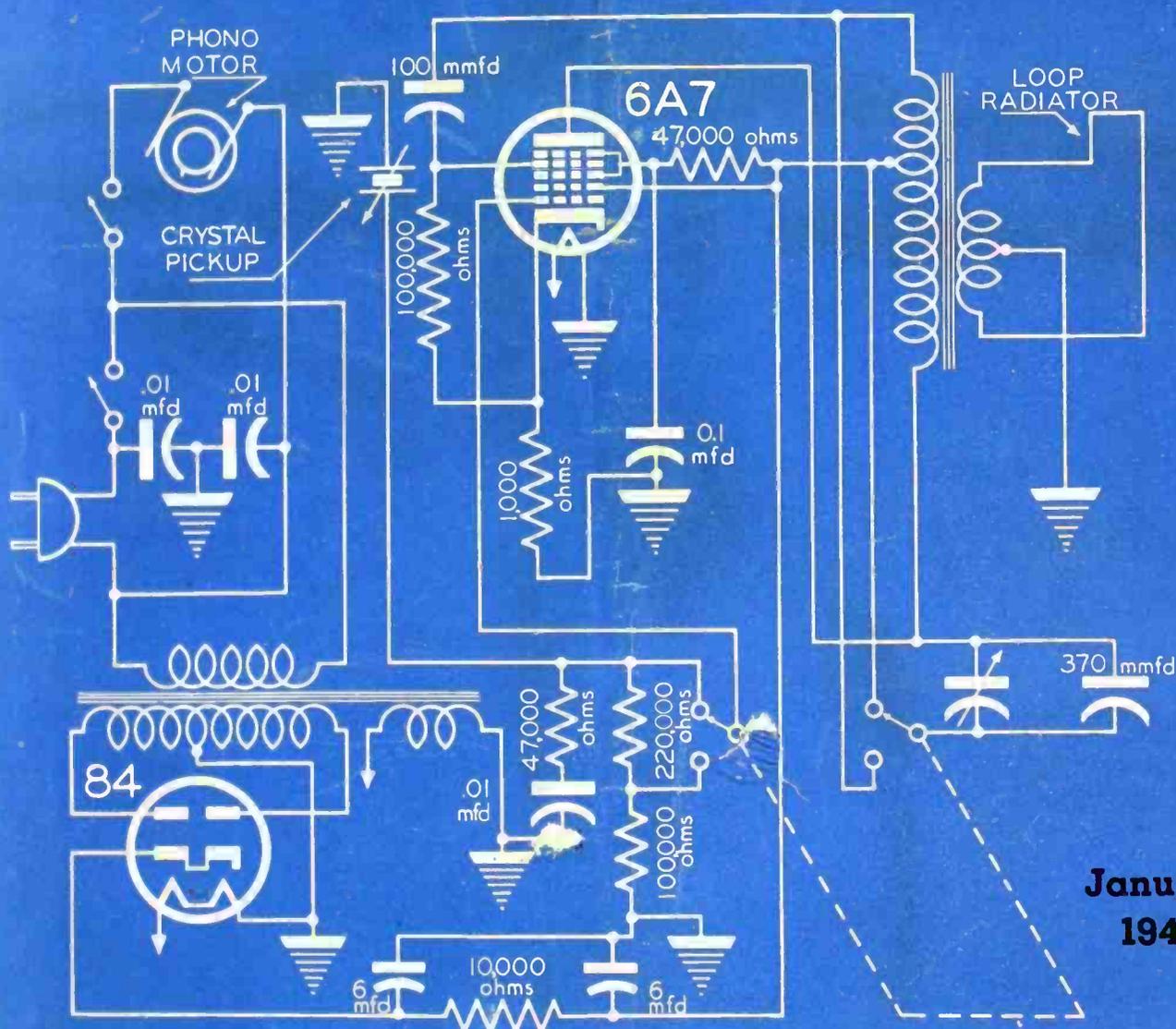


RADIO • TELEVISION • ELECTRONIC

SERVICE

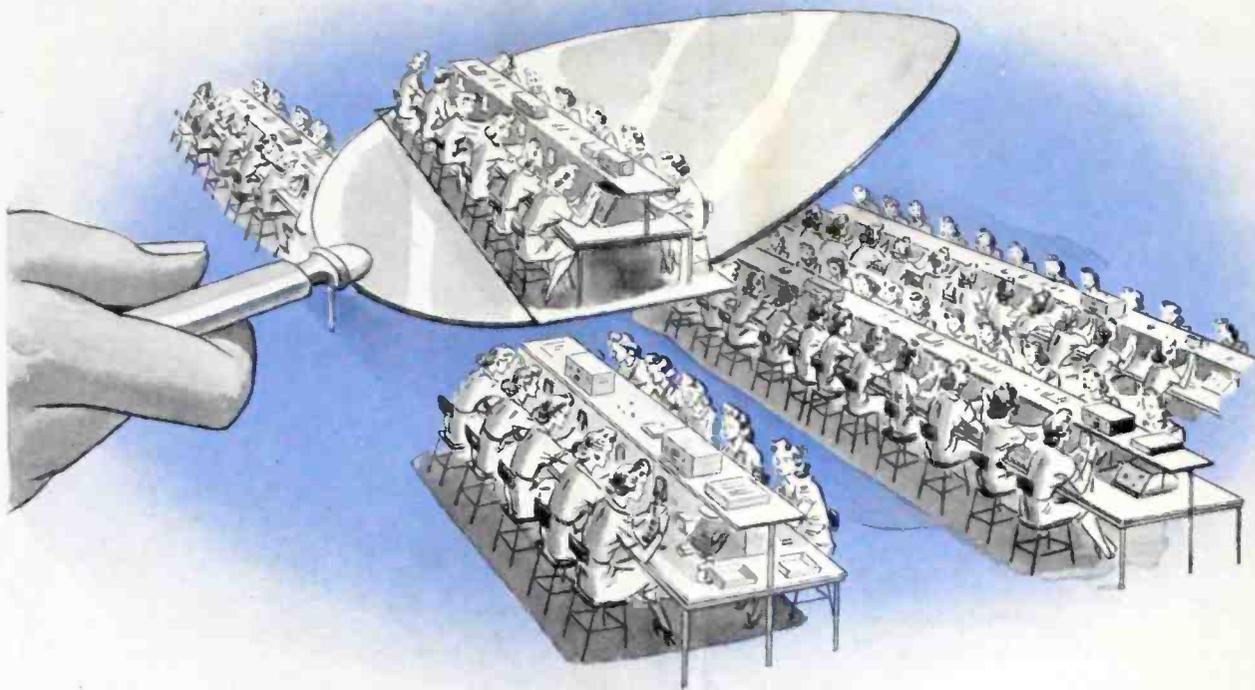


January
1945

A remote type record player with a variable output frequency of 530 to 570 kc. (See page 32.)

Annual Index . . . Pages 20 to 23

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE



Cut Yourself a Slice of Radio Production Line

**and guarantee delivery on your
first radio requirements**



"Buy your new radio from Your Radio Dealer"—that is the theme of MECK advertising to your customers—appearing in Liberty Magazine.

Your biggest postwar problem is—deliveries. Here is a sales plan that answers that problem by guaranteeing deliveries.

An organized sales and distribution plan makes it possible for you to depend on *your share* of the finest radios available immediately after civilian set production starts.

Meck Radios will be sales leaders, year in and year out—from the start. You can now reserve a section of my production line and stop worrying.

Ask your Parts Jobber today or write

JOHN MECK INDUSTRIES, PLYMOUTH, INDIANA

John Meck



MECK RADIOS

TABLE MODELS • PORTABLES • CONSOLE COMBINATIONS • PHONOGRAPHS



History of Communications. Number Thirteen of a Series

MILITARY RADIO COMMUNICATIONS



Today the allied military radio equipments represent the "tops" in engineering design. Progress from the spark transmitter of World War I to present-day equipment is, indeed, a far cry. Taking up where they left off December 7, 1941, Universal Engineers, with their added experience with precision military equipment, shall produce for the public, electronic devices not of fantastic design — but of proven utility and quality.

After Victory is ours, radio amateurs, affectionately known as "hams," will be back after their experience with military radio equipment with an even greater desire to operate their own "rigs." It will be then that Universal will again have Microphones and recording components available on dealers' shelves.

< *FREE—History of Communications Picture Portfolio. Contains over a dozen pictures suitable for office, den, or hobby room. Write for your "Portfolio" today.*



UNIVERSAL MICROPHONE COMPANY
INGLEWOOD, CALIFORNIA



EDITORIAL

THE accelerated production-line methods of war plants appear to have prompted a production-line trend in service shops, particularly those operated by one or two persons. These Service Men have devised systems that provide for rapid, yet courteous counter attention and bench as well as field servicing. Stores have been planned so that a minimum of floor walking or searching is necessary for parts or equipment. Instruments are mounted on snap panels, with spade terminal strips that are removable for component repair or field work. Sectional shelves to house incoming or outgoing receivers or receivers held because of lack of parts, form another feature of this method. Technical bulletins, service cards and circuits properly indexed and filed are also used. And a systematic instrument check method for every receiver, similar to production-line check technique, is used too; a procedure that requires a substantial knowledge of circuit basics. Thus detailed circuit study is a *must* on the program. This is particularly true for receivers of the complex design, such as combinations and a-m/f-m type. And it will be increasingly necessary for the projected a-m/f-m, phonograph and television models.

These *production line* methods have proved so effective in expediting receiver repair that we plan to run several articles describing in detail how to apply them to large and small stores, during the next few months. The presentations will be well illustrated. Watch for them!

REPORTS from the WPB indicate that many returning servicemen have inquired about parts allotments for new service shops. Unfortunately the replies have not been too favorable, for many parts are not too plentiful these days. And instruments are quite a scarce item, too. WPB advice has been to delay new-shop plans for awhile and instead employ servicing talents in a war plant where technical assistance is needed badly. We believe that this is sound advice. Employment in war plants will serve to improve technical skill and in addition aid the war effort!

SERVICE

A Monthly Digest of Radio
and Allied Maintenance

Reg. U. S. Patent Office

Vol. 14. No. 1

January, 1945

LEWIS WINNER

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ALFRED A. GHIRARDI

Advisory Editor

F. WALEN

Managing Editor

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F. Walen, Secretary

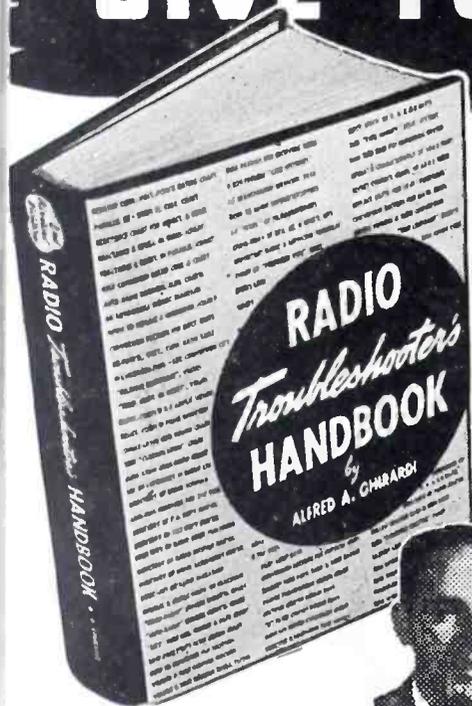


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Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price: \$2.00 per year in the United States of America and Canada; 25 cents per copy. \$3.00 per year in foreign countries; 35 cents per copy.

THESE GHIRARDI BOOKS GIVE YOU THE ANSWERS



Speed Up! Do More Work in Less Time! Make More Money!

Regardless of what Radio set you are called upon to repair, this 3rd (Wartime) Edition of Ghirardi's famous RADIO TROUBLESHOOTER'S HANDBOOK is guaranteed to save you time! From beginning to end, it's designed to help you repair more radios BETTER AND TWICE AS FAST. Hundreds of servicemen write that it has paid for itself on the first job or two.

THE HELP YOU NEED!

Never before has such a wide variety of useful servicing information been compiled so helpfully. In addition to over 400 pages of Trouble Case Histories (common trouble symptoms, their causes, and remedies) for 4,820 specific receiver and record changer models, there are literally scores of time-saving graphs, and tables, which give instant answers to your daily problems.

A. A. Ghirardi is not a theorist. He is a practical radio man who spends more time in leading service shops and with manufacturers than he does in his own office. He knows exactly the help servicemen need—and this new, fully revised edition of his RADIO TROUBLESHOOTER'S MANUAL brings you full benefit of his years of rich experience.

CUTS SERVICING TIME IN HALF!

Included are I-F alignment peaks for over 20,000 superhets; dozens of pages on interchangeable tube types and modernizing old receivers; the most complete tube chart ever compiled; plug-in and ballast resistor replacement charts; a tabulation of I-F transformer troubles—condenser, resistor, coil, and transformer charts and formulae—and hundreds of pages more designed to give you just the help you need—WHEN YOU NEED IT MOST!

Sold for only \$5 complete (\$5.50 foreign) on an absolute 5-Day Money-Back Guarantee. Can you afford to be without it these busy days?

A. A. Ghirardi—the man who has personally answered over 50,000 inquiries on radio construction and servicing!



SAVE TROUBLESHOOTING TIME

Cut down your troubleshooting time with the greatest compilation of "Case Histories" ever published! This big new wartime edition of A. A. Ghirardi's Radio Troubleshooter's Handbook contains common trouble symptoms and remedies for over 4,800 receiver and record changer models—all carefully indexed for instant reference. A servicing information gold mine that has taken years to compile! Used daily by thousands of shops throughout the world!

SAVE REPAIR TIME

When a Radio comes in for repairs, first turn to your Handbook instead of to your tester. You'll be amazed what a whale of a lot of time you'll save.

For remember: Ghirardi's TROUBLESHOOTER'S HANDBOOK isn't a "study" book. It's a reference book that you turn to when you want the answer to a specific repair question or to learn about some specific set.

MAKE MORE MONEY

Why bother figuring out things that have already been figured out for you and recorded in easily-found, quickly understood style in this big new 710-page manual-size book?

Smart servicemen everywhere say Ghirardi's TROUBLESHOOTER'S HANDBOOK is helping them turn out from 50% to 100% more work with less labor and that means 50% to 100% more money for the same amount of effort!



THIS IS THE BOOK THAT WILL TEACH YOU RADIO SERVICE WORK *Right!*

Ghirardi's famous 1300-page MODERN RADIO SERVICING is a hard-hitting, intensely practical course in modern service work . . . the only single, inexpensive book that gives a thorough explanation of the workings of all Test Instruments; Receiver Troubleshooting Procedure; Circuit Analysis; Testing and Repair of Component Parts; Installation; Adjustment; Maintenance; etc. 706 illustrations, 720 self-testing review questions, 766 different topics.

SPECIAL MONEY-SAVING COMBINATION OFFER

Make your servicing library complete—keep it up-to-the-minute and profit accordingly. Get both Ghirardi's RADIO TROUBLESHOOTER'S HANDBOOK and MODERN RADIO SERVICING—a big \$10 value for only \$9.50 (\$10.50 foreign). Over 2,000 pages chock-full of the finest, most practical help money can buy!

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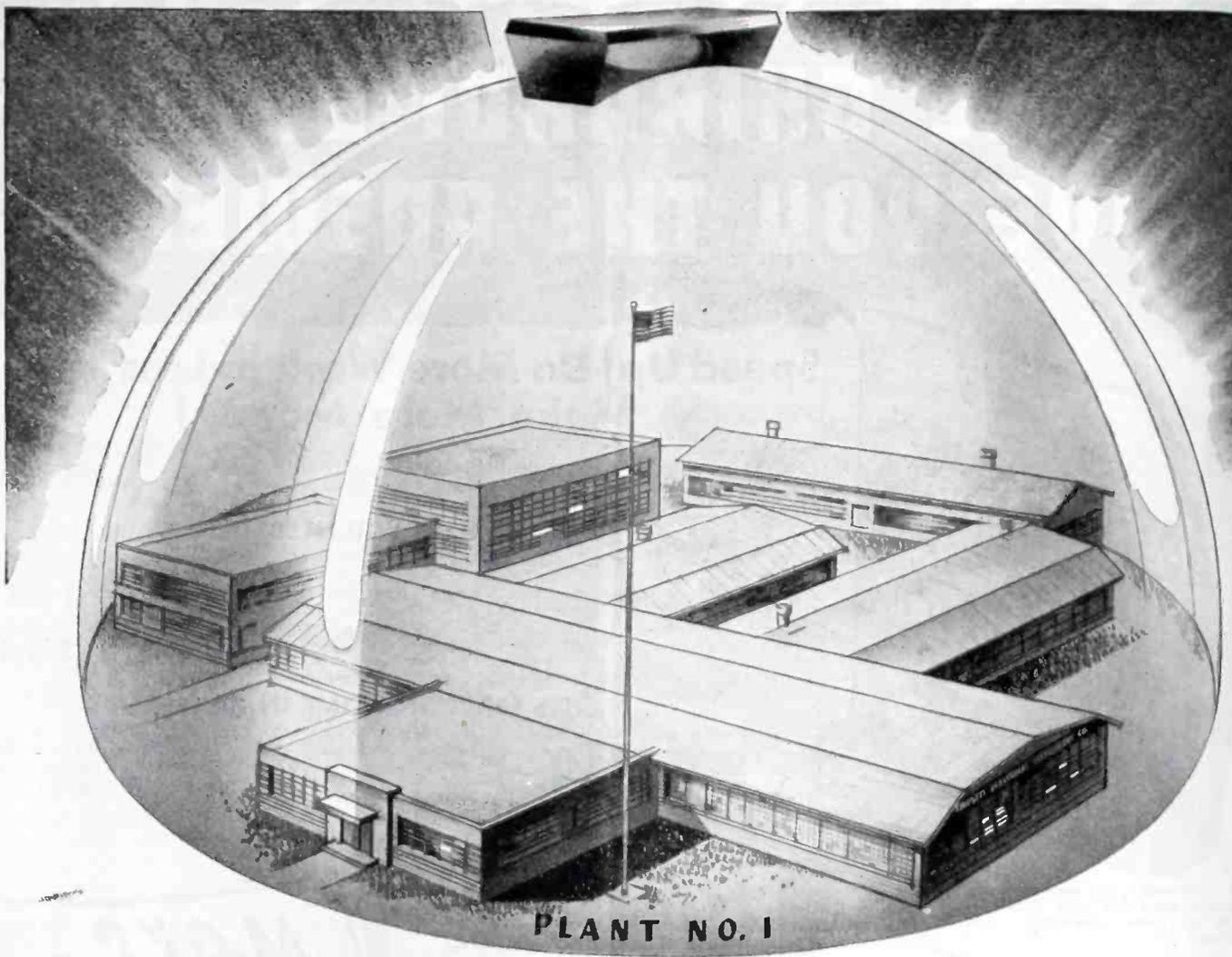
Enclosed find \$5 (\$5.50 foreign) for Ghirardi's new 3rd Edition RADIO TROUBLESHOOTER'S MANUAL, postpaid; or send C.O.D. (in U. S. A. only) for this amount plus postage. I may return the book at the end of 5 days and receive my money back.

MODERN RADIO SERVICING, \$5 (\$5.50 foreign).
 Check here if you wish to take advantage of MONEY-SAVING COMBINATION OFFER (see above).
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Name
Address
City & Dist. No. State

5-DAY MONEY-BACK GUARANTEE

MAIL THIS NOW!



PLANT NO. 1

"DUSTLESSTOWN, OHIO"

● It's the little things that loom biggest in the manufacture of delicate electrical measuring instruments. Little things like specks of dust or breath condensation can play havoc with accuracy. That's why Triplet Instruments are made in spotless manufacturing departments; why the air is washed clean, de-humidified and

temperature-controlled; why every step in their mass production is protected. As a result Triplet Instruments perform better, last longer and render greater service value.

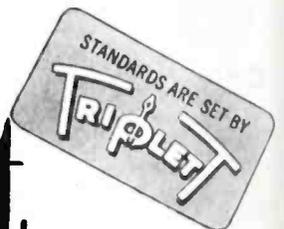
Extra Care in our work puts Extra Value in your Triplet Instrument.



*Precision first
...to last*

Triplet

ELECTRICAL INSTRUMENT CO. BLUFFTON, OHIO



A black and white photograph of a modern office interior. In the center, a large, tilted sign reads "New Idea FOR THE BIRTH OF NEW IDEAS". The office features a curved desk, a chair, and a man in a light-colored shirt standing in the background. The scene is overlaid with several thin, white, curved lines that create a sense of motion and design.

New Idea
FOR THE BIRTH
OF NEW IDEAS

The entire Detrola Radio plant is a new idea in radio manufacturing technique. All of its departments—administrative, engineering, design, production—are spacious, orderly and modern . . . and modernly equipped. This not only promotes employee efficiency, but stimulates workers to conceive ideas for ever-greater improvement of both our products and manufacturing methods. Such conditions have enabled us to achieve high quality, high volume war production. They will likewise enable us to build highest quality radio receivers, automatic record changers, record players, radio television receivers and other electronic devices when our efforts are again happily directed toward those peacetime pursuits.

DETROLA RADIO

DIVISION OF INTERNATIONAL DETROLA CORPORATION - HEADQUARTERS AT CHATFIELD, DETROIT 8, MICH.

C. RUSSELL FELDMANN  PRESIDENT

BUY MORE WAR BONDS

RECIPE FOR "PRECISION-EL"

(MT. CARMEL STYLE)



Back to work with a smile—These men and women look forward to their jobs each day. They're Meissner's famed "precision-el." With many of them working to produce vital electronic equipment for the Armed Forces is a "family affair," for a place in this home front army of "precision-el" isn't restricted only to dad — mother, brother and sister contribute to the quality of Meissner products, too.



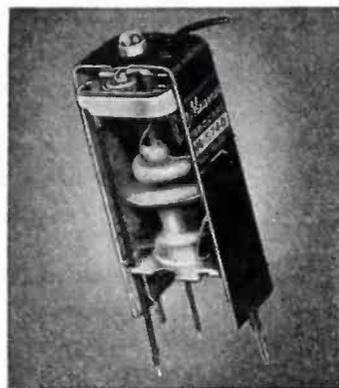
Splitting thousandths of an inch is all in the days work for this skilled machinist, yet he finds new reason to smile with each job done better. He, and hundreds like him, are responsible for the recognition of Meissner's "precision-el" by an exacting precision industry.

Take Mt. Carmel, Illinois, a typical American city, where men and women can work to produce and acquire the better things of life. Add pleasant and congenial working conditions like those you'll find at Meissner, exacting jobs like those you'll find in electronics — wait for the smile that means pride in a precision piece of work well done, and — presto — there you have it — "precision-el."

The men and women whose progress is shown on these pages are typical of Meissner famed "precision-el." Look at them. You'll find them just one more reason why Meissner products, precision built by "precision-el," do your job better.



"Precision-el" at work—still smiling, intent on the job at hand. Now it's a job that will bring victory nearer . . . After victory, it will be a job that makes for better living. Always, it's a better job, thanks to the smile that's always there.



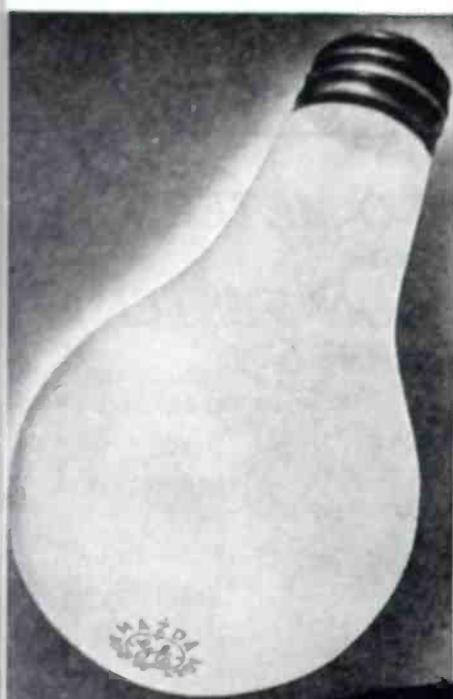
Easy Way To "Step Up" Old Receivers!

Designed primarily as original parts in high-gain receivers, these Meissner Ferrocart I. F. Input and Output Transformers get top results in stepping up performance of today's well-worn receivers. Their special powdered iron core permits higher "Q" with resultant increase in selectivity and gain. All units double-tuned, with ceramic base, mica dielectric trimmers, thoroughly impregnated Litz wire, and shield with black crackle finish. Frequency range, 360-600. List price, \$2.20 each.

MEISSNER

MANUFACTURING COMPANY • MT. CARMEL, ILL.

ADVANCED ELECTRONIC RESEARCH AND MANUFACTURE
Export Division: 25 Warren St., New York; Cable: Simonrice



PRESTIGE + POPULARITY = PROFITS

PLAN NOW FOR PROFITS— From tomorrow's big market for G-E electronic tubes!

IT'S time NOW to look ahead—plan ahead—to when electronic tubes will again be available in volume to increase the figures on the profit side of your ledger.

People then, as always, will buy what they know—and respect. They have known and bought G-E Mazda lamps for decades, until this name has become a symbol for light. Now they see G-E electronic tubes in all-page General Electric radio advertisements that run in 18 leading national magazines reaching 8,000,000 readers every month.

In addition, G-E tubes are brought each week to the attention of 28,000,000 radio listeners. Under the very eyes of radio dealers and service men a big, profitable market tomorrow—when G-E tubes can be supplied to all who want them—is being built. Retailers who look confidently ahead to prosperous times, are making G-E tubes a "must" for their post-war stocks. Think back over the years to how G-E Mazda lamps have swelled the cash receipts of thousands of stores! Then think forward to the new, identical oppor-

tunity offered to radio dealers and service men by G-E electronic tubes! Soon this opportunity will be yours. Prepare to take early advantage of what it offers you in the way of assured income and fullest participation in the benefits of G-E leadership. Write for the name of your nearest G-E tube distributor. Address *Electronics Department, General Electric, Schenectady 5, N. Y.*

Tune in General Electric's "The World Today" and hear the news from the men who see it happen, every evening except Sunday at 6:45 E.W.T. over CBS network. On Sunday evening listen to the G-E "All Girl Orchestra" at 10 E. W. T. over NBC.

GENERAL ELECTRIC



RECIPE FOR "PRECISION-EL"

(MT. CARMEL STYLE)



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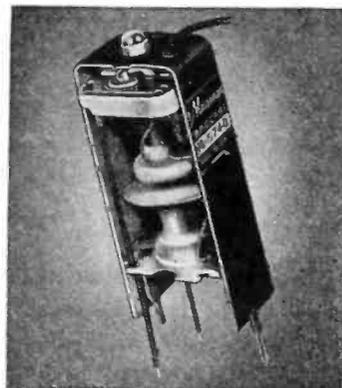
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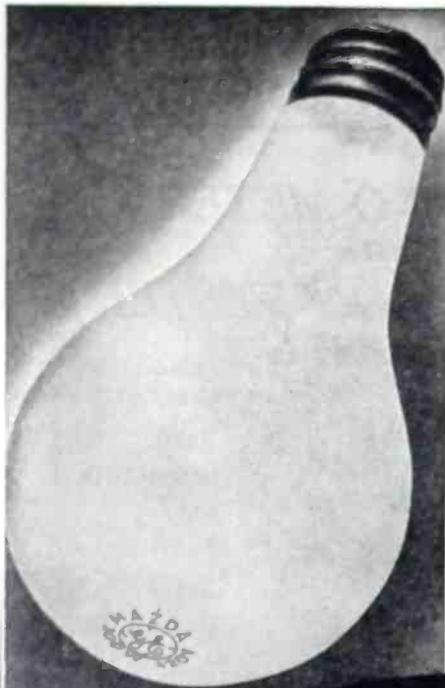
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PRESTIGE + POPULARITY = PROFITS

**PLAN NOW FOR PROFITS—
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for G-E electronic tubes!**

It's time NOW to look ahead—plan ahead—to when electronic tubes will again be available in volume to increase the figures on the profit side of your ledger. People then, as always, will buy what they know—and respect. They have known and bought G-E Mazda lamps for decades, until this name has become a symbol for light. Now they see G-E electronic tubes in full-page General Electric radio advertisements that run in 18 leading national magazines reaching 50,000,000 readers every month.

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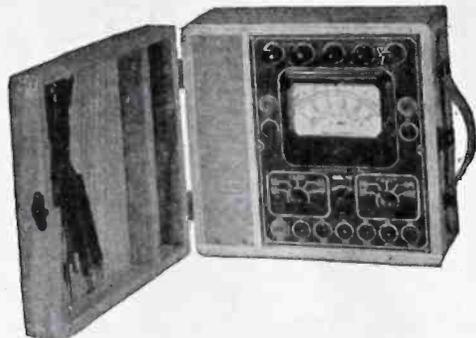
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GENERAL ELECTRIC

ALL FOUR MODELS DESCRIBED ON THIS PAGE ARE NOW AVAILABLE FOR TEN-DAY DELIVERY ON PRIORITY OF AA-3 OR BETTER

THE MODEL 710

VOLT-OHM-MILLIAMMETER



* Sensitivity 1,000 ohms per volt on both A.C. and D.C. * Direct reading. * Completely self-contained. * No external source of current required.

SPECIFICATIONS:

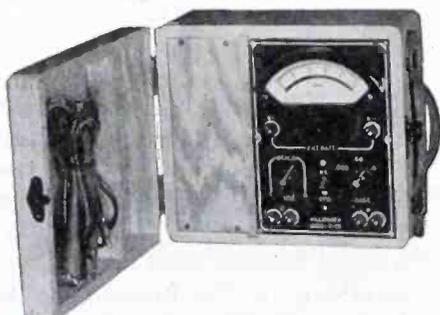
6 D.C. VOLTAGE RANGES: 0 to 15/60/150/300/600/1500 Volts
 6 A.C. VOLTAGE RANGES: 0 to 15/60/150/300/600/1500 Volts
 7 D.C. CURRENT RANGES: 0 to 3/15/50/150 Milliampers
 0 to 3/15/30 Amperes
 A.C. CURRENT RANGE: 0 to 3 Amperes
 5 RESISTANCE RANGES: 0 to 1,000/10,000/100,000 ohms
 0 to 1 Megohm 0 to 10 Megohms

The MODEL 710 comes complete with cover, self-contained batteries, test leads and instructions. Size 6" x 10" x 10". Net weight 11 pounds. Price.....

\$34.50

THE NEW MODEL P-25

MEASURES: SWITCH RESISTANCE, CONTACT RESISTANCE, FRACTIONAL OHM STANDARDS, ETC. INDISPENSABLE IN THE QUANTITATIVE ANALYSIS OF ALLOYS BY THE RESISTANCE CHECK METHOD; INSURES RAPID ACCURATE BOND TESTING!!!



RANGE:
 .00005
 OHMS
 TO
 .5
 OHMS

FEATURES:

- Operates on self-contained battery—no external source of current required.
- Mirror scale on meter eliminates parallax enabling extremely accurate readings.
- Linear scale.

SPECIFICATIONS:

- Accuracy—1% or better at any points.
- The built-in standard resistors are all of the 4 terminal type and are individually adjusted to an accuracy of 1/2 of 1%.
- Circuit employed is exclusive adaptation of the potentiometric method of low resistance measurement.

Model P-25 Milliohmmeter comes complete with battery, all test leads and instructions. Price

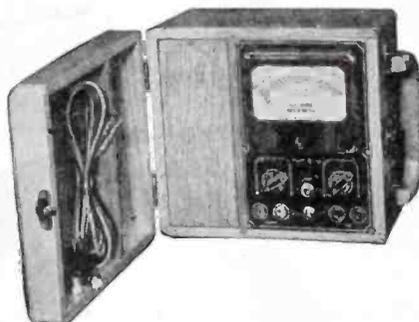
\$49.50

THE MODEL 610-B

MEG-O-METER

A NEW BATTERY-OPERATED

INSULATION TESTER!!



INDICATES LEAKAGE UP TO 200 MEGOHMS AT A TEST POTENTIAL OF 500 VOLTS D.C.

NO HAND CRANKING:

The 500 Volt Test Potential is made instantly available by throwing the front panel toggle switch.

DIRECT READING:

All calibrations printed in large easy-to-read type enabling exact determination of leakages from 0 to 200 Megohms.

3 RESISTANCE RANGES:

In addition to the 0 to 200 Megohm Range which is used for insulation testing two additional lower ranges are provided, 0 to 20,000 Ohms and 0 to 2 Megohms.

Model 610-B comes housed in hand-rubbed, rugged Oak Cabinet complete with cover, self-contained batteries, test leads and instructions. Only

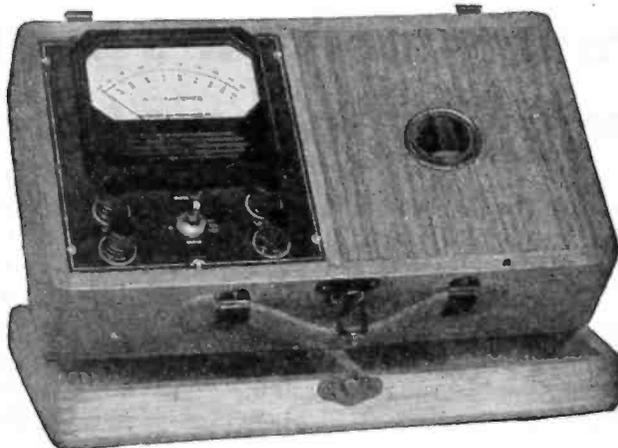
\$62.50

THE MODEL 720

A.C. AMMETER

MEASURES A.C. CURRENT UP TO

200 AMPERES



4 RANGES: 0 to 10/50/100/200 Amperes

The Model 720 combines the two most efficient methods of measuring A.C. Current. Heavy-duty binding posts on front panel used for measuring low currents to 50 Amperes. Built-in torroid transformer permits measurement of currents up to 200 Amperes without breaking line. Necessary only to insert either leg of the line through front panel core opening.

Model 720 comes housed in heavy-duty, leatherette covered cabinet, complete with cover and instructions. Size 13" x 7" x 4 1/2". Price.....

\$49.50

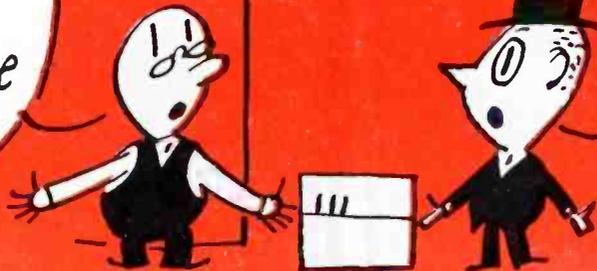
SUPERIOR INSTRUMENTS CO.

Dept. B, 227 Fulton Street

New York 7, New York

We haven't
the brand
you want—
but we have
BLANKOS

CIGARETTES



Never heard
of them—but
okay—I have
to take
what I can
get

**You gotta smoke
—even if it's cornsilk**

It goes in the radio service business, too. • We don't blame you for taking what you can get, Mr. Radio Service Man. • We know you are a business man and that you have a job to do. We understand why you have to accept spot merchandise in a pinch like this. • We also believe, however, that you think along sound lines, that you really want **BRANDED**

MERCHANDISE, and that ordinarily you depend on the reputation of the manufacturer who stands back of that merchandise. • Uncle Sam, who is the most careful of buyers and who thinks about reputations, has drafted IRC Resistors and Controls. That leaves us leaving you out on a limb. (Remember — scarcity, these days, is a mark of leadership!)

*I'll be glad when
I can quit selling
foot-in-the-door
merchandise, and
get back to IRC*



• Most people are fed up with substitutions. They've had too much oleo-margarine, too many ersatz non-elastic girdles, and cigarettes with unheard-of names. Just as soon as they can, they want to get back to real things -- dependables. • We hope that goes for you and IRC Resistors and Controls. It looks now as if things might ease up soon -- and we could again build on quality together.

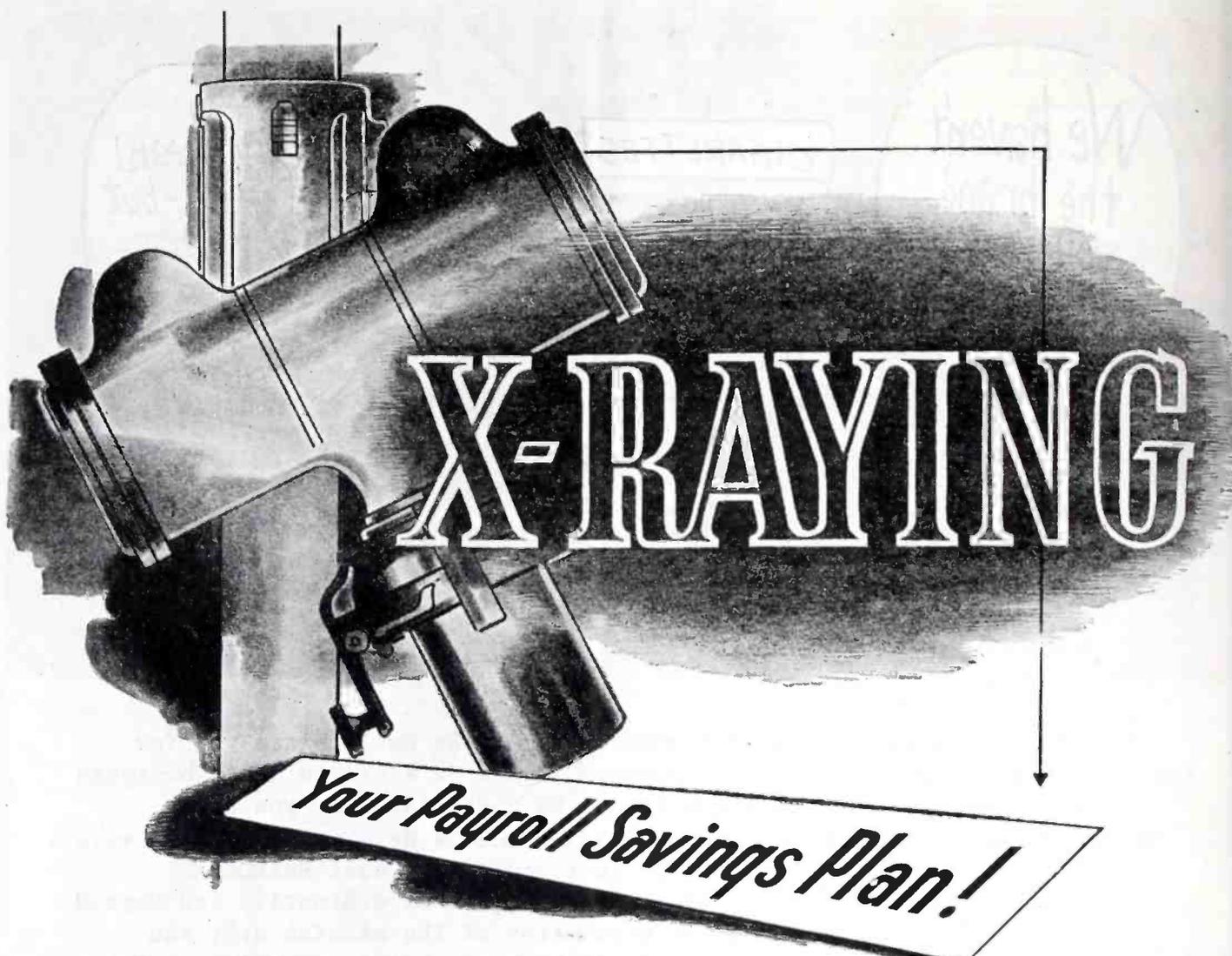


**INTERNATIONAL
RESISTANCE CO.**

401 N. BROAD ST. • PHILADELPHIA 8, PA.

IRC makes more types of resistor units, in more shapes, for more applications than any other manufacturer in the world.





X-RAYING

Your Payroll Savings Plan!

We can all see with the naked eye that the Payroll Savings Plan provides the most stable method of war financing. Analyze it under the X-ray of sound economics and other important advantages are evident.

A continuous check on inflation, the Payroll Savings Plan helps American Industry to build the economic stability upon which future profits depend. Billions of dollars, invested in War Bonds through this greatest of all savings plans, represent a "high level" market for postwar products. Meanwhile, putting over Payroll Savings Plans together establishes a friendlier re-

lationship between management and labor.

To working America the Payroll Savings Plan offers many new and desirable opportunities. Through this systematic "investment in victory," homes, education for their children and nest eggs for their old age are today within the reach of millions.

The benefits of the Payroll Savings Plan to both management and labor are national benefits. Instilling the thrift principle in the mind of the working men and women, the Payroll Savings Plan assures their future security—and is a definite contribution to the prosperity of postwar America!

The Treasury Department acknowledges with appreciation the publication of this message by

SERVICE

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SPRAGUE TRADING POST

A FREE Buy-Exchange-Sell Service for Radio Men



"T" is for TROPICALIZED!

... and it means that standard Sprague KOOLOHMS now have the same high degree of humidity protection formerly available only on special order to match exacting military specifications. This new standard construction includes a glazed ceramic outer shell and a new type of end seal. Catalog designations remain the same except that the letter "T" has been added to the old type numbers.

Thus, once again Sprague leads the way! No need for you to study and choose between power wire wound resistor types or coatings. One type of KOOLOHMS, the standard type, does the job—under any climatic condition, anywhere in the world!

FOR SALE OR TRADE—Meissner 12-tube, 5-band receiver, last made in 1942; good condition, \$120. Diagram, etc., on request. Want Hickok 155 Tracometer, Supreme 562 Audolyzer or 560-A Vedolyzer, RCA 162 Rider Chanalyzer or Meissner 9-1040 Analyst, Hallerfrater S-22-R, or S-20, or S-20-R, Howard 437-A, 436-A, or 435-A, Echophone EC, EC-3 or EC-2, or Howard 445, Mike Blackwell, 360 W. California Ave., Memphis 5, Tenn.

WANTED—Sky Buddy or Echophone EC-1 in good condition. State price. Cpl. Frank Debski, Squadron "D," Army Air Base, Santa Maria, Calif.

URGENTLY NEEDED—Television receivers, transmitters, cameras, cathode ray tubes, iconoscope, etc. Send pictures, description and prices air mail. All inquiries answered. P. O. Jorgenson, 1437 W. 41st Ave., Vancouver, B. C., Canada.

URGENTLY NEEDED—Following tubes: 25Z5's, 50L6's, 12SA7's, 1A7's. Also portable lab. tube tester and V-O-M comb. or small radio, table model, or portable. A. Tanner, 421 E. 22nd St., New York, N. Y.

WANTED—Car radio to fit 1941 model Plymouth. Also 45 volt and 90 1/2-volt batteries. G. S. Bennage, Marionville, Mo.

FOR SALE—#189 Supreme Sig. gen., good condition. Also want 6, 12, 25, 35 and 50-volt tubes. Joe F. Ries, 1521 S. Kent St., Arlington, Va.

FOR TRADE—Have a number of tubes, meter-tested, perfect, not boxed: 6AG7, 6V4, 5U4, 5Z3, 807, IV, 6A6, 6V6. Want Astatic phono pick-up, phono turntable (G.I.) and camera 2A anastigmat or similar. C. Wachpress, 78-15 68th Rd., Middle Village 1, N. Y.

FOR SALE—Atlas 6" lathe with all gears; auto longitudinal feed; 4"-4 jaw chuck, 1/2"-3 jaw chuck, centers, face plate, 4-tool holders with cutting tools, thread cutter, oiler rest, milling attachment, taper attachment, 3/4-h.p. motor. Like new. Weston tube checker No. 661. Sound Radio & Electronics, 210 Kings Highway, Brooklyn 3, N. Y.

WANTED—Tube tester, sig. gen. and V-O-M multimeter; any type in working condition. J. T. Wentworth, 1559 St. Stephens Rd., Mobile 17, Ala.

WANTED—1, 2, or 3-tube receiver, preferably AC. Not over \$4. Lt. W. E. Brown, 0-1558840, 1247 Cook St., Lakewood 7, Ohio.

WANTED—Following tubes, any quantity: 50L6s, 12SA7, 12SQ7, 1H5, 1A7, 1A5, 35Lg, 25L6, 12A8, F. E. Moncrief, 8830 Fourth St., Port Arthur, Texas.

WANTED—All types slide rules, including Cooke's Radio Slide Rule. Will trade Cooke's Radio Math. Book. Also have two jewel meters from Jewell #199 set tester. Sgt. Tony Owsiany, 103rd Army Airways Communication Sqdn., 232 E. Main St., Logan, Ohio.

URGENTLY NEEDED—Modern tube tester; all-wave sig generator-analyzer; Rider's Manuals 6-7-8. C. W. Alleman, 2419 Sharon Ave., Dallas 11, Texas.

WANTED—Recorder and play-back unit, including mike. Describe tube layout of amplifier circuit, what type mike, cutter, play-back unit. State price. J. D. White, 1164 Lamar Ave., Memphis 4, Tenn.

FOR SALE—Radio City Products #663 electronic multimeter, used a few times. John Anderson, 514 South Park St., Elizabeth, N. J.

FOR SALE OR TRADE—Have Webber #20 oscillator, Philco 088 sig. gen., both all-wave and battery power. Also Gernsback manuals vols. I and II. Want: Solar CE, QCA or BCC condenser tester and superior channel analyzer. Ray Parker, 112 Avenue C West, Kingman, Kans.

WANTED—Tubes: 147, 1N5, 145, 3Q5, 50L6, 35L6, 35Z5, 12A8, 6A7, 6A8, 6S97, 6SQ7 and others. State quantity and price. Also want Rider's manual and voltohmmeter. Have for sale or trade gasoline motor for Easy washing machine. Used only a few times. G. S. Hobbs, P. O. Box 697, Suffolk, Va.

WANTED—Complete used set or single volumes Rider manuals. Edmond McGee, 41 Birch St., Worcester 3, Mass.

FOR SALE—High fidelity PA tuner complete with 9 tubes, \$17.50; Detroita table radio in perfect condition, \$15; new 18-watt amplifier with mike, cables and speakers; new crystal pick-ups; new 12-inch heavy duty PM speakers; \$15 complete record player. Also small quantity of tubes. D. Jarden, 7149 Ardleigh St., Philadelphia 19, Pa.

FOR TRADE—Knight recording and play back unit. John L. Werner, R. D. 1, Middleport, Ohio.

FOR SALE OR TRADE—80-watt amplifier using 6B3J, 6C5, 6C6, 6N7, 2/6F6's, 2/6L6's, 2/83's rectifier with separate plate windings on transformer. Transformer coupled with tapped output 3-6-12-250-500 ohm lines. Sell for \$75 or trade. What have you? Also have 1940-41 N.R.I. course for swap. Want receivers. Stanley Barthelman, 2508 1/2 S. Nebraska St., Marlon, Ind.

WANTED—Complete N.R.I. or Sprayberry course. State age, condition, price. Cash, latest tubes or G.E. tube tester, not late model. Albert Spector, 178 Cornell St., Roslindale 31, Mass.

URGENTLY NEEDED—Cash for Rider's Manuals VI-XIII. Also 110v AC, phono motor and pick-up. Lyle C. Newell, 113 E. Arrow Wood Lane, Oak Ridge, Tenn.

URGENTLY NEEDED—Rider's manuals vols. VIII-XIII inc., any condition if no pages missing. Must be reasonable. Buford Brown, Box 307, Trion, Ga.

WANTED—Late tube tester; sig. gen.; 6 7 or 8-in. V-O-M; panel meter; also stock for radio shop. F. Tartaglino, 63 Hoffman St., Torrington, Conn.

WANTED—Following tubes: 25Z5, 1A7, 12A8, 50L6, 12SA7, 12SK7, 12Q7, 12K7, 35Z5, 35Z4, 6SA7, 25Z6, 117Z6, new or used. Victor's Radio, 11036 E. Jefferson, Detroit, Mich.

WANTED—Up-to-date set analyzer, test speaker and signal tracer. Need tubes 27, 30, 35, 56, 41, 40, 80. Edward D. Sharlow, 1344 Eastland Ave., Akron, Ohio.

FOR TRADE—Diamond point tube tester meter; DC milliamperes meter; various tubes, audio transformers, chokes, etc. Want Resdrite volt-milliamperes. Write for list. Herb's Radio Service, 217 S. Wooster Ave., Strasburg, Ohio.

WANTED—Used or new photo motors, pick-ups and record players. David A. Bensman, North High School, Sheboygan, Wis.

WANTED—Rider manuals vols. 8-13. Will buy single volumes. Theodore Lohr, 140-28 247th St., Rosedale, L. I.

FOR SALE—QST magazine, 1927 through 1934, complete with indexes, \$10. H. D. Morton, Wm. G. Brown Co., Gloucester, Mass.

FOR SALE—Weston exposure meter, cino No. 819, with leather pouch and neckband. Used very little. Cost \$24. Will trade for part payment on any test instrument except V-O-M or oscillator. P. K. Kallmeyer, 1511 145th Pl., Whitestone, L. I.

WANTED—Tube checker that tests all tubes; up-to-date tube chart included. First answer gets the sale. M. E. Zuccarello, Rt. 2, Jefferson Highway, Baton Rouge, La.

FOR SALE—Dual-speed record player with high fidelity amplifier, fine PM speaker, heavy duty G. I. motor, beautiful cabinet. Also Webster deluxe intermix record changer; plays fifteen 10 or 12-inch records automatically intermixed; low pressure crystal pick-up; housed in table model cabinet. D. Jarden, 7149 Ardleigh St., Philadelphia 19, Pa.

WANTED—One each "101 Short Wave Hookups"; "10 Most Popular Short Wave Receivers"; "Hammarlund 'Short Wave Manual'". Norman Brown, Box 420, Brandon, Manitoba, Canada.

FOR SALE—New Vertrod #100 house radio pole antenna kit with instructions \$5; Philco di-pole antenna, 50-ft. lead-in, \$5; GTC Porta Power Pak, 1 1/4 to AC, \$7.50; audio chokes, 25e ea.; Bud 2.5 M.H.R.F. choke, 50c; three 9 prong plug-in bakelite coils, 25c; back numbers Radio Craft and Short Wave Craft, 5c ea. Edwin T. Larason, Box 46, Martinsburg, W. Va.

WANTED—Noble 30-watt amplifier with 2 speakers and mike. Also want Rider Chanalyzer or a V-T-V-M. P. B. Davies, 122 Syndicate Ave., Fort William, Ontario, Canada.

WANTED—Rek-O-Cut 12" or 16" recording mechanism, or similar overhead arbor-type cutter, crystal head preferred. Bruce Piper, Olney, Ill.

WANT TO BUY—Any quantity of most any type radio tubes—boxed, original factory-sealed. State quantities and quote prices. Radio Labs, 119 S. Water St., Mobile 21, Ala.

FOR SALE—Supreme #45 tube tester, \$10. RCA 3-inch oscillograph, TMY122B, \$75. Excellent condition. Ralph Hunter, 12 North St., Catskill, N. Y.

FOR SALE—Hammarlund comet-pro communications receiver; speaker in cabinet; power supply, AC coils, 10-20-40-80 meters full coverage. Excellent operating condition. Complete, \$45. Herman Fischer, 626 Carlton Ave., Brooklyn 17, N. Y.

FOR SALE OR TRADE—Hickok #51X tube tester & analyzer; Sky Champion with X-tal and B meter. Want SX-17 or late model Hickok #510X or what have you? J. Wm. Anderson, 2506 West Ave. 33, Los Angeles 41, Calif.

SEND US YOUR OWN AD TODAY!

For over two years now, the Sprague Trading Post has been helping radio men get the materials they need or dispose of radio materials they do not need. Literally thousands of transactions have been made through this service. Hundreds of servicemen have expressed their sincere appreciation of the help thus rendered.

Send your own ad to us today. Write PLAINLY—hold it to 40 words or less—confine it to radio materials. If acceptable, we'll gladly run it FREE OF CHARGE in the first available issue of one of the five radio magazines wherein the Trading Post appears every month.

HARRY KALKER, Sales Manager.

Dept. S-15, SPRAGUE PRODUCTS CO., North Adams, Mass.

Jobbing Distributing Organization for Products of the Sprague Electric Co.

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SYLVANIA NEWS

RADIO SERVICE EDITION

JANUARY

Published in the Interests of Better Sight and Sound

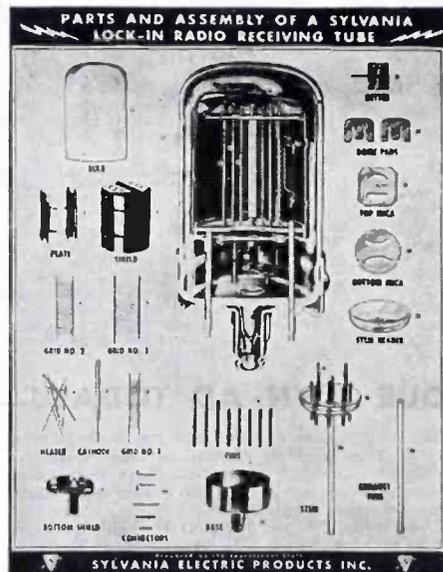
1945

SYLVANIA SERVICEMAN SERVICE

by
FRANK FAX



Among the newest of Sylvania Electric's helps for servicemen is a large chart, measuring about 32 by 43 inches, and lithographed in 4 colors, showing in full detail the parts and assembly of a Sylvania Lock-In Radio Receiving Tube. The chart,



which is reproduced in the accompanying illustration, clearly shows the location of each part in the complete assembly of the tube.

This chart is being distributed to servicemen throughout the country, and is free on request to Emporium, Pa.

Sylvania Launches Broad Study of Public's Wants in Sets and Tubes

Servicemen's Problems to Get Special Consideration in Nationwide Survey

As a major step in its consistent policy of assisting radio servicemen to carry on their business efficiently and profitably, Sylvania Electric Products Inc. is launching a nationwide survey of the trends of public preferences and buying habits in the field of radio and television sets and tubes. The information is expected to be of great value to servicemen in planning for post-war.

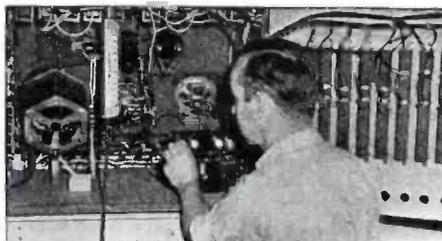
Thousands of personal interviews will

SYLVESTER SURVEY



"I wonder if I could have your views on what the postwar radio will be like?"

HANDY UNIT LIGHTS HARD-TO-REACH SPOTS



The Sylvania Fluorescent Extension Cord Lamp, which fits through openings as small as 2 inches square, brings the advantages of fluorescent lighting to hard-to-reach spots, and may prove a useful tool for the serviceman.



Here is the first of the new Sylvania questionnaire advertisements.

be conducted with set owners, to determine the types of new sets they plan to buy, and also to study the market for postwar renovation of old sets and for tube replacements. In addition, Sylvania Electric is initiating a series of questionnaire advertisements, which will reach millions of readers of national and general business magazines.

These advertisements will stimulate public interest in getting the most out of radio and television, and hence will help to build business for the serviceman. Results of the survey will be published in future issues of SYLVANIA NEWS.



SYLVANIA ELECTRIC

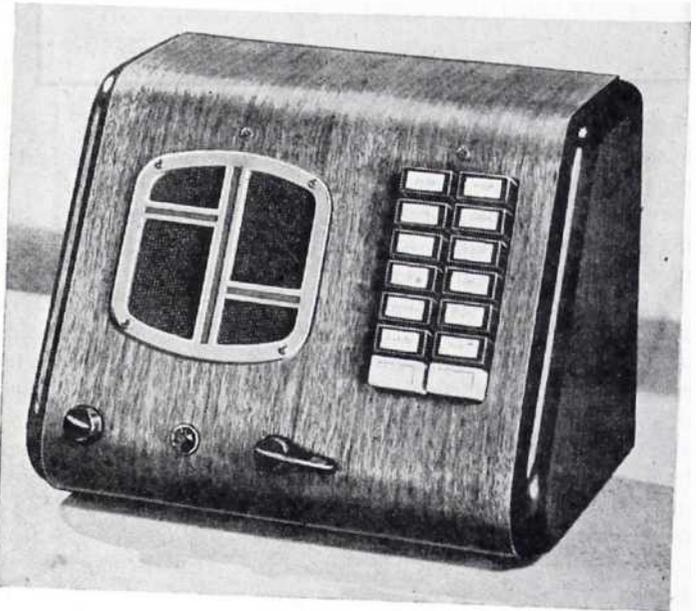
SYLVANIA ELECTRIC PRODUCTS INC., Radio Division, Emporium, Pa.

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, ACCESSORIES; INCANDESCENT LAMPS



Left, rapid-fire intercommunicating system unit used by the Navy. (Courtesy Executone.)

Below, commercial intercommunicating system unit. (Courtesy Operadio.)



INTERCOMMUNICATOR AMPLIFIERS AND SYSTEMS

by **ALFRED A. GHIRARDI**

Advisory Editor

CIRCUITS employed in intercommunicator amplifiers are similar in many respects to those used in receiver and p-a audio systems. The multiplicity of switching circuits usually makes the intercommunicator schematic wiring diagrams appear quite complicated at first glance. However, the circuits are really not so complicated, for usually the switching and wiring to each remote station is merely a duplicate of all the others.

Types of Intercommunicator Systems

There are several types of intercommunicator systems—each designed to fulfill certain operating requirements. The more simple systems consist primarily of a powered master station whose output may be switched to one

or more remote stations (either individually or collectively) in order to talk to them. The remote stations may, individually, talk back to the master station, utilizing the amplifier in the master station to amplify the speech signals in both cases. The master station comprises a 2- or 3-stage audio amplifier and power supply of conventional design, delivering from 1 to 5 watts to either a p-m speaker or line-matching transformer it contains. P-m speakers are used in both master and remote stations, functioning both as microphones and speakers in each. The remote stations usually make use of some type of momentary switch to call the master station, but this is not necessary in all systems. The Philco-phone is an example of this design. Some installations use a master type of unit for all of the stations so that

a remote station may call the master even with the master turned off. Naturally since each station in such systems contains an amplifier and all associated equipment, they are more expensive than the simpler types. A more important advantage of such a system is that a higher level signal is transmitted, reducing the possibility of hum or noise pickup on long circuits. Most systems do not provide for intercommunication between remote stations, but a few do.

G.E. Handy-Phone System

One of General Electric's simple 2-way loudspeaker intercommunicator systems, the *Handy-Phone*, is illustrated in Fig. 1. This is designed for use in offices, houses, small hospitals or other places where voice

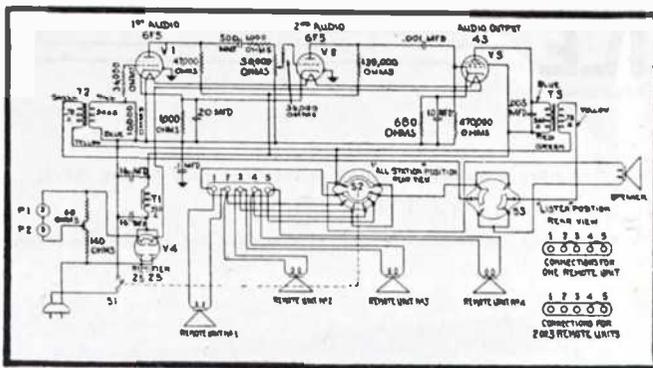


Fig. 1. G.E. two-way loudspeaker intercommunicator system for one to four-station operation.

communication between a central master station and from one to four remote stations is desired. The system consists of one FM-41 master station and from one to four FS-5 remote speaker-phone stations.

The master station has a three-stage audio amplifier composed of two 6F5-triode stages and a 43-pentode output with some unusual equalizers and series resistors to limit overloading. The input transformer T_2 is loaded with 10,000 ohms (resistor R_4), and a series resistance of 36,000 ohms, R_{11} , appears in the grid circuit. The volume control potentiometer, R_3 , is located in the grid circuit of the second tube. Since its value is only 50,000 ohms, an attenuating resistor, R_{10} , of 100,000 ohms is used ahead of it to limit the gain. Another series limiting resistor, R_{12} , of 36,000 ohms is connected in series with the grid.

The two 6F5 tubes use the common 1,000-ohm self-biasing resistor, R_6 , for obtaining grid bias. This is bypassed by 20-mfd condenser, C_1 . The 43-power output stage is conventional. It is self-biased by the voltage drop in 680-ohm cathode resistor R_7 , bypassed by 10-mfd condenser C_5 . A .005-mfd equalizing condenser, C_8 , is connected across the output transformer.

A 25Z5 supplies half-wave power through a heavy choke and dual 16-mfd filter section. The heaters of all tubes, and the dial lights with their shunt ballast resistor R_2 , are all in series and are furnished current from the power line through a dropping resistor R_1 . Note that the chassis is not the B-

lead of the power supply. This B-lead is bypassed to the chassis through the condenser C_3 .

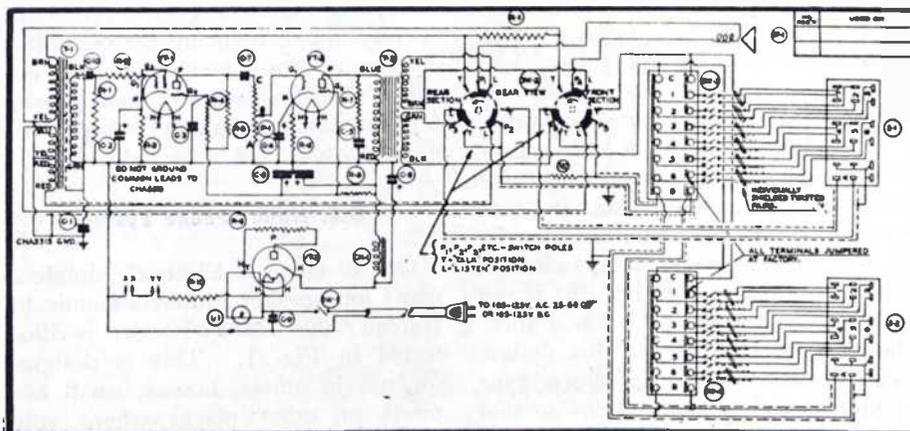
When the system is operated from an a-c source, all d-c potentials are supplied by the 25Z5 rectifier tube and its associated filter circuit. The tube is connected as a half-wave rectifier.

When the system is operated from a d-c source, the 25Z5 rectifier tube and filter remain in the circuit and serve two purposes. If the power cord should be plugged in with incorrect polarity, the 25Z5 tube protects the filter condensers from damage. On correct d-c polarity the 25Z5 tube passes the d-c and the filter circuit aids in smoothing the supply voltage, thus minimizing line noise.

The speaker-phone used in this unit is simply a permanent-magnet type loudspeaker and may be connected at will, either as a microphone to the input circuit of the amplifier, or as a loudspeaker to the output circuit of the amplifier by means of the talk-listen switch S_2 .

Each type FS-5 remote station uses a similar speaker-phone of the permanent-magnet type, but does not incorporate an amplifier or power supply; all operating power being supplied from the master station unit. Depending upon whether the remote station is speaking, or being spoken to, its speaker is connected either to the input or output circuits of the am-

Fig. 2. Master station of Operadio 420B-12, with a flexible switching system.



plifier in the master unit by means of the talk-listen switch S_2 .

In operation, when the talk-listen switch, S_2 , is in the normal listen position, the remote station functions as a microphone and is connected to the input of the amplifier, while the master station speaker is connected across the output of the amplifier. However, when S_2 is placed in the talk position, the master station speaker functions as a microphone and is connected to the input of the amplifier, while the remote station is connected to the output of the amplifier and functions as a speaker. The selector switch, S_2 , connects either any one individual remote station or all remote stations to the master unit. When it is turned to the all position, the remote station units are connected in a series-parallel combination across the output of the amplifier.

Other Popular Systems

The schematic diagram in Fig. 2 shows the circuit arrangement in the master station of Operadio's 420B-12. The unit consists of an input transformer T_1 , 2-stage high-gain amplifier, output transformer T_2 , p-m speaker-microphone, and power supply. A more or less complicated switching system is included, depending upon the number of remote stations to be employed, and their type.

The input transformer T_1 , is provided with two primary windings and an electrostatic shield. A low-impedance primary (top winding in the diagram) is provided as a match for the microphone voice coil when the unit is acting as a transmitter to talk to a remote station. An intermediate-impedance winding with centertap is used to match the line when the unit is in the receiving position. The line is balanced to ground, the centertap being connected to the chassis. The power supply is isolated from the chassis but connected by the .025-mfd capacitor C_1 . An equalizer is connected across the secondary of the input transformer, and a 30,000-ohm anti-overload resistor, R_2 , is used in series with the control-grid of the 12SJ7 first audio tube. The volume control, P_1 , is at the grid circuit of the 50L6 second audio tube.

The output transformer is provided with two secondaries and also a shield. A low-impedance winding (upper one) matches the voice coil, and a somewhat higher impedance winding (lower one) feeds the line. A standard 35Z5 rectifier supply using a choke filter for the first section and a resistance for the second provides adequate filtering. A .00025-mfd con-

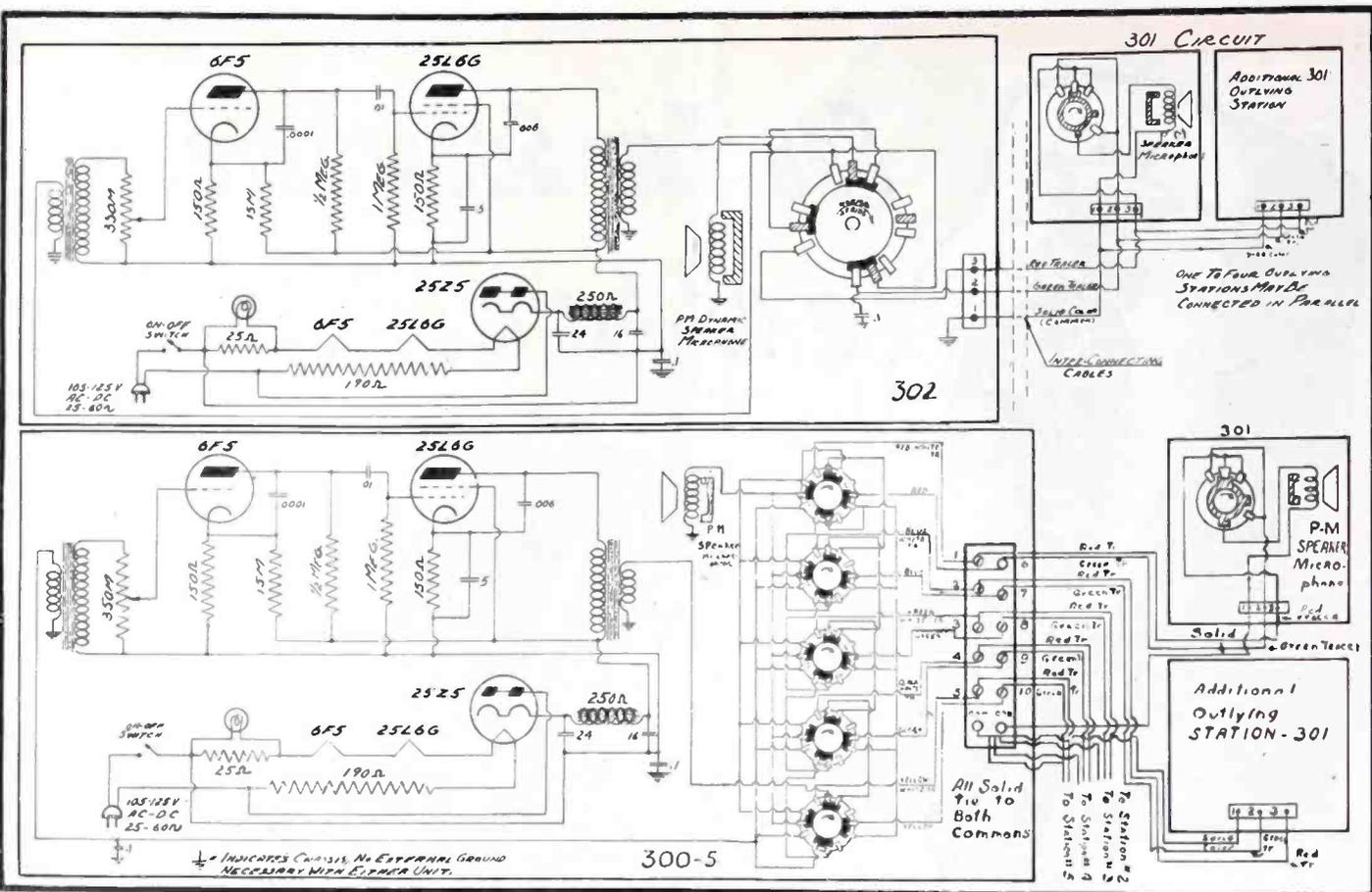


Fig. 3. A master station, USL-300, with provision for 5 remotes.

denser, C_6 , is connected directly across the line cord for bypassing r-f disturbances.

A simpler master station, USL 300-5, with arrangements for five remote stations is illustrated in Fig. 3. The wiring of one of the remote stations also is included in this diagram. The system uses a 6F5 triode and 25L6-power stage with the 350,000-ohm volume control at the input. The same amplifier is available in the 302 type, which provides a simple switch for only a single out-going circuit. However, up to four remote station units may be connected in parallel to this one circuit.

In the three intercommunicators described thus far, communication can only be carried on between the master station and the remote stations, or vice versa. A remote station cannot speak to another remote station. Fig. 4 shows a versatile type of intercommunicating system, USL 303, of the low-impedance wired variety, one in which any station may talk to any other station. Also, a remote station may call the master, even with the master tuned off. All stations use the same type of unit and are really master stations. Except for a few minor circuit changes, the amplifier is similar to that shown in Fig. 3.

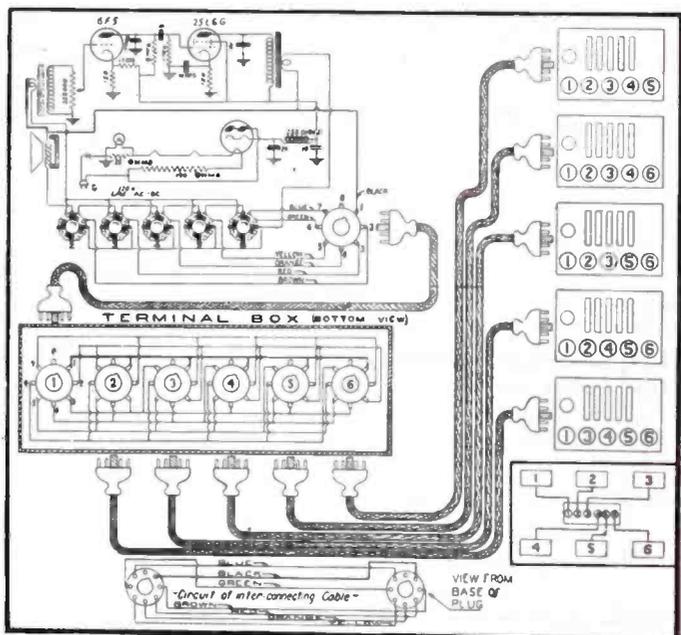
Executone has several models similar to those we have described, except that they make use of 150 mil tubes; 12SJ7 first audio and 50L6 beam out-

put powered by a 35Z5 rectifier with resistance filters. The input transformers contain static shields, and the volume control is located in the second stage. Large amplifiers and speakers are available for voice-paging and industrial music systems.

Remler makes a number of wired intercommunication sets, all of which use a balanced-line for the interstation wiring, neither side of the line being grounded. Fig. 5 shows the RM-2030 series master station unit which uses

a 12SC7 dual triode feeding a 50L6. No grid bias is used on the first stage, the grid return being made directly through the secondary winding of input transformer, 12. The second stage has very low bias, obtained through a 270,000-ohm grid leak, 6. A 250-mmf condenser, C_2 , is connected across the input secondary. A 1/2-megohm volume control, 10, is located in the third amplifier stage and has a high-frequency boost arrangement which increases the highs (in proportion) as the volume is lowered. The 500-mmf condenser, 8, across the top section of the control accomplishes this. The

Fig. 4. A low-impedance type of wired intercommunicator system, USL-303, providing conversation between any station.



Can You Substitute a 43 for a 50L6-GT?

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You can find out quickly by looking on page 12 of the RCA Tube Substitution Directory. You can also find out what changes are involved in substituting each of 9 other tube types for the 50L6-GT.

THIS is just one example of over 2000 substitutions listed in this directory, which was published by RCA to help you use available tubes in place of hard-to-get-types. Here's what's in it:

1. Numerical-alphabetical listing of more than 300 RCA receiving tube types.
2. In most cases, one or more types which can be used as substitutes. Suggested substitutions are keyed to cathode voltages and functional groupings in a "Classified Chart of Receiving Tubes."
3. Notations (with clear, detailed explanations) of space limitations, and the wiring, filament- or heater-

circuit, and socket changes involved in making the substitutions.

4. Sample calculations of series and shunt resistances in heater strings.

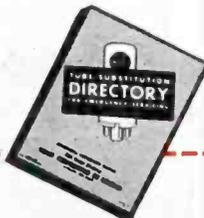
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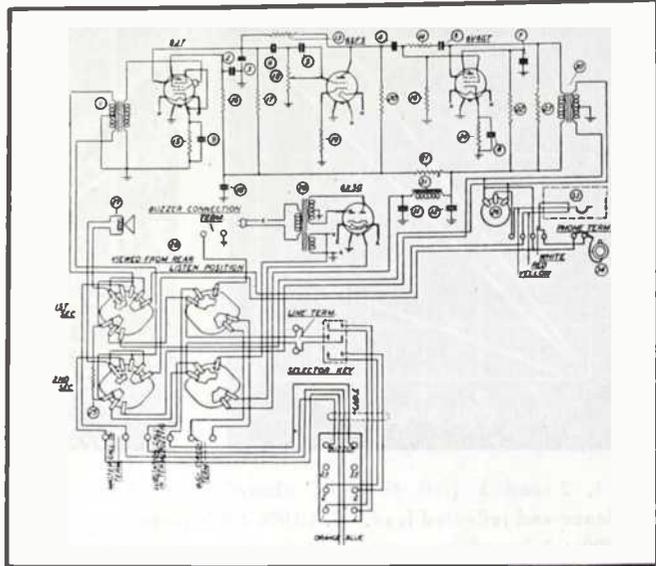
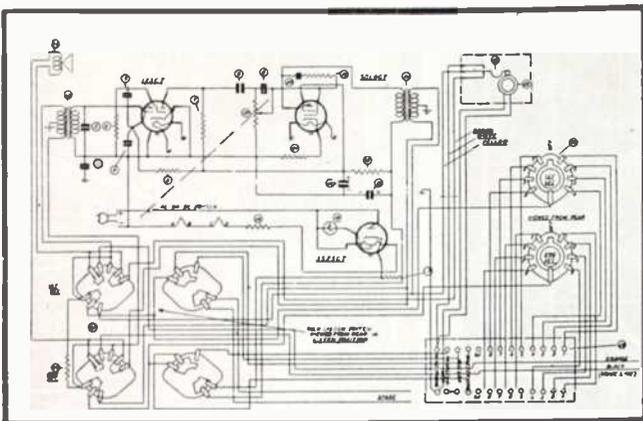


RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, NEW JERSEY

LEADS THE WAY . . . In Radio . . . Television . . . Tubes . . .

Phonographs . . . Records . . . Electronics



Figs. 5 (above) and 6 (right). Remler models are shown here. In Fig. 5 we have a series master model, and in Fig. 6 appears the amplifier circuit of a 3-stage high gain unit.

50L6 power tube employs a 120-ohm bias resistor, 21, without a capacitor. A degenerative feedback loop, 20-19, from plate to grid improves the quality. This consists of 1-megohm resistor, 19, in series with 0.001-mfd condenser, 20.

The balanced-line transmission minimizes induction pickup from other lines, power, telephone, buzzer or bell, etc.; also from machinery with stray fields, motors, contactors, transformers, etc. The use of a *balanced line* for the interstation wiring (neither side of the line being grounded) necessitates the use of a uniformly twisted pair of wires for each voice circuit.

This system may be provided with a buzzer installed in the master station so that the master station may be called by a remote station by means of the buzzer signal when the remote station desires to talk to the master. At the remote stations at which such buzzer *calling* facilities are to be provided, *calling* switches must be installed. Then the procedure is: *Calling* remote station turns its *calling* switch to the *call* position. A test tone buzz will be heard before the voice reply if the master station is *not* busy. At the master station, the call of the remote station is indicated by a buzzer signal. To answer, the *talk-listen* control is turned to the *talk* position and the call is acknowledged by voice. Releasing the control to the *listen* position enables the remote station to be heard. When the conversation is finished, the *talk-listen* control at the *master* station is returned to the *stand-by* position.

All remote stations in this Remler system are wired to the master stations in the same manner, regardless of the size of the speaker-microphone unit or the type of housing. A twisted pair of wires (selector line) is required between the master and each remote. For calling remote stations,

an additional pair of wires is necessary. This second pair (buzzer line) can be run in a loop, with the buzzer line leads of each calling remote station connected across it. Stranded twisted-pair wire (No. 22) or 22-gauge solid twisted pair duct wire is suitable for interstation wiring runs of up to 1,000'. For over 1,000', No. 19 twisted pair wire should be used. For runs of 3,000' or over, matching transformers Remler 4402 or 4403 are required.

Fig. 6 shows the amplifier circuit of the Remler series RM-2050 master station which has some unusual features, including a separate incoming-signal volume control and an earphone in addition to the speaker. The amplifier is a 3-stage high-gain type with 6J7 pentode, 6SF5 triode and 6V6 beam output. Degenerative feedback occurs in three separate circuits: Second audio plate to first audio plate through a 10-megohm resistor, 13; current degeneration through the 1,000-ohm cathode bias resistor, 19, on the 6SF5; and third audio plate to second audio plate via a 2.2-megohm resistor, 14, and 0.01-mfd capacitor 6.

Fig. 6. Reproducer used in an intercommunicator system. (Courtesy Executonè)



The volume control, 18, is located in the second stage and has the same *high* boost circuit arrangement as does the circuit of Fig. 5. A 15,000-ohm load resistor, 23, is connected in parallel with the output transformer primary. A warning light shows when the system is busy.

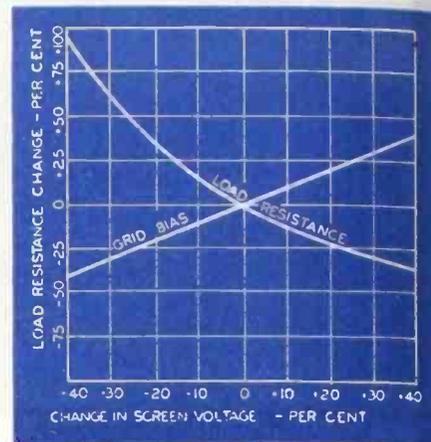
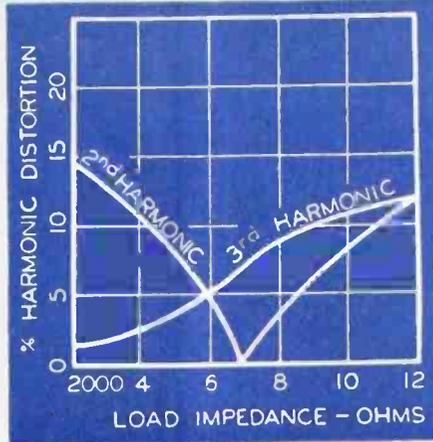
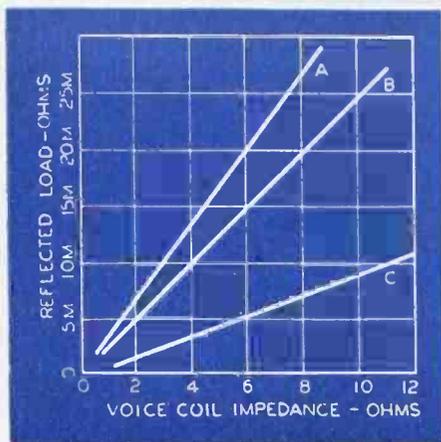
When required, more than one remote station can be connected to one selector line to operate simultaneously when called by a master station. If two remote stations are used, they must be connected in parallel. When more than two are used, they must be connected in series groups of two stations per group and the groups connected in parallel across the selector line. If there is an odd station, it must be connected in parallel with a series group. The volume of each station will be reduced in proportion to the number of stations operating simultaneously.

R-F and Other Types of Intercommunicators

There are a few types of r-f intercommunicators which utilize the existing power lines as a transmission medium. These are actually carrier-current systems which use frequencies from 100 to 300 kc, accompanied by insignificant radiation and a minimum of interference. The master unit is a bonafide radio transmitter, and the remote stations are radio receivers. Both must be connected on the *same side* of the watt-hour meter in the power line, since any watt-hour meter between them acts as a r-f choke, greatly attenuating the signals. Some of these systems suffer severely from man-made electrical interference caused by electric razors, series motors and contact devices that operate on the line used as the transmission medium.

Other audio intercommunication

(Continued on page 31)



Figs. 1, 2 and 3 (left to right, above). Fig. 1 are plots for three different types of transformer ratios, plotted against load impedance and reflected load. *A*, 10,000 : 3 impedance ratio = 57.7 : 1 turns ratio. *B*, 7,000 : 3 impedance ratio = 48.3 : 1 turns ratio. *C*, 2,000 : 3 impedance ratio = 25.8 : 1 turns ratio. Fig. 2 is taken from a standard tube manual and offers values of harmonic distortion for various load impedances for a 6F6 tube. Fig. 3, a conversion plot. Output pentodes and tetrodes are referred to here.

LOUD SPEAKER

by E. B. MENZIES

Auckland, New Zealand

MANY Service Men are inclined to use the broad specification of 7000-ohms, 10,000-ohms, or 2000-ohms when ordering speaker transformers. This practice has a substantial following in our country, and is a practice to be avoided. For the practice is, of course, a poor one. Perhaps responsibility lies to some extent in the loosely-quoted speaker transformer data, wherein primary impedance has been cited, and specific loads omitted. The practice of winding such transformers for loads approximating the values of voice coils in common use oftentimes introduces the problem of harmonic distortion. This is particularly true of pentode output tubes, and of beam tetrodes. Large variations in the value of load impedance applied to a triode have only minor effects so far as harmonic distortion is concerned.

The problems of matching a source to a load, is, so far as the Service Man is concerned, simply one of transformer ratios, since he can and must assume that the manufacturer has provided sufficient primary turns to assure good bass response and transformer efficiency. Turns ratios, valuable data for the Service Man are not commonly quoted by manufacturers of replacement speaker transformers. A transformer merely reflects on its primary. The load imposed on its secondary does not (apart from its own losses) impose a load on the primary until a load is applied to the secondary. It is the turns ratio, and not the number of primary turns

which therefore governs reflected impedance.

This problem is somewhat more acute today, since many of the exact replacement transformers are not available.

Turns ratio of a transformer is the square root of the impedance ratios concerned. Hence,

$$\text{turns ratio} = \sqrt{\frac{\text{tube load resistance}}{\text{voice coil impedance}}}$$

This relation holds as long as all the output power is taken from one secondary winding, as we have in receivers. If the turns ratio is calculated from the foregoing, then the reflected load on the primary may be: reflected

$$\text{load} = \left(\frac{N_1}{N_2} \right)^2 \times R, \quad \text{where } N_1 =$$

number of primary turns, N_2 = number of secondary turns, R = impedance of load.

Let us take a case of matching a 6F6 (7000-ohm load) to a 3-ohm voice coil. The above will give a turns ratio of 48.3 to 1. Further, calculation of the reflected load will supply the value, 7000 ohms.

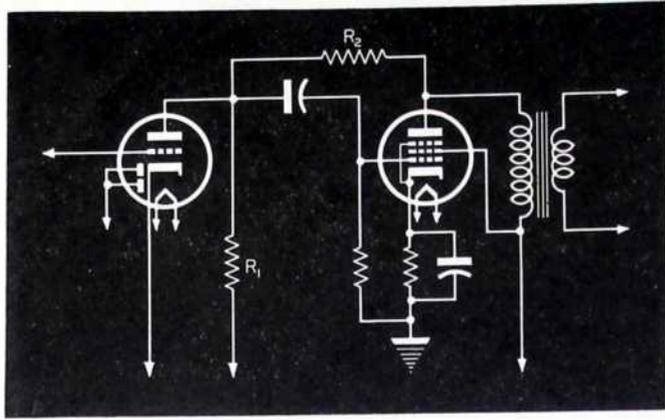
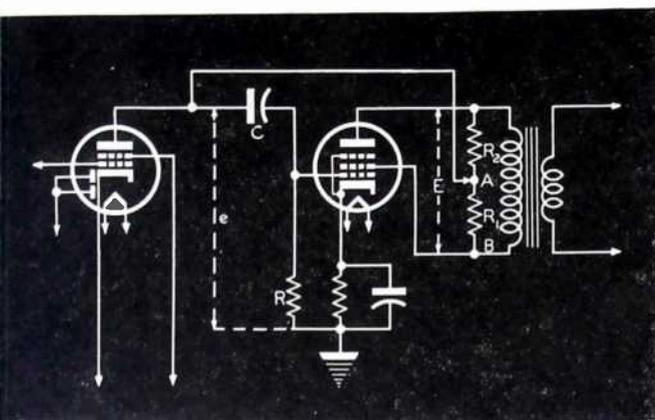
If a transformer has the correct ratio to match 7000 to 3 ohms, what might happen if a 4-ohm load were connected instead of three ohms. Fig. 1 offers graphs for three different

values of transformer ratio, plotted against load impedance and reflected load.

If we refer to curve *B* (the one to refer to since it is drawn for the ratio 48.3 to 1), we note that at a voice coil impedance of three ohms we have a reflected impedance of 7000 ohms. At the 4 ohm load point, however, we see a reflected impedance of nearly 10,000 ohms. Now let us study Fig. 2, which is taken from a standard tube manual, and offers values of harmonic distortion for various load impedances for a 6F6 tube. We note that a rise of plate-load impedance from 7000 to 10,000 ohms means a rise of the second harmonic from zero to approximately 8%, and a rise of third harmonic from about 7 to 11%. Incidentally, the curves of Fig. 2 were very probably drawn from tests made with a resistive load, and distortion percentages would be appreciably higher with a speaker as load. The speaker provides a load which varies considerably with frequency, and is reactive, not resistive over the major portion of the audio frequency range.

It is apparent therefore that turns ratio data is valuable. The simplest way to ascertain turns ratio, if it is not known, is to connect up the primary of the transformer to the 110 volt a-c line, and measure the voltage at the secondary or voice coil winding, with an accurate a-c meter. Since, neglecting losses, turns ratio is equal to voltage ratio, the turns ratio will

$$\text{be, turns ratio} = \frac{E_1}{E_2}, \quad \text{where } E_1 = \text{pri-}$$



Figs. 4 and 5 (left to right, above). Fig. 4, an audio system using 6B8 or 6F6 tubes, or their equivalents. Fig. 5, an audio system using 6Q7 and 6F6 or equivalents, with but one resistor R_2 for feedback. Its value depends upon the driver plate load. Generally, its value will be several times that of the plate resistor.

M A T C H I N G

primary voltage (rms), E_2 = secondary voltage (rms). Incidentally, no load should be applied to the secondary during the check.

One further question must now be apparent. If a transformer of the exact required ratio is not available, what can we do to assure best performance. The writer has used two different methods to overcome this problem.

The first method uses a reduction of screen potential. When a speaker transformer, due to incorrect ratio, presents a load to the output tube in excess of the optimum value, the required load for the tube may be increased by reduction of screen and bias potentials. Tube manuals carry such conversion charts; an extract from one of them appears in Fig. 3. The curves refer to output pentodes and beam tetrodes. To increase the required load impedance from 7000 to 10,000 ohms (about 40% increase) a 2% reduction of screen potential and 25% reduction of bias voltage is necessary. It should be remembered that in reducing screen voltage, the screen must be adequately bypassed to ground.

Negative voltage feed-back was the other method used. The use of negative voltage feedback for the reduction of harmonic distortion does not have too wide an application. But it was tried and found effective.

Let us refer to Fig. 4 which applies to the audio and using 6B8 and 6F6 tubes or their equivalents. With the plate-load resistor connected to

point B no feedback is applied. Connecting to point A naturally applies feedback. We must know the following to apply this method correctly.

Voltage gain (M): Referring to Fig. 4 and assuming that R is very much greater than X_c , voltage gain will be E/e , where E = peak audio voltage across transformer primary at full output, $= \sqrt{2R_L \times W}$ where W = watts output. R_L = load impedance, and e = maximum value of negative bias, assuming grid is not driven positive.

$$\text{Feedback fraction (B): } B = \frac{R_1}{R_1 + R_2}$$

assuming that $R_1 + R_2$ is very much greater than the load impedance.

Gain reduction factor = $M/M_1 = 1 - BM$. Where M_1 = gain with feedback and B is in this case negative.

Db loss = $20 \log$ gain ratios (with and without feedback).

Distortion reduction is also an important factor. Harmonic distortion is reduced by a factor approximately equal to the gain reduction factor.

$$\text{Therefore } D_1 = \frac{D}{\text{gain reduction factor}}$$

where D = distortion without feedback, and D_1 = distortion with feedback.

Typical Case

Let us assume a 6F6 operating as a power output tube with a 250-volt

B supply, and operating according to recommended conditions. Load impedance will be 7000 ohms; 3 watts output. Calculating E , we find it equal to $\sqrt{7000 \times 3} = \sqrt{21,000} = 145$ volts approximately.

Assuming the grid driven to peak of bias voltage, voltage gain

$$= \frac{E}{e} = \frac{145}{16} = 9.06$$

In the feedback fraction calculation, let us assume $R_1 = 10,000$ ohms and $R_2 = 100,000$ ohms (typical values).

$$B = \frac{10,000}{10,000 + 100,000} = \frac{1}{11} = .09$$

The gain reduction factor = $1 - BM = 1.82$, B being negative.

Gain with feedback

$$= \frac{M}{\text{gain reduction factor}} = \frac{9.06}{1.82} = 5$$

Loss: Since gain ratios are proportional to output voltages with same input voltage, db loss = $20 \log 9.06$

$$= 20 \log 1.81 = 5.1 \text{ db.}$$

Distortion reduction: since

$$D_1 = \frac{D}{\text{gain reduction factor}} = \frac{D}{1.82}$$

distortion apparent through any mismatch will be reduced by just under one-half.

The application of negative feedback is commendable, particularly if

(Continued on page 31)

JANUARY, 1944 — DECEMBER, 1944

An asterisk preceding a listing indicates that a partial or complete circuit accompanies the text.

AMPLIFIERS		Limitation Order L-76 Revocation P-A Systems for Industrial Uses Increased by WPB.....		Sept. 2	*Electronic Production Testing Devices. (Part I). By S. J. Murcek	July 14
*Amplifiers for R-F. By Arnold D. Peters.....	Nov. 12	Preference Ratings and Parts.....	Mar. 2		*Electronic Production Testing Devices. (Part II). By S. J. Murcek	Aug. 22
*Amplifier (Gibson EH-150).....	Dec. 15	Price Ceiling and Rating Rulings of the OPA and WPB.....	June 2		*Electronic Production Testing Devices (Part III). By S. J. Murcek	Sept. 22
*A-M/F-M Audio Unit (Zenith 12H-689).....	July 19	Production of Scarce Tube Types, WPB Program.....	Jan. 2		*Electronic Voltage and Speed Regulators (Part I). By S. J. Murcek	Feb. 22
*Frequency Control in Phonograph Circuits. By Willard Moody.....	Aug. 11	Receiver Design versus Service Requirements.....	Feb. 2		*Electronic Voltage and Speed Regulators (Part II). By S. J. Murcek	Mar. 22
P-A Systems for Industrial Uses Increased by WPB (Editorial).....	Mar. 2	Receiver Servicing.....	Aug. 2		*Electronic Voltage and Speed Regulators (Part III). By S. J. Murcek	April 22
*Vega 180 (High Gain Amplifier)	Dec. 16	Receiver Survey.....	July 2		Evolution of The Clip. By Ralph S. Mueller	July 10
		Service Men's Place in Postwar Servicing.....	Oct. 2		*Fixed Capacitors. By Alfred A. Ghirardi	Aug. 9
		Standard Symbols.....	July 2		*Frequency Control in Phonograph Circuits. By Willard Moody.....	Aug. 11
		Television Postwar Expansion.....	April 2		*High Fidelity and Tone Control. By Edward Arthur.....	Dec. 18
					*Instrument Design. By Willard Moody	Sept. 12
					Magnetized Screwdriver. By Barry Kassin	Jan. 35
					*Motorola 40-F (novel antenna system receiver).....	Dec. 33
					Old Timer's Corner.....	Nov. 39
					Old Timer's Corner.....	Dec. 35
					*Photocontrol Applications (Part II). By S. J. Murcek.....	Jan. 19
					Postwar Trends in Service Equipment. By Raymond Soward..	Dec. 11
					*Ser-Cuits. By Henry Howard.....	Jan. 16
					*Ser-Cuits. By Henry Howard.....	Feb. 20
					*Ser-Cuits. By Henry Howard.....	Mar. 26
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					*Ser-Cuits. By Henry Howard.....	May 22
					*Ser-Cuits. By Henry Howard.....	June 14
					*Ser-Cuits. By Henry Howard.....	July 22
					*Ser-Cuits. By Henry Howard.....	Aug. 14
					*Ser-Cuits. By Henry Howard.....	Sept. 15
					*Ser-Cuits. By Henry Howard.....	Oct. 22
					*Ser-Cuits. By Henry Howard.....	Nov. 24
					*Ser-Cuits. By Henry Howard.....	Dec. 27
					*Servicing Automatic Record Changers (Philco Types 35-1285; 35-1286).....	Sept. 11
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					Servicing in the Postwar Era. By H. A. Newell.....	Oct. 26
					Servicing in the Postwar Era. By H. B. Donley.....	Oct. 27
					Servicing in the Postwar Era. By I. J. Kaar.....	Oct. 13
					Servicing in the Postwar Era. By M. J. Schinke.....	Oct. 28
					Servicing in the Postwar Era. By S. J. Thompson.....	Oct. 12
					Servicing in the Postwar Era. By W. E. McConnell.....	Oct. 12
					Servicing in the Postwar Era. By Win Campbell.....	Oct. 27
					Servicing in the Postwar Era. By W. L. Jones.....	Oct. 13
					Servicing in the Postwar Era. By C. A. Nichols.....	Oct. 26
					*Service Jobs in Wartime. By Willard Moody.....	Oct. 18
					*Signal Tracing with Multivibrators. By M. E. Heller.....	Feb. 10
					*Sound System Planning. By Sidney Harman.....	Mar. 14
					*Special Electronic Tests (Part I). By S. J. Murcek.....	May 12
					*Special Electronic Tests (Part II). By S. J. Murcek.....	June 16
					The EPEI Conference.....	Nov. 34
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					Tool Demagnetization. By Barry Kassin	Jan. 35
					Transformer Uses. By David V. Chambers	Sept. 29
					*Vacuum-Tube Voltmeter, A Simple War Brought Global Job to Service Men in 1943. By W. L. Jones	Jan. 14
					Wartime Exchanges. By Harry Kalker	Aug. 20
					*Wartime Repairs (SERVICE Contest First Prize Entry). By Ray Pentecost	May 10

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*Vacuum-Tube Voltmeter (Measurements Corporation Model 62)	May	28
*Voltmeter, A Simple Vacuum-Tube. By Harry R. Evans.....	Dec.	12

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*Tone Control, High Fidelity and. By Edward Arthur.....	Dec.	18
*Tone Control Service Help for Philco 38-7 Receiver. By Willard Moody	Oct.	33

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Transformer Uses. By David V. Chambers	Sept	29
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*Diode Detectors. By Arthur Moore	Oct.	11
Production of Scarce Tube Types, WPB Program (Editorial)....	Jan.	2
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*AVC systems, A Study of. By		
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Edward Arthur	Nov.	11
*Volume Control Modifications for Philco 38-7 Receiver. By Willard Moody	Oct.	33

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Servicing in the Postwar Era. By H. B. Donley.....	Oct.	27
Servicing in the Postwar Era. By W. L. Jones.....	Oct.	13
Servicing in the Postwar Era. By I. J. Kaar.....	Oct.	13
Servicing in the Postwar Era. By W. E. McConnell.....	Oct.	12
Servicing in the Postwar Era. By H. A. Newell.....	Oct.	26
Servicing in the Postwar Era. By C. A. Nichols.....	Oct.	26
Servicing in the Postwar Era. By M. J. Schinke.....	Oct.	28

Servicing in the Postwar Era. By S. J. Thompson.....	Oct.	12
*Service Jobs in Wartime. By Willard Moody	Oct.	18
Service Men's Place in Postwar Servicing. (Editorial).....	Oct.	2
War Brought Global Job to Service Men in 1943. By W. L. Jones	Jan.	14
Wartime Exchanges. By Harry Kalker	Aug.	20
Wartime Repairs (SERVICE Contest, 1st Prize). By Ray Pentecost	May	10
*Wartime Repairs (SERVICE Contest, 2nd and 3rd Prize Entries). By Nat Bader and Paul Granucci	June	12
*Wartime Repairs (SERVICE Contest, 4th, 5th, and 6th Prize Entries). By Chester W. Sharp, D. P. Cohn and E. Dewar.....	July	12
*Wartime Repairs (SERVICE Contest, 7th, 8th, 9th and 10th Prize Entries). By David Chambers, Fred Guska, Paul Sarnoluk, and C. L. Fairchild.	Aug.	12
*Wartime Revision of Circuits. By Willard Moody	Nov.	14
Wartime Servicing in New Zealand. By H. B. Menzies.....	Jan.	7
WRENS, The (Britain's Girl Radio Mechanics). By H. W. Barnard	Feb.	9

A DEALER IN BUZZ-BOMB ALLEY

by A. W. LINES

London Dealer and Air Training Corps Instructor

THE buzz bombs affected Britain's trade seriously during the first week or so. In our own case repairs stopped coming in almost entirely for the time, and the reduced trade was principally in flashlights, flashlight bulbs and batteries, and other articles for use in the blackout and the shelters. Evacuation from London and the outlying districts began, and this caused an even greater drop in trade in my area in Southern England, where it finally fell almost to vanishing point.

A few weeks later we became used to the bombardment, and trade then began to return to normal. Broken and battered sets began to trickle into our workshop.

Damages were similar to those we had already met in the blitz of 1940-1; broken cabinets and dials, broken tubes (these, curiously, are somewhat rare as a result of blast damage) and, almost invariably, smashed speakers. The blast appears to consist of alternate waves of intense suction followed by violent pressure, and in the case of speakers the cone is first sucked out of the frame, and then slammed back again. As can be imagined, the result



A. W. Lines with some of his ATC students inspecting a power supply repaired after a buzz-bomb damage. (Courtesy Odhams Press, Ltd., London.)

is a battered cone, often smashed completely from the frame, a broken spider, and a speech coil that is, to put it mildly, badly bent. On one or two occasions, when there was difficulty in obtaining a replacement speaker, I tried to stiffen and reshape the damaged cone and coil, but without much success.

One receiver damaged by a flying bomb that dropped at the end of the road about 200 yards from my home, had a broken dial and a smashed speaker, yet the tubes showed no sign of damage and the dust on the chassis was undisturbed. The cabinet was almost unscratched, although my friend's house was left with few of

the walls standing, and much of his furniture was ruined. I suffered little damage from this bomb. My own radio was quite unaffected, despite the fact that the window by which it stands was blown out (for the third time).

In a nearby house, that suffered severe damage, a set was discovered in the pan of the water closet. Scarred and damaged, but apparently more or less in one piece, it was plugged into the mains and, to the amazement of everyone, proved to be still in working order!

The spares situation has not been affected much by the flying bombs. Tubes have lately been in rather better supply, especially since the *lend-lease* types began to arrive in Britain from the U.S.A. Speakers of the permanent-magnet types are obtainable. Small and tubular condensers are plentiful, but electrolytic condensers are very scarce indeed, and can only be bought in twos and threes. All in all, however, we have managed to carry on fairly well.

In spite of the upsets caused by the attacks, the members of the radio trade in Britain's *buzz-bomb alley* managed to keep the flag flying, and felt that in so doing they were playing their small part in the general efforts to ensure a speedy victory.

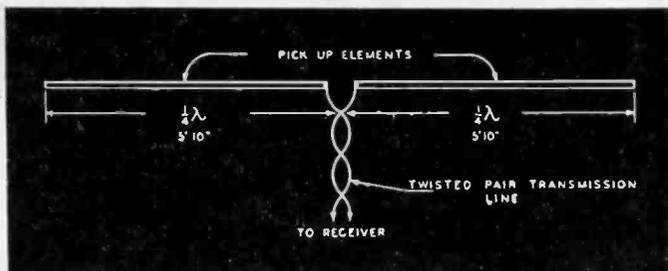
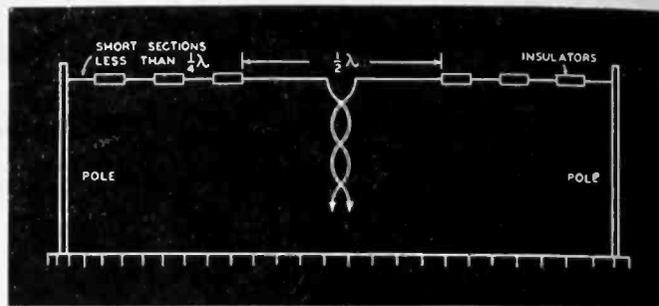


Fig. 2. A half-wave dipole antenna between pole supports. The supporting wires are broken up into lengths, small in comparison with a half-wavelength, to prevent absorption of signal energy by the supporting wires.

Fig. 1 (left). The half-wave dipole antenna.



F - M ANTENNAS

by WILLARD MOODY

ANTENNAS for f-m broadcast pickup demand more attention than the standard a-m types. At the high frequencies in which f-m operates, line-of-sight transmission effects must be considered. Therefore the flat top must be high and in the clear. And if possible there should be a clear direct line between the receiving and transmitting antennas. If the received signal is weak, distortion and noise will result. If the antenna is not installed properly, excessive noise in between stations may be heard. Essentially, such an antenna consists of a flat top, lead-in transmission line, and coupler for matching line to receiver.

The Flat Top

The flat top is the pickup element that is cut by radio waves. A voltage is induced which subsequently is fed to a transmission line. While we call the pickup element a flat top, in some cases the element may be vertical or at an angle. Usually, it is a 1/2-wavelength element. The expression for finding wavelength in meters when the frequency in megacycles is known is

$$\lambda_m = \frac{300}{f_{mc}} \text{ meters} \quad (1)$$

Therefore, if the frequency is 40 megacycles,

$$\lambda_m = \frac{300}{40} = 7.5 \text{ meters}$$

Since a meter is equal to 3.28 feet, the wavelength in feet is

$$\text{Feet} = 7.5 \times 3.28 = 24.6'$$

The pickup is usually made a half-wavelength long. Therefore,

$$24.6/2 = 12.3'$$

Due to *end effects*, the actual wavelength will be modified at high frequencies of 40, 50 and 60 mc. Therefore 12.3' should be multiplied by 0.95 to get the necessary length. Then,

$$12.3 \times 0.95 = 11.68'$$

If each section of the flat top or pickup element is 1/4-wavelength long the total will be a 1/2 wavelength. Since 1/2 divided by 2 equals 1/4,

$$11.68/2 = 5.84' = 1/4 \lambda$$

The .84 part of the above figure can be converted into inches by multiplying 0.84 by 12, giving 10" as the answer approximately. Then, each 1/4-wave section for 40 mc would be about 5' 10" long. The overall length, shown in Fig. 1, would be about 10' plus 20" or twice 1/4 wave, equalling 1/2 wave.

Since many of the f-m stations now operate on the low end of the band, between 42 and 46 mc, you may design the flat top for a peak at a midway point or 44 mc. (A change in frequency assignments, due to the recent FCC hearings may change this position). In this way you may find it possible to get better performance than if the antenna were designed for 40, 50 or 60 mc.

The conductor material used for the pickup element should have a low r-f

resistance. This is somewhat more critical than for low-frequency antennas. A heavy copper wire of 14 gauge or heavier, or 1/4" diameter copper tubing, can be used. Aluminum tubing has been used. Steel or other high resistance materials should not be used. If the pickup element is self-supporting, guy wires will not be necessary. The field of the pickup element will not be distorted if wires are kept away from its vicinity. This is the advantage of using heavy tubing. If guy wires are used, they should be split up into short sections as shown in Fig. 2. Each section should be shorter than a 1/4 wavelength.

It may be found, in some cases, that polarization plays an important part in reception. The directional pattern for a 1/2-wave antenna is depicted in Fig. 3. Assuming the wire is stretched North and South, best reception would be obtained East and West, or at right angles to the antenna (horizontal). In some cases a vertical pickup element may give better reception. In still other cases it may be found that best reception can be obtained by tilting the pickup element at an angle. This is shown in Fig. 4. One way of checking the installation would be to connect the antenna temporarily to the input of a battery portable f-m receiver. Such a receiver could be specially built by the Service Man, for use with earphones. The set need not have a limiter and would consist of a mixer, i-f amplifier, second detector and first audio tube. Dispensing with an output tube would mean the battery drain would be low. Then,

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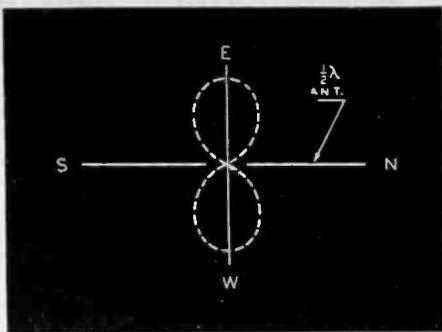


Fig. 3. Approximate directional pattern of a typical half-wave antenna. Maximum pickup is at right angles.

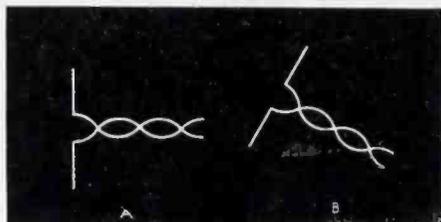


Figure 4. At A, the vertical dipole; B, the tilted dipole. Vertical or tilted mounting may be required in some locations.

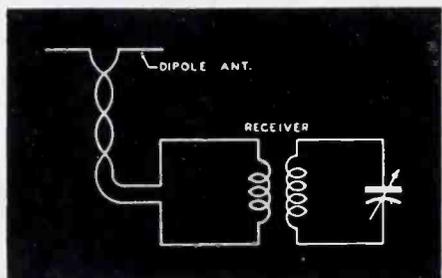


Fig. 5. Coupling the dipole antenna, by means of a transmission line and Z-matching transformer to the receiver.

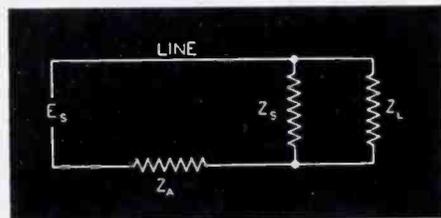


Fig. 6. Simplified equivalent circuit, looking from the antenna terminals into the line and receiver load impedance. The line resistance is Z_A and shunt leakage is Z_S .



Fig. 7. The spacers used in the line must have good insulation properties. Otherwise, losses may be excessive. Increased shunt current means lowered load current.

the antenna would be adjusted for best pickup. With the flat top adjusted, the next step would be to connect the transmission line to the receiver.

Leadin Transmission Line

This line may take the form of a twisted cable which is weatherproofed. The cable is shown in Fig. 5 and leads to the receiver. The usual f-m receiver has a special input circuit for an f-m antenna, consisting of a low impedance primary. The impedance at the center of the antenna may be about 70 ohms for half-wavelength type of antenna. Using a line which has a surge impedance of 70 ohms and terminating the line in a 70-ohm impedance, the pickup of the leadin will be very low and the noise level will be low. For analysis let us look at Fig. 6. Here the signal voltage at the center of the antenna is small and the current is a maximum at resonance. In view of this, to get a maximum current and power in the load Z_L , which is the input impedance of the receiver, we must keep the shunt resistance across the load high. This shunt or leakage resistance is Z_S and may be due to moisture absorption and leakage in the dielectric material. If Z_L is 70 ohms, the shunt resistance will have to be quite low to effect the current in Z_L , so that insulation problems are reduced using a low-impedance system. The series resistance of the cable is important. This is Z_A . If small, thin wire is used the resistance will be high. This means the losses will be high since $P = I^2 Z_A$. Therefore, for maximum signal strength we should use large diameter wire.

Higher Line Impedance

If the line impedance is made higher and we use an open wire line, the current in the wire will be reduced and the loss in the series resistance, Z_A , will be cut down. The voltage between the wires will be increased and the shunt resistance losses will become more critical so far as the leakage of the spacers between the wires is concerned. That's why the spacing insulators, as shown in Fig. 7, should be of small diameter and of good quality with high leakage resistance. When a film of moisture or dirt forms on such insulators the leakage resistance decreases in value and this shunts current away from the load Z_L . In any event, the line output impedance must be matched to the receiver input impedance.

Coupler for Matching Line to Receiver

The usual coupling circuit is shown

in Fig. 5; a coupler consisting of a simple r-f transformer with a low-impedance primary. The amount of voltage induced in the secondary is determined by the output voltage of the transmission line and the design of the coupling transformer. Decreasing the spacing between the windings or increasing it permits control of coupling. Selecting the proper number of turns for primary and secondary, the maximum amount of induced voltage can be obtained. If the secondary is resonant, its impedance at resonance is very low and is equivalent to a resistance. Then, the series impedance of the primary inductance is lowered because of coupled circuit effects. For maximum power transfer, impedances should be matched. If we assume the output impedance of the line is 70 ohms, as shown in Fig. 8, then the primary impedance should be 70 ohms. If we can get an approach to a 70-ohm resistive impedance we should do it. Approximately, the impedance reflected back from the tank circuit $L_S - C_S$ into the primary is

$$Z_P = \frac{\omega^2 M^2}{Z_S}$$

where

Z_S = secondary impedance (series)
 Z_P = reflected impedance into primary
 M = mutual inductance

$$= \sqrt{L_P L_S} \times -1/k$$

k = coefficient of coupling
 $\omega = 2\pi f$

Coupling Experimentation

We could experiment with different values of primary inductance and coupling until the desired conditions were obtained. If we assume unity coupling, all of the flux developed about the primary links with the secondary completely, the turns ratio would give some idea of the voltage stepup. For fifty turns on the secondary and five turns on the primary the ratio would be ten to one. It we look from the primary into the secondary, increasing the coupling reduces the Q of the secondary and reduces the voltage build up of resonance so that the design is a compromise. That is,

$$Z_k = \frac{\omega^2 M^2}{Z_P}$$

and

$$Q_s = \frac{\omega^2 L_s^2}{R + Z_k}$$

where R is the secondary r-f resistance
(Continued on page 30)



more efficient
... in miniature

The dainty watch that graces a lady's wrist is just as efficient a time piece as the huge chronometer of the century past. Modern engineering has made it so. Likewise, the modern miniature electronic tubes will do everything the large, old style tubes will do. The minute dimensions of miniature tubes themselves and their sockets open up entirely new possibilities in the compactness of electronic equipment.

Manufacturers of radio sets and other electronic equipment will unquestionably use

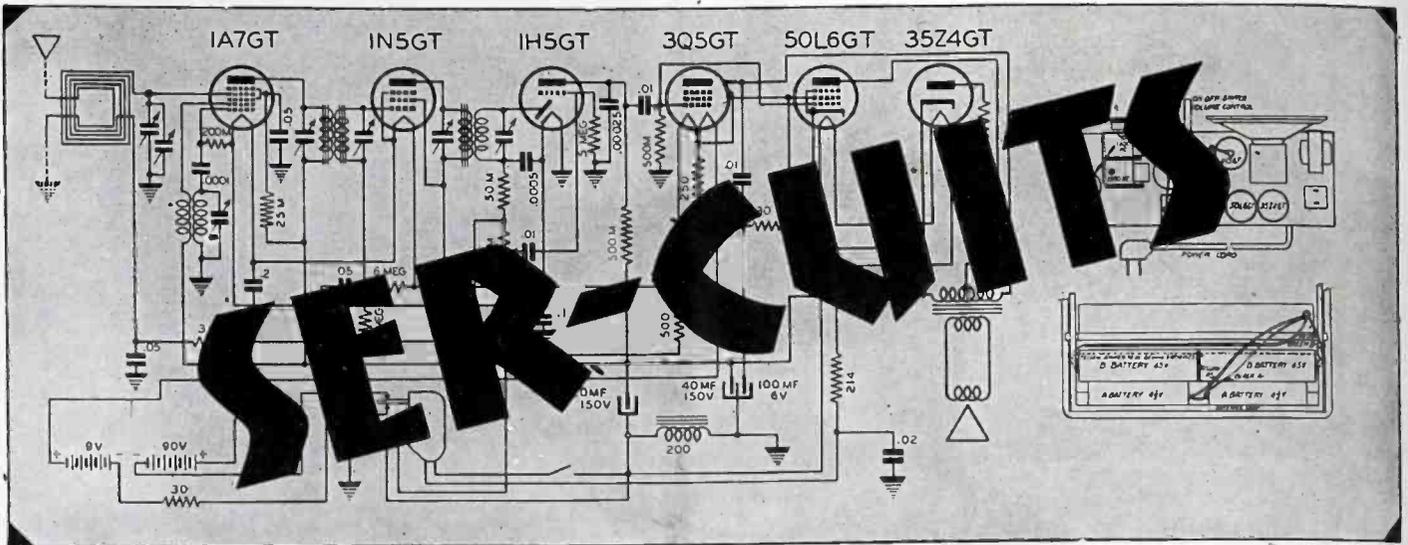
many miniature tubes in their future products. TUNG-SOL therefore, while continuing to make the old style tubes for replacement, will produce the new miniature tubes necessary to service the new sets as they come on the market. TUNG-SOL jobbers and dealers will be in position to furnish all types of tubes ... new and old.



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SERVICE, JANUARY, 1945 • 27



ONE of the most important servicing instruments in the shop is the portable utility unit. Ideally suited for service work where extreme sensitivity and higher voltage ranges are not the important factor, it expedites a variety of servicing. One such model which offers many effective features is shown in Fig. 1. It is the G. E. unimeter UM-3.

Its range coverage is 0-2½-10-50-250-1000-2500 d-c volts; all at 2000 ohms-per-volt. The highest range is obtainable at a separate jack. A-c volts: 0-2½-10-50-250-1000-2500 volts. All are at approximately 1300 ohms-per-volt; the highest range is obtainable at a separate jack.

Resistance ranges are: 0-1000, 100,000 and 1 megohms—center scale values are 40, 4000 and 40,000 respectively with a self-contained battery. With external batteries the range can be easily raised to 30 megohms.

On d-c the ranges are: 0-1-10-100

by HENRY HOWARD

milliamperes; 0-1-10 amperes. The two ampere ranges are obtainable on two separate jacks.

Db calibrations are: 12 to ± 54 db in 5 ranges; milliwatts into 500 ohms is used as 0 reference level. Accuracy is 2% of full scale value on d-c ranges, 5 on a-c ranges. Size, 9" by 10" by 4½". Weight, 9¼ pounds.

Wells-Gardner 8A51

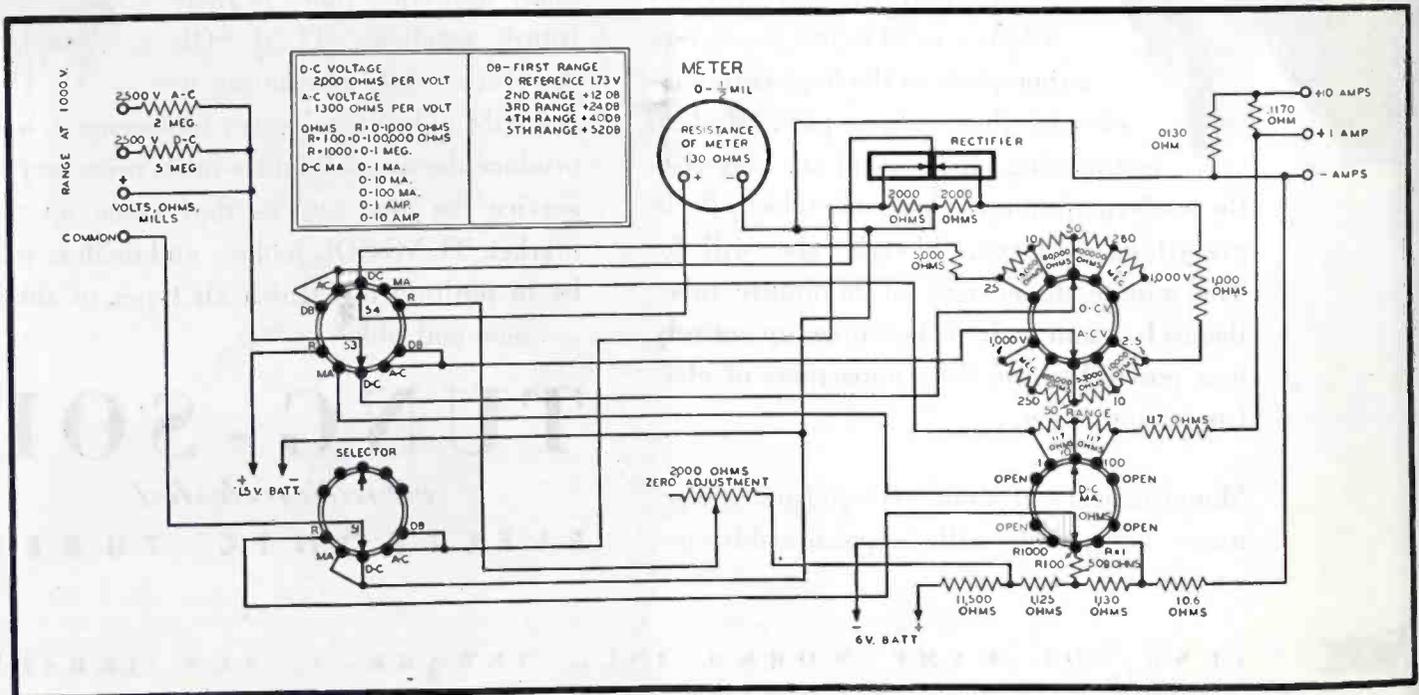
An 8-tube, 2-band phono combination, Wells Gardner 8A51, with both a foil and loop antenna, a sharp cut-off first detector (6SJ7), two i-f stages and an audio equalizer, appears in Fig. 2. The foil antenna (plus external antenna when connected) supplies pickup for the short-wave transformer and also the loop primary for broad-

cast. The short-waves do not pass through the loop primary since a 300-mmfid condenser bypasses them to ground.

The oscillator circuit is very interesting. The bandswitch is shown in broadcast position where a cathode feedback coil is used. The cathode current travels through part of the short-wave transformer and through the tickler to ground. Coupling to the converter tube is via (hot) cathode to the detector cathode through a 2,200-ohm bias resistor and a .02-mfd bypass. On short-waves, the oscillator grid is switched to the short-wave coil which is tapped for the cathode connection. A plate tickler is also used, and supplementary oscillator coupling takes place from the plate to the detector signal grid by means of a small 7-mmfid capacitor. The low end of the oscillator coil is grounded, shorting the cathode broadcast tickler, but the broadcast grid

(Continued on page 30)

Fig. 1. The G.E. UM-3 portable utility tester.



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*

Japanese components illustrated obtained from the Pacific war theatre for the UTC Research Laboratory



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 ...very narrow frequency range,



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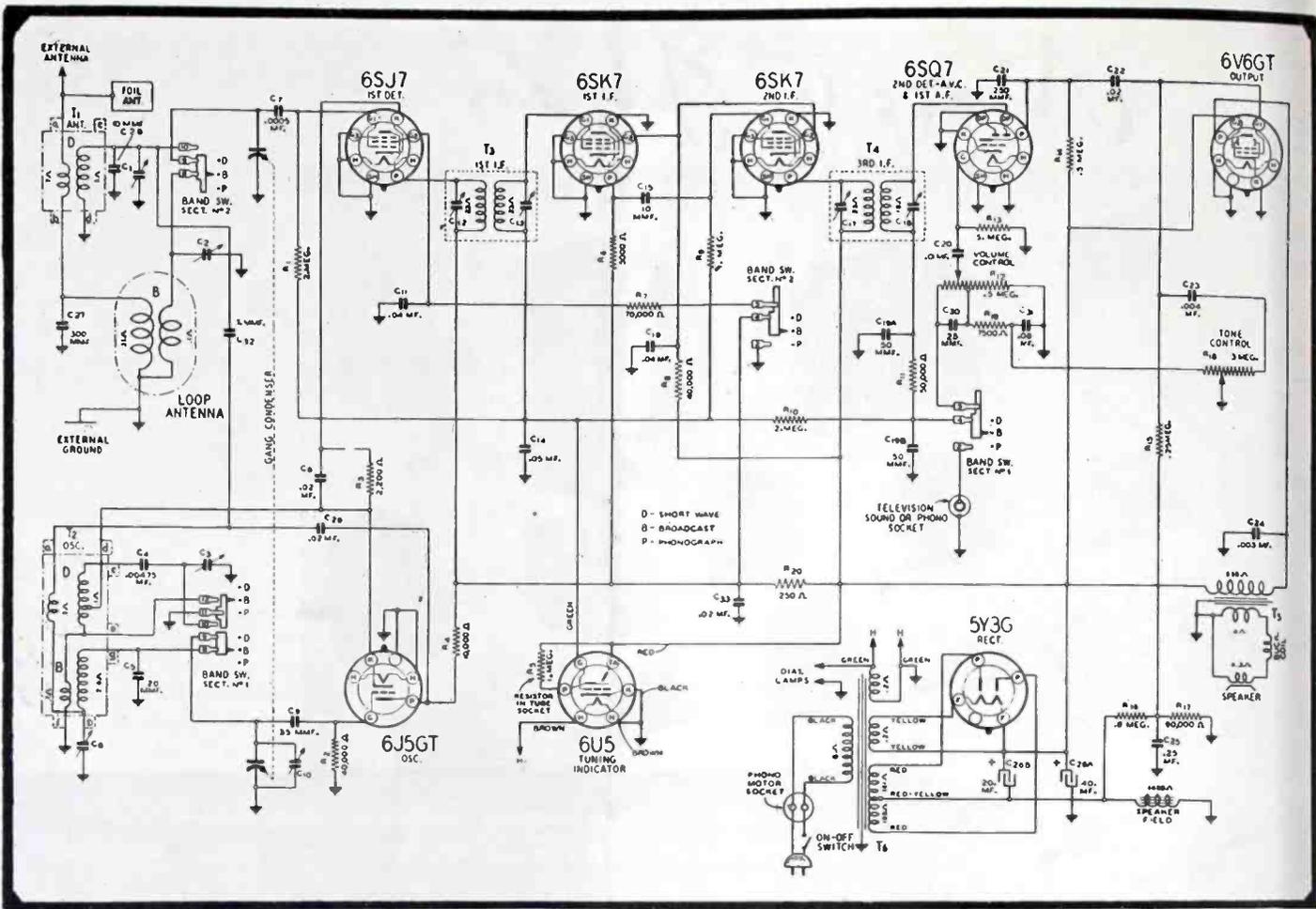


Fig. 2. Wells-Gardner 8-tube, 2-band 8A51 receiver.

coil is left open. The grid condenser in this 6J5GT oscillator is small, only 35 mmfd.

Philips 838U.

The Philips t-r-f receiver, 838U, operates from a-c or d-c, 200-250 volts, the heater current being regulated automatically by a ballast resistor. A dial lamp, called scale lamp,

is connected directly in series with the heaters. It is rated at 10 volts, 200 ma. The antenna is shunted with a 100,000-ohm resistor and feeds two input transformers (l-w and m-w) through a wave trap. There are only two tuned circuits.

A unique form of avc is used. It

consists of feeding back some of the voltage developed across the grid leak of the detector to the r-f grid. For this purpose the grid leak is composed of two resistors, 640,000 and 1.25 megohm, the bias being developed by the former. A T filter prevents r-f from being fed back. There is also provision for an external high impedance speaker.

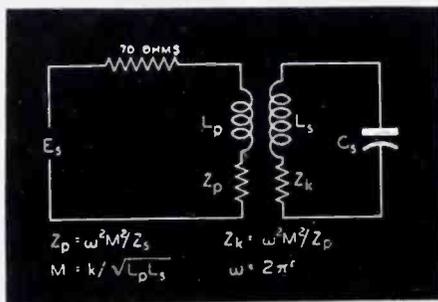
F-M ANTENNAS

(Continued from page 26)

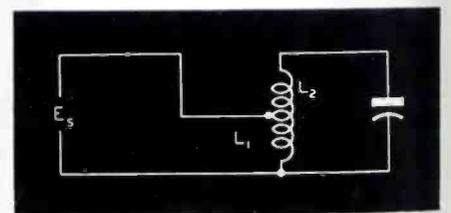
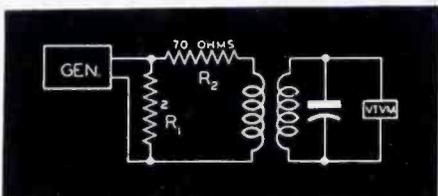
and Z_k is the coupled impedance in the secondary due to the presence of the primary.

If the coupled circuit secondary is designed first to have high Q and to resonate with the desired signal frequency, the primary turns and coupling may be adjusted until maximum secondary voltage is obtained. This setup is shown in Fig. 9. A powerful oscillator is used to set up a strong current in the primary circuit resistance R_1 . The reason is that R_1 is low compared to R_2 to make the source practically 70 ohms and thus simulate an actual doublet antenna installation. For a given number of primary turns the coupling can be adjusted until maximum output voltage is obtained. Using a low Z transmission line, the coupled impedance will be lower and

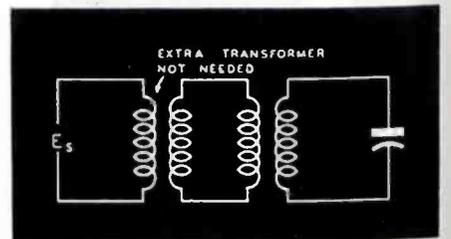
(Continued on page 31)



Figs. 8 (above) and 9 (below). Fig. 8, a simplified equivalent electrical circuit, looking from the line into the receiver. The line source is assumed to have a 70-ohm impedance value (surge impedance). Fig. 9, a set-up for experimentally determining optimum transformer design. Adjustments are made for maximum secondary voltage.



Figs. 10 (above) and 11 (below). Fig. 10, an autotransformer coupling arrangement used in some receivers for stepping up the low impedance of the line to a value that will match the high Z-input of a tube. Fig. 11, some make the mistake of using an extra transformer. Avoid this error. If the set is designed to match a low Z line, no external antenna matching transformer is required.



F-M ANTENNAS

(Continued from page 30)

The reduction of the secondary circuit will be less than if a high Z line is used.

In some cases an autotransformer arrangement, as shown in Fig. 10, can be used for the purpose of coupling the line to the receiver input circuit. The input signal voltage causes a current to flow in the lower part of the coil, L_1 , and the field developed links with the upper part of the coil, and induces a larger voltage by the amount of the turns ratio (approximately). This voltage is then built up by resonant circuit action. In some cases an extra transformer is included in the antenna circuit. The reason is that the antenna manufacturer often includes a matching transformer with the antenna kit. If the set is designed to match a standard f-m antenna instead of an ordinary inverted L type, the inclusion of the extra transformer will mean a loss of signal strength. This is shown in Fig. 11.

SPEAKER MATCHING

(Continued from page 19)

If the receiver has more audio gain than is required, since it not only assures minimum distortion, but also allows for better all-round frequency response, as well as better transient response. It will be obvious also that incorrect plate loads due to a mismatch will have much less effect if feedback is added to the audio amplifier. The application of negative voltage feedback actually results in an apparent drop of tube plate impedance.

Loss of audio gain is naturally a consideration, particularly as the driver tube must provide more power if the output grid is to be driven fully. Feedback fraction can not, therefore, be increased indefinitely. In any case, to many radio owners, tonal quality is more important than power output. Throughout this discussion, no mention has been made of power output reduction, as we decreased screen potential. It is presumed that tone quality is the prime consideration.

Incidentally, an increase of screen voltage above that of the plate, is not recommended in the conversion chart, Fig. 3.

Fig. 5, which shows a tube combination such as 6Q7 and 6F6 or their equivalents, requires only the addition of one resistor R_2 to provide feedback. Its value will depend upon the value of the driver plate load, but in general its value will be several times that of the plate resistor.

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While these two columns read identically, word for word, the smudged column is a visual representation of an acoustical condition when background noise interferes with transmitted speech.

The words may be readable, but effort and concentration are required for accuracy. And so with reproduced sound: with general purpose microphones articulation is lowered even though ambient noises do not completely override speech. The Electro-Voice Differential is specifically designed to erase interfering background noise. Speech is clean, clear, crisp... unadulterated by stray pickup or distracting background.

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The words may be readable, but effort and concentration are required for accuracy. And so with reproduced sound: with general purpose microphones, articulation is lowered even though ambient noises do not completely override speech. The Electro-Voice Differential is specifically designed to erase interfering background noise. Speech is clean, clear, crisp... unadulterated by stray pickup or distracting background.

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INTERCOMMUNICATORS

(Continued from page 17)

systems include a variety of private telephone systems of which Automatic Electric's P.A.X. automatic dial system is a well known example.

Wiring Between Stations

The systems we are considering require special wiring between stations; some use ordinary twisted pairs, others special shielded cable to minimize induction. The Service Man making an installation is cautioned to use the type of wire or cable recom-

mended by the manufacturer of the intercommunicator units, unless tests made to determine the performance of alternate types prove them to be satisfactory under the actual installation conditions encountered. In any case, wiring should always be kept as far as possible from other wires carrying electric light or power currents, as well as telephone currents, and from stray magnetic or static fields of electric motors, contactors, and other apparatus.

In systems which employ a balanced line for interstation wiring, a uniform

(Continued on page 32)



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PHILCO RECORD PLAYER

(See Front Cover)

FEW phono innovations have become as popular as the remote control record players. An interesting design of such a record player appears on the cover, this month. It is Philco's 41-RP-6. Its transmission range is from 530 to 570 kc.

A crystal pickup with a shunt equalizer and voltage divider feeds the modulator grid. The equalizer consists of a .01-mfd capacitor in series with 47,000 ohms; the divider is made up of two series resistors, 100,000 ohms and 220,000 ohms, and is used in connection with a local-distance switch.

When the player is installed close to the receiver the range switch is in the near position; when further away, the switch must be in the distant position. If the reception is noisy, even with the set close by, the distant position is recommended.

CORRECTION

The i-f grid return in Fig. 1a of the Edward Arthur paper on page 11, November issue of SERVICE, should not be grounded.

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INTERCOMMUNICATORS

(Continued from page 31)

ly-twisted pair of wires must be used for each voice circuit. Solid or stranded, uniformly-twisted pairs of the proper wire-size are recommended.

Wire Size for Interstation Wiring

The size of the twisted wire to be used in wiring a remote station to the master station for various distances between stations is of considerable importance. In general, the greater the distance to be covered, or the greater the volume required, the larger the wire diameter (smaller the gauge number) required for satisfactory operation.

G. E. engineers have prepared some practical general data on wire sizes for wiring between stations located various distances apart, and for various operating conditions. These data appear below:

- (A) For maximum volume operation, (Continued on page 34)



OLD TIMER'S

CORNER

by **SERVICER**

WALKED into Ed's radio shop the other afternoon and found him quite upset. Seems as if Ed had a fine store and plenty of business, but he couldn't turn it out very fast. Nearly all the sets were behind in delivery, and he was puzzled as to how he was ever going to finish 'em up.

What's more, Ed said, he found that he was getting "cash poor" even if he had a backlog of repairs which might get him on easy street.

I told Ed that he ought to know that he was being paid for what he did for folks, and not what he knew . . . at least that was the way the customers put it. When he got the radios back and they played fine, he was a good guy. If he kept them waiting for months while he got to the trouble, even if he fixed it . . . well, he'd be in a pretty fix. And his chances of keeping their good-will and their business was pretty slim.

It wasn't that Ed isn't smart. Like his Dad, Ed has a way with tools and he's a whiz with the ohm-sifter and a pair of ear-phones. Usually found the troubles in a breeze. Only now and then he was stumped. Then he'd boil, and the time he spent on trying to find the ailment was a shame.

While we were talking, a bright young man wandered in with a rather big case under his arm. Said he wanted to see the shop, which was Ed. After a few words, he opened his bag of tricks and there was the nicest piece of apparatus you ever did see. He hooked it up to a set and asked Ed what the trouble was with the set.

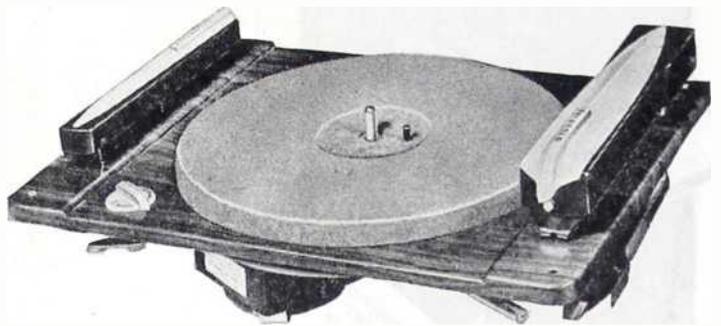
Ed's brow wrinkled and wrinkled. His face reddened. He was ready to explode. But that didn't phase the stranger a bit. He asked what the trouble was from the customer's angle; and Ed sourly told him that the set didn't play. Stranger asked to use Ed's old signal generator. He hooked it to the antenna post of the sick set. Then with a long probe attached to the gadget, he went from point to point. Finally he looked up. Here's the trouble, he said; condenser has an open in it! That surely shook Ed up, and when we replaced that pesky condenser, sure enough, the set played like a bird.

The stranger explained his gadget which he said operated on the *signal tracing* principle. Its like this, he said. If you started from here, Berryport, to meet your friend, there, in Canterville which is about 60 miles away down the highway, and you didn't get there, how would your friend go about finding out what had happened to you, supposing he was that interested?

Obviously if you started down the highway for Canterville you are not here, and you must have either gotten off the highway or you are still on it somewhere's between here and Canterville.

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Won't do your friend much good, if he wants to save time, to telephone all over the county at random searching for you. The logical thing to do is to call the next town after this one on the highway, which would be Hightown. If you passed there, then you are not between there and here. Then he would try Grand Lake, the next town. And if you passed there, he would know that you weren't between here and Grand Lake. Then he'd call Meadville and if you had not gotten there, he'd know that you were somewhere between Grand Lake and Meadville. It would be silly to look after Meadville, since he has already located the last town you passed through and the first one which you have not yet reached. So he'd organize the search between Grand Lake and Meadville, and

like as not he'd find you there, somewhere. See?

Well, he continued, in a radio set, as you and your friend know, the signal comes in at the antenna post, and travels through the set being amplified and having other things done to it as it passes through. If it does not come out of the speaker, it must be "off the track" somewhere in the set. So all that I did, said the stranger, was to start at the beginning of the set and find the signal as it passed through each stage of the receiver. When I found that it stopped, I looked for the last place where I had seen it, and then looked between that place and where it stopped. The rest was easy!

So that's how Ed and I came to change our ideas about some of the improved
(Continued on page 34)

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OLD TIMER'S CORNER

(Continued from page 33)

test equipment which is creeping into radio servicing. We have our orders in now for that new gadget because if we can service our sets faster, we can make more money . . . And then there's more time for that fishing which we have been putting off for the duration!

I knowed it will be hard for Ed and I to give up our titles as the best screw-driver Service Men in the county, but as I said to Ed, even if we can make more money from the same business we're getting now, then it will pay us to change. The new test equipment will look swell, and we might even plan to do our servicing in the front window . . . like the cute little girl who does that sewing down by the Singer people. We always did like to stop and watch her!

INTERCOMMUNICATORS

(Continued from page 32)

use wire sizes *no smaller* than those indicated below:

Maximum distance in ft.	75	125	200	300	500	600	750	1250
Wire size	28	26	24	22	20	19	18	16

(B) When the area to be covered is small and the local noise is not great, less volume from the stations will be satisfactory and smaller connecting wires may be used. For moderate volume operation, use wire sizes *no smaller* than those indicated below:

Maximum distance in ft.	150	250	400	600	1000	1200	1500	2500
Wire size	28	26	24	22	20	19	18	16

(C) When very little volume is required from the stations, a still smaller size connecting wire may be used. If the area to be covered is very small and very little noise is present, use wire sizes *no smaller* than those indicated below:

Maximum distance in ft.	375	600	975	1500	2500	3000	2900	6000
Wire size	28	26	24	22	20	19	18	16

(D) In some special application, it may be desirable to locate the remote station several miles distant from the master station. This may be accomplished by the use of special line transformers without resorting to extremely large wire sizes.

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CORPORATION

TEST EQUIPMENT

IN THE POSTWAR ERA



by L. A.
GOODWIN, Jr.

Manager
Test-Measuring
Equipment Section
RCA Victor Division

WHILE the trend to improved servicing methods and increased use of test equipment was definitely underway prior to the war, it is believed that the postwar Service Man will be much more test-equipment conscious than ever before. This should be true regardless of whether we speak of the Service Man who continued in business during the war, the man who closed up for this period and will again return to service, or newly trained radio technicians who plan to begin servicing after the

war is difficult to predict the exact requirements of all items of test equipment required for servicing f-m, television and all of the new electronic fields which will soon be opened to the Servicing Industry. Undoubtedly, the special instruments will be needed to meet the particular requirements of these new fields. There will, likewise, be a continued use and application for general-purpose type equipments such as oscilloscopes, signal tracers, tube tester and voltage and resistance measuring instruments. Obviously, a great many servicing problems will continue which can be efficiently diagnosed by the general type instruments. Where specific techniques, which cannot be handled by these equipments, are increased, the test equipment industry undoubtedly provide special units for such applications. As techniques improve, these special devices will, no doubt, find their way into other general purpose equipments.

Information available at this time indicates that the requirements for the new instruments are such that costs will probably be higher than the average costs have been in the past for servicing equipment. An increased knowledge of the techniques involved in the new fields will be necessary to use properly the equipments which will be available. It must be remembered that the finest equipment is of little value unless the know-how is there to put it to work efficiently.

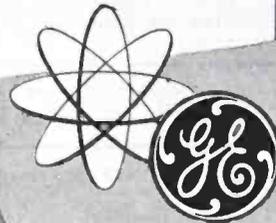
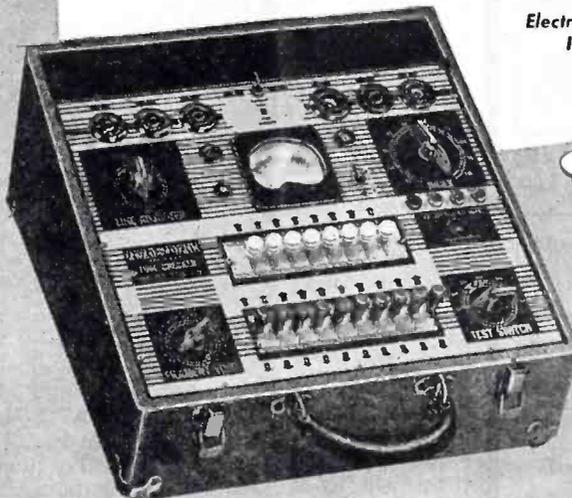
G-E TUBE CHECKER

Quick, easy, accurate tube checking which saves you time and trouble and keeps your customers happy—that's the job the TC-3P is built to do. Line Voltage and tube quality, or shorts, may all be checked on one selector switch. Individually operated switches permit placing the proper voltage on the proper pin of the tube. The G-E Tube Checker is available in either the Portable (TC-3P) or Counter Model (TC-3). Write: Electronics Department, General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

177-D1

Electronic Measuring
Instruments



TC-3P

STAMINA



The inherent stamina of Cinaudagraph Speakers is due to experience in design and manufacturing plus highest inspection standards. In all types of Cinaudagraph Speakers, from small watch-like Handie-Talkie units to large auditorium speakers, you'll find the same precision, the same painstaking workmanship and the same long-lived faithful reproduction.

Watch Cinaudagraph Speakers after Victory!



Cinaudagraph Speakers, Inc.

3911 S. Michigan Ave., Chicago

Export Div., 13 E. 40th St., New York 16, N. Y.

"No Finer Speaker Made in all the World"

Matched MIDGET CONTROLS



They look alike; their dimensions are the same; they mount the same way — these Clarostat wire-wound and composition-element controls. Fully interchangeable, mechanically speaking.

Clarostat midget composition-element controls have been available for years past. Their stabilized element has established brand new standards for accurate resistance values, exceptional immunity to humidity and other climatic conditions, and for long trouble-free service. And now the Clarostat midget wire-wound control is being made, and, when priorities permit, will be likewise available to servicemen.



Ask Our Jobber . . .

Ask him to help you with your wartime servicing problems. Clarostat replacements take care of most of the usual jobs. Ask for latest catalog.



CLAROSTAT MFG. CO., Inc. • 285-7 N. 6th St., Brooklyn, N. Y.

OLD TIMER'S CORNER

(Continued from page 33)

test equipment which is creeping into radio servicing. We have our orders in now for that new gadget because if we can service our sets faster, we can make more money . . . And then there's more time for that fishing which we have been putting off for the duration!

I knewed it will be hard for Ed and I to give up our titles as the best screw-driver Service Men in the county, but as I said to Ed, even if we can make more money from the same business we're getting now, then it will pay us to change. The new test equipment will look swell, and we might even plan to do our servicing in the front window . . . like the cute little girl who does that sewing down by the Singer people. We always did like to stop and watch her!

INTERCOMMUNICATORS

(Continued from page 32)

use wire sizes *no smaller* than those indicated below:

Maximum distance in ft.	75	125	200	300	500	600	750	1250
Wire size	28	26	24	22	20	19	18	16

(B) When the area to be covered is small and the local noise is not great, less volume from the stations will be satisfactory and smaller connecting wires may be used. For moderate volume operation, use wire sizes *no smaller* than those indicated below:

Maximum distance in ft.	150	250	400	600	1000	1200	1500	2500
Wire size	28	26	24	22	20	19	18	16

(C) When very little volume is required from the stations, a still smaller size connecting wire may be used. If the area to be covered is very small and very little noise is present, use wire sizes *no smaller* than those indicated below:

Maximum distance in ft.	375	600	975	1500	2500	3000	2900	6000
Wire size	28	26	24	22	20	19	18	16

(D) In some special application, it may be desirable to locate the remote station several miles distant from the master station. This may be accomplished by the use of special line transformers without resorting to extremely large wire sizes.

NATION-WIDE
MAIL ORDER
DISTRIBUTORS
SINCE 1928



RADIO AND
ELECTRONIC

DEVICES

For . . .

TRADE
INDUSTRY
VOCATIONAL
COMMUNICATION
PUBLIC UTILITY
and
EXPERIMENTAL
APPLICATIONS

BURSTEIN-APPLEBEE CO.

1012-14 MCGEE ST.

KANSAS CITY 6, MISSOURI

FADA
Permanent
NEEDLES

List \$1.00

Special Introductory Offer 39¢
(TO DEALERS ONLY—IN LOTS OF 6 OR OVER)

- Plays 4M Records without changing
- Better Tone Reproduction
- Help Reduce Background Hiss
- Longer Record Life

FADA OF NEW YORK
928 BROADWAY NEW YORK 10 N. Y.
Large Stock of Replacement Parts and Cabinets

SERVICE TO SERVICEMEN . . . THAT'S STANCOR'S RECORD

Standardize
ON

STANCOR

Call your nearest Stancor Jobber . . .
or write us for his address

Transformers

STANDARD TRANSFORMER
1500 N. HALSTED STREET • CHICAGO



CORPORATION

TEST EQUIPMENT

IN THE POSTWAR ERA



by L. A.
GOODWIN, Jr.

Manager
Test-Measuring
Equipment Section
RCA Victor Division

WHILE the trend to improved servicing methods and increased use of test equipment was definitely underway prior to the war, it is believed that the postwar Service Man will be much more test-equipment conscious than ever before. This should be true regardless of whether we speak of the Service Man who continued in business during the war, the man who closed up for this period and will again return to servicing or newly trained radio technicians who plan to begin servicing after the war.

It is difficult to predict the exact requirements of all items of test equipment required for servicing f-m, television and all of the new electronic fields which will soon be opened to the *Servicing Industry*. Undoubtedly, some special instruments will be needed for the particular requirements of these new fields. There will, likewise, be a continued use and application for general-purpose type equipments such as oscilloscopes, signal tracers, tube testers, and voltage and resistance measuring instruments. Obviously, a great many servicing problems will continue which can be efficiently diagnosed by the general type instruments. Where specific techniques, which cannot be handled by these equipments, are involved, the *test equipment industry* will doubtless provide special units for such applications. As techniques improve, these special devices will, no doubt, find their way into other general purpose equipments.

Information available at this time indicates that the requirements for these new instruments are such that costs will probably be higher than the average costs have been in the past for radio servicing equipment. An increased knowledge of the techniques involved in the new fields will be necessary to use properly the equipments which will be available. It must be remembered that the finest equipment is of little value unless the *know-how* is there to put it to work efficiently.

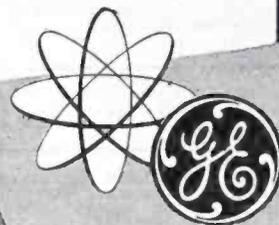
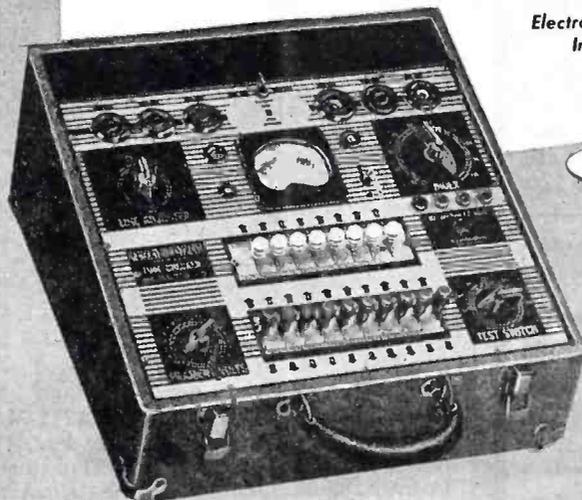
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GENERAL ELECTRIC

177-D1

Electronic Measuring
Instruments



TC-3P

STAMINA



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Watch Cinaudagraph Speakers after Victory!



Cinaudagraph Speakers, Inc.

3911 S. Michigan Ave., Chicago
Export Div., 13 E. 40th St., New York 16, N. Y.

"No Finer Speaker Made in all the World"

NEED PARTS?

National can supply you quickly with most of those hard-to-get parts at exceptional prices. Take a look at these bargains—

TUBE SPECIALS

All fully guaranteed.
 Type 27 (Pear Shape)..... 33c ea.
 100 for \$24.90
 Types UX200, 31, 89..... 39c ea.
 Types 39, 6F8G, 6SN7GT, 4S, 55 49c ea.
 Types 6SL7GT, 6Z5, 1T4, 3S4. 59c ea.
 Types 7H7, 7N7, 22..... 69c ea.
 Only these types available, while they last, do not ask for others.

6 ft. Electric Cord Sets, high grade, soldered, molded, rubber plug at one end, stripped and tinned at other.
 Each, 29c; 10 for \$2.75; 100 for \$24.60

3,000 m.f.d. at 3v F.P. Condenser in aluminum can 1 1/2" X 2 1/16" H. Fresh stock. Special, while they last. Each..... \$1.39
 10 for\$11.09

A Superior Mike Cable, single conductor, shielded, and pre-war natural rubber cover.
 13c per ft.; 100 feet, \$9.90

CONTINENTAL CARBON RESISTOR KIT No. C6 Assortment. 100 RMA coated 1/2 and 1 Watt resistors (2/3 are one watt). Unusual bargain at\$3.35

AERIAL KIT containing aerial wire, rubber coated lead-in, insulators, ground clamp, window strip, etc.Each, 89c

20 MFD 150 WV Tubular Pigtail Electrolytic, One Year Guar.Each, 35c; 10 for \$3.30

10 MFD 450 WV Tubular Pigtail Electrolytic, One Year Guar.Each, 43c; 10 for \$3.95

Deluxe assortment of 50 Bakelite Set Screw Knobs for 1/4" Shaft.....Kit, \$4.19

50 MFD 150 WV Tubular Pigtail Electrolytic, One Year Guar.....Each, 49c; 10 for \$4.45

ASSORTMENT OF 147 FIRST LINE 600 WV TUBULAR BY-PASS CONDENSERS CONSISTING OF 64 .01-600WV, 32 .02-600WV, 24 .05-600WV, 27 .1-600WV, One Year Guarantee. List Price, \$33.30. **\$11.95**
 Your cost only.....

Assortment of 200 pcs. Special Radio Hardware including Tube Sockets, Terminal Strips, Grid Caps and Plugs.....Kit, \$1.49

20x20/150WV Tubular Electrolytic, First Line Condenser. One Year Guarantee.
 Each, 61c; 10 for \$5.60

BALLAST TUBES—K42B, K42C, K49B, K49C, K55B, K55C, L49B, L49C, L55B, L55C.
 Each, 45c; 10 for \$3.99
 100-37, 100-70, 100-77 and 100-79.
 Each, 59c; 10 for \$5.45

Continental Bakelite Suppressors—S19A (Straight type with Rajah spring snap-on connector, fits all makes of spark plugs. Terminal nut cable connector.) Each, 18c; 10 for \$1.65

HI-TEMP RUBBER PUSH BACK WIRE—Solid and Stranded (#20)
 100 Ft. Roll, 71c; 10 for \$6.50

LOCTAL SOCKETS—(Metal Supporting Ring.)
 10 for \$1.10; 100 for \$9.99

10 MFD 50WV Tubular Pigtail Electrolytic Condenser. One Year Guar. Each, 28c; 10 for \$2.45

10x10/450WV Tubular Electrolytic, First Line Condenser. One Year Guarantee.
 Each, 74c; 10 for \$6.90

Assortment of 25 Muter Candohm Wire Wound Resistors (All are 7 to 15 W, 15 or more are between 100 and 500 Ohms.)...Assortment, \$4.99

20% deposit required on all C.O.D. orders. Don't forget L-265 or AA-3 Certificates. Orders of \$25.00 or more, accompanied by payment in full, will be shipped prepaid.

Free Bulletin No. 1100 lists hundreds of other radio parts and supplies. Write for it today!

NATIONAL ELECTRONIC SUPPLY

77 W. Washington Blvd. Chicago 2, Ill.



BUSHNELL PROMOTED BY MAGNAVOX

L. H. Bushnell has been appointed San Francisco district sales manager of the radio-phonograph division of The Magnavox Company.

His headquarters are at 1355 Market Street, San Francisco.

* * *

SYLVANIA PROMOTES WISE

Roger M. Wise is now vice president in charge of engineering of Sylvania Electric Products Inc.

Sylvania's director of engineering for the past two years, Mr. Wise previously served as the company's chief radio engineer for ten years.



* * *

C-D APPOINTS KEN BURCAW AS S-M

K. C. Burcaw has been appointed sales manager of the jobber division of the Cornell-Dubilier Electric Corporation.

Mr. Burcaw was formerly sales manager of Radiart in Cleveland.



* * *

KEN-RAD RADIO TUBE PLANTS BOUGHT BY G.E.

The General Electric Company has purchased the radio tube manufacturing and plant facilities of the Ken-Rad Tube and Lamp Corporation at Owensboro, Kentucky, and at Huntington and Rock Port, Indiana, and will take over operation of government-owned plants at Tell City, Indiana, and Bowling Green, Kentucky.

The sale does not include the electric lamp manufacturing business of Ken-Rad.

Carl J. Hollatz, formerly executive vice president of Ken-Rad, will manage the new G. E. operation, which will be known as the Ken-Rad division of the electronics department.

* * *

CALAMARAS BECOMES NEDA EXECUTIVE SECRETARY

Louis Calamaras has been elected executive-secretary of the National Electronic Distributors Association. Offices will be located at 221 N. La Salle Street (2240 La Salle-Wacker Building), Chicago, Illinois.

* * *

PEERLESS CATALOG

A 20-page catalog, bulletin 431, describ-

For Soldering in Tight Places...

DRAKE

No. 400 Soldering Iron

Smallest Industrial Iron Ever Designed

60 Watts — 1/4 in. Tip
 Only 9 in. long. Wt. only 8 oz.

This mighty mite is backed by DRAKE's 25 years of soldering iron manufacturing experience. The high quality and long-service of DRAKE Soldering Irons have made them outstanding favorites with all types of radio men everywhere. The DRAKE No. 400 is an outstanding value at



Only \$4.50
 List

Drake Has an Iron for Every Purpose. Ask Your Radio Parts Jobber

DRAKE ELECTRIC WORKS, INC.

3656 LINCOLN AVE., CHICAGO 13, ILL.

ing transformers, windings, and reactors has been published by Peerless Electric Products Co., 6920 McKinley Avenue, Los Angeles 1, California.

The catalog contains photographs and illustrations, diagrams, and construction details.

Industry personnel may secure a free copy by writing on company letterhead.

* * *

PHILCO SELF-SERVICE SUPER-MARKETS

Over 100 Philco distributors throughout the country have organized self-service super-markets where merchandising principles featured by retail super-markets in the grocery trade have been adapted to radio parts distribution operations.

The company's first largest self-service super market was started in Philadelphia.

Charles E. Gerhard, manager of Philco parts sales reports that the super-market has meant a large increase in dollar-volume over the old methods of selling parts. He says that Service Men have found the new method a time and money-saver.

* * *

CITY RADIO PUBLISHES FIFTH EDITION OF WARTIME SERVICE MANUALS

The fifth edition of "Wartime Radio Service" has been published by the City Radio Company, 504-6 East Washington Street, Phoenix, Arizona. The newest edition contains expanded data on tube substitutions, burned-out tube repairs, part replacements, tube characteristics in chart form, etc.

* * *

LEACH NOW S-P-M FOR BENDIX RADIO

Claude Leach, Jr. has been appointed

sales-promotion manager for the home radio division of Bendix.

* * *

"E" AWARDS

The Varick and Hubert Street plants of United Transformer Company in New York City were recently awarded the Army-Navy "E." The Sprague Electric Company, North Adam, Mass., received a third white star for the "E" flag recently.

* * *

AMPHENOL A-N INSERT CHART

A chart of molded A-N insert arrangements for electrical connectors has been published by American Phenolic Corporation, Chicago 50, Illinois.

All standard inserts from one contact to one hundred contacts are shown in full size. Socket or pin arrangements are indicated together with wire sizes. Also included are coaxial cable connections and grounded or shorted inserts. The chart is 50" x 38".

A complete chart of A-N and Amphenol 97 shell types and styles is enclosed with each chart.

A copy will be sent on receipt of request on company letterhead.

* * *

NEAL BEAR BECOMES RADIART S-M

Neal Bear, has been named distributor sales manager of The Radiart Corporation, Cleveland, Ohio.

Mr. Bear has been with The Radiart Corporation for seven years. Recently he has been acting as operations manager.



* * *

NEWS OF THE REPRESENTATIVES

At a recent meeting of the Chicago and chapter the following officers were elected: president, Russ Diethert; vice

president, C. R. Bluzat; and R. Edward Steem, secretary and treasurer.

National president Irvin Aaron of Milwaukee, attended a New York chapter meeting recently.

Farris and Koenig of the Missouri Valley chapter are now located at 406 W. 34th St., Kansas City 2, Mo.

* * *

W. W. BERNS HONORED BY FIVE-TOWNS RADIO CLUB

W. W. Berns was honored recently by members of the Five-Towns Radio Club for his administrative work.

The January meeting of the club was held at the home of Sidney Gould, president of the Recordisc Corp.

* * *

U.M.C. PRICE LIST DATA

A price-list bulletin, 1460, covering twenty-seven carbon, dynamic and velocity types in palm, stand, throat, lip, hand and cartridge styles, has been issued by Universal Microphone Co., Inglewood, Cal.

* * *

WHITE NOW JENSEN RADIO PRESIDENT

Thomas A. White has been elected president and general manager of Jensen Radio Manufacturing Company. He succeeds W. E. Maxson, who has retired.

Mr. Maxson will remain on the board of directors.

* * *

GENERAL ELECTRONICS CATALOGS

A catalog, 101, covering d-c voltmeters, ammeters, milliammeters, microammeters and radio-frequency ammeters of the a-c thermocouple type, has been published by the General Electronics Manufacturing Company, 6014 West Washington Boulevard, Culver City, California.

* * *

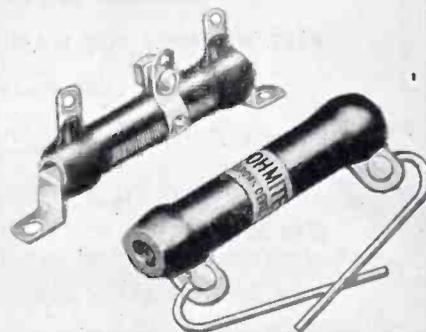
HAVENS BECOMES S-M OF NOMA CONDENSER DIVISION

B. H. Havens has been appointed sales manager of the condenser division of Noma Electric Corporation, 55 W. 13th Street, New York 11, N. Y.

Mr. Havens will direct merchandising of Noma condensers through sales representatives and parts jobbers in key cities throughout the United States.

OHMITE RESISTORS

Your Guide to
DEPENDABLE RESISTANCE CONTROL



The service-record of Ohmite Brown Devil and Dividohm Resistors before and during the war... is your best guide to resistance-control tomorrow. Widely used in military and industrial equipment... everywhere! Write for Stock Unit Catalog No. 18.

Authorized Distributors Everywhere



OHM'S LAW CALCULATOR

Figures ohms, watts, volts, amperes... easily. Solves any Ohm's Law problem with one setting of the slide. Send only 10c in coin.

OHMITE MANUFACTURING CO.
4877-FLOURNOY ST. • CHICAGO 44, U. S. A.

Be Right with **OHMITE**
RHEOSTATS • RESISTORS • TAP SWITCHES

SPEED UP REPAIRS WITH THESE G-C AIDS!



FREE STEEL CABINET

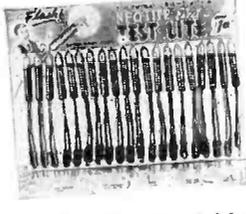
G-C Dial Belt Kits

Exact replacement woven fabric belts. Easy to install — no stretching — no adjustments — a perfect fit every time. Kits come with 25, 50, 100, 200 or 300 belts.



Radio Chemical Laboratory

Twenty 2 oz. bottles. A complete assortment of cements, solvents, coil dopes, lubricants, cleaners, etc. Brushes in bottle caps. Indexed steel rack.



G-C Ne-O-Lite

New improved design. Useful hundreds of ways. Tests AC and DC lines, DC polarity, fuses, etc. You can't afford to be without this handy all-purpose trouble shooter.

Order From Your Radio Parts Jobber
ALWAYS ASK FOR G-C PRODUCTS

GENERAL CEMENT MFG. CO.
ROCKFORD, ILLINOIS



FIFTH EDITION
WARTIME RADIO SERVICE

75 PAGES—OVER 1500 TESTED TUBE SUBSTITUTIONS

The only book of its kind—Will save its cost over and over in time saved—Though you may know the substitution, you save the time it takes to figure the changes.

Each Substitution Set Down Like the Example Below

TUBE	SUBSTITUTE	CIRCUIT CHANGES NECESSARY
12SA7	12K8	Make adaptor as follows: no. 1 on base to no. 1 on top no. 2 on base to no. 2 on top no. 3 on base to no. 3 on top no. 4 on base to no. 4 & 6 on top no. 5 on base to no. 5 on top no. 6 on base to no. 8 on top no. 7 on base to no. 7 on top no. 8 on base to cap

THE LAST THIRTEEN PAGES CONTAIN A VERY COMPLETE TUBE CHARACTERISTICS CHART WITH CLEAR BASE VIEWS

REPAIRING BURNED OUT TUBES

CHANGING 1.4 & 2.0 VOLT FARM RADIOS FOR ELECTRIC OPERATION

BEST METHODS FOR MAKING ADAPTORS

Price \$3.00 Postpaid

Get this money making time saver from your distributor today or order from

CITY RADIO CO.

The RADIO CITY of PHOENIX, ARIZONA
 EAST WASHINGTON AT FIFTH STREET

DISTRIBUTORS AIRMAIL TODAY FOR PROPOSITION

TUBES—PARTS

RADIO DEALERS—SERVICEMEN

Send for our list of available tubes and repair parts. Sylvania, Tung-Sol, National Union.

M. V. MANSFIELD CO.
 937 LIBERTY AVE. PITTSBURGH 22, PA.

Ted McElroy

World's Largest Manufacturer of
 Wireless Telegraphic Apparatus

COMPLETE CENTRAL OFFICE EQUIPMENT

McElroy Manufacturing Corp.
 32 Brookline Avenue • Boston, Massachusetts

UNIVERSAL MIDGET TOOLS

DANDY SIXTEEN PIECE SET

Midget Pliers, Diagonal Cutters, Four Midget End Wrenches. Needle-nose Pliers, Screwdriver, Six Punches and Chisel, Round File, Midget Crescent Wrench. \$14.85. IMMEDIATE DELIVERY. Remit Today. Catalogue Free with Order. DEALERS TOOL SUPPLY, 1527 Grand Street, KANSAS CITY, MISSOURI.

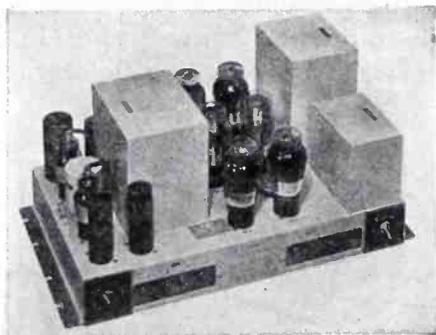
WHEN YOU CHANGE YOUR ADDRESS

the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies. Be sure to notify the Subscription Department of SERVICE at 19 B. Forty-seventh St., New York 17, N. Y., giving the old as well as mailed to the old address. We ask your cooperation.

LANGEVIN AMPLIFIERS

Medium gain, high-power bridging amplifiers, type 101, have been announced by The Langevin Company, Inc., 37 West 65th Street, New York.

All models in the 101 series are said to deliver 50 watts to a nominal load impedance with less than 3% rms harmonic distortion at 400 cycles. The gain control is said to provide continuous adjustment over a 40-db range and bridging connections. Weight approximately 45 pounds.



HICKOK MAGNETIC FLUXMETER

A fluxmeter, 256, utilizing an electronic circuit connected to an indicating meter so that when an exploring inductor is placed in a magnetic field the indication of the meter will be in proportion to that field, has been developed by the Hickok Electrical Instrument Co., 10529 Dupont Avenue, Cleveland, Ohio. Model is designed to operate from 105-120 volts a-c, 50-cycle circuit.

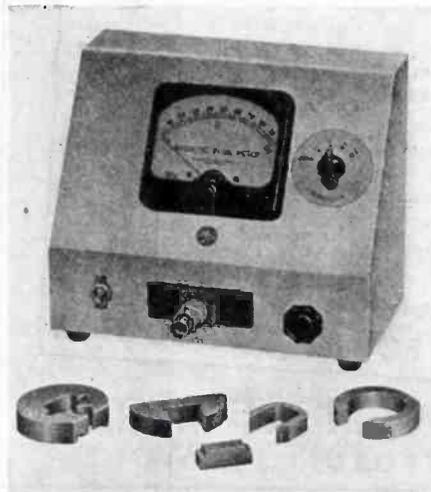
Magnetic flux measurements can be compared within plus or minus 3%.

NEW PRODUCTS

Higher accuracy can be obtained by calibrating the instrument with a known gauss standard and using it shortly afterwards.

Has one sensitivity control, a four-position control, that serves the dual-purpose of turning the instrument off and selecting the three sensitivity positions. The balance control is used to pre-set the meter at zero.

Supplied with one standard exploring inductor that can be used to measure air



gaps 1/2" or larger, or bar or disc type magnets.

Meter is a Hickok 4" rectangular size. Width, 9 1/2"; height, 10 1/2"; depth, 5"; net weight, 10 ounces.

* * *

STRUTHERS-DUNN VACUUM SWITCH KEYING RELAY

A vacuum-switch keying relay, type 78CCA100, has been announced by Struthers-Dunn, Inc., 1321 Arch Street, Philadelphia 7, Pa.

Relay has seven poles, including one double-throw pole which handles high-voltage radio-frequency currents by means of a vacuum switch.

* * *

ELECTRO PLASTIC GLASS-CERAMIC METAL PLATINGS

Plating processes adapted for application to glass and ceramics have been announced by Electro Plastic Processes, 2035 West Charleston Street, Chicago 47, Illinois.

The process is said to be adaptable to the hermetic sealing of such electrical components as resistors, condensers, small relays, transformers, instruments, etc. Either glass or ceramic cases can be plated with a metallic band for soldering to metallic and caps. Any normal soldering method is said to be satisfactory; hot iron, oven soldering or electronic.

* * *

RCP SIGNAL GENERATOR

A signal generator covering 95 kc to 100 mc, model 704, has been announced by Radio City Products Company, 127 West 26th Street, New York 1, N. Y. Fundamental frequencies are said to be continuously variable from 95 kc to 25 mc in 5 bands; and calibration is said

be accurate to 2% per band up to the broadcast band and within 3% for high frequency bands.

Uses a planetary drive condenser with direct reading calibration. Output can be modulated or unmodulated. Self-contained modulation is either 400 cycles or 1,000 cycles sine wave which modulates carrier. Meter is available for external use.

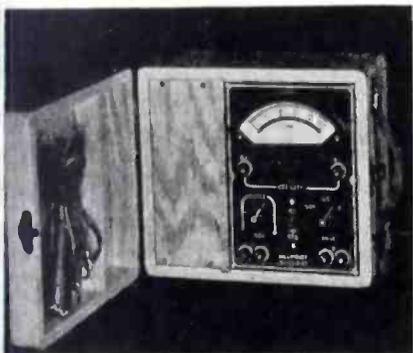
A five step ladder attenuator is used for controlling output.



SUPERIOR INSTRUMENTS MILL-OHMMER

A direct reading linear scale milliohmmer, type p-25, has been developed by Superior Instruments Co., 227 Fulton St., New York 7, N. Y.

Has 3 ranges: 0 to .005/.05 .5 ohms. Accuracy is said to be 1% or better. Circuit employed is adaptation of the potentiometric method of low-resistance measurement. Meter scale divisions are in ohms. Size, 6" x 8" x 9".



IDEAL COMMUTATOR UNIVERSAL CHUCKS

A 3-jaw chuck has been announced by the Ideal Commutator Dresser Company, 125 Park Avenue, Sycamore, Illinois. Body is high tensile strength semi-steel. Rib construction. Scroll of alloy steel.

Two sets of jaws are furnished, one for internal and the other for external work. Chuck is available in 5" size. A mounting adapter is furnished.

CARTER MAGMOTOR GENERATOR

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JOTS AND FLASHES

NOMA Electric names B. H. Havens to direct capacitor sales. . . . Jack Geartner, formerly Arcturus Tubes s-m and more recently with Emerson Radio, appointed home radio division s-m of Electronic Corp. of America. . . . Burton Browne, Chicago advertising agent specializing in radio and electronic accounts, moves to 619 N. Michigan Blvd. . . . Fourth white star awarded to General Radio Co., Cambridge, Mass., for continued excellent in war production. . . . Meissner Mfg. Co., Mt. Carmel, Ill., wins third star for their "E" pennant. . . . Congratulations to Otto Paschkes, president of Solar Mfg. Corp. now celebrating his 25th anniversary in the radio industry. . . . Irvin Aaron, president of the national association of the *Representatives*, recently addressed the regular meeting of the New York chapter. . . . Terry Cunningham, nationally known advertising executive, has been appointed manager of the commercial department of Colonial Radio Corp. . . . Sylvania Electric adds J. T. Millican to sales force for East Central territory with headquarters in Cleveland. . . . Universal Microphone appoints Don Lewis, Salt Lake City, as factory sales representative for Wyoming, Colorado, Utah, Nevada, Arizona, New Mexico, Idaho and Montana. . . . Army-Navy "E" to Regal Electronics Corp., New York. . . . White star for "E" pennant won by Insuline Corp. of America. . . . Magnavox names V. J. Sanborn as Cleveland district sales manager of radio-phonograph division. . . . Hallcrafters SCR-299 featured in Dec. 30th issue of *Liberty* in article titled *It's a Radio War*. . . . Morton E. Ornitz elected a vice president of Emerson Radio & Phono. Corp. . . . Bendix Radio names Jack T. Dayton eastern district manager for New York territory. . . . The George W. Onthank Co. appointed RCA Victor distributor in the Des Moines area. . . . Employees of Allied Radio Corp., Chicago, oversubscribed their 6th War Loan quota by almost 600%. . . . Exceptionally large attendance at Winter Meeting of Institute of Radio Engineers, January 24-27 speaks highly of interest in postwar plans of entire industry. . . . See Alfred A. Ghirardi's interesting article on *Intercommunicators* in this issue. . . . Sidney M. Robards appointed manager of the RCA department of information. . . . Robert F. Taylor, member of the *Representatives*, has been released from the Army after serving as a Captain with the U. S. Army Ordnance Department for two and a half years. He will cover the Chicago area for Wirt and Palmut companies.

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