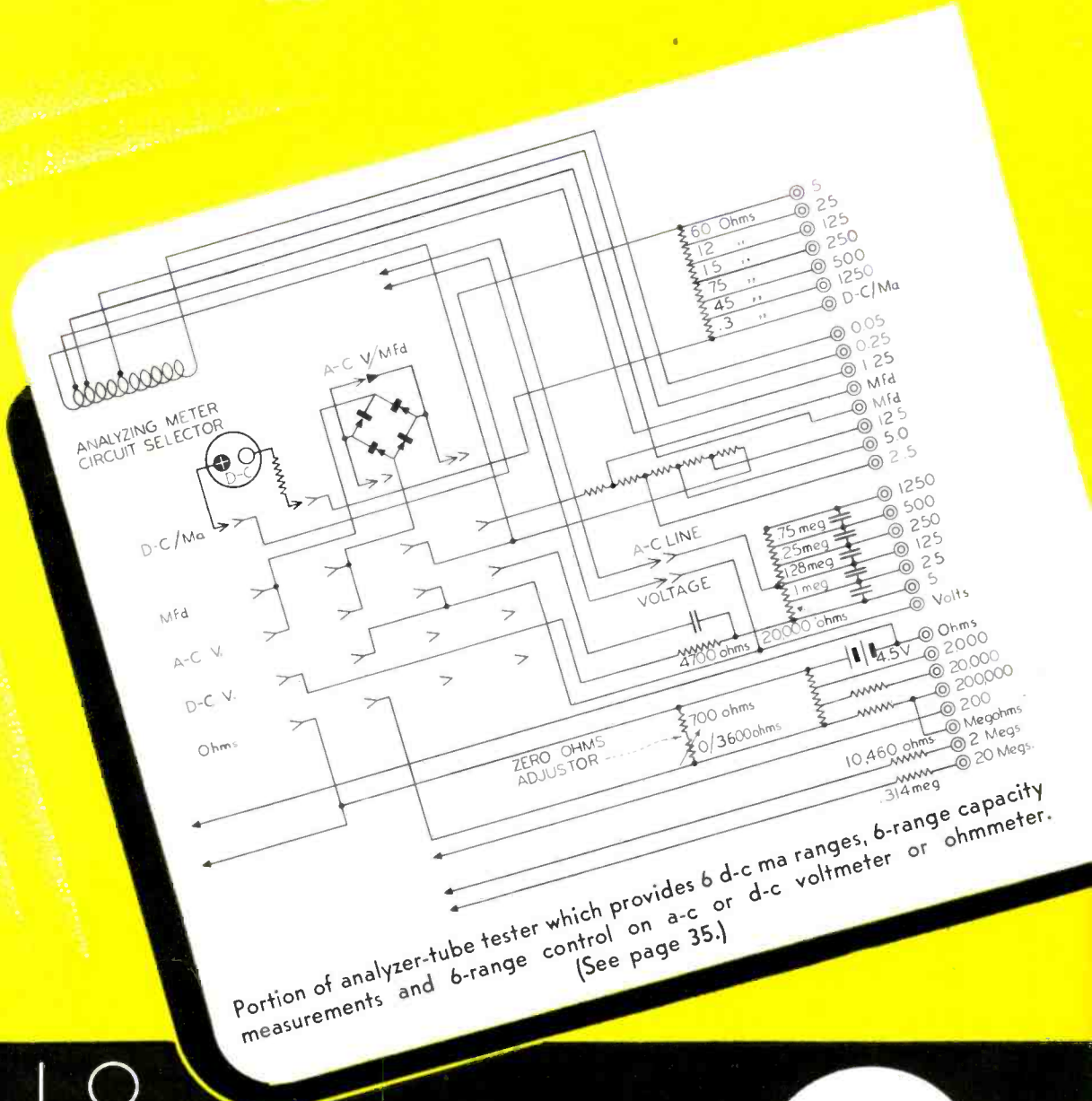
SERVICE

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE



Portion of analyzer-tube tester which provides 6 d-c ma ranges, 6-range capacity measurements and 6-range control on a-c or d-c voltmeter or ohmmeter.
(See page 35.)

★ RADIO
★ TELEVISION
★ ELECTRONICS

April
1944

"bring me the order book, Miss Jones!"

"It's going to be a pleasure to make out this order. Although we are not getting all the tubes we'd like, Hytron surely is doing its utmost to help us by its allocations. We certainly can use these tubes."

Hytron is happy to be able to do at least something toward supplying your demands for civilian receiving tubes. WPB rulings guide our actions entirely; we must ration carefully the few tubes available.

Please bear in mind, too, that Hytron is still helping to fight this war. The WPB has our full cooperation in its conscientious effort to do everything possible to fill the insatiable demand for tubes—both on the home front and on the fighting front. Naturally, the boys in the Services come first.

HYTRON HYLIGHTS

The WPB has ruled that, insofar as possible, MR receiving tubes available for civilian use shall be allocated to established distributors on a pro rata basis of their 1941 purchases. Unfortunately, this means that Hytron cannot accept orders from new distributors. In addition, we ask our authorized distributors to refrain from sending in their orders until they have been informed by the factory or by their Hytron representative, that tubes have been allocated to them.

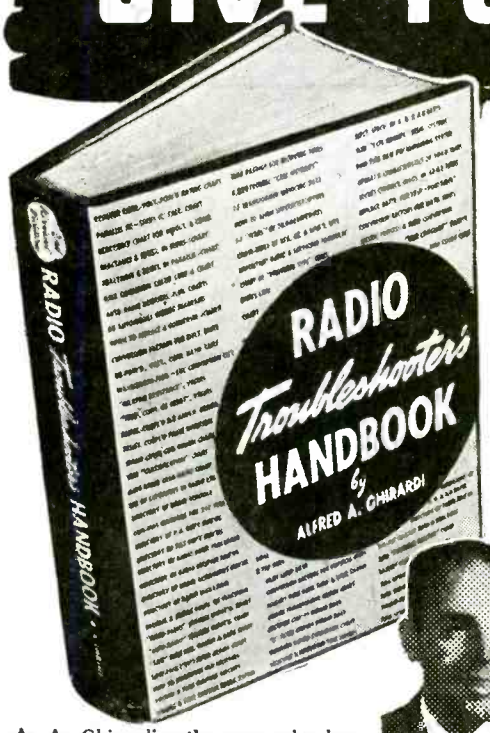
OLDEST EXCLUSIVE MANUFACTURER OF RADIO RECEIVING TUBES

HYTRON CORPORATION ELECTRONIC AND RADIO TUBES

SALEM AND NEWBURYPORT, MASS.

BUY ANOTHER WAR BOND

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.

GEARED TO WARTIME NEEDS

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!**

Only $5

complete ($5.50 foreign)—or

See Special Money-Saving Combination Offer Above Coupon

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!

RADIO & TECHNICAL DIVISION OF
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Dept. S44, 232 Madison Ave., New York 16, N. Y.

☐ 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.

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5-DAY MONEY-BACK GUARANTEE

MAIL THIS NOW!

EDITORIAL

STRIKING predictions on the size of the f-m and television postwar market have been made during the past few weeks. According to Zenith's chief engineer, J. E. Brown, there will be 20,000,000 f-m receivers and 2,000 transmitters within five years after the war. He pointed out that at least 28,000,000 homes can be served conveniently and economically by f-m broadcasting.

In a television prediction, J. D. McLean of General Electric stated that eighteen months after construction of equipment begins, we will have forty active television stations covering a service area of thirty million. And within five years after this period, there will be one-hundred active stations covering a service area of sixty-seven million people.

Allen B. DuMont, in a recent talk, appropriately titled *TNT* or *Television Now and Tomorrow,* said that television will set new standards in marketing, fully in keeping with the coming age of super-marketing.

There appears to be quite a field in the making for the Service Man!

FROM New Zealand Service Man, E. B. Menzies, has come a choice bit on the future of the service industry. He says, "This war has brought and will bring many changes in the service industry. And one prediction for the future can now be made with certainty. Those who do not or did not believe in training, and who firmly believed in the infallibility of just a screw driver and a voltmeter, are due to be sadly disillusioned in the future. For the Service Man will have to have a fuller understanding of all principles, a basic knowledge of mathematics, and complete familiarity with both the equipment being tested and the testing equipment being used. The postwar Service Man should be able to check receivers and components as thoroughly and as accurately as a careful manufacturer."

SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U.S. Patent Office

Vol. 13. No. 4 April, 1944

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on the threshold of a new Era!

THIS is an "Electronics" war! Radio and electronics are writing a most vital chapter in the history of modern warfare. Many of the new developments in electronic tubes are military secrets, but in the postwar period the whole world will benefit by the tremendous strides in the engineering achievements and manufacturing methods born of military needs.

Yes, the foundation is being laid *today* for the glorious peacetime era of electronic achievement that will begin on that *tomorrow* when victory is assured. Then, as now, Raytheon will supply electronic tubes with the "Plus-Extra" performance qualities that have built the Raytheon reputation over the years.

When the Peace is won, Raytheon, due to its unique wartime experience, will be better qualified than ever before to supply manufacturers of postwar radios and of industrial electronic equipment with electronic tubes for the most exacting applications.

Raytheon Production Corporation

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All Four Raytheon Divisions Have Been Awarded Army-Navy "E" Plus Stars

RAYTHEON

High Fidelity

RADIO & ELECTRONIC TUBES

DEVOTED TO RESEARCH AND THE MANUFACTURE OF TUBES FOR THE NEW ERA OF ELECTRONICS

SPRAGUE TRADING POST

A FREE Buy-Exchange-Sell Service for Radio Men

IMPORTANT NOTICE!

We discourage offers to buy or sell anything beyond the O.P.A. ceiling prices, and will not knowingly accept such ads for the Sprague Trading Post.

TUBES FOR SALE OR TRADE—Approx. 900 in all of the following types: 1LA4; 1LB4; 1LH4; 1LD5; 1D8; 1Q5; 1A5; 1A6; 1B5; 1C5; 1D7; 1G4; 1G5; 1E5; 1F7; 1H6; 1S5; 2A4; 2A6; 2B7; 3A8; 3C7; 6E7; 6A3; 6A4; 6A5; 6B8; 6C5; 6C8; 6J5; 6L5; 6L6; 6N6; 6N7; 6P5; 6V7; 6Z7; 6AB5; 6AE6; 6AF5; 6AF6; 6AD6; 7A4; 7A5; 7B5; 7B6; 7B4; 7E6; 7F7; 7H7; 7L7; 7V7; 7S7; 7G7; XXL; XXD; XXFM; XXB; 485; 182; 41; 59; 84; 6Z4; 89; 99. Vogue Radio, 2725 Boston Blvd., Detroit 6, Mich.

WANTED—Good test and lab. eqpt. for cash. Describe fully. All letters answered. AA Radio Service, 1455 Glenarm Pl., Denver 2, Colo.

USED TUBES FOR SALE—Large number, all types, set-tested. Also five 954 acorn tubes. Domestic Appliance Service, Bridgehampton, N. Y.

32V. EQUIPMENT WANTED — Cash for radios, irons, cleaners, fans, motors & 32V light plants, new or used. Or will trade completely modernized AC-49 Hickok tube tester. Norwest Radio Laboratories, Shelby, Mont.

FOR SALE—Aerovox L-C checker, model 95. Like new. M. E. Armstrong, Austin, Minn.

WANTED FOR CASH—Sky-traveler S-29 in any condition, also capacitor analyzer or bridge, motor turntable unit, 5-band coil assembly. Lt. Hsieh James, Hq. Sq., Scott Field, Ill.

WANTED—Good V-O-M for cash. Norman Berg, Box 183, Hillsboro, Kans.

NEW TUBES FOR SALE—Guaranteed, in original cartons. About 50 6-v. receiving tubes, both metal and glass, also 25 other types. Write for list. R. L. Lindell, 1761 Fontainbleau Crescent, Norfolk 5, Va.

FOR SALE—Late issue, 56 National Radio Institute instruction and reference texts. $10 f. o. b. J. H. Wickman, Jonesville, Mich.

FOR SALE—Triplett 1210A tube tester in good condition. O. T. Bolick, 227 Rebance St., Charlotte 2, N. C.

WANTED for Air Station Base: Gen. Industries home recording unit, recording output meter, good dynamic mike, hi-fi speaker, or what have you? Sgt. T. M. Yule, HYD. M.O.T.G. 81 Marines, Edenton, N. C.

FOR SALE OR TRADE — S-29 Hallicrafter in good cond., $50, or will trade for Triumph oscillograph, wobbulator, or RCP 414P and 803, Hickok 510X or what have you? Cash difference. R. E. Tutt, Loyalton, Calif.

FOR SALE — Rimco Dynalyzer (dynamic set analyzer) like new. C. Kettler, 1408 Virginia St., Sioux City, Iowa.

WANTED—Short wave receiver for soldiers' day room. Lt. Leo Meister, Office of Chief of Ordnance, Washington, D. C.

WILL TRADE—Latest Dumont 164E oscillograph in perfect cond. for RCA Chanalyst equally good. Russo Bros., 509—76th St., Brooklyn 9, N. Y.

WANTED—7" foundation meter in good condition. Richesin Radio Lab., 1611—4th St., San Rafael, Calif.

WANTED—Carron or Supreme 571 sig. generator, also late tube tester, Hickok 510X preferred. R. T. Warner, 433 Birch St., Boulder City, Nev.

RADIO STORE WANTED—in good location, New York or 100 miles from it. Give full details. George Rado 101 Elwood Ave. Mt. Vernon, N. Y.

FOR SALE—Late model Fada port. radio; Delco table radio; 5-tube kit with tubes; and 175' 7x22 phosphor bronze aerial wire. Albert Cummings, 51 Hancock Street, Auburndale, Mass.

FOR SALE—Signal tracer, $20; Battery eliminator for portables, $20; also many types of tubes, new and used. Weir Cove Radio, 508 Garden Way, Weir Cove, W. Va.

WILL TRADE new Superior 1240 tube checker, 70 tubes, many new filters, cabinets, and cash. Want Reflex camera, must de 4.5 or better. H. Samkofsky, 527 Bedford Ave., Brooklyn, N. Y.

WANTED—E-200 Precision signal generator. W. W. Story, 812 N. Harvard, Tulsa, Okla.

WANTED—All-wave sig. generator, tube checker, oscillograph, analyzer, and other test eqpt. Hyman Weiss, 32 Home Ave., Albany, N. Y.

WANTED—Tube tester and sig. generator. Clarence Lynch, 245 Worcester St., Southbridge, Mass.

WILL TRADE job printing for radio test equipment. Roy B. Wanders, 3228 N. Osanam Ave., Chicago 34, Ill.

WANTED—good multitester; sig. generator (10 meg.) battery or electric; tube tester not more than 3 yrs. old with instructions. James Simmons, 1739 Elmwood Ave., Norfolk, Va.

WANTED—New or used Isolantite socket for 955 tube (acorn). Need three. Cpl. J. J. Horvath, 35532079, Btry. C., ECP, Fort Bliss, Texas.

WANTED—One 50L6 or 50L6G/GT for soldier's radio. Tech. Sgt. E. Keene, Anti-Tank Co., 405 Infantry, A.P.O. 102, Camp Swift, Texas.

WANTED—Good record player attachment for table radio or phono motor and pickup and arm for making one. Lt. H. McLean, C.A.A.F., Childress, Texas.

WANTED—Sig. generator and test eqpt., any make or model. Describe. Quick Service Radio & Elec. Co., 5119 Florida Ave., Tampa, Fla.

FOR SALE—New R.C.P. sig. generator #703 in original factory carton. $30. S/Sgt. G. B. Wiggin, 7 Valley Pl. So., New Haven 15, Conn.

FOR SALE—Clough-Brengle tube tester, #125A, A-1 condition, with inst. & tube charts, $30. Herbert H. Ledbetter, Elizabethtown, Ill.

WANTED FOR CASH — Good 2nd hand tube tester, late model. Describe. Also want 50L6, 35Z5, 35L6, 12SA7 tubes. Price's Radio Service, 47 Lincoln Ave., Trenton 9, N. J.

WANTED—1-6C5G; 1-6N7G; 1-80; and 2-2A3 tubes. Phillip Landis, P. O. Box 1296, Jacksonville 1, Fla.

WANTED FOR CASH—Late model tube checker and a sig. generator. Fred A. Reithel, P. O. Box 205, Rosiclare, Ill.

WANTED—Late model receiver, must have good B.F.O. tube & operate on 110v. a-c or d-c. Also want port. radio. T/4 Chas. O. Rice, H.Q. Btry. 921 F.A., A.P.O. 96, Camp White, Ore.

WANTED—Superior 1280 set tester and 1230 sig. generator; Triplett push button vibrator tester 1671; Readrite "Ranger" tube tester 432-A; R.C.P. 308P port. tube tester; 16mm. sound projector; also radio sets of all kinds, tubes, parts. Kenneth C. Burpee, Goldentone Radio Sales & Ser., Rt. #1, Dowling, Mich.

WANTED — Supreme 561 oscillator, 562 audolyzer, V-O-M, and cond. tester or other eqpt. to start small shop. C. E. Harmon, 3rd St., Chester, W. Va.

WANTED — All-wave sig. generator & multimeter. E. L. Smart, P. O. Box 292, Liberty, Texas.

RADIO PARTS WANTED—New or used, also tubes. Cash waiting. Frank Henderson, Marine Radio Service Station, 201 Monroe St., Mobile, Ala.

WANTED—Good used oscilloscope with or or without wobbulator. Cpl. E. T. Greene, Box 193, Bainbridge, Ga.

FOR SALE—Howard comm. receiver #460, A-1 condition; also comb. all-wave, battery-operated oscillator & V-O-M in port. case, like new. C. E. Ecklen, 217 N. Washburn, Minneapolis 5, Minn.

TUBES FOR SALE—Have several hundred 50L6; 35Z5; 35L6; etc. Send old tubes to turn in & we will give 10% off. F. S. M. Bailey, 12th & Market, Brownsville, Texas.

WANTED—50L6GT tube & a 50,000 ohm wire wound potentiometer, preferably new. Eugene T. Menkoff, 201 S. 36th W Pl., Tulsa 6, Okla.

WANTED—Test eqpt. urgently needed for new shop; V-O-M, late tube checker, analyzer, signal generator, diagrams, etc. Also parts. B. V. Hurley, Box 272, Soquel, Calif.

HOW TO SUBSTITUTE CAPACITORS *Accurately*

Besides listing the "Victory type" Sprague Atom Electrolytics and TC Tubulars for wartime service use, this folder contains helpful information on making these 18 Capacitor types do the work of the 473 capacitors normally included in our catalog. Send a post card today for your copy.

WANTED—Pair of earphones, at least 2,000 ohm. David Wood, RFD #2, Bethel, Conn.

FOR SALE—5" Dumont #148 oscilloscope. Needs 3 sweep condensers that can easily be replaced. Otherwise perfect. George Miller, 520 W. 124th St., New York 27, N. Y.

WANTED—Used television receiver, can be home-made job, but must be in A-1 condition. Cash or will swap Weston 771 tube tester with ohmmeter and DC voltmeter all in one unit. Also have Readrite 712 tester, 3-meter with plug-in socket cable. Also have 16mm. films and silver screen. Henry Bollmann, Springfield & Plainfield Aves., Berkeley Heights, N. J.

FOR SALE—Hickok R.F.O.-5 3" scope, practically new, $170 f.o.b.; Garrard-R.C. 11 automatic changer $75; AC-DC new Webster 3-post changer R.M.E. 69 with D.B. 20 & speaker mounted on relay rack, $225 f.o.b. Sterling Electronic Labs., 521 W. 131st St., New York, N. Y.

YOUR OWN AD RUN FREE!

This is Sprague's special wartime advertising service to help radio men get needed parts and equipment, or dispose of radio materials they do not need. Send your ad today. Write PLAINLY—hold it to 40 words or less. Due to the large number received, ads may be delayed a month or two, but will be published as rapidly as possible. We'll do everything we can to help you—and the fact that thousands of pieces of Radio-Electronic equipment are in operation today as a result of sales or "swaps" made through The Trading Post offer convincing proof of the far-reaching effectiveness of this service. Remember that "Equipment for Sale" ads bring best results.

Different Trading Post ads appear monthly in Radio Retailing-Today, Radio Service-Dealer, Service, Radio News, and Radio Craft. Sprague reserves the right to reject ads which do not fit in with the spirit of this service.

When buying Capacitors—please ask for Sprague's by name. We'll appreciate it!

HARRY KALKER, *Sales Manager*

Dept. S-44, SPRAGUE PRODUCTS CO., North Adams, Mass.

SPRAGUE CONDENSERS
KOOLOHM RESISTORS

Obviously, Sprague cannot assume any responsibility, or guarantee goods, services, etc., which might be exchanged through the above advertisements

A Third CITATION

FOR THE INSTRUMENT LEADER

. . . FOR MERITORIOUS WAR PRODUCTION

This third citation for meritorious war production . . climaxing a long record of war service . . . is a source of justifiable pride to the men and women of WESTON.

The record began back in the earliest days of our defense period, when a large segment of WESTONS' capacity was assigned to the production of instruments vital to military needs. Thus, when we finally were forced into this world struggle, WESTON was ready for *full-scale war production.*

This new star which adorns our "E" pennant marks the *third* time WESTON has been *first* in this highly specialized field to receive each successive war citation. Weston Electrical Instrument Corporation, Newark 5, New Jersey.

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters...Aircraft Instruments... Electric Tachometers...Dial Thermometers.

FOR OVER 55 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

Are you properly emphasizing the SAVINGS FEATURE OF YOUR PLANT'S PAYROLL SAVINGS PLAN?

WITH the war swinging into its tensest phase, now's the time to emphasize over and over again the *savings* feature of your Payroll Savings Plan. To press home to all your people the need of building up their savings—the need of building up their savings not only in wartime but also in the years directly after the war. To point out that a bond cashed before its full maturity is a bond killed before it has given its fullest service to its owner—*or to his country!*

Buying War Bonds, holding War Bonds, and keeping wartime savings mounting—all are absolutely vital. But no one of these is enough by itself. The *savings habit* must be carried over into the years of reconstruction which will follow the war. For if, at war's end, we have 'flash-in-the-pan' spending, *everybody loses.* The spender loses, you lose, and the country loses! While a working public, convinced of the value of continued, planned saving, is the soundest possible foundation for private enterprise of every sort.

We call these bonds War Bonds—and with their aid we will win this war at the earliest possible moment! But they're Peace Bonds, too—and, rightly used, they will win for their holders, *and for all of us,* a happy and prosperous place in the years of peace to come.

WAR BONDS to Have and to Hold.

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

SERVICE

★ Let's All Back
★ the Attack...
★ with War Bonds!

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council

RCA DYNAMIC DEMONSTRATOR

BUY MORE WAR BONDS

UNIVERSALLY accepted for practical laboratory and vocational instruction in radio.

Consists of the working parts of a six-tube radio receiver, mounted in proper functional position on a large schematic diagram suitable for use in visual instruction. Jacks are provided for interruption and test of the various circuits. When used with modern radio test instruments, facilitates both qualitative and quantitative analysis of radio circuit conditions — an ideal setup for rapid radio instruction. RCA Dynamic Demonstrators, like the one shown above, are in very extensive use today in practical laboratory and vocational radio training schools. For audio demonstrations — for service adjustments — for signal tracing technique — for all manner of measuring, checking, testing, analyzing. (NOTE: Currently, deliveries can be made from stock, subject to prior sale, on a priority of A-1-a or higher.) Please address inquiries to Test and Measuring Equipment Section, RADIO CORPORATION OF AMERICA, Camden, New Jersey.

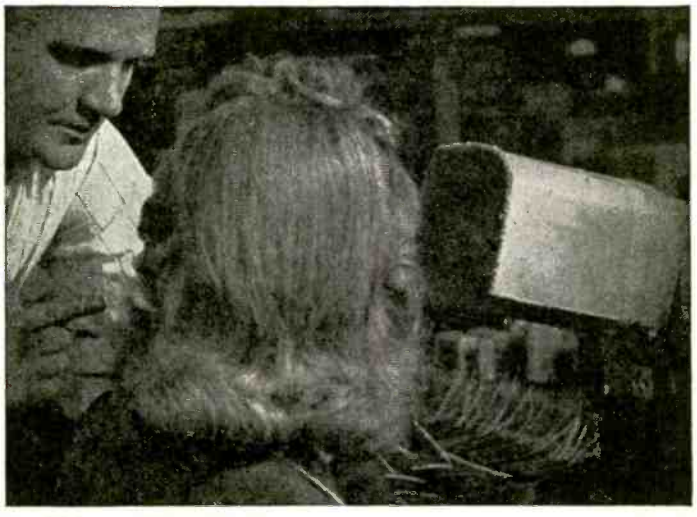
RCA Test and Measuring Equipment

RADIO CORPORATION OF AMERICA

ENVY OF AN INDUSTRY...

MEISSNER'S FAMED "PRECISION-EL"

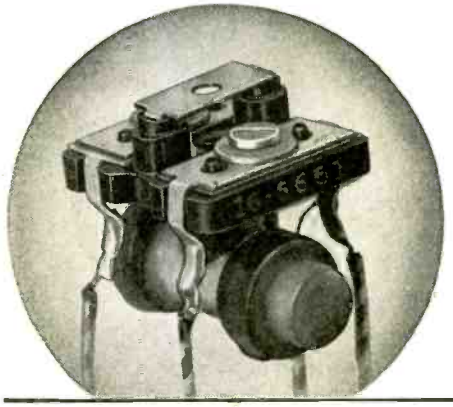
Men of Long Experience: You don't have to be much of a judge of character to know that here's a man who knows his job from A to Z, takes pride in his work. He's typical of the "precision-el" who turn out Meissner's famous line of "Precision-Built" electronics products.



The Meissner "Know How" has long been envied by many in all phases of the electronics industry. There are said to be more electronics technicians per thousand population in Mt. Carmel than in any other American city.

Mighty Unit of America's Might: As far as the camera's eye can reach, it seems, are row upon row of skilled workers engaged in producing vital electronics material for Uncle Sam. This is one unit of the main Meissner plant at Mt. Carmel, Illinois.

Four of a Kind: From miles around Mt. Carmel, entire families have turned to electronics for a place in Meissner's great postwar plans. This family group of four employes, combining many years of varied experience, is about to report at one of the big gates.



ULTRA COMPACT!

Right — it's Meissner's "mighty midget" — a Cartwheel I. F. Transformer only 1⅜" by 1-1/32" by 1¼" high! The perfect replacement unit for the many sets using odd shapes and locations for their I. F. transformers. Excellent, too, for countless AC-DC or Midget type receivers. It's complete with dual trimmers, with one-piece molded plastic trimmer base. Unshielded. For 456-kc only. Our supplies, of course, are limited.

MEISSNER

MANUFACTURING COMPANY • MT. CARMEL, ILL.

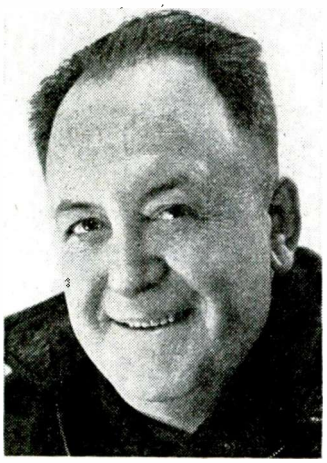
ADVANCED ELECTRONIC RESEARCH AND MANUFACTURE

SERVICE
A Monthly Digest of Radio and Allied Maintenance

THE WINNERS IN THE SERVICE CONTEST

TO a Chicagoan, Ray Pentecost, of Metropolitan Radio Service, 4314 Elston Avenue, Chicago 41, has been awarded the $100 War Bond first prize in the SERVICE contest. Mr. Pentecost, who is a veteran of World War I and has been in the servicing business since 1920, provided several unique wartime repair notes in his winning entry. He covered reconditioning of variable condensers, i-f and antenna coil substitutions, power transformer maintenance, noise cures in speakers, and tube substitutions.

In his discussion of condenser repairs, Mr. Pentecost pointed out how he reconditioned warped, die cast type 4-gang condensers, and repaired bearings and stripped screws. Pie-wound i-f and antenna coil primary repairs through the use of an ohmmeter, and soldering or welding via receiver plate power, were also described.



First prize winner, Ray Pentecost, of Metropolitan Radio Service, 4314 Elston Avenue, Chicago 41, Illinois. Mr. Pentecost is a World War I veteran, and has been a Service Man for the past twenty years.

Second Prize Winner

THE $50 War Bond second prize was awarded to Nat Bader, 709 Brighton Beach Avenue, Brooklyn, New York. Mr. Bader, who at the present time is engaged in war work, disclosed replacement and substitution methods in his winning entry. These substitution ideas concerned filter chokes, resistor line cords, and power transformers.

Third Prize Winner

PAUL GRANUCCI, 174 North Whittelsey Avenue, Wallingford, Connecticut, was awarded third prize, a $25 War Bond.

Mr. Granucci is a Yale University graduate. He holds amateur license W1FRK and also a commercial first class telephone license. He analyzed power transformer and tube substitution problems in his entry. Mr. Granucci is a former civilian member of the U. S. Signal Corps.

Fourth Prize Winner

FOURTH prize, also a $25 War Bond, was awarded to Chester W. Sharp who runs a radio shop on West Main Street, Pryor, Oklahoma. Mr. Sharp has been in the radio servicing field since 1928.

In his winning entry he discussed intermediate frequency and volume control substitutions and repair.

In the May issue will appear the first prize entry of Ray Pentecost. In subsequent issues, the entries of other prize winners will also be presented.

Fifth Prize Winner

A veteran Canadian Service Man, E. M. Dewar, 1515 St. Antoine Street, St. Hyacinthe, Quebec, was awarded the fifth prize, a $25 War Bond.

A complete analysis of an r-f 8-tube receiver conversion was presented by Mr. Dewar as his entry. Featured in this analysis were tube substitutions, i-f stage conversions, speaker and dial replacements.

War Stamp Winners

FIVE $10 War Stamp awards were also made. Winners were David V. Chambers, 5856 Market Street, Philadelphia; Paul Sarnoluk, 117-21 147 Street, South Ozone Park, New York; C. L. Fairchild, 620 Wright Avenue, Elgin, Illinois; Fred Guska, 1220 Buhres Avenue, Cleveland, Ohio; and John A. Smith, 535 Liberty Street, Belleville, Michigan.

David Chambers covered repairs of filter condensers, filter chokes and bleeder resistors in his SERVICE entry.

Repair of volume controls and speakers on the old type Stromberg-Carlsons was discussed in the entry of Paul Sarnoluk.

The use of substitute tubes in the old type Colonial receivers, as well as in the popular variety of five-tube a-c/d-c receivers, was the subject of C. L. Fairchild's entry.

Fred Guska's entry covered the repair of a 35Z5 when the filament is burned out. He also showed how to eliminate hum in a 25L6 output.

The use of a p-m speaker in place of a defective dynamic speaker was described by John A. Smith in his contest entry.

DISTRIBUTION SOUND

by SIDNEY HARMAN

David Bogen Co., Inc.

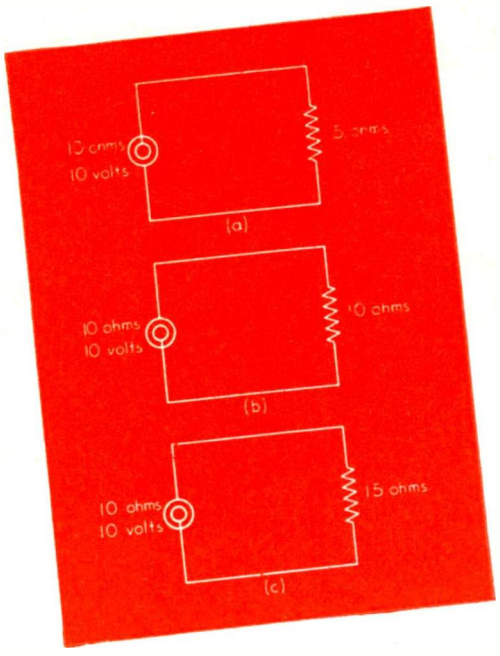


Fig. 1
Three conditions of load: (a) below exact match, (b) exact match, (c) above exact match.

WE have previously analyzed the various aspects and problems of determining the sound system equipment. Certainly, it is necessary that a competent selection and location of speakers be achieved and that the correct amplifying equipment, microphone, tuner and record player be selected. However well these problems may be solved, the end result will be unsatisfactory if the various components of the system are not put together properly.

Matching Speaker Lines

Examination of any amplifier manufactured by a reputable company will disclose that the secondary of the output transformer (or transformers) is multi-tapped. These taps may be at 4, 8, 15, 250 and 500 ohms, and in the case of an amplifier, providing two separate power output stages, a 1000-ohm tap may be made available. This will permit paralleling of the two 1000-ohm secondaries to provide full output from the separate power sections on a 500-ohm line.

What actually is a 500-ohm line, or an 8-ohm or a 15-ohm line? Very simply it is a distribution line which requires a load of either 500 ohms, 8 ohms or 15 ohms to effect the most efficient transfer of power. Thus if an amplifier is to be employed with a single permanent magnet speaker of 8-ohms impedance, best matching will result from connecting the speaker to the 8-ohm tap of the output transformer.

To see this condition most clearly, let us consider Fig. 1. Assume that the a-c generator provides a source of 10 volts and that it has an internal impedance of 10 ohms. Consider three possible conditions of load: (*a*) less than exact match, 5 ohms; (*b*) exact match, 10 ohms; and (*c*) more than exact match, 15 ohms.

Voltage Across Load

Under each of the three conditions, the following equations show the voltage across the load.

$$E = \frac{5}{15} \times 10 = 3\ 1/3 \text{ volts} \qquad (a)$$

$$E = \frac{10}{20} \times 10 = 5 \text{ volts} \qquad (b)$$

$$E = \frac{15}{25} \times 10 = 6 \text{ volts} \qquad (c)$$

The greater the load, of course, the greater the voltage across it. We are not interested in voltage, however, but in power, the formula for which is

$$P = \frac{E^2}{R}$$

Power Developed in Load

Let us determine the power developed in the load under each of the three conditions above.

$$P = \frac{(3\ 1/3)^2}{5} = 2.2 \text{ watts} \qquad (a)$$

$$P = \frac{(5)^2}{10} = 2.5 \text{ watts} \qquad (b)$$

$$P = \frac{(6)^2}{15} = 2.4 \text{ watts} \qquad (c)$$

It is evident from the above that a perfect match provides maximum transfer of power.

It will be remembered that earlier in the article, reference was made to the practice of using output transformers with multi-tapped secondaries. It should first be remembered that when a load in the form of a speaker is connected to the secondary of the output transformer, a condition similar to that represented in Fig. 2 exists. Reference to a tube manual will show the value of load required for optimum operating condition of the output tube.

The Output Transformer

In order to provide the required load, the output transformer is used. It is so designed that when its secondary is properly loaded, the reflected impedance on the primary will be the value required to match the output tube.

The reflected load is obtained from the formula

$$Z_{RL} = N^2 Z_{SL}, \text{ where}$$

Z_{RL} is the reflected load, N^2 is the square of the turns ratio of the transformer, and Z_{SL} is the secondary load. Thus, the reflected impedance on the primary of the output transformer (the impedance which loads the output tube for power transfer), is a function of the product of the square of the turns ratio between the primary and secondary windings of the transformer and the load on the secondary.

Selecting Output Transformer

A good practical method for selecting the output transformer, is to make certain that the inductive reactance ($X_L = 2\pi fl$) of the primary, when the

LINES OF THE SYSTEM

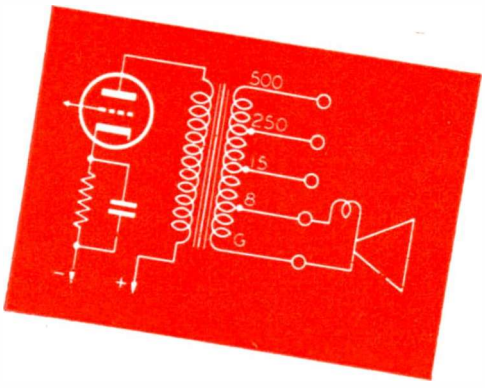


Fig. 2. Typical single-tube output circuit, showing multi-tapped secondary transformer, with 8-ohm winding loaded with permanent magnet speaker.

secondary winding is unloaded, is at least five times the reflected load, at the lowest frequency to be amplified. If X_L of the primary is lower than 5 times the value of the reflected load (Z_{RL}), a loss of low frequency response will result. It should not be construed from the above that this is a completely accurate or invariable rule. For one thing it is offered only as a practical guide and for another, it is conceivable that under certain conditions it would be desirable for the inductive reactance to be lower in value than five times the reflected impedance. Consider the case discussed in the previous article of this series (SERVICE, March 1944). It was shown that the elimination of all frequencies below 400 cycles reduces articulation by less than 5%, and that 50% of the power output of an amplifying system is required to reproduce the band of frequencies under 400 cycles. Therefore, limiting the amplified band to those frequencies over 400 cycles would permit the use of smaller powered amplifiers to do bigger sound jobs. This, then, is one of a number of situations in which it might be desirable to have a lower X_L than that determined by the method outlined above.

It should be pointed out that transformer losses also affect the accuracy of the formula, $Z_{RL} = N^2 Z_{SL}$. If the resistance of the secondary winding is relatively high with respect to the seconary load, the value of Z_{RL} will be higher than calculated. Transformer magnetic core losses cause the value of Z_{RL} to be less than the calculated value.

Line Losses

In most installations, the speakers are located at a considerable distance from the amplifier, and as a result rather long speaker lines must be run. When lines longer than 50 feet are run, the consideration of line losses usually becomes a most important one.

For example let us consider an amplifier providing an output of 20 watts, and driving four loudspeakers, each with a voice coil impedance of 8 ohms, and all connected in parallel to the four-ohm secondary tap of the output transformer, as shown in Fig. 3.

It will be seen that the speaker loop has been shown as two resistors in series with the paralleled speaker voice coils in Fig. 3b. These represent the d-c resistance of the line. Let us assume that the total value of this resistance is 2 ohms. The total load on the secondary of the output transformer is 4 ohms, and this loads the secondary perfectly. The amount of power dissipated in the line, however, is equal to that dissipated in the speakers and there converted to sound energy. This is obviously inefficient.

18 Wire Resistance

The familiar 18 wire has a resistance of 6.38 ohms per thousand feet. Fifty feet of two-conductor 18 wire, therefore, represents a total resistance of .638 ohm, and if the total length of speaker cable in the system shown in Fig. 3 were fifty feet, the system as shown would be a satisfactorily efficient one. It would actually be preferable under this condition to connect the speakers to the two-ohm tap, for a better match would then be achieved.

Long Speaker Lines

When long speaker lines are used, it becomes necessary to use speaker line-matching transformers. These transformers serve two purposes: (*1*) to raise the impedance presented by the loudspeakers, so that the resistance of the line is small by comparison; and (*2*) to furnish different amounts of power to the different speakers in terms of the requirements indicated by the survey. (SERVICE, March 1944).

Ten-Speaker Arrangement

We shall use an example to demonstrate these points. Let us assume a system requiring 100 watts of power to be distributed among ten speakers in the following manner: 2 speakers require 20 watts each; 4 speakers require 10 watts each; and 4 speakers require 5 watts each.

Let us assume that the total run of cable is 2,000 feet. (This example is shown in Fig. 4.)

We shall examine the problem in terms of using a single 100-watt amplifier. Actually, it would be good practice to use an amplifier or combination of amplifiers which would make at least 120 watts available.

The total line resistance, if 18 wire is used, is roughly 25 ohms. If we use a 500-ohm line, and select the speaker matching transformers carefully, a most efficient system will result, for the resistance of 25 ohms is negligible compared to 500. It may seem that the

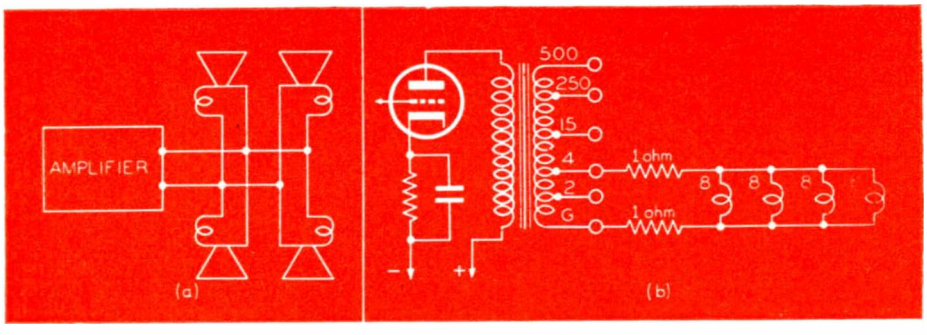


Fig. 3. Speaker line, run at 4 ohms, and matching four 8-ohm speakers to the output of a twenty-watt amplifier.

higher the impedance of the line the more efficient the system, but there are a number of conditions which limit the the value of the line to be used. In actual practice, lines of 100 to 500 ohms are usually employed.

Disadvantages of High Impedance Lines

Should a distribution line higher than 500 or 600 ohms be used, the voltages in the line would be higher, increasing the possibility of leakage and insulation breakdown. It is quite evident that a leakage of 8,000 ohms between the two wires of the speaker lines is unimportant when the impedance of that line is 500 ohms, but that it would become a serious consideration if the impedance of the line were 4,000 ohms.

If too high a line impedance is used, a loss of high frequency response will also result, due to the capacity of the line. A total distributed capacity of .015 mfd may very well exist between the two conductors of the speaker lines. At 6,000 cycles this represents a capacitive reactance of approximately 2,300 ohms ($X_c = \frac{1{,}000{,}000}{2\pi fc}$), and provides an easy path relative to the 4,000-ohm impedance of the line.

Selection of Matching Transformers

We shall, then, use a 500-ohm line, paralleling all speakers to insure the continued operation of all other speakers in the system, should one speaker voice coil open.

Most transformer and amplifier manufacturers make available tapped matching transformers with the primary values clearly marked for given values of secondary load. These transformers are also available with varying power handling capacities. One can obtain matching transformers, designed to handle 5, 10, 15 or 20 watts, with primary taps ranging from 500 to 14,000 ohms when the secondary is loaded with 8 ohms.

In order to determine the value of primary impedance required to transfer the required power from the line to the speakers as outlined above, the following simple formula may be used

$$Z_L \left(\frac{P}{p}\right) = Z_{RL}$$

where Z_L = the impedance of the line
P = power output of the amplifier
p = power required in the given speaker
Z_{RL} = required value of primary impedance of line matching transformer

In our problem, this equation becomes

(*A*) For the speaker requiring 20 watts

$$500 \left(\frac{100}{20}\right) = 2{,}500 \text{ ohms}$$

(*B*) For the speaker requiring 10 watts

$$500 \left(\frac{100}{10}\right) = 5{,}000 \text{ ohms}$$

(*C*) For the speaker requiring 5 watts

$$500 \left(\frac{100}{5}\right) = 10{,}000 \text{ ohms}$$

All speakers are in parallel, and it can be determined that the effective value of all speakers in parallel is 500 ohms, a perfect match for the 500-ohm line.

Interpolating Impedances

It may sometime prove necessary to obtain primary impedances of the line matching transformers which cannot be obtained in standard transformers. In many cases it will be found possible to obtain the required value or one sufficiently approximate to it to prove acceptable.

A standard line matching transformer may have a primary winding tapped at 500; 1,000; 1,500, and 2,000 ohms. The impedance between any two taps can be determined from

$$Z_p = (Z_B - Z_C)^2$$

where Z_p is the reflected impedance on that portion of the primary transformer between any two of the taps.

Thus, the reflected impedance between the 2,000 and 1,000 ohms is 172 ohms.

The Baffle

[A discussion of baffles, omitted from the March issue because of lack of space, is presented herewith.]

Cone type speakers require baffles in order to provide a bass response. Since low frequencies tend to diffuse, they radiate from the front of the cone to the rear and there, due to phase relationships, are cancelled out. A baffle is used to extend the effective path of sound from the front to the rear of the cone, thereby reducing cancellation. In some systems where fidelity is a requisite, a good bass response will be demanded, and sometimes it is desirable to limit the frequency response of the amplifier for reasons of economy or efficiency. Once the lowest frequency to be amplified and distributed has been established, the following simple formula can be used to determine the baffle size:

(*1*) baffle length in feet = ½ wavelength of lowest frequency to be amplified and distributed.

As an example, let us use the case outlined previously, where it was decided to limit the low frequency response to a cutoff at 400 cycles. In the first article of this series, the formula for wavelength was established as

(*2*) wavelength in feet $= \frac{\text{Velocity}}{\text{Frequency}}$

At 0° C, the formula becomes $W = \frac{1100}{400} = 2.75$ feet

The baffle length, in accordance with equation *1*, would, therefore, be 1,375′ or 16½″. This is the length from the front of the cone to the rear, and if the sound man wishes to construct a simple baffle which will adequately serve the purpose, a piece of plywood 16″ square with the speaker mounted in the center, will do splendidly.

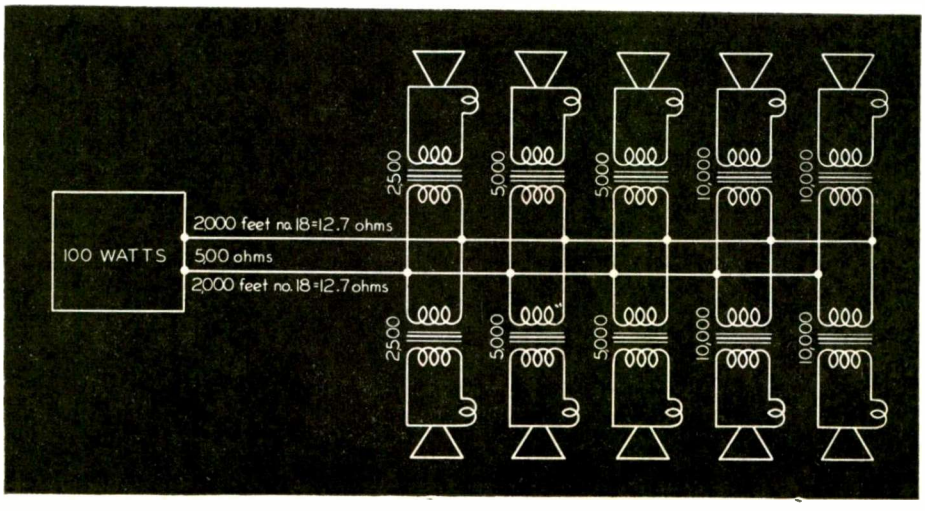
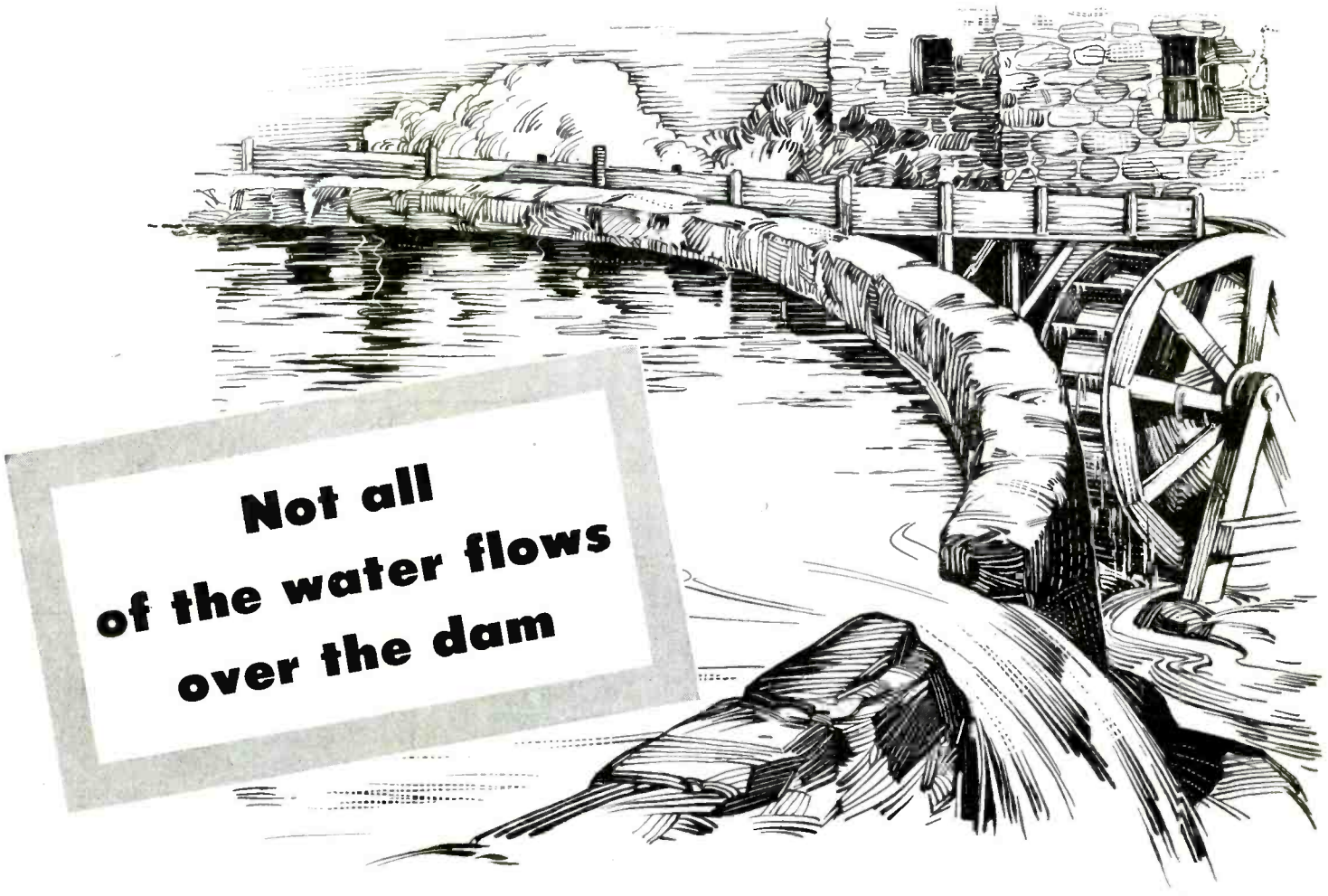


Fig. 4. System of 10 speakers, receiving different amounts of power over a 500-ohm line, 2,000 feet long.



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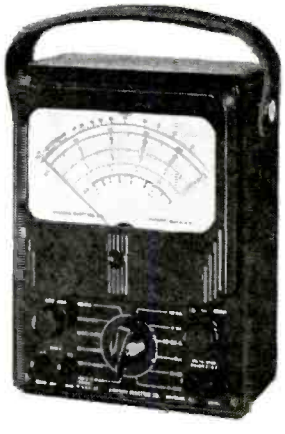

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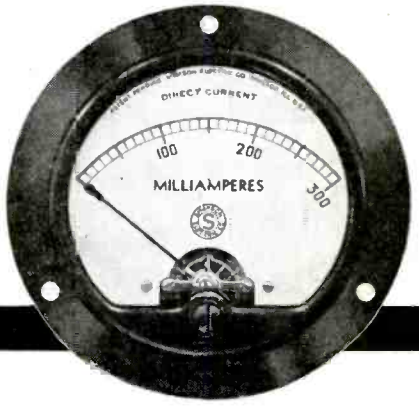


Buy War Bonds and Stamps for Victory

ANTENNA COUPLING AND SWITCHING METHODS

by M. E. HELLER

PART TWO

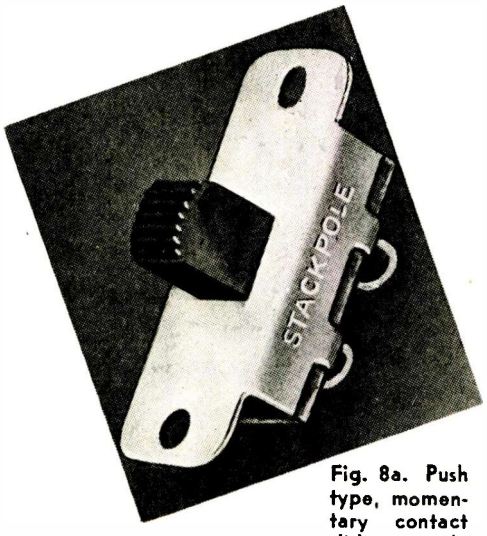
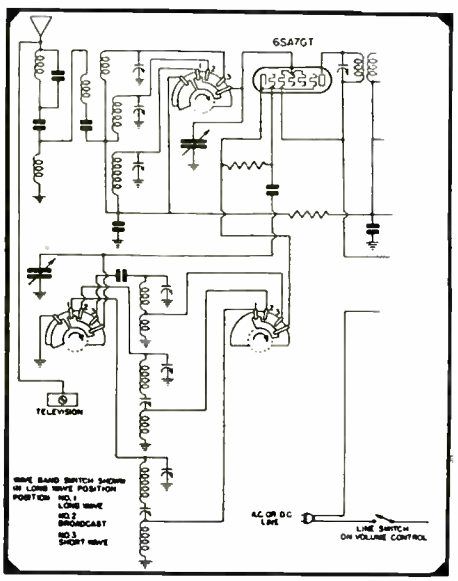


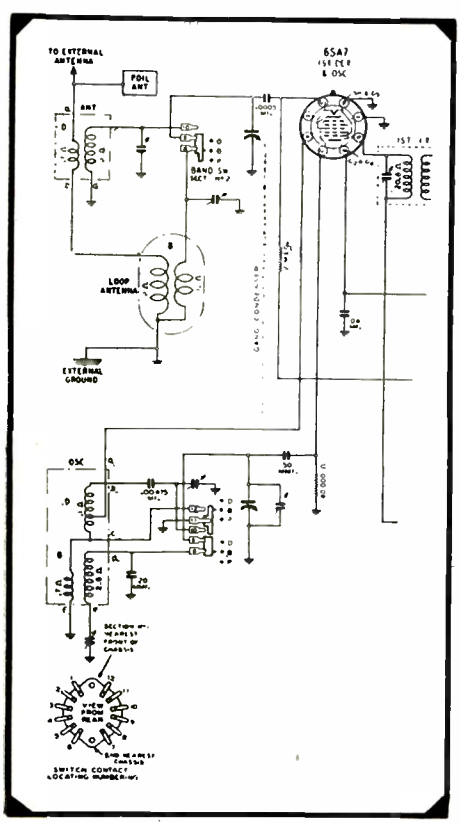
Fig. 8a. Push type, momentary contact slide switch. (*Courtesy Stackpole*)

LET us consider some loop receivers where plenty of circuit tricks are introduced to provide antenna coupling. Not all use switching methods. We have some 2-band sets where no switching is required, as, for instance, the Truetone model D1176 shown in Fig. 10. This set contains both a loop and foil antenna, the latter serving principally for s-w. Both the s-w primary and the loop primary are low impedance. Thus the signal voltage is pretty well divided, and not much s-w voltage is lost in the loop primary. The secondary switch is a simple spdt in the converter grid.

A similar 2-band coupling circuit is shown in Fig. 11. The loop primary consists of a single turn around the outside of the loop. Capacity coupling is minimized by connecting the input grid to the inside turn and grounding the outside turn of the loop. Thus, the inside *hot* turns are somewhat shielded by the low potential outer turns. The loop primary is, of course, of very low impedance so there is little loss of s-w signals.

An alternative method of solving the 2-band coupling problem appears in Zenith models 6S596-6S597, Fig. 12. When an external antenna is not used, a short cabinet antenna supplies the pickup for s-w signals. A shorting bar is placed across the high impedance loop primary, as well as a





Figs. 9 (upper right) and 10 (lower left). In Fig. 9 appears a portion of the Emerson DD-268, 270, 272, and 276 covering l-w, b-c, and s-w bands with inductive coupling, and with an i-f of 455 kc. A series type of trap is tuned to this frequency and the primary coil is isolated by two .02-mfd series condensers. No antenna switching is performed, but the unused secondaries are shorted. In Fig. 10 appears the input circuit of Truetone D1176. Here a foil antenna is used for s-w. Since the s-w primary and the loop primary are of low impedance, the signal voltage is pretty well divided and there is very little loss in the loop primary.

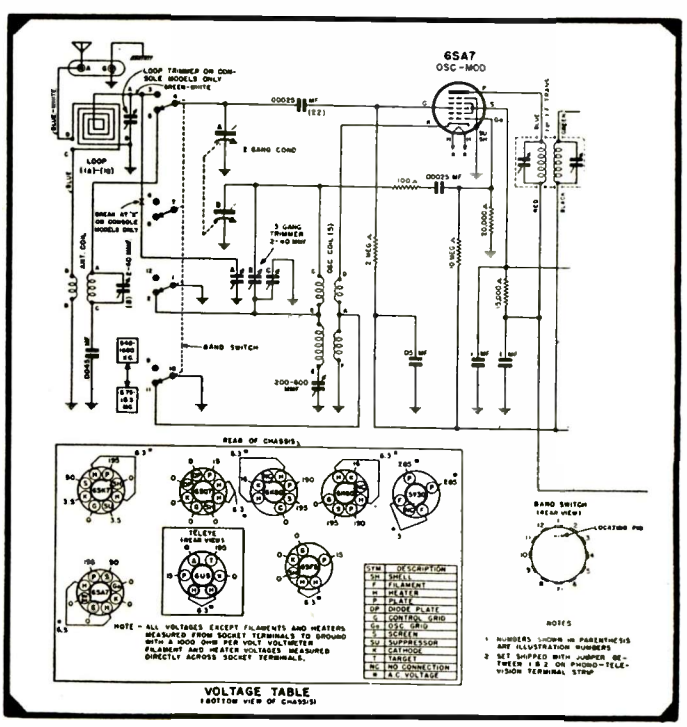
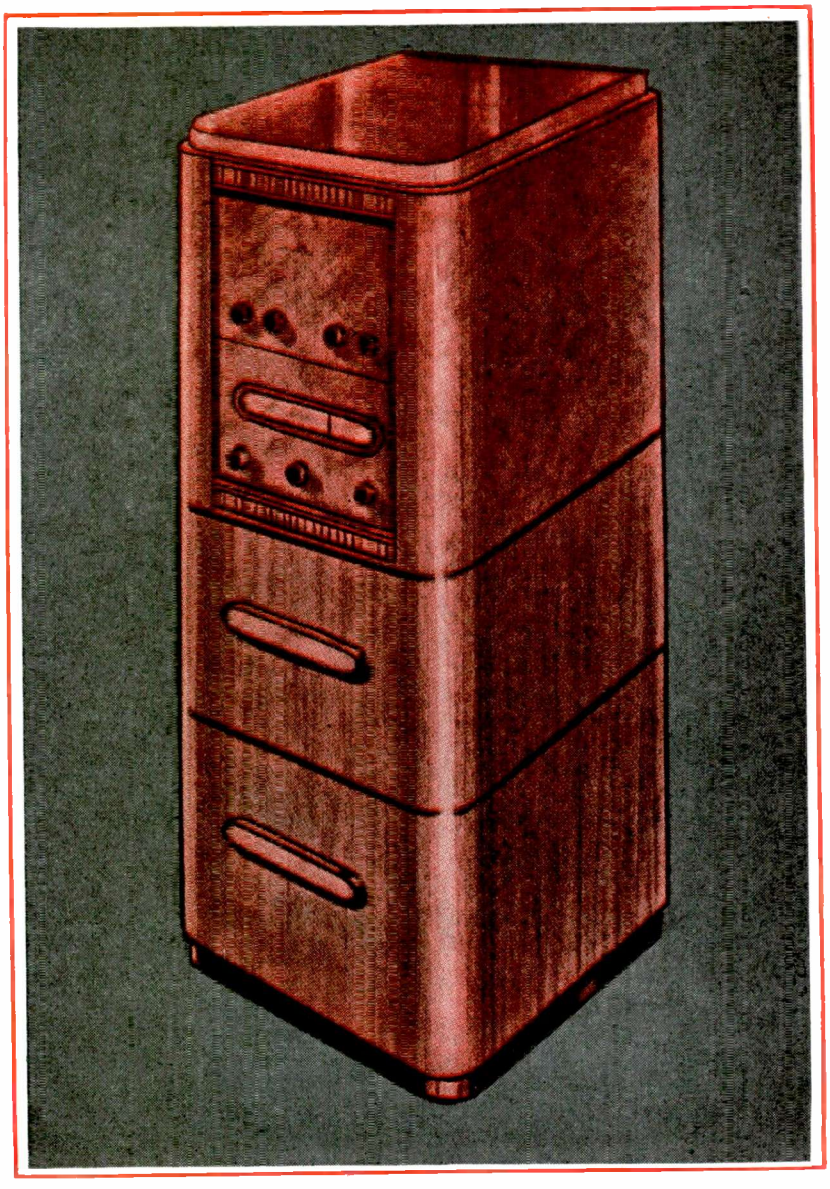


Fig. 11. Sentinel seven-tube 2-band receiver with a loop primary consisting of a single turn wound around the outside of the loop.



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ANTENNA COUPLING

(*Continued from page* 14)

50-mmfd condenser. When greater signal levels are desired, the shorting bar is removed and an external antenna connected to the *A* post. The bypass condenser has little effect on b-c signals being transferred to the loop, but it readily bypasses s-w signals to the s-w transformer, preventing r-f choking action of the loop primary. The loop is electrostatically shielded and operates with a loading coil on the grid side. Fig. 13 shows a similar arrangement with a high impedance loop primary but, instead of using a cabinet antenna for s-w reception, a pickup from a third wire in the line cord is used. A 50-mmfd series condenser is also employed. This loop is not shielded nor is it loaded with a series coil

Still another method of obtaining 2-band antenna coupling in a loop re-

(*Continued on page* 18)

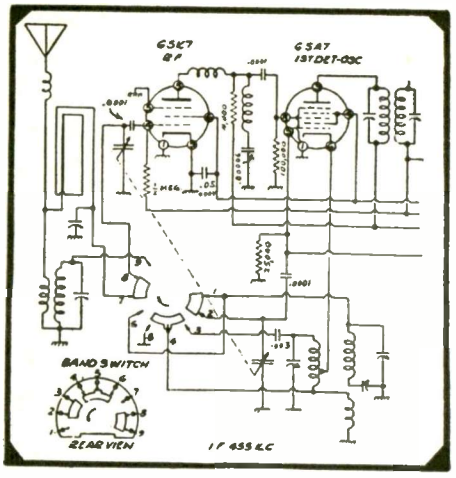

Fig. 14. Antenna-loop input circuit of Admiral A-7 receiver. The antenna is connected at the junction of the loop and an s-w transformer.

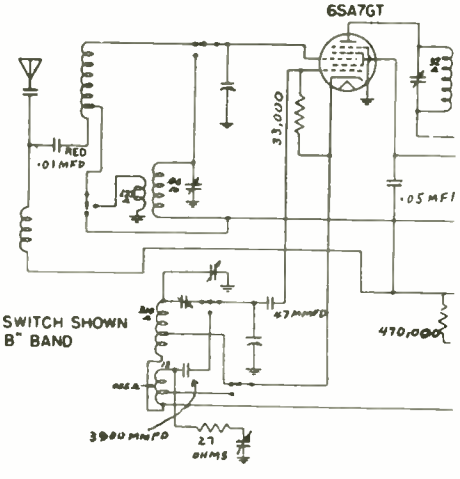

Fig. 15. Autotransformer coupling used in the General Electric J-709 receiver. Note the .01-mfd. series condenser, r-f choke to ground, and a second .01-mfd condenser in the antenna circuit.

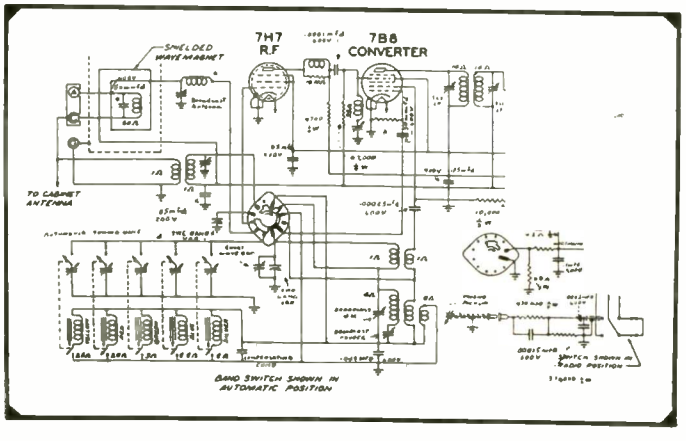

Fig. 12. Input circuit of Zenith 6S596-6S597 with a shorting bar placed across the high impedance loop primary, as well as a 50-mmfd condenser. To increase signal strength the shorting bar is removed and an external antenna is connected to the A post.

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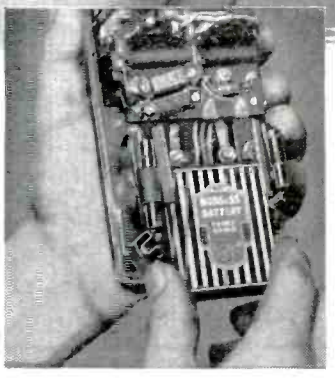

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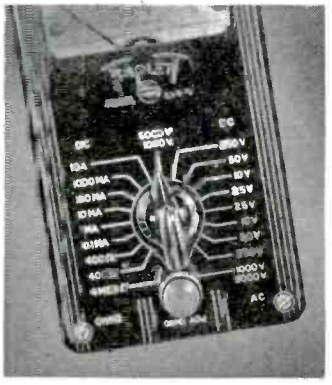

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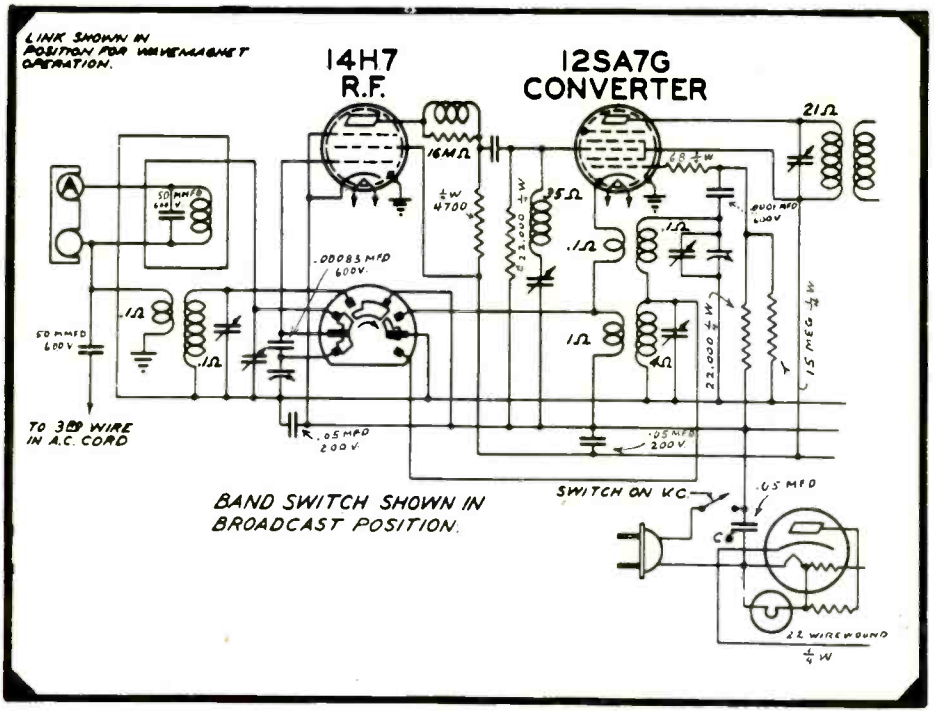


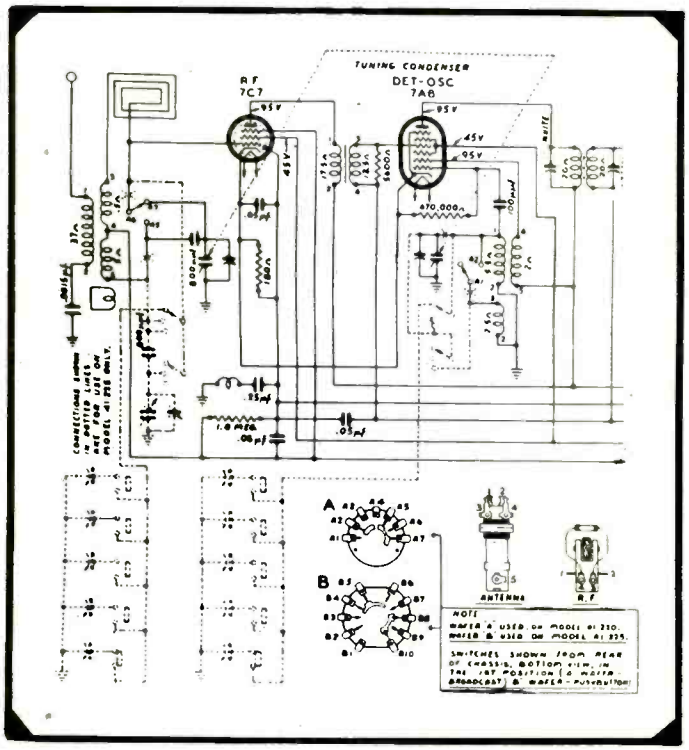
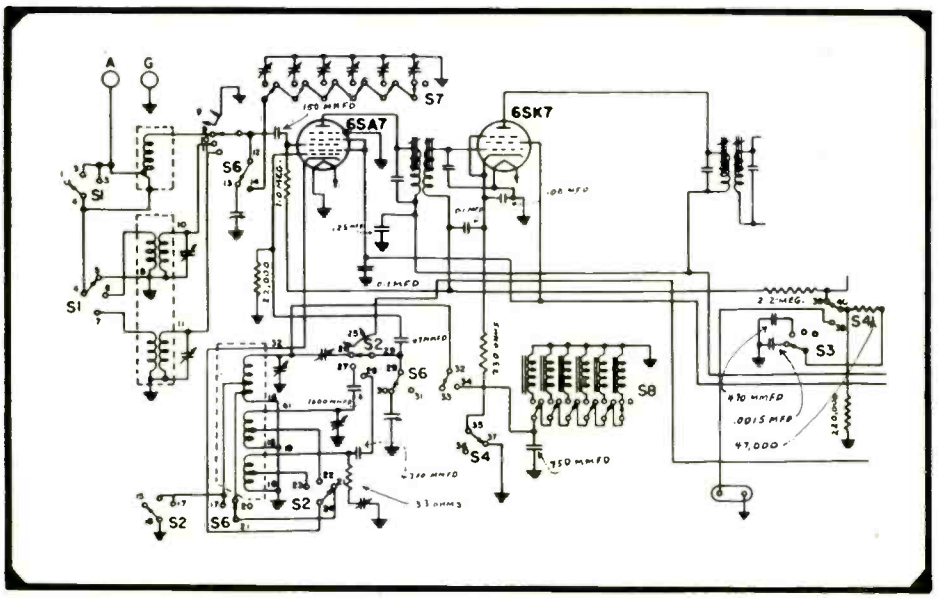


Fig. 13 (top), 17 (left), and 16 (below). In Fig. 13 appears the Zenith 6D512 receiver input wherein a cabinet antenna is replaced by a third wire in the line chord for short-wave pickup. Fig. 17 illustrates the input system of Philco 41-220 and 41-225. Here an antenna transformer with a split secondary has been provided for both b-c and intermediate s-w band coupling. On the broadcast band the upper portion of a secondary acts as a loop loading coil into which signals are magnetically coupled from the high impedance primary. In Fig. 16 appears a three - band G.E. H-87 with a loop autotransformer.



ceiver is shown in Fig. 14. The loop proper is connected in series with the primary of the s-w transformer which does double duty as a loading coil. The antenna is connected at the junction, serving the s-w transformer in the conventional manner but introducing b-c signals by means of the reactance drop across the s-w primary. The combination acts as an autotransformer. Note the antenna loading coil. General Electric uses a tapped loop with autotransformer coupling in model J-709, Fig. 15. The circuit is quite different than the previous one though. A .01-mfd series condenser, an r-f choke to ground and a second .01-mfd are all involved in the antenna lead to one side of the loop. For b-c, the loop tap is grounded; for s-w the tap is connected to the s-w primary.

G. E. H-87

A loop autotransformer is also used in the G.E. 3-band model H-87, shown in Fig. 16. The top coil is a tapped loop while the other two coils are conventional s-w transformers. A 2-section switch connects the antenna across a part of the loop for b-c and, at the same time grounds the low side of the loop. On the other two bands, the loop primary section is shorted while the antenna is switched to the appropriate primary coil. This is a complete and direct switching system in contrast to the bypassing and other tricks of the foregoing sets.

Philco 4-220, 225

In the Philco models 41-220 and 41-225, Fig. 17, an antenna transformer with a split secondary handles both b-c and intermediate s-w band coupling. The tap on the secondary is grounded to r-f (actually, it is the avc feeder). On b-c, the top part of the secondary acts as a loop load coil into which signals are magnetically coupled from the high impedance primary. On s-w, the r-f amplifier grid is switched to the lower part of the secondary, bringing along the loop system which shunts the s-w coil. A shorted turn is coupled to the transformer to eliminate resonance peaks in the frequency ranges covered.

G. E. J-64

The input circuit of a 3-band receiver with two separate loop antennae is shown in Fig. 18, G.E. J-64. The large loop serves b-c and first s-w band, a separate coil is switched in

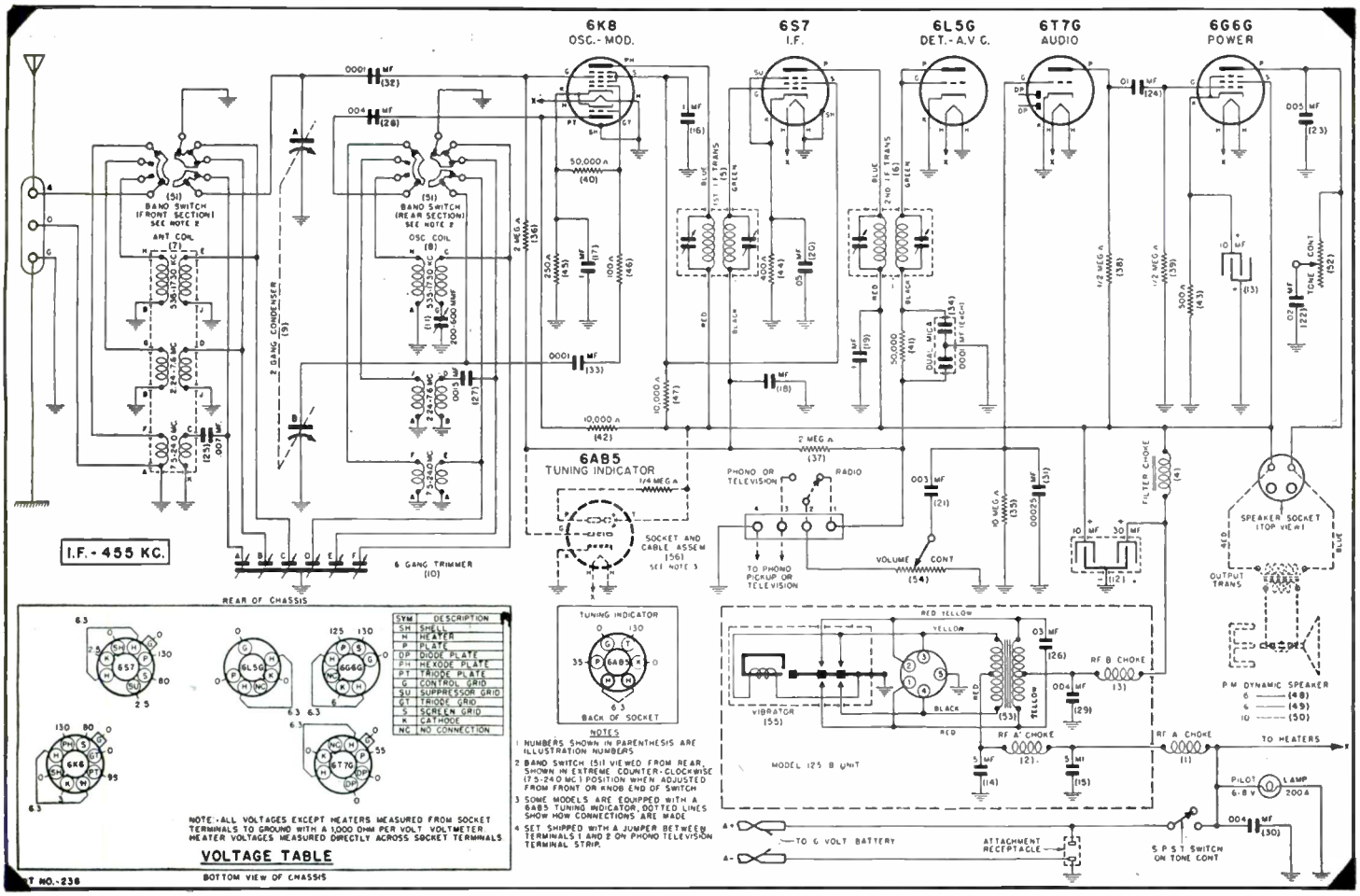
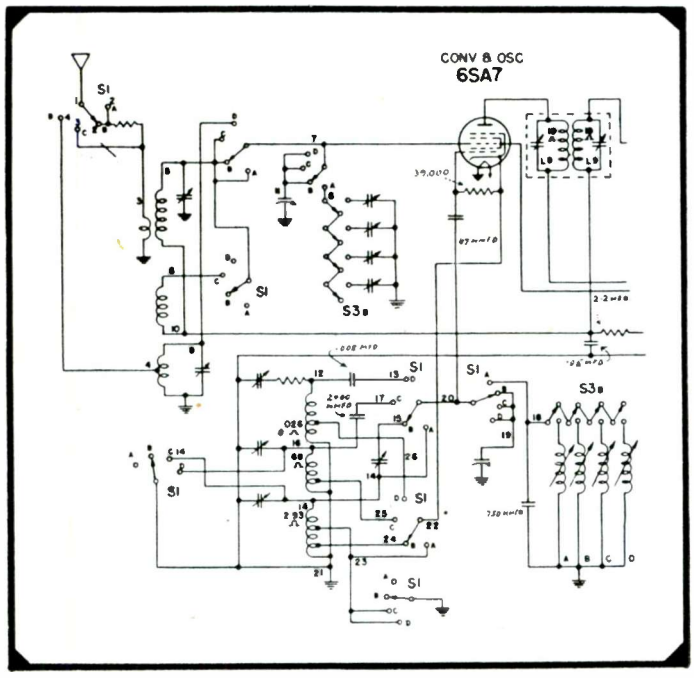
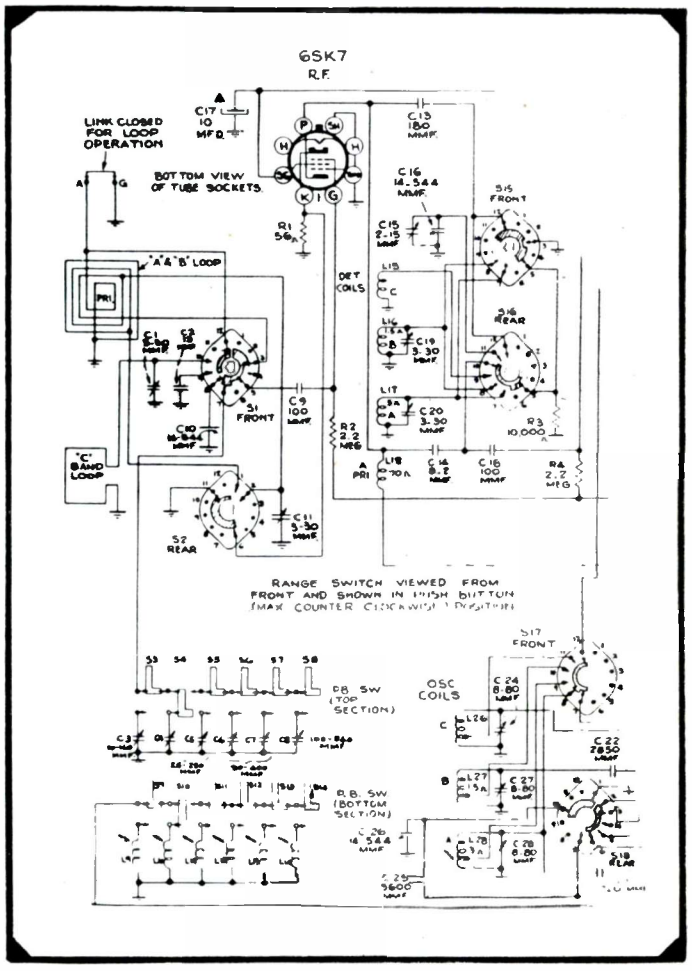


Fig. 20. Battery type Sentinel 236 receiver with band-switch covering 535-1730 kc, 2.24-7.6 mc, and 7.5-24 mc bands.

parallel with the loop to cover the s-w band, and a small loop is used for the second s-w band. A 4-position antenna switch inserts a 1000-ohm resistor in series with the main loop primary for push-button or manual b-c tuning, connects the primary directly on the first s-w band and connects the antenna directly to the small loop for the second s-w band. Another receiver which uses a large loop for *A* and *B* bands and a separate small loop for the *C* s-w band is the RCA Victor 18T, Fig. 19. A shorting link is used for loop operation. No antenna resistors or condensers are used.

Figs. 18 (below) and 19 (right). In Fig. 18, three-band G.E. J-64 with two separate loop antennae. Large loop serves for b-c and first s-w band. Fig. 19, RCA 18T, which also uses a large and small loop method of tuning.





should be checked. If this is normal, check the first filter for open or loss of capacity. If rectifier is defective, check the other condensers for shorts, before inserting a new 11726.

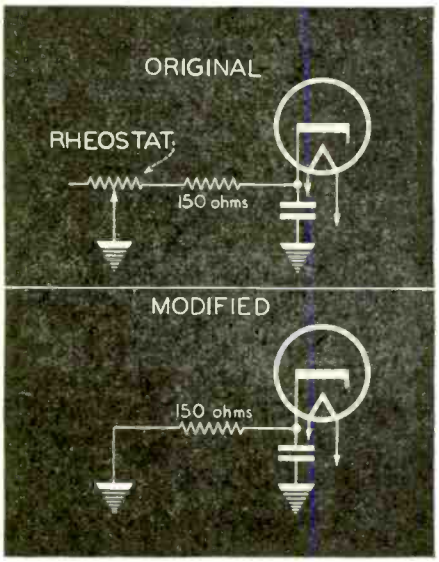
Clifford R. Stout.

•

AIRLINE 62-196

Wartime replacement for hard-to-get special dual volume control used on some of these models: Front section is a conventional 1-megohm audio taper control, which can be replaced. The rear section, however, is a rheostat, used to vary cathode bias, with a 150 ohm limiting resistor in the circuit. Simply eliminate rheostat and ground limiting resistor.

Clifford R. Stout.



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SILVERTONE 7083 3-WAY 1942 PORTABLE

High pitched whistle which sounds like an audio oscillation: Originates in the 1H5 amplifier-detector avc tube and is due to a slight microphonic condition often present in these tubes. Change tubes. Or for a permanent cure, place an .0005-mfd 600 v condenser from 1H5 plate to ground. This latter method caused a slight high frequency cut-off, but is considered by many customers to be an improvement.

Clifford R. Stout.

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ELIMINATING VOLUME CONTROL SQUEAKS

When the volume control on the radio begins to squeak, a few drops of carbon tetrachloride dropped in between the leaves will generally cure the noise in a jiffy. After dropping the carbon tetrachloride in between the leaves, the control should be given a few twists to distribute the solvent. Generally the noises are caused by some oil that has become slightly hard. The carbon tetrachloride dissolves whatever grease may have hardened between the leaves.

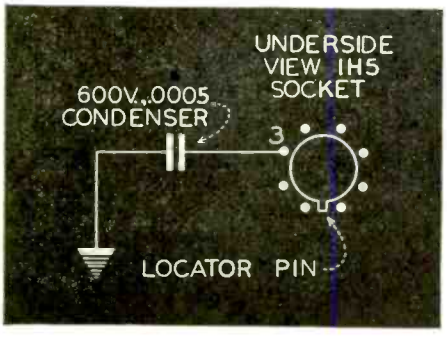
Stephen Porter Lathrop.

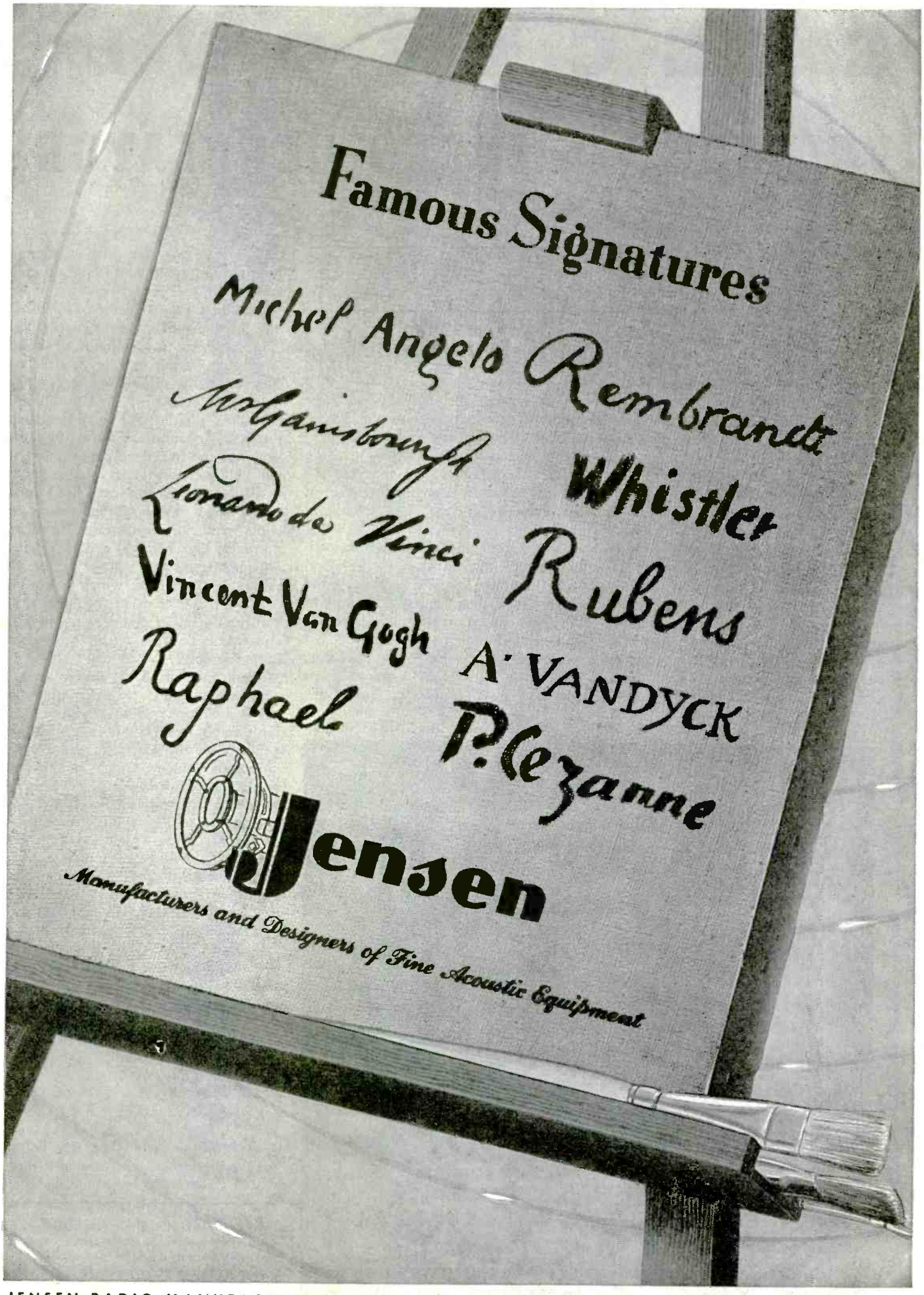
•

ZENITH 6G501M 3-WAY PORTABLE

B voltage drops: In this model, which is frequently operated on batteries, the *B* voltage may drop too low for receiver operation. Assuming the batteries to be okeh, the 11726 rectifier should be checked. If this is normal, check the first filter for open or loss of capacity. If rectifier is defective, check the other condensers for shorts, before inserting a new 11726.

Clifford R. Stout.





ELECTRONIC VOLTAGE AND SPEED REGULATORS

PART THREE

by S. J. MURCEK

THE operation of the a-c voltage regulation system in Fig. 5 is very similar to that of the d-c system in Fig. 1. In Fig. 5, decrease of the power loading on the output terminals *8, 9,* and *10* of the alternator *2,* results in an increase in the a-c voltages across these terminals. As a result, the voltage across the terminals of the voltage indicator tube *37* increases, increasing its filament temperature, and, in turn, its plate current.

The rise in the indicator tube plate current results in an increase in the voltage across resistor *36,* which swings the control grid of the pentode *30* positive, with respect to its cathode. Since the pentode plate current increases, this is also true of the voltage across the plate resistor *29,* swinging the plate of the pentode more negative with respect to its screen grid. Here, the rectifier thyratrons energizing the alternator field winding *7* conduct later in each positive a-c half-cycle, the cathodes of these tubes being common with the screen grid of the pentode and the control grids effectively with the pentode plate. It is self-evident that the a-c output voltages decrease because of the decrease in the field excitation current.

An increase in the alternator loading results in a decrease in the alternator output voltages. This, quite evidently, brings about the reverse of the reactions occurring with alternator voltage increases.

Control of the regulation voltage level is accomplished through variation of the pilot voltage across the pilot tube *34.* The pilot voltage is subdivided into several separate components by the voltage divider system consisting of the resistors *42* and *43,* and resistance of the potentiometer *35.* The minimum a-c voltage to which the system output may be reduced occurs when the sliding contact of the potentiometer *35* is at its positive terminal. With such an adjustment, the grid of pentode *30* begins to swing positive, and to reduce the system output voltage, when the voltage across resistor *36* is greater than that across resistor *42.* With the potentiometer slider arm at its negative terminal, however, the voltage across resistor *36* must equal the voltage across resistances *42* and *35,* which is considerably greater than in the former instance. Variation of the potentiometer slider arm position varies the system output voltage.

Electronic speed regulators bear a close resemblance to electronic voltage regulators. Since the speed of the electric motor shaft rotation is dependent on the electrical power considerations under which it operates, electronic regulation may be thus applied to equipment speed control.

The d-c motor is effectively a d-c generator. When operated as a generator, the voltage output of the device is directly dependent on the armature speed and the field structure magnetization. If the field magnetization is made constant, the armature voltage varies only with its shaft speed, and may be said to be directly proportional to the shaft speed. In a given motor, designed for operation from a 125-volt d-c source with a running speed of 2,500 rpm, reduction of the input voltage to 75 volts gives a shaft speed, therefore, of

$$\frac{75}{125} \times 2{,}500 \text{ or } 1{,}500 \text{ rpm}$$

It is quite evident that the voltage across the motor armature is a direct

(*Continued on page 24*)

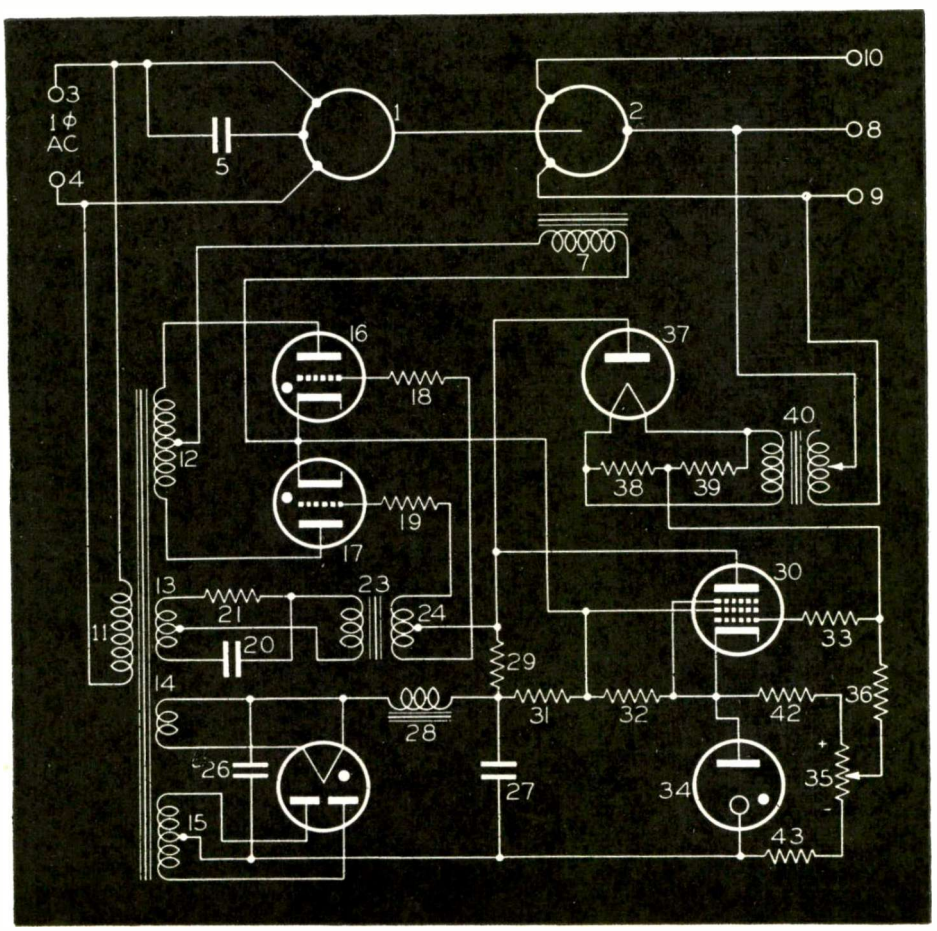


Fig. 5. A conventional a-c electronic voltage regulation system. A single-phase capacitor-operated motor drives a d-c exciting field winding. This is very similar to the d-c type of regulation system.

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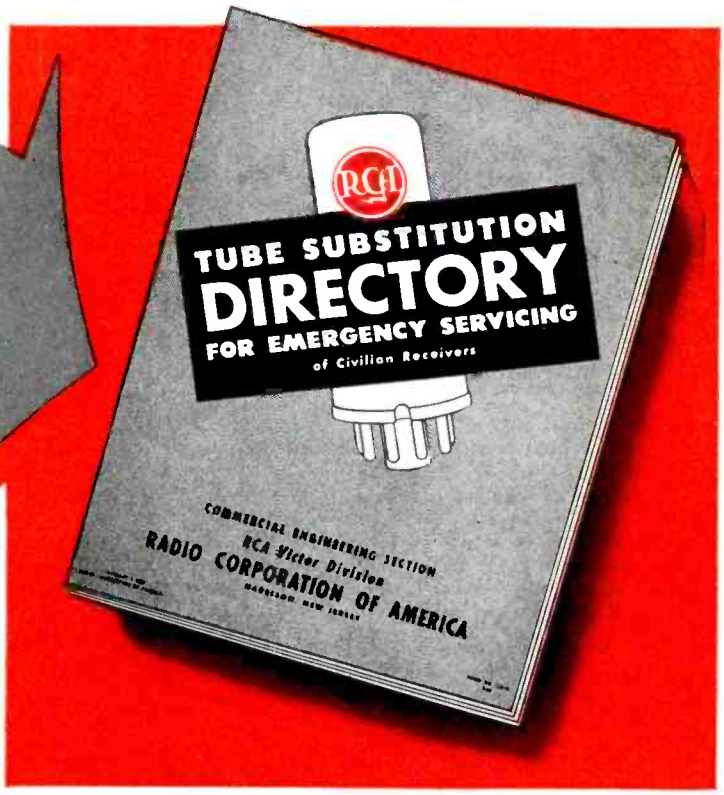

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ELECTRONIC VOLTAGE AND SPEED REGULATORS

(*Continued from page 22*)

indication of its shaft speed. This fact provides a means whereby electronic voltage regulation may be readily applied in the control of motor speeds.

A fundamental electronic motor speed regulation system is given in Fig. 7. This system is essentially a voltage regulated control system, in that the motor shaft speed varies directly in accordance with the system regulation voltage.

Power for operation of this motor and its associated speed regulation system is taken from an a-c supply source, being applied to the primary winding of the power transformer *1*, at terminals *2* and *3*. A portion of this power is rectified by means of the vapor rectifier tube *14*, being subsequently filtered by capacitors *11* and *13*, and inductor *12*. The resulting d-c voltage is regulated by means of the gaseous voltage regulator tube *16*, then applied to the field winding *17* and the speed control potentiometer *18* resistance element. Here, it should be observed that the field magnetization and the voltage across the resistance element of the speed control potentiometer are *constant*.

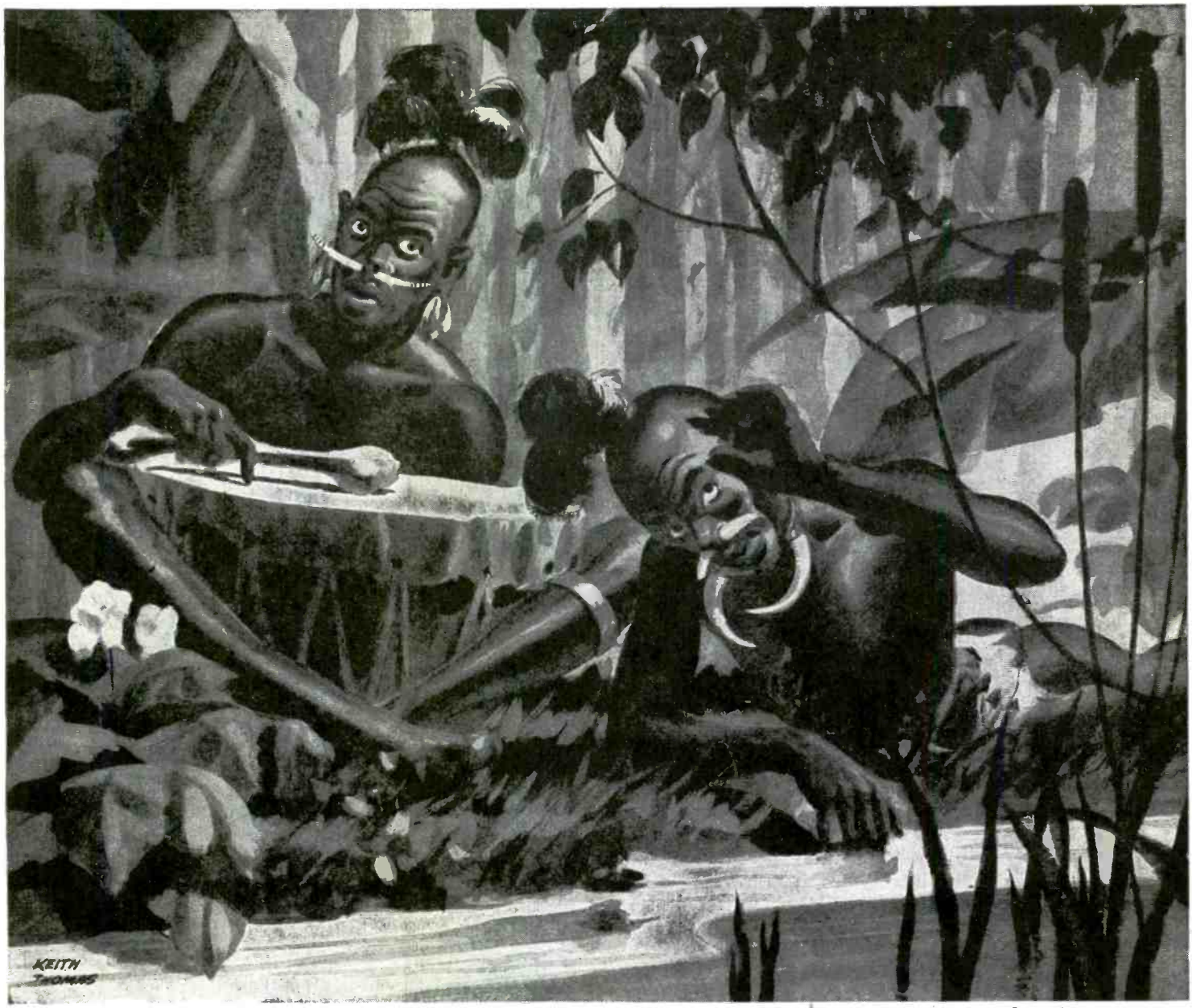
In series with the slider arm of the speed control potentiometer is the 90° a-c grid voltage component lag network, so characteristic of thyratron grid circuits. This network consists of the transformer winding *4* on the power transformer core, the resistor *9* and the capacitor *10*. It provides the a-c grid voltage lagging component necessary for phase-shift control of the thyratron *20*.

Initially, the motor armature is started by closure of switch *22*. Since the armature shaft speed, at this time, as well as the voltage across the armature, is zero, the grid of thyratron *20* is positive with respect to the cathode over the entire positive a-c half-cycle, by the voltage existing between the slider arm and the negative terminal of the speed control potentiometer. Thyratron *20* must, therefore, conduct, and the motor shaft begins to rotate. As the shaft speed increases, the armature voltage also increases, the latter approaching the voltage existing between the potentiometer slider arm and the negative terminal of the d-c power supply. Since the negative brush of the motor armature is common with the negative d-c lead, the voltage between the grid and cathode of the thyratron decreases.

Eventually, the voltage across the motor armature approaches the voltage which exists between the negative terminal and the slider arm of speed control potentiometer *18*. Here, the negative half-waves of the a-c thyratron grid voltage component cause the thyratron to conduct later in each positive a-c half cycle, until the armature voltage tends to decrease, preventing further rise in the motor shaft speed. This is the equilibrium speed condition.

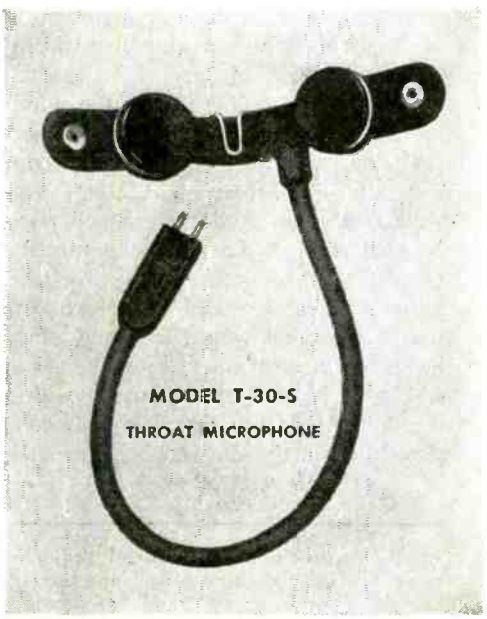
Increase in the loading of the motor shaft increases the armature current, the increased system voltage drop causing a resultant decrease in the armature voltage, and therefore the motor shaft speed. Consequently,

(*Continued on page 26*)



History of Communications Number Three of a Series

PRIMITIVE COMMUNICATIONS



An early communications instrument was the Tom-Tom—to prove its efficiency, it is still used by the natives of Africa. Tom-Tom signals are "Beat out" along jungle lined rivers, but even then distance is a handicap, and "repeater" stations are many.

Like all means of communications, other than voice communication, translation of coded signals must take place in which additional skill is required, and another chance of error is presented. As in the case of the Tom-Tom beater: knowledge of the Tom-Tom code was restricted to a special family within the tribe, and was handed down from generation to generation.

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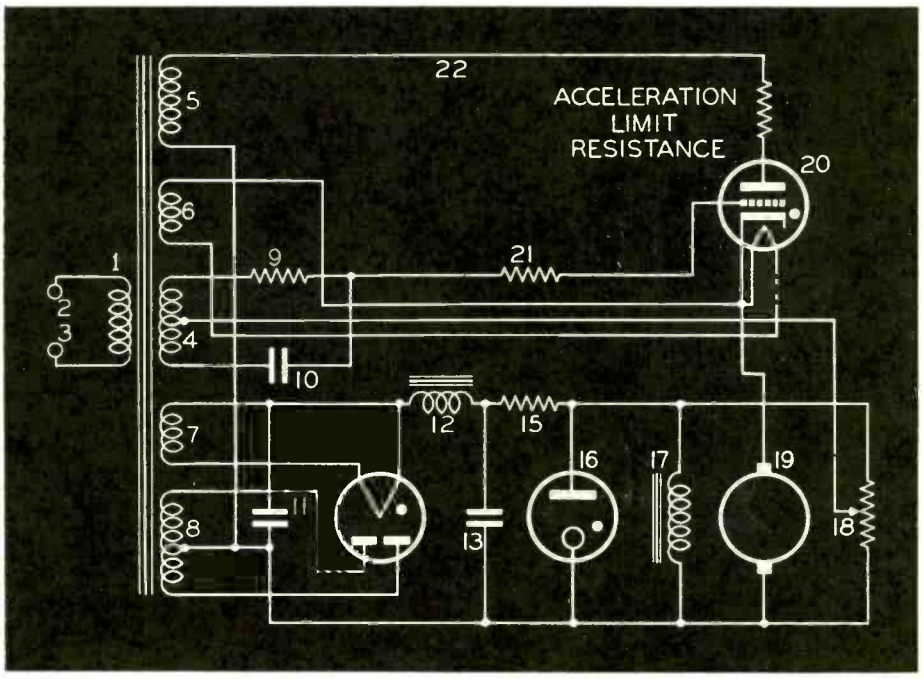

Fig. 7. A fundamental electronic motor-speed regulation system circuit. This is essentially a voltage regulated control system, since the motor shaft speed varies directly in accordance with the system regulation voltage.

the control grid of the thyratron *20* is slightly more positive with respect to the cathode, enabling the tube to conduct earlier in each positive half-cycle. In this manner, the armature voltage is returned to the equilibrium condition, restoring the motor shaft speed to the original value. Conversely, a decrease in the loading of the motor shaft decreases the armature current, and the system voltage drop disappears as a direct result. At this time, due to the increased voltage across the motor armature, the armature speed tends to increase. However, also as a result of the increased voltage across the armature, the cathode of the thyratron is more positive with respect to the arm of the potentiometer *18*. Hence, the tube conducts later in each positive half-cycle, decreasing the effective voltage across the motor armature, thus maintaining its speed constant.

The circuit of Fig. *7* may be modified in various ways, through the introduction of suitable electronic control voltages operating directly on the thyratron grid circuit. These additional voltages may provide acceleration current surges, or may operate to limit the maximum armature current conducted through the motor armature. This circuit is common in most industrial motor control applications.

A precision motor speed regulator, shown in Fig. 8, utilizes the voltage developed across the commutator of a small tachometer generator as the means for controlling and regulating the motor speed. In this circuit, the tachometer generator *2* is provided with a permanent magnetic field structure, *5*. Therefore, the voltage across the generator brushes varies only with the shaft speed. Usually, the tachometer is directly connected, sometimes belt driven, to the shaft of the controlled motor *1*. The controlled motor, in the instance of Fig. 8, is a d-c motor which receives its armature power from a separate source, throught the terminals *3* and *4*. The electronic regulator operates on the field winding *6* of this motor.

In general, the circuit of Fig. 8 operates in much the same manner as the voltage regulator circuit of Fig. 1. In Fig. 8, if the motor shaft speed rises, the voltage across the armature of the tachometer generator also increases. Thus, the control grid of pentode *34* is driven positive with respect to its cathode, which, due to the increased plate current, causes the anode of the tube to assume a negative polarity with respect to its screen grid. Since the plate is common to the control grids of the two thyratron rectifiers in series with the a-c phase-shift voltage from the winding *12* and the phase shifting network, and the tube cathodes are connected to the screen grid, the thyratrons must conduct later in each positive half-cycle. Later conduction by these tubes decreases the voltage across the motor field *6*. Normally, the motor speed would increase, since the field is weakened. However, the field winding *6* operates in opposition to another field winding which is connected across the d-c supply terminals,

(*Continued on page* 30)

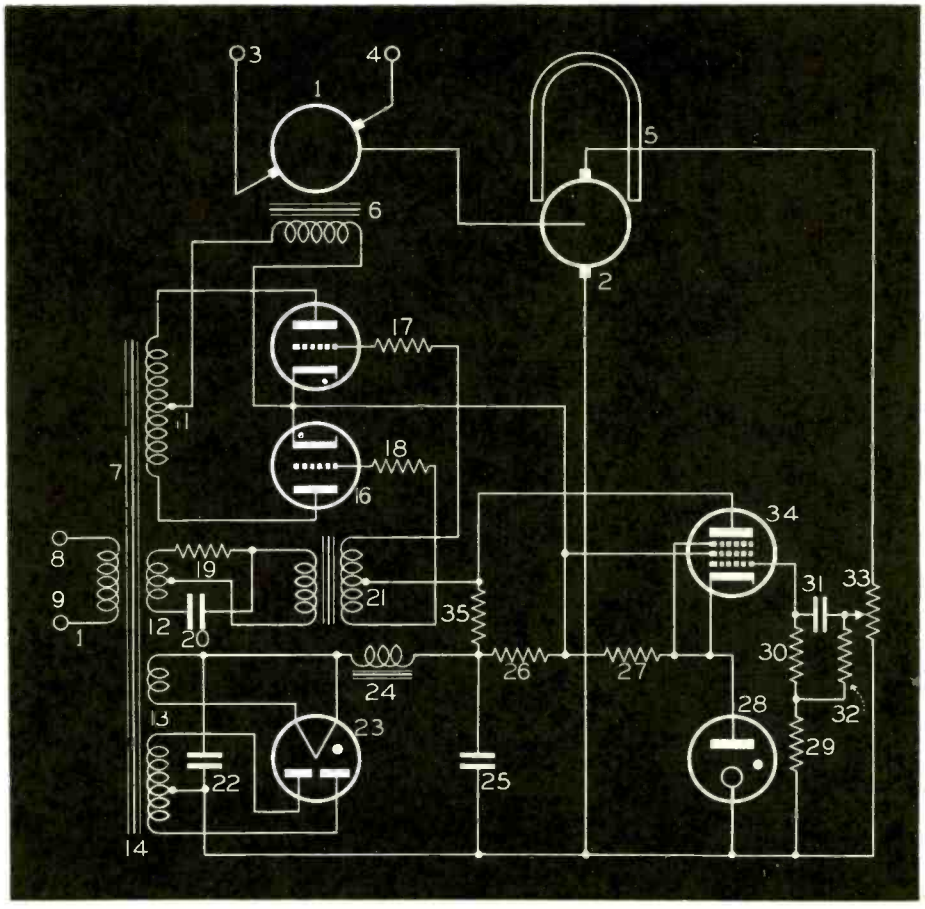

Fig. 8. A precision motor-speed regulator system utilizing the voltage developed across the commutator of a small tachometer generator as the means for controlling and regulating motor speed.

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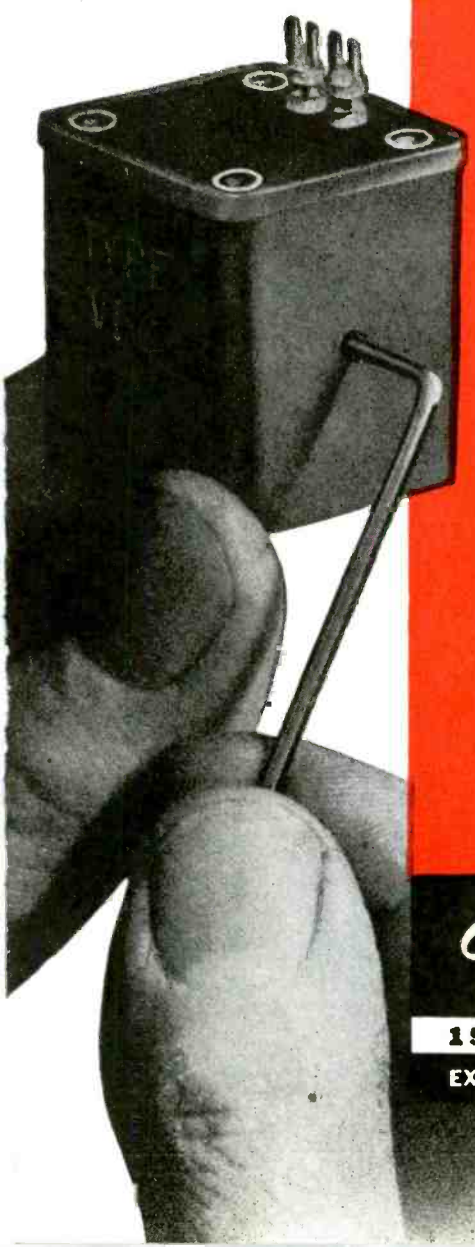

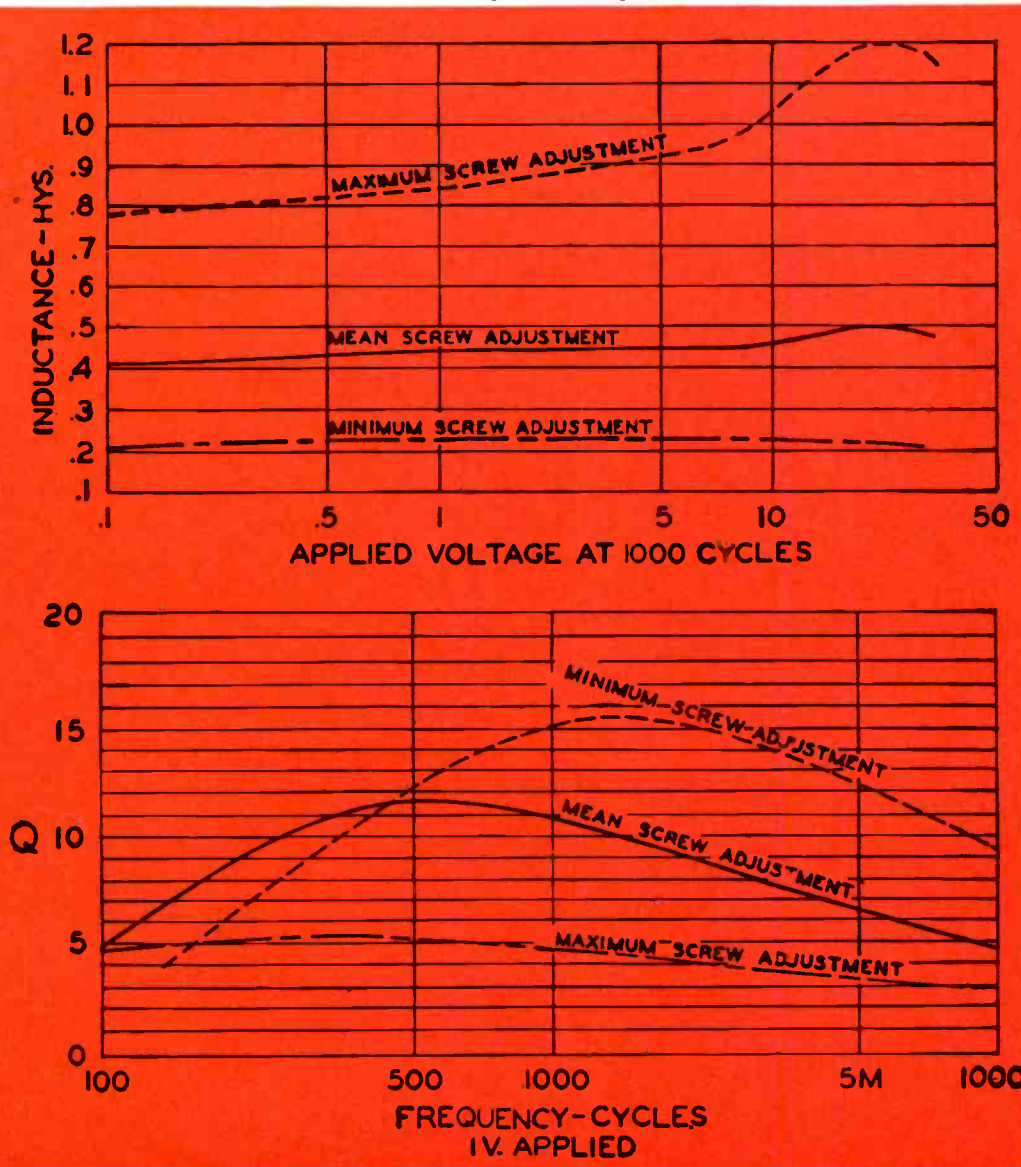

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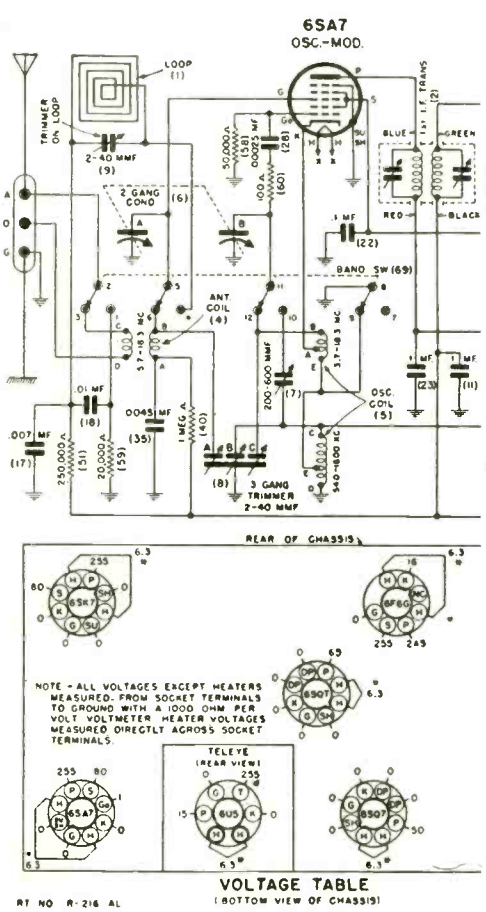
SER-CUITS

by HENRY HOWARD

A RECORDER combination, Sentinel model 216J, is shown in Fig. 1. The antenna circuit has many features. Note that the diagram shows the bandswitch in short-wave position. The antenna coil is arranged for a doublet. A loop is used on b-c with the antenna being coupled capacitively across a .007-mfd condenser on the ground side. A hot-cathode oscillator circuit is used on both bands, the short-wave coil remaining in the cathode circuit when switched to b-c. The b-c padder is in the high side towards the grid.

Separate diodes are used with delayed avc. A tone control using a 5-megohm variable is connected in the volume control circuit. The arrangement is most unusual for the 5-megohm variable as well as the volume control is tapped. The tap is grounded. When the arm is at the left, the bass compensation system is inoperative, accentuating the highs; with the arm at the tap, there is, of course, no effect.

Fig. 1. Sentinel 216 J.



ELECTRONIC CONTROL REGULATORS

(*Continued from page 26*)

(not shown in Fig. 8). Thus, the field strength of the motor field structure is increased, decreasing the speed of the motor.

With a decrease in the speed of the motor shaft, obviously the inverse of these reactions will occur, the strength of field *6* increasing. Thus a portion of the magnetization provided by the constant field winding is cancelled. In this manner, the speed of the motor shaft is increased.

The speed of the motor is regulated at such a level that the voltage across resistor *29* just equals that existing across the glow regulator tube *28*. So that this condition will exist, the voltage across resistors *29* and *32* must be such that the requisite voltage magnitude appears across resistor *29*. This is equally true of the potentiometer *33*, which controls the speed of the motor shaft through manipulation of the voltage level at which the system stabilizes.

A sudden increase in the speed of the motor shaft, in Fig. 8, causes the capacitor *31* to charge, in series with the resistors *30* and *29*. Thus, the thyratron rectifiers are momentarily cut-off by the increased voltage drop occurring across the plate load resistor *35*. The loss of the excitation current by field winding *6* permits the full strength of the constant exciting field to be applied to reduce the speed of the motor shaft. Such action by the circuit is required, for the inductance of the auxiliary field winding *6* is sufficient to delay the application of corrective current variation rapidly. Therefore, a momentary decrease of the current to this field winding to zero, is sufficient to cause a small change in the field magnetization.

On a sudden decrease of the motor shaft speed, the inverse of these reactions takes place. The control grids of the thyratron rectifiers are driven to the maximum positive d-c voltage. Here, the tubes conduct *fully forward*, conducting the entire positive half-cycle through the winding *6* of the motor field structure. This, in turn, effects a small, but rapid change in the level of field magnetization so that the motor speed is increased.

In each of the instances mentioned in the preceding two paragraphs, the effects of the charge current of capacitor *31* are momentary, since the current must eventually decline to

zero, as the capacitor voltage rises to that existing across resistor *33*. The circuits associated with capacitor *31* are known as an *instantaneous response* system.

Maintenance and repair of electronic voltage and speed regulators is carried out in much the same manner as that of audio frequency or public address systems. All the experience and testing equipment, used in audio maintenance and repair are just as useful in serving electronic equipment of this nature.

Direct Coupled Similarities

In carrying out a diagnosis of defective operation by such a system, only one salient characteristic of such systems must be borne in mind by every Service Man: except for the customary dynamic control portions of such circuits, the regulating circuits are always of the directly-coupled type, somewhat reminiscent of the old *Loftin-White* system. Otherwise, circuit functions will respond to instrumentation in much the same manner as conventional audio circuits.

Low Audio Frequency Tests

The dynamic portions of electronic regulation systems are tested with, in most instances, low audio frequencies. This is especially true of the inverse feedback circuits associated with the circuit of Fig. 1. Instantaneous response systems should be checked at high frequency, near 5,000 cps, as well as at low frequency. In each system, the purpose of the test is intended to establish the a-c continuity of each such system thus tested.

In reviewing some of the highlights of electronic voltage regulation we find that the electronic voltage regulator consists of a thyratron rectifier which supplies the d-c power to a generator or alternator field winding, a control preamplifier and a voltage analyzing system. The major difference between the a-c and d-c generator voltage regulators lies only in the voltage analyzing circuit arrangement.

In the d-c generator voltage regulator system shown in Fig. 1, Part I of this series, we noted that a d-c generator was driven by a three-phase a-c power motor with the d-c power output of the system appearing between the d-c terminals.

Installations which are complicated and difficult to diagnose should be referred to the service engineering department of the factory which manufactured the regulator. In such instances, it is well for the Service Man to function as a consulting technician. This procedure places the latter in a position to receive the necessary diagrams and information required to effect a correct installation or repair.

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NEWS OF THE REPRESENTATIVES

The annual convention of the Representatives of Radio Parts Manufacturers will be held June 6 and 7 at the Hotel Stevens, Chicago, according to David Sonkin, national secretary. The board of governors will meet on June 6, and the delegates on June 7.

The Chicagoland chapter has designated the following delegates to the convention: Royal A. Stemm, Harry Halinton, and Walter Bauman. The New England chapter will be represented by Raymond Perron and Harrison Reynolds.

Two chapters elected new members recently. Alfred Crossley of 549 West Randolph Street, Chicago, has been added to the Chicagoland chapter roster. The Missouri Valley chapter has accepted Jules Bencke, 578 Arcade Building, St. Louis, as a member; and L. D. Marsh, 110 Battery Street, Seattle, Washington, as a member-at-large.

* * *

LIP MIKE DEMONSTRATED ON RADIO PROGRAM

The *lip* mike, developed by the Electro-Voice Manufacturing Company of South Bend, Indiana, in collaboration with the Fort Monmouth Signal Corps unit, was given a public demonstration over CBS recently in a two-point hook-up on the Vox-Pop program. Parks Johnson interviewed workers of the ELCO submarine plant at Groton, Connecticut, who were equipped with the small microphone, while Warren Hull and workers of ELCO's PT Boat plant at Bayonne, New Jersey, also wearing the lip mike, completed the two-point broadcast.

* * *

ELECTRIC INSTRUMENT DATA SHEETS ISSUED BY G-E

The first series of a new kind of parts publication, covering 2½" d-c and r-f ammeters and voltmeters of the internal-pivot design for radio and aircraft, has been published by G. E. This series includes nine loose-leaf pages.

An interesting feature of these pages is that they illustrate the parts *exploded* in their proper relation to each other in an assembled instrument, making it possible to identify the parts easily and giving a clear picture of the construction of an instrument.

* * *

FABEL ELECTED VICE PRESIDENT OF CARDWELL

Joseph K. Fabel, former assistant district manager of the New York section of the Army-Navy Electronics Production Agency, has been elected vice president in charge of sales of the Allen D. Cardwell Manufacturing Corporation, Brooklyn, New York.

* * *

RCA TUBE SUBSTITUTION DIRECTORY

A 16-page *Tube Substitution Directory* has just been published by Radio Corporation of America, 596 South Fifth Street, Harrison, New Jersey. The directory, which covers more than two-thousand substitutions, includes a listing of 304 RCA receiving tube types with substitution types which may serve as replacements, a classified chart of receiving tubes, and sample calculations of series and shunt resistors in heater strings. The directory costs ten cents, and may be had from RCA distributors or the Harrison office.

* * *

KIEVIT PROMOTED BY SYLVANIA

Ben Kievit, supervisor of customer services of Sylvania Electric Products, Inc., Emporium, Pennsylvania, is now field engineer in the equipment sales department for the New York and New England area. He will be located at the N. Y. City office, 500 Fifth Avenue.

Mr. Kievit has been with Sylvania since 1930, when he joined the company as a research physicist. He is a senior member of the Institute of Radio Engineers, and a member of the Electronics Committee of that group. He has served as technical editor of the Sylvania *Engineering News Letter and the Technical Manual.*

* * *

ELLMORE NOW UTAH ENGINEERING SALES VICE-PRESIDENT

W. A. Ellmore has been named vice president in charge of the sales and engineering departments of Utah Radio Products, Chicago.

Other appointments announced include the promotion of Chester L. Walker, formerly chief engineer, to sales manager in charge of Utah's manufacturing and

equipment division. Marion S. Danisch has succeeded Mr. Walker as chief engineer; and Gordon S. Carbonneau, formerly production engineer, has been appointed engineer in charge of the quality control division.

* * *

RCP TEST INSTRUMENTS CATALOG

Catalog No. 128 has been released recently by Radio City Products Inc., 127 West 26 Street, New York 1, New York. The catalog describes and illustrates standard commercial testing instruments, including multitesters, insulation testers, limit bridges for precision resistance testing, vacuum tube testers, electronic voltmeters, combination tube, battery and set testers with plug-in analyzer units, volt-ohm milliammeters, signal generators, and push button analyzers.

* * *

NEW OFFICES FOR ELECTRICAL APPARATUS COMPANY

The Electrical Apparatus Company has moved its offices from 1018 Commonwealth Avenue to 1200 Soldiers Field Road, Boston, Massachusetts.

* * *

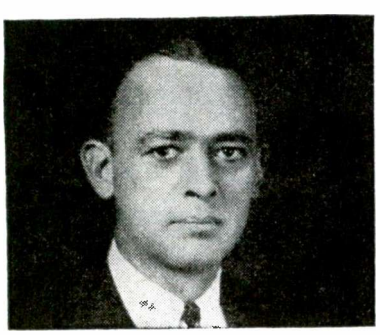
LEON GOLDER LEAVES ROLA CO.

After a period of service dating from the establishment of the company, Leon Golder has resigned as secretary and sales manager of The Rola Company Inc., Cleveland, Ohio.

* * *

IRC APPOINTS HARDWICK

International Resistance Company, Philadelphia, has appointed A. H. Hardwick to the company's executive sales staff. Mr. Hardwick was formerly president of Hardwick, Hindle Inc., Newark, New Jersey. He will make his headquarters in New York City at 165 Broadway.



* * *

NEW COLOR TELEVISION TECHNIQUE

The Scophony Corporation of America, 527 Fifth Avenue, New York, has announced the development of a new carbon technique for theatre television by the National Carbon Company. This improvement is said to increase the carbon crater intensity of brilliance by seven times the normal standards of color television.

* * *

HAZELTINE AND RCA LICENSES TO MECK INDUSTRIES

Hazeltine and RCA licenses to manufacture radio receivers after the war have been issued to the John Meck Industries, Plymouth, Indiana.

* * *

SYLVANIA OPENS WEST COAST HEADQUARTERS

A west coast headquarters office at 111 Sutter Street, San Francisco, has been opened by Sylvania Electric Products Inc. B. K. Wickstrum, Pacific Coast sales manager for Sylvania's lighting products, is in charge of this office.

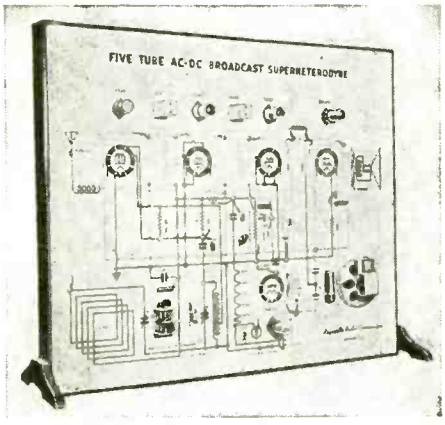
NEW PRODUCTS

SUPERHET DEMONSTRATOR

A 5-tube instruction type superhet, assembled on a 30" x 36" imprinted panel and mounted in a reinforced hardwood frame 3" deep is now being made by the Lafayette Radio Corporation, 901 West Jackson Boulevard, Chicago 7. It may be set up on a table or blackboard or placed on a wall for vertical observation.

Wired for 110-volt a-c/d-c operation.

Demonstrator boards come with drilled panel in kit form or completely assembled and wired.



* * *

CENTRALAB SILVER MICAS

Capacity ranges of from 6 to 2000 mmfd measured at 1 megacycle are now available in silver mica capacitors being made by Centralab.

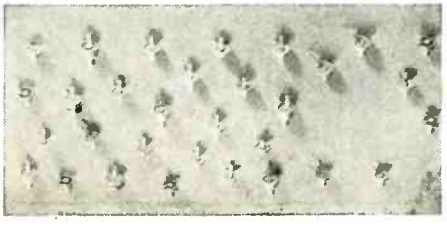
Types 830, 833, and A831 have ranges of from 6 to 650 mmfd. Terminal types available include light right angle, heavy right angle, long tongue, U-shaped and post terminals.

Type A831 is of *feed-thru* construction available with one or two terminals riveted to the center capacitor plate. Also available with center terminal rivet drilled .030" maximum for the purpose of threading a wire lead through the hole.

Type 832 is similar to type 830 but with a deeper cup to accomodate more mica film. It is available with or without threaded stud. Capacities from 650 to 2000 mmfd can be manufactured. Available with light right angle, heavy right angle, long tongue and U-shaped terminals.

Type 833 provides a capacity ground to the chassis with *lead-thru*.

Power factor of all types is said to be .08% for resonant circuit application, .12% for bypass or blocking use. Leakage resistance is said to be 10,000 megohms.



ANALYZER-TUBE TESTER

[See Front Cover]

THIS analyzer and tube tester, Supreme 385, tests tubes for emission and provides 6-range voltage and current measurements, a-c/d-c for voltage and d-c for current. The instrument also provides for 5-range resistance measurements, 6-range capacity measurements, leakage measurements of paper and electrolytic condensers, tests for gassy tubes and output measurements.

On the cover appears a portion of the analyzer which serves as a d-c milliammeter, capacity meter and a-c or d-c voltmeter and ohmmeter. The one mil d-c meter has a 300-ohm resistor in series as a protection against overloading.

D-C Milliampere Ranges

For the six d-c milliampere ranges the meter is connected across the entire shunt potentiometer. On the highest range, 1250 ma, the shunt value across the binding posts is .3 ohm, the series resistance value being 75 ohms.

For capacity measurements the meter is connected to a full-wave rectifier which is switched across a second potentiometer. For a-c voltages the rectifier is connected in series with a condenser for the five-volt range and to a tapped multiplier for the other ranges up to 1,250 volts. Provision is made for reading the line voltage and for adjusting the primary tap on the power transformer by simply pushing a button which places the meter on the 125-volt scale. For d-c voltages a 4,700-ohm resistor is connected to the meter and the same multiplier is used.

The ohmmeter uses a 4.5-volt battery for 200, 2,000 and 20,000-ohm ranges, and a separate high voltage rectifier supply for the .2, 2 and 20-megohm ranges.

Capacity Measurements

In making capacity measurements, a separate high voltage winding on the power transformer is used to provide the potential and the meter-rectifier combination is used as a milliammeter. The highest a-c voltage is, of course, used on the lowest capacity range, or .001 to .05-mfd. When low voltages are used it is permissible to test the high capacity ranges of electrolytic condensers on a-c. The low capacity ranges must not be used for electrolytics, in the event insufficient reading is obtained on the high ranges, because of the excessive voltage.

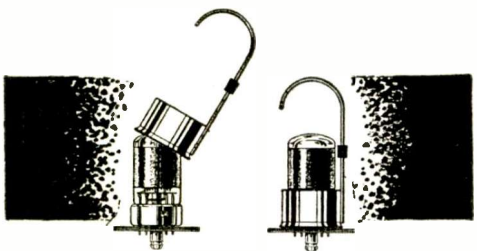
TUBE PULLING MADE EASY

SYLVANIA SERVICEMAN SERVICE

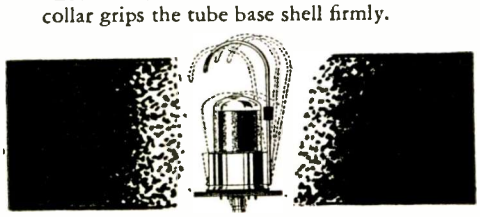
by FRANK FAX

THIS gadget makes it easy to pull radio tubes of the "Lock-in" type. And only 25 cents buys it.

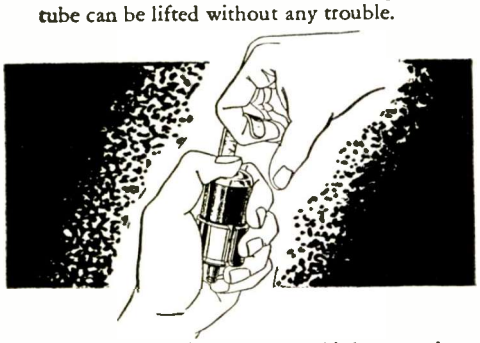
Here's how it works:



Slip the rubber bushing, packed with the Puller, over the handle to ½-inch from the collar. Then insert the Puller over the "Lock-in" tube. Push it down so that the collar grips the tube base shell firmly.



Push handle sideways, or rotate, until a *snap* indicates unlocking of the "Lock-in" pin. Do not lift up on the Puller until the tube is unlocked. After the unlocking, the tube can be lifted without any trouble.



To release tube from Puller, hold the curved handle with one hand, push down firmly on top of the tube with thumb of other hand, holding open end of the Puller toward the palm so that the released tube does not fly out.

If your jobber does not have this item in stock, write to FRANK FAX, SYLVANIA, EMPORIUM, PA.

SYLVANIA

ELECTRIC PRODUCTS INC.

RADIO DIVISION · EMPORIUM, PA.

JOTS & FLASHES

GOOD to see Lieutenant Henry Johnson (j. g.), USN, former Sylvania ad man, on furlough after long and eventful action in the Pacific. . . . Ralph P. Glover opens consulting engineering office at 1024 Superior St., Oak Park, Ill. . . . A. H. Hardwick managing new New York offices of International Resistance Co. and the Connector Corp. at 165 Broadway. . . . "Mike" F. Mayger, Chicago ad agent specializing in radio, becomes father of baby girl . . . congratulations, Mike. . . . W. A. Ellmore, v-p in charge of engineering at Utah Radio Products, assumes additional duties of sales manager . . . thanks to all you servicers for your entries in the SERVICE contest . . . winners are announced in this issue . . . sorry to report death of Joseph E. Galvin, Motorola Radio official who had been in charge of production and employee relationships . . . new tube plant acquired by Ken-Rad in Rockport, Ind. Army-Navy "E" award to Wilcox-Gay Corp. of Charlotte, Mich. . . . Stromberg-Carlson Co. awarded second white star for its "E" pennant . . . George T. Bryant named hearing-aid sales manager by Graybar Electric with headquarters at 420 Lexington Ave., N. Y. . . . radio tubes are NOT subject to the new 20% Federal Excise Tax . . . Sylvania to enlarge their radio tube factory at Brookville, Pa. . . . Oden F. Jester, ex v-p in charge of sales for Utah, has been appointed a v-p of Meissner Mfg. Co., Mt. Carmel, Ill. . . . Meissner also announces opening of new sales offices in Palmolive Bldg., Chicago . . . here's hoping that conditions will soon permit an easing of current paper restrictions . . . we're anxious to add more pages to SERVICE . . . can't do much about it now under present drastic regulations . . . 5th War Bond Drive gets under way in June . . . be prepared to do your share and more . . . April Fool number of *The Solar System*, full of comedy and cartoons . . . a swell employee morale stimulant . . . if you're not receiving *The Acrovox Research Worker* better request that your name be added to the mailing list . . . it's chock full of good technical data for you . . . RCA-Victor of Canada names Frank R. Deakins as president . . . Frank D. Thompson, known by many radio men through his past association with radio and electrical publications, now Pvt. F. D. Thompson, Signal Corps, USA, Co. B 37, Camp Crowder, Mo. . . . J. H. "Robby" Robinson, director of distributor sales for National Union, recently completed business trip through South and Midwest.

ADVERTISERS IN THIS ISSUE*

SERVICE INDEX—APRIL, 1944

*Due to paper restrictions several advertising pages had to be omitted from this issue.

ACTUAL SIZE

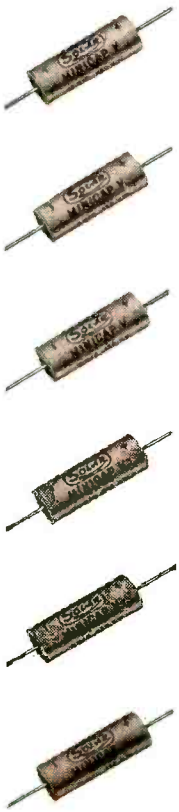
Meet the NEW "MIDGET MINICAP"

TINY ELECTROLYTICS BY Solar

10 CAPACITY AND VOLTAGE RATINGS

These replacement Capacitors are dry electrolytics of *very small diameters.* They fit!

They are built to American War Standards. Their dependability is guaranteed by Solar's "Quality Above All". And they make for peace . . . your peace of mind!



25 VOLTS WORKING

25 Mfd.

PART NO. MV-2525 — List Price $.60
Diameter 9/16" — Length 2¼"

100 Mfd.

PART NO. MV-25100 — List Price $.85
Diameter ¾" — Length 2¼"

50 VOLTS WORKING

10 Mfd.

PART NO. MV-5010 — List Price $.55
Diameter 9/16" — Length 2¼"

150 VOLTS WORKING

20 Mfd.

PART NO. MV-220 — List Price $.75
Diameter 11/16" — Length 2¼"

20 + 20 Mfd. Negative Common

PART NO. MV-2020 — List Price $1.30
Diameter 13/16" — Length 2¼"

50 Mfd.

PART NO. MV-250 — List Price $1.10
Diameter 15/16" — Length 2¼"

250 VOLTS WORKING

20 Mfd.

PART NO. MV-2520 — List Price $1.00
Diameter 13/16" — Length 2¼"

450 VOLTS WORKING

10 Mfd.

PART NO. MV-410 — List Price $.85
Diameter 13/16" — Length 2¼"

10 — 10 Mfd. Negative Common

PART NO. MV-41010 — List Price $1.40
Diameter 1" — Length 2¾"

40 Mfd.

PART NO. MV-440 — List Price $1.75
Diameter 1-5/16" — Length 3¼"

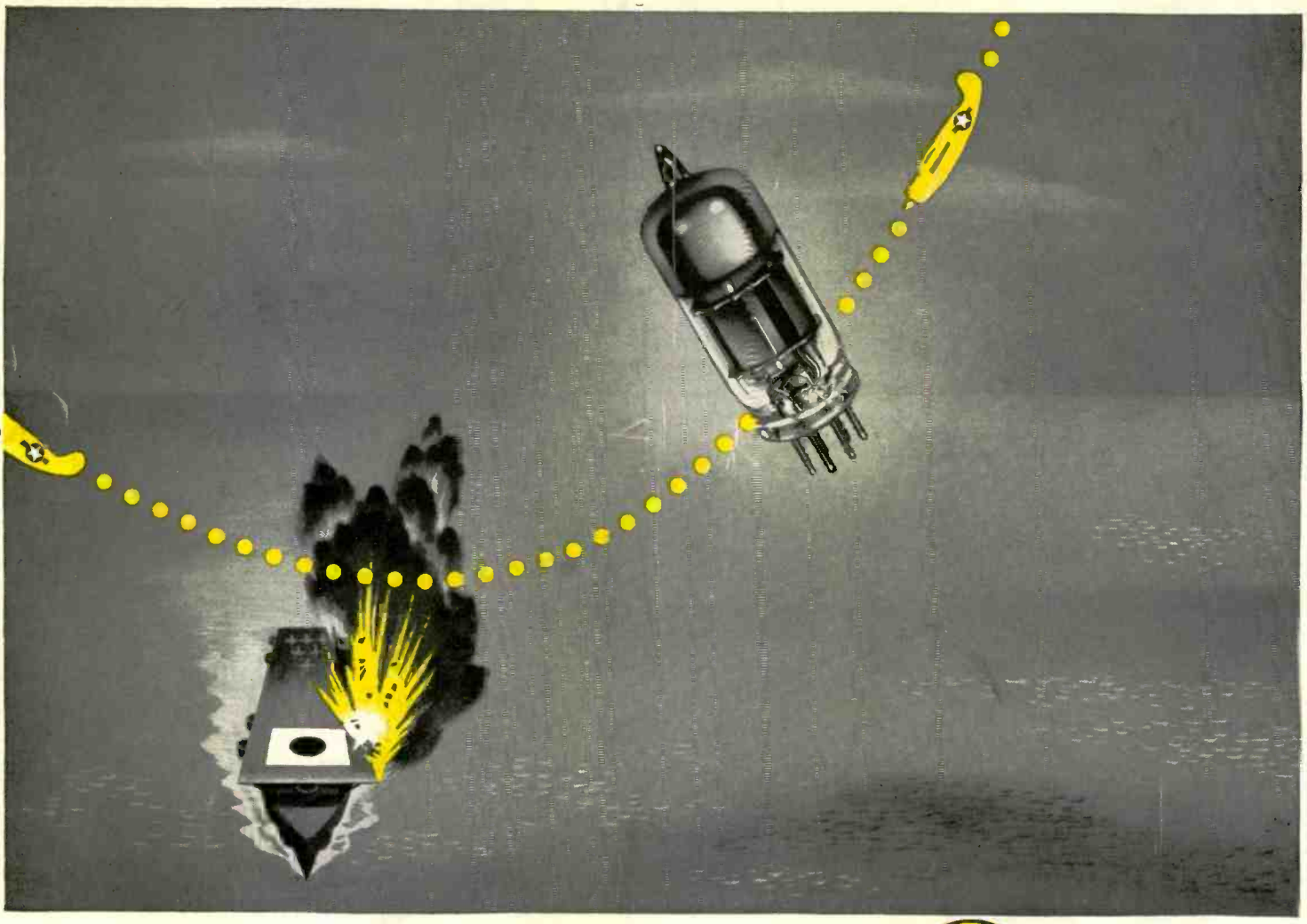
NOTE: Government regulations prohibit the former practice of supplying metal mounting straps with these capacitors. However, the small size and light weight of Minicap "Vees" make them truly "self-mounting."

ARMY E NAVY
SOLAR MFG. CORP.

Solar SOLAR CAPACITORS

SOLAR CAPACITOR SALES Corp., 285 MADISON AVE., NEW YORK 17, N. Y.

SOLE NATIONAL DISTRIBUTORS OF SOLAR CAPACITORS TO THE JOBBING TRADE



They know their G's

What is this menace to flying men and their equipment which our scientists call "G's"? And why are N. U. engineers who design tubes for airborne radio and electronic devices taking so much pains these days, to *know* their "G's"?

In a mild form, most of us have felt "G's" at work on a roller-coaster, when we take the turns and hit the dips. However, in high speed flight, with its shifting, twisting, turning, about-face maneuvers—"G's" *really* shake your insides. Think of a dive bomber pilot as he pulls out of a high vertical power dive. That's when "G's" can become dangerously high. And when there are *too many* "G's"—look out!

Research into the effects of "G's" on the delicate, indeed flimsy filaments and other parts of tubes, has enabled N. U. engineers to provide our armed forces with tubes individually tested to withstand many more "G's" than a pilot or a plane ever has survived. For such battle-tested N. U. Tubes there will be many post-war uses, with profit opportunities for service engineers. *Count on* National Union.

NATIONAL UNION RADIO CORPORATION, NEWARK, N. J.
Factories: Newark and Maplewood, N. J., Lansdale and Robesonia, Pa.

NATIONAL UNION

RADIO AND ELECTRONIC TUBES

Transmitting, Cathode Ray, Receiving, Special Purpose Tubes • Condensers • Volume Controls • Photo Electric Cells • Panel Lamps • Flashlight Bulbs