RADIO NEWS

OCTOBER
1947
35c

ELECTRONIC PARTS MERCHANDISED IN MODERN MODE

Free to Servicemen...

this great source of money-making ideas

Mail coupon below—your subscription will start at once

Meet "The Capacitor"—the magazine that's published by Cornell-Dubilier solely to help servicemen speed up their work—build up their business.

It has no frills—it isn't cluttered up with complicated mathematics—and you could read it for years without learning how to build a crystal set. Instead its articles are meaty, down-to-earth—practical discussions of the problems every serviceman meets every day. Never before has there been such a great demand for helpful servicing ideas—and "The Capacitor" is C-D's answer to this demand.

Use "The Capacitor" to help build up *your* service business—as it has for thousands of other successful servicemen. *Don't wait—mail coupon NOW and your FREE subscription will start immediately.*

THE TRADING POST—Looking for a new 'scope at a bargain price? Need a helper? Have you anything to sell? If so, write up an ad and send it in to "The Trading Post"—the serviceman's clearing house—which appears every month in "The Capacitor." This feature alone may make "The Capacitor" worth many dollars to you.

LATEST FM CIRCUITS—*"It works all right on AM but when I try to use FM all I get is a lot of noise."* You'll be hearing that story more and more as the new FM jobs come on the market. Get set for them now by keeping up with the new FM circuits as they appear in "The Capacitor."

"THE CAPACITOR IS EXCELLENT"—*"I received my first copy of 'The Capacitor' the other day and I want to tell you that I think it is excellent. The articles are very interesting and clearly written. You have my congratulations on a very fine magazine."* Culled from the hundreds of letters received every week.

1910 1947

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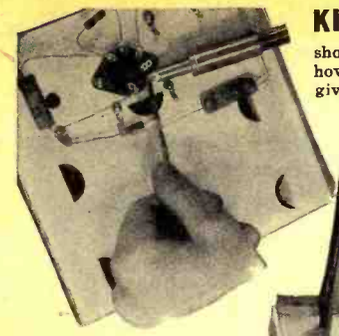


KIT 1 (left) I send you Soldering Equipment and Radio Parts; show you how to do Radio Soldering; how to mount and connect Radio parts; give you practical experience.

KIT 2 (left) Early in my course I show you how to build this N. R. I. Tester with parts I send. It soon helps you fix neighborhood Radios and earn EXTRA money in spare time.

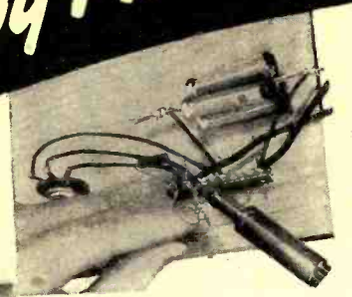
VETERANS

You can get this training in your own home under G. I. Bill. Mail coupon for full details.

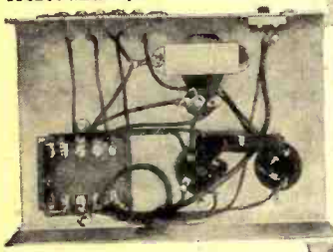
Be a RADIO Technician

Learn by PRACTICING in Spare Time

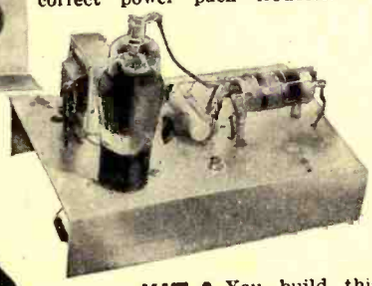
with BIG KITS of RADIO PARTS I send you



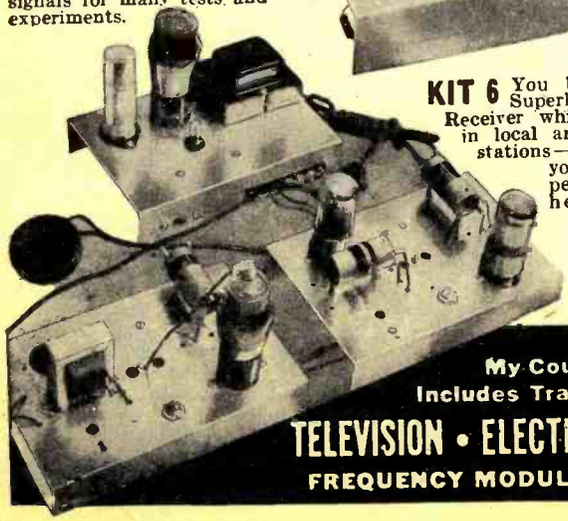
KIT 3 You get parts to build Radio Circuits; then test them; see how they work, learn how to design special circuits; how to locate and repair circuit defects.



KIT 4 You get parts to build this Vacuum Tube Power Pack; make changes which give you experience with packs of many kinds; learn to correct power pack troubles.



KIT 5 Building this A. M. Signal Generator gives you more valuable experience. It provides amplitude-modulated signals for many tests and experiments.



KIT 6 You build this Superheterodyne Receiver which brings in local and distant stations—and gives you more experience to help you win success in Radio.

My Course Includes Training in

TELEVISION • ELECTRONICS

FREQUENCY MODULATION

Do you want a good-pay job in the fast-growing Radio Industry—or your own Radio Shop? Mail the Coupon for a Sample Lesson and my 64-page book, "How to Be a Success in Radio-Television-Electronics," both FREE. See how I will train you at home—how you get practical Radio experience building, testing Radio circuits with BIG KITS OF PARTS I send!

Many Beginners Soon Make Extra Money in Spare Time While Learning

The day you enroll I start sending EXTRA MONEY manuals that show how to make EXTRA money fixing neighbors' Radios in spare time while still learning! It's probably easier to get started now than ever before, because the Radio Repair Business is booming. Trained Radio Technicians also find profitable opportunities in Police, Aviation, Marine Radio, Broadcasting, Radio Manufacturing, Public Address work. Think of even *greater* opportunities as Television, FM and Electronic devices become available to the public! Send for FREE books now!

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Mail Coupon for Sample Lesson and my FREE 64-page book. Read the details about my Course: letters from men I trained; see how quickly, easily you can get started. No obligation! Just MAIL COUPON NOW in envelope or paste on penny postal. **J. E. SMITH, President, Dept. 7KR, National Radio Institute,** *Pioneer Home Study Radio School,* **Washington 9, D. C.**

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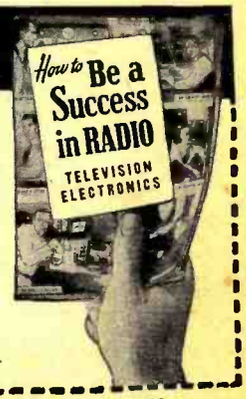

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RADIO NEWS

First in radio-electronics

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OCTOBER, 1947

COVER PHOTO: A section of Concord Radio Corporation's new sales room in Chicago. Complete stocks of radio parts, well displayed, are the secret of this distributor's merchandising success. Photo by Arthur E. Haug

FOR THE SERVICEMAN-DEALER

FOR THE AMATEUR

OF GENERAL INTEREST

DEPARTMENTS

VOLUME 38 • NUMBER 4

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"THE hottest ham performance ever at this price . . ." That's the verdict of amateurs who have had a chance to try Hallicrafters new Model SX-43.

This new member of the Hallicrafters line offers continuous coverage from 540 kilocycles to 55 megacycles and has an additional band from 88 to 108 megacycles. AM reception is provided on all bands, except band 6, CW on the four lower bands and FM on frequencies above 44 megacycles. In the band of 44 to 55 Mc., wide band FM or narrow band AM just right for narrow band FM reception is provided.

One stage of high gain tuned RF and a type 7F8 dual triode converter assure an exceptionally good signal-to-noise ratio. Image ratio on the AM channel on band 5 (44 to 55 Mc.) is excellent as the receiver is used as a double superheterodyne. The new Hallicrafters dual IF transformers provide a 455 kilocycle IF channel for operating frequencies below 44 megacycles and a 10.7 megacycle IF channel for the VHF bands. Two IF stages are used on the four lower bands and a third stage is added above 44 megacycles. Switching of IF frequencies is automatic. The separate electrical bandspread dial is calibrated for the amateur 3.5, 7, 14, and 28 megacycle bands.

Every important feature for excellent communications receiver performance is included.

Model SX-43

$169.50

FEATURES FOUND IN NO OTHER RECEIVER AT THIS PRICE

- ALL ESSENTIAL AMATEUR FREQUENCIES FROM 540 kc to 108 MC
- AM - FM - CW RECEPTION
- IN BAND OF 44 TO 55 MC: WIDE BAND FM OR NARROW BAND AM . . . JUST RIGHT FOR NARROW BAND FM RECEPTION
- CRYSTAL FILTER AND EXPANDING IF CHANNEL PROVIDE 4 VARIATIONS OF SELECTIVITY ON LOWER BANDS
- SERIES TYPE NOISE LIMITER
- TEMPERATURE COMPENSATION FOR FREEDOM FROM DRIFT
- PERMEABILITY ADJUSTED "MICROSET" INDUCTANCES IN THE RF CIRCUITS
- SEPARATE RF AND AF GAIN CONTROLS
- EXCEPTIONALLY GOOD SIGNAL-TO-NOISE RATIO
- SEPARATE ELECTRICAL BANDSPREAD CALIBRATED FOR THE AMATEUR 3.5, 7, 14 AND 28 Mc BANDS

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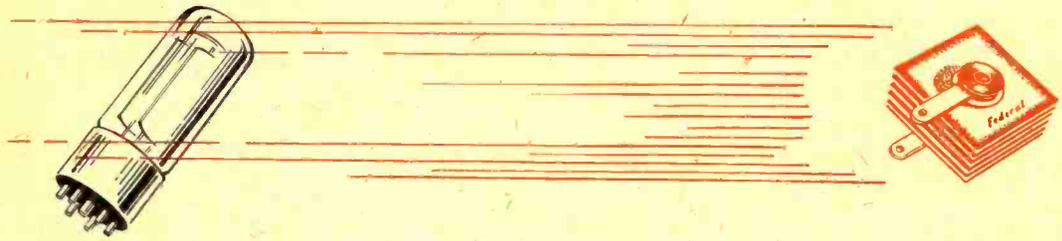

FTR

STORY WITHOUT WORDS

...here's how it can boost your profits

AS SURELY AS the "gasoline buggy" replaced the horse-drawn carriage, the Miniature Selenium Rectifier—an original Federal development—is destined to take the place of the rectifier tube in AC-DC receivers. Already, more and more manufacturers are building it into their radio sets—and more and more maintenance shops are installing it in the sets they service.

What about *you?* Here is really a big chance for you to make *extra money*—by *modernizing* AC-DC sets now using a rectifier tube—giving them faster starting, better all-around performance. And as new sets using the Miniature Rectifier as original equipment come to you for servicing, you'll want to be ready with replacements. It's your opportunity to be a *leader* by introducing this improvement *now*—by installing Federal's Miniature Selenium Rectifier in every AC-DC receiver you service.

Available through major jobbers from coast to coast—complete with detailed instructions.

KEEPING FEDERAL YEARS AHEAD... is IT&T's world-wide research and engineering organization, of which the Federal Telecommunication Laboratories, Nutley, N. J., is a unit.

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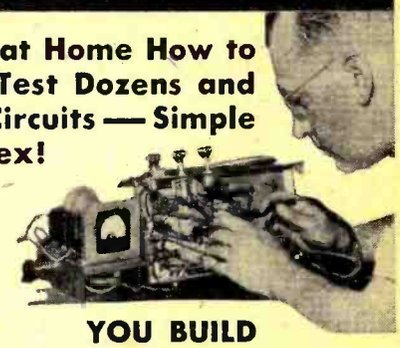
YOU GET 8 BIG KITS OF RADIO PARTS & EQUIPMENT including 2-BAND SUPER RECEIVER! and 16 RANGE METER FOR TESTING

You Learn at Home How to Build and Test Dozens and Dozens of Circuits — Simple and Complex!

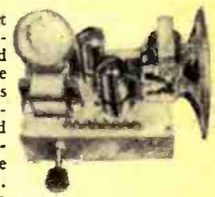
YOU DO OVER 175 INSTRUCTIVE EXPERIMENTS



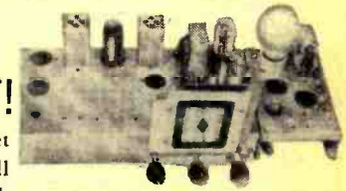
Set has Long and Short Wave Tuning.. All Sprayberry Equip. is yours for KEEPS.

YOU BUILD ALL THESE TESTERS ..... AND MORE!

I give you a fine, moving-coil type Meter Instrument on Jewel Bearings — with parts for a complete Analyzer Circuit Continuity Tester. You learn how to check and correct Receiver defects with professional speed and accuracy.



You'll get valuable experience and practice building this Signal Generator and multi-purpose Tester. Makes a breeze out of fixing Radios and you don't have to spend money on ready-made Equipment.



Soldering, wiring, connecting Radio parts . . . building circuits with your own hands — you can't beat this method of learning. When you construct this Rectifier and Filter, Resistor and Condenser Tester, etc., you get a really practical slant on Radio that leads to a money-making future.

SPRAYBERRY HOME TRAINING is PLANNED to MAKE MONEY for you FAST!

I train you with regular professional Radio Equipment. I tell you exactly what to do . . . how to do it. You handle Radio Parts, see them operate, learn what they're for. With the fine Kits I supply, you learn how to build Radio Circuits, construct your own Test Equipment. I'll show you how to cause typical Radio defects so you can watch and see how they act. You learn the latest methods for trouble-shooting and repair. All this adds up to the finest kind of "bench" experience. And you get it right in your own home. In no time at all, you'll be ready for a business of your own or a good job in Radio, FM, Television, Radar, Industrial Electronics, etc. Now's the time to get started!

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For the RECORD.

BY THE EDITOR

"RADIOS for Everyone . . . Everywhere" is the dominant theme as the Third Annual National Radio Week (October 26-November 1) gets under way. Marking the 27th anniversary of radio broadcasting, the Third Annual observance of National Radio Week will be carried out under the joint sponsorship of the Radio Manufacturers Association (RMA) and the National Association of Broadcasters (NAB).

Of particular interest to our many thousands of radio servicemen readers, National Radio Week is a thee-way cooperative combination designed to keep retail sales volume high, to increase radio listening audiences, and to maintain steady and full employment in the radio industry. National Radio Week will also climax the year-round "Radio-in-Every Room" campaign sponsored by RMA and endorsed by NAB, the object of which is to increase radio set ownership and radio listening by encouraging families to have radios available throughout the house and for each member of the family.

This important week will be observed by all branches of the radio industry as well as allied groups interested in increasing the listening audience. Radio dealers, broadcasters, and radio advertisers have the greatest stake in its success but many other groups will benefit from the national recognition accorded to radio broadcasting on its 27th birthday.

Dealers will be provided with promotion material, posters, streamers, etc., and will have ample stocks to display the newest radio receivers. Broadcasters will be given similar promotion materials plus special aids and suggestions for broadcasting during Radio Week. The networks and national radio sponsors are being asked to devise their own programs for Radio Week, using spot announcements, program tie-ins where practical, special programs, and other devices to point up radio's development during the past 27 years, its stature today, and its future potentialities.

A number of special events are being developed by the RMA-NAB Joint Committee which will include a nationwide contest for high school students in which "The Voice of Democracy" will be chosen competitively in local, regional, and national contests. Another contest for women listeners will be conducted by the Association of Women Broadcasters with the cooperation of RMA whose members will donate the prizes. Other special events, such as local and national forums, may be included.

Promotion material soon to be available to broadcasters, radio dealers, and others interested in actively supporting National Radio Week includes a 32-page, two-color workbook giving background and suggestions for cooperative observances, posters, window streamers, radio scripts, advertising copy, etc. A special 8-page folder, which forms a part of the workbook, will be made available separately to retail organizations for distribution to their members.

Radio servicemen have at their fingertips a golden opportunity to cash in on National Radio Week. Shop work should be kept at a minimum in order that time will be available to make calls on as many customers as possible. When you do drop by for a visit, don't stress any particular sales campaign, rather inquire as to the perfomance of all sets in the household. Take advantage of this opportunity to personally tune in several stations on each set and point out salient features of the new FM-AM television sets. And be sure to leave your business card.

THE radio amateurs, particularly the "oldtimers," who have seen radio grow from a mediocre beginning into one of the foremost industries of our day, can well remember the early days of broadcasting when Doc Conrad and Doc De Forest gave birth to this "electronic era." No one has contributed more than the American amateur to the rapid growth of AM, FM, TV, and electronics. As we celebrate National Radio Week, we should not forget the contributions made by these men. As in the past, the future holds equal opportunity for today's amateur. From his attic and basement will come many more new ideas and developments.

RADIO NEWS is proud of its long association with radio broadcasting and we point with pardonable pride to the fact that we have already passed our 27th anniversary of service to radio servicemen, amateurs, and the industry itself.

We welcome this opportunity to join in the celebration of National Radio Week. .....O.R.

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New Communications Receivers—Earliest Delivery from ALLIED

HALLICRAFTERS S-47

New FM-AM receiver. AM reception 535-1720 Kc. and 5.9-18.2 Mc.; FM reception 88-108 Mc. 14 tubes plus rectifier. Bandspread from 9-12 Mc. and 15—18 Mc. Calibrated slide-rule dials; dual tone controls. 500 ohm output. Phono input socket; push-button channel selection; response essentially flat from 30-7500 cps AM; 30-15,000 cps FM. 110 v. AC. 12 watts power output. In cabinet, **NET** . . **$200.00**
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Newest model in the world-famous, dependable HRO line—a remarkable performer under any receiving conditions. Features modern styling, voltage regulated 6C4 oscillator, double-action type variable noise limiter, tone control, accessory power take-off, separate power supply for 110-220 v. AC operation. Complete with tubes and power supply. **NET** **$299.36**

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The new SX-43 gives you more value—greater performance, broader frequency coverage (550 Kc. to 55 Mc. and 88-108 Mc.)—a fine investment in the medium price range. AM-FM-CW reception, Crystal filter, calibrated main and bandspread dials, variable tone control, precision engineered for custom-built performance! This is a real, big-league, all-around Communications Receiver for Ham or Short Wave Listener. **NET** **$169.50**

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National NC-2-40D	225.00	RME-84	98.70
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Can you afford less than the best — when the best costs you less?

MODEL 906 FM/AM SIGNAL GENERATOR: 8 ranges calibrated ±1% accurate, 90 kc. thru 210 mc. 0-100% variable 400~AM; 0-500 kc. variable FM sweep built-in. Metered microvlts; variable 0-1 volt. Strays *lower* than $500 laboratory generators. Only $99.50 net.

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SEND FOR COMPLETE CATALOG. See these and Silver communication transmitters, receivers, "Micro-match", Xtal-controlled VFO, pre-tuned freq. multiplier at your jobber.

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Here in one easily portable unit is complete amplifier equipment to produce recordings on remote assignments that equal the best recordings in permanent installations.

Presto 90-A has 3 low-level input channels with mixers, master gain control and variable high and low frequency equalizers.

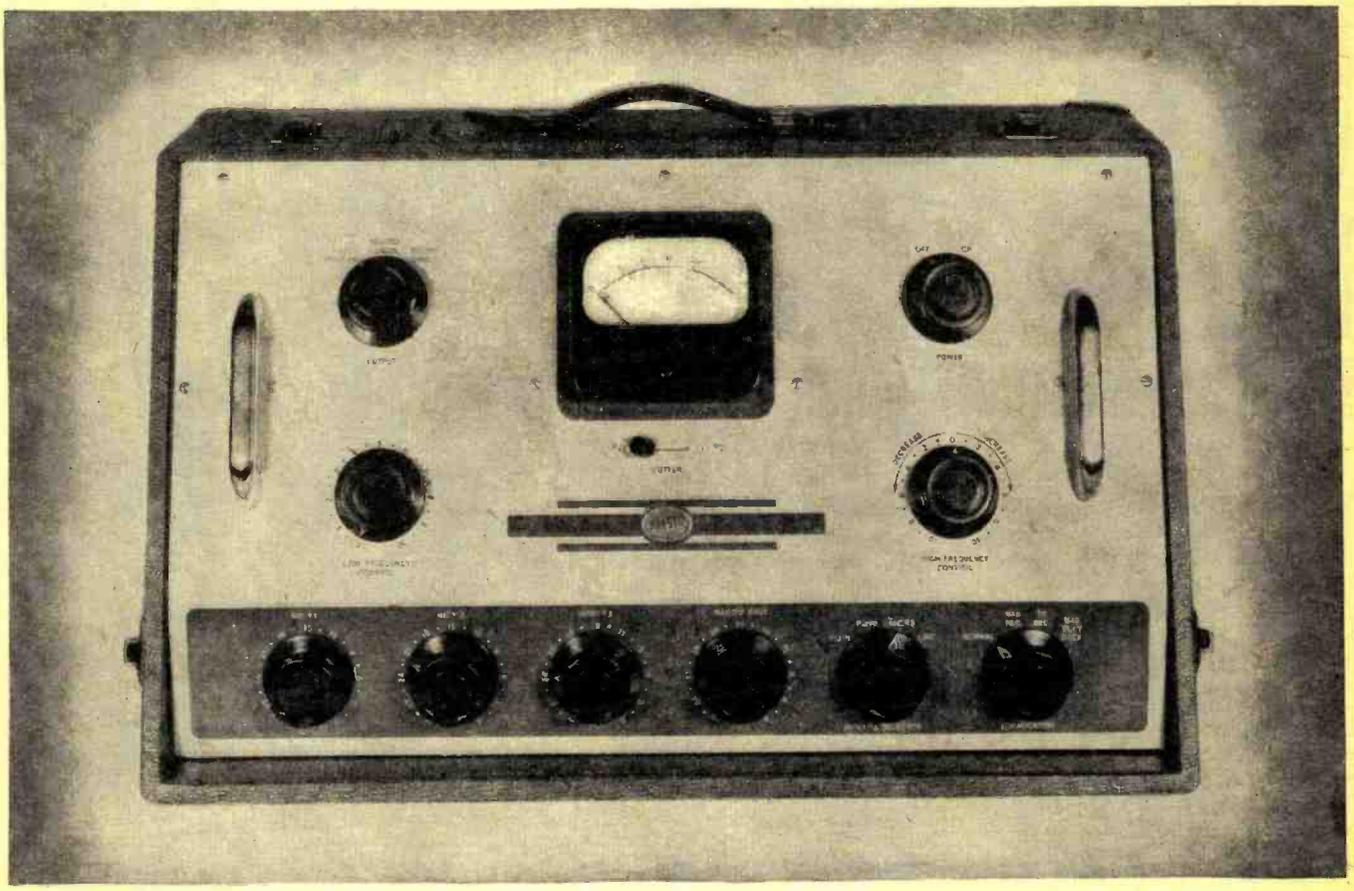
It has four fixed characteristics: flat between 30 and 15,000 CPS... NAB recording...78 r. p. m. recording...playback complimenting NAB recording.

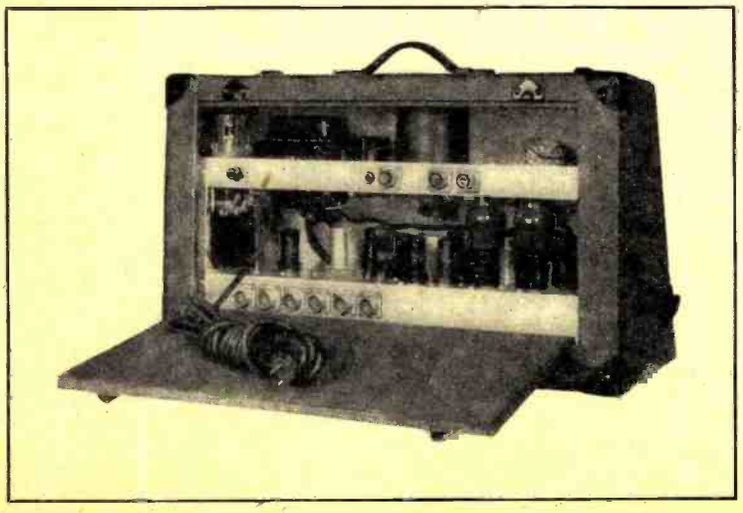
Other features include: line input and output, V.U. meter, switching for one or two recorders, over-all gain—115 db, power —10 watts undistorted.

In quality of parts and workmanship and in flexibility of operation, the Presto 90-A is the equal of the finest studio equipment.

Presto engineers are proud to present this new recording console as a forward step in recording equipment.

Immediate delivery can be made from stock.





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THE servicing shop of Francis Reese in Olean, N. Y. has been the subject of several success stories recently published in radio magazines. Shops so featured are significantly distinguished by a better-than-average profit and a complete set of Rider Manuals. Thus, at Reese you will find all volumes, kept conveniently handy for ready reference. For, no other single source of information supplies the essential data contained in Rider Manuals) and nowhere but in the first fourteen volumes can you find the material you must have to service 80% of the receivers now in American homes. (Those issued from 1920 to 1942.)

To those shops repairing any and all makes of receivers, sets of all ages, this pre-war data is absolutely essential for profitable operation.

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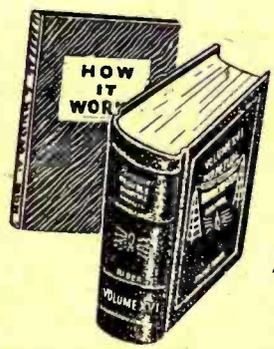

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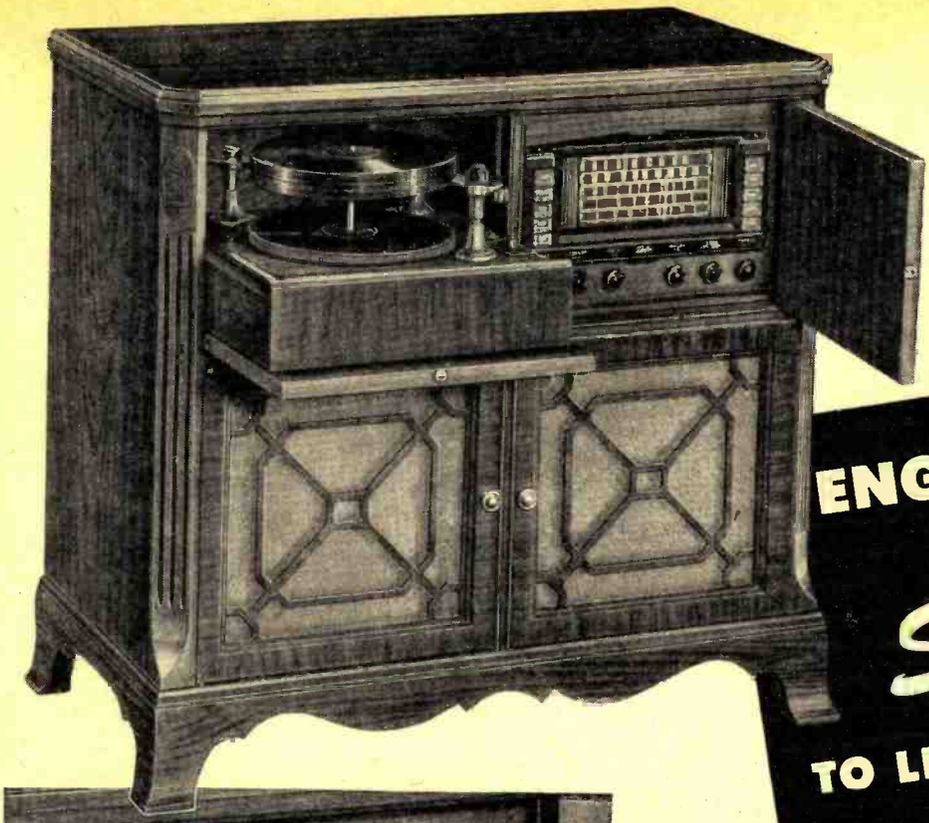

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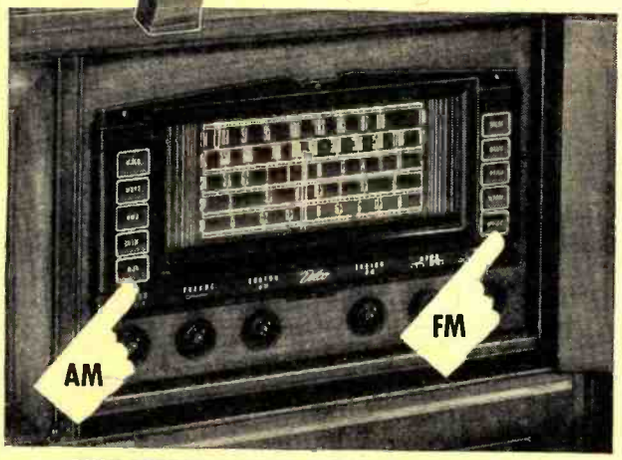

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Spot Radio News

★ *Presenting latest information on the Radio Industry.*

By FRED HAMLIN
Washington Editor, RADIO NEWS

SCHOOL BELLS are ringing over the air this year more numerously and frequently than ever before, according to a survey made as this went to press. And on the heels of this comes word of a survey into the future by the FCC indicating that radio in education is to stay. Twenty-three states reported active interest in establishing statewide FM educational networks. Plans have already reached the legislative stage in California, Pennsylvania, South Carolina, Virginia, and Wisconsin, and planning committees are active in Georgia, Illinois, Kentucky, Louisiana, Michigan, and Texas. Planning is also under way in Indiana, Maryland, Montana, and New Jersey. A score of other commonwealths have expressed active interest.

FCC IS HAPPY about the whole thing, which culminates their encouragement of educational radio begun in 1938. First FM "school" station went on the air as early as May, 1939, run by the New York City Board of Education. War knocked out further progress in the field. Comeback was slow, but as of this summer, six educational FM's held regular licenses, 32 building permits were outstanding, and eight applications were pending. . . . Radio education is not, however, brand new—there were 171 licenses in the field as early as 1925 and within ten years after that, more than a hundred others were added. Most of these were universities, all standard AM's. They're also still going strong.

SPEAKING OF radio education and history, we're tempted to turn the column this time into a book review on what will probably be the best buy in radio literature during the fall season. It's called "Radio—A Public Primer" and was written by George O. Gillingham, public relations head of FCC. Lest anybody think we are splitting royalties with Mr. G. on his tome, it should be added that no royalties are due the author. He wrote it for the government, and the Government Printing Office, Washington, D. C., will send you a copy on request after the publication date—sometime before Nov. 1—for the handsome sum of (about) ten cents. Final price had not been set as this went to press. . . . The FCC pamphlet is actually a new edition of the same thing, written by Gillingham when he came to FCC in 1939 from TVA, where he was a Washington press man. Subsequently he went to war for five years, winding up as a lieutenant colonel in the chemical warfare service. Returning, he found his 1939 version of the "Primer" dated, and, between answering phones, he has revised it.

BEST THINGS about the primer are that it is singularly free of gobbledygook, a language designed to be so filled with long words that even the guy who wrote it can't make out the meaning; and that it swings clear around the radio circuit, giving brief, clear glimpses of what the other half of the radio industry is doing. We found it full of tasty morsels of radio history, news, and believe-it-or-nots, some of which you may have forgotten or (like us) never knew. For instance:

"Radio" in its present-day sense is an American word, introduced by the Navy in 1912 as "radiotelegraphy." The long end of it was later dropped by the Americans, although the British still frown on the contraction.

First radio crooner was Enrico Caruso. De Forest had him on the air in 1910.

Attempts were made to organize a fully-authorized Federal radio bureau as early as 1911, but radio was a governmental stepchild until the Communications Act of 1934, which created the FCC.

The AM broadcast band is only one/thirty-thousandth of the entire known radio spectrum, which extends from 10 to 30 million kc.

It took nearly ten years for F(requency) M(odulation) to get to first base. A healthy experiment in the early 1930's, it didn't get an okay for commercial operation from FCC until 1941.

Is there such a thing as a radio station operating in the U. S. without a license? Yup. Matter of fact, *all* government radio stations are exempt from licensing.

The largest single radio group today licensed by the Commission is hams. Aviation is second, with some 17,000 airborne stations and 1100 on the ground.

THE LAW, according to the FCC Primer, has pioneered in radio. In 1916, New York City had a station, KUVS, to communicate with police boats in the harbor. Pennsylvania

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SPOT RADIO NEWS

was the first to have a state police radio system, in 1923. Michigan had the first radio patrol automobiles. Detroit, incidentally, was responsible for a fad in early broadcasting, when its police asked for a station designation KOP. Other nifties: WGN for "World's Greatest Newspaper," Chicago Tribune tower; WACO for guesswhere in Texas, and Miami Beach's WIOD for "Wonderful Isle of Dreams." . . . But FCC is careful to add that special designations cannot be handed out these days. You take what's on the top of the list. You can't even take over a designation from a pal or your father, because under present rules a vacated call must be kept inactive for five years to avoid confusion. . . . Hams, FCC adds, have done an outstanding job of cherishing call letters—"gravestones even bear beloved call signals." They add that "perhaps the outstanding example of a deceased's call being perpetuated is the case of WIAW. For many years it was held by Hiram Percy Maxim, the inventor, and remains as a memorial in identifying the West Hartford, Conn., headquarters station of the great amateur station which he founded—The American Radio Relay League."

RADIO BEING WHAT IT IS, FCC is busy as ever, latest policing activities involving so-called "ambulance chasers"—legal and other characters who run after police and fire calls in an effort to pick up some business. "From time to time," the Commission reports, "complaints are received that certain repair men, ambulance operators, and other unauthorized persons intercept such calls to capitalize on fires, accidents, crimes, etc. This is contrary to the Communications Act, which protects intrastate as well as interstate and foreign communications from interception or divulgence for private benefit."

THAT TELEVISION HOOK-UPS will continue to figure in radio debates both in Washington and elsewhere during the winter, was indicated with the recent *American Telephone and Telegraph* announcement that it had requested FCC to withdraw tariffs previously filed "covering rates for intercity television transmission." These rates were due to become effective late in summer. Withdrawing them would mean an eventual cut in rates, Washington concensus agrees, but *AT&T* begged to dissent. "No change is contemplated in the basis of charges for pickup and other wire and radio facilities provided by *Bell System* telephone companies for special point-to-point transmission of television programs," officials stated, adding: "Present experimental television service over the New York-Washington coaxial cable which has been given without charge to the television industry will be continued

(*Continued on page* 167)

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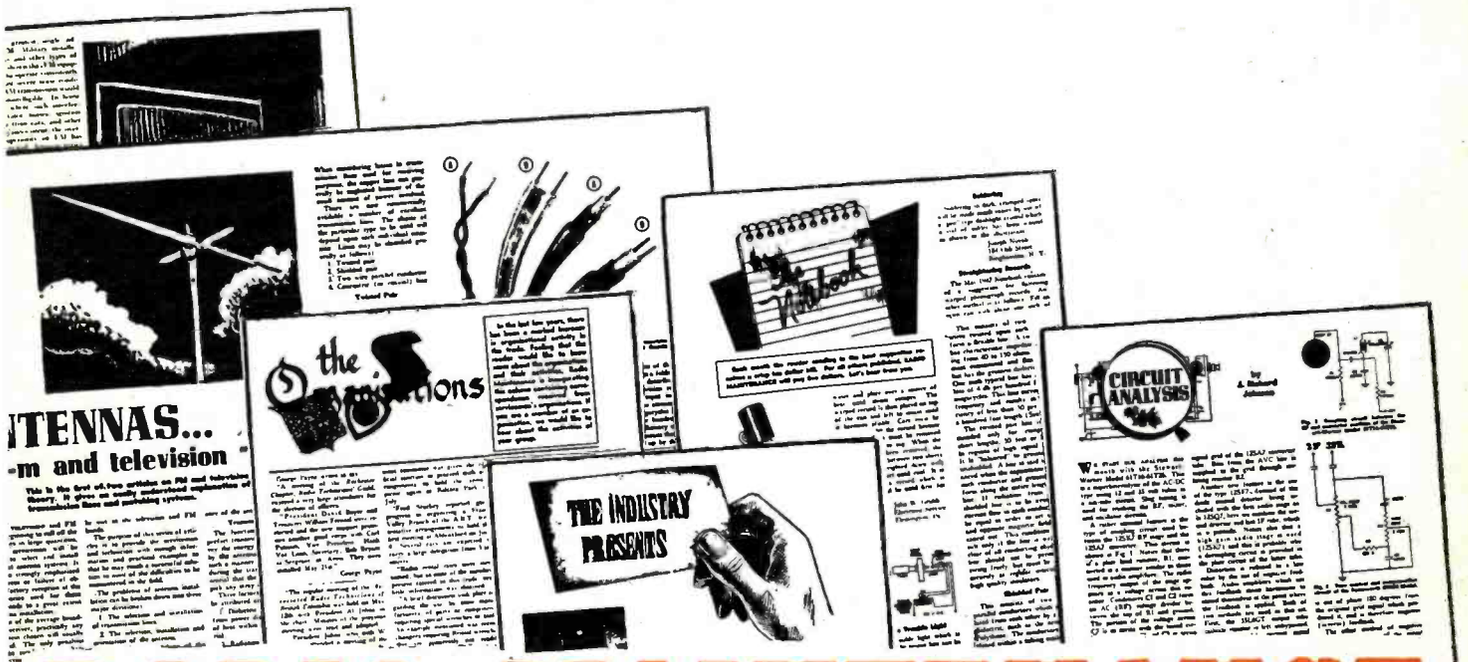

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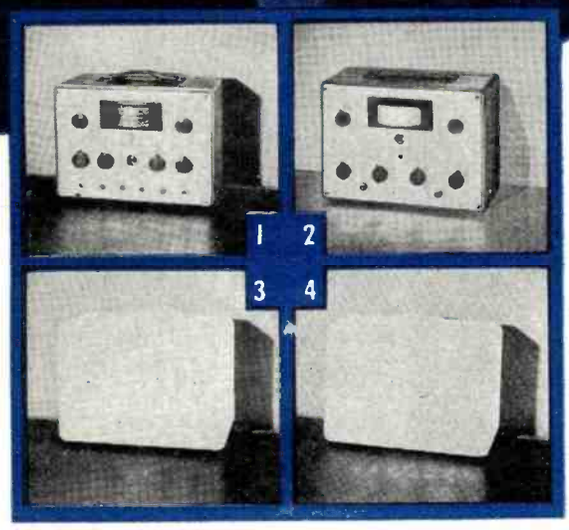

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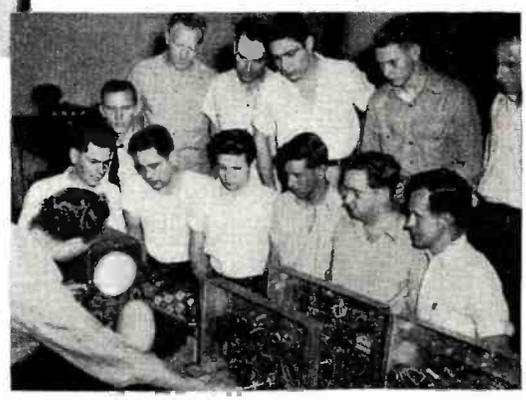

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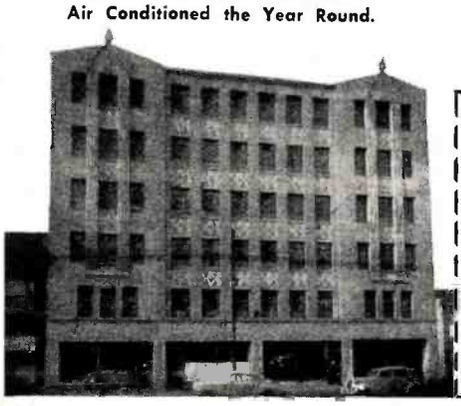

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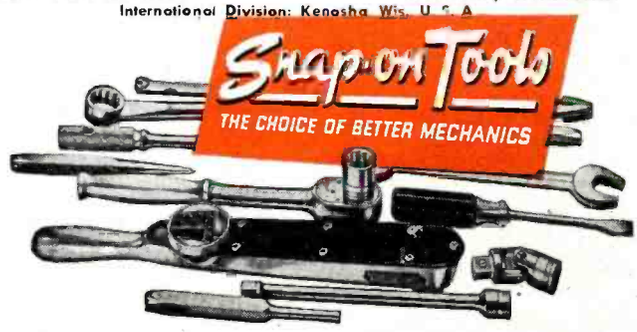

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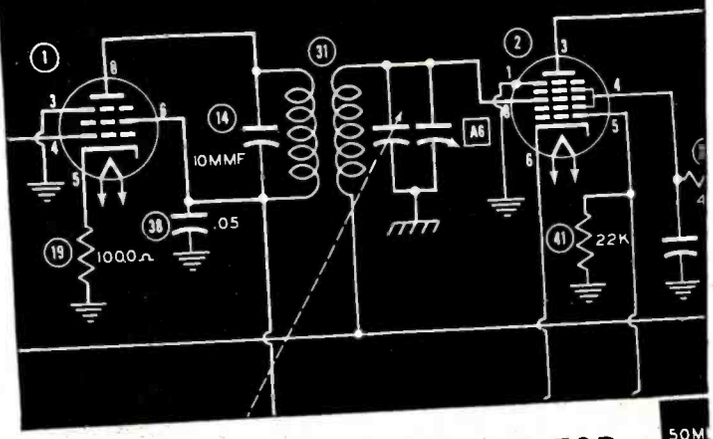
I am proud to announce to my Servicemen friends the successful development of a new system of "Standardized Schematics" that is now yours *exclusively* in PHOTOFACT Folders. We have worked on this project for over one year, because we knew that uniform, standardized schematics would save you hours of time and countless headaches—would help you earn more. NOW—we have developed *uniform, standardized diagrams on all sets.* Now—you can save time—go from diagram to diagram and see the *same,* easy-to-understand symbols and designations. You no longer have to puzzle out the differences in schematic notations or bang your head against queer-looking diagrams. You'll recognize instantly the functions of all parts in *any circuit.* The standards used in our new diagrams are *yours*—the result of the PHOTOFACT "Standards Poll" and thousands of interviews with Servicemen. I wish space would permit me to tell you more—but PHOTOFACT Set No. 23 speaks for itself. You owe it to yourself to see the new diagrams. Use them—learn what a difference they'll make in faster, more profitable servicing.

Howard W. Sams



NOW! UNIFORM SCHEMATICS FOR FASTER, MORE PROFITABLE WORK!

Beginning with Set No. 23, and thereafter, all PHOTO-FACT Folders will feature the new, uniform "Standard Notation" schematics. Each and every diagram is drawn to the same basic set of clear, uniform, easy-to-understand standards. Here's what the new "Standard Notation" Schematics mean to you: Makes circuit analysis simple, quicker, fool-proof, more accurate! No more time wasted puzzling over odd-looking diagrams! No more trouble with varying symbols and confusing styles! Just ONE CLEAR STANDARDIZED STYLE FOR ALL CIRCUITS—SAVES YOU TIME—HELPS YOU EARN MORE. Only PHOTOFACT offers you the "Standard Notation" Schematics!

TWO IMPORTANT NEW HOWARD W. SAMS PUBLICATIONS

DIAL CORD STRINGING GUIDE

There's only one *right* way to string a dial cord. And there's only *one* book that shows you how. It's the Howard W. Sams DIAL CORD STRINGING GUIDE. Here, for the first time, in *one* handy pocket-sized book, are all available dial cord diagrams and data covering 1938 through 1946 receivers. Licks the knottiest dial cord problem in a matter of minutes. This low-cost book is a "must" for servicing. You'll want two copies—one for your tool kit and one for your shop bench. Order them today. ONLY **75c**

1947 AUTOMATIC RECORD CHANGER MANUAL

Nothing like it! COVERS MORE THAN 40 *DIFFERENT* POST-WAR MODELS. Absolutely *accurate, complete, authoritative*—based on actual study of the equipment. Shows exclusive "exploded" views, photos from all angles. Gives full change cycle data, information on adjustments; service hints and kinks, complete parts lists. Shows you how to overcome any kind of changer trouble. PLUS—for the first time—complete, accurate data on leading WIRE, RIBBON, TAPE, and PAPER DISC RECORDERS! Over 400 pages; hard cover; opens flat. No modern service shop can afford to be without this manual. ONLY **$4.95**

FREE PHOTOFACT AIDS!

FREE. *PHOTOFACT CUMULATIVE INDEX*—Your guide to more than 1800 receiver models and chassis (1946 and 1947 models covered in PHOTOFACT Folder Sets 1 through 20).

FREE. *HOW TO FILE FOLDER*—Shows 5 good ways to file PHOTOFACT Folders, including new "30-Second" filing method.

Ask your parts jobber for FREE copies of these PHOTOFACT aids, or write us direct.

RESERVE SET NO. 23 TODAY

MAIL THIS ORDER FORM TO YOUR PARTS JOBBER TODAY—or send directly to HOWARD W. SAMS & CO., INC., 2924 E. Washington Street, Indianapolis 6, Indiana.

My (check) (money order) for $..... enclosed.

☐ Send PHOTOFACT Set No. 23 (at $1.50).

☐ Send . . . SAMS' DIAL CORD STRINGING GUIDE(S), at $0.75 per copy.

☐ Send . . . SAMS' 1947 AUTOMATIC RECORD CHANGER MANUAL(S) at $4.95 per copy.

☐ Send PHOTOFACT Volume No. 1 (including Sets Nos. 1 through 10) with DeLuxe Binder, $18.39.

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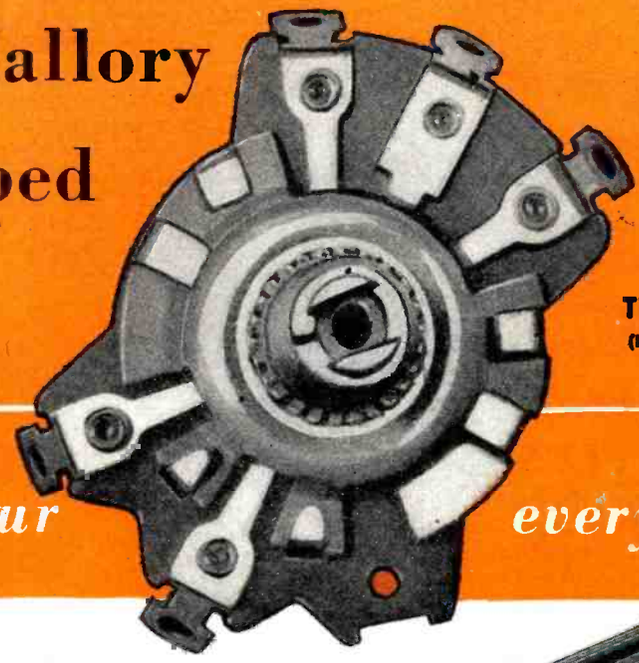
HOWARD W. **SAMS** & CO., INC.
INDIANAPOLIS 6, INDIANA

Export—Ad. Auriema—89 Broad St., New York 4, N. Y.—U. S. of America
Canada—A. C. Simmonds & Sons, 301 King St., East—Toronto, Ontario

PHOTOFACT SERVICE

"The Service that pays for itself over and over again"

10 Resistance Values in Mallory Double-Tapped Controls...



TYPE DTM
(DOUBLE TAP)

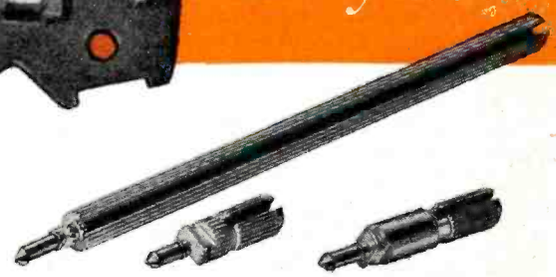
To supply your every need

MALLORY is pretty fussy about the taper and resistance values of the controls it makes. That's because it has a thorough knowledge of controls in all original receiving sets ... conscientiously duplicates these controls with a streamlined, but *complete* line of replacements.

Mallory Double Tapped Midget Controls are a case in point. They come in ten resistance values—to supply every need! By merely combining them with the right Mallory Plug-In Shaft, you can duplicate most double tapped original controls in the "special" category.

Furthermore, Mallory provides *large* double tapped controls in four resistance values. These are to replace originals with fixed shafts of 3 inches or less.

See the Mallory Catalog for the complete story. Or contact your Mallory distributor.



INSIST ON MALLORY—
THE COMPLETE CONTROL LINE

Mallory is the manufacturer that offers:

- 33 Correctly Tapered Wire-Wound Controls
- 31 Values in Single Tapped Controls
- 10 Values in Double Tapped Controls
- 12 Clutch Type Controls
- 10 Universal Dual Controls
- 92 Popular Special Controls

You Expect More—and Get More—from Mallory

P.R. MALLORY & CO. Inc.

MALLORY

VIBRATORS ... VIBRAPACKS®... CAPACITORS ... VOLUME CONTROLS ... SWITCHES ... RESISTORS ... FILTERS ... RECTIFIERS ... POWER SUPPLIES.

®Reg. U. S. Pat. Off.

APPROVED PRECISION PRODUCTS

National Radio Week
Oct. 26—Nov. 1

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Within the INDUSTRY

KENNETH W. SICKINGER, formerly a department manager with *Oakes & Company* of Chicago, has been placed in charge of advertising for the Radio Division of *Stewart-Warner Corporation.*

Prior to his connection with *Oakes & Company,* Mr. Sickinger was assistant general sales and advertising manager of the *Belmont Radio Corporation* of Chicago. He has also been associated with *Rainfair, Inc., Western Advertising Agency* and the *Racine Journal-Times.*

Mr. Sickinger will maintain offices in Chicago.

* * *

FARNSWORTH TELEVISION & RADIO CORPORATION has announced the appointment of the *J. N. Ceazan Company* of San Francisco as distributors of *Farnsworth* products in 47 counties in northern California and 10 counties in western Nevada.

One of the oldest wholesale distributing organizations in the West, the *Ceazan Company* was founded in 1919. Julius N. Ceazan, founder of the company, serves as president.

The firm's warehouse and offices are located at 1547 Mission Street in San Francisco. In addition, the company maintains permanent display space at the Western Merchandise Mart.

* * *

JOSEPH W. WHITESIDE, a *General Electric Company* employee since 1929, has been named sales manager of the company's new tube parts and equipment sales section.

The new section, which is part of the Tube Division, has been set up to sell electronic tube parts and tube-making equipment to manufacturers. In addition to his new duties, Mr. Whiteside will continue to be responsible for all purchases, including subcontracting, for the Tube Division. He will maintain headquarters at the company's plant in Schenectady.

* * *

HARVEY W. HARPER, Chairman of the Board of *Tung-Sol Lamp Works Inc.,* has just issued a statement refuting the rumors of a possible merger between *Tung-Sol* and *National Union Radio Corporation.*

According to Mr. Harper, "There is no basis whatsoever to the rumor that this company will merge with the *National Union Radio Corporation.* In fact no such proposal has ever been made or considered by the present management of *Tung-Sol Lamp Works Inc.,* and so far as this management is concerned, there is no intention of proposing such a merger."

* * *

ORRIN E. DUNLAP, JR., has been elected to the post of Vice-President in Charge of Advertising and Publicity for *Radio Corporation of America.*

Mr. Dunlap became Director of Advertising and Publicity of *RCA* on January 1, 1944, after serving four years as Manager of the Information Department.

Before joining the company in 1940, Mr. Dunlap was Radio Editor of *The New York Times* for eighteen years. He is a member of the ARRL, a life member of the Veteran Wireless Operators' Association and a senior member of the I.R.E.

He is the author of ten books on radio, including two volumes on the subject of radio as an advertising medium.

* * *

EDWARD A. MILLER has been named Vice-President in charge of Engineering by the Board of Directors of the *Acme Electric Corporation* of Cuba, New York.

After joining the company in 1930, Mr. Miller devoted his time to improving the design and performance of the company's line of luminous tube transformers. He was also active in the development of various equipment used by the communication and radio industries.

He is an active member of the I.R.E. and the A. I. E. E.

* * *

STANLEY H. MANSON, public relations manager of *Stromberg-Carlson Company,* has been appointed chairman of the Radio Manufacturers Association Advertising Committee, succeeding John S. Garceau, advertising manager of *Farnsworth Television & Radio Corporation,* who resigned after seven years' service in the post.

As chairman of the subcommittee in charge of the RMA "Radio-in-Every-Room" campaign, Mr. Manson has been active in the committee's sales promotion activities.

The RMA Advertising Committee has been enlarged because of the expanding activities of the committee. Victor A. Irvine, advertising manager of *Motorola, Inc.,* has been named vice-chairman of the committee.

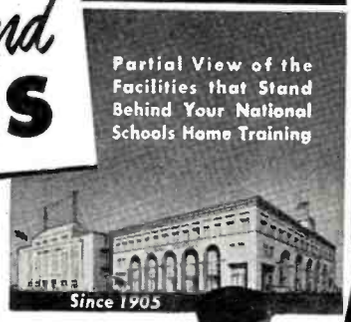
Opportunity now FOR YOU!

NATIONAL SCHOOLS SHOP METHOD

HOME TRAINING *in* RADIO TELEVISION *and* ELECTRONICS

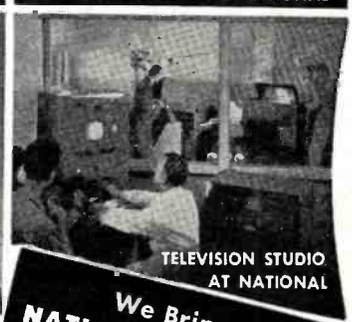
RADIO SHOP AT NATIONAL

BROADCAST STUDIO AT NATIONAL



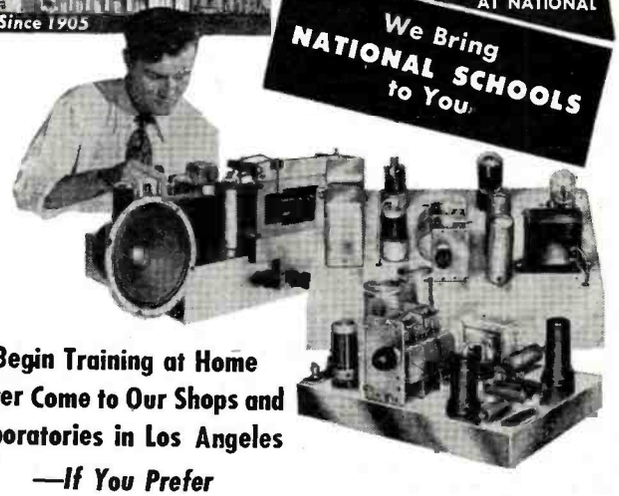
Partial View of the Facilities that Stand Behind Your National Schools Home Training

Since 1905



TELEVISION STUDIO AT NATIONAL

We Bring NATIONAL SCHOOLS to You



A PRACTICAL RESIDENT TRADE SCHOOL

With Its Own Shops and Laboratories

FOR OVER 40 YEARS

TODAY, OPPORTUNITIES IN THE RADIO, ELECTRONICS AND TELEVISION INDUSTRY ARE TAKEN FOR GRANTED

We see them everywhere: The Home Radio Service Field continues to grow. **Television is here** . . . Television Broadcasting facilities are being rapidly expanded. Television sales, service, installation and maintenance requirements are more and more important from day to day. **Electronics is an important factor** in many applications for utility, safety, accuracy and convenience. **Airlines** are finding new uses for Radio bringing new benefits to air transportation. **Ships** at sea are employing Radar together with other conventional Radio apparatus for ship-to-shore communications and safety. **Frequency Modulation** is modernizing Radio Broadcasting, offering static-and-interference-free reception in the home. **The list of Radio applications is almost endless,** and every one represents increasing opportunities in our modern world for the **RADIO, TELEVISION AND ELECTRONICS TECHNICIAN WITH A SOLID TECHNICAL BACKGROUND.**

NOT JUST ANY TRAINING WILL DO

It is not a question of opportunity but rather how to take advantage of existing opportunity. Only proper training can make these opportunities a **reality**. National Schools of Los Angeles, one of the oldest and largest technical trade schools in the United States, **offers you Shop Method Home Training, a proved method that builds qualified technicians.** Here is Home Training that BRINGS RESULTS.

Behind **all** training from National Schools stands a permanent faculty of experienced instructors and engineers. These men are daily teaching resident students right in our own Shops and Laboratories. From first hand experience with students here at school, our instructors understand the needs and ambitions of men like you. All of our instructors, both Home Study and Resident, have ideal facilities to make your training practical, up-to-the-minute, interesting. It takes years of experience to know how to train men, especially in the practical technical trades. Established almost 50 years ago, National Schools has a rich background of experience to help you to take full advantage of the opportunities in the Radio, Television and Electronics Industry

HERE'S JUST A FEW OF THE INTERESTING FACTS YOU LEARN WITH THE FREE MANUAL

1. Routine for Diagnosing Radio Troubles.
2. Preliminary Inspection of Receivers.
3. How to Check Power Supply.
4. How to Identify Various Stages of Receivers.
5. How to Trace the Circuit and Prepare Skeleton Diagram.
6. How to Test and Measure Voltages.
7. How to Test Speaker in Audio Stages.
8. How to Test Detector, I.F., R.F., and Mixer Stages.
9. Complete Reference Table for Quickly Locating Receiver Troubles.

Begin Training at Home Later Come to Our Shops and Laboratories in Los Angeles —*If You Prefer*

National's Master Shop Method Home Training in Radio, Electronics and Television is COMPLETE in itself. No other training is necessary; but, some men do prefer to take a short experience course here in our resident shops and laboratories, at the end of their Home Study training. They find it helpful to spend a short period of time in our modern Broadcasting Station, or our New Television Laboratories and Studios, or our Extensive Radio Servicing Shops—as well as other departments covering every specialized phase of the Radio Industry.

You are welcome to take advantage of this additional instruction if you wish. If you are interested, check the coupon below. Full details will be sent you by return mail. National Schools' OUTSTANDING FACILITIES MAKE IT POSSIBLE TO OFFER THE FINEST POSSIBLE TECHNICAL TRADE TRAINING IN RADIO, TELEVISION AND ELECTRONICS.

You Get All This Radio Experimental Equipment to Use and Keep at Home!

LEARN BY DOING is the basic principle of National's Shop Method Home Training. We send you standard Radio parts for an interesting series of experiments which demonstrate the fundamentals of Radio, Television and Electronics. The very essence of this training is EXPERIENCE—you get actual experience by building many different types of circuits. You build a fine, long distance MODERN SUPERHETERODYNE RECEIVER, signal generator, low-power Radio transmitter, audio oscillator, etc. This **practical work** develops your knowledge of Radio step by step, makes you a **practical** Radio Technician.

VETERANS

During the war, National trained enlisted men under contract with the War Department. Both the Armed Forces Institute and Marine Corps Institute used our lesson texts on a wide scale. Now, we are training veterans, both resident and home study, through the Veterans Administration. If you are a veteran of World War II—and qualified for training under the G.I. Bill of Rights, check the coupon for special information.

G. I. APPROVED

NATIONAL SCHOOLS

LOS ANGELES 37, CALIFORNIA EST. 1905

MAIL OPPORTUNITY COUPON FOR QUICK ACTION

NATIONAL SCHOOLS, Dept. 10-RN
4000 South Figueroa Street, Los Angeles 37, California

Mail me FREE the two books mentioned in your ad, including a sample lesson of your course. I understand no salesman will call on me. I have checked below the plan which interests me.

NAME ..... AGE.....

ADDRESS .....

CITY ..... STATE.....
(Include your zone number)

- ☐ I am interested in home study only.
- ☐ Send information on your Combined Home-Study and Modern Resident Shop Training.
- ☐ Veteran of World War II.

Plans are now being completed for observance of National Radio Week, October 26-November 1, an annual event inaugurated in 1945 by the National Association of Broadcasters. The RMA "Radio-in-Every-Room" campaign will reach its climax coincident with the National Radio Week observance.

* * *

SAM NORRIS, Sales Manager for *Amperex Electronic Corporation* since 1942, has been named Executive Vice-President of the company.

Well-known in the industry for his activities in the Radio Manufacturers Association and the National Electrical Manufacturers Association, Mr. Norris has announced the establishment of an independent development group of engineers to work closely with customers on application problems. He will also visit South America to renew prewar trade contacts and to expand the firm's export business.

* * *

RADIO MANUFACTURERS ASSOCIATION'S Parts and Transmitter Divisions have named new section chairmen for the 1947-48 fiscal year.

Chairman J. J. Kahn, President of the *Standard Transformer Corp.*, announced the appointment of 20 section chairmen for the Parts Division: Coil Section, Edwin I. Guthman, *Edwin I. Guthman & Company, Inc.;* Fixed Capacitor Section, W. Myron Owen, *Aerovox Corporation;* Fixed Resistor Section, J. Hall Stackpole, *Stackpole Carbon Company;* Instrument & Test Equipment Section, R. L. Triplett, *The Triplett Electrical Instrument Co.;* Insulations Section, John W. Apgar, *Irvington Varnish & Insulator Co.;* Metal Stampings and Metal Specialties Section, S. L. Gabel, *Superior Tube Company;* Phonograph Cartridges and Pickups Section, George B. Fraser, *The Astatic Corporation;* Plastics and Molded Parts Section, John J. Bachner, *Chicago Molded Products Corporation;* Record Changer and Phono Motor Section, Allan W. Fritzsche, *The General Industries Company;* Socket Section, Frank Holmstrom, *Hugh W. Eby, Inc.;* Speaker Section, Laurence A. King, *The Rola Company, Inc.;* Speaker Parts Section, A. D. Plamondon, Jr., *The Indiana Steel Products Company;* Special Products Section, William R. MacLeod, *King Laboratories, Inc.;* Switch Section, William S. Parsons, *Centralab;* Transformer Section, R. A. Hoagland, *Jefferson Electric Company;* Variable Condenser Section, G. F. Behringer, *The American Steel Package Co.;* Variable Resistor Section, D. S. W. Kelly, *Allen-Bradley Company;* Vibrator Section, Ray F. Sparrow, *P. R. Mallory & Co., Inc.;* Wire Section, R. G. Zender, *Lenz Electric Mfg. Co.;* and Wire Wound Resistor Section, D. T.

(*Continued on page* 120)

READY

For immediate delivery

AIR KING WIRE RECORDER

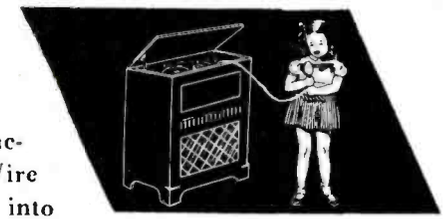
and RADIO-PHONO COMBINATION

AIR KING OPENS AN EXCITING NEW FIELD IN HOME ENTERTAINMENT.

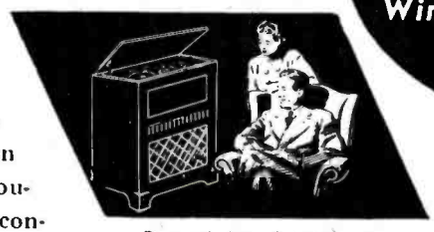
Air King was the first radio manufacturer to successfully combine the Wire Recorder, Radio and Phonograph into a smooth functioning, foolproof, home entertainment unit that even a child can operate. Another out-growth of Air King's Engineering "Know-How".

Consumer acceptance of the Wire Recorder, in combination with a radio phonograph at no extra cost has been sensational! It has proven itself in thousands of American homes and is considered by top merchandisers to be the hottest item of the year.

Smart dealers will insist upon the Wire Recorder in all future radio-phono combinations.



Records your voice, Disc Records or Radio Programs. simple, finger-tip controls.



The music lovers' dream comes true. Amazing high fidelity noise free recordings.

One hour of recording on a small spool of wire. Replay or erase for new recording.

It's a Radio, Phonograph and Wire Recorder all in one!

Model 4700

FEATURES YOU CAN SELL!

- Records Voice on Wire, through Microphone.
- Records Phonograph Records on Wire.
- Records Radio Broadcasts on Wire.
- Powerful Super-Sensitive Radio.
- High Quality Phonograph.
- Amazing Air King "Wiretone" Reproduction.

FIRST AID PROGRAM for HEALTHY BUSINESS

Air King places its Advertising and Sales Promotion Department at your disposal. Write today, for information on our First Aid Program to help you promote the Air King line in your community. A new idea in manufacturer dealer cooperation.

Air King believes that progress makes sense and dollars too. Here is your opportunity to get on the Air King bandwagon and be the first to sell the Air King Wire Recorder Radio-Phono Combination in your community.

★ WE HAVE A LIMITED NUMBER OF DISTRIBUTOR AND DEALER TERRITORIES OPEN ★
Write or wire (New Address): Air King Products Co., Inc., 170 53rd Street, Brooklyn 32, N. Y.
Export Address: Air King International, 75 West Street, New York 6, N. Y.

The Royalty of Radio Since 1920 **AIR KING RADIO** Division of HYTRON RADIO & ELECTRONICS CORP.

KEN-RAD TUBES BUILD BUSINESS FOR MY RADIO REPAIR SHOP!

You hear that statement from service-men who've learned that at all times they can count on Ken-Rad tube quality, stamina, and long playing life.

Ken-Rad *double acceptance*—by dealers and users —means a *doubled sales-and-profit potential!*

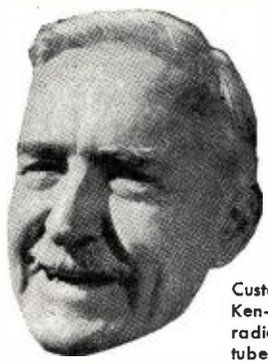
As a radio-repair specialist or tube dealer you can "cash in" on the twofold popularity of Ken-Rad tubes—their acceptance by service experts because they're *good tubes*, and the favor they enjoy with radio owners based on their fine performance and long life.

Profits can come not alone from your growing volume of Ken-Rad tube business, but by selling more parts and repair time to owners who seek the superior service you offer your clients. *For Ken-Rad tubes are your most effective advertisement of this service.*

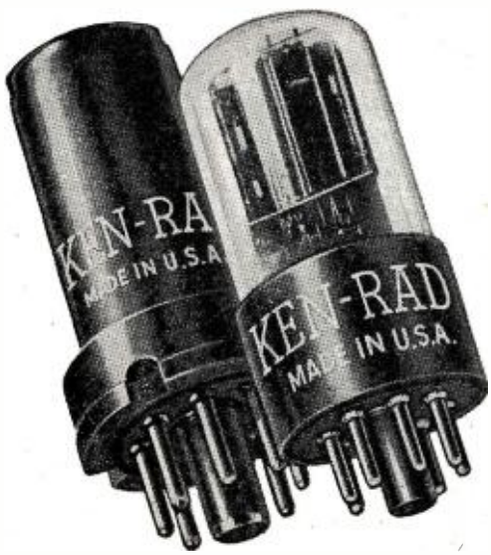
Here is a splendidly engineered *modern* line of receiving tubes, backed by great facilities in research and manufacture, with a brand name deservedly popular and growing more so daily. Here too is OPPORTUNITY to increase your sales, boost your income, underscore with the Ken-Rad good name your own fine local reputation.

Put Ken-Rad double acceptance to work for *you* . . . profitably!

SPEAKING FOR APPRECIATIVE OWNERS, KEN-RAD TUBES BUILD GOODWILL!



Customers soon discover that Ken-Rad tubes give a "lift" to radio performance. Advanced tube design and precision manufacture are responsible.



● Write for Ken-Rad Booklet ETR-16, "Essential Characteristics". This well-known publication contains the technical data you need to select Ken-Rad tube types for sets being repaired. The three "C"s apply throughout: Convenient, Concise, Comprehensive. Just one of many Ken-Rad helps—*including the trade's finest display, advertising, and promotion material*—available to radio service-men and tube dealers!

178-FP-6650

KEN-RAD *Radio Tubes*

PRODUCT OF GENERAL ELECTRIC COMPANY

Schenectady 5, New York

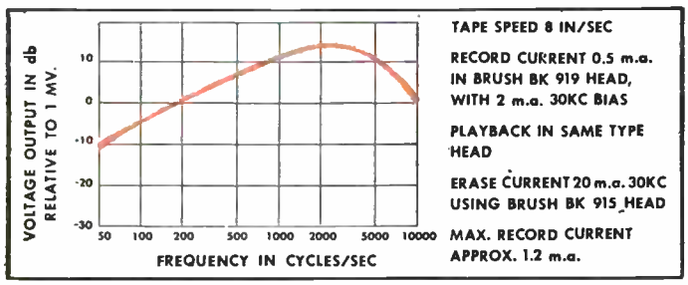
Announcing

SCOTCH BRAND *Sound Recording* TAPE

OFFERING HOME AND PROFESSIONAL RECORDERS A NEW STANDARD OF TONE FIDELITY AND EASE OF HANDLING

Developed in the research laboratories of the 3M Company . . . the world's largest manufacturers of pressure-sensitive adhesive tapes . . . "SCOTCH" Sound Recording TAPE is now available in quantity for immediate delivery. No other magnetic recording medium can offer all these advantages:

1. Better frequency response at slow recording speeds—due to "SCOTCH" Sound Recording Tape's extremely thin, uniform magnetic coating.
2. Low noise level because of uniform dispersion of particles and mirror-like surface.
3. Higher Coercive Force—350 oersteds—insures higher frequency response and greater signal strength.
4. Flat surface and large area provide positive contact with the pick-up and give greater dynamic range.
5. Uniform width control in manufacture insures even, constant tracking.
6. Adequate space on ¼ inch width for multiple sound tracks.
7. The non-magnetic tape backing between the layers of magnetic coatings in the roll prevents "cross-talk."
8. Easy to handle. No snarls, backlashes, or kinks.
9. Freedom from breakage. Resin treated backing provides a tensile strength of 8 to 10 pounds.
10. Can be marked on back to indicate start and stop of different sound sequences in the same roll.
11. Easily edited by snipping out unwanted portions and then taping together with "SCOTCH" transparent Tape.
12. Perfect reproduction for several thousand playbacks. Erases clean with low power—no special erase head required.



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THE 3M COMPANY

Here's How CREI Home Study Training Prepares You NOW for a BETTER Job and a SECURE Career in Radio-Electronics and Television

CREI Courses for Every Radioman Keep You Ahead of Competition—Earn You More! Never before have so many men like you had the opportunity to step ahead into better-paying jobs and enjoy lasting success. Men with up-to-date technical training are needed in every branch of radio-electronics. That's because radio's *manpower* has not kept pace with radio's *technical* developments.

What are you doing to meet this need for highly trained, expert technicians and engineers? You must improve your technical knowledge not only to qualify for the better job you want, but to *hold* the job you now occupy. CREI offers you a proved program of technical self improvement that you can study in your spare time, at home. The same type of practical, down-to-earth training for which thousands have enrolled since 1927.

Remember, too, there's a CREI course for *you*. No matter what your radio experience—CREI offers complete training in radio-electronics for *any* man who wants to improve his ability and his chances for advancement. You can "*go all the way* with CREI" from introductory basic principles to advanced training and on to specialized engineering subjects.

Read our 24-page booklet and a free sample CREI lesson . . . then judge for yourself There is no obligation. You are already started in this field. Find out how you can rapidly prepare to advance beyond your present level. Send the coupon NOW!

VETERANS! CREI TRAINING AVAILABLE UNDER THE "G. I." BILL!

Capitol Radio Engineering Institute

An Accredited Technical Institute

DEPT. RN-10, 16TH AND PARK ROAD, N. W., WASHINGTON 10, D. C.

Branch Offices: New York (7): 170 Broadway • San Francisco (2): 760 Market St.

SAMPLE LESSON *FREE*

Now, see for yourself! Mail the coupon for free sample lesson and see how simple it is to study at home and improve your ability the CREI way.

"ELECTRON PHYSICS AND ELECTRON THEORY"— This interesting lesson from the Radio-Electronics course discusses modern theories of the composition of matter, including *atomic energy*, and their relation to present-day radio and electronics.

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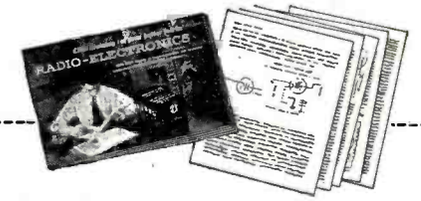

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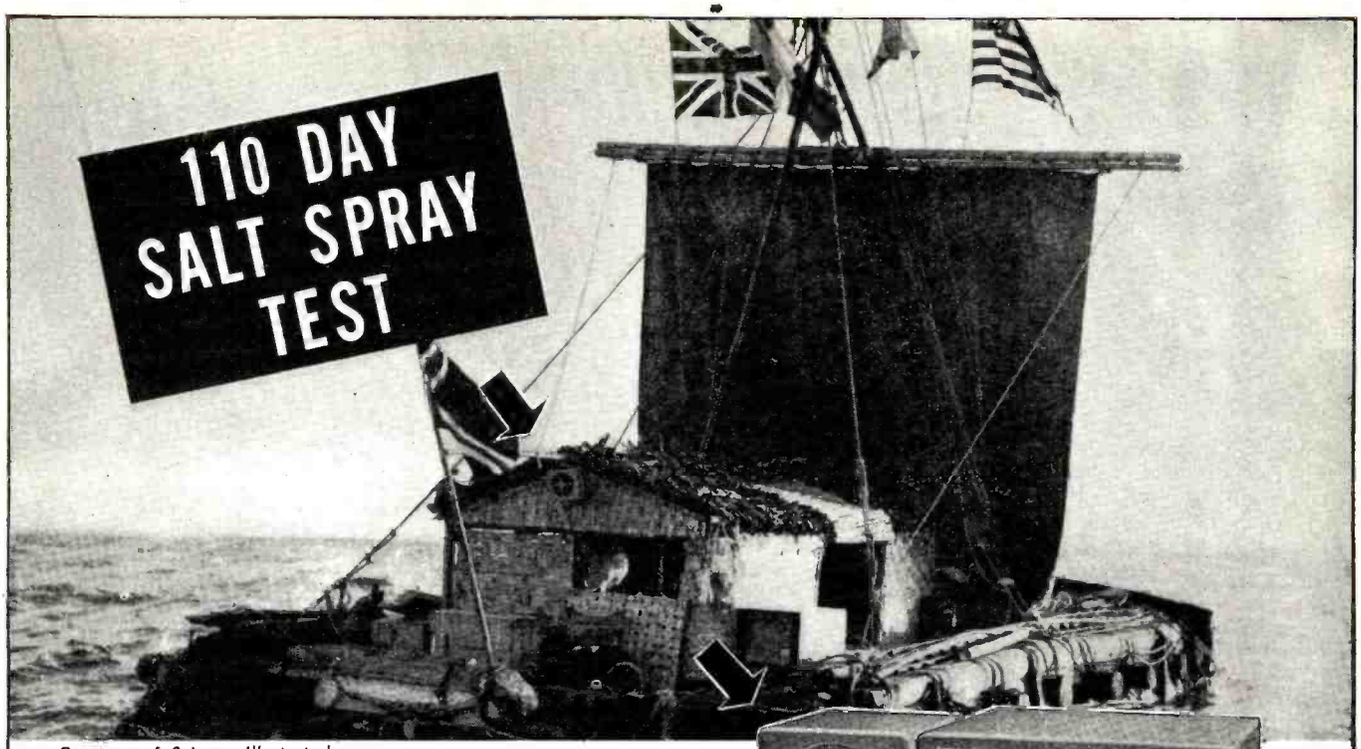

Courtesy of Science Illustrated

Captain Bjorn Arnold Rorholt, Los Angeles, Calif.
c/o Norwegian Embassy
Washington, D. C.

Dear OM,

I have the answers to the questions regarding the radio equipment on the Kon-Tiki; I will first put the question as sent to them and then their reply

1 – Q, Have you tried generator GN58 for receiver?
A, No.
2 – Q, How many batteries did you take?
A, All. 41 six volts and 30 forty-five volts.
3 – Q, Is there any difference in output between generator and battery operation?
A, Not tried yet.
4 – Q, Are you using 6995 KC crystal from the ten meter rig?
A, Yes, but ten meter rig in use too.
5 – Q, Have you removed last audio valve in 173 Receiver?
A, Tried, but receiver then too weak.
6 – Q, What kind of antenna do you normally use?
A, L antenna
7 – Q, Have you tried balloon or kite supported antennas?
A, Both tried.
8 – Q, Have you tried voice modulation since shortly after leaving Peru?
A, Yes, results not good.
9 – Q, Do you use mark two transmitter?
A, Yes, and then very good.
10 – Q, How does the NC-173 stand up under conditions on board?
A, Excellent.
11 – Q, How many hours can you operate the transmitter on one set of batteries?
A, High tension batteries very long life but long articles kill our heater batteries.

In case you did not hear me yesterday their heater batteries are used but Raaby tells me that they make 1½ volt units from their 45 volt batteries and then use four of these for six volts and thus get about four days service from each set. They have about five sets left so are O.K. for sometime yet.

"Pen" sends his vy 73 to you as do I and I hope to work you again soon. I am anxious to meet the boys but I am also going to miss these daily contacts with the raft.

I hope Knut, and Torstein keep up their radio and get on the air when they get back to Norway for I would enjoy very much keeping up our friendship via amateur radio.

Again VY73 to you Pronto and hope to cul.

Very Sincerely,

HAL – W6EVM

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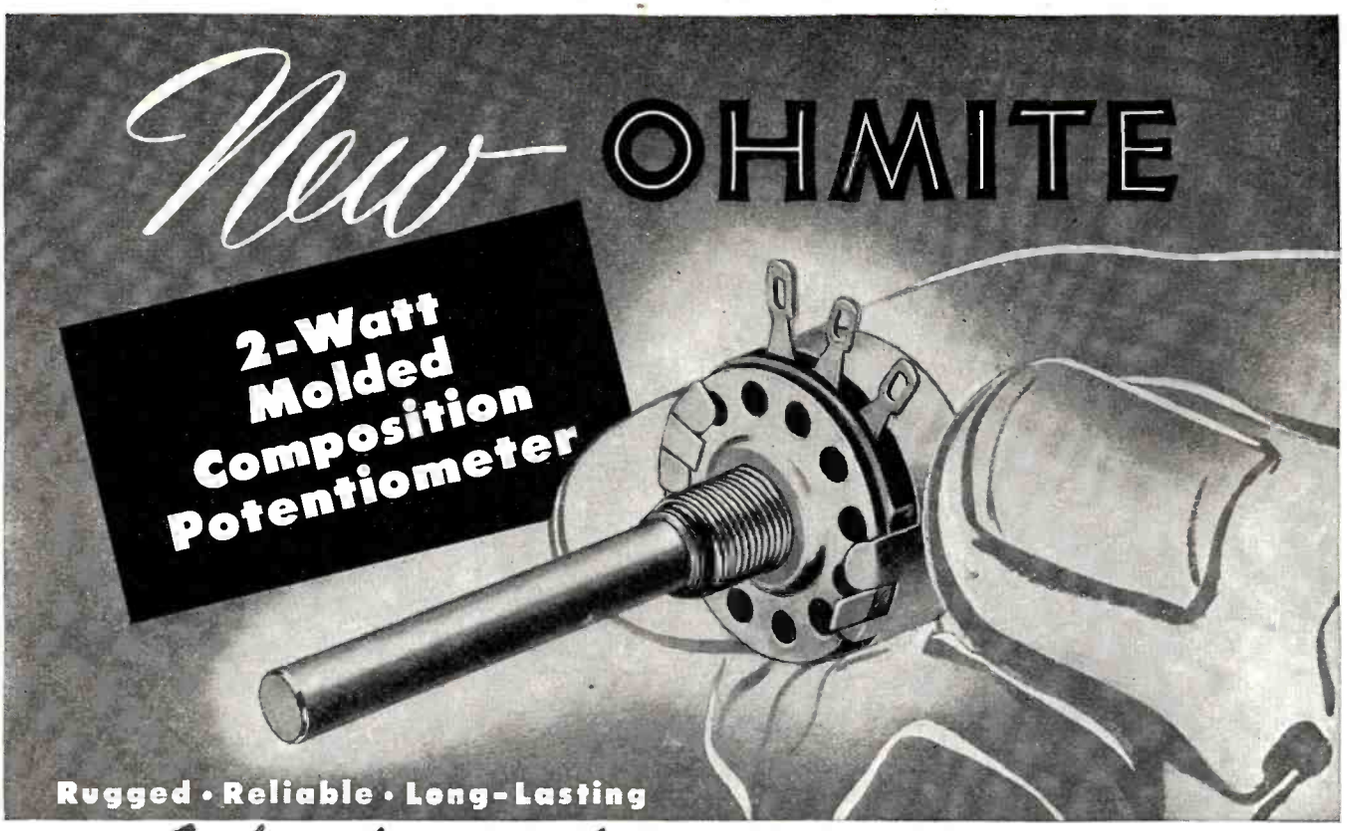

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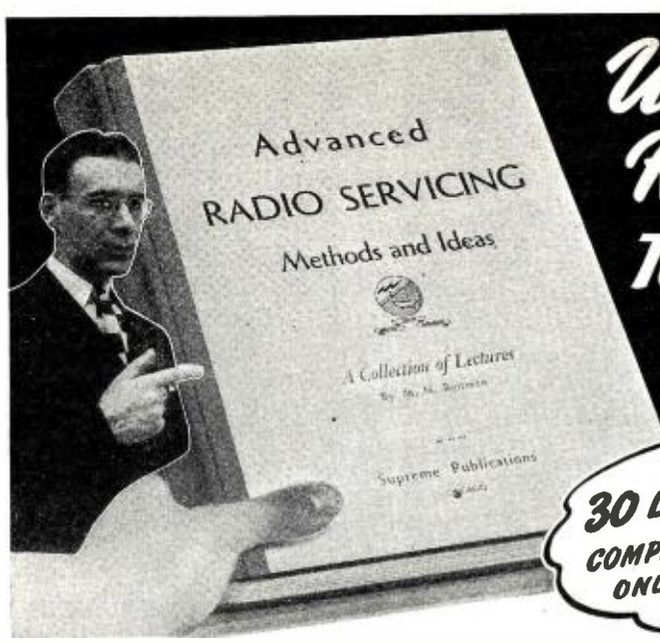

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Write for Descriptive Booklet

ADAPTING the TBY-7 for Amateur Use

This easily converted war surplus item covers the 28 and 50 mc. amateur bands.

By
W. B. Ford, W6YT

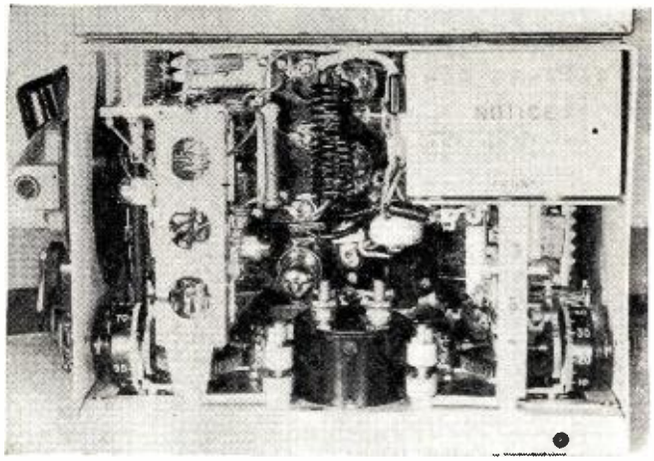
Light enough to be carried on operator's back, this "walkie-talkie" like unit makes excellent rig for those cross-town contacts.

NOT all of the surplus radio gear now available is easily adapted for amateur use. Some of it requires the installation of new tuning units to bring it within licensed bands, and nearly all of it requires the rewiring of the filament circuits if the equipment is to operate from conventional power supplies. Many of the units were built so compactly that a major operation is necessary before any part of the circuit can be altered, and often the work becomes so involved that the builder begins to wonder if the time could not have been spent more profitably in building new equipment. A notable exception to the above is the little TBY-7 transmitter-receiver, which was used in Navy landing operations.

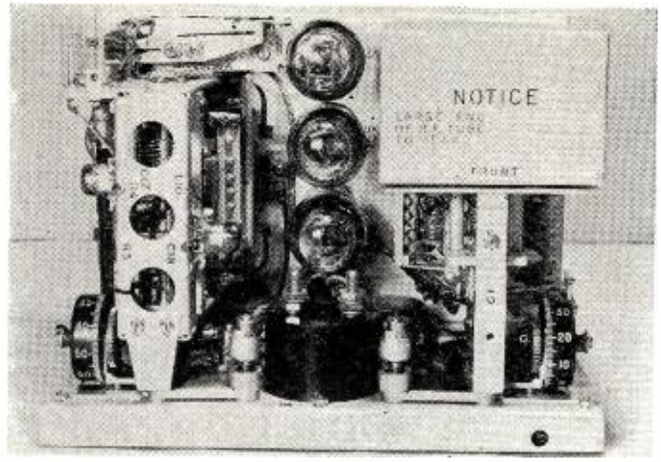
When the writer first saw the TBY-7 he was impressed with the possibilities it offered as a portable unit for field trips, a mobile rig for the car, or as a supplementary set to the home transmitter when low-powered contacts are desired. Weighing less than 50 pounds, complete with storage battery and vibrator power supply, it is equipped with a canvas carrying case that may be strapped to the operator's back when desired. The battery provides a minimum of 15 hours' continuous operation when the transmitting and receiving periods are of approximately the same length. When the battery is discharged it may be recharged from the car battery or a convenient six-volt charger. Finally, the transmitting section may be adapted to meet existing regulations with a minimum of circuit changes.

The r.f. section of the transmitter, in its original state, consists of a self-excited oscillator using two 958-A tubes in push-pull. The tuning circuit consists of a split-stator condenser, 22 $\mu\mu$fd. per section, and four inductances mounted on a rotating turret assembly, which is controlled by a four-band switch on the front panel. The tuning range is continuous from 28 to 80 mc. The oscillator is inductively coupled to the antenna coil which is, in turn, connected through a send-receive relay switch to a sectional whip antenna mounted on the side of the metal case. An additional terminal is provided to connect the unit to other types of antennas. The antenna circuit is tuned by means of a 100 $\mu\mu$fd. variable condenser mounted on the front panel. The oscillator may be either voice modulated or tone modulated by using the type 30 audio tube as a tone generator. A 5000 kc. crystal is provided for checking the transmitter over its tunable range. A 1E7 twin pentode tube in push-pull serves as a modulator. A push switch on the microphone operates the send-receive relay.

The receiver section consists of an r.f. amplifier using a 959 tube, followed by a superregenerative detector with a 958-A tube. The r.f. and detector stages are tuned over the 28-80 mc. range by means of ganged 14 $\mu\mu$fd. condensers and turret coils, similar to those used in the transmitter. The first audio stage uses a type 30 tube, which also serves as a tone generator when m.c.w. is being used. The second audio stage is a push-pull arrangement using the same 1E7 that serves as the voice modulator for the transmitter. Vol-



Interior view of the TBY-7 after unit has been converted to crystal control. Note crystal oscillator mounted to meter studs.



The TBY-7 before conversion. Tube directly behind meter is removed to provide space for installing the new oscillator unit.

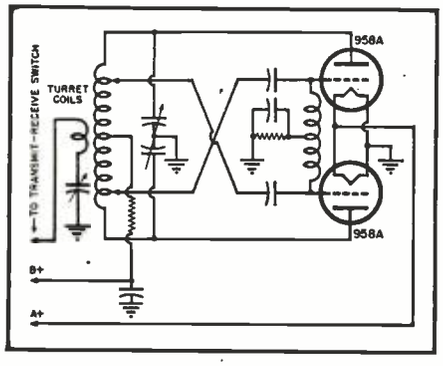


Fig. 1. Schematic diagram of the original wiring for transmitter section of the unit.

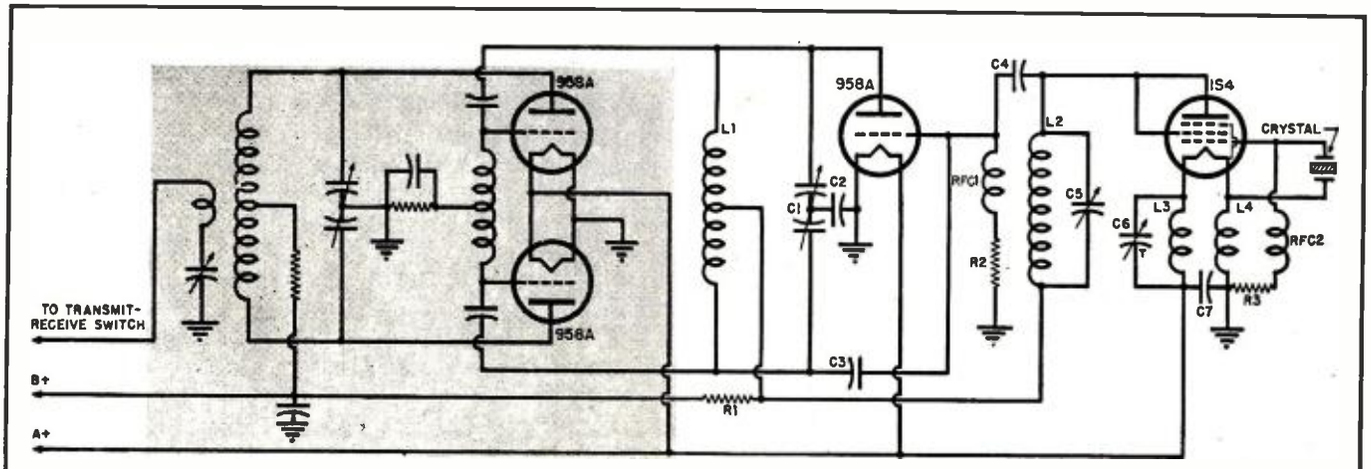
ume and regeneration controls are provided on the front panel. Correct filament voltages are maintained through rheostats and a voltmeter mounted on the front panel. The voltmeter also serves as a milliammeter to determine the plate load of the transmitting tubes. The 5000 kc. crystal oscillator used for checking the transmitter also provides checking points for receiver calibration.

The TBY-7 was intended to be used with a specially built dry-battery pack, which supplies "A," "B," and "C" voltages, or a combination vibrator-storage battery pack with similar outputs. Either of the power supplies may be securely attached to the bottom of the unit. Since both types of power supplies were made solely for use of the Armed Forces, it is very unlikely that any dry battery packs with fresh batteries may be obtained today. The purchaser of a TBY-7 may either make up his own dry-battery pack, or obtain one of the vibrator-storage battery packs generally listed as TBY-7 accessories. From the viewpoint of economy, the vibrator unit is strongly recommended over the dry battery pack, since the present price of the former is little more than cost of one set of batteries. Then, too, there is the matter of easy recharging, which is of no minor importance when one considers the many uses to which the little set may be put.

The vibrator-storage battery combination consists of a four-volt, leakproof storage battery and a vibrator unit which supplies voltages of 2.35, 3.3, 4.2, 8.6, and 158 volts. The storage battery may be separated from the vibrator for charging, or it may be charged while attached to the vibrator. Only in the former case does the charging polarity have to be observed. When the vibrator and battery are attached together and connected to a six volt storage battery or other charging source, a dry rectifier and relay within the vibrator section case automatically connects the charging source to the four-volt battery at the correct polarity. Floating indicators visible through the side of the battery case permit the condition of the battery to be determined at all times.

In analyzing the original circuit of the TBY-7, it was readily seen that stabilized frequency control would be necessary if it were to comply with present day requirements. Furthermore, since both the transmitting and receiving sections covered two of the licensed bands, namely the 28 and 50 mc. bands, it seemed desirable to include those bands when designing the oscillator for frequency stability. Several possible combinations were

Fig. 2. TBY-7 transmitter after unit was rewired and crystal control added. Balance of the transmitter-receiver remains unchanged.



R_1—10,000 ohm, ½ w. res.
R_2—150,000 ohm, ½ w. res.
R_3—100,000 ohm, ½ w. res.
C_1—25 μμfd. (per section) split-stator var. cond.
C_2—.002 μfd. mica cond.
C_3—2 μμfd. mica cond. or twisted pushback
C_4, C_7—.001 μfd. midget mica cond.
C_5—100 μμfd. midget var. cond.
C_6—100 μμfd. trimmer cond.
L_1, L_2, L_3, L_4—See text
RFC_1, RFC_2—2.5 mh. r.f. choke
Crystal—See text
3—958A tubes
1—1S4 tube

tried on paper and the one finally chosen was one that would require the least changes in the original circuit, that change being the switching of the grid leads in the self-excited oscillator from the turret coil to the buffer-doubler or buffer-tripler coil, depending upon the frequency of the final stage. Like most of the radio equipment designed for the Armed Forces, there is little wasted space in the TBY-7, hence the matter of finding space for the two stages necessary to cover the frequency ranges desired presented a real problem. Space was finally provided by removing the type 30 tube (directly back of the voltmeter) which served as a crystal calibrator for checking the transmitter and receiver. The small space occupied by the 5000 kc. calibration crystal was not needed, but since the crystal was no longer required for its original purpose, it was removed and set aside for some future use.

A crystal oscillator stage was mounted on a piece of ⅛ inch bakelite as shown in Fig. 3. Two strips of 20 gauge sheet steel, drilled and shaped as shown, serve as brackets to mount the oscillator stage on the meter terminals. The ends of the mounting brackets are bent in opposite directions, so that they can be mounted on the bakelite strip at the proper angle. Since the brackets will be "hot" whenever the voltmeter is in use, care should be taken that they do not make contact with any other metal parts of the oscillator stage. A 1S4 tube connected as a triode serves as the oscillator. This tube was preferred to an acorn type, due to its smaller socket requirements. The 1S4 is connected in parallel with the 958-A filaments (Fig. 2) in the transmitter, so that its filament voltage is slightly below the specified 1.4 volts. This, however, seems to have no effect upon the operating efficiency of the tube. The oscillator tube doubles in its plate circuit for both operating frequencies and uses a 7194 kc. crystal for the 28 mc. band, and an 8650 kc. crystal for the 50 mc. band.

The inductances L_3 and L_4 consist of eight turns each of No. 20 d.c.c wire, wound side by side on a 1 inch form. L_3 is tuned with a 100 $\mu\mu$fd. trimmer and once adjusted needs no further attention. The inductance L_2 consists of 14 turns of No. 16 enameled wire, closewound on a 1 inch form, and is tuned with a 100 $\mu\mu$fd. midget variable condenser. This combination tunes both doubled frequencies and provides ample excitation to the following buffer stage. Single tip jacks are used for the crystal holder. RFC_1 RFC_2 and R_3 are mounted on the under side of the bakelite strip. The positive filament lead from the 1S4 tube is connected to the filament terminal of the 958-A transmitting tube, directly above the transmitter turret coils.

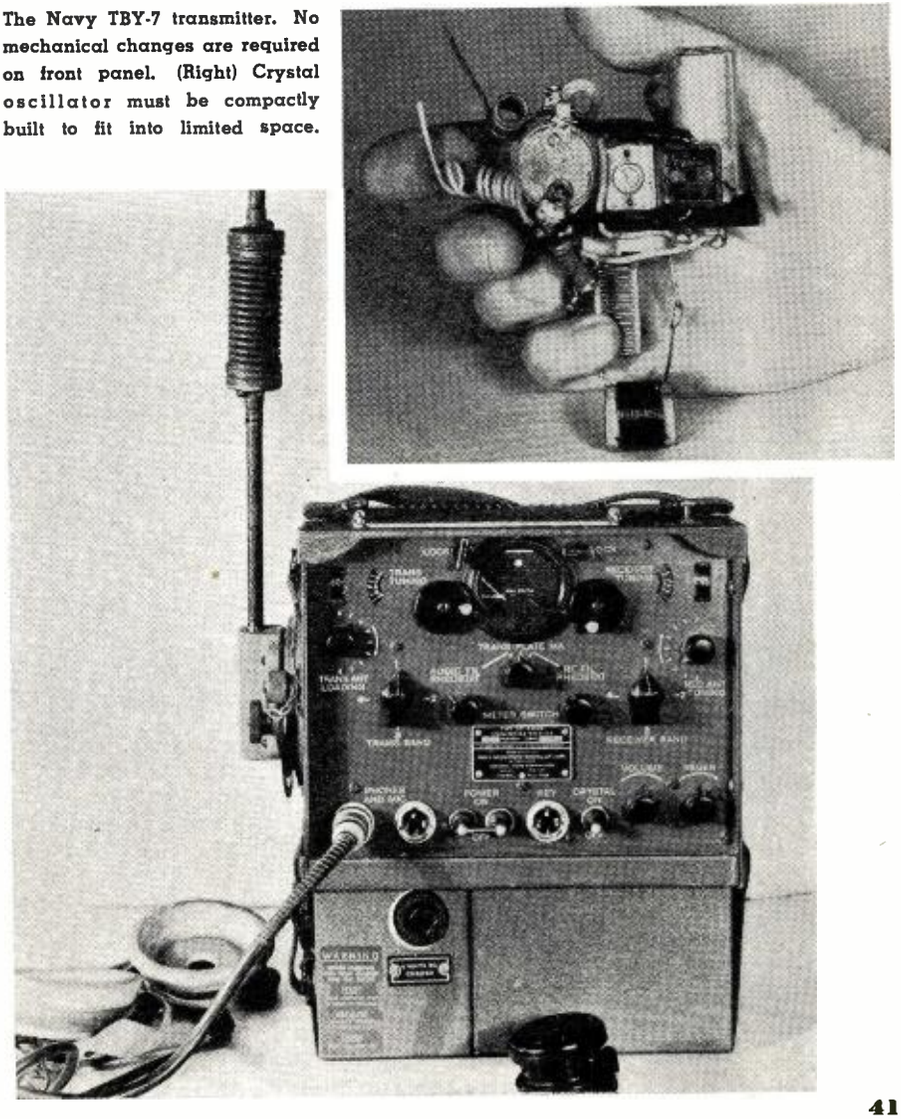
The buffer stage consisting of a 958-A tube is mounted on the side of the detector shield can and its associated tuning unit, L_1 and C_1. The tuning unit consists of a split-stator condenser, 25 $\mu\mu$fd. per section, and air-wound coils for the particular frequency being used. By using a condenser of larger capacity, one coil could have been made to cover both frequencies, but to provide a satisfactory L/C ratio, it was deemed advisable to provide two coils. The occasion is rare when it is desired to change from the 28 mc. to the 50 mc. band, or vice versa, instantly, but even when the time element does enter, the coils may be changed in a matter of a few seconds. The variable condenser is mounted on the back of the metal cabinet. Mounting holes may vary with different makes of condensers. The condenser is adjusted by means of a screwdriver and is of the locking type. The buffer stage coil mount consists of a ⅛ inch piece of bakelite, properly drilled and tapped. This strip is mounted directly upon what would be the bottom of the condenser, the condenser being mounted on the cabinet with the bottom side up. Clip for securing the coils to the bakelite strip consists of pieces of No. 26 gauge spring brass. The inductance L_1 consists of 14 turns No. 16 enameled wire, ⅝ inch i.d., air wound, 1¾ inch long, for the 28 mc. band, and 6 turns No. 16 enameled wire, ⅝ inch i.d., air wound, 1 inch long, for the 50 mc. band. The resistor R_1 is mounted on terminal strips soldered to the metal frame directly above the end of transmitter turret coils. Before the lid of the metal cabinet could be closed it was necessary to remove the metal frame that held the spare acorn tubes, which was riveted to the lid.

Tuning the transmitter is done in the conventional manner. Since two additional tubes will register current beyond the original center mark of the milliammeter, that marking should be disregarded. With proper antenna loading the meter needle will swing to about three-fourths full scale, dipping in the usual manner when resonance is reached.

Even with the low power output of this transmitter, many satisfactory DX contacts may be made on either 28 or 50 mc. when conditions are right. There is a particular thrill in a good contact made with this extremely low power.

During the few months the author has owned the converted TBY-7 it has

(*Continued on page* 201)



The Navy TBY-7 transmitter. No mechanical changes are required on front panel. (Right) Crystal oscillator must be compactly built to fit into limited space.

A SIMPLIFIED SIGNAL GENERATOR

By
H. G. PRATT, W8SEA

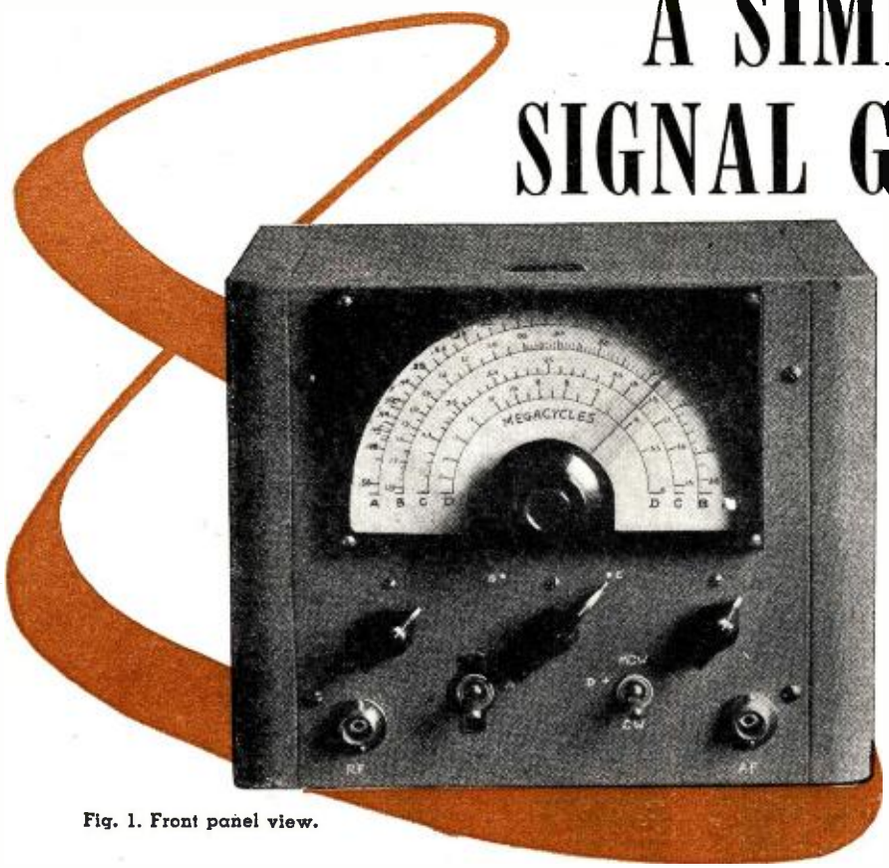


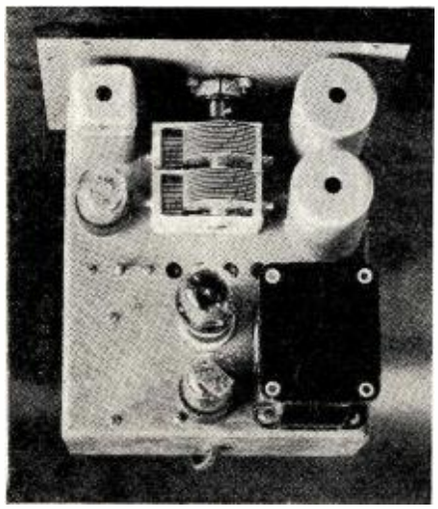
Fig. 1. Front panel view.

A low-cost signal generator that covers 170 kc. to 15 mc. in four bands. Separate audio signal is also available.

IN VIEW of the general scarcity of new test equipment, it is felt that many amateurs and servicemen will be interested in a description of a simple and economical signal generator.

As can be seen from the schematic (Fig. 3), the design is straightforward, including only the features that are essential to the average job of alignment and troubleshooting by the signal injection method.

Fig. 2. Top view shows parts layout.



One half of a 6SN7 tube serves as the r.f. oscillator in the conventional tuned grid oscillator circuit. Four coils, in conjunction with the two-gang variable condenser, are used to cover the range from 170 kc. to 15 mc. A three-gang rotary switch is used to select the desired coil. All coils are equipped with permeability tuning slugs and trimmer condensers. Determination of the frequency range for each coil resulted from the following reasoning. Band A should cover all intermediate frequencies commonly used in the average receiver. Recalling that several old sets using 175 kc. i.f. amplifiers are still in circulation, (those 1928 models that just won't give up) this coil is adjusted for a lower limit of 170 kc. With the tuning condenser specified, the high frequency end can be trimmed down to 500 kc., just to keep it in round numbers.

The second coil, for Band B, should cover the entire broadcast band for convenience in aligning the front end of broadcast receivers. As a single 240 $\mu\mu$fd. variable condenser will not cover this range easily, the second section of the dual condenser is connected in parallel on this band only. A single 365 $\mu\mu$fd. condenser could have been used instead, but would have reduced the bandspread on the higher frequency bands.

The third coil, used on Band C, is adjusted for a low frequency limit of 1500 kc., which allowed the high frequency end to be rounded off at 5 mc.

The fourth coil, designated Band D, is then adjusted for a low frequency limit of 5 mc. and the upper limit is about 15 mc.

Output from the oscillator is taken from the plate through an attenuator network and coupling condenser to the front panel *"R.F. Output"* jack. C_{10} at the output jack allows the generator to be connected to the plate of a receiver tube without using an external blocking condenser.

Audio Frequency Section

The second half of the 6SN7 is used as the audio oscillator and modulator. An audio transformer serves as a tuned grid circuit and feedback coil for this oscillator. Plate voltage for the r.f. oscillator is taken from the audio oscillator plate to produce a modulated output. S_2 opens the cathode circuit of the audio oscillator for unmodulated r.f. output. An audio coupling network and attenuator is incorporated to provide a variable a.f. signal at the front panel jack.

Power Supply

A transformer type power supply is used to avoid unhappy entanglements with a.c.-d.c. sets. As the current drain is low, a resistance-capacity filter is used. A VR150/30 tube is connected across the output, and greatly improves the oscillator stability.

Construction

Figs. 2 and 4 show the general location of component parts on the 7 x 7 inch chassis. The tuning condenser is mounted in the center, on top of the chassis, with the bandswitch directly below. The coils are mounted on either side of the tuning condenser, allowing easy wiring of the r.f. circuits. Four trimmer condensers, one for each coil, can be seen directly behind the tuning condenser. The 6SN7 tube is located near the tuning condenser, with the audio transformer on one side and the power supply on the other side. A fair degree of isolation is obtained by the location of parts, and by placing shields over the coils. The entire unit is housed in a metal cabinet to provide further shielding.

The oscillator coils are the only components that require special comment. L_1 and L_2 are both replacement windings for 455 kc. i.f. transformers, mounted on a polystyrene coil form, fitted with an adjustable powdered iron slug. The use of a tuning slug allows the inductance to be adjusted to the desired value without resorting to the tedious process of removing or adding turns to the coil. When first assembled, L_1 is cemented in place with coil dope, while L_2 is left free to slide on the form until the proper location is determined (as described under "Adjustments").

L_3 and L_4 make up the coil for Band B, and is one of the "universal replacement" broadcast band r.f. coils which comes equipped with a tuning slug. No modification need be made on this coil.

L_5 and L_6 are used on Band C. The grid coil (L_5) is wound with 85 turns of #28 enameled wire, closewound on a half inch form. The plate coil (L_6) consists of 60 turns of the same wire, jumble wound as shown in Fig. 5.

L_7 and L_8 are grid and plate coils for Band D. The grid coil is wound with 13 turns of #28 enameled wire, spaced one diameter between turns, on a half inch form. L_8 is separated ⅛" from the grid coil, and consists of 13 turns of #28 wire, closewound. This coil is also provided with a tuning slug for final adjustment.

The location of parts is such that short, direct leads may be used in the r.f. wiring, and shielded leads are not required. However, all leads in these circuits should be of solid wire which will not be easily jarred around, as any movement would otherwise cause an unstable signal and errors in calibration.

The dial used is one having a blank scale, upon which the final calibration may be marked with drawing ink.

Initial Adjustments

After wiring has been completed and checked, a few adjustments will be necessary before calibration is started. First remove the 6SN7 tube and connect a milliammeter in series with the VR tube (point "X," Fig. 3). As soon as the rectifier has warmed up, R_7 may be adjusted until the meter reads 25 to 30 ma. This adjustment is not critical, and is only to insure that the VR tube is operating within its ratings.

The next step is to check the r.f. oscillator on all four bands. With the 6SN7 in place, remove the shield from Coil A, and connect a milliammeter in the grid return of the r.f. oscillator (point "Y," Fig. 3). With the bandswitch on Band A, and the power turned on, oscillation will be indicated by a deflection of the meter. The position of L_2 may now be adjusted until grid current of about one ma. is obtained. Now rotate the tuning condenser from maximum to minimum while observing the grid current. If the current should drop to zero, coupling must be increased by moving L_2 closer to L_1. If the grid current tends to jump or become unstable (caused by the oscillator blocking or motorboating), coupling must be reduced by increasing the spacing between L_1 and L_2. It is to be expected that the grid current will change somewhat across the band due to the changing LC ratio, however, the fluctuations should be smooth and gradual. Abrupt changes, caused by overcoupling, indicate a change in mode of operation and must be avoided. Likewise, too little coupling will result in oscillation failing or becoming unstable over a portion of the band. After the proper location for L_2 is determined, it is cemented in place with coil dope and the shield replaced.

With the meter still in the grid circuit, check the operation of the remaining three bands by observing grid current as in the case of Band A. With the coils specified, no difficulty should be experienced. However, should there be an indication of improper coupling it may be corrected by either of the two general methods listed below.

To increase coupling: Move the grid and plate coils closer together or increase the number of turns on the plate coil.

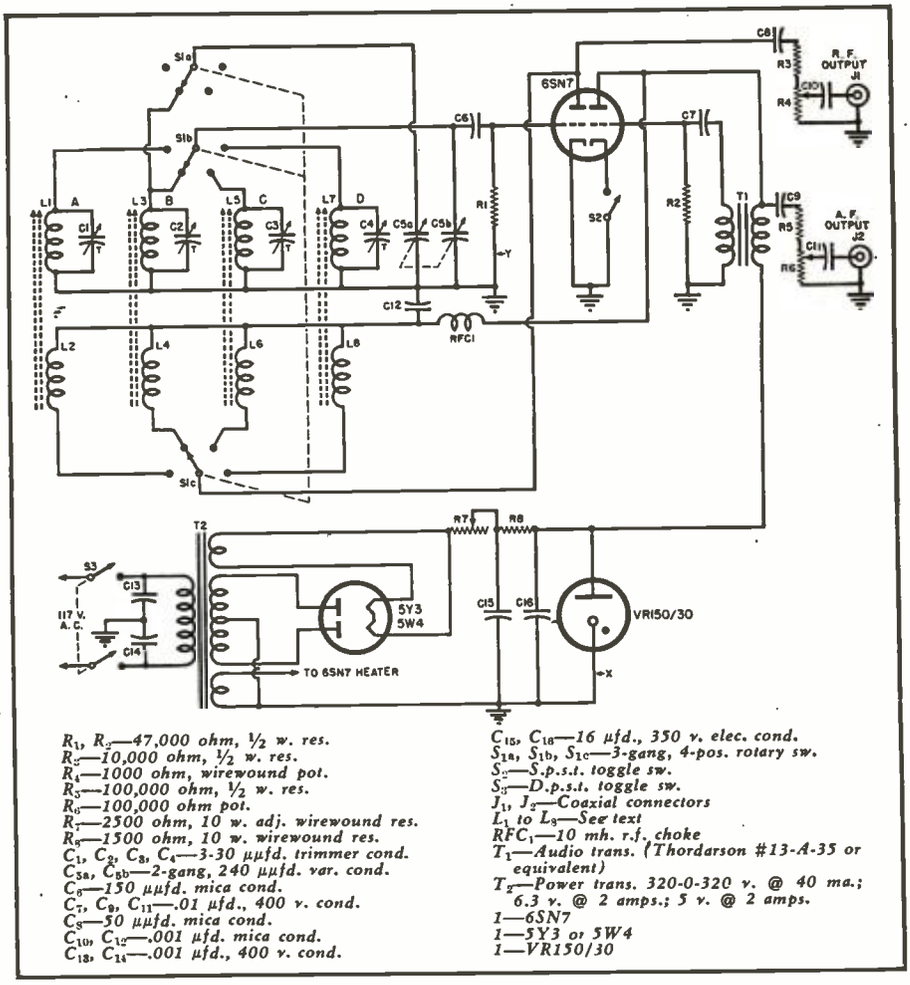
To reduce coupling: Move the coils farther apart, or decrease the number of turns in the plate coil.

Should one coil completely fail to oscillate at any point, it is advisable to check the wiring first, as no amount of coupling will cause oscillation if one of the coil connections is reversed.

Like most adjustments, these are easier to make than to describe, and actually not too critical. Any value of grid current from about ½ to a maximum of 5 mils will give satisfactory results.

The audio oscillator may be

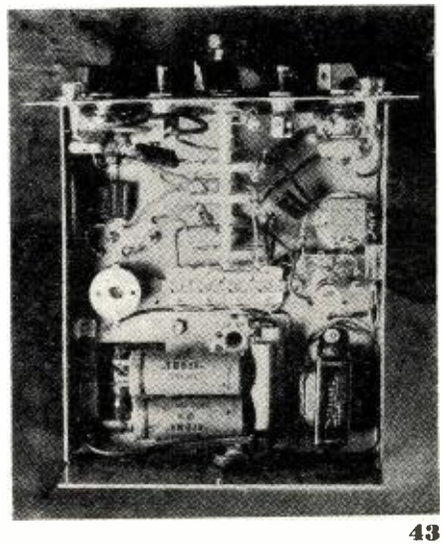
(*Continued on page* 176)



R_1, R_2—47,000 ohm, ½ w. res.
R_3—10,000 ohm, ½ w. res.
R_4—1000 ohm, wirewound pot.
R_5—100,000 ohm, ½ w. res.
R_6—100,000 ohm pot.
R_7—2500 ohm, 10 w. adj. wirewound res.
R_8—1500 ohm, 10 w. wirewound res.
C_1, C_2, C_3, C_4—3-30 μμfd. trimmer cond.
C_{5a}, C_{5b}—2-gang, 240 μμfd. var. cond.
C_6—150 μμfd. mica cond.
C_7, C_9, C_{11}—.01 μfd., 400 v. cond.
C_8—50 μμfd. mica cond.
C_{10}, C_{12}—.001 μfd. mica cond.
C_{13}, C_{14}—.001 μfd., 400 v. cond.
C_{15}, C_{16}—16 μfd., 350 v. elec. cond.
S_{1a}, S_{1b}, S_{1c}—3-gang, 4-pos. rotary sw.
S_2—S.p.s.t. toggle sw.
S_3—D.p.s.t. toggle sw.
J_1, J_2—Coaxial connectors
L_1 to L_8—See text
RFC_1—10 mh. r.f. choke
T_1—Audio trans. (Thordarson #13-A-35 or equivalent)
T_2—Power trans. 320-0-320 v. @ 40 ma.; 6.3 v. @ 2 amps.; 5 v. @ 2 amps.
1—6SN7
1—5Y3 or 5W4
1—VR150/30

Fig. 3. Schematic diagram of a.c. operated signal generator.

Fig. 4. Under chassis view.



10-METER MOBILE FM TRANSMITTER

By
RAY FRANK, W9JU
Associate Editor, RADIO NEWS

Construction details for a compact narrow-band FM rig with filament type tubes and stable oscillator.

Fig. 1. The completed rig, ready for installation. An idea of its size may be gained by comparison with a package of cigarettes.

THE use of amateur narrow-band FM has up until the present time generally been confined to fixed stations. Inasmuch as police and other emergency services have been using narrow-band FM with great success for several years, it was decided to try this type of modulation for amateur mobile work. The transmitter to be described is giving an excellent account of itself on 10-11 meters, in W9ETI's NBFM mobile installation.

There have been many different types of FM transmitters described in the various publications in the past few years. Some have used crystal control, while others have resorted to the v.f.o., modulated by a reactance tube. It was felt that the use of a v.f.o.-reactance tube type would offer greater versatility for mobile work as it is easily possible to QSY to get away from interference.

One of the difficulties of the v.f.o. type is the attainment of the necessary stability of the oscillator, under the extreme vibration encountered in this type of service. In addition, to keep the rig simple, the output of the oscillator must be relatively high to keep the number of stages to a minimum.

The completed rig, exclusive of the power supply, is illustrated in Fig. 1. The case used is a standard 4 by 5 by 6 inch box. The small size is deliberate to allow the placing of the rig in almost any location in the car. Components used, however, are all standard, and there is no noticeable loss of efficiency, or undue crowding.

The lineup consists of a 2E30, used as an oscillator, a 2E30 tripler, and a 5516 final amplifier. An 0A2 voltage regulator is used to hold the voltage constant on the oscillator and reactance tube. Modulation is supplied by a 9001 used as a reactance tube.

There is no battery drain, except that of the 9001 heater, until the microphone switch is closed. This results in a great saving of power during listening periods.

A 2E30 was tried in place of the 9001 reactance tube, in an effort to reduce the battery drain to zero during standby periods, but the characteristics of this tube are such that satisfactory performance could not be obtained. Unfortunately, none of the filament type tubes available in miniature sizes have characteristics suitable for this application.

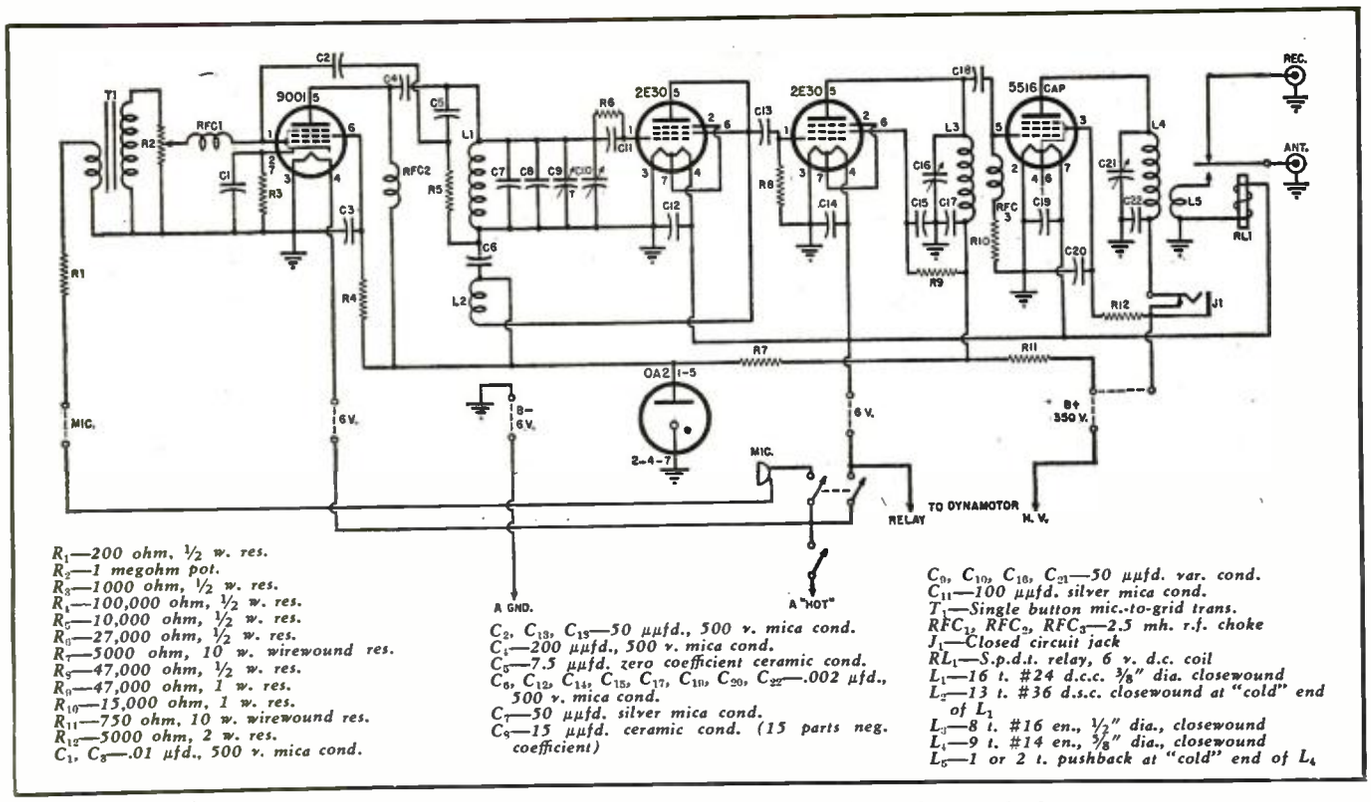
A chassis measuring 3¾ inches wide, 5 inches long, and 2 inches deep is formed from scrap aluminum. The microphone transformer T_1 is mounted in the right center, with the four miniature tubes grouped about it. The top view of the chassis, Fig. 4, clearly shows this placement. The 9001 reactance tube is mounted at the right lower corner, with the 2E30 oscillator near the front panel. The oscillator coil, L_1 L_2, is mounted below the chassis between these two tubes.

To the left of the transformer are mounted the 0A2 regulator tube along the rear edge, and the 2E30 tripler in the front center. The final tank coil L_4 L_5 and the final tuning condenser C_{21} are mounted to the left of the doubler. The final tube is located at the left center, with the antenna relay RL_1 in the lower left corner.

In the under chassis view, Fig. 3, parts are shown located to afford the shortest leads. The bandset condenser C_9 is mounted along the left edge of the chassis by means of a small bracket, and once set, need not be touched again. A plug button in the side of the case allows this condenser to be adjusted after the transmitter is placed in the case, if necessary.

No audio stage is used, the microphone transformer feeding directly into the grid of the reactance tube. Deviation is controlled by means of a one megohm potentiometer R_2. As this control need not be changed once set, it is mounted along the rear edge of the chassis and a screwdriver slot is cut in the end of the shaft.

The tuning condenser for the oscil-



R_1—200 ohm, ½ w. res.
R_2—1 megohm pot.
R_3—1000 ohm, ½ w. res.
R_4—100,000 ohm, ½ w. res.
R_5—10,000 ohm, ½ w. res.
R_6—27,000 ohm, ½ w. res.
R_7—5000 ohm, 10 w. wirewound res.
R_8—47,000 ohm, ½ w. res.
R_9—47,000 ohm, 1 w. res.
R_{10}—15,000 ohm, 1 w. res.
R_{11}—750 ohm, 10 w. wirewound res.
R_{12}—5000 ohm, 2 w. res.
C_1, C_3—.01 µfd., 500 v. mica cond.
C_2, C_{13}, C_{19}—50 µµfd., 500 v. mica cond.
C_4—200 µµfd., 500 v. mica cond.
C_5—7.5 µµfd. zero coefficient ceramic cond.
C_6, C_{12}, C_{14}, C_{15}, C_{17}, C_{18}, C_{20}, C_{22}—.002 µfd., 500 v. mica cond.
C_7—50 µµfd. silver mica cond.
C_8—15 µµfd. ceramic cond. (15 parts neg. coefficient)
C_9, C_{10}, C_{16}, C_{21}—50 µµfd. var. cond.
C_{11}—100 µµfd. silver mica cond.
T_1—Single button mic.-to-grid trans.
RFC_1, RFC_2, RFC_3—2.5 mh. r.f. choke
J_1—Closed circuit jack
RL_1—S.p.d.t. relay, 6 v. d.c. coil
L_1—16 t. #24 d.c.c. ⅜" dia. closewound
L_2—13 t. #36 d.s.c. closewound at "cold" end of L_1
L_3—8 t. #16 en., ½" dia., closewound
L_4—9 t. #14 en., ⅝" dia., closewound
L_5—1 or 2 t. pushback at "cold" end of L_4

Fig. 2. Schematic diagram of the complete rig. A suggested control system is shown.

lator C_{10} and the tripler plate condenser C_{16} are mounted at the left side and center respectively, of the chassis. A closed circuit jack J_1 is mounted at the right hand side to permit measuring the final plate current.

The oscillator coil is wound on a ⅜ inch diameter ceramic form, salvaged from a piece of surplus equipment. It is desirable to use a ceramic form in this position as the change in dimensions with temperature change is negligible. This results in much better frequency stability. A pillar type standoff insulator may be used if a coil form is not available.

The tripler tank coil, L_3, is wound on a piece of ½ inch diameter polystyrene rod and is located just to the right of the tripler plate condenser.

To allow the shafts of the tuning condensers to be at ground potential the "cold" ends of the tripler and final tank coils are connected to the condensers by means of bypass condensers, rather than direct. It is desirable to use mica condensers in these positions to keep the losses low.

All variable condensers used were of the APC type. The particular ones used are equipped with locking nuts, although this is not necessary. The condenser used for oscillator tuning, C_{10}, has a ¼ inch shaft, which permits the attachment of a small dial. This dial is equipped with a lock to insure against accidental movement.

The two voltage dropping resistors R_7 and R_{11} are mounted under the chassis as far from the oscillator components as possible. It would probably be preferable to mount these units above the chassis to eliminate as much heat as possible from under the chassis.

Wiring of all components associated with the oscillator section should be very rigid. Any mechanical movement of parts in this section of the transmitter will have a serious effect on the frequency.

It was decided at the outset, that inasmuch as FM is also allowed on the 11 meter band, that the transmitter should be capable of operation on this band as well as ten meters. The oscillator works on one third the output frequency, so, in order to cover the range of 27,160 kc. to 29,700 kc., a

(*Continued on page* 124)

Fig. 3. Bottom view of the chassis. The bandset condenser is located at the left hand side and mounted by a small bracket.

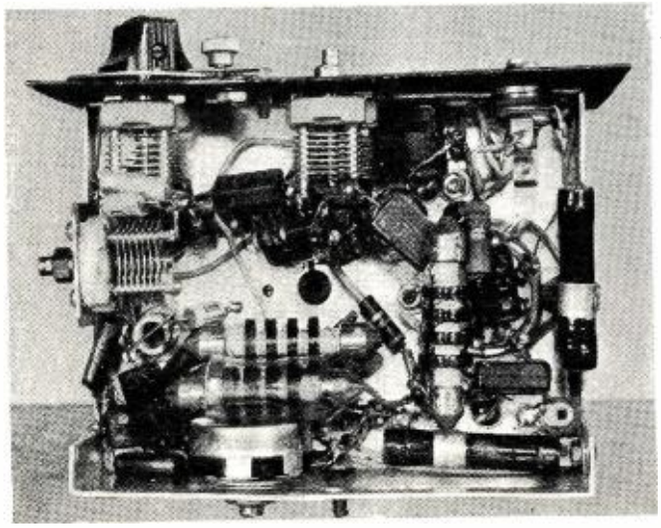
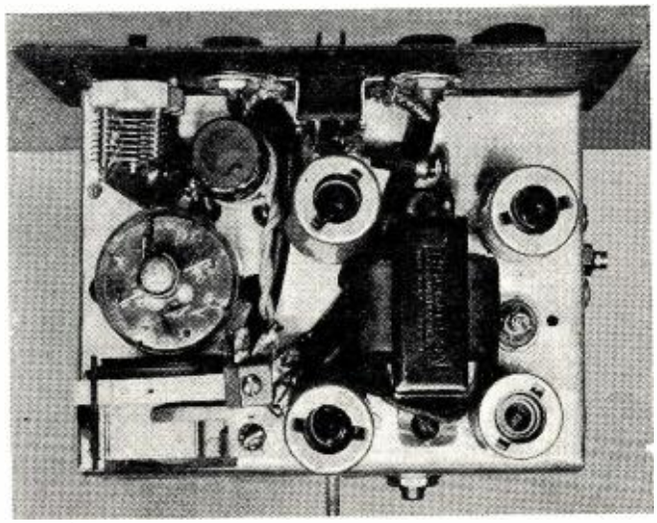


Fig. 4. The four miniature tubes are grouped around transformer, T1, with antenna relay mounted below the final.



Television CAMERA TUBES

By
HENRY J. SEITZ

The RCA image orthicon shown makes possible round-the-clock television coverage of news and special events. It picks up scenes in candlelight and semi-darkness and paves the way for practical outdoor TV programming.

A review of the many basic principles that are applied in the design of camera tubes.

MANY interesting principles, scientific as well as electronic, are embodied in the action of an ordinary television camera tube. Physicists, chemists, and electronic engineers have combined both their talents and skills in the production of this most marvelous device.

Heinrich Hertz, the German physicist, in experiments conducted about 1880 first demonstrated what is today known as the photoelectric effect. He found that an electric spark could be made to jump more rapidly between spark-gap electrodes if one of them was more brightly illuminated than the other.

Max Planck, whose name is synonymous with the well-known mathematical constant, developed the idea that the energy inherent in light is accumulated into small bundles or quanta. Einstein, in 1905, gave increased credibility to the photoelectric theory by further elaboration upon the above concept.

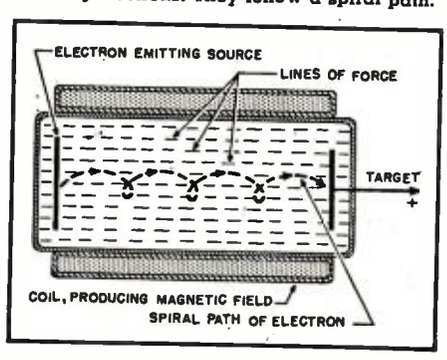
The amount of energy required to tear an electron away from its parent atom is dependent not only upon certain characteristics of the atom in question but also upon the quanta of applied light. The energy contained within a quantum of light or *photon*, as it is more commonly called, is proportional to its frequency and is expressed by the equation $E=hf$, Planck's constant h being equal to 6.55×10^{-34} joule-second, and f the frequency.

Sir J. J. Thompson, a British physicist whose research into the nature and qualities of electron particles has immeasurably enriched both the knowledge and practical application of television, proved conclusively by means of electrostatic and magnetic fields that electrons are negative particles and can therefore be influenced or deflected.

A fundamental rule of electron physics states that a magnetic field has the same effect upon a stream of electrons in free space as it has upon a wire or line carrying the equivalent of current. Another and quite important principle to bear in mind is that while an electrostatic field will deflect electrons along its lines of force, a magnetic field will deflect them perpendicularly to its lines of force.

Speeding electrons, when under the influence of a magnetic field, will proceed towards their destination in a somewhat spiral or corkscrew fashion. (See Fig. 1.) In the basic image dissector, for instance, it has been possible through the use of advanced mathematics to prove that the electrons comprising the image do rotate through a certain angle. This, however, does not cause distortion inasmuch as the entire electron image is rotated as a whole. For the purposes of future discussion we shall therefore assume that electrons in motion, unless influenced otherwise, travel in straight lines from source to target.

Fig. 1. The effect of magnetic field on moving electrons. They follow a spiral path.



First proposed by Carey, Rignoux and Fournier in 1906 developed what might be called the first television mosaic. Their rather crude device consisted of banks of horizontal and vertical photosensitive selenium cells each of which was individually connected by means of a wire to shutters on a viewing screen. However inefficient from present day standards, simple patterns and letters were transmitted by means of this device.

The transmission and assembly of a single picture element was brought forth by Nipkow in 1884. However due to insufficient knowledge and techniques in handling small signal voltages, the scanning disc point-by-point transmission method was forced to await later and more favorable developments in the field of signal amplification.

Exceptional progress in the field of all electronic television closely followed the discoveries of the German scientist, Von Ardenne, in 1930. During these same thirties the "eyes" of American television developed, thanks to the contributions of Dr. V. K. Zworykin and Philo T. Farnsworth. Each of these progressive minds working independently brought forth his own type of camera tube, namely, the

iconoscope of Dr. Zworykin and the *image dissector* of Farnsworth.

Many of the principles which were previously mentioned, find good application in the Farnsworth image dissector shown in Fig. 2. The tube itself consists of an evacuated glass cylinder approximately four and one-half inches in diameter, one end of which is occupied by the photosensitive cathode. A shielded target, containing a small aperture, connects directly to an electron multiplier located near the other end. A nickel coating on the tube's inner surface between the photocathode and target serves as the anode.

By means of a focusing lens an electron image is formed upon the photosensitive cathode, which, in effect, corresponds to the distribution of light and shade on the person or scene being televised. An axial magnetic field, in combination with the positive anode, forces the electron image towards the target aperture.

Transverse magnetic fields produced by coils external to the tube cause a planar deflection of the image horizontally as well as vertically. Separate low and high frequency linear saw-tooth currents make the image pass before the aperture in a series of 525 interlaced lines 30 times per second. In this way tiny areas of the image are progressively selected and passed on to the first section of the electron multiplier.

In operation, electron multipliers are, in effect, somewhat unusual in that the secondary emission characteristics of a series of increased potential anodes are used to excellent advantage. Multiplier action is based on the fact that a greater number of secondary electrons are dislodged than the incident or primary electrons engaged in the act of bombarding. Consequently this gives rise to tremendous amplification.

Multiplier gain may be calculated easily by means of the following formula: $I = I_o S^n$ where:

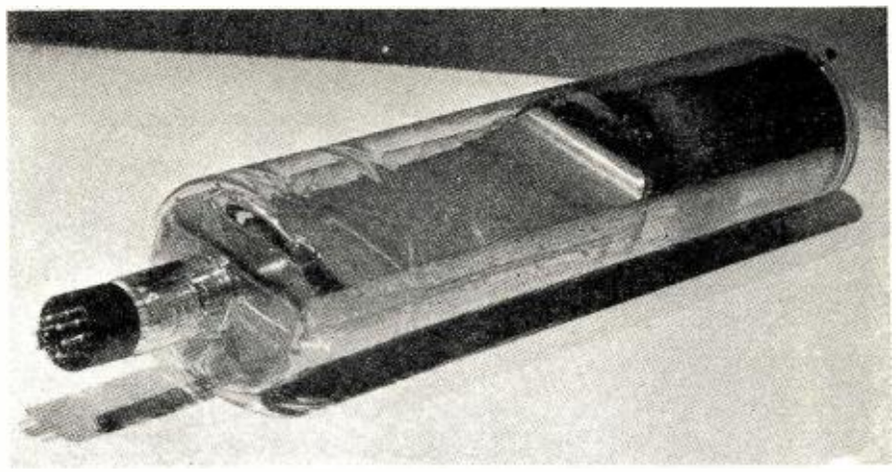
I = multiplier output current
I_o = photo-current passing thru image aperture
S = multiplier secondary emission ratio
n = number of stages

Close examination of the mosaic of a standard type of iconoscope, shown in Fig. 3, would reveal that it is composed of innumerable small silver globules distributed rather uniformly upon a thin sheet of mica. Light responsiveness is accomplished through the use of ingenious manufacturing controls which permit the addition of photo-sensitive elements. In most cases vaporization accounts for a thin film of caesium being deposited on the surface of the tiny silver globules.

Separated from each other and insulated by the mica sheet, each of these minute globules may be thought of as tiny individualized light sensitive condensers. Disproportionate charges are quickly accumulated when light from a televised object or scene is projected upon them by means of lenses. The charge may be said to increase as the illumination persists or grows in intensity.

A thin film of conducting material, which also serves as a transmission medium, covers the back of the mosaic plate described. Signal currents generated during scanning action are passed from this point to the input of the picture amplifier.

An electron gun located in the base of the iconoscope produces what might aptly be termed "impact electrons." Concentrated into a fine needle-like beam they are then accelerated towards and against the mosaic target. In these days of jet propulsion, rockets, and supersonic speeds, one is, to



The orthicon tube. Its mosaic differs from that of the iconoscope in that the back area is covered with a translucent conducting film, on which the picture is focused.

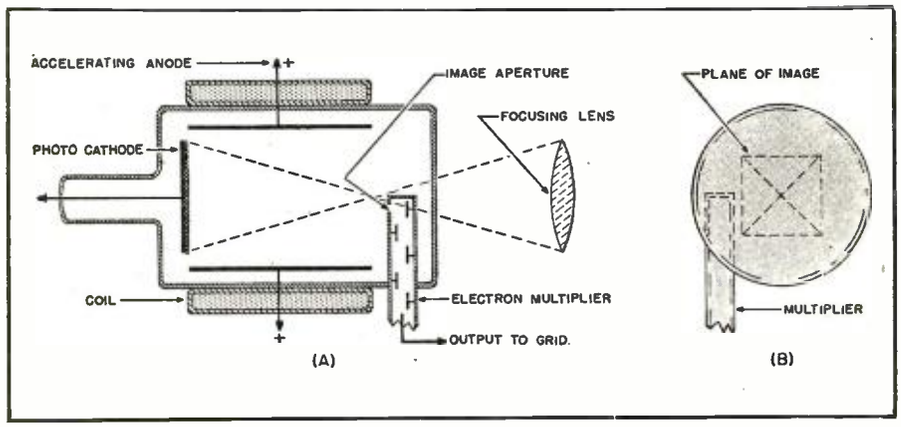
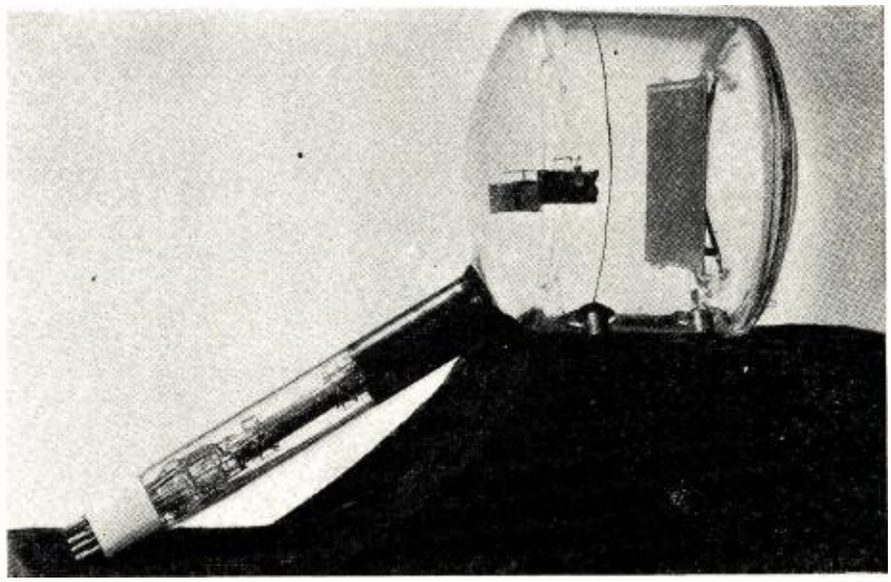


Fig. 2. Diagram illustrates the basic operation of the image dissector tube.

The iconoscope tube is widely used in television broadcasting work.



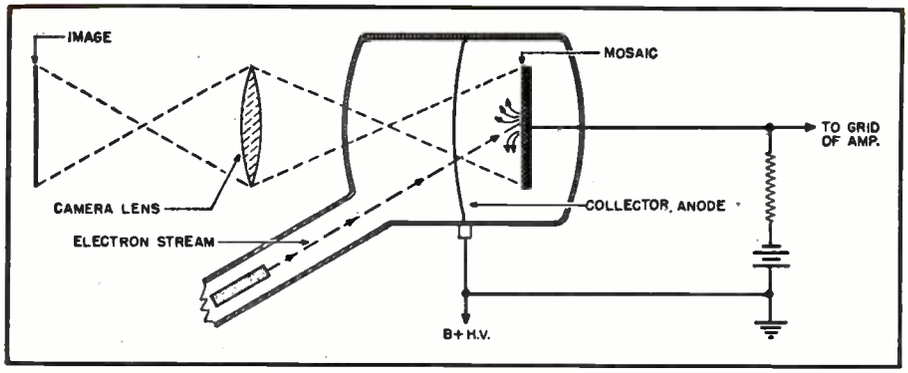


Fig. 3. Diagram illustrates the basic operation of the iconoscope tube.

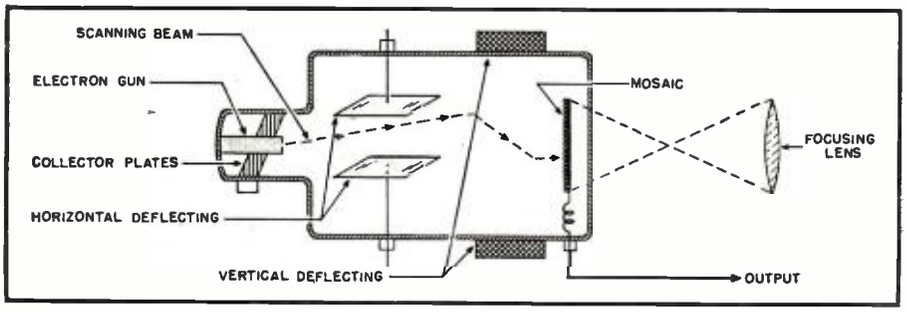


Fig. 4. Operation of orthicon tube is illustrated.

put it mildly, staggered at the velocities these infinitesimal particles attain. Assuming an accelerating voltage of, say, 10,000, these impact electrons merely lope along at 5.86 x 10^9 centimeters per second.

Some form of controlling action must be devised if the mosaic is to be scanned according to standard practices. Recollecting the earlier experiments of Thompson, it becomes necessary to devise either electric or magnetic fields of force to accomplish this.

Many important considerations must be borne in mind when designing technical equipment relative to force fields. Not only does electron velocity play an important part, but, in addition, a continuous changing force potential must be maintained as the beam is swept across a mosaic line. Some means of instantaneous force reversal is also required in order to rapidly move the beam during retrace to the start of the next line. From this explanation it is apparent that two such fields are necessary—one for influencing the scanning beam in a horizontal direction, the other in a vertical.

The solution to the problem is, however, not quite this simple as the mosaic reacts unfavorably under the influence of the scanning beam. Secondary electrons in great quantity are being emitted and they form an electron cloud which must be dissipated in one way or another.

These electrons may, in some cases, return directly to the globules from which they were ejected. However, should they venture to other parts of the mosaic, a spurious signal is generated which must be compensated for along the television camera chain.

Operating at a high positive potential, modern type iconoscopes employ what is termed a collector anode. This ring-like conductive coating which, in cooperation with the mosaic, is responsible for the iconoscope's output, is located a short distance from the mosaic.

A goodly portion of the secondary electrons are attracted to this anode, providing a return path between the globules and the mosaic coating.

The camera tube mosaic is at this point functioning properly. Scientific analysis of mosaic action is rather complex, but reduced to fundamentals, the action is this; the electrical charge deficiency, previously predominant on each globule, has now been restored to equilibrium through the scanning beam's action. During this process the tiny condensers comprising the mosaic's surface have discharged individually, each contributing its pulse of current towards the generation of the over-all signal.

Additional development work by television engineers finally resulted in a camera tube which reduced to a negligible degree the spurious effects of secondary electron emission. Experimentation further revealed that the use of low velocity scanning electrons produced no recognizable secondary emission effects.

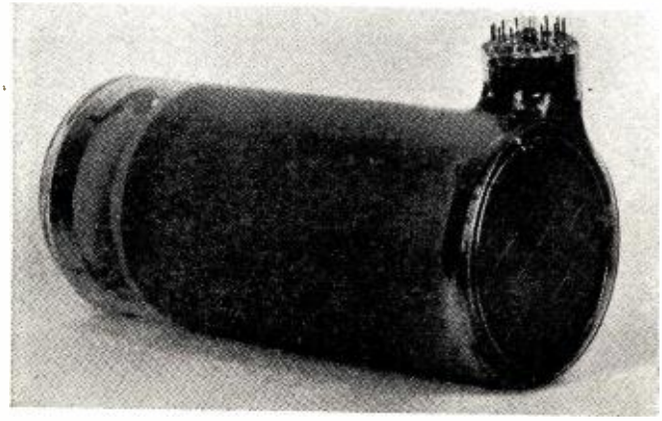
The beneficial signal producing effects of the secondary electrons must, however, be accounted for and, accordingly, some means must be devised to compensate for this deficiency. In the ortho-iconoscope (orthicon) a linear output is obtained by collecting the effects of low velocity scanning electrons. See Fig. 4.

Try to visualize a stream of electrons moving towards the mosaic at a fairly low rate of speed. Some of them, corresponding to the charge deficiency on the globules they contact, are naturally absorbed. Others are turned away and according to orthicon theory they return to a collector plate by paths which are more or less parellel to their original routes.

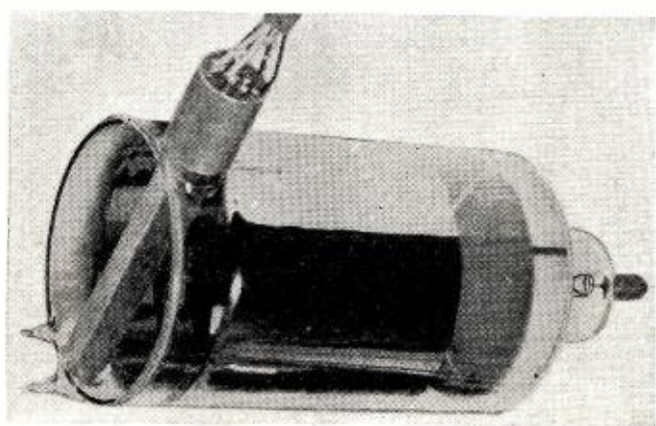
An orthicon mosaic differs somewhat from that of an iconoscope, in that its back area is covered with a translucent conducting film. The picture to be transmitted is focused upon this. As in the case of the iconoscope, photoelectrons are released to await the action of the scanning beam.

(*Continued on page* 186)

Present Farnsworth image dissector television tube.

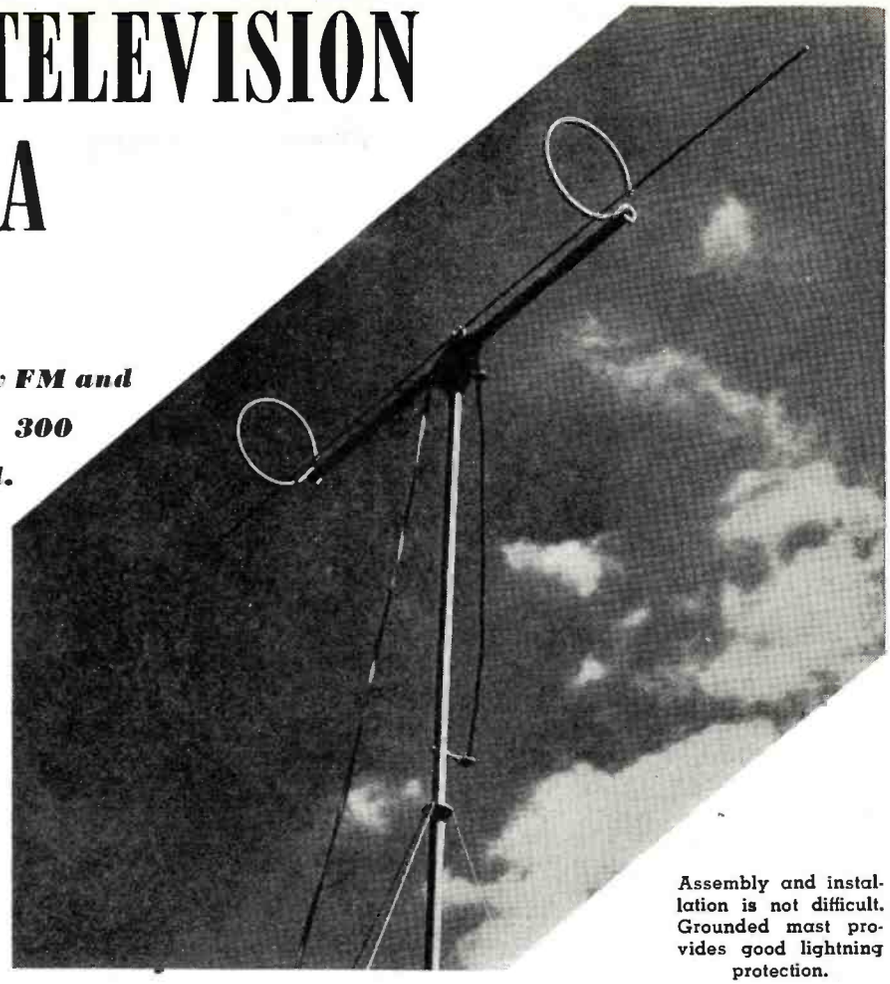


Early d.c. type image dissector tube used in 1936-37.



ALL-WAVE TELEVISION FM ANTENNA

Single antenna that covers new FM and both TV bands. A standard 300 ohm transmission line is used.



Assembly and installation is not difficult. Grounded mast provides good lightning protection.

WITH the production of television receivers hitting an all-time high, one of the most urgent requirements of the industry has become the production of suitable television antennas for all types of video installations.

One of the recently introduced antenna units consists of a relatively thin dipole which is a half-wave long at 70 mc. placed near a relatively thicker dipole which is a half-wave long at 128 mc.

The short, thick dipole is connected at its end through inductive rings to the approximate mid-points of the thin, long dipole section. These rings, besides end-feeding the short dipole, give mechanical support to the thin dipole. In the lower television band, the antenna acts as a broad-band folded dipole resonant at approximately 65 mc., with the thin member resonant at approximately this frequency and the short, heavy member end-loaded by the inductive rings at its ends.

In the higher television band, the long, thin dipole is one and one-half wavelengths in the center of the band, and the short member is end-fed by means of the inductive rings connecting it to the long member in such a manner that currents flow in the two dipoles approximately in-phase, thus substantially raising the radiation resistance of the antenna above a one and one-half wavelength dipole.

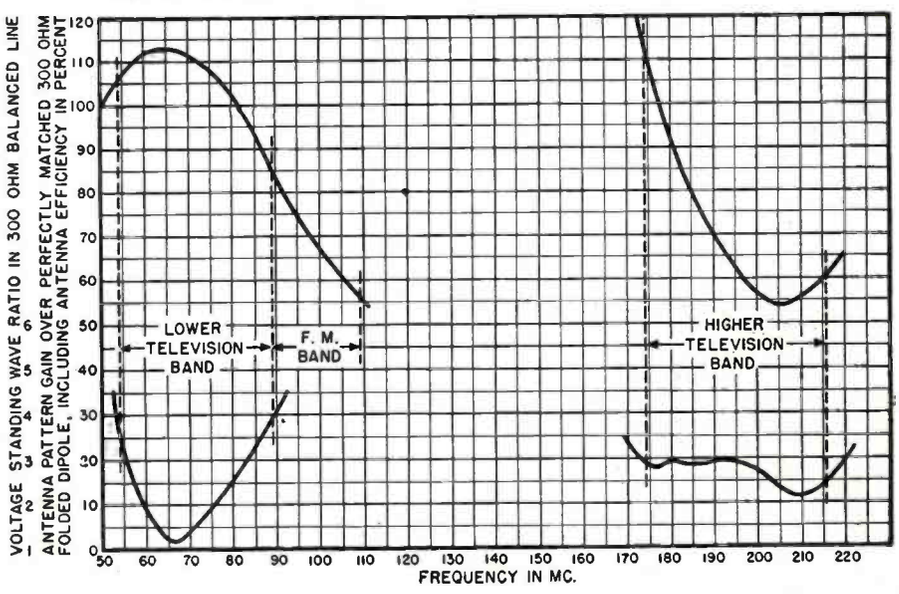
The most important performance characteristic of this unit is the relative impedance match between the antenna and its associated transmission line. A mismatch between the antenna and the transmission line results in a loss of signal but more important is the possible production of reflected images if the receiver match to the transmission line is imperfect.

A good criterion of the degree of match between the antenna and the transmission line is indicated by the standing wave ratio of the current or voltage along the transmission line when terminated by the antenna. This characteristic is shown in Fig. 1. It should be noted that the standing wave ratio is 4:1 or less in the low television band and under 2.8:1 in the high television band. The ideal standing wave ratio would, of course, be 1:1, but even with a ratio of 4:1, the energy loss, or the energy reflected, is only 36% and when it is considered that the reflection at the antenna is the second reflection in the production of a second image, it may be seen that this magnitude of reflected signal is very low.

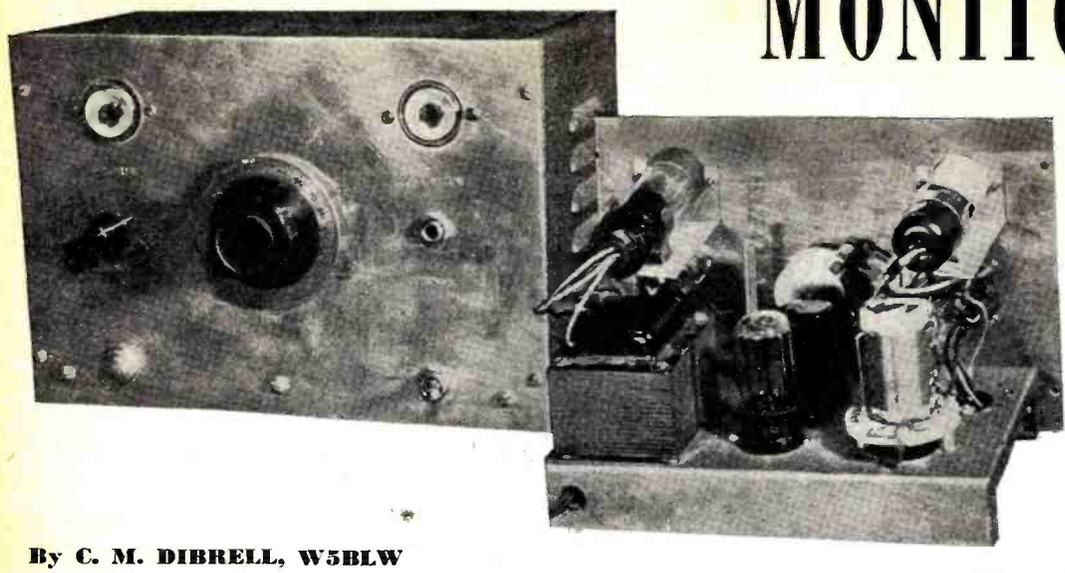
The loss in power resulting from the mismatch between the antenna

(*Continued on page* 197)

Fig. 1. Performance curves of all-wave FM and television antenna.



Easy-to-Build MODULATION MONITOR



Front and rear view of the home-built modulator unit. Most of the component parts are readily available from the junkbox. The vertical shaft directly over the glass rectifier tube (rear view) is the calibration control, R_1. It is placed inside since it is adjusted during calibration only.

By C. M. DIBRELL, W5BLW

The use of electronic tuning eyes to indicate both carrier level and 100% modulation reduces construction cost.

THE modulation meter to be described here was designed to register peaks of speech modulation by means of an eye tube. Because this type of indicator has no inertia it is superior for this type of application to the usual type of meter used for this purpose. With a meter type modulation monitor the meter is adjusted to read 100 per-cent for a steady tone input to the transmitter modulator while it is modulating 100 per-cent. For speech modulation it is customary to keep the meter reading around 80 in order to take care of those peaks that the meter does not register.

For amateur use, where indication of 100 per-cent modulation is the main requirement, and indications of lower percentages of modulation are not very useful, an instrument using eye electron-ray tubes is a very useful piece of equipment.

One eye tube is used to indicate a reference level of r.f. signal fed into the monitor from the transmitter and the other eye tube is used to indicate when 100 per-cent modulation exists.

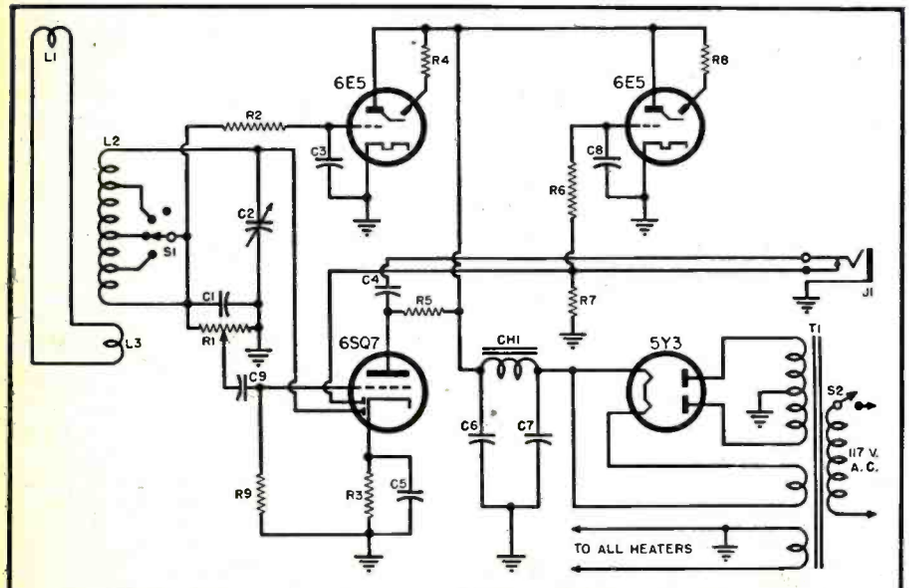
The circuit is simple. A pick-up coil, L_1, is mounted in inductive relation to the final amplifier tank circuit and the signal picked up is fed through twin-lead 75 ohm cable to L_2 of the modulation monitor. C_2, L_2 serves to tune the input signal to resonance and feed one diode of the 6SQ7 tube. The rectified r.f. signal develops a d.c. voltage across R_1. This d.c. voltage is then fed through filter resistor R_2 to the control grid of the *"Carrier"* eye tube. C_2 is adjusted so that the eye tube just closes, thus establishing a reference level of r.f. signal input.

The audio component of the input signal is coupled through potentiometer R_1 and C_9 to the grid of the triode section of the 6SQ7. Output of the 6SQ7 plate circuit is coupled through monitor jack, J_1, to another diode of the 6SQ7 which serves to rectify the audio voltage. This produces a d.c. voltage which varies with modulation and is then coupled to the control grid of the *"Modulation"* eye tube through the delay circuit, R_6, C_8.

After the instrument has been calibrated, operation of the unit is simple. Merely adjust bandswitch S_1 to the desired band. Then adjust C_2 until the *"Carrier"* eye just closes. Now, when speaking into the microphone, the *"Modulation"* eye tube will indicate

(*Continued on page* 188)

Complete schematic diagram of a.c. operated modulation monitor.



R_1—.5 megohm pot.
R_2, R_4, R_7, R_8, R_9—1 megohm, ½ w. res.
R_3—1000 ohm, ½ w. res.
R_5—270,000 ohm, ½ w. res.
R_6—3.3 megohm, ½ w. res.
C_1—100 μμfd. mica cond.
C_2—100 μμfd. var. cond.
C_3, C_4, C_8—.02 μfd., 400 v. cond.
C_5—10 μfd., 25 v. cond.
C_6, C_7—8 μfd., 350 v. elec. cond.
C_9—.01 μfd., 400 v. cond.
J_1—Closed circuit jack
S_1—4-pos., single-pole rotary sw.
S_2—S.p.s.t. toggle sw.
T_1—Power trans. 300-0-300 v. @ 40 ma.; 6.3 v. @ 2 amps.; 5 v. @ 2 amps.
CH_1—Filter choke, 400 ohms @ 40 ma.
L_1—4 t. link pickup coil
L_2—40 t. #24 en. closewound on 1½" form tapped 20, 10, 5 turns from bottom
L_3—3 t. link, wound ¼" below L_2
2—6E5 tubes
1—5Y3 tube
1—6SQ7 tube

Brush PL25 crystal pickup uses correctly balanced offset cartridge.

The Recording and Reproduction of SOUND

By OLIVER READ
Editor, RADIO NEWS

Part 8. A discussion of representative crystal cartridges and the various methods of coupling which may be used to give best reproduction.

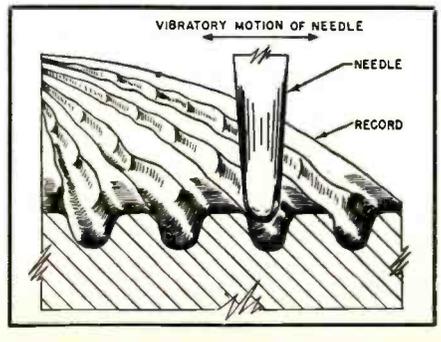
ONE of the greatest contributing factors to the successful reproduction of voice and music through electronic systems is the development of the modern pickup. These units are found in a variety of shapes and sizes and are usually divided into the following classifications; 1. magnetic, 2. crystal, and 3. moving coil. It should be explained, however, that there are many varieties and versions of each. From the most inexpensive type commonly employed in the average home phonograph, to the elaborate precision made instruments designed specifically for broadcast and high fidelity recording and reproduction, we find various shapes, sizes, etc., in use.

Since around 1930, the electric phonograph and radio-phonograph combinations for homes have appeared on the market in ever increasing numbers. Performance has steadily improved through the years to such a degree that reproduction of recorded sound today leaves little to be desired.

The success of these devices, as far as home recording is concerned, is due largely to the development and improvement of pickup cartridges using crystal elements of Rochelle salts (sodium potassium tartrate). The use of this substance has resulted in improvements such as decreased needle pressure, higher output voltage, and wider frequency response.

The home recorder may employ an inexpensive preamplifier and omit complicated equalizers in conjunction with the modern crystal phono pickup and still obtain satisfactory reproduction of commercial records. The voltage developed by crystal cartridges of this type is sufficient to enable them to perform satisfactorily with ordinary low gain type amplifiers. The comparatively low cost of crystal phono cartridges, together with their other advantages, has permitted radio and phonograph manufacturers to produce equipment for home use priced within the means of almost everyone.

Fig. 1. Greatly enlarged cross-sectional view shows needle following record grooves.



The Crystal Pickup

Back in 1880, Madame Curie, working with her husband, discovered that certain crystals would develop electrical charges on their surfaces when subjected to mechanical stresses. This phenomenon became known as the piezoelectric effect (electricity developed due to pressure or torsion). This is the principle upon which a crystal pickup cartridge functions.

The needle, following the groove of a record upon which sound has been recorded, is vibrated in proportion to the amplitude of the recorded sound. See Fig. 1. This vibration is imparted to the crystal element through a needle chuck or torque wire assembly or variations thereof. The illustration, Fig. 2, shows the construction of a low needle pressure type cartridge and a conventional removable needle type cartridge.

In both of these types a torsional crystal element (twister) is used and is so mounted that the needle vibration imparts torsional forces to the crystal element. The motion of the

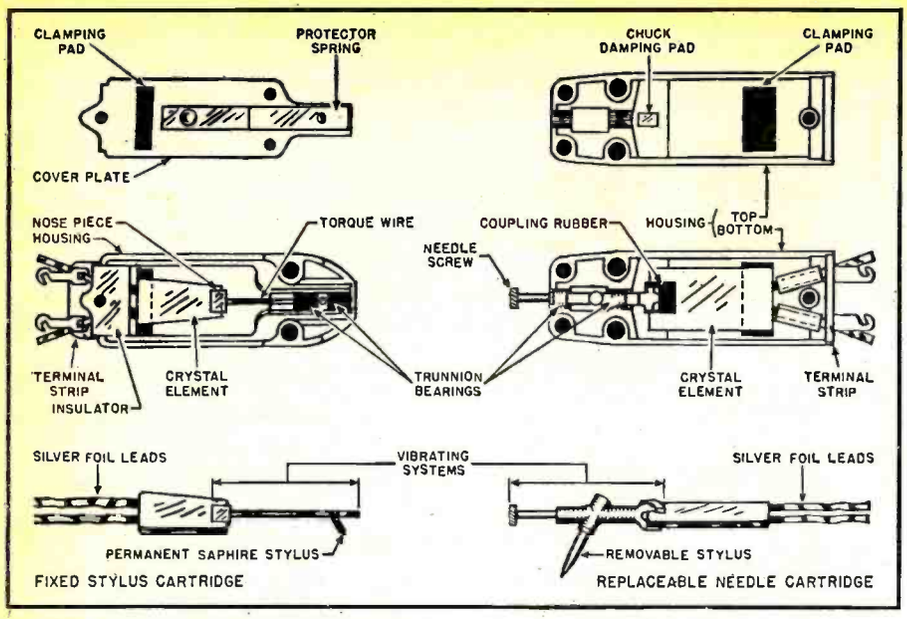


Fig. 2. Note the differences in construction between the fixed needle (left) and the replaceable needle (right) cartridge.

vibrating system is almost entirely absorbed by the twisting of the torque wire in the low pressure cartridges and the flexing of the coupling rubber in the conventional type so that the crystal, practically speaking, does not vibrate. However, the flexing of the torque wire or coupling rubber applies forces to the crystal directly proportional to the needle motion. The crystal generates voltages corresponding to these forces. Various types of rubber and other damping materials, such as Viscoloy, etc., are used for controlling output voltage, frequency response and other characteristics.

Crystal cartridges are made in a great number of styles with a wide variety of electrical characteristics in order to accommodate a multitude of various applications. The size, shape, and required needle pressure of a cartridge has a great deal to do with the styling of the pickup arm. The output voltage and frequency range of the cartridge are factors taken into consideration by equipment manufacturers when they are designing the amplifier and speaker combination with which the cartridge is to be used. Much time is spent on the circuit design of an amplifier, and a crystal cartridge used for reproduction of records becomes one of the basic components of the amplifier input circuit.

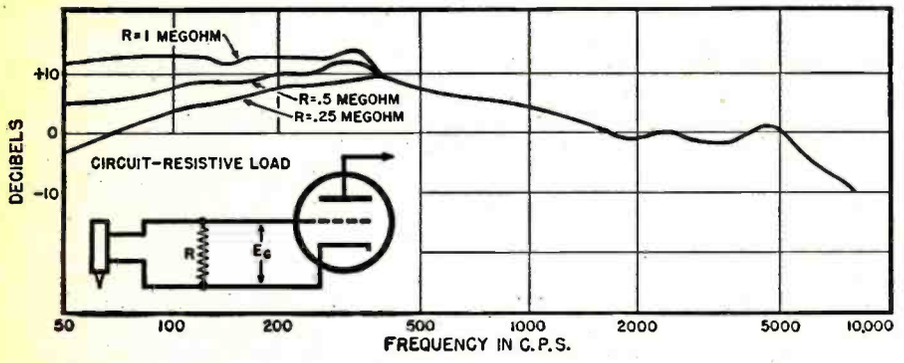
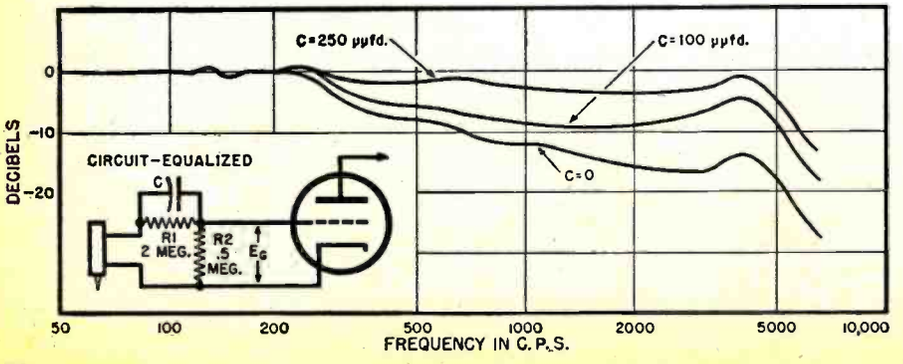


Fig. 3. Decreasing the value of R decreases bass response. A .5 megohm load is normal.

Fig. 4. Improved equalization is afforded by adding the RC circuit shown in the inset.



It is well-known that the various components of any circuit cannot be replaced with any but those of like characteristics without disturbing the circuit balance or changing the performance of the equipment. When it becomes necessary to replace a crystal phonograph cartridge, this should be done with an exact duplicate or substitute of the original in order to obtain optimum results.

Requirements

The technical specifications for pickups and cartridges should be consulted prior to making selections or recommendations. Information concerning output voltage, needle pressure, and frequency range is of particular interest and value. Selection of the proper pickup and accurate installation will determine to a great extent the type of reproduction which may be obtained.

Great care should be exercised when installing a pickup arm to make sure that the motor board is perfectly level and that the pickup is mounted squarely, that is, on a direct plane with the surface of the record. Otherwise the needle will not properly track the record grooves. This would cause excessive needle and record wear. If the amplifier with which the pickup is to be used is of the high-gain, high-output type and it is necessary that the volume be kept at high level, it may be advisable to install a pickup and turntable mechanism in a compartment or cabinet separate from the speaker, in order to prevent feedback.

Certain types of turntable motors may cause a considerable amount of turntable vibration which may produce a disagreeable rumbling noise. Before installing a pickup on the motor board of a turntable using such a motor, the direction of maximum vibration should be determined. Following this, the pickup arm should then be installed so that it is parallel with the vibrating motion. Observance of this precaution will do much toward preventing this rumbling.

Equalizers for Crystal Phonograph Pickups

It is sometimes advisable and often necessary, due to the many individual tastes involved, that an equalizer be employed in the input circuit of an amplifier in series with the phonograph pickup in order that the response of the pickup be entirely satisfactory to the listener. This is especially true of radio receivers or amplifiers which were not originally designed for phonograph operation. An understanding of the proper application of equalizers, to be covered later, is of great help to the serviceman called in for consultation and advice by the listeners whose equipment does not have enough low frequency or sufficient high frequency response to suit them.

Crystal pickup cartridges are high

impedance devices and should, therefore, be connected across a high resistance load. The usual value employed is .5 megohm. By decreasing this value the low frequency response of the pickup cartridge may be decreased, while increasing the value will increase the low frequency response of the cartridge. See Fig. 3. However, if this value is made either too high or too low, the bass and treble balance of the cartridge may be upset. In addition, the over-all performance would be quite unsatisfactory. For best results with average crystal cartridges this value must be kept between .25 megohm and 1 megohm.

With the value of low resistance being adjusted for optimum low frequency response (optimum in this case being that which is most satisfying to the individual listener), the pickup may be further compensated by using the equalizer circuit shown in Fig. 4. The value of capacitance to be used is usually between 50 $\mu\mu$fd. and 500 $\mu\mu$fd., depending on the amount of high frequency response desired. R_1 may be between 1 megohm and 5 megohms.

When the total value of R_1 and R_2 is 2 megohms, maximum bass response is obtained. Any further increase in the value of R_1 has no further effect on the low frequency response of most cartridges. Further increase in the value of R_1 does, however, minimize the effects of increased temperatures on the low frequency response. As the temperature increases, the low frequency response of the cartridge has a tendency to decrease slightly and if a condition exists where the operating temperature varies between normal room temperature (approximately 70° F.) and 100° to 110° F., it may be advisable to employ a higher value of resistance for R_1.

It should be noted that as the value of R_1 is increased, the value of capacitance should be decreased proportionately. Another important factor to remember is that when a circuit is equalized there is necessarily a reduction in output of the cartridge and, therefore, it may be that increasing the value of R_1 will not allow sufficient excitation voltage to reach the input tube grid to enable the amplifier to deliver its full rated power output. If this is the case, it is best that the total values of R_1 and R_2 be held to 2 megohms or less. By using a slightly more elaborate circuit, such as is shown in Fig. 5, both high and low frequency response may be varied independently. One switch is used to control the low frequency response while the other switch is used to control the high frequency response.

Temperature and Humidity Effects

Crystal devices employing Rochelle salt crystal elements function best at temperatures between 70° and 80° F. when the relative humidity is approximately 50%. They are very much like human beings in that wherever human beings can live comfortably, the crystal element will function normally and have a very long life span. The piezoelectric limitations of Rochelle salt crystal pickup cartridges are between —40° F. and 120° F. If exposed to temperatures above 120° F., the crystal will lose its piezoelectric activity permanently. Adequate ventilation should be provided around the phonograph or radio cabinet in order that the temperature around the pickup be kept at the lowest possible value. Pickup cartridges and other crystal devices should not be stored near heaters or radiators nor should they be displayed in store windows or show cases where bright sunlight is apt to shine on them.

When leads are being soldered to the cartridge terminals during installation or service, the soldering iron should not be applied for a longer period of time than necessary to make a solid joint.

In extremely dry climates, crystal pickups have a tendency to become dehydrated (loss of natural moisture) when subjected to high temperatures. If the crystal becomes dehydrated, nothing can be done to restore it to normalcy. In climates where the temperatures and relative humidity are extremely high, crystal cartridges have a tendency to take on excess moisture.

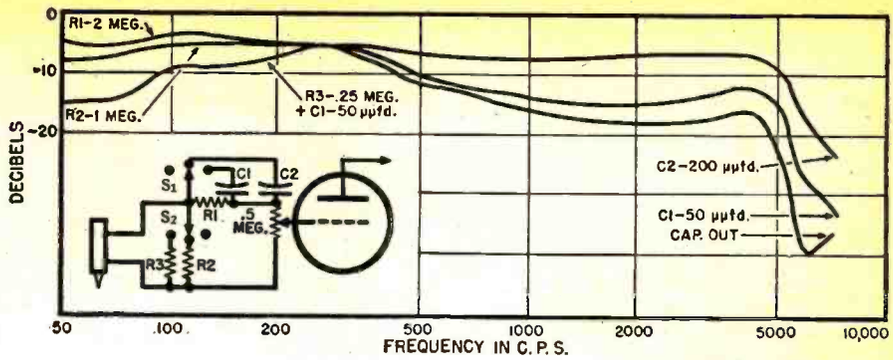


Fig. 5. High and low frequency response may be set independently with this equalizer.

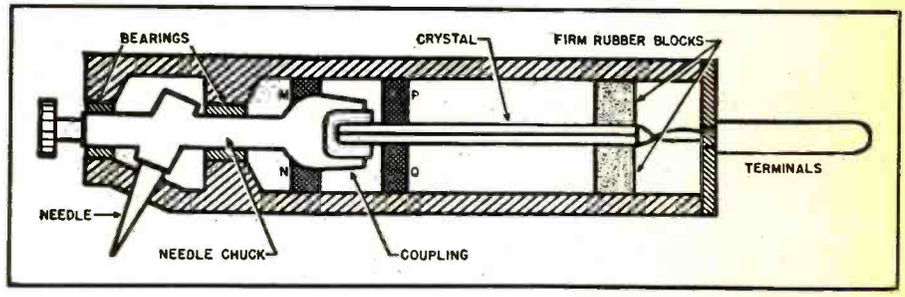


Fig. 6. Cross-section of construction details of typical cartridge employing rubber coupling between the needle and the chuck.

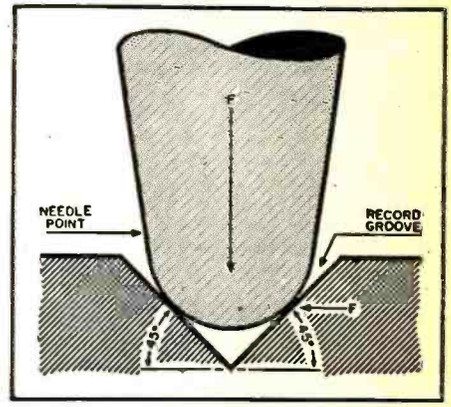
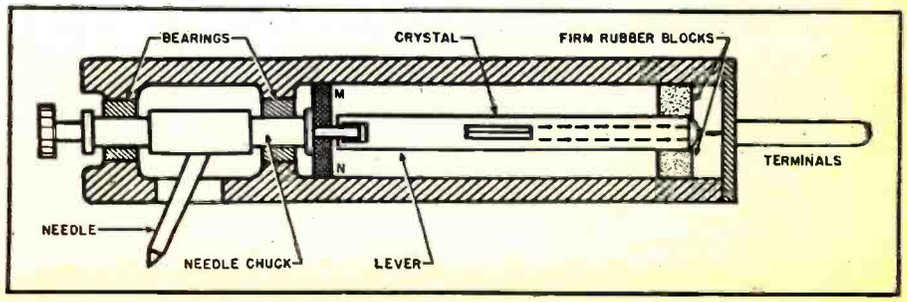


Fig. 7. Cross-sectional view of reproducing stylus in the record groove.

PN Crystal Cartridges

One of the recent developments in the crystal cartridge field is known as the "PN" which differs from the Rochelle salt crystal elements (*Continued on page* 153)

Fig. 8. Motions of the needle chuck are transmitted to the crystal via lever action in this Shure-designed crystal cartridge.



TELEVISION

By
W. W. WAYE

Fig. 1. The single dipole with "ribbon" lead-in and matching section is one of the simplest types of television antennas.

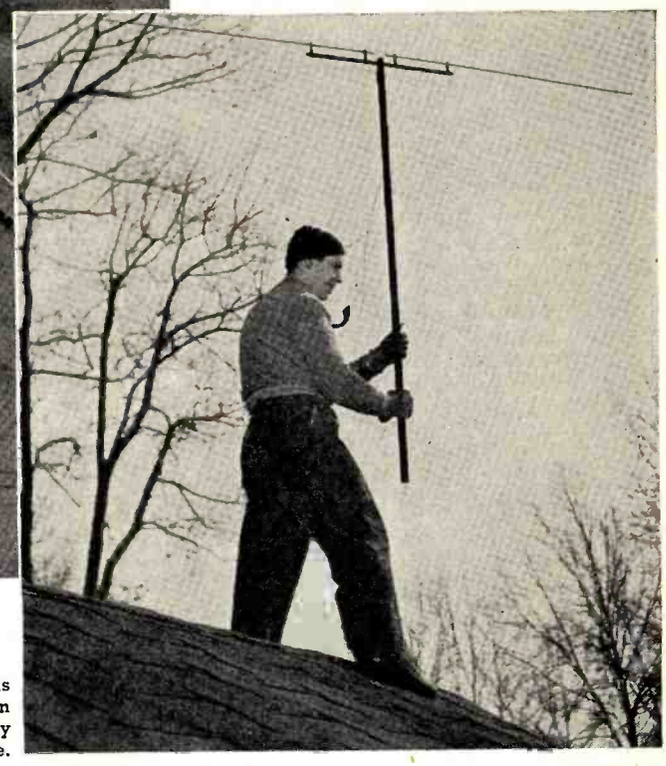


Fig. 2. Portable dipole is used to probe various roof locations for best antenna site. Lead-in connects dipole with television receiver, where relative signal strength and picture quality are observed for each of the various roof positions of dipole.

Lead-In—
300-ohm "twin-lead ribbon" line; similar to type K-1046, Federal Telephone and Radio Corp.

Matching Section—
4-foot length of 150-ohm "twin-lead ribbon" line; similar to above.

Stand-Off Insulators—
Polystyrene, for mounting lead-in.

Fibre-Head Nails—
For mounting lead-in.

Dipole Antenna Assembly—
Complete with metal rods of suitable length, wooden supports, and 4- or 5-foot mounting pole, with all tunable factors adjustable; similar to Shur Television Antenna, Shur-Antenna-Mount, Inc.

Heavy Metal Bracket—
For upright mounting of antenna pole and sufficiently versatile to permit mounting on crest of roof, sloping sides, on horizontal or vertical surfaces; similar to Adjustable Mount, Shur-Antenna-Mount, Inc.

Small Compass—
To locate direction of stations not visible to eye.

Simple Battery Telephone System—
For two-way communication between roof and receiver; any suitable, inexpensive system.

Tools, Soldering Iron, Nuts and Bolts.

Table 1. Necessary parts and equipment required to install television antenna.

NO MATTER how well designed and manufactured, a television set is inefficient or even useless unless it is properly installed. A *good* installation means an *individual* installation, designed to fit the needs and solve the problems of each particular case. This means *personalized* planning, constructing, siting, orienting, and tuning of the antenna system for every set installation. Adding to all this, such work in city or metropolitan areas is usually far more complex than in residential, suburban, or rural districts.

Using the simplest antenna, a single dipole, with any kind of television receiver, let's adapt the *Basic Procedure,* outlined last month, for the easiest and simplest of all installations, *a remote, suburban residence.*

This is a practical demonstration of an actual installation. The work illustrated is typical of the procedure for *all* kinds of dwellings and houses in remote, suburban districts.

The site for this installation was a two-story frame dwelling located on a rise of land near Woodcliff Lake, in northern New Jersey. There were no high buildings, metal obstructions, or mountains in the vicinity. The house was approximately 15 miles (direct, or line-of-sight) from midtown New York, where the principal television stations for the area are situated.

Offering no obvious difficulties, the site was purposely chosen as being ideal for the simplest type of television installation. The site was selected by Jack McNally, New York television engineer, who also participated in the roof operations according to the *Basic Procedure of Installation.*

Preliminaries

After sale of a television receiver, the dealer made a good-will visit to the customer's home in northern New Jersey. His purpose—to make a preliminary survey of the place of installation, to explain some of the critical requirements of television, to determine the customer's preference of two stations for "best reception" with a single antenna, and to establish the eventual location of the receiving set.

The customer's choice for the *Primary Channel* (the station most preferred) was WABD, transmitting on Channel 5. Choice for the *Secondary Channel* was WCBS, operating on Channel 2.

The customer was advised that

INSTALLATION

Part 2. Details covering the proper procedure to follow in installing the simplest of TV antennas.

probably *other* stations operating in the area might *also* be received on other channels, but that the receiving system was to be installed especially for reception of the *Primary* and *Secondary Channels*.

Best interior location for the television receiver was a compromise of these factors; the customer's preference for location, the viewing distance (6 feet) recommended by the set manufacturer, absence of sunlight, presence of ventilation, and a position remote from any household electrical apparatus likely to cause interference.

A quick survey, made from the ground, outside, indicated several likely sites for the antenna, somewhere along the peak or crest of the roof. The *approximate* distance of the lead-in route was then estimated—from the probable location of the antenna to the established location of the receiver.

All of this information was later turned over to the two technicians assigned to this installation. They then prepared the necessary equipment for the suburban installation. (See Table 1.)

The customer's television set had a conventional input impedance *rating* of 300 ohms. This meant that the lead-in to be connected to the receiver *also* had to be rated at 300 ohms, for best reception of the signals. Accordingly, an extra-sufficient length of 300-ohm "twin-lead ribbon" was cut for the lead-in.

The installation order called for a single dipole antenna. Since all single dipoles have an impedance rating of about 75 ohms, however, the 300-ohm lead-in could *not* be connected (later) directly to the dipole. To correct the mismatch or difference of impedances, a short piece of special wire known as a "matching section" was necessary. Consisting of a length of 150-ohm "twin-lead ribbon," the matching section was constructed and (later) connected between the dipole and the lead-in.

Length of each of the two metal rods used determines the frequency band or channel best received. A good *average* length, for reception of *all* channels, 1 to 6, is about 40 inches. However, certain channel preferences of the customer can always be favored. For this installation, each rod was cut to a length of 32 inches to favor reception of the *Primary Channel* (station WABD on Channel 5).

All equipment and tools, along with the two technicians, were transported to the customer's dwelling.

During delivery and installation, the television set was handled with great care. After placement in its previously established location, the receiver was thoroughly checked and pronounced to be operating normally.

Outside the house, final assembly of the single dipole antenna was completed. The two metal rods were held in place by wooden insulators, allowing a 2-inch center separation between the rods. Each of the two conductors of the matching section was soldered to a terminal connector of a metal rod. The other end of the matching section was connected to the extra-sufficient length of 300-ohm "twin-lead ribbon" lead-in.

The dipole assembly, matching section, and lead-in loop were then taken to the roof (Fig. 1). The lead-in was run loosely from the roof to the interior location of the television set, and then connected to the input terminals of the receiver. A similar, loose length of two-conductor covered wire was run between roof and receiver, and used to connect the two portable earphone-and-speaker sets of the battery operated telephone system.

Siting the Antenna

Best site for locating the antenna was determined by a trial-and-error method, known as "probing." This is based on the principle that with a portable dipole connected to an operating receiver, the signal strength and image quality of the television picture will vary according to different roof positions of the horizontal dipole.

The method of siting the antenna is briefly this: Two technicians are required, one man on the roof with the portable antenna assembly (Fig. 2) and one man at the operating controls of the television set (Fig. 4). They maintain communication by means of the two-way portable telephone system. And, they work as a team!

The receiver is switched to the

Fig. 3. Best antenna site is the particular roof location that will provide the most favorable reception of the two desired television channels.

Fig. 4. Signal strength and picture quality are observed at TV receiver as various dipole locations are tried.

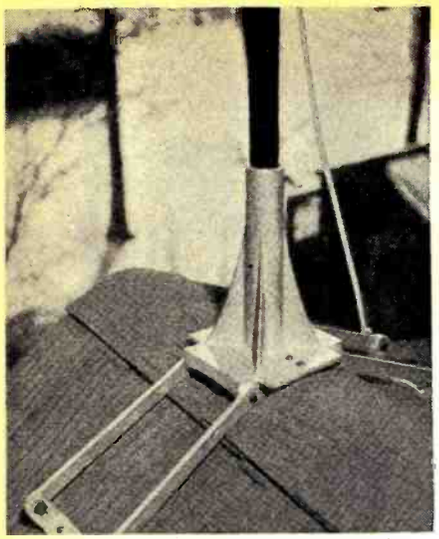


Fig. 5. Mounting bracket for dipole assembly shown attached to roof proper.

Fig. 6. Before tightening, dipole antenna is oriented for most favorable reception.

Primary Channel desired by the customer, and the controls are adjusted to obtain the best possible image on the screen of the set. This image may be weak or distorted, even with proper adjustment of receiver controls.

The roof technician holds the antenna assembly upright, so that the metal rods of the dipole are always in a horizontal position. Then, as the antenna is moved through various positions on the roof, the desirability of each position or site is judged *at the receiver*—in terms of signal strength and picture quality. This entire "probing" procedure is repeated for the *Secondary Channel.*

When all likely and accessible regions of the roof have been "probed," the best locations are *re*tested—*on both of the preferred channels*—until the best, single site is found for the antenna.

This is the general method of "probing." Let's see how it worked in practice—for the actual installation!

The "probing" dipole was held aloft at a considerable number of potential locations on the roof, while the observer at the set reported relative signal strength and picture quality, on both *Primary* and *Secondary Channels,* for each roof location.

Because of the distance (15 miles) from the midtown district of New York to the customer's home, television signals from both WABD and WCBS appeared to arrive from almost the same direction. Greatest signal strength and best picture quality—at any one of the roof sites—was obtained when the metal rods of the dipole faced *broadside* to the direction of the transmitters in New York. For all other bearings of the dipole, a weak signal was received on the *Primary Channel,* and no signal at all on the *Secondary Channel.*

In the vicinity of a brick chimney protruding above the roof, the strength of all received signals was somewhat diminished, and when the portable dipole was so located that the chimney was *between* the antenna and its distant objective, the received signals vanished. It was then discovered, under a thick layer of soot, that the inside of the chimney was lined with thin copper sheet-metal, placed there years before to protect the inner brickwork.

Several roof positions just above the back door proved very unsatisfactory. Good picture reception was suddenly distorted beyond recognition, every time someone rang the doorbell!

Other causes of noise interference were centered around the kitchen of the house, where a variety of electric household appliances caused interference and distortion of the television picture.

Trouble from all of these sources of noise was eliminated by raising the dipole as high as possible and moving away from the vicinity of the electrical disturbances.

As might be expected, the only noise-free region of the roof was along its highest part, the peak, or crest. Moving along this peak, the strongest signal and best picture quality was obtained with the dipole in a position near the edge of the roof and in a direction toward midtown New York (Fig. 3). This happened to be the only part of the roof that provided a perfect, unobstructed line-of-sight path toward the two transmitters, even clearing nearby trees. This site was chosen as the best location for the antenna.

The next step was the mounting of the complete dipole assembly in an upright position by means of a heavy mounting bracket. After the metal bracket was attached to the roof, the antenna assembly was placed in position, with the long mounting pole inserted into the roof bracket. The antenna assembly was *not* fixed permanently in any position, but left free to rotate so that the dipole could next be oriented.

Orientation

The purpose of orienting the receiving dipole is to make certain that it is pointing *exactly* in the direction of the transmitting antenna of a desired station.

Human eyesight is far from infallible, and as the optical distance increases, many factors influence the accuracy of human vision. Directions can only be *estimated,* and then not too accurately. Thus, the only true means of orientation is to use the television receiver itself.

In this installation, the two stations preferred by the customer, WABD and WCBS, were actually located within a mile of each other in New York. But at a distance of 15 miles, signals received from either television station seemed to be coming from about the same direction.

(*Continued on page* 189)

Table 2. Glossary of television terms and pertinent installation data.

"Best Reception"—
The installation of a single antenna to receive at least two channels preferred by customer.

Channels—
Frequency bands used by television stations for broadcasting.
Most popular channels:

1—44-50 mc.	4—66-72 mc.
2—54-60 mc.	5—76-82 mc.
3—60-66 mc.	6—82-88 mc.

Seven other channels are assigned between 172-216 megacycles.
Primary Channel is the station best received after set is installed.
Secondary Channel is the station received second best after set is installed.

Dipole—
A television antenna consisting of two metal rods held in a fixed horizontal position. Has an impedance rating of about 75 ohms.
Length favors one or more channels preferred by customer; rod length for each channel:

1—53.5 inches	4—36 inches
2—44.5 inches	5—31.5 inches
3—40 inches	6—29.5 inches

For two or more channels, take average.

Directivity—
The way a dipole receives; well in the two directions broadside to the metal rods, but not so well in other directions.

Impedance—
The "ohms rating" of a dipole or lead-in. The input to each television set is also rated.

Lead-In—
A plastic twin-conductor known as "twin-lead ribbon." The most popular size for television is rated at 300 ohms; available also at 150 ohms, 75 ohms. Can be any length desired.

Matching Section—
Short piece of "twin-lead ribbon" rated at 150 ohms, and connected between dipole and set lead-in. Length favors one or more channels preferred by customer:

1—48.5 inches	4—33 inches
2—40.5 inches	5—28.5 inches
3—36 inches	6—26.5 inches

To cover all channels use 37 inches.

"Probing"—
The process of searching with a portable dipole, connected to set, to locate best site for antenna, based on observed picture signals.

A Serviceman's TUBE TESTER

By FRED J. LINGEL
The Triplett Electrical Instrument Co.

Complete construction details for a commercially built service instrument.

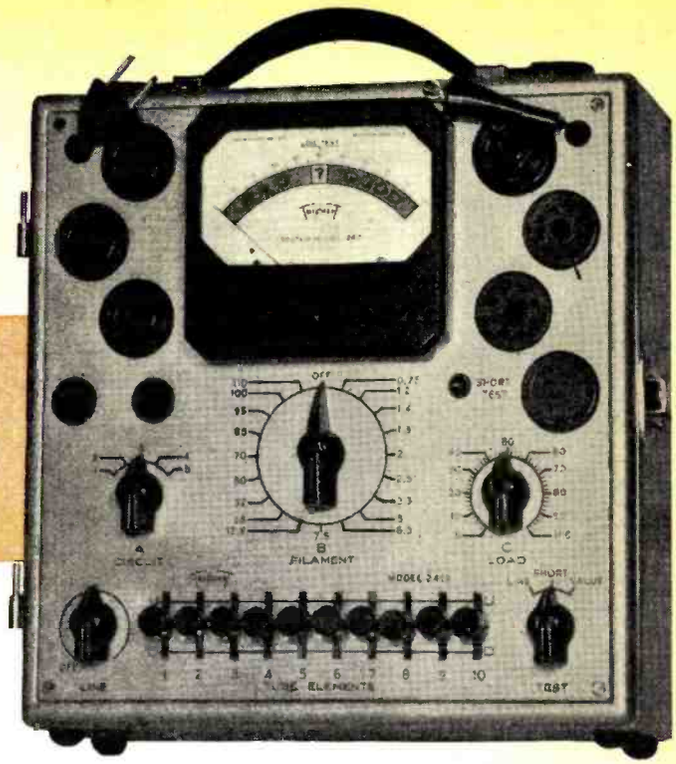


Fig. 1. Panel view of Triplett Model 2413 tube tester.

IN DESIGNING a serviceman's tube tester, a number of factors must be taken into consideration and the proper proportion established between these factors just as in any other design problem. In addition to the usual requirements of accuracy, compactness, and minimum cost, the serviceman's tube tester must be simple to operate and yet have maximum circuit flexibility.

Simplicity of operation is not only indicated by a minimum of control settings but a great deal depends on the number and arrangement of the controls and the straightforwardness of the circuit. For example, a tube tester with only four control settings for a tube set-up may require considerable hunting through a multiplicity of controls which are *not* moved. This takes time, and more important, increases the possibility of error. In addition, the use of "trick" switching circuits, often used to keep control settings at a minimum, makes it more difficult for the serviceman to "picture" his tester circuit. Both of these features tend to slow up the rate of making the settings. On the other hand, a tester with a few more control *motions* may be faster in the long run. The fewer controls and the ability to "picture" the test circuit also help reduce the chances for tube damage due to an error in the test set-up.

Fig. 1 illustrates the panel arrangement of the *Triplett* Model 2413 tube tester.

In order to keep the circuit straightforward, and therefore, help the serviceman to "picture" what he is doing in making a tube check set-up, this tube tester uses a combination of lever and rotating switches with the lever switches numbered to correspond to the RMA tube pin numbers. These controls provide a maximum of flexibility and still retain clarity of circuit. This arrangement also gives maximum freedom from obsolescence due to changing tube types.

For maximum assurance against plugging tubes in the wrong socket, this tube tester provides one socket for each type of tube base. Tubes, therefore, cannot be plugged into the wrong socket simply because they will not fit! This not only is safer, but it also simplifies the set-up operation because it eliminates the reference to special sockets on the tube chart, the socket from the panel, and the operation of hunting for the special socket.

Fig. 2 shows the circuit of a *Triplett* Model 2413 tube tester. Most of the components may be obtained from regular radio parts suppliers. The transformer is special for this application and while generally not available on the open market, two or three separate transformers with secondary voltages as shown may be used instead. *(Editor's note: Tube tester transformers of various ratings are available from most parts dealers. Obtaining one with the exact ratings required is rather an impossibility, however as suggested by the author, two or possibly three separate transformers can be used. A transformer of this type can be home built. The article "Practical Transformer Design and Construction" published in the June, 1947 issue of* RADIO NEWS *will provide full details on how this can be done.)*

All Elements Check

The circuit permits a thorough test of tube elements, shields, and taps. The check for both short-circuited and open-circuited elements is generally more complete than that obtained with a dynamic mutual conductance test alone, as commonly made in portable type tube testers. The main reason for a dynamic mutual conductance test is to check for open or misplaced elements. It does not necessarily check for continuity to the shields, such as in metal tubes. A dynamic mutual conductance test alone does not provide a means of checking element taps of the type used in some of the newer high frequency type tubes and in some of the high voltage filament types. In order to make a complete tube test, it must be possible, as in this unit, to get at each tube pin and make an open and short check.

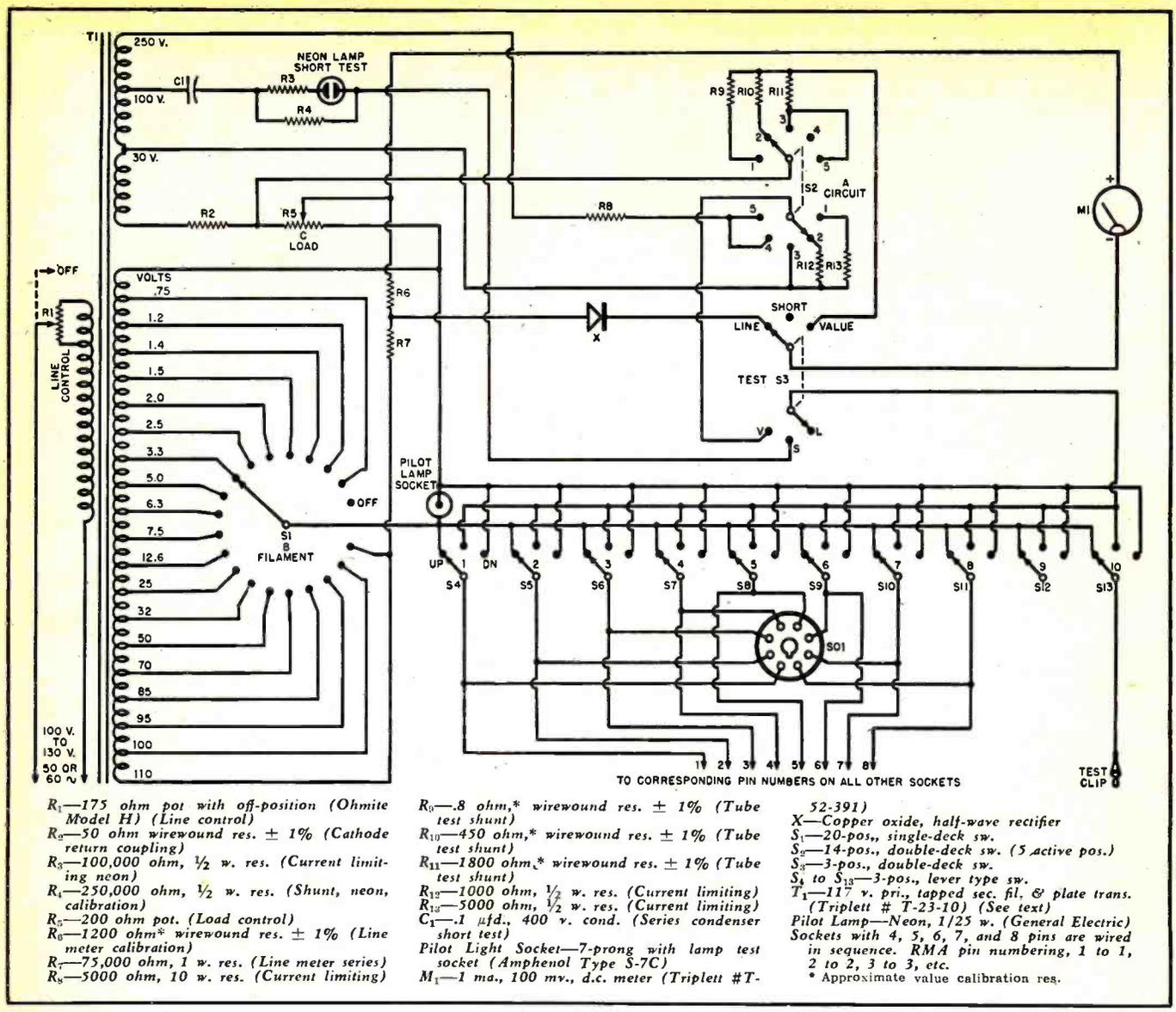
New Tube Types

The straightforward switching employed enables the serviceman to set up for new tubes without waiting for data from the tube tester manufacturer. This is a radically different approach to the tube testing problem not readily possible before, except in the laboratory type of tube tester. An example of such "set-up" instructions used for this tester is given below.

Use 3 or more new tubes and proceed as follows:

(*a*) Refer to manufacturer handbooks under the particular tube type for filament voltage and pin connections.

(*b*) Set *"A-CIRCUIT"* switch (S_2) as follows:



R_1—175 ohm pot with off-position (Ohmite Model H) (Line control)
R_2—50 ohm wirewound res. ± 1% (Cathode return coupling)
R_3—100,000 ohm, ½ w. res. (Current limiting neon)
R_4—250,000 ohm, ½ w. res. (Shunt, neon, calibration)
R_5—200 ohm pot. (Load control)
R_6—1200 ohm wirewound res. ± 1% (Line meter calibration)*
R_7—75,000 ohm, 1 w. res. (Line meter series)
R_8—5000 ohm, 10 w. res. (Current limiting)
R_9—.8 ohm, wirewound res. ± 1% (Tube test shunt)*
R_{10}—450 ohm, wirewound res. ± 1% (Tube test shunt)*
R_{11}—1800 ohm, wirewound res. ± 1% (Tube test shunt)*
R_{12}—1000 ohm, ½ w. res. (Current limiting)
R_{13}—5000 ohm, ½ w. res. (Current limiting)
C_1—.1 μfd., 400 v. cond. (Series condenser short test)
Pilot Light Socket—7-prong with lamp test socket (Amphenol Type S-7C)
M_1—1 ma., 100 mv., d.c. meter (Triplett #T-52-391)
X—Copper oxide, half-wave rectifier
S_1—20-pos., single-deck sw.
S_2—14-pos., double-deck sw. (5 active pos.)
S_3—3-pos., double-deck sw.
S_4 to S_{13}—3-pos., lever type sw.
T_1—117 v. pri., tapped sec. fil. & plate trans. (Triplett # T-23-10) (See text)
Pilot Lamp—Neon, 1/25 w. (General Electric)
Sockets with 4, 5, 6, 7, and 8 pins are wired in sequence. RMA pin numbering, 1 to 1, 2 to 2, 3 to 3, etc.
* Approximate value calibration res.

Fig. 2. Schematic diagram of tube tester. Circuit permits a thorough test of all tube elements, shields, and taps.

"1" for diode types.
"2" for filament types excluding diodes.
"3" for indirectly heated (cathode) types excluding diodes.
"4" for target or eye tubes.
"5" for gaseous rectifiers and gaseous control tubes.

(*c*) Set *"B-FILAMENT"* switch (S_1) to filament voltage.

(*d*) Refer to base drawing in "Manufacturer's Handbook" on tubes for the type being set up. Levers "1, 2, 3, 4, etc." (S_4 to S_{12}) compare to RMA pin numbers.

(*e*) Set all levers in normal or center position. This is plate position and all elements in this position are tied together.

(*f*) Find the first filament connection pin on tube base and move corresponding lever to *"UP"* position. This connects one side of filament to the filament transformer.

(*g*) Find the second filament connection pin on tube base and move corresponding lever to *"DN"* position. This connects the opposite side of the filament to the filament transformer. If filament is tapped, move corresponding filament pins to connect the two sections of filament in parallel.

(*h*) Find the cathode connection pin on tube base and move corresponding lever to *"DN"* position. This connects the cathode to one side of the filament transformer.

(*i*) If the tube is of the multi-section type, such as duodiodes, duotriodes, etc., find the elements not under test and move corresponding levers to *"DN"* position.

(*j*) Insert tube into proper socket.

(*k*) Hold *"TEST"* switch (S_3) in *"LINE"* position. Turn on *"LINE"* control and adjust so that meter reads at *"LINE TEST"* mark.

(*l*) Hold *"TEST"* switch in value position. Adjust *"C-LOAD"* (R_5) control for each tube so that the majority of the new tubes read 70 on the meter scale.

(*m*) List settings at end of tube chart for further reference.

Fig. 3 shows the simplified circuit of each of the several test circuits used in the tube tester. These simplified circuits are followed in most tube test set-ups, however, in some special cases such as in sub-miniature triodes, Fig. 3A will be used even though it is primarily designed for diode checks. In general, these circuits function as follows.

In the diode check, Fig. 3A, the plate voltage at the transformer is set to 30 volts. A 5000 ohm resistor is connected between the plate transformer tap and the diode plate to limit the plate current to a safe value. Due to the low permissible diode current, it is necessary in some diode checks to add a note "Good tube reads over 20," etc. This note indicates that the maximum diode current was less than that required to deflect the instrument into the "good" section and it was, therefore, necessary to establish a lower reference point on the scale. The .8 ohm resistor in series with the negative instrument terminal is used to adjust for small variations in the potentiometer, transformer, and instrument.

The 200 ohm potentiometer provides a vernier adjustment of the instrument full-scale current. The setting of this control is determined from the

average of "good" tubes as noted in operation (*l*) under the section headed "New Tube Types." The 50 ohm resistor in series with the low side of the high voltage winding is used as a combination limiting resistor and fuse. It serves to reduce possible damage to the transformer and instrument in the event of an improper set-up, etc.

In the filament type triode and pentode check, Fig. 3B, the plate voltage at the transformer is again set to 30 volts. The 1000 ohm series resistor between the transformer and the tube under test permits greater current to flow from the filament and helps insure sufficient loading to approximate most operating conditions. The 450 ohm resistor in series with the negative instrument terminal increases the

(*Continued on page* 132)

Table 1. Operating instructions and tube chart. Switch and control settings for the most commonly used tubes are given.

LINE TEST

1. Insert power cord into a 110 volt, 60-cycle supply.
2. Set "A-CIRCUIT" knob (switch S_2) as shown in column "A-CIR."
3. Set "B-FILAMENT" knob (switch S_1) as shown in column "B-FIL."
4. Set "C-LOAD" knob (R_5) as shown in column "C-LOAD."
5. Set levers (switches S_4 to S_{13}) as shown in columns "UP" and "DN."
6. Insert tube in socket.
7. Turn "LINE" knob (R_1) until meter pointer reads at "LINE TEST" mark, with "TEST" knob (S_3) held in "LINE" position.

SHORT TEST ("TEST" knob in "SHORT" position)

8. Move each lever (switches S_4 to S_{13}) in center position one at a time down to position "DN" and back to center.

Move each lever in light face type (table below) one at a time up to center position and back.

A shorted tube is indicated by a bright red glow of the "SHORT TEST" neon lamp.

VALUE TEST

9. Hold "TEST" knob (S_3) in "VALUE" position and read tube condition on meter.
10. Release "TEST" knob. Return all levers to center position and turn "LINE" knob to "OFF."

CONTINUITY TEST (all tubes except ballast tubes.)

1a. Follow operations 1, through 9.

2a. With "TEST" knob in "VALUE" position, move each lever shown in light face type and active levers in center up one position and back. Refer to tube manufacturers' data for active pin numbers, these correspond to the lever numbers on the tester. Continuity between tube pin and the element being tested is indicated by a change in pointer deflection. A small change denotes a satisfactory plate or screen connection. A large change denotes a satisfactory grid or cathode connection.

3a. Release "TEST" knob.

4a. Move each lever in dark face type one at a time up one position and back. Continuity of the filament or other internal pin connections is indicated by a bright red glow of the "SHORT TEST" neon lamp.

CONTINUITY TEST (pilot lamps and other miniature base bulbs)

1b. Follow operations 1 and 7 under "LINE TEST."

2b. Set "B-FILAMENT" knob to voltage of lamp under test.

3b. Place lamp in center of 7-prong socket.

4b. A "good" lamp is indicated by normal lighting of its filament.

CONTINUITY TEST (ballast tubes and electrical appliances)

1c. Follow operations 1 and 7 under "LINE TEST."

2c. Place jumper lead in No. 1 position (marked) of octal base.

3c. Set "B-FILAMENT" knob to "OFF" position.

4c. Set lever 1 in "DN" position.

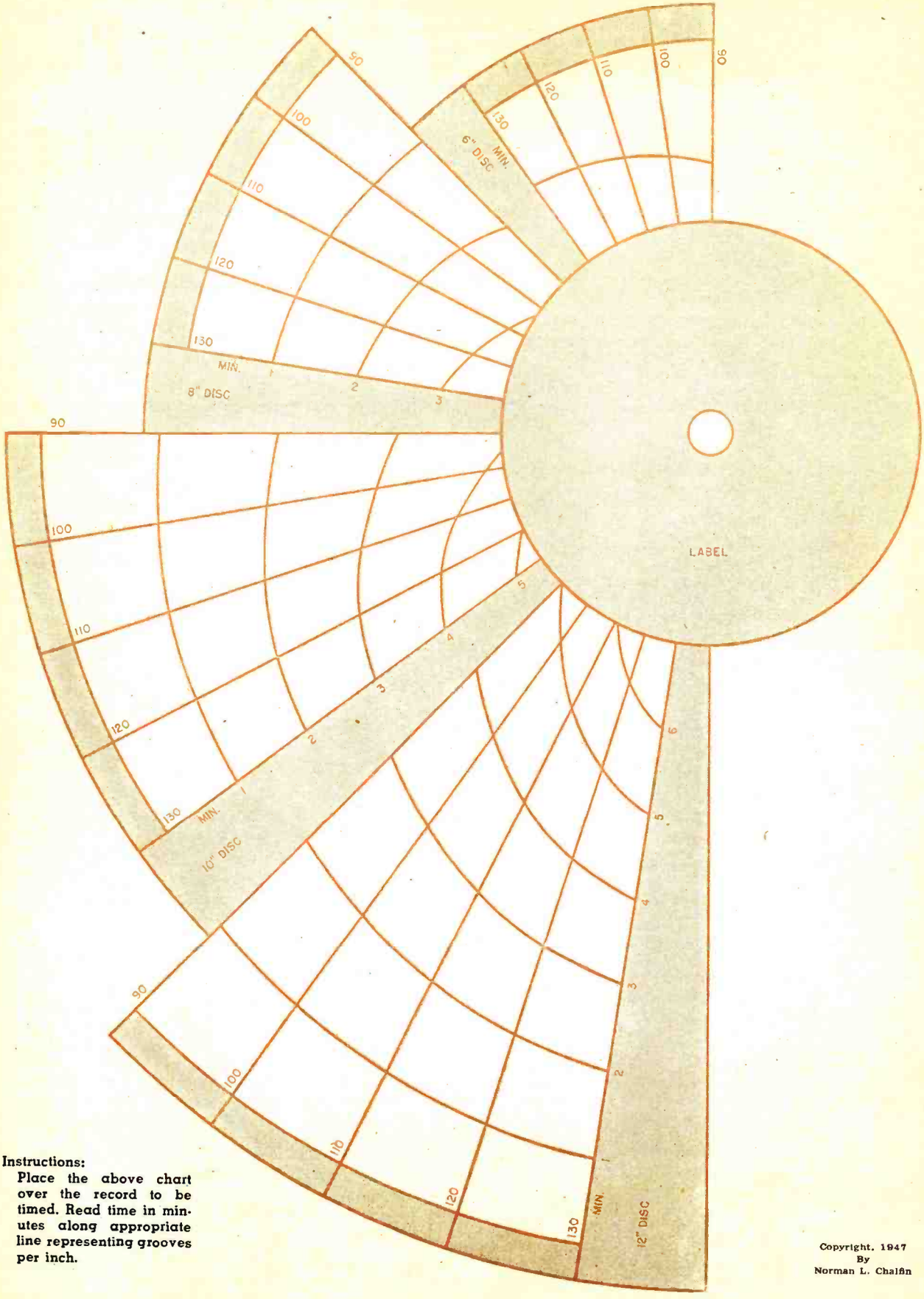
5c. Short grid cap lead and test probe clip together and note that the neon lamp glows. Connect grid cap clip and test probe clip to pins of ballast tube or to terminals of appliance being tested. A bright glow of the neon lamp indicates continuity.

CAUTION: Do not handle the metal parts of the test leads during the test.

6c. Refer to the ballast tube or appliance manufacturer's data for internal connections.

TUBE TYPE	KNOBS A Cir. (S_2)	B Fil. (S_1)	C Load (R_5)	LEVER POSITION UP	DN
5U4	3	5	35	2	48
5U4 (Test 2)	3	5	35	2	68
5W4	3	5	48	2	48
5W4 (Test 2)	3	5	48	2	68
5Y3	3	5	57	2	48
5Y3 (Test 2)	3	5	57	2	68
6A7	3	6.3	31	1	67
6A8	3	6.3	25	2	78
6AB7	3	6.3	23	2	57
6AC5	3	6.3	34	2	78
6AG5	3	6.3	20	4	237
	(Shows short on 2 and 7)				
6AG7	3	6.3	24	2	57
6AK5	3	6.3	20	3	247
	(Shows short on 2 and 7)				
6AL5	1	6.3	23	3	12456
6AL5 (Test 2)	1	6.3	23	3	14567
6B4	3	6.3	28	2	7
6B6	3	6.3	32	2	4578
6B6 (Test 2)	1	6.3	40	2	3478-10
6B6 (Test 3)	1	6.3	40	2	3578-10
6B8	3	6.3	45	2	4578
6B8 (Test 2)	1	6.3	40	2	34678-10
6B8 (Test 3)	1	6.3	40	2	35678-10
6C4	3	6.3	26	4	37
	(Shows short on 1 and 5)				
6C5	3	6.3	35	2	78
6C6	3	6.3	31	1	56
6D6	3	6.3	40	1	56
6E6	3	6.3	31	1	2347
6E6 (Test 2)	3	6.3	31	1	4567
6F5	3	6.3	30	2	78
6F6	3	6.3	32	2	78
6F7	3	6.3	43	1	4567
6F7 (Test 2)	3	6.3	82	1	2367-10
6G6	3	6.3	36	2	78
6H6	1	6.3	25	2	3478
6H6 (Test 2)	1	6.3	25	2	4578
6J5	3	6.3	27	2	78
6J7	3	6.3	31	2	78
6K5	3	6.3	26	2	78
6K6	3	6.3	34	2	78
6K7	3	6.3	30	2	78
6K8	3	6.3	22	2	34678-10
6K8 (Test 2)	1	6.3	22	2	678
6L5	3	6.3	32	2	78
6L6	3	6.3	27	2	78
6L7	3	6.3	25	2	78
6Q7	3	6.3	33	2	4578
6Q7 (Test 2)	1	6.3	47	2	3478-10
6Q7 (Test 3)	1	6.3	47	2	3578-10
6R7	3	6.3	37	2	4578
6R7 (Test 2)	1	6.3	33	2	3478-10
6R7 (Test 3)	1	6.3	33	2	3578-10
6SA7	3	6.3	26	2	67
6SC7	3	6.3	38	8	2367
6SC7 (Test 2)	3	6.3	33	8	4567
6SD7	3	6.3	23	2	57
6SF5	3	6.3	28	8	27
6SF7	3	6.3	30	8	357
6SF7 (Test 2)	1	6.3	40	8	23467
6SG7	3	6.3	19	2	357
	(Shows short on 3 and 5)				
6SH7	3	6.3	19	2	357
	(Shows short on 3 and 5)				
6SJ7	3	6.3	27	2	57
6SK7	3	6.3	34	2	57
6SL7	3	6.3	28	7	12368
6SL7 (Test 2)	3	6.3	28	7	34568
6SN7	3	6.3	29	7	34568
6SN7 (Test 2)	3	6.3	29	7	12368
6SQ7	3	6.3	30	8	3457
6SQ7 (Test 2)	1	6.3	40	8	23467
6SQ7 (Test 3)	1	6.3	40	8	23567
6SR7	3	6.3	37	8	3457
6SR7 (Test 2)	1	6.3	33	8	23467
6SR7 (Test 3)	1	6.3	33	8	23567
6SS7	3	6.3	30	2	57
6ST7	3	6.3	30	7	3458
6ST7 (Test 2)	1	6.3	95	7	23468
6ST7 (Test 3)	1	6.3	95	7	23568
6T7	3	6.3	35	2	4578
6T7 (Test 2)	1	6.3	40	2	3478
6T7 (Test 3)	1	6.3	40	2	3578
6U6	3	6.3	24	2	78
6U7	3	6.3	32	2	78
6V6	3	6.3	26	2	78
6V7	3	6.3	36	2	4578
6V7 (Test 2)	1	6.3	50	2	3478-10
6V7 (Test 3)	1	6.3	50	2	3578-10
6W7	3	6.3	33	2	78
6X5	3	6.3	28	2	378
6X5 (Test 2)	3	6.3	28	2	578
6Y6	3	6.3	19	2	78
7A4	3	6.3	27	1	78
7A5	3	6.3	23	1	78
7A6	1	6.3	28	1	24678
7A6 (Test 2)	1	6.3	28	1	23478
7A7	3	6.3	28	1	78
7A8	3	6.3	32	1	78
7B4	3	6.3	27	1	78
7B5	3	6.3	29	1	78
7B6	3	6.3	31	1	45678
7B6 (Test 2)	1	6.3	58	1	234578
7B6 (Test 3)	1	6.3	58	1	234678
	(Shows short on 4 and 7)				
7B7	3	6.3	33	1	78
7B8	3	6.3	27	1	78
7C5	3	6.3	29	1	78
7C6	3	6.3	33	1	45678
7C6 (Test 2)	1	6.3	40	1	234578
7C6 (Test 3)	1	6.3	40	1	234678
	(Shows short on 4 and 7)				
7C7	3	6.3	33	1	78
7E6	3	6.3	28	1	45678
7E6 (Test 2)	1	6.3	45	1	234578
7E6 (Test 3)	1	6.3	45	1	234678
	(Shows short on 4 and 7)				
7E7	3	6.3	36	1	3478
7E7 (Test 2)	1	6.3	40	1	235678
7E7 (Test 3)	1	6.3	46	1	245678
7F7	3	6.3	30	1	23478
7F7 (Test 2)	3	6.3	30	1	25678
7G7	3	6.3	19	1	78
7H7	3	6.3	22	1	78
7J7	3	6.3	33	1	3478
7J7 (Test 2)	3	6.3	33	1	25678
7L7	3	6.3	23	1	78
7N7	3	6.3	28	1	23478
7N7 (Test 2)	3	6.3	28	1	25678
7Q7	3	6.3	24	1	78
7Y4	3	6.3	33	1	378
7Y4 (Test 2)	3	6.3	33	1	678
7Z4	3	6.3	49	1	378
7Z4 (Test 2)	3	6.3	41	1	678
12SA7	3	12.6	24	2	67
12SC7	3	12.6	30	8	2367
12SC7 (Test 2)	3	12.6	30	8	4567
12SJ7	3	12.6	28	2	57
12SK7	3	12.6	28	2	57
12SQ7	3	12.6	28	8	3457
12SQ7 (Test 2)	1	12.6	40	8	23467
12SQ7 (Test 3)	1	12.6	40	8	23567
25Z5	3	25	25	1	2346
25Z5 (Test 2)	3	25	25	1	3456
35L6	3	32	20	2	78
35Z5	3	32	21	7	238
35Z6	3	32	20	2	3478
35Z6 (Test 2)	3	32	20	2	4578
50L6	3	50	21	2	78
80	3	5	55	1	24
80 (Test 2)	3	5	55	1	34
83	3	5	26	1	24
83 (Test 2)	3	5	26	1	34
83V	3	5	24	1	24
83V (Test 2)	3	5	24	1	34
117L7	3	110	25	2	1678
117L7 (Test 2)	3	110	20	2	134578

Timing Chart For 78.26 R.P.M. Phonograph Records



Instructions:
Place the above chart over the record to be timed. Read time in minutes along appropriate line representing grooves per inch.

A 600-watt Phone Transmitter

By
RUFUS P. TURNER, W1AY

Fig. 1. Front view of transmitter. Compare with layout sketch of Fig. 4 for identification of the various stages. Safety grille has been removed from bottom shelf to show the high-voltage power supply.

This low-cost transmitter, covering the 80, 40, 20, 10 and 11 meter bands, combines the advantages of good modulated carrier power (360-390 watts) and an inexpensive transformerless cathode modulator using the conventional type radio receiver tubes.

SINCE installing the transmitter described in this article, we have had the pleasant experience at W1AY of receiving from many QSO points on 75, 20 and 10 meters flattering comments on both voice quality and signal strength. The sincerity of these reports has been evidenced by requests for the circuit diagram of the modulator-final amplifier combination.

The modulation method has aroused no end of curiosity when described over the air (and the author has been compelled to mail out a number of pencil sketches), which is surprising because the system is, in reality, bewhiskered. It is a *series* cathode modulation scheme first described by Dawley a few years ago[1] and has been applied to this specific transmitter design. Using four parallel-connected 6L6 metal tubes as the modulator and only two 6SJ7 speech amplifier stages, the simple audio unit requires no separate plate-screen power supply, modulates 100% a final amplifier input of 660 watts, and provides a measured carrier output of 360 to 390 watts. According to the receiving operators who have heard the signal riding through typical 75-meter QRM, results belie the simple specifications.

How the modulator works in conjunction with the final amplifier can be seen by examining the circuit schematic, Fig. 2. The four 6L6 modulator tubes are connected in parallel and their plates are connected to the filament center tap of the push-pull 810 final amplifier. The 6L6 cathodes are returned to ground through a 50-ohm resistor, R_{18}, which serves to supply fixed bias to the 6L6 tubes. As a result of this scheme, a d.c. voltage drop appears between the 6L6 plates and ground. By making the 810 plate voltage 2400, the d.c. voltage drop across the 6L6's becomes 400 volts. The center tap of the 810 grid coil L_3, is grounded directly (that is, not returned to filament center tap), so that the final amplifier receives *fixed* grid bias voltage as a result of this cathode voltage drop, and no additional bias supply (power supply, battery, or grid resistor) is required.

The audio voltage developed by the 6L6's in the cathode circuit of the 810's is sufficient to cathode modulate the final amplifier—and no modulation transformer is required to do the job. The dynamic plate resistance of the modulator is reduced to a satisfactory value by means of degenerative feedback introduced by resistor R_{18} connected between the 6L6 plates and the plate of the second 6SJ7 tube. The two 6SJ7 speech amplifier tubes also receive their plate and screen voltages from the voltage drop in the 810 cathode circuit, through the simple choke input filter (CH_1, C_{30} and R_{23}) which removes any ripple from the speech amplifier voltage. Thus, the final amplifier power supply furnishes operating voltage to the entire audio section as well. An effective voltage of 2000 appears between the 810 plates and filament center tap, and 400 volts across the modulator.

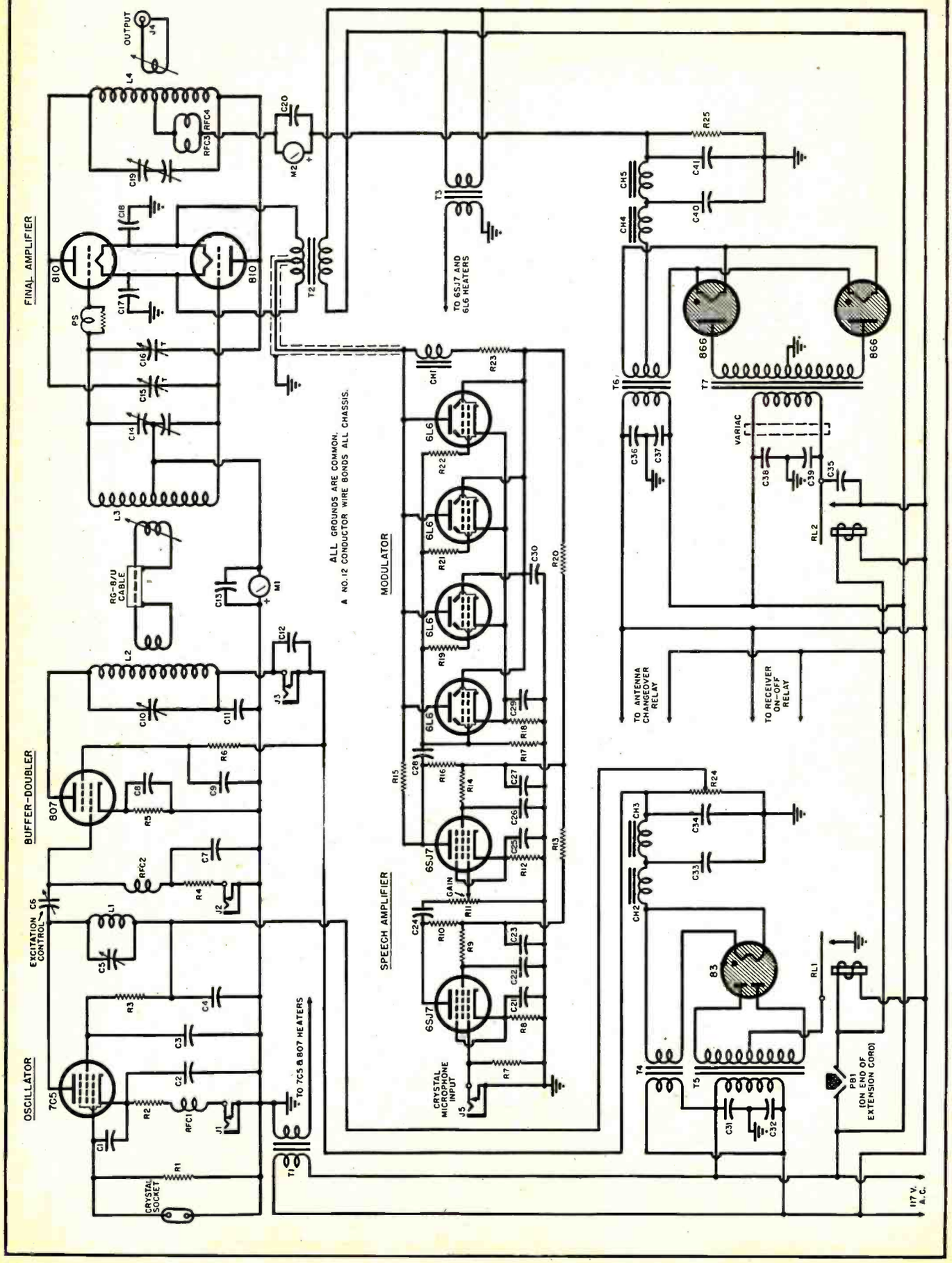
The speech amplifier has ample gain for the usual amateur microphones. Using an *Astatic* D104 diaphragm-type crystal microphone, we find that there is gain to spare.

The entire speech amplifier-modulator is built on a 15" x 7" x 3" chassis with ample "breathing space" both above and below the chassis. The unit is small and compact but definitely is not crowded. The separate 6.3-volt filament transformer, T_3, is mounted on the modulator chassis, although modulator filament voltage might have been obtained from a huskier exciter filament transformer. (T_1). Fig. 3 gives a close-up view of the speech amplifier-modulator.

From Fig. 2, it will be noted that the modulator has no frills whatever. It is a straight resistance-coupled amplifier *direct coupled* to the final r.f. amplifier cathode, and is conventional in every respect except, perhaps, the use of parallel-connected output tubes.. The 100-ohm resistors, R_{19}, R_{21} and R_{22} discourage any tendency toward para-

[1] Dawley, Ray L., "Series Cathode Modulation," RADIO, December 1939

Fig. 2. Complete schematic diagram of low-cost, 600-watt phone transmitter. See opposite page for parts list.



R_1, R_{17}—100,000 ohm, ½ w. res.
R_2—150 ohm, 10 w. res.
R_3, R_4, R_{13}, R_{20}—10,000 ohm, 1 w. res.
R_5—300 ohm, 10 w. res.
R_6—40,000 ohm, 10 w. res.
R_7—5 megohm, ½ w. res.
R_8—2000 ohm, 1 w. res.
R_9—2 megohm, 1 w. res.
R_{10}—500,000 ohm, 1 w. res.
R_{11}—500,000 ohm pot.
R_{12}—500 ohm, 1 w. res.
R_{14}, R_{15}—500,000 ohm, ½ w. res.
R_{16}—100,000 ohm, 1 w. res.
R_{18}—50 ohm, 10 w. res.
R_{19}, R_{21}, R_{22}—100 ohm, 1 w. res.
R_{23}—2500 ohm, 10 w. res.
R_{24}—50,000 ohm, 50 w. res. (with slider)
R_{25}—50,000 ohm, 200 w. res.
C_1—40 μμfd. mica cond.
C_2—250 μμfd. mica cond.
C_3, C_4—.002 μfd. mica cond.
C_5—50 μμfd. midget var. cond.
C_6—100 μμfd. midget var. cond.
C_7, C_8, C_9, C_{11}, C_{13}—.005 μfd. mica cond.
C_{10}—100 μμfd. var. cond. (.038" spacing)
C_{12}—.005 μfd., 1000 v. mica cond.
C_{14}—50 μμfd. (per sec.) split stator cond. (.038" spacing)
C_{15}, C_{16}—2-10 μμfd. neutralizing cond.
C_{17}, C_{18}—.002 μfd., 2500 v. mica cond.
C_{19}—100 μμfd. (per sec.) split stator cond. (.077" spacing)
C_{20}—.005 μfd., 3000 v. mica cond.
C_{21}, C_{25}—10 μfd., 25 v. elec. cond.
C_{22}, C_{24}, C_{35}, C_{36}, C_{37}, C_{38}, C_{39}—.1 μfd., 600 v. cond.
C_{23}, C_{27}, C_{29}—8 μfd., 450 v. elec. cond.
C_{26}—.02 μfd., 400 v. cond.
C_{28}—.05 μfd., 400 v. cond.
C_{30}—50 μfd., 50 v. elec. cond.
C_{31}, C_{32}—.1 μfd., 400 v. cond.
C_{33}, C_{34}—4 μfd., 1000 v. oil-filled cond.
C_{40}, C_{41}—4 μfd., 3000 v. oil-filled cond.
J_1—Midget closed circuit jack
J_2, J_3—Midget closed circuit jack (insulated)
J_4—Coaxial output chassis connector
J_5—Midget closed circuit jack in shield can
CH_1—10-12 hy., 75 ma. midget filter choke
CH_2—5-25 hy., 225 ma. swinging choke
CH_3—20 hy., 300 ma. smoothing choke
CH_4—5-25 hy., 500 ma. swinging choke
CH_5—20 hy., 500 ma. smoothing choke
RFC_1, RFC_2—2½ mh., 125 ma. r.f. choke
RFC_3 RFC_4—1 mh., 300 ma. r.f. choke
M_1—0-50 ma. d.c. meter
M_2—0-500 ma. d.c. meter
PS—Parasitic suppressor (Ohmite P-300)
L_1—Oscillator plate coil (See Table 1)
L_2—807 plate coil (end link) (National AR-E)
L_3—810 grid coil, c.t., center link (Barker & Williamson Type BCL or JVL)
L_4—810 plate coil, c.t., center link (Barker & Williamson Type TVH)
PB_1—S.p.s.t. push-button type sw.
RL_1, RL_2—115 v. a.c. relay, 10-20 amp. contacts
T_1—Fil. trans. 6.3 v. @ 4 amps.
T_2—Fil. trans. 10 v. @ 10 amps., c.t.
T_3—Fil. trans. 6.3 v. @ 5 amps.
T_4—Fil. trans. 5 v. @ 4 amps.
T_5—Power trans., 475-0-475 @ 300 ma.
T_6—Fil. trans., 2.5 v. @ 10 amps., c.t.
T_7—Power trans., 2500-0-2500 v. @ 500 ma.
1—7C5 tube
1—807 tube
2—810 tubes
2—6SJ7 tubes
4—6L6 tubes
1—83 tube
2—866 tubes

Parts list covering all major components used in phone transmitter. Schematic diagram is shown on opposite page.

sitics in the 6L6 stage. The 6L6 tubes pass both grid and plate mils of the 810's, but they can handle this current (about 375 milliamperes) safely.

Readers desiring to apply this same scheme to modulate final amplifiers having up to 1 kilowatt input, but where a higher d.c. voltage drop than 400 volts must appear across the modulator in order to obtain sufficient audio voltage for complete cathode modulation (peak audio voltage equal approximately to 20% of the final amplifier d.c. plate voltage), will find it desirable to use two or more parallel-connected 807 tubes instead of 6L6's. Dawley has already pointed out that practice shows beam power tubes with degenerative feedback superior to triodes as series cathode modulators.

Exciter

The exciter section is composed of a 7C5 crystal oscillator and 807 buffer. It is advisable to operate the 807 as a straight-through amplifier in order to guarantee adequate excitation for the push-pull 810 final. However, it is permissible to double, triple, or quadruple in the oscillator plate circuit, as well as operating as a straight crystal oscillator with 10- to 80-meter crystals.

The oscillator is very active but is easy on crystals. It furnishes more than enough excitation for the 807 buffer, even when multiplying the crystal frequency. The oscillator plug-in plate coil, L_1, may be wound on a 1½-inch diameter form or may be purchased. The accompanying oscillator coil table (Table 1) gives numbers of turns required for the various amateur bands.

It is advisable to adjust the exciter output for not more than 5 milliamperes 807 grid current. For this purpose, an excitation control is provided —the variable coupling condenser, C_6. This component allows smooth variation of the 807 grid mils over a wide range.

The 807 plate tank is link-coupled to the 810 grid tank by means of a length of *Amphenol* RG-8/U coaxial cable. It is recommended that either the buffer plate tank or final amplifier grid tank have a swinging link, in order that the 810 excitation may be adjusted closely for proper grid mils. However, it is not necessary that *both* of the tanks have swinging links.

Exciter Power Supply

The oscillator-buffer power supply consists of transformers T_4 and T_5, chokes CH_2 and CH_3, filter condensers C_{33} and C_{34} voltage divider R_{24} and the type 83 tube. C_{31} and C_{32} are bypass condensers for the power line.

A good power supply should be employed in this position, however this unit need not be costly. Choke input is employed in the filter. The separate rectifier filament transformer permits full push-to-talk operation without the disadvantage of having the rectifier filament extinguished during standby periods.

This power supply delivers approximately 460 volts to the 807 buffer and 300 volts to the 7C5 oscillator. Series screen dropping resistors in the oscillator and buffer stages reduce these voltages to the proper screen values. Some improvement may be expected in operation of the buffer-doubler stage by employing 600 to 700 plate volts on the 807.

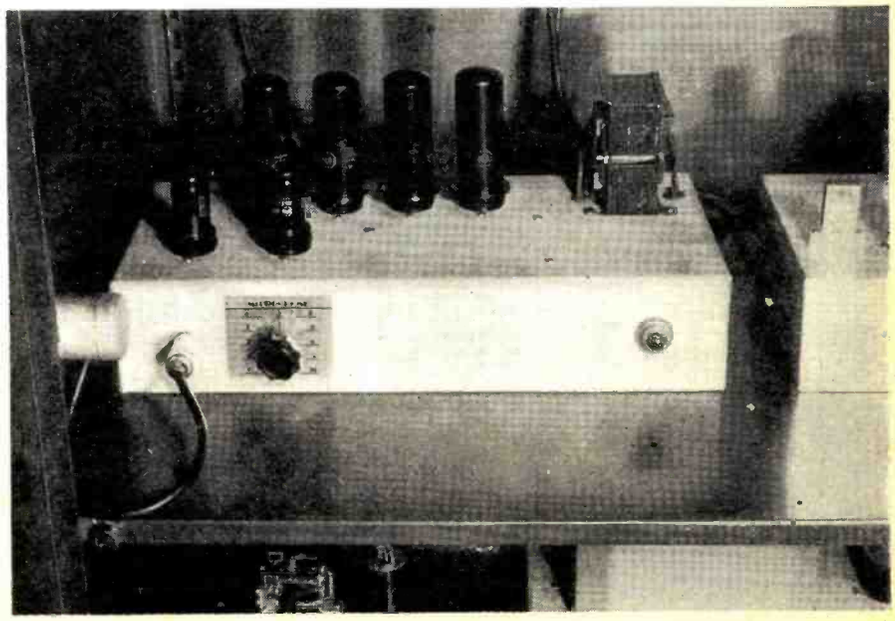
Final Amplifier

It will be noted from Fig. 2 that the 810 final amplifier is a conventional push-pull stage neutralized in the common manner. Its only slight points of difference are the omission of a grid resistor and the returning of the filament bypass condensers, C_{17} and C_{18}, directly to ground, instead of to the center tap of the filament transformer, T_2.

We found that the factory-made parasitic suppressor, PS, removed any tendency of the final amplifier toward self-oscillation or the generation of spurious frequencies. We found no advantage whatever, nor even a difference in operation, in either grounding the rotors of the 810 plate tank tuning condenser, C_{19}, connecting them to "B-plus," or connecting them to ground through a bypass condenser.

(*Continued on page 138*)

Fig. 3. Close-up view of the speech amplifier-modulator chassis. A 6.3 volt transformer is mounted on the right of the chassis. Note shield can to left of the modulator which encloses auxiliary microphone jack mounted through side of cabinet.



WIRELESS PRE-AMP

By
RICHARD L. PARMENTER

Two views of the wireless pre-amp. Self-contained oscillator transmits signal to any radio.

Designed primarily as an amplifier for musical instruments, this unit is versatile in that it lends itself to various other applications. Output is picked up on any home receiver.

PRESENTING to the musician the advantages of portability, economy, and versatility as well as having very few limitations as to location, this amplifier-oscillator should have wide appeal for those in the musical field. For the beginner and professional alike, it offers the advantages of electrical amplification for musical instruments and eliminates the need for the heavy, bulky speaker and amplifier that are usually associated with that system. It may be used in any location that has either an a.c. or d.c. power line and its fidelity is dependent almost wholly on the quality of the broadcast radio that is available. If it is desirable to play the instrument for a large gathering such as a party in a home or small hall, several radios may be placed at strategic points and by a slight extension of the antenna ample coverage can be obtained. It may also be used as a small public address system by substituting a crystal microphone for the musical instrument. This feature is often desirable for announcing or for vocalists. For the radioman and experimenter there is an opportunity to make a dollar by building these units for musically minded friends who play guitar, mandolin, violin, etc., in fact, almost any instrument that is suitable for electrical amplification. Since the unit is compact and uses few parts its cost is nominal and there should be a chance to make a reasonable profit. Another selling point is the fact that it can double for a phono-oscillator of the wireless type, by using the jack provided for the purpose.

Circuit Design

Referring to the circuit diagram shown in Fig. 1 it will be noted that three tubes are used. A 6SJ7 is used as a high gain voltage amplifier, a 6J5 serves as the voltage amplifier and modulator while a 6SK7 functions as the oscillator. The 6SJ7 provides the necessary gain so that a wide variety of pickups and microphones may be used, the only requirement being that a high impedance type be selected since the input is directly into the grid of this tube. Since the unit was designed primarily for instrumental amplification, the phono-oscillator being incidental, this jack is installed on top of the chassis and is accessible by merely removing the back cover. This cover is held on by two barrel nuts which are screwed on to spade lugs, one on each side of the cabinet.

The volume control also acts as a control for percentage of modulation and it is suggested that the builder experiment a bit with this in order to achieve the best possible quality. It would be desirable to have individual gain controls for both inputs so that mixing could be accomplished but since size was also a factor in the design of this instrument, the first stage control was sacrificed. Its use is suggested since its inclusion would be an advantage. No tone control is used since the tone can be set on the receiver being used and then left alone.

The 6SK7 tube operates as an electron-coupled oscillator and provides ample radio frequency carrier for normal uses. If the signal at the receiver being used is insufficient, a short piece of flexible wire may be attached to the antenna post of the amplifier to increase the radiation. Three to five feet should be enough for most cases. If lengths longer than this are used, precautions should be taken to see that the signal is radiating only as far as is needed for good operation. In any event the instrument should not be permitted to interfere with nearby radio receivers. The output from the 6J5 tube (audio frequency) is injected into the 6SK7 via the suppressor grid and thus modulates the electron stream flowing in that tube. The percentage of this modulation may be varied by the volume control and will be found to differ with different pickups used and/or different musical in-

struments. Over modulation should be avoided due to the inherent distortion involved.

Rather complete bypassing will be noted. This is necessary due to the high gain characteristics of the first tube. The grid leads of all three stages may have to be shielded if feedback troubles are encountered. In any event, it would be well to shield the leads of the 6SJ7 and 6J5. A decoupling network in the high voltage lead to the first tube is provided to avoid the possibility of common coupling effects. The power supply section is a conventional, half-wave affair using a selenium rectifier which saves space and contributes to the simplicity of construction. The 75 ma. size selenium rectifier was used. Care should be exercised when installing this unit to insure that the correct polarity has been observed. Connect — and + terminals as shown in the diagram. R_{13} is a current limiting resistor to hold down the initial surge of current and to prolong the life of the rectifier. The line cord resistor, R_{12}, is a standard unit of 330 ohms. For this unit a 50 watt resistor of 400 ohms could be used with the slider set at 325-330 ohms. The resistor is perhaps preferable but it should be mounted so that the heat will be dissipated properly and should not be located near the rectifier unit.

Construction

The chassis was made of a piece of sheet metal 7" x 5½" which was bent at right angles at 2" so as to form a shelf 7" x 3½" and then a ¼" flange was bent down on the shelf. This is shown in the photo, however, these specifications need not be followed exactly as any conveniently small chassis can be used. In the rear view photo the tubes from left to right are; 6SK7, 6J5, and 6SJ7. The coil is behind the 6J5. A small standoff insulator with a *Fahnestock* clip is used for the antenna connection but an insulated binding post could be used equally well. The jack for the phono-input is mounted on top of the chassis and is behind the rectifier. It would be more convenient, of course, to have this on the front panel but the builder may use his own discretion. When mounting the parts on the chassis, plan the layout so that the adjustable padding condenser, C_{11}, is mounted on the front of the panel adjustment. This is necessary so that when using the "box" in different locations it will be possible to adjust for a clear spot on the broadcast band.

Below the chassis all wiring is done "point-to-point." Bypass condensers are mounted right at the sockets. Short leads are desirable even at the expense of appearance. Keep the filament wiring as far as possible from other wiring, especially the grid and plate leads. Run a piece of bus-bar the length of the chassis. Ground it at one end of the chassis and then make all ground connections to this bus. Use no external ground with the unit.

The cabinet is constructed of two pieces of pine board 3" x 5", ¾" thick for the ends. The top and bottom are Masonite 3¼" x 8½". The panel is also constructed of Masonite and this is drilled for the instrument jack, volume control, and the off-on switch. A ¼" hole through which an insulated screwdriver may be inserted to tune the padding condenser, C_{11}, is also included. Assembly is accomplished by using flat head wood screws and the whole box, except the front panel, may be painted flat black enamel. While some other finish might be preferable, flat black makes for a neat appearance and is quite durable. A dime store plastic handle is attached to the top of the box for convenience in carrying the unit.

The professional appearing front panel is achieved by using a procedure borrowed from the photo-finisher. A piece of tracing paper large enough to cover the front panel is marked for the holes to be drilled. This is then removed and the lettering and designing is done on this. Use pencil at first and then ink in the final product being sure that the solid areas in black are good and solid and that the lettering is quite heavy. Remember that what appears in black on the paper will come out white in the finished panel. Now use this drawing in place of a photographic negative and print out using Velox F3 or F4 contact paper. The exposure for most convenient handling is about 3 seconds using a 40 watt lamp about 10 inches away. Experimentation is necessary, of course. Anyone who dabbles in photography can give you instructions and details on this or, better still, take the drawing that you have made to him and let him process it for you.

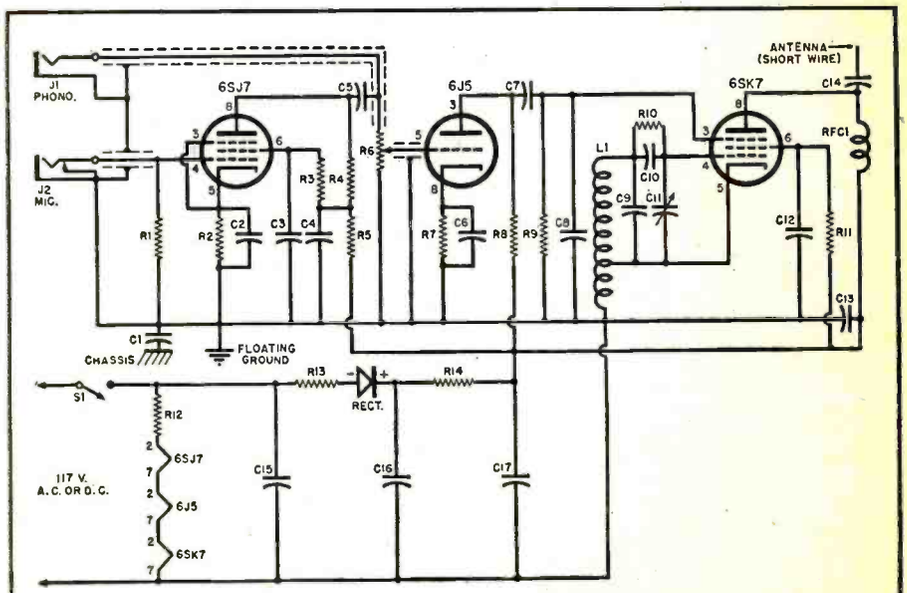
This photographic print is then mounted on the panel using some good adhesive such as *Casco* glue. Make sure that the glue contains no lumps since these would show conspicuously on the glossy panel. For greater durability this panel may be covered with a clear plastic material which may be cemented in place using clear *Duco* cement.

Operation

After the unit has been wired and checked for correct connections the line plug may be inserted. Oscillation may be detected by running over the broadcast band on a nearby receiver. A spot should be found that will have the rushing sound of a station but there will be no modulation on it. Set the volume control on the receiver at nearly full on and the control on the "box" at about half point. Then plug a record player into the phono jack and play a familiar record to identify the carrier of the unit. If no record player is available merely touching the grid of either 6SJ7 or 6J5 will cause a motorboating sound which can help you identify the carrier. Now if the frequency is not "in the clear" adjust the padder condenser previously mentioned for a better frequency. In our location the low fre-

(*Continued on page* 146)

Fig. 1. Complete schematic diagram of three-tube, a.c.-d.c. operated pre-amp.



R_1—500,000 ohm, ½ w. res.
R_2—4000 ohm, ½ w. res.
R_3—1 megohm, ½ w. res.
R_4—200,000 ohm, ½ w. res.
R_5, R_{11}—50,000 ohm, ½ w. res.
R_6—1 megohm pot.
R_7—3500 ohm, ½ w. res.
R_8, R_{10}—100,000 ohm, ½ w. res.
R_9—25,000 ohm, ½ w. res.
R_{12}—330 ohm line cord res. or 400 ohm, 50 w. res. with slider set at 330 ohms
R_{13}—75 ohm, ½ w. res.
R_{14}—1000 ohm, 2 w. res.
C_1, C_3, C_{13}—.1 μfd., 400 v. cond.
C_2, C_6—10 μfd., 25 v. elec. cond.
C_4—8 μfd., 150 v. elec. cond.
C_5, C_7—.01 μfd. mica cond.
C_8, C_9—300 μμfd. mica cond.
C_{10}—100 μμfd. mica cond.
C_{11}—3-30 μμfd. ceramic trimmer cond.
C_{12}—.005 μfd., 400 v. cond.
C_{14}—25 μμfd. mica cond.
C_{15}—.05 μfd., 400 v. cond.
C_{16}, C_{17}—40/40 μfd., 150/150 v. elec. cond.
J_1—Open circuit phone jack
J_2—Closed circuit phone jack
L_1—96 t. #30 en. closewound on ⅜" dia. form. Cathode tap 33 t. from gnd.
RFC_1—30 mh. r.f. choke
S_1—S.p.s.t. toggle sw.
Rect.—75 ma. selenium rectifier
1—6SJ7 tube
1—6J5 tube
1—6SK7 tube

FM RECEIVER ALIGNMENT

By
IRVING ABEND

Successful FM alignment depends on your "know-how." Procedure is similar to that used for AM with the exception of limiter and discriminator adjustments.

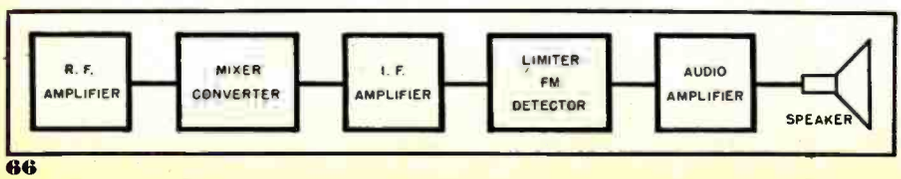
ALIGNMENT of FM receivers can be accomplished with a minimum of equipment, consisting of a signal generator capable of generating frequencies up to 16 mc., and if r.f. alignment is required, frequencies of 42-50 mc. for the old FM band, and 88-108 mc. for the new FM band. Either a v.t.v.m. or a multimeter of at least 5000 ohms-per-volt sensitivity can be used. Some receivers may only be aligned properly by the use of a v.t.v.m. but in all cases of FM receiver alignment a v.t.v.m. is preferable.

FM alignment technique can be developed by the proper approach, and in most instances closely resembles broadcast receiver adjustment except for the discriminator and the frequencies used for the i.f. and r.f. sections.

Due to the variety of discriminator and general FM receiver designs used by manufacturers, it is always best, if possible, to review the instructions for adjustment issued by each manufacturer before making any attempt to align an FM receiver. This procedure is advantageous and may eliminate possible troubles which may be encountered if an attempt at adjustment is made before full particulars of a set are known. The reason for this precaution is because FM receiver design is a relatively new art which has very little precedent, allowing each manufacturer to design sets to his own way of thinking, with the result that every FM set contains circuits which are the brain-children of one particular engineer. Essentially, however, the basis of circuit design is the same in every case, and the radio serviceman can recognize this if he has at least a basic understanding of FM receivers and their functions.

Referring to Fig. 1, it can be seen that an FM receiver is essentially the same as an AM broadcast set except for the discriminator. It has an r.f. stage which may consist of an r.f. tube or antenna coil, a mixer or converter, an i.f. amplifier, a second detector or discriminator, and an audio amplifier.

Fig. 1. Block diagram of a typical FM broadcast type receiver.



Before an FM set is aligned, the i.f. frequency must be determined. Most prewar sets used 4.25-4.3 mc. as standard for i.f. and discriminator operating frequencies, but some receivers may use i.f.'s in the vicinity of 6.25, 8.25, 12.25, or 15 mc. The standard i.f. for the new FM band is 10.7 mc. and any sets designed for the new band will undoubtedly use this i.f. frequency. Manufacturers generally state all operating frequencies of a particular receiver in their instruction sheets, but if one is not available, the method for determining the i.f. will be explained later.

The first and most important step is the checking and adjustment of the discriminator. Extreme care should be taken in this procedure as this circuit is the heart of all FM sets. On this operation depends the proper detection, without noticeable distortion, of the FM signal. If the discriminator is not properly aligned, very noticeable audio distortion will result.

To adjust a discriminator properly, some knowledge of its operation may prove helpful, and a brief description of various circuit arrangements, all producing the same result, will be given. The most common form of FM discriminator is the Foster-Seeley circuit, which was used in most prewar FM receivers.

A conventional Foster-Seeley discriminator circuit is shown in Fig. 2A. It consists of a primary coil A and a center tapped secondary coil B. The primary is connected to the center tap of the secondary through condenser C, and the primary voltage appears across resistor R. The secondary is connected to the diode plates of V_1 and V_2. Fig. 2B shows a simplified version of 2A. Referring to Fig. 2B, the voltage E_p (primary voltage) is in series with each half of the secondary voltages E_1 and E_2. E_1 is rectified by the diode tube V_1 causing a d.c. voltage drop across R_1C_1 with polarity as shown. E_2 is rectified by diode tube V_2 causing a d.c. voltage across R_2C_2 with polarity as shown. A signal voltage appearing across the primary and induced into the secondary will cause equal d.c. voltages to appear across R_1C_1 and R_2C_2 when this signal voltage is at the frequency of primary and secondary resonance. The d.c. voltages are in series and opposite in polarity with the resulting voltage appearing between point X (Fig. 2A) and ground equal to zero. If the signal voltage is either above or below the resonant frequency of the primary and secondary circuits, $E_p + E_1$ or $E_p + E_2$ will be either higher or lower in voltage depending on whether the frequency is higher or lower than resonance. Let us assume the frequency to be above and the resultant voltage $E_p + E_1$ will be increased while $E_p + E_2$ will decrease. A higher d.c. voltage will be

developed across R_1C_1 with the result that the voltage between point X and ground will be positive. If the frequency was lower than resonance a negative potential would appear between point X and ground. It can then be seen that a signal varying in frequency at an audio rate would produce a variation in voltage between point X and ground corresponding to that audio frequency. Referring to Fig. 2A, R_3 and C_3 comprise a de-emphasis network to attenuate the higher audio frequencies that are pre-emphasized at the FM transmitter. This network is proportioned so as to attenuate the higher audio frequencies by the same amount they are accentuated at the FM transmitter.

A variation of the circuit using a choke instead of a resistor is shown in Fig. 3A. Fig. 3B shows a circuit which eliminates R shown in Fig. 2A and uses only one bypass condenser, C_1. Fig. 3C shows a circuit with ungrounded cathode with respect to direct current.

To align the discriminator, the operating frequency must first be determined if it is not known. Connect a signal generator between point Y in Fig. 2A and ground. If two limiters are used, connect the generator to the grid of the first limiter. It is always advantageous to use a condenser of .01 to .1 μfd., in series with the generator lead. Set the generator for maximum output, and connect the v.t.v.m. probe to point Z in Fig. 2A. If a multimeter is used, connect the multimeter as a milliammeter between R and the junction of R_1 and R_2. Bypass the leads at the connections with a condenser of at least .01 μfd. Set the multimeter to the 0-1 mil scale. (Note: a lower or higher scale may be needed depending on the signal strength and circuit components. Point Z is negative with respect to ground. The negative lead of the multimeter should be connected to the loose end of resistor R.) Vary the frequency of the signal generator between 4 and 16 mc. The frequency at which maximum deflection of the v.t.v.m. or multimeter occurs is the operating frequency.

To check the discriminator, leave the signal generator connected as before and connect the v.t.v.m. to point X, Fig. 2A, or when using a multimeter connect the negative lead to point Z, use a 50 volt or higher scale, and connect the positive lead as described below. Set the signal generator to approximately 50 kc. above the operating frequency of the discriminator. If a v.t.v.m. is used, record the voltage as to magnitude and sign. If a multimeter is used, connect the positive lead to point X and record the voltage. Now set the signal generator approximately 50 kc. below the operating frequency of the discriminator. Record the voltage on the v.t.v.m. as to magnitude and sign, or connect the positive lead of the multimeter to ground and record the

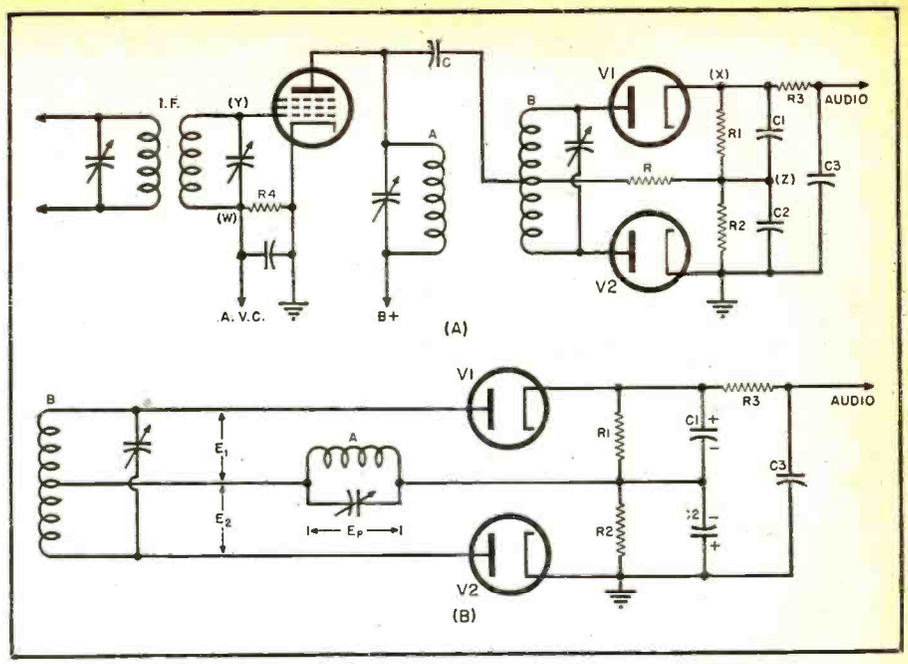
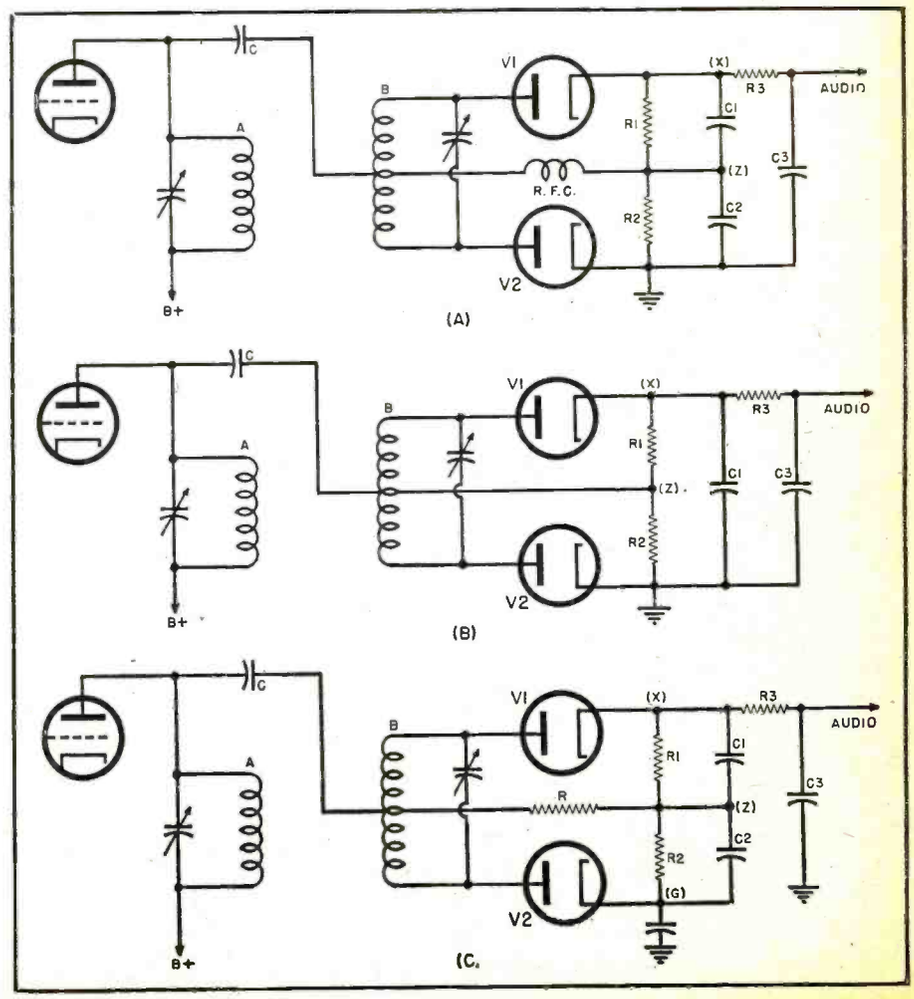


Fig. 2. (A) Schematic diagram of conventional Foster-Seeley discriminator. (B) A simplified diagram of discriminator circuit shown in Fig. 2A.

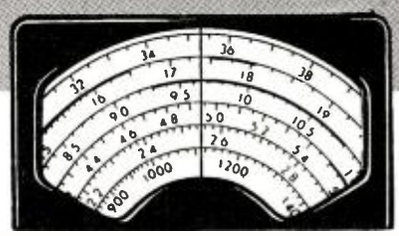
voltage. Set the generator approximately 75 kc. higher, then lower, and record the voltages as described above for the 50 kc. settings. When using the v.t.v.m. the readings for the upper and lower frequencies should be about equal (within 10% of each other) and of the same polarity. If extremely accurate equipment is used the read-

(*Continued on page* 113)

Fig. 3. Variations of the Foster-Seeley discriminator shown in Fig. 2A. (A) Choke used in place of resistor, R. (B) Resistor, R, has been eliminated from the circuit and (C) cathode is grounded with respect to d.c.



International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

THIS month's ISW Department is dedicated to radio station HP5J/HP6J, "La Voz de Panama," Box 34, Panama City, Republic of Panama, and to the genial manager and director of its "Daily Newspaper of the Air," George Williams.

We are grateful to Paul Kary, Pennsylvania, and to Mr. Williams for this material.

George Williams has been in radio since 1915. In 1919, he was one of the first to talk in experiments from the British Flagship, *Queen Elizabeth,* in Scapa Flow when the U.S. fleet, led by the flagship, *New York,* was with the British fleet. After the German naval surrender, much experimenting was carried out by three officers on board the *Queen Elizabeth* and at a distance of 20 miles, speaking messages were exchanged.

As a British naval officer in World War I, George Williams was the first to pick up the German message of surrender which read: "Good morning, if you can hear, please answer." This was the first German message which led up to the surrender in 1918. It was Mr. Williams who tapped out the famous message from Admiral Beatty, Commander-in-Chief of the British fleet, to the Commander-in-Chief of the German High Fleet, which read: "The German flag will be hauled down today, at 15:57, and not hoisted again without permission."

After this, the Germans scuttled the German fleet and salvage work was begun. Williams and others carrying out the radio experiments went aboard the German battleship, *Bayden,* after she was salvaged, to strip her of radio equipment so the British could learn about the German *telefunken* (for with this method the Germans could transmit at a given distance to avoid their signals being picked up by the enemy, and this the Allies could not do at that time, never being sure how far their signals would go!). "After acquiring this German equipment," explains Mr. Williams, "months were taken up in experimenting. Then we started on the exchange of messages by 'talking.' At that time if anyone had said that soon we would be exchanging messages so many thousands of miles as we now do, we would have called him a 'fool.' "

In 1931, Panama was not on the air. A company was formed, called "Servicio Publico de Radio S.A." Using transmitters atop La Poyera building in Panama City, and by the use of loudspeakers placed in all parts and on street corners of the city, news, music, and other entertainment was given to the public. Hundreds would gather in the evenings to listen to these broadcasts. It was not until 1933 that Panama first went on the air—and Mr. Williams, who was then carrying his "Radio Newspaper" to the public by means of the loudspeakers, also took to the ether! Although Panama is a Spanish-speaking country, the first news broadcast in Panama was his in *English*—which was followed many months later by a Spanish newscast.

The "Voice of Panama" then took over in place of the loudspeaker system, but the company is the same, and the contract to allow the loudspeaker system to operate is still in force.

Mr. Williams explains that "La Voz de Panama" cannot be missed when you arrive in Panama City. "As soon as you leave the main railroad station, if you look right across the main street, you will see it. In fact, it is right next door to the famous night-club known the world over as Kelly's (Mrs. Kelly is well-known in the United States for her night club entertainment in Panama). Then, if you stay at the famous International Hotel, where the Casino is situated, you will look out into the 'Voice of Panama.' Many of the guests, incidentally, have complained that the loudspeakers on the balconies of the 'Voice of Panama' building wake them up too early Sundays for 'Take It or Leave It,' which is followed by the national lottery drawings."

Not only is "Take It or Leave It" one of Mr. Williams' outstanding programs, but there is a long list of others. "World's Most Honored Music" at 1800-1830* Sundays is a popular feature. "Green Hornet," "Lest We Forget These Great Americans," and other U.S. State Department programs; "They Lived to Tell the Tale," "America Speaks," "Story of the U.S.A.," "A Look at Australia," "A Look at South Africa," and so on are presented regularly.

There are few people in the Republic of Panama, and the Canal Zone, who do not know George Williams—for he has been on the air for 16 years in Panama "without as much as 48 hours' vacation!" He probably holds the record for "sticking to the job" as

(*Continued on page* 148)

Studio A of the "Voice of Panama" in Panama City showing George Williams, Director of the station's popular "Radio Newspaper," at the microphone.

* Unless otherwise indicated, time herein is expressed in American EST; *add* 5 hours for GCT "News" refers to newscasts in the *English* language.

Utility Locker makes Deluxe CABINET

By
CHARLES H. WELCH,
W5MHK

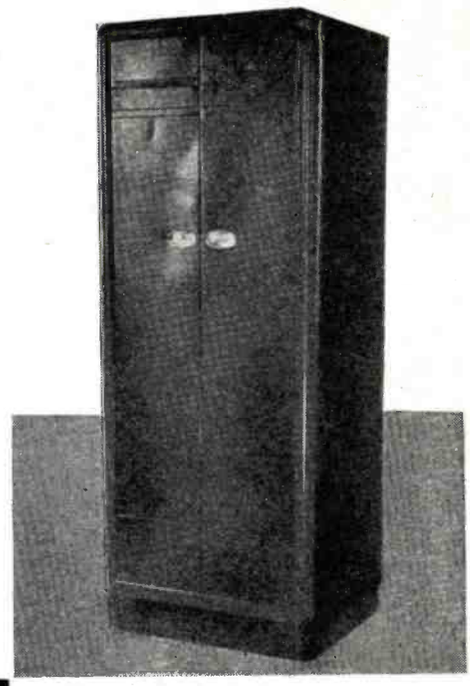


Fig. 1. Utility locker before conversion. These units are universally available.

Fig. 2. (Left) rear view of converted cabinet showing correct way of hanging doors. (Above) front panel view showing window and meter holes cut in Masonite panel.

Your rig housing can look professional even though basic unit is a low-cost metal cabinet.

IT IS DOUBTFUL that there is a single case on record in which a ham has viewed commercially-built broadcast equipment without wistful sighs and mutterings about wishing his rig looked as good as that. If he decided to do something about it, a quick glance at price lists on such streamlined cabinets usually was enough to pull his head down out of the clouds, but quickly. If that shoe fits you, take heart fellow, no longer need your lusty sighs riffle the pages of your log-book, for here is a cabinet which can hold up its head in any company, and you can own one like it for about thirty dollars and a very few hours' work. This is a conversion job—*not* a construction job, so you'll need only the barest essentials in ham shack tools.

The first step, of course, is to get the cabinet which you are going to convert. The one shown in the photograph of Fig. 1 is marketed as a metal utility locker. It is first cousin to the utility cabinets usually used for kitchen storage. The utility locker differs in having greater depth and no shelves. Its dimensions are sixty-five inches high, twenty-six inches wide, and twenty inches deep. It is of all-steel construction, spot welded, and comes in several colors. It sells at furniture stores for about $22.50. Of course, it is not necessary to obtain a cabinet identical to this one, though care should be exercised in selection, making sure that the unit is one with rounded corners and streamlined appearance, as well as of sturdy construction.

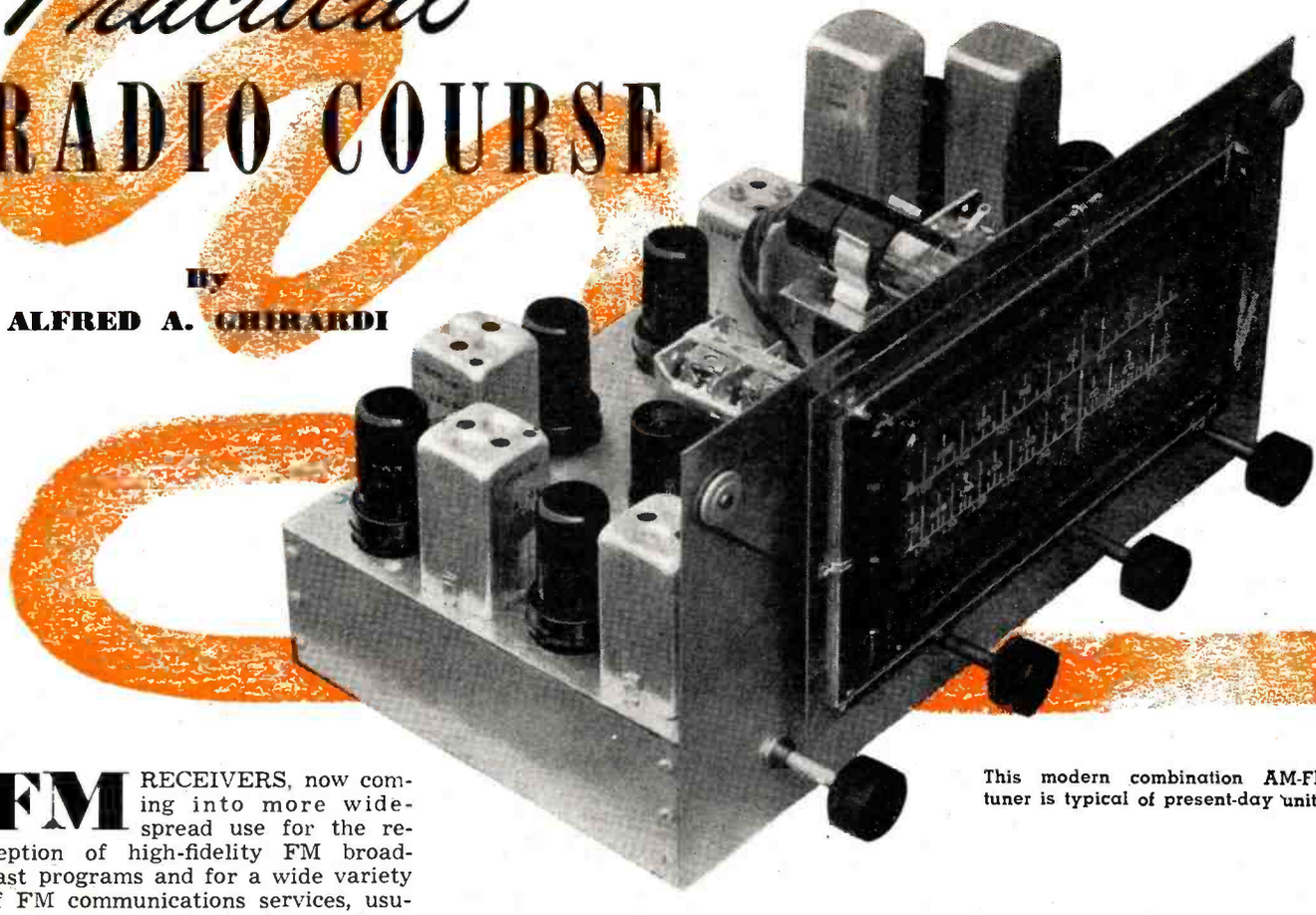
The first step is to remove the doors, hinges and all. The hinges are spot-welded to the cabinet and should be cut free with a small cold chisel, taking care not to damage the cabinet or hinges any more than necessary. Any roughness left by the weld should be smoothed off before painting later. The door opening is then measured for the panel. The panel itself is cut out of tempered Masonite or similar material. This material has several advantages. It is inexpensive, is easily worked, and when enameled, takes a very good finish. A metal panel could, of course, be substituted if desired. The window for observation of the final amplifier tubes is of plexiglas or similar plastic. If you didn't get any of it on the surplus market, it can be obtained at your local airport in the lighter weights. The window frame is of extruded aluminum molding as sold at lumber yards for edging linoleum table-tops, etc. It comes in many shapes and sizes, so you may choose the one best suited to your panel material. The meter holes are easily cut in the panel, though it pays to use some foresight in the number and spacing, so more may be added easily later, if necessary.

An angle-iron frame should now be made. Its inside dimensions should match those of the door opening. This will be the door frame when the doors are installed in the back of the cabinet. It should be so constructed that one side of the angle-iron will bolt flat against the back, the other turning in to make the door facing. This

(*Continued on page* 162)

Practical RADIO COURSE

By
ALFRED A. GHIRARDI



This modern combination AM-FM tuner is typical of present-day units.

Part 55. Analysis of circuits, components, and signals that make up present-day high-fidelity FM receivers.

FM RECEIVERS, now coming into more widespread use for the reception of high-fidelity FM broadcast programs and for a wide variety of FM communications services, usually employ the superheterodyne principle. Consequently, each FM receiver employs an intermediate-frequency amplifier (see Fig. 1) that contributes the major part of the r.f. gain of the receiver and provides the selectivity necessary to prevent possible interference from adjacent-channel FM transmitters.

Because FM signals have several special characteristics that differ from those of AM signals, it is necessay to design the i.f. amplifier of an FM superheterodyne receiver to have special selectivity and bandpass characteristics to meet their requirements. These requirements will be better understood if we digress from our study of intermediate-frequency amplifiers at this point in order to review briefly the fundamentals of frequency modulation and to become better acquainted with the characteristics of the FM signals commonly employed in high-fidelity FM broadcasting, and those used in FM communications work.

Review of Amplitude Modulation

It will be recalled from the discussion presented in a previous article[1] of this series that when *Amplitude Modulation* (AM) is employed for modulating an r.f. carrier wave by an audio-frequency modulating voltage, the frequency of the carrier remains constant but its *amplitude* is varied in accordance with the variations in the modulating voltage. This is illustrated by the series of audio modulating voltages (drawn at the center) and the series of corresponding amplitude-modulated r.f. waves produced (each one is drawn directly above the audio modulating voltage that produced it) in Fig. 4. Observe from these illustrations that the following relations between the modulating voltage and the amplitude-modulated r.f. carrier wave hold true:

1. During modulation the *amplitude* of the transmitted modulated r.f. wave (and the radiated power) is varied, but its frequency remains unchanged. (Observe that in the amplitude-modulated waves shown at *A, B, C, D,* in Fig. 4, the amplitude of the r.f. wave varies but the frequency-number of cycles per second—remains unchanged.)

2. An increase in the *amplitude* of the audio modulating voltage (weak sound, to loud sound, to louder sound) causes the *amplitude* of the resulting amplitude-modulated r.f. wave to vary over a wider range. (Compare waves *A* and *B*—also waves *C* and *D* —in Fig. 4).

3. An increase in the *frequency* of the audio modulating voltage (low frequency sound to higher-frequency sound) increases the *rate* at which the amplitude of the modulated r.f. wave is varied. (Compare waves *B* and *C* in Fig. 4).

4. The bandwidth occupied by the sideband frequency components produced depends only upon the *highest frequency* of modulation, and not upon the degree of modulation. (Study illustrations *A, B, C, D;* then study and compare the corresponding sideband component illustrations above them in Fig. 4).

5. Since only one pair of sidebands is produced for each modulating frequency, a bandwidth of *twice* the highest modulating frequency is sufficient for satisfactory passage of the amplitude-modulated wave under any degree of modulation. (Study illustrations *A, B, C, D* and the corresponding sideband frequency component illustrations in Fig. 4).

In frequency modulation (FM), the modulating is done by varying the *fre-*

[1] See Alfred A. Ghirardi, Practical Radio Course, Part 54, (RADIO NEWS, July 1947).

quency of the transmitted wave; its amplitude remains unchanged. Sideband frequency components are created in the frequency-modulation process, as in the amplitude-modulation process, but they can be much more numerous in FM. A summary of the more important relations that exist between the modulating voltage and the resulting frequency-modulated r.f. wave follows:

1. During modulation the *frequency* of the transmitted wave is varied but its amplitude remains unchanged. (Study frequency-modulated waves *E, F, G, H* in Fig. 4, and observe that the amplitude is constant in each but the frequency varies, as indicated by the occasional narrowing and widening of the r.f. alternations.) The radiated power also remains unchanged.

2. An increase in the *frequency* of the audio modulating voltage increases the *rate* at which the frequency of the transmitted wave is varied. (Study frequency-modulated waves *F* and *G*, and the audio modulating voltage wave, directly above, corresponding to each.)

3. An increase in the *amplitude* of the audio modulating voltage causes the frequency of the transmitted wave to *deviate* or be varied over a wider range. (Study frequency-modulated waves *E* and *F*, *G* and *H*, and the audio modulating wave corresponding to each.)

4. The frequency-modulated r.f. wave is the sum of a *center-frequency* component and numerous pairs of *sideband* frequency components. (The center-frequency component has the same frequency as the unmodulated carrier.) The two components comprising the *first* sideband pair have frequencies respectively higher and lower than the center-frequency component by the amount of the modulating frequency (just as in amplitude modulation). Observe this in the sideband component illustrations (directly below) corresponding to frequency-modulated waves *E, F, G, H* in Fig. 4. There are additional pairs of sideband components which can have appreciable amplitude and therefore be of considerable importance. For example, the *second* pair of sideband components, having frequencies that are higher and lower than that of the center frequency component by *twice* the amount of the modulating frequency, can also be important. (See frequency-modulated wave *F* and the illustration, directly below it, of the center-frequency component and sideband components of which it is composed.) The same is often true of the *third* pair of sideband components which are of frequency removed from the center frequency by *three* times the modulating frequency (see wave *H* and the illustration of its sideband components directly below it), and of higher orders of sideband component pairs whose frequencies differ from the center frequency by correspondingly greater amounts. When the modulation is slight, only the pair of sideband components nearest in frequency to that of the center-frequency component will have sufficient amplitude to be important. Under this condition, the bandwidth required is no greater than it would be if amplitude modulation were used instead. (Study waves *A* and *E* and observe the number and frequency-spacing of the sideband frequency components produced for each.) As the extent or level of the modulation is increased (corresponding to greater *depth* of modulation in AM), more pairs of sideband components acquire appreciable amplitude and become important, so the bandwidth transmission and reception requirements become much greater than for amplitude modulation. (It will be instructive to compare both the *amplitudes* and the *frequency separation* of the various sideband components produced by the different frequency-modulation conditions illustrated in Fig. 4, by examining and comparing, in turn, the illustrations of the sideband component composition of waves *E* and *F*, *F* and *G*, and *G* and *H*. The sideband components produced in FM may be compared directly with those produced in AM by examining, in turn, the sideband component illustrations corresponding to waves *E* and *A*, *F* and *B*, *G* and *C*, *H* and *D* (in Fig. 4).

5. The bandwidth produced in FM depends upon both the level of modulation and upon the modulating frequency. The greatest bandwidth occurs when the wave is subjected to *maximum modulation* (100%) at the *highest modulating* frequency, for then the frequency difference be-

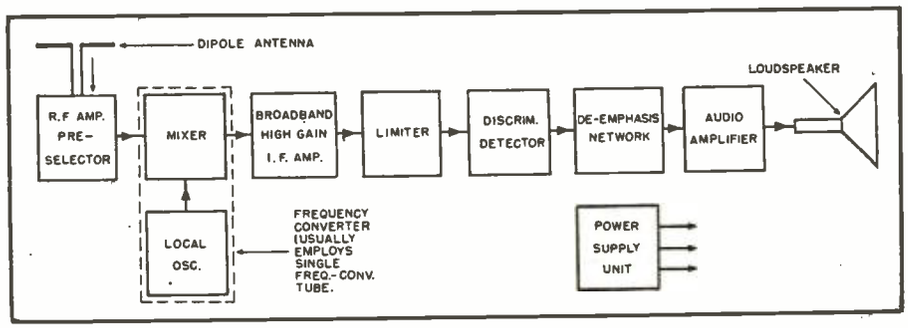


Fig. 1. Basic elements of a typical FM superheterodyne broadcast receiver.

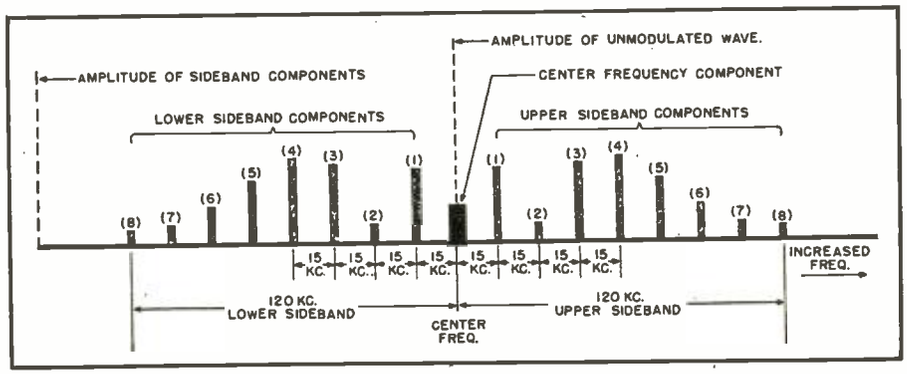
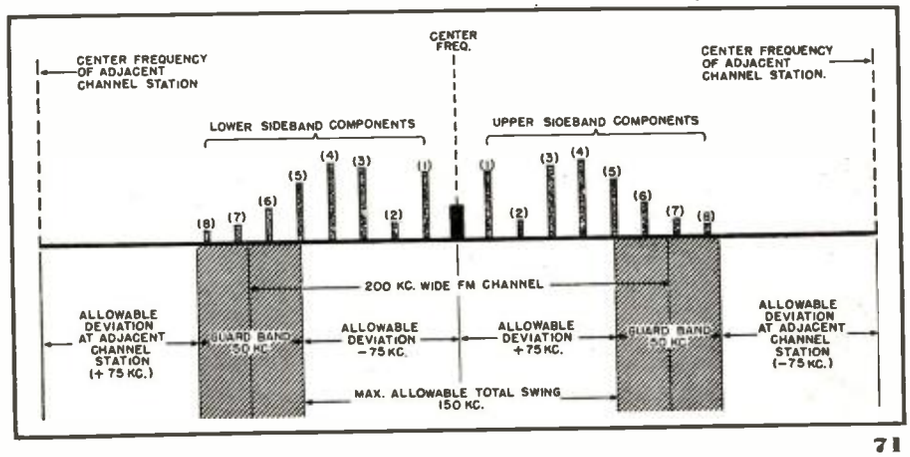
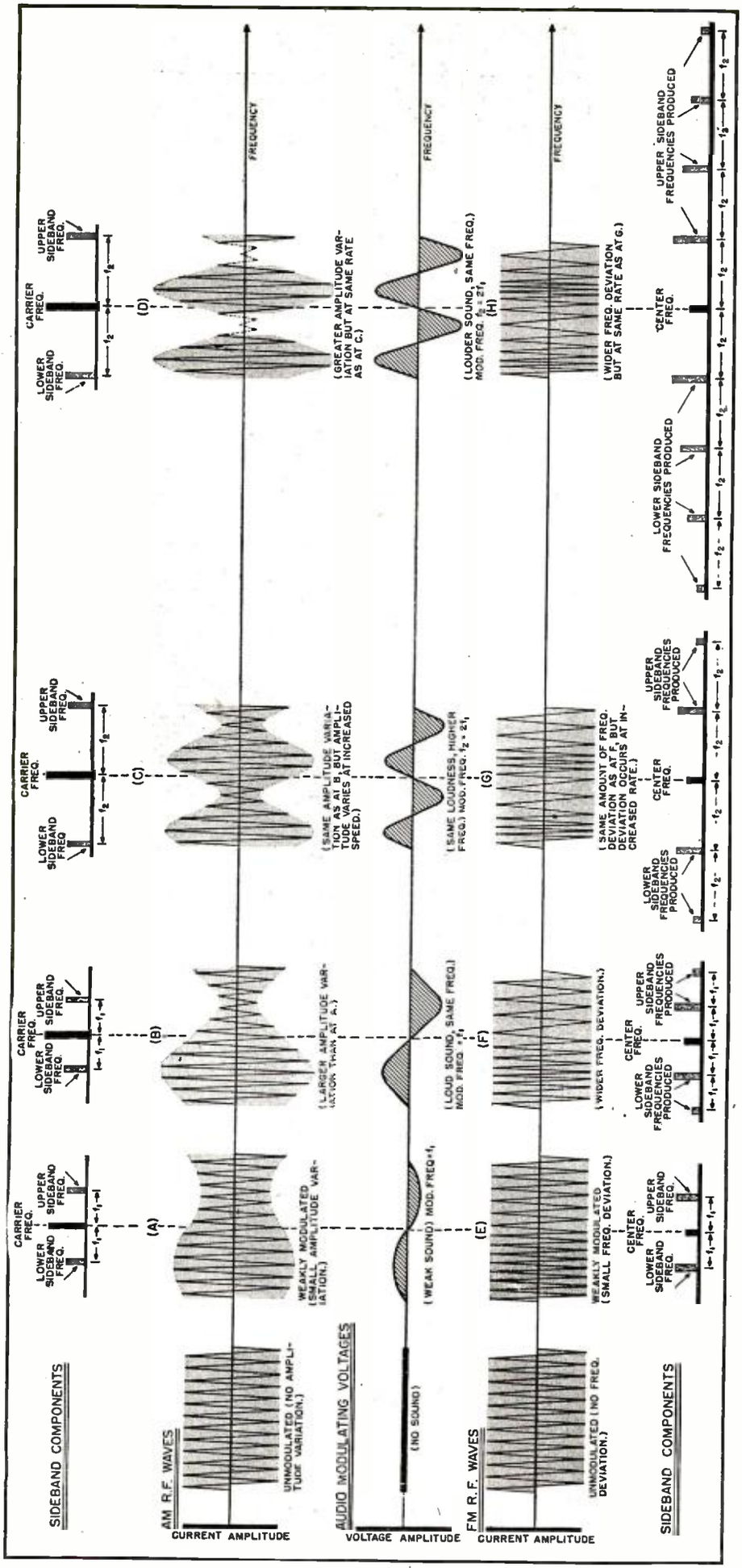


Fig. 2. Illustrating the center-frequency component and eight pairs of sideband components produced (drawn here in their relative amplitudes) when the frequency is varying over the full deviation range of ± 75 kc. (100 percent modulation) at 15 kc. per second, in FM broadcasting. The separation between each two adjacent sideband components is equal to the modulating frequency.

Fig. 3. FCC standard FM broadcast signal and transmission channel specifications. The sideband frequency components set up at 100 percent modulation, when the audio modulating frequency is at the system-maximum of 15 kc., are shown at the top of their relative amplitudes.





tween successive sideband components is greatest and the amplitudes of those far removed from the center-frequency are large enough to make them important (see Figs. 2 and 4). Under this condition, the bandwidth may exceed considerably the peak-to-peak frequency swing. (See strongly-modulated wave *H* and its sideband component illustration in Fig. 4.) The least bandwidth is required under a condition of slight modulation, but under any condition of modulation the total channel width is never less than the amount of twice the modulating frequency. (See weakly-modulated wave *E* and its sideband component illustration, in Fig. 4.)

It will be instructive to compare these characteristics of frequency modulation with those stated previously for amplitude modulation.

A frequency-modulated current or wave may be visualized as one of constant-amplitude, but whose frequency is caused to vary, from its "center" or "resting" value, by the audio modulating voltage. The extent *to which its frequency is caused to vary from its "resting" value, from instant to instant, is governed by the* amplitude *of the modulating voltage at each instant. The* rate *at which it is caused to vary at any instant is governed by the* frequency *of the modulating voltage at that instant.*

Audio Frequency Range Required for Speech

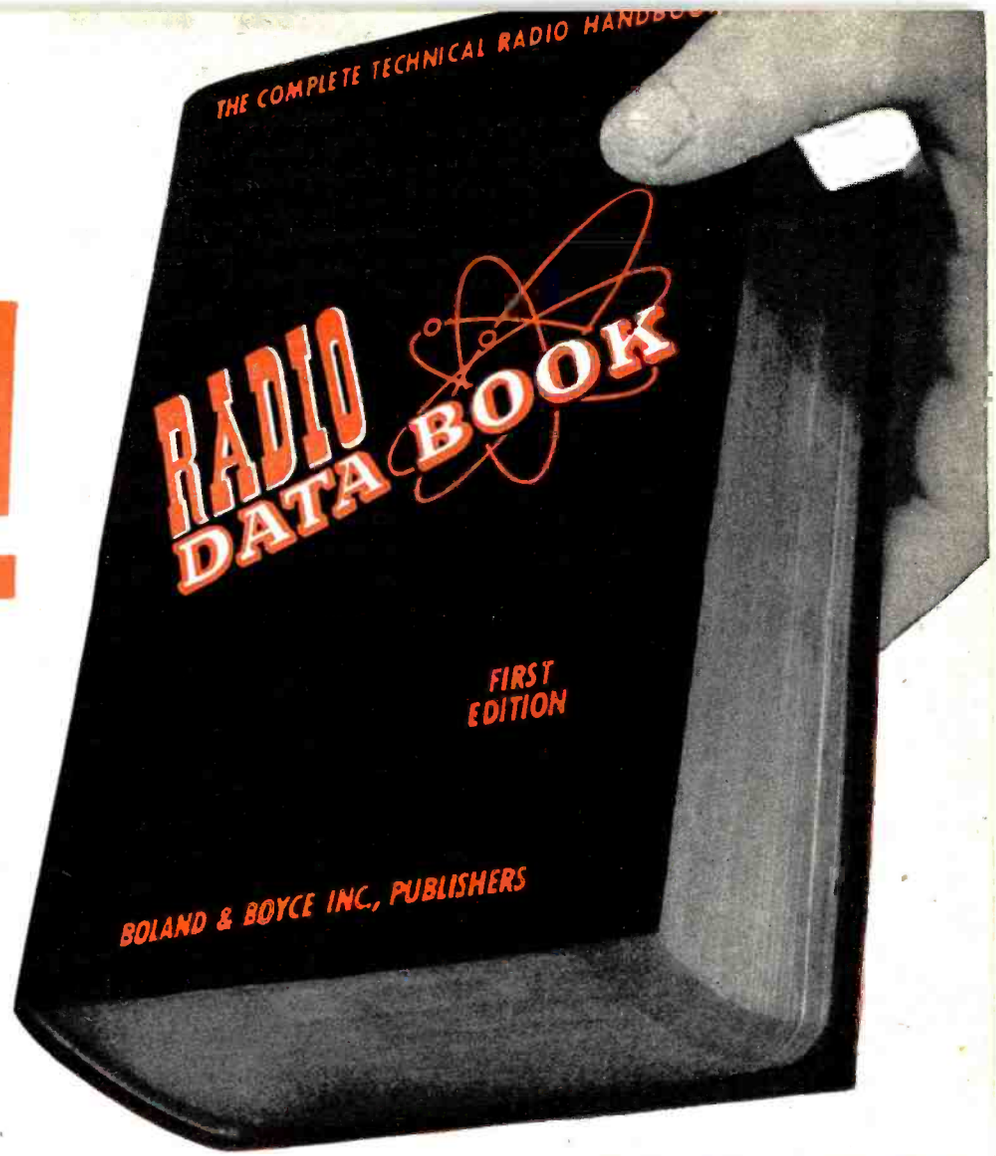
In FM communications systems, such as those employed for police radio, emergency radio, some phases of amateur radio, etc., it is usually necessary to transmit *speech* intelligence only. In such communication the highest audio modulating-frequency that must be handled for intelligible communication is of the order of only about 3000 cycles, so the sidebands required to be transmitted are comparatively narrow.

Audio Frequency Range Required For Hi-Fi Broadcasting

In a high-fidelity FM broadcasting system, for transmission and realistic reproduction of any sound material including a symphonic program, it is desirable that an adequate *dynamic* (volume) range and the full audio *frequency* range from 50 to 15,000 cycles be transmitted, received, and reproduced so that all the important overtones of musical instruments such as the violin, flute, etc., will not be lost and full realism preserved. Since frequencies higher than about 15,000 cycles are inaudible to most human ears, it has been decided that the audio cut-off in American high-fidelity FM broadcasting, should occur at about 15,000 cycles (15 kc.). This is in contrast to a cut-off value of the order of 5000 cycles which, for sev-

Fig. 4. Direct comparison of the effects produced by amplitude modulation and frequency modulation when first the amplitude, and then the frequency, of the modulating audio voltage, or sound, is increased.

NEW!



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eral reasons, is the limited value employed in AM broadcasting.

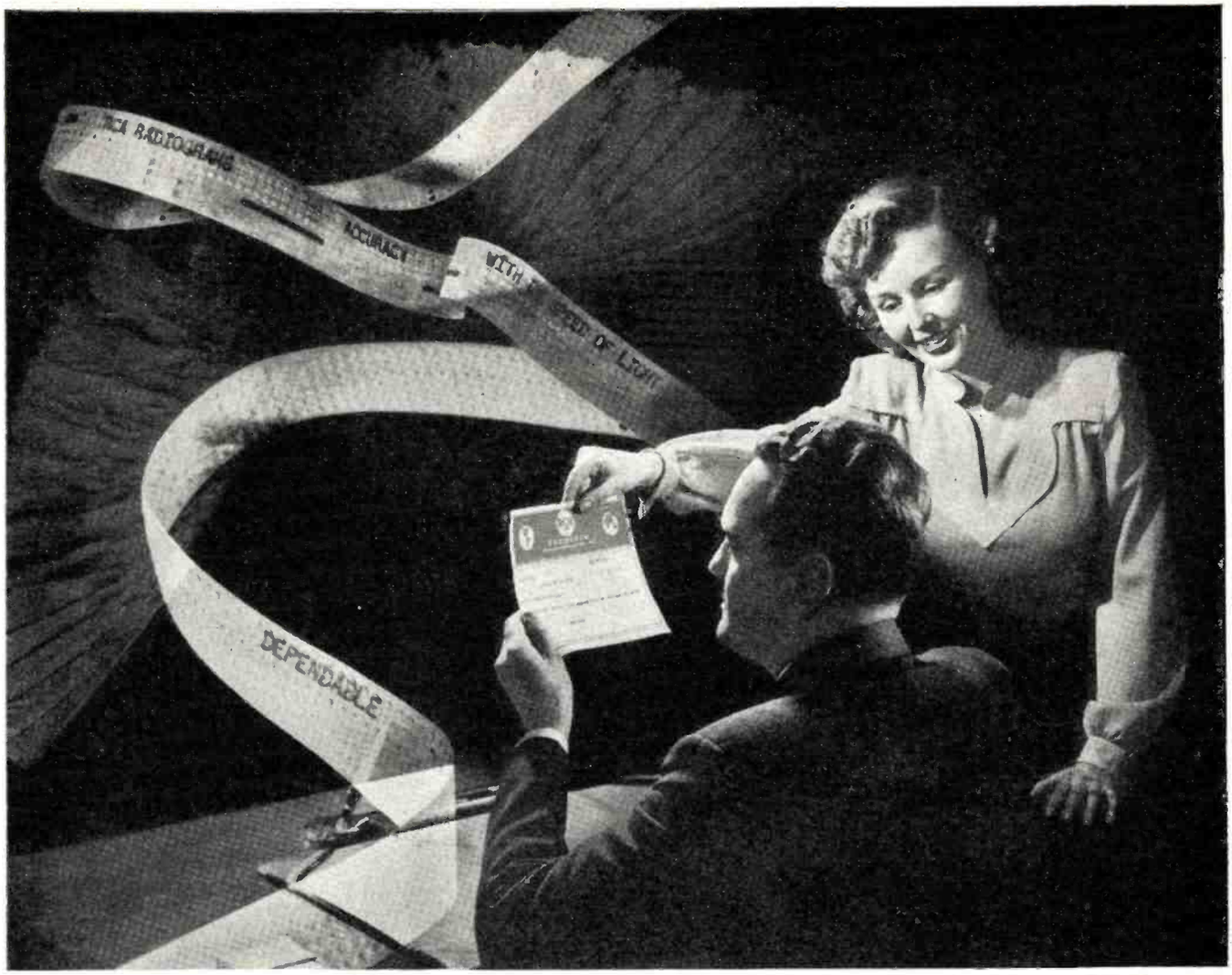
Composition of Signals in Hi-Fi FM Broadcasting

As previously explained, and illustrated in Fig. 4, for an equal maximum modulating frequency and level of modulation, the bandwidth required by FM signals is much greater than that for AM signals since a wider set of sidebands, containing sideband frequency components that are important, is produced in FM. Thus, in AM sound broadcasting since the highest modulating frequency is 5 kc., the highest-frequency sideband components that will be produced have frequencies respectively higher and lower than the carrier frequency by the amount of 5 kc. Consequently, transmission of a total bandwidth of $2 \times 5 = 10$ kc., centered at the carrier frequency, is adequate, and AM broadcast station channels may be spaced only 10 kc. apart.

By contrast, in the case of FM signals a large number of pairs of sideband components of appreciable amplitude (and importance) may be present along with the center frefuency component. Maximum bandwidth is required when the FM signal is fully modulated (100% modulation) at the highest modulating frequency, for then the frequency difference between successive sideband components is greatest and the amplitudes of those far removed from the center-frequency are large enough to make them important. (See Figs. 2 and 4.) The actual numerical value of the maximum bandwidth it is necessary to transmit depends, therefore, upon the number of important pairs of sidebands to be transmitted, as well as upon the maximum modulating frequency.

An extensive study of the sideband requirements and other factors involved in FM broadcasting has been made in order to determine how wide a frequency swing or *deviation* produced on each side of the unmodulated center frequency shall be designated as representing 100% modulation. The engineering standards of the FCC now define a frequency swing or deviation of ±75 kc. from the center frequency (often called the *resting frequency*) as 100% modulation and, by FCC regulations, American FM broadcast transmitters are now allowed this maximum modulation swing or deviation on either side of the unmodulated center frequency. This means that when the modulating frequency is at the maximum value of 15 kc., and the modulation is 100%, the signal frequency will have deviated ±75 kc. from its assigned center or resting frequency. This practice provides a frequency deviation ratio of 75/15, or 5 to 1, with full modulation at the highest modulating frequency.

It can be shown mathematically (by the use of Bessel factors) that if the frequency of the FM wave is varying over this full range of plus or minus



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75 kc., at 15 kc. per second (100% modulation at the highest modulating frequency 15 kc.) a center-frequency component and *eight* important pairs of sideband components are present, each sideband pair having frequencies that are higher and lower than the center frequencies by n times the numerical value of the modulating frequency (where n = the pair number). The 16 individual sideband components comprising these eight pairs (labeled numerically for identification) are illustrated in Fig. 2 in their correct relative amplitudes. Observe that the amplitude of the center-frequency component is much less than that of the unmodulated wave, only 17.76 per-cent as great, in this case.

The theoretical total bandwidth required by the *eighth* pair of sideband components will be, 8 x 15 x 2 = 240 kc., centered at the unmodulated center frequency. Actually, it is not necessary to provide for a bandwidth as wide as this because, as can be seen from Fig. 2, the amplitude of those sideband components of frequency near the limits of this theoretical band are of comparatively small amplitude (for example, the amplitude of the eighth sideband pair is quite small, being only 1.84% of the unmodulated carrier amplitude, that of the seventh pair is 5.34%, etc.) and they appear only when the transmitter is strongly modulated at the higher audio frequencies.

Specifications for Standard FM Broadcast Channel

Since some relatively weak sideband components actually extend beyond 75 kc. on either side of the center frequency, to avoid the possibility of interference between powerful FM broadcast stations assigned to adjacent transmission channels, a *guard band* of 50 kc. is allowed between the maximum modulation swings of adjacent-channel stations. This is illustrated in Fig. 3. Since the total permissible frequency swing or deviation is 2 x 75 = 150 kc., this, plus the guard band, makes a total channel width of 150 + 50 = 200 kc. necessary for each FM broadcast transmitter. The specifications for the standard American FM broadcast channel (FCC regulations) are illustrated in Fig. 3 for reference. The sideband frequency components that are produced at 100% modulation when the audio modulating frequency is at the system maximum of 15 kc. are shown in their relative amplitudes at the top of the illustration. Observe that those which are eliminated by the standard transmission channel specifications are the higher-frequency ones of relatively low amplitude (and importance).

By FCC regulation then, an *FM broadcast channel* comprises a band of frequencies 200 kc. wide (see Fig. 3). Such a channel is designated by its *center* frequency. In America, channels for FM broadcast stations now begin at 88.1 mc. and continue in suc-

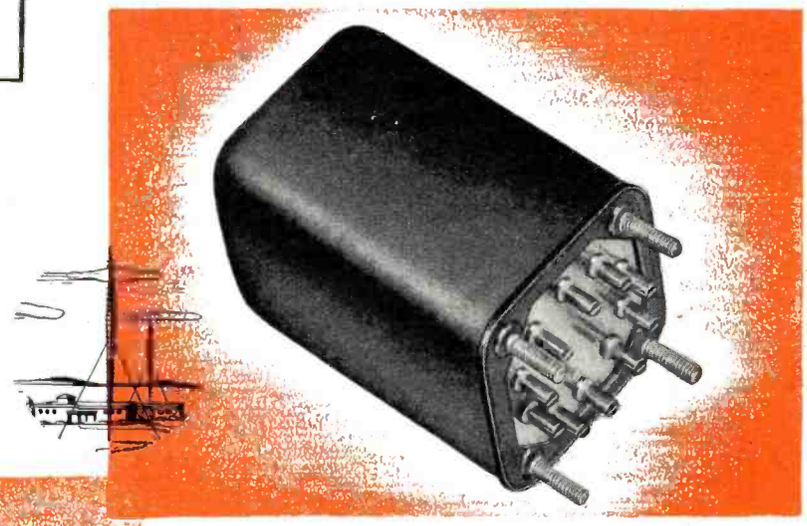
(*Continued on page* 110)

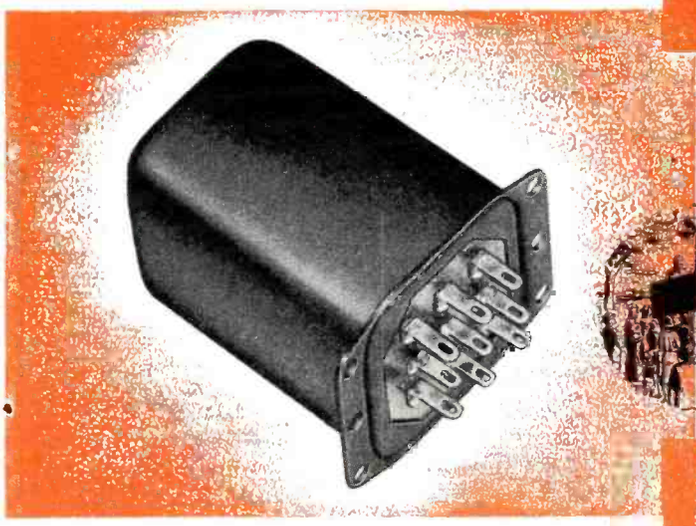
AUDIO TRANSFORMERS *for* [UNIFORM RESPONSE LOW DISTORTION IN 3 FREQUENCY RANGES

Write for Catalog showing complete new stock line

Full Frequency Range

30 to 15,000 Cycles, provides uniform response over this entire band with ± ½ db up to 10 watts of audio power, within ± 1 db over 10 watts. Standard RMA impedances. Hum balancing coil structures and nickel alloy shielding. Included are Input, Output, Driver, and Modulation Transformers; Modulation Reactors. *Sealed in Steel* construction, stud mounting, with pin-type terminals.





Public Address Range

50 to 10,000 Cycles, frequency response within ± ½ db up to 10 watts of power, within ± 1db over 10 watts, throughout this range. Secondary impedances match 600 and 150-ohm lines, 16, 8 and 4-ohm reproducing systems. Listed are Driver and Output Transformers. *Sealed in Steel* construction, flange mounting, with solder lugs or wire leads.

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200 to 3,500 Cycles, affords response with variations not exceeding ± 1 db over the range of voice frequencies. For use with 600 or 150-ohm lines. Input, Output, Driver and Modulation Transformers offered. *Sealed in Steel* construction, flange mounting, with wire leads or solder lugs.

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DIVISION OF ESSEX WIRE CORPORATION

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Model 315—SIGNAL GENERATOR

Micro-cycle band spread vernier tuning. Vitally important for tuning and aligning FM and Television receivers where tuning is very sharp and critical. The extreme wide range and accuracy afforded by the micro-cycle vernier band spread dial assures accurate frequency adjustment for test or alignment of broadcast FM or Television receivers. Vernier dial divided into 100 divisons. Any frequency can be tuned and repeated within .02% accuracy. Spring loaded split gears eliminates back lash and play providing smooth, accurate tuning. Extremely accurate and stable throughout its range. Window casing encloses dial and fine pointer, protecting the pointer against being accidently bent or jarred out of calibration.

- Range 75 KC to 150 MC.
- Complete broadcast band from 550 KC to 1700 KC is covered on one range without switching.
- Unused coils are automatically shorted out to eliminate dead spots and absorption.
- Linear dial calibration, DOES NOT CROWD UP on the high frequency end of the dial.
- Accuracy better than .5% throughout the broadcast band and 1% on the higher frequencies.
- Just as accurate at high end of dial as the low end.
- Indirect lighting of dial scale with two hooded lights.

$64.50

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Model 113A—MULTI-ANALYST

Permits rapid tracing or following a signal audibly through the receiver from antenna to speaker, locating the faulty section quickly. Isolates the precise cause of trouble with the VTVM section by making point to point checks giving both audible and visual indications. Perfect for checking distortion or fading. Signal may be traced through entire receiver without interfering with its normal operation.

- Wide frequency response from 30 cycles to 200 mc.
- High input impedance of 26 megohms on DC.
- All electronic AC and DC voltmeter and ohmmeter.
- DC and AC ranges 0-5, 10, 100, 500, 1000 volts.
- Ohmmeter reads from .1 ohm to 1,000 megohms in six ranges.
- Built-in speaker for monitoring either IF, RF or AF channel.
- VTVM cannot be damaged by overload.
- Will substitute for any defective stages in a radio receiver or amplifier.
- Tests—phono pick ups—microphones, etc. for distortion or voltage output.

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A versatile test instrument for all radio and electronic service work, in manufacturing plants, laboratories, etc. Accurately measures wide ranges of resistance and voltages easily and rapidly. Visually traces signals in any receiver. Its huge 8½" meter makes readings easier and more accurate.

- No drift after short warm-up period.
- RF—AC probe permits linear readings from 50 cycles to 300 megacycles.
- DC ranges 0-5, 10, 100, 500, 1000, 5000 volts.
- AC ranges 0-5, 10, 100, 500, 1000 volts.
- Ohmmeter reads .1 ohm to 1,000 megohms, in six ranges.
- 26 megohms DC input resistance prevents loading when making voltage tests.
- Electronic on all functions.
- Meter circuit is designed to make burnout of meter impossible.
- Meter specially damped for fast accurate reading.

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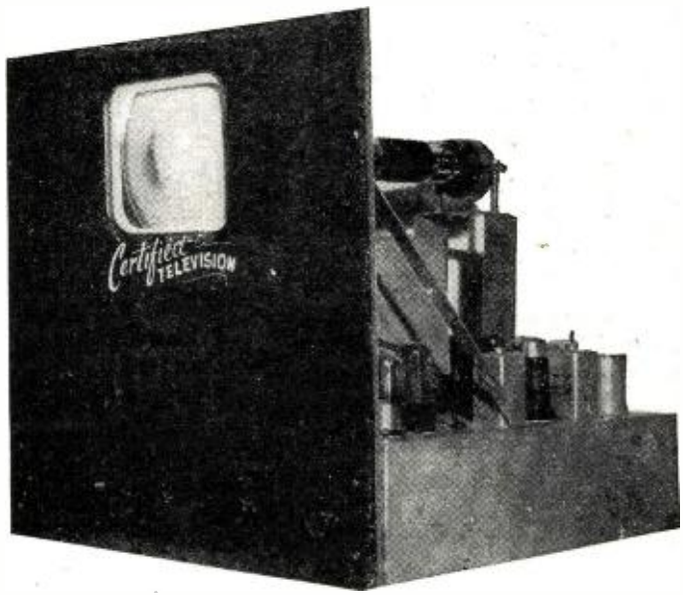

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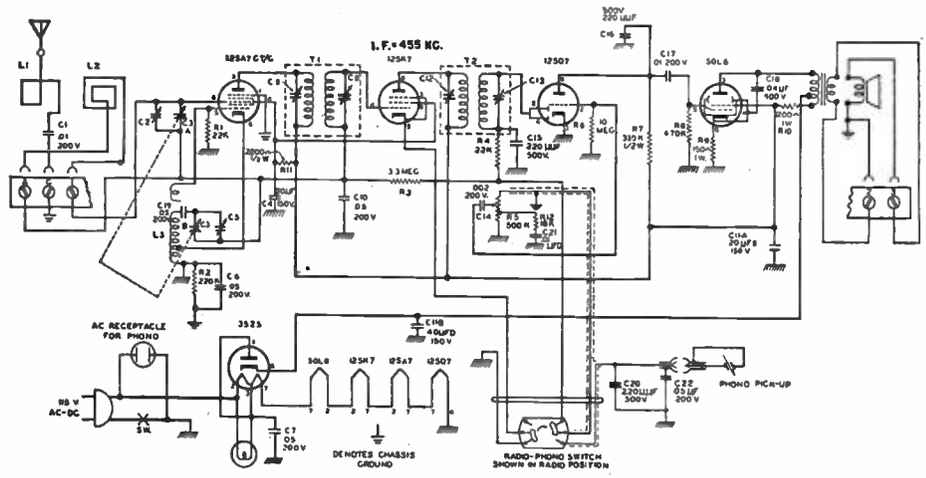
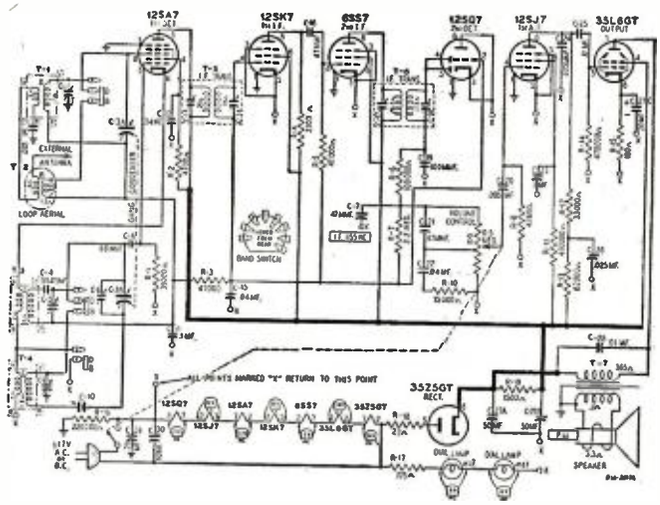
the RN CIRCUIT PAGE

(FOR PARTS LISTS SEE PAGE 98)

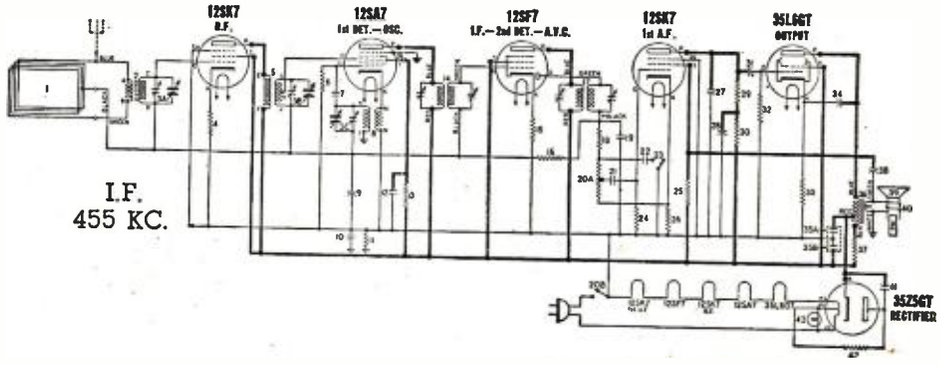
RADIO NEWS, OCTOBER, 1947 — MAJESTIC MODELS 5A445, 5A445R



RADIO NEWS, OCTOBER, 1947 — TRUETONE MODEL D2630

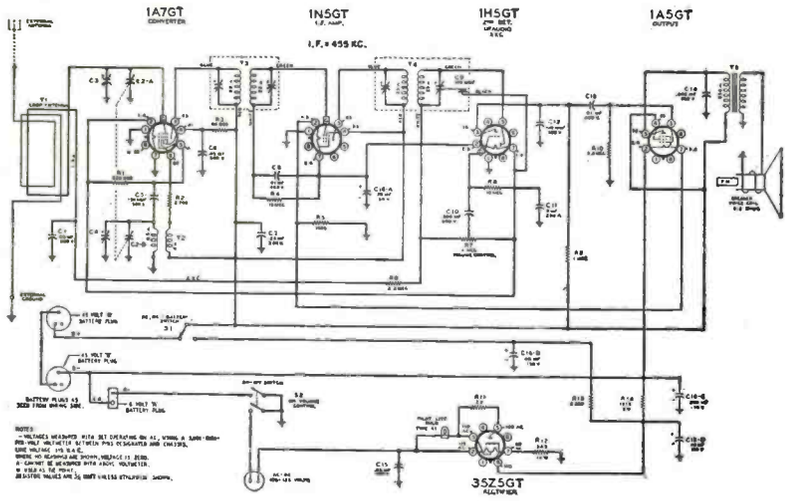


RADIO NEWS, OCTOBER, 1947 — STEWART-WARNER MODELS 9002-A, B, P, R

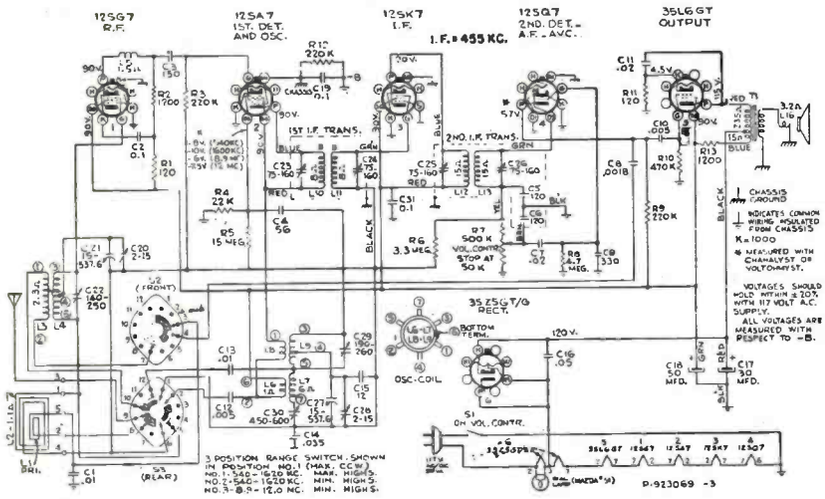


Here, and on following pages, are circuit diagrams and parts lists of many new postwar radio receivers. Radio News will bring to you other circuits as quickly as possible after we receive them from manufacturers.

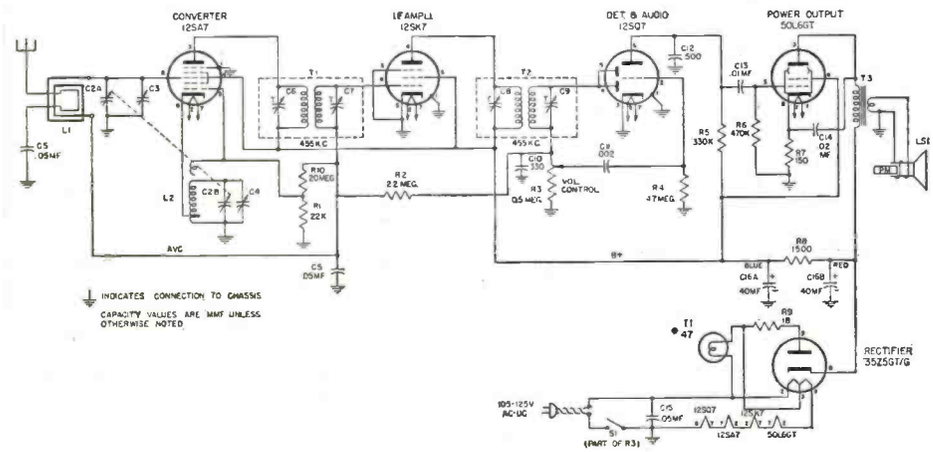
RADIO NEWS, OCTOBER, 1947 — **GRANTLINE MODEL 510**



RADIO NEWS, OCTOBER, 1947 — **RCA MODEL 56X5**



RADIO NEWS, OCTOBER, 1947 — **GENERAL ELECTRIC MODELS 110, 111**



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ANTENNA TRANSFER SWITCH SW-225

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26 ft. of Coaxial Cable RGU8, 52 ohm..... **89c**

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50L6.....39c 6V6.....39c

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All Fully Enclosed

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100 mil 10H..... **59c**

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Milliammeter for indicating resonance of tuned station, NEW.....ea. **49c**

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Ideal for indicating direction of antenna systems—BRAND NEW.....ea. **95c**

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Signal Corps, 8000 ohms and 200 ohms, each.....used **79c**

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100 Resistors ½ to 1 watt..... **95c**

100 Tubular bypass condensers, assorted. 01 to .1, all 600 Volt..... **$4.69**

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½ Meg. Volume Controls 2" shaft with switch. 10 for..... **$3.00**

½ Meg. Volume Controls 2" shaft without switch. 10 for..... **$1.95**

Crystal Pick-up, new light wt.....ea. **$1.79**

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2-volt Willard type 27/2 the exact replacement in Pre-War Model LB 530 "GE" Portable Radios. Plastic case, size 3¹⁵/₁₆x3½x5½" high. Shipped dry. Uses standard battery electrolyte List value $8.75. BRAND NEW! Your Cost..... **$1.95**

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H-603, one micro second, 200 pulses per second..... **$1.95**

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H-602, 16 micro seconds, 60 pulses per second..... **$3.95**

ALL THREE ABOVE FOR ONLY.....$7.50

McELROY RADIO TELEGRAPH SIGNAL RECORDER MODEL RR2-900-42

Complete with three tubes: one—117Z6-GT; two — 117P7-GT; like brand new, complete with beautiful maple finish wooden case. Each only..... **$5.95**

NEW BC 223 AX TRANSMITTER

801 Oscillator and 801 Power Amplifiers, 2—46 modulators and 1—46 speech amplifier; 4 Xtal Frequencies and Master Oscillator on selector switch. 10 to 30 watts output. Tone voice or C.W. Mod. Ideal for 80 meter band. Black wrinkle case. Tubes included, packed in original cases, less crystals, only..... **$14.95**

Shipping wt. 125 lbs.

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For operation VHF frequencies in range of 140-144 mc. Four channel crystal controlled, manufactured by Western Electric—12 or 24 V. operation. Complete with crystal and dynamotor. Used. Good condition..... **$24.95**

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0-10 amps., DC.....ea. **$2.95**

INTERPHONE AMPLIFIER

Comes in an aluminum cabinet 9¾"x4¾"x5½" DC output at 60MA, less tubes. Yours for only..... **95c**

LP-21 ADF LOOP

Low impedance loop, good for direction finder one Selsyn motor, one Selsyn transmitter. freq. range of loop 100 Kc to 1750 Kc: BRAND NEW in original cartons, each..... **$6.95**

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6 or 12 volt input; output 145 volts and 90 volts; less vibrator, voltage regulator and rectifier tube; ideal mobile power supply unit; excellent condition, each..... **$4.95**

MONTHLY SPECIAL!

AM-61 Indicator Amplifier

15 tubes including two VR105; 6L7GT; 6SN7GT; with blower motor, brand new in original carton, with metal cover .....ea. **$9.95**

SELSYN INDICATORS

For use with beam rotators for indication of direction of beam. Operate from 15-24V. 60-cycle AC supply. Complete with Selsyn Transmitter and wiring instructions.

Large model, 5 inch diameter, only..... **$2.95**

Small model, 3 inch diameter, only..... **$2.45**

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	12BE6
6V6	6SQ7
6X5	12A6
6AG7	50B5
35W4	6SJ7
12AT6	12SL7GT
1S5	12J5
1R5	35Z5
50L6	6SS7
6AT6	12K8

49¢

Transmitting MICA CONDENSERS

.0008 at 5000 VDC..24c .00005 at 3000 VDC.19c

Assorted—100 mica condensers.....$1.19

OIL-FILLED CONDENSERS

.25 MFD at 1500 VDC.....59c
.25 MFD at 15,000 VDC.....$6.95
1 MFD at 1000 VDC.....59c
.1 MFD at 3000 VDC.....59c
4 MFD at 600 VDC.....29c
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BRAND NEW perfect carbon hand mikes. light wt., 200 ohms, single button, press to talk switch, 5 ft. rubber cord, plug, dust cover. ONLY..... **69c**

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Freq. range: 22 to 30 meg.....$24.95
Freq. range: 37 to 53 meg.....24.95
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AC operated, complete with carrying case and magic eye for tuning indicator, veneer tuning dial.

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Power Converter Unit PE-104A for BC-654. each only..... **$4.95**

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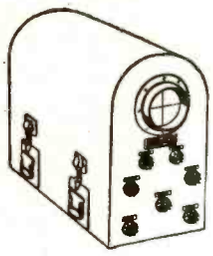
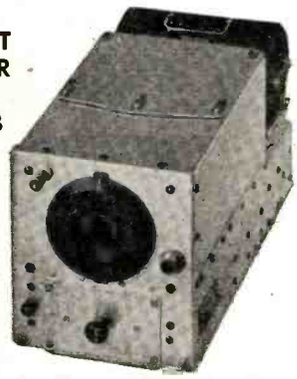


Modified BC-412, 5" Radar Oscilloscope; ideal for first class laboratory instruments; 110V 60 cycles, complete with tubes and power supply brand new in original cartons.

Each.. **$49.95**

ARMY AIRCRAFT RECEIVER Model BC-946-B



Broadcast band from 520 to 1500 kc. Tube complement: 3—12SK7, 1—12SR7, 1—12A6, 1—12K8. Designed for dynamotor operation, but is easily converted to 110 or 32 volt operation. Has two I.F. stages and three gang condenser. Comes packed in sealed carton complete with tubes and instruction manual, but less dynamotor..... **$12.95**

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BC-453-A; 190-550 kc, complete with tubes; BRAND NEW IN ORIGINAL CARTONS **$7.95**
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BC-454-A; 3-6 mc; complete with tubes; BRAND NEW IN ORIGINAL CARTONS **$5.95**
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BC-455-A; 6-9 mc, complete with tubes; BRAND NEW IN ORIGINAL CARTONS **$5.95**
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1.5 to 3 Meg..... **$4.95**

Used, in A-1 condition. Complete with 6 tubes.

TRANSMITTERS (274N Series)

All Brand New in Original Cartons
Complete with Tubes and Crystal

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BC-458—5.3-7 Mc..... 5.95
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DM 32A. Each 95c, 3 for..... $2.00

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The ARB is a six tube, four band, superheterodyne Aircraft Radio Receiver with built-in dynamotor, designed for the reception of MCW (tone or voice) or CW within the frequency range 195 Kc to 9.05 megacycles.
Used..... **$16.95**

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Used, in good condition, complete with tubes and calibrating crystal, freq. range 2,000 Kc to 18 mc; A-1, A-2, A-3 type transmission; power output 100 watts
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Contains power supply 110 V, 400 cycles, has 7 tubes such as 3CP1, brand new, complete with tubes.
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Has 45 tubes, one 5" scope tube, one 2" scope tube, has 3 meters, 4 power supply units 110V 400 cycles, complete with tubes. Each..... **$39.50**

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BC-348 RECEIVER. Used as is, only 40 in stock, first come—first served.....ea. **$24.95**

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Frequency range 170-180 Mc; IF 30.5 Mc; complete with 11 tubes; self-contained power supply, brand new in beautiful wooden carrying case..... **$9.95**

RAX-1 3-RECEIVER COMBINATION

No. 1—4 bands, tunes from 200-1500 kc. ea. $15.00
No. 2—4 bands, tunes from 1500 kc to 9 mc. ea. 15.00
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Each receiver complete with tubes and 24 V Dynamotor. Used, A-1 condition. 3 Receiver combination. Complete..... **$34.95**

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Combination Interphone, Amplifier and 6-Tube Superheterodyne Receiver designed to operate directly from a 24V aircraft battery. Tuning range 200 kc to 550 kc. complete with mounting rack, jackbox and cords. This unit is used as range receiver and interphone amplifier.
Brand new..... **$9.95**

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Complete with receiving and transmitting coils, junction box, control boxes, plugs, power supply, instruction manual and spare parts which include tubes. Brand new in original carton.
A real buy..... **$24.95**

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Navy type low and high frequency transmitter with power supply and tubes. Operates from 200 Kc to 18,100 Kc; requires 115V, 800 cycles,
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Carbon type, with PL-68 plug, brand new...$1.95
Used..... 1.00

MICROPHONE AND RECEIVER P-60

Dynamic type, 50-ohm impedance; mike and phones interminate in 5-wire male plugs, 3-ft. cord..... **$1.49**

OXYGEN MASK MICROPHONE T44C

Used with SCR-522, magnetic type complete with JK-26 and PL-179. Used, A-1 condition..... **95c**

Wholesalers, dealers, institutions and other quantity purchasers . . . Write, Wire, Phone for Quantity Prices. All Shipments F.O.B. Chicago—20% Deposit Required on all orders. Minimum order accepted $5.00.

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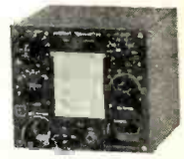
RCA AVT-112A Aircraft Transmitter



For radio-telephone communication; for 6, 12 or 24 volt source freq. range from 2,500 to 6,500 Kc. Small in size and wt. (wt. 6 lbs.). Complete with 6 tubes, oscillator circuit, power amplifier modulators, dual tuning indicator and amplifier, with instruction manual, less crystal . .
BRAND NEW IN ORIGINAL CARTONS—ONLY..... **$12.95** each

COMPANION (RECEIVER) FOR ABOVE RCA AVR 20. BRAND NEW $12.95 ea.

POWER SUPPLY

For the APN-4; complete with 16 tubes; 110 V 400 cycles; brand new..... **$10.95**
used..... $7.95

AN18/APT-10

Pre-amplifier model K-1, designed to raise output level of magnetic type microphone, complete with 2 tubes 6SL7GT and 28D7 and hand switch, brand new in original cartons.
Each **$1.95,** 3 for **$5.00**

SETCHELL CARLSON RADIO RECEIVER

BC-1206-C

Designed to receive A-N beam signals. 24-28 vdc 21.6 watts. Tube complement: 14H7 or 14A7, RF amplifier; 14H7 or 14J7, mixer; 14A7 or 14H7, IF amplifier; 14R7, detector and 1st audio amplifier; 28D7, output amplifier. 195 to 420 kc. 4" high x 4" wide x 6⅝" long—wt. 3 lbs., 4 oz.
Used A-1 cond..... **$4.95**
BRAND NEW
in original carton..... **6.95**

RADIO TRANSMITTER and RECEIVER APS-13

Light weight air-borne radar system, radio transmitter and receiver APS-13; tube complement: 5—6J6, 9—6AG5, 1—VR105, 2—D21; unit is brand new, complete with tubes, the tubes alone are worth more than this LOW PRICE OF ONLY..... **$10.95**

GLIDE PATH RECEIVER R-89/ARN-5

Glide Path Receiver used in the Instrument Landing System covering the frequency range 332 to 335 mc; complete with the following tubes: 7—6AJ5, 1—12SR7, 2—12SN7, 1—28D7, and including three crystals 6497KC, 6522KC, 6547KC . . units are in A-1 condition for ONLY..... **$8.45**

BC-733 D LOCALIZER RECEIVER. NOW ONLY..... **$8.50**

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The standard very-high frequency airborne receiver transmitter. 100 to 156 megacycles. 4 channels selected from remote conurol box. Used, as is—"Complete with Tubes"
ONLY..... **$14.95**
Excellent Condition $19.95

BC-625

VHF transmitter, frequency range 100-156 Mc; four channels. Part of the SCR-522. Complete with tubes less crystals.
Used, good condition.....ea. **$9.95**

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VHF Companion receiver for above transmitter. Complete with tubes less crystals. Used, good condition. Diagram with either unit included .....ea. **$8.95**

VEEDER-ROOT METER AND CASE

Counts up to 1000.
Each..... **95c**

WESTON OUTPUT METER No. 687

3 scales 0-50.
A-1 Condition
ONLY..... **$6.95**

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What's New in Radio

SPRAGUE "TELOHMIKE"

Designed to facilitate the checking of condensers and resistors, the new deluxe "Telohmike" Model TO-3 just introduced by *Sprague Products Company* of North Adams, Massachusetts, has several new features not found in previous models of this unit.

A "Speedy Check" feature enables

the operator to locate open, intermittent, or shorted condensers without removing them from the circuit. The "Telohmike" is a bridge-type capacitance and resistance analyzer with built-in d.c. volt-milliammeter. A direct reading calibrated dial is color coded to correspond with the selector switch. Capacity ranges are from .00001 μfd. to 2000 μfd. in four steps. Resistance ranges are from 2.5 ohms to 25 megohms in three steps. The d.c. meter range is 0-15, 150, 750 volts and 1.5, 15, and 75 ma. The insulation resistance range indicated by direct meter reading is 0-2500 megohms.

Full details will be furnished upon request to *Sprague Products Company,* North Adams, Massachusetts.

NEW MINIATURE TUBES

Radio Corporation of America has recently supplemented its miniature tube line by adding three new types, the 1U5, the 6BJ6 and the 12AL5.

The 1U5 is a diode-pentode for use in portable receivers. It is similar to the 1S5 but has a different basing arrangement and utilizes an improved structure which greatly reduces any tendency toward microphonic effects.

The 6BJ6 is a remote-cutoff amplifier pentode particularly useful in mobile equipment where heater-current drain is an important consideration and in a.c.-d.c. AM and FM receivers. It features a 6.3 volt, 150 ma. heater, high transconductance, and low grid-plate capacitance.

The 12AL5 is a high-perveance twin diode like the 6AL5, but has a 12.6 volt, 150 ma. heater and is intended especially for use as a ratio detector in a.c.-d.c. FM receivers. In circuits utilizing wide-band amplifiers the low internal resistance of the 12AL5 makes it possible to obtain increased signal voltage from a low-resistance diode load.

Technical bulletins covering each of these types are available from the Tube Department, *Radio Corporation of America,* Harrison, New Jersey.

DIAMOND NEEDLE

Electrovox Co., Inc. has introduced a new and popularly-priced diamond tipped phonograph needle to the trade.

Marketed under the tradename "Walco Diamond," this new unit will provide lifetime service under normal operating conditions, according to the manufacturer. The needle is composed of an aluminum alloy metal, bent and shaped to produce maximum frequency response with lowest surface noise.

Complete data on packaging, discounts, etc. will be supplied by the manufacturer, *Electrovox Co., Inc.,* 31 Fulton St., Newark 2, New Jersey, upon request.

PORTABLE KIT

Radio Kits Company of New York has added a new unit to their line of ready-to-build radio kits.

The Model 210 is a portable receiver with three-way operation from a.c., d.c., or batteries. The power switch is located on the front of the set so that the type of operation may be selected without opening the case. A five-inch Alnico V permanent magnet dynamic speaker is included in the kit. The case is covered with a weather-tested aircraft material.

Details of this kit or others in the

company's line will be provided upon request to *Radio Kits Company,* 120 Cedar Street, New York 6, New York.

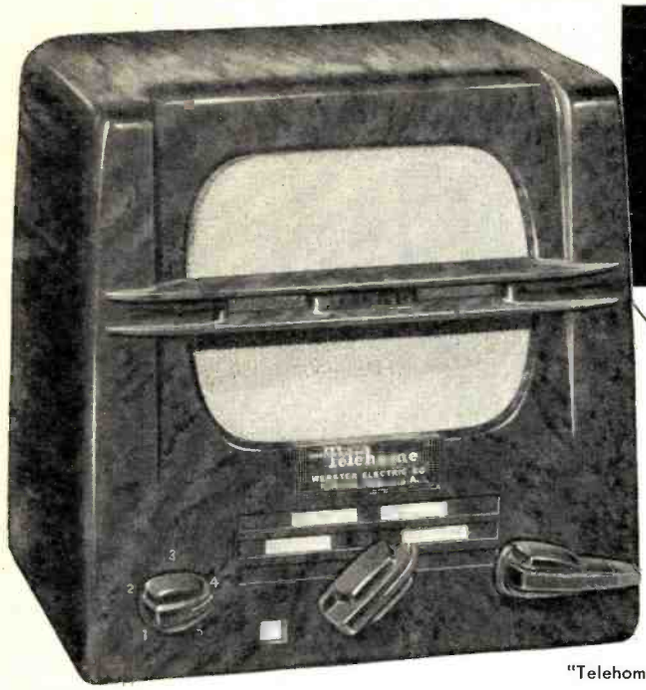
"FILMGRAPH" MODEL HK

Capable of recording over two million words, the new "Filmgraph" Model HK permanent recorder and instantaneous reproducer has been designed to provide automatic continuous recordings of two-way telephone conversations, hearings, conferences, interviews, reports, and dictation.

This newest unit developed by *Miles Reproducer Co., Inc.,* utilizes a single reel of 16 mm. safety film to provide 300 hours of permanent recording. 5000 feet of M2 film on which 100

We Tap a New Market!

. . . With a New Intercommunication System for the HOME



"Telehome" Master Station

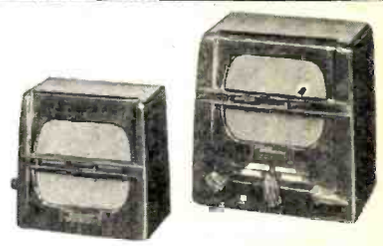
WEBSTER ELECTRIC

Telehome

HOME INTERCOMMUNICATION

BY THE MAKERS OF

Teletalk



Master Station, Speaker unit and 100 feet of wire . . . complete in one package $49.50

Extra speaker unit 9.50

Door speaker 7.75

Prices slightly higher west of Rockies

The New Telehome Models for Living Room or Kitchen . . . Special Speaker for the Door

• Intercommunication Systems invade the home with the same high quality units that are available for commercial use.

This opens up the opportunity to sell to retail outlets and the widespread consumer market.

Designed and built specially for home use, it will be sold as a package consisting of a master unit and one speaker unit and one hundred feet of wire at a moderate price within range of everyone.

The new "Telehome" is available as a complete line, with additional speaker units available for those who want them. In addition, a special door speaker can be had separately. A Master wall-type station is provided for new home builders and is constructed as a built-in for modern kitchen cabinets or kitchen wall.

Complete promotion material is available to back up their sale with advertising in the Saturday Evening Post to tell the story to millions of consumers.

If you haven't already had the complete story, write to Webster Electric, Racine, Wisconsin for complete details.

As Advertised in Saturday Evening Post

Licensed under U. S. Patents of Western Electric Company, Incorporated, and American Telephone and Telegraph Company.

WEBSTER ELECTRIC

RACINE WISCONSIN

Established 1909

Export Dept. 13 E. 40th Street, New York (16), N. Y. Cable Address "ARLAB" New York City

"Where Quality is a Responsibility and Fair Dealing an Obligation"

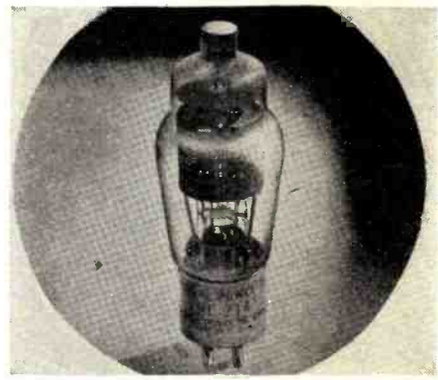
sound tracks may be cut across the width of the film, provide 3 hours continuous recording per track. Selection of recording for playback is facilitated by "Track" and "Zone" indicators.

Complete performance details will be forwarded by *Miles Reproducer Co., Inc.,* 812-814 Broadway, New York 3, New York.

NEW THYRATRON

A quick heating thyratron, the NL-714, has been announced by *National Electronics, Inc.,* of Geneva, Illinois.

This industrial tube is interchangeable with the 5557/FG-17 and attains its characteristic stability by the use



of an inert gas filling in addition to the usual mercury.

A data sheet giving full details on the performance of the NL-714 is available upon request to *National Electronics, Inc.,* Geneva, Illinois.

TRANSFORMER IDENTIFICATION

Merit Coil & Transformer Corporation of Chicago, has announced that its line of transformers will now carry full details on the units in the form of a permanently attached strip.

This method of packaging will replace the older technique of printing name, number, and engineering application data on the box in which the unit is housed.

A strip of self-annealing material will be attached to the top of the transformer itself with full engineering application data permanently available at all times.

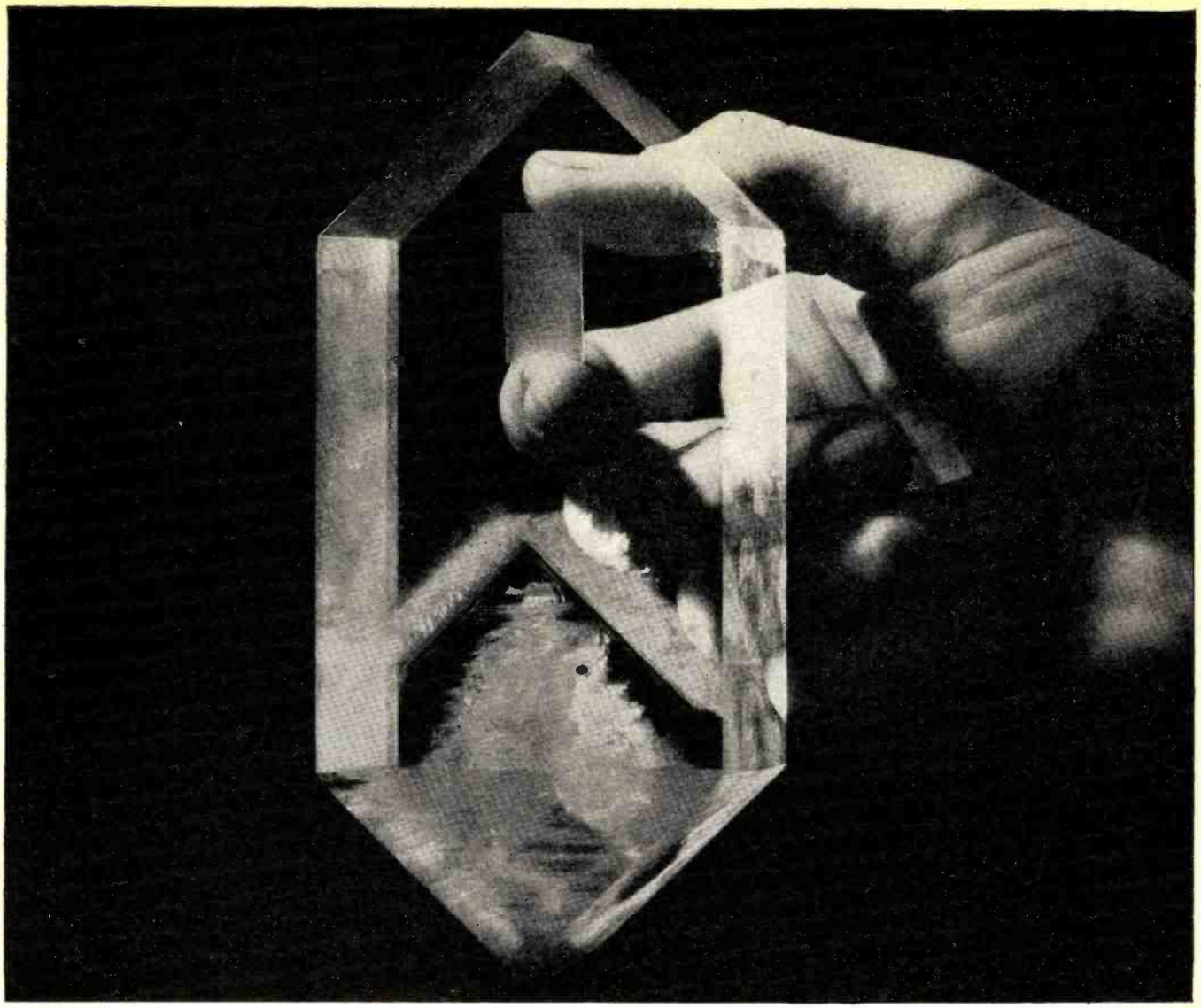
Details on this new line of transformers will be furnished by *Merit Coil & Transformer Corporation,* 4427 N. Clark St., Chicago 40, Illinois.

COMPOSITION RESISTORS

Ohmite Manufacturing Company of Chicago has announced that its line of "Little Devil" resistors has been expanded to including ½ and 1 watt sizes having a tolerance of ± 5%.

Both of these units are full ½ and 1 watt resistors, yet the size of the ½ watt unit is only ⅜" long x 9/16" diameter, while the 1 watt unit is 9/16" long x 7/32" diameter. These resistors meet all test requirements for the Joint Army-Navy Specification JAN-R11 including salt water immersion cycling and humidity tests.

(*Continued on page* 170)



A CRYSTAL THAT GREW FROM A SEED . . . *The large crystal in the foreground is an EDT (Ethylene Diamine Tartrate) crystal. It started from a seed (a piece of mother crystal) and in three months grew in a slowly cooling solution to the size shown. The small plate is cut from a large crystal, then gold-plated for electrical connection and mounted in vacuum. Cultivated EDT crystals can do the same job as quartz in separating the nearly 500 conversations carried by a coaxial circuit.*

Crystals for Conversations

AT WAR'S END, the Bell System began to build many more Long Distance coaxial circuits. Hundreds of telephone calls can be carried by each of these because of electric wave filters, which guide each conversation along its assigned frequency channel. Key to these filters was their frequency-sensitive plates of quartz.

But there was not enough suitable quartz available to build all the filters needed. Bell Telephone Laboratories scientists met the emergency with cultivated crystals. Years of research enabled them to write the prescription at once—a crystal which is grown in a laboratory, and which replaces quartz in these channel filters.

Now Western Electric, manufacturing unit of the Bell System, is growing crystals by the thousands. Many more Long Distance telephone circuits, in urgent demand, can be built, because the scientists of Bell Telephone Laboratories had studied the physics and chemistry of artificial crystals.

BELL TELEPHONE LABORATORIES

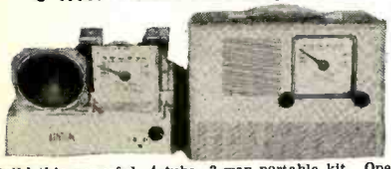
EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

PERSONAL PORTABLE RADIO KIT ONLY $10.95

PERSONAL PORTABLE KIT, $10.95

PERSONAL PORTABLE KIT MODEL K-PX. Small size leatherette covered case 8x6x7. Easy to build. Operates on self contained B and A batteries. Rec. Broadcast 550 to 1600 K.C. Incorporates a standard superhet circuit with avc. Has 3 inch Alnico five PM speaker. Priced complete with batteries, pictorial diagram and tubes 1R5, 1S5, 1T4 and 3S4. Not AC DC, but straight battery operated. Has 2 gang cond. Everyone should have one of these personal portables. Everything furnished. Kit K-PX .....Net **$10.95**

3-WAY PORTABLE KIT, $17.95



Build this powerful, 4-tube, 3-way portable kit. Operates on 110 volts AC or DC or self contained batteries. Receives broadcast 550 to 1650 K.C. Incorporates a standard superhet circuit with AVC and loop Ant. Has Alnico 5 PM Speaker, 2 gang condenser. All Parts and batteries are furnished including tubes Disc Rectifier, 1R5, 1T4, 1S5 and 3S4. Has attractive leatherette portable cabinet size 7x9x9. Weight 14 lbs. Kit model 3-ZA .....Net **$17.95**

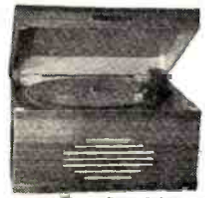
RADIO-PHONO COMB. KIT, $24.95

Build this beautiful portable combination radio phonograph. We furnish everything. Beautiful two tone portable case, latest rim drive phono motor, Astatic crystal pick-up. All parts to build high quality 5 tube AC-DC radio. Tunes broadcast 550 to 1650 KC, has tone control, loop antenna, 6" Alnico 5 PM speaker. Tubes 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5. Simple diagram furnished. Kit Model RP-12. Wt. 20 lbs. .....Your Cost **$24.95**

RECORD PLAYER SCOOP, $14.95

Assemble this single record player. Only a few minutes required to mount pick up, motor and ready wired and tested amplifier. Everything furnished including tubes 12SR7, 50L6 and 35Z5. Has heavy duty Alnico V PM speaker, tone and volume controls. Has latest crystal pick up and 78 RPM phono motor. The attractive Alligator covered case is small and ruggedly constructed. (15x6½x11.) This is our leader in a portable record player. Weight 18 lbs. Kit J-20. Net.....**$14.95**

WALNUT CABINET RECORD PLAYER $16.95



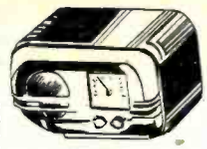
Beautifully made, highly polished walnut cabinet with hinged lid. Plays 10" records with lid closed. Latest rim drive phono motor and high output. Astatic crystal pick-up. High power 3 tube AC-DC phono amplifier (wired and tested). Heavy duty 4" Alnico 5 PM Speaker. Single record player kit. Model WL-3. Wt. 15 lbs. .....Your Cost **$16.95**

KIT WL-3R—IN SAME CABINET AS WL-3 EXCEPT HAS 5 TUBE AC-DC RADIO AND RECORD PLAYER, $19.95

KIT K-7A. Easily assembled into a fine working, attractive, transformer type AC, broadcast receiver; 550 to 1700 KC. Has push-pull audio, tone control and 6½" Alnico 5 PM speaker. Beautifully made 14" walnut cabinet. Incorporates a standard superhet circuit, with AVC and loop antenna. All parts, schematic and tubes 6SA7, 6SK7, 6H6, 6SN7, 2—6V6's and 5Y3 furnished. Has full 90 mil. power trans. Weight 17 lbs. Dealers Net **$19.95**

Deluxe AC Kit, $14.95. Model JD5 AC. Has beautifully made 12" walnut cabinet. All parts furnished to build a powerful broadcast 5 tube AC, power transformer type, superhet. Rec. 440 to 1700 KC. Slide rule dial, 2 gang tuning cond. Loop aerial. Heavy duty Alnico V. PM speaker. Everything furnished including photos, diagram and tubes. 6SA7, 6SD7, 6SQ7, 6K6 and rectifier. Kit JD5 AC. Net.....**$14.95**

5-TUBE AC-DC KIT, $9.95



Kit Model P-85. We have finally been able to achieve our goal. Here it is. A good 5-tube broadcast AC DC superhet radio receiver for less than ten dollars. The beautiful 10 inch plastic cabinet is made of the finest material. The chassis is of the standard accepted superhet design. 456 KC ifs AVC and 5 inch Alnico 5 PM speaker. Attractive vernier dial. Two gang tuning condenser. Loop ant. We defy anyone to offer a better working AC DC receiver kit. Priced complete with diagram, photos and tubes 12BE6, 12BA6, 12AT6, 50B5 and 35W4. Nothing else to buy. You can't go wrong on this value. Kit Model P-85 .....Net **$9.95**
SUPERHET. 4-Tube. 1½—90 Volt FARM RADIO KIT complete, less 1000-hour battery; similar cab. to Model P-85. Model PB-48.....Net **$9.95**

NEW SUPER MIDGET KIT, $12.95 MODEL KP-T

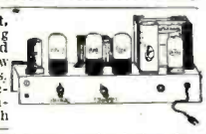
Build this new super Midget Broadcast Radio. Has beautifully made, highly polished walnut cabinet. Size 7½ x 4½ x 5½. Attractive slide rule dial. Incorporates a standard superhet circuit with 456 KC IFS & AVC. Has 2 gang condenser and loop ant. Every part including Alnico V. P.M. speaker and tubes. 12BE6, 12BA6, 12AT6, 50B5 & 35W4. Furnished as well as photo and easy to follow diagram. Weight 5 lbs.

20-WATT UTILITY AMP. KIT, $17.95

Build this 20 watt utility 110 volt AC, 20 Watt power amplifier. Ready punched aluminum chassis, size 12 x 6 x 2½ inches. Has two input circuits, one mike and one phono. Mike stage has 135 DB gain, for crystal or dynamic mike. Has bass and treble controls. Designed for use with PM speakers; has 8-16 ohm output transformer. All parts, controls, transformers and easy-to-follow diagram furnished, including tubes: 2-6SN7, 6J5, 2-6L6GA, 5Z3. Kit Model 20-LX. Net.....**$17.95**
12" 12 watt Alnico 5 PM speaker, $6.95 extra. Astatic crystal mike and desk stand, $7.95 extra.

6-110 VOLT UTILITY AMP. KIT, $29.95

Model 20-LX6 20 watts output. Similar in appearance to the model 20-LX except on slightly larger chassis. Has same tube line up and input circuits. Has power supply that will work on 6 Volt DC, or 110 Volts AC. Equipped with super heavy duty vibrator. Has output voltage to run a reg. AC phono motor when used as a 6 volt unit. All parts tubes and easy to follow diagram furnished.
Model 20-LX6 amp. kit. Net $29.95. Ship. weight 30 lbs. Latest 12 in. P.M. Alnico, V speaker, 12 watt. Net **$6.95**
Crystal mike and desk stand.....**7.95**



12 WATT Amplifier Kit, **$10.95.** For recording and utility use. Matched component parts assure low hum level and good bass. One control, fades from record to microphone; tone control. Priced complete with all parts and tubes: 2—6V6, 6SN7, 6SH7, 7Y4. Diagram and photos furnished. 12" Alnico V PM speaker **$6.95** extra. Crystal desk mike **$4.95** extra.
Kit AC-12. Net.....**$10.95**

9-TUBE KIT, $24.95

AHK-11 Kit. A deluxe 9 tube, twin speaker, high fidelity receiver kit; housed in a beautiful hand rubbed walnut cabinet; of latest design, with dual speaker grills in perforated gold tint plastic.
Circuit employs push-pull parallel 12A6's delivering 10 watts of undistorted power to twin 6" G.E. Alnico V speakers. Other tubes: 12K8, 12SK7, 12H6, 12J5, 12SL7 and two dry disc rectifiers in voltage doubler circuit (equivalent to 11 tubes in all). Has 10" slide rule dial. Complete with instructions; ready to wire.
Your Net **$24.95**

PORTABLE RADIO RECORDER KIT $54.95

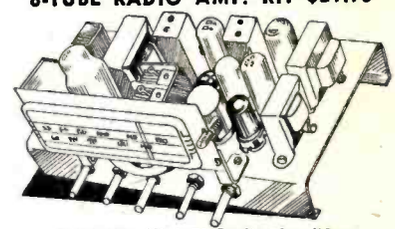
$90.00 value for only $54.95. We furnish every part to build a powerful radio and dual speed recorder. The attractive leatherette case houses the sensitive superhet broadcast radio and General Industries R90L 33⅓ and 78 RPM dual speed recorder; play back mechanism. The 6 tube receiver and amplifier is all on one chassis; 12SA7, 12SQ7, 12SK7, 12SL7, mike gain; two 35L6 push-pull output; plus disc rectifier. Has plenty of gain for crystal or dynamic mike. Has 6" heavy duty PM speaker and tone control. Kit G-31, everything complete, with tubes and diagram. **$54.95.** Crystal mike and desk stand **$4.95** extra. This is without a doubt one of the best values in kits we have ever offered. Wt. 40 lbs.

DELUXE CONSOLE CABINET, $39.95

- Slide Away Changer Comp.
- Record Album Compartment
- Beautiful, All Walnut Construction

This is the first time we have been able to offer a beautiful floor model console, RADIO-PHONO cabinet. Finest all walnut construction; hand rubbed finish. 34" long, 33" high, 16" deep. Holds 12" speaker, large record compartment. Slide away changer compartment will accommodate changer of the Webster 56 class and smaller. Receiver compartment is 15x14½x7½ inches. Will accommodate our Model PRK-10 kit; advertised below. Dealers, here is your chance to buy good cabinets at the right price. Convert those low-priced sets into radio-phono combinations. Weight 50 lbs. Net, **$39.95.** Price with Webster 56 changer....**$59.90**

8-TUBE RADIO AMP. KIT $29.95



Build this High-Fi Radio Amplifier

- Beautiful 8" Slide Rule Dial.
- Standard Superhet Circuit covering Broadcast 550 to 1700 K.C.
- 2-Gang Tuning Condenser.
- Offered with 12 or 15 in. PM Speakers. Push-pull 6V6 Output stage giving 15 watts of full range audio.
- Dual Tone Controls (Bass and Treble).
- Inputs for both Mike and Phono pick-up.

Here is something new in radio. A real 15 watt power amplifier with bass and treble controls. Has extra gain stage for crystal or dynamic mikes. And on the same chassis, a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SR7, 6SN7, 6SJ7, two 6V6 and 5Y3. No cabinet. Extra care in designing the power supply section assures low hum level, making this unit ideal for recording as well as P.A. use. We furnish everything as well as schematic diagram and photos of the completed chassis. Weight 35 lbs. PRK-10 Radio Amp. Kit with 12 P.M. Speaker.....Net **$29.95**
PRK-10X Radio Amp. Kit with 15 In. $30.00 value
Cinnaudagraph speaker.....Net **$42.95**
WHY NOT ORDER A G.I. RECORDER MECHANISM AND THE CABINET, SHOWN ABOVE, WITH THIS KIT? PRICES ON G.I. UNITS ELSEWHERE IN THIS AD.

Walnut mantel type cabinet; made expressly to house the PRK-10 kit. Ready cut. Accommodates receiver chassis only, not speaker. Weight 8 lbs. Net. **$6.95**

DELUXE REC. CHASSIS, $22.95

DeLuxe broadcast receiver chassis kit model AB-4, this kit is offered those who want a good receiver to install in their cabinet. The design is of the accepted type; standard superhet. Has power transformer push-pull 6V6's output tubes; tone control; 2 gang condenser and 8 inch deluxe slide rule dial; similar in appearance to our PRK-10 kit; shown above; except it has no provision for mike. Offered with a 12" 15 watt Alnico 5 PM speaker. Priced complete with diagrams, photos and tubes 6SA7, 6SQ7, 6SN7, 2 6V6 and 5Y3. Wt. 22 lbs.
Kit model AB-4.....Net **$22.95**

DALBAR AUTOMATIC PHONO RADIO SCOOP PRICE, $39.95

Dalbar 5 tube superhet receiver 550 to 1600 KC. (not a Kit) complete chassis with tubes 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5. Has heavy duty PM speaker and attractive airplane dial. We furnish everything. This Dalbar chassis, latest single post automatic record changer and attractive ready cut walnut cabinet. You can slip the chassis into the cabinet and have a good quality radio phono comb. in only a few minutes time. Model DB-5, weight 30 lbs.

JUKE BOX QUALITY AMPLIFIER KIT, $29.95

This is the finest in audio amplifiers. Four 6V6 tubes in push-pull parallel and hooked up as cathode followers to drive any P.M. speaker. Gain stage for crystal or dynamic mike as well as any phono pick up. Has variable tone control and fader control. We furnish all parts, nothing else to buy. Has a streamlined spatter finished chassis with cover (ready punched). Complete with diagram, photos and tubes 6SH7, two 6SN7, four 6V6 and 5U4. Will give 18 watts of the sweetest audio you have ever heard. Wt. 25 lbs. Kit model JB-18 net **$29.95**

McGEE RADIO COMPANY *WRITE FOR CATALOG* *SEND 25% DEPOSIT—BALANCE C.O.D.* *1225 McGEE ST., KANSAS CITY, MISSOURI*

450 MC. TRANS.-REC.

$14.95 TWO FOR $27.00

BRAND NEW! FACTORY CARTONED

ARMY BC-645 I.F.F. UNIT. Early in the war when radar picked up a plane, there was no way of knowing whether it was friendly or not. That was before BC-645 was invented. BC-645 sent out a signal that identified the plane as American. It probably saved more lives than any other piece of electronic equipment made. With some modifications the set can be used for 2-way communication, voice or code, on the following bands: ham band 420-450 mc., citizens radio 460-470 mc., fixed and mobile 450-460 mc., television experimental 470-500 mc. Equipment capable of doing the jobs of the modified set sells for hundreds and hundreds of dollars. The 15 tubes alone are worth more than the sale price. 4-7F7, 4-7H7, 2-7E6, 2-6F6, 2-955 and 1-WE316A. It now covers 460 to 490 mc. Each BC-645 is shipped with a Belmont factory printed conversion diagram, showing how to make AC power supply modulator and how to make Transmitter and Receiver changes. Most Hams and experimenters already have the few parts necessary. New BC-645 with tubes less power supply. Shipping weight 25 lbs. Extra WE316A Tubes $1.29 each. 12 Volt Dynamotor $3.95

BC-654 TRANSMITTER RECEIVER $12.95

GUARANTEED TO BE IN GOOD CONDITION

7-Tube Superhet Receiver and 6-Tube Trans. with 25 Watts Power.

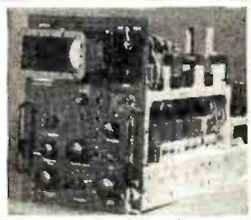
Order Now at this Scoop Price. Covers 3800 Kc. to 5800 Kc.

Portable voice and CW transmitter and receiver for portable, mobile, and fixed station operation. 7-tube superheterodyne receiver with 3.5 microvolt sensitivity on voice and 0.5 microvolt sensitivity on CW, and 100 milliwatts undistorted power output. 455 KC IF. Uses 3—1N5GT, 1—1A7GT, 2—3Q5GT, 1—1H5GT tubes. 6-tube transmitter, with antenna tuning network, Colpitts thermal compensated oscillator, class C final with 2—307A tubes in parallel, and crystal oscillator for checking frequency every 200 KC. 25 watts output on CW and 11.2 watts output on voice. Frequency range, transmitter and receiver, 3800 to 5800 KC. Ideal for Hams! Comes complete with cover; furnished with all tubes necessary for the operation of the trans. and rec. Less power supplies. These units are used but in good condition. Shipping weight 50 lbs. ..... $12.95; 2 for $25.00

Send your order to our Kansas City store. This unit will be shipped from our Chicago warehouse. Immediate delivery. You can hardly tell they are used. BC-654 Less all tubes and crystal. $7.95

654 VIBRATOR POWER PACK 6 OR 12 V.D.C. INPUT $4.95 EXTRA.

R65 SCOPE, $29.95



Another receiver indicator unit; with gobs of material. Complete with 28 tubes such as: 6SA7, 6SK7, 6H6, 2X2, 5Y3, etc., plus 3BP1 scope tube. A multitude of controls, RF coils, switches, etc. All are in perfect condition; just removed from aircraft. Case size, 9x12x16". Ideal to convert to test scope and beautiful for general salvage. Weight 35 lbs.

Scoop Price $29.95

BC929 RADAR, $14.95

BC-929 A Radar Indicator Scoop. This unit could be rebuilt into a fine test scope. It is an ideal size. 8x9x14 priced with tubes 2—6SN7, 2—6H6, 6G5, 6X5 and 2X2. This is a red hot buy. However you will have to change the power trans. for 60 cycle use. Guaranteed to be in good condition.

Scoop Price $14.95

Weight 20 lbs. Has 3 in. Cr Tube.

NAVY SALVAGE SCOOP! $3.95

Navy model ZA Glide path receiver. Has 3—6C6 tubes; several controls, transformer and handy case; size 6x7x12 inches. Ideal for salvage, near new condition $3.95. 2 for..... $6.95

PACKARD BELL PRE-AMP., $1.99

Housed in a handy aluminum case 5x4x5, priced complete with tubes 6SL7, 28D7, has many usable parts. Relay and control PL68 plug and patch cord.

SWITCH-POT. SALVAGE, 99c

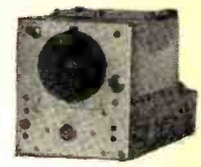
A real salvage scoop. Has 3 toggle switches, 1 band switch, 6 standard size carbon controls, knobs, etc. Scoop price .99. 3 for..... $2.50

BC-1366 Jack Box 11 bank banana plug jack and socket with 5 position single deck switch and control. 2 phone jacks. Scoop price .59 2 for $1.00

SCOOP, $1.99

Heavy Duty Vibrator—Made for 6-110 volt amplifiers. Freq. 60 CPS. Scoop price. $1.99 135 ma 6-110 volt conventional power transformer, with all windings; will run phono motor ..... $5.95 (Use with above vibrator.)

POPULAR AIRCRAFT COMMAND RECEIVERS

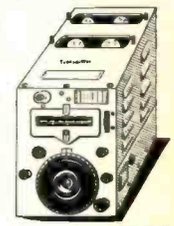


These command receivers have proven to be one of the best values in war surplus. We continue to get repeat orders. Hams and experimenters buy them to convert to other frequencies and for use as they are made. Designed for 28 volts DC input and easily converted to AC DC operation, etc. For your convenience, we will include with each receiver a diagram of the Bc 454. As all of command receivers are similar, this will assist you in becoming familiar with them. Weight 8 lbs. Priced with tubes, three 12SK7, 12SR7, 12K8, 12K6.

Brand New BC453 200 to 500 KC..... $6.95
Brand New BC454 3 to 6 MC..... 4.95
Near New BC454 3 to 6 MC..... 3.95
Brand New BC455 6 to 9 MC..... 4.95
Near New BC455 6 to 9 MC..... 3.95
Brand New BC946 550 to 1500 KC with Factory Instruction Book... 12.95

28 Volt Dynamotor for 453, etc..... $0.95
Triple remote control head for SCR-274 (BC-453-B, BC-454-B, BC-455-B)..... $1.95
Flexible cable for tuning SCR-274..... .79
Mounting Rack for three receivers..... 1.95

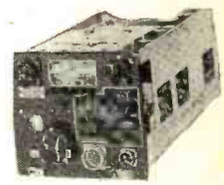
AIRCRAFT COMMAND TRANSMITTERS



This really fits the ham's dream. Ideal for a 55 watt transmitter with 575 volts at 250 MA plate supply, or VFO to drive a high power rig. It's a companion unit to the 454-455-453 series aircraft receivers. Made by Western Electric and really rugged. The oscillator will hold the frequency, even under rough operating conditions. Has 12J5 M. O. and 2-1625 (807) in parallel as final P. A.; or buffer to feed into a high power rig. Built-in crystal dial calibration checker. Antenna loading inductance. Priced with tubes and crystal. For your convenience a diagram of the BC-457 will be sent you. All of the command transmitters are essentially the same hook-up.

Brand New BC457 4 to 5.3 MC..... $7.95
Near New BC457 4 to 5.3 MC..... 3.95
Brand New BC458 5.3 to 7 MC..... 7.95
Near New BC458 5.3 to 7 MC..... 5.95
Brand New BC459 7 to 9.1 MC..... 7.95
Brand New BC696 3 to 4 MC..... 9.95

NAVY ARB RECEIVER, $19.95



You can convert this over, easily to a good ham receiver. It's one of the hottest values in surplus receivers. 28 volts DC input. Covers 4 bands. 195 kc to 9 mc. This is a deluxe type superhet receiver, note that the frequency coverage includes the standard broadcast band. Has 4 gang tuning condenser; can be converted to a 110 volt AC receiver. Priced complete with tubes: 12SF7, 12SA7, 3-12SF7 and 12A6. Has dial built on front of chassis. Electric driven or manual band change switch. Weight 28 lbs. Size 6x7x15 inches.

ARB Near new condition, with tubes and dynamotor..... Net $19.95

GLIDE PATH RECEIVER, $6.95

R-89/ARN-5 Glide Path Receiver 11 tube superhet. Formerly used for blind landing. Adaptable for many uses. Receives 326 to 335 MC. Contains six relays. 11 tubes 7—6AJ5, 12SR7, 2—12SN7, 25D7. Size 13x5x6. Weight 12 lbs. A beautiful piece of equipment. Has three crystals. Priced complete with xtals and tubes.

R-89/ARN-5 Near new condition ..... Net $ 6.95

VEEDER-ROOT METER AND CASE

Counts number of feet of trailing wire antennae; number turns when winding on coil; applicable for many uses; beautiful bakelite case, jeweled dialite, pilot light enclosed, 3 position switch, counts up to 1000.

Each 95c

BOX SCOOP 79c

ARMY SPARE PARTS BOX. Handy for tools or fishing tackle etc. Has water tight hinged lid. Made of ⅜ water proofed plywood. Size 3 x 11 x 5½. Scoop Price 79c

AM-26 $1.49

INTERPHONE SALVAGE SCOOP

AM 26 interphone amplifier. This unit is nice for parts salvage and the aluminum case is usable for receiver building etc. Size 9½x4½x5". Has two transformers, four tubes sockets, three filter condensers, three position panel switch, toggle switch, and many small parts. All are in perfect condition.

$1.49; 2 for $2.49

NEW KEYS 49c

10 for $3.95

McGEE RADIO COMPANY

WRITE FOR CATALOG

SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

RADIO SERVICEMEN! McGEE HAS THE VALUES IN RADIO TUBES AND PARTS

HOT SPECIALS IN P.M. SPEAKERS

12" P.M. 7 oz of A.V. 18 watt only.....$6.95
All are guaranteed.

12" 5 oz. Alnico 5 Pm Speaker.....12 watt Net $5.95
10" 5 oz. Alnico 5 Pm Speaker.....10 watt Net 4.95
8" 3.15 oz. Alnico 5 Pm Speaker... 8 watt Net 3.49
8" 2.15 oz. Alnico 5 Pm Speaker... 6 watt Net 2.95
6" 2.15 oz. Alnico 5 Pm Speaker... 6 watt Net 1.95
RED HOT SPECIAL—6" 5 oz. Alnico 3 Square Pm Speaker $1.49; 10 for.....$13.50

GENERAL ELECTRIC 5½" P.M. $1.95

5½" G-E 1.5 oz. Alnico 5 Pm Speaker with output transformer for 50L6 $1.95 (mount for either 6 or 6½" speaker.) Scoop price $1.95; 10 for....$17.50

CHOICE OF 3½", 4" or 5" P.M. $0.99

3½", 4", or 5" Pm Speaker with 1 oz. Alnico 5 magnet. Your choice 99c each. Order all you need. May never again be sold at this price. All brand new and guaranteed perfect. Choice of 3½", 4", or 5" 1 oz. Alnico 5 Pm Speaker. Scoop Price..99c each

DYNAMIC SPEAKERS

6½"	1000	ohm Field Speaker	$2.49
5"	3000	ohm Field Speaker	1.89
5"	1000	ohm Field Speaker	1.89
5"	450	ohm Field Speaker	1.89
4"	450	ohm Field Speaker	1.89
4x6"	450	ohm Field Speaker	1.89

SPECIALS IN TUBULAR CONDENSERS

Cornell Dubilier .05 Mfd. 600 volt condenser. Scoop Price $0.09 each. 100 for.....$7.50

Solar Sealtites .05 Mfd. 400 volt condensers or .01 400 volt $0.07 each. 100 for.....$5.00

600 VOLT TUBULARS, MANUFACTURERS TYPE

Guaranteed all good brands condensers; .001, .005, .01, .02, .05, all 600 volt. Any size $0.08 each. 100 assorted for.....$6.50

POPULAR F.P. ELECTROLYTICS

in Alum. Cans. Easy Twist. Mounting all small size.

10 x 10 x 10 Mfd. 450 volt	$0.49	20 x 40 Mfd. 400 volt	$0.49
30 Mfd. 450 volt	.49		
20 Mfd. 450 volt	.39	40 x 40 Mfd. 250 volt	.39
20 Mfd. 300 volt, 10 Mfd 350 volt, 20 Mfd. 25 volt	.39	40 x 20 Mfd. 150 volt 20 Mfd. 25 volt	.39

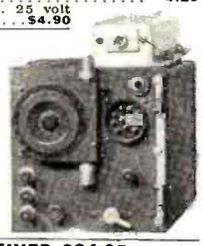
TUBULAR ELECTROLYTICS

In paper tubes with pig tail leads

Cornell-Dubilier, 8 Mfd. 450 volt $0.39 each. 100 for.....$32.50
Cornell-Dubilier, 16 Mfd. 450 $0.59 each, 10 for.....5.25
Aerovox, 8 x 8 Mfd. 450 volt. $0.49 each. 10 for 4.50
Aerovox, 20 x 20 Mfd. 150 volt. $0.39 each. 10 for.....3.50
Sprague, 50 x 30 Mfd. 150 volt. $0.49 each. 10 for.....4.25
Solar 50 x 30 Mfd. 20 Mfd. 25 volt $0.59 each, 10 for.....$4.90

RU-19 REC. $7.95

2-Band Aircraft Receiver RU-19



Priced complete with six tubes, 3 78's and 2 77's plus twin output tube. Guaranteed to be in good condition.
RU-19 type A receives 200 to 400 KC and 4130 to 7700 KC.....$7.95
RU-19 type B receives 200 to 400 KC and 2500 to 4700 KC.....$7.95

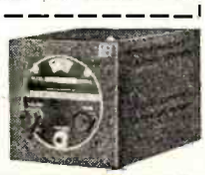
BC-310B RECEIVER $24.95

Bendix Radio Compass Receivers. Built-in dynamotor. 14 volts DC input. 5 gang tuning comdenser, 3 bands: 150 KC through broadcast band to 1500 KC. Has S meter ,12 tubes, (6 volt type). A beautiful radio receiver. Easy to convert to AC operation. In good condition. Weight 30 lbs.....Net $24.95

RCA AVT-112A TRANSMITTER $12.95

Brand new RCA aircraft transmitter Model AVT-112-A. Crystal controlled 2500 KC to 6500 KC. b Designed for 6, 12, and 24 volt DC and 350 volt DC input. 6 tubes: 6AF6 dual tuning indicator, 6V6 Pierce oscillator, 6V6 P. A., 2 6V6 as plate modulators, 6SL7 tuning indicator amplifier. This is the nicest piece of equipment you have ever seen. 6 x 6 x 5½ inches and weighs 6 pounds. Every ham or ham to be should have one of these. All brand new with tubes (less Crystal) and complete instruction book. This unit covers 80 meters and 3105 and 6210 aircraft bands. Cost $12.95. 2 for $25.00.

NEW BC-1206 $7.95



Designed to receive A-N beam signals. 24-28 vdc. Tube complement: 14H7, 14A7, RF. 14H7, 14J7, 14A7, 14H7, IF amplifier: 14R7, detector and 1st audio: 28D7, output. 195 to 420 KC 4" high x 4" wide x 6⅜" long. Weight 4 lbs. Net $7.95 when purchased with AVT-112A, $5.95.

G.I. RECORDER MECHANISMS

Latest 1947 General Industries recording assemblies with 4 ohm magnetic cutters and crystal play back.
Model R70-L—78 RPM. Net.....$24.50
Model R90-33 and 78 RPM. Net..... 28.95
Model R130-L—Automatic changer with cutter. 78 RPM. Net..... 40.10

MALLORY SYNC. VIBRATOR $.99

This is a standard type 6 volt vib. unit. Has long leads. Easily installed in the old case. A red hot item if we ever had one.

SCOOP PRICES ON VIBRATORS

Standard 6 volt vibrators for every day replacement use—All guaranteed.

4 prong war surplus; new in bent cans	$0.79
4 prong UTAH NP-42 for Philco	1.29
4 prong SMALL for Ford	1.49
4 prong OFF-Set for Delco	1.49
5 prong standard sync.	1.49
6 prong standard sync.	1.49
6 prong reversible sync.	1.99
7 prong reversible sync.	1.99
5 prong OFF-Set sync.	1.99
Sync. unit: Vibrator unit only; with cond.	1.99
7 prong 2 volt; G. E. sync.	1.99

PHONO MOTOR SCOOP $1.95

Yes that is the right price only $1.95. Latest type rim drive 110 volt 60 cycle AC phono motor. Best type of construction. Only 2000 to sell while they last only.....Each $1.95
Latest type, light weight crystal pick up arm. Has standard output crystal. Scoop price.....$1.69

RU-19 FOR SALVAGE $2.95

RU-19X or ARMY equal. SALVAGE PARTS SCOOP. Has many usable parts, condensers, resistors, etc. Less tubes and plug in coils. All are in good condition. RU-19 Salvage Scoop $2.95 ea.; two for $5.00.

AMERICAN XTAL CARTRIDGE $1.49

American crystal replacement phono cartridge. Standard mounting; most one size used. Long shielded leads. Scoop price.....$1.49

SUPERHET BROADCAST TUNER

for connection to phono amp. or P.A. system. Compact chassis 5x3½x3 inches. May be mounted inside the record player cabinet. Requires only three connections to amplifier. Uses 6SA7 or 12SA7; 6SK7 or 12SK7 and crystal diode. Complete with tubes, loop antenna, dial and instructions for connecting to any amplifier. Net $7.95. Specify if tuner is to be used with AC or AC-DC type amplifier.

RECORD PLAYER $9.95

POWERFUL SINGLE RECORD PLAYER KIT Z-26. Housed in an attractive leatherette covered cabinet. Latest 78 RPM rim drive motor and light weight pick-up. Ready wired and tested 70L7 type tube amplifier. Tone and volume control, 5" PM speaker (Alnico V). This kit easily slips together. Priced complete with tubes and hook-up instructions. Kit Z-26.....Net $9.95

AUTO CONTROL $3.98

Universal under-dash auto radio control; made from Crowe parts $3.98. Choice of drive ratios 8, 10, 12, 16, or 20 to 1. To find the ratio that you need count the turns from minimum to maximum of the condenser gang and double. Specify ratio when ordering. If off-on switch is desired add $1.00 to the price. 30" auto cables; per pair.....38c

SCR 274 COMMAND SET $24.95

SCR-274 Command set. Removed from planes; guaranteed to be in good condition. Here is what you get: 3 Receivers—BC-453-B (200 to 500 KC) BC-454-B (3 to 6 MC), BC-455-B (6 to 9 MC)—Triple remote tuning head, with three flexible shafts and triple shock mounting rack. Two transmitters BC-457-A (4-5.5. MC), BC-458-A (5.3-7 MC) and twin shock mounting rack. Antenna current meter, modulator and dynamotors. Each receiver has its own dynamotor. Scoop Price $24.95, complete.

CATHODE RAY TUBES BRAND NEW

3BP1	Net	$2.95
5CP1	Net	3.95
5BP1	Net	3.95
5FP7	Net	3.95
7BP7	Net	4.95
9LP7	Net	4.95

75% OF ALL THE TUBES YOU USE AT 49¢ EACH

Guaranteed Standard Brands. Cartoned and Uncartoned

1B4	6SA7	12H6	25L6GT	78
1B5	6SC7	12J5GT	25Z6GT	80
1S5	6SD7GT	12SA7	26	1L4
1T4	6SF5	12SG7	27	50L6
3Q4	6SF7	12SH7	35L6GT	
3S4	6SG7	12SJ7	35W4	
5U4G	6SH7	12SK7	35Z3	
5Y3GT	6SJ7	12SL7GT	35Z4GT	
6AC7/1852	6SK7	12SN7GT	35Z5GT	
6C5	6SN7GT	12SR7	39/44	
6C8	6SQ7GT	14A7/12B7	41	**49c**
6D6	6SR7		42	
6F6GT	6V6GT	14B6	43	
6H6	6X5GT	14C7	45	
6J5	12AT6	14H7	50B5	
6K6GT	12BA6	14Q7	56	
6K7	12BE6	14R7	75	
6L7	12C8	14S7	76	
			77	
7A6	7C5	7Y4	35A5	7B8
7A7	7C6	7Z4	0Z4	
7A8	7E7	30	1H5GT	**69c**
7B4	7F7	32	6A7	
7B5	7H7	33	6A8	
7B6	7N7	34	1N5GT	
7B7	7Q7	35/51	1A7	
1LA4	1LC5	1LE3	3Q5GT	
1LA6	1LC6	1LH4	6L6	**99c**
1LB4	1LD5	1LN5		

Scoop Civilian type high imp. head phones (9500 ohms.) Brand new factory cartoned. Have full length regular type leads. Net $1.29 each; 10 for.....$10.95

Broadcast crystal radio receiver, with crystal, $0.99, 10 for.....$8.90

SELSYN INDICATORS $2.95

Selsyn indicators. 5" diameter. Will operate on from 15 to 24 volts 60 cycle AC. Model I-82A can be used as either selsyn transmitter or selsyn receiver, Scoop Price. $2.95, 2 for $5.49

BRAND NEW BC-223AX TRANSMITTER $16.95 TWO FOR $31.95

Brand New Factory cartoned BC 223 AX transmitter. Has 801 OSC and power amp. 2-46 modulators and 46 speech amplifier. Four xtal frequencies and Master oscillator. Up to 40 watts output on CW, tone or voice. Ideal for the 80 meter band. Comes with 3 coils. 2 to 3 MC. 3 to 5 MC. 3.5 to 5.25 MC. Less xtal with tubes and frequency chart. Weight 120 lbs.

NEW NAVY 6-9 MC. REC., $7.95

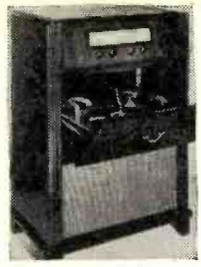
Navy Aircraft Receiver R 27. 6 to 9 MC. Brand new, factory cartoned. Has black wrinkle finish. With tubes 2—12Sk7, 12K8, 12SF7, 12SR7 and 12A6. This is the latest model with stabilized oscillator. Priced with tubes, 28 volt dynamotor, remote control, 6 ft. control cable. Less the power cable. Scoop Price.....$7.95

Left to Right

New Remote Control Head and volume control CW, MCW, sw. for BC-455-B 6 to 9 MC receiver. Scoop Price..$0.99
BC-631-13 Jack Box, NEW. Has 10M gain control and Jones 6 screw terminal block. Salvage Price.....$0.29
Salvage Scoop BC-732-A Radio Control Box. Toggle switch, volume control and 6 position single pole cam-operated switch; phone jack. Scoop Price.$0.49

McGEE RADIO COMPANY WRITE FOR CATALOG — SEND 25% DEPOSIT—BALANCE C.O.D. 1225 McGEE ST., KANSAS CITY, MISSOURI

FM/AM RADIO PHONO. ONLY $95.00



Console, complete with record changer. AM/FM Meck model 10A7/FA-27. Dealers net....$95.00 Lots of 3.....$85.00

1948 Models of Meck FM/AM Radios

JOHN MECK TRAILBLAZER FM/AM Radio Receiver. Available in two styles: An attractive mantel set and a beautiful console model with automatic record changer. The 10 tube circuit meets RMA standards; covers broadcast 550 to 1750 KC and 88 to 108 MC FM. The new ratio detector eliminates the use of limiters. Base booster and tone control. Furnished with the following tubes, complete: 4—6BA6, 2—6BE6, 25L6, 25Z6, 6AT6, and 6AL5. Full 10" illuminated dial and large speaker.

AM/FM Meck model 10A7/FA-26. Dealers net .....$49.90 Lots of 3.....$47.95

3 HIT MODELS BY SETCHELL CARLSON

5-Tube Model 416

The 5 tube superhet model 416 is truly a post war model. The streamlined cabinet made of plastic; covers the radio on all sides. Receives 550 to 1650 KC. Has 2 gang condenser, AVC, loop antenna and full size 12 and 50 volt tubes. Complete, ready to play. Model 416 Walnut plastic cabinet $17.48. Lots of 3, $16.99. Model 416 Ivory plastic cabinet $18.19. Lots of 3, $17.70. Weight 8 lbs.

6-Tube Model 427

The 6 tube superhet model 427 is the last word in mantel radio sets. The 3 gang condenser; fully utilizes the 6 full-size 12 and 50 volt tubes. There is no better broadcast AC-DC radio (530 to 1650 KC). Priced with tubes, ready to play.
Model 427 Walnut plastic cabinet $24.15
Lots of 3 ..... 23.00
Ivory plastic cabinets 25.15
Lots of 3 ..... 24.15
Weight 9 lbs.

5-Tube Portable

Model 447 5 tube plus rectifier; portable radio is of advanced design. 5 miniature tubes and disc rectifier; 3 gang condenser, loop antenna, modern cabinet design, full 6½" Alnico 5 PM speaker. This set is a distance getter. Operates on self-contained dry batteries or 110 volts AC-DC. With tubes, ready to play. Model 447, $27.97 each. Lots of 3, $26.60. Weight 10 lbs. 300 hour battery pack $2.95 extra.

MECK PEE WEE SUPER $11.95

Meck, 5 tube superhet; using miniature tubes. Small plastic cabinet (7x4x5"), 2 gang condenser, loop antenna. Alnico 5 PM speaker. This is a red hot value in a small radio receiver; broadcast 550 to 1650 KC. Priced with tubes; ready to play.

Model 800B, Black plastic cabinet.....$11.95
Lots of 3.....$10.95
Model 800W, White plastic cabinet.....$12.95
Lots of 3.....$11.95
Weight 5 lbs.

MECK FM CONVERTER $14.95

It's sensational. Makes any regular AM (ordinary radio) radio receive FM Signals (88 to 108 MC). Just announced by John Meck Industries. Order your sample today. Dealers Net $15.95. Same cabinet as Pee Wee shown above.
Lots of three.....$14.95

MECK FARM RADIO $16.95

JOHN MECK INDUSTRIES BATTERY RADIO. Full 5 tube superhet circuit; covering broadcast band: 550 to 1650 KC. Full size Alnico 5 PM speaker and beautiful cabinet 17x8x9". Large enough to hold 1000 hour farm battery pack. Priced complete with tubes, less battery pack: 1R5, 2-1T4, 1S5, and 3S4. Has loop antenna with provision for external antenna. Net price $16.95. In lots of 10.....$15.95
1000 hour battery pack.....$4.98

1948 MODELS OF KARADIOS

"For Your Car"

Karadio Model 80-A—The greatest radio ever offered to the ham; covers broadcast 80, 40, 20 and 10 meter bands. Here is your chance to get a communications type car radio easy to mount under dash. Has R.F. stage; separate PM speaker. Designed for 6 volts D.C. input. Band 1—530 to 1700 KC; Band 2—3 to 7.3 MC; Band 3—14 to 30 MC. Net Price.....$79.50

Karadio Model 80-B (airport model). Similar in appearance to model 80-A; except covers different frequency. Band 1—190 to 450 KC; Band 2—535 to 1700 KC; Band 3—2.4 to 6.8 MC. Input six volts DC. Net $62.50

Karadio Model 1200—A fine broadcast (535 to 1700 KC) car radio. Compact size makes for easy installation (5½x2¾x8 inches). Input six volts D.C. Has tuned R.F. stage; separate 6" PM speaker and conventional high gain superhet circuit. Similar in appearance to Model 80; shown above.
Net Price $38.95

1948 MODEL—MIKE-BROADCASTER ONLY $7.95

Broadcasts 800 to 1500 KC from either a phonograph pick-up or a crystal or dynamic mike. Makes any radio receiver a P.A. system, record player or recording amplifier. Gives broadcast quality. Has fader control from mike to record, simulating a regular broadcast station. This is a powerful model; using 2-35L6, 12SJ7 and 35Z5 tubes. Priced with tubes and connecting instructions. Works on 110 volts AC-DC. Crystal mike and desk stand $4.95 extra. Model DE-5 truly a de-luxe mike-phono oscillator.

3-TUBE PHONO. OSC. ONLY $3.95

Model DE-4—Phonograph oscillator. Broadcasts from 800 to 1500 KC. Gain for any crystal pick up. A new powerful circuit is used to assure plenty of power. Has variable gain control for proper modulation. Priced with tubes ready to operate, two 50B5 and 34W4.
Model DE-4 Net.....$3.95

MECK DISC RECORDER $79.00

The John Meck Industries (Audar) portable disc recorder incorporates all of the latest in modern engineering. A transformer type amplifier with plenty of volume and good tone quality. Records may be cut and played back at 33⅓ or 78 RPM. Priced complete with crystal mike and cutting and playback needles. Ready to operate; yours for only $79.00
Weight 35 lbs.

MECK 3-WAY PERSONAL PORTABLE $21.95

Model 5D-7 Broadcast superhet (550 to 1650 KC) Personal portable; only 5x6x8 inches. A big radio in a small package. Operates on 110 volt AC-DC or self-contained batteries. Has 4 miniature tubes and disc rectifier. Uses 2 45 volt 455 Eveready B battery and 5 flashlight cells. Net.....$21.95
In lots of 3.....$20.95
Kit of batteries $2.69—Extra weight 10 lbs.

TIME SWITCH $4.95

Self-starting Electric Clock; with built in TIME SWITCH. Turns radio or appliance off or on at any pre-set time. Use your radio as an alarm clock.
Scoop Price $4.95

LAST MINUTE SPECIALS

Red hot PM speaker values. All have 20 oz. of alnico 3 magnet. Latest production. Ideal for amplifiers and radio set replacement. Fully guaranteed.
12 in. 20 oz. alnico V. 20 watts.....Net $5.49
10 in. 20 oz. alnico V. 20 watts.....Net 4.49
8 in. 20 oz. alnico V. 15 watts.....Net 3.98

Thordarson power transformer scoop T 70R62 or T 44915 for 60 cycle 115 AC. 700 volts C.T. at 145 mills. 6.3 v. 4.5amps. and 5 v. 3amps. Scoop price 3.49

Spring wound phono motor with all hardware turntable crank etc. reg. $6.50 value. Scoop price 2.98

Thordarson filter choke. 200 mil, 10 henry; fully shielded. Most beautifully made choke you ever saw. Weight 5 pounds. Scoop price $1.99. 3 for 5.50

R-32 Victor etc., replacement power transformer. Made by Utah. Upright mounting. Has all windings 1½, 2½, 5 etc.....Net 4.95

100 assorted ¼ (¼) watt carbon resistors; non-insulated type.....Net 1.19

G-E Plastic AC cord; with molded cap 6½ foot 19c
8 foot 24c

Utah VPR-1 50 mil strap mounting choke; 30 henrys. This is the standard size as used by 4, 5 and 6 tube radios.....Net Price .49

Auto aerial closeouts.
4 section. Top Cowl less lead.....$0.69
3 sect. 66" side cowl, 30" lead..... 1.79
4 sect. 96" side cowl, 30" lead..... 2.79
72" ICA Uni-mount with lead..... 1.79

ARC-4 140-152 MC. $24.95

for operation on VFH frequencies from 140 to 152 MC. Four channels crystal controlled transmitter and receiver. Designed for 12 or 24 volt DC operation.
Scoop Price.....$24.95
Weight 35 lbs.

BRAND NEW RADIO COMPASS $69.50

SCR-269-F Brand New Radio Compass; Automatic direction finder. Complete with all component parts; $69.50. This unit was designed for Army Navy as a primary navigation compass. Constant reception is possible so that fixes can be made at any time; to establish a ship or plane's position. Plotting fixes is accomplished by selecting two or more stations and plotting these on the navigation map. The point of intersection indicates the position of the ship or plane. This equipment comes complete with 17 tubes; superhet receiver which is tunable from 200 to 1750 KC in three bands. A complete instructtion manual for operation and maintenance accompanies each unit.

MEISSNER RADIO AND DISC RECORDER $109.50

Not much need be said about the Meissner Model radio, receiver and disc recorder. A standard transformer type broadcast (550 to 1650 KC) radio and amplifier; with tone and volume controls. Records and plays back at 33⅓ or 78 RPM from its own radio or from crystal microphone. Priced complete with mike, ready to operate. Net Price....$109.50
Weight 45 lbs.

10 STATION INTERCOM $29.95

This 10 station push-button inter-com. originally cost the dealer over $40.00. Attractive walnut finished cabinet; made by East coast manufacturer. With tubes 14F7, 50L6 and 35Z5. Master and one substation, net $29.95. Extra sub $5.95 each.

3-WAY REGAL SUPER-MITE $22.95

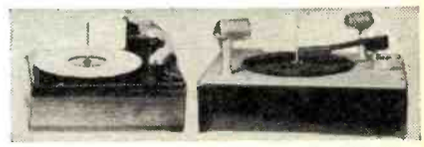
No Taller Than a Pen

Regal Model 747—3-way personal radio. Receives broadcasts 550 to 1650 KC. Small in size; only 4x5x 8 inches. However uses full size parts with 2 gang condenser and loop. Priced complete with 4 miniature tubes and disc rectifier. Net $22.95 each. In lots of 3 $21.95
Kit of batteries $2.05 extra.

REGAL 5-TUBE AC-DC $15.95

A scoop value. Full-fledged; 5 tube superhet broadcast (550 to 1650 KC). Loop antenna, 5" dynamic speaker, attractive 10" plastic cabinet and slide rule dial. Order now for Christmas sales. $15.95 each.
In lots of 3.....$14.95

MAGUIRE CHANGER $11.95



Latest Maguire 2 post record changer, plays 10 12" or 12 10" records automatically. Net.....$11.95
Made to fit walnut base, $2.49 extra.
General Instrument single post automatic record changer plays 12 10" or 10 12" records automatically. Net.....$12.95
Made to fit walnut base, $2.49 extra.

SCR-522 AS-IS $12.95—Two for $25.00

SCR-522 You are all familiar with this 100 to 156 MC Transmitter, receiver. These 522's that we have are in rough looking cases and some of the outside connectors have been damaged. However, separate the transmitter and receiver and remove the case, you will have usuable merchandise. There are not many more of these units available; we have just 100 to sell.

WE HAVE A LARGE STOCK OF ALL THE RADIOS ETC. ADVERTISED ORDER FOR XMAS NOW!

McGEE RADIO COMPANY

WRITE FOR CATALOG

SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

Increase Your Sales With CONTESTS!

By ZENN KAUFMAN

Secure the most cooperation from your salesmen by breaking the routine with live sales contests.

REACH into your wastebasket and pull out today's newspaper. You and 36 million other **fairly** live people bought a paper today. Why? Couldn't you live without knowing about the war in China, the budget row in Congress—or the rest of the front-page news? Sure you could. But we pay a million dollars a day for papers because we are interested in conflict—and news is a series of conflicts, Crime, labor, sports, war, and politics—every headline a conflict. Harry Overstreet, a practical psychologist, says:

"Fundamental to all dramatic movement is the presence of conflict. Situations arouse us when two forces are at grips; when we are unsure of the outcome. Dullness is dull because we are not precipitated into the midst of a fight."

People Like Conflict

People like action. Action is competition, whenever possible. Above all, people delight in conflicting action. Because we all love contests or fights, the sporting pages of newspapers are closely read. In offices, politics, or in the street, the fighting man or dog gets far more attention, proportionately, than a three-alarm fire.

George M. Cohan, while writing plays and running his own theatre, used to hold the public eye by a series of fights. Whenever he could get an interview or even in a paid announcement, Cohan devoted much space to attacking unfriendly critics with the sole purpose of inducing them to denounce him at great length. He even put out a little newspaper of his own to battle them.

Some Novel Contests

Three beverage makers in Milwaukee together sponsored a free six-day bike race. This conflict attracted 40,000 people who were not only fed appropriate advertising plugs about the three beverages through loudspeakers, but had to *buy* them in quantities to quench their long-drawn out thirst. The *Chevrolet Motor Company* has seen its soapbox derbies grow into a world-wide conflict. With tryouts in every town, with elimination semi-finals in 120 cities, the final event has assumed enough importance to rate a national radio hookup together with thousands of columns of news publicity. It all started because one *Chevvie* dealer realized that conflict—even a contest of small boys in toy automobiles—makes news.

Use Sales Contests

Sales contests bring conflict to salesmen. Use them. No man works his hardest except (a) under fear of being fired, or (b) the white heat of competition. Since you can't continuously threaten to fire your salesmen, the only alternative (for maximum effort) is a well-planned sales contest.

The formula for successful contests is:

1. Not too long. 30 to 60 days is top.
2. An exciting theme. Try "Every Man a Millionaire." Give $10,000 in paper money for each sale. First man to get a million gets the prize. Another good theme is "A Trip to the Savings Bank." A chart marks off into steps the route from the home office to the bank. As his sales go up, each man moves towards the bank where cash prizes are waiting.
3. Fair and simple scoring plan. Bad quota setting is responsible for more contest failures than any other single fault. Make your scoring simple.
4. Steady weekly follow-up. A scoreboard. Write letters to your men every week. Get the wives into the picture. Better to spend a little less on prizes, rather than omit proper follow-up.
5. Interesting prizes. Use (a) medals, plaques, (b) cash, (c) choice of items from a whole book of prizes, (d) trips and cruises. Keep talking about your prizes all the time. It's not *what* you give that counts—it's how much build-up you give it.

A contest is in itself a conflict—with a cast, plot, scenery, action, suspense—and all the elements of a real show. Harrison, a *GE* distributor in Newark once opened a sales contest with a visit from an orphan asylum band. When those kids got through playing at the sales meeting the average blood pressure of the salesmen was up at least 5 points. And that's what makes enthusiasm.

Prize contests bring this same element of *conflict* to consumer merchandising. 45 million entries are made in prize contests in an average year. Major Bowes earned $150 a minute by pitting amateurs against each other on a national network. There's no end to the ingenuity that can be put into these contests. *McCorkells*, a San Pedro, California, appliance dealer, ran

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You use, test, repair full-size apparatus — just like you'll later handle on the job. Previous experience unnecessary.

FREE ELECTRICAL BOOK

Send now for big, illustrated book on COYNE Electrical Training. Many large pictures of our shops. Tells about Free Lifetime Employment Service to Coyne graduates. Other vital facts. Check coupon for "ELECTRICITY" and mail today.

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If you prefer Radio, COYNE gives quick, practical training in Radio Construction, Testing, Repair; also Public Address, Sound Systems, FM, Television. Many branches of Radio open to you.

Want to be Your Own Boss?

Hundreds of **Coyne** graduates have successful Radio shops of their own. We show you how to start, how to build for a lifetime future. No previous experience required to take **Coyne** Radio Course.

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Check coupon for "RADIO" to receive our big FREE book of photos and facts about **Coyne** Training in Radio, Sound and Television. Describes the vast new opportunities in this field, and how we make it easy to get ahead. Rush coupon NOW.

COYNE HAS BEEN TRAINING MEN SINCE 1899

B. W. COOKE

For nearly 50 years, the great shops of COYNE have been turning out men and young men trained for better jobs in practical fields. **Coyne** graduates hold responsible positions in many leading electrical and radio firms.

NON-VETERANS who are short of cash can finance their tuition and pay it in easy monthly payments after graduation.

VETERANS! Coyne is authorized to accept veterans for G. I. training. Coupon brings bulletin.

ADDED TRAINING in ELECTRIC REFRIGERATION included with either course

CHECK COUPON FOR ELECTRICITY OR RADIO—MAIL NOW!

B. W. COOKE, President,
COYNE ELECTRICAL SCHOOL,
500 S. Paulina St., Dept. 77-81H, Chicago 12.

Send me your BIG FREE BOOK—for the Course checked below, and tell me about your special plans to help me. This does not obligate me and no salesman will call.

☐ ELECTRICITY ☐ RADIO

NAME.....

ADDRESS.....

CITY..... STATE.....

COYNE ELECTRICAL SCHOOL
Dept. 77-81H
500 S. Paulina Street, Chicago 12, Ill.

a contest in which folks were asked to guess the cost of operating a refrigerator for 30 days. The *Boston Edison Company* ran an essay contest (Topic: What I Have Learned About Electric Cooking); found 18% of all entrants were in the market for a new stove. In Boise, Idaho, they ran a Cookery Quiz, asking the public to check answers to 18 questions.

Put *conflict* into your advertising. Major Bowes made $150 a minute by presenting *conflicting* talent on the air. Dramatize the battle between appliances, the champions of health, and old-fashioned drudgery. At the New York World's Fair one of the most talked of exhibits was the one in which the power companies put on a dish-washing race between the old-fashioned gal who did it by hand and a modern miss who let Mr. Reddy Kilowatt do the job. Guess who won? Show how Kid Kilowatt puts the K.O. on lost time and particularly on hard work.

Put the element of *conflict* in your advertising—in your selling—in your windows. It's a sure-fire way to get attention. The public is always ready for a fight. If you show that your product is fighting the things that they don't like they will be quick to pick you as the winner. You'll be the odds on favorite for all bets!

(Acknowledgement is made to Harper Brothers for permission to reprint parts of "Showmanship in Business" by Goode and Kaufman.)

—30—

FACSIMILE IN COLOR

A NEW method of facsimile reception which will be in the price range of the average pocketbook has been announced by Finch Telecommunications, Inc.

Known as "Colorfax," this new system has been designed to provide direct reception in the home, of comics in full colors as they are now printed in newspapers.

Product of joint research by W.G.H Finch and Dr. LaVerne Philpott, this "Colorfax" machine is capable of transmitting in full color from any one point to a multiplicity of receivers, and of recording the transmission permanently on any ordinary white paper.

This new unit does not require the use of special electro-sensitive papers. Any paper, such as typewriter bond, telegraph or business machine rolls, or ordinary letterhead paper may be used. This means that the cost of servicing facsimile machines will be reduced and that home users of facsimile receivers will be able to make recordings on any type of suitable paper stock which will fit the machine.

In the first press demonstration of "Colorfax," full color pictures were transmitted and received over the system, in multicolor. In this case, four colors were used, just as in Sunday comics. Each picture was transmitted and received by line, each line carrying the full colors before tracing the next one. Additional colors, besides the basic four, were produced by surprinting just as is done in ordinary color printing from plates.

—30—

DAVEGA COMMUNICATIONS DIVISION

Presenting the NEW MODEL SX-43

hallicrafters

"The Radio Man's Radio"

...to give amateurs:

MORE VALUE
Never before all these features at this price

GREATER PERFORMANCE
AM-FM-CW . . . all essential amateur frequencies from 540 kc. to 108 Mc.

LOWER PRICE
$169.50
Sets available after August 1947

MODEL SX-43

The SX-43 offers continuous coverage from 540 Kc. to 55 Mc. and has an additional band from 88 to 108 Mc. AM reception all bands. CW on four lower bands and FM on frequencies above 44 Mc.

ONLY $169.50

← MODEL SX-42

A truly post war radio. Greatest continuous frequency coverage of any communication receiver —from 540 Kc. to 110 Mc. in six bands. FM-AM-CW. 15 tubes.

Speaker 29.50

ONLY $275.00

← MODEL S-40A

Overall frequency range from 540 Kc. to 43 Mc. in four bands. Nine tubes, built-in dynamic speaker.

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Overall frequency range from 540 Kc. to 32 Mc. in four bands. Compact and rugged. AC-DC. Built-in speaker.

ONLY $47.50

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The most comprehensive antenna book yet published, with all the old tried-and-true standards, and many a new one.

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* The *ELECTROTATOR*, an *electrically* rotated broadside curtain.

WRITTEN BY W. W. SMITH, W6BCX, Editor of the prewar "Radio" and "Radio Handbook". Many of you know him as the developer or first popularizer of the *Lazy-H* array, the *Plumber's Delight* three-element rotary, the *Bi-Square* array, the link-coupled universal antenna coupler, and various other little gems which after many years are still helping hams snag dx, save money, avoid pink tickets for harmonics, and otherwise keep them contented.

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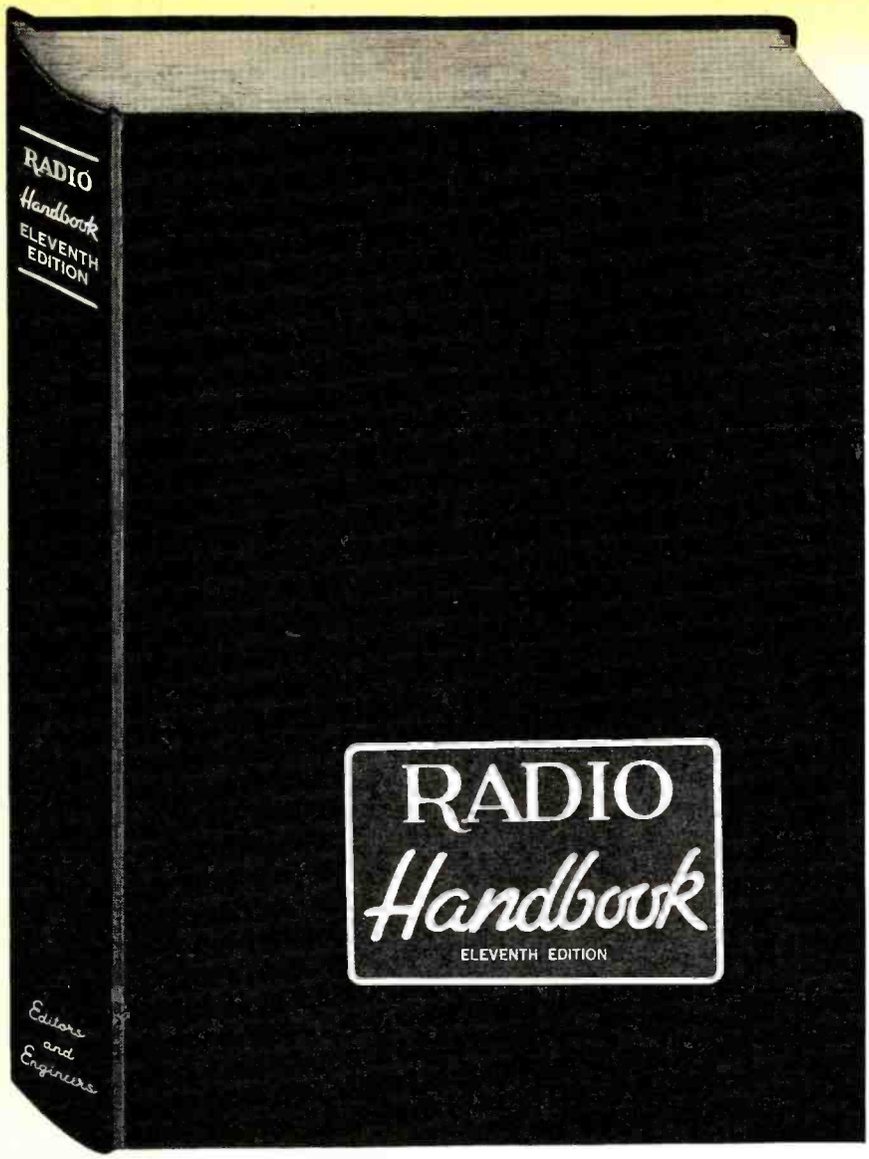

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Parts Lists

(FOR CIRCUIT DIAGRAMS APPEARING ON PAGES 80 AND 81)

STEWART-WARNER MODELS 9002-A, B, P, R

Part No.	Code and Description
502140	4—390 ohm, ¼ w. res.
502130	6—22,000 ohm, ¼ w. res.
502133	11—220,000 ohm, ¼ w. res.
502291	13—4700 ohm, ¼ w. res.
502264	15—47 ohm, ¼ w. res.
502269	16—3.3 megohm, ¼ w. res.
502131	18—47,000 ohm, ¼ w. res.
502145	20A, 20B—500,000 ohm vol. control & sw.
502136	24—10 megohm, ¼ w. res.
502135	25—2.2 megohm, ¼ w. res.
502128	26—2200 ohm, ¼ w. res.
502133	29, 30—220,000 ohm, ¼ w. res.
502134	32—470,000 ohm, ¼ w. res.
502138	33—130 ohm, ¼ w. res.
502469	37—1500 ohm, 1 w. res.
502574	42—33 ohm, ½ w. res.
502123	3A, 3B, 3C—Var. gang cond.
502159	7—50 μμfd. mica cond.
502155	9—.1 μfd., 200 v. cond.
502158	10—.2 μfd., 200 v. cond.
502262	12—.25 μfd., 200 v. cond.
502160	19, 27—110 μμfd. mica cond.
502453	21—.002 μfd., 400 v. cond.
502470	22—.0008 μfd., 400 v. cond.
502153	28—.05 μfd., 200 v. cond.
502156	31—.004 μfd., 400 v. cond.
502151	34—.01 μfd., 400 v. cond.
500256	35A, 35B—40/20 μfd., 150/-150 v. elec. cond.
502152	38—.02 μfd., 400 v. cond.
502157	41—.05 μfd., 400 v. cond.
502246	1—Loop ant.
502121	2—Ant. coupling coil
502146	5—R.f. coil
502198	8—Osc. coil
502102	14—First i.f. trans.
502103	17—Second i.f. trans.
502213 or 502904	36—Output trans. for R-502-208 or A-502208 speaker
500546	23—Sw. & tone control
502214 or 502903	39—Cone & voice coil for R-502208 or A-502208 speaker
R-502208	40—5" PM speaker

GRANTLINE MODEL 510

Part No.	Code and Description
C-9B1-27	R_1—220 ohm, ½ w. res.
C-9B1-67	R_2—2700 ohm, ½ w. res.
C-9B1-84	R_3—68,000 ohm, ½ w. res.
C-9B1-302	R_4—15 megohm, ½ w. res.
C-9B1-62	R_5—1000 ohm, ½ w. res.
C-9B1-34	R_6, R_{10}—3.3 megohm, ½ w. res.
101252	R_7, S_2—1 megohm vol. control & sw.
C-9B1-37	R_8—10 megohm, ½ w. res.
C-9B1-31	R_9—1 megohm, ½ w. res.
C-9B1-42	R_{11}—22 ohm, ½ w. res.
130343	R_{12}—545 ohm, 14 w. res.
C-9B1-66	R_{13}—2200 ohm, ½ w. res.
130344	R_{14}—1975 ohm, 6 w. res.
C-8D-10770	C_1, C_6—.05 μfd., 200 v. cond.
B-8A-10246	C_{2A}, C_{2B}, C_3, C_4—Two-gang var. cond. including ant. & osc. trimmers. Range of gang: 14-452 μμfd. (ant.) and 10-198 μμfd. (osc.).
C-8F3-8	C_5, C_{12}—.0001 μfd., 500 v. cond.
C-8D-10775	C_7—.25 μfd., 200 v. cond.
C-8D-10761	C_8, C_{13}—.01 μfd., 400 v. cond.
C-8F3-8	C_9—.0001 μfd., 500 v. cond. (Part of 2nd. i.f.)
C-8D-10785	C_{10}—.005 μfd., 600 v. cond.
C-8D-10771	C_{11}—.1 μfd., 200 v. cond.
C-8D-10789	C_{14}—.002 μfd., 600 v. cond.
C-8D-10813	C_{15}—.05 μfd., 400 v. cond.
119-123	C_{16A}, C_{16B}, C_{16C}, C_{16D}—20/-40/200/40 μfd., 50/150/-10/150 v. elec. cond.
B-13E-10250	T_1—Loop ant. assembly
A-13E-10239	T_2—Osc. coil
108201	T_3—Input i.f. trans.
108200	T_4—Output i.f. trans.
105127	T_5—Output trans.
125153	S_1—Line-battery sw.

GENERAL ELECTRIC MODELS 110, 111

Part No.	Code and Description
URD-081	R_1—22,000 ohm, ½ w. res.
URD-129	R_2—2.2 megohm, ½ w. res.
RRC-037	R_3, S_1—.5 megohm vol. control & sw.
URD-137	R_4—4.7 megohm, ½ w. res.
URD-109	R_5—330,000 ohm, ½ w. res.
URD-029	R_7—150 ohm, ½ w. res.
URF-053	R_8—1500 ohm, 2 w. res.
URE-007	R_9—18 ohm, 1 w. res.
URD-153	R_{10}—20 megohm, ½ w. res.
UCC-019	C_1, C_{11}—.002 μfd., 400 v. cond.
RCT-017	C_{2A}, C_{2B}—Var. tuning cond.
UCC-028	C_5, C_{15}—.05 μfd., 400 v. cond.
UCU-1040	C_{10}—330 μμfd. mica cond.
UCU-2045	C_{12}—510 μμfd. mica cond.
UCC-025	C_{13}—.01 μfd., 400 v. cond.
UCC-026	C_{14}—.02 μfd., 400 v. cond.
RCE-040	C_{16A}, C_{16B}—40/40 μfd., 150/-150 v. elec. cond.
RAB-043	L_1—"Beam-A-Scope" assembly
RLC-031	L_2—Osc. coil
RTL-035	T_1—First i.f. trans.
RTL-036	T_2—Second i.f. trans.
RTO-023	T_3—Output trans.

RCA MODEL 56X5

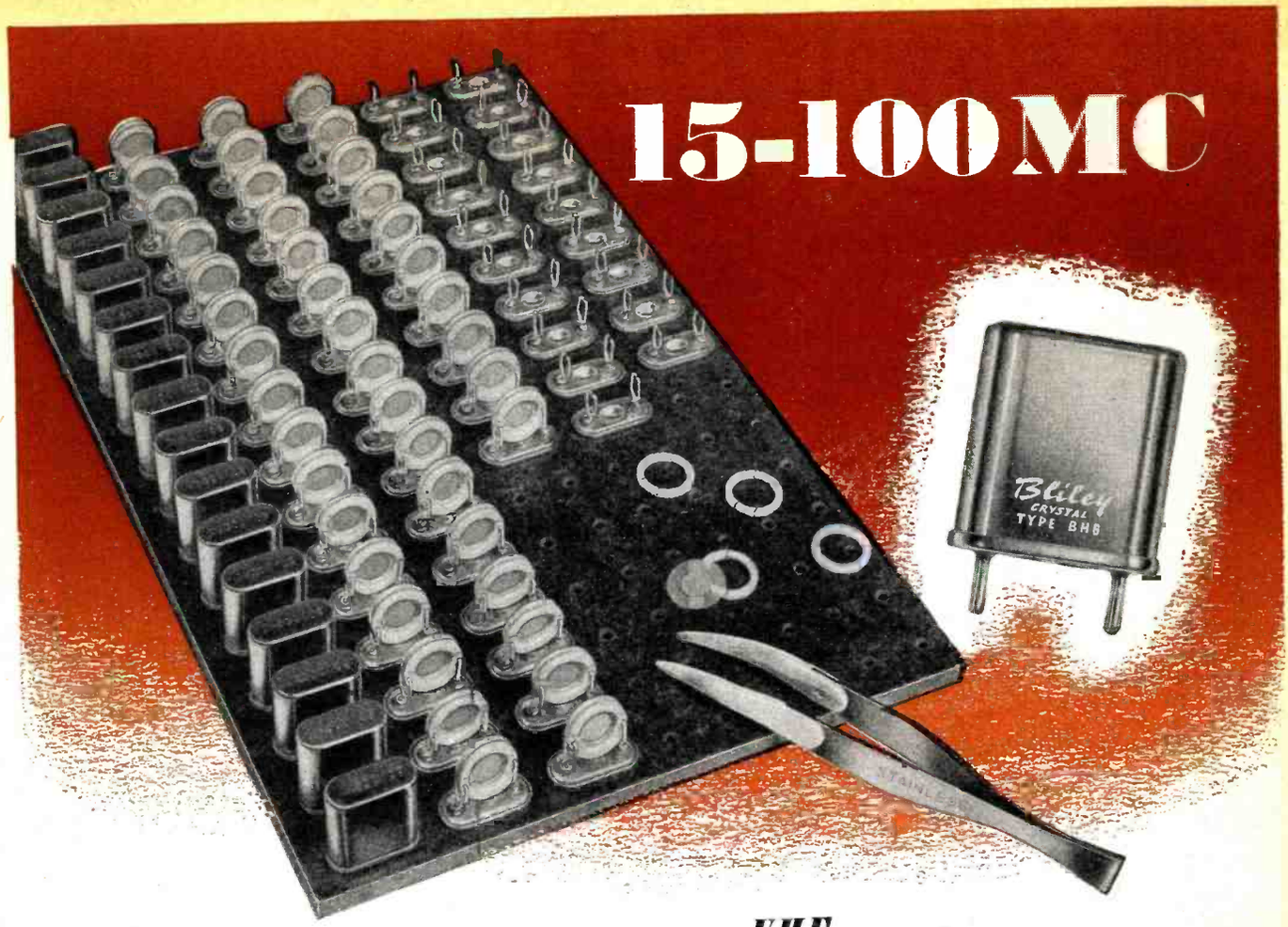
Part No.	Code and Description
30189	R_1, R_{11}—120 ohm, ¼ w. res.
30731	R_2—1200 ohm, ¼ w. res.
14583	R_3, R_9, R_{12}—220,000 ohm, ¼ w. res.
30492	R_4—22,000 ohm, ¼ w. res.
38785	R_5—15 megohm, ¼ w. res.
12928	R_6—3.3 megohm, ¼ w. res.
36242	R_7, S_1—Vol. control & power sw.
30931	R_8—4.7 megohm, ¼ w. res.
30648	R_{10}—470,000 ohm, ¼ w. res.
6134	R_{13}—1200 ohm, 1 w. res.
70652	C_1, C_{18}—.01 μfd. cond.
70617	C_2, C_{19}, C_{31}—.1 μfd. cond.
39632	C_3—150 μμfd. mica cond.
39622	C_4—56 μμfd. mica cond.
70412	C_5, C_8, C_{25}, C_{26}, L_{12}, L_{13}—Second i.f. trans.
70711	C_7, C_{11}—.02 μfd. cond.
70712	C_8,—.0018 μfd. cond.
39640	C_9—330 μμfd. mica cond.
70627	C_{10}, C_{12}—.005 μfd. cond.
70635	C_{14}—.035 μfd. cond.
39606	C_{15}—12 μμfd. mica cond.
70615	C_{16}—.05 μfd. cond.
39152	C_{17}, C_{18}—30/50 μfd., 150/150 v. elec. cond.
39838	C_{20}, C_{21}, C_{27}, C_{28}—Var. tuning cond.
70416	C_{23}, L_3, L_4—Antenna coil
70411	C_{23}, C_{24}, L_{10}, L_{11}—First i.f. trans.
39839	C_{29}, C_{30}—190-260 μμfd./450-600 μμfd. adj. mica cond.
39841	L_1, L_2—Antenna loop
70418	L_5—Peaking coil
39892	L_6, L_7, L_8, L_9—Osc. coil.
36800	T_1—Output trans.
39837	S_2, S_3—Range sw.

MAJESTIC MODELS 5A445, 5A445R

Part No.	Code and Description
9-184	R_1, R_4—22,000 ohm, ¼ w. res.
9-182	R_2—220,000 ohm, ¼ w. res.
9-206	R_3—3.3 megohm, ¼ w. res.
13-28	R_5—.5 megohm vol. control & sw.
9-160	R_6—10 megohm, ¼ w. res.
9-89	R_7—330,000 ohm, ½ w. res.
9-207	R_8—470,000 ohm, ¼ w. res.
9-251	R_9—150 ohm, 1 w. res.
9-216	R_{10}—1200 ohm, 1 w. res.
02-100	R_{11}—2200 ohm, ½ w. res.
9-269	R_{12}—18,000 ohm, ¼ w. res.
5-57	C_1, C_{17}, C_{21}—.01 μfd., 200 v. cond.
7-24	C_2, C_3, C_6—Ganged tuning cond.
19-32	C_4—20 μfd., 150 v. elec. cond.
5-40	C_5, C_7, C_{10}, C_{19}, C_{22}—.05 μfd., 200 v. cond.
	C_8, C_9, C_{12}, C_{13}—Trimmer cond. (Part of gang)
19-24	C_{11}—20/40 μfd., 150 v. elec. cond.
5-52	C_{14}—.002 μfd., 200 v. cond.
6-151	C_{15}, C_{16}, C_{20}—220 μμfd., 500 v. cond.
5-58	C_{18}—.04 μfd., 400 v. cond.
3-116	T_1—First i.f. trans.
3-117	T_2—Second i.f. trans.

TRUETONE MODEL D2630

Part No.	Code and Description
B84393	R_1—39,000 ohm, ½ w. res.
B84472	R_2—4700 ohm, ½ w. res.
B85473	R_3, R_5—47,000 ohm, ½ w. res.
B84332	R_4—3300 ohm, ½ w. res.
B85104	R_6—100,000 ohm, ½ w. res.
B85225	R_7—2.2 megohm, ½ w. res.
B85475	R_8—4.7 megohm, ½ w. res.
36X309	R_9—.5 megohm vol. control & sw.
B84153	R_{10}—15,000 ohm, ½ w. res.
B85474	R_{11}, R_{14}—470,000 ohm, ½ w. res.
B84333	R_{12}—33,000 ohm, ½ w. res.
B84823	R_{13}—82,000 ohm, ½ w. res.



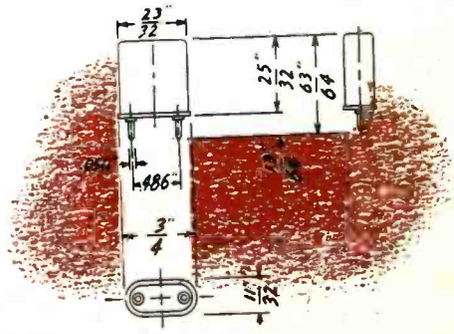
A Significant Advance in VHF Design

with BLILEY BH6 CRYSTAL UNITS

Crystal performance in the range 15-100 mc is an accomplished fact with the new BH6 unit. New processing techniques produce paper thin quartz plates operating on third, fifth, and seventh overtones. Stability, precision, and reliability have all been proven in this outstanding design—another triumph of Bliley engineering and craftsmanship.

Crystal holders look pretty much alike externally but the internal assembly is the vital spot. In the BH6 unit a pair of ceramic rings rigidly clamp the delicate quartz crystal in position. The crystal, lapped as thin as .004", is processed to micro-tolerances and silver plated to insure long term precision. Every step is carefully controlled and inspected before the complete assembly is hermetically sealed in its metal case.

The finished BH6 crystal unit is not a prima donna —it will meet the most rigid service requirements in your VHF equipment. Design engineers are invited to write for recommendations covering oscillator circuits best suited for optimum performance; stating qualifications such as drive requirements to the following stage, frequency tolerance, and temperature range over which tolerance must be maintained.



Bliley CRYSTALS

BLILEY ELECTRIC COMPANY • UNION STATION BUILDING, ERIE, PENNSYLVANIA

Leo's 275 watt XMTR Kit

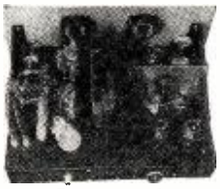
Get on the air with Leo's 275 Watt sensation of the year available on Easy Pay plan. And remember, Leo offers you more for your transmitter or receiver—in many cases it will be enough for the down payment. Complete with all parts, tubes, meters, cabinets, one-set of coils.

KIT FORM $351.45

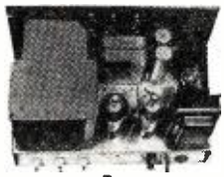
WIRED $376.45 AS LOW AS $70 down

Write for prices of individual sections.

Immediate Delivery



B A



D

C

Compare These Features With Any Kit

A versatile, advanced design transmitter kit that will give you efficient performance on 6, 10, 20, 40, and 80 meter bands on phone & C.W. Available in complete kit form or in individual sections. There's nothing like it on the market for quality, features, and price.

A—RF Exciter Section—Here is one of the most efficient exciter driver units available. Capable of 40 watts input on all bands including 6 meters. 6 meter output from 2E26 tube obtained by using crystal frequencies from 8333 to 9000 KC. 40 meter crystals do a F.B. job for the 10 and 20 meter bands. 7C5 regenerative type crystal oscillator, with provisions for ECO, driving the new 2E26, giving high efficiency on all bands. Voltage regulation is provided for oscillator tubes and screen of 2E26 offering high stability to both stages. Tube line-up: 7C5 oscillator; 2E26 buffer doubler; and two VR150 voltage regulators. Chassis size 7"x12"x3". Uses 8¾"x19" relay rack panel when used with Final RF section. Weight 10 lbs.

B—Final RF Section—Another brand new feature never before used in transmitters is a front panel Coupl-Trol that controls the amount of coupling of the antenna to the final amplifier. The latest in easy to drive triodes, the V70D's are used in the final amplifier. Designed for the shortest RF leads and parts, and placed to eliminate the presence of parasitics and self-oscillation. Tube line-up: two V70D's. Chassis size: 10"x12"x3". Utilizes 8¾x19" relay rack panel when used with exciter section. Weight 16 lbs.

C—Speech Amplifier and Modulator Section—The latest in circuit design and the use of zero bias on the four 6L6's gives more power than ever before with very low static plate current. The use of resistance coupling up to 6F6 driver gives excellent reproduction of audio frequencies, and. incorporation of a high quality audio transformer from the 6F6 to the 6L6's gives more efficiency and better matching between stages. Power consumption is cut down and heat dissipation is held to a minimum by this improved circuit design. Plate voltages are relay controlled for ease of operation. This new speech amplifier and modulator is capable of modulating inputs from 300 to 350 watts. Tube line-up: 6SJ7; 6C5; 6F6; four 6L6's and 83 rectifiers. Load: 450 volts at 250 amps. Chassis size: 12"x17"x3". Utilizes 8¾"x19" relay rack panel. Net weight 48½ lbs.

D—Dual Power Supply Section—Tube line-up: 5Z3; two 866A's. Load: 600 volts at 200 amps, and 1150 volts at 300 amps. Chassis size: 12"x17"x3". Utilizes 8¾"x19" relay rack panel. Net weight 58 lbs.

W.R.L. Globe Trotter XMTR Kits

Amateurs the nation over are praising the performance of this high quality low cost rig. It's a 40 watt input kit including all parts, chassis, panel and streamlined cabinet. Write for export prices. **$69.95**

Cat. No. 70-300 Less tubes....
Cat. No. 70-312 Same as above wired $79.50
1 set coils, meters, tubes, extra... 17.15

FOR ANYTHING IN RADIO— YOU'LL GET THE BEST DEAL FROM LEO, WOGFQ

World Radio Laboratories INCORPORATED

FREE

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Department R-10
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- ☐ Send latest Free Flyer
- ☐ Send more data on 275 Watt XMTR
- ☐ Send data on the Globe Trotter XMTR
- ☐ Send data on your Good Surplus

Send more data on.....

Name..... Call letters.....

Address.....

City..... Zone.... State.....

Part No.	Code and Description
B84181	R_{15}—180 ohm, ½ w. res.
B85224	R_{16}—220,000 ohm, ½ w. res.
B84270	R_{17}—775 ohm, 28 w. wire-wound res.
43X214	R_{18}—27 ohm, ½ w. res.
C85152	R_{19}—1500 ohm, 1 w res.
B66102	C_1—.001 µfd., 200 v. cond.
17A152	C_2, C_9—2-25 µµfd. ant. & osc. trimmer
14A148	C_{3A}, C_{3B}—Gang cond.
46X289	C_4—.00475 µfd., 180 v. cond.
17A174	C_5—2-25 µµfd. osc. trimmer
	C_6—Part of C_3
47X463	C_7—47 µµfd. mica cond.
47X466	C_8—68 µµfd. mica cond.
17A234	C_{10}—250-525 µµfd., 600 kc. padder
B66104	C_{11}, C_{23}—.1 µfd., 200 v. cond.
B66403	C_{12}, C_{15}, C_{22}—.04 µfd., 200
	C_{13}, C_{14}—Part of T_5
47X446	C_{16}, C_{21}—47 µµfd. mica cond.
47X476	C_{17}, C_{18}—Part of T_6
B66502	C_{19}—100 µµfd. mica cond.
	C_{20}—.005 µfd., 200 v. cond.
47X467	C_{24}—470 µµfd. mica cond.
B66103	C_{25}, C_{26}—.01 µfd., 200 v. cond.
B64253	C_{30}—.035 µfd., 200 v. cond.
45X342	C_{27A}, C_{27B}, C_{27C}—50/50/20 µfd., 150/150/25 v. elec. cond.
D66204	C_{29}—.2 µfd., 400 v. cond.
D66104	C_{30}—.1 µfd., 400 v. cond.
9A1443	T_1—"D" range ant. coil assembly
9A1818 or 9A1792	T_2—"B" band loop ant.
9A1444	T_3—"D" range osc. coil assembly
9A1442	T_4—"B" band osc. coil assembly
9A1793	T_5—First i.f. trans.
9A1894	T_6—Second i.f. trans.
51X118	T_7—Output trans.

-30-

LONG DROP

WORD has recently been received by the engineers of General Electric Company's Tube Division that an electronic tube that fell 10,000 feet from a Flying Fortress survived to power a radio transmitter.

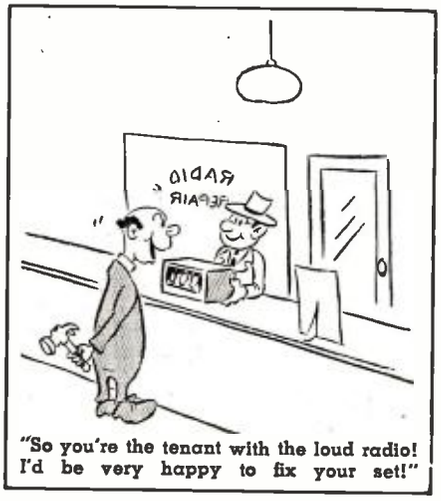
The electronic tube's descent, following an attack by the Luftwaffe on a formation of Flying Fortresses in 1943, was described in a letter received by the company from A. A. Bliek, Enschede, Netherlands who reported that the tube is still functioning.

During the battle several airplanes exploded and shortly thereafter a package fell to the earth. Upon examination, it was discovered that the package contained a GL-211, a standard transmitting tube, and that no damage had been done to the filament or other elements. The tube is now in operation in V.E.R.O.N.'s (a Netherlands radio amateur group) transmitter.

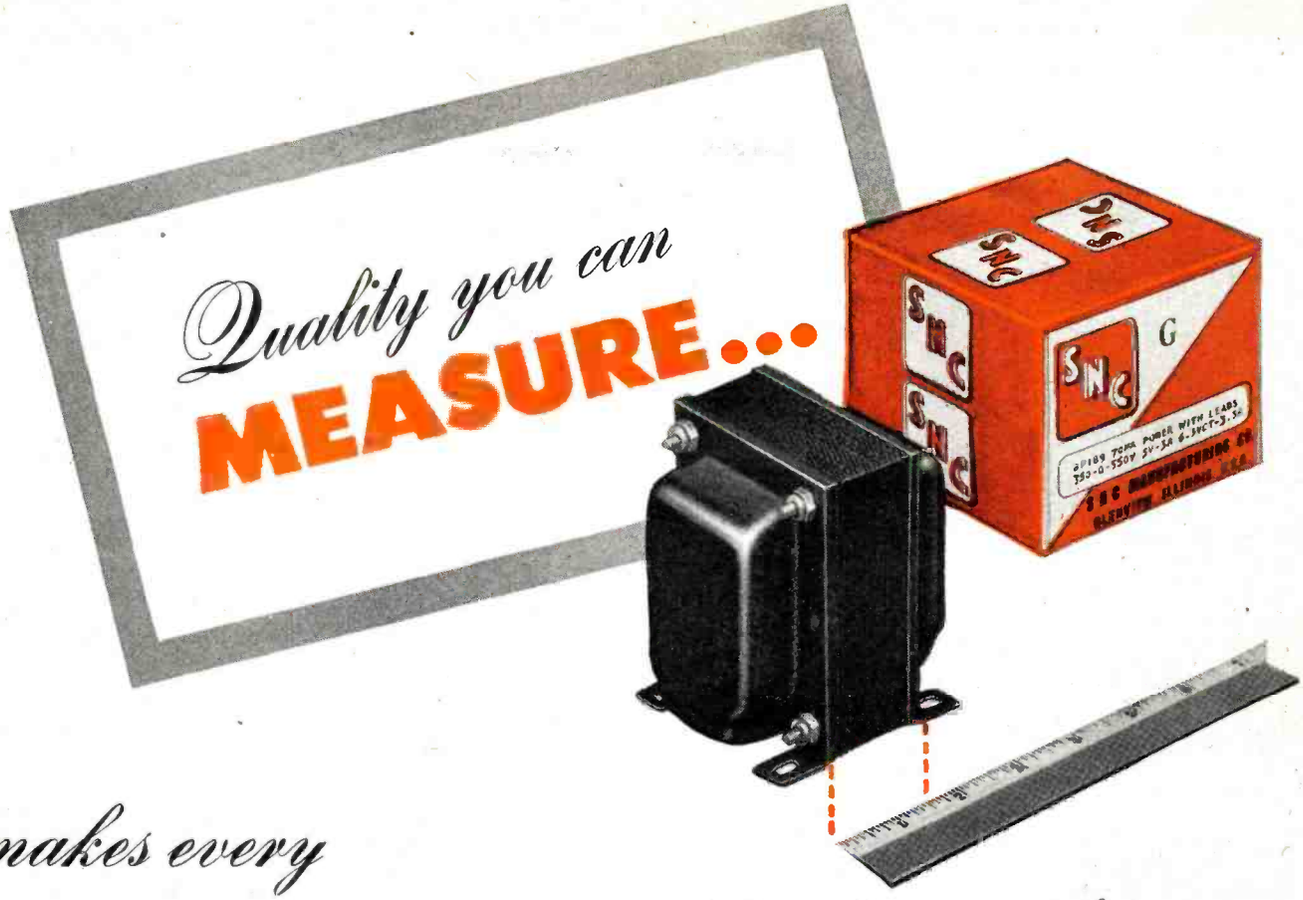
According to the company engineers, the fall is remarkable in view of the fact that the filament of the tube is made of thoriated-tungsten, an extremely brittle substance, and its envelope is glass.

-30-

"SEE PAGE 10"



"So you're the tenant with the loud radio! I'd be very happy to fix your set!"



makes every

SNC TRANSFORMER *give outstanding performance*

Join the increasingly large number of manufacturers, retailers, hams and other component part buyers who rely on SNC for quality, trouble-free equipment. Write for catalog today.

Place a rule against the stack of an SNC No. 8P189 transformer and the *extra* width clearly indicates the added quality built into every item in the complete SNC line.

Skillful engineering, latest production techniques and highest quality materials . . . backed by careful workmanship, exacting step-by-step inspection and rigorous final testing . . . are just a few of the reasons why SNC transformers keep rejects at a minimum and give outstanding performance.

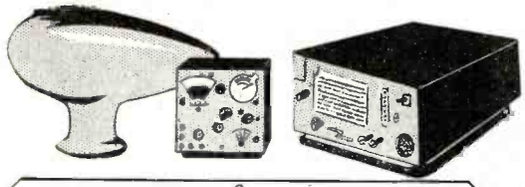
Remember! SNC gives MORE applications with SMALLER inventories for GREATER profits!

SNC MANUFACTURING CO., INC.

Quality Transformers

WEST LAKE AVE. NEAR LEHIGH • GLENVIEW, ILLINOIS

HERSHEL offers extra discount in celebration



Brand New Automatic Direction Finder

RADIO COMPASS

SCR-269 F COMPLETE WITH COMPONENT PARTS **$75.00** NO. OT-100

The radio compass SCR-269-F was designed to be the primary radio navigation compass for the United States Army and Navy Air Forces. Constant reception is possible day or night so that fixes can always be made to establish the plane's or ship's location.

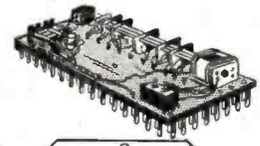
Plotting fixes is accomplished by selecting two or more stations and plotting these on the navigation map. The point of intersection of these lines indicates the location of the craft.

This equipment comes complete with 17 tubes superheterodyne receiver which is tunable from 200-1750 KC in three bands. A complete instruction book for operation and maintenance accompanies this equipment.

NEW BC-223AX TRANSMITTER

$14.95 NO. OT-109

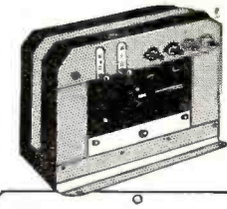
Complete with tubes and tuning unit covering 80 meter Ham band, including frequencies charts, less Xtals.



BK22K Relay

$2.95 NO. OT-110

Used in conjunction with SCR269F, changeover contains 29V, step relay, 5 deck, 6 position switch. 12V D.P.S.T.



1KW MODULATION TRANSFORMER

$14.95 NO. OT-111

RCA Mod. Trans. conservatively rated at 550 Watt audio to modulate that new KW rig. Audio Watts—550 Sec. #1—450 Mils Sec. #2—80 Mils Turns Ratio—Pri: Sec. #1-1:1 Pri: Sec. #2 Top—25:1. Impedance Ratio—Pri: #1-1:1 Sec. Pri: Sec. #2-25:1 Pri: Sec. #2 Top—625:1. DC Resistance—Pri: 135 ohms Sec: #1, 112 ohms; Sec. #2, 99 ohms. Transformer insulation tested: Pri. 8000 V.; Sec. #1-11,000V; Sec. #2-2000V. to the rest of the coils and core. Primary center-tapped for Class "B" modulators. Secondary #2 will carry 80 Mill to modulate screens of beam power or screen grid tubes. Primary will match any Class "B" tubes up to 10,000 ohms plate to plate, such as 810's, 751's, 800S's, ZB 120's, 203's, HY51Z's, 813's, 828's, 805's, 203Z's. Size 9½" wide, 7½" deep, 7¼" high. Heavy channel iron mounting brackets. Weight approx. 40 lbs.

EXTRA SPECIAL!

R.L.T. Tube Tester

$39.95 NO. OT-108

Tests all tubes up to 117 V

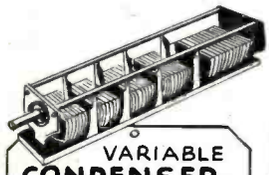
Tests shorts and leakages

Tests individual sections

Works on 90-125 V 60 cycle AC

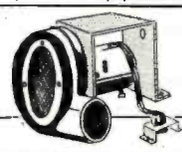
Comes in portable cabinet complete with all operating instructions.

BUY FROM HERSHEL & SAVE!



VARIABLE CONDENSER

6 Gang silver plated, Sec. 1: 350 M.M.F.D., Sec. 2: 3, 4, 5, 60 M.M.F.D., Sec. 6: 80 M.M.F.D. **89¢** NO. OT-101

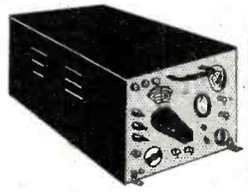


SQUIRRELCAGE BLOWER

2" outlet, 110AC, 60cy Silent Ball Bearing Motor, with mounting bracket **$7.95** NO. OT-164

CORONA BALLS

Grid and plate connections for VT 127-250 TH etc. Round Ball type heat dissipating silver plated. **10¢** OT-116 **1.00 Doz.**

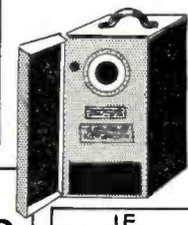


ARR7 Air Borne

VERSION OF HALLICRAFTER SX28A

129.00 NO. OT-112

With 3 RF stages (one re-radiation suppressor r-f), 12 tubes. Motor and manual tuning. S-meter. F-selectivity control, crystal filter. AVC, phasing control, ANL, etc. Also furnishes video output for scope, and panoramic output for scanning. Complete with tubes and Xtl, but without power supply. Power requirements: 270v. at 135 ma. Now; in sealed cases.

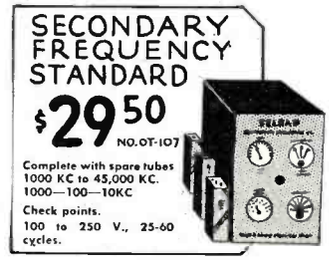


FILAMENT TRANSFORMERS

110-V, 60 cy. Pri. sec.—5V—3A. Shelled Case..... **$1.49** NO. OT-163

110-V, 60 cy. Sec.: 2.5V at 5.25 amps. Shelled Case.... **$2.45** NO. OT-162

110-V, 60 cy.; Sec.: 1, 5V at 10 amps.; Sec. 2, 5V at 10 amps.; Connected in series will give 10V at 10 amps. Shelled Case..... **$3.95** NO. OT-106

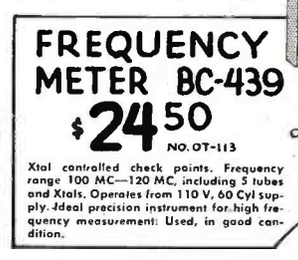


SECONDARY FREQUENCY STANDARD

$29.50 NO. OT-107

Complete with spare tubes 1000 KC to 45,000 KC. 1000—100—10KC

Check points. 100 to 250 V., 25-60 cycles.



FREQUENCY METER BC-439

$24.50 NO. OT-113

Xtal controlled check points. Frequency range 100 MC—120 MC, including 5 tubes and Xtals. Operates from 110 V, 60 Cyl supply. Ideal precision instrument for high frequency measurement. Used, in good condition.

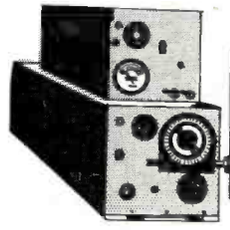
IF TRANSFORMER

mounted in aluminum shield can, 1500 KC, with air trimmer, impedance coupled type. **95¢** NO. OT-115

BN IFF TRANSMITTER & RECEIVER

$9.95 NO. OT-102

Widely used on 144MC and now also successfully used as a television receiver, this being made possible by the wide band 30 MC I.F. channel and video amplifier: being sold at this exceptionally low price for the encouragement of television. Original diagram furnished. Less tubes and power transformer, wt. 100 lbs.



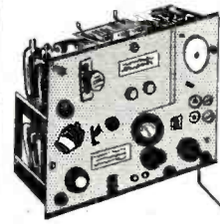
BC-AR230 Transmitter

Including 4 tubes and RF Amps. meter.

BC-AL229 Receiver

Including 6 tubes. Used in aircraft.

BOTH UNITS FOR ONLY **$9.95** NO. OT-105



BC-654-A PORTABLE RECEIVER-TRANSMITTER

$12.50 NO. OT-114

The frequency range of both transmitter and receiver is continuous from 3700 to 5800 kilocycles; all stages gang tuned by anti-back lash worm gear dial mechanisms.

The BC-654-A is 18" wide, 14" high, and 9½" deep. Weight 44¾ pounds. Power required for Receiver—1.5, 45, and 90 volts D.C. Power required for Transmitter—1½, 6, 51, 84 volts D.C. and 500 volts D.C. at 160 Ma. Operates from Dynamotor PE-103-A. Complete with carrying case.

CERAMIC INSULATORS

$1.00 DOZ. NO. OT-103 HIGH VOLTAGE FEED THRU

Scope Transformer

$3.95 NO. OT-104

110V Pri: 60 cy, Sec: 4000 V at 10MA. Size 6 x 4 x 3½

Shalcross AKRA-OHM WIRE WOUND

±1% 1 MEG **89¢** NO. OT-165

SOCKETS FOR ACORN TUBES..	NO. OT-117....	$ .19
POWDERED IRON 3/8 SLUG.....	NO. OT-118.....	.10
JACKS-PL55, PL68.....	NO. OT-119.....	.15
ASS'T. MICA CONDENSER. per 100..	NO. OT-120.....	1.95
3 LBS. ASST. HARDWARE.....	NO. OT-121.....	1.00
PIN STRAIGHTENER for min. tubes.	NO. OT-122.....	.49
VARIAC 1AMP.....	NO. OT-123.....	3.95
EAR PHONES, 2000 OHMS, used.	NO. OT-124.....	.95
JOHNSON SOCKETS #210-25W...	NO. OT-125.....	.39
5V FILAMENT TRANS. 60AMP....	NO. OT-126.....	5.95
SCR 625 MINE DETECTOR.....	NO. OT-127....	49.50

HERSHEL RADIO CO.

5249 GRAND RIVER AVE. DETROIT 8, MICH.

All Orders F.O.B. Detroit—Minimum order $2.00—Mich. Customers add 3% tax.

Successful Retail Operation Features Personalized Service

"PEOPLE are music-hungry. I believe the retailing of radios, phonograph combinations, records, and appliances will be a bigger business than we ever thought possible."

The speaker is Helen Gunnis, owner of one of Milwaukee's most successful music specialty shops. The influence of twenty-five years in the radio and appliance field is evident in the casual, intimate atmosphere of her shop at 765 North Broadway.

Pale green walls, deeper green record cases and counters, six soundproof blonde wood record booths, with built-in red leather seats, and informally placed chairs and tables make up the furnishings of the first floor. On the mezzanine, there are four soundproof display parlors, for the sale of radios and radio-phonograph combinations. Fluorescent lighting is used throughout.

Special merchandising campaigns and a new window display every week stimulate interest with both the old and new customers.

"We try to keep the atmosphere informal at all times. Our customers are never urged to make a purchase. And a clerk never approaches a buyer until he indicates that he would like some help. People are free to come and go, and to examine any of the instruments or record albums we have on display.

"I think it is well for every music dealer to specialize in some phase of the radio accessory field, as well as merely selling the instruments. For example, our shop is known as the best source of classical record albums in Milwaukee. Thus our customers depend upon us not only when they buy their instruments, but afterward, when they want new records."

Three salespeople, besides Miss Gunnis, and her sister and business manager, Miss Estelle Gunnis, make up the sales staff of the shop. All have some musical education and a thorough working knowledge of radios and phonographs. "We believe you cannot sell people music, unless you know music."

The first dealer in the country to use the "self-service" system in selling phonograph records, Miss Gunnis still believes that method is the most successful. "We let the buyer browse, make his selections and try them at his leisure. Of course, here we do not have the one great problem that department stores or very large shops have. Our records are never stolen. The personal contact we have with our customers eliminates this possibility."

Among the services that the shop offers its customers is that of making up libraries of records. "Trying to give them well-balanced selections of the better music is not a simple job. It involves much paper work before I can even decide what to choose. Take this job I just completed recently. A man from upstate sent me a letter saying that he wished to increase his music library by buying $300 worth of classical albums. He enclosed a list of those he already had, and wanted me to select the rest. That meant making out a large chart so that he got a proportioned, well-balanced selection of the best in the classical field available today. I enjoy this sort of work however, and find that it always brings other customers in for advice, not only in selecting their library albums, but often in buying their instruments as well."

Gunnis Music Shop advertisements appear in the local daily newspapers and other periodicals. However, the greater part of the shop's advertising appears in concert and theatrical programs. "After all, we try to serve a certain group in the buying public, and it is only logical to advertise where they will read. We find our program insertions are always quite successful. But then, that is only advertising. It is being able to serve our customers satisfactorily that is our main concern." —30—

A restful, unhurried atmosphere makes this record store a pleasant place to shop.

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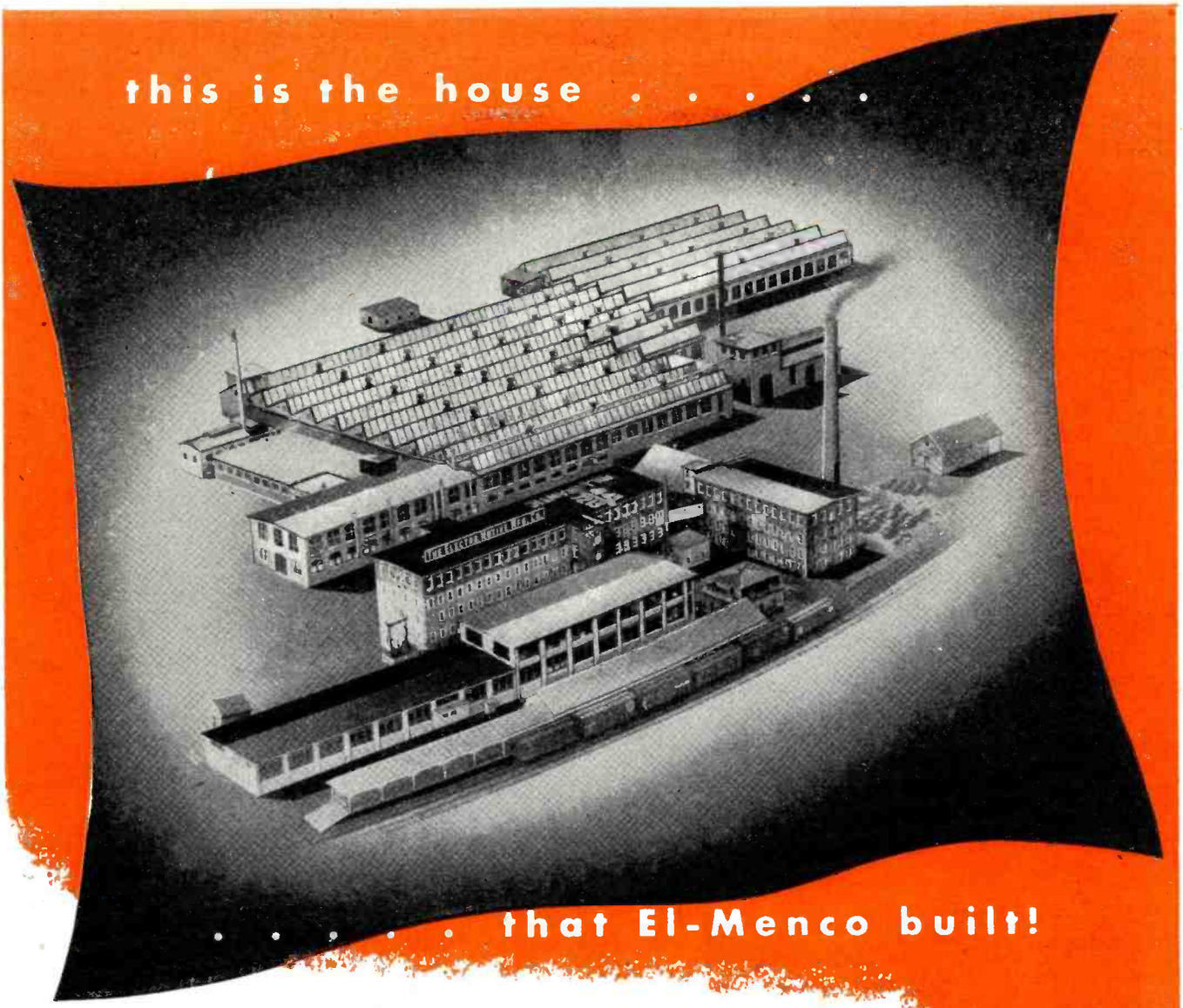

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Size is not necessarily a sign of greatness. But when size is the result of consistently steady growth, based on an ever-widening demand for a product, then it is truly indicative of outstanding quality.

Year after year, in more and more instances, El-Menco Capacitors become first choice with manufacturers who are proud of their products.

Send for samples and complete specifications.

Foreign Radio and Electronic Manufacturers communicate direct with our Export Department at Willimantic, Conn., for information.

THE ELECTRO MOTIVE MFG. CO., Inc., Willimantic, Conn.

Write on firm letterhead for samples and catalog.

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RADIOMEN'S HEADQUARTERS ✱✱ WORLD WIDE MAIL ORDER SERVICE!!!

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For 5-6 tube sets—650V, 45MA, 5V & 2.5 or 6.3V..... 1.75
For 6-7 tube sets—675V, 50MA, 5V & 2.5 or 6.3V..... 1.90
For 7-8 tube sets—700V, 70MA, 5V & 6.3 or two 2.5... 2.35
For 8-9 tube sets—700V-90MA; 5V-3A; 2.5V-3.5A; 2.5-10.5A 2.85
For 9-11 tube sets—700V, 100MA, 5V & 6.3 or 6.3V-4A.. 2.85
For 9-15 tube sets: 600V, 150MA; 5V & 6.3V..... 2.95

TRANSFORMERS — All types in stock. **AUTO-TRANSFORMERS**; Steps up 110v to 220v, or steps down 220v to 110v—$1.95. **FIL. TRANS.**: 6.3v, 8 Amps.—$1.98; 5v, 10 Amps.—$1.98; **Universal Output Trans.** 8 Watt—89c; 18 Watt—$1.29; 30 Watt—$1.69. **AUDIO TRANSFORMERS**: S. Plate to S. Grid 3:1—79c; S. Plate to P.P. Grids—79c; Heavy Duty Class AB or B, P.P. inputs—$1.49; Midget Output for AC-DC sets—69c; **MIKE TRANSFORMER** for T-17 Shure microphone, similar to UTC ouncer type—$2.00. Stancor **S8** or **D8** mike to line or grid—$1.95.

CONDENSERS—PAPER TUBULAR 600 WV—.001; .002; .005—8c; .01; .05—9c; .1—10c; .25—23c; .5—36c; **ELECTROLYTICS**: 8mfd 200v—20c; 10mfd 35v—20c; 30mfd 150v—23c; 20/20mfd 150—35c; 30/20 150v—46c; 50mfd 150v—43c; 8mfd 475v—34c; 16mfd 350v—65c; **OIL CONDENSERS**: 4mfd 600v—49c; **BATH TUB TYPE CONDENSERS**: 3X.1mfd—20c. **RESISTORS**: All types in stock at the lowest prices: Resistor Kits—100 2 watt resistors—$1.95.

FILTER CHOKES: 200, 300, 400, 500 ohm light duty—59c; 200 or 300 ohm heavy duty—99c; 250 ma 35 ohm, made for U.S. Navy, fully shielded—$1.95; 75 ohm 125 ma—25c or 25 for $4.25; "Meissner type" tapped filter chokes—25c; 8 amp. iron core A filter—25c; Choke-condenser combination, ideal to replace any size speaker field when installing PM speakers—79c.

110 V. CIRCUIT BREAKERS of Magnetic type: Following Current Ratings in Stock: 1.25, 3, 4, 8 Amps. Please Specify. $1.95 each.

Seven Assorted I.F. Transformers—$1.98; Five Asstd. Oscillator Coils—69c.

SPEAKERS-PM dynamic type-4"—$1.55; 5"—$1.55; 6"—$1.95; 8"—$3.95; 10"—$5.95; 12"—$7.50.

HEADPHONES—Highest quality Signal Corps headsets with 12" cord and plug $1.25. 5' rubber covered patchcords with phone plug & socket—45c.

SELENIUM RECTIFIERS—Dry disc type 1½" by 1". 1.2 Amp. maximum, suitable for converting DC relays to AC, for supplying filament source in portable radios, converting DC meters to AC applications, and also may be used in low current chargers—90c.

METER RECTIFIERS—Full wave, may be used for replacement, or in construction of all types of test equipment—$1.25 Half Wave—90c.

LINE FILTERS—each unit contains two 2 mfd. oil filled condensers and a 15 amp. iron core choke. This filter has innumerable uses such as oil burner line filter, etc. A ten dollar value for 98c.

WILLARD rechargeable 2v storage batteries for portable radios or any other purpose—$2.95.

PUBLIC ADDRESS AMPLIFIERS—25 watts peak output. This unit has separate input circuits for microphone and phono. The gain of the microphone circuit is 122 db. The phono circuit has a gain of 82 db. The frequency response is flat from 50 to 12000 cycles. A $65 value for only $32.

Miniature pliers set contains one of each of the following: Needle nose, flat nose, parrot nose, standard nose. All contained in a leatherette case. Your cost—$1.98.

FLUORESCENT LIGHT BALLASTS—Single 30 or 40 watt—$1.68; Dual 40 watt—$3.50.

ATR battery eliminator. Handy for servicing car radios or any other purpose requiring 6 or 12v at 14 amps. Net price—$36.00.

SOCKET WRENCH SET consisting of 5 sockets ranging in size from 5/16 to ½" and a handle—79c.

AUTOMATIC WIRE STRIPPERS will strip up to 1000 wires per hour, a handy tool for any service job—$3.52.

Six Foot Asbestos Insulated Flat Iron Cords, one end has a male plug, the other end has a standard flat iron socket. Your price—70c each or 10 for $5.

FREE!!!! THIS MONTH ONLY.
A HIGH GRADE CRYSTAL PICK-UP WITH THE PURCHASE OF EACH PHONO MOTOR AT $4.95.

MICROPHONES — All nationally known brands. Bullet crystal—$5.45; Bullet Dynamic—$7.45; Mike Jr.—60c; Handy Mike—90c; Lapel Mike—93c; **SHURE T-17 MIKES**, with push to talk switch—99c.

20 ASST'D COIL FORMS, including 11 ceramic, 3 polystyrene, and 6 fiber, all useful sizes—50c.

VARIABLE CONDENSERS: 350 MMFD, 5 gang—$1.95; 4 gang—$1.49; 3 gang—83c; 2 gang—79c; 7.5 to 20 MMFD, 1750v spacing, extra long shaft Hammarlund—69c; miniature variables—25 MMFD—39c; 50 MMFD—49c; 75 MMFD—59c; 100 MMFD—69c; 140 MMFD—79c.

TRANSMITTING RF CHOKES, 4 PIE, 350 Ma.—25c or 5 for $1.00.

INTERRUPTION FREQUENCY COILS for super-regenerative receivers or the tremendously popular FM adapters for standard broadcast sets. Iron core with a resonant frequency of 50 KC—39c; Air Core, 100 KC—29c.

30 MC IF TRANSFORMERS, double slug tuned—25c.

VIDEO AMPLIFIER PLATE COILS—Slug Tuned—25c.

REMOTE CONTROL UNIT: Aluminum case 4x3x2" containing 2 potentiometers, triple pole switch, 4 knobs, geo mechanism, counter and phone jacks—59c.

MODULATION TRANSFORMERS: 30 watt, open type—$1.95; 40 watt, cast aluminum case—$2.95; Class "B" input transformers, cast aluminum case—$1.95; Transceiver audio transformers—65c; Transceiver modulation transformers—65c.

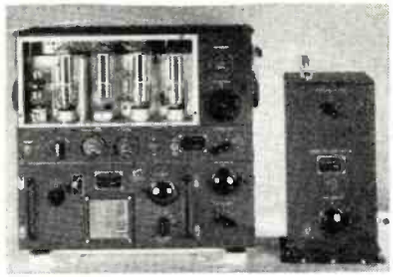
GENERAL ELECTRIC RT-1248 15-TUBE TRANSMITTER-RECEIVER

TERRIFIC POWER—(20 watts) on any two instantly selected, easily pre-adjusted frequencies from 435 to 500 Mc. Transmitter uses 5 tubes including a Western Electric 316 A as final. Receiver uses 10 tubes including 955's, as first detector and oscillator, and 3 7H7's as IF's, with 4 slug-tuned 40 Mc. IF transformers, plus a 7H7, 7E6's and 7F7's. In addition unit contains 8 relays designed to operate any sort of external equipment when actuated by a received signal from a similar set elsewhere. Originally designed for 12 volt operation, power supply is not included, as it is a cinch for any amateur to connect this unit for 110V AC, using any supply capable of 400V DC at 135 MA. The ideal unit for use in mobile or stationary service in the Citizen's Radio Telephone Band where no license is necessary. Instructions and diagrams supplied for running the RT-1248 transmitter on either code or voice, in AM or FM transmission or reception, for use as a mobile public address system, as an 80 to 110 Mc. FM broadcast receiver, as a Facsimile transmitter or receiver, as an amateur television transmitter or receiver, for remote control relay hook-ups, for Geiger-Mueller counter applications. It sells for only $29.95 or two for $53.90. If desired for marine or mobile use, the dynamotor which will work on either 12 or 24V DC and supply all power for the set, is only $15.00 additional.

RT1463 7 tube amplifiers containing 3-7F7, 1-7Y4, 3-7N7, 4 potentiometers, numerous resistors, filter and bypass condensers, filter chokes, power and audio transformers, and six sensitive plate circuit relays. A military development that provided amazing stepless control proportional to correction required, for ailerons, rudder and elevator, in the original application. A control amplifier of the ordinary type would deflect the rudder by some arbitrary amount when the ship was blown off the course to port or starboard. The result would either be that the correction was insufficient and the plane continued off course, or the correction would be too great, starting a series of tackings that would greatly increase fuel consumption and elapsed time in reaching the objective. This phenomenal unit, with its 3 amplifiers and six 5000 ohm relays in bridge circuits, will accurately control any 3 operations, related or unrelated, in minutely adjustable uniquely quantitative variations in either forward or reverse directions. 9"x7"x8" black crackle aluminum case. Brand new in original carton $12.95, or used $9.95.

BRAND NEW BC 348 COMMUNICATIONS RECEIVER

Featuring coverage from 200 to 500 Kc. and 1500 to 18000 Kc. on a direct reading dial with the finest vernier drive to be found on any radio at any price—high sensitivity with a high degree of stability—crystal filter—BFO with pitch control—standard 6 volt tubes. Contains a plate supply dynamotor in a compartment within the black crackle finished cabinet, the removal of the dynamotor leaves plenty of room for the installation of a 110V, 25 or 60 cycle power supply. These receivers, which make any civilian communications receiver priced under $200.00 look cheap and shabby by comparison, are only $69.95 brand new. Power supply kit for conversion to 110V 25 or 60 cycles is only $8.50 additional.



GENERAL ELECTRIC 150-WATT TRANSMITTER

Cost the Government $1800.00 Cost to you $44.50!!!

This is the famous transmitter used in U. S Army bombers and ground stations, during the war. Its design and construction have been proved in service, under all kinds of conditions, all over the world. The entire frequency range is covered by means of plug-in tuning units which are included. Each tuning unit has its own oscillator and power amplifier coils and condensers, and antenna tuning circuits—all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle, and the milliameter, voltmeter, and RF ammeter are mounted on the front panel. Here are the specifications: FREQUENCY RANGE: 200 to 500 KC and 1500 to 12,500 KC. (Will operate on 10 and 20 meter band with slight modification.) OSCILLATOR: Self-excited, thermo compensated, and hand calibrated. POWER AMPLIFIER: Neutralized class "C" stage, using 211 tube, and equipped with antenna coupling circuit which matches practically any length antenna. MODULATOR: Class "B"—uses two 211 tubes. POWER SUPPLY: Supplied complete with dynamotor which furnishes 1000V at 350 MA. Complete instructions are furnished to operate se from 110V AC. SIZE: 21½ x 23 x 9¼ inches. Total shipping weight 200 lbs., complete with all tubes, dynamotor power supply, five tuning units, antenna tuning unit and the essential plugs. These units have been removed from unused aircraft and are guaranteed to be in perfect condition.

BC-947A ONE KILOWATT HIGH FREQUENCY TRANSMITTER

This relay-controlled transmitter includes a 115V, 60 cycle power supply, protected by 3 magnetic circuit breakers, that alone is worth more than the price we are asking for the whole rig, even on today's surplus market. On the front panel are six 3½" GE or Weston meters, including 250 MA, 50 MA, 1000 MA, 150V AC, and 1500V DC at 1000 ohms per volt for screens and plate. The rack-type 21"x15"x36" unit contains six amplifier and rectifier tubes aggregrating over $60.00 at WAA current wholesale prices. Western Electric's price to the government was $1500.00. Shipping weight 500 lbs. Your cost, as is, only $69.95.

ARMY BC 312 COMMUNICATIONS RECEIVER

This receiver covers the frequency range of 1.5 MC to 18 MC in six direct reading bands. The dial, that is driven with split gears to prevent backlash, has 4500 logging divisions per band with approximately 600 divisions on the 20 and 40 meter ham bands and 1000 divisions on 80 meters. Two stages of RF before the converter in this set give it a very high signal to noise ratio and maximum sensitivity. Outstanding features of this receiver are: BFO with pitch control, send-receiver relay, jacks on the front panel for headphones and speaker output and mike and key input, all tubes are standard 6 volt types. This receiver was designed to withstand rough usage in the field and for operation from vehicles while in motion, so it is ruggedly constructed and contains a dynamotor power supply.—Your cost $49.95. Conversion kit to 110 VAC is available for $6.50.

BC-654 TRANSMITTER-RECEIVER—This medium power transmitter and the very sensitive receiver is a natural for 80 meter operation (phone or cw). These units are brand new and come complete with 17 tubes, key, microphone and 200 KC calibrating crystal—$39.95.

Minimum order $3.00—All prices subject to change.—25% deposit with C.O.D. orders

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CABLE ADDRESS BUFRAD

LOW RANGE OHMMETER

By
S. C. GAINEY

This accurate service tool provides 1 and 10 ohm midscale readings.

HERE is an instrument which is very useful to the serviceman and experimenter, i.e., an ohmmeter with a backup scale and two low ranges (0-50-500) and having 1 ohm and 10 ohms at midscale.

A voltage regulator tube is used to stabilize the power supply so that full scale adjustment can be maintained. The high voltage is used to give the unit extreme accuracy as far as the power supply is concerned. The maximum errors the power supply introduces are .35 of 1% on the 500 ohm range and .035 of 1% on the 50 ohm range. These figures are in contrast to errors of 8% and .8% which would have occurred if a 4.5 volt battery had been used.

The meter used in this unit was an old iron cased 2" d.c. ammeter with the shunt removed. The fundamental range of the movement was 15 ma. A resistance scale was obtained from a 3" meter and was then photographed and enlarged to match the meter used.

In the construction of this unit R_1 and R_2 should be about 5000 ohms at the beginning and then their resistance may be reduced as needed. In building this ohmmeter make sure that the power supply leads are connected directly to the binding posts *H* and *C*; that resistor R_4 is connected between posts *H* and *L* and that the meter leads, between posts *L* and *C*, are heavy and as short as conveniently possible.

Two precision resistors are needed for calibrating this instrument. These resistors should be equal to the value at midscale (or some point near midscale) of each range. A 1 ohm and a 10 ohm resistor were used to calibrate the original model. The resistance measured at *L* and *C*, with the power supply disconnected, must be equal to the value at midscale on the low range. The resistance measured at *H* and *C* must be equal to the value at midscale on the highest range.

When the construction of the unit has progressed sufficiently to get a full-scale reading on the meter, R_2 and R_5 can be calibrated. At this point in the construction R_4 can be of any low value. To calibrate the low range, R_2, R_3 and

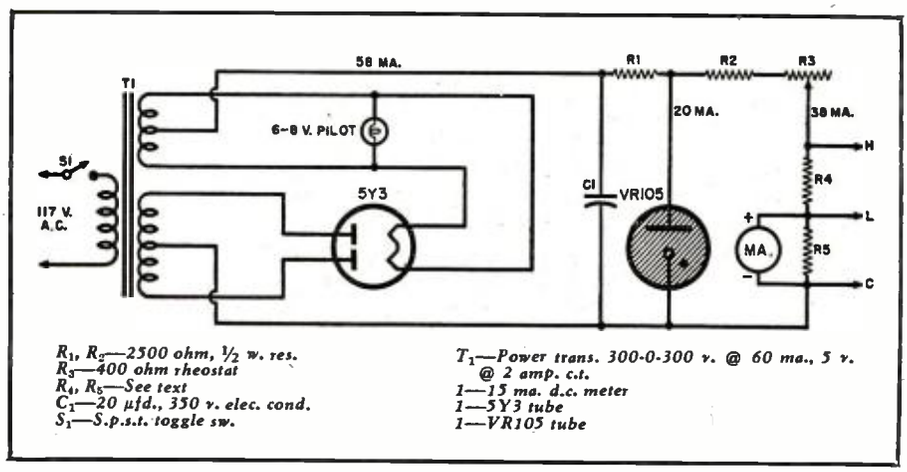
Front panel view of ohmmeter. An inexpensive 15 ma. d.c. meter is used.

R_5 must be adjusted so that the meter pointer indicates full-scale when no calibrating resistor is connected to *L* and *C*, and so the pointer indicates 1 ohm when the 1 ohm calibrating resistor is directly connected to *L* and *C*. During this procedure the value of R_1 may need to be lowered to keep the VR105 operating. Never adjust R_1 low enough to let the VR105 dissipate more than 30 ma. When the calibration of R_2 and R_5 has been completed, R_1 should be adjusted so that the VR105 dissipates 20 ma. when the line voltage is 115 to 117, and the meter indicates full scale.

To complete the calibration R_4 must be adjusted so that the meter pointer indicates 10 ohms on the highest range when the 10 ohm calibrating resistor is directly connected to *H* and *C*. Adjust R_3 to get a full scale reading. Long test leads should not be used when measuring low resistance.

-30-

Schematic diagram and complete parts list for low range ohmmeter.



R_1, R_2—2500 ohm, ½ w. res.
R_3—400 ohm rheostat
R_4, R_5—See text
C_1—20 μfd., 350 v. elec. cond.
S_1—S.p.s.t. toggle sw.

T_1—Power trans. 300-0-300 v. @ 60 ma., 5 v. @ 2 amp. c.t.
1—15 ma. d.c. meter
1—5Y3 tube
1—VR105 tube

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Here is the finest radio Midwest has ever produced in its 28 years of manufacturing—a world-ranging, 5-band radio with improved Midwest No-Drift FM . . . plus Standard Broadcast and 3 short wave bands, Television Audio Switch-over, and Color-Ray Tone Selection. The Series 16* Super De Luxe Chassis is a powerful, magnificently-toned radio that challenges comparison for performance, sensitivity, selectivity, and advanced engineering features. Supplied with satin stripe copper finish panel—ready to mount in your present cabinet. Send today for the FREE 1948 Midwest Radio Catalog. Buy your radio direct from the manufacturer on Easy Terms and 30 Days Trial and SAVE!

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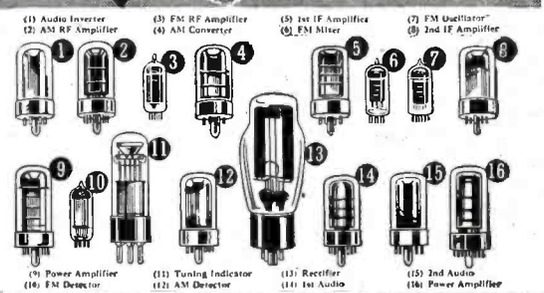

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cessive steps of 200 kc. to and including 107.9 mc. The FM broadcast band extends, therefore, roughly from 88 to 108 mc. In order to further reduce the possibility of adjacent-channel interference between their signals, it has been the policy of the FCC to assign FM broadcast stations that serve the same service area to transmission channels whose center frequencies are spaced 400 kc. apart.

Elements of Superheterodyne FM Receiver

A block diagram of a conventional FM receiver, illustrating the essential units employed, and their sequence in the signal circuit, is shown in Fig. 1. It will be instructive to briefly review the function of each.

The received FM radio-frequency signal voltage from the dipole receiving antenna is usually applied to a tuned r.f. amplifier stage designed with a passband approximately 75 x 2 = 150 kc. wide, and employing an r.f. pentode tube for good gain. This tuned r.f. amplifier supplies an overall r.f. gain of the order of about 20 to 50 and thus improves the signal-to-noise ratio. It serves also to reject signals of image frequency,[2] and strong signals at the intermediate frequency, which might otherwise reach the i.f. amplifier and cause serious interference in the output.

In accordance with superheterodyne principles, the amplified FM signal voltage from the r.f. amplifier, and the constant-amplitude r.f. voltage generated in the local oscillator section of the frequency converter, are applied to separate control grids of the frequency converter tube. (A frequency converter comprising a *separate* mixer and oscillator are shown in Fig. 1.) Frequency conversion takes place, and the component of plate current at the "difference" frequency is fed to a broad-band, high gain intermediate frequency amplifier. As in AM receivers, this i.f. amplifier must contribute the major part of the r.f. gain and provide the selectivity necessary to prevent possible interference from signals of adjacent-channel FM transmitters. Two stages of high gain amplification employing r.f. pentode tubes are usually necessary in the i.f. amplifier of FM receivers, since the gain per stage that can be realized in practice is rather low because of the necessity of using a rather high intermediate frequency (10.7 mc.) in the amplifier.

Since most types of FM detector (demodulator) circuits are responsive to *amplitude* as well as *frequency* variations (modulations) that are present in the detector input voltage

[2] The *image frequency* is that frequency which differs from the desired signal frequency by *twice* the intermediate frequency, and which lies on the same side of the desired signal frequency as does the oscillator frequency. See Alfred A. Ghirardi, *Practical Radio Course, Part 54*, (RADIO NEWS. July 1947).

during reception of FM signals, a device called a *limiter* must precede such detectors.[3] It is called a limiter because its function is to reduce or limit all (undesired) amplitude modulation that may be present in the frequency-modulated signal. Such amplitude modulation, if not removed, would cause interference in the output of the receiver. Amplitude modulations can get into the signal input to the receiver as a result of such things as interference from nearby electrical ignition systems of motor vehicles, atmospherics, electrical interference from household electrical appliances, fading, noise bursts, reflection of the transmitted signal from moving objects, etc. It is apparent that proper design and effective functioning of the limiter tube is very important, for such amplitude modulations must be removed. With an effective limiter located immediately ahead of the detector, and with sufficient r.f. amplification in the receiver to raise the signal up to that necessary to obtain limiting action, amplitude variations due to noise and interference will be removed, for the limiter is designed to pass *frequency* variation but prevent a "saturated" condition to voltage *amplitude* variations. This ability to remove objectionable noise impulses from the received signal without affecting the "quality" of the reproduction is one of the important advantages of the FM broadcasting system over the AM system. In some FM broadcast receivers *two* limiter tubes are used in cascade to insure most effective quieting.

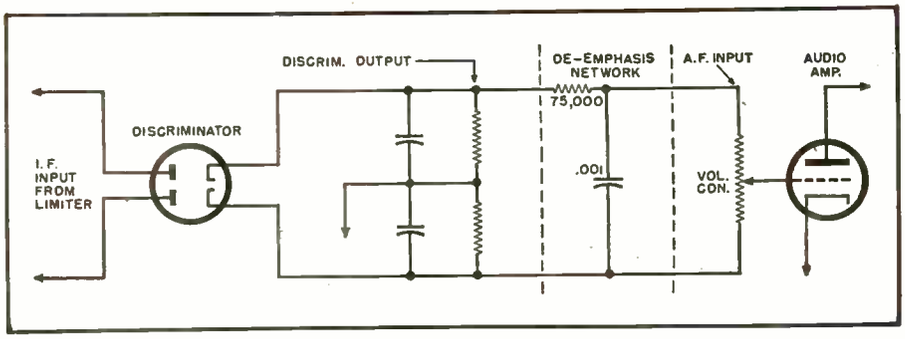

Fig. 5. Typical 75 microsecond de-emphasis network and its position in the frequency modulation broadcast receiver.

The output of the limiter is the FM signal, still at intermediate frequency and substantially free of disturbing impulses. It is now necessary to derive the audio-frequency components from the frequency-modulated wave. This is *demodulation*. Demodulation is performed by an FM detector tube in which *frequency* deviations or changes in the FM signal applied to the input of the device result in direct current *amplitude* changes at the output which are directly proportional to the r.f. modulation at the source.

The type of FM detector used usually employs two diodes arranged to deliver an output voltage whose polarity depends upon whether the applied instantaneous signal frequency is *higher* or *lower* than the mean frequency of the input tuned circuits, and whose amplitude depends on the extent by which the applied frequency differs from the mean frequency. Therefore, since such detectors are able to discriminate between frequencies above and below the mean frequency of the coupled tuned circuits, they are called *discriminators* and are most often referred to by this name.

Since a standardized pre-emphasis[4]

[3] The ratio detector is an exception. When one is used, the limiter is unnecessary.

[4] In FM broadcast service it is desirable in the interest of noise reduction at the higher audio frequencies to employ (in the transmitter) a.f. pre-emphasis networks that make the frequency deviation (modulation) relatively greater at the high audio frequencies (that is, when the modulation frequency increases). Pre-emphasis is usually expressed as the time constant in microseconds of an R-C circuit giving the desired frequency characteristics. In America the FCC has now standardized the use of 75 microseconds pre-emphasis in the signals from Amerian FM broadcasting stations.

of 75 microseconds is purposely employed in FM broadcast transmitters to increase the amplitude of the high-frequency components of the audio-modulation, FM broadcast receivers must incorporate corresponding *de-emphasis* to compensate for this and bring the amplitude of the high-frequency components of the detected (demodulated) signal down to the same proportion with respect to the lower-frequency components that exist in the original audio modulating voltage—if an over-all linear audio characteristic for the entire system is to be attained. This function is usually performed by a 75 microsecond *de-emphasis* attenuating network connected in the discriminator output. This network usually consists simply of a 75,000 ohm resistor in series with the discriminator output circuit and a .001 μfd. condenser shunting this output, as shown in Fig. 5. Other combinations of R and C that will provide the same 75 microsecond de-emphasis can be used of course.

In other FM services, where a different value of pre-emphasis may be applied at the transmitter a de-emphasis network having different values of R and C than those specified above will be necessary in the receiver in order to exactly compensate for the pre-emphasis applied at the transmitter.

The demodulated, de-emphasized audio signals are fed to a high-fidelity audio amplifier and then to a high-fidelity acoustic system. It is important that *both* of these have adequate wide-range characteristics and introduce negligible distortion, for the capabilities of a well-designed FM receiver are limited only by those of the audio amplifier and acoustic system associated with it.

This completes the FM broadcast receiver system!

It is evident that the functional elements of the FM superhet broadcast receiver differ from those in AM superhet broadcast receivers only in the limiter, discriminator, and de-emphasis network. However, it must be remembered that in the FM broadcast receiver the r.f. circuits operate at frequencies in the 88-108 megacycle spectrum and their selectivity characteristics must be such as to enable them to pass a band approximately 150 kc. wide; the i.f. circuits operate at much higher frequencies than do those in AM broadcast receivers (as we shall presently see) and also are required to pass a frequency band approximately 150 kc. wide; the audio-frequency circuits and acoustic system must respond satisfactorily over a wide audio frequency range from 50 to 15,000 cycles-per-second.

Now that we know *what* performance characteristics are required in the i.f. amplifier, we are ready to study various phases of its design in greater detail.

(To be continued)

FM Receiver Alignment

(*Continued from page 67*)

ings should be equal, but with average equipment, percentage of error is greater. Care should be taken that the generator settings above and below the operating frequency are the same with regards to frequency separation from the center or operating frequency, to give more acurate results. If voltage readings, as described, are not within 10% of each other the discriminator will need adjustment.

Connect generator and v.t.v.m. or multimeter as described when testing to determine the operating frequency. Set the generator to the known operating frequency, and adjust the primary trimmer or primary adjustment for maximum meter deflection. Connect the v.t.v.m. to point *X* (Fig. 2A) or multimeter negative lead to point *Z* and use a 50 volt or higher scale. Adjust secondary trimmer, or secondary adjustment until the v.t.v.m. reads zero. (Note: When tuning the secondary the meter will swing first from one polarity maximum, and then the other, crossing through zero. The correct setting is between these two maxima, which is zero). When using the multimeter, the positive lead must be connected first at point *X* (Fig. 2A) and then to ground. The secondary is adjusted until the meter readings at these two points are equal. In some cases of very bad misalignment this procedure may have to be repeated with the primary adjustment, if adjustment is found to be wrong when checked as described above in checking discriminator alignment. The circuits shown in Fig. 3A, 3B, and 3C may be aligned in the same way as described above with the following exceptions. In Fig. 3B one end of a resistor of between 1 and 2 megohms should be soldered at point *Z* and the v.t.v.m. should be connected between ground and the free end of the resistor for primary adjustment. Secondary adjustment may be made as described, between point *X* and ground. A multimeter is not recommended for use in aligning the circuit of Fig. 3B. In Fig. 3C point *G* is used instead of ground for all purposes of alignment.

Fig. 4 shows one circuit of the new ratio detector. This is essentially the same as the previous FM detectors shown except for a few minor circuit changes. *A* and *B* are primary and center tapped secondary. *T* is a tertiary winding wound over *A*, taking the place of the primary with regards to connections to the center tap of the secondary. *T* takes the place of the primary *A* in developing the voltage E_p shown in Fig. 2B. The diodes V_1 and V_2 with condenser C_1 are connected in such a way as to eliminate amplitude modulation effects. Alignment is the same as previously described, point *Z* and ground are used for primary adjust-

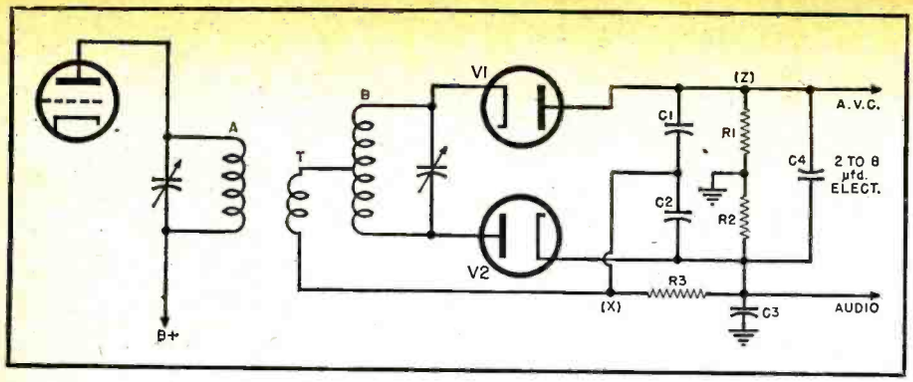

Fig. 4. Diagram of the relatively new ratio detector circuit.

ment, and point X and ground is used for secondary alignment. C_3 is the de-emphasis condenser and C_1-C_2 are r.f. bypass condensers. Audio output is taken from point X. A multimeter may be connected to point Z and X when aligning the detector and will act the same way as the v.t.v.m. at point Z and the secondary is adjusted for zero scale readings for multimeter or v.t.v.m. A 5000 ohm-per-volt meter and 50 volt scale must be used. This type of detector eliminates the use of limiting tubes before the discriminator.

The i.f. alignment can be accomplished equally well with a v.t.v.m. or multimeter. Read the manufacturer's instructions if available, and note whether the i.f. transformers should be aligned stage-by-stage or over-all. If instructions are not available, over-all alignment may be used without serious trouble.

Connect one end of a 1 or 2 megohm resistor to point W in Fig. 2A, and attach the v.t.v.m. probe to the free end. If a multimeter is used, remove the grounded end of R_4 from ground and connect the negative lead to the free end of R_4 and the positive lead to ground. Use the 0-1 milliampere scale at first, switching to a higher or lower scale if necessary. An alternative method is to connect the v.t.v.m. or meter to point Z (Fig. 2A) as in discriminator primary adjustment and align the i.f.'s for maximum scale deflection. If stage-by-stage alignment is indicated, connect the signal generator successively between grid and ground of each i.f. stage starting with the last and ending with the mixer or converter signal grid, adjusting each i.f. transformer primary and secondary for maximum meter deflection. If over-all alignment is followed, connect the signal generator to the mixer or converter grid and adjust the i.f. transformers starting with the last one. When using a v.t.v.m. keep the signal generator output adjusted so the v.t.v.m. reading is approximately 5 to 10 volts when making all i.f. adjustments. If a multimeter is used the output current should be kept between 50 and 100 microamperes. Any i.f. coils associated with limiter stages are aligned in the same manner as the regular i.f.'s.

Some i.f. transformers are triple-tuned (three adjustments) and it is best they be left undisturbed unless a wobbulator and oscilloscope is available for visual alignment, by someone experienced in that procedure.

An r.f. alignment is generally not necessary unless the r.f. circuits have been disturbed or it is known that they are not set correctly. If they need adjustment, connect the v.t.v.m. or meter as described under i.f. alignment. Connect the signal generator to the mixer or converter signal grid. Set the tuning mechanism to the high end of the band. Set the signal generator at the dial reading of the receiver. (Note: The upper frequency of the old FM band is 50 mc. and of the new band is 108 mc. These are the usual frequencies of adjustment at the

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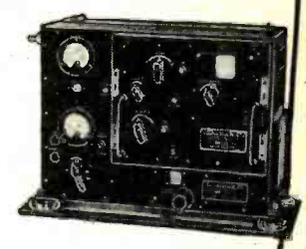

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upper end of the bands). Wobble the receiver tuning control and note whether the maximum meter deflection occurs at the correct setting. If it does not, adjust the oscillator trimmer with the generator and receiver dials at the same setting with regard to frequency, until maximum meter deflection occurs. Now check the low end of the band (42 or 88 mc.); the receiver dial should read the same as the generator. If this is not true the oscillator inductance is not correct or the dial pointer on the receiver may be off scale. Check the dial pointer travel to ascertain its correct operation, adjust it if necessary, and realign as before.

If the oscillator is incorrect it may be adjusted if very badly off, but it is generally advisable to leave this part of the receiver alone. Connect the signal generator to the antenna and adjust the r.f. and antenna trimmers at the high end of the band with the receiver and signal generator at the same setting for maximum meter deflection. It may be necessary in most cases to rock the receiver tuning control for maximum meter deflection when adjusting the r.f. trimmer.

If inadequate or inaccurate equipment is used for the above adjustments very serious misalignment causing reduced sensitivity and possible audio distortion may result. If test equipment is doubtful and a receiver seems to be properly adjusted it is best to leave well enough alone and avoid possible trouble. FM is not akin to AM where inaccurate adjustment is concerned, and this is especially true of the FM detector.

—30—

V.H.F. FORUM

A NOVEL "over the air" discussion was instituted recently by members of the Midwest V.H.F. Club of Chicago. A bi-weekly program of technical discussions has been planned.

The central station used for control is W9ENP/W9DXX, located on the 36th floor of the Skyline Athletic Club. The antenna proper is located on the 46th floor, and the station is consistently heard within a radius of 100 miles from Chicago.

The round table each meeting consists of a narrator, two experts on the subject to be discussed, and two typical hams to ask questions. Subjects dealing solely with v.h.f. are discussed. The first program dealt with a discussion of antennas for v.h.f. work, and the guest expert was Jack Brown of the Andrew Co. Listeners are invited to suggest topics for future discussion.

The proceedings of the original meeting were retransmitted by at least five stations in the Chicago area and reports of reception have been received from five surrounding states. It is planned to eventually extend the coverage to the entire Midwest by means of relay stations.

Evidence of the interest in this program was the complete silence of the 144 mc. band during the hour-long transmission, with the exception of the participating stations.

—30—

WWV-TECHNICAL BROADCAST SERVICES

RADIO station WWV, of the National Bureau of Standards, is broadcasting six important technical services to the nation and five to the world, 24 hours a day.

Standard radio frequencies, time announcements, standard time intervals, the standard musical pitch of 440 cycles per second, and standard audio frequencies are transmitted continuously to the corners of the earth. As an additional service, ionospheric and radio propagation disturbance notices are broadcast twice each hour, stating whether or not radio disturbances are expected.

Eight transmitters are used on frequencies of 2.5, 5, 10, 15, 20, 25, 30 and 35 megacycles. All of the frequencies are broadcast continuously except 2.5 megacycles which is broadcast only at night. Because of the range of frequencies provided, reliable reception is, in general, possible throughout the United States and North Atlantic Ocean area at all times.

The basic component of all the services, with the exception of the radio propagation disturbance warnings, is a quartz crystal-unit with a series-resonance frequency of approximately 100,000 cycles per second. Using electron tube circuits, the crystal oscillates continuously and the resulting frequency is multiplied and divided to give the appropriate frequencies for the five services. Three separate crystal-units and associated apparatus are maintained at the station. As the entire service depends upon the maintenance of constant frequency, the crystal-units are sealed in painstakingly insulated boxes and kept in a vault approximately 25 feet below the surface of the earth, under conditions of constant temperature and humidity.

The national standard of frequency, of which the National Bureau of Standards is the custodian, is fundamental to much of the work in radio, electronics, acoustics, and other fields where measurements require accurate frequencies. Any desired frequency, including those throughout the microwave region, may be precisely measured, by reference to the standards broadcast by the station, with the aid of one or more auxiliary oscillators, harmonic generators, and radio receivers. The accuracy of each of the transmitted radio and audio frequencies is better than one part in 50 million.

Eastern Standard Time is announced in International Morse Code every five minutes, using the zero to twenty-four system with 0000 at midnight. The exact moment to which the time refers is the moment of interruption of the audio frequencies of 440 and 4000 cycles per second.

The standard time intervals, transmitted on each of the carrier frequencies, utilize a special pulse of .005 second duration broadcast every second. Heard as a faint "tick" in the background of the broadcast, the .005 second pulses working each second provide an indispensable standard time interval for purposes of physical measurements, for quick and accurate calibration of timing devices, and for the adjustment of very low frequency oscillators. Intervals of one second, as broadcast, are accurate to one millionth of a second. One, four, and five minute intervals, accurate to one part in 50 million, are marked by the beginning and ending of the periods when the audio frequencies are off, and are synchronized with the series of seconds pulses. The 59th in each series of 60 second pulses is omitted to designate the end of each minute.

The standard musical pitch of 440 cycles per second, A above middle C, is broadcast for four minutes and interrupted for one. This sequence is continuous on each of the radio carrier frequencies. The service is used by musicians and those concerned with the manufacture or maintenance of musical instruments. Since 1925 that frequency has been the standard musical pitch in the United States' music industry.

A warning of radio propagation disturbance is broadcast in code on each of the standard radio carrier frequencies at twenty and fifty minutes past the hour. If radio propagation disturbance over the North Atlantic is expected or is in progress, a "warning," or series of six "W's" in telegraphic code, follows the time announcement; if no disturbance is in progress or expected, a "no warning," or series of eight "N's," follows the time announcement.

A warning means that ionospheric and radio propagation disturbances are anticipated within 12 hours or are in progress, with their most severe effect on radio transmission paths crossing the North Atlantic. These are the paths which lie in or near the northern auroral zone (the region of maximum occurrence of aurora) which is the seat of most ionospheric disturbance.

A radio propagation disturbance is characterized by low received intensities, accompanied by flutter or rapid fading and often a complete fadeout on the frequencies normally used at a given time of day. By shifting to lower-than-normal frequencies for the time of day during which a storm is predicted, it may be possible to get signals through, although with lower-than-normal intensity. Due to the increased auroral-zone absorption during the disturbance, usable transmission may be impossible on any high frequency. Moreover, direction-finding equipment is likely to be unreliable during such a period.

Users of the technical broadcast services select the frequency which reaches them best, either by empirical observation, or by making use of the available techniques for prediction of best frequencies.

Although a great number of variables affect radio wave propagation and the distance range, the National Bureau of Standards has developed techniques for the prediction of best frequencies over any specific path during any future month. By means of such techniques and the prediction service of the National Bureau of Standards, it is possible for a user to prepare for his locality a graph, or table, showing the best frequency for any period of the day in any month, three months in advance. Basic radio propagation predictions and instructions for using them are prepared by the staff of the Bureau's Central Radio Propagation Laboratory under the title "Basic Radio Propagation Predictions Three Months in Advance," and are available from the Superintendent of Documents, U. S. Government Printing Office, at the rate of 15 cents per copy or $1.50 for a year's subscription. —30—

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8mfd.	600v	1.10	15mfd.	2000v	4.95
10mfd.	600v	1.15	.1mfd.	2500v	1.25
1mfd.	1000v	.60	.25mfd.	2500v	1.45
2mfd.	1000v	.70	.5mfd.	2500v	1.75
4mfd.	1000v	.95	.05mfd.	3000v	1.95
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6C4	.69	829-A-B	3.00
6C5	.49	832	2.25
6F6	.89	833A	49.50
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6SR7	.89	885	1.10
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7F7	1.25	913	3.00
7L7	1.59	954	.75
9JP1	14.95	955	.75
10Y	1.50	956	.75
12X3	1.50	957	.75
15E	1.50	958	.75
HK24	1.75	959	.75
28D7	.75	1005	1.98
30	.75	1616	2.95
35T/TG	3.50	1619	.75
VR90	.75	1624	.90
VR105	.75	1625	.75
VR150	.75	1626	.75
100TH	7.95	8001	8.95
100TS	3.00	8003	9.95
211	1.25	8005	4.95
75T	2.95	8011	3.75
250TH	14.95	8016	1.65
257B	14.95	8025A	3.95
304TH	9.95		

SCR-522 100-156 MC.
RECEIVER AND TRANSMITTER
Licensed for Railway and Taxicab Use
The ideal all-purpose transmitter-receiver for work in the 100-156 mc. spectrum. Four channel push-button operation, crystal-controlled, AM, phone, mobile or fixed station service. Ideal for amateur, aircraft, marine, railroad, taxicabs, police and experimental. Amplitude modulated—High transmitter output. Receiver has 10 tubes and transmitter has 7 tubes including two 832's. 60 cycle operation. Complete conversion instructions and schematic furnished with each unit. Tube complement 2—832; 3—12A6; 1—6G6; 2—6557; 1—12J5GT; 1—12C8; 1—9002; 3—9003; 1—12AH7 GT and 3—12SG7. Complete with tubes. **$14.95**

BC-348 RECEIVER
Built for continuous duty, this band switching, six band receiver with a freq. range of 200 to 500 kc. and complete 1500 kc. to 18,000 kc. Has automatic noise compensator —constant sensitivity on all bands—output at 300 or 4000 ohms—xtal filter AVC-MVC-BFO; Smooth vernier tuning; 90 turns of tuning for each band. Complete with built-in dynamotor for 28v DC. 8 tubes. Conversion instructions and schematics. Wonderful buy at **$49.50**
Conversion kit for 110v-60 cyc. operation, complete $7.50

TRANSFORMERS—115 V 60 CYC.
HI-VOLTAGE INSULATION

1600v at 4ma; 700v at 150ma; 6.3v at 8A	$8.50
3710v at 4ma; 2x2.5v at 3A	9.95
2500v at 10ma	6.50
2150v at 15ma	6.50
1750v at 4ma; 6.3v at 3A	7.95
1540v at 4ma; 340-0-340 at 240ma	7.50
550-0-550v at 150ma; 5v at 3A; 2x6.3 at 3 amp	7.95
500-0-500v at 100ma; 5v ct at 3A	4.95
442-0-442v at 1000ma	9.95
425-0-425v at 150ma; 6.3v at 7.5A; 6.3v at 3A; 5v at 3A	5.95
400-0-400v at 200ma; 5v at 3A	4.95
350-0-350v at 150ma; 6.3v at 6A; 5v at 3A; 78v at 1A	4.95
350-0-350v at 35ma-XLNT for VOLT-DBLR	1.49
300-0-300v at 65ma; 2X 5v at 2A; 6.3v at 2½A; 6.3v at 1A	3.49
325-0-325v at 120ma; 10v at 5A; 6.3v at 7A	3.49
350-0-350v at 85ma; 2X 5v at 2A; 6.3v at .6A; 6.3v at 3.75A	7.50
250-0-250v at 100ma; 2X 6.3 at 4A; 6.3v at 5A; 6.3v at 1A	4.95
2.5v at 2A; 5v at 3A	2.95
2.5v at 10A	3.25
5v at 115A	9.95
5v at 190A	17.50
6.3v at 6.6A	3.25
6.3v at 3.1A	1.95
6.3v at 21.5A; 6.3v at 2A; 2.5v at 2A	6.95

FILTER CHOKES
HI-VOLTAGE INSULATION

4 Hy at 250ma	$1.98	12 Hy at 300ma	$3.95
10 Hy at 250ma	2.49	15 Hy at 100ma	2.95
10 Hy at 400ma	4.95	15 Hy at 125ma	3.25
12 Hy at 100ma	2.95	30 Hy at 70ma	1.95
4 Hy at 600ma	5.95	.1 Hy at 5 Amps	6.95
10 Hy at 200ma	1.98	15 Hy at 75ma	1.49
200 Hy at 12ma	1.39	10/20 Hy at 85ma	1.95

BLOWER
Hi-air blast, designed for transmitting tube service. Motor operates on 100-125v 60 cycle at 7000 RPM. Noise free with self contained chokes and filters. Enclosed in satin finish, aluminum cabinet. Measures 4" high x 2¾x3¼". Many uses.
Super buy at **$5.95**

All merchandise guaranteed. Mail orders promptly filled.
All prices F.O.B. New York City. Send money order or check.
Shipping charges sent C.O.D. Minimum order $5.00.

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INDUSTRIALS—LABS—SCHOOLS—AMATEURS
Let us quote on components and equipment that you require. We have too many items to be listed on this page. Place your name on our mailing list now for new catalog.

RADIO HAM SHACK Inc.
63 DEY STREET • NEW YORK 7, N. Y.

Within the Industry

(*Continued from page 30*)

Siegel, *Ohmite Manufacturing Company.*

Chairman S. P. Taylor, distributor sales manager of *Western Electric Company,* named five section chairmen for the Transmitter Division: Aviation Section, H. M. Hucke, *RCA Victor Division* of *Radio Corporation of America;* Broadcast Transmitter Section, C. W. Miller, *Industrial Electronic Division, Westinghouse Electric Corp.;* General Communications Section, Natale Gada, *General Electric Company;* Marine Section, C. E. Maass, *Western Electric Company;* and Transmitter Tube Section, A. Frankel, *Lamp Division, Westinghouse Electric Corp.*

* * *

WILLIAM M. MAGUIRE has been transferred from the Salem, Massachusetts plant of *Sylvania Electric Products Inc.,* to the Distributor Sales Department of the Radio Tube Division of the company.

In his new post Mr. Maguire will serve as a products specialty salesman in cooperation with *Sylvania* sales division managers and distributors in the eastern half of the United States.

Mr. Maguire joined *Sylvania* in 1930. During the war he was active in proximity fuze tube production and also served as a member of the electronic test equipment standardizing committee.

* * *

MARK SIMPSON MANUFACTURING CO., INC., manufacturers of a line of packaged sound equipment and accessories, have appointed the *W. H. Connors Company* of Denver, Colorado, as their factory representative for the states of Colorado, New Mexico, Utah, Wyoming, and parts of Idaho and Montana.

W. H. (Bill) Connors, founder and owner of the firm, is assisted by his son Carl in the business.

* * *

STEPHEN J. DEITZ has been named head of Sales Engineering for the *Industrial Control Division* of *The Langevin Manufacturing Corporation,* manufacturers of broadcast audio facilities and custom-built sound installations.

Mr. Deitz was formerly connected with *Ripley Company* where he was responsible for the design and engineering of industrial electronic controls manufactured by that organization.

The company also announced the appointment of Ralph J. Hugh as sales

MONEY BACK GUARANTEE We believe units offered for sale by mail order should be sold only on a "Money-Back-If-Not-Satisfied" basis. We carefully check the design calibration and value of all items advertised by us and unhesitatingly offer all merchandise subject to a return for credit or refund. You, the customer, are the sole judge as to value of the item or items you have purchased.

The New KT-30 CHANNEL ANALYZER

The Ultimate in Signal Tracing Includes . . .

METER—For direct reading of signal intensity
SPEAKER—For listening to the signal
PHONE—For checking distortion and listening to the signal in low-gain channels

Comparative signal intensities indicated directly on the meter as Probe follows the signal. A special 4½" P.M. speaker with oversize Alnico V magnet is used for quality checks. Many previously designed Signal Tracers were unable to measure and check low signal intensities. This disadvantage has now been overcome for the Model KT-30 incorporates a special circuit which permits the meter to be put across the output of the Signal Tracer. To accomplish this it is necessary only to flip a front panel switch. This results in additional gain and sensitivity permitting measurement of low signal intensities. An earphone provided with the unit permits listening to the signal in low-gain channels. Incidentally, insertion of the phone automatically cuts out the speaker.

$29.95 NET

Complete with detector probe, test leads, self-contained batteries and earphone. Heavy-gauge crystalline cabinet.

The New Model 650-A A.C. Operated
SIGNAL GENERATOR

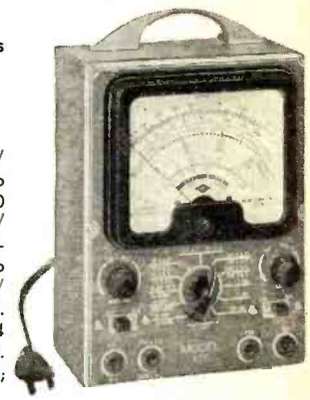
- **Operates on 110-120 Volts 50 to 60 Cycles A.C.**
- R.F. Frequencies from 100 Kc. to 35 Mc. on Fundamentals in 5 bands by front panel switch manipulation. One additionol band provides Harmonics from 30 to 105 Mc.
- Audio Modulating Frequency—400 Cycles Pure Sine Wave. Distortion less than 2%.
- Attenuation: Features a newly designed 3-step ladder type of attenuator (T pad). The first step provides lowest output and can be multiplied by 10 and by 100 by turning the multiplier switch.
- Hartley Excited Oscillator Electron coupled to a Buffer Amplifier. Frequency stability is assured by modulating the amplifier stage.

Complete with coaxial cable, test leads and instructions. Heavy gauge grey crystalline cabinet with beautiful two-tone etched front panel. Size 9½" x 10" x 6."

$39.95 NET

The New Model 670 SUPER METER

A Combination
VOLT-OHM-MILLIAMMETER plus
CAPACITY REACTANCE,
INDUCTANCE and
DECIBEL MEASUREMENTS



D.C. VOLTS: 0 to 7.5/15/75/150/750/1500/7500. A.C. VOLTS: 0 to 15/30/150/300/1500/3000 Volts. OUTPUT VOLTS: 0 to 15/30/150/300/1500/3000. D.C. CURRENT: 0 to 1.5/15/150 Ma.; 0 to 1.5 Amps. RESISTANCE: 0 to 500/100,000 ohms, 0 to 10 Megohms. CAPACITY: .001 to .2 Mfd., .1 to 4 Mfd. (Quolity test for electrolytics). REACTANCE: 700 to 27,000 Ohms; 13,000 Ohms to 3 Megohms.

INDUCTANCE: 1.75 to 70 Henries; 35 to 8,000 Henries.

DECIBELS: −10 to +18, +10 to +38, +30 to +58.

THE MODEL 670 COMES HOUSED IN A RUGGED, CRACKLE-FINISHED STEEL CABINET COMPLETE WITH TEST LEADS AND OPERATING INSTRUCTIONS. SIZE 5½" x 7½" x 3".

$28.40 NET

The New Model CA-11 SIGNAL TRACER

SIMPLE TO OPERATE . . . BECAUSE SIGNAL INTENSITY READINGS ARE INDICATED *DIRECTLY ON THE METER!*

- ★ SIMPLE TO OPERATE — only 1 connecting cable—NO TUNING CONTROLS.
- ★ HIGHLY SENSITIVE — uses an improved Vacuum Tube Voltmeter circuit.
- ★ Tube and resistor-capacity network are built into the Detector Probe
- ★ COMPLETELY PORTABLE —weighs 5 lbs. and measures 5"x6"x7".
- ★ Comparative Signal Intensity readings are indicated directly on the meter as the Detector Probe is moved to follow the Signal from Antenna to Speaker.
- ★ Provision is made for insertion of phones.

THE MODEL CA-11 COMES HOUSED IN A BEAUTIFUL HAND-RUBBED WOODEN CABINET. COMPLETE WITH PROBE, TEST LEADS AND INSTRUCTIONS.

$18.75 NET

The New Model 450 TUBE TESTER

Speedy operation—assured by the newly designed rotary selector switch which replaces the usual snap, toggle, or lever action switches.

SPECIFICATIONS

• Tests all tubes up to 117 volts. • Tests shorts and leakages up to 3 Megohms in all tubes. • Tests both plates in rectifiers. • New type line voltage adjuster. • Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes • Noise Test detects microphonic tubes or noise due to faulty elements and loose internal connections. • Uses a 4½" square rugged meter. • Works on 90 to 125 volts 60 cycles A.C.

EXTRA SERVICE—May be used as an extremely sensitive condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

$39.50 NET

GENERAL ELECTRONIC DISTRIBUTING CO.

Dept. RN-10, 98 Park Place
NEW YORK 7, N. Y.

director of the *Industrial Control Division*. Mr. Hugh was formerly sales manager of the *Ripley Company*.

* * *

TRADIO, INC., manufacturers of coin-operated radios, have announced the completion of a new plant in Asbury Park, New Jersey. Covering 20,000 square feet in area, the factory has a capacity of 15,000 sets per month.

The building houses the company's administrative offices as well as a new experimental laboratory. A cafeteria for employees has been set up adjacent to the factory.

* * *

M. B. LESKIN has been appointed head of jobber sales and advertising at *Permoflux Corporation*.

This new appointment is in line with the company's recently announced intention to enter the jobber field after years of engineering and manufacturing experience in the supplying of speakers for radio set producers.—30—

TELEX "MONOSET" CONTEST

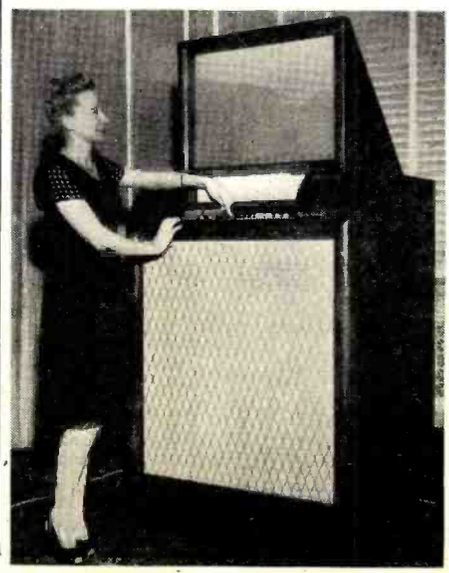
THERE is still time for amateurs with a flair for writing to enter the Telex contest which is offering $175.00 in cash and 25 Telex Monosets as prizes.

The contest consists of writing a 50-word statement on the subject "Why the Telex Monoset is better than old-style earphones." The first prize is $100.00 cash and a Monoset; second prize is $50.00 cash and a Monoset; the third prize winner will receive a Monoset and $25.00 in cash, while the next 22 runners-up will receive Monosets.

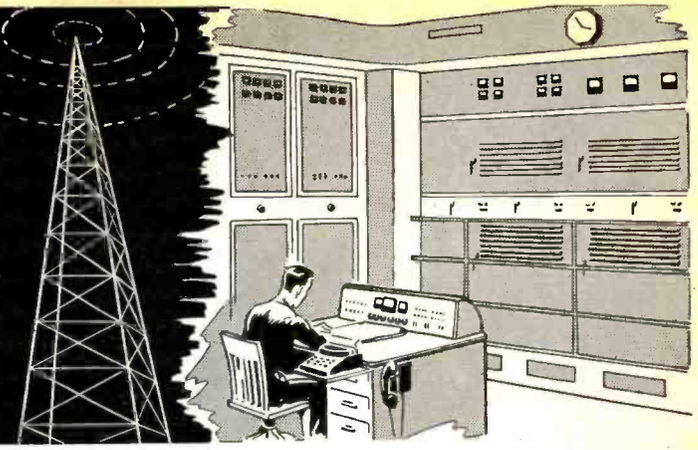
Complete contest rules and official entry blanks are available at local jobbers. Entries must be postmarked by midnight October 15, 1947.

—30—

A new projection television receiver, said to embody the world's largest screen, was recently demonstrated to the press by the Telicon Corporation of New York City. Designed primarily for public meeting halls, taverns and other public places, this unit which provides three square feet of screen, can be viewed by several hundred people at a distance of approximately 100 feet under ordinary room lighting conditions. Set is operated by push-button tuning system.



You can be a BROADCAST TECHNICIAN or ENGINEER...



ADD TECHNICAL TRAINING TO YOUR PRACTICAL EXPERIENCE

USE CIRE TRAINING AND COACHING SERVICE—AND GET YOUR "TICKET" IN A FEW SHORT WEEKS!

Employment opportunities are plentiful. Now is the time to get in on the ground floor. Permanent employment—steady, good pay. Advancement to those who are qualified. These are only a few of the attractive features of this interesting, pleasant employment!

Get your license without delay. Let Cleveland Institute prepare you to pass the FCC license examinations, and **to hold the jobs which a license entitles you to,** with CIRE streamlined, **post-war** methods of coaching and training.

Your FCC Ticket Is Recognized in All Radio Fields as Proof of Your Technical Ability

More than ever before an FCC Commercial Operator License is a sure passport to many of the better paying jobs in this New World of Electronics.

Employers frequently give preference to the license holder, even though a license is not required for the job. Hold an FCC "ticket" and the job is yours!

Hundreds of Satisfied, Successful Students

"I have taken the first class phone license examination and received my first class ticket last Saturday, May 31. In closing I must say yours is an excellent radio course, and I really appreciate your help and the fine service you have rendered me."
Student #2876N12

"I passed the FCC examination in radiotelephone 2nd class, at Detroit on June 3rd, and I want to thank you for your ready assistance as my instructor on Section I of Nilson's Master Course."
Student #2799N12

"I have had my 1st class radiotelephone license since March of this year, and plan to continue with your course since I find it a great help in studying transmitters."
Student #2779N12

"After sending in Lesson E-9 I took the commercial operator's license examination for 2nd class radiotelephone, and passed O.K. I received the license last week."
Student #2772N1

FREE BOOKLET—Tells you the Government requirements for all classes of FCC *commercial* licenses. (Does not cover Amateur License examinations.) Use coupon below for Booklet B.

OTHER Cleveland Institute Home Study Courses Offer Complete Technical Radio Training from Low-Level to College-Level, for the Radioman with Practical Experience!

COURSE A—Master Course in Radio Communication

A complete course covering the technical fundamentals of radio-electronics, for the radioman who wants a general review. Includes preparation for Broadcast station employment.

COURSE B—Advanced Course in Radio Communication Engineering

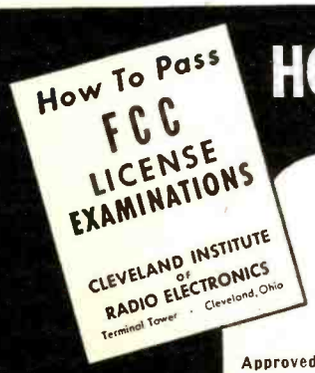
A genuine college-level radio engineering course, completely mathematical in treatment. For the advanced radioman with considerable practical experience and training.

COURSE C—Specialized Television Engineering

An advanced college-level course for the radioman who has had formal training equivalent to A and B.

These three courses in radio-electronics offer a complete, thorough technical training for the radioman who wants to cover the field. Available separately or combined.

FREE CATALOG—Describes all Cleveland Institute home study courses—tells of CIRE unique, post-war methods of training. Use coupon below for Catalog A.



HOW TO PASS Commercial Radio Operators' FCC LICENSE EXAMINATIONS...

Don't Delay—Write Today!

Approved for Training Under "G-I Bill of Rights"

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Contractors to the Canadian Broadcasting Corporation
RN-10 TERMINAL TOWER — CLEVELAND 13, OHIO

Cleveland Institute of Radio Electronics
RN-10 Terminal Tower, Cleveland 13, Ohio

☐ Veterans check for enrollment information under G-I Bill. NO OBLIGATION—NO SALESMEN.

Gentlemen:

☐ Please send me your Booklet B, "HOW TO PASS THE FCC COMMERCIAL LICENSE EXAMINATIONS," and information about your home study course for preparation for FCC License Examinations. (Does not cover Amateur License Examinations.)

☐ Please send me your Catalog A, describing all of your home study radio-electronics courses.
I desire training in course ☐ A ☐ B ☐ C.

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Mobile FM Rig

(*Continued from page 45*)

fundamental range of 9053 kc. to 9900 kc. is required in the oscillator.

The controls as seen in the front view, Fig. 1 are, lower left, oscillator tuning condenser C_{10}; lower center, tripler plate tuning condenser C_{16}; lower right, meter jack. The connections for the antenna and receiver are located on either side of the six prong male *Jones* plug used for the power terminals. The final tank condenser control (C_{21}) may be seen near the right hand side.

Because of their small size, regular male single contact microphone connectors were used for the antenna and receiver connections. To provide as much ventilation as possible, a series of ¼ inch holes was drilled in the bottom of the cabinet and along the upper sides. The cabinet is mounted to a wooden base by means of four one-pound shock mounts. As the total weight of the unit is only three and one-half pounds, this method of mounting provides adequate cushioning against mechanical shock.

Only five of the six terminals on the power plug are necessary for this application so two of the terminals were tied together and used for the high voltage terminal. By removing the link between these two terminals, a modulation transformer may be connected, and the rig plate-modulated by any modulator capable of 15 watts of audio.

The phase splitting network across the oscillator coil, consisting of C_5 and R_5, uses values that are quite different from those usually used in transmitters of this type. The particular values used were derived by calculation according to the figures given in *"Frequency Modulation"* by *Hund*. With the values given, the reactance of condenser C_5 is approximately 2000

IDENTIFYING CATHODE-RAY TUBES

THE rapidly expanding field of uses for CR tubes and the development of phosphors with characteristics adaptable to special applications has made it increasingly difficult to determine a tube's exact characteristics at a glance. There is, however, a standard system for designating such tubes, administered by the Data Bureau of the Radio Manufacturers Association, and used by most manufacturers with one or two exceptions.

The section governing the nomenclature of these tubes is quoted for your information and future reference:

"RMA Standard M8-402: It shall be standard to use the following system of type designation for television picture tubes:

"The designation shall consist of three groups of symbols. The first symbol will be a number to correspond to the nominal maximum bulb diameter in inches. A tube having a maximum diameter within plus or minus one-half of an integer shall be assigned that integer. A tube falling exactly on a one-half inch dimension shall be assigned the next larger integer. The second symbol shall be a letter or a double letter to distinguish between tubes having the same nominal maximum bulb size. The third symbol shall consist of the letter P and a number to designate screen characteristic."

The screen characteristic is defined by two properties, color and persistence, and is coded by further RMA standards under the designations P1, P2, etc. As an example, consider a 5LP1. From the designation it may be determined that the tube is a 5" unit of the "L" series and has a green medium persistency screen such as used in oscilloscope or radar work.

Table 1 gives a breakdown of screen characteristics for the various screen number designations. Approximate definitions of the terms used for qualitative description of persistence are given in Table 2. —30—

Long:	Visible for more than 1 second.
Medium:	Luminescence is below 10 per-cent of initial brightness within 30 milliseconds or less.
Short:	Luminescence is below 10 per-cent of initial brightness within 3 milliseconds or less.
Very Short:	Luminescence is below 10 per-cent of initial brightness within 30 microseconds or less.

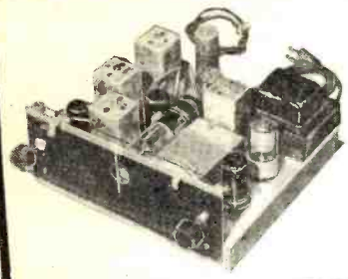
Table 2

Table 1

Phosphor	Color Fluorescence	Color Phosphorescence	Persistence	Principal Application
P1	Green		Medium	Oscilloscope & Radar
P2	Blue-Green	Green	Long	Oscilloscope
P3	Yellow		Medium	Oscilloscope
P4	White		Medium	Television
P5	Blue		Very Short	Oscilloscope (high-speed photography)
P6	White		Short	Color Television
P7	Blue	Greenish Yellow	Long	Oscilloscope & Radar
P10	Purple	Purple	Very Long	Oscilloscope & Radar
P11	Blue		Short	Oscilloscope (Photography)
P14	Blue	Orange	Long	Radar

Courtesy of General Electric Company

ROCK BOTTOM PRICES!
ON ALL TOP QUALITY ITEMS

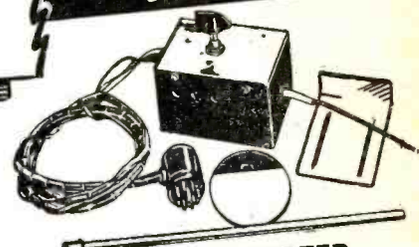


F. M. TUNERS
(88-108 MC.)

Armstrong circuit. 8 tubes: 1 rf, mixer osc. 2 I.F.'s, 1 limiter, 1 disc. rectifier, tuning eye (not furnished), 3 gang tuning condenser, built in 110v A.C., 300 V power supply, 300 ohm dipole input. Each unit checked and guaranteed. Completely wired, ready to plug in. Supply limited.

$24.95 With 7 Tubes

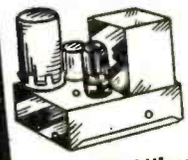
Special Purchases!!
LIMITED SUPPLY ONLY
ALL ITEMS SUBJECT TO PRIOR SALE
Order Now!



F. M. CONVERTER

From old 42-50 Mc. band to new 108-88 Mc. F.M. band
Bring your old F.M. set up to date with this easy to install converter. Formerly $15.00. They won't last forever!

Our Price Complete **$5.00**



12V Vibrator Pack

Output 270 V.D.C. @ 65 Ma. Ideal for aircraft or boats. **$7.50**

12V Vibrator

4 Prong.

75¢ Each
10 for $5.00

TUBES!

YOUR CHOICE **50¢**

OZ4	6J5	12C8
1G5	6K7	12SA7
1A7	6J7	12SF7
1R6	6S8	12SG7
1S5	6SA7	12SH7
1T4	6SG7	12SK7
2C26	6SJ7	12SN7
1LC6	6SN7	12SQ7
3S4	6SK7	31
5R4	6SQ7	35L6
5U4	6V6	35W4
VR150	6X5	35Z4
5Y3	6Y6	50B5
5Z3	7F7	50L6
6AB7	7N7	VR105
6AC7	12A6	954
6AG5	12AT6	955
6AG7	12AH7	956
6C4	12BA6	9004
6F6	12BE6	9006
6H6		2051

6SL7	$0.75	3B24	$3.00
100TH	5.00	5CP1 with socket	3.96
250TH	5.00	715B	3.00
6B4	.75	724B	1.00
1LH4	1.00	1N5	.75
2C40	2.50		

Special bonus: Deduct 10% for orders of $20 or over.
All popular brands, some in original cartons, money back guarantee.

XTAL DIODES

1N22 1N23 1N27 1N29 **50¢** Each

CRYSTAL PHONES

200-600 ohms. Unusually sensitive. Less rubber pads. Used. Guaranteed perfect working order.

50¢ Each
10 for $4.00

SOLDERING IRON $1.50 Each

100 Watt 110V AC

THIS MONTH'S FEATURE KITS!

Short Wave Experimental Receiver Kit

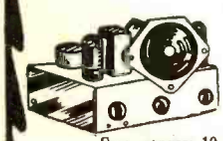
2-30 MC. 2 dual triodes, 6SL7 and 12SN7, provide 4 tube sock. Kit comes complete, except speaker

$4.00 Per Kit

BROADCAST BAND TRF

$6.95 Less cabinet. Includes speaker, tubes, wound oscillator coil, etc., etc.

Most amazing 2 tube circuit on the market, provides 4 tube operation. Has nearly as much sock as ordinary 6 tube superhet. Ideal for the beginner, student or hobbyist. Can be built in several hours.



WALKIE TALKIE

$10.00
2 for $18.50

Freq. ranges: 10, 5, 2½ meters. 2 tubes gives 4 tube operation. Operates off 90V battery. Operating range up to 20 mi. Includes speaker, tubes, etc.

25 POUNDS OF RADIO PARTS

We are swamped with tremendous quantities of parts that cannot be placed in our regular stock. Worth many times selling price. We must sell at the ridiculously low price of

25 lbs. for $3.00

25% Deposit on All C.O.D. Orders.
All Items F. O. B. Chicago, Ill.

GUARANTEED NEW AND PERFECT METER BARGAINS

YOUR CHOICE **$3.00**

Sangamo 0-50 DC MA, both sides center, 3" round.
Triplett 0-15 RF Amps, 3" round.
McClintock 0-15 DC MA; 0-150 MA; 0-300 MA; 3" square face.
Weston 0-200 MA, 3" round.
Aero Frequency Meter 380-420 cycles per sec.; 125V; 3" round.
McClintock 0-5 MA, 3" round.

Westinghouse A.C. Industrial Meters
KA-25 Type, 6" Square Face, Brand New! Original Cartons

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0-200 Amps
0-250 Amps
0-300 Amps
0-150 Kilowatt
0-600 Volt with Shunt

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ohms or one fifth the value of R_5.

As reactance tubes are very sensitive to voltage changes, the plate voltage for the 9001 is obtained from the voltage regulator. Stabilization of the voltage in this manner prevents any undesired frequency shift caused by varying plate voltage.

When first tried, the frequency drift due to warm up was quite serious. However, with the values of condensers shown in the oscillator circuit, this drift has been reduced to where the starting frequency and final frequency difference is only 900 cycles after 15 minutes' operation. This value is better than most crystal oscillators. In other mechanical layouts it would probably be necessary to use different values of compensation.

The microphone used is a surplus T-17 type. As there was much more audio available than necessary, this was reduced somewhat by the inclusion of a 200 ohm resistor in the microphone lead. This also improves the audio quality as the microphone voltage is reduced to a low value.

When construction has been completed, the shorting link across the power plug should be opened and the 2E30 tripler removed from its socket. The deviation control R_2 should be set at minimum.

An accurately calibrated receiver or frequency meter, capable of tuning the range of 9000 kc. to 10,000 kc.,

NEW NBFM AUTHORIZATION

A NEW order recently promulgated by the Federal Communications Commission specifies the frequencies and types of emission available for the operation of amateur radio stations. The order includes the authorization for use of the band 5650-5925 mc. which the Commission recently allocated to replace the amateur band 5650-5850 mc. The allocation of the wider band contained a qualification to the effect that amateur operations between 5775 and 5925 mc. are subject to such interference as may result from the operation of industrial, scientific, and medical devices assigned to the frequency 5850 mc.

The order also authorizes the use of narrow band frequency modulation for radiotelephony in the bands 3850-3900 kc. and 14,200-14,250 kc., by Class A amateur radio operators at stations licensed to the holders of Class A amateur radio operator licenses. In addition, the holder of any class of amateur radio operator license is authorized to use narrow band FM radiotelephony at any licensed amateur radio station on frequencies from 28.5 to 29.0 mc. and from 51 to 52.5 mc.

This authorization is on an experimental basis until further order of the Commission, but in no event to continue beyond August 1, 1948. The Commission stresses the fact that this authorization is on a temporary experimental basis, subject to cancellation at any time, if after a reasonable trial period, experience shows that NBFM is not desirable in portions of the amateur phone bands also occupied by AM amateur signals.

SPRAGUE TRADING POST

SWAP—BUY OR SELL

FOR SALE—10" meter receiver, 1851-HY615-6F6; with coils, tubes, less power supply $14; 5 band coil switch turret assembly, 75 watts, $4; T-200, good condition $5; high voltage replacements for 872 rectifiers, exact substitute, will deliver 8000v d-c, $2.50 ea., $4.50 pair. Bill Benner WoPJo, 145 S. Maple, Webster Groves 19, Mo.

FOR TRADE—30 watt, 80 meter, fone, c-w transmitter complete with tubes, coils, power supply and mike. Want TR4 with tubes and power supply or similar 2 meter transceiver. James Rector, W6ZRB, 3555 W. 109th St., Inglewood, Calif.

FOR SALE—Meissner communications 14" receiver, 5 band 38 to 555 meters with 12" dynamic speaker in excellent condition, everything included, $125. Donald E. Schultz, Edcouch, Texas.

SELL OR TRADE—BC-312 receiver, revamped, write for details. Want RME69 or what have you? Meyer Birnboim, 70 Polson Ave., Winnipeg, Manitoba, Canada.

SELL OR TRADE—Recorder, Presto K. $280 or swap for Hallicrafter transmitter HT9 or Collins 32-RA for 10 meter operation or a comparable phone-CW transmitter. W6PFK, Eichenberg, 2271 Hayes St., San Francisco, Calif.

FOR SALE—Complete 200 watt transmitter with 813 final, mod. 811's in rack cabinet; Sky Champ receiver and spare parts of all kinds including CR tubes, transmitting tubes, etc. Jim King, WJZM, Clarkeville, Tenn.

FOR SALE—Millen R-9'r, complete with 6AK5, $20. Want Stancor P-6170 or equivalent. George M. Boyd, W9SIT, 2457 Armitage Ave., Chicago 47, Ill.

FOR SALE — Latest Hallicrafter S-39 Ranger portable 9 tube battery or ac-dc operated communications receiver. Aligned and complete with batteries and instruction manual; used less than 100 hours, $100. W. H. Horton, W4FHB, Box 666, Stanford University, Calif.

FOR SALE—Hallicrafters 15 tube receiver, SX-28; 550 kc—42 mc, including matching Hallicrafters-Jensen bass reflex cabinet with 12" speaker. Excellent condition, $200. Otto Pollei, Jr., 2122 Edgeland Ave., Louisville, Ky.

FOR SALE—Hallicrafters S-36, practically new $300; also partly assembled Meissner traffic master $75. Lon G. Rankin, 738 Patterson Ave., San Antonio, Texas.

SELL OR TRADE—BC957A radar receiver-indicator including 31 tubes, 5HP4 and WE708B, UHF grounded grid amplifier; 13 tube receiver with 7 IF's; sweep generator and amplifier; video amplifier; 115v-60r. H.V. supply, etc.; sold by W.E. for $2500. Want communication receiver or 5" oscilloscope. W. G. James, 93 Georgia Ave., Oak Ridge, Tenn.

FOR SALE—Signal Corps bug, J-36 used little $4. Omar Evans, Hazelton, W. Va.

FOR SALE—New Dumont 5" oscilloscope, Philco audio signal generator, small amplifier, 35 watt phone-cw transmitter. Wayne Storch W9FOC, Beecher, Ill.

WILL TRADE—100 watt, 7 tube transmitter, 4 bands M.O.P.A. 3—807's. Want good communications receiver, good tube tester or what have you? Gordon Simkin, 3405 Farago Ave., El Monte, Calif.

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FOR SALE—DeLuxe Midwest radio, 16 tubes A-1 condition, chassis, all tubes and speaker. Needs re-alignment on high frequency bands. $35—Frank Bou, W3ESX, 3131 N. Percy St., Philadelphia 33, Pa.

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WANTED—Hallicrafters S-38 receiver also battery portable. Charles Holstein, 246 E. 148th St., Bronx, N. Y.

FOR SALE—8 tube communications receiver, 6 wave bands designed by M. Silver; 12" Jensen speaker in bass reflex cabinet $75. J. G. Deutsch, 4715 Sylvan Ave., Pittsburgh 7, Pa.

FOR SALE—BC-645, new partially converted for ham operation, 12v dynamotor for BC-645A, RG8U cable or will trade for BC-654 in good condition. J. H. Gagnon, Shirley Mills, Me.

FOR SALE—National FB7, 11 tube communications receiver with speaker and power supply $35. Also Zenith 6 tube superhet radio either portable or 110 volts, new batteries, good selectivity $50. Phillip Mills, Box 241, Oswego, Kans.

SELL OR TRADE—National ham bandspread NC81X receiver, Xtal filter; Foth-Derby camera f2.5, 1/500 second; U.S.M.S. radio correspondence course, all assignments completed and corrected. Want oscilloscope, high-fidelity loudspeaker. Arthur Freund, Whittier St., Hartsdale, N. Y.

FOR SALE—HRO5TA1, 7 months old, complete with speaker and power supply and 4 sets of B.S. coils. Like new, $200. C. H. Ernsberger, W2VSKY, Romulus, N. Y.

SELL OR TRADE—Western Electric 242-A tubes and 205-D tubes. All inquiries answered. A. L. Oliviera, W1PWL, 94 Potomska St., New Bedford, Mass.

FOR SALE—Ham equipment, transformers, chokes, coils, condensers, sockets, etc.; both new and used. Must break up station. James F. Mehren, W9SSS, Box 211, Tinley Park, Ill.

FOR SALE—National NC100-XA receiver with speaker. Perfect condition $170. B. B. Barker, 7W 4th St., Sterling, Ill.

SELL OR TRADE—Have complete 8 mm photographic apparatus including fan cooled projector, camera, screen, tripod, color and BW films and splicing unit to trade for good short wave receiver with at least three bands. Cash or trade. F. Machovec, 710 N. Glover St., Baltimore 5, Md.

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FOR SALE—Two transceivers, batteries, phones and mikes, antennas, tubes and parts for changing from 6 to 2 meters included. Perfect condition. Each unit $24 or $40 for two. Bob Crum, 1419 Schilling Ave., Chicago Heights, Ill.

FOR SALE—Hallicrafters S-40 almost new; complete with home-made S-meter, uncalibrated but accurate. $85. Marion Calvert, 1310 S. 9th St., Lawrenceville, Ill.

WILL TRADE—Components for 3 stage TRF, 6E5, 6J7, 76's, 2A3's, 12" Jensen, matching transformer, FP38 and phono motor. Want homebuilt midget oscilloscope and multimeter or $55. P. Morgan, 130 Wentworth South, Hamilton, Ont., Canada.

WANTED—Hallicrafters SX28A, not over $100; also preselector to cover 10-19-20-25 and 31 meter bands. Write full details. Jose Vezquez, 2640 S. 9th St., Philadelphia, Pa.

FOR SALE—TBY-8 portable transmitter-receiver, 28-80 megacycles; phones, mike, antenna, carrying case $40; also single tube amplifier $10. Edward Matthews, Jr., 171-35 Courtney Ave., Flushing, N. Y.

FOR SALE—100 watt input phone transmitter, 6V6 osc. 6V6 doub. 829 final. 6SF5, 6SF7, 6N7, 815 class B modulator. Two power supplies, 866 Jr. & 83 rectifier tubes, 500 volts, 300 mills & 450 volt, 250 mills. Complete with Turner xtal mike, 40 meter xtal and B & W coils for 10 meter band. $100. Frank L. Rigg, 5328 East Drive, Rockford, Ill.

WANTED — Stancor 10-P transmitter. Also SW-3 coils and coil rack. Arthur C. Wells, Sr., 1205 South L St., Arkansas City, Kans.

FOR SALE—300 tubes, all types, 25 assorted speakers, 15 Philco aerial kits; 2 portable phono with 3 tube amplification; phono pickups; power transformers; 6 volts filaments, Eastman 16mm projector, etc. Sell part or all. Write for list of items and prices. William Gorges, Atlantic Radio Service, Atlantic, N. Carolina.

WANTED—TU-17A tuning units for BC-223A and dynamotor power supply. Keweenaw Radio Shop, Calumet, Mich.

FOR SALE—Phone CW crystal rig, 40 watts, tubes 7C5, 6SJ7, 6J5, 3—6L6, 20, 40, 80 and 10 meter band. Complete with coils, tubes and power supply. $50. Frank Bou, c/o Bot. Dept. & of P., 38th & Woodland Ave., Philadelphia, Pa.

SELL OR TRADE—Johnson 10 meter KW coil, 80 meter CL adjustable KW coil & base; B & W JTEL 75 watt turret assembly 2A band hopper coils and VLS 80, 500w coil & base. Want various bud coils such as MLS-80 & base, OLS-80, OEL-10, etc. Verne L. Whynott, Box 512, Bridgewater, N.S., Canada.

FOR SALE—Two BC-1335 tranceivers, F-M 27.9 to 30 Mc. FB for 11 or 10 meter mobile operation. Self contained 6 volt power supply. $20 ea., crystal controlled. Gus Slack, 2328 44th St., Des Moines 10, Iowa.

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should be used to set the oscillator frequency. The oscillator tuning condenser C_{10} should be set at minimum capacity during this operation and the bandset condenser C_9 rotated slowly until the oscillator frequency is approximately 9900 kc. In the unit described this occurred with the bandset condenser at approximately half scale.

When the high frequency end has been set the tuning condenser should be turned to minimum and the frequency again checked. The frequency should now be approximately 9050 kc. Insufficient range is an indication of too little inductance in the oscillator coil. Forcing the turns of this coil closer together or adding a turn or two will increase the inductance.

In the event the frequency range is too great, a turn or two should be removed from the coil, or the turns spread slightly. When the proper range has been attained, the coil should be coated with a good coil dope to prevent further changes.

The 2E30 tripler may now be placed in its socket, the shorting link reconnected, and the tuning condenser C_{16} tuned for resonance. A neon bulb touched to the stator plates of the condenser will indicate maximum output. At this point, the use of an absorption type wavemeter is desirable to prevent tuning to the wrong harmonic. With the values given, resonance will occur at about mid-scale.

A 0-10 ma. meter should now be inserted in series with the grid leak of the final, R_{10}. It is essential that the r.f. choke be used in series with the grid leak if sufficient excitation is to be obtained. No choke is needed on the tripler due to the high value of grid leak used.

Retuning the tripler should give a grid current of 6 to 10 ma. as indicated on the meter. When plate voltage is applied to the final this will drop to approximately 5 ma.

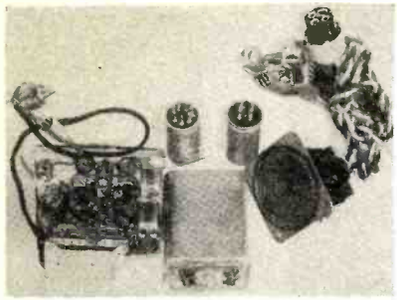
A load may now be connected to the final, consisting of a 25 watt lamp coupled to the final tank by a one or two turn link. Removing the dummy phone plug will apply voltage to the final. A 0-200 ma. meter should be plugged in the meter jack J_1. The final should be quickly tuned to resonance as determined by the brightness of the bulb, and minimum plate current.

Power requirements are 6 volts at 2.15 amps. and 350 volts at 150 ma. A 350 volt dynamotor was used in this installation, although one of the surplus PE-103 units could be used. If the PE-103 unit is used, it will be necessary to make R_{11} a 3000 ohm, 20 watt unit to reduce the voltage on the oscillator and tripler to the proper value. R_{12}, the screen resistor in the final stage, should also be changed to a 10,000 ohm value.

The link will vary depending on the type of antenna feed used. With a quarter-wave antenna mounted on the car bumper, and fed with 52 ohm coax, a one turn link gave a loading of 90 ma. If a 500 volt plate supply is

Here it is

BC-728-A FOUNDATION KIT



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1—spare receiver as illustrated ..... value $ 1.79
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Complete total value....$26.71

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Special..... **$1.89**
Original Cost $25.00
6 foot extension cord.....$0.49

CARBON THROAT MICROPHONE

This microphone will work into any 200 ohm impedance input circuit. Has adjustable strap to fit any neck. In operation this microphone is strapped around the throat thereby facilitating full freedom of both hands and head movement. Ideal for ultra high frequency mobile work for hams. Can also be used as a hi-grade Carbon Mike by simply drilling three holes in case. Sensitivity of this mike equal to mikes costing $10 and $15. Supplied with strap, 10" cord and plug.
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1T4	1.10	30	75c	813	5.95
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1N5GT	1.10	35Z3	99c	815	2.25
1N21B	35c	35L6	99c	826	1.75
1LN5	1.92	32L7	1.50	829B	3.95
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1S5	1.10	37	69c	832	2.25
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3Q5GT	1.10	39/44	59c	837	2.50
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6AG7	99c	50B5	1.59	8005	3.25
6AK5	99c	50L6	99c	8011	4.95
6AL5	99c	70L7	1.59	8012	4.95
6AT5	98c	71A	69c	8016	1.49
6B4	1.29	75	69c	0Z4	1.25
6B6G	89c	713A	1.65	2D21	75c
6B8	99c	717A	1.25	2X2	84c
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6C5	51c	955	75c	4C/3S	7.95
6C21	12.95	956	75c	5R4GY	1.15
6C6	75c	957	75c	5T4	98c
6D6	75c	958A	75c	5U4	98c
6F5	51c	959	75c	5W4	98c
6F6	95c	1614	1.75	5Y3	60c
6F6G	80c	9001	1.15	5Y4G	59c
6F7	1.25	9002	98c	5Z3	89c
6F8	1.10	9003	98c	5Z4	89c
6G6	1.10	9004	98c	6X5	89c
6H6	59c	9005	98c	25Z6	98c
6H6GT	89c	9006	69c	35Y4	99c
6J4	1.50	10Y	1.50	35Z5	99c
6J5	59c	15E	1.50	80	75c
6J6	89c	HF100	6.95	82	98c
6J7	80c	HY69	1.75	83	94c
6K6	69c	HY75	1.25	83V	98c
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6K8	1.25	T20	1.95	2171C	7.50
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6N7	1.25	2C26A	75c	872A	2.25
6R7	98c	2C34	1.15	884	75c
6SA7	90c	2C40	2.60	991	50c
6SC7	85c	2C44	1.75	2050	90c
6SF5	79c	2E25	3.95	2051	90c
6SG7	89c	2E30	2.25	8020	5.95
6SH7	65c	2J32	20.00	RK60	1.25
6SJ7GT	69c	2J33	20.00	RK72	3.50
6SK7	79c	211	1.25	VR78	75c
6SL7	89c	2J56	20.00	VR90	75c
6SN7GT	69c	3C24/	1.35	VR105	75c
6SQ7	89c	3E29/	2.95	VR150	75c
6SR7	89c	75T	2.95	Z22S	1.95
6SS7	75c	304TH	9.85	874	1.95
6Q5	98c	304TL	4.95	1613	95c
6Q5G	98c	307A	8.25	1616	2.95
6U5	98c	446A	2.60	1619	98c
6V6GT	99c	6C4	64c	1624	98c
6Y6G	89c	703A	7.50	1625	98c
7AE7	75c	705A	4.95	2AP1	2.25
7C4	1.50	715B	4.95	3AP1	3.45
7F7	1.25	723A/B	9.95	3BP1	2.95
7L7GT	1.39	800	2.25	5BP1	3.95
12AT6	1.10	801A	1.25	5BP4	5.45
12SA7GT	99c	802	1.49	5CP1	3.95
12SG7	89c	803	8.95	7BP7	7.95
12SH7	89c	805	3.75	913	3.00
12SJ7	79c	807	95c	7DP4	14.95
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used, the maximum final current should be held to 75 ma.

In operation it is possible to vary the output frequency by over 100 kc. with no noticeable decrease in output without retuning the transmitter. With an input to the final of 32 watts, the measured output was 22.5 watts.

When tuning of the r.f. section has been completed, the microphone should be connected, and the deviation control slowly advanced as the microphone is spoken into. A receiver should be used to monitor the transmission as this is done. The deviation should be kept as low as possible, consistent with satisfactory reception. In the rig described, using the T-17 microphone, the deviation control is normally set at slightly less than ¾ full on.

A receiver, especially designed for use with the transmitter, and of approximately the same size, is currently being designed. This receiver will afford either narrow-band FM or AM reception.

—30—

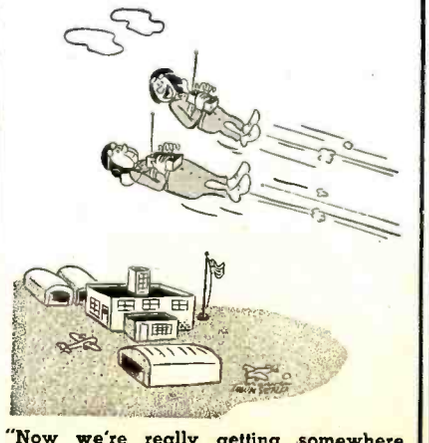
DAD TAKES OVER

THE Federal Communications Commission has granted the plea of Ernest Melvey, 6416 Francis Avenue, Seattle, Washington for permission to change his amateur station call letters from W7HVS to W7HUX.

In order to do this, the Commission waived Section 12.81 of its rules which requires that amateur calls be assigned systematically to prevent partiality. The extenuating circumstances which caused the Commission to make this exception was Mr. Melvey's desire to use the call letters of an amateur station which had been operated by his late son, Robert, who died in action aboard the cruiser "Nashville" when that ship was hit by a Japanese suicide plane during the war.

The Commission was impressed by the father's wish to perpetuate his son's call letters on the air "in remembrance of the good times" the two had together. In granting this particular request, however, the Commission indicated that it did not mean that it was relaxing its long adhered to policy against transfer of amateur call letters or requests for particular amateur calls.

—30—



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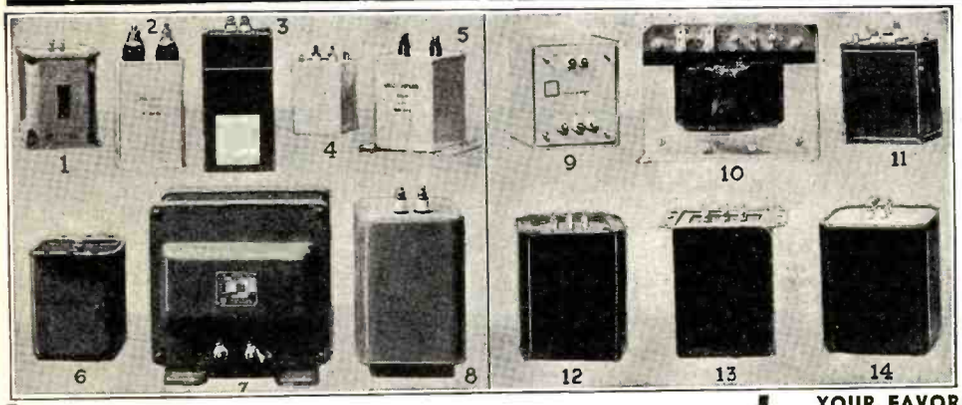

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Serviceman's Tube Tester

(*Continued from page* 59)

instrument full scale current to permit an accurate setting of the 200 ohm potentiometer "*C*" load control.

In the heater cathode type triode and pentode check, Fig. 3C, the plate voltage at the transformer remains at 30 volts and is connected directly to the tube under test. The 1800 ohm resistor in series with the negative instrument terminal still further increases the instrument full scale current to permit proper instrument indication.

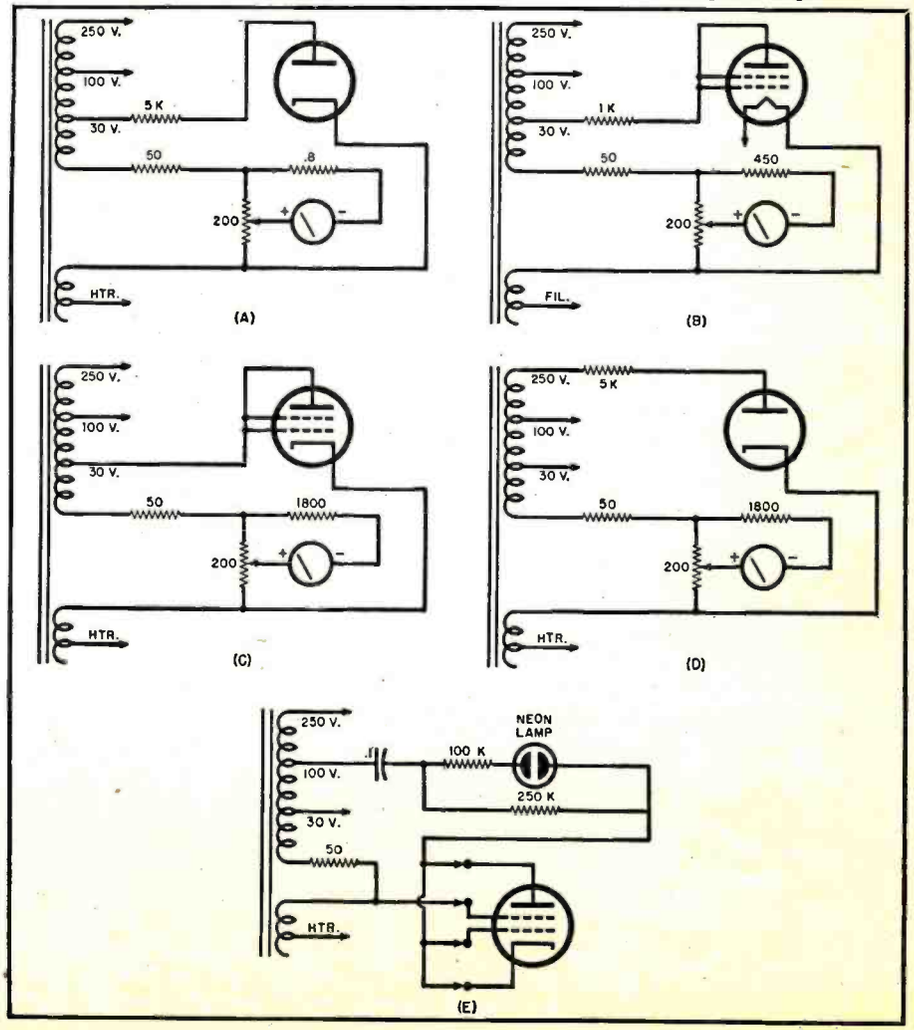
In the eye tube and gaseous rectifier check, Fig. 3D, sufficient voltage is applied to the plate to insure proper ionization of the gas. The 5000 ohm resistor in series with the 250 volt plate tap protects the tube against excessive current flow yet it is low enough to insure full plate loading on gaseous rectifiers. The 1800 ohm resistor in series with one of the instrument terminals increases the current required for full scale deflection of the test instrument.

An eye tube is checked by visual inspection of the tube itself. 250 volts are applied to the eye control electrode plate for the eye-closed check and 0 volts for the eye-open check (250 volts are applied to the target in both tests).

The short-test circuit, Fig. 3E, consists of 100 volts a.c. applied to all elements through suitable limiting resistors, 100,000 and 250,000 ohms. The .1 μfd. blocking condenser in series with the 100 volt transformer tap prevents the neon lamp from glowing due to electron flow in the tube under test. By following the short-test procedure given in the instructions, a short check is made between each element of the tube including the shield. This test will generally indicate "shorts" of 500,000 ohms and less.

A continuity test of each element to its base pin and of all internal taps may be made as shown in the operating instructions. Moving an element connection will result in a change in instrument indication as the element connection is broken by the lever switch. Satisfactory internal pin connections, such as taps and jumpers, are

Fig. 3. Simplified circuit diagram of each of the several test circuits incorporated in tube tester: (A) for diode type tubes, switch S_2 in position 1; (B) for filament type triode and pentode tubes, switch S_2 in position 2; (C) for indirectly heated cathode type triode and pentode tubes, switch S_2 in position 3; (D) for target and eye tubes, switch S_2 in position 4 and for gaseous rectifiers and gaseous control tubes, switch S_2 in position 5; (E) short check, switch S_3 in "Short Check" position. Switch positions refer to the schematic diagram, Fig. 2.



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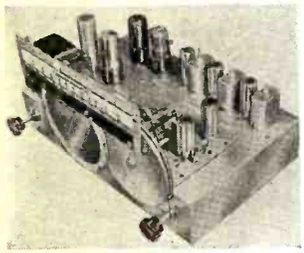

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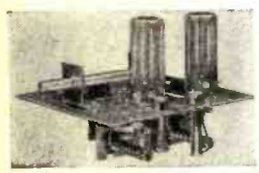

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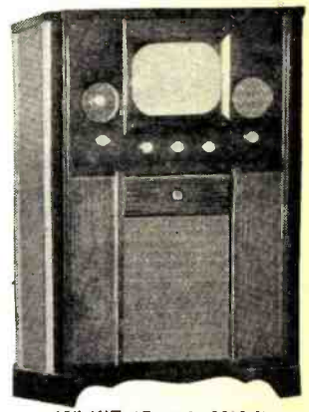

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October, 1947

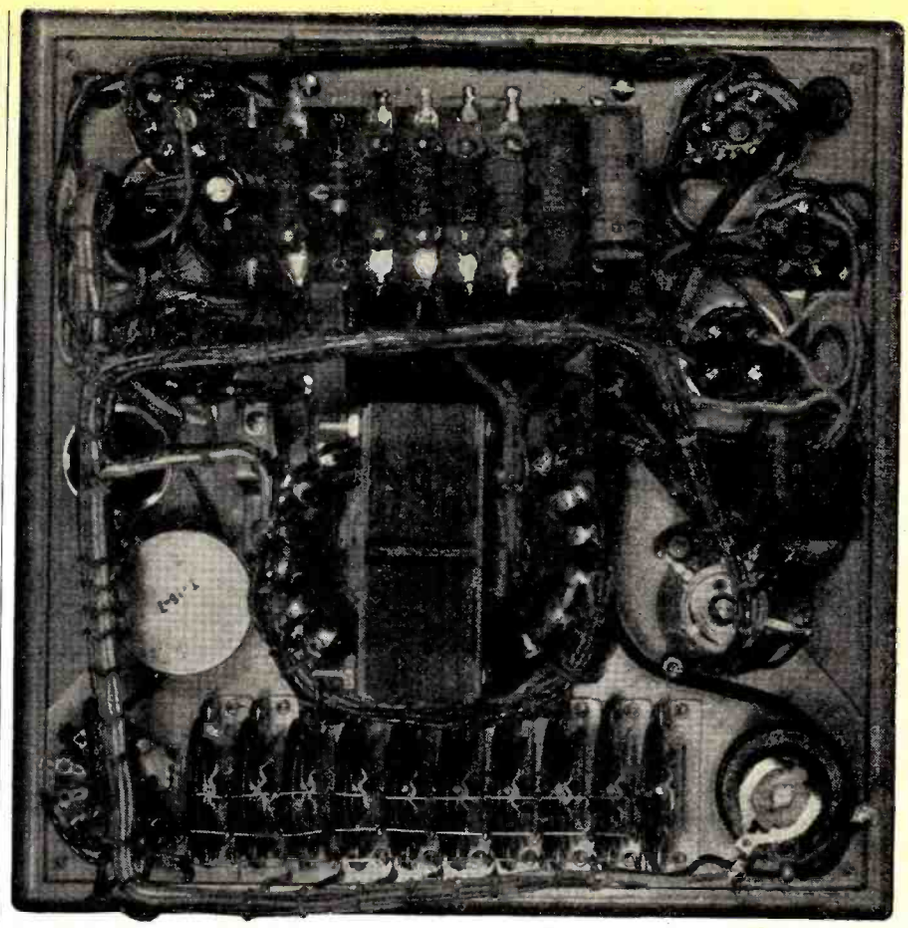
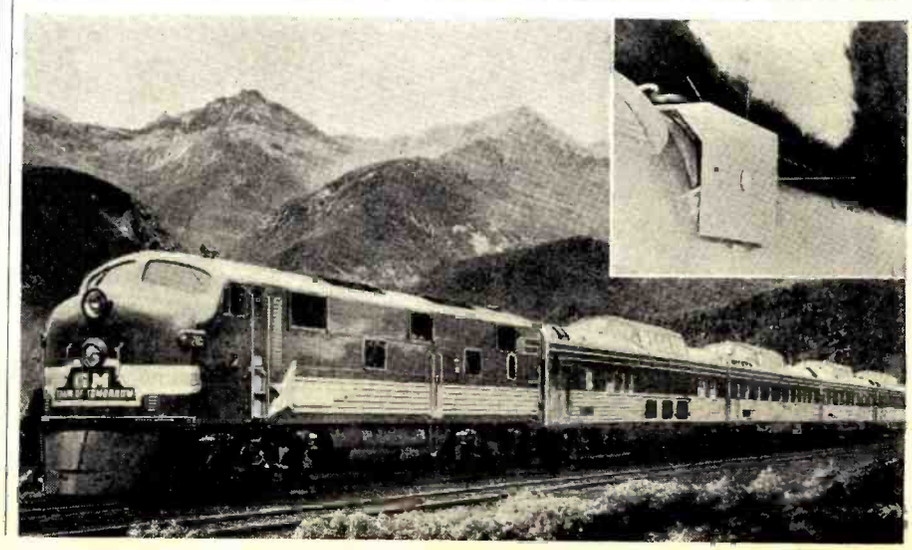


Fig. 4. Internal wiring and placement of component parts of the tube tester.

indicated by a glow of the "short-test" lamp with the test knob in *"SHORT"* position.

Changes in line voltage and variations due to different filament currents are compensated for by adjustment of the line control knob (R_1). This changes the transformer primary voltage and the correct voltage is indicated by a rectifier type voltmeter connected across the transformer 100 volt secondary winding. The *"GOOD-BAD"* indicating instrument is converted to a simple rectifier type voltmeter by turning the "test" switch to *"LINE"* position. —30—

Two great titans of the transportation world were linked recently when passengers aboard the General Motors' "Train of Tomorrow" talked to persons aboard the H.M.S. Queen Elizabeth in Mid-Atlantic. The 152-162 mc. band was used for the transmission. A Motorola transmitter-receiver was installed in the train and used for talk-out only. An a.c. operated receiver was used to pick up the talk-back from the ship. An aerial pickup of the transmission was made and then carried over leased wires to WGN where it was carried over Mutual landlines to New York, then via ship-to-shore radio to the ship. Inset shows the ground plane antenna with quarter-wave whip used on train.



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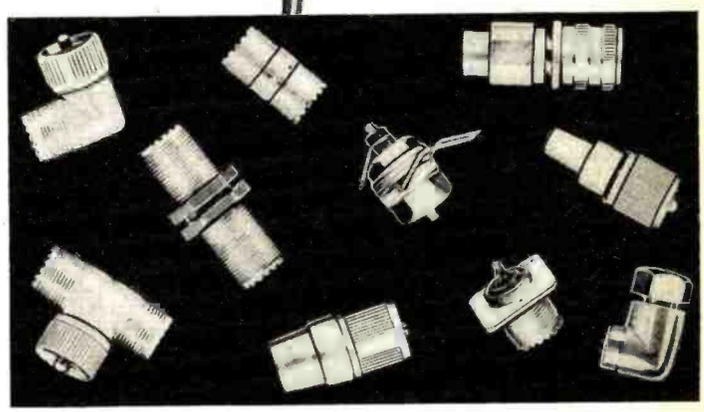

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"HIGHWAYS IN THE SKY—THE STORY OF THE AACS" by Louis Shores. Published by *Barnes & Noble,* New York. 252 pages. Price $3.00.

Major Louis Shores, historian for the AACS, has written a thrilling and thoroughly readable report on the often unappreciated work of the Army Airways Communications System. Although the general public rarely heard of the work of these men, many aviators, following the skypaths laid out by these radiomen, owe their lives to the fact that this ingenious and hard-working part of the Army had blazed unmistakable trails across the uncharted wilderness of the sky.

Although the wartime usage of the AACS system is a thing of the past, the stations and routes set up by this group can now provide new highways for the ever-growing, world-wide commercial aviation network.

Beset by difficulties and tragic shortages of materials, the work of the AACS and this book stand as a tribute to American radiomen. The teamwork displayed by this widely scattered branch of the service is worthy of the best radio tradition.

We would like to recommend this book enthusiastically to our readers because it is moving tribute to that unsung profession which can be depended upon in a crisis to make good bricks without straw—or rather workable equipment from materials at hand. All royalties on this book have been assigned to the AAF Aid Society so in purchasing this book you are not only letting yourself in for a lot of good reading but helping out a very worthy cause.

* * *

"AIRCRAFT ELECTRICITY FOR THE MECHANIC," by Charles Edward Chapel. Published by *Coward-McCann, Inc.,* New York. 461 pages. Price $5.00.

There are few texts on the market today that are devoted exclusively to a single phase of the electrical field as applied to a specific industry. Sensing the need for a practical, "how-to-do-it" book on the subject of aircraft electricity, the author has prepared a thoroughly workable text which may be used either as a home study volume or in formal classroom work.

Since the problems encountered in the servicing of aircraft differ greatly from those to be found in other electical fields, the book deals directly with electrical circuits as they are found in modern aircraft. After a brief but necessary discussion of the fundamentals of electricity, the author swings into the aircraft field with a discussion of the aircraft storage battery, generators, generator control systems, motors, ignition systems, aircraft electric instruments, engine starting systems, lighting, landing gear circuits, remote control battery system, electric propeller control systems, wire identification systems, etc.

Diagrams have been used extensively to illustrate the material under discussion. In addition, a series of review questions accompany each chapter in order that the student may check his grasp of the subject and so prepare for licensing examinations.

Three especially valuable chapters deal with aircraft electrical inspections, outlining the procedures and requirements; how to get a job; and a listing of the tools which the aircraft maintenance electrician will need in his trade.

* * *

"SLIDE RULE SHORT CUTS" by W. P. Miller, San Diego, California. 15 pages. Price $1.50.

The second edition of this slide rule handbook has been especially designed to assist radio and electronic engineers, and technicians with a practical guide to slide rule techniques.

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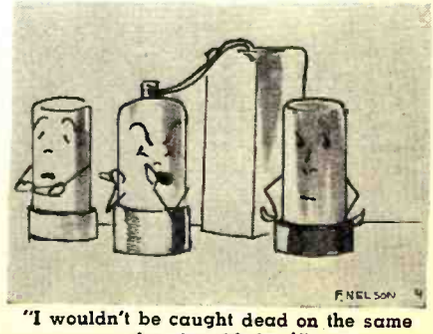
—30—



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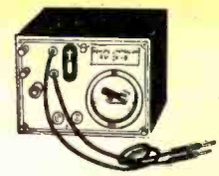

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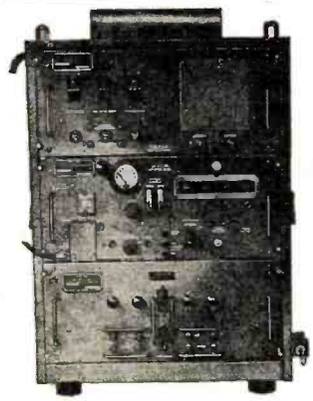

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600-watt Transmitter

(*Continued from page 63*)

It will be observed that the spacing of C_{19} is uncommonly low for a phone transmitter. This advantage is afforded, of course, by cathode modulation. The plate spacing is no greater than that ordinarily required for c.w. and the cost of the condenser is appreciably lower than that of the widely-spaced component usually employed at 2000 volts modulated.

Cathode modulation is likewise more lenient as regards excitation. The 807 furnishes sufficient grid drive for cathode modulated 810's. Type 8005 tubes probably would be still easier to drive.

The final amplifier output is link coupled through the coaxial fitting, J_4. This makes it possible to run a length of neat-appearing coaxial cable, such as *Amphenol* RG-8/U between the transmitter and a remote antenna coupler.

High-Voltage Power Supply

The main power supply must be capable of delivering 2400 volts of well-filtered d.c. to the transmitter. This voltage divides between the 810's and the 6L6's, with 2000 volts effective between the 810 plates and filament center tap and 400 volts across the modulator unit. The writer employed a variac in the primary circuit of the high-voltage transformer, T_7, as shown in Fig. 2. This was because the d.c. voltage delivered was nearer 2600 than 2400 and needed to be reduced. However, if the d.c. output voltage is near the 2400-volt mark in a reader's transmitter, the variac will not be a *must*, although an added refinement.

Metering

A plug-in d.c. milliammeter is used in the various circuits of the exciter. Plugged into jack J_1, this meter reads oscillator cathode current. At jack J_2, 807 grid current is indicated; and at jack J_3, 807 plate current is read. The meter should have two ranges, 0-10 and 0-100 ma. Oscillator cathode current (under full buffer load) will be approximately 65 milliamperes. 807 grid current will vary from nearly zero to nearly 20 ma., depending upon the setting of C_6, but should be adjusted to 5 milliamperes maximum. 807 plate current must not exceed 100 milliamperes.

For personal safety and the prevention of short circuits, the 807 plate jack, J_3, must be insulated from the chassis and should be recessed sufficiently to prevent contact with the fingers when the meter plug is inserted. The 807 grid jack, J_2, must be connected "backwards" (that is, the jack frame must not be grounded, as is the case with J_1, but must be connected to the lower end of resistor R_1. If this is not done, the meter connections will have to be reversed when reading 807 grid current.

Grid and plate milliammeters are

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Push-to-Talk Circuit

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Since the modulator and speech amplifier receive their d.c. operating voltages from the final amplifier, the relay controlling the high-voltage power supply switches the audio stages on and off as well.

The 115-volt coils of the several relays are connected in parallel and the line voltage is fed to them through the push-to-talk push-button.

Keying

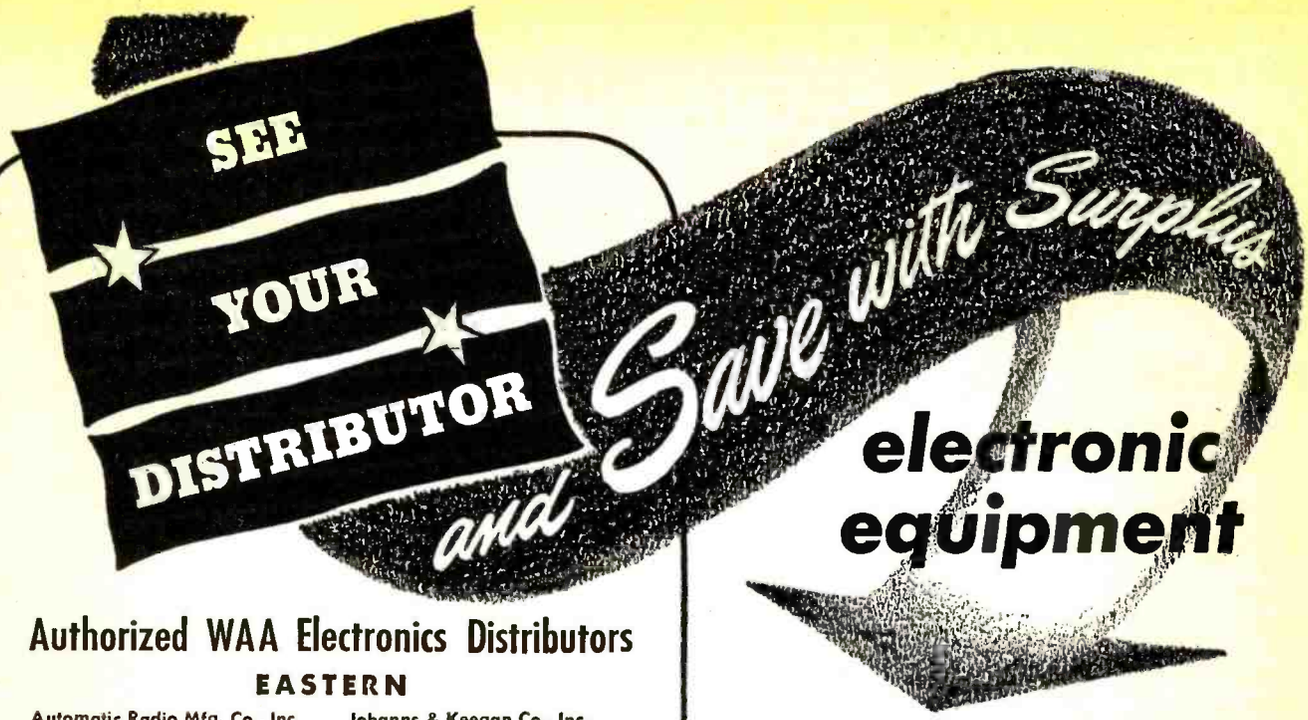
For c.w. operation, oscillator keying may be accomplished by plugging the key leads into jack J_1. The 6L6 modulator tubes must be left running in order to provide final amplifier grid bias. For final keying, a 4000-ohm, 20-watt grid resistor must be connected temporarily between the center tap of the 810 grid coil, L_3, and meter M_1. This resistor must be removed before the transmitter subsequently is used on phone. When keying with the modulator tubes running, care should be taken to remove the microphone and/or reduce the setting of the gain control to zero.

It appears that *electronic keying* of the final amplifier might easily be accomplished by means of a keyed d.c. voltage applied to the control grids of the 6L6 modulator tubes, that is, across resistor R_{17}. The speech amplifier gain control, of course, would have to be turned to its *"OFF"* position and the microphone removed. The voltage applied to the grids would have to be

Table 1. Complete winding specifications for oscillator plate coil, L_1.

BAND (METERS)	SPECIFICATIONS
80	37 t., #20 en. wire. Close-wound
40	21 t., #20 en. wire. Spaced by diameter of wire.
20	9 t., #20 en. wire. Spaced to winding length of 1½ inches.
10, 11	3 t., #20 en. wire. Spaced to winding length of ⅞ inch.

All coils wound on 1½" diameter forms



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negative and high enough in value to reduce the final amplifier plate current to zero. The circuit would be arranged so that depressing the key would remove this cut-off voltage from the grids. One way of accomplishing this would be to connect a keying relay in the circuit in such a way that its normally-closed upper contacts would be in series with the negative voltage and the 6L6 grids. The contacts then will be opened and the cut-off bias removed when the key is depressed and the relay coil energized.

Antenna Coupling

A coaxial cable, attached to J_1, may be employed to link-couple the transmitter to a conventional antenna coupler which then may be placed at the point where the antenna feeders enter the shack.

If a doublet antenna is used for transmitting, the far end of the coaxial line may be connected directly to the center of the antenna, no antenna coupler being required.

The variable link on the 810 plate tank coil, L_4, permits convenient and smooth variation of final amplifier loading.

Construction Hints

The various circuits of the transmitter are, in general, so conventional that all of the rules of good design and layout applied to other transmitters pertain equally well here.

In the exciter section, care must be taken to isolate the input and output circuits of the 807 stage. With this in mind, C_8 and L_3 must be enclosed in a heavy-gauge shield box or else mounted below chassis. C_{10} and L_2 must be kept above chassis. An external shield can must enclose the 807 tube and extend as high as to the bottom of the plate electrode. If there is any tendency toward parasitics in the 807 stage, 50-ohm, 1-watt carbon resistors must be connected in the 807 grid and screen leads.

There should be ample room on the final amplifier chassis for free circulation of air. However, over-long leads must be avoided. This applies especially to leads run between tuning condensers and coils. All external connections must be made to reliable terminal strips mounted on the backs of chassis.

Metal 6L6 tubes must be used in the speech-amplifier-modulator. Results are not nearly so satisfactory when 6L6G's are employed. Leads in this stage must be kept as short as practicable. The microphone jack, J_5, and the first grid resistor, R_7, should be enclosed in a small metal can to minimize hum and r.f. pickup. For the same reason (hum), filament transformer T_3 and filter choke CH_1 must be mounted on the end of the chassis farthest away from the 6SJ7 tubes. It is a good idea to mount the filament transformer on top of the chassis and the choke underneath. The lead connecting the 6L6 plates to the 810 filament center tap must be shielded with

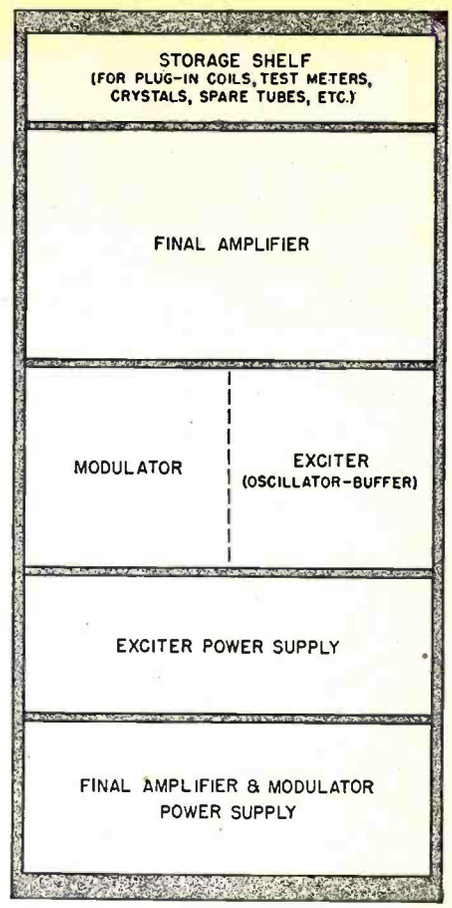

Fig. 4. Transmitter arrangement. Compare with Fig. 1. Cabinet measures 71 inches high, 37 inches wide and 20 inches deep.

metal braid and this shield must be connected to the modulator chassis on one end and to the final amplifier chassis on the other end.

The separate chassis must be bonded together electrically with a heavy conductor wire (at least No. 12) which, in turn, must be connected to the best available ground in the shack, for example to the *cold* water pipe. This is an important matter which must not be overlooked by the operator. Personal safety and stable operation are enhanced by this ground connection.

Assembly

Most amateurs undoubtedly will favor rack and panel construction, which is entirely permissible. Our personal preference is the plain chassis type of construction, since this allows us to place each component in its best electrical position with no concern as to the final appearance of controls on a front panel.

The accompanying photographs show how our transmitter is arranged. The separate chassis have been mounted on the adjustable-height shelves of a regulation steel utility cabinet. This cabinet, which is 71" high, 37" wide, and 20" deep, was obtained at an office-supply house and is usually known as an "office storage cabinet." The four lower shelves hold the transmitter chassis, while the top one is used to store extra plug-in coils, crystals, spare tubes, meters, and other trans-

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1LA6	1.60	6N7GT	1.10	12SK7GT	.75
1LB4	1.60	6P5GT	.90	12SL7GT	1.10
1LC5	1.60	*6Q7	.90	12SN7GT	.90
1LC6	1.60	*6R7	1.10	12SQ7GT	.75
1LD5	1.60	6SA7GT	.75	*12SR7	.90
1LH4	1.60	*6SB7Y	1.32	12Z3	.57
1LN5	1.60	*6SC7	.90	14A7/12B7	1.32
1N5GT	.90	6SD7GT	1.32	14H7	1.32
1Q5GT	1.10	6SF5GT	.90	14Q7	1.10
1R5	1.10	*6SF7	.90	14R7	1.10
1S4	1.10	*6SG7	.90	24A	.67
1S5	1.10	6SH7GT	.90	25L6GT	.75
1T4	1.10	6SJ7GT	.75	25Z5	.67
1T5GT	1.10	6SK7GT	.75	25Z6GT	.67
1U4	.90	6SL7GT	1.10	26	.52
1V	.62	6SN7GT	.90	27	.47
2A3	1.32	6SQ7GT	.75	30	.90
2A6	1.10	*6SR7	.75	32L7GT	1.60
3Q4	1.10	*6SS7	.67	35/51	.67
3Q5GT	1.10	*6ST7	1.10	35A5	.90
3S4	1.10	6U5/6G5	.90	35L6GT	.67
3V4	1.10	6U7G	.67	35W4	.57
*5T4	1.32	*6V6	1.32	35Y4	1.10
5U4G	.67	6V6GT	.75	35Z3	.90
5V4G	1.10	6X5GT	.67	35Z4GT	.55
5W4GT	.62	6Y6G	1.19	35Z5GT	.57
5X4G	.75	7A4	.90	36	.67
5Y3GT	.47	7A5	.90	37	.57
5Y4G	.52	7A6	.90	38	.75
5Z3	.75	7A7	.90	39/44	.67
*5Z4	.90	7A8	.90	41	.57
6A6	1.10	7B5	.90	42	.57
6A7	.67	7B6	.90	43	.90
*6A8	.90	7B7	.90	45	.55
*6AB7/1853	1.32	7B8	.90	45Z3	.75
6AC5GT	.90	7C5	.90	45Z5GT	.75
*6AC7/1852	1.32	7C6	.90	46	1.10
6AD7G	1.10	7C7	.90	47	.75
6AF6G	1.10	7C8	.90	50B5	.90
6AG5	1.60	7E5	.90	50L6GT	.75
*6AG7	1.60	7E6	.90	50Y6GT	.75
6AK5	.90	7E7	1.10	53	1.10
6AL5	.90	7F7	1.10	55	.75
6AQ5	.90	7F8	1.32	56	.55
6AQ7GT	1.10	7G7/1232	1.32	57	.62
6AT6	.75	7H7	1.32	70L7GT	1.95
6B4G	1.32	7J7	1.32	71A	.62
6B7	.90	7K7	1.32	75	.57
*6B8	1.32	7L7	1.32	76	.62
6BA6	.90	7N7	1.32	77	.62
6BE6	.90	7Q7	.90	78	.62
6C4	.75	7V7	1.60	80	.47
*6C5	.75	7Y4	.90	81	1.32
6C6	.67	*12A6	1.32	82	.90
6C8G	1.10	12A8GT	.67	83	.90
6D6	.67	12AT6	.75	84/6Z4	.75
6D8G	1.10	12BA6	.90	85	.62
6E5	.75	12BE6	.90	89	.27
*6F6	.75	*12C8	1.32	117L7/M7GT	1.95
6F8G	.90	*12H6	.75	117N7GT	1.60
6G6G	.90	12J5GT	.67	117P7GT	1.60
*6H6	.75	12J7GT	.75	117Z6GT	1.10

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mitter accessories. A protective grille made of metal lath normally covers the front of the lowest section, which houses the high-voltage power supply, but was removed temporarily for the photograph, Fig. 1.

The units on the various shelves are identified in Fig. 4.

The microphone is plugged into the left-hand side of the cabinet at the level of the third shelf which holds the modulator. An auxiliary microphone jack has been inserted through this cabinet wall and is protected electrically by a small microphone shield can, seen in Fig. 3. This jack is connected by a short length of shielded cable to a shielded plug which is shown plugged into the microphone jack on the modulator chassis in Fig. 3.

Adjustment and Operation

When the 810 final amplifier is operating properly, its grid current will be approximately 33 milliamperes; its plate current approximately 330 milliamperes. After carefully neutralizing the final amplifier and testing for and correcting any parasitics in this stage, the transmitter may be adjusted in the following manner:

1. *Be sure that the 6L6 tubes have finished heating up before ever applying plate voltage to the 810 stage!*
2. Tune exciter throughout.
3. Connect dummy antenna to transmitter output jack and tighten output coupling by swinging link at least three-quarters in on amplifier tank coil L_4.
4. Apply excitation to final amplifier and tune 810 grid tank to resonance. Reduce speech amplifier gain control to zero.
5. Apply 810 plate voltage and tune 810 plate tank to resonance. If 810 plate current is higher than 330 ma., and grid current is higher than 35 ma., reduce excitation and retune C_{19} until plate current is normal. But if 810 plate current exceeds 330 ma. and grid current is 33 ma. or lower, reduce 810 plate current by decreasing antenna coupling (swinging link out of L_4). If, on the other hand, 810 plate current is lower than 330 ma., increase antenna loading, excitation, or both, until proper grid and plate currents both are obtained.
6. Advance speech amplifier gain control to about half-scale and whistle into microphone. The modulation should cause some movement, usually downward, of 810 grid milliammeter, but only slight movement of plate milliammeter.
7. At this point, an oscilloscope and, if available, some form of carrier shift indicator should be employed to examine the modulation pattern and percentage. The signal should be listened to with a diode or crystal monitor. If good linearity and resultant good speech quality are not obtained, further adjustments should be made to excitation, antenna loading, and audio level until pleasing results are secured. After several tune-up sessions, the operator will become thor-

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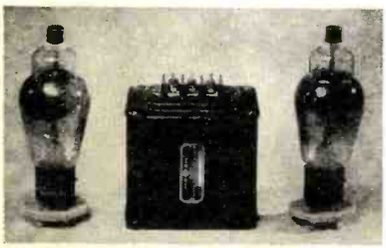

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TRANSFORMER ONLY for Two 866A's	$ 3.95
872A's COMB. TRANSFORMER, sockets	12.00
872A TRANSFORMER 115 60cy	6.95

W.E. Telephone jacks Type 223 four for	$ 1.00
RM-13G Remote Control telephone Amplifier	14.95
RM-53 Telephone remote control	2.95
BC605D Interphone Amplifier	7.95

Autosyn synchro differentials 115V/60cy	$ 6.95
Autosyn Type 5/50V, 115V/60c.....2 for	8.95
Autosyn AY1&5/24-28V/60&400cy, PR	3.95
AUTOSYNS XX1 REPEATER 115V/60cy, pair.	8.95
SYN REPEATER TYPEII/115V/60cy, pair	18.00

GR. VARIAC 200B/Variable 0-135V60c/1A.$9.95

Transf 115V/60c pri; 1200VCT/300ma	5.98
Transf. 115V/60cpri; 700VCT/120ma/ 6.3V/2.4A, 5V2/2Amp. $2.69...2 for	5.00
Tr. 115V/60c/pri; 500VCT/60ma, 6.3V/4A	1.49
TR 11 /60cpri, 1350VCT/150ma/6.3V/ 5A/5V/2A CASED UTC	7.50
TR 115V/60cpri; 1100VCT/212ma csd	6.50
TR 115V/60c p; 840VCT&154V/250ma	4.95
BLOWER 100CFM & Trans. 115V/60cy's	5.95
BLOWER 125CFM/115V/60c enclosed	8.95

Choke 20hy/100ma/98c; 50Hy/150ma csd	$1.49
Choke swinging 15-20Hys/150ma	2.95
Choke GE 12Hy/300ma cased HVins	2.95
Choke 15Hy/400ma/or20Hy/300ma/15KV	7.95
Choke 12Hy/500ma/95ohms csd HVins	9.95
Choke 3Hy 40ma/3 for $1; 0.5Hy/100ma/4 for	.98
3Hy/400ma/15ohms $2.75; 8Hy/200ma/2 for	2.89

Transf. Thordarson 115V/50-60cy; 1100 VCT/150ma, 6.3V 3A, 5V/3A HVinstld.s	3.95
Extension cord Hviduty 16ft & M&F plug.	1.00
Antenna bowl hf 2⅛"D & rod.....2 for	.98
Variable Condsr 18-157mmf/3000V	.98
Antenna SCM50/16ft & ins base & gnd	3.95
Antenna SCM50/18.5ft & ins base & gnd	4.95
Antenna sections SCM50/39½".....12 for	1.00
Antenna parabolic, Drive & selsyns MTR	16.95

COLLINS ART/13 SPEECH AMPLIFIER COMPLETE INPT

DYNAMIC OR CARBON MICROPHONE OR LINE INPUT: Output PP class "B" GRIDS. Noise Level down—55DB. INCLUDES INPT TRANSF, 1st AUDIO to PPGrids MODULATOR TUBES, 6V6 sidetone adj Audio osc AMP & Hdphone monitoring jack. WT 5LBS. DIM 7-½L 3½W 5"H, minus tubes & power supply. "TAB" SPECIAL..... $4.95

WITH TWO 6V6 & 6SJ7..... 7.49

W.E. 125 to 250 Watt multi-cellular, nine Driver trumpet complete. NEW	$125.00
REFLEX REENTRANT TRUMPET projector 35 to 55 watts with W.E. head complete	29.95
W.E.Driver PMheads 25to55 watt waterproof conservative rating $12.95	TWO for $24.95
W.E. Diaphragm ES671349-3 for PM heads	3.95
Speakers PM 4" Alnico 5/$1.30; 5" size	1.45
Universal tube & Voice Coil transformer	.98

$2 Min. order FOB N.Y.C. Add Postage all orders and 25% deposit. Worth 2-7230. Send for catalog 99. Specialists in International Export, College & Industrial trade. Money-back "TAB" Guarantee.

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THAT'S A BUY • • • CORNER CHURCH & LIBERTY STS., ROOM 200 • • • THAT'S A BUY

oughly familiar with the proper settings of the various controls for highest output, good quality, and high modulation percentage.

8. After all adjustments are made, remove dummy antenna and substitute regular transmitting antenna. Adjust antenna coupler, if any, for maximum loading consistent with good quality and high modulation percentage. If no antenna coupler is employed, adjust final amplifier loading by variation of the output link coupling.

—30—

Wireless Pre-Amp
(*Continued from page* 65)

quency end of the broadcast band is more "open" than the high so this end was used. With the values given a tuning range from approximately 580 kc. to 730 kc. is provided. If it is desirable to have this range nearer the high frequency end of the band use a smaller size mica condenser for C_9, e.g., 100 $\mu\mu$fd.

TELEVISION'S NEW EYE

TELEVISION has brought forth many developments in a multitude of fields until, today, pictures receivable in the home are rapidly increasing in clarity and quality.

One of the latest additions to the industry's growth was demonstrated for the first time over the air July 21, and met with immediate enthusiastic reception. This optical development, known as the Zoomar Lens, is designed to augment any existing camera facilities without severe mechanical or electrical adaptation problems. Invented by the physicist, Dr. Frank G. Back, already well-known from his work on the stomach camera and optical equipment for wartime projectiles, its primary purpose was for 16 mm. camera work. Later adapted for 35 mm. and television, it consists of a single unit, automatic focusing lens system which will cover the entire field previously scanned by a tri-turret assembly of 4-inch to 13½-inch lenses.

Installation of the unit on existing facilities accomplishes many purposes, a particularly important factor being the release of equipment previously tied up in multi-camera coverages of studio and remote presentations. It is designed in two models, one for outdoor or indoor sports events and the other for indoor stage type studio programming.

In its initial demonstration over the air on WCBS-TV, the double header ball game between the Brooklyn Dodgers and the Cincinnati Reds was given a coverage and a continuity never before screened for TV fans. The most dynamic illustration is in the case of a long fly ball to deep field. Initial focus is made on the pitcher-batter combination for the windup and the toss. When the ball is hit, the scanned width is enlarged as the ball soars toward the outfield, and is in sight on the screen at all times. As it nears the fielder about to make the catch, the field of vision is narrowed down and moved in on this player so at the time of the catch the fielder appears as large on the screen as did the batter at the time of the hit. It gives the viewer the impression of riding a camera boom to far outfield to closer observe the action taking place.

A study of the above description is self introductory to studio uses. For a small stage production, such as a play, the camera unit may be set up 25 or 30 feet from the action on a fixed mount and the entire proceedings scanned from this point. Full stage scenes, shifting to sectional action and close ups of individual actors, can be accomplished with smooth precision and on only one camera unit. Automatic elimination of moving dollies, heavy cabling, and hoarsely whispered instructions readily produces a large and much desired drop in stage noises. A new technique in following the action is easily developed, and the over-all gain in quiet operation and fluid continuity of view will pay off in large dividends.

—30—

New Zoomar lens attached to an NBC television camera. These new single-unit, automatic focusing systems replace multi-camera systems usually required for complete coverage.

SAVE TIME! SAVE MONEY!

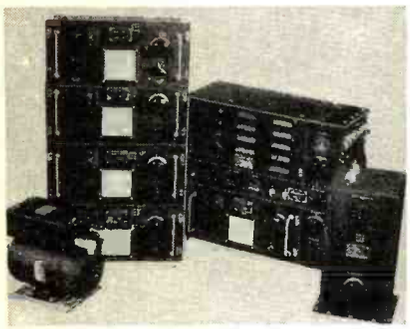
Free! A book full of schematic diagrams and conversion information on war surplus equipment such as BC-375-E, SCR-274-N, SCR-522, BC-221, APN-4, APN-1 and many others.

R & M Engineering Department has worked out the latest and many new ways to eliminate the worry and headaches of converting surplus equipment. This book contains wiring diagrams of each equipment and conversion information on how to adapt with wiring changes. One of these books *free* with each equipment you purchase. **We have selected the most desirable and choice radio gear and present them to you with a *SATISFACTION GUARANTEE*! *You save money when you deal with us.***

SCR-274-N COMMAND SET COMPANION OR STANDBY

Here are a couple of things you can do with equipment included in the SCR-274-N Command Set. The transmitter VFO driver stage gives you the BC-375-E higher RF output—as high as 150 watts. Make swell standby receivers with the BC-348 on round table "rag chews." Includes all this equipment: 3 Receivers—190-550 kc, 3-6 and 6-9.1 mc; two transmitters, 4-5.3 mc, 5.3-7 mc; four dynamotors—28 volts DC input; 1 modulator with carbon mike input; two tuning control boxes; one antenna coupling box with r-f ammeter; antenna relay and 5000 volt 50 mmfd. WE vacuum condenser (antenna relay can be used with most rigs); and a complete set of tubes for each unit—29 POPULAR TUBES in all. Mechanical cables with tuning receivers supplied for $1.00 extra. Complete diagrams and instructions on other conversions and uses furnished with set.

only **$19.50**



ARMY AIR FORCE BC-375-E TRANSMITTER

It's been written about and talked about—just the thing for beginner or old-timer. Has five tubes, 5 tuning units. Transmitter designed to operate from 200 kc to 12 mc (less BC band). Equipped with antenna tuning unit—BC-306-A—variometer and tap switch. Dynamotor (PE-73-C) complete with relay, fuses and filter. Diagram and instructions for its use supplied with each set. Weight approximately 275 lbs. only **$29.50**

SPECIAL COMBINATION
THIS MONTH ONLY

One SCR-274-N Command Set and One BC-375 Transmitter as shown in the illustrations above

BOTH FOR ONLY $39.50

Famous "PUTT-PUTT"

(HRU-28) DC POWER SUPPLY
24-28 VOLT at 70 AMPS—2000 WATTS

This unit is just fine for your Field Day, to operate your BC 375, ART/13 Collins trans., BC 348 Rec., and all your gear.

This gasoline engine generator power supply is a one-cylinder, two-cycle gasoline engine, approximately 4 horsepower. Automatic starting when 24-volt battery is attached. Voltage regulator adjustment can adjust from 12 volts to 35 volts, DC. Ideal power supply to operate all war surplus radio equipment (24 volt DC).

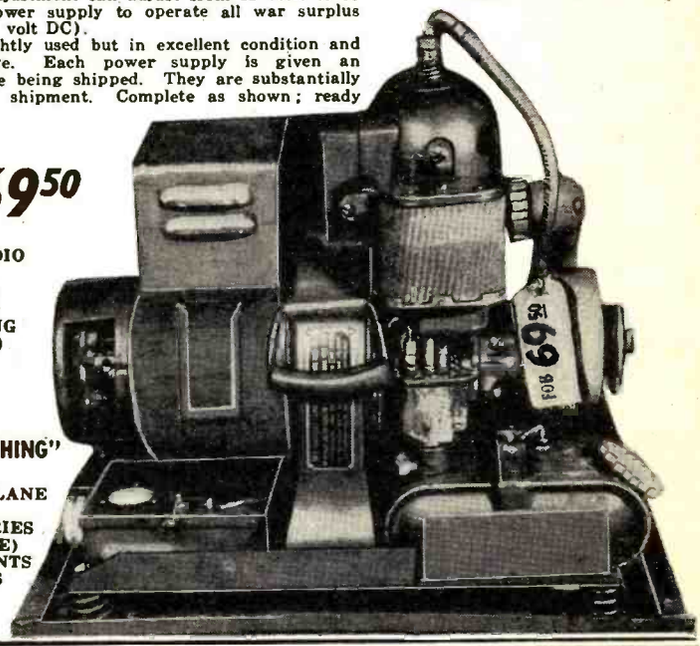
These units are slightly used but in excellent condition and guaranteed operative. Each power supply is given an operating test before being shipped. They are substantially crated for domestic shipment. Complete as shown; ready to operate.

The HRU-28 gasoline engine generator is the same as the commercial designation C-10.

Over-all dimensions:
Height 21½ inches.
Width 17½ inches.
Length 24⅝ inches.
Weight 115 pounds.

only $69.50

- AMATEUR RADIO STATIONS
- BOATS, LIGHT SYSTEMS
- FARM LIGHTING (AUXILIARY)

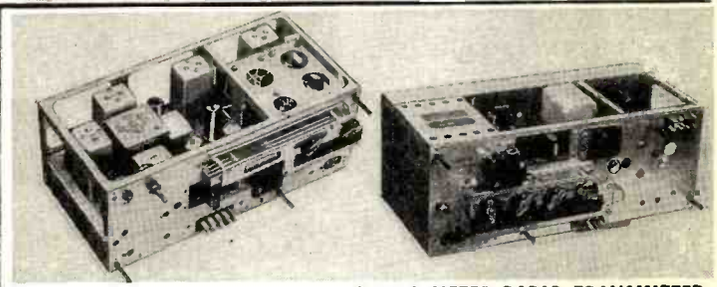


"OPERATES EVERYTHING"

- STARTING AIRPLANE ENGINES
- CHARGES BATERIES (FAST CHARGE)
- FARM IMPLEMENTS
- POWER MOWERS
- WELDERS

MOUNTS

Shock mounts and rack mounts of all types available for BC-348, SCR-274-N, BC-375 and SCR-522. Available at a very low cost. Write for listing of mounts today!



BC-624 VHF RECEIVER
2 METER

10 tubes, 4 crystal channels, tunes from 100 to 156 mc. Excellent receiver for the VHF experimenter. Does a fine job on 144 mc. Makes basic unit for conversion of FM or television.

only **$8.00**

2 or 6 METER RADIO TRANSMITTER
BC-625-A

The famous SCR-522 transmitter only, covers from 100-156 mc., crystal control, four crystal channels, seven tubes, two of which are 832's. 8 watts power output, 100% modulation, built-in modulator. Steady, reliable, beautifully made of finest components. Can be made to furnish 50 mc and 144 mc. Can be used as drive for any frequency above.

only **$12.50**

IMMEDIATE DELIVERY!

SPECIAL ON ANTENNAS

A 40-foot, heavy duty, light tubular steel, five section, telescopic antenna mast. Collar of each section has 3 guy wire points and uses cotter pins or bolts to secure sections. An ideal mast for mounting UHF directional arrays, television mast or all purpose antenna.

$19.50 each: two for $35.00

We save you time and money by shipping direct to you from our nearest warehouse . . . located in the East, Mid-West and West Coast.

SAVE C.O.D. CHARGES BY REMITTING IN FULL DIRECT . . . TO R & M RADIO CO. . . . OR SEND 25% DEPOSIT ON ALL ORDERS

R & M RADIO COMPANY

1426 N. QUINCY STREET • ARLINGTON, VIRGINIA

There are numerous types of electronic musical instrument pickups on the market, some of them using the magnetic principle and others the vibration type. Needless to say, price and the musician's preference will be the determining factors in any choice made regarding these units. In any radio catalog or music store types such as the *Turner, Brush, Amperite, Lectrolab* and others may be found. Any of these are suitable if they are the high impedance type. Similarly, any electric guitar may be plugged in to the instrument jack and any phono player may be used in its respective jack.

For the experimenter and radio builder this should prove to be a worthwhile project especially if one has musically minded friends who have or are interested in the electronic type of instrument. Compared with the cost of amplifiers ordinarily used for this type of reproduction, the cost of this unit is very nominal and it offers advantages to the professional or semi-professional musician as a supplement to his regular amplifier or for emergency use.

—30—

International Short-Wave

(*Continued from page* 68)

well as for the length of time he has aired his voice—dating back to 1919—well, that's something of a world's record, it seems to us.

Before the Japanese attack on Pearl Harbor, George Williams knew of the grave situation existing and on October 1, 1941, placed his radio facilities at the disposal of U.S. authorities in the Canal Zone. He was one of the first to start a radio program for the promotion of the War Bond Drive. On September 9, 1942, Arnold Bruckner, chairman, War Savings Bond Committee, Balboa Heights, Canal Zone, wrote him: "At the conclusion of the series of War Bonds programs which have been broadcast weekly since April 26, 1942, over the station, 'The Voice of Democracy,' I want to again thank you for your generous cooperation in making the broadcasting facilities available for this purpose. The ever-mounting sales of War Savings Bonds and Stamps in the Canal Zone are evidence of the fact that these broadcasts have materially aided in stimulating interest in the program, and I earnestly hope that you will be able to make these facilities available to us again in the event the programs are resumed, or for any special program that might be arranged."

Mr. Williams is an ardent supporter of democracy and the United States' "Good Neighbor" policy. He has often been heard to say: "Good will can do more to bind the Americas together—and thus keep war from our shores—than the doubling of the United States Navy, the building up of the Army, and even the two large oceans which divide us from the Old World and its continuous wars."

His campaign on behalf of democracy has not ended in Panama. He has written articles for every democratic paper that would print them in all parts of the Americas. As early as December, 1940, over a year before Pearl Harbor, he wrote in "Central America Express" of Costa Rica: "Are we callous to the sufferings of the world? Are we immune to the fate of democracy everywhere? Do we think that because, in the past, we have escaped, we shall forever be safe? To maintain peace we must expel war from the world—and to do this, we must help in stopping those that believe as their slogan 'Rule or Ruin' and those who use brute force as their weapon."

The magazine, "Export Trade & Shipper," January 20, 1941, reported that "George Williams with his famous 'Radio Newspaper' in Panama, has been doing an excellent job with his broadcasts on behalf of the U.S.A. and good will between the Americas, that his name and program were mentioned on the floor of Congress the other day by the Hon. John M. Coffee, Congressman, and an expert on Latin American affairs." Congressman Coffee wrote Mr. Williams, "Words fail me in attempting adequately to express on behalf of all liberty-loving American citizens the gratitude we feel because of the good will you have created for us."

During the war, radio entertainment for the Armed Forces from HP5J/HP6J did not stop with remote control broadcasts, although these programs took Mr. Williams as far away from the studio as Rio Hato. Special line service was installed by the Army Signal Corps and extended as far as the Limits, then into the Panama Electric Light Company circuit direct to the studios. From the studios, Mr. Williams conducted such programs of the Office of War Information as "You Can't Do Business With Hitler" and "This Is Our Enemy," and the "Victory Spots." Troops in the area tagged Mr. Williams as the "Silver Dollar Bondman" as they looked forward to his program conducted from various USO clubs and Army posts, giving away silver dollars and Savings Bonds to witty servicemen. But this all came to an end with the inauguration of the Armed Forces Radio Network and the banning of commercial broadcasting, which was perhaps a woeful loss of silver dollars for the boys in the Services! Mr. Williams continued, however, to broadcast for the spiritual welfare of the troops with his program, "The Ave Maria Hour," and a rebroadcast of religious services under the direction of Joseph R. Koch, department chaplain, Quarry Heights, Canal Zone.

Mr. Williams describes his "Daily Newspaper of the Air" as designed "to give a news-hungry public what they want, when they want it—short, informative, pertinent facts about current events." He admits that he often scoops leading U.S. commenta-

tors. He numbers among his friends many of the leading commentators, including Lowell Thomas, who autographed a photo for George with this quip: *"May you live forever!"*

(Incidentally, we understand that Mr. Williams uses four radio receivers—two are *Hallicrafters*—tuned to c.w. whence he gets much of the news he broadcasts on his "newspaper.")

HP5J operates in the 31-meter band on 9.605, and HP6J operates on 1360 kcs. (220 meters) in the broadcast band. Daily schedule of programs directed by Mr. Williams is 1230-1300 and 1800-1830, except that on Saturday the last transmission runs 1800-1900, the final half-hour being the religious program, "Haven of Rest." The "Daily Newspaper of the Air" is broadcast at 1230 and 1800. Various programs of HP5J/HP6J are sponsored by firms in Panama, in the United States, and in Canada. Daily schedule of the station is 0700-2235.

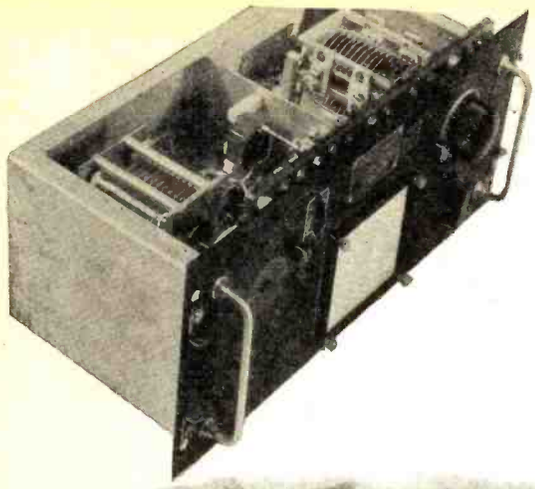
Other Panama Stations

Other Republic of Panama stations are listed as HP5A, 11.695, Panama City, "Cadena Panama de Radiodifusion," 500 watts, 0700-2300; HP5G, 11.780, Panama City, "Radio Panamericana," 800 watts, 0630-2230; HOB, 6.175, Panama City, "Radio Panamericana," 0630-2230; HOLA, 9.505, Colon, "Radio Atlantico," 0800-1300, 1600-2200; HP5K, 6.005, Colon, "La Voz de la Victor," 800 watts, 0730-2300 (uses some *English*); HP5H, 6.122, Panama City, "La Voz del Pueblo," 500 watts, 0700-0000; HOXA, 15.100, Panama City, "Radio Centro Americana," 7.5 kw., now temporarily off the air; and HP5B, 6.030, Panama City, "Radio Miramar," 800 watts, current schedule not known but is probably 1800-2300.

Facts About Panama

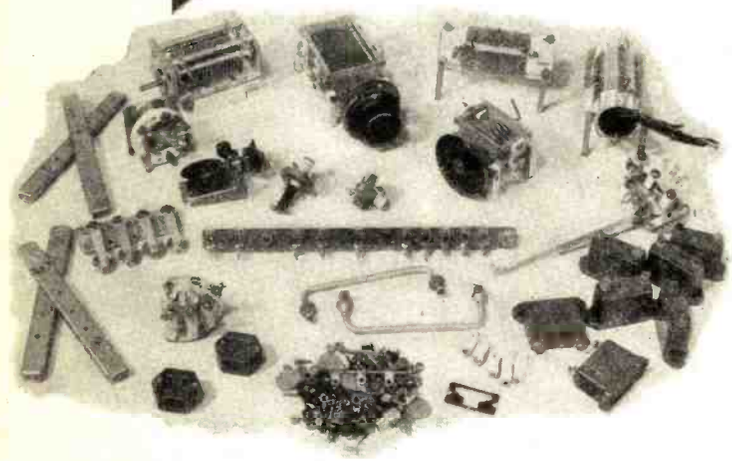
In 1513 Vasco Nuñez de Balboa forced his way through the jungles to discover the Pacific Ocean, and in 1538 Spain's Emperor Charles V. established the Real Audiencia de Panama with jurisdiction over Nicaragua to the north and all the Spanish Provinces to the south as far as the Strait of Magellan (including the Provinces of Cartagena, Peru, Chile and what is now the Argentine). Panama became independent from Spain by a movement of its own, November 28, 1821, and subsequently joined the Great Colombian Confederation formed by Venezuela, Colombia, and Ecuador. It broke away from Colombia on several occasions but never fully succeeded in separating until November 3, 1903, when it finally seceded and became an independent Republic. It was recognized as such by the United States on November 13th of that year.

Panama occupies the entire isthmus of that name, connecting North and South America, lying between the Caribbean Sea on the north and the Pacific Ocean on the south. Panama is one of the six Central American or Middle American countries.



Words Fail Us!

We Wells people have never liked sensational advertising but when we find a piece of equipment like this G. E. Tuning Unit offered for a tiny fraction of its real value, it's hard to be modest about it. Naturally, these units tune to frequencies outside of the ham bands. But we have yet to see a real Radio Amateur who can't cut a few coil turns to build a useful piece of equipment.



Brand New
G. E. Tuning Units
$2.50 each

Easily Converted to:

MASTER OSCILLATOR TUNER
C. W. TRANSMITTER
RESONANT LINE TUNER

PARTS ALONE WORTH 20 TIMES OUR PRICE

Practically every part in the unit fits right into Amateur requirements. So we suggest that you order extras to be dismantled for spare parts.

Look At These Parts — All For $2.50

1—Aluminum Panel 16¾" x 7¾"
1—Micrometer Drive unit for ¼" shaft
1—GE Planetary Drive unit for ¼" shaft
1—150 MMFD Trans. Plate Tuning Cond. 31 plate, ceramic insulated
1—125 MMFD Trans. Plate Tuning Cond. 25 plate, ceramic insulated
1—35 MMFD Transmitting Plate Tuning Cond. 7 Plate
1—Single pole 6 Pos. Heavy duty Ceramic band switch with knob
2—2 Pole Double Throw Heavy duty Ceramic band switch with knob
3—100 MMFD Transmitting mica cond. 3000 WVDC
1—60 MMFD Transmitting mica cond. 2000 WVDC
3—90 MMFD Transmitting mica cond. 3000 WVDC
2—40 MMFD Transmitting mica cond. 2500 WVDC
2—Ceramic coil forms 5" long, 2" dia. wound with No. 14 wire
1—Micalex strip 12" x ¾" x ¼" with Banana Plug jacks
1—Gang of 4 transmitting neutralizer condensers
2—Aluminum handles 5" long, 1¼" dia.
2—Ceramic flexible shaft couplings
15—Ceramic standoff insulators. Tapped ends
8—Aluminum standoffs tapped ends
Brackets, screws, lugs, misc. wire and ventilated case, lock washers, etc.
1—5 millihenry 300 MA choke RF
1—6 millihenry 300 MA choke RF
1—15000 ohm 5 watt resistor

Two Models Available:

TU 5B 1.5 to 3 Mc — $2.50 each
TU 10B 10 to 12.5 Mc — $2.50 each

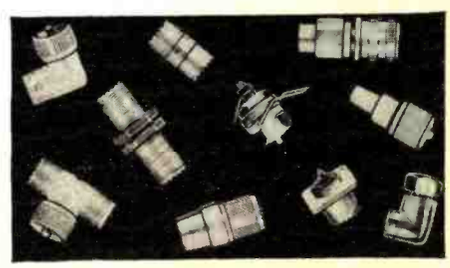
Black crackle dustproof cabinet for above — 50c each

These tuning units may be ordered directly from us or through your local Jobber.

We Think We Have Enough for Everybody

CO-AX CONNECTORS

We carry large stocks of all "83" series connectors in stock. Write for listing 100A or order from your Jobber.



Write for Amateur Radio Catalog H200-A

WELLS SALES, INC.

320 N. LA SALLE ST., DEPT. R-10, CHICAGO 10, ILL.

By a treaty of November 18, 1903, ratified February 23, 1904, and with a supplemental (Taft) agreement in the same year, the United States acquired the right to construct the Panama Canal across the isthmus, a strip (the Canal Zone) extending for five miles on each side of the Canal, the terminal cities of Cristobal, adjacent to Colon, and Balboa, adjacent to Panama City, and islands for defensive purposes in the bay, in perpetuity and exclusive control for police, judicial, sanitary, and other purposes. The United States also has complete jurisdiction over sanitary and quarantine matters in the two cities of Colon and Panama and owns and operates the Panama Railroad, 47 miles long, connecting these cities. In return, the United States paid Panama $10,000,000 outright, and $250,000 gold a year rental, beginning after the lapse of nine years.

A new treaty with the United States, replacing the Taft agreement (abrogated June 1, 1924) and modifying the treaty of 1904, was signed in Washington, March 2, 1936, by which the United States renounced its guarantee of Panamanian independence specified in the treaty of 1903, also the right to intervene to maintain order in the cities of Panama and Colon. The annual rental charge of $250,000 in gold was changed (retroactive to February 26, 1934, in consequence of the dollar devaluation) to 430,000 balboas, the currency of Panama (equivalent in value to the U.S. dollar). The treaty further provided that no new private business be established in the Canal Zone, and only Government employees be allowed to reside there.

Of the total area of Panama, five-eighths is unoccupied and only a small portion of the remainder is properly cultivated. Immigration is restricted. The forest resources are great. Stock raising is carried on extensively. Chief exports are bananas, cacao, and coconuts. Area is 33,667 square miles and the 1941 estimated population, 635,836. Panama City is the capital.

The Roman Catholic religion prevails but other faiths have representation. Education is compulsory for all children between the ages of 7 and 15. There are 588 primary schools, 7 secondary schools, a college for the higher instruction of boys, a secondary school for girls, a professional school for girls, and crafts and trades schools for boys. The National University is in Panama City. Spanish is the official language and its use is compulsory.

In taking our leave of HP5J/HP6J in Panama City, we suggest you tune in George Williams' "Daily Newspaper of the Air" at 1230 and/or 1800 on 9.605 to hear his familiar voice *"broadcasting the news of the day from the Crossroads of the World!"*

* * *

Fernando Po Data

More information concerning the projected super-powered Spanish station now under construction comes this month from Lee Johnson, Maine, who has translated this clipping from a Madrid newspaper.

"Work began early this year on the island of Fernando Po, south of Nigeria, on the west coast of Africa, for a radio station to be known as *'Radio Atlantic.'* This station is to be operated by the Sociedad de Radiodifusion Intercontinental, a Spanish organization.

"It is expected that the station will be completed in about 17 months. The transmitter site occupies about 60 acres and is located at Mosula, about 40 miles west of the capital city of Santa Isabel.

"The direction of the antenna system will be Madrid but—augmented by beam antennas—the programs will be directed also in four directions—Europe, Africa, United States, and South America.

"Transmissions will utilize mainly Spanish, *English,* German, Portuguese, Italian, and French.

"*Radio Atlantic* will have 200 kw. power in the antenna and will operate in the 13- and 17-meter bands. Thus, it will be the most powerful commercial station in the entire world. There are two other stations of the same power in California, but they were constructed for military service in 1946. These California stations radiate programs and propaganda destined exclusively for Japan, Korea, and Manchuria and are heard there with such great strength that it seems the stations are in those countries.

"The Voice of Spain will be heard in all parts of the world. This will be, in the first place, a demonstration of our progress technically, and of our high ambitions, and, in the second place, no less important, Spain will be able to speak in a strong voice to people in every spot in the world, directly and definitely, without necessity of obscure intermediates."

(Fernando Po is an island—771 square miles—in the Bay of Biafra, and in the past was known as an exile for political offenders.)

* * *

Lamphouse Annual

The 1947 *Lamphouse Annual,* published in New Zealand, is now available. It contains complete U.S., Australian, and Asiatic broadcast logs, s.w. log, and New Zealand "ham" addresses; log covers 30 pages. Can be had for five 5-cent stamps or 5 IRC's, from Arthur T. Cushen, 212 Earn Street, Invercargill, New Zealand.

* * *

Club Notes

Germany—Berlin now has a radio club—Deutscher Amateur Radio Club-Berlin (DARC), address is Berlin-Rudow, Fuchsienweg 51; its publication will be "QTC." The German s.w. club was established in June at a meeting of German amateurs in Stuttgart. All previously-formed clubs were merged into DARC, with divisions in the American Zone, the British Zone, and in Berlin proper. Address of the German QSL Section is now DARC, QSL Section, Christoph Str. 27, Stuttgart. This information

comes from Horst Miers, (7) Berlin No. 18, Barnimstr. 8, Germany, who adds: "I presume that following the war many German special (*wehrmacht*) tubes have come to America and other countries. I can give extensive information about all German special tubes to amateurs who are interested."

* * *

Verifications

Correct address for reports to Radio Nacional de Espana is Director of Programs and Broadcasts, Aveneda del Generalisimo, 40, Madrid, Spain (Espana). This station verified in both Spanish and *English;* latter cardverie said: "Radio Nacional de Espana verifies your perfect report of reception dated 30-4-47 and sends you its kind greetings;" signed by E. Thomaas de Carranza. (Casey)

ZPA-5, 11.948, Encarnacion, Paraguay, sent nice card in red, white, and blue, with large overprint of call letters ZP-5 and ZPA-5; printed frequency on card is 11.950. PCV, Kootwijk, Netherlands, 18.070, verified on prepared form from General Direction of Postal and Telecommunication

(*Continued on page* 158)

Sound Recording

(*Continued from page* 53)

usually employed in the manufacture of phono pickups. The "PN" (primary ammonium phosphate) will temporarily stand temperatures as high as 212° F. with no permanent damage. They will withstand operating temperatures of 140° to 160° F. for a considerable time without suffering any permanent damage. Compared with the Rochelle salt crystal elements a "PN" element with the same dimensions and in the same assembly will produce a slightly higher open circuit output voltage. (Open circuit

TELEVISION COVERAGE

A RECENT FCC report has disclosed that the number of applicants for commercial television transmitting licenses has dropped from a high of 140 in October, 1945 to 75 as of June 5th this year.

The FCC has granted a total of 65 commercial television construction permits in 37 cities in 24 states. Of this number 11 stations are already on the air and 54 are required to be on the air within the next 12 to 18 months. In addition, there are ten more applications pending before the Commission—for a total of 75 commercial stations. The metropolitan population of the 37 cities to be served is around 44,000,000 with an additional 11,000,000 suburban residents within range of the stations.

The 11 stations now on the air are serving eight cities with a population of 27,000,000 persons, i.e., Albany-Schenectady, Philadelphia, Washington, St. Louis, Detroit, Chicago, and Los Angeles.

There are approximately 54,000 television receivers in the United States at the present time.

—30—

means no load resistance, cable capacitance, or other impedances connected to the element.)

The capacitance of a typical Rochelle salt crystal cartridge element is approximately 1500 $\mu\mu$fd., while that of a "PN" element having the same dimensions is about $\frac{1}{10}$th this value. Because of this comparatively low capacitance, a "PN" type cartridge cannot be used to replace a Rochelle salt type crystal cartridge directly for two reasons: 1. The additional capacitance of the cable or wire connected to the cartridge causes considerable loss of output. 2. The lower capacitance of a "PN" element requires that the load resistance used in pickup applications be approximately ten times the value used with a corresponding Rochelle salt unit if it is desired to obtain the same frequency response. This means values of from 5 to 50 megohms. When these high values of resistance are used at the input of a high gain amplifier, difficulties with insulation and noise pickup are much more severe than with the conventional low values. Certain manufacturers have employed "PN" crystal cartridges with equipment especially designed for their use.[1]

We mentioned previously that there were many varieties and versions of the crystal type pickup. In any pickup the torsional motion of the needle is transmitted to the crystal through a needle chuck. The needle is quite brittle and torsionally stiff. Therefore, if the needle were connected directly to the crystal, the pickup would present a high needle point impedance to the record. This would result in poor tracking and high record wear. For proper performance, the torsional stiffness of the crystal must be decreased by a ratio of roughly 25:1. Previously this has been done by interposing an elastic rubber block between the needle chuck and the crystal. The pickup cartridge, shown in cross section, Fig. 6, typifies this construction. The crystal is held at its lead end by means of two firm rubber blocks. At the front end the crystal is coupled to the needle chuck by means of a soft rubber coupling. Torsional motions of the needle compress the rubber coupling. The pressure thus developed acts upon the crystal and produces an output voltage proportional to the pressure.

The record groove is capable of transmitting only a limited torque to the needle chuck. This can be seen by examination of Figs. 1 and 7. This shows the groove and the needle point in cross section. The walls of the groove are inclined at approximately 45°. Therefore, the side force upon the needle point cannot exceed the vertical pickup force, otherwise the needle rides "uphill," resulting in distortion and record wear. Torque is force times distance. The maximum theoretical torque, T_m which can be applied by the record to the needle

[1] Poff, J. K.; "The Crystal Phonograph Reproducer—Its Application and Care." Service Engineer, The Astatic Corporation, Conneaut, Ohio.

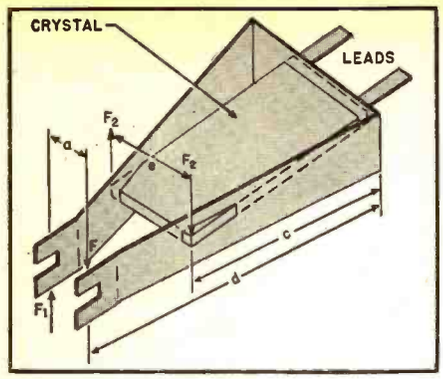


Fig. 9. An isometric drawing of the lever system design.

chuck of a pickup is given by the following formula:

$T_m = Fh$ *dynes-cm* ..... (1)

Where: F is the vertical pickup force in dynes; h is the vertical distance from needle to needle chuck axis in cm.

The maximum torque is, therefore, limited by the needle force and by the length of the needle which, because of practical considerations, cannot exceed ½ to ¾ of an inch. The actual torque is considerably less than the value indicated by (1). Because of unevenness of records, turntables, and the inertia effects of the tone arm, a part of the torque actually generated is lost in the needle chuck areas. In a conventional pickup, what remains of the original torque is transmitted into the rubber coupling in the crystal. The potential energy due to this torque is divided between the crystal and the rubber coupling in proportion to their respective compliances.

Inasmuch as the coupling compliance is related to the crystal compliance by a ratio of 25:1, it is seen that 25/26ths of the energy received from the record is spent in compressing the rubber coupling and is wasted. The remaining 1/26th is actually applied to the crystal. If means are employed for more efficient transmission of energy into the crystal, the output voltage may be increased theoretically by the square root of the energy ratio or approximately 5 to 1. This indicates the desirability of eliminating the elastic rubber coupling. But if the elastic coupling is eliminated, the impedance presented by the crystal to the needle is too great for proper tracking. To remedy this it is necessary to resort to an impedance matching device. Transformers for electrical matching are well-known to radio engineers. However, in mechanics, the lever plays the counterpart of an electrical transformer.

In the new pickup described here and developed by *Shure Brothers*, a torsional lever system was developed to lower the needle point impedance and to efficiently transmit the needle chuck torque into the crystal.

Lever Type Pickup

The new pickup developed by *Shure* is illustrated in cross section in Fig. 8. Fig. 9 shows an isometric drawing of

the lever system. The lever consists of a single strip of thin aluminum perforated to receive the crystal and bent in a trapezoidal shape. The rear portion of the lever and crystal assembly is held in the cartridge case between two firm rubber blocks. The ends of the lever engage the needle chuck through two composition pads which serve to provide longitudinal shock isolation between the chuck and the lever but have negligible transverse compliance. For all intents and purposes, the motions of the needle chuck are faithfully followed by the ends of the lever. This particular type of lever pickup has an important structural advantage over most conventional pickups because it does not depend upon soft rubber couplings, or other materials which deteriorate with age, for generation of voltage.

The structure of the lever pickup is dynamically simple. Since the lever is rigidly coupled to the needle chuck, the system has only one degree of freedom and can be damped therefore, with a single set of damping pads, *M* and *N* in Fig. 8. In contrast to this, the conventional pickup (Fig. 6) has two degrees of freedom; the needle chuck and the crystal which are loosely coupled by the rubber coupling member. Two separate sets of damping pads *MN* and *PQ* are therefore required. The selection and control of two sets of damping pads has made it difficult to control such pickups in production. In the design of the lever type pickup, care is taken to hold the lateral mass referred to the needle point to a very low value. The needle chuck is made of a very light alloy. When used with an aluminum shank needle, it presents to the record a mass of less than 50 milligrams. Tests on frequency records with needle forces of one ounce indicate good tracking at all frequencies.

(To be continued)

GERMAN HOME RADIO RECEIVER

BY KARL GREIF

A NEW radio receiver of German manufacture which is being marketed under the tradename "Saba" has several new features which are of interest to the radio industry.

The receiver features an enormous slide-rule dial, with the names of cities located in such a manner that when the pointer is in a certain marked rectangle on the dial, that city is "in tune". This feature is in addition to the regular calibration in kilocycles and meters.

Tuning is accomplished with a very heavy fly-wheel, high ratio cable, and pulley system. The tuning knob is at the right end, as well as the band switching control. Possible selections included "Phono," "150-400 kc.," "500-1500 kc.," "30-92 meters" and "13.5-36 meters." At the left of the front panel is located the "on-off" and volume control—pulling out on this knob turns the set on with any 50-60 cycle voltage from 110 to 220 volts, in steps. The other knob on the front, at the right, is for tone control. Dual range is provided by pulling out on this knob.

The circuit is very selective and extremely sensitive. Forty-two clear stations have been logged without advancing the volume above local station level. Background noise is at an absolute minimum. The set uses a separate i.f. resonant circuit for each band. —30—

Product of a German company, this "Saba" home receiver could be classed as "above average" in the European market. The usual type of receiver manufactured on the Continent is of the two- or three-tube regenerative variety.

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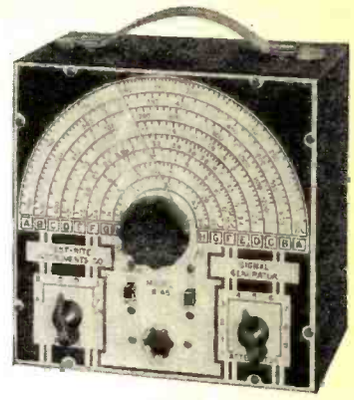

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- 2 RESISTANCE RANGES: 0-10,000 ohms; 0-1 Megohm.
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- Beautiful hand-rubbed oak case. Complete with test leads and all operating instructions

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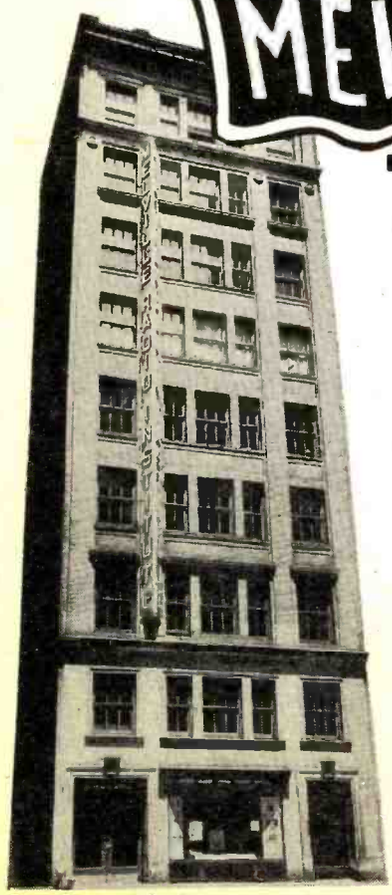

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International Short-Wave

(*Continued from page* 153)

Services, 12 Kortenaerkade, The Hague; stated, "PCV is one of the Netherlands PTT commercial transmitters, also used for the radio-telephone traffic from Amsterdam to Paramaribo (Surinam)." The Direction Generale des Telegraphes de Suede verified reception of a Swedish fone station as "one of the Swedish transmitting stations, SAT3-10, situated at Horby in the very south of Sweden, and used since March 1947; SAT-4 (the one reported) has a frequency of 13.862.5." A verie-letter was received from PJD, 11.900, St. Maarten Island, N.W.I.; station is located at Phillipsburg and is crystal-controlled; signed by Acting Chief of Radio Station PJD, C. Peterson; duration 32 days. Omdurman Broadcasting Station, % Public Relations Office, P.O. Box 282, Khartoum, Anglo-Egyptian Sudan, operating on 13.320 and 9.650 with 250 w., verifies within 6 weeks by mimeographed sheet. THA, L'Ingeneiur Techniques de la Radiodiffusion, 10, Rue Hoche, Algiers, Algeria, operating on 11.835 with 12 kw., QSL'd by *English* letter, also sending schedules; duration 3 months. COCX, 9.273, 1 kw., % Estacion de Onda Larga CMX, Mil Diez, Reina 314 (Altos), Habana, Cuba, sent letter-verie in Spanish in 6 weeks for report sent in Spanish. (Kary)

* * *

This Month's Schedules

(*Note:* By now some stations will have returned to Standard Time from Summer Time—making certain schedules herein *one hour earlier than listed.*—K.R.B.)

Alaska—WXEG, 12.255, Adak, is still often heard calling Seattle around 0105. (Nankervis)

Algiers—THA, 11.838, has been heard in West Virginia around 1945 to 2030 sign-off—with Arabic chant, singing, and news (French); used "La Marseillaise" at sign-off. (McLaughlin)

Andorra—Radio Andorra, about 5.990, still has *English* session, mostly music, at 1600-1630 daily. (Peddle) Still asks for report and says will play request numbers. (Miers)

Angola—CR6RA, 9.470, Luanda, is heard in Sweden from around 1415 to approximately 1600; sign-off varies slightly. Suffers QRM from TAP, 9.465, Ankara, until 1530. (Skogsberg) Is heard in Newfoundland. (Peddle) Good level in Australia, closes with Portuguese National Anthem. (Gillett)

In verifying for Paul Kary, Pennsylvania, in record time of 32 days, CR6RL gave this data: CR6RA, 11.035, 400 watts, *Collins* transmitter; CR6RC, 11.730, 150 watts, *Phillips* transmitter; CR6RL, 16.172, 9.500, 7.299, 1 kw., *Standard* transmitter; and CR6RN, 9.742, 1 kw., *RCA* transmitter. No schedules were sent. Report was forwarded registered airmail and verification came same way.

CR6RB, 7.175, "Radio Clube de Louanda," is heard in South Africa from 1300 to sign-off at 1430; fair signal. (Laubscher) Call clashes with that of Benguela, 9.165, so Luanda's 7.175 outlet may be "CR6RD."

Argentina—LRS-2, 11.970, Buenos Aires, heard from 2030 with excellent signal; announces "LR-4 en Buenos Aires y LRS, LRS-1, LRS-2 ondas cortas, Emisoras Radio Splendid." LRS on 9.316 has fair signal with some CWQRM, at same time, and LRS-1 on 5.986 is seldom audible. (Kary) LRS-2 is heard in New Zealand daily to 2300 sign-off, fine level. (Cushen)

Australia—Melbourne's VLR2, 6.150, is being heard in South Africa from 1500 sign-on; has news at 1545 and runs to around 1715. (Laubscher)

VLB, 9.54, has replaced VLC8, 7.280, in the daily beam to Britain, 1245-1415; VLA8, 11.76, still parallels. (Pearce)

The evening transmission to Eastern North America, 1900-2015, on VLA7, 17.800, is inaudible to only fair; VLC9, 17.840, used in parallel to South America, is usually obliterated by Moscow. News at 1930.

Frequencies of 17.840 and 15.200 are reported in dual to South America daily, opening at 1615.

Australia—Sendergruppe Rot-Weiss-Rot, 9.575, has been heard in Britain at 0000 giving calls of Sender-Salzburg, Sender-Linz, and Sender-Wien; has news in German and program details; often carries orchestral concerts from Vienna around 0115. (Pearce)

Belgian Congo—A station identifying as "Ici Radio Congolia, Leopoldville," at 1300 sign-on is heard on 9.21 daily, in South Africa; program is in an African language with African-type music; signs off at 1330, also with French announcement, followed by Belgian National Anthem; signals poor with severe CWQRM. (Laubscher) May be OQ2RC.

Leopoldville uses 9.745 and 17.770 in parallel in the daily (*English*) period, 1530-1645; news at beginning and headlines just before closedown; the 16-m. outlet has the better signal here in the East.

At times it appears that Leopoldville's 16-m. outlet is on 17.746 (measured) rather than listed and announced 17.770 (Arthur)

Belgium—ORF, 18.467, Ruiselede, heard calling WOF-2, New York, at 1500; modulation only about 80 percent; goes to scrambled telephony after making contact; slight CWQRM from PJY on 18.464. (Kary)

Ceylon—SEAC's 15.120 has much improved signal here in the East now, mornings, and on Sundays in the 1130-1330 beam to Britain; announces 17.770 in parallel for this Sunday period and use of 9.520, 6.075, and 3.395 to India and East Asia. The 17.770 frequency is heard here in parallel at 0730 when news is given; two wavelengths in the 19-m. band are used at that time—15,120 and 15.230, the latter is heard with very weak level and bad QRM. Roger Legge, New York, informs me that the 15.230 channel is

used principally for the Indian transmissions although it does carry a few *English* sessions.

Chile—CE-1227, 12.270, is heard evenings; announces "Radio Ejercito en Punta Arenas, Republica de Chile;" has news in Spanish at 1943-1950. (Kary)

China—XMAG, 4.275, Nanking, 1 kw., heard with news from AFRS in Los Angeles at 0800; signs off at 1000; QRA is XMAG, S.S.O., Army Advisory Group, A.P.O No. 909, % PM., San Francisco, California. (Cushen)

In verifying its 9.730 channel for Kary, Pennsylvania, XGOA, Nanking, stated that the 11.835 transmitter uses a center-fed, half-wave, delta-matched antenna running east-west, and that the antenna for 9.730 runs parallel.

Actual frequency of XGOY's 31-m. outlet is 9.663, scheduled during summer at 0535-0735. (Dilg) The 19-m. outlet announced as 15.170 appears to be actually 15.165. (Baxter, Dilg)

In an airmail letter dated July 4, Fung Chien, director of Chinese International Broadcasting Station, XGOY, Chungking, notified Kary, Pennsylvania, that "XMP*A* is the Chinese Armed Forces Radio Station, 720 and 12,200 kcs., broadcasting every day at 0700-0800, 1200-1400, and 1800-2300 hours Nanking time (1700-1800, 2200-0000, and 0400-0900 EST). Its address is No. 10, Snake Mountain, Hanchungmen, Nanking, China."

Director Fung Chien sent along these current schedules:

XGOA—Nanking, 15.35 and 9.73—1900-2200, news at 2010 and 2130, and talks (*English*) at 1910, 2040 (news commentary), 2100; on 15.35 at 0300-0900, news at 0420, 0500 (commentary), 0800, and talks (in *English*) at 0310, 0740; listed in parallel at 0700-0730 are 9.730 and 11.835, and the same frequencies are listed to parallel at 0815-0900 sign-off. (Possibly by now the 11.835 channel will have replaced 15.35 in the 0300-0900 transmission.)

XGOY—Chungking, 11.913, to Australia, New Zealand and East Asia, 0355-0530, no *English* except that on Saturdays carries "Back to the Bible" at 0500-0530, and on Sundays has "The Baltimore Gospel Hour" at 0430-0530; 9.658 and 7.153, to East Asia and South Seas, 0535-0735, news at 0600 and repeat at 0630 (except Sunday when carries Peking Opera), and has "Sermons in Song" on Wednesdays at 0635; 15.17 and 7.153, to North America and Europe, 0745-1000, news at 0800 (relayed from XGOA, Nanking), and 0900 (but on Sunday has Foreign Ministry news in code at 0900-0935); 15.17 and 7.153, to Europe, China and South Seas, 1000-1050, news at 1000, closing with National Anthem.

Location of the station heard on 11.685 at 0800 with AFRS news is yet unknown. Call sounds like "XGAF." (Dilg) Sanderson, Australia, lists call as XGAS and as heard at 0730 with news in Chinese and music.

Colombia—HJDE, 6.145, Medellin, "La Voz de Antioquia," has a nice signal at 2300; signs off around 2310. (Norris)

Cyrenaica—Vague reports have been received that *Radio Cyrenaica,* in North Africa, is being heard around 1530 on a frequency of 15.320. (Harrison)

Dominican Republic—HI1R, 6.430, "La Voz de Fundacion," signs off at 2005 with Dominican National Anthem; listed location is San Cristobal, but announces Ciudad Trujillo. After HI1R leaves the air, TGWB, Guatemala City, "La Voz de Guatemala," can be heard; this is apparently a new frequency for the Guatemala outlet; is no longer on 6.534. (Kary)

Dutch Borneo—Pontianak, 6.65, is heard in Australia at 0600 with musical program. (Sanderson) Schedule is only 45 minutes. (Dilg)

Ecuador—HC5HC, 4.960, Riobamba, has fair signals from 2115 until after 0000; announces "Estaciones Ondas del Chimborazo en Riobamba"; suffers bad aircraft QRM. (Kary) Is low-powered.

Ethiopia—Radio Addis Ababa, ETA, listed at 15.074 but actually lower, around 15.057, is still heard irregularly; reported by Dilg on West Coast around 0900; is heard here in East as early as 1300 to around 1458 sign-off. Appears to be on daily, including Sunday. At times has severe interference from WNC, Hialeah, Florida, used to contact South American points. ETA uses both Amharic and *English* for announcements, and plays many old records, mostly of American origin. Is heard in Britain as early as 1220 with dance recordings (Pearce). Heard there by Brownless as early as 1205, so transmission probably begins at 1200.

Frequency varies a great deal, has been logged in New York as low as 15.055. (Legge)

The 9.620 outlet of *Radio Addis Ababa* is heard in Australia at good strength prior to sign-off at 1100. (Gillett)

(*Continued on page* 179)

KEEP VIBRATOR SPRING TIGHT

TO keep noise at a minimum and the vibrator prongs in perfect contact it is essential that the spring holding clamps have good tension against the vibrator case.

These clamps may be adjusted with pliers as shown. . . . . H. L.

Deluxe Cabinet

(*Continued from page* 69)

can be seen in the rear-view photograph, Fig. 2 (left). This frame should be of rather light angle-iron, and may be either welded or bolted. Incidentally, the smaller sizes of angle-iron are sometimes difficult to find, and a good source of one-inch size is old iron beds. They use several feet of it on either end for stiffening.

Mark off the opening you are going to cut in the back. It should be marked to the *inside* dimensions of the frame. After the opening is cut, a few minutes spent with a hammer will roll the edge inside so that the frame will fit. This is an added stiffening measure although it is not absolutely necessary. Drill a one-quarter inch hole at each corner of the marked-off opening, and start down the scribed lines with a cold chisel. This is easier than you may think, and is a matter of only five minutes or so with a small, sharp chisel. When the opening is cut, roll the edge and slip the frame in place. Drill through frame and cabinet back, and bolt with a dozen bolts.

With the frame bolted in place, you are now ready to hang the doors. This is done by simply drilling and bolting the same hinges which were removed from the front. Angle-iron door stops should be installed. The doors originally fastened with spring catches. These may still be used. Since the doors are made so that one must be opened before the other, a single interlock switch is sufficient. The one used in the illustrated cabinet is a s.p.d.t. plunger-type *Micro-Switch* (war surplus). It is hooked up to turn on a green pilot light as it opens the high voltage circuits.

The chassis mount or shelf is simply a frame made up of angle-iron, and bolted through the sides of the cabinet. This method has been found satisfactory, though there are many other ways to do it. With this type of mounting, all connections to each chassis are made through a multi-contact *Cannon* plug or a terminal strip. It is then possible to remove the knobs on the front of the panel and slip the chassis out the back as is done with home radio receivers. It is inadvisable to try to hang a chassis from the Masonite panel if it is carrying transformers or other heavy components.

Painting the cabinet is a simple but important part of the procedure. Many combinations of colors and shades are possible. *Raytheon* broadcast equipment, for instance, is done in two-tone brown; *General Electric* in blue. Both are exceptionally good looking units, and there are many other combinations which would look as well. The cabinet shown in the photographs is two-tone gray. The contrast is accented by a one-eighth inch stripe of Chinese vermilion at the edge of the dark gray on the sides. Any good fin-

ish will do. The cabinet illustrated was enameled. The finish is of a nationally known brand, and brushed on carefully. Spraying would, of course, be better and in that case the use of automobile finishes is to be recommended. Masking tape was used in applying the stripes and darker color. If you are not already familiar with masking tape, your paint dealer can supply it and explain its use.

It has been the intention in this article to deal in generalities, so that the idea could be suited to your cabinet and requirements. There are many variations possible. For instance, the front opening could be beefed up so that standard rack-mounting panels would fit. Another variation is to leave the doors on the front and mount a sub-panel behind them so that the transmitter could be closed up when not in use. A console containing speech amplifier, cathode-ray modulation monitor, and remote controls for the transmitter could be built to set on the operating table. The utility cabinet mentioned earlier could be used for lower power rigs, if allowance is made for its shallower depth. No provision has been made for ventilation, as it should be tailored to the particular layout you use.

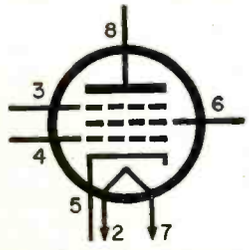
There you have it, a cabinet capable of housing a half-kilowatt without crowding, and also capable of holding its head up alongside the best of broadcast equipment as far as looks is concerned—and all for about thirty dollars. —30—

TUBE SYMBOLS

AN INTERIM report, based on a total of 4211 replies out of 25,000 ballots in the Howard W. Sams & Co., Inc. balloting, shows that 35.4% of radio service engineers prefer "Method 3" (see figure below) for designating tube symbols on service schematics.

Runner-up, with a total of 24.1%, is "Method 7" which is more or less in standard use in the radio tube manuals.

The method which is being selected by the greatest number of service engineers provides base pin connections numbered in conformance with RMA basing standards. Sequence of the pins is arranged for clarity of circuit presentation and not in the same order as the tube socket. The various tube elements are shown in the drawing.



The results of this survey, which was conducted at the request of the RMA Service Committee, will be turned over to the committee for presentation to members of Radio Manufacturers Association.

Editor's Note: Readers will undoubtedly recognize "Method 3" as one that has, for some time, been used by RADIO NEWS. In conformance with the suggestions made in this survey, we plan to add the pin numbers to the tube symbols appearing in the schematic diagrams of construction type articles.—30—

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

FREE PHOTOFACT AIDS

Howard W. Sams & Co., Inc. have prepared three new service information folders which are available without charge to all radio servicemen.

The first of the folders is a complete cumulative index to more than 1000 postwar radio receivers, combinations, record changers, recorders, and sound amplifiers. The second folder is designed for "Photofact" subscribers and describes five simple ways to file the folders. The third folder is a specimen "Photofact" folder covering a popular radio-phonograph combination.

All three of these servicing aids are available without charge to radio servicemen and may be obtained from local parts jobbers or by writing direct to *Howard W. Sams & Co., Inc.*, Indianapolis 6, Indiana.

CONDENSER CATALOGUE

The new *Pyramid Electric Company* catalogue, J-4, is now available for distribution to those requesting a copy.

The new catalogue lists a wide variety of d.c. dry electrolytic condensers in cardboard or metal containers. Capacities of the units range from 5 μfd. to 2000 μfd. at voltages of from 6 to 600 working volts.

A special section of the catalogue is devoted to the company's new "Twist-Mount" line of condensers and includes capacity, working voltage, can sizes, physical dimensions, and prices for the entire line.

Copies of catalogue J-4 may be secured from *Pyramid Electric Company*, 155 Oxford, Paterson, New Jersey.

SELENIUM RECTIFIERS

Selenium Corporation of America has recently issued a series of data sheets covering characteristics, applications, and design factors of the company's line of selenium rectifiers.

Included in the listing are instrument rectifiers, selenium barrier-layer cells for replacement in photoelectric radio-phonograph sets, and power rectifiers. Complete data on all of these types is given in such a form as to make the bulletin of value to design engineers.

Copies of these data sheets may be secured by writing *Selenium Corporation of America*, 2160 E. Imperial Highway, El Segundo, California.

SPEAKER DATA

Complete data on 52 types of PM speakers, 54 types of electromagnetic speakers, and 20 types of transformers are included in the new 4-page bulletin just issued by *Permoflux Corporation*.

The data supplied includes characteristic specifications for all types, sizes, flux density, voice coil diameters and impedance, watts, dimensions and recommended transformer sizes. In addition, transformer specifications include primary and secondary impedance, primary d.c., and ma., watts, and application data.

The bulletin is available free of charge from *Permoflux* distributors or from *Permoflux Corporation*, 4900 West Grand Avenue, Chicago 39, Illinois, or 236 South Verdugo Road, Glendale 5, California.

FM TRANSMITTERS

The *Broadcast Equipment Section* of *Radio Corporation of America* is now offering an 8-page booklet covering their 250 watt, 1 kw., and 3 kw. FM transmitters to FM station owners and prospective owners.

All of the transmitters featured in this booklet are in stock and ready for immediate shipment. This line includes the BTF-250A, the BTF-1C and the BF-3B. Details about the *RCA* lightweight "Pylon" antenna are also given.

Copies of this booklet may be obtained from the *Broadcast Equipment Section, Engineering Products Department, Radio Corporation of America*, Camden, New Jersey.

RESONANT RELAYS

The newly published catalogue sheet No. 116A contains complete information on the new *Stevens-Arnold* resonant relays.

Designed for remote control applications, the new resonant relays have been extended in range downward to 20 c.p.s. The line includes a 60 c.p.s. unit as a standard model. This particular 60-cycle relay is useful because of the general availability of that frequency.

A copy of catalogue sheet No. 116A will be forwarded to those writing *Stevens-Arnold Inc.*, 22 Elkins Street, South Boston 27, Massachusetts.

HAM BOOKLET

A new technical reference folder, designed especially for the nearly 100,000 radio hams in this country and containing a roundup of tube information, some of it never before published, has just been issued by the *RCA Tube Department*.

Titled "Headliners For Hams," the new folder is a combination technical bulletin, price list, catalogue, and sales brochure. It contains design information and covers a selected group of

TRIPLE BONUS---TRIPLE BONUS

the GREATEST--
yes, the GREATEST--
TEST EQUIPMENT story ever told

1000 pieces of LATEST MODEL, Standard Brand Test Equipment to be sold this month. TUBE CHECKERS, SIGNAL GENERATORS, OSCILLOSCOPES, VTVM's, MULTITESTERS, etc.

LABORATORIES, SCHOOLS, RADIO DEALERS, SERVICE MEN, HAMS, EXPERIMENTERS, STUDENTS:

Get a TRIPLE BONUS on EACH piece of equipment valued at $40.00 or more. Just fill out the coupon below. Act now!

Buy for cash, on time-payment plan, or Radiomart lay-away plan

Radiomart INC.

Dept. RNA
149 Riverdale Ave.
Yonkers, New York

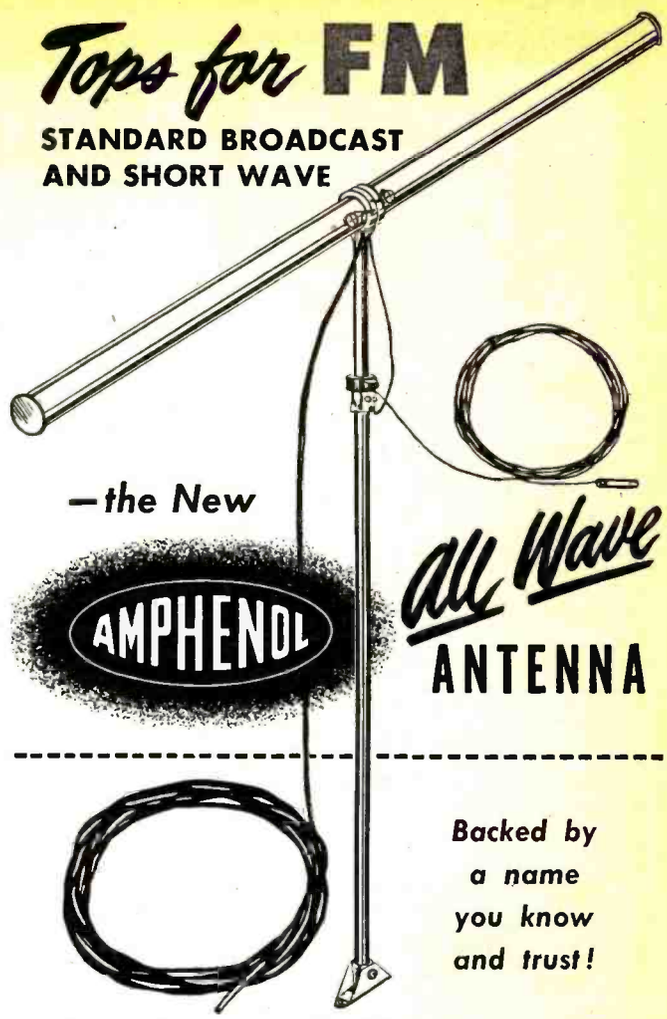
I am interested in learning more about the greatest test equipment story ever told. Please send details of your great triple-bonus plan. I am particularly interested in buying the following equipment:

Name .....

Address .....

☐ Laboratory ☐ Service Man
☐ School ☐ Ham
☐ Radio Dealer ☐ Experimenter

Tops for FM
STANDARD BROADCAST AND SHORT WAVE



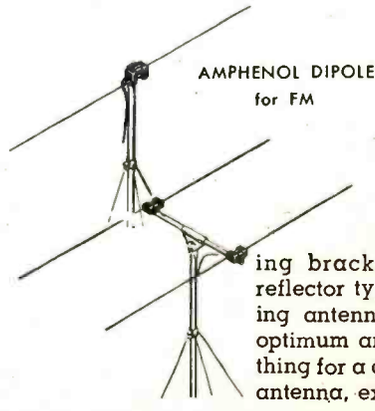
—the New

AMPHENOL

all Wave
ANTENNA

Backed by a name you know and trust!

• In actual tests, over the 500 kc-108 mc frequency range, the new Amphenol All-Wave Antenna out-gains the best double doublet. It assures interference-free reception, even in areas of low signal strength.
• The All-Wave Antenna combines a horizontally polarized FM dipole with a 65-foot copper wire antenna for standard broadcast and short wave. A special wave filter channels energy to receiver input. A leadin of 52 ohm coaxial transmission line reduces interference to the minimum.
• The All-Wave Antenna is individually packaged for unit sale with installation instructions, all hardware (except guy wires), and a guy wire clamp.



AMPHENOL DIPOLE for FM

• Amphenol dipoles, and reflector arrays, build up ample gain for finest reception of FM. Efficient, even in areas of low signal strength, they virtually eliminate multipath reception. Mounting bracket and masthead (of reflector types) swivel, thus allowing antenna plane to be tilted to optimum angle. Kit contains everything for a complete 88-106 mc band antenna, except guy wires.

Amphenol Dipole Antennas are available now thru your jobber, or get prices and technical data by writing direct.

AMERICAN PHENOLIC CORPORATION
1830 SOUTH 54TH AVENUE • CHICAGO 50, ILLINOIS
COAXIAL CABLES AND CONNECTORS • INDUSTRIAL CONNECTORS, FITTINGS AND CONDUIT • ANTENNAS • RADIO COMPONENTS • PLASTICS FOR ELECTRONICS

RCA's most popular amateur tubes.

Information in the colorful three-page folder includes new ratings on the 807, 808, 810, 813, and 829-B; new operating conditions for frequency doublers; and new data on modulators.

The folder is available without charge from *RCA* tube distributors or from the *Commercial Engineering Section, Tube Department, Radio Corporation of America,* Harrison, New Jersey.

NEUTRALIZING CONDENSERS

A four-page folder describing the new NZ-10 Neutralizing Condenser has been released by *The Hammarlund Manufacturing Company Inc.* and is now available for distribution.

The new NZ-10 unit replaces the company's N-10 condenser which is no longer being manufactured. Application data, construction details, and features of the NZ-10 are included in the folder.

Copies of the booklet are available to manufacturers, experimenters, and amateurs who make their request to *The Hammarlund Manufacturing Company Inc.,* 460 West 34th Street, New York 1, New York.

IMPEDANCE VECTORGRAPH

A leaflet, "Sound Advances," which describes a newly developed Impedance Vectorgraph is now available from *Sound Apparatus Company* of New York.

The laboratory instrument described in this four-page leaflet is designed for measuring the input impedance of loudspeakers, microphones, headphones, pickups, recording heads, transmission lines, filters, transformers, etc.

A functional diagram and complete specifications on the Impedance Vectorgraph are included in the bulletin which may be obtained from *Sound Apparatus Company,* 233 Broadway, New York 7, New York.

POWER SUPPLY BULLETIN

Carter Motor Company of Chicago, manufacturers of rotary electric power supplies for radio communications equipment, have just released their latest sales bulletin, No. 447-J.

This bulletin illustrates many models, including the company's Super Dynamotor, the Super Converter, the Multi-Output Dynamotor, the *Carter* Genemotor, and the Magmotor.

In addition, the bulletin includes graphic presentation of voltage input and output, and outstanding features of each of the previously mentioned products.

Copies of Bulletin No. 447-J may be secured by writing *Carter Motor Company,* 2664 N. Maplewood Avenue, Chicago, Illinois.

RESISTANCE STANDARDS

Rubicon Company of Philadelphia has recently published a new 12-page illustrated bulletin which is now available for distribution.

Bulletin No. 100 describes in detail the company's complete line of re-

sistance standards and resistance bridges. Operation, application, construction, and other pertinent data is furnished on Wheatstone, Kelvin, Mueller and Limit bridges which are available in a variety of models for laboratory, plant, and field use.

Standard resistors of the Bureau of Standards and Reichsanstalt types, standard shunts, and a wide range of decade resistance boxes are also described. Individual decade resistors suitable for use as components in equipment are also listed.

Copies of Bulletin 100 will be sent upon request to *Rubicon Company,* 3666 Ridge Avenue, Philadelphia 32, Pa. -30-

Spot Radio News
(*Continued from page* 18)

until final tariffs are filed." When that will be is anybody's guess.

PROGRAMMING IN TELEVISION continues to be highly experimental and often unsatisfactory—but our bet is that the boys will keep pitching around until they hit on some very successful material. Latest try was the first art telecast of Washington's world-famous National Gallery, late this summer. In black and white, television broadcast some of the Gallery's masterpieces with such clarity that still pictures were successfully taken and reproduced in newspapers the following day. Dramatization of the story behind one of the pictures was featured in the telecast, but some difficulty was experienced because three separate rooms had to be used. Critical comment: "As an experiment, the National Gallery's venture was fascinating, but the results did not prove that the medium was up to it," in the words of Jane Watson Crane, Washington art critic.

ANOTHER PERMANENT ITEM on the radio news roster, from the looks of things, will be what the National Association of Broadcasters and the Radio Manufacturers Association chose to call "freedom of communication" and the FCC terms "public service responsibility of broadcasters." Carrying the torch for the RMA-NAB groups is Judge Justin Miller, NAB president, whose stand on FCC's criticism of what goes on the air has been that any Federal interference would infringe on freedom of speech. Backing him up this summer were leading representatives of all U. S. media, meeting at NAB headquarters in Washington. Accepting invitations were such notables as the president of the newspaper publishers association, the publisher of *Collier's,* and representatives of books, movies, and radio. Supplementing the opposition to FCC was an affirmative attack by the RMA advertising committee, which recommended sponsoring another radio listener contest during National Radio Week, Oct. 26-Nov. 1. RMA

will cooperate with the NAB Association of Women Broadcasters which conducted the contest last year. . . . Meantime, the industry's opposition to FCC "censorship" is concentrating on an attack on FCC's "Blue Book" criticizing some of the Commission's attitudes toward broadcasting generally and commercials in particular.

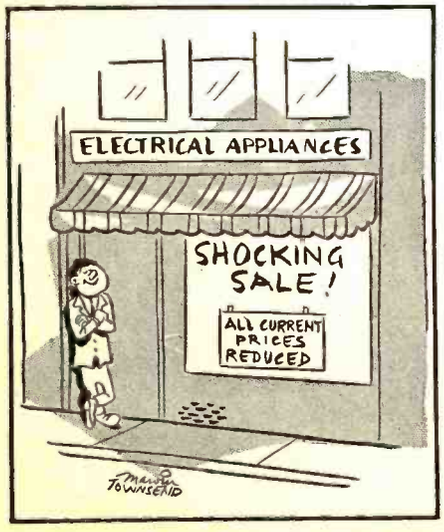
SUMMING UP for the industry, Judge Miller says: "Within the proper scope of its authority, the Commission is performing a tremendous task well, working with me and with the broadcasters, generally, on a very friendly and cooperative basis." But he adds: "While it is entirely proper and desirable for informed critics to analyze and challenge practices and performances of radio broadcasting, it is an entirely different proposition for a government agency which is engaged in 'regulation of interstate commerce' to be stirring up such criticism. It is as if the Postmaster General, in administering the law concerning the use of second-class mail privilege, by magazines and newspapers, should issue a 'report' condemning the contents of such publications and urging critics to attack them. If additional regulation is necessary," he said, "it should come from the industry itself and from the listening audience, in the manner similar to the practice followed in the press, the motion picture industry, and in the professions." Adding that the large majority of Americans like present-day broadcasting as it is conducted in this country, he stated that "Americans do not want government-operated broadcasting or governmentally controlled broadcasting."

ON THE PRODUCTION FRONT, business continues to be good. Latest tabulations show that a total of 8,610,644 radio and television receivers were produced by RMA members during the first half of the year. More television receivers were produced in June alone than in the entire year 1946, and the half-year output of FM-AM receivers was up two-and-a-half times that of the previous year. June's record output of 11,484 television receivers brought the semi-annual total to 46,389 as contrasted with only 6476 all during '46. . . . A total of 445,563 FM-AM receivers were produced by RMA member-companies during the first six months of 1947 as compared with only 181,485 in '46. June's output was off to 76,624 as compared with 84,507 in May. This was a seasonal decline that had been anticipated. . . . FM-AM's are on the upgrade in another respect—the percentage of these receivers to the total set production rose from 1.4 to more than 5 during the first half of the year. Consoles were far in the lead in the FM-AM field, but table models are now showing gains. A total of 361,689 radio-phonograph combinations, 15,615 straight consoles, and 68,259 table models were produced during the six month period. . . . Auto radio produc-

tion during the same period also exceeded the 1946 total. In the first six months of this year, 1,208,159 were built; 1946 total—1,153,458.

IN CASE YOU didn't hear about it, radio played a leading role in all of the summer record flights, and was a special feature in the light plane field. Tiny, powerful radio units were used in the Piper Supercruisers round-the-world Evans-Truman jaunt. An unusual aspect of the equipment was provision for v.h.f. transmission. A *Bendix* v.h.f. transmitter was installed, making possible not only line-of-sight, static-free two-way transmission but also use of ground controlled approach radar equipment here and abroad. Lightness was another feature. The pilots specified a maximum of forty pounds. *Bendix* filled all requirements —radio communication and navigation equipment, a range and broadcast receiver with crystal-controlled spot tuners for reception of 6440 kilocycles and 2870 kilocycles, direction-finding facilities, medium frequency transmitter and the v.h.f. and kept the total weight at 26.87 pounds. The outfit enabled each flier to do a rounded job of radio navigation. They could transmit over long distances by using the 6440 kilocycle channel, using either voice or telegraph. On the receiving end were Army, Navy and CAA stations abroad. By using spot-tuners on the PAR-70 receiver, they got the benefit of two extra frequency channels—2870 kilocycles and 6440 kilocycles. In addition to the tunable frequencies normally used on this type of small receiver, this unit also covers the 200-400 kc. and the 550-1500 kc. bands. This latter channel is used by broadcast stations. By using a rotatable loop antenna, the two bands were employed as a radio compass for direction finding. The 2870 and 6440 kilocycle frequencies provided by the spot tuners were also used to pick up control towers and enroute stations and were available for GCA. The 200-400 kilocycle tunable frequency range permitted flying the airways radio ranges in continental United States.

—30—



What's New in Radio

(*Continued from page 86*)

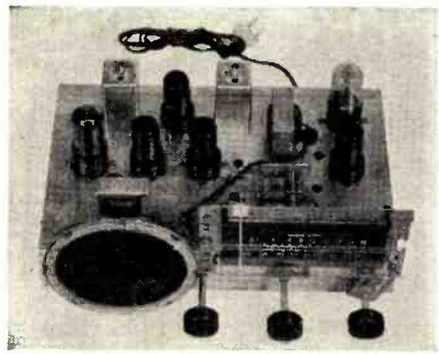
These resistors are completely sealed and insulated by molded plastic. Leads are soft copper wire, hardened immediately adjacent to the resistor body, strongly anchored, and hot solder coated. Each unit is individually marked with resistance value and wattage in addition to the color code.

Ohmite Manufacturing Company, 4980 West Flournoy Street, Chicago 44, Illinois, will forward bulletin on these resistors and advise where they may be purchased if you will drop them a line asking for the "Little Devil Bulletin."

B.C. AND S.W. KIT

The Radio Craftsmen of Chicago are announcing a new radio receiver kit, the Model RK6S, which covers the standard broadcast band from 550 to 1600 kc. and short-wave bands lying between 5.5 and 18 mc.

This receiver operates on either a.c. or d.c., 105-125 volts. The set



uses six standard tubes which are furnished with the kit. The kit has been engineered to produce good results whether the unit is assembled by a novice or an experienced radioman.

A complete 20-page instruction booklet accompanies the kit. Nine photograms showing various assembly steps are used to illustrate the text material. Assembly details are given in easy-to-follow numbered steps and a large-sized blueprint of the circuit is also included in the instruction manual.

The Radio Craftsmen, 1341 South Michigan Avenue, Chicago 5, Illinois, will supply additional information on the Model RK6S to those requesting it.

V.H.F. CRYSTAL

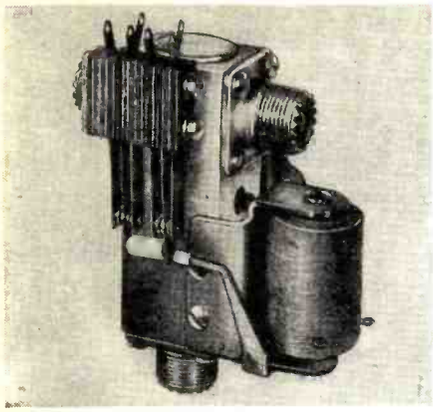
Bliley Electric Company of Erie, Pennsylvania, has just announced a new v.h.f. crystal designed for the 15-megacycle range.

This new unit, the Type BH6, employs a paper-thin quartz plate operating on third, fifth, and seventh overtones. The crystal, lapped as thin as .004", is processed to micro-tolerances and silver plated to insure long term precision. A pair of ceramic rings clamp the delicate plate rigidly in position. Recommendations covering oscillator

circuits best suited for optimum performance will be made by the manufacturer on request. Address inquiries on this new unit to *Bliley Electric Company,* Erie, Pa.

NEW RELAY

Advance Electric & Relay Co., of Los Angeles, California, is currently manufacturing a new relay designed for s.p.d.t. switching of 50 ohm coaxial lines.



Known as the *Advance* Series 7200 a.c. or 8200 d.c., this relay features an inspection port at the top of the unit for easy access to the internal ¼" silver contacts and 3/16" silver contacts for simultaneous control of indicator lights and other associated circuits.

Advance Electric & Relay Co., 1260 West 2nd Street, Los Angeles, California, will supply full details on request.

TEST RECORD

Of special interest to servicemen engaged in the adjustment and testing of record changers and coin operated phonographs is the new test record just announced by *Walter L. Schott Co.* of Beverly Hills, California.

The new *Walsco* standard test record embodies a patented principle which permits accurate adjustment to the proper set-down and tripping position of the pickup through the use of a series of three consecutive tones.

The lead-in grooves are modulated from the outer edge of the record in a series of three consecutive tones. In testing the record changer, proper adjustment is attained when only two tones are heard.

Suitable for thousands of tests, the record is made of high quality material, scientifically designed, and provision made for flatness, concentricity, thickness, and accelerated pitch grooves.

Additional information will be supplied by *Walter L. Schott Co.,* 9306 Santa Monica Boulevard, Beverly Hills, California.

TELEVISION KIT

The *Telekit Sales Division of Electro-technical Industries* has just introduced a new seven inch television kit which contains all necessary component parts except tubes.

Pretested instruction books accompany each unit and explain every step of the assembly process. Photographs, diagrams, and full details put the assembly of this receiver within the range of any mechanically minded person.

The company is also marketing a ten inch kit which provides electromagnetic scanning and focusing.

Full details, including prices, on these kits will be supplied by *Electrotechnical Industries,* 121 N. Broad Street, Philadelphia, Pennsylvania.

CRYSTAL CONVERTER

Receivers designed to operate in the old FM band can now be converted to provide operation in the 88-108 mc. band through utilization of a new crystal converter which is being marketed by *Crystal Devices Co.*

Using germanium crystal diode units, this converter requires no power connections from the set. The antenna is connected to the unit and the output is wired to the antenna terminals of the receiver. Two screwdriver adjustments are used to set the semi-fixed tuning.

The converter is shipped, pretuned to the center of the new band, with complete instructions on installation and operation. Details may be secured by writing *Crystal Devices Co.,* P.O. Box 380, G.P.O., New York 1, New York.

PICTURE TUBE MASK

Telectro Components of Belleville, New Jersey, is offering manufacturers of television sets and equipment a new combination picture tube mask and protective plate made of optical plastic.

This new unit masks the image with an opaque white finish. Shadowed corners are eliminated, allowing full view of the entire picture tube surface at the proper aspect ratio. The protective plate follows the contour of the picture tube surface. The complete unit allows the picture tube to be installed forward in the cabinet permitting a wider viewing angle and

a simplification of the design and construction of cabinets.

Prices will be quoted by the manufacturer on request. Address inquiries to *Telectro Components,* 141 Belleville Avenue, Belleville 9, New Jersey.

TV RECEIVER PARTS

Vision Research Laboratories has announced a complete line of television receiver parts and accessories.

Of particular interest to the receiver designer is the No. 510 permeability tuned television coil kit. This coil kit contains a total of thirteen components including video i.f., sound i.f. peaking coils and traps. These coils have been designed for use in high definition television receivers where bandwidths of approximately 4 mc. are required. The kit also includes a discriminator transformer. The coils are available either in complete kit form or as separate items.

Additional details on these or other television components may be secured by writing *Vision Research Laboratories,* P.O. Box 52, Kew Gardens, New York.

DALMOTRON INTERCOM

Dalmo Victor Company of San Carlos, California, is currently marketing a low-cost intercommunication unit which has been designed specifically for the small office, store, plant, or shop.

This new *Dalmotron* Model 101 incorporates a patented circuit which requires the use of only half an amplifier. The calling unit utilizes the

amplifier of each of the other units as well as its own—a feature which contributes to the compactness of the intercom.

Each *Dalmotron* is a master station which can either transmit or receive. Designed for maximum simultaneous usage, a six unit system can handle two separate two-way conversations while the rest of the system remains open for paging.

Dalmo Victor Company, San Carlos, California, will supply literature and additional details on the Model 101 and other units in their line, upon request.

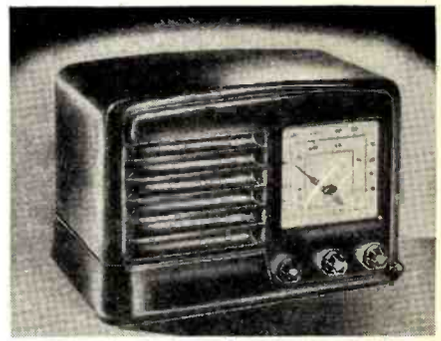
FM CONSTRUCTION KIT

Radio Kits, Inc., has started marketing a new FM radio receiver kit, the Model FM-7.

This table model receiver kit, which

sells in the low-priced field, is completely self-contained or can be used as a tuner in connection with a high quality amplifier. The FM-7 covers the full range from 86 to 110 mc. A phono jack is provided in the rear of the chassis. This jack is connected with a d.p.d.t. switch which feeds the signal either to the speaker in the radio or to the phono jack. The kit is also provided with an extra jack for connecting an additional loudspeaker, if desired.

The kit comes complete with tubes, speaker, and cabinet. The r.f. section is pretuned at the factory. The kit uses two i.f. stages, one limiter



and one discriminator. Miniature tubes are used throughout.

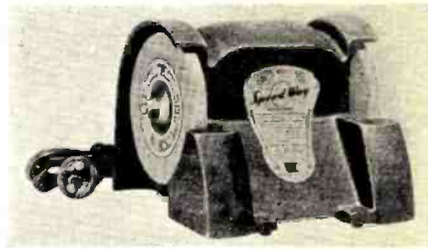
Additional information will be supplied on request to *Radio Kits, Inc.*, 120 Cedar Street, New York, New York.

BENCH GRINDER

Speedway Manufacturing Company has announced a new popularly priced bench grinder for service shops.

The Model 117 operates on 110-120 volts, a.c., and features a speed of 3400 r.p.m. The unit is rated at 1/15 h.p. intermittent duty. It is equipped with self-aligning bronze bearings.

The unit is 8" x 6" and weighs 7½ pounds. The grinder is finished in



blue crackle and comes complete with two grinding wheels, one coarse and the other fine, a built-in thumb switch, and a 6 foot rubber covered cord with unbreakable plug.

Speedway Manufacturing Company, Cicero, Illinois, will furnish prices and additional details on the Model 117 upon request.

NEW MODEL B MOTOR

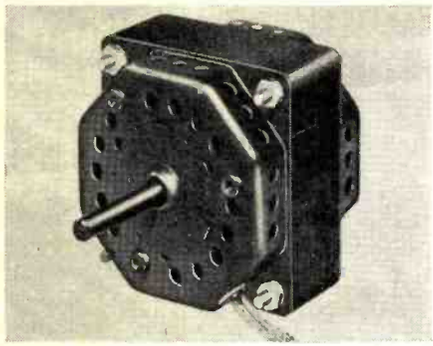
Alliance Manufacturing Company of Alliance, Ohio, has announced the production of a new Model B small motor.

This newest addition to the company's line of "Powr-Pakt" motors may be used as a power source for driving fan blades, magnetic tape, disc,

and wire recorders, and similar devices.

The motor is rated a 1/70th horsepower at 1600 r.p.m. when operated on 115 volts, 60-cycles. Within its recommended usages, the motor is good for continuous duty operation without additional external cooling.

The Model B is a semi-enclosed four-



pole, shaded pole induction motor. It measures 3⅜" square and has a length of 2⅞" over the main portion of the end bracket and approximately 3¼" over the bearing housing.

Engineering specifications and performance details on the Model B motor will be supplied by *Alliance Manufacturing Company,* Alliance, Ohio, on request. -30-

LICENSE REVISIONS

THE Federal Communications Commission has announced the first step in its plan to place the commercial radio operator examinations and licenses in step with the advancements which have been made in the industry.

The plan provides, in part, for three classes of broadcast operator licenses authorizing operation of standard, international, FM, facsimile, television, developmental, and auxiliary broadcast stations. At the present time only the first class radiotelephone operator's license authorizes operation of these stations.

Under the new plan the three new classes of broadcast operator's licenses would be valid for operator duties as follows: "Broadcast Engineer-Operator"—Chief Engineer or Staff Operator of any standard, international, FM, facsimile, television, developmental, and auxiliary stations; "Broadcast Technician-Operator"—Chief Engineer of a standard broadcast station of not more than 1 kw. power employing a non-directional antenna system, or an FM broadcast station, or the Staff Operator of any standard, international, FM, facsimile, television, developmental, and auxiliary station; "Broadcast Radio-Operator"—Staff Operator of a standard broadcast station not exceeding 1 kw. power employing a non-directional antenna system, or the Staff Operator of an FM broadcast station of not more than 1 kw. effective radiated power.

All broadcast stations would be required to employ at least one Engineer-Operator with the exception of FM broadcast stations, standard broadcast stations of 1 kw. or less with non-directional antenna. The excepted stations could employ at least one Technician-Operator in lieu of the Engineer-Operator.

-30-

Signal Generator
(*Continued from page 43*)

checked by connecting a pair of headphones to the audio output jack. When S_2 is in the modulation "ON" position, a steady audio note should be heard. With the a.f. transformer specified, a note of about 400 cycles is obtained. If it is desired to change the frequency of the a.f. oscillator, this may be accomplished by changing the values of C_1 or R_2. Increasing the value of either of these components will produce a lower frequency note, while reducing the value will produce a higher pitched note. Another method of reducing the frequency of oscillation is to connect a small mica condenser across the grid coil; the larger the capacity, the lower the resulting frequency. At any rate, the note finally chosen should be one which is pleasing to the ear of the individual, as he will doubtless listen to it over extended periods of time.

Calibration

Several methods of calibration are possible, the most practical being a direct comparison between the output signals of the generator and a known standard. The known frequency standard may be a heterodyne frequency meter, if available. Otherwise, the generator may be calibrated by using a receiver and a crystal calibrator, or another signal generator for a standard. If the receiver calibration is sufficiently accurate, it may be used alone. Irrespective of the standard used, the final calibration accuracy can be no better than that of the standard, and a certain amount of care should be exercised to preserve as much of this available accuracy as possible.

Before beginning the actual calibration, the band limits should be set. With the signal generator connected to a receiver, turn to Band A, and set the tuning condenser at maximum capacity. Now adjust the slug in coil L_1 until the output is on 170 kc. As the average "All-Band" receiver does not tune below 500 kc., it will be necessary to listen to a harmonic of the signal generator. With the generator set at 170 kc., the 4th harmonic should be heard at 680 kc., the 5th harmonic at 850 kc., and so on at 170 kc. intervals. Check at least two adjacent harmonics to be sure that they are 170 kc. apart. If not, the separation between two adjacent harmonics will be equal to the generator frequency and indicate what adjustment is necessary to move the generator to the desired frequency. Moving the iron slug into the coil reduces frequency, while withdrawing the slug increases frequency.

After the low frequency end of Band A is set, turn the tuning condenser to the minimum capacity and adjust trimmer condenser C_1 for an output frequency of 500 kc. Successively repeat these two adjustments of upper and lower limits until both are as desired. This is necessary because one adjustment will affect the other, and both must be adjusted correctly to give the desired tuning range.

The other band limits may now be adjusted by the same general method except it will be simpler tuning to the fundamental frequency of the generator, instead of harmonics. The band limits of the instrument illustrated were set as follows: Band A—170 kc. to 500 kc.; Band B—500 kc. to 1500 kc.; Band C—1.5 mc. to 5 mc.; and Band D—5 mc. to 15 mc. These values are given mainly as an illustration, and need not be followed exactly, as the adjustments allow for considerable change to suit personal preferences.

After the limits have been set, they should not be altered. The actual calibration may now be undertaken. Assuming that another signal generator is to be used as a standard, the procedure is as follows.

Connect the output of the standard and the output of the signal generator to the antenna terminals of a receiver. Set the standard to 170 kc. and tune the receiver to a harmonic of the standard, with the beat frequency oscillator of the receiver turned on. Once the standard signal has been tuned in, the beat oscillator is turned off and the signal generator to be calibrated is tuned to the low end of Band A. A beat will be heard as the generator crosses 170 kc. Carefully tune the generator to zero beat and then scribe a mark on the dial which will be labeled 170 kc.

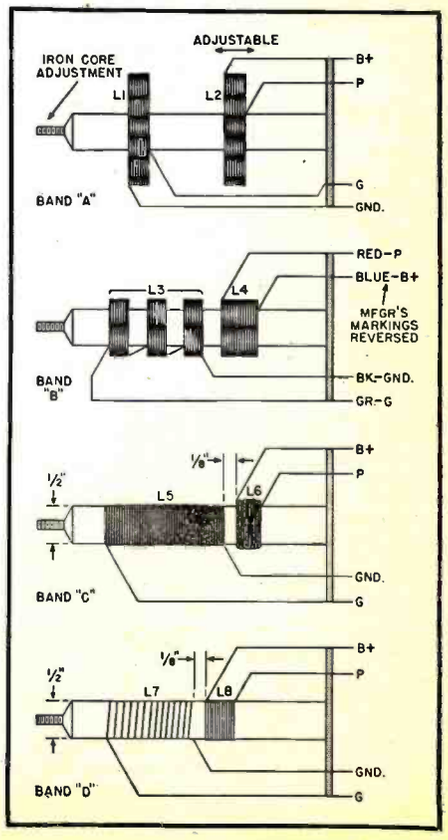


Fig. 5. Details of coil construction.

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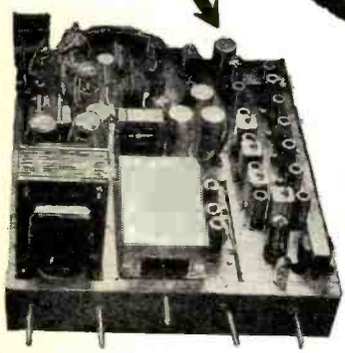

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5Y4	.39	25L6GT	.55
5Z3	.55	25Z5	.49
6A7	.51	25Z6GT	.55
6A8GT	.51	35L6	.55
6AC5GT	.69	35W4	.43
6AR5	.55	35Z5	.43
6AT6	.55	41	.43
6AU6	.69	42	.43
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6D6	.55	50B5	.68
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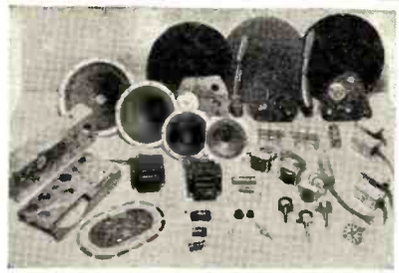

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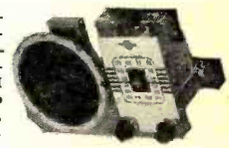

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Then proceed to the next point to be calibrated, say 175 kc. and repeat the same procedure, namely: 1. Set the standard generator to the desired frequency; 2. Tune the receiver to this signal; 3. Tune the generator under calibration to zero beat with the standard. The output level of both generators should be kept low, to give a sharp and well defined zero beat.

The number of points to be calibrated is a matter of wide speculation. Theoretically, the more points calibrated, the more accurately the generator may be adjusted to a given frequency. Practically speaking, a fewer number of calibration points, clearly and accurately located, prove to be more useful than a dial which is cluttered up and hard to read.

Operation

Once calibrated, the operation is straightforward and conventional. A shielded lead is desirable for the output lead, and may be fitted with test clips for convenience. When plugged into the *"R.F. Output"* jack, signals will be available for checking receiver circuits from 170 kc. to 15 mc. Higher frequencies may be obtained by using harmonics of the generator. The r.f. output is of sufficient amplitude to work directly into the diode second detector of a conventional receiver, which is a desirable feature for locating receiver troubles.

With the same output lead connected to the *"A.F. Output"* jack, a variable level audio signal is available for rapid checking of the operation of audio amplifier stages.

In general, the instrument provides all that is required from a simple signal generator at a minimum expense and using only parts that are readily available. —30—

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International Short-Wave

(*Continued from page* 161)

France—North American Service of the French Broadcasting System, Paris, is scheduled at 1700-1715 on 15.24, 15.35, 17.85, and at 1915-2015 on 9.55, 11.845, 15.35.

Freetown—Sierra Leone, 8.125, is heard irregularly on Sundays *only* from 1530; tests are prior to opening up of radio-telephony service to Bathurst, Accra, and Lagos; asks for reports. (Pearce) Call has been reported as SHV-3, and as ZHV-5. May also use 15.840 on occasion. Transmitter is said to be a *Marconi* SWB-8E, running 1 kw.

French Indo-China—Saigon's 49-m. outlet has been moved down to 6.165 from 6.193. (Dilg) The 11.780 channel parallels and has good signal mornings in the East; news at 0500 and 0900.

"The Voice of Vietnam," 9.470, has *English* at 0705-0715. (Dilg) News in French at 0545; location Hanoi. (Sanderson)

Germany—AFN, 6.080, Munich, has news and weather forecast at 1400. (Pearce) Now signs off around 1700 after short newscast. (Harrison) AFN on 7.470 is heard Saturdays and irregularly other days with relays of special events; usually has baseball game to about 0930. (Harrison)

Berlin, 6.710, has been heard in Britain at 1530 with Forces' request records; bad CWQRM; often takes dance music from British Forces' Network, Hamburg, at 1630; signs off at 1700 with "God Save The King." (Peace) Is in British Sector.

U. S. stations at Munich operate 1200-1700 on 7.290, 11.870, 9.540.

Leipzig now opens at 9.730 at 2200; Hamburg, 6.115, opens at 2300. (Beck) Measured Frequency of Leipzig is 9.728. (Arthur, Norris)

Gold Coast—From Head Office, Broadcasting Department, P.O. Box 250, Accra, Gold Coast Colony, the superintendent of broadcasting informs Kary, Pennsylvania, that while we are pleased to hear that our 19-m. transmissions (15.430) have been reaching you well in the past, it is not proposed at present to use that channel on regular schedules as our programs are normally directed within the Colony, thus requiring lower frequencies.

The 4.910 outlet is heard in New Zealand to 1300 when signs off with "God Save the King." (Cushen)

Greece—SVR, 13.670, Athens, has been heard around 1820 instead of SVS for relaying network reporters; after the broadcast, has been heard announcing as going over

"How do such thin legs support such a big tub!"

to telegraphy. (Kary) Normally, SVS, 13.725, works WQV, 14.800, New York, evenings. (Arthur)

Guatemala—TGWA is back on normal schedule of 0730-1500 on 15.17; 1700-0015 on 9.76. TGOA, 6.102, signs off at 0000 except Saturdays when runs to 0100 (Sunday). (Beck)

Haiti—The new Haitian station, HHCN, 5.660, Port-au-Prince, is being heard fair early evenings to 2032 sign-off; has bad aircraft QRM. (Kary)

Hawaii—KRHO, Honolulu, is scheduled 2030-0200 and 0230-0345 on 17.800; 0400-1000 on 15.250.

Holland—Lately, the "Happy Station Programs" from PCJ, Hilversum, have been shortened to 75 minutes, and usually have been preceded by a 15-minute newscast; it is expected that the full 90-minute session will be resumed shortly, according to Eddie Startz, who produces and presents the "Happy Station" periods.

"News on the Netherlands" is now presented daily (including Sunday) at 2130 and 2300 on 9.590, 11.730, and 6.020, beamed to North America; is also heard on these frequencies at 1730 to South America; at 1300 to Europe and South Africa; and is beamed on 17.77, 15.22, and 6.020 at 0430 to the Pacific Area.

India—Mysore's VU7MC, about 6.085, has been heard in California with a weak signal around 0630-0700. (Nankervis)

English periods listed by AIR include 2130, 15.190, 11.830, 11.760, 9.670, 7.290; 2230, 21.510, 17.830, 15.290, 15.160, 11.870, 0030, 21.510, 17.830, 15.190, 15.160, 11.870; 0130, 21.510, 17.830, 15.290, 15.190, 15.160, 11.870; 0300, 17.760, 15.290, 15.190, 11.830, 9.670; 0500, 21.510, 15.290, 15.160, 11.870; 0630, 21.510, 17.830, 15.190, 11.870; 0730, 17.760, 15.130, 11.830, 9.670; 0930, 21.510, 15.160, 11.870, 9.590; 1030, 21.510, 17.760, 15.160, 11.870, 11.830, 9.670, 9.590, 7.290; 1100 (BBC relay), 21.510, 11.870, 9.670.

I have had good reception recently of news from AIR at 0730 on the 15.130 channel; others listed for that time are weak here in the East.

Iran—EPB, 15.100, Teheran, has been heard here in West Virginia with erratic signals lately; some days is almost local in character, on others is wholly inaudible. A man reads the news at 0715 and sign-off is 0730.

Java—Radio Batavia appears to use approximate frequencies of 9.545, 10.365, 9.685, and 15.145 at 0530 when has news. At 0930-1000 use is made of 15.145 and 11.440, beamed in *English* to the United States. Frequencies of 19.350 and 18.600 are used usually around 1100-1200, last fifteen minutes being *English* to Europe.

Cushen, New Zealand, says *Radio Batavia* uses additional frequencies of 6.180, 10.060, and 4.960 in the 0530 newscast period, and also announces a frequency "in the 41-meter band" as parallel. Gillett, Australia, lists latest frequency of *Radio Batavia* as 6.175.

Ricardo, Holland, informs me that

the Bandoeng-Batavia stations (PMA, 19.345, PLA, 18.600, YDC, 15.145) are 3 kw. each and employ beam antennas N.W.-S.E., so as to be directed towards Malacca, Holland, Great Britain, Australia, and New Zealand; and that the 11.44 transmitter uses a rhombic antenna, directed towards San Francisco; PMA and PLA also use rhombic antennas, while YDC has a horizontal antenna system. He lists *English* transmissions on 15.145 and 11.440 at 0930-1000 daily, and on 19.345 and 18.600 at 1145-1200 daily; the 15.145 and 11.44 stations have Indonesian programs at 1730-2030, 2230-0130, and 0630-0925; Dutch at 0430-0630 and 1000-1100; these programs are relayed by "regional" stations on 28.9 m., 31.4 m., 3 kw., and on "local" stations on 61.7 m. nd 115.3 m., 300 watts. Mr. Ricardo explains that call in *English* is, "This is Radio Batavia, Java;" for Dutch transmissions, "Hier is Radio Batavia;" and for Indonesian transmissions, ". . . disinih-la Poesat Radio Rismi Indonesia."

Kenya—Nairobi's VQ7LO appears to have settled down on 4.865; is seldom heard now on 4.885. (Pearce)

Malaya—Singapore's 15.300 and 15.275 channels of the British Far-Eastern Broadcasting Service are heard in Britain at 1145 with news. (Brownless) The 15.275 transmitter is best here in the East, mornings, but usually is only fair level.

The British Far-Eastern Broadcasting Service in Singapore has informed *Radio Australia* that they recently started using a 10-kw. short-wave transmitter; they plan to add at least two more to their service, for relay purposes, and to provide a service in the Malayan Union not covered by medium-wave programs, the letter stated. A South Australian listener recently reported test transmissions from Singapore in the 49- and 60-meter bands, which may be the new Malayan transmitters in operation.

Mexico—XDY, 9.925, heard on West Coast in Spanish at 2005-2035 and at other times. (Nankervis)

Mozambique—Lourenco Marques is fair level in Australia around 1600 on 3.490 while the 4.925 outlet, in relay, is a very fine signal. (Gillett)

Beira, in verifying for Gerald Nankervis, California, sent a nice card of red and green parallel stripes down through, on white background. Listed power as 300 watts, calls and frequencies as CR7IB, 7.255 (this one was heard by Nankervis), and CR7IC, 3.498; gave schedule of 0145-0545 and 1300-1500 daily; Sundays at 0400-0700 and 1300-1500. Verification was sent airmail but took 48 days to reach California.

The special program on July 13 from Beira lasted an hour; was directed to the United States and consisted of popular Portuguese music with requests for reports and calls to G. Nankervis in between discs. (Laubscher) The broadcast was inaudible in the United States, according to several monitors both East and West whom I asked to check it.

CR7IB has not been heard in Britain since April. (Pearce)

New Zealand—Latest information from Cushen, New Zealand, about the long-promised s.w. stations in Wellington is that the two 10-kw. transmitters with frequencies in the 19-, 25-, and 31-meter bands are expected to begin operations towards the end of the year. Mr. Cushen also reports ZLO, Waiouru Military Camp, North Island, is using call of *Radio Waiouru* in broadcasts daily on 6.800 from as early as 0145 to after 0430; no set schedule; gives sports results and plays modern recordings for troops in Japan; studios are at the camp, but it is likely that the transmitter is the old ZLT7 of the Post and Telegraphs Dept. in Wellington. (ZLT7 formerly operated on 6.715 around 0430 daily.)

Northern Rhodesia—ZQP is now scheduled on announced "31-, 41-, and 76.6 meters" at 1000-1200, daily except Saturday, to Africans *only; no English;* Saturdays, to Africans and Europeans, 1000-1200, with musical program (dance, cowboy, African, and request music), using *English* and Africaans announcements; Sundays, 0400-0530 to Europeans in *English only,* and at 1030-1130 in *English* and Africaans, including church service for Africans, hymns, and other sacred music. Woman announces both daily and Sunday. In daily beam, sign-on is with beating of tom-toms, on Sundays has march introduction. Usually has local news following sign-on. The 41-m. frequency appears around 7.285 and *not* 7.220 as listed by the station. (Laubscher) The 31-m. outlet (9.710) is heard irregularly in California, usually around 1000. (Dilg)

Norway—LCR is the call of the Oslo fone station on 19.930. Has been heard very weak at 0713 calling New York. (Kary)

Palestine—The Forces' Broadcasting Unit, Jerusalem, tested during July on 7.250, but on August 1 resumed regular schedule on JCKW, 7.220, at 1200-1600, except Sunday and Wednesday when carries a late night transmission at 1605-1800. Sometimes acknowledges reports over the air. (Laubscher) Tests heard in Britain. (Pearce) Were good level in Sweden, but at times suffered QRM from Rome on the same frequency; it was announced that after August 3, schedule on 7.250 would be 1600-1800 on Sundays and Wednesdays; said reception reports would be welcomed by No. 1, The Forces Broadcasting Unit, Jerusalem, British Forces in Palestine. (Zachrisson)

In verifying the 6.170 frequency for Flitcraft, Indiana, officials of the Jaffa station stated they had a "new" station on 11.720 and wished reports on that frequency. Roger Legge, New York, has heard this station (actually on 11.725) signing on at 2250.

Panama—HOLA, 9.505, Colon, is scheduled weekdays to 1700 when signs off with the Panama National Anthem; has *English* at 1600-1700; on

Sundays, signs off at 1600, on which day the *English* period runs 1530-1600. (Company)

Philippines—Cushen, New Zealand, has been advised by KZPI, Manila, that its sister-station, KZOK, is to be used *only* for Spanish-Tagalog transmissions, leaving KZPI for *English* broadcasts throughout. Cushen has heard KZOK on a medium-wave frequency of 1000 kcs.

KZPI has moved to about 9.500; the sister-station, KZOK, is using 9.695 (listed 9.692); these are *not* in dual. (Dilg) KZOK is believed to operate 1630-1100 daily, that being its schedule in the medium-wave band (1000 kcs.) (Radio Australia)

According to the Philippines Radio Training Magazine, the Government of the Philippines may acquire the surplus 50-kw. short-wave transmitter at Malolos from the U.S. State Department. It is proposed to utilize this transmitter to publicize and acquaint peoples of other nations with the development of the Philippines. (Radio Australia)

KZRH, 9.640, Manila, is heard weakly in South Africa from around 1000 to 1100 sign-off. (Laubscher)

Portuguese China—Radio Clube de Macau, in verifying by card and airmail letter, reported use of 200 watts to a pair of Osran MT9F tubes, antenna center-fed Hertz with tuned feeders; gave schedule as in Chinese, 0330-0600, and a Portuguese-*English* service at 0600-0830, with news (*English*) at 0650. (Cushen) Frequency is about 9.354.

Portuguese Guinea—Bissau, 16.350, has been logged after 0700; the 7.100 outlet has been heard at 1700-1745. (ISWC)

Rumania—Transmission from Bucharest on 9.25 begins at 1330 in Rumanian; German, 1345; French, 1400; *English,* 1415; begins and ends *English* period with announcement, "This is the Rumanian short-wave station, Radio Dacia Romana on 25- and 32.4 meters." Seems to be off Sundays. Signals weak in South Africa on 9.25, and the 25-m. outlet has not yet been logged. (Laubscher) Only the 9.25 outlet is heard in Britain. (Pearce)

South Africa—Capetown's 5.885 is still good throughout the 2345-0130 transmission, while Johannesburg's 6.007 is sometimes heard signing on in dual; latter is much the weaker; relays BBC news at 0100. (Beck)

Johannesburg's 3.450 outlet is fair strength in Australia to sign-off at 1605; also operates on 9.875 and is heard with BBC news at 1100. On Saturdays, Capetown's 5.885 appears to run to 1700. (Gillett)

Spain—Kenneth Dobeson, representative in Britain for Radio Nacional de Espana, lists Madrid, 9.368.4, 40 kw., French at 1330; German, 1400; Italian, 1410; Portuguese, 1420; Russian, 1435; *English,* 1500; Arabic, 1530; Spanish, 1545 to 1600 closedown; on Sundays schedule is slightly modified, with news (*English*) at 1545. Is also used daily to Latin America, 1830-2202. Alicante, 7.914.7, 1.2 kw., 0700-

1000, 1400-1800. Tenerife, Canary Islands, EAJ43, 7.558, 0730-0900, 1230-1700. Radio Seu, Madrid, 7.141, EDV10, 10 kw., 1100 or 1200 to 1700. Oviedo, FET22, 7.130, 25 kw., 0730-0900, 1345-1830. Cuenca, EAJ7, 7.100, 2 kw., 0800-1000, 1400-0700. Cordoba, FET15, 7.042, 2 kw., 1400-1600. Valencia, 7.035, 1 kw., 0700-1000, 1400-1800. Malaga, EAJ9, 7.025, 2 kw., 0830-1000, 1500-0700. Valladolid, FET1, 7.006, 0730-0900, 1500-1800. Tetuan, Spanish Morocco, 7.067, 0230-0300, 0830-1000, 1330-1800, with French at 1445, Arabic at 1500-1600. Mr. Dobeson reports that four 100-kw. short-wave transmitters are being built in Spain by *Marconi Espanola*, type TBS802, as used by the BBC for its Overseas Services, and that the contract is worth 270,000 English pounds. He says that Radio International, Tangiers requests reports on its 6.200 outlet, power 1 kw., scheduled 0800-1100, 1400-0700; QRA is Herbert R. Southworth, Director General, Radio International, 34, Calle Goya, Tangier, Morocco.

Sweden—The Swedish Solar Eclipse Expedition in Brazil, SH2-D, was heard in Sweden. Listeners can QSL via S.S.A., Stockholm 8, Sweden (Sverige).

Switzerland—Roger Legge, New York, furnishes us with this current list of Swiss stations (those marked with an asterisk are now in use): HED5, 9.545; HED6, 9.655; HED7, 15.120; HED8, 17.770; HED9, 26.020; HEI2, 6.345; HEI3, 7.210; HEI4, 9.539; HEI5, 11.715; HEI6, 11.775; HEI7, 15.320; HEI8, 17.795; HEI9, 21.605; HER2, 6.055; *HER3, 6.165; *HER4, 9.535; *HER5, 11.865; *HER6, 15.305; *HER7, 17.784; HER8, 21.520; HER9, 25.640; HEU2, 9.520; HEU3, 9.665; HEU4, 11.718; *HEU5, 11.815; *HEU6, 15.315; HEU8, 17.775; HEU9, 21.705.

Trinidad—By this time it is likely that VP4RD, Port-of-Spain, will be on the air with regular transmissions. Watch for this one around 0600 on 9.625; other frequencies that may be used are 6.085 and 12.950.

U.S.S.R.—Moscow's 11.630 outlet is heard signing off with "The Internationale" at 1900. (Kary)

North American morning beam is announced for 0745-0815 on 11.75, 15.11, 15.17, 15.23, 17.83, 21.53; the evening period runs 1820-1950 on 11.89, 15.17, 17.83, with 15.23 in use 1820-1930. (Beck) A frequency of about 17.839 is heard with loud signals in the 1820-1950 beam, and sometimes 17.860 is used also.

Miers, Berlin, lists *English* broadcasts from Moscow, presumably beamed to Britain, at 11.30, 15.36, 11.63, 9.61 (one-half hour, news, Soviet papers review, music and on Thur., Fri., Mon., Tue. has "Russian By Radio at 1145); 1330, 15.36, 11.63, 9.61, 6.02 (news, commentary); 1500, 15.36, 11.63, 9.61, 6.02 (news, commentary and on Thur., Fri., Mon., Tues. has "Russian By Radio"); 0730, 15.36, 11.63 (one-half hour, news); on Saturdays at 1500 and Sundays at 1145 presents "Letter-

box Program," asking for reports to Radio Moscow, Overseas Service, English Programs, Moscow, Soviet Union. This schedule also given by Harrison, England.

Vatican—HVJ, 9.660 and 15.095, heard with news at 0900. (Harrison) During the winter this period will be at 1000 instead of 0900.

* * *

Last Minute Tips

Mervyn Laubscher, South Africa, reports that CR6AA, Angola, "is definitely on the air again; heard to sign-off at 1430 on about 7.17-7.18; difficult to determine sign-on due to terrific amateur QRM, but is heard just after 1300, so presume signs on at that hour; this is *not* a 'Radio Clube' station; only gives call as far as I can make out. Slightly below CR6AA is another strong signal from 'Radio Clube de Louanda;' call sounds like CR6RB, although this closes with Benguela; schedule is 1330-1430 daily. A 'new' Portuguese-speaking station is heard on about 9.29 with very weak signals, signing off at 1400, sometimes as early as 1330."

Pearce, England, says the Arabic transmission on about 6.782, reported by some as from Baghdad, Iraq, is heard to 1600 sign-off, after time-pips; he believes this is Jaffa's 6.790 outlet, and *not* Baghdad.

Freemantle Overseas Radio, Ltd., 18, Park Street, London, W.I., and New York, no longer represent *Radio Andorra* and cannot provide information or verifications. (ISWC)

Radio Makassar, 9.365, now signs off as "the capital of East Indonesia of the Indonesian Archipelago." (Dilg) Should be running now to 0930, with news (*English*) at 0800 on Mon., Wed., and Fri.

Recently when signing off in *English* at 1528 on the 6.030 frequency, *Radio Moscow* announced would be pleased to receive letters from listeners, addressed to Listeners Section, Radio Moscow, U.S.S.R. (Pearce)

The *S.S. America,* heard on July 22 when 1000 miles from New York, verified on prepared form sent the station, and enclosed colorful postcard view of the ship; transmitter used is *RCA* 8009-A, 600 watts output, with four 813's in the final amplifier stage. (Kary) Call appears to be WEDI.

Peddle, Newfoundland, sends these schedules of VONH, 5.970, St. Johns: 0830-1230 and 1630-2200; news 1200, 0530, 0615, 2100 (BBC), and 2130. Mr. Peddle says that VONH has been heard in England, Gibraltar, North Africa, Barbados, eastern U.S., Canada, and Greenland, although power is listed as only 300 watts. Studios are in the Newfoundland Hotel in St. John's; programs are fed by underground cables to the transmitter at Mount Pearl, a park about 6 miles away. A dipole antenna is employed.

A new Dutch station in Java has been heard on 11.030 with bad CWQRM; identification was frequently given but not understandable; program consisted chiefly of music with lots of Forces' request records and messages from Holland; gave schedule as 1830-2030, 1030-0130, and 0430-1130. (Laubscher)

A station using a Scandinavian language is heard on 6.120 until closing at 1600; believed to be OIX-1, Finland. (Gillett)

Radio Noumea, 6.16, New Caledonia, is scheduled 1800-1900 and 0330-0500. (Gillett)

British radio publications list Azerbaijan, Iran, at 1200-1300 on 12.180. (Harrison) This may be a harmonic of *Radio Tabriz,* listed 6.087. A station heard in Australia at 0815 on 11.965 is believed to be *Radio Tabriz;* had native-type music to 0830, then 5 clock chimes were sounded; left air abruptly at 0920. (Gillett)

Moscow's Latin American beam is on 17.83, 15.36, 15.17, 11.63 (Leningrad), 2000-2230. CBLX, 15.09, Montreal, now often runs as late as 2200. (Beck)

XGOA, 15.35, Nanking, has news at 0400; 9.73 outlet carries a separate program at that time. (Balbi)

Due to space limitation, the s.w. list recently compiled by Arne Skoog, Swedish DX-er, for "Roster i Radio," Box 16174, Stockholm 16, Sweden (Sverige) had to be run in three issues of that publication; anyone desiring this list can obtain the three issues by sending two IRC's to the address just given. .....K. R. B.

Television Tubes

(*Continued from page 48*)

If serious aberration of the televised scene is to be avoided, it is of major importance in low velocity scanning that the electrons strike along axial lines perpendicular to the mosaic. The rather unique effects of combined electric and magnetic fields act to produce this. Horizontal deflection is caused by means of an axial magnetic field acting in conjunction with a transverse electrostatic field. Electrons in motion through this combination are forced to move sidewise, that is, at right angles to their original paths.

A transverse magnetic field generated by the vertical deflecting coils accounts for the downward and retrace vertical motions of the scanning beam. Force fields in operation are indeed a thought provoking subject. Their efficient application in the orthicon attests to their remarkable versatility in later developments.

Highly advantageous results can ofttimes be achieved through a combination of similar and yet diverse electronic techniques. The image iconoscope is an excellent illustration. Its sensitivity range is notably increased through the actions of both image dissector and basic iconoscope principles.

Up to this point consideration has been given to camera tubes containing but a single mosaic. In the image iconoscope good use is made of the photoemissive properties of an additional mosaic called the photocathode.

Optical to electrical conversion is accomplished by focusing the televised image upon the back area of the photocathode. The front area is covered with the light sensitive globules. Light energy, proportional to the scenes' characteristics, passes through this plate thereby releasing electrons from its front surface.

An opposite mosaic, chiefly responsible for the camera tube's output, is located at the other end of the glass enclosed envelope. Electrons emitted by the photocathode are drawn to this. Increased numbers of corresponding secondary electrons are released when photocathode electrons strike this surface.

Scanning action is accomplished at this point by means of an electron gun located in the side of the tube. Additional electrons released by the scanning beam are picked up by the collector anode. From here on the operation and signal conversion is appreciably the same as in the conventional iconoscope.

A rather interesting feature of the image iconoscope is the scanned mosaic. This usually consists of a china-coated, flat metal or mica plate having high secondary emissive characteristics.

With the introduction of the image orthicon, Fig. 5, leading broadcasters have agreed that the art of television has at last grown to its full maturity. Its unique adaptability to both indoor and outdoor televising is amazing. Football, baseball, and tennis games, in fact, all outdoor activities can now be televised easily without too much worry about overcast or cloudiness. Its sensitivity is so great that this tube is said to be capable of televising a person by the light of a single candle placed some five or six feet away.

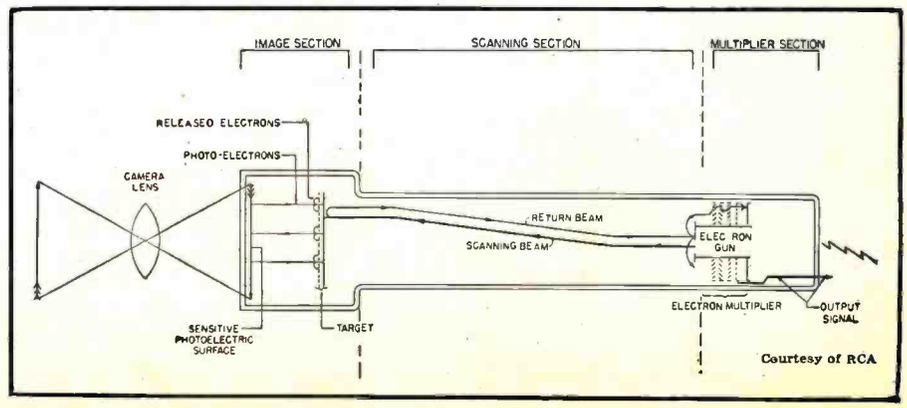
By means of lens action, a photosensitive surface inside the face of the glass envelope absorbs light from the televised object or scene. Photoelectrons emitted from this source, which incidentally has a greater sensitivity than either the orthicon or iconoscope mosaic, are then attracted towards a fine sieve-like grid.

With the exception of this grid which is kept at positive potential with respect to the photocathode, photoelectric action up to this point is quite similar to that of the orthicon.

Most electrons upon reaching the grid are accelerated through it to strike upon a thin sheet of specially prepared glass placed directly behind. Secondary electrons in greater proportion than primary or incident electrons are thereupon released. The glass target consequently develops a positive charge which appears on its opposite surface.

Glass was always thought to have good insulating properties. In the image orthicon, however, the glass is only about .0001 of an inch in thick-

Fig. 5. Simplified functional diagram of the image orthicon tube.



ness and through the magic of electron physics what happens to one side of it also happens to the other.

Scanning is accomplished by influencing the action of an electron stream, the velocity of which is accurately controlled. This enables the electrons to hit the target area, rebound and return to a collector by appreciably the same path. Modulation of the return trace is responsible for a signal appearing at the input of the electron multiplier located in the base of the tube.

Electron beam modulation occurs in accordance with the charge distribution over the scanned area. Predominantly positive areas absorb a greater number of electrons from the scanning beam, therefore fewer return and multiplier action corresponds to low signal levels.

Darker portions of the scanned area, being less positive, attract fewer of the electrons. The greater number of electrons present at the multiplier's input is therefore comparable to increased signal output.

Television, up to the present, has been fraught with grief, but a glimpse into the future seems to justify the hours of experimentation as coast-to-coast television, inter-continent programming and transocean television move a step closer to reality.

The author wishes to express his appreciation to Mr. E. L. Bragdon, Department of Information, *Radio Corporation of America,* and Mr. E. E. Ferrey, Assistant Director of Public Relations, *Farnsworth Television and Radio Corporation* for their efforts in securing data pertinent to the preparation of this article.

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"We now leave the air due to a bad coil in your radio. Call Waymouth 4216 for a Repairman!"

Modulation Monitor

(*Continued from page* 50)

the peaks of modulation clearly. R_6, C_8 causes the eye to remain closed long enough to indicate all peaks clearly. The capacity of C_8 can be adjusted, if desired, to provide either slow or fast action of the *"Modulation"* eye closure during modulation. The larger the value of C_8, the slower will be the reopening of the eye tube.

Calibration of the monitor may be accomplished with the aid of an oscilloscope by feeding the transmitter into a dummy antenna and then either whistling a sustaining note or feeding a tone into the transmitter speech input system. Next adjust the speech gain for 100 per-cent modulation as indicated on the oscilloscope. R_1 in the modulation monitor should not be adjusted until the *"Modulation"* eye is closed. At the same time C_2 should be adjusted for full closure of the *"Carrier"* eye. The monitor is now calibrated.

Audible monitoring is possible by plugging headphones into jack, J_1. This disconnects the *"Modulation"* eye tube grid, since both visual and audible monitoring is not possible at the same time with this instrument. Audible monitoring provides for a "quality" check of the transmitter.

Most hams can construct this instrument from available parts. The one built by the author and shown in the photographs, was constructed in a metal box measuring 10 x 7 x 6 inches. The left eye tube is for *"Carrier"* while the right eye is for *"Modulation"* use. The bandswitch is mounted under the left eye tube, while the phone jack is installed under the right eye tube. The center dial is for tuning. Arrangement of parts is not critical but all of the audio wiring should be shielded to prevent r.f. from getting into the audio circuits.

This monitor is a pleasure to use. It is possible to turn up the speech gain and speak into the microphone in a natural, relaxed voice from a distance of a foot. The operator can operate in this manner without fear of overmodulating since he can watch the indicator and speak loudly enough to hit 100 per-cent on peaks.

Using the monitor also reduces the possibility of BCL interference, a point not to be overlooked. It is known that a carrier modulated in excess of 100 per-cent acquires sharp cut-off periods which cause high damping to create a broad signal and can generate spurious frequencies at odd places on the dial. This can bring about shock excitation in nearby receiving antennas and powerlines.

There is no reason why this circuit could not be built right into the transmitter, obtaining its power from the transmitter or speech amplifier filament and plate supplies. The instrument constructed by the author was used for checking police radio stations

and thus had to be self-contained.

If the monitor is constructed as part of the transmitter an additional switch could be placed in the control grid circuit of either eye tube and the circuit arranged so as to place the grid of the eye across a resistor in the grid return circuit of each stage in the transmitter. The grid current flowing through the resistor would indicate excitation to that particular stage. Since the eye tube is connected by the switch across the resistor, it could also be used as an indication of the excitation. Thus, the eye could be used to tune up each stage of the transmitter and then switched over to function as a modulation indicator.

This modulation monitor was compared directly with a broadcast station modulation monitor and the indication on this instrument coincided with that of the broadcast monitor.

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Television Installation

(*Continued from page* 56)

This condition considerably simplified the procedure of orientation.

Since the sky was overcast during the installation, the technician on the roof first "got his bearings" by use of a small hand compass. From his knowledge of the geographical location of the two transmitting antennas, he was able to *estimate* the direction or bearing of both distant stations.

Selecting the *Primary Channel,* WABD, for orienting first, the dipole was turned broadside to the *estimated* direction of the WABD transmitting antenna and the television receiver was switched to the *Primary Channel.*

The technician on the roof next slowly rotated the entire dipole assembly *in the mounting bracket* (Fig. 6) while the man at the set observed strength and quality of pictures received at various bearings of the antenna.

Best antenna position for receiving

Fig. 7. The dipole is tuned by adjusting space separation between two metal rods, results being observed at TV receiver.

Fig. 8. Dipole assembly mounted permanently and roof installation completed. Fastening lead-in in place is next step.

the *Primary Channel* was found easily, and indicated by a pronounced, brilliant glow of intensity when the dipole was turned broadside to the transmitting station on the *Primary Channel.* This position checked closely with the *estimated* position and direction. The receiver was then switched to the *Secondary Channel,* the dipole was aimed in the *estimated* direction, and the entire orienting procedure was repeated (Fig. 6).

Only a very slight movement of the dipole was necessary, however, to determine the best antenna position for reception of the *Secondary Channel.* Even though the signals *seemed* to be coming from the same direction, there was a difference in bearings for the two television stations. There was also a difference in signal strength, by comparison of the reception of the *Primary* and *Secondary Channels.* Station WABD was considerably stronger than the *Secondary Channel.*

For this reason, the dipole was permanently oriented in the direction of the weaker station on the *Secondary Channel.* Some slight loss could be tolerated in reception of the (stronger) *Primary Channel* in an effort to obtain a better signal from the station on the *Secondary Channel.* This position, for receiving *both* stations, was double-checked several times, by switching back and forth between the two stations while observing and comparing the intensity and quality of the two received signals.

No unusual picture effects or distortion were observed during orientation of the single dipole.

Tuning the Antenna

After orientation, the dipole was tuned by adjusting the amount of space separation between the two metal rods of the dipole assembly.

When the antenna was first assembled, this distance was not particularly critical. A distance of about 2 inches was adequate, but for precise tuning of the dipole for the individual

installation, this distance between the two metal rods required more critical adjustment.

With the receiver switched to the *Primary Channel,* the space separating the two metal rods was adjusted so that the strongest picture signal was received. The receiver was then switched to the *Secondary Channel,* and readjustment of the spacing was attempted (Fig. 7) in an effort to obtain a brighter picture on the *Secondary Channel.* Readjustment was small, but it resulted in an improved signal.

An *average* value of space separation for good reception of *both* channels was then estimated by the roof technician, and the spacing readjusted accordingly. Using this amount of separation, the receiver was switched back and forth between the *Primary* and *Secondary Channels* to make certain both signals were of about the same intensity and good quality.

Final Work

With all antenna adjustments completed, the position of the complete antenna assembly was permanently secured in the metal mounting bracket (Fig. 8). One bolt, through the bracket and mounting pole, held the dipole antenna assembly in a fixed position. Being sufficiently rigid, no guy wires or other antenna supports were considered necessary.

Next, the lead-in "ribbon" was permanently installed. Using polystyrene stand-off insulators, when available, the "twin-lead ribbon" lead-in was installed by the roof technician, following a downward route, and avoiding pipes and large metal objects wherever possible.

Fig. 9. Typical test pattern as received on primary channel of this installation.

During installation of the lead-in, the man at the receiver observed picture images on the *Secondary Channel*—the weakest station, in terms of signal strength—to detect any aberrations or distortion effects which might have been introduced by an unsatisfactory lead-in route. Since no distortion, reflection, or other interference was encountered, the entire lead-in was secured in place. Considerable slack in the lead-in was removed at the receiver, and the "twin-lead ribbon" was then reconnected to the 300-ohm input terminals of the receiver.

After attachment of necessary lightning arrestors and completion of minor construction work, the operation of the television set was given a final test for "best reception." The observed reception of a test pattern on the *Primary Channel*—WABD—was bright, clear, and distinct. (Fig. 9.)

The owner was furnished with operating instructions, and one of the technicians aided him in the actual operation of the receiver. Then—and *only* then—was the installation pronounced complete!

The procedure used is basic, and important! It is the exact procedure used for all suburban dwellings, houses, and similar locations. In addition, *it forms the first part of much more highly complicated installations,* which are *not* simple and certainly *not* trouble-free.

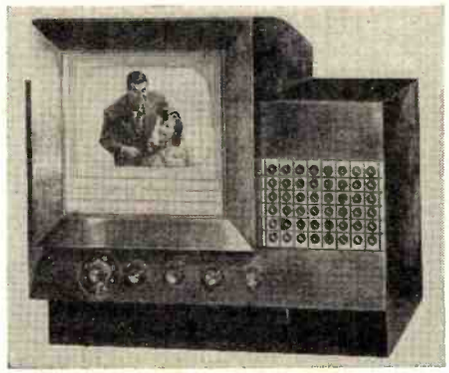
Received pictures are not always ideal (Fig. 9) using a single dipole antenna. All too often the pictures are badly distorted by noise interference and by *reflected* signals of the originally transmitted signals. These produce multiple images, or "ghosts," of the same station, at the same time, on the screen of the television set. However, these typical "troubles" are minimized or entirely eliminated by using *a directional antenna.*

(To be continued)

NEW RECEIVERS for Fall Market

PHILCO TV RECEIVER

Philco Corporation is now presenting several new television receivers to the trade, one of which, the Model 1000, features a 10 inch picture tube of sufficient brilliance to permit pro-



grams to be viewed in normal light without darkening the room.

Another feature of this direct-view table model receiver is the *Philco* Electronic Control, a new development that automatically brings in stations perfectly tuned, sharply focused, and firmly synchronized without need of adjustments by the viewer. The company's new Automatic Level Control which is also incorporated in this receiver compensates for signal variations and avoids fading and fluctuations in sound and picture.

The Model 1000 is in the moderate price class and further details on this receiver and other units in the company's line will be supplied upon request to *Philco Corporation*, Philadelphia, Pa.

FM TUNER

Pilot Radio Corporation has recently introduced their new Pilo-

tuner," Model T-601 for tuning the 88-108 mc. FM band.

The unit includes an r.f. stage, a mixer, an i.f. stage, a driver and a ratio detector. Power is supplied by a selenium rectifier and the set is designed to operate on a.c. only. The set has a built-in antenna with external connection for a dipole unit. Temperature compensated ceramicon tuning assemblies with copper condenser plates and machine stamped r.f. coils provide good stability.

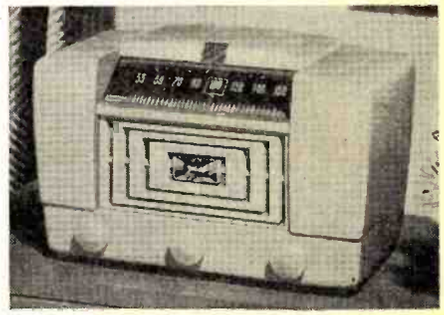
The "Pilotuner" may be connected directly to any audio amplifier, record player, or into the phono input of an AM receiver. It is housed in a wooden cabinet 8¾" x 6¾" x 5 3/16".

Further information on the Model T-601 will be supplied by *Pilot Radio Corporation*, 37-06 36th Street, Long Island City 1, New York.

LOW PRICED TABLE RADIOS

Two new table model radios which feature advanced styling at low prices have been announced by *Radio Corporation of America*.

Known as the Models 66X11 and 66X12, these units feature easy-to-read straight line tuning dials with a



pointer that frames the calibration numbers. In addition, these receivers have two-point tone control, extra large built-in magic loop antenna, built-in ground, a.v.c., a.c.-d.c. operation, selective superheterodyne circuit, and the *RCA* "Golden Throat" tone system. The receivers have five tubes plus a rectifier.

The Model 66X11 is furnished in walnut finished plastic while the Model 66X12 comes in an antique ivory finish.

Details on either, or both, of these receivers will be furnished by the *RCA Victor* Home Instrument Department, *Radio Corporation of America*, Camden, New Jersey.

CHAIRSIDE RECORDER

Audar Inc. is currently offering a combination disc recorder with built-in radio and automatic record changer for use in the home.

Designated the Model RER-9, this new unit features one 4-position switch for radio, recording radio, record playing, and microphone recording. The

switch automatically switches all tone compensation circuits to provide maximum bass and treble adjustment for each operating condition. The speaker baffle design provides for cone back pressure relief through the front grille for high fidelity bass reproduction.

The recorder-changer mechanism will record up to 10 inch discs and

will play ten 12" records or twelve 10" records. A magic eye tube is used as a tuning indicator for the radio position and as a volume level indicator in the radio and microphone recording positions.

This model is housed in a modernistic cabinet finished in fine-grained plastic coated fabric with hand rubbed mahogany panels and trim. The unit measures 31" x 20" x 17".

Additional information on the Model RER-9 will be supplied upon request to *Audar, Inc.*, Argos, Indiana.

COIN RADIO

Designed primarily for restaurants, cafes, snack-bars, and drug stores, *Music Menu Inc.* of Los Angeles has recently introduced a new coin operated radio receiver which provides several new features.

The die-formed aluminum cabinet, trimmed with chrome steel and red

plastic, has a smoked pearl Hammertone baked enamel finish which houses a six tube *RCA* licensed chassis, 12½" x 10½" x 6".

The radio is equipped with two cylinder type locks and a *National* slug rejector. An electric credit unit makes it possible to accept up to 24 coins at one time and an electric coin counter maintains an actual coin record. A *Haydon* synchronous timing motor controls the playing time from one

minute to two hours depending on whether the unit is set to receive 1, 5, 10 or 25 cent pieces.

Standard radio tubes, Hi-Q coils, built-in master volume control, and standard external volume control are added features of the unit. Operation is on 110 volt, 60-cycle a.c., with units for 50-cycle operation also available.

Music Menu Inc., 207 West Pico Blvd., Los Angeles 15, California, is the manufacturer and will supply added details on request.

HOME TV RECEIVER

Remington Radio Corporation is now in production on a new television receiver designed for the home, the "Rembrandt" Model No. 80.

The unit houses a 12" cathode-ray

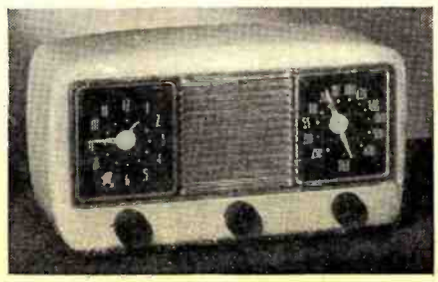
tube which provides an image size of approximately 8" x 10". The *DuMont* Inputuner incorporated in this receiver provides continuous tuning from 44 to 216 mc. and FM coverage. All thirteen television channels may be received on this set without adjustments being made.

The cabinet is 39" x 24" x 18" and is made of ¾" mahogany veneer.

Remington Radio Corporation, 80 Main Street, White Plains, New York, will supply prices and shipping dates on this unit upon request.

THE "RADALARM"

A new table model receiver which combines a plastic-housed radio with an electric alarm clock has been in-



troduced by *Garod Radio Corporation* as one unit in the new fall line.

The "Radalarm" is housed in a plastic case with a contrasting clear plastic clock and dial face. The specially designed electric clock which incorporates the *Telechron* movement is smooth and quiet in operation.

A built-in loop antenna in the radio unit provides pickup over the entire broadcast band. The controls include volume and station selector knobs as well as a radio-alarm switch and time-setting knob. This radio is in the moderately-priced field.

Garod Radio Corporation, 70 Washington Street, Brooklyn 1, New York, will supply additional details on this new line.

TV CONSCLE

The Model T-502 television receiver, which was especially designed to meet the requirements of the home owner,

has been announced by *United States Television Mfg. Corp.* of New York.

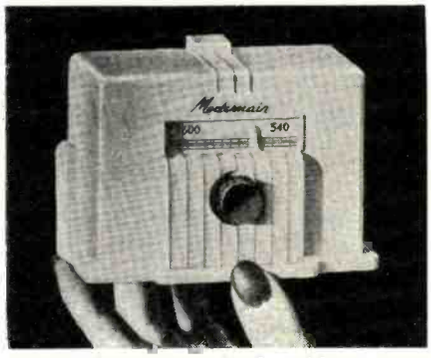
One-third more compact than earlier television consoles, this new receiver features automatic frequency control as well as automatic picture lock-in. Besides providing a 54 square inch television picture, this receiver also incorporates FM, AM, and short-wave reception and a choice of *Seeburg, Webster,* or *Garrard* phonograph units which will handle ten 12" records or twelve 10" records.

The cabinet can be supplied in either Georgian design in dark mahogany with matched crotched veneers, or in modern bleached mahogany. The unit measures 36" x 40" x 22".

United States Television Mfg. Corp., 3 West 61 Street, New York 23, New York will supply full details on request.

MIDGET BATTERY RADIO

The new *Modernair* 500 radio which measures only 4⅜" x 3" x 3" and op-



erates from standard midget type batteries has been announced by *Modernair Corporation* of Los Angeles.

This plastic miniature unit uses a specially designed condenser to give full broadcast reception despite its

"SEE PAGE 10"

small size. Battery cost is said to average less than one cent an hour. The new Hi-Mu 1L4 pentode which is used in this set provides low current drain with resultant long battery life.

This Model 500, which comes in red, white, or blue Tenite plastic, is equipped with an antenna connection wire and a small spring clip. A ground connection on the back panel of the unit is provided for use with an outside antenna.

Modernair Corporation, 925 S. Grand Avenue, Los Angeles 15, California, will furnish additional details on this unit to those making their request direct to the company.

NEW RECEIVER LINE

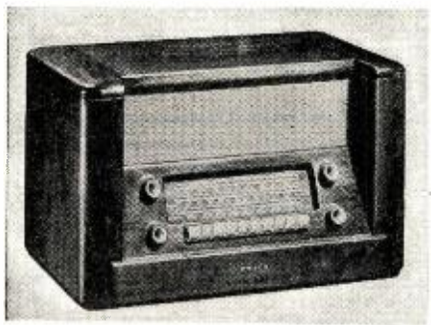
Sparks-Withington Company of Jackson, Michigan, have introduced their new fall line of *Sparton* Challenger radio receivers to the public.

The line includes both console and table model receivers and covers a wide range of prices and styling. One table model receiver in the line, the Utility Model No. 100, is a 5 tube, a.c.-d.c. unit which uses a 5" speaker and a built-in loop antenna. This set provides full broadcast band coverage. The cabinet is of polished ivory plastic.

Details of this receiver and others in the *Sparton* line will be supplied on request by *Sparks-Withington Company,* Jackson, Michigan.

TABLE MODEL FM RECEIVER

One of the outstanding units in the new *Philco* line is the company's Model 482 table radio which incorporates FM, standard broadcast, and short-wave reception.



This new receiver provides separate tone controls for treble and bass, ten push-buttons, and a beam power pentode audio system which furnishes three watts of undistorted volume.

The unit uses eight tubes plus a

rectifier and is housed in a duotone cabinet of solid walnut and birdseye maple-grained hardwood with a gold and tan open-weave grille. The cabinet is 12" x 20" x 12⅝". The unit comes complete with a built-in triple aerial system.

Philco Corporation, Philadelphia 34, Pennsylvania will supply prices and additional details upon request.

-30-

All-Wave Antenna

(*Continued from page* 49)

and the transmission line is negligible.

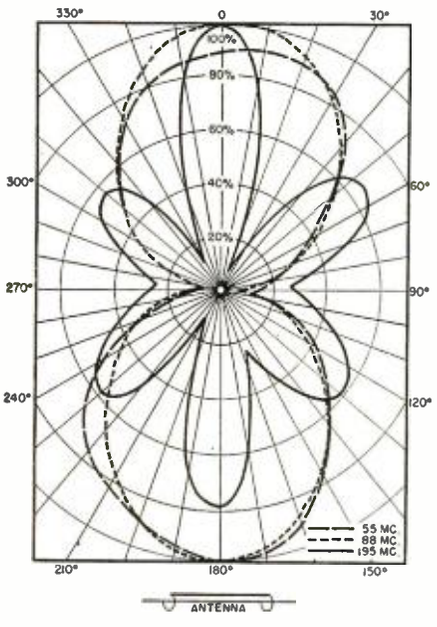
The second most important characteristic of this new "All-Wave Antenna" is the direction from which maximum reception is obtained. This is important since in the majority of receiving set installations all signals in the television and FM bands will be received from approximately the same directions, as it is the present practice to install television and FM transmitting antennas on the tallest buildings within any city. It is desirable, therefore, that the maximum reception from the antenna be from the same direction no matter what the frequency. The curves of Fig. 2 show field patterns for the Model 300 antenna at representative frequencies in the frequency range under consideration.

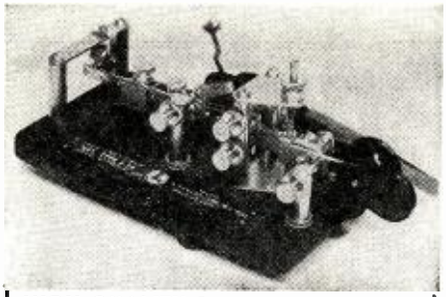
The field patterns shown are all with respect to 100 per-cent response in the maximum direction, hence the relative antenna gain cannot be determined from these figures. The curve of Fig. 1 illustrates the antenna pattern gain with respect to a perfectly matched 300-ohm folded dipole.

A transmission line impedance of 300 ohms was chosen since it represents the tentative standard of the RMA and because of its economy and extremely low attenuation. Noise

(*Continued on page* 199)

Fig. 2. Curves show horizontal field pattern of the antenna at 55, 88, and 195 mc.





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pickup on the transmission line is admittedly poorer with a balanced unshielded transmission line than with a fully shielded coaxial or fully shielded "Twinax" cable. However, if the 300 ohm line is transposed by twisting (one twist per foot of length), the noise pickup is only 1.5 times as bad

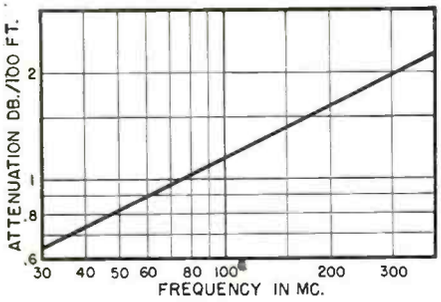


Fig. 3. Antenna line attenuation.

as that obtained with standard RG/59U coaxial cable. This comparison was made with both cables matched at both ends. As mentioned before, this cable has extremely low attenuation, lower, in fact, than similar type cables having lower impedances. The actual line attenuation over the frequency range of interest is shown in Fig. 3.

As may be seen from the photograph, all elements of the antenna are securely grounded to the support member. This permits grounding of the support member to insure protection from lightning. This precaution should be taken in any installation where the antenna is as high, or higher, than surrounding objects such as trees, buildings, etc.

This new Model 300 All-Wave television and FM antenna was produced through the combined efforts of *Tri-craft Products Company* and *Belmont Radio Corporation,* both of Chicago.

—30—

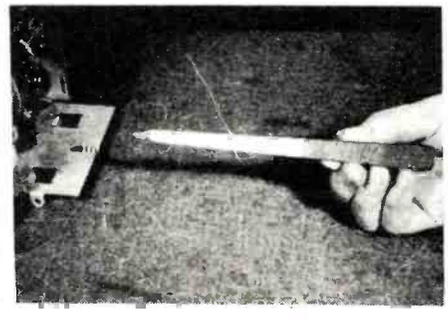
ADD A NAIL FILE TO YOUR SERVICE KIT

A FINGER nail file of the type shown will find many uses in the service kit.

The handle should be taped to avoid shocks and a notch filed near the pointed end will increase the usefulness of the tool.

Wires may be pulled on to check connections—using the notched end of the file—contacts in switches may be cleaned and like tasks performed.

Some may prefer to grind the small end of the file flat to use as a screwdriver . . . . . H. L.



INDEX OF ADVERTISERS

October, 1947

Adapting the TBY-7

(*Continued from page* 41)

more than justified its original cost and the small amount of work involved in adapting it for amateur use. It is an ideal set for cross-town contacts, either as a mobile or stationary installation. —30—

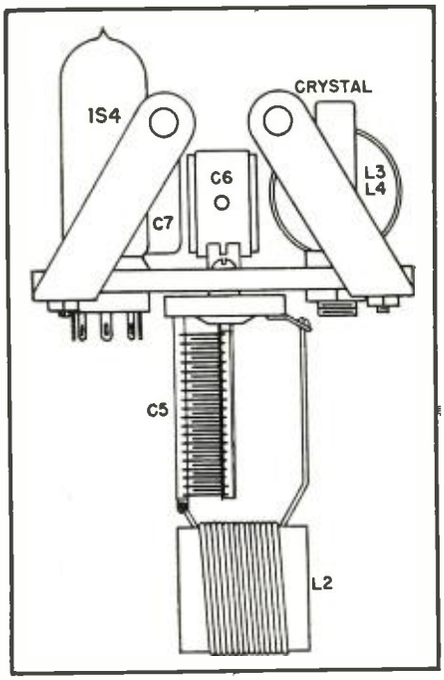


Fig. 3. Rear view of crystal oscillator stage shows placement of component parts.

ERRATA

In the article "A Local Contact Rig" appearing in the July, 1947 issue of RADIO NEWS, the parts list on page 53 omits a value for C_7. This should be a .01 μfd., 600 v. cond.

* * *

Two items in the August, 1947 issue are incorrect as printed. In the article, "The Recording and Reproduction of Sound," the formula appearing in the center column of page 58 should be $H = \frac{B}{\mu}$ instead of $H = \frac{\mu}{B}$. The accompanying text is correct.

In the second article, "A 3-Element Rotary Beam," the formula appearing in the first column on page 111 should be $.66\lambda/4 = 165/f$ or 5'7¼".

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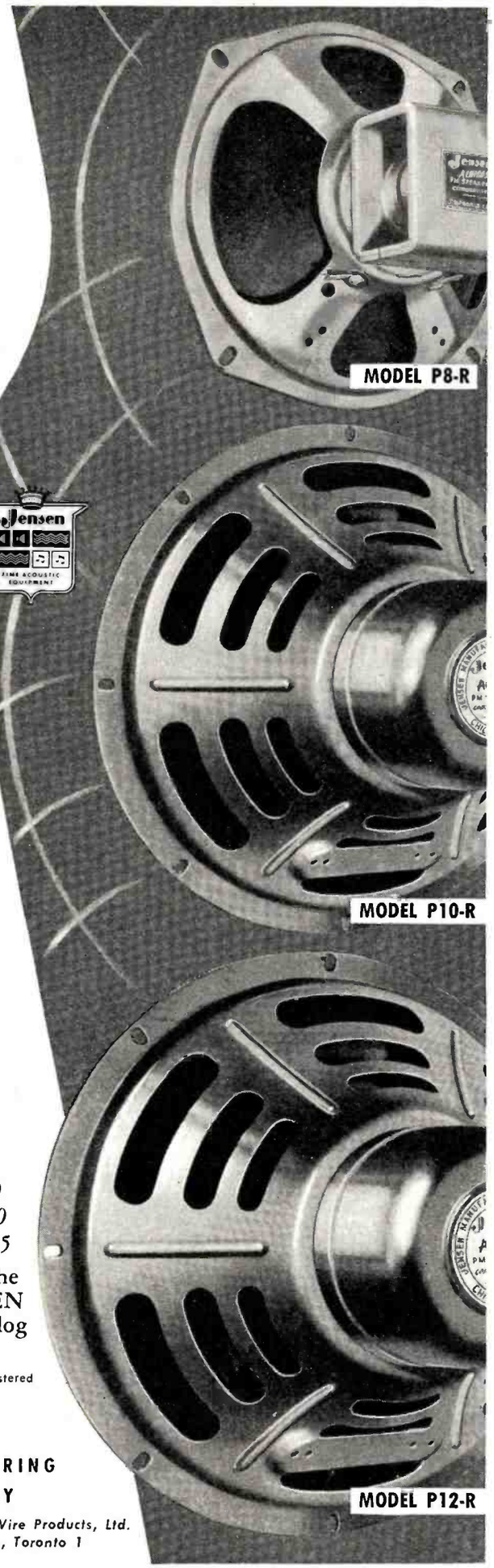

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