enable bringing up the low frequency and for both low and high frequencies simultaneously.
7. Audio chassis alone suitable for mobile operation with a genomotor.
8. Dimensions and arrangement suitable for rack panel or rack cabinet construction.
9. Provision for electron mixing of two inputs if desired.
10. Provision for a low impedance input transformer of extremely low hum pickup if desired.
11. Low hum level and distortion.

No Trick Circuits

All these features are obtained with no trick circuits and extremely simple wiring.

Before designing this amplifier, a thorough analysis was made of the operation of the 6L6 tube to determine the best conditions of operation from both engineering and economical angles. A pair of these tubes will deliver 32 watts of audio power in self bias, or 60 watts of audio power in fixed bias (in Class A B). However, to obtain the full 60 watts of clean power in fixed bias, a power supply with extremely good regulation and a bias supply of extremely low resistance must be provided, also the driver tubes must have very low internal resistance.

Precautions To Be Taken

While a bias battery will readily take care of the low resistance bias supply, extreme precautions would have to be taken care of in the plate supply to obtain optimum operation. A choke input filter would in any case be necessary with its corresponding increase in cost of components. As an ideal driver, one or two 2A3 tubes would have to be used as they are the only receiver type tubes with a very low plate resistance. After examining these facts, a compromise fixed bias arrangement was tried using the same power supply (condensed input) as for self bias operation, a *22½* volt C battery for bias, and a pushpull metal tube driver. This condition was found quite satisfactory and gave almost as much power as the ideal fixed-bias condition (*Turn to page* 189)

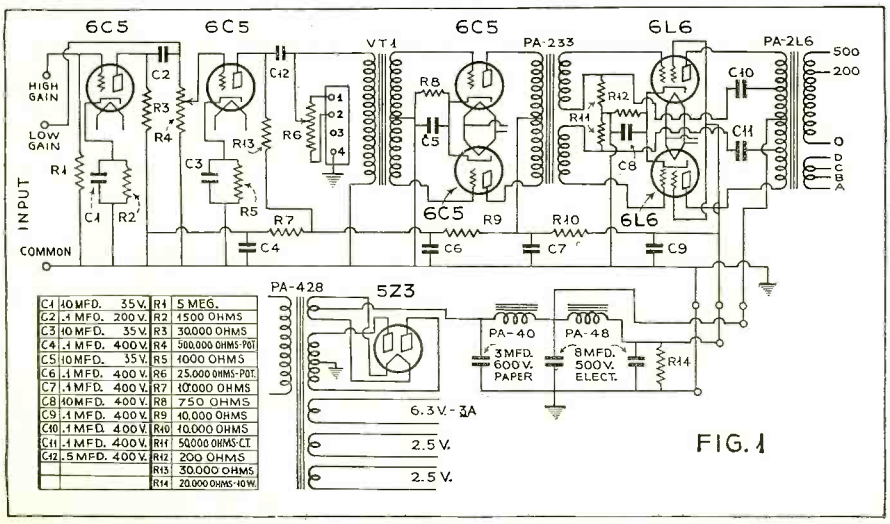


FIG. 1

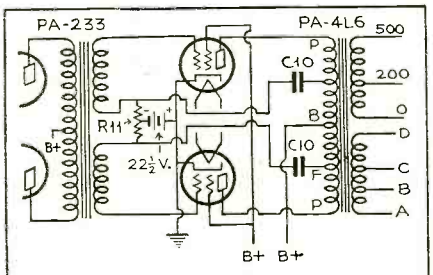


FIG. 2
CIRCUIT MODIFICATION FOR FIXED BIAS

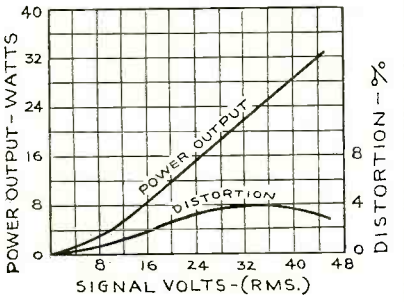


FIG. 3 6L6 DISTORTION CURVE SELF-BIAS

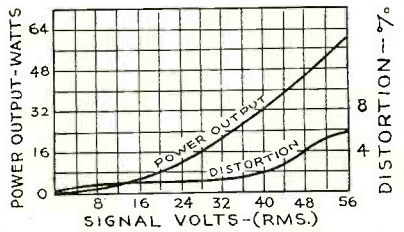


FIG. 4 6L6 DISTORTION CURVE WITH FIXED BIAS

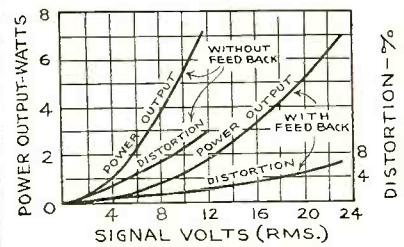
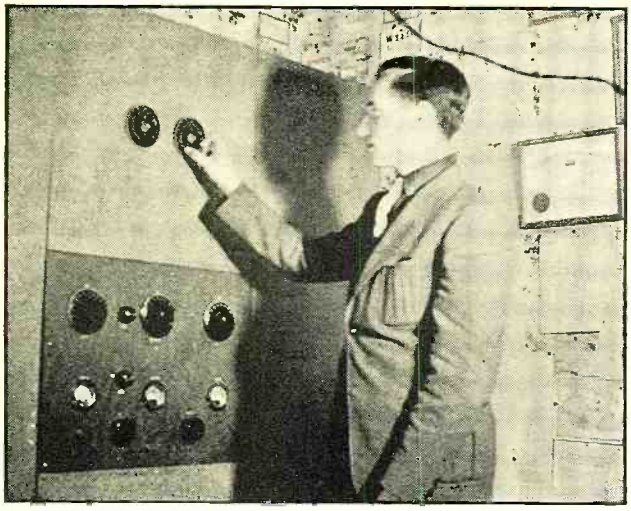


FIG. 5 CURVE SHOWING REDUCTION OF DISTORTION WITH FEEDBACK. (SINGLE 6L6)



TUNING UP

George Pasquale, W8OQU, of Wellsville, New York, tunes up his amateur rig.

The "HAM" Shack

Conducted by
Everett M. Walker
Editor for Amateur Activities

Design For A C. W. 20-40 Meter Transmitter

THE new 6L6, while designed primarily for receiving set audio amplifiers, is developing into one of the most interesting tubes for the amateur transmitter. It is an excellent crystal oscillator and will provide more output on both crystal fundamental and harmonic than any other arrangement now available to the amateur. Furthermore, it is a good frequency multiplier and buffer.

WITH the 6L6 tube now available we decided to lay out a simple, inexpensive transmitter that would meet the requirements of the c.w. man who desires to operate principally on the 20 and 40-meter bands. The first aim was to keep the cost down without the sacrifice of efficiency; the second to provide a reasonable amount of output that could compete with the amount of interference on these bands; third, to provide quick band-switching so that the operator could switch between these two bands with a minimum amount of effort.

To keep the cost down a "refined" type of breadboard construction was selected. Unlike most breadboard layouts all the moving parts and circuit components are mounted under the baseboard. Only the tubes and coils are above. The box-like frame is 9 inches deep, 18 inches long and 4½ inches high. All controls and meters are mounted on the front panel, which is 4½ inches high and 18 inches wide.

The 6L6 was selected for the oscillator because of its high output capability and its efficiency as a doubler. By using a tube with high harmonic output in a two-tube transmitter the problem of band-switching is greatly simplified because of the fact it is only necessary to change the number of turns on the grid coil and on the output tank coil. The amplifier tube following the oscillator is a Taylor type 55. This tube incidentally, performs excellently at high frequencies and is capable of operating as low as one meter. The 55 offers a medium power output that stands a good chance of competing with bad QRM when it is coupled to a good antenna.

It will be noted the parts are laid to follow the schematic diagram. This makes short leads possible with the resultant high efficiency. On the baseboard at the left are the crystal, the 6L6 and the plate tank coil of the oscillator. Slightly to the right of the center is the Taylor 55. The coil in the middle is a "self-tuned" grid coil. In front of this tube is the neutralizing condenser and at the extreme right is the amplifier tank coil.

The front panel contains all controls, meters and jacks. At the extreme left is the oscillator condenser, followed in order by the meter jack for measuring the plate current of the oscillator; the 0-150 milliameter; the grid-current meter jack (at top), the band control switch and key jack; final amplifier 0-200 milliameter plate current meter and finally, the amplifier tank condenser.

Reading Plate Current

The final-amplifier, plate-current meter is permanently connected in the plate circuit of the 55. However, the 0-150 milliameter is used for two functions: measuring the oscillator plate current and amplifier grid current. The leads of this meter are connected to a standard 'phone plug, and it is inserted in the jack of the circuit to be measured.

THE 20-40 METER RIG

At the left is the top view, below, the front view and, at right, the bottom view of the c.w. transmitter designed by W2MW.

Sockets are mounted in holes through the baseboard. All wiring except for the leads to the neutralizing condenser and final tank circuit are below the baseboard. Filament, plate and C-bias connections are made to the terminal strip at the rear. The high voltage is connected to a separate 2-terminal strip. A switch is provided for cutting the plate voltage on the final amplifier to facilitate neutralizing and tuning.

Voltages for the screen and plate of the 6L6 are obtained through a voltage divider, mounted at the rear. The voltage-divider method of obtaining the screen voltage is necessary in view of the fact keying is done in the oscillator cathode circuit. The key is connected in series with the cathode resistor at the point marked "X" on the diagram. If a dropping resistor were to be used to obtain this voltage, when the key was up the voltage would jump and probably damage the tube. It was found that the 6L6 gives the greatest output with between 250 and 300 volts on the screen. Oscillator keying tends to reduce keyclicks and fascilitates break-in operation. However, it is necessary to use a combination of battery-resistor bias on the amplifier in order to provide plate-current "cut off" when the key is up—45 volts is sufficient for this purpose.

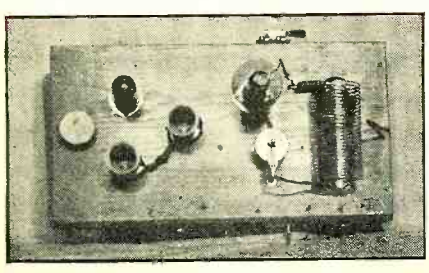
Band Switching

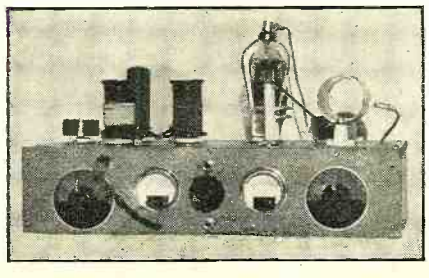
One of the tricks of this transmitter is the method of switching from one band to another. Of course, it is necessary to use a crystal that will double into 20 meters from the 40 meter c.w. band.

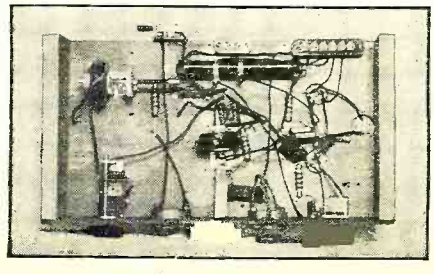
It will be noted that two Ohmite tank-coil switches are employed: one in the grid circuit and one in the final tank circuit. The grid coil has no condenser connected across it, it being "self tuned." It is wound with 30 turns of No. 24 double-cotton-covered wire on a standard 1½ inch coil form and tapped at 14 turns from the grid end. This arrangement provides a rather broadly-tuned grid circuit and eliminates an additional tuning control. Some experimentation may be necessary in adding or subtracting turns in order to obtain peak grid current.

This method was selected for two reasons: first it facilitates using the harmonic output of the oscillator for 20-meter operation (which could not be done with other forms of coupling); second, it provides a good transfer of energy over each of the two bands the transmitter is designed to

(*Turn to page* 178)







¶ A Department for the amateur operator to help him keep up-to-date.

License Code Speed Advanced

THE Federal Communications Commission has announced as of June 13, the code speed requirement to qualify for an amateur license has been increased from 10 to 13 words-a-minute. The new code speed is in line with the recommendation adopted by the Board of Directors of the American Radio Relay League last May. The A.R.R.L. board debated advancing the requirement to 12 or 15 words-a-minute, finally reaching a compromise recommendation of 12½ words-a-minute. The commission made it a flat 13.

Amateur license requirements were not changed in any other respect. The questions are exactly the same as heretofore, covering transmitters, receivers, regulations, etc. The advance in the code speed requirement should not discourage applicants. Actually it is not much more difficult to master 13 words-a-minute than 10. Once the intricacies of learning to think in the code equivalent of a letter (i.e. to know automatically that dot dash is A without having to go through the reasoning process of: "dot dash, now that is A") speed is quickly acquired. The first five words-a-minute are the hardest; the transition from 5 to 10 is quick, and from 10 to 13, quicker. The number of words a minute is computed on the basis of five letters to the word.

The Amateur and Television

WHERE does the amateur stand on the ultra-high frequencies? Only the

(*Turn to page* 170)

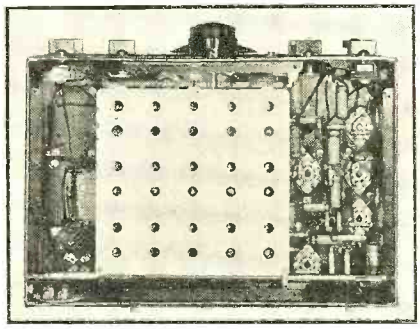
New AMATEUR Receiver

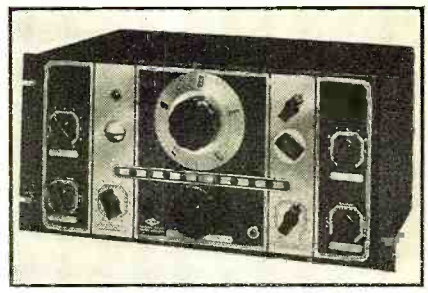
By Robert Ames

A NEW communication-type receiver which should find wide usage among amateurs is the new National 12-tube NC—100 receiver which covers all frequencies from 30 megacycles to 540 kilocycles, taking in the wavelength ranges from 10 meters, through the Broadcast Band. The receiver employs the following tubes: a 6K7 as a r.f. preselector, a 6J7 as a detector, a 6K7 h.f. oscillator, two 6K7 tubes as i.f. amplifiers, a 6C5 tube as second detector, a 6J7 tube for a.v.c., another 6J7 tube as b.f. oscillator, two 676 tubes for the push-pull out-put and a 6E5 tube as a tuning indicator. The rectifier tube is a type 80.

SLIDING COIL ASSEMBLY

Bottom view of the new receiver in which the square compartment slides laterally, to make contact with the proper set of coils.

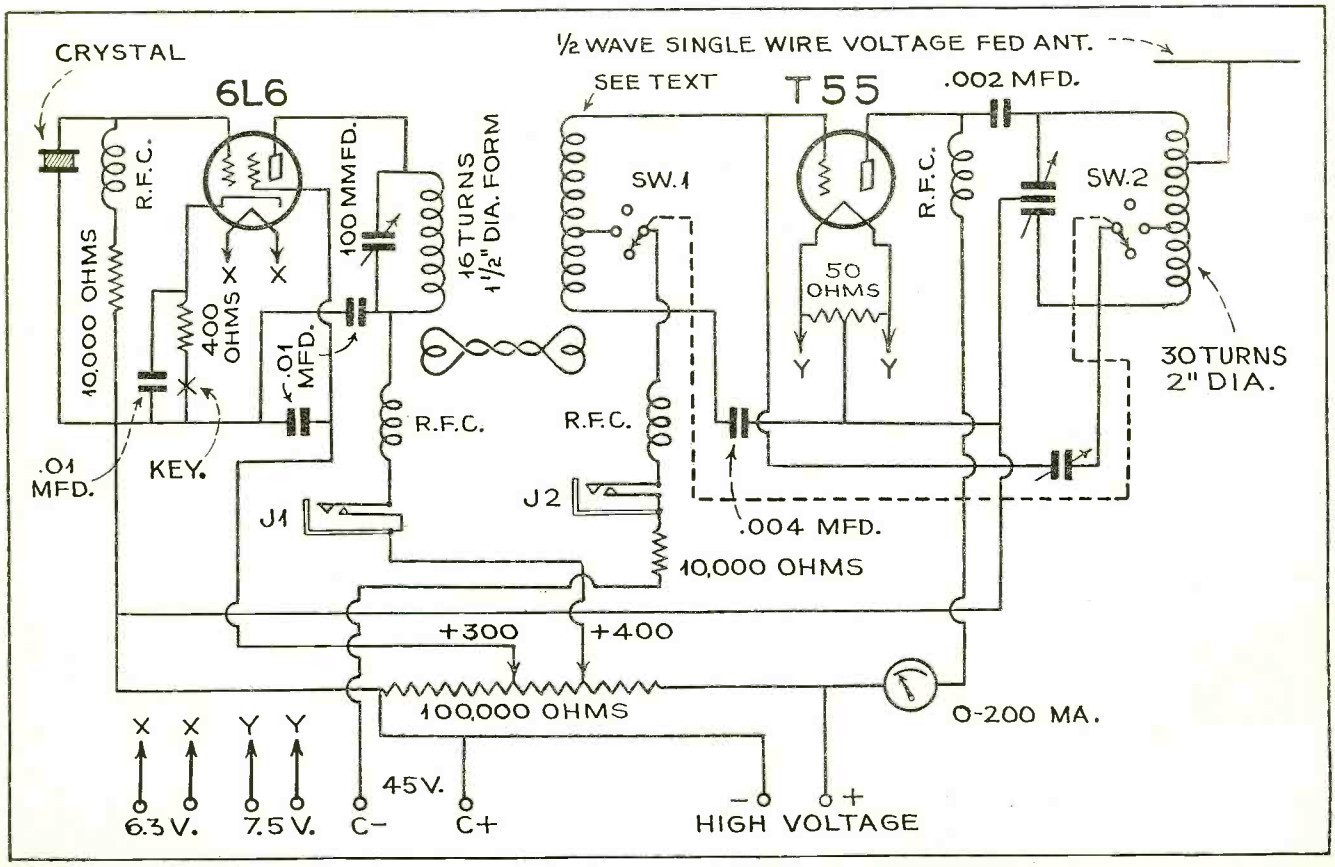


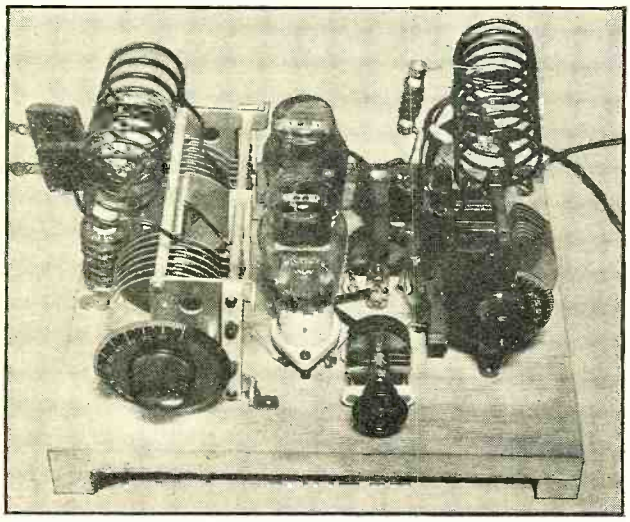


The main feature of the receiver is the unique coil-changing mechanism contained in a completely shielded "catacomb" in which each individual coil is shielded from all the others. The whole mechanism might be termed an automatic plug-in-coil system, in which the coil changing is done by a rack-and-pinion device controled from the central knob on the front panel. The whole catacomb slides horizontally so that each coil in passing makes contact with a set of "fingers" which connect the coils in the circuit. One of the illustrations shows this coil assembly in the bottom view of the chassis.

The controls on the front panel are as follows: at the upper left is a tone control, while the knob below controls the power supply—turned to the extreme left both the A and B power are turned "off", at the next point to the right AC is turned "on" with the B power "off," while at the extreme right both the A and B power are turned "on." The control to the right of this is the r.f. gain. The central lower knob is the automatic coil-changer knob while above it is the main tuning dial. To the right of the coil-changer knob is the audio gain control.

(*Turn to page* 173)





DETAILS OF THE 801 OUTPUT STAGE

This is the final amplifier, mounted on its wooden sub-base and connected to the crystal-exciter unit shown on the opposite page. It is simple to build and works like a charm.

Getting ON TEN

A well-known amateur, on both the design and operation of a very FB 10-meter operation, giving all the get the same

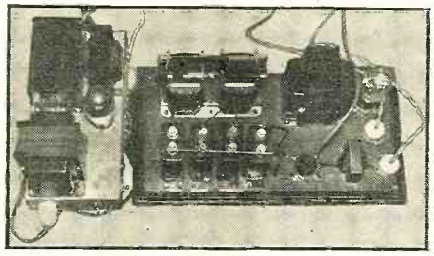
By **Paul**

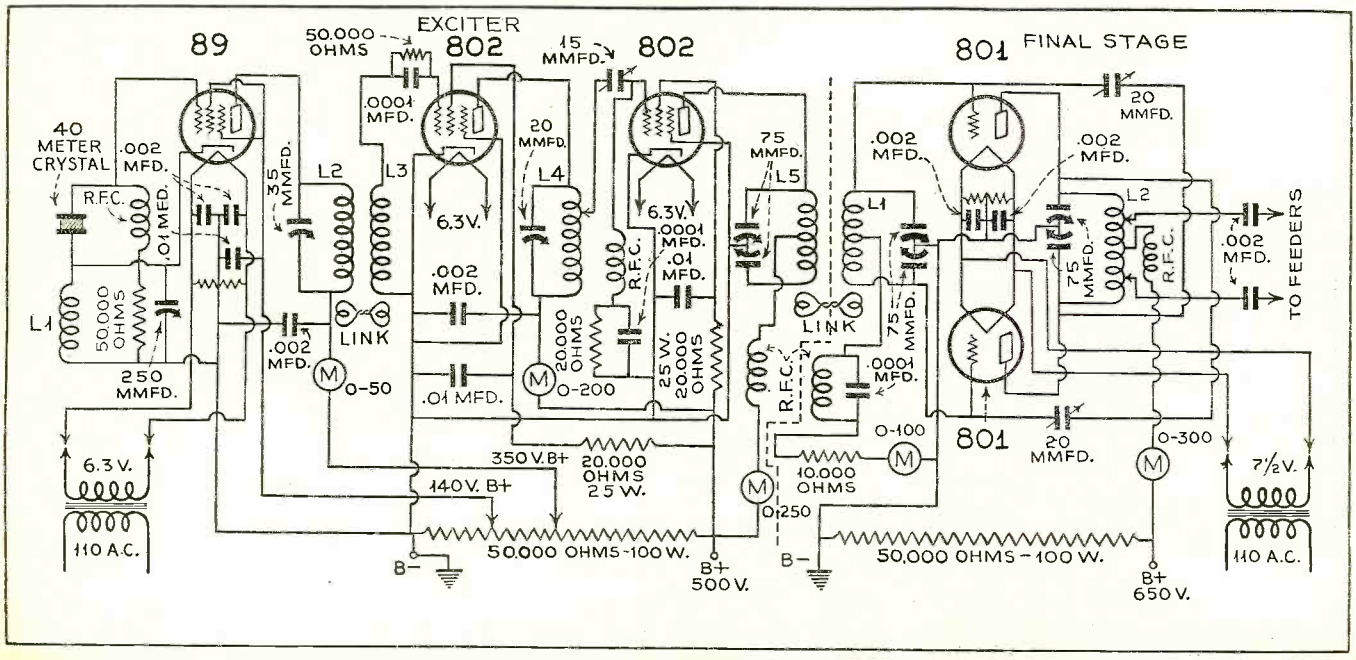
THE logical step for the 5-meter amateur who wants to get his first taste of real distance transmission and reception, as well as to become familiar with crystal control in a transmitter, is the 10 meter band. I have heard many amateurs talking about getting started on 10 meters and there seemed to be some doubt in their minds how to design and build a really suitable 10-meter transmitter. I have been using at my own station, W2IPH, a very efficient crystal-controlled transmitter that I believe to be ideal for medium power work on this band—one which has enabled me to contact amateur stations thousands of miles away and one which is easy to get into operation and when in operation is stable and with a good quality of modulation. It is built up on a "bread board" layout, in two sections. One for the exciter unit, shown in the upper right photograph and one for the final output stage, shown in the upper left photograph. The same transmitter operates very well on 20 meters and for both 10 meters and 20 meters operation uses a 40-meter crystal in the oscillator.

Making the Layout

For the purposes of placing the output stage close to the window on my operating table I have built the exciter backwards, with the oscillator at the right end, progressing through the doubler stage to the left-hand side of the exciter unit. The final stage hooks onto the left of this through a link circuit. In the wiring diagram, however, the standard left-to-right progression of the circuit is shown. Referring to the photograph of the exciter, the 40-meter crystal circuit is shown at the right, with its input and output coils and tuning condensers and with a 0-50 plate milliammeter. The crystal is in back of the 89 tube, which is shielded with an ordinary receiving tube shield. This circuit is link-coupled to the input coil of the next 802 doubler stage. The 89 stage doubles in the plate circuit to 20 meters. In the center of the exciter layout may be seen the 802 doubler which doubles in its plate circuit to 10 meters. The coil for the input circuit of the 802 is in back and slightly to the right of the 802 tube with the grid leak and condenser shown running to it. On the left of the tube is the tuning condenser and output coil with a 0-200 milliammeter shown at the rear. The buffer stage is on the left end of the layout with its 802 tube capacity—coupled from the previous stage and with its output-tuning condenser and coil plainly visible. Notice that there are two flat vertical shields (which are grounded) on the right and left of this stage. Also in operation this buffer stage is coupled to

THE TWO POWER SUPPLIES

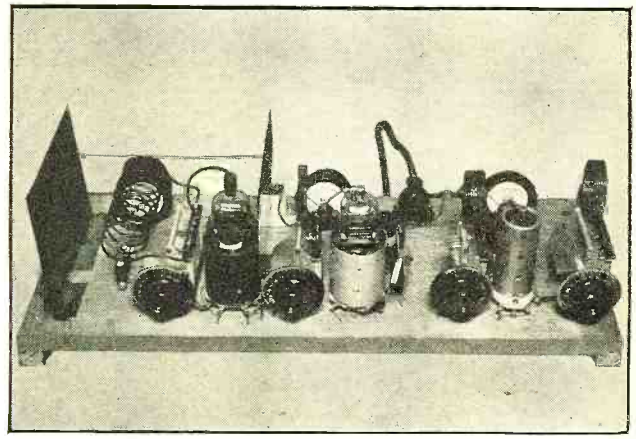




Started METERS

10- and 5-meter bands, outlines the crystal-controlled transmitter for circuit details so that anyone can results as he does

Cintrat



CRYSTAL EXCITER AND DOUBLER STAGES

At the extreme right is the crystal oscillator with an 89 tube, in the center is the 802 doubler and at the left is the 802 buffer in a design which is easy to build and operate.

the final amplifier by a one-turn link. Both of the links used in the transmitters are coupled to the "cold" or ground end of the input and output coils and are simply inserted between the turns of the coils with a twisted lead of the required length coupling the units. Note that both the 802 tubes are partly shielded and this is very important if good results are to be obtained. The base end of the tube *must be shielded and the shield should extend up to but not beyond a point level with the bottom of the internal shield inside the tube itself!* These shields are grounded at filament center tap.

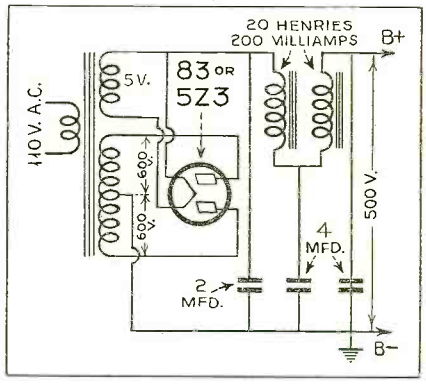
Final R.F. Amplifier

Referring to the photograph of the final stage, the two 801 tubes are in the center position with the input coil and tuning condenser at the right and the output coil and tuning condenser at the left. The two neutralizing condensers lie between the tubes and the input-tuning apparatus. Direct antenna coupling is made to the output coil through two fixed condensers set in series with the feed lines. The 50,000-ohm, 100-watt "bleeder" resistance is mounted below the sub-base for both the exciter and the output stage units.

Two similar power units are employed for this equipment, one for supplying A and B voltages to the exciter and one for supplying A and B voltages to the final stage. The circuit for these power units is also shown on these pages and also a photograph of the two actual power units used which, although different in constructional details, have the same circuit constants. The power unit for the exciter power supply uses a 5Z3 rectifying tube but a type 83 rectifier tube is used in the power supply for the final 801 stage. The bleeder resistors were included in the exciter and final amplifier stages rather than in the power supply so that all adjustments could be made right at the transmitter.

The coil data for the crystal controlled transmitter are as follows:

THE POWER SUPPLY CIRCUIT



Exciter Coils for 20-Meter Operation

L1—6 turns, 1¾ inches in diameter, No. 16 wire, single spaced

L2—8 turns, 1¾ inches in diameter, No. 16 wire, single spaced

L3—grid coil, 20 turns, No. 24 wire closely wound on a 1 inch form

L4—10 turns, 1¾ inches in diameter, No. 16 wire, single spaced

L5—10 turns, 1¾ inches in diameter, No. 10 wire, spaced ⅜ inch between turns

Exciter Coils for 10-Meter Operation

L1, L2 and L3—same as above

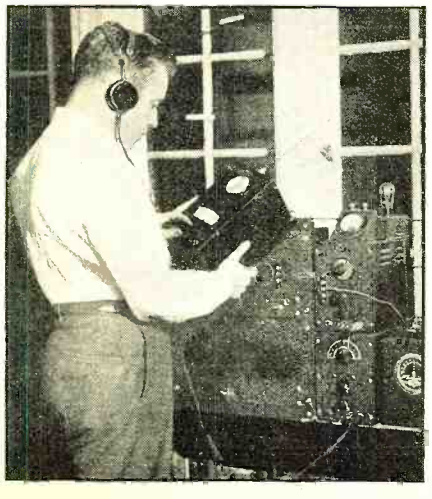
L4—4½ turns, 1¾ inches in diameter, No. 16 wire single spaced

L5—10 turns, 1¾ inches in diameter, No. 10 wire, spaced ⅜ inch

Coils for Output Stage for 10 and 20 Meters

L1 and L2—10 turns, 1¾ inches in diameter, No. 10 wire, spaced ⅜ inch.

The reason for coil specifications being the same for both 10 and 20 meters for the output amplifier is the fact that the specified capacities of the tuning condensers make the coils suitable for both bands, with only a variation in condenser setting. (*Turn to page* 188)

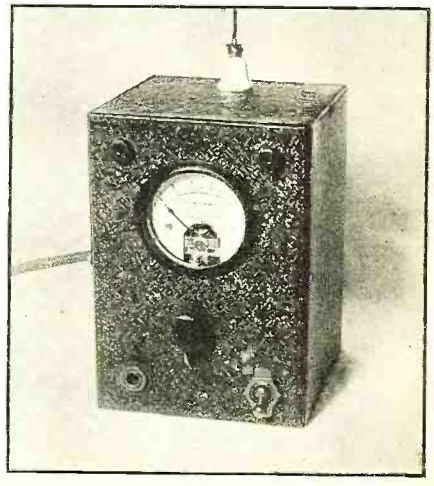


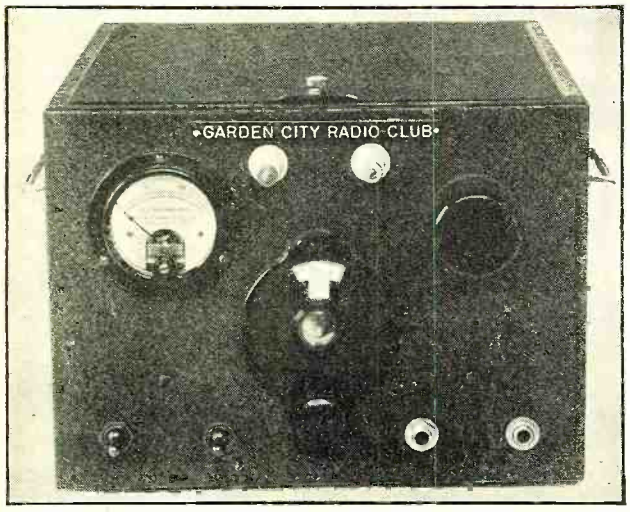
The Rig-Checker

HOW often does the amateur wish he had some kind of a compact device which he could use around his station that would do practically all the measuring work and adjustment necessary to keep the station working at top notch at all times? The devices described here will do just that.

TWO new measuring units, known as "Rig Checkers", have recently been designed by A. J. Haynes and offered by the Radio Construction Laboratories for amateur use. These gadgets have been tested at the Weschester Listening Post

(*Turn to page* 185)





THE TRANSMITTER COMPLETE IN ITS CABINET

Note the compact and neat layout for the front panel, which includes plate milliammeter, central tuning dial, the buzzer modulator, the antenna terminals, the filament and plate toggle switches and jacks for the phones and key.

Amateurs Report Yacht

PORTABLE

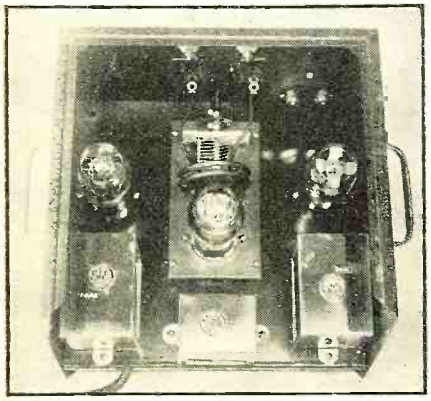
Amateurs interested in portable-mobile, portable-marine, or portable-aviation transmission and reception will welcome this descriptive article on the type transmitter and receiver used this summer with so much success in reporting the yacht races on the Long Island Sound. This equipment was designed by amateurs of considerable technical ability and produces results that are little short of amazing

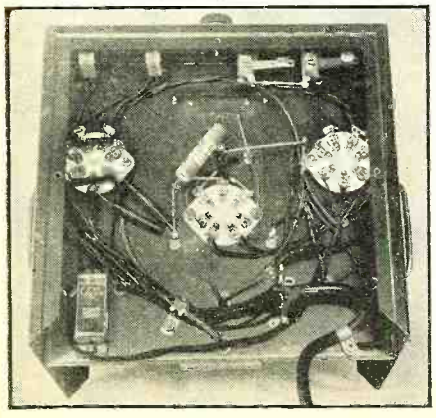
By Arthur H. Lynch

SOME of the requirements of transmitters and receivers for portable marine work included the desirability of non-radiating receiver units so that the boats did not interfere with each other, transmitters that were portable, rugged, extremely simple and suitable for operation from batteries. Standard parts were used, to be described here, as the accompanying pictures show, and in the preliminary tests that were made the receiver and transmitter gave excellent accounts of themselves. With the antenna not more than 25 feet above the water the transmitter was picked up by a portable-mobile station more than 100 miles away and the signal was reported as being R8. Another preliminary test of the transmitter from a fixed station resulted in transmissions over 60 miles with the following scale of results: 220 volts—R8, 180 volts—R8, 135 volts—R7, 90 volts—R6, 45 volts—R4.

CONSTRUCTION DETAILS

The illustration, directly below, is the inside view of the transmitter, showing the power, oscillator, and modulator tubes and the various transformers. The oscillator itself sits on a victron panel below which the subbase is cut away. The bottom view shows the underneath side of the subpanel.





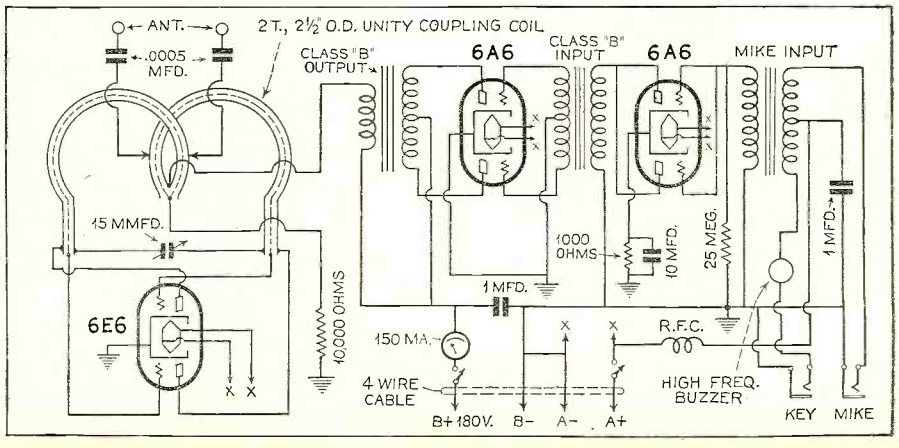
The Transmitter

The circuit diagram and the mechanical drawings give all the important points for the duplication of the units and it will be seen by referring to the front view of the transmitter that either ICW or telephone transmissions may be had by the simple expedient of using the left-hand or right-hand jack on the front of the transmitter cabinet. The two toggle switches permit the transmitter to be operated with the plate supply "off" while the receiver is in

Origin of the Design

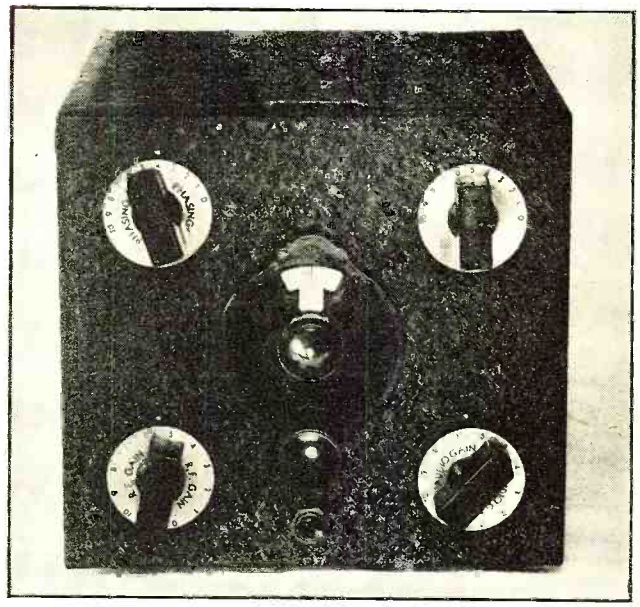
CURTIS ARNALL, who is a member of the City Island Yacht Club and a famous radio personality, conceived the idea of having the yacht races that take place on Long Island Sound this summer reported by amateur radio so that the "rocking chair squad" would be able to follow the yachts themselves, even though they were one hundred or so miles away.

He communicated his desire to the American Radio Relay League and Mr. F. E. Handy, the League's Communications Manager, turned the job of securing the equipment and the personnel over to the Garden City Radio Club. In order to be sure that the job was handled in a satisfactory manner, the Garden City Club, in addition to soliciting the co-operation of all of the other clubs of the New York area, established a technical committee whose job it was to design a suitable transmitter and receiver as a standard sample from which those fellows who would like to handle the jobs aboard the yachts would be able to follow.



Races with this Standard

5-METER RIG



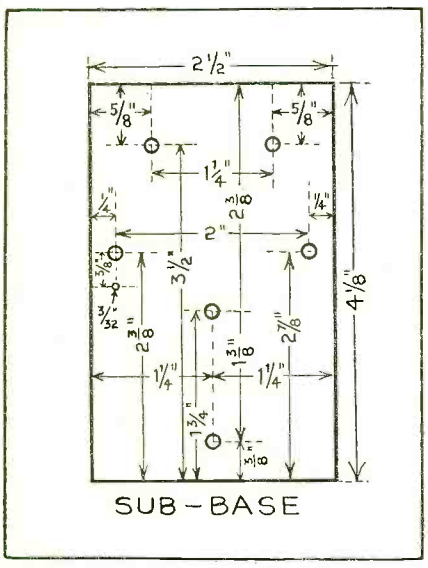
5-METER RECEIVER THAT REALLY RECEIVES

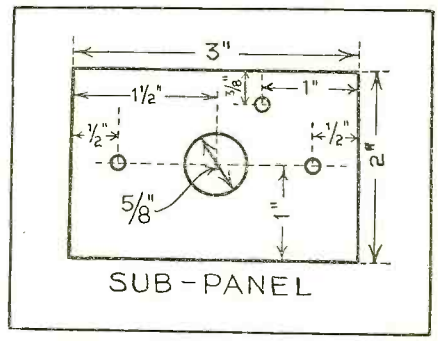
No alibis have to be made for this excellent regenerative receiver. Users call it the "Ace" of simple 5-meter sets employing no more than three tubes.

operation, while the filaments can remain heated. Special care has been taken in the transmitter to avoid inefficiency in the radio-frequency circuit and that is the reason that an isolantite type socket has been employed for the oscillator tube and that the complete oscillatory circuit has been set up on a separate victron base. A rectangular hole slightly smaller than the victron base is cut in the sub-panel and this may be seen in the view of the under side of the transmitter. In order to prevent direct current getting into the antenna system two large condensers are placed in the antenna feeder circuit. Adjustment of the buzzer tone for ICW operation is accomplished by simply removing the lid from the buzzer which is mounted on the front of the transmitter and adjusting the thumb screws.

A vernier dial, with positive action, is employed so that the vibration which is experienced on board boats or in automobiles will not result in a shifting of the oscillator condenser.

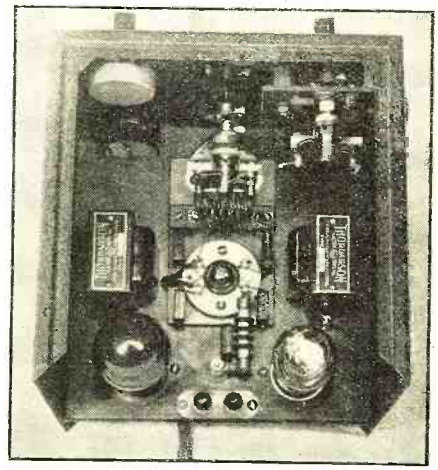
In assembling the transmitter it will be seen that the top, rear and bottom of the National SW3 cabinet are removed and this results in a great simplification of the work. There are absolutely no tricks in this circuit and it is completely straightforward and lends itself admirably to simple duplication.





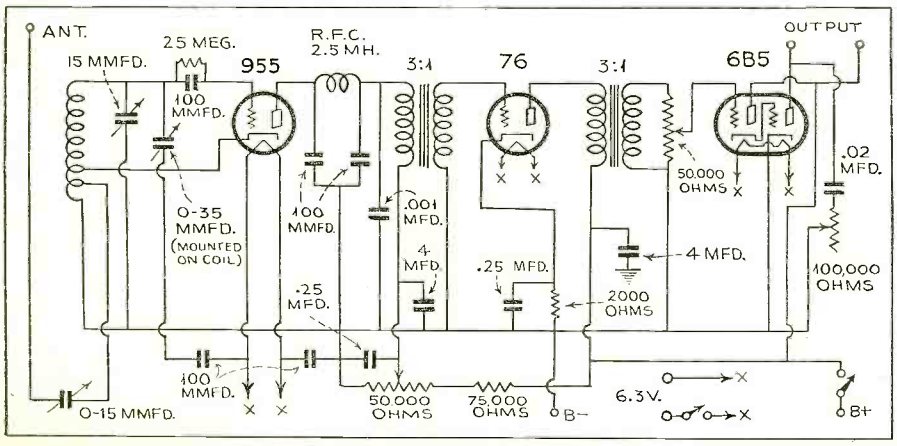
The Receiver

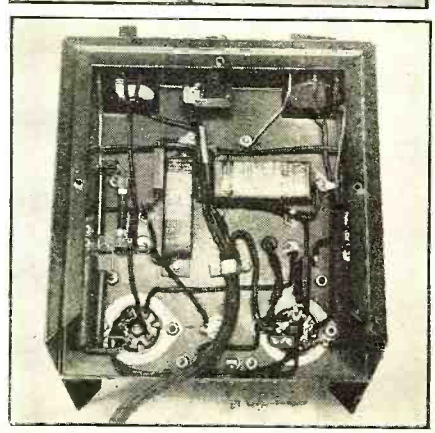
Before selecting a receiver for a companion unit the twenty odd members of the Garden City Radio Club undertook to investigate the performance of various ultra-high-frequency circuits and the unit which is described here was chosen as a result of that investigation. The outside (*Turn to page* 186)



RECEIVER CONSTRUCTION

The illustration, at the right, shows the inside view of the receiver and the distribution of the various parts. The bottom right view shows the under side of the receiver, with the wiring to the various parts.

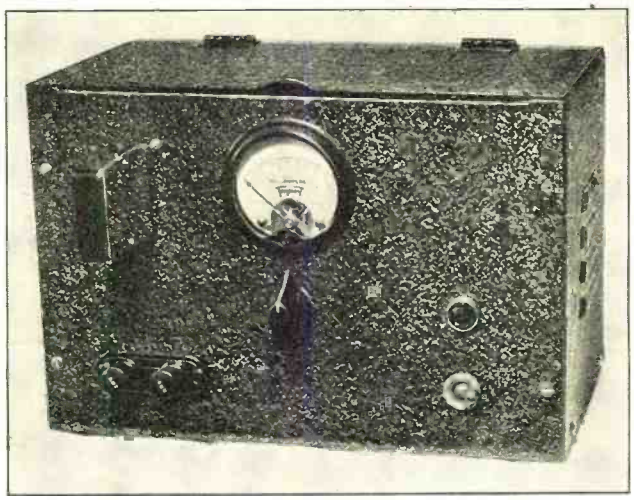




Inexpensive

"Lab" CRYSTAL Oscillator

By The Staff



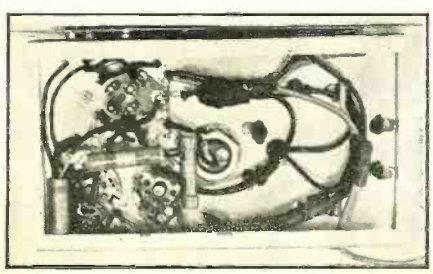
A HIGH-PRECISION UNIT

A speedy and highly accurate instrument for checking receiver or signal generator calibrations throughout all ranges. A built-in power supply furnishes all operating voltages from the a.c. line.

RECENTLY a need was felt in the RADIO NEWS laboratory for an accurate frequency standard for use in checking receiver calibration, r.f. oscillator calibration, etc. The accompanying photographs and circuit diagram show the instrument which was built up to fill this need. The unit described here is a crystal oscillator with built-in power supply to operate from the a.c. line, using a 6L6 "beam-power" amplifier tube for the oscillator because of the abundance of strong harmonics which this tube provides. So useful has this device proved that the circuit, photos and parts lists are presented herewith for the benefit of others who may have need for a similar unit.

The crystal employed will depend on the purpose for which it is to be primarily used. The cheapest crystals are those employed by amateurs and resonate in the 160, 80 and 40 meter bands. One resonating around 2000 kc. will prove very useful for checking the calibration of tunable r.f. oscillators or signal generators. Such a crystal will provide check points every 2000 kc. throughout the high-frequency range of the oscillator. Then by tuning the oscillator in the low frequency ranges so that its harmonics beat with the crystal fundamental, additional calibration points are obtained at ½, ⅓, ¼, etc., of the crystal frequency. When the calibration of an r.f. oscillator has been checked, it in turn can be employed to check the calibration of receivers or other equipment.

It is not necessary to purchase an expensive crystal of accurately known frequency for this work. If it is rated at *approximately* 2000 kc., for instance, its frequency can be readily determined to 1 part in 10,000 by a simple procedure, requiring only the use of a receiver and any sort of a tuned r.f. oscillator. This is accomplished by first tuning the receiver to resonance with the crystal fundamental frequency, then tuning the other oscillator around the 1000 kc. range until its second harmonic heterodynes the crystal to zero beat as heard in the de- (*Turn to page* 187)



The Reason For

"Matched" P.A. *Equipment*

A MODERN SOUND SYSTEM

The Webster Model PA-417A offers a typical example of the careful matching made possible where the entire equipment is marketed as one unit.

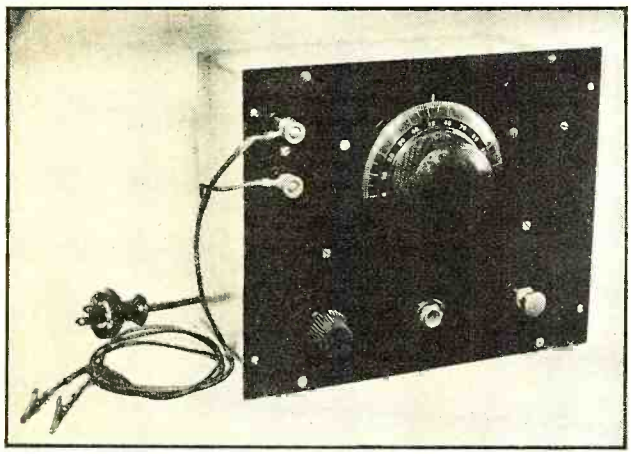
DURING the past two years there has been a notable improvement in the character of manufactured sound equipment. This is due in part to the realization that a sound system must be considered as a complete unit, from microphone to speaker, rather than a haphazard assembly of the various components. The difficulties likely to arise with the latter procedure will be apparent from a study of the accompanying curves, which were submitted by the Webster Company, Chicago, Ill., to illustrate this point.

In curve "A", the frequency characteristic of a typical carbon microphone is given. This microphone was not especially selected but was picked up on the open market and may be assumed to represent the average run. It will be noticed that there is a well defined peak (x) from 2000 to 3000 cycles.

Curve "B" represents the frequency characteristic of one particular speaker. It will be noticed that a sharply defined peak occurs within the peak output range of the microphone.

Curve "C" shows a composite of curves "A" and "B" and indicates what we may expect when an amplifier of flat characteristics is used with the above units.

The result of such a combination is a system which becomes abnormally sensitive within the peak range indicated, making it necessary to reduce the gain of the amplifier to avoid feed-back and howl. This causes an overall loss in efficiency and (*Turn to page* 188)



FOR EXPERIMENTERS AND SERVICEMEN

Not only will this instrument provide an accurate indicator for matching coils and condensers but it is equally effective in checking alignment of tuned circuits.

Serviceman's RESONANCE INDICATOR

By Joseph Wininsky

IN radio-frequency work the serviceman and experimenter often find it necessary to match coils, check the tracking properties of tuning condensers or to adjust a series of tuned circuits to resonance. The instrument described here is designed for just such uses.

FUNDAMENTALLY this simple unit consists of a high-frequency oscillator beating with some harmonic of a low-frequency oscillator so that a condition of zero beat is indicated in headphones connected in the plate circuit of the former. Now when a tuned circuit is connected across the grid circuit of the low-frequency oscillator and C1 (Figure 1) is adjusted to zero beat with some harmonic, a very slight change in the electrical characteristics of this tuned circuit will upset the condition of zero beat. Thus we have a simple and very accurate method of comparing tuned circuits, tuning coils and condensers, and adjusting them to exact resonance.

The Tubes Used

Three type –27 tubes are used, two as oscillators and one as rectifier in the plate supply. Of course, any other suitable triode may be used, such as the 56, 76, 6C5, etc The entire unit is contained in a metal case 8¾ inches long, 7 inches high and 5 inches deep with a panel 9½ inches long, 8 inches high, of 1/16 inch steel. The accompanying photographs show the layout of the parts and general method of construction.

Oscillator Coils

The two oscillator coils are home made. L1 consists of 45 turns secondary, 20 turns tickler, L2 consists of 11 turns secondary, 7 turns tickler. All windings are wound with No. 26 enameled wire on a 1½ inch form.

A detailed account of the construction of this device is not necessary as the illustrations and drawings are self explanatory. Suffice it to say that the small filament transformer is mounted under the bottom panel as is also the filter choke. The filter condensers are mounted directly above the transformer on the top side of the panel. The two oscillator coils, variable condenser, power switch, phone jack, and variable resistor are mounted on the front panel. Precautions for insulation should be taken where necessary.

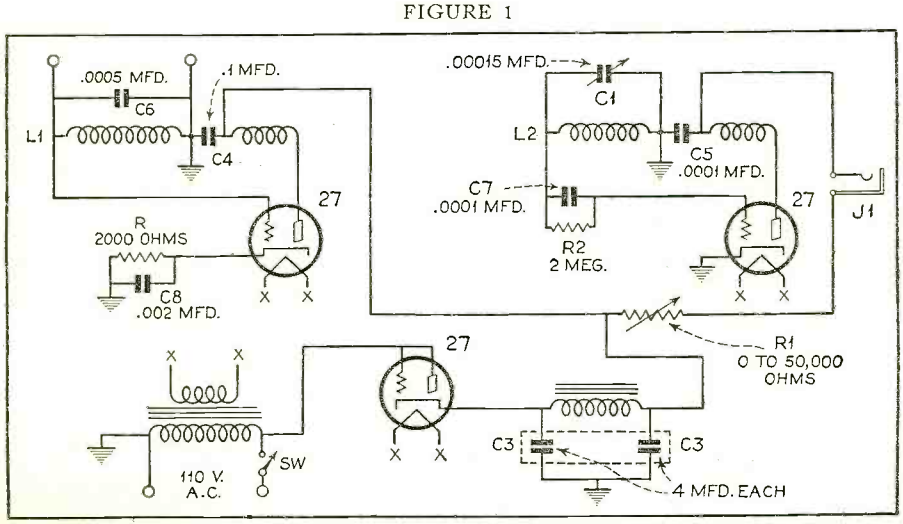
Operating Data

After the unit has been assembled and wired insert tubes and plug in headphones. If the high-frequency oscillator is functioning properly a distinct click should be heard upon touching the stator plates of the variable condenser with a metal screw driver. If there are indications that this circuit is not oscillating try reversing the tickler connections. The variable resistor should control any howls or squeals that may take place. Now upon rotation of the tuning condenser a series of beat notes should be heard, one every 10 or 15 points on the dial. This shows that the low-frequency oscillator is functioning and after placing the instrument in its shielding case it is ready for use. A shielded lead about 20 inches long provided with spring clips on one end and spade tips on the other is used for connecting to the circuit under test.

How It Is Used

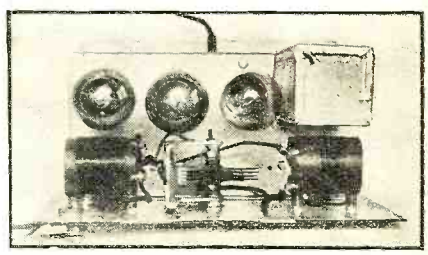
If a tuned radio-frequency amplifier is to be aligned the procedure is as follows. Make sure tubes and shields of receiver are in place. *The external grounds should be disconnected.* The test lead is clipped to the ground (chassis) and grid end of the detector tuning coil. Now turn the indicator dial until a beat note is heard in the phones and carefully tune to zero beat. Next move the grid clip to the grid of the preceding r.f. stage. If condition of zero beat is not maintained in this stage adjust trimmer condenser until it is. Proceed in this manner with remaining stages. The alignment may be checked at any other setting of the tuning condensers without disturbing the trimmers as would have (*Turn to page* 168)

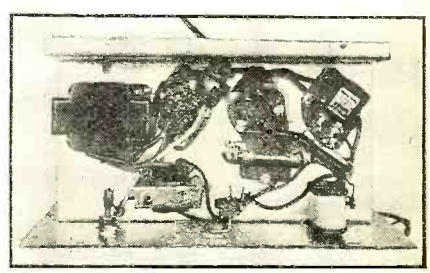
FIGURE 1



CHASSIS VIEWS

Constructors can readily follow the layout as shown here.





THE SERVICE BENCH

tells YOU Something about

Southern Service

. . .

Service Shops

. . .

Service Sales

. . .

Promotion

FIGURE 1

Conducted by Zeh Bouck, *Service Editor*

THIS issue of RADIO NEWS appears in the full heat of summer. Technically, however, it is the September issue—and it is about the time the far-sighted begin making preparations for the winter.

WINTER HEADQUARTERS

THIS department receives many letters from servicemen with migratory inclinations requesting information regarding radio service conditions in the south-land, with the idea of opening winter headquarters somewhere south of the Mason-Dixon Line. These letters are best answered by one who has operated in both northern and southern fields, and the following observations by R. B. Lawton, of New York State and Florida, will be welcome by many servicemen.

"I operate a radio service business in Northern New York State. During most of the year, we have a generous amount of work. However, we are in a resort section so there is a time during the Winter when things are quiet. We then close the shop, lock up our little log house, and load a few necessities, plus a P. A. system into our roadster. Next our two dogs climb on-board, my wife and I wedge ourselves in, and we start South to be gone about two months.

"I have had a connection with a wholesale radio service supply house in St. Petersburg, Florida, which has enabled me to see something of service activities in the South. If we grant that the serviceman's duty in his community is to keep all sets, which come under his care, in the best possible condition, then the conscientious Southern service man has a lot heavier responsibility, than the northern 'grief-hounds'. Climate sees to that. Temperatures are constantly high during a Summer lasting for over half the year. Salt air contributes its own complications. Consequently every part in a radio is more subject to break-down than in more favorable climates. Audio transformers, i.f. transformers, chokes—in fact, coils of all descriptions are subject to surprisingly frequent breakdowns.

"Consequently the careful serviceman's biggest job is to find out, not why the radio stopped, but what is most likely to make it stop next! For sets that are repaired by merely replacing a single by-pass condenser or resistor that is entirely gone, without checking probable causes of future trouble, have a persistent habit of 'kicking up' again in about three days.

"All resistors and condensers have to be individually tested, audio and i.f. transformers given a breakdown test, usually done by shorting primary windings to the chassis while the set is in operation, and listening for noise while the short is being applied. Transformers, which are noisy, when subjected to this overload, or were so before it was applied, are rejected if the serviceman wants any peace of mind.

"I believe I am correct in saying that when the usual north serviceman finds a defective intermediate-frequency transformer, he replaces the entire assembly, coil, shield, padding condensers, and all. This defect develops so frequently in the South, that a more economical method is generally used. Every parts distributor has a considerable stock of i.f. coils—just the coil without any extras. The old coil is removed and a new one installed in the same can.

Coil Rewinding

"Some shops are equipped to wind certain types of coils themselves. One service man of my acquaintance makes a specialty of re-winding field coils, another very frequent source of trouble. Every serviceman is familiar with the RCA-Victor speakers which are assembled and then welded together—thus trapping the field coil. In the North these speakers give little trouble and when a replacement is occasionally needed, frame and coil are purchased together. However, the tropical serviceman takes a husky hammer and cold chisel and cracks the welds apart. Then he winds his own field coil. He taps the end of the U which surrounds the coil and reassembles the speaker with bolts instead of a weld.

"One might gather from this that Florida is a veritable Utopia for the radio man. Alas, this is not the case. The radio man is no less susceptible to Florida's climatic attractions than the rest of humanity and a large number have come down from the North and settled here. These, added to the local crop, which naturally developed, have lined the streets with radio shops. In St. Petersburg, I think, gas stations and eating places are the only types of business more numerous. In addition, a large percentage of repair work must be done at materially lower prices than would be charged by self-respecting shops for the same work in the North. There are two major reasons for this. In the first place, a large part of the business comes from winter residents. Now some of these folks have plenty of money to spend, but some of them are just like your's truly. They have just about enough to come down and keep warm for a time, with maybe a little piecing out, in one way or another, while here. The 'stake' is frequently made up by setting aside what the winter's coal at home would cost and then adding the least amount that is economically possible or perhaps all they have, whichever is the least. Consequently, if radio repairs are very high, the radio is set aside till they are back home. Whatever his ancestry, the average visitor shows marked Scotch influence while in Florida. They generally know the home-town man better and will accept an estimate from him that they balk at when away.

"Secondly, salaries earned by year around residents are lower than in the North. Just what the ratio is I cannot say, but a list of salaries of $10,000 or over per year in the State was recently published in the newspapers. There were 39 such salaries in the entire state! And I suspect that middle-sized incomes are reduced somewhat in proportion. So the serviceman gets a little less per job to make the radio 'make the music go round and round' here than in the North.

The Flat Charge Fallacy

"Fortunately few Florida shops, good, bad, or indifferent, have fallen into the practice of making flat charges on any or all repairs. I had this and other such deplorable customs in mind, when I mentioned 'self-respecting' shops above. Radio service businesses are licensed in Florida, as are all businesses. This license is purely a tax and in no way a certificate of professional merit. There are three licenses that must be obtained before opening a shop: state, county and city. In a way it is good for the serviceman as well as the state coffers. It helps keep servicing from being carried on as a side-line, which sometimes means haphazard work. Usually a serviceman must give his full working day to radio, if he is even to keep up-to-date on the subject. The license law helps the year-around shops tremendously by making it less attractive for shops to come and go with the tourist season.

"The above observations have been made on the West Coast of Florida. The same rapid break-down, of course, occurs on the East Coast of the State for the same reasons. There are lots of shops there too. Prices for work done in the Miami area are probably higher. I have been told so, but have had no chance to obtain direct information in that section recently."

THIS MONTH'S RADIO SERVICE SHOPS

A Compact Radio Service Shop

The Hill Radio Service establishment (Figure 1) holds several points of interest for the serviceman confronted with space limitations. Mr. Hill, who services for two dealers specializing in Crosley and RCA radios, has mounted his test panels between banks of vertical drawers which contain tools and parts. The tubes on the side of the left-hand cabinet, are standard shop tubes and not for sale.

The test equipment is built around a thoroughly modernized Jewell 199 analyzer. All voltage, current, resistor, capacity, continuity, leakage and tube tests are

(*Turn to page* 168)

THE FIRST MESSAGE OVER THE LINE

Chief Thomas F. Burns of the Bridgeport, Connecticut Fire Department delivering the inaugural message over the new fire-alarm, public-address system.

Public Address *Replaces* FIRE BELLS In Station Houses

By Thomas F. Magner

AFTER being the main artery for fire department signal communication for a half century or more, the fire house bell and telephone are "on the way out," literally speaking. Like the fire horse and shiny steamer that was relegated to to the background by modern motivation and a tankful of gasoline, so will the fire alarm bell, in the course of a few years, be tossed aside for the latest method of receiving alarms in America's fire stations—the "Talkalarm" remote P. A. system.

SINCE radio has been applied to send the human voice through the air and into receiving sets, fire department officials throughout the country have argued that some new method should be devised to speed the receiving and sending of alarms, other than by the time-worn bell and telephone method. Bridgeport, Connecticut, is the first city in the United States to install an electronic system. Its eleven fire stations, chief's office and assistant chief's dormitory are linked to the system. After a thorough test for speed and accuracy it has proven satisfactory to officials there. The fire station or apparatus floor unit is located alongside the "watch" desk, being supported by a wall flange. This unit contains an amplifier and speaker and pilot light, the latter showing "red" at all times.

Two cables fitted with detachable plugs supply the unit with power of 110 volts A.C. current and sound. Good ventilation is afforded the apparatus floor unit by perforated metal grille back covers. In performance these apparatus floor units supply sufficient volume in a station large enough to house 6 to 8 mobile pieces of apparatus and if doorways or pole holes are open, the sound is clearly heard in the dormitories. The quality of reproduction of the "talkalarm" is natural. It not only carries the order but reenacts the individual dispatcher.

The main unit or Master Control Desk is located in the alarm room alongside the PBX telephone switchboard. This unit is operated by a dispatcher on duty. It houses the microphone line and controls the entire system. In it is the "siren howler" which is an electrically operated warning signal. This unit also contains a pilot light, a microphone and a visual frosted glass disc indicator showing the volume of the voice as it passes through the microphone. Included also are the line terminals and matching equipment. Provision is also made for remote microphone or advance alarm signals to connect with circuits of street call boxes.

The system gets its name by virtue of a direct headquarters-to-fire-station "alarm" being announced by a human voice through a microphone. It also does away with the use of the station telephone for fire calls.

How System Works

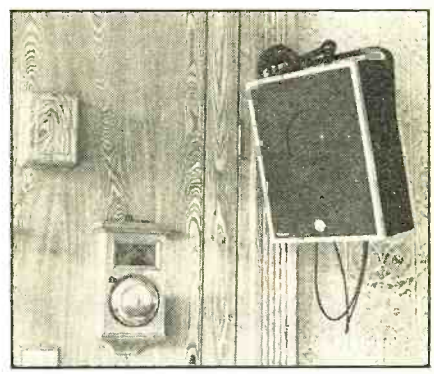
When the dispatcher at headquarters receives a fire call over the PBX board, he immediately lifts the "siren howler" lever upward. The "howler" brings the men at attention in all stations. The lever is then pressed downward and the dispatcher sends out his announcement through the mike. Each fireman listens for the fire location and the companies due to respond on that particular call, leave quarters.

The system saves considerable time when an alarm is received coming into the dispatcher from a street box. The moment the first "blow" is received in headquarters from the box, a dispatcher trips off the "howler" lever. This signal notifies the men to "stand by" for a fire call. A second operator "picks" the box number from the incoming circuit. The dispatcher then announces: "Box —— is in. Covering Companies Respond!"

In order to send the box number to newspaper offices, private homes of fire officials and police radio rooms, the box number is sent out over the regular circuit after the "talkalarm" announcements are completed.

LOUDSPEAKER VS. BELL

A close-up view of the alarm unit, located alongside the "watch" desk in each fire station. Words instead of clanging bells are now the rule.



Shielded Coil *Inductance*

By The Technical Editor

WHILE it is difficult for many to calculate the inductance of a coil of given dimensions, it is next to impossible to determine the inductance of a shielded coil except by measurement. Here is a simple graphical method of determining the reduction in inductance due to a

(*Turn to page* 175)

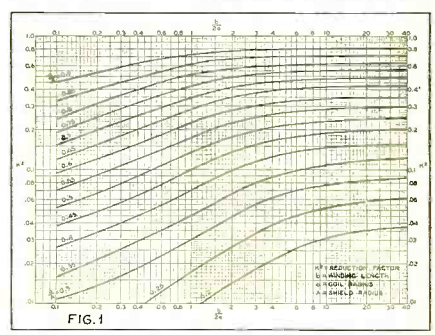
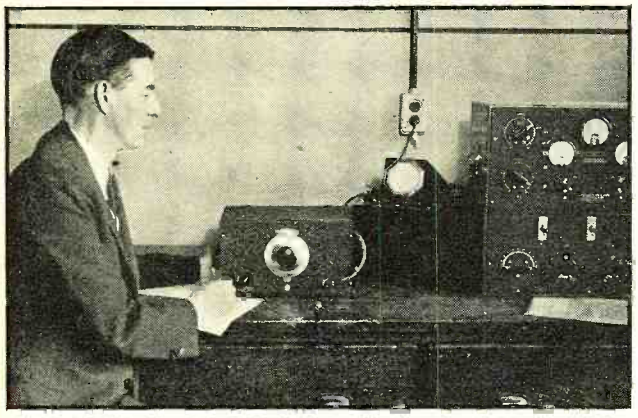


FIG. 1



CALIBRATING THE OSCILLATOR

The author and designer calibrating the finished job. With this oscillator tuned to resonance at 1,000 cycles with the G.R. laboratory standard audio oscillator the variation did not exceed 1/6 cycle per second as checked on the oscillograph

A Few Dollars Builds B. F. Audio

As simple to build as a 3-tube receiver, lator is suitable in both stability and

By John H.

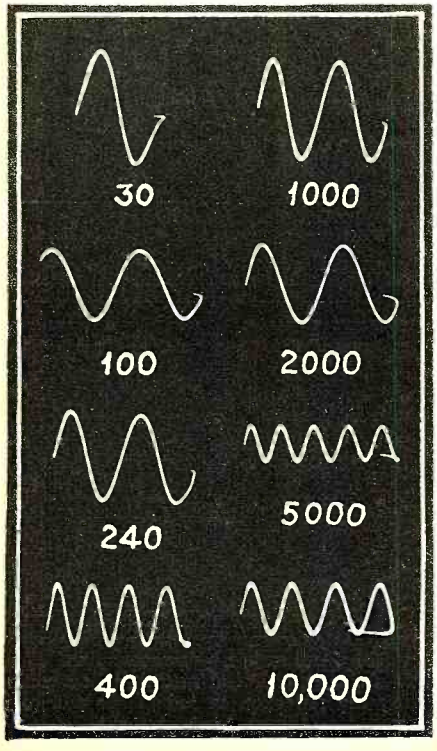
OSCILLATORS covering a wide range of audio frequencies form an indispensable part of the equipment of all radio laboratories and factories. They are used in making performance curves and in production testing of practically every type of sound reproducing apparatus. With the present trend toward increasingly high fidelity of reproduction, widespread interest has developed among service organizations for satisfactory instruments of this type.

The beat-frequency type offers distinct advantages in speedy operation over a wide and continuously variable range of audio frequencies. Through its use, speaker rattles or other deficiencies are quickly revealed. It is essential for the proper adjustment of audio filters in high fidelity receivers.

A satisfactory instrument of this type should have substantially pure sine wave output, since a high percentage of harmonics will make it useless for measurement purposes. It should be free from "birdies", a common defect caused by spurious beats occurring between undesired frequencies generated in the individual oscillators and mixer. To avoid frequency drift, each oscillator must be of identical design, free from harmonics and with carefully adjusted voltages. Furthermore, the circuits must have high inherent electrical stability.

DATA ON OSCILLOGRAMS

These oscillograms were made with a Triumph Oscillograph and a hand camera using Kodak Supersensitive Panchromatic film; exposures from 7 to 12 sec. at f:5.4. Negatives about 2/5 original size, printed on AZO F4 paper



Simple to Make

The instrument to be described meets these requirements yet is no more difficult to build than a simple receiver. There are no special coils to wind, no ticklers or taps to adjust, no special shielding, no ponderous array of batteries. Yet, as the oscillograms indicate, its output is substantially a pure sine wave, slight distortion being apparent only at 30 cycles.

A relatively unfamiliar means of obtaining oscillation has been adapted to both the variable and fixed frequency oscillators. In spite of its simplicity, it should be distinctly understood that it is not a secondary emission dynatron. It utilizes the negative resistance characteristics of pentodes which results when voltages of the values indicated are applied to individual elements. This method of obtaining negative resistance is thoroughly described in Application Note No. 45, issued by the RCA Radiotron Company.

The Circuit Details

As shown in Figure 1, the instrument employs three tubes, 6C6's being used as the oscillators and a dual triode 6A6 as the mixer. A 22½ volt B battery and a 4½ volt C battery mounted within the case, and an external filament supply transformer constitute the entire power supply. If desired, the filament supply may be taken from the associated amplifier or a storage battery. The filament transformer is mounted externally to avoid any possibility of hum pick-up. The inductances L1 and L2 are simple 2.1 milli-henry Hammerlund r.f. chokes. The fixed-frequency oscillator is tuned to approximately 108 kc. by means of C3 and C4. The variable frequency oscillator range extends from 108 kc (with C10 and C11 at minimum capacity setting) to approximately 94 kc. C11 is a 15 mmfd. midget variable condenser from which one rotor plate was removed and the remaining one bent to give a small capacity change at low-capacity settings. The total rated range is from 30 to 13,000 cycles, but it will be found possible to operate below 30 cycles if desired since there is no noticeable tendency toward interlocking with this circuit even as low as 2 or 3 cycles per second. The upper limit may be in-

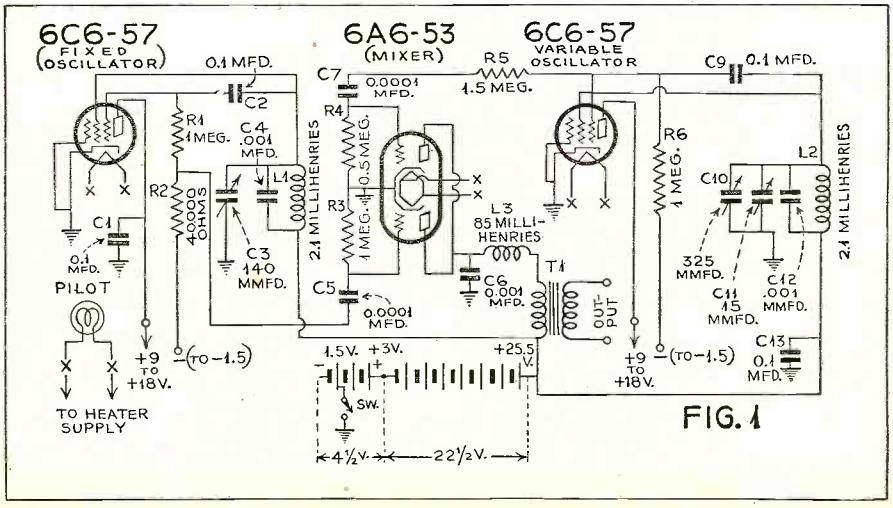
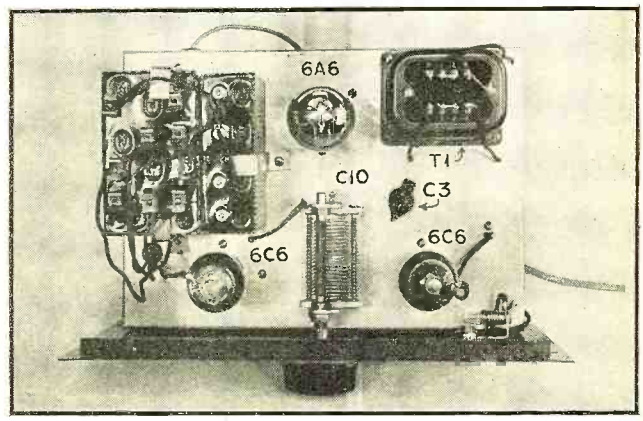


FIG. 1

You This Precision Oscillator

and made up of standard parts, this oscil- wave-form for precision laboratory use

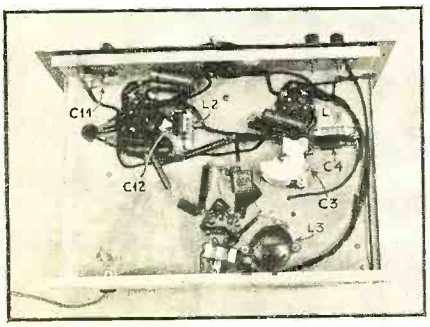
Potts



creased or decreased by using smaller or larger capacitances to replace C4 and C12. The variable-frequency oscillator output is fed through R5, and the blocking condenser C7 to one grid of the 6A6. R5 limits the input to the grid and also minimizes back-coupling reaction from the plate of the 6A6 to the suppressor of the 6C6. The fixed-frequency oscillator output appears across R1 and R2 in series. The very small voltage drop across R2 is fed into the remaining grid of the 6A6. This form of coupling has been selected because it keeps the grid at low potential with respect to stray voltages so no shielding is required. The plates of the 6A6 are connected in parallel, so that modulation of the stronger variable frequency by the weaker fixed frequency is effected in the plate circuit. The oscillograms prove that grid rectification as used in this instrument is satisfactory. The 85 millihenry r.f. choke, L3, with C6, are used to bypass r.f. components. T2 is an interstage transformer, its excellent frequency characteristic making it desirable for this instrument.

Construction Data

The instrument is assembled on an Insuline chassis measuring 7½ by 11 by 2½ inches. After drilling, the parts may be assembled and wired in accordance with the general layout indicated in the photographs. Keep the wiring of the oscillator circuits as nearly alike as possible. The inductances, L1 and L2, should be placed at right angles, though the stray field is small. The leads to the 6A6 grids should be well separated. Particular care should be taken with the heater leads. These should be twisted together and kept as far as possible from leads carrying r.f. The 22½ and 4½ volt batteries are joined in series. Voltages indicated are with respect to ground, which is taken at the −3 tap on the 4½ volt battery.



The plate voltages are not critical. The higher voltage gives greater output and the lower, maximum stability.

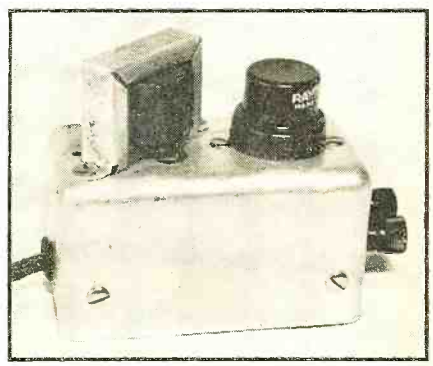
When completed, the output terminals should be joined to the input of a good two-stage audio amplifier. The oscillator has a high-impedance output designed to work directly into a grid, therefore the leads should be short. Connect a speaker to the amplifier and vary C10 until an audio note is heard. With C10 and C11 at minimum capacity setting, adjust C3 (which is mounted on the chassis) until no sound is heard (zero beat). Leaving C3 set, varying either C10 or C11 should cause a low-frequency note to be heard. If C3 cannot be adjusted to zero beat as indicated, interchange C12 and C4 and repeat. C4 should have the lower capacitance. C3 is used to compensate for inequalities of capacitance.

It is desirable to match the tubes in any beat-frequency oscillator. This may be done by interchanging the tubes with the instrument adjusted to a very low frequency. The frequency change should be as small as possible. They should likewise be matched for thermal characteristics. Disconnect the filament supply while listening to a low note. Only a slight change in pitch should result as the tubes cool.

Calibration without laboratory apparatus may be effected by comparison with notes of a musical instrument, as described by Mr. Burris last month. Middle C on the piano is 256 cycles (international pitch) and the frequency will double for (*Turn to page* 169)

Instrument POWER Supply

By Gerard Kelley



QUITE often a laboratory technician or experimenter finds a need for a moderately high voltage—low current supply that can be used as a means of supplying grid-bias, for resistance-measurement work or as a power supply for taking characteristics of high impedance multi-element tubes. To be practical for this type of work, such a supply unit should be small and reasonable in cost. The little unit shown here meets these requirements to a "T".

In the preliminary experimental work most of the rectifier tubes on the market were found unnecessarily large and their heat dissipation too high for the service proposed here. The small metal duplex-diode 6H6 type tube appeared to be the best tube for the job and accordingly a number of 6H6's were secured and characteristic and life curves taken. It was found that a steady current, up to 10 ma., could be secured with reasonable life. Next the 6H6 tube was tried as a voltage doubler and additional life tests were made, with excellent results. An output of 10 ma.

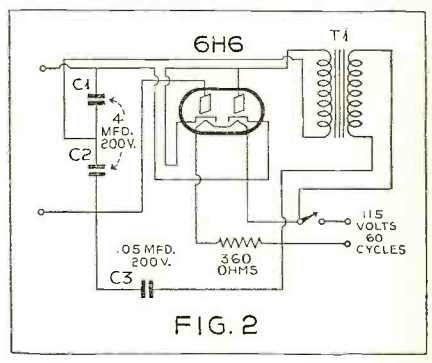
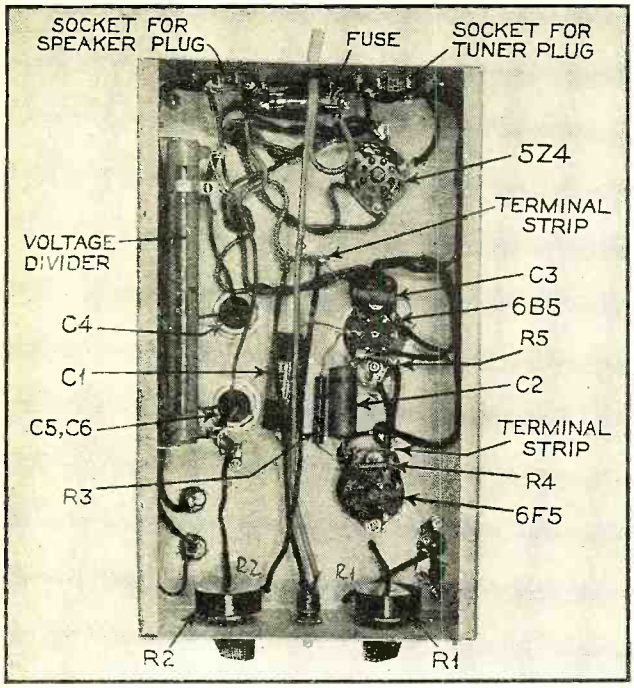


FIG. 2

was obtained at 190 volts and up to 300 volts at 1 ma. The regulation curve shown in Figure 1 was secured with a 6H6 that had been used in a power supply, operating with a drain of 4 ma. for over three months.

The circuit of the power unit is shown in Figure 2. For the test set-up, from which the curve was made, a high resist-

(*Turn to page* 169)



BELOW THE DECK

The layout is simple and the wiring easy. All parts are numbered to correspond with the parts list and schematic circuit published last month.

Practical Construction The Radio

This series of articles is presented
sire to obtain a working knowledge
have some theoretical knowledge
tical experience which is so essential

Part 5—Combination A.F.

By John M.

IN the previous installment the discussion on the amplifier and power pack wasn't quite completed. Therefore the remainder will be covered in the present article, together with advice on construction and operation.

The tone control has been added because one or more of the tuners to be described in later articles will be of the all-wave type. Such reception often requires that interfering noise be reduced and since most such noise consists of high-pitched sounds, a tone control which reduces high notes is helpful.

The ordinary type of control depends on the fact that a condenser offers an easy path for high frequencies and not for low frequencies, its "impedance" becoming lower and lower as the frequency increases. Thus a condenser placed across the circuit by-passes some of the audio currents, particularly those of higher frequencies. A variable resistor in series with the condenser will regulate this action, the adjustment of the resistance value varying the degree of tone control. When the series resistance is large enough there will be no tone control action. In Figure 1 of last month, the tone control consists of C_3 and R_2.

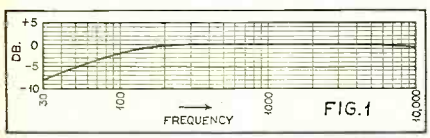


FIG.1

Performance Curves

Whenever the best quality is desired the tone control should be adjusted for maximum resistance by turning the control R_2 all the way to the left. Maximum noise reduction, on the other hand, is obtained with R_2 turned to the opposite extreme. If a greater degree of tone control is required it can be obtained by changing C_3 from .01 to .05 mfd.

In order to judge the performance of an amplifier the radio man makes curves showing the variation in output for different frequencies while the input is held constant. This is called the "fidelity curve" and in its most perfect form it should be a straight line. Figure 1 shows the curve of the amplifier as it was measured in the RADIO NEWS Laboratory. It was measured with the amplifier connected to a resistance load instead of the speaker. Therefore, it does not include the characteristics of the speaker.

The gain or amplification of the amplifier is 77 decibels. It is not possible here to go into an explanation of the decibel as a unit. One might think of a decibel as representing a change in sound level just sufficient to be noticeable to the ear. In practical language a 77 db. gain means that it takes .25 volts at the input terminals of the amplifier to obtain 4 watts output (the maximum output for the 6B5). The signal across the output transformer primary is then 170 volts approximately.

Construction

In selecting the parts employed in the model discussed in this article every effort was made to keep the cost as low as possible, consistent with the required quality. It is not imperative that the parts employed by the constructor be of the exact makes and type numbers shown in the list of parts last month but it *is* important that the quality and electrical values be the same if results are to equal those provided by the model. If substitutions are made they may in some cases require some alteration in the drilling layout.

The first thing to do is to prepare the chassis. The socket holes can be made easiest with a punch such as the Livermore Five-In-One Punch on sale at many radio stores. Holes of five different sizes can be made with this tool. The holes for the socket mounting screws should be laid out after the large holes are punched, thus allowing for any slight error in placement of the large holes.

All except the socket holes can be made with ordinary twist drills. Start the larger holes with a small drill, then

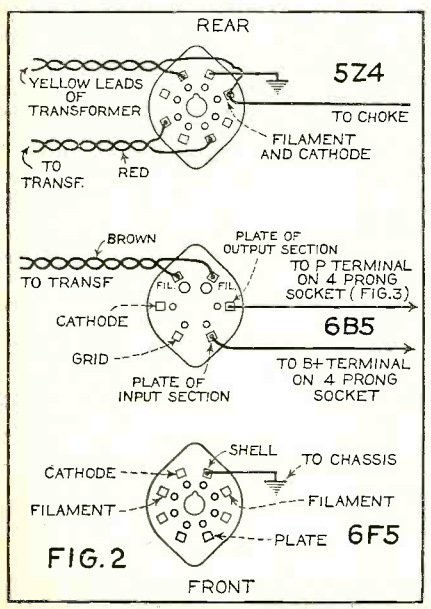


FIG.2

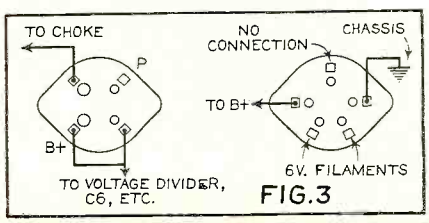


FIG.3

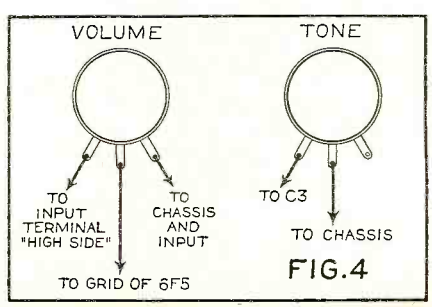


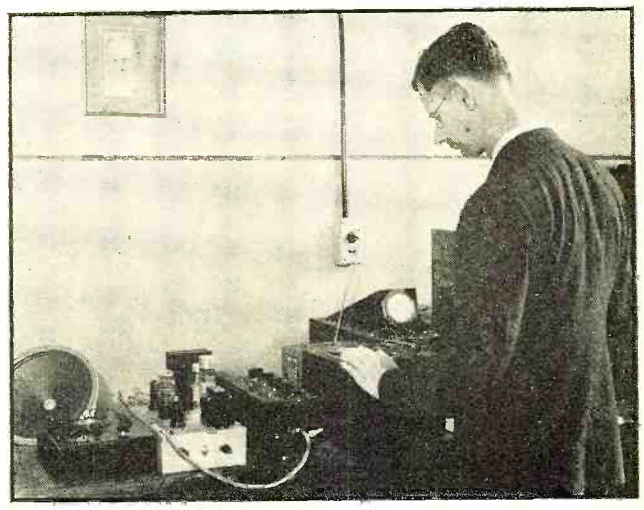
FIG.4

and Instruction for Beginner

for the benefit of beginners who de-
of radio, and also for those who
of the subject but lack the prac-
to thoroughly understanding radio

Amplifier and Power Unit

Borst



"LAB" TESTING THE AMPLIFIER

Precision measurements of this amplifier made by the author in the R. N. Lab. show a gain of 77 decibels, extremely low hum and a response as shown in Figure 1.

use a larger one of the required size.

The centers of the tube sockets mounting screw holes are shown 1½ inches apart in Figure 2 of last month. There are three standard spacings of these mounting centers: 1½ inches, 1$\frac{11}{16}$ inches and 1$\frac{23}{32}$ inches. At present the smallest size is the most often used. If sockets with the wider spacing are used the holes in the chassis should be spaced accordingly.

All sockets on the chassis are to be placed with the filament terminals towards the rear; that is, the notches in the central hole of the metal tube socket should point towards the rear and the large holes of the middle socket should be at the rear. (See Figure 2). The sockets for the cables should be placed as shown in Figure 3.

Avoid Short Circuits

When mounting the choke and the input terminals, care should be taken to prevent short circuits. The lugs stick through the holes and no part of the lug or any metal connected to it should touch the chassis. This is so important that a special test is recommended. This is done by connecting one terminal of a voltmeter to a battery, and the other terminals of the voltmeter and battery to the lug and the chassis respectively. If the meter shows a voltage reading it indicates a short circuit.

After all the parts have been mounted, the terminal lug strips are mounted with screws as shown in the bottom view, also the fuse holder.

Beginning with the wiring it is perhaps easiest to begin with the transformer connections. The wires are distinguished by their color. A paper comes with the transformer which explains the color code; they are also shown in Figure 1.

The electrolytic condensers must be connected with due regard to their polarity. The electrolytic condenser consists of two aluminum foils separated by an electrolyte (a solution which conducts electricity and is decomposed by the current). The current causes an extremely thin film to form on one of the foils. This film being non-conductive, the whole becomes a condenser. Due to the fact that the film is extremely thin, the capacity can be made large in relatively small space. This type of condenser will be ruined if the polarity is ever reversed; they are good only in d.c. circuits, or when a.c. is superimposed on d.c. as in the power pack. In our case all the negative terminals should be connected to the chassis. The condensers are marked and color coded; the colors are also shown in Figure 1 of last month.

The proper connections to the sockets are shown in Figure (*Turn to page* 185)

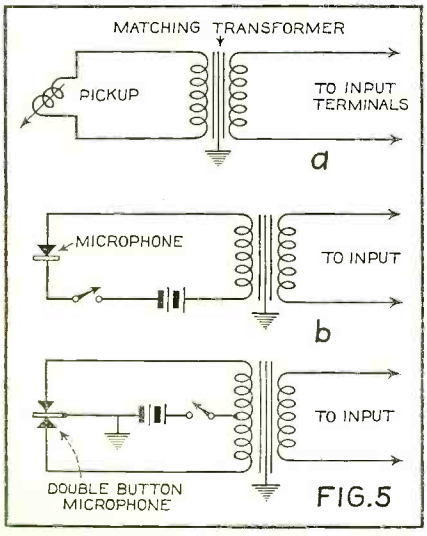


FIG. 5

CBS "Wrist Watch"

By Samuel Kaufman

NOT long ago you read on these pages of a micro-wave transmitter built into a gentleman's top hat. The sartorial trend in low-wave pedestrian stations continues with the costume of CBS announcer Bob Trout pictured herewith. This is the latest word in high-frequency fashions.

No, that's not a wrist watch Bob's wearing. It's a microphone encased in a wrist strap. And that rather natty cane contains an antenna and radio-frequency oscillator. The binocular case houses an audio amplifier and modulator. Power is supplied by batteries in a concealed money-belt and that, perhaps, is the reason Bob can't make that lower button greet the buttonhole.

The "walking transmitter" can cover a range of one mile. The idea was born in time for use at the Democratic National Convention in Philadelphia last June and will henceforth be used for roving interviews.

The End

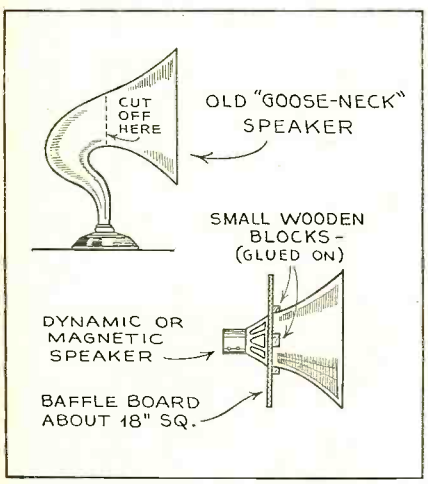
The RADIO WORKSHOP

¶ Items of interest for beginners, experimenters and radio constructors.

Conducted by The Associate Editor

A Use for Old Goose-neck Horns

An old goose-neck speaker such as were used back in 1924-25 can be made into a directional horn baffle for modern dynamic or magnetic type reproducers. Simply cut off the horn at the point where its diameter is the same as that of the speaker cone frame, whatever size it might be, (6, 8, or 12 inches), and mount a baffle on the opening as shown in the drawing. This should be fairly large if a good response is to be obtained. Fasten the speaker on

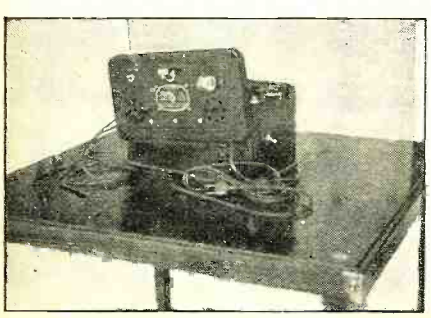


the baffle in the usual manner. I have heard several of these speaker installations in connection with public-address equipment and the results were very good considering the low cost.

HARRY D. HOOTEN,
Beech Hill, West Va.

New Condenser Tester

I believe fellow experimenters will be interested in my simple condenser tester, the circuit of which is shown in Figure 1 and



illustrated by the accompanying photograph. A device of this kind will also be found very handy as a continuity tester in checking resistors, testing parts for shorts,

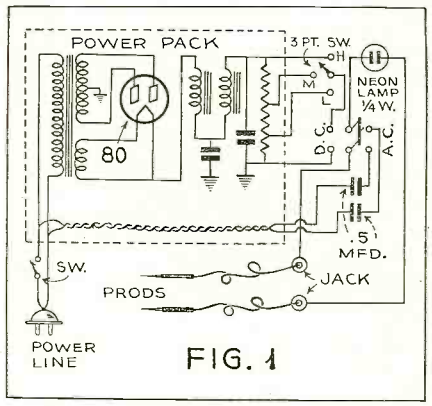


FIG. 1

etc. The circuit is self-explanatory. The d.c. power supply I use is an old General Radio power unit, the neon lamp and switches are mounted on the cover. The provision of both a.c. and d.c. test voltages makes the condenser tester much more flexible in making tests for shorts, opens, capacity and leakage of electrostatic and electrolytic condensers.

THOMAS V. WILLIAMS,
Iron Mountain, Mich.

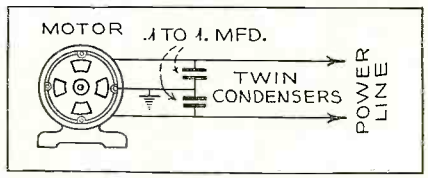
Eliminating Man-Made Static

An interesting announcement was recently received from Philco Radio & Television Corp. of their new interference kit. It consists of a number of condenser and choke coil combinations to take care of the many different sources of man-made static. Accompanying the kit is a 12-page manual entitled "Eliminating Radio Noise Interference." The book is written and illustrated in a very simple style to make it readily understood by anyone interested in radio. It tells exactly the nature of the interference, how it is generally transmitted, how it can be located and advises the necessary types of filters for its elimination.

The following is quoted from a section from this book:

"Man-made static is a radio signal which has no particular basic frequency, but is broad over a large portion of the broadcast and short-wave bands. Different sources of interference may cover comparatively large bands, but might not cover the entire band. For example, a small motor may be heard louder at the high-frequency end of the broadcast band than at the low-frequency end. Another small motor may be located sufficiently far away from the receiver so that it does not produce any interference on the broadcast band, but it might be heard on a portion of the short wave band. In general, man-made static interference is stronger on the short-wave band than on the standard broadcast band. Since short-wave receivers have become the standard for modern radio reception, it becomes increasingly important to eliminate the source of noise which interferes with short-wave entertainment.

Most man-made static is produced by small motors or defective electrical wiring. Electrical devices such as vacuum cleaners, electric fans, oil burners, mixers, automatic heaters, and irons are the worst offenders. Defective electrical wiring is often a source of noise, and it is usually possible to locate a loose fuse or a loose wire contact in a socket or plug of some of the household fixtures or switches. Larger motors often



cause interference in those cases where the radio set is located in the neighborhood of a factory or any large building containing heavy electrical equipment. Electric power lines and equipment, and trolley lines and cars are also bad offenders in many cases.

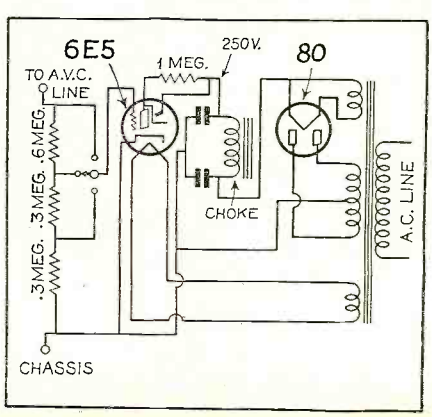
The circuit shown above shows how interference from a small motor can be generally corrected. Two condensers are employed with their common center point connected back to the frame of the motor. In this type of circuit, the path of the interference is from one motor terminal through one condenser back to motor frame and from the other motor terminal, through the other condenser and back to frame. The size of the condenser units to be used is dependent upon the intensity of the interference."

Resonance Indicator for Aligning A.V.C. Receivers

This device using the type 6E5 tube as a resonance indicator eliminates the usual difficulty of aligning receivers by means of an output meter and replaces the more expensive vacuum tube voltmeter or cathode ray oscillograph.

As shown in the accompanying circuit, it consists of the 6E5 electron ray tuning indicator tube hooked up with tapped input circuit and power supply, the input being simply connected to the a.v.c. line of the receiver and the usual procedure followed.

H. MADDICKS,
Daylesford, Vic., Australia



Cash for Kinks

EVERY experimenter, from time to time, works out some simple idea or kink that could be profitably passed along to his fellow experimenters through the "Radio Workshop", a department which caters especially to the exchange of such ideas. Send your ideas to the Workshop Editor, and wherever possible include a simple but clear drawing or a photograph. All ideas published will be paid for at regular space-rates.

The Reason for High-Resistance Voltmeters

The use of inexpensive, low-resistance voltmeters frequently leads to erroneous readings, and the uninformed experimenter is often confused by the measurement results.

As pointed out in a recent issue of the *Aerovox Research Worker,* the sensitivity of the voltmeter is expressed in ohms per volt and equals the total resistance of the meter divided by the number of volts indicated at full scale deflection. This figure indicates how much current it takes to operate the meter, for instance, if an 0-10 voltmeter has a resistance of 10,000 ohms, the sensitivity would be 1,000 ohms per volt, and from ohm's law it is easily ascertained that the meter draws a current of 1 ma. at full scale deflection. Similarly, if the 0-10 voltmeter had a resistance of but 1,000 ohms, the sensitivity would be 100 ohms per volt, and would require 10 ma. to move the needle to full scale deflection. This illustrates that the higher the resistance of the voltmeter for a given range, the greater the sensitivity.

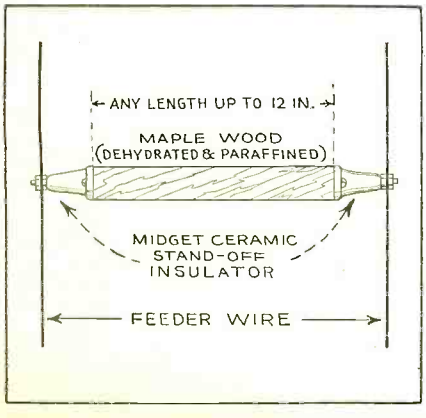
The lack of sufficient sensitivity results in inaccuracy when the instrument is used in high-resistance low-current circuits. Thus if a low-resistance low-sensitivity voltmeter is connected across a high-resistance value, the paralleled resistances alter the circuit to such degree that, although the voltmeter accurately reads the voltage impressed upon it at that moment, a false picture is obtained of the normal working condition of the circuit. It is obvious, then, that the resistance of the voltmeter must be such that it will not materially alter the conditions in the circuit to be measured. This is usually satisfied by an instrument of 1000 ohms-per volt sensitivity, which, while more costly, will avoid troublesome errors.

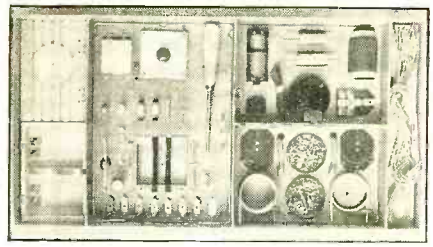
Spreaders for Zepp Antennas

The commercial feeder spreaders for transmission lines for zepp antenna systems are usually available in only 4 or 6 inch lengths although many amateurs prefer to use 10 or 12 inch spreaders.

An easy way to make spreaders of any desired length and yet retain part of the advantages of the low-loss ceramics is to use midget stand-off insulators, mounting them on the ends of a maple stick as shown in the drawing. The maple wood should be dehydrated by heating it in an oven and then weather-proofed by boiling in paraffin for an hour or so.

HARRY D. HOOTON,
Beech Hill, W. Va.





Radio Beginners' Kit

Our European correspondent reports that the well-known concern of Siemens & Halske of Germany is offering the radio beginner a complete kit of radio constructional parts from which he can gain actual experience by assembling and reassembling the parts into many interesting radio instruments, such as low-power transmitters, oscillators of various types, receivers, etc. The illustration shows two boys with a finished oscillator, all set for operating results. It will be noticed that the wooden baseboard has five runways, the various parts slide into these grooves and are fastened in their allotted location. A store of experience by actual operation and a great deal of fun can be had with a kit of this type.

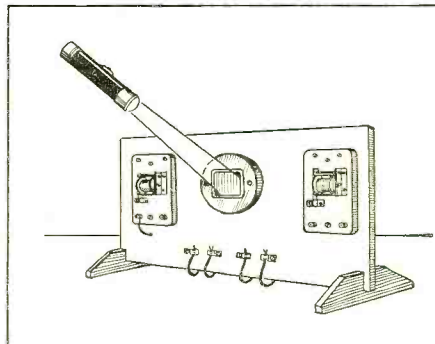
A Novel Photo-Electric Cell Experiment

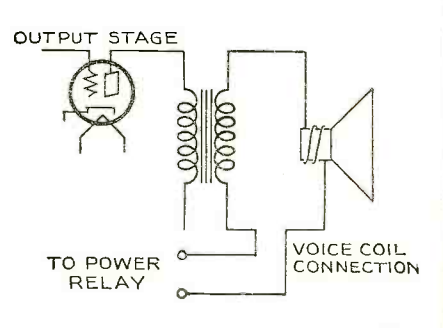
The Gilbert "Electric Eye" described in last month's "Radio Workshop" or other similar equipment can be used for many novel home experiments. One which is interesting and easily accomplished is an arrangement for silencing a radio with a flashlight.

The particular experiment shown is applied to a set employing a dynamic type speaker. The photocell panel may be placed on top or underneath the radio receiver. The first thing to do is to connect the batteries to their respective terminals on the panel and to connect the lower lead of the sensitive relay to terminal No. 1 as shown in the drawing. With the set turned off, and be sure of this, find the two speaker leads that connect between the secondary side of the output transformer and the voice coil of the speaker. The drawing shows the leads in question. The next thing to do is to cut one of these leads and splice on two 6 or 8 foot lengths of wire and connect them to the two lower posts on the power relay.

When the above connections have all been made you are now ready to try the experiment. The radio is turned on and it will play in the usual manner. When you want to silence the set, simply flash the beam from the flashlight on the electric eye. This will cause the sensitive relay to open the circuit to the power relay which in turn opens the speaker circuit and cuts the program off instantly. Removing the light from the cell permits the set to operate again.

In the case of a magnetic type speaker, there are only two connecting leads so it will be a simple matter to open one side of the circuit and make the connections to the power relay.





Circular Slide Rule

A new improved type of circular slide rule is offered by United Transformer Corp. This rule, 7 inches in diameter, is equivalent to a 20-inch straight rule. It contains 8 scales, one fixed and 7 movable. There is an inverted scale and another for square roots. This last one occupies twice the circumference of the disk and is therefore in two parts. A very useful scale is the one which is folded at $\frac{1}{\pi}$ which facilitates many solutions of equations involving decibels. The card is provided with a stroboscope edge to determine speeds of 78 and 33⅓ r.p.m. turn-tables.

(*Turn to page* 191)

SHORT-WAVE STATION LIST

(Aeronautical Stations of the United States)

Call Letters	Location	Frequency Chain
KAER	Lake Minchumina, Alaska	1, 3
KAES	Kennecott, Alaska	7
KAET	Chitina, Alaska	7
KAEU	Cordova, Alaska	7
KAFA	Aberdeen, S. Dakota	Purple A
KAFB	St. Paul, Minn.	Purple A
KAFC	Nr. Sioux City, Iowa	Purple A
KAFD	Kansas City, Mo.	Purple A
KAFE	Bismarck, No. Dakota	Purple A
KAFF	Sioux Falls, S. Dakota	Purple A
KAFG	Omaha, Nebr.	Purple A
KAFH	Burbank, Calif.	Blue A, B
KAFI	Portable	Purple A
KAFK	Portable Kansas City, Mo.	Purple A
KAFL	Portable	Blue A
KEU	Burbank, Calif.	Red A
KFM	Sacramento, Calif.	Red A
KFO	Oakland, Calif.	Red A
KGE	Medford, Oregon	Red A
KGJW	Brownsville, Texas	Orange A, B
KGQZ	San Diego, Calif.	Red A; Blue A
KGSH	Portable	Brown A
KGSK	Billings, Montana	Purple A, B
KGSL	Glendive, Montana	Purple A
KGSN	Portable No. 1, Kansas City, Kan	Blue A
KGSO	Portable, No. 2, Kansas City, Kan.	Blue A
KGSV	Great Falls, Montana	Blue A
KGSX	Spokane, Wash.	Purple A
KGSY	Missoula, Mont.	Purple A
KGSZ	Seattle, Wash.	Purple A
KGT	Fresno, Calif.	Red A
KGTA	Winslow, Ariz.	Blue A
KGTD	Wichita, Kansas	Blue A
KGTF	Fort Worth, Tex.	Brown A, B
KGTH	Salt Lake City, Utah	Blue A, B
KGTJ	Las Vegas, Nev.	Blue A, B
KGTL	Kingman, Ariz.	Blue A
KGTO	Portable	Red A
KGTP	Portable	Purple A
KGTR	Robertson, Mo.	Blue A
KGTV	Beaumont, Calif.	Brown A
KGTX	Pocatello, Idaho	Blue A
KGTY	Butte, Mont.	Purple A; Blue A
KGTZ	Spokane, Wash.	Red A
KGUA	El Paso, Texas	Brown A, B; Orange A, B
KGUG	Big Spring, Texas	Orange A, B; Brown A, B
KGUL	Abilene, Texas	Brown A
KGUN	Douglas, Ariz.	Brown A; Orange A
KGUO	Tucson, Ariz.	Brown A
KGUP	Phoenix, Ariz.	Brown A, B
KGUQ	Indio, Calif.	Brown A, B
KGUR	Glendale, Calif.	Brown A, B; Orange A, B
KGUS	Blythe, Calif.	Brown A, B
KGUT	Robertson, Mo.	Brown A, B
KGUU	Little Rock, Ark.	Brown A
KIFM	Fairbanks, Alaska	2, 3
KIJE	Pendleton, Ore.	Red A
KIKJ	Baudette, Minn.	2994 kc.
KIKL	Los Angeles, Calif.	Lighter-than-air
KIKU	Wenatchee, Wash.	Purple A
KIKV	Anchorage, Alaska	7
KIMU	Koyuk, Alaska	2, 4
KIMY	Nulato, Alaska	2, 3
KINA	Nome, Alaska	1, 3
KINC	Tana Crossing, Alaska	2, 4
KINF	Bethal, Alaska	2, 4
KINH	Ketchikan, Alaska	2, 4
KINI	McGrath, Alaska	1, 3
KINL	Juneau, Alaska	2, 4
KINO	Lat 48. 30. 00 N; Long. 134. 10. 00. W	2, 4
KINS	Lat. 62. 50. 00. N; Long 141. 30. 00. W	2, 4
KINU	Rainy Pass, Alaska	7
KINV	Illiamna, Alaska	7
KINW	Flat, Alaska	2, 4
KINZ	Skagway, Alaska	2, 4
KIOO	Oklahoma City, Okla.	Brown A, B
KIOS	Springfield, Mo.	Brown A, B
KIOT	Tulsa, Okla.	Brown A, B
KJE	Reno, Nevada	Red A
KKO	Elko, Nevada	Red A
KMP	Omaha, Neb.	Red A
KMR	North Platte, Neb.	Red A
KNBD	Alameda, Calif.	1
KNBF	Mokapu Peninsula, T. H.	1, 2
KNBG	Sumay, Guam	1
KNBH	Midway, Sand Island	1, 2
KNBI	Wake Island	1, 2
KNBJ	Dallas, Texas	Yellow A, B
KNBK	Brownsville, Texas	Yellow A, B
KNBL	Honolulu, T. H.	5
KNBM	Oklahoma City, Okla.	Yellow A, B
KNBN	Houston, Tex.	Yellow A, B
KNBO	Kansas City, Mo.	Yellow A, B
KNBP	Wichita Falls, Tex.	Yellow A, B
KNBQ	Amarillo, Texas	Yellow A, B
KNBR	Corpus Christi, Texas	Yellow A, B
KNBS	Austin, Texas	Yellow A, B
KNBU	San Antonio, Tex.	Yellow A, B
KNBV	Fort Worth, Tex.	Yellow A, B
KNBW	Waco, Texas	Yellow A, B
KNCB	Wichita, Kansas	Yellow A, B
KNCH	El Paso, Texas	Orange A, B
KNCI	Monroe, La.	Green A, B
KNCJ	Dallas, Texas	Green A, B
KNCK	Casper, Wyo.	Red A, B
KNCL	Cheyenne, Wyo.	Red A, B
KNCM	Billings, Mont.	Red A, B
KNCN	Sheridan, Wyo.	Red A, B
KNCO	Denver, Colo.	Red A, B
KNCP	Portable aboard Vessel MIDWAY	6
KNCQ	Port. aboard vessel WAKE	6
KNCR	Portable mobile	2
KNCS	West Yellowstone, Mont.	Blue A
KNCT	Tulsa, Okla.	Yellow A, B
KNCV	Miles City, Mont.	Purple A, B
KNCX	Robertson, Mo.	Yellow A, B
KNCY	Shreveport, La.	Green A, B
KNWA	St. Paul, Minn.	Purple A, B
KNWB	Fargo, N. Dakota	Purple A, B
KNWD	Bismarck, N. Dakota	Purple A, B
KOE	Cheyenne, Wyo.	Red A
KQC	Rock Springs, Wyo.	Red A
KQD	Salt Lake City, Utah	Red A
KQM	Des Moines, Iowa	Red A
KQQ	Iowa City, Iowa	Red A
KQX	Bakersfield, Calif.	Red A
KRA	Boise, Idaho	Red A
KRD	Pasco, Wash.	Red A
KRF	Lincoln, Neb.	Red A
KSI	Glendale, Calif.	Blue A, B
KST	Kansas City, Mo.	Blue A, B
KSV	Amarillo, Tex.	Blue A
KSX	Albuquerque, N. Mex.	Blue A, B
KTU	Redding, Calif.	Red A
KVO	Portland, Ore.	Red A
KZJ	Seattle, Wash.	Red A
WAEC	Pittsburgh, Pa.	Blue A
WAEE	Nr. Philadelphia, Pa.	Blue A
WAEF	Newark, N. J.	Blue A, B
WAEG	Cresson, Pa.	Blue A
WAEH	Milwaukee, Wis.	Purple A, B
WAEI	Detroit, Mich.	Brown A, B
WAEJ	Springfield, Ill.	Brown A
WAEO	Chicago, Ill.	Blue A, B
WAEP	Portable	Brown A
WAEQ	Elmira, N. Y.	Brown A
WAER	Roanoke, Va.	Brown A
WAES	Syracuse, N. Y.	Brown A
WAET	E. Hartford, Conn.	Brown A
WAEV	Knoxville, Tenn.	Brown A
WAJA	Portable-Mobile (Atlanta, Ga)	Green A
WAJC	Memphis, Tenn.	Yellow A, B
WAJD	Jackson, Miss.	Yellow A, B; Green A, B
WAJE	Birmingham, Ala.	Green A, B
WAJF	Daytona Beach, Florida	Green A
WAJG	Murfreesboro, Tenn.	Green A
WAJH	Indianapolis, Ind.	Green A
WAJI	Vero Beach, Fla.	Green A
WAJY	St. Petersburg, Fla.	Green A
WAJZ	Boston, Mass.	Brown A
WAQA	Chicago, Ill.	Yellow A
WAQB	New Orleans, La.	Yellow A
WEEA	Atlanta, Ga.	Green A, B
WEEC	Charleston, S. C.	Green A, B
WEEF	Spartanburg, S. C.	Green A, B
WEEG	Greensboro, N. C.	Green A, B
WEEJ	Jacksonville, Fla.	Green A, B
WEEK	S. Washington, Va.	Green A, B
WEEM	Miami, Fla.	Green A, B
WEEO	Summit, Ill.	Green A, B
WEEP	Newark, N. J.	Green A, B
WEER	Richmond, Va.	Green A
WHDP	Wilmington, Del.	Blue A
WHG	Columbus, Ohio	Blue A, B
WHM	Indianapolis, Ind.	Blue A
WKDL	Miami, Fla.	Orange A, B
WMDU	San Juan, Puerto Rico	Orange A, B
WMEP	Suffield, O.	Lighter-than-air
WMER	Portable	Brown A
WMEW	Portable-Mobile	Lighter-than-air
WNAJ	Toledo, Ohio	Red A
WNAK	Cleveland, O.	Red A
WNAM	Kylertown, Pa.	Red A
WNAO	Newark, N. J.	Red A
WNAU	Moline, Ill.	Red A
WNEG	Charleston, W. Va.	Brown A
WNEH	S. Washington, Va.	Brown A, B
WNEY	Baltimore, Md.	Green A
WNEZ	Camden, New Jersey	Green A
WOEC	Chattanooga, Tenn.	Green A
WOEE	Portable	Green A
WOEL	Mobile, Ala.	Green A
WOEM	Montgomery, Ala.	Green A
WOEN	New Orleans, La.	Green A, B
WOEO	Atlanta, Ga.	Green A, B
WOER	Raleigh, N. C.	Green A
WOES	Savannah, Ga.	Green A
WOEV	Louisville, Ky.	Green A, B
WOEZ	Chicago, Ill.	Yellow A, B
WQEP	Portable-Mobile	Lighter-than-air
WQEQ	Portable-Mobile	Lighter-than air
WREJ	Portable (nr. Baltimore)	Orange A
WREO	S. Washington, Va.	Lighter-than-air
WREP	Peoria, Ill.	Brown A
WREX	Portable-Mobile	Lighter-than-air
WSDC	Newark, N. Jersey	Brown A, B
WSDD	Boston, Mass.	Brown A, B
WSDF	Louisville, Ky.	Brown A
WSDG	Chicago, Ill.	Brown A, B
WSDH	Murfreesboro, Tenn.	Brown A, B
WSDI	Cincinnati, O.	Brown A, B
WSDJ	Elkins, W. Va.	Brown A
WSDK	Memphis, Tenn.	Brown A, B
WSDM	Albany, N. Y.	Brown A, B
WSDO	Buffalo, N. Y.	Brown A, B
WSDP	Columbus, O.	Brown A
WSDQ	Berea, O.	Brown A, B
WSDS	Chicago, Ill.	Purple A, B
WSDZ	Indianapolis, Ind.	Brown A
WUCG	Chicago, Ill.	Red A

Red Chain: **A** 3, 147.5, 3,162.5, 3,272.5, 3,182.5, 3.322.5, 4,335, 5,122.5, 5,572.5,5,582.5, 5,592.5, 5,662.5 kc.
B 5,310 kc.

Blue Chain: **A** 2,906, 3,062.5, 3,072.5, 3,088, 4,937.5, 4,947.5, 4,952.5, 4,967.5, 5,652.5, 5,672.5, 5,692.5 kc.
B 2,720, 2,732, 4.110, 6,510(D), 6,520(D), 6,530(D), 8,015(D) kc.

Brown Chain: **A** 3,127.5, 3,222.5(D), 3,232.5, 3,257.5, 3,242.5, 3,447.5, 3,457.5, 3,467.5, 3,485, 4,917.5, 5,602.5, 5,612.5, 5,632.5, 5,887.5 kc.
B 2,612, 2,636, 3,467.5, 4,690, 6,540. 6,550. 6,560, 8.015(D), 10,190(D) kc.

Green Chain: **A** 2,854, 2,922, 2,946, 2,986, 4,122.5. 5,652.5, 5,707.5(D)
B 2,608. 2,748, 4,740, 4,745, 5,310, 6,590. 6,600 kc.

Purple Chain: **A** 2,854, 2,994, 3,005, 5,377.5(D). 5,887.5(D) kc.
B 2,644, 6,490(D), 8,130(D) kc.

Yellow Chain: **A** 2,912, 3,485, 5,042.5, 5,682.5, 5,887.5 kc.
B 2,640, 4,650 kc.

Orange Chain: **A** 2,870, 2,986. 3,082.5, 5,165. 5,375, 5,405(D), 5,692.5, 6,570, 8,220, 12,330. 16,440 kc.
B 2,648, 2,986, 3,082.5, 5,165. 5,375, 6,570(D), 6,580(D), 8,015, 8,220, 12,330. 16,240, 16,440 kc.

Lighter-than-air—2,930, 6,615, 4,335, 4,480. 4,495 kc.

1—2986,5165, 8220, 12,330, 16,440 kc.
2—1638, 2986, 5165, 8220, 12,330, 16,440 kc.
3—1638, 2648, 3082.5, 4125, 6560. 8015 kc.
4—2648, 3082.5, 4125, 6570, 8015 kc.
5—5375, 6610 kc.
6—1638, 2986, 5165, 8220, 12330 kc.
7—2922, 2946 kc.
D—daytime only

The 316-A Tube

(*Continued from page* 142)

watts at 500 megacycles and 4 watts at 600 megacycles. The tube will not oscillate at frequencies below 750 megacycles.

The tube has a rugged and thick glass envelope, as shown in the illustration, which has given rise to the nick-name of "Door Knob" tube because it happens to look somewhat like one. Surely amateurs experimenting with ultra-high frequencies will welcome this new tube, as it will enable them to get considerable amounts of power which is impossible at these very high frequencies with old type tubes.

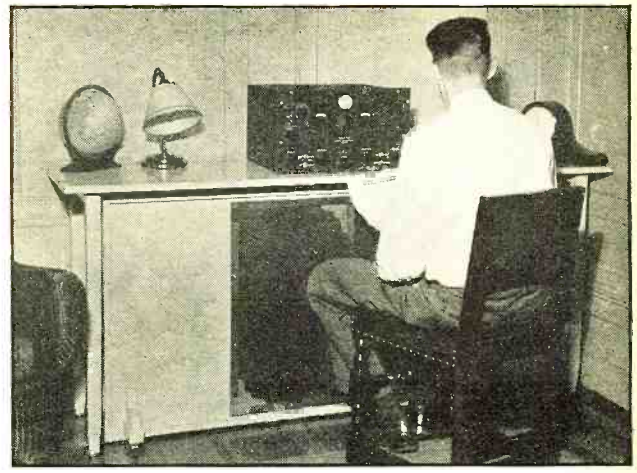
Radio a Great Educational Force

By Walter H. Candler

For a number of years radio has been playing a conspicuous part in our educational processes. At present we can only approximate its far reaching influence. I am persuaded that one of the most significant and potential phases of radio is its bringing together the peoples of the earth on a basis of common understanding. This will exert a powerful influence on future education. As a matter of fact, I see radio rapidly taking its place as an integral part of our curriculum.

Modern Super Tunes In ALL Continents

By S. Gordon Taylor



CONDUCTING the operating tests of the "Super Pro" receiver has been a most interesting proceeding for a number of reasons. First of all the sensitivity and selectivity proved to be a close approach to the ideal. For the more technically minded reader the curves presented last month, covering independent laboratory measurements of this receiver, tell a complete story of these features. So far as it was possible to judge from the "On the Air" tests the receiver lives up in every way to the unusually high standards indicated by these measurement curves.

During these tests all of the ranges of the receiver were thoroughly tried out, with most attention devoted to the amateur, the standard broadcast and the short-wave broadcast ranges. There is practically no part of the world which was not heard on both amateur and short-wave broadcast ranges. The Australian and Japanese short-wave broadcast stations, for instance, were brought in readily during the few occasions when the tests were continued in the early morning—also a number of low-power Australian amateur phone stations. It might be added that this represents excellent reception in view of the fact that the reception tests were made in an apartment house in New York City where the noise level is troublesome.

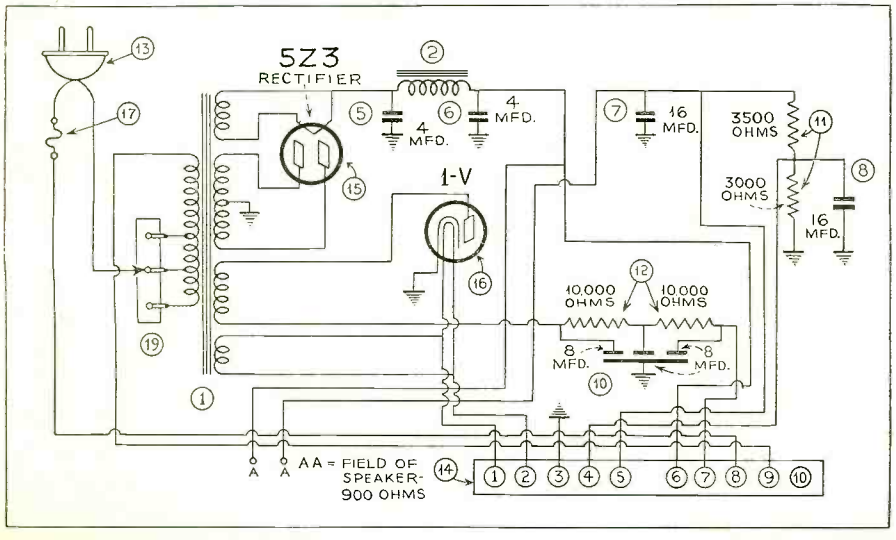
Typical of the results obtained on the various ranges, a summary of the reception on the 20 meter amateur phone band is presented. A glance through the log of stations heard disclosed twenty-four English amateur stations and seventeen others in Spain, France, Portugal, Italy, Ireland, Holland, Belgium, and Norway. South America was represented by a dozen stations, ranging from the Guianas to the Argentine. The Australian VK's were heard on several occasions when the test period was continued late enough to permit. Among the parts of the world not generally heard—and certainly rarely heard in noisy city locations—were SU8MA, Alexandria, Egypt and VU2BG, Assam, India.

High Signal-to-Noise Ratio

By running through the log it would be possible to go on indefinitely mentioning countries and stations heard on the other bands, both amateur and short-wave broadcasting, but the foregoing should certainly indicate the excellent mileage range of this receiver. The one thing that might be added is that every signal recorded in the log was a loudspeaker signal.

One of the outstanding features of this receiver as demonstrated by those reception tests is its unusually good signal-to-noise ratio, a feature which is directly responsible for its ability to bring in some of the stations heard in this noisy test location. One of the reasons for it is an input circuit carefully designed to transfer the maximum amount of signal energy and the minimum of noise from the antenna to the grid of the first tube. Efficient antenna coils, proper coupling and electrostatic shields all play a part in this. Another important reason for its quiet operation is the use of two stages of high gain r.f. amplification on all bands. It is a well-known fact that much of the internal noise in a superheterodyne develops in the converter circuit. However, by building up signal voltages in the r.f. stages, the signals applied to the converter grid are so much greater than the tube noise that the latter becomes a negligible factor.

THE "SUPER PRO" POWER SUPPLY



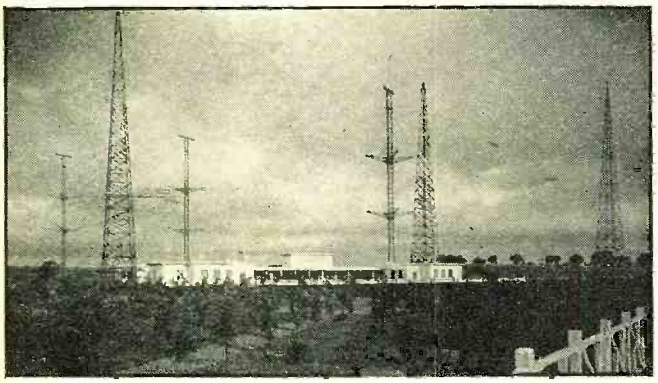
Dial Calibration

No operating test article on this receiver would be complete without mentioning the accuracy of the main dial calibration—a degree of accuracy which is little short of amazing. The tank dial is calibrated in frequencies throughout all ranges and an accurate check of this calibration was made, employing the harmonics of a low-frequency crystal oscillator. This check was repeated after a lapse of six weeks and no noticeable variation was found in spite of the fact that the receiver had been in daily operation during this period.

In the lowest frequency range, 540-1160 kc. the maximum error of calibration was found to be 2.5 kc. The maximum errors found in the other four ranges were: 1160-2500 kc., 5 kc.; 2.5-5.0 megacycles, 10 kc.; 5.0-10.0 mc., 20 kc.; 10.0-20.0 mc., 30 kc. All of these errors represent the *maximum* found in each of the ranges. Actually, of course, the average error is much smaller than these figures indicate.

Band Spread

The band-spread system proved to be a highly effective one. Not only does it spread stations out comfortably in all ranges but it has the further advantage that stations can be logged with a good degree of accuracy. The method used in tuning the receiver is to set the tank condenser at the high-frequency end of the particular portion of the range to be covered, with the band-spread dial set at 100. Rotating the band-spread dial from 100 down to zero will tune downward from the frequency indicated on the tank dial. Thus, in tuning the 20 meter ham band, which extends from 14.0 (*Turn to page* 184)



STATION CNR REPORTED HEARD AGAIN

This is the extensive transmitter and antenna installation at CNR, Rabat, Morocco, which is now being reported broadcasting on two frequencies.

The DX *for the*

Conducted by

Laurence

THE forty-second installment of the DX Corner for Short Waves contains the World Short-Wave Time-Table for 24-hour use all over the world. Consult it regularly and make your all-wave set pay big dividends!

Post Card Idea Taking Hold!

We are pleased to report that the use of Post Cards for our Official Short-Wave Listening Post Observers' reports is resulting in better data for the DX Corner and a great increase in the efficiency of compilation and filing of the reports and that one-half of our observers are now using this improved method as against only one-third of the reports received a month previously. We are also planning next month on giving special mention to the six Official Observers who send in the best reports over the whole of next month and only those received on the post cards will be eligible. By far the best and most comprehensive report for the past month was that of Observer Partner, who not only did a fine job in logging and compiling his verifications but gave us much wanted information which is incorporated in the listing and Time Table this month. At least a dozen other Observers also did fine work but they sent their reports in on letter-heads with such a raft of other material that made it extremely difficult to compile. What we need are *short, concise statements about new stations or station changes.* Keep your information on stations logged specific! Please do not send us long lists of the ordinary run of stations heard, because everybody knows they are on the air without much change from month to month. We repeat, for our Observers and listeners who wish to send reports, that they can be arranged in paragraphs in two ways, as follows:

NEW STATIONS

W8XK, Pittsburgh, Pa., 11870 kc., daily 5 p.m. to 9 p.m., E.S.T. (Verification.)

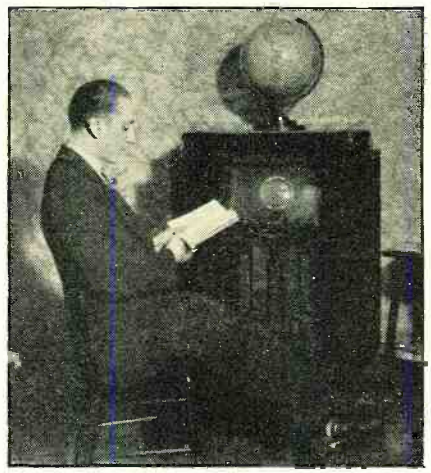
A QUEBEC LISTENER

Meet Laurent Gagnon, a listener on the short waves as well as an ardent reader of RADIO NEWS. *His Listening Post is at Quebec, Canada.*

STATION CHANGES

CB960, Santiago, Chile, moved to 9590 kc., same schedule as before. (Announcement.)

This form of reporting will guarantee an up-to-date and more workable



THE WORLD'S ORIGINAL ORGANIZATION OF

S.W. PIONEERS
Official RADIO NEWS Listening Post Observers

LISTED below by states are the Official RADIO NEWS Short-Wave Listening Post Observers who are serving conscientiously in logging stations for the DK Corner.

United States of America

Alabama, J. E. Brooks, L. T. Lee, Jr., William D. Owens; **Arizona,** Harry Wolf; **Arkansas,** James G. Moore, Caleb A. Wilkinson, Claude H. Dalrymple, Charles Holt, John Hartshorn, Chester A. Joerger, C. W. Bourne; **California,** Eugene S. Allen, A. E. Berger, C. H. Canning, Earl G. DeHaven, G. C. Gallagher, Werner Howald, Robert J. McMahon, Oriente I. Noda, George C. Sholin, James E. Moore Jr., Phil E. Lockwood, Hank G. Wedel, H. H. Parker, Fred A. Pilgrim, Frank Andrews, Fred M. Craft, Radio Fellowship Andrews C. Akins, Gabriel M. Costes, Bernard L. Wood; **Colorado,** Wm. J. Vette, T. B. Mechling; **Connecticut,** H. Kemp, George A. Smith, Harold R. Smith, Philip Swanson, Herbert J. Hyde; **District of Columbia,** Phillip R. Belt; **Florida,** James F. Dechart, George H. Fletcher, E. M. Law; **Georgia,** C. H. Armstrong, Guy R. Bigbee, James L. Davis, John McCarley, R. W. Winfree, Owen Reeve, Ed McKay; **Idaho,** Bernard Starr, Lawrence Swenson. Melton and Gilpin Amos; **Illinois,** E. Bergemen, Larry Eisler, Robert Irving, R. O. Lamb, Charles A. Morrison. Phillip Simmons, Ray A. Walters, Floyd Waters, Robert L. Weber, J. Ira Young. Evert Anderson. Eddie Zarn, Louis Horwath Jr., Heinie Johnson, Gus Bartsch, Arthur Evans, Leo Herz, Bruce Holmgren; **Indiana,** Freeman C. Balph, Arthur B. Coover, Earl R. Roberts, Henry Spearing, Ted Stark; **Iowa,** Clarence Morman, E. P. Webb; **Kansas,** William Schumacher; **Kentucky,** W. W. Gaunt, Jr., George Krebs, Charles Miller, William A. McAlister, James T. Spalding, J. E. Wilson; **Louisiana,** Roy W. Peyton, Irving G. Couvillion; **Maine,** Danford L. Adams, M. Keith Libby, Vincent M. Wood. R. C. Messer, Clayton D. Sands, H. Francis Shea; **Maryland,** Howard Adams, Jr., J. F. Fritsch, Forrest W. Dodge, Lyman F. Barry, Oliver Hersowitz, Wm. J. Thomas III, August J. Walker; **Massachusetts,** Armand A. Boussey, Walter L. Chambers, Arthur Hamilton. Sydney G. Millen, Harold K. Miller, Roy Sanders, Donald Smith, Robert Loring Young, James B. Robbins, George James Ellsworth, Albert Pickering, Jr., W. C. Reichardt, Francis T. Reilly, G. L. Harris, Edward J. Dailey, Jr., James A. McGregor, Jr.; **Michigan,** Ralph B. Baldwin, Stewart R. Rupple, Jerry M. Hynek, Lewis W. Jones; **Minnesota,** M. Michaelson, E. M. Norris, Dr. G. W. Twomey, Walter F. Johnson, Preston C. Richardson; **Mississippi,** Mrs. L. R. Ledbetter; **Missouri,** C. H. Long, Walter A. Greiner, R. C. Ludewig, Merton T. Meade, Lewis F. Miller, Raymond W. Sahlbach, Robert S. Nash; **Montana,** Henry Dobrovolny, Charlie E. Hansen; **Nebraska,** Hans Andersen, P. H. Clute, Harold Hansen Louis T. Haws, John Havranek; **Nevada,** Don H. Townsend. Jr.; **New Hampshire,** Paul C. Atwood, Alfred J. Mannix; **New Jersey,** William Dixon, Morgan Foshay, George Munz, R. H. Schiller, Paul B. Silver, Earle R. Wickham, George W. Osbahr, A. Kosvnsky, Robert F. Gaiser, Morton Dennis Meehan, Fletcher W. Hartman, Peter J. Tortoriello; **New Mexico,** G. K. Harrison; **New York,** Donald E. Bame, John M. Borst, H. S. Bradley, William C. Dorf, Capt. Horace L. Hall, Robert F. Kaiser, I. H. Kattell, W. B. Kinzel, William Koehnlein, T. J. Knapp, A. J. Leonhardt, Joseph M. Malast, S. Gordon Taylor, Edmore Melanson, Joseph H. Miller, R. Wright, Harry E. Kentzel, Howard T. Neupert, A. C. Doty, Jr., Thaddeus Grabek, Kenneth L. Sargent, Robert J. Flynn, George Pasquale, Frank J. Flora, James E. Lynch, Pierre A. Portmann, A. J. Umlauf, Alvin H. Behr, E. Scala, Jr., Daniel H. Carey, Kenneth Dressler, Gerald Liccione, Harry J. Potthoff; **North Carolina,** W. C. Couch, E. Payson Mallard, H. O. Murdoch, Jr., E. H. Goodman; **North Dakota,** Billie Bundlie, Ray N. Putnam; **Ohio,** Paul Byrns, Charles Dooley, Virgil Scott, Stan Elcheshen, Albert E. Emerson, Samuel J. Emerson, R. W. Evans, Clarence D. Hall, Donald W. Shields, C. H. Skatzes, Orval Dickes, Edward DeLaet, M. L. Gavin, Arthur Leutenberg, **Oklahoma,** H. L. Pribble, Robert Woods, W. H. Boatman, Wade Chamhers; **Oregon,** Harold H. Flick, George R. Johnson, James Haley, Ernest R. Remster, Ned Smith. Virgil C. Tramp, Jack Frost; **Pennsylvania,** Harold W. Bower. Roy L. Christoph, John Leininger, George Lilley, Edward C. Lips, Charles Nick, Hen F. Polm, C. T. Sheaks, K. A. Staats, F. L. Stitzinger, Walter W. Winand. J. B. Canfield. Charles B. Marshall, Jr., S. G. DeMarco, R. H. Graham, Thomas R. Jordan, John G. McConomy. Steve Scibal. Jr., Leon Stabler, Joseph Stokes. R. B. Oxrieder; **Puerto Rico,** Manuel E. Betances, A. N. Lightbourn, Jose D. Caro Costas, Jr.; **Rhode Island,** Carl Schradieck, Joseph V. Trzuskowski, Spencer E. Lawton; **South Carolina,** Edward

Short Wave Corner

M. Cockaday

Time-Table. We believe that our Observers will agree it takes a long time for your editor to go through 5-page letters with reports of reception on which at least 4 pages are on the standard run of stations without any change from month to month. Please, all Listeners and Observers, conform to these recommendations.

If you have the correct station slogans and the addresses they may be added to the end of each station's paragraph.

WELCOME TO THE FOLD

This is the Listening Post of newly-appointed Observer E. H. Goodman at Charlotte, North Carolina. He uses an ACR-175 receiver.

ANOTHER VERIFICATION TO TRY FOR

It may be that you can pick up programs of TGW in Guatemala as did Observer Sahlbach to whom this "veri" was addressed.

Reports of Listening Post Observers and Other Short-Wave Readers of the DX Corner

Listed in the following columns is this month's consolidated reports of short-wave stations heard by our wide world listening posts. Each item is credited with the Observer's surname. This allows our readers to note who obtained the information. If any of our Readers can supply Actual Time Schedules, Correct Wavelengths, Correct Frequencies and any other Important Information (in paragraphs as recommended) the DX Editor, as well as our Readers, will be grateful for the information. On the other hand, readers seeing these reports can try their skill in pulling in the stations logged and in trying to get complete information on these transmissions. The report for this month, containing the best information available to date, follows:

Europe

I2RO-3, Rome, Italy, 9635 kc., reported heard daily 1-5 p.m. Mondays, Wednesdays, Fridays, 6 to 7:30 p.m., E.S.T.; Tuesdays, Thursdays, Saturdays, 6:15 to 7:45 p.m., E.S.T. Birds can be heard singing in the intervals between selections. (Leutenberg Kernan, Miller.)

I2RO-4, Rome, Italy, 11810 kc., reported heard, schedule as in Time-Table (Immicke, Skatzes, Westman, Miller, Sigurdsson, Leutenberg.)

RAN, a new Moscow station, 9520 kc., reported heard 7 to 9 p.m., E.S.T., with a program in English (Reilly, Sigurdsson.)

RKI, Moscow, U.S.S.R., 15040 kc.

(*Turn to page* 166)

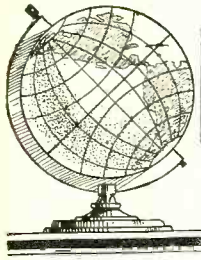
SHORT-WAVE LISTENING POST OBSERVERS

Bahan, Ben F. Goodlett; South Dakota, Paul J. Mraz; Tennessee, Charles D. Moss, Eugene T. Musser, Darrell Barnes; Territory of Hawaii, O. F. Sternemann; Texas, James Brown, Carl Scherz, Bryan Scott, James W. Sheppard, John Stewart, Overton Wilson, Isaac T. Davis, Arthur Immicke, Earl P. Hill, Roy E. DeMent; Utah, Earl Larson, A. D. Ross; Vermont, Eddie H. Davenport, Dr. Alan E. Smith, John Eagan, Fred Atherton; Virginia, G. Hampton Allison, L. P. Morgan, D. W. Parsons, Gordon L. Rich. Gaines Hughes, Jr., E. L. Myers, A. T. Hull, Jr., Wheeler T. Thompson, E. W. Turner, Douglas S. Catchim; Washington, Glenn E. Dubbe. A. D. Golden, J. Wendell Partner, Jack Perry. Wesley W. Loudon, Jack Staley; West Virginia, Kenneth R. Boord, R. E. Sumner, Fred C. Lowe, Jr.; Wisconsin, Willard M. Hardell, Walter A. Jasiorkowski. E. L. Frost, Howard E. Sauberlich; Wyoming, L. M. Jensen, Dr. F. C. Naegeli, Eric Butcher.

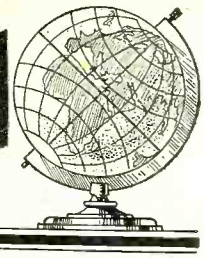
Official RADIO NEWS Listening Post Observers in Other Countries

LISTED below by countries are the Official RADIO NEWS Short-Wave Listening Post Observers who are serving conscientiously in logging stations for the DX Corner.

Argentina, J. F. Edbrooke, Santiago E. Roulier.
Australia, Albert E. Faull, A. H. Garth, H. Arthur Matthews. C. N. H. Richardson, R. H. Tucker, Harold F. Lower, E. O. Stafford, Ron Gurr.
Belgium, Rene Arickx.
Bermuda, Ralph Clarke.
Brazil, W. W. Enete, Louis Rogers Gray, Flavio Mascarenhas.
British Guiana, E. S. Christiani, Jr.
British West Indies, D. G. Derrick, Edela Rosa, N. Hood-Daniel, Aubrey H. Forbes.
Canada, J. T. Atkinson, A. B. Baadsgaard, Jack Bews. Robert Edkins, W. H. Fraser, Fred C. Hickson, C. Holmes, John E. Moore, Charles E. Roy, Douglas Wood, Claude A. Dulmage, A. Belanger, Robert B. Hammersley, Cyril G. Clark, Fred Cox, Arthur Church, Arthur E. MacLean, George L. Loke.
Canal Zone, Bertram Baker.
Canary Islands, Manuel Davin.
Chile, Jorge Izquierdo.
China, Baron Von Huene.
Colombia, J. D. Lowe, Italo Amore.
Cuba, Frank H. Kydd, Dr. Evelio Villar, Augusto Anca, Juan Manuel Salazar, Jose L. Lopez, Rafael Penalver y Ballina.
Czechoslovakia, Ferry Friedl, Joe Klar.
Denmark, Hilbert Jensen.
Dominican Republic, Jose Perez.
Dutch East Indies. E. M. O. Godee, A. den Breems. J. H. A. Hardeman.
Dutch West Indies, Rein J. G. van Ommeren.
Egypt, Aram Iskanian.
El Salvador, Jose Rodriguez R.
England, N. C. Smith, H. O. Graham, Alan Barber, Donald Burns, Leslie H. Colburn, C. L. Davies, Frederick W. Gunn, R. S. Houghton, W. P. Kempster, R. Lawton, John J. Maling, Norman Nattall, L. H. Plunkett-Checkemian. Harold J. Self, R. Stevens, L. C. Styles, C. L. Wright, John Gordon Hampshire, J. Douglas Buckley, C. K. McConnan, Douglas Thwaites, J. Rowson, A. J. Webb. F. Crowder, J. E. Puyenbroek, J. N. Street.
France, J. C. Meillon, Jr., Alfred Quaglino, S. F. Carville.
Germany, Herbert Lennartz, Theodor B. Stark.
Greece, S. E. Stefanou.
Guatemala, Luis Diez.
Holland, L. Hintzbergen, R. Groeneveld.
Iceland, Arni Sigurdsson.
India, D. R. Wadia, A. H. Dalal, Terry A. Adams, Harry J. Dent, H. W. Kamen.
Iraq, Hagop Kouyoumdjian.
Irish Free State, Harry Dumpleton, W. J. Humphries.
Italy, A. Passini, Dr. Guglielmo Tixy.
Japan, Masall Satow, Tomonobu Masuda, Shokichi Yoshimura.
Malaya, D. A. Seneviratne.
Malta. Edgar J. Vassallo.
Manchukuo, Anatol Kabatoff.
Mexico, Felipe L. Saldana. Manuel Ortiz G.
New Zealand, Kenneth H. Moffatt, B. A. Peachey, Eric W. Watson.
Newfoundland. Frank Nosworthy.
Norway, Per Torp.
Palestine, W. E. Frost.
Panama, Alberto Palacio.
Peru, Ramon Masias.
Philippine Islands, Victorino Leonen, Johnny Torres.
Portugal, Jose Fernandes Patrae, Jr.
Scotland. Duncan T. Donaldson.
South Africa, Mike Kruger, A. C. Lyell, C. McCormick, H. Westman, L. E. Williams.
South West Africa, H. Mallet-Veale.
Spain, Jose Maria Maranges.
Straits Settlements, C. R. Devaraj.
Sweden, B. Scheierman.
Switzerland, Dr. Max Hausdorff.
Turkey, Hermann Freiss, M. Seyfeddin, A. K. Onder.
Venezuela, Francisco Fossa Anderson.



WORLD SHORT WAVE TIME-TABLE

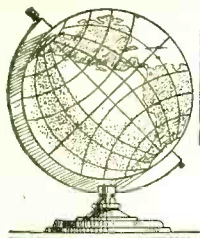


Compiled by LAURENCE M. COCKADAY

Hours of transmission for the World's Short Wave Broadcast Stations

												FILL IN LOCAL TIME												
8	9	10	11	M	1	2	3	4	5	6	7	EASTERN STANDARD TIME	8	9	10	11	N	1	2	3	4	5	6	7
01	02	03	04	05	06	07	08	09	10	11	12	GREENWICH MEAN TIME	13	14	15	16	17	18	19	20	21	22	23	00

HOURS OF TRANSMISSION												*Wave-length Meters*	*Call Letters*	*Frequency Kc.*	*City Country*	HOURS OF TRANSMISSION											
											D	13.93	W8XK	21540	Pittsburgh, Pa.	D											
										XS	D	13.94	W2XE	21520	New York, N. Y.			D									
										XS	D	13.97	GSH	21470	Daventry, England	D	D	D	D								
											D	16.86	GSG	17790	Daventry, England	D	D	D	D	D	D	D	D	D	D		
												16.87	W3XAL	17780	Bound Brook, N. J.	XS	D	D	D	D	D	D	D	D	D		
												16.88	PHI	17775	Huizen, Holland	P	P				S						
												16.89	DJE	17760	Zeesen, Germany	D	D	D									
												19.43	PRADO	15440	Riobamba, Ecuador								S	S	S	S	
						D	D	D				19.52	HAS3	15370	Budapest, Hungary	S	S										
												19.56	DJR	15340	Zeesen, Germany												
												19.57	W2XAD	15330	Schenectady, N. Y.				D	D	D	D					
												19.60	GSP	15310	Daventry, England											D	D
											D	19.62	LRU	15290	Buenos Aires, Arg.	D	D	D	D	D	D	D	D	D			
				D	D	D	D	D	D	D		19.63	DJQ	15280	Zeesen, Germany												
										D	D	19.65	W2XE	15270	New York, N. Y.	D	D	D	D	D	D	D	D	D			
					D	D	D	D	D	D	D	19.68	TPA2	15244	Pontoise, France	D	D	D	D	D	D	D	D	D			
								T	T	S	V	19.71	PCJ	15220	Eindhoven, Holland	W	W	W									
												19.72	W8XK	15210	Pittsburgh, Pa.		D	D	D	D	D	D	D	D	D	D	
D	D	D					D	D	D	D	D	19.74	DJB	15200	Zeesen, Germany	D	D	D					D	D	D	D	D
												19.76	GSO	15180	Daventry, England					D	D	D	D	D			
	D	D										19.82	GSF	15140	Daventry, England		D	D	D	D	D	D	D	D	D	D	D
									XS			19.84	HVJ	15121	Vatican City			I									
									D	D	D	19.85	DJL	15110	Zeesen, Germany												
				S	S	S	S	S	XB	XB	S	20.00	SV1KI	15000	Athens, Greece							D	D	D	D		
				D								20.04	LZA	14970	Sofia, Bulgaria			S	S	U	U	S	S				
												20.55	JVH	14600	Nazaki, Japan								E				
S	S	S										22.16	SPW	13653	Warsaw, Poland				C	C				S	S	S	
			I	XS	XS							22.95	VPD	13075	Suva, Fiji Islands												
	S	S	S							V	S	24.52	TFJ	12235	Reykjavik, Iceland						S	S					
					D	D	D	T				25.00	RV59(RNE)	12000	Moscow, U. S. S. R.	S	S	S			S	D	D	D			
D												25.25	TPA3	11880	Pontoise, France			D	D	D	D	D	AC	AC			
												25.27	W8XK	11870	Pittsburgh, Pa.									D	D	D	
I	I											25.31	DJP	11855	Zeesen, Germany					D	D						
												25.36	W2XE	11830	New York, N. Y.							I	I	I	I	I	
										D	D	25.36	W9XAA	11830	Chicago, Ill.				D	D	D	D	I	I	D	D	I
												25.40	I2RO	11810	Rome, Italy	D	D	D	D	D								
D	D	D										25.43	DJO	11795	Zeesen, Germany							D	D				
				D	D	D						25.49	DJD	11770	Zeesen, Germany				D	D	D	D	D	D	D	D	
D	D	D	D									25.53	GSD	11750	Daventry, England				D	D	D	D	D				
D	D	D	D									25.58	CJRX	11730	Winnipeg, Canada												
D	D	D										25.60	TPA4	11720	Pontoise, France									D	D	D	
		Sa	Sa	Sa				D	D	D	D	25.62	HJ4ABA	11710	Medellin, Col.				D	D				I	D	D	
					D	D		I	I	I	I	27.93	JVM	10740	Nazaki, Japan								E				
												28.14	JVN	10660	Nazaki, Japan	I							E				
												29.04	ORK	10330	Ruysselede, Belgium						D	D	I				
D	D											29.51	HS8PJ	10165	Bangkok, Siam	A	A				I						
							K	K			K	30.43	EAQ	9860	Madrid, Spain					S	S			D	D	D	
D	D										D	31.00	CQN	9677	Macao, Asia	K											
												31.07	YNLF	9655	Managua, Nicaragua	D				D	D	D			D	D	
												31.09	CT1AA	9650	Lisbon, Portugal								G	G	G	I	
D	D	D	D	Sa								31.14	I2RO	9635	Rome, Italy						D	D	D	D	XS	XS	
I	D	D	D									31.20	HJ1ABP	9615	Cartagena, Col.				D	D	D				D	D	
D					I							31.25	CB960	9600	Santiago, Chile												
				M								31.27	HH3W	9595	Port-au-Prince, Haiti					D							D
												31.27	HBL	9595	Geneva, Switzerland									Sa	Sa		
				S	S			S	S	S	S	31.28	W3XAU	9590	Philadelphia, Pa.				D	D	D	D	D	D	XS		
W	W											31.28	VK2ME	9590	Sydney, Australia	S		S	S	S							
D	D	D										31.28	PCJ	9590	Eindhoven, Holland												V
			I	I	D	I	XS	XS	XS	XS	XS	31.28	HP5J	9590	Panama City, Pana.			S	S	D	S						D
	D	D										31.32	VK3LR	9580	Lyndhurst, Australia												
D	D	I										31.32	GSC	9580	Daventry, England											D	D
D	D	D	D	D						XS	D	31.32	HJ2ABC	9573	Cucuta, Col.				D				D			D	D
D	D	D			D	D	D					31.35	W1XK	9570	Millis, Mass.	D	D	D	D	D	I	I	I	I	I	I	D
D	D	D			D	D	D	D				31.38	DJA	9560	Zeesen, Germany	D	D	D						D	D	D	D
D	D	D	D						D	D	D	31.45	DJN	9540	Zeesen, Germany	D	D	D						D	D	D	D
												31.48	W2XAF	9530	Schenectady, N. Y.									D	D	D	D
D												31.48	LKJ1	9530	Jeloy, Norway				D	D	D	D	D	D			
				D	D	D						31.51	RAN	9520	Moscow, U. S. S. R.												D
C	C	C										31.55	GSB	9510	Daventry, England					D	D	D	D	D	D		
								XS	XS	XS		31.55	HJU	9510	Buenaventura, Colom.					C	C						
D	D	D	D									31.55	VK3ME	9510	Melbourne, Australia												
XA	XA	M	M									31.56	XEFT	9505	Vera Cruz, Mex.				D	D	D	D	D				D
										D	D	31.58	HJ1ABE	9500	Cartagena, Col.				XA	XA						S	XS
	I	I	Sa	S	S	S	S	S				31.71	XGOX	9460	Nanking, China	D											
D	D	D	I	I								31.75	TGWA	9450	Guatemala City					I	I						
												31.82	COCH	9428	Havana, Cuba	D	D	D	D			D	D	D	D	D	D
												31.98	CSW	9380	Lisbon, Portugal									D	D		
												32.88	HAT4	9125	Budapest, Hungary										S		
XM	XM	XM	AL									34.19	HCJB	8775	Quito, Ecuador								S	S	S	XM	
			D	D	D			D	D			34.29	ZBW	8750	Hong Kong, China	D	D	Sa									
XA	XA	XA										34.62	CO9JQ	8665	Camaguey, Cuba												
D	D											34.92	YNVA	8590	Managua, Nic.												
											D	38.48	HBP	7797	Geneva, Switzerland										Sa	Sa	
											Sa	39.95	JVP	7510	Nazaki, Japan	D	D						AM				
											W	41.20	SM5SD	7281	Stockholm, Sweden												
											S	41.80	CR6AA	7177	Lobito, Angola, Afr.	W	W					L	L	L			
D												42.15	HB9B	7118	Basle, Switzerland								W				
												42.37	VP3MR	7080	Georgetown, B. G.	S	S	S					D	D	D	D	
D	D											42.80	EA8AB	7010	Tenerife, C. I.	D	D					XC	XC				
AC							D					43.48	HI3C	6900	La Romana, D. R.						D	D					D
				I	I	I	I	D	D	D	D	44.14	HIH	6796	San Pedro, D. R.					AC	AC		S				AC
D	D	I	I									44.44	JVT	6750	Nazaki, Japan							Z					
	T	T	T									44.71	TIEP	6710	San Jose, Costa Rica									I	D	D	
												45.00	HC2RL	6667	Guayaquil, Ecuador									S	S	S	



WORLD SHORT WAVE TIME-TABLE

(*Continued from the Previous Page*)

Hours of transmission for the World's Short Wave Broadcast Stations

												FILL IN LOCAL TIME												
8	9	10	11	M	1	2	3	4	5	6	7	EASTERN STANDARD TIME	8	9	10	11	N	1	2	3	4	5	6	7
01	02	03	04	05	06	07	08	09	10	11	12	GREENWICH MEAN TIME	13	14	15	16	17	18	19	20	21	22	23	00

HOURS OF TRANSMISSION												Wave-length Meters	Call Letters	Frequency Kc.	City Country	HOURS OF TRANSMISSION											
XS			S	S								45.25	H1T	6630	Trujillo, D. R.					XS	XS					XS	XS
D	D											45.38	RV72	6611	Moscow, U. S. S. R.					I							
Th	Th	Th	Th	D	D	D						45.80	H14D	6550	Trujillo, D. R.				XS	XS	XS			XS	XS	XS	XS
D	D											45.80	T1RCC	6550	San Jose, Costa Rica				S	D	D				D	D	Th
D	I											46.01	YV6RV	6520	Valencia, Venezuela				D	D	D				D	D	D
D	D											46.08	H1L	6510	Trujillo, D. R.											D	D
												46.53	HJ1ABB	6447	Barranquilla, Col.				D	D					D	D	D
												46.66	H11S	6430	Puerto Plata, D. R.					D	D					D	D
D	D	D	D								D	47.02	T1PG	6380	San Jose C. R.	D	D			D	D					D	D
D	D	D	I	I	I							47.06	YV4RC	6375	Caracas, Venezuela										D	D	D
D	D										D	47.24	HRP1	6350	San Pedro Sula, D. R.					D	D					D	D
I	I	Sa	Sa									47.54	H1Z	6310	Trujillo, D. R.					S	S	S			I	I	I
I	I											47.62	YV12RM	6300	Maracay, Venezuela												
XS	XS											47.77	H1G	6280	Trujillo, D. R.												XS
-	D	D										47.77	CO9WR	6280	Sancti Spiritus, Cuba		D			D				D	D		
												48.08	H18Q	6240	Trujillo, D. R.				D	D	D				D	D	D
XS	XS	XS										48.12	HRD	6235	La Ceiba, Hond.					S	S						
L	L	L										48.15	OAX4G	6230	Lima, Peru												L
AM												48.19	HJ1ABH	6225	Cienaga, Colombia												AM
D	D	I	I	I								48.50	H11A	6185	Santiago, D. R.				D	D	D						D
D	D	D	D									48.70	CJRO	6160	Winnipeg, Canada												
			Sa	Sa								48.78	VE9CL	6150	Winnipeg, Can.												
D	D											48.78	HJ2ABA	6150	Tunja, Colombia						D						D
D	D											48.78	YV3RC	6150	Caracas, Venezuela				D	D	D				D	D	D
		D	D									48.78	HJ5ABC	6150	Cali, Colombia				D	S	S						
D	D	D		D	D	M						48.78	COKG	6150	Santiago, Cuba		D	D	D		D	D		D	D	D	D
	D	D	D	D								48.86	W8XK	6140	Pittsburgh, Pa.												
												48.89	CR7AA	6136	Lourenzo Marques, A.	S	S	S		D	D	D	XS				
D	D	D										48.94	XEXA	6130	Mex. D. F., Mex.												D
D	D	D	D									48.94	COCD	6130	Havana, Cuba											D	D
D	D	D	D									48.96	HJ3ABX	6128	Bogota, Col.										D	D	D
		D										49.02	W2XE	6120	New York, N. Y.												
D	D	D	D	D								49.10	CHNX	6110	Halifax, N. S.		D	XA	XA	XA	XA	XA	XA	D	Sa	D	D
			Sa									49.18	W3XAL	6100	Bound Brook, N. J.									AH			
J	J	J	J	J								49.18	W9XF	6100	Chicago, Ill.												
D			XS	XS			XS	D	XS	XS	S	49.20	ZTJ (JB)	6098	Johannesburg, Africa	S	D	D	XS	D	D	D	D				
D	D	D										49.22	HJ4ABE	6095	Medellin Col.				D							D	D
D	D	D										49.26	CRCX	6090	Toronto, Canada							S	S	D	D	D	D
XS	XS	XS										49.30	HJ5ABD	6085	Cali, Col.												N
XS	XS	D										49.31	HJ3ABF	6084	Bogota, Col.				D								XS
									XA	XA		49.32	VQ7LO	6083	Nairobi, Kenya, Afr.	E	E		U	U	U	XC			XS	XS	
D	D	XS	XS									49.34	HP5F	6080	Colon, Panama					S	D	XS		S	S		D
D	D	D	D									49.34	W9XAA	6080	Chicago, Ill.	D	D	D	D	D	D	D	D	D	D	D	D
											XS	49.34	ZHJ	6080	Penang, S. S.	XS											
D	D						D	I	I	I	I	49.35	DJM	6079	Zeesen, Germany												D
												49.41	OER2	6072	Vienna, Austria	I	D	D	D	D	D	D	D	D	Sa	Sa	
D	D			D	D	D	Sa			XS	XS	49.42	YV7RMC	6070	Maracaibo, Ven.				D	D					D	D	D
												49.50	W8XAL	6060	Cincinnati, Ohio	D	D	D	D	D	D	D	D	D	D	D	D
D	D											49.50	W3XAU	6060	Philadelphia, Pa.												D
												49.50	OXY	6060	Skamlebaek, Denmark					S	S	D	D	D	D	D	
D	D	D	D									49.59	HJ3ABD	6050	Bogota, Col.												D
D	D	D										49.59	H19B	6050	Trujillo, D. R.					D						D	D
	D											49.63	HJ3ABI	6045	Bogota, Colombia												
XS	XS	XS		Sa								49.65	HJ1ABG	6042	Barranquilla, Col.					XS	XS	S				XS	XS
D	D	D										49.75	HP5B	6030	Panama City, Pana.					D				I			D
												49.83	DJC	6020	Zeesen, Germany				D	D	D	D	D	D			
D	D	D				I	I					49.83	XEUW	6020	Vera Cruz, Mex.											D	D
		S	S	S	S					N	N	49.85	ZHI	6018	Singapore, Malaya	N											
D	D	D	I									49.90	HJ3ABH	6012	Bogota, Colombia				D	D	D	D		S	S	D	D
			Sa	Sa								49.92	COCO	6010	Havana, Cuba		D	D	D	D				D	D	D	
D	D	D	D		I							49.95	HJ1ABJ	6006	Santa Marta, Col.					D							D
												49.96	CFCX	6005	Montreal, Can.	D	D	D	D	D	D				Sa		
D											D	49.96	HP5K	6005	Colon, Panama	D				D						D	D
				Sa								49.96	VE9DN	6005	Montreal, Canada							D					
D	D	D	D	D								50.00	XEBT	6000	Mexico City, Mex.			D	D	D	D	D	D	D	D	D	D
												50.00	RV59	6000	Moscow, U. S. S. R.						I	D		D	D		
Z	Z	Z									S	50.17	H1X	5980	Trujillo, D. R.	S	S	S		D	D			D	D		
		D	D									50.21	XECW	5975	Xantocam, Mexico												
D	D	D										50.25	HJN	5970	Bogota, Col.				D								
D	E	E	E									50.25	XEWI	5970	Mex. D. F., Mex.							S		C			
									S			50.26	HVJ	5969	Vatican City							D					
Xa	D	Sa	Sa									50.50	TG2X	5940	Guatemala City												
XS	XS											50.72	HH2S	5915	Port au Prince, Haiti						D						XS
D	D	S	S									50.76	HRN	5910	Tegucigalpa, Hond.					D		S	S	S	D	D	D
D	D											50.85	YV8RB	5900	Barquisimeto, Ven.					D						D	D
D	D											51.15	H11J	5865	Trujillo, D. R.					D	D	D				D	D
D	D											51.46	T1GPH	5830	Alma Tica, Costa Rica					D	D						D
D	D											51.72	YV2RC	5800	Caracas, Venezuela		S	S	D	D	D	S	S	S	D	D	D
	AH	AH	AH									51.90	OAX4D	5780	Lima, Peru		AN	AN	AN								
			D	D	D			D	D			55.45	ZBW	5410	Hong Kong, China												
D	D	D	D	D	D	D	D	D	D	D	D	70.21	RV15	4273	Khabarovsk, Siberia	D	D								D	D	D

List of Symbols

A—Thursday, Sunday
C—Monday, Wednesday, Friday
D—Daily
E—Tuesday, Thursday
F—Friday
G—Tuesday, Thursday, Saturday
I—Irregularly
J—Tuesday, Thursday, Friday, Sunday
K—Monday, Friday
L—Wednesday, Saturday
M—Monday
N—Monday, Wednesday, Thursday
O—Monday, Tuesday, Wednesday, Friday
P—Except Tuesday, Wednesday
S—Sunday
T—Tuesday
Th—Thursday
U—Sunday, Monday, Thursday
V—Sunday, Wednesday
W—Wednesday
Z—Tuesday, Friday
AC—Monday, Thursday, Saturday
AG—Tuesday, Sunday
AH—Monday, Wednesday, Saturday
AL—Except Monday, Sunday
AM—Monday, Thursday
AN—Tuesday, Saturday
Sa—Saturday
XA—Except Saturday, Sunday
XB—Except Tuesday, Thursday
XC—Except Tuesday, Thursday, Sunday
XM—Except Monday
XS—Except Sunday
XY—Except Tuesday, Sunday
XSa—Except Saturday

MANCHESTER RADIO SOCIETY

Seated at the table are Mr. F. Fielding, Radio Editor of the Manchester (England) Evening Chronicle and beside him RADIO NEWS *Short-Wave Observer, Mr. R. Lawton, who is Secretary of the Society. On the left and right of the table respectively are Mr. W. Weatherby, Entertainments Manager and Mr. A. Wimtunley, Technical Advisor. The photograph was taken at an executive meeting of the North Manchester Radio Society.*

The DX Corner
(Short Waves)

(*Continued from page* 163)

RNE, Moscow, U.S.S.R., 12000 kc., reported heard after 5 p.m., E.S.T. (McGregor, Edlin, N. C. Smith.)

SV1KI, Athens, Greece, 15000 kc., reported heard 3 to 7 p.m., E.S.T. (Stefanou.)

LZA, Sofia, Bulgaria, 14970 kc., 2 kw., reported heard Sunday, Monday, Wednesday, Friday, 5 to 7 a.m., 11 a.m. to 1 p.m., E.S.T. (Stefanou, Carville, Self, Scheierman.) The address of this station is M. Tobalov, Chief Engineer, Radio Garata, Station LZA, Sofia, Bulgaria.

CSW, Lisbon, Portugal, 9380 kc., reported broadcasting in Portuguese, Spanish, French and English. (Styles.)

SPW, Warsaw, Poland, Observer Partner thinks the correct frequency of this station is 13653 kc.

LA4R, Tromso? or Tonsburg, Norway, heard on the 40-meter band. Observer N. C. Smith reports this station comes in best around 12 midnight, E. S. T. Several languages are used.

EA8AB, Radio Club de Tenerife, 7010 kc., reported heard Mondays, Wednesdays, Fridays, Saturdays, 3:15 to 4:15 p.m., E.S.T. (Scheierman, Miller.) The address is C. R. Enrique Diaz Exposito, P. O. Box 225, Santa Cruz de Tenerife.

SM5SD, Stockholm, Sweden, 7090 kc., increased power to 200 watts and frequency as stated. Schedule as per Time Table (Scheierman.)

HAS-3, Budapest, Hungary, 15370 kc., heard 6 to 7 a.m., E.S.T., Sunday mornings. (Edlin, Andrews, Partner.)

PCJ, Eindhoven, Holland, heard Tuesday 3 to 6 a.m., E.S.T., Wednesdays, 7 to 11 a.m., E.S.T., on 9590 kc. (Mascarenhas, Atherton, Street, Allison, Stefanou, Jones, Reilly.) Was reported heard on 11372 kc., at 7:15 p.m., E.S.T. (McGregor.) Another Observer reports them heard on 15220 kc.

PHI, Huizen, Holland, 17770 kc., 23 kw., reported on the air Sundays 7:30 to 9:30 a.m., 1 to 2 p.m., E.S.T. On Mondays, Thursdays, Fridays and Sundays heard 7:30 to 9:30 a.m. (Styles.)

TYA, Pontoise, France, 12240 kc., has been heard relaying PTT, Paris, 1:30 to 3 a.m., E.S.T. (Partner.)

TPA-2, Pontoise, France, 15244 kc., now heard 1 a.m., E.S.T. onwards. (Dressler.)

GSF, Daventry, England, 15140 kc., has replaced GSD in transmission 5 to 12 p.m., E.S.T. (Partner, Sholin.)

GSI, 15260 kc., heard 6 to 8:30 p.m., E.S.T. (Lopez.)

GSP, Daventry, England, 15310 kc., same time as GSI (Kerman, Lopez, Boatman.)

G2BY, Middlesex, England, 14210 kc., is an English amateur reported heard daily and asking for reports from SWL's. Will QSL. 12:30 p.m. to 1:30 p.m., E.S.T. (Dressler.)

DJB, Zeesen, Germany, 15200 kc., reported heard 4:30 to 10:50 p.m., E.S.T. (Allison, Silvius, Partner, Skatzes, Jones.)

DJC, Zeesen, Germany, 6030 kc., reported heard 10 p.m., E.S.T. (McGregor.)

DJN, Zeesen, Germany, 9540 kc., reported heard from 12:30 a.m. onward and as late at 7:25 p.m. (Lopez, Dressler.)

DJO, Zeesen, Germany, 11795 kc., reported heard 4 to 5 p.m., E.S.T. (Stabler.)

DJP, Zeesen, Germany, 11855 kc., reported heard same time as DJO. (Stabler.)

A CHOICE VERIFICATION

This is the verification card of HRD, a station that was at first reported as HRV and also HRB. Mr. Sahlbach hopes the card will settle the controversy.

DJQ, Zeesen, Germany, 15280 kc., starts transmitting 12:30 a.m. E.S.T. with the same program as DJN. (Partner, Dressler.)

DEKKA, German dirigible, **Hindenburg**, reported heard 5280 kc. (Skatzes.)

GBTT, S. S. "Queen Mary," reported heard 4420 kc., 10:45 p.m., E.S.T., was heard on 8800 kc. (Atherton, Sholin.)

FNSK, S.S. "Normandie," reported heard on the 8 mc. band. Send all reports to the French Line, 610 Fifth Avenue, New York City. (Carville, Atherton.)

Asia

PLP, Bandoeng, Java, 11000 kc. heard daily 6-10 a.m. E.S.T., except Saturday, when they are on 7-10:30 a.m. On Sundays they are hear 8-11:30 a.m. E.S.T. (Amos, Howald, Gallagher, Gavin, Partner, Dressler, Cox.)

PMN, Bandoeng, Java, 10260 kc., same schedule as **PLP** (N. C. Smith, Partner, Lyell, Cox.)

YDB, Sourabaya, Java, 9650 kc., same program as **PLP** (Gavin, Partner, Dressler.)

VS6AQ, Hong Kong, China, 14 mc., heard 9:30-10:15 p.m., talking to Philippine amateurs (Cox).

ZBW, Hong Kong, China, 8750 kc. and 5410 kc. 250 watts, reported heard as per Time Table (Howald, Gavin, Silvius, Lyell). Address: P. O. Box 200, Hong Kong, China.

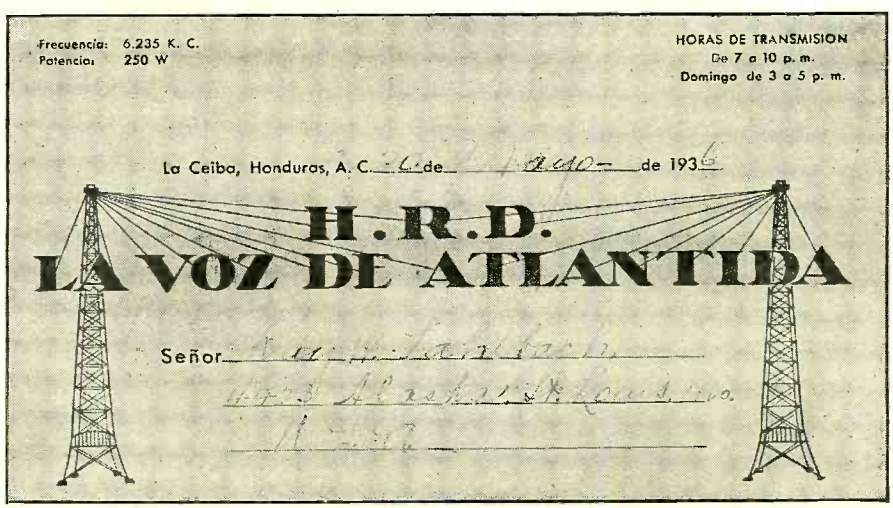
XGOX, Shanghai, China, 9460 kc., reported heard 7:30-9:30 a.m. E.S.T. (Gallagher, Silvius, Cox).

XGW, Shanghai, China, 10420 kc., heard 11 a.m.-3 p.m. E.S.T., playing records (Partner).

HS8PJ, Bangkok, Siam, 10165 kc. (Styles, Houghton), 10170 kc. (Williams, Potts), 9350 kc. (Silvius), 10 kw., heard Sundays and Thursdays 8-10 a.m., with a lady announcing. American dance music and Oriental tunes are played. Observer Westman says they are on the air Mondays 12 noon-2 p.m. and 4 p.m.-6 p.m., E.S.T. Also reported heard Mondays 8-10 a.m. (Miller, Westman, Markuson). Address: **HS8PJ**, Experimental Broadcasting Station, Bangkok, Siam.

ZGE, Kuala Lumpur, Federated Malay States, 6135 kc., reported heard Mondays and Fridays 6:40-8:40 a.m., E.S.T. and irregularly Tuesdays (Andrews. Partner).

VUB, Bombay, India, 9565 kc., schedule in Sundays 1-2 a.m., Tuesdays, 11 a.m.-12:30 p.m., Saturdays 11:30 a.m.-12:30 p.m. and Mondays irregularly (Styles, Street, Hynek, Lyell).



VWY2, Poona, India, reported heard testing with music (Reilly). Does anyone know frequency?

RV15, Khabarovsk, U.S.S.R., 4273 kc., heard 12 midnight-7:30 a.m., E.S.T. (Ames, Gallagher).

JVN, Nazaki, Japan, 10660 kc., heard irregularly Monday and Tuesday 4-5 p.m., E.S.T., with test broadcasts for the Atlantic Seaboard of the United States (Anca, Neyland, Amos, Messer). Also reported heard at 5 a.m. (Gavin). Re-broadcasts the Japanese ball games 1:40-2:40 a.m., E.S.T. (Gallagher).

JVP, Nazaki, Japan, 7510 kc., reported heard regularly same program as **JVN** (Messer, Jones).

JVH, Nazaki, Japan, 14600 kc., heard 12 midnight-1 a.m. and used fairly regularly instead of **JVN** (Howald, Houghton, Lyell, Sholin, Markuson).

JVG, Nazaki, Japan, 14910, heard irregularly 12 midnight-2:30 a.m. (Howald, Markuson, Partner).

JVL, Nazaki, Japan, 11660 kc., heard irregularly, same schedule as **JVG** (Partner).

Africa

FIU, reported as the proper call for **FIQA,** Tananarive, Madagascar, 49192 meters, heard 10-11 a.m., E.S.T. (Williams). Observer Williams would like to correspond with other RADIO NEWS English-writing DX'ers. His address is P. O. Box 352, Port Elizabeth, South Africa.

VQ7LO, Nairobi, Kenya, Africa, 6083 kc., 5 kw., on the air Mondays, Wednesdays, Fridays, 5:45-6:15 a.m., 11:30 a.m.-2:30 p.m., E.S.T. Heard Tuesdays and Thursdays 5:45-6:15 a.m., 8:30-9:30 a.m., E.S.T. Heard Saturdays, 11 a.m.-3 p.m. E.S.T., Heard Sundays 11 a.m.-2 p.m., E.S.T. (Puyenbroek, Street, Lyell).

ZTJ, Johannesburg, Africa, 6098 kc., heard as per Time Table (Partner, Andrews, Lyell).

ZSR, Capetown, Africa, 9180 kc., reported heard but no schedule given (Partner).

CNR, Rabat, Morocco, Africa, 12830 kc., and 8035 kc. reported heard on both frequencies (Lyell).

ZEC, Salisbury, Rhodesia, Africa, 9560 kc., 6000 kc., 13900 kc., reported heard but no schedule given (Lyell).

CR6AA, Lobito, Angola, Africa, 7170 kc., heard as per Time Table (Lyell).

CR7AA, Lourenco Marques, Mozambique, Africa, 3350 kc., heard as per Time Table (Lyell).

Durban, Natal, Africa, on 6145 kc. No schedule given (Lyell).

North America

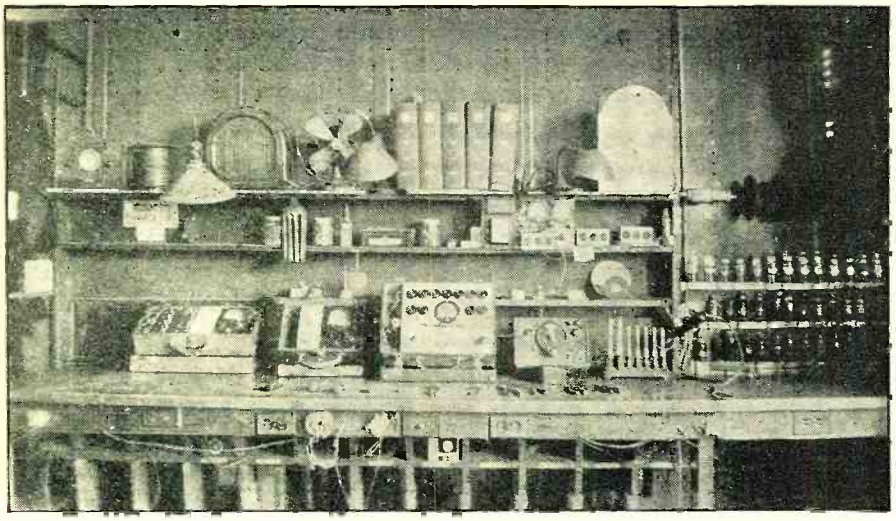
W1OXDA, The schooner *Effie Morrisey,* now in Newfoundland, 14246 kc., heard working **W2OJ,** daily, at 6 p.m., E.S.T. Also heard on 12862 kc. at 9 p.m. Also irregularly on 8655 kc. (Dressler, and Potthoff). Observer Potthoff was the first to send them complete reception reports.

W9XAA, Chicago, Illinois, 11830 kc., reported heard 6:30 a.m. to 4 p.m. and 9 p.m. to 12 m. (Imicke, Hynek, Kernan, Atherton). Address of this station is 666 Lake Shore Drive, Chicago.

W2XAD, Schenectady, N. Y., 15330 kc., reported heard as per Time Table (Silvius, Allison, Lopez, Stefanou).

W3XAU, Philadelphiia, Pa., 9590 kc,. will be off the air until August 5th when they will be back with 10 kw. power (Keitch).

(*Turn to page* 176)



A TYPICAL SERVICE BENCH

Figure 2. This is a typical and workable service bench as used by Lindley's Service of Indianapolis, Indiana. While not elaborate in any sense of the word arrangements for turning out good work are always at hand.

THE SERVICE BENCH

(*Continued from page* 152)

available. An r.f. oscillator may be modulated by record or microphone for audio-frequency tests, locating speaker rattles, etc., and rendering the serviceman independent of actual broadcasting conditions which are highly variable and unsatisfactory in Mr. Hill's location (Memphis, Texas) during the day. Outlets are provided for all useful a.c. and d.c. voltages. A Triplett, model 1180-x portable analyzer completes the shop equipment.

A Typical Radio Service Shop

While no particular angle or piece of apparatus of Merrill Lindley's service bench (Indianapolis, Ind.), shown in Figure 2 can be featured, the arrangement as a whole, is, we feel, typical among thousands of well-equipped and efficient service laboratories. Mr. Lindley writes:

"My shop is not elaborate, but has turned out many a satisfactory service job, which, after all, is the main thing. From left to right is a point-to-point tester, volt-ohmmeter, portable tube-tester, all-wave oscillator, and, above, another tube-tester. The top of the bench is made of tempered masonite, which makes a good, durable working surface. A complete stock of standard volume controls, resistors and condensers is kept on hand.

"I might add that the most used instrument in the shop is the volt-ohmmeter and that about 95 per cent of all radio troubles are located with this instrument. Bad tubes are still the major cause of radio difficulties."

Tool for Attaching Belt Tension Springs

"Many receivers have a coil tension spring which tightens the dial drive belt. Removing and replacing this spring is often quite a job in the confined space. I have devised a tool having a sheet steel or brass blade, which can be forced between the coils of the spring, near the eye, which greatly facilitates matters. The drawing of Figure 3 is pretty much self-explanatory. The blade is turned over about 1/16th inch along the top and both sides, contributing rigidity, and preventing the tool from slipping. The outer end remains flat to permit insertion between the spring coils. The blade is brazed at about a 45-degree angle to a metal rod which is used as a handle."—E. T. Gunderson, Jr., Humbolt, Iowa.

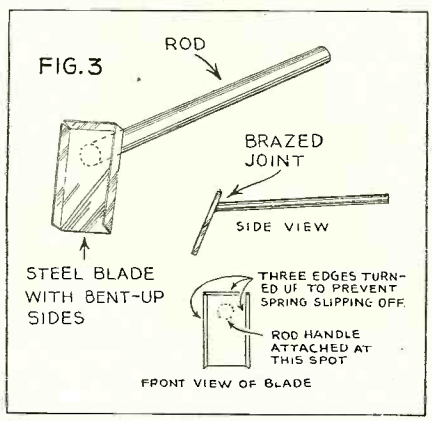
The blade can be made of almost any convenient stiff sheet metal. If spring stee is used, it should be first annealed by heating white hot and then cooling in air. After the blade is formed, it should be tempered, by again heating and cooling under oil or water.

THE DAY'S WORK

Chris L. Schultz, of the Chris L. Schultz Radio Service, Brazil, Indiana, contributes the following items from his service note-book:

Majestic 70 Series

"There has been considerable complaint about the Majestic 70 series having so much bass that the reproduction sounds drummy. As there are a considerable number of these sets still in use the following suggestion may be employed to good advantage. These sets use three audio



transformers peaking in the lower register and, as a result, the low notes are amplified much more than the high ones. Consequently, if there is a loss in the lower register somewhere in the audio circuit an improvement in reproduction will result. The method of acquiring this loss is quite simple and requires only a mica condenser and a resistor. The lead from the first audio transformer to the grid of the first audio tube, a 26, is broken and a mica condenser of suitable value inserted, while a resistor of from one-half to one megohm is connected from grid to ground to complete the job. This is in effect a high-pass filter and by proper choosing of the condenser any amount of bass may be allowed to pass. In several sets improved in this way I found that a condenser of 0.0003 mfd. is about right, but any value may be used bearing in mind that the smaller the condenser the less bass will be passed. (*Obviously a form of compensation that can be employed on any receiver with too much bass*—ED.)

"One trouble that could be found in most any set was quite unusual. The owner stated that the set had to be turned on for about ¾ of an hour before it would play, and then it played until turned off. Upon testing the set, no plate voltage on the r.f. tubes was found and further testing indicated a short-circuit from plate to ground. Easy enough. Short-circuited plate by-pass! But upon beginning to remove the part in question noticed that the wire from plate seemed to touch the metal case of the plate by-pass condenser. Bending the wire away removed the short-circuit and the set played as soon as the tubes heated. That the set played after being allowed to heat for such a long time was no doubt due to the heat generated causing the contact to break as it was touching just enough to short-circuit.

Crosley 42-S

"Low volume on a Crosley 42-S was traced to the bottom plate of the chassis touching the center terminal of the volume control. Incidentally, this set cannot be operated in an inverted position because of damage to the wet electrolytic con-

(*Turn to page* 188)

Resonance Indicator

(*Continued from page* 151)

been necessary using an ordinary oscillator and output meter. Intermediate amplifiers in superheterodyne receivers are aligned in the same way.

To determine if a set of coils is properly matched, simply clip the test leads across one of them and tune the resonance indicator to zero beat. Upon connection to any of the other coils zero beat should be obtained at the same setting. If zero beat is obtained at a lower dial setting, the inductance is too low. If at a higher dial setting the inductance is too high. (Providing, of course, that the dial reads 100 when the condenser is closed.) Ganged condensers may be checked in the same way.

In the year or so during which the author has constantly found use for this device it has proven to be of inestimable value, and the fact that it is powered from the light mains seems to have no bearing on the results of which it is capable. But remember, it is not a frequency meter, it can be used only to indicate a condition of resonance when the values are approximately the same.

List of Parts

1 2.5 volt filament transformer. (1100 turns No. 32 DCC wire as primary, and 25 turns No. 16 enameled wire as secondary wound over an old audio transformer core at least ½ sq. in. cross section will suffice.)
1 filter choke (may be the primary of small audio transformer)
Sw, power switch
3 wafer type sockets, 5 prong
2 oscillator coils (as specified)
1 20 in. shielded lead (shield itself may be used as one conductor)
1 vernier dial, 1 phone jack
Condensers and resistors of values shown in Figure 1
Wire, hardware, etc.
The constructor may use his own judgment in building a suitable case.

Service Side-Line

(*Continued from page* 134)

will usually do the rest. But if you are a good salesman, the matter of eye strain can be brought up in a casual sort of a way as follows:

THE SERVICEMAN: "A peculiar thing about inadequate lighting is that so few of us are aware of it. It is estimated that a large percentage of headaches blamed on other causes are actually due to insufficient lighting. For instance, right here—fairly close to this window—one would believe that there is enough light for reading a newspaper. And there is no doubt about it that you can read a newspaper here without realizing that you are straining your eyes. But, as you can readily see on the meter, there is bound to be eye strain. The ultimate result is usually glasses a few years sooner than they would otherwise be necessary."

The solution will be obvious to your customer—a few 100-watt lamps here and there in place of 75s, and, if you are a good salesman, perhaps an additional floor or bridge lamp.

Another interesting application of the Sight Light Indicator is in measuring the light reflection or absorption characteristics of walls. Many instances of insufficient lighting are due, not to inadequacy of the light source but to light absorption by dark walls. A demonstration can be made by placing a piece of white paper, about a foot square, against the wall. A reading is taken with the indicator five inches away from the center of the paper as shown in the top illustration. A second reading is made with the white paper removed, and the reflection factor is the ratio of the two readings.

It will be often possible to convince the house wife that repapering or a new coat of paint in her kitchen is imperative in the solution of her lighting problem, and if arrangements are made with a local decorator, there is no reason, ethical or otherwise, why the radio serviceman should not receive a commission on such work.

The progressive serviceman will follow the lead of the lighting companies, and feature his light analysis service. In the cases of schools, restaurants, etc., it may well lead to several highly profitable jobs as well as contributing a consistent increase in revenue.

B.F. Oscillator

(*Continued from page* 155)

each octave above this point. Likewise, we may divide by two for each lower octave. After obtaining several points, a curve may be plotted and the higher frequency points determined by extrapolation. A musician's pitch pipe, forms a convenient means of rechecking frequency calibration each time the instrument is used, for precise work.

In operating, the small dial is calibrated for the lower frequency range while the large dial is used for the balance. This combination will be found to give a smooth and non-critical coverage of the entire range without the use of specially shaped variable condensers.

The output of this instrument is about .3 volts at 400 cycles. Therefore, an amplifier will be necessary for nearly all applications. Both the RADIO NEWS amplifier and the small unit described in this issue in the Beginner's series have given excellent results. An amplifier, especially designed for this instrument, will be described in a later article.

Parts List

C1, C2, C8, C9—Aerovox tubular by-pass condenser 0.1 mfd., 200 volt
C3—Hammarlund Type MC-140M midget Midline variable condenser, 140 mmfd.
C4, C6, C12—Aerovox fixed mica condensers, .001 mfd.
C5, C7—Aerovox fixed mica condensers, .0001 mfd.
C10—Hammarlund Type MC-325M midget Midline variable condenser, 325 mmfd.
C11—Hammarlund "Star" midget variable condenser, 15 mmfd. (see text)
L1, L2—Hammarlund Type CH-X midget r.f. chokes, 2.1 m.h.
L3—Hammarlund Type RF-85, r.f. choke, 85 m.h.
R1, R3, R6—I.R.C. resistors, 1 meg., 1 watt
R2—I.R.C. resistor, 40,000 ohms, 1 watt
R4—I.R.C. resistor, .5 meg., 1 watt
R5—I.R.C. resistor, 1.5 meg., 1 watt
R6—Center-tapped filament resistor, 60 ohms, (used only if filament transformer is not center tapped)
SW—Insuline s.p.s.t. toggle switch
T1—Amertran De Luxe interstage a.f. transformer, Type D-11
1 National Precision dial, type N., 0-100, clockwise rotation
1 Yaxley pilot light, bracket and bulls eye
1 Insuline #2218 dial plate and pointer knob, 0-100
1 Insuline pointer knob.
1 Insuline steel cabinet, #3828, 12x8x7 inches
1 Insuline steel chassis #1531 (not drilled), 11x7½x2½ inches
1 Binding post terminal strip, 2-gang
2 wafer sockets 6-prong
1 Wafer socket 7-prong (large)
2—6C6 or 5 tubes
1—6A6 or 53 tubes
1 Filament transformer (see text)
1 22½-volt type 5156 Burgess battery
1 4½-volt type 2370 Burgess battery
1 Line cord and plug

Power Supply

(*Continued from page* 155)

ance voltmeter and a d.c. milliammeter were connected in the output and a suitable load resistance was connected directly across the output terminals of the supply.

In order to allow the greatest flexibility of the unit in conjunction with various types of equipment it was not deemed good

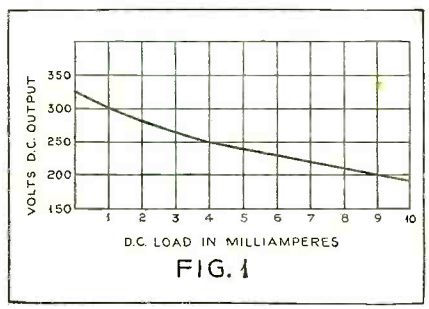


FIG. 1

practice to make a direct connection between the power-supply line and the d.c. output circuit as is standard with universal a.c.—d.c. receivers and therefore a line isolation transformer was employed. The most practical commercial transformer found for the purpose is the United Transformer Company type "UTM". This transformer is designed to couple the plate of a power tube to a magnetic speaker. The secondary has two taps, one for a 7,000 ohm speaker and the other for a 4,000 ohm reproducer, it is this latter winding which is used, making it a 1.1 transformer. To drop the power line input voltage to 6.3 volts for the filament of the 6H6 tube, a standard 360 ohm line resistance cord is used. One side of the power line is connected to the negative side of

(*Turn to page* 192)

RADIO PHYSICS COURSE

ALFRED A. GHIRARDI

Lesson 54. Resonance

A SIMPLE relation exists between the frequency of a circuit and the *wavelength* of the electrical voltage impulses to which it responds. The wavelength is equal to the speed of propagation of the electric waves, divided by the frequency in cycles. This speed is approximately 186,000 miles or 300,000,000 meters per second for electric waves. We usually express wavelengths in meters, so it is necessary to use the velocity of propagation in meters. If f is the frequency in cycles per second then

$$\text{Wavelength in meters} = \frac{300{,}000{,}000}{f} \quad ..(21)$$

$$\text{of f (cycles)} = \frac{300{,}000{,}000}{\text{wavelength}} \quad ..(22)$$

$$\text{or f (k. c.)} = \frac{300{,}000}{\text{wavelength}} \quad ..(23)$$

The customary symbol for wavelength in meters is the Greek letter "lambda" (λ).

If we substitute the value of f from equation (20) into equation (22) we obtain:

$$\frac{1}{2\pi\sqrt{L\,C}} = \frac{300{,}000{,}000}{\text{Wavelength}}$$

from which wavelength in meters $= 300{,}000{,}000 \times 2\pi\sqrt{L\,C}$

where L is in henries and C is in farads.

If L is expressed in microhenries and C is in microfarads this expression reduces to:

$$\text{Wavelength (meters)} = 1885\sqrt{L\,C} \quad ...(24)$$

These expressions enable us to compute the combination of inductance L and capacitance C necessary to tune a series circuit to resonance at any frequency or wavelength.

Example:

What wavelength corresponds to 1,500,000 cycles?

Solution:

$$\text{Wavelength} = \frac{300{,}000{,}000}{f} = \frac{300{,}000{,}000}{1{,}500{,}000} =$$

200 meters. Ans.

Example:

What inductance is required to tune to 600 meters with a tuning condenser of .00035 microfarads capacitance?

Solution:

$$\text{Wavelength} = 1885\sqrt{L\,C} \text{ or } L = \frac{\text{wavelength}^2}{1885^2 \times C}$$

$$\text{from which } L = \frac{600^2}{1885^2 \times .00035} =$$

300 microhenries. Ans.

The Amateur and Television

(*Continued from page* 145)

future holds the answer to that question. But, as it now appears, it may be only a question of time before all of the frequencies above 30,000 kilocycles are taken out of the experimental classification they now are accorded, and re-allocated to other services.

Television appears to be the amateur's most serious competitor on the ultra-high frequencies. There is no question but television will be here within the next two years. As a matter of fact, it is here now, and only awaits exploitation and the ironing out of a few minor "bugs" in field tests now in progress.

In June the Federal Communications Commission held public hearings on the question of allocation of frequencies above 30,000 kilocycles. No specific cases were brought before the board, the purpose of the discussions merely being to determine how "public interest, convenience and necessity" could be served best by revising the experimental set up on these frequencies. Television was one of the services that received major consideration. For the first three days of the conference leading manufacturers and engineers paraded before the commission and delivered their views on the status of television and what frequencies would be desired.

One of the most interesting discussions along this line from the standpoint of the amateur was delivered by James M. Skinner, chairman of the Radio Manufacturers Association Special Committee on Television and President of the Philadelphia Storage Battery Company.

On the subject of "Nationwide Coverage" of television, Mr. Skinner said: "It is not easy to find sufficient space in the radio spectrum for enough television channels to provide nationwide coverage, especially since consideration has to be given to what are believed to be the necessities of services other than television.

"The most valuable part of the spectrum for television starts at 42 megacycles. At this frequency a given amount of broadcasting power provides the greatest signal intensity in the surrounding territory. The R. M. A. Television Committee report will request therefore a television band extending from 42 to 90 megacycles.

"From 56 to 60 megacycles there is a band allocated to amateurs. *R. M. A. recognizes the service the amateurs have contributed to radio development and their importance to the nation in providing a reserve of trained radio operators in times of emergency. R. M. A. will therefore not request these frequencies for television unless it is found by the commission that this band is not urgently needed by the amateurs, or is not especially well suited to amateur work.* If so, another desirable television channel could be provided from 54 to 60 megacycles and a highly desirable continuous television band would result.

"Television has had its greatest development to date at frequencies toward the 42 megacycles end of the bank requested. However, research work is in progress in the section toward 90 megacycles. It is known that as the frequency increases the amount of power required to provide a given intensity of signal increases tremendously. Much more power is required at 90 megacycles than at 42 megacycles. Moreover, poor reception areas, in the so-called shadows produced by tall buildings, increase greatly as the frequency increases.

"It is confidently believed, however, that the upper channels toward 90 megacycles will be very useful in establishing broadcasting in localities where the area to be covered is not too great, and where not too many tall buildings are present, whereas the channels toward 42 megacycles will provide the greater signal strength and penetration necessary to cover large metropolitan areas. (*To next page*)

"Without the amateur band, the space from 42 to 90 megacycles provides seven television broadcasting channels. This is probably not enough for nationwide television service, because it is doubtful whether stations on the same frequencies can be located closer than several hundred miles apart without interference. . . ."

Mr. Skinner went on to say much additional space in the spectrum above 90 megacycles must be reserved for experimental purposes.

"R. M. A. should prefer that the additional space be continuous from 90 megacycles. but we recognize that other services probably have legitimate needs in that part of the spectrum," he said.

"R. M. A. therefore will ask for an experimental television band starting at 120 megacycles. This is required to provide space for television relaying and television pick up from the field to the transmitter, as well as much needed space for additional broadcasting channels in the future. But it is practically virgin territory and a vast amount of research must be done before television broadcasting becomes a reality at these frequencies."

That gives a clear picture of how the land lies. The amateur's work in the development of ultra-high frequencies is recognized. But the question probably will be decided on merits of "public interest, convenience or necessity." We wish to point out, however, that television should not be placed on frequencies between 56 to 60 megacycles because that band will be subject to harmonic interference from the 10 and 20 meter amateur bands. Also, another point of importance. The frequencies from 4 meters to 6 meters are now known to have, at certain times of the year, skip distances beyond which their signals travel a thousand miles or more which would cause interference between television service in other cities. To eliminate this, television should be started on wavelengths below 2.5 meters.

Calls Heard

By I. Bjargmundsson, P. O. Box 65, Hafnardirdi, Iceland, on 20 meter 'phone: F8DR, F8NH, F8DC, F8IJ, F8PU, CO6OM, OK3VA, HI2K, HI5X, HI7G, X2AH, NY2AE, K4DDH, VP9R, VP6YB, FA8AF, OZ1NW, SM5PC, LA1G, LA4A, EA3AA, OK2AK, CT1BY, ON4VK, ON4PA, PK4DG, YV4AC, SU1PM, YR5AW, KA1AK, EI2J, XE3AG, EA3CZ, TI2IC, VE2HY, VE1CN, VE1SW, VO1I, VO1J.

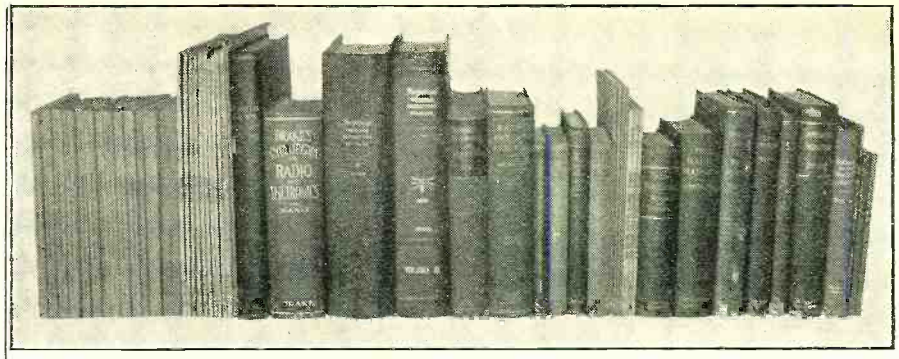
By C. O. Thompson, 38 Hillcrest Avenue, Hurstville, N. S. W., Australia; on 20 meters: W3IF, W6BAX, W6CSI, W6DRY, W6EQB, W6FIS, W6ITH, W6LFL, W6LOF, W6LSX, W6NEX, W6FGS, W7BSW, W9BYY, W6KOO, VE3ACT.

By Joe Tanaszi, Genoa, Ohio, on 20 meters: XE2N, XE1HH, YE2AH, XE1G, XE3D, CO2HY, CO2SV, CO2RA, CO2AV, CO7CX, CO6OM, CO5RY, CO8YB, CO8RQ, TI2AV, TI3AV, TI2FG, TI2RC, HP1A, HI4X, HI5X, HI7G, K6KKP, K6JLV, VP4TH, VP6YB, VP9R, YN1HS, PY1GK, PY2BO, LU6AP, LU8AB, ON4VK, CE1AR, G5ML, G5NI, G5JO, PAOWD, EA2BT, YV4AC, HC1FE, NY2AE, PZ1AA, YV4AC, HJ1ABM.

Unlimited Possibilities on Short Waves

By J. M. Muniz

Reports reaching us from all over the world indicate that the development of efficient all-wave receivers has created more interest, sales and even international good will than any other development within the Radio Industry. Three years ago, coast to coast reception was a feat, today, with a modern all wave receiver, the listener hears programs from every corner of the world, often clearer than standard broadcasts from stations only a few miles distant. The short-wave field presents unlimited possibilities and judging from the advances made during the last two years, great things are in store for the industry and the public.



THE TECHNICAL REVIEW

CONDUCTED BY ROBERT HERTZBERG

Principles of Radio Engineering, by R. S. Glasgow; McGraw-Hill Book Co. 1936. A textbook intended for students following a college course in radio communication; which should also be of interest to engineers, servicemen wishing advanced study, and others. It deals with the fundamentals of alternating currents, tube circuits, and the various types of apparatus as transmitters, receivers and amplifiers. The author has managed to include much useful data which has not been available except scattered throughout periodical literature. Graphical determination of amplifier tube distortion, detector characteristics, new material on iron-core inductances, push-pull circuits, antennas and transmission lines are among these subjects. The reader learns why a pentode has more frequency discrimination than a triode, why a diode introduces distortion at high percentages of modulation and what to do about it, etc. Although considerable mathematics is needed to fully understand the text, readers with less knowledge of this useful science can still benefit by the studying of this book.

The chapter headings are: I Alternating currents, II Resonant circuits; III Properties of Coils and Condensers; IV Coupled Circuits; V Oscillatory Circuits, VI Fundamental Properties of Vacuum tubes; VII Audio-frequency amplifiers; VIII Input impedances of a triode; IX Radio-frequency amplifiers for reception; X Oscillators and Radio-frequency power amplifiers; XI Modulation; XII Vacuum-tube detectors; XIII Receiving Systems; XIV Antennas and Wave propagation.

A Treatise on Practical Wax Recording, by E. K. Barnes published by Universal Microphone Co. 1936. The subject of recording is more or less shrouded in mystery. Therefore any discussion of the subject is welcome. This booklet describes the principles and practice of recording sound on wax and acetate discs. The apparatus is explained as well as the making of the records and routine of the studio.

Television with Cathode Rays, by A. H. Halloran; Pacific Radio Publishing Co. June 1936. Now that television is coming over the mountain we begin to see books on the subject. Since there are liable to be many changes and additions, the author of this one has had the foresight to issue it in loose leaf form. Additional material will be made available later. The text begins with a brief review of the theory of alternating current circuits then introduces the reader to electron optics. The cathode-ray tube and its associated circuits are explained. Finally the complete television receiver and transmitter are described in the last two chapters. It gives considerable detail concerning the equipment used by Farnsworth and RCA.

Review of Articles Appearing in the June, 1936, Issue of the Proceedings of the Institute of Radio Engineers

Using Concentric Lines as Interstage Couplers, by Francis W. Dunmore. This receiver, for use between 100 and 300 megacycles, differs from conventional designs in that it utilizes concentric transmission lines as interstage couplers. Its appearance as well as its operation is therefore unusual.

The Design of Radio-Frequency Choke Coils, by Harold A. Wheeler. The lowly r.f. choke, which has not received much analytical attention, is treated at great length in this paper, and some improved forms are suggested.

Radio Field Intensity and Distance Characteristics of a High Vertical Broadcast Antenna, by Samuel S. Kirby. The definite superiority of a vertical antenna over the old T and L types is indicated by the results of exhaustive tests made with station WBT, Charlotte, N. C.

Theory of the Single-Stage Amplifier, by Bernard Salzberg. The theory of the single stage vacuum tube amplifier is generalized and also extended to include phenomena occurring at high frequencies.

Frequency Modulation Propagation Characteristics, by Murray G. Crosby. Early work on frequency modulation is described wherein the propagation characteristics were determined for frequencies between 9000 and 18,000 kc.

Review of Contemporary Literature

Vacuum Tube Methods of Measuring Insulation Resistance of Condensers. Aerovox Research Worker, May, 1936. The true condition of a suspected condenser cannot be determined with ordinary test instruments; therefore the use of a sensitive, simple v.t. meter is suggested. The idea is worthy of widespread adoption.

Inductive Neutralization of R. F. Amplifiers, by L. M. Craft and Arthur A. Collins. QST, June, 1936. Capacitive neutralization has been so generally used in transmitting work that the advantages of inductive methods for some purposes have been overlooked. This article gives practical, working information.

Progress in Sound Pictures, by Carl Dreher. Electronics, June, 1936. Volume range expansion, wider frequency range; automatic rerecording, new playback tech-

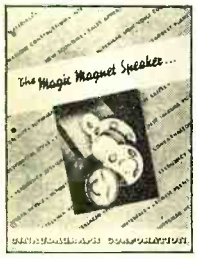
nique, and ultra-violet recording are some of the new developments in this allied field.

Improving Low-Frequency Response, by R. D. Rettenmeyer. Radio Engineering, June, 1936. A resume of methods that have been developed for improvement of low-frequency response, with particular emphasis on the reduction of cabinet resonance effects.

Free Bulletins

Permanent Magnet Speakers

The first catalogs of the new Cinaudagraph "Magic Magnet" loudspeakers are off the press. These finely illustrated bulletins, describing in detail the various models, should be of interest to radio servicemen, amateurs and experimenters. To obtain a copy free, write to RADIO NEWS, 461 Eighth Avenue, New York City.



Catalogs On Recording Equipment

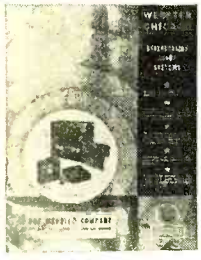
A complete line of high-grade instantaneous recording equipment, discs and related accessories is illustrated in two new folders brought out by Presto Recording Corporation. Copies of these folders, which should be of interest to broadcast stations, schools, conservatories of music, etc., are available free of charge from RADIO NEWS, 461 Eighth Avenue, New York City.

Folder On New Service Condensers

The circular 131A just released by Cornell-Dubilier Corporation describes at length a new series of midget dry electrolytic condensers in cardboard containers which are especially designed for service replacement work. Servicemen and dealers will want a copy for their files. They are obtainable without charge from RADIO NEWS, 461 Eighth Avenue, New York City.

Sound Systems

Catalog No. 436 of the Webster Company illustrates and describes an extensive variety of synchronized sound systems and accessories. It is a valuable reference manual for the P. A. specialist. To obtain a copy free of charge, write to RADIO NEWS, 461 Eighth Avenue, New York City.



Transformer Replacement Catalog

A large listing of power and audio transformers for transmitting, amplifier and service replacement purposes is given in Bulletin VR-1 of the United Transformer Corporation. To obtain a free copy write to RADIO NEWS, 461 Eighth Avenue, New York City.

RADIO NEWS Booklet Offers Repeated

For the benefit of our readers, we are repeating below a list of valuable technical booklets and manufacturers' catalog offers, which were described in detail in the March, April, May, June, July and August, 1936, issues. The majority of these booklets are still available to our readers free of cost. Simply ask for them by their code designations and send your requests to RADIO NEWS, 461 Eighth Avenue, New York, N. Y. The list follows:

Mh1—Sound Equipment catalog. Inter-World Trading Corp. Free.

Mh2—Radio Parts catalog of Bud Radio, Inc. Free.

Mh3—Amateur Equipment catalog of Wholesale Radio Service Co., Inc. Free.

Mh4—Tube Tester Booklet of Supreme Instruments Corp. Free.

A2—"Your Future in Radio", 32-page book of Sprayberry Academy of Radio. Free to readers seriously considering a modern education in radio.

A3—Radio Capacitor catalog of Solar Mfg. Co. Free.

My1—Information on a new antenna system. Technical Appliance Corp. Free.

My2—Condenser bulletin of Cornell-Dubilier Corp. Free.

My3—Free. Instructive bulletins on measuring resistance and proper use of resistors to extend meter ranges. Aerovox Corp.

My4—Free. Folders on Polyiron core coils. Aladdin Radio Industries, Inc.

My5—1936 condenser catalog. Sprague Specialties Co. Free.

Je1—Sound Equipment Catalog of the Webster Co. Free.

Je2—Radio Parts Catalog of Allied Radio Corp. Free.

Je3—Transmitter Bulletins of the Collins Radio Co. Free.

Je4—Radio Supply Catalog of Wholesale Radio Service Co., Inc. Free.

Je5—Spring Radio Catalog of Radolek Co. Free.

Jy1—Tube Engineering Bulletin on Harmonic Analysis of Modulation. Ken-Rad Corp. Free.

Jy2—Free Tube Chart of the Raytheon Production Corp.

Jy3—Public Address Catalog of Operadio Mfg. Co. Free.

Jy4—Latest Radio Parts Bulletins Utah Radio Products Co. Free.

Jy5—Commercial Refrigeration Booklet of the Frigidaire Corp. Free.

Jy6—Short-Wave Catalog of Harrison Radio Co. Free.

At2—Modulation Booklet. United Transformer Corp. Free.

At3—Precision Instrument Catalog. Clough-Brengle Co. Free.

At4—P. A. Equipment Catalog. Wholesale Radio Service Co., Inc. Free.

At5—Amateur Radio Booklet. New York Wireless School. Free.

Amateur Receiver

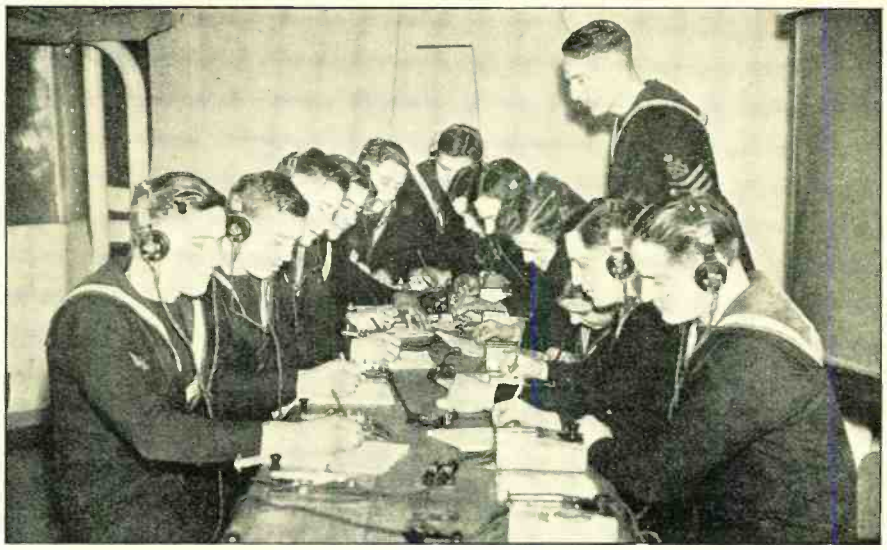
(*Continued from page* 145)

At the extreme lower right is the control switch for a.v.c. or manual volume control. The c.w. oscillator is energized by turning this switch further to the right. Above this latter control is the control for the c.w. oscillator "pitch." At the left of this latter control are two crystal controls, one for selectivity and one for phasing. In a similar position on the left of the receiver is the visual tuning control and a pilot light. The front of the panel also contains a jack for plugging in headphones.

The amateur or short-wave listener can obtain more information on the other features of this set by studying the circuit diagram in the National Manual and if still further information is required it can be obtained by writing to RADIO NEWS.

Television—Telephone Service

Berlin, Germany—A new type of telephone service, the first of its kind, was opened between Berlin and Leipzig on May 25. This service permits the two parties to see each other during the telephone conversation. A specially constructed cable is employed which transmits frequencies up to 500 kc. The service was inaugurated with considerable ceremony, attended by technical experts, army officers, political leaders and governmental representatives. The fee for a television conversation of 3 minutes costs $1.20; the distance is 105 miles. It is planned to extend the services to Hamburg and to Munich.



QRD? QRD? QRD?

CONDUCTED BY GY

GREAT honor has come to one of our brother ops and it is with real pleasure that we let the whole, wide world know that Brother Karl Baarslag has outdone himself by having his book, "SOS TO THE RESCUE" published by the Oxford Press, whose name would alone stamp it as worthwhile and authoritative.

WHILE ye Ed cannot outdo any of the reviews of "SOS to the Rescue" which appeared in numerous papers all over the country, we can say truthfully that it is the most interesting and authentic saga of the sea and the part that radio operators have played in rescues which we have ever had the pleasure of digging the old probiscus into. It is also a reference work and due to the amount of honest research into past records and fact finding by Brother Baarslag it will stand any questions which may be shot at it.

With the RCA lab. continuing to experiment, it looks as though the lowly amateur might eventually be shut out of any part of the air. The latest idea is a hookup between towboats floating around the harbor and their offices in the city. Preliminary tests have already demonstrated that such a service would be entirely successful, as signals at such widely separated points as Perth Amboy, N. J., and Yonkers and Whitestone, N. Y., were clear without any interference. The tests are being conducted on a wavelength of 11 meters and the receiver is adapted specially to this service and incorporates fixed tuning and automatic noise suppression which makes it virtually silent in operation until it picks up the carrier wave from the shore transmitter. The receiver is operated from a 6-volt storage battery. Perhaps we get consolation from the fact that these sets will go out of order and will require the services of one of our snappy radiops.

If any of ye old salts have gone through a somewhat similar experience, the following story printed through the courtesy of CREI News is quite credible. Ye Ed went through a "number nine" typhoon, but this one takes the cake. Written by Delery Freret from Iloilo, P. I., it says in part: "On February fourth we took the distressed Izushima Maru in tow, but by nightfall the wind and sea increased and she broke her tow. We decided to stand by for better weather, especially as her radio was inoperative and she could not call for help. During the night the sea and winds kept increasing until at 0330 when I went off watch it was blowing in excess of 110 miles per hour and the average wave was 65 feet high. With only 6 feet of free-board, flush deck, and a load of rails, we were in a ticklish situation ourselves. Oil didn't help the troubled waters a bit. At 0725 a huge wave caught us broadside, starboard side, and swept over the boat deck. I was in the bunk against the wooden wall of the radio room's sleeping quarters and the wall was crushed in and I was pinned under the wreckage. Luckily the mattress was on top, which saved me from the lifeboat which came inside also. . . . Somehow I managed to get free and rushed over to the shack. What was left was on fire from short-circuits, due to a can of alcohol wedged behind the main control panel. The fire was soon put out. The spark x'mtr was smashed from the table and lying against the control panel on the opposite side of the room. The receiver was flattened against the wall with a 2 x 4 sticking through the panel. The tube set generator under the table was submerged in fuel oil and sea water. The tube set itself was the only thing not crushed, as it stood screwed to the only bulkhead still remaining. . . . There wasn't a chance of getting to the radio, much less using it so we went into Yokohama without sending a single signal. . . . Mr. Biser's lecture notebook came in handy when I had to wind new coils for my motor generator and it also helped a lot with the automatic starter." Which certainly goes to show that an op has to know more about his equipment than just the "on-and-off" switch and the bug. Which also goes to prove that an Auxiliary X 'mtr should have been aboard said vessel and that another op would have aided the situation if poor Freret had been pinned under the wreckage or been swept overboard and left the ship "opless." Yeh, lots could have happened, but for the grace of God.

Whew, what a hectic and exciting time we have been having this past month listening to rumors, collecting dope and trying to get in on the inside of things. First, the CTU amalgamation is a complete, irreparable flop. Mr. Frank Powers, President of the CTU, says in part, "Recent developments make it appear that

there is a wide divergence between methods and policies of ARTA and CTU, so far as affiliation with or participation in the internal disputes of other organizations is concerned. *Until ARTA recognizes the rights of other organizations to autonomy,* which right has steadfastly been demanded the ARTA has had the temerity and stupid should be postponed." It was with high hopes that ye Ed had entertained the idea of such an affiliation, as it would have given solidarity to the organization plus a recognition which is hard to define. Brother Powers must have had facts to go on, otherwise we believe that he would not have made such a statement or refused the affiliation. If such is the case, then the rank and file of the organization of ARTA should demand to know why the Arta has had the temerity and stupid insolence to mix in other organizations' affairs unless they directly concerned them. And we cannot understand how the internal disputes of another organization might affect the ARTA. Furthermore, we might add that before telling some one else how to put their house in order, it might be a good idea to first look around, clean up the dirt and straighten out the furniture in their own domicile. Or is their own house in such good order that now the time has come to look around and see how the neighbors are living?

Secondly, why is it necessary for the ARTA publication to be suspended? It surely can't be for the lack of money, as it was published for some time without the membership strength which it has today. Or has the expense gone up with new men added to the payroll, such as relatives or ward heelers who are on every political organizations' payroll. Regardless of what the excuse may be, it would be a shame for an organization the size of ARTA to discontinue the only private means to apprise the membership of the views, notes, information and general news that is usual in any organization. A paper for, by and of the rank and file!

A very good idea has been brought out by Brother Haddock in reference to a discussion with Mr. Herbert Moore, Pres. Transradio Press Service. The question of vessels where ARTA members were aboard subscribing for its press schedule, and the ARTA having the privilege of placing items on the schedule most suited to their needs. It was decided that Brother Haddock bring this to the attention of the AC for their views and then form some concrete basis for a contract with Transradio. Not a bad idea, and we hope that it goes through as then the boys out yonder can get an earful of what's going on without waiting two months for mail . . . and with this for a closeout we say everything will come out in the laundry and with 73 . . . ge . . . GY.

Shielded Coils

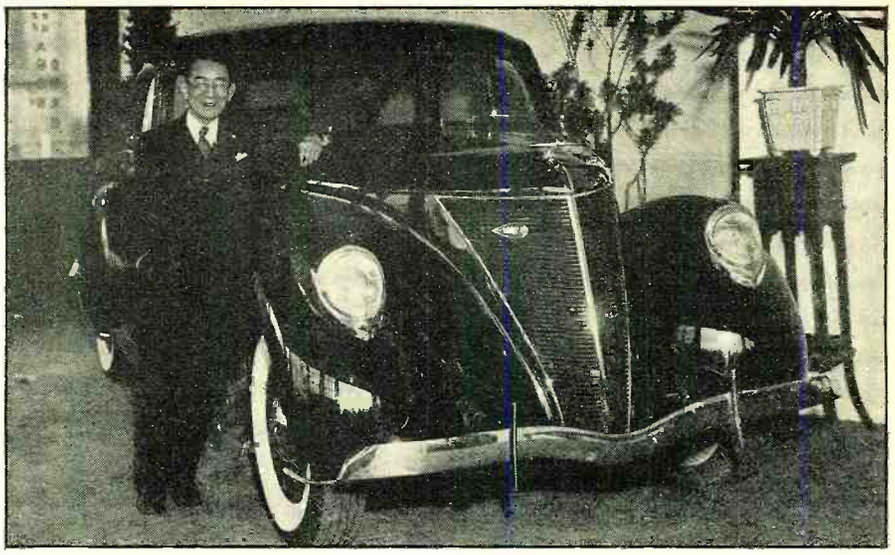
(*Continued from page* 153)

coil shield

The shield can be considered as a single turn coil which is coupled to the coil; if the coupling coefficient is K^2, the inductance of the coil is La, then the inductance of the shielded coil is equal to $L = La(1-K^2)$.

The value of K^2 can be found from the dimensions of coil and shield by means of the curves in Figure 1. Here *a* represents the radius of the coil, *b* the length of the coil, *A* the diameter of the shield. All dimensions are in inches. Following is an example of its application. The di-

(*Turn to page* 181)



AMERICAN APPARATUS FAVORED IN JAPAN

Meet Shokichi Yoshimura, newly-appointed Short-Wave Observer for RADIO NEWS *for Japan. He is enthusiastic about American radio and American automobiles, as the picture verifies.*

The DX Corner (Short Waves)

(*Continued from page* 167)

W8XK, Pittsburgh, Pa., 15210 kc., heard up to 5 p.m., E.S.T. (Lopez).

W8XK, Pittsburgh, Pa., 11870 kc., reported heard 6 to 9 p.m., E.S.T. (Lopez).

KNEE, Salt Lake City, Utah, 2830 kc., is used for transmitting news of the Speed Events on the Bonneville Salt Flats, usually at about 8 to 9 a.m. (Amos).

W8XWJ, Detroit, Mich., reported heard on the ultra-high-frequencies, probably around 9 meters. (Nash).

W9XOK, St. Louis, Mo., 35.5 megacycles, 100 watts, heard daily except Saturday and Sunday 12 N. to 9 p.m., E.S.T. Relay station WEW of St. Louis. (Nash).

CFCX, Drummondville, Quebec, Canada. 6005 kc., kill give a DX test program dedicated to M.N.R.C. and RADIO NEWS-readers, 2 to 3 a.m. on September 20 (Meehan). They are heard regularly 6 to 8 p.m. E.S.T. (Partner, Styles, Hartman, Atherton).

CJAT, has changed from the Broadcast Band to the Short-wave Band. Who knows the schedule and frequency? (Kilkney).

VQJM, S. S. *Monarch of Bermuda,* heard on the 8 megacycles band (Atherton). Address: The Furness Line, Pier 95, North River, New York City, for reports.

KHAGV, Pan American Airways, *China Clipper,* heard but no frequency or schedule given. (Silver).

TFJ, Reykjavik, Iceland, 12235 kc., heard 1:40 to 2 p.m., E.S.T. (Sigurdsson, Messer and Neyland).

W8XQ, 6424 kc. Reported heard. No location or schedule given (Meade).

CMA5, Havana, Cuba, 17260 kc., reported heard (Anca).

CO9JQ, Camaguey, Cuba, now transmitting on 8665 kc., heard 8-9 p.m., E.S.T. (Cindel, Self).

XEXA, Mexico City, Mexico, has changed frequency to 6130 kc., heard 7-11 p.m., E.S.T. (Partner, Hynek).

XEWI, Mexico City, Mexico, transmits on 11940 and 5970 kc., heard 8-9 p.m., daily. On Tuesdays and Thursdays they are on 10 p.m.-12 midnight (Stabler, Partner). This is the new call for old XEVI Station slogan is "La Voz de Mexico."

XEFT, Vera Crux, Mexico, reported changed to 9505 kc., heard 11 a.m.-4 p.m. and 7:30 p.m.-12 midnight E.S.T. (Partner).

XECR, Mexico City, Mexico, 7380 kc., reported heard 7-8 p.m., E.S.T. (Jones, Stefanou).

XEBT, Mexico City, Mexico, 600 kc., reported heard 11 p.m.-1 a.m., E.S.T. (Lopez). The station slogan is "El Buen Tono".

Central America

TIEP, San Jose de Costa Rica, 6710 kc., has been heard on the air with their new transmitter (Hansen, Lopez). Station slogan: "La Voz del Tropico".

TIPG, San Jose de Costa Rica, 6410 kc., 1 kw., heard 7:30-9:30 a.m., 12 noon-2 p.m., 6-11:30 p.m., E.S.T. (Silvius, Lopez, Dressler). Station slogan "La Voz de la Victor".

TI5HH, San Ramon, C. R., 5525 kc., heard 9-11 p.m., E.S.T. (Jones).

TI6OW, Puerto Limon, Costa Rica, heard on 6850 kc. (Betances).

HH3W, Port-au-Prince, Haiti, now heard on a frequency near 12RO on the 31-meter band (Betances).

HH2T, Port-au-Prince, Haiti, 11560 kc., reported heard from 8 p.m. onward (Self).

HRD, La Ceiba, Honduras. 6235 kc., heard as per Time Table (Hartman, Carville). Station slogan: "La Voz de Atlantica".

HRN, Tegucigalpa, Honduras, 6710 kc., heard as per Time Table (Lopez).

HP5F, Colon, Panama, 6080 kc., reported heard daily 7-10 p.m. and Sunday, 4-6 p.m. (Styles, Self). Address: Sociedad Publica de Radio, Colon, Panama.

HP5K, Colon, Panama, 6005 kc., reported heard 6-9 p.m., E.S.T. (Wright, Amos, Betances, Gallagher).

HP5J, Panama City, Panama. No frequency given. Reported heard 12 noon and 9-10:30 p.m., E.S.T. (Lopez).

HI8Q, Trujillo, D. R. 6240 kc., 200 watts, reported heard daily 11 a.m.-2

p.m. and 5-8 p.m., E.S.T. (Betances, Hartman, Partner, Dressler, Edlin, N. C. Smith, Meehan). Station slogan: "Carta Real." Address: Avenida, Espana, No. 12, Trujillo, D. R.

HI4V (some say it is HI4D) Trujillo, D. R. 6560 kc., heard as per Time Table (Dumpleton, Hartman).

HI1J, San Pedro de Macoris, D. R., 5865 kc., reported heard 1-3 p.m., E.S.T. (Partner).

TGW, Guatemala City, Guatemala, 6000 kc., and 9450 kc., 200 watts, daily 6-8 a.m. and 3-6 p.m. Transmits Sundays 4 p.m.-12 midnight (Street).

TG2X, Guatemala City, Guatemala, 5940 kc., relays TGW Saturdays 10 p.m.-6 a.m. Sundays (Partner).

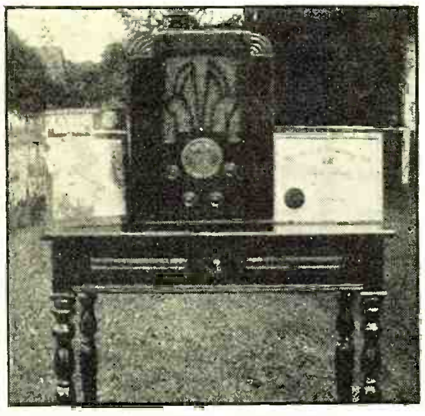
TGWA, Guatemala City, Guatemala, 9450 kc., relays TGW Saturdays 10 p.m.-6 a.m. Sundays. Also on irregularly 12 noon-2 p.m., 8-9 p.m., 10-11 p.m., E.S.T. (Partner).

YNLF., Managua, Nicaragua 9650 kc., heard daily 7:45-8:45 a.m., 12:15-2:15 p.m., and 6:15-9:25 p.m., E.S.T. On Saturdays they are reported heard 9-10 p.m. (Lopez, Gallagher).

South America

HJ1ABE, Cartagena, Colombia, 9500 kc., reported heard (Partner).

HJ1ABG, Barranquilla, Colombia, 6043 kc., 8-11 p.m., E.S.T. (Lopez, Gallagher, Partner).



CALIFORNIA EXPANDS

This is the Listening Post of George C. Akins who has been doing fine work as an Official Observer and who takes his receiver out into the good old California sunshine so that RADIO NEWS *readers can see what they look like (both the set and the sunshine). Notice the esteemed L.P.O. Certificate and the trusted Radioman's Magazine on either side of the set.*

HJ1ABP, Cartagena Colombia, 9600 kc., reported heard 11:30-2 p.m., 5:30-11:30 p.m. and an Saturdays until 12:30 p.m. On Sundays heard 5-8 p.m., E.S.T. (Bourne, Self, Jones, DeMent, Partner, Wright, Lawrence).

HJ2ABD, Bucaramanga, Colombia, 5985 kc., heard 8:30 p.m., E.S.T. (Stafanou). Observer Betances says the frequency is 6140 kc.

HJ2ABC, Cucuta, Colombia, 9573 kc., reported 4-4:30 p.m., 11 a.m.-12 noon and 6-9 p.m., E.S.T. (Houghton, Lopez). Station slogan: "La Voz de Cucuta".

HJ3ABX, Bogota, Colombia, 6128 kc., 5:45-11:30 p.m., E.S.T. (Self, N.C. Smith, Cindel). Station slogan: "La Voz de Colombia".

HJ3ABF, Bogota, Colombia, is now on 6084 kc., and signs off with chimes. (Houghton).

HJ3ABD, Bogota Colombia, 6050 kc., reported heard daily 7 p.m.-12 midnight. (N. C. Smith).

HJ4ABD, 6061 kc., heard testing 6-11 p.m., except Sunday (Houghton) Observer Wright says the frequency is 5770 kc. Observer Gallagher says the frequency is 6030 or 6040 kc. Observer Kernan says the frequency is 5760 kc. Observer Lopez says the frequency is 5700 kc. Observer Amos says the station slogan is: "Colombia Broadcasting". Observer Gavin says they sign off with the William Tell Overture. Observer Lopez says station slogan is: "La voz Catia desde el Valle de la Burra".

HJ4ABE, Medellin, Colombia, change frequency to 6095 kc., heard 11 a.m.-12 noon and 6-10:30 p.m., E.S.T. (Gallagher, Atherton, Edlin, Meade). Station slogan: "La Voz de Antioquia".

HJ4ABC, Pereira? Colombia. Shortwave listener Mr. P. E. Chapman says he has received verification from HJ4ABC, Pereira, and they state they are on 6451 kc., 9 to 11 a.m. and 6 to 9 p.m. This is the same frequency and station call other listeners report as IBAGUE, Colombia, and for which a number of verifications have been copied and sent to RADIO NEWS. So this mystery has not been solved as yet.

HJ5ABC, Cali, Colombia, 6150 kc., heard 9 to 11:30 p.m. E.S.T. (Wright)

HJU, Buenaventura, Colombia, 9510 kc. reported heard (Silver, Lopez, Stefanau De Sahlbach, Coover). Station Slogan! "La Voz del Pacifico".

HJ3ABH, Bogota, Colombia, 6012 kc. reported heard 6 to 11 p.m. (Amos). Programs end with "Traumerei."

PPQ, Rio de Janeiro, 11660 kc., reported heard 7:30 to 8:50 p.m., E.S.T. (Atherton).

PRF5, Rio de Janeiro, reported heard testing on 9501 kc., with 60 kw. power (Reilley, Leutenberg).

LSX, Buenos Aires, Argentina, 10350 kc., heard testing 8 to 9 p.m., E.S.T. (Howald, Jones, Atherton).

LRX, Buenos Aires, Argentina, has changed frequency to 9660 kc., heard 5 to 9 p.m., E.S.T. (Mascerenhas and Gallagher and Stefanou). Observer Partner says the frequency is 6640.

LRU, Buenos Aires, Argentina, 15290 kc., reported heard 7:30 to 8:30 a.m., E.S.T. (Jones, Partner, Hartman). Observer Scherman says they are heard also at 4:45 p.m., E.S.T.

YV2RC, Caracas, Venezuela, reported heard as schedules in Time Tables (Gavin).

YV7RMO, Maracaibo, Venezuela, 6070 kc., reported heard using its new transmitter (Lopez, Edlin). Observer Meade says the frequency is 6075 kc. Observer Gallagher reports hearing them at 1:45 a.m. Station slogan: Radio Difusora, Maracaibo." Station address: P.O. Box 100, Maracaibo, Venezuela.

YV12RM, Maracay, Venezuela, 6300 kc., reported heard (Atherton, Leunberg). Station slogan: "La Voz de Aragua."

YV11RB, Ciudad Bolivar, Venezuela, 6545 kc., reported heard testing with music until 12 midnight (Gallagher, Betances).

YV14RC, Caracas, Venezuela, 6270 kc., is a new station, soon to be on the air with a schedule 10:30 a.m.-1:30 p.m., 3:30-10:30 p.m., E.S.T. (Andrews).

YV5RMO, Venezuela, 5850 kc., reported heard 8 p.m., E.S.T. (Stefanou).

Observer Betances says the station's new slogan is "Ecos del Zulia". Old station slogan: "Ecos de Caribe".

VP3MR, Georgetown, British Guiana, 7080 kc., reported heard daily 4:45-8:45 p.m. and Sundays 7:45-10:15 a.m., E.S.T. (Atherton, Dumpleton, Carville, Hartman, Harris, Jones).

VP3BG, Georgetown, British Guiana, still broadcasts on 7220 kc., although it operates as an amateur rig on the 14 mc. band, according to Observer Atherton.

PZ1AA, Paramaribo, Surinam, Dutch Guiana, 25 watts, is not an amateur but an experimental station, according to Observers Miller, Messer and Atherton. Station address: S. Mobach, superintendent, Government Radio Service, Paramaribo, Surinam, Dutch Guiana.

CP5, La Paz, Bolivia, 6080 kc., reported heard 7-10:30 p.m., E.S.T., (Hynek).

OCI, Lima, Peru, 10970 kc., heard testing with music (Gallagher).

OAX4D, Lima, Peru, 5780 kc., heard on Wednesdays and Saturdays 9-11:30 p.m., E.S.T. (Amos). Station address: Antonio Santello, Av. 28 de Julio No. 950, Lima, Peru.

OA4R is a 20-meter amateur broadcasting daily 6:30-7 a.m. and 4:30-5 p.m., E.S.T. (Smith).

CEC, Santiago, Chile, 10670 kc., heard on Mondays and Wednesdays 7:15-8:20, E.S.T., with news in Spanish. Also reported heard at 4 p.m. Thursdays (Mascarenhas) and at 7 p.m., E.S.T. Tuesdays and Saturdays (Houghton, Styles).

Oceania

KZRM, Manila, Philippine Islands, 6140 kc., reported heard 5-7 a.m., irregularly (Sholin). Observer Partner says this station now transmits on 10910 kc. and that the call is KTR relaying KZRM.

KBB, Manila, Philippine Islands, 8710 kc., reported heard irregularly early mornings E.S.T. Station address: F. J. Oclassen, Superintendent, Radiophone Department, Philippine Long Distance Telephone Company, Manila, P. I.

KKH, Tahuku, Hawaii, 7520 kc., reported heard Mondays 11 p.m.-12 midnight sending a program to C.B.S. (Partner). The station rebroadcasts KGMB and sometimes is heard as late as 2:30 a.m. (Bourne, Gavin, Liccione).

VPD, Suva, Fiji Islands, 13075 kc., reported heard 12:40-1:30 a.m. and Observer Partner says they seem to be on a frequency of about 13100 kc. Observer Cox thinks their frequency is nearer 1300 kc. Observer Gallagher says that they have a terribly overmodulated signal. Observer Gavin says that they usually start late, about 12:45 a.m., E.S.T. Other listeners reporting them are: DeMent, Silvius, Hynek.

VK6ME, Perth, Western Australia, 9590 kc., will very shortly be on the air with 500 watts. (Craft, Andrews, Partner).

VK3ME, Melbourne, Australia, 9500 kc., reported heard as per Time Table (Carville, Silvius, DeMent, Drewwler, Evans, Gavin, Dumpleton, Partner).

VK2ME, Sydney, Australia, 9590 kc., reported heard Sundays 1-3 a.m., 5-9 a.m. and 10 a.m.-12:30 p.m., E.S.T. (Dressler, Carville, Gallagher, Dumpleton, Street).

VK3LR, Lyndhurst, Australia, 9580 kc., heard Fridays and Sundays starting at 1 a.m. and often as early as 12:15 a.m., E.S.T. (Gallagher, Allison, Dumpleton).

ZLT, Wellington, New Zealand, reported heard at 11:30 a.m., E.S.T., but with no frequency given (Gallagher).

Readers Who Are Awarded "Honorable Mention" for Their Work in Connection with This Month's Short-Wave Report

R. S. Houghton, Arthur Evans, Kenneth Dressler, J. Puyenbroek, H. Westman, L. E. Williams, Stabler, Fred Cox, E. Scala, Jr., Frank W. Edlin, C. H. Skatzes, James A. McGregor, Morton Meehan, C. H. Jones, N. C. Smith, Robert S. Nash, Jose L. Lopez, A. J. Cindel, Elfer Miller, R. Neyland, Lewis W. Jones, Jack Frost, Byron Silvius, Gerald Liccione, J. Wendell Partner, George C. Sholin, Antonio Santello, Flavio Mascarenhas, Francis T. Reilly, Fred Atherton, Augusto Anca, W. H. Boatman, Frank Andrews, Roy E. DeMent, G. Hampton Allison, L. C. Styles, Melton and Gilpin Amos, Jerry M. Hynek, Fletcher W. Hartman, C. Gallagher, Malcomb L. Gavin, Isaac T. Davis, R. C. Messer, Arthur B. Coover, Manuel E. Betances, Harold Self, G. L. Harris, P. E. Chapman, A. C. Lyell, Charles E. Hansen, S. E. Stefanou, Harold A. Lawrence, M. J. Markuson, Boris Scheierman, S. F. Carville, Marvin Meade, Arthur Immicke, Arni Sigurdsson, Lawrence Wright, Werner Howald, Arthur Leutenberg, Dan Firman, Ray Sahlbach, Ken Moore, Shokichi Yoshimura, Dr. Max Hausdorff, Oliver Amlie, E. H. Goodman, Edward DeLaet, W. E. Frost, Joe Miller, C. W. Bourne, L. M. Jensen, Robert E. Haworth, Harry Dumpleton, Eduardo Oliva Radelat, J. N. Street, Jack Staley, John J. Kernan, Paul B. Silver, Harry J. Potthoff.

C.W. Transmitter

(*Continued from page* 144)

use. It might be pointed out here that one band-switch could be eliminated—the one in the grid circuit—if it was desired to use the amplifier as a doubler. However, the output on 20 meters is not quite so high with this arrangement.

Both the switches for changing bands are coupled together by means of a flexible coupling (National) that facilitates making a right-angle turn. It is necessary that both switch shafts be insulated. This layout was necessary to bring the switches as near as possible to their respective coils. They are connected so the unused portion of the coil is short-circuited or dead-ended. This tends to reduce losses.

It is essential that the final amplifier circuit be followed exactly. In the first place it was necessary to use parallel plate feed in order to avoid tapping the plate voltage on the center of the plate tank coil. Obviously, if this were done, it would be necessary to use two switches tapping in an equal number of turns from each end in order to retain the center-tap arrangement when switching from one band to the other. With parallel feed, all the advantages of split-stator are retained without the bothersome center-tap problem. The split stator condenser arrangement also was necessary to get fixed neutralization. While the capacity of this condenser is rather small (60 micromicrofarads per section) it is adequate for c.w. operation on both 20 and 40 meters. A higher capacity condenser should be substituted if the transmitter is to be used on lower frequencies.

The transmitter is designed to change

from one band to the other without requiring resetting of the dials. The trick is to adjust the clip on the tank so that, when switching from one band to the other the same amount of capacity will be necessary on both bands. With a little experimenting the correct setting is easy to find.

The method is first to tune up the transmitter for 40 meters. The plate current should be taken off the amplifier by means of the switch at the rear of the baseboard. Then adjust the oscillator for resonance. This is done by tuning for minimum plate current. The plate current should be about 100 milliamperes at resonance with about 400 volts on the plate. Then try keying the oscillator to make sure it does not lag, but gives a crisp note in the monitor, without clicks. Next put the meter plug in the grid circuit of the final amplifier. The grid current should be in the neighborhood of 30 milliamperes.

Following this, the amplifier is neutralized. This may be done by tuning the plate-tank condenser (with plate voltage off) with a neon bulb held near one end of the final-amplifier tank coil. Unless it is accidently neutralized, it will glow brightly at resonance. Then adjust the neutralizing condenser until there is no indication of r.f. in the amplifier tank coil. Try readjusting the tank condenser to make sure it may be rotated over practically the entire range without the neon bulb glowing. The final amplifier is now neutralized. After this, the plate voltage may be applied and the tank condenser tuned for minimum plate current.

Normally there will be about 30 milliamperes of grid current at 40 meters and 20 at 20 meters. This is sufficient excitation with this type tube for c.w. operation on both these bands. The oscillator coil is coupled to the amplifier grid by means of a one turn link circuit. If it is impossible to load up the oscillator or obtain sufficent grid current, a two turn link may be tried. However, one turn was found sufficient in the transmitter described here.

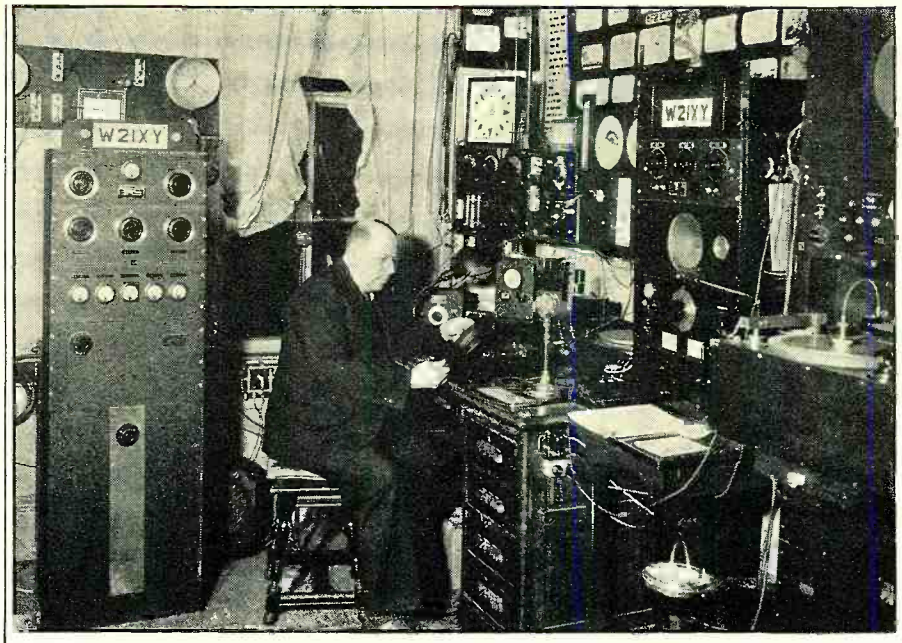
To adjust the transmitter to 20 meters, the clip should be placed a little less than half-way down the tank coil. The tank coil has 30 turns and is 2 inches in diameter. Then turn the band selector switch to the 20-meter setting. Keep moving the club a turn at a time until the dial setting is the same for both bands. It then will be possible to switch the transmitter from 20 to 40 meters, or vice-versa, at will.

With a transmitter that switches from one band to another so easily, it is desirable to have an antenna that will perform equally as well on both bands. The idea is to have one that requires no adjustment. The only type antenna that meets these requirements is the single-wire, voltage-feed type. The antenna itself should be cut to half wavelength of the lowest frequency the transmitter is to be used on. The tap should be 11 percent of the length from the center. Other types of antenna such as the "Zepp" that work well on two bands require retuning for each band setting. Twisted-pair and two-wire matched impedance antenna cannot be used effectively on even harmonics and therefore are not recommended unless the transmitter is to be used on one band only.

List of Parts for 20-40 Meter Transmitter

Crystal and holder
Four Radio frequency choke coils (National)
Three .01 1,000 volt condensers
One .002 5,000 volt condenser (for plate of amplifier)
One .004 1,000 volt condenser
One 100 mmf. variable condenser (Cardwell)

(*Turn to page* 181)



CAPT. HALL'S PAGE

NEWS items regarding various short-wave stations will always be of interest to all of us. This article will deal with the personal appeal that the owners and operators attempt to impart to us.

MANY listeners to the German short-wave stations have accompanied their reports to the engineers with a photograph. The German stations now ask you to kindly follow this pleasant practice to even a greater extent and send them photographs showing something of the lives you lead, your radio equipment, or your daily work. Of especial interest to the directors of the "D" stations, are pictures of group reception or of your short-wave club meetings. Listeners have also sent cuttings from magazines or the local press, referring to the German stations and its programs. The German station is extremely thankful for the trouble thus taken but reminds us that care should be taken not to omit particulars as to source of clippings and exact date. Without this information such cuttings lose much of their value.

Short-wave listeners who tuned in PZ1AA (heard on the foreign amateur band) were under the impression that this station was just another "amateur." Such is not the case as evinced from a letter received from S. Mobach, superintendent of the radio service of Surinam. We quote from the letter, "As this station is Government owned and purely experimental, we do not use QSL cards. We hope, however, that this letter will serve as a verification." PZ1AA utilizes 25 watts power and is located in Paramaribo, Surinam, Dutch Guiana.

"La Voz de los Muchachos," English translation, "The voice of the boys," is the slogan used by HIZ. This station operates on 6315 kc., with a power of 100 watts. The address is: Frank Hattan, Calle Duarte 68, Cindad, Trujillo, Dominican Republic.

"La Voz de Atlantida," or HRD, operates on 6235 kc., with 250 watts. This station is located in La Ceiba, Honduras. Operating schedule is: daily 1 to 10 p. m. and Sunday, 3 to 5 p. m.

Did we hear some one mention that the Saigon commercial phone stations were not active? Albert Novack, New York, just received a verification which reads, "We take pleasure in verifying your report of reception of our station FZR, 16250 kc, while working 'phone' with Paris." The address of this DX catch is: Boite 238, Saigon, Indo-China.

Here is a real honest-to-goodness flea power station for you to go after! F3JD, France, has been on the air with 5-watts power—on phone—and worked TI1AF, Costa Rica. How many short-wave fans have this amateur's cards among their collection of QSLs? Well, within a short time F3JD will be using 30 watts. Compared with the excellent results he had with 5 watts—there is no telling where he will be heard!

Speaking of low-powered transmitters, Kenneth J. Mallalieu, whose call letters are VP2KM, was reported by short-wave listeners in every part of the world when he was using 30 watts. An increase in output will be VP2KM's next move. Reports are always answered by this amateur whose voice transmissions are heard on 14 meg. The address: Basseterre, St. Kitts, B. W. I.

Carlos Videche of Alajuela, Costa Rica, is on the air with the call TI5CV.

One of the most gorgeous cards that we have seen in many a day, is sent out by LY1G. Peter Jastrzendskas, the owner-operator, places nine commemorative stamps on the envelope to show his appreciation when QSLing a short-wave listener. This amateur is heard speaking German on the high-frequency side of the 14 meg. amateur band. Address, Hippodromo 14, Kaunas-Sanciai, Lithuania.

Now we come to the schooner "Effie Morrissey." Clifton F. Foss is the "sparks" or radio operator on board. His amateur call letters are W2OJ, and while away his wife who is also an operator, will endeavor to contact the "Effie" through the home station (W2OJ). The schooner has been assigned several frequencies within and outside the amateur band, viz.: 12862, 8655, 14246 and 14190 kc. The last mentioned will be used by Mrs. Foss to contact her husband. Schedules have been made for 7 to 9 p. m. and during the early

morning hours, possibly around 7 a. m. Reports should be addressed to Mr. Foss at his home address: 8214 11th Avenue, Brooklyn, New York. QSL cards will be sent out immediately upon the return from the cruise which takes the Morrissey into northern waters.

In Colombia, South America, there are only three amateur phone stations active on the 14 meg. band. They are, HK1Z, HK5AM, and HK1ABM. How many have you logged?

COKG, is heard on 23 meters with a very fine signal but according to a verification received by John W. Blecha, New York, this station operates only on 48.74 meters. The address: Box 137 Santiago, Cuba.

W2XE, Wayne, New Jersey, will not verify unless a complete report is sent. This must include time of reception, frequency, title of songs, name of artists, actual quotations of speeches, etc.

Two Japanese stations, JAP, 1198 kc. and JUI, 7570 kc., are heard giving out news bulletins in English, at 6.30 a. m. and midnight E.S.T.

Denis Richardson, operator of ZS1B, is now on the air daily at 1.30 a. m. E.S.T. We quote from a letter received from this DX station: "My frequency is 14080 kc. I can get an R7 signal (code) into the sixth (United States) district, but they tell me my carrier is not modulated when I use phone. But I get R8 from Brazil, Argentina, England, and India, all on phone! I need only a QSO with the United States to get my phone WAC." Short-wave listeners hearing Denis are asked to send reports to: Post Office Box 35, Capetown, South Africa.

A report to hand reads, "About 5 a. m. CQN, Macao, China, now parked alongside YBD, Java, and 3LR, Melbourne, Australia, on the 31 meter band, is holding forth and all stations are distorted."!!!! What would you say about that?

The Moscow station is now broadcasting daily (in English) on 9.52 meg. at 7 p. m. E.S.T. Programs in English take place on Sunday, at noon on 15.18 meg. and on Monday, Wednesday and Friday on 12 meg., at 4 p. m.

Dr. Roberto Levi, the world famous operator of HC2RL, Guayaquil, Ecuador, is paying this country a visit. Having flown here from South America, the Doctor is honoring many short-wave listeners by "dropping in" for a little chat. HC2RL in person—is just what you would expect—a highly cultured, well-read gentleman, whose aim in his radio life is to cement the bond of friendship now so closely knit between the two Americas. We just had to ask Dr. Levi a few questions. The paramount one was, "Why do not the South American stations announce more often in English?" Here is the Doctor's answer: These Spanish-speaking stations are operated a la American style with sponsored programs. Hats, groceries, meat, tooth paste, are being boomed by the announcers. Therefore why waste valuable time on an English announcement when station operators know we are not going to purchase any of these products? Sensible reasoning!

Dr. Levi explained that his station, operating on 6.67 meg., is *not* commercial but was born of the idea of good-will between the Americas. Talent of the highest grade is HC2RL's motto. Tune in HC2RL while Dr. Levi is here on an extended transcontinental trip and listen as Mrs. Levi chats to her husband. This informal broadcast takes place every Sunday at 8 p. m., E.S.T.

Within a short time all the South American stations will discontinue sending out verification cards. This rather revolutionary idea was started by one or two of the stations and proved very successful for them. All reports in the future will be acknowledged over the air. The station operators feel that all short-wave fans derive considerable satisfaction from hearing their names called from a distant land. This means that after you send a report to a station you must listen nightly to know if your report reached them. We sincerely hope this postage-saving idea is not adopted by the real DX stations. The majority of short-wave fans want something more tangible than hearing their name called when they log a distant catch and send in a report.

Shielded Coils

(*Continued from page* 175)

ameter of a coil is .75 inch, its length (length of the winding) 1.5 inch. When this coil is placed inside a shield can with a diameter of 1.25 inch what will be the reduction in inductance due to the shield.

Solution: Stating the above in another way:

$b = 1.5$; $a = 0.375$; $A = 0.625$. Then $b/2a = 1.5/0.75 = 2$ and $a/A = 0.375/0.625 = 0.6$. The curves show the relations between the last two quantities and K^2. For this case $K^2 = 0.28$. The inductance will then be reduced 28 percent. It will be equal to (1-0.28) X 100 = 72 per cent of the unshielded value.

The accuracy of this method is sufficient for all practical purposes when the length of the shield is longer than that of the coil by at least the radius of the coil. When the can is square *A* may be assumed to be 0.6 the length of one side.

Information for this article was supplied by RCA engineers.

Police Radio In Venezuela

Caracas, Venezuela—The government of the Federal District has appropriated a sum of $1,366.36 for the purchase of a radio broadcast transmitter to be used by the police at Caracas.

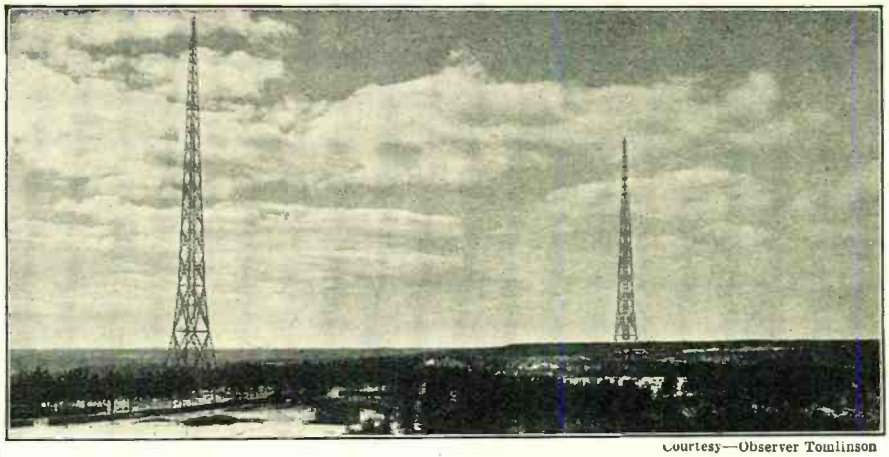
C.W. Transmitter

(*Continued from page* 179)

One 60 mmf. split stator midget condenser, double spaced (Hammarlund)
One 10,000 ohm resistor, 2 watt (in 6L6 grid circuit)
One 400 ohm resistor, 25 watt (in 6L6 cathode)
One 10,000 ohm resistor (in Taylor 55 Grid circuit)
One 100,000 ohm voltage divider, 100 watts (Ohmite)
One 50 ohm center tapped resistor (across 55 filament)
Three closed circuit jacks
Two milliammeters (one 0-150; one 0-200)
Three four prong sockets
One five prong socket (for crystal)
One metal tube socket
Two 1½ inch coil forms (Hammarlund)
Two band changing switches (Ohmite)
One 6, one 2 post terminal switches
One flexible coupling (National)
Two pointer dials

No Sponsored Programs In England

London, England—The British Government announced that direct advertising and sponsored programs in British radio broadcasting and television will be forbidden for ten years to come. The expenses for the programs are obtained through an annual license fee of 10 shillings. The government also agreed to take all steps within its power to prevent advertisers from going to foreign stations to have their programs addressed to British listeners.



Courtesy—Observer Tomlinson

THE DX CORNER

S. GORDON TAYLOR

(*Far Broadcast Waves*)

FINLAND'S 150-KW. STATION

The towers and station shown above are those of the long-wave station LAHTI. Transmissions begin daily at 1:30 a.m., E.S.T., on 166 kc.

AT this season of the year broadcast band DX reception is at low ebb and it is therefore logical that the DX corner should be somewhat curtailed this month. For the same reason observers naturally find little to report. It is suggested, however, that they start forwarding reports again as soon as the DX reception opens up in the early Fall in order that the "Best-Bets" list can be started in the earliest possible issue.

DX listeners who are interested in becoming RADIO NEWS Listening Post observers may well take advantage of the slow season to send in their applications, including in their application letters a brief summary of the equipment used and their DX accomplishments during the past season.

Readers and observers are invited to send in photographs of themselves and their listening posts. Good snap shots will serve the purpose, and all which are suitable will be published in the DX corner during the coming season.

Getting Ready for the DX Season

This is the ideal time of the year to take inventory of DX equipment and study the possibilities of improvements which can be made during the summer in preparation for the DX season to come. There may be room for improvement in your antenna system. Perhaps a way can be figured out to increase its size or height and thus bring about improved pick up. If you can not put up a new antenna it would be worth while to go over the old one carefully to make sure that all the joints are good. The ground system should also be made the object of careful examination. A cold water pipe usually makes an effective ground but sometimes this is not the case and occasionally a marked improvement may be obtained by burying an old water boiler, an old automobile radiator or almost any large mass of metal, a few feet below the surface of the ground, preferably at a point where the ground is damp. Surrounding the metal mass with rock salt or charcoal will help to keep the ground moist. Incidentally, in some cases it is found that the ground, whether it be a water pipe or a manufactured ground system serves very effectively as an antenna where the receiver is one which draws its operating power from the lighting lines. This is accomplished by simply connecting the ground to the antenna binding post of the receiver leaving the ground binding post of the set without any connections. Or if there are two ground systems available good results are sometimes obtained by connecting one to the antenna binding post and one to the ground binding post.

It is also worth while to experiment with an antenna tuning unit. An unusually effective one—the RADIO NEWS "Tenatuner"—was described in detail in the July, 1935 issue. For the benefit of those who do not have this earlier article the circuit will be republished in the DX Corner next month.

Other improvements worthy of consideration include a thorough check up of

ANOTHER YL DX'ER

Right: Miss Emily Griswold, well known for her DX activities at West Hartford, Conn. She also operates the "Clearing House," which constituted such an important part of the "Interclub Plan" put in operation last year to reduce conflicting DX specials.

tubes. Most radio dealers will test tubes without charge. Any shown to be substandard can then be replaced before the DX season starts.

A good tuning meter is distinctly worth while and can easily be installed on any receiver which employs automatic volume control. An article on page 88 of last month's RADIO NEWS explains how this is done.

Next Month

The first real DX to look forward to in fall is likely to be that from across the Pacific. With this idea in mind the October issue of RADIO NEWS will contain an up-to-date list of the trans-Pacific broadcast stations.

As a final thought—don't forget that the best short-wave reception of the year takes place during the summer and the Broadcast Band DX listener will find plenty to interest him on the short-wave ranges until such time as the season for his favorite hobby opens up.

Radio in the Forest Service

(*Continued from page* 138)

chasers," who require compact and portable voice communication. They are often carried by road and trail crews, rangers and other traveling forestry officers.

The PF Kitbox

The PF Kitbox is a small chest, containing heavier duty batteries than those regularly furnished with the PF Radiophone, and a half-wave antenna for semi-permanent installation. A compartment for the PF Radiophone is part of the equipment. The weight of this set, exclusive of the PF Radiophone, is about 35 pounds. It was designed for use by lookoutfiremen, small fire crews, and small maintenance crews. In lookout service, the half-wave antenna is permanently installed at the lookout station and the PF Radiophone plugged into the batteries contained in the PF Kitbox. When a fire occurs, the lookout-man has only to unplug the PF Kitbox battery cable, drop the set into the PF Radiophone bag, which contains batteries and a short antenna, and his complete 15-pound voice-set is ready to travel.

Type M Radiophone

The type M Radiophone, a voice and code transmitter, weighs about 100 pounds and has an effective working range of about 50 miles. It functions on 110-120-volt, 60 cycle alternating current.

In Alaska, where roads are practically non-existent and the dependence upon radio for communication is so urgent, another type radio set, known as type B, is in use. This plugs into regular 110-volt a.c. light mains. Almost all of the patroling is accomplished by boat in the National Forests in Alaska and it is of advantage to have these boats equipped with type B sets. They are often at the docks for several months at a time and the regular electric light main supplies current for the radio apparatus.

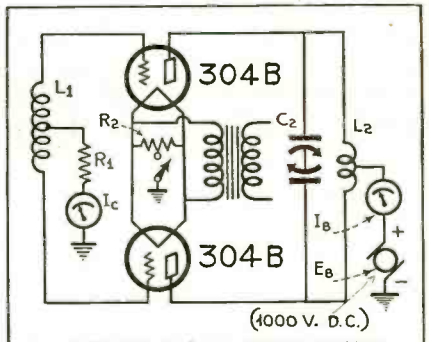
The use of radio in the National Forests is confined entirely to emergencies occurring within the domain of each forest. All the stations are linked by land-line telephones for administration purposes and communication between forests is also effected by conventional telephone.

The 304-B Tube

(*Continued from page* 142)

—180 volts at a plate current of 0.1 amperes, 65 watts power output and 35 watts plate dissipation. At a plate voltage of 750 volts the grid bias is —100 to —135 volts with a plate current of 0.1 amperes and a power output of 50 watts and a plate dissipation of 25 watts.

As a plate-modulated r.f. oscillator or



L_1 - 5 TURNS 3/16" O.D. COPPER TUBING, 2" INSIDE DIA., PITCH OF WINDING 3/8".
L_2 - 2 TURNS 5/16" O.D. COPPER TUBING, 2" INSIDE DIA., 1 1/2" SPACING BETWEEN TURNS.
C_2 - SPLIT STATOR VARIABLE TRANSMITTING CONDENSER APPROXIMATELY 80 MMFD. PER SECTION.
R_1 - GRID LEAK 5000 TO 7000 OHMS.
R_2 - CENTER TAPPED FILAMENT RESISTOR 20 TO 30 OHMS.

FIGURE 1

power amplifier, Class C, the maximum plate voltage is 1000 volts at 0.1 amperes, with 50 watts plate dissipation and a maximum grid current of 0.02 amperes. For this use the tube would normally be used at the 1000 volts with —180 volts grid bias at 0.1 amperes plate current so that when the modulation was "off" the power output in watts would be 65 watts and the plate dissipation would be 35 watts.

The tube operates extremely well in the frequency range from 30 megacycles to 300 megacycles and the accompanying diagram shows a circuit for using the tube as a push-pull oscillator for 60 megacycle operation employing two 304-B tubes. The values of the circuit elements are given in the diagram. The antenna should be coupled direct to the center of the plate tank-coil, L2. The limit of oscillation on this tube is about 400 megacycles. In no case should the plate dissipation be allowed to exceed 50 watts.

A pair of 304-B tubes may also be used in a balanced circuit as a Class B audio amplifier and for this use these tubes require a driving stage capable of approximately 10-watts output. For this use the grid bias must be held constant and not by the grid-leak method or by the series-resistor method. A battery or other good source of bias is therefore necessary. At a plate voltage of 1250 volts the grid bias should be —110 volts, static plate current per tube 20 milliamperes, which will give a load impedance, plate-to-plate, of 14,000 ohms. For 1000-volts operation, the grid bias is —85 volts, static plate current per tube 20 milliamperes, producing a load impedance, plate-to-plate, of 10,000 ohms. At 750 volts plate voltage the grid bias is —55 volts, static plate current per tube 20 milliamperes, with a load impedance, plate-to-plate, of 7000 ohms. The power required in the modulator, for 100 percent modulation of a Class C r.f. amplifier, is one half the d.c.

power input to the Class C amplifier plates.

The grid-plate terminals of the tube are taken out at the top of the tube as shown in the photograph. The two large terminals in the base are for the filament leads, the two small terminals in the base being left blank.

Metal-tube Browning

(*Continued from page* 141)

the 360° vernier scale is no longer fastened to the tuning knob but is mounted on an auxiliary shaft which is gear driven from the main condenser shaft. This means that *both* pointers will log accurately and always return to the same spot for any given station. The tuning is now exceedingly smooth, with absolutely no lost motion or back-lash.

A larger-dial escutcheon and ivory colored dial add considerably to the appearance of the new receiver. It is interesting to observe that most of the changes which have been made from the original "Browning 35" are minor ones and in the nature of refinements rather than fundamental alterations of the design layout.

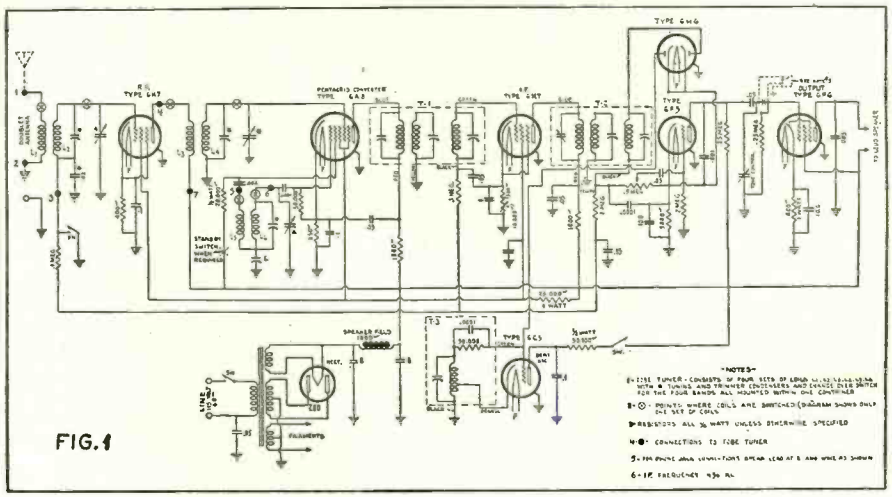


FIG. 1

Modern Super

(*Continued from page* 161)

to 14.4 megacycles, the tank condenser is set at 14.4 meg. It is then found that the entire 20-meter band covers from 12 to 100 on the 100 degree band-spread dial, and the phone portion of this band from 41 to 65 on the dial. As an example of the "logability" of this system it is interesting to point out that G5NI, the well-known English amateur phone station at Birmingham has been tuned in numerous times over a six-week period and always came in within one degree of the original setting.

An excellent idea of the degree of band spreading obtained will be given by the following table which shows the actual measured coverage of the band-spread dial, with given settings of the tank condenser, for a number of the popular short-wave broadcast and amateur ranges.

		Tank	B.S.	Range
75m.	c.w.	3.9	0-100	3500-3900 kc.
75m.	Phone	4.0	79-100	3900-4000 kc.
40m.		7.3	12-96	7000-7300 kc.
20m.	Total	14.4	12-100	14000-14400 kc.
20m.	Phone	14.4	41-65	14150-14250 kc.
19m.		15.5	0-100	14930-15500 kc.
25m.		11.9	0-100	11650-11900 kc.
25m.		12.1	0-100	11840-12100 kc.
31m.		10.0	0-100	9150-10000 kc.
50m.		6.2	0-100	5970-6200 kc.

In some of the short-wave broadcast ranges one revolution of the band-spread dial will not cover the entire band. Thus with the tank condenser set at 11.9 mc. the band-spread dial covers from 11.65 to 11.9 meg. while the portion of the 25 meter band up to 12.1 meg, is covered with the tank condenser at the 12.1 meg. setting.

As these tests took place during the early summer it was impossible to accomplish any outstanding DX on the broadcast band. One interesting experience was found at 9 p.m. on a warm June evening when stations were heard on every U. S. broadcast channel with the exception of two. On another June day at 3 o'clock in the afternoon stations were heard on 72 of the broadcast channels. Even during the summer season it was found possible almost every evening to bring in the Louisiana station on 850 kc. with the high-powered local WABC in full operation on 860 kc.

It is no trick at all with this receiver to bring in without interference the Chicago stations operating 10 kc. away from other powerful New York stations.

The variable selectivity control serves its purpose best in the broadcast band. For DX work it is set for maximum selectivity, but when listening to local programs, rotating the selectivity knob to the minimum position avoids side-band cutting and produces an excellent degree of fidelity with the result that the local programs are reproduced in a realistic manner. A mid-way adjustment of this control results in maximum sensitivity. It is questionable whether there is any location where the full sensitivity of the receiver could be used but if anyone were fortunate enough to have such a location this sensitivity would be found an asset.

On the basis of the tests conducted by RADIO NEWS it is evident that this receiver is an excellent instrument for any type of listener whether he be a ham, a commercial operator, a short-wave listener or a broadcast-band DX'er. In all these types of service the crystal incorporated in the crystal model can be used to advantage where the interference between stations is severe. This is particularly true in the amateur bands where bad interference is suffered in reception of c.w. signals. However, the usefulness of the crystal filter is by no means limited to c.w. reception. It is highly effective in separating phone signals as well. Of course, in phone reception a great amount of side-band cutting takes place, but not enough to prevent understanding speech.

The Radio Beginner

(*Continued from page* 157)

2 and 3. Figure 2 shows the sockets on the chassis as they look from the bottom. Figure 3 gives the bottom views of the sockets at the rear of the chassis.

The terminal lug strips serve as a support for connections which would otherwise hang in the air. The first one serves to support R_4 while the other one is used to support one side of the line and the junction between C_3 and R_2 of the tone control.

The volume control and tone control are wired as in Figure 4. This is a view of the bottom of the chassis looking from the rear.

The constructor might first complete the power pack and then test it by turning it on, seeing that all the tubes light and (with due caution) measuring the high-voltage. With the voltage divider in the circuit as the only drain, there will be about 430 volts.

When the other tubes have been connected the plate voltage will be dropped to approximately 310 volts. With the power turned off the slider on the voltage divider can be connected to the high side and adjusted until the total current is 70 ma. The slider will then be less than an inch from the high end. The plate voltages will be slightly over 300 volts.

Use of the Amplifier

The input of the amplifier can be connected to the two-tube receiver described in installment three. Remove the audio tube of the battery set and connect the input terminals of the amplifier across the secondary of the transformer being sure that the grounded side of the transformer connects to the chassis. If the set has a tendency to squeal it can be cured by a .00025 mfd. condenser across the primary of the transformer. It may also be useful to ground the speaker chassis.

If it is desired to use a phonograph pick-up of the "high-impedance" type it is simply connected to the input terminals direct. With a pick-up of the low-impedance type a suitable matching transformer is required, as shown in Figure 5a. The amplifier can also be employed with a carbon microphone, either single button or double button, as shown in Figures 5b and 5c. The other types of microphones such as the crystal, velocity, etc., are too low in output for use with this amplifier. In all these cases it is important to keep the leads in the amplifier input circuit short. Where a transformer is used with microphone input, etc., its case should be grounded and it may be necessary to shield the leads from it to the amplifier input in order to prevent instability and pick-up of hum.

The Speaker

The Wright De Coster Model 820B dynamic speaker used with this amplifier was selected for this use because it offers the attractive combination of good quality and low cost. Another advantage is that its 1800-ohm field is just right to permit the field to function as one of the chokes in the power-supply filter, thus insuring freedom from hum and saving the cost of an extra choke. Also it comes equipped with a cable and plug, thus simplifying the program of making connections to the main unit.

Without a baffle, which may be a flat board or a cabinet, a dynamic speaker will not properly reproduce low notes because in the case of low frequencies the sound from the back of the cone tends to cancel that from the front. The remedy is to make the path from front to back rather long by mounting the speaker on a baffle. The lower the note the larger this baffle should be. In order to fully reproduce a 50 cycle note, for example, the baffle would have to be 22 feet square. Of course, no one would care to make so large a baffle. For practical purposes a baffle three or four feet square gives very good results. Placing the baffle on the floor, extends its size at least in one direction.

When a speaker is placed in a cabinet, the sides of the cabinet constitute an effective part of the baffle. A smaller baffle or cabinet does not bring out the low notes fully but is better than none at all.

The articles to follow in this series will provide instructions for building various types of tuners, both t.r.f. and superheterodyne, which may be used with this amplifier-power supply unit.

Two New Rig Checkers

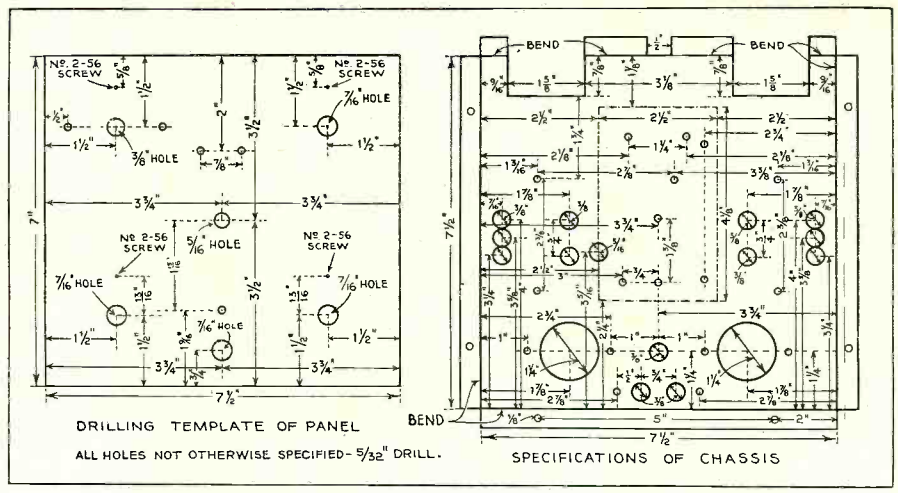
(*Continued from page* 147)

during the past month and have certainly proved their worth in checking up on all transmitted as well as received signals. The devices in question are pictured on Page 147, one being the more elaborate unit, completely portable and operating on dry cells, and one a smaller unit, shown at the right, which is an a.c. operated device and having many of the features of the larger job. These little units certainly bear out the expectations one might have after examining the name "Rig Checker," but they have so many uses in the station that they might also be termed "Jack of all Gadgets". The larger of the two units will serve for the following purposes: 1. as a field strength meter; 2. as a station monitor; 3. as a wavemeter; 4. a v.t. voltmeter; 5. a d.c. voltmeter; 6. as a signal-strength indicator; 7. as a milliammeter; 8. as a over-modulation or frequency-shift indicator. This job is furnished complete with seven plug-in-coils for the various amateur wavelength bands and with a tube and a phone plug, with the necessary resistors and with batteries. It incorporates a high Q tuning circuit with a type 30 tube, connected as a diode, and an 0 to 1 milliammeter connected in series across a portion of the tuned circuit.

The Small Checker

The smaller type Rig Checker is meant for fixed use at the station and works on 110 volts a.c. It has no tuned circuit and therefore will not serve as a field-strength meter or as a wavemeter, but it will do all the other things that the bigger job can accomplish. Both of these units utilize a short length of stiff wire, about 10 inches in length, attached to the top antenna insulator for picking up signals. Besides all of their various uses as measuring instruments they are invaluable as a station monitor to prevent the station from going on the air with too little or too much modulation or with no modulation at all. By their use a standard check can be made on all transmissions, which at times will save any amateur a lot of unnecessary embarrassment.

Both of these handy units are supplied fully equipped and accompanied by a descriptive folder giving complete instructions for their use. If further information is required on these units by our readers it may be obtained by writing to the designer care of Radio News.



5-Meter Rig

(*Continued from page* 149)

dimensions of the receiver are 7½ inches wide, 7 inches high and 7½ inches deep and it will be seen that the controls are disposed in a very symmetrical fashion. Looking at the receiver from the front and starting in the lower left-hand corner the indicator marked "r.f. gain" is actually the potentiometer which controls the voltage on the plate of the detector tube. The upper left-hand control marked "phasing" is a 15 mmfd. variable condenser in series with the antenna and it is very handy for maintaining practically constant efficiency in the antenna circuit relays of the portion of the band in which tuning is done. The upper right-hand control is the ordinary audio tone control and it is especially desirable where local interference of the high-frequency type appears. The lower right-hand control is the regular audio volume control. The small toggle switch directly below the main tuning dial is in the plate circuit and permits the operator to put the receiver out of operation while transmitting. Naturally, the large dial in the center is the main tuning control.

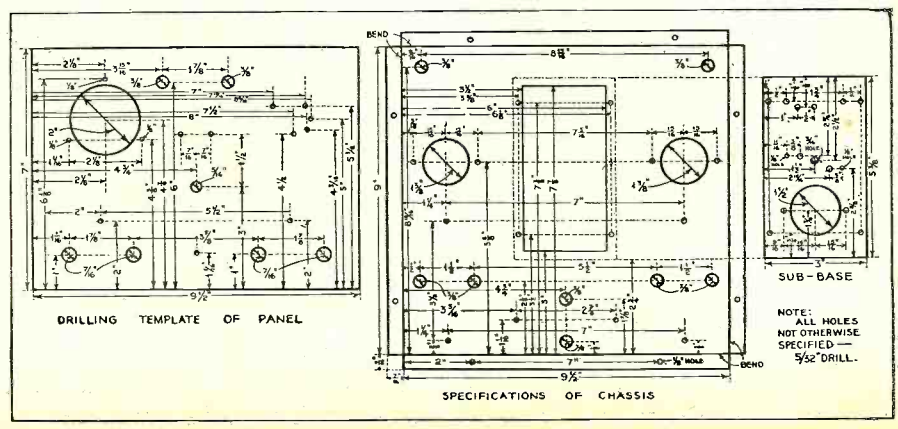
There are a few interesting points in connection with the receiver which have not appeared in other receivers designed for high-frequency use and they are particularly desirable for portable-mobile operation. It will be observed that the tuning inductance is set in a pair of pins on a small piece of victron and the entire tuning circuit including the variable condenser has been made very compact so that the leads to the tube and other high-frequency portions of the circuit are very short. The audio transformers selected for this particular unit were chosen for the reason that they are equipped with a static shield and it has been found that this shield results in a very noticeable decrease in ignition noise when the receiver is used in a car, power boat or airplane.

Another departure from ordinary practice is the use of the Triad 6B5 for the second audio stage. This tube provides very much more than the ordinary amount of audio volume. The entire radio-frequency circuit including the isolantite socket for the mounting of the 955 tube, the victron base for the tuning inductance and the support for the main tuning condenser are all mounted upon a piece of copper sheet.

These two units were designed and built by Edwin Ruth, W2GYL, who is chairman of the Technical Committee of the Garden City Radio Club and by Harry Larsen, W2IER. The preliminary tests were carried on at the present author's station at 40 Wall Street and aboard the yawl "West Wind" during the race from City Island to Bridgeport, Connecticut, and return. A receiver similar to the one described here has been in use in the present author's car for many months and it has always equalled the performance of any receiver when located at a fixed point where comparative tests were made.

List of Parts for Receiver

2—National variable tuning condensers, 15 mmfd., type STHS
1—National trimmer condenser, 35 mmfd., type M30
5—Aerovox mica condensers, .0001 mfd., type 1467
1—Aerovox mica condenser, .001 mfd., type 1467
1—Aerovox cartridge paper condenser, .25 mfd., type 484
2—Aerovox midget dry electrolytic condensers, 4 mfd., type PBS-5
1—Aerovox tubular dry electrolytic condenser, 25 mfd., 25 V.R., type PR25
1—Sprague midget paper condenser, .02 mfd., V.R. 500
1—National 5-meter coil on Victron mounting
4—National controls, type HRO
1—National choke, 2.5 mh., type R-100
1—National dial, type BM
1—National feed-thru stand-off insulator



2—Electrad volume controls, 50,000 ohms
1—Electrad volume control, 100,000 ohms
1—I.R.C. metallized resistor, .25 megohm, ½ watt
1—I.R.C. metallized resistor, 75,000 ohms, 1 watt
1—I.R.C. metallized resistor, 2,000 ohms, 1 watt
1—National socket for type 955 tube
1—American Phenolic socket, 5-prong
1—American Phenolic socket, 6-prong
1—S.P.S.T. toggle switch
2—Thordarson A.F. transformers, type 7574
1—twin binding post assembly
1—Eby binding post input
1—National Victron sub-panel, 3x2x⅛ inches
1—copper tuning assembly sub-base, 4⅛x2½ x1/16 inches
1—4-wire battery cable
2—National flexible coupling units, type TX10
1—National cabinet with self-supporting chassis, type C-SRR

List of Parts for Transmitter

1—Century high-frequency buzzer
1—National variable condenser, 15 mmfd., type UMA
2—Cornell-Dubilier mica condensers, .0005 mfd., type 4
1—Aerovox dry electrolytic condenser, 10 mfd., 50 V.R., type PR50
2—Aerovox cartridge condensers, 1 mfd.
1—Unity coupling coil, 2 turns—2½ inch O.D.
1—National dial, type B
1—National choke, 2.5 mh., type R-100
2—National feed-thru stand-off insulators
2—Yaxley open circuit jacks
1—Electrad Vitreous enameled resistor, 10,000 ohms, 10 watts
1—I.R.C. metallized resistor, 1,000 ohms, 1 watt
1—I.R.C. metallized resistor, .25 megohm, 1 watt
3—National Isolantite sockets, 7-prong
2—S.P.S.T. toggle switches
1—United microphone transformer, type CS5
1—United class B input transformer, type CS29
1—United class B output transformer, type CS33
1—National Victron tuning assembly sub-base, 5⅜x3x3/16 inches
1—National flexible coupling unit, type TX10
1—National metal cabinet, type SW3, with self-supporting chassis
1—4-wire cable
1—Beede milliammeter, 0-150

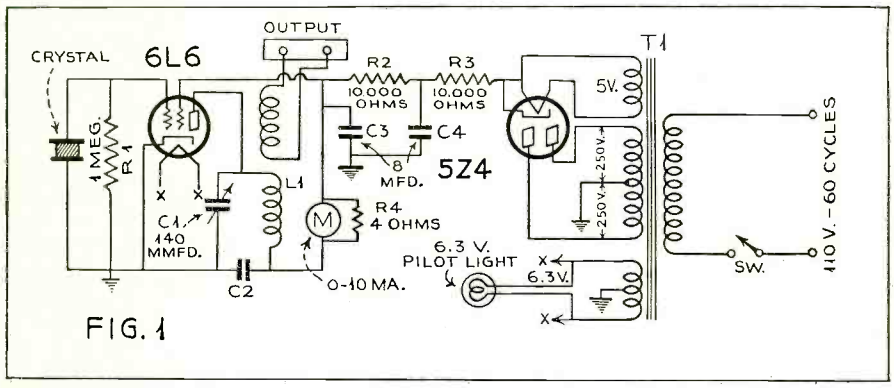


FIG. 1

Crystal Oscillator

(*Continued from page* 150)

ceiver. Next tune the receiver to resonance with the tuned oscillator to determine its approximate frequency then tune in a broadcast station on the nearest adjacent broadcast channel. The result will be an audible hetrodyne between the tuned oscillator and the broadcast station on that channel. The pitch of this heterodyne is then estimated, or can be more accurately determined by finding the nearest note on a piano and converting this pitch to terms of frequency.

As an example, suppose after following this procedure, the broadcast station proved to be KDKA and it was just lower in frequency than the tuned oscillator, heterodyning at some audible frequency. Inasmuch as broadcast stations are required to maintain their carrier frequencies constant within 50 cycles and most of them stay well within this range, the frequency of the tuned oscillator would be 980 kc. less the frequency of the audible heterodyne. Now, running up a piano keyboard the note nearest might be found to be middle E. The frequency of this note is 320 cycles, therefore the tuned oscillator frequency is 980,000 cycles less 320 cycles or 979.68 kc. The crystal frequency would therefore be twice this, or 1959.36 kc. The only factors of error here are those resulting from inability to determine by ear exact zero beat between the oscillators, and to precisely judge the frequency of the audible heterodyne between the oscillator and the broadcast station carrier. With due care these errors combined should not amount to more than approximately 100 cycles. For applications around the laboratory or shop this degree of accuracy is so far superior to the accuracy with which receiver or signal generator dials can be read that it is entirely negligible.

The harmonics of this crystal oscillator will provide good strong signals all the way down to 1 or 2 meters. Using a crystal that resonated at 737.81 kc., for instance, a 5-meter receiver was calibrated using harmonics around the eightieth which were sufficiently strong to be the equivalent of a good R9+ signal in the 5-meter receiver.

One practice followed in the laboratory is to use this oscillator in conjunction with a simple tuned r.f. oscillator. Naturally, when an attempt is made to use the harmonics of a relatively low-frequency oscillator, there is usually some difficulty in identifying the harmonics. To overcome this the tuned r.f. oscillator is adjusted to one of the low harmonics of the crystal, such as the fifth for instance. Then as the receiver under test is tuned down through its range the audible beat of the two oscillators will be heard at the fifth harmonic of the crystal frequency, the tenth harmonic, etc. Then between these multiples of five it is easy to keep track of the other harmonics.

No modulation was provided in the crystal oscillator as all the crystal harmonics will show up in a receiver either by watching the tuning meter if it has one, by listening to the suppression of noise in a.v.c. receivers or by the use of a beat-frequency oscillator if the receiver in question is equipped with one.

Where a very low frequency crystal is employed, such as 100 kc., numerous calibration points can be obtained to check calibrations in the broadcast band. If the main interest is in short wave or ultra-short wave calibrations, a crystal of higher frequency can be employed.

The method suggested above can be reversed with a fair degree of success by adjusting the tunable oscillator so that the crystal will beat with one of its harmonics. In that case, any of the conventional tubes could be used in the crystal oscillator as its higher harmonics would not be used.

The method of using the oscillator to check the calibration of a receiver should be quite obvious. The first step is to make, by simple multiplication, a complete list of the frequencies at which harmonics of the

crystal fall. Then it is only necessary to tune the receiver through its range, starting at the low frequency end (assuming that a low-frequency crystal is used). As the receiver is tuned to resonance with each harmonic, a notation is made of the frequency as read on the receiver dial and beside it is noted the frequency of the harmonic. The difference between these two will be the calibration error of the receiver. Due to the relatively high power of the harmonics of the crystal oscillator, it will normally not be difficult to keep track of them if tuned in regular sequence but in any event the use of a separate tuned oscillator will provide an audio beat at every fifth harmonic (or other multiple) thus providing a sufficient check to keep the harmonic count straight.

The unit provides for using different crystals if desired. The crystal plugs into an ordinary 6-prong tube socket and coils of the plug-in type make the tuned circuit adaptable to crystals of any frequency. When crystal and coil are plugged in it is only necessary to rotate the condenser until the meter dips, thus indicating an oscillating condition. Best operation is obtained just off the point of maximum dip. The non-oscillating plate current is around 12 ma. The meter may be an 0-10 ma. meter, shunted to provide full-scale deflection when the circuit is not oscillating. Or a higher range meter may be employed without a shunt if desired.

Parts List

C1—Hammarlund "Star" midget variable condenser, 140 mmfd.
C2—Aerovox fixed tubular condenser, type 484, .05 mfd., 400 volt.
C3, C4—Aerovox 2-section electrolytic condenser, type GG, 8-8 mfd., 200 volt.
R1—I.R.C. carbon resistor, 1 meg., ½ watt.
R2, R3—Electrad wire-wound resistors, 10,000 ohms, 10 watts
R4—Wire resistor meter shunt
T1—Wholesale Radio Service Company power transformer, type MYB 1353, primary 110 v. 60 cycles; secondary, 250/250 v. at 65 ma.; 6.3 volt., 5 v.
1 Triplett type 223 milliammeter, 0-10 ma.
1 Bud crystal holder
1 crystal
1 Hammarlund plug-in coil, 4 prong (range to suit crystal)
1 6-prong wafer socket for crystal
1 4-prong wafer socket for coil
2 Octal wafer sockets
1 Insuline steel cabinet, 9x5x6 inches, type 3825
1 Insuline cadmium plated steel chassis, blank, 8½x4¾x1½ inches, type 1560
1 Yaxley pilot light bracket and bulls eye
1 double binding post strip
1 Insuline toggle switch, S.P.S.T.
1 Insuline pointer knob (small)
Rubber grommets, assorted sizes
1 6.3 volt pilot light
6 feet power cord, plug

The Service Bench

(*Continued from page* 168)

denser. The same is true with other sets using wet electrolytics."

SERVICE NOTES

Philco, through the Radio Manufacturers Association, is offering a new three-color illuminated electric flashing sign, to the radio serviceman. This sign is 12 by 6 inches, and is suitable for counter or window display. Net price to the serviceman is $2.00.

Matched P.A.

(*Continued from page* 150)

unnatural reproduction in the entire system.

For best results, it is apparent that careful study must be given to the choice of microphones and speakers of desirable frequency characteristics and that they should be so matched that peaks and valleys do not occur. Though many systems may be improved by careful selection along these lines, it should be remembered that this procedure is difficult and expensive outside the factory.

On 10 Meters

(*Continued from page* 147)

This also provides an excellent Low-C circuit for 10-meter operation.

The size of the link-coupling loops used in the two coupling units is approximately one turn half the diameter of the coil, although some slight variation from this may be experimented with for best results.

For modulating this transmitter I use a standard Wholesale Radio, Model B-46 modulator system which can be obtained complete and mounted in a cabinet. I also use a Model D-104 crystal microphone at the input. The modulator in question utilizes a 57 tube, resistance coupled to a 2A6 tube, in turn resistance coupled to a 46 tube which is transformer coupled to a pair of 46's in push-pull. This modulator unit uses an 83-type rectifier tube for its B and C power. The output transformer on this unit is tapped and is connected to the output stage of the r.f. amplifier through the 6000-ohm tap. The circuit diagram showing details of the modulator circuit will be published next month. I use this same modulator with a 5-meter linear transmitter using two 801 tubes, the circuit details of which will also be included in next month's article.

The procedure I find best to follow in getting the r.f. circuits into operation is as follows. First of all get the crystal oscillator working, with the voltage tapped on the plate circuit at 350 volts and with approximately 140 volts on the screen of the 89 tube. After it is oscillating, adjust the plate mils by tuning the tuning condensers to between 12 and 14 mils of plate current. This is done with the screen and plate voltages disconnected from all the other tubes. Next, set the single-turn link coupling in between the first or second turn of the coils between the 89 and the 802 circuit. These should be inserted at the ground and, as already mentioned. Then connect the 500-volt tap to the plate of the 802 tube and the 180-volt tap on the separate resistor to the screen of this tube and adjust the condenser in the plate circuit to resonance so the tube draws about 35 mils plate current. This should be done rather rapidly. Now connect the plate and screen voltages to the second 802 tube and adjust resonance to approximately 20 mils. Next insert the second link-circuit loop in the plate coil of the second 802 (near the cold end) and the remaining loop in the grid coil of the 801's (also near the cold end) and tune the grid circuit of the 801's to resonance, with the grid meter or with a neon tube, without any plate voltage on the 801's. Then adjust the two neutralizing condensers on the output stage, with the plate circuit tuned to resonance, to minimum brilliancy in a neon tube held near the plate circuit coil. With this stage properly neutralized you will now be ready to apply the plate voltages to the 801's and finally to the plate tank circuits so that they draw about 35 mils. A final retuning all the way along the line will get everything lined up for the best efficiency. It may be necessary to move the link couplings either one way or another, one or two turns, to get best results.

I am particularly fond of this whole rig, due to the efficient way it keeps on performing and the lack of trouble that develops in use on either band and I believe that fellow amateurs who will follow out the details as I have outlined them will be able to get the same results that I am getting. I couple this rig direct, through two .002 mfd. fixed condensers to a two-wire, matched-impedance antenna for 10-meter operation and to a Johnson "Q" antenna for 20-meter operation. Any fellow "hams" building this rig are invited to write me care of RADIO NEWS, for any further details regarding the rig's design or operation. I also wish to acknowledge the many helpful suggestions and full cooperation of W2ADI in working out the proper constants and circuit details of this transmitter.—*Paul Cintrat, W2IPH.*

Rural Super

(*Continued from page* 141)

the variable condenser very slightly until the station comes in at the correct dial setting.

Adjustment of the r.f. and detector sections may be made in a similar manner. Care must be used not to bend the condenser rotor plates inward until they rub on the stator plates. Very little bending of plates should be necessary. This work should be carefully checked by tuning in several stations and noting how the dial setting compares with the frequency as given in a call book. For best results, always use a test oscillator for alignment. Feed a 175 k.c. signal into the grid of the 1A6 and adjust the i.f. transformers for maximum gain as registered by an output meter connected across the speaker terminals. Use a 1400 k.c. signal for setting the oscillator, detector, and r.f. trimmers and make any other adjustments that may be necessary by carefully bending the rotor plates of the variable condenser either in or out to the position of maximum response. For the greatest economy in operation, the receiver should be used with a 2 volt storage A battery of at least 300 ampere hours capacity, and two heavy duty B batteries. For places where an ordinary wet battery would be undesirable, a special storage cell with semi-solid acid may be obtained. In case a 3 volt dry A battery or an "Air-Cell" is used for the filament supply, it will be necessary to use a resistance or voltage regulator tube to step the voltage down to 2 volts at the tubes. This value should be carefully checked at the filament prongs (with all tubes in place) and the resistance adjusted to operate the tubes with not more than 2 volts across this point.

List of Parts

1 Crowe airplane type tuning dial calibrated in kilocycles
1 DeJur-Amsco three gang tuning condenser with 175 kc. oscillator tracking section
2 Meissner 175 kc. intermediate transformers
3 Gen-Ral r.f. coils:
  1 Antenna coil
  1 Oscillator coil
  1 Intermediate, det. coil
Resistors and condensers as shown in Figure 1
1 Piece alloy chassis metal—12¾ x 12½
3 Large tube shields
1 Small tube shield
4 Four-prong wafer sockets
1 Five-prong wafer socket
1 Six-prong wafer socket
1 Terminal strip—5 wire
3 Knobs
1 Antenna-ground strip
4 Grid clips
1 Dial light assembly
1 Double wiring tie
2 Single wiring ties
1 Four-wire battery cable
1 Package miscellaneous screws, solder and hookup wire

Accessories

1 Cabinet
1 Rola 6" PM. dynamic speaker
1 Speaker plug—4-prong
3 45 volt "B" batteries (or less)
1 2-volt "A" battery (1 dial lamp)

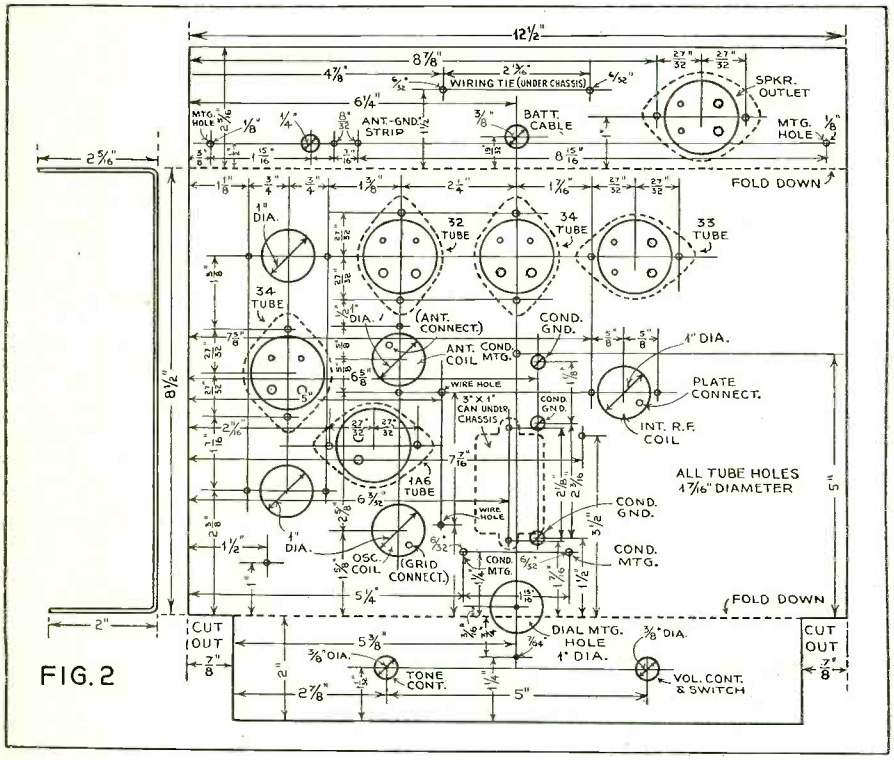


FIG. 2

Beam-Power Amplifier

(*Continued from page* 143)

would provide. After two months of checking the 6L6 tube in various amplifiers, the writer would recommend that these tubes be operated self bias. In this condition of operation, they will give the

longest tube life, will take care of practically any possible PA or low power modulation requirement, and will minimize the possibility of ruining speakers due to high power transients.

Figures 3 and 4 illustrate the distortion curves of 6L6 tubes operated in both self- and fixed-bias AB based on Hygrade Sylvania data. It is apparent that in the fixed bias condition the distortion starts to rise rapidly when the point of grid current flow is passed.

Considerable development work has been done during the past few years on methods of reducing hum, noise and distortion in amplifier circuits by feeding back a portion of the energy from the output circuit back into the input circuit. Stabilized feedback of this type is very critical, but under good conditions has been found to produce unbelievable results.

A recent amplifier in the writer's laboratory using a single 2A3 tube delivered 25 watts of audio power at 5% distortion. While circuits of this nature are not as yet suitable for commercial service due to the critical adjustments required, a simplified form of feedback that involves no complications has been incorporated in this amplifier. Fig. 2 illustrates the feedback circuit. Two taps are provided on the output transformer, 10% off from the center tap of the primary winding. These points are coupled back to the grids of the same tube. This 10% feedback causes a reduction in power sensitivity or gain of about 50%. However, a considerable reduction in effective plate resistance is obtained and some reduction in distortion. Fig. 5 illustrates a curve worked up by Hygrade Sylvania showing the relative percentage distortion versus power output of a *single* 6L6 with and without feedback.

The 6L6 tube, while a tetrode, has the common failing of pentodes and other high power sensitivity tubes in that the plate resistance of the tube is quite high. In normal operation, this resistance is 22,500 ohms. Few people realize the importance of plate resistance where a tube is used with a load of varying impedence. Mr. O. Schade of RCA recently brought this point up strikingly in an analysis of the matching of an output tube to a loudspeaker. Fig. 6 illustrates a simplified im-

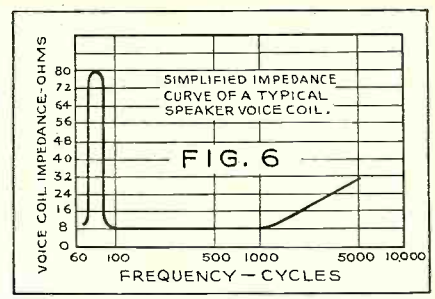


FIG. 6

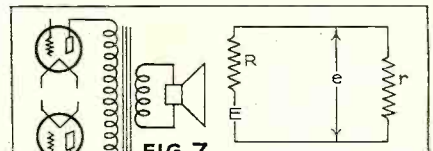


FIG. 7
ELECTRICAL EQUIVALENT OF SPEAKER OUTPUT CIRCUIT.

pedance curve of a dynamic speaker. In Fig. 7 we illustrate the effective circuit of this speaker coupled to an output tube.

Taking the a.c. output voltage from the tube as E, the internal tube resistance as R, and the reflected speaker impedance at any given frequency as r, we find that e, the voltage developed across the speaker equals

$$e = E\left(\frac{r}{R + r}\right)$$

If the plate resistance of our tube is 45,000 ohms (pushpull) and the reflected load at 1000 cycles is 6600 ohms, the actual voltage developed across the speaker will equal

$$e = E\left(\frac{6600}{45{,}000 + 6600}\right) = .13E$$

However, at the point of renonance of the speaker system, this reflected speaker load will increase to about 66,000 ohms. This would mean that the speaker voltage would now be

$$e = E\left(\frac{66{,}000}{45{,}000 + 66{,}000}\right) = .6E$$

INDEX TO ADVERTISERS

It is obvious that a considerable increase in power to the speaker is entailed. The combination of this increase in power plus the normal resonance of the speaker itself will result in a very strong boom, and in some cases may even cause failure of the speaker. Now, let us analyze the same condition, but using stabilized feedback so that the plate resistance is reduced to approximately 7000 ohms. e at 1000 cycles would equal.

$$e = E\left(\frac{6600}{7000 + 6600}\right) = .49E$$

and at the resonance frequency would equal

$$e = E\left(\frac{66{,}000}{7000 + 66{,}000}\right) = .9E$$

The ratio here is very much smaller. Another case where a similar condition is met with is where a tube is used as a driver for a class B amplifier. Since at maximum power output the grid impedance of the class B tube is very low, it is seen that the greatest power transfer from the driver tube would be obtained if the driver resistance were low. In other words, if the reflected impedance of our grid circuit at maximum swing were 1000 ohms, and the source impedance of the driver tubes were 45,000 ohms, approximately 1/46 of the effective voltage would be delivered to the grid circuit. If the source impedance were reduced by feedback to 7000 ohms, approximately 1/8 of the voltage would be delivered to the grid circuit. The great increase in efficiency is obvious. Still greater driver efficiency can be obtained using 2A3's instead of 6L6's because even though their power output is less, they have lower plate resistance.

The high power sensitivity of the 6L6 lends itself very well to a simple high-gain amplifier using a minimum number of tubes. In the amplifier described, a total of four stages are used to give an overall gain of 118 DB. The circuit consists of a single 6C5 resistance coupled to a second 6C5, transformer coupled to pushpull 6C5's which in turn drive the 6L6's with a special input transformer. In many cases it is desirable to couple a relatively high level source into an audio amplifier of this type. If this high level device such as a phonograph pickup or carbon microphone is fed directly into the first tube, the resultant high gain would increase the hum level, and would mean that the volume control would always be operated over at one end. To take care of this special condition, an extra terminal is brought out on this amplifier from the second grid circuit. When a high level source is used, the high gain terminal is shorted to ground automatically eliminating the noise inherent in the first tube and the source is fed directly into the second tube. See Fig. 1. The volume control of this amplifier is unusual in the fact that the calibrated etched plate reads directly in DB attenuation.

Other features and further data concerning circuit modifications will appear in an article to follow.

The Radio Workshop

(*Continued from page* 159)

A Crystallized Finish Easily Applied to Your Cabinet

To obtain a professional finish for my radio cabinets, panels, etc., I have been using a crystallizing lacquer obtainable from most any large radio store or paint house. The cabinet is simply painted with the crystallizing lacquer and it is then placed in an enclosure with an open gas burner which is used to absorb the oxygen liberated by the paint. A gas range oven meets this requirement very nicely. Fifteen minutes at medium baking temperature is sufficient time required for the baking. "Editor's note. We have an announcement on the General Cement Mfg. Co.'s air-drying crystallizing lacquer which is said to be easy to apply, requires no skill or special equipment and can be applied on wood or other materials. This lacquer is generally supplied in black but it can be obtained in red, green, blue, yellow and brown."

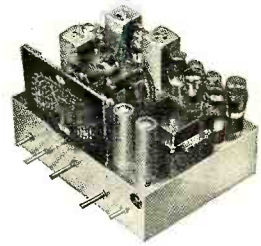
JOSEPH S. NAPORA,
Uniontown, Pa.

What's New in Radio

(*Continued from page* 139)

Receiver With Many New Refinements

The new Hetro 12-tube all-wave receiver embodies the latest in all-wave receiver design and developments. It incorporates a new large oval tuning dial, a new simplified Robot tuner, a cathode-ray tuning eye, a universal power transformer and a tuning range in 5 bands from 7 to 2100



meters. The set is designed to deliver 20 watts output and it is available in either table, console or phonograph combination. All parts are fully impregnated for tropical use. The 12 tubes employed are as follows: two 6K7's, one 6K7G, one 6L7G, one 6J7G, one 686G, two 6C5G's, two new 6L6 power beams tubes and one 5Z3 rectifier.

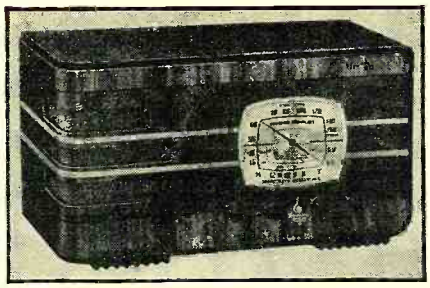
New Cutting Head

Broadcast stations, sound recording studios, schools and individuals working with instantaneous recordings will be interested in the new Audak model 7-B cut-

ting head. It is available in any impedance desired from 2 up to 10,000 ohms. The instrument is sturdily constructed and correctly balanced.

1937 Receiver Line

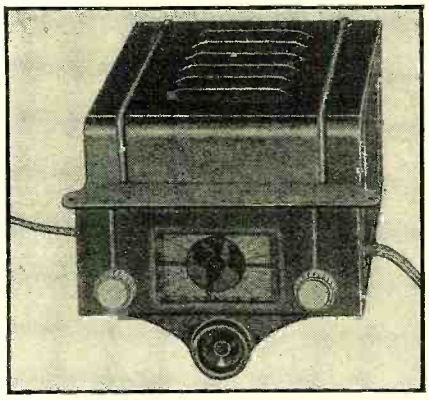
Emerson Radio & Phonograph Corp. introduces their 1937 line, comprising 25 new models, including all-wave console and table a.c. operated models, universal and portable battery sets and a choice of several motor car receivers. An exclusive Emerson feature is the large attractive



"Gemloid" tuning dial with its calibrated tuning bands, set off with large numerals to simplify tuning. The model F-133, illustrated below, is a 6-tube a.c.-d.c. superheterodyne. The tube equipment comprises one 6A7, one 6D6, one 75, one 43, one 25Z5 rectifier and one 3CR-241 ballast tube.

Auto Set with Cathode-Ray Tuning

The Automatic Radio Mfg. Co. introduces model J60, a 6-tube motor car receiver equipped with a cathode-ray tuning indicator. It is compactly designed, with volume and tuning controls mounted di-



rectly on the front panel and it features simplicity of installation for attaching directly to the instrument board of the car.

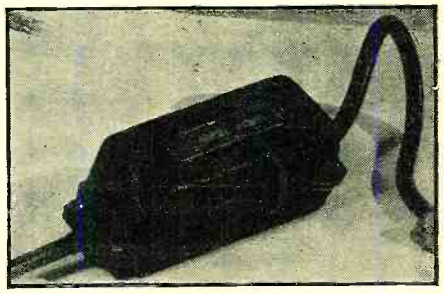
New 12-Inch Speaker

An announcement was recently received from the Wright-DeCoster Co. of their new Model 990, twelve-inch dynamic type reproducer, equipped with a universal field coil to match standard field resistances of

2500, 2200, 1800, 1500, 1000, 700, 300, and 1800 tapped at 300 ohms. This speaker has the new para-curve diaphragm which gives it a wide frequency range.

External Microphone Transformers

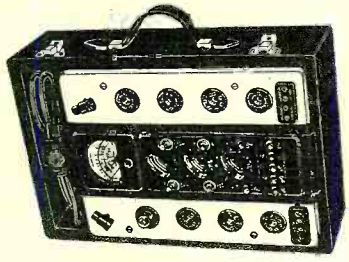
The new Amperite cable-type input transformer is designed to match a low-impedance microphone directly to an audio amplifier having a high-impedance input circuit. The output obtained by the use of this specially designed transformer with a low-impedance microphone equals that obtainable with high-impedance microphones. As many as 4 velocity microphones can be



fed into one transformer. Hum pick-up is eliminated by the hum neutralization design of the transformer.

Checks All Tubes

Servicemen and dealers will be interested in the new portable Weston "Checkmaster". It is completely self-contained, checks all tubes, has a neon short-check used under actual operating conditions, includes a spare socket for future use, checks the tubes under three separate classifications, with individual tests on elements of



diodes, has a quick and easy reading scale, and incorporates voltage ranges up to 1,000 volts and a resistance range up to 2,000,000 ohms.

Compact Electrolytic Condensers

The Aerovox series GLS5 and GLS250 tiny dry-electrolytic condensers in metal containers measuring only 1 inch in diam-

eter are now available in capacities of 4, 8, 12 and 16 mfd., for 250 and 450 d.c. working voltages.

Power Supply

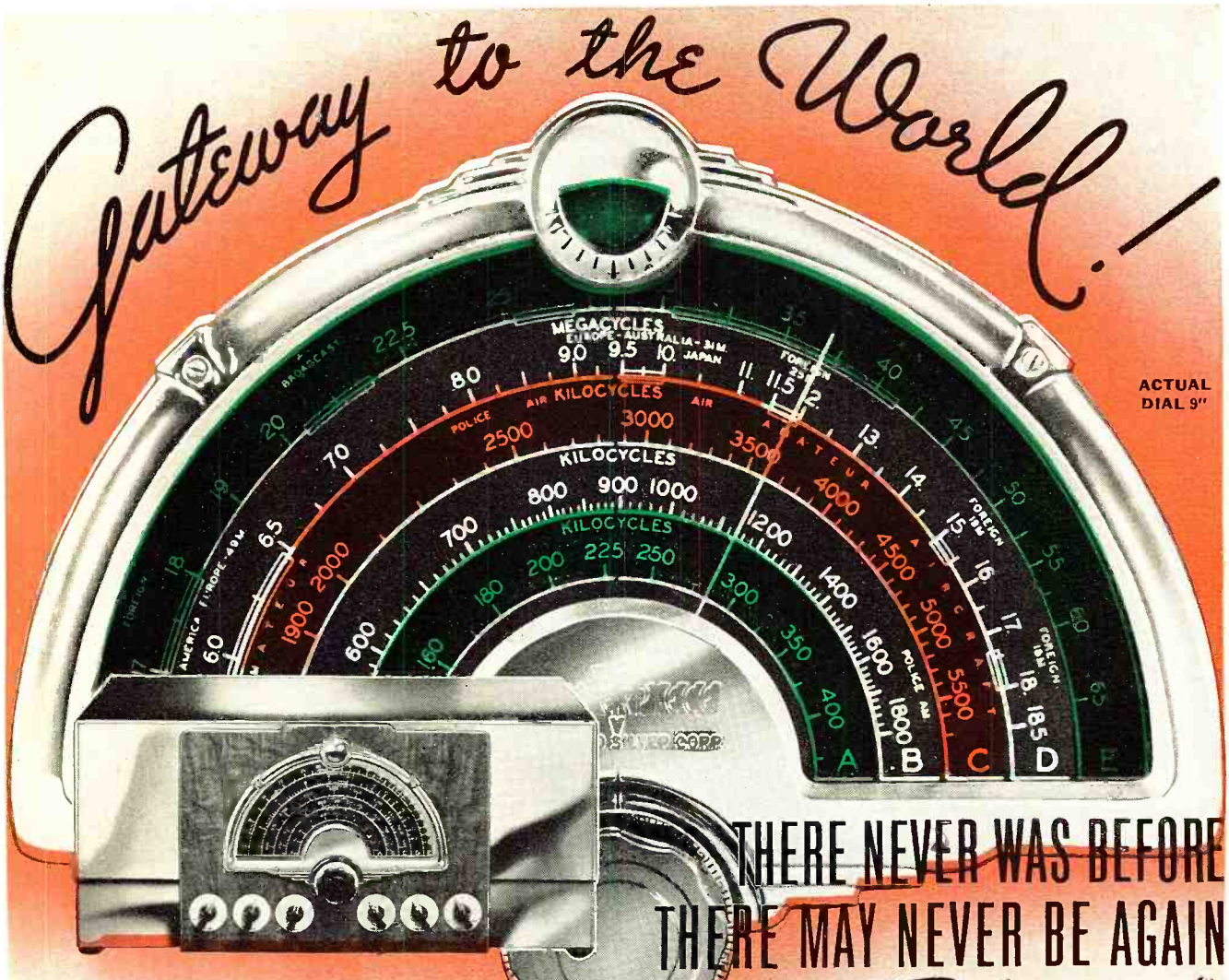
(*Continued from page* 169)

the output through the .05 mfd. condenser, C3.

In most applications the 2 voltage doubling condensers C1 and C2 provided the necessary filtering, where additional filterage was required, the resistance-capacity filters of the amplifier proved sufficient. When the unit is to be used to test condensers, it is best to use a 50,000 ohm resistor in series with the positive lead. This is to prevent a short circuited condenser from burning out the rectifier tube.

Printed by Art Color Printing Company, Dunellen, New Jersey, U. S. A.

Gateway to the World!



THERE NEVER WAS BEFORE
THERE MAY NEVER BE AGAIN
A RADIO SUCH AS *This!*

LET McMURDO SILVER *Build* A RADIO— ESPECIALLY FOR YOU!

Just as a radio for operation in Tokio should be quite different from a radio intended for operation in St. Louis, your radio should undoubtedly be quite different from that of a friend three blocks away. The MASTERPIECE is the world's only truly custom-built radio — built especially for each owner — not just built for the finest average reception conditions.

It's NEW! The McMurdo Silver MASTERPIECE V is as startlingly different as the first inter-planatary rocket flight will be! When you first see it — even before you roll the controls — you'll know why it is called "The Radio of 1940." It has fourteen points of construction never found before in any equipment for the reception of radio signals! Scientists, case-hardened to radio phenomena, have been frank in their curiosity to tear one apart to see what makes it "tick." Never before have we been so proud to present a new model of "The World's Only Truly Custom-Built Radio!"

$34.00 DOWN - $17.08 MONTHLY

For the first time it is possible for anyone to own the finest there is. Our own easy payment plan puts the "millionaire's radio" into any home.

Send this coupon TODAY for complete technical details.

McMURDO SILVER

MASTERPIECE

CHICAGO STUDIO—3354 NORTH PAULINA STREET
NEW YORK DEMONSTRATIONS—63 CORTLAND STREET

"THE WORLD'S ONLY TRULY CUSTOM-BUILT RADIO"

MAIL THIS COUPON

McMurdo Silver Corp.
3354 N. Paulina St.,
Chicago, U. S. A.

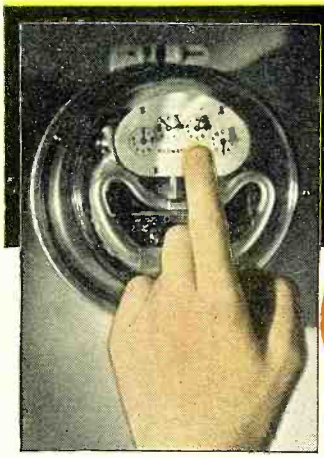
Please send me full details on the new MASTERPIECE V.

NAME_____

ADDRESS_____

Exclusive New MIDWEST ELECTRIK-SAVER

Slashes Radio Current Bills IN HALF !



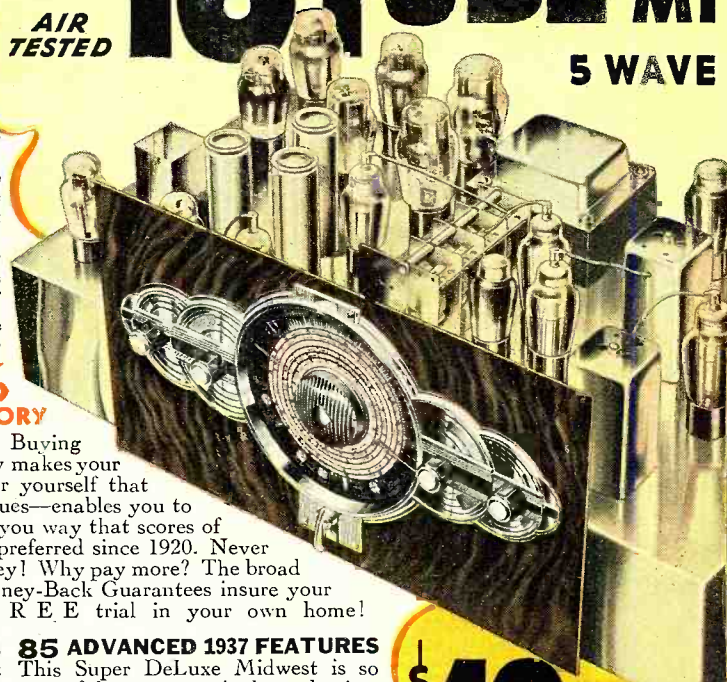
The Electrik-Saver is today's most sensational radio feature. It cuts radio wattage consumption as much as 50% and results in Midwest 16 and 18-tube radios consuming no more current than an ordinary 7 or 8-tube set.

This feature enables the "Air Tested" Midwest to operate on low line voltages—as low as 80 volts! In addition, the Electrik-Saver increases tube life, reduces strain on the set, eliminates repair bills and makes for more consistent and gloriously realistic reception.

NEW 1937 AIR TESTED

16-TUBE MIDWEST

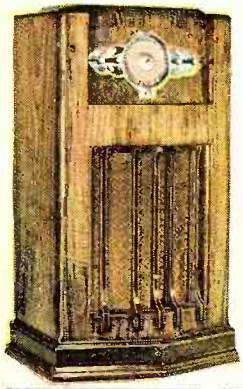
5 WAVE BANDS
9 to 2,200 METERS



SAVE UP TO 50%
DIRECT FROM MIDWEST FACTORY

NO middlemen's profits to pay! Buying direct from the Midwest factory makes your radio dollar go twice as far. See for yourself that Midwest offers you greater radio values—enables you to buy the more economical factory-to-you way that scores of thousands of radio purchasers have preferred since 1920. Never before so much radio for so little money! Why pay more? The broad Midwest Foreign Reception and Money-Back Guarantees insure your satisfaction. You get 30 days F R E E trial in your own home!

Once again, Midwest demonstrates its leadership by offering the world's most powerful and most beautiful ALL-WAVE 16-tube, 5-Band Radio. A startling achievement, it makes the whole world your playground. Powerful Triple-Twin tubes (two tubes in one!) give 18-tube results. This advanced radio is a master achievement, a highly perfected, precisely built, radio-musical instrument that will thrill you with its marvelous super performance . . . glorious crystal-clear "concert" realism . . . and magnificent foreign reception. The Dual Audio Program Expander gives a living, vital realistic quality to voice and musical reproduction. Before you buy, write for the F R E E 40-page four color 1937 catalog TODAY.

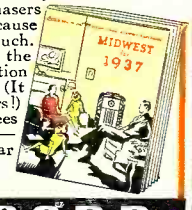


85 ADVANCED 1937 FEATURES

This Super DeLuxe Midwest is so powerful, so amazingly selective, so delicately sensitive that it brings in distant foreign stations with full loud speaker volume on channels adjacent to powerful locals. Scores of marvelous M i d w e s t features, many of them exclusive, make it easy to parade the nations of the world before you. You can switch instantly from American programs . . . to Canadian, police, amateur, commercial, airplane and ship broadcasts...to the finest and most fascinating foreign programs. The new Midwest Tuning System, for example, shows you exactly where to tune for foreign stations . . . while Automatic Aerial Adaption triples the number of foreign stations that can be secured and doubles the excitement and joy of short wave tuning.

MIDWEST USES LESS CURRENT THAN AN ORDINARY LIGHT BULB

With a Midwest, the finest entertainment the world has to offer is at your command. It is preferred by famous orchestra leaders, musicians, movie stars and discriminating radio purchasers everywhere. It enjoys an increasing world-wide sale because it outperforms ordinary receivers costing twice as much. You can order your Midwest "Air-Tested" radio from the new 40-page catalog with as much certainty of satisfaction as if you were to come yourself to our great factory. (It pictures the beautiful 1937 radios . . . in their actual colors!) You pay as little as 10c a day. Three iron-clad guarantees protect you: (1) A Foreign Reception Guarantee—(2) Absolute Guarantee of Satisfaction — (3) One-Year Warranty. Fill in and mail the coupon N O W!



$49.95 (LESS TUBES)

COMPLETE WITH GIANT THEATRE-SONIC SPEAKER

TERMS AS LOW AS 10¢ A DAY

Only MIDWEST gives you
16 TUBES
5 WAVE BANDS
9 TO 2200 METERS
ELECTRIK-SAVER
PUSH BUTTON TUNING
AUTOMATIC AERIAL ADAPTION
DUAL AUDIO PROGRAM EXPANDER
30 DAYS FREE TRIAL

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

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

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

MIDWEST RADIO CORPORATION
Dept. C-11, Cincinnati, Ohio

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

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

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

MIDWEST RADIO CORP.

DEPT. C-11
Established 1920

QUALITY RADIOS SINCE 1920

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