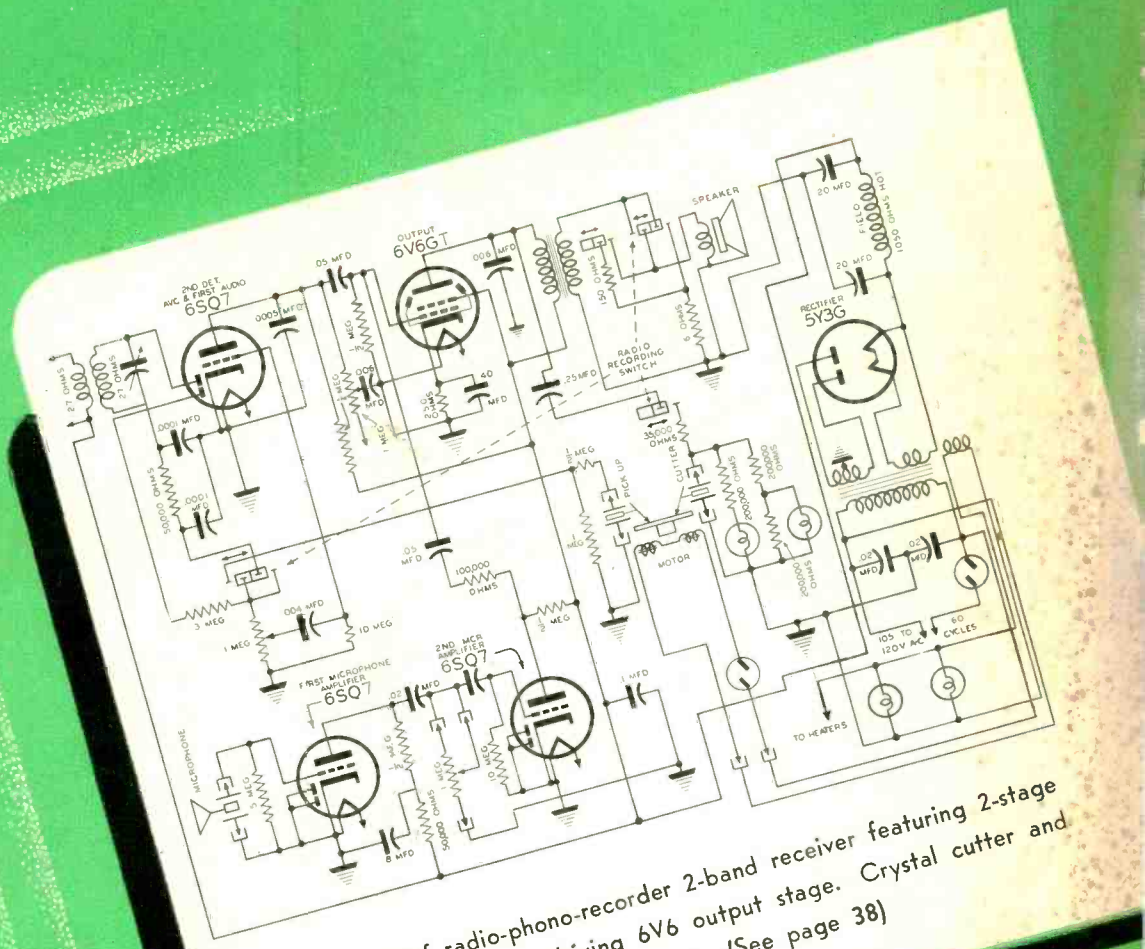
SERVICE

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE



Audio system of radio-phono-recorder 2-band receiver featuring 2-stage microphone pre-amplifier driving 6V6 output stage. Crystal cutter and microphone are used. (See page 38)

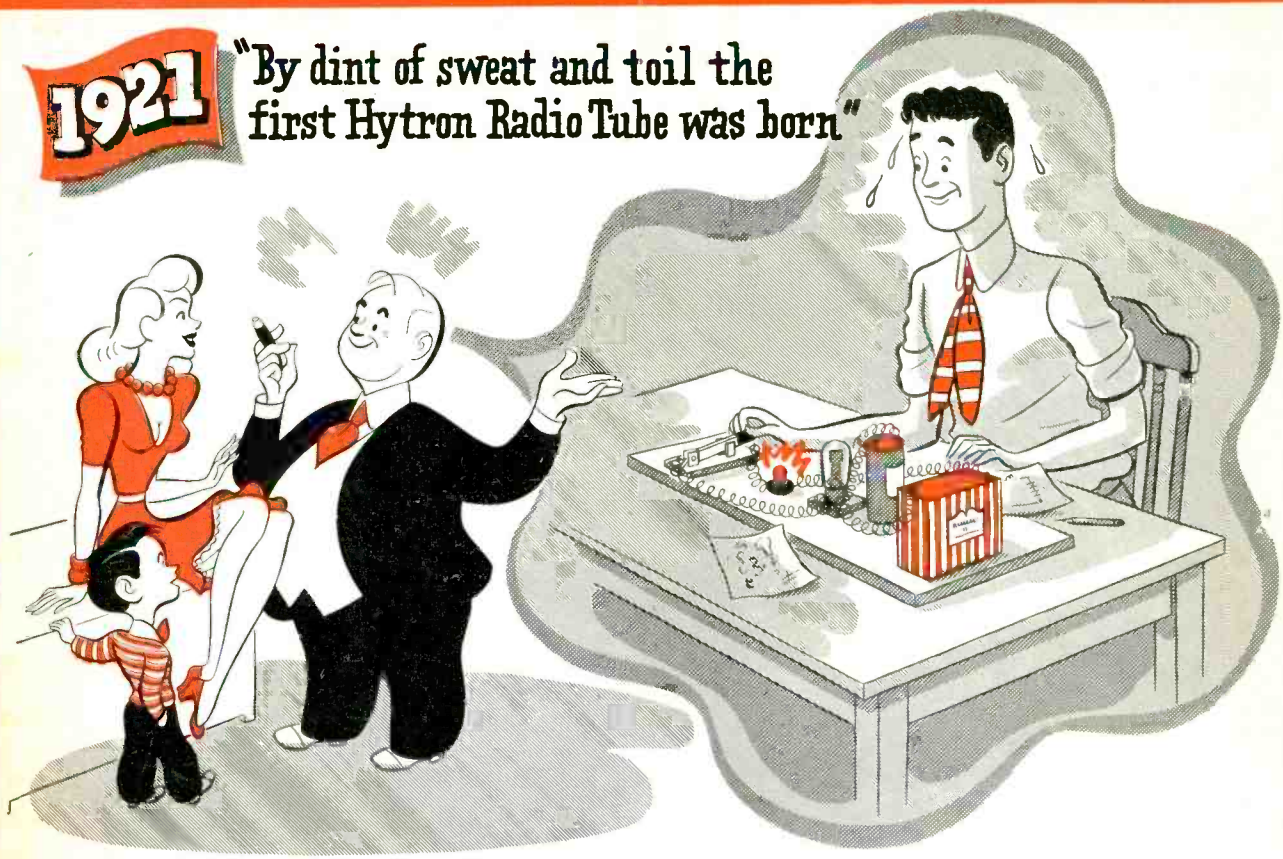
★ RADIO

★ TELEVISION

★ ELECTRONICS

November 1944

1921 "By dint of sweat and toil the first Hytron Radio Tube was born"



Imagine the thrill of seeing the tiny lamp glow with the emission current of the first Hytron tube! That first emission test kit was primitive. There were no commercially available meters. The measuring instrument was of necessity a lowly lamp bulb. What a sigh of relief and satisfaction must have followed the faint glimmer which proved the first tube actually worked!

When Bruce A. Coffin, founder of Hytron, tackled the manufacture of radio tubes, he really started something. He wound grids on a hand mandrel, and spot-welded each turn to the side rods. His plates were stamped by hand from nickel strip. Filaments were coated tediously one at a time.

Two gas torches formed a crossfire in which he shaped with hand tools the stem and envelope. The mount structure first sealed into the envelope, was then sealed to a glass manifold mounted on a mercury pump. There was no getter. The tube was heated red hot by a generator connected across the elements, and tipped off. A 5-KVA spark transmitter bombarded the elements.

In short, when Hytron (the only survivor) began, there were two other exclusive radio receiving tube manufacturers. Tube making was an art, with only a smattering of science. Hytron's growth over the years amazes one. A Hytron plant of today—the intricate automatic machinery—the observance of unbelievably tight manufacturing tolerances—the painstaking assembly of minute parts—are the results of years of experience built into every Hytron tube.

HYTRON MASTER TEST STATION*

HYTRON HYLIGHTS

A striking contrast to the original emission tester, is the illustrated modern Hytron test kit. Automatic range control for the extremely accurate measuring instruments — electronic fuse protection — voltage-regulated power packs throughout — a wealth of controls within easy reach — ease of servicing with standardized components — cathode ray null indicator for the GR vacuum tube bridge — ability to patch any meter or power supply into the desired circuit — these are typical features of the modern equipment used to test your Hytron tubes.

*See the October RADIO NEWS for a detailed description.

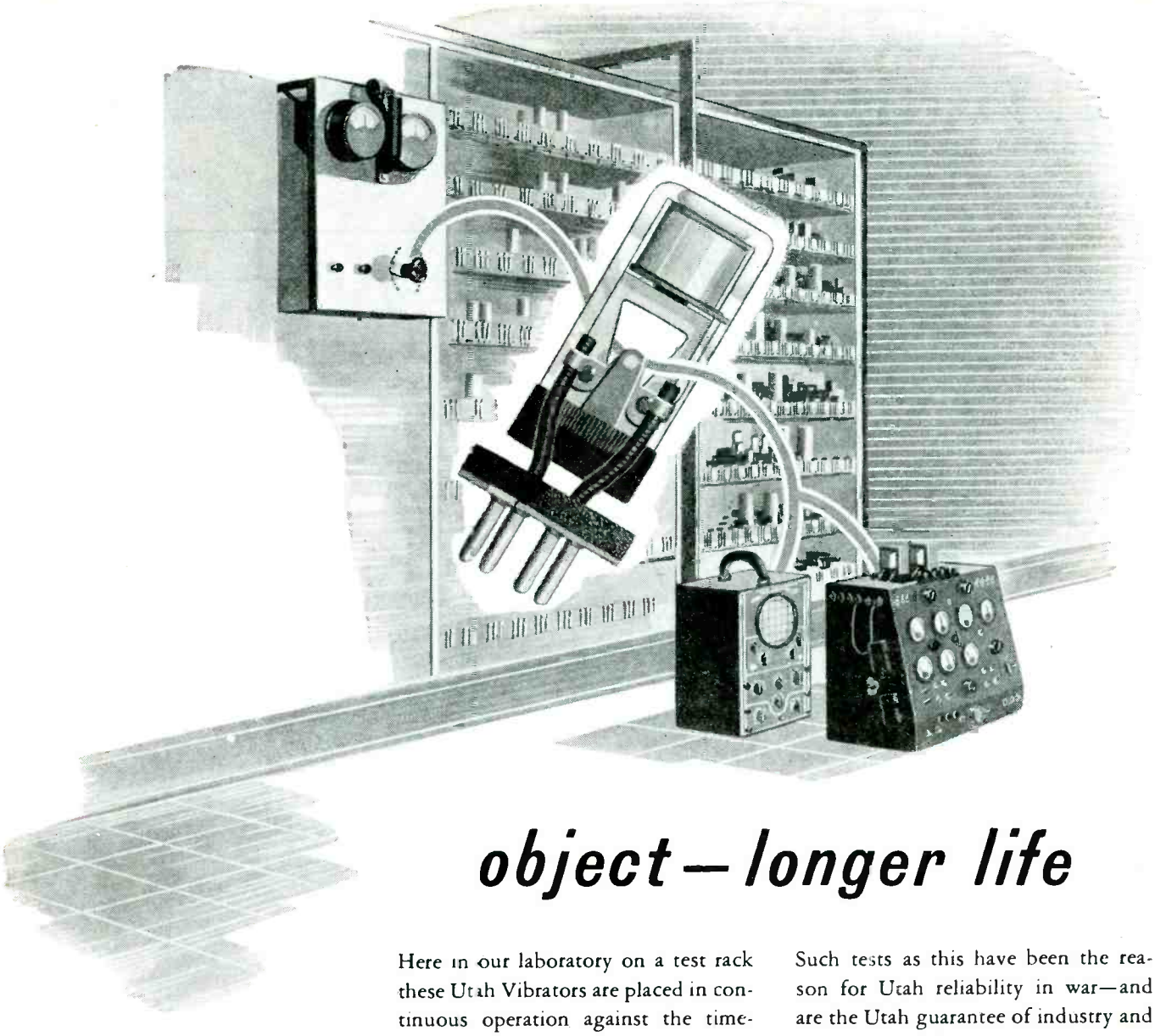
BUY ANOTHER WAR BOND

OLDEST EXCLUSIVE MANUFACTURER OF RADIO RECEIVING TUBES

HYTRON RADIO TUBES

HYTRON CORPORATION ELECTRONIC AND RADIO TUBES

SALEM AND NEWBURYPORT, MASS.



object—longer life

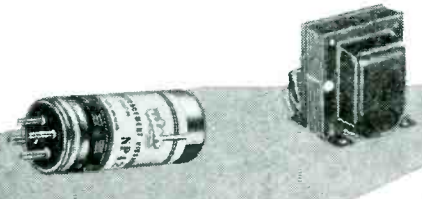
Here in our laboratory on a test rack these Utah Vibrators are placed in continuous operation against the time-clock until they finally break down.

Thus Utah engineers prove the worth of design and the quality of materials that give their product such an enviable record of long, trouble-free service.

Such tests as this have been the reason for Utah reliability in war—and are the Utah guarantee of industry and consumer satisfaction in peace.

★ ★ ★

Every Product Made for the Trade, by Utah, is Thoroughly Tested and Approved



Keyed to "tomorrow's" demands: Utah transformers, speakers, vibrators, vitreous enamel resistors, wirewound controls, plugs, jacks, switches and small electric motors.

utah

Utah Radio Products Company, 816 Orleans Street, Chicago 10, Ill.

EDITORIAL

PROPOSALS for the development of receivers that would be easier to service and maintain, initiated several months ago by a receiver manufacturer, have prompted many interesting forums among engineers and Service Men. Several engineers have indicated that easier-to-service-and-maintain receiver design means a more expensive receiver. The use of individual leads instead of harnessed wiring, separate electrolytics in place of blocks, screw type units instead of riveted pieces, etc., all provide for increased cost, these engineers say. Others point out, however, that it is possible to use a few improvised production methods, that are not costly, and still provide for servicing simplification. Sectional methods of production, using complete r-f, a-f, oscillator, etc., units, as we do now in military equipment, offer one answer, they say. These units are easily removed and can either be serviced or replaced completely, if time demands such a move. The difficulty of getting to speakers can also be overcome, they say, by layout design. One engineer suggested a channeled chassis for the speaker to permit slide motion.

It appears as if some program of easier-to-service receiver design may be adopted by several manufacturers. Experts have indicated that such models are possible and at popular prices. We hope so . . . and await the results with interest.

ELECTRONIC equipment was defined in quite a complete manner in a recent ordinance for the licensing of radio and electronic Service Men, issued in Madison, Wisconsin. According to the ordinance . . . "electronic equipment is any device or devices which are directly or indirectly connected with or containing a vacuum tube having two or more internal elements for the purpose of effecting amplification or rectification, visual indicators, cathode-ray tubes or in any way modifying or changing electrical current in any manner or changing electrical energy to another form of energy, including aerials or other devices used in connection therewith . . ."!

SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U. S. Patent Office

Vol. 13. No. 11 November, 1944

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SPRAGUE TRADING POST

A FREE Buy-Exchange-Sell Service for Radio Men

REPLACING WET ELECTROLYTICS WITH DRYS

In many cases—particularly in old sets—you can use Sprague Atoms (midget drys) in available Victory Line types to replace unavailable wet electrolytic capacitors. Atoms stand the gaff! A few precautions should, of course, be observed, and these are described in the Sprague "Victory Line" Catalog C-304. Write for your copy today.

WANTED — Plug-in coils, 4-prong two windings broadcast band or short wave. Malcolm Ginnis, 4702 15th Ave., Brooklyn 19, N. Y.

WANTED—National P.W.O. cond. drive, Precision E200 or Hickock 19X sig. generator, Precision EV & RF 10 tester, and AGS receiver complete. W. E. Schwenzer, 3619 Peach, Erie, Pa.

URGENTLY NEEDED BY DISABLED WAR VETERAN — Test equipment, manuals, tubes, and supplies. Please quote lowest prices. G. H. Nieder, 1209 Sidney St., St. Louis 4, Mo.

WANTED — Tube tester, to test all tube types. J. E. Forrest, 1407 Montana St., San Antonio 3, Texas.

WANTED — Hallicrafters HT-7 frequency standard. Chas. A. Tappan, W8TDB, RD#1, Lockwood, N. Y.

FOR SALE—50-watt 32 v. RCA marine transmitter and receiver—needs slight repairs. $150. The Radio Shop, 234 Canty Street, Pascagoula, Miss.

FOR SALE — 100-watt P.A. system, 12 tubes, 100-watt output transformer amplifier will carry 24 speakers with 3 additional output transformers, accommodates 500-1000-1500 and 2000 ohm line, 2-12" heavy duty P.M. speakers in Kaner bell baffles. Perfect condition, with schematic and instructions. Has plug-in filter condensers for fast field service. System in brown crackle finish, with screen covering; chrome carrying handles. $200 less mike. Ward Lantis, 111 Shelby St., Kingsport, Tenn.

WANTED—AC sig. generator, modern tube checker and RCA chanalyst. Bill's Radio and Electric Shop, 1116 Kenmore Ave., Buffalo 17, N. Y.

FOR SALE — Variable condensers. 2-50 mmfd., 1-35 mmfd., 50's ganged with flex. coupling, with knobs and hardware, in orig. cartons. $5 for lot. A. P. Morgan, Jr., 69 Brookfield Rd., Upper Montclair, N. J.

FOR SALE — Weston #301 voltmeter, 0-150 DC v., 200 ohms per v. resistance, 2% accuracy. Like new. $9.50. Robert M. Weiss, 124 Sullivan Place, Brooklyn, N. Y.

WILL TRADE—RCA oscillograph #155A with new 3AP1 RCA cathode ray tube, for Hallicrafters SX-24 or S-20R and $18. Charles Franklin, 17 W. Keller Street, Mechanicsburg, Pa.

FOR SALE OR TRADE—2 Green Flyer phono motors with 10" and 12" turntables. Want P.A. outfit, or part of P.A. outfit. Will pay difference in cash. Guido Paolini, 88 South St., Westboro, Mass.

URGENTLY NEEDED — K&E Log-Log Duplex Vector #4083-3S slide rule for research engineering. Must be A1—preferably new. Joe Kishiyama, 3305A, Newell, Calif.

FOR SALE—Portable Wheatstone Bridge, combination Wheatstone and Murray loop resistance tester. Coils 1/10 of 1% accurate; has built-in galvonometer with sensitivity of 1 microampere per millimeter, $25. Weschler Electric Co., 3960 West 165th Street, Cleveland 11, Ohio.

FOR SALE—New Hytron HY-75, $1; and new RCA 807, $2.25. C. B. Davis, 681 Delmar Ave., Atlanta, Ga.

WANTED—Output transformer to match 6L6's push-pull. Carte's Radio Service, Hico, West Virginia.

WANTED—Complete set Rider manuals—preferably separate volumes, but will consider combinations. W. G. Cordell, 3921 Shields Blvd., Oklahoma City 9, Okla.

FOR SALE—Voltmeter, scale readings up to 150 v. In excellent condition. Ralph J. Terella, 26 Fayette St., Cambridge 39, Mass.

WILL TRADE — Crystal mike with 7' cable, brand new, for radio test equipment or what have you? Kinard Radio Service, 1110 W. 4th St., Big Spring, Texas.

WANTED—Supreme #599 or similar type test equipment. K. H. Carlos, 1640 Green St., Philadelphia 30, Pa.

FOR SALE—New Hallicrafter #SX-28-A, with 12" speaker and extra kit of tubes. D. Jarden, 7149 Ardleigh Ave., Philadelphia 19, Pa.

WANTED—Up-to-date tube checker and RCA junior voltohmyst, in good condition. Harry E. Bryant, 1332 Kalamath Street, Denver 4, Colorado.

URGENTLY NEEDED—Tube checker for all types of civilian tubes, combination ohm-amp-voltmeter, and sig. generator. Jay H. Moss, 1636 Gladstone Avenue, Detroit 6, Mich.

WANTED—Howard communication receiver, preferably #430. Capt. Hsai Chu, 121-A, B. O. Q. 605, P. A. A. B., Pueblo, Col.

WANTED — Schematic and operating instruction manual for Superior #1280 tube and set tester. George Weber, 2503 Newtown Ave., Long Island City 2, N. Y.

WANTED—V-O-M or multitester and sig. generator, in A-1 condition. Arthur Cobham, Palo Seco, Balboa, Canal Zone.

WANTED—Superior #710 volt-ohm-milliameter and Echophone #EC1. Irby H. Kolb, S 3/C, 273-31-05, U. S. S. Soubrissen Detail, Treasure Island, San Francisco, Calif.

FOR SALE—16 old Deforest audions for school research work; also used 75's and 50 series tubes, and Eastman #1A camera, using 616 film. E. E. Evans, New Hampton, Iowa.

URGENTLY NEEDED—32 v. DC to 110 v. AC converter of 150 to 200 watts output, preferably vibrator type. Also want antenna detector and oscillator coils for Zenith #6B164. John W. Reigel, R.D.#2, Annville, Pa.

FOR SALE OR TRADE—50-watt Hallicrafters deluxe P.A. system, including one Shure mike, one American mike, and two Utah P.M. speakers. Speakers and amplifier in portable case. Want test equipment and tubes. Charles Wakal, 38-7-F Reloc. Br., McGehee, Ark.

FOR SALE—Triplett multi-purpose tester and power output tube tester #1501, used but in good working order, complete with side panels (#1504) for free point testing, directions, tube charts and supplementary information. Radio Laboratory, Patchen Road, So. Burlington, Vt.

URGENTLY NEEDED — Volt-ohm-milliameter. Clinton Weddle, P. O. Box 265, Bassett, Va.

WANTED—Set of standard 6-prong plug-in coils for BDC and SW band tunable with 140 mmfd. condenser, small diameter (1-3/16") desired. R. J. Replinger, A/S, NROTC—Barracks 19, Evanston, Illinois.

FOR SALE—Howard 7-tube comm. receiver, like new; also new Jewell 3" MA, range 12, 60, and 300 Ma. Kates Bros. Electric Co., Woodridge, N. Y.

WANTED—Tube and set tester such as RCP 802 or 803, or Superior #1280. Lester W. Stiles, 101 Pearl St., Schuylerville, N. Y.

FOR SALE OR TRADE — Vacuum tube voltmeter Measurement Corp. #62, push button selection of five ranges 1, 3, 10, 30 and 100 v. ac. ord. c. (Specifications on page 39 of Radio Electronics Edition of Radio News, Sept. issue). Will trade for 35 mm. camera or will sell for cash. Peter Simonetti, 21 Carlton Ave., Brooklyn 1, N. Y.

FOR SALE—Thordarsen home built 60-watt amplifier, $50—power supply is separate. Complete with tubes. Bensman, 1210 North Ave., Sheboygan, Wisc.

WANTED—872A rectifiers; pair of Elmac 1000T's, 750 TL's or any comparable tubes; filament and driver transformers for above tubes; No 0 or 00 wire; 3" to 5" oscilloscope; and microameters. H. N. Luke, 2113 Somerset Place, Oklahoma City 6, Okla.

WANTED — Late model test equipment, such as Supreme, Hickock, Precision, etc. tube checkers, V-O-Ma. meters Xtal freq., etc. Charles F. Elgasser, Jr., 2771 "A" St., San Diego 2, Calif.

FOR SALE OR EXCHANGE — Superior tube tester—volt, ohm, milliameter, condenser tester combination — also phono motors. Want 3" scope and 35L6, 56L6, 1H5, 1N5 and 12v. tubes. W. Morrison, 24 West 30th Ave., Spokane 9, Wash.

WANTED—7 or 9 tube Howard receiver #435A. D. Jackson, Box 171, Highwood, Illinois.

URGENTLY NEEDED—Radio City #309P tube tester and C1271 voltohmmeter, pocket size. What radio parts do you have for sale? Dale Ormsbee, Box 84, Murphy, Calif.

FOR SALE — Supreme radio tester with tube checker, condenser checker, and V-O-M, $90; also radio phonograph comb., $50. Ivon H. Prescott, P. O. Box 193, Wiscasset, Maine.

YOUR OWN AD RUN FREE!

Send us your Sprague Trading Post advertisement today. We'll be glad to run it free as part of our special wartime advertising service to the radio profession. WRITE CAREFULLY OR PRINT. Hold it to 40 words or less. "Equipment for Sale" and "Wanted" advertisements of an emergency nature will receive first attention. Different Trading Post ads appear regularly in RADIO RETAILING-TODAY, RADIO SERVICE-DEALER, SERVICE, RADIO NEWS and RADIO-CRAFT. Please do not specify any particular magazine for your ad. We'll run it in the first available issue that is going to press. Sprague of course, reserves the right to reject ads which, in our opinion, do not fit in wth the spirit of this service.

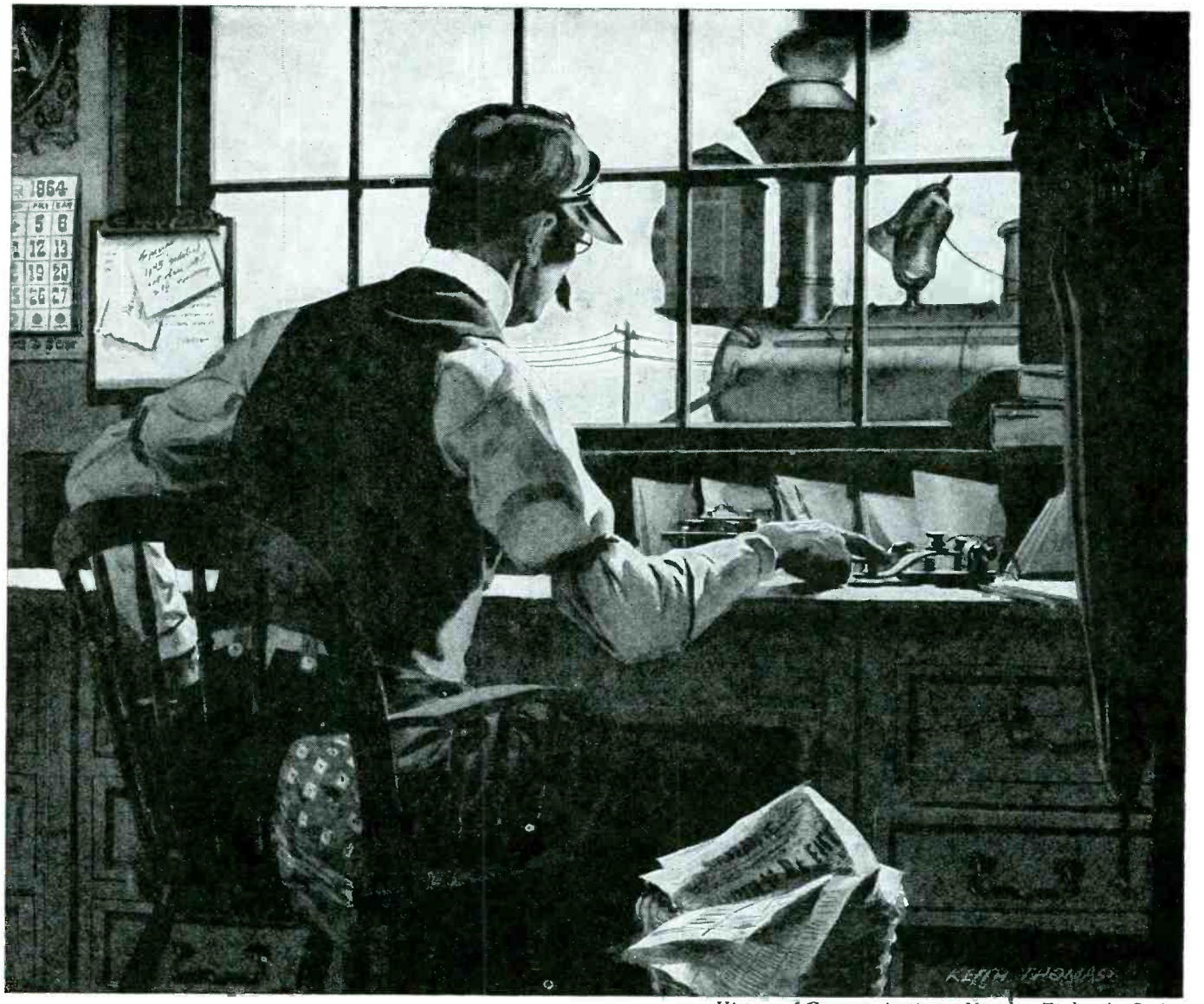
SPRAGUE PRODUCTS CO., DEPT. S-114, North Adams, Mass.

(Jobbing distributing organization of products manufactured by SPRAGUE ELECTRIC COMPANY)

SPRAGUE CONDENSERS *KOOLOHM RESISTORS

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

*TRADEMARK REG. U. S. PAT. OFF.



History of Communications. Number Eight of a Series

EARLY RAILROAD COMMUNICATIONS BY TELEGRAPH

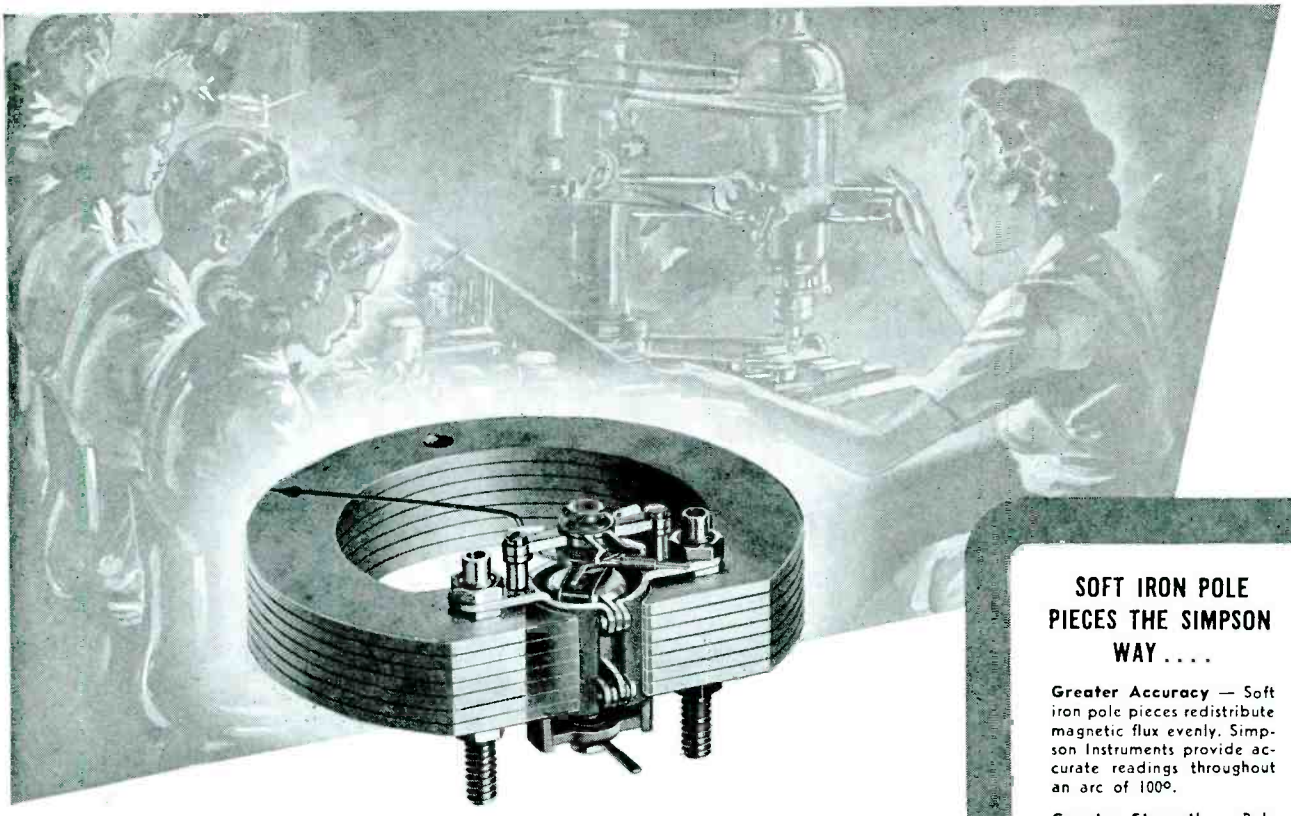
Communication by telegraph was probably one of the first of the electronic arts which met with commercial success in America. Of constant interest to every boy in a small town, the telegrapher down at the depot was a hero — a man of great science. With the advent of faster locomotives, telegraphy was a speedy method of traffic control.

Today, and for the postwar period, the picture will include electronic voice communications for the streamlined trains which travel one hundred miles per hour. There must be a more flexible control via electronics, plus the added possibility of passenger luxury in radio telephones. Universal stands ready as an electronic manufacturer to serve in the era of applied electronics.

< Model 1700-UB, illustrated at left, is but one of several military type microphones now available to priority users through local radio jobbers.

UNIVERSAL MICROPHONE COMPANY
INGLEWOOD, CALIFORNIA

FOREIGN DIVISION: 301 CLAY STREET, SAN FRANCISCO 11, CALIFORNIA ·· CANADIAN DIVISION: 560 KING STREET WEST, TORONTO 1, ONTARIO, CANADA



These soft iron pole pieces tell the story—

EXPERIENCE is a much used, and too often abused, word. Yet in any field experience is the only source of practical knowledge—the only sound basis for further advance.

Measured in terms of time alone, the experience of the Simpson organization is impressive enough. For more than 30 years this name has been associated with the design and manufacture of electrical instruments and testing equipment. But the real value of this experience is to be found in the many fundamental contributions Simpson has made to instrument quality.

The use of soft iron pole pieces in the patented Simpson movement serves as an example. An admittedly finer type of design, these soft iron pole pieces have been employed by Simpson to provide maximum strength as well as accuracy, and to achieve a simpler assembly that permits faster, more economical manufacture.

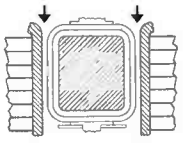
For today's vital needs, this experience enables Simpson to build "instruments that stay accurate" in greater volume than ever before. For your postwar requirements it will insure the correct interpretation of today's big advances.

SOFT IRON POLE PIECES THE SIMPSON WAY....

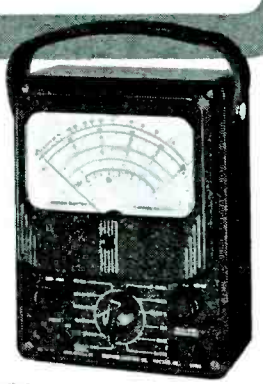
Greater Accuracy — Soft iron pole pieces redistribute magnetic flux evenly. Simpson Instruments provide accurate readings throughout an arc of 100°.

Greater Strength — Pole pieces are used to anchor full bridges across top and bottom of movement. Moving assembly is locked in permanent alignment.

Smooth Walled Air Gap No cracks or irregularities to invite dust or other foreign particles, which might interfere with movement of armature. Reamed to accurate dimensions after assembly.



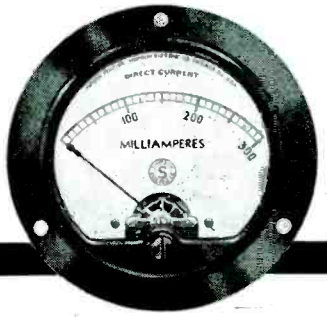
Speed and Economy—Pole pieces are stamped, not machined. This is one of many ways Simpson has speeded construction, and lowered costs, of this basically better movement.



SIMPSON ELECTRIC CO.
5208-5216 Kinzie St., Chicago 44, Ill.

Simpson

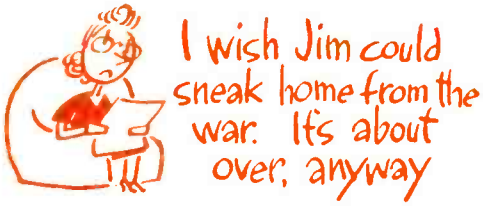
INSTRUMENTS THAT STAY ACCURATE



Buy War Bonds and Stamps for Victory

The things we make are *Vital* to the war... do you want us to "slip you a few?"

We might--by a little fancy fenagling--slip you a few IRC wire wound Resistors and Controls. • But our conscience would bother us like all get out. • And we don't believe there is a single jobber or serviceman among you who--if he sat down and thought it out--would want us to. Every one of you has a relative or a friend or somebody out there fighting, and you wouldn't have us cheat him or them--not for a minute. • We imagine you can get some kind of wire wounds and controls from somebody at this time, but it just happens that ours are of a quality that Uncle Sam wants in a quantity that we can supply. In a way, we are stuck because we are so good, and we hope you'll be proud to be stuck with us. • With postwar business as the goal, there's bound to be a certain amount of off-side play. But we are not slipping anything over at the expense of our fighting boys who can't slip out of this war until it's over. • If our products are so good that Uncle Sam has to have them, they must be the kind that YOU will want for YOUR CUSTOMERS as soon as you can get them.



PREFERRED FOR PERFORMANCE • FIXED & VARIABLE RESISTORS • IRC

INTERNATIONAL RESISTANCE CO.

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

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

Official U. S. Marine Corps Photo

Keep Your Plant's Quota "OUT FRONT!"

Victory depends upon materials—as well as men! To keep our American forces "closing in" overseas, you and every other manufacturer here at home must *keep on making* "Out Front" War Bond Quotas!

This means *action now* on *every* point in the fighting 8-Point Plan to step up Payroll Deductions. For instance, have you a 6th War Loan Bond Committee, representing labor, management and other important groups in your company? Selected Team Captains yet—preferably returned veterans? If so, have you instructed them in sales procedure—and given each the Treasury Booklet, *Getting the Order?*

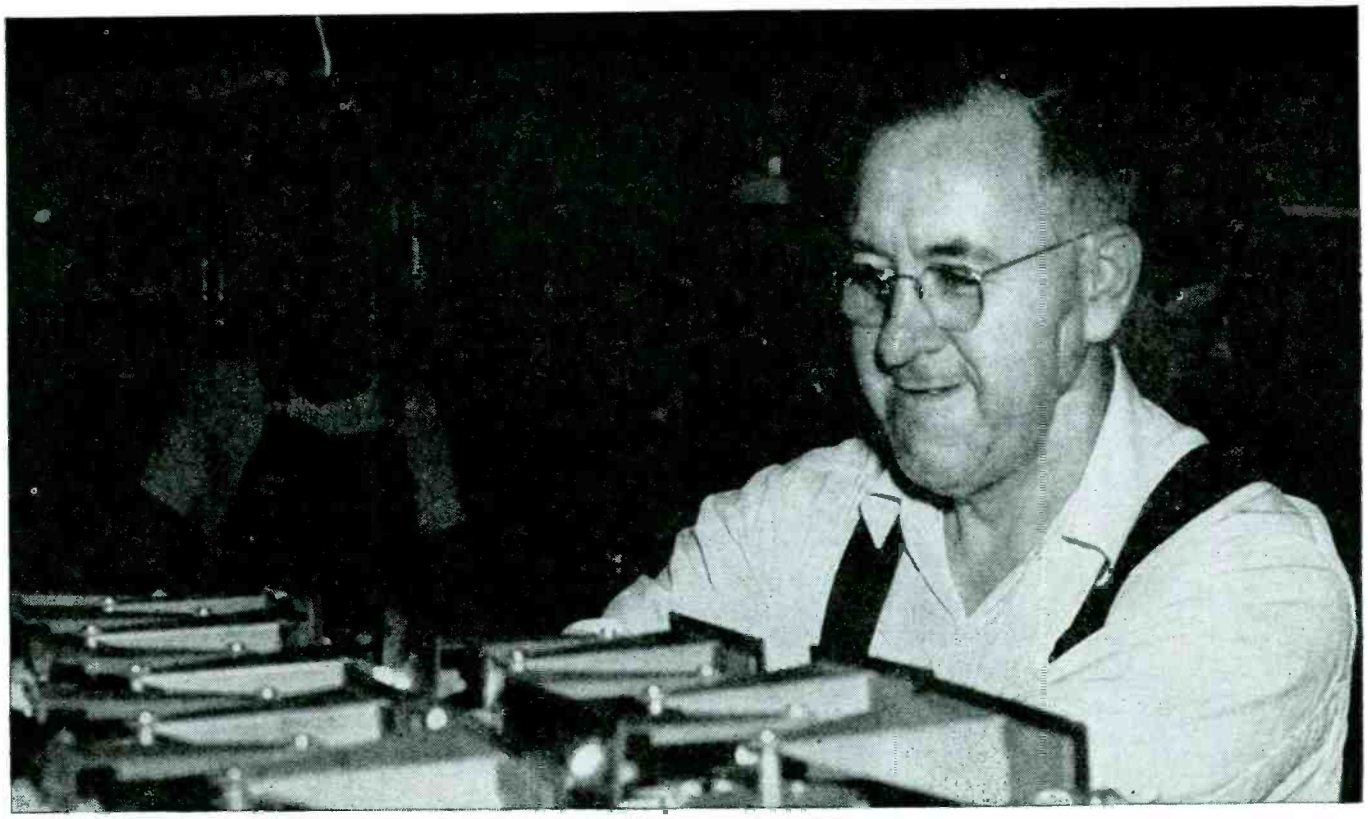
How about War Bond quotas? Each department—and individual—should have one! Assigning responsibilities is vital, too! Have you appointed enough "self-starters" to arrange rallies, competitive progress boards and meeting schedules? Are personal pledge, order or authorization cards printed, and made out in the name of each worker? Planning for resolicitation near the end of the drive? Your State Payroll Chairman is ready now with a detailed Resolicitation Plan. And, have you contracted for space in *all* your regular advertising media to tell the War Bond story?

Your positive *Yes* to *all* points in this forward-to-victory 8-Point Plan assures your plant meeting an "Out Front" Quota in the 6th War Loan—and speeds the day of unconditional surrender!

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

SERVICE

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



MEN OF MEISSNER

...ON THEIR FACES ARE THE SMILES OF PRIDE IN WORK WELL DONE

In the little city of Mt. Carmel, Illinois — famous for music and electronics — the men of the Meissner Manufacturing Company are now devoting their skill and experience to speeding the final day of Victory. All were hand-picked for their jobs — many "grew-up" in the business, doing their share toward making the name Meissner stand for the ultimate in radio quality. They have had the pleasure of turning out perfect work — felt the thrill and satisfaction that comes with achievement. And in the bright, post-war world of tomorrow, it will be these same men of Meissner that add new fame to the name of Meissner radio and other electronic equipment.

Skill PLUS "Know How" — The secret of Meissner's reputation for superb quality precision work is more than just great skill and intricate machines. It is a combination of these two, PLUS the "know how" that comes only from years of experience.

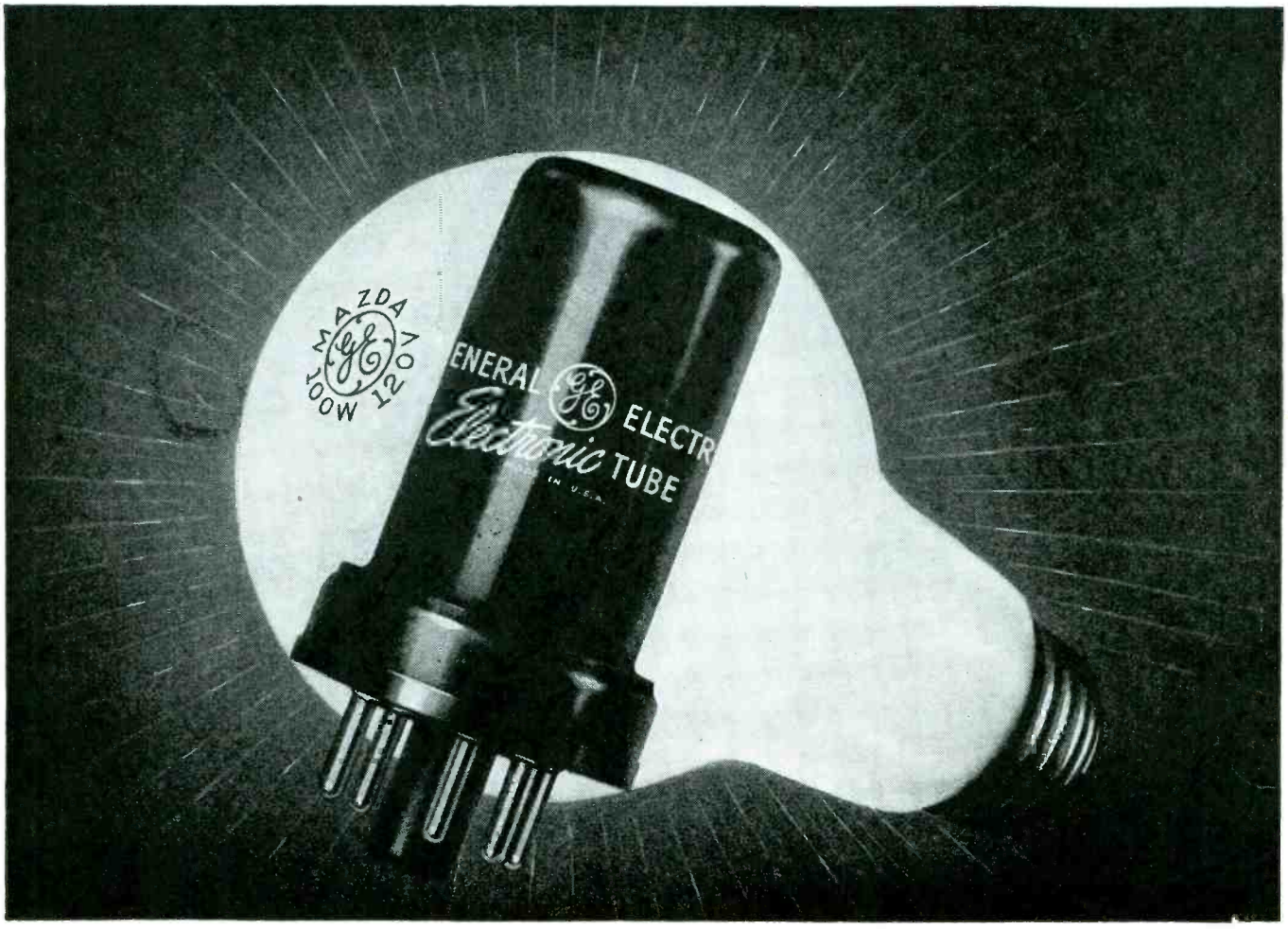
Expert — His is a heritage for producing far-famed quality. Mt. Carmel, Illinois, is said to have more electronic technicians per thousand population than any other city in America.

Meissner's Precision-el — that's the name earned by the Meissner personnel for their skill, and for the pride they have taken in doing their precision work right.

MEISSNER **MANUFACTURING COMPANY • MT. CARMEL, ILL.**

ADVANCED ELECTRONIC RESEARCH AND MANUFACTURE

Export Division: 25 Warren Street, New York; ***Cable,*** Simontrice, New York



YOUR COMING BEST SELLER!

—a forecast of your future electronic tube business

A little G-E symbol goes a long way—into the homes, stores, factories and farms of millions—into the confidence of a buying America that has learned to depend on G-E MAZDA lamps as it does on sunlight.

General Electric Research stands back of the quality which has built the wide public acceptance for G-E MAZDA lamps. And it is also at work on G-E electronic tubes. The same effective advertising is carried to consumers through national advertising media. Consequently, G-E electronic tubes are earning the same consumer confidence now given to the famous G-E MAZDA lamps.

Today, the market for electronic tubes in communications and industry is growing rapidly. Tomorrow, these growing markets will combine with FM broadcasting, Television and electronic applications to vastly increase your replacement-tube market.

Plan now to profit from this growing demand by selling the complete line of G-E electronic tubes. *Electronics Department, General Electric, Schenectady 5, N. Y.*

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

There's a G-E Electronic Tube for Every Purpose

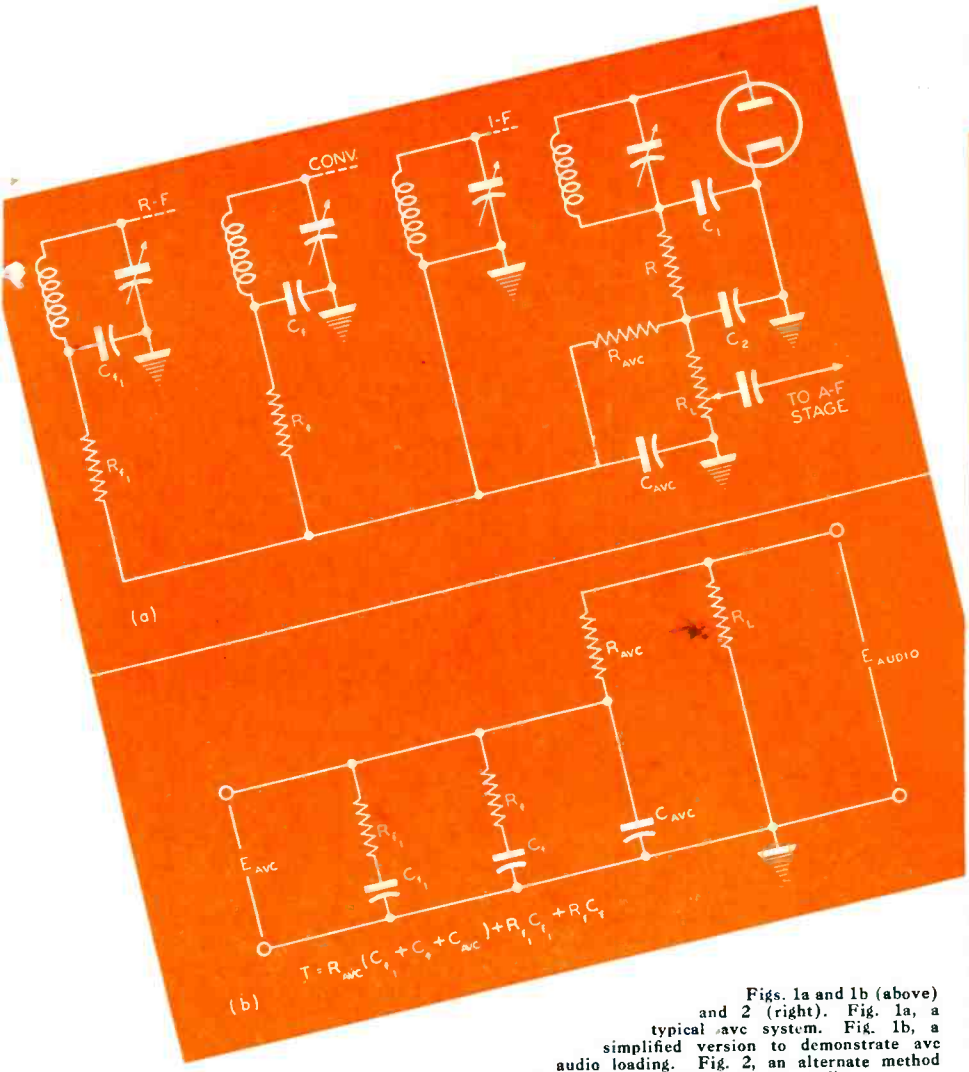
GENERAL ELECTRIC

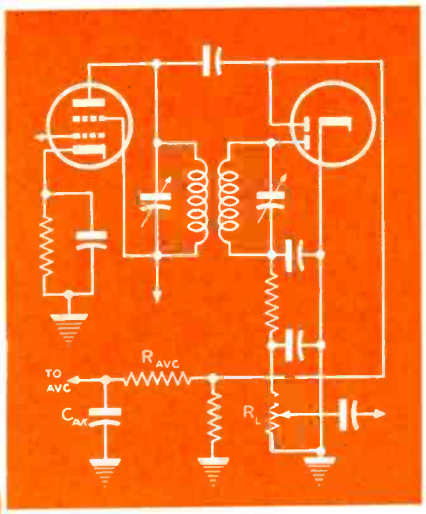
176-C7-8850

SERVICE
A Monthly Digest of Radio and Allied Maintenance

A STUDY OF AVC SYSTEMS

by EDWARD ARTHUR





Figs. 1a and 1b (above) and 2 (right). Fig. 1a, a typical avc system. Fig. 1b, a simplified version to demonstrate avc audio loading. Fig. 2, an alternate method of reducing avc loading on the audio.

QUITE often, the Service Man has been faced with the complaint: "My set doesn't sound the same as it did before it was repaired." While some of these complaints may be dismissed as pure fantasy, there are instances when the complaints are justified, particularly when expensive receivers are involved.

Some of the trouble would seem to lie in the Service Man's lack of appreciation for the receiver designer's job. Production design of a receiver is an arduous task, and only accomplished after much "blood, sweat, and tears." Component values play an important part. If the Service Man understands the practices and principles behind receiver design, he is then prepared to give the customer the utmost in listening pleasure.

The center point of a receiver is the detector, for it is here that the intelligence is separated from the carrier. However, in modern receivers, the detector stage performs multiple operations. It is here that avc, davc, qavc, tuning indicators, and other similar systems, are incorporated to ease tuning and volume setting. These associated circuits quite often are a source of distortion and poor results, and just as frequently overlooked, or caused to function poorly by improper parts replacement.

Fig. *1a* shows a common type of avc system associated with a diode detector. When the circuit is rearranged as in Fig. *1b*, it can be seen that the avc circuit forms a parallel path for any audio voltages developed across R_L, the volume control. While both a-c and d-c voltages appear across the volume control, with no d-c loading effect from the avc circuit, it will be noted that the latter acts as an a-c shunt circuit for audio voltages. This shunting effect will vary with frequency due to the presence of the avc bypass condensers, whose reactance (a-c resistance) will vary inversely with frequency. This, then, would have a decided effect on the frequency response of the circuit.

A more important factor is the distortion created by this associated circuit. The loading effect of a diode is a function of its a-c and d-c load resistance. Thus the higher the load resistance the less power will be drained from the preceding stage. With the introduction of a-c shunt circuits, the load resistance is decreased. This decrease has a tendency to increase the distortion. Some idea of this increase may be gathered from the fact that shunting a .5-megohm load resistance with a 1-megohm resistor increases the distortion factor

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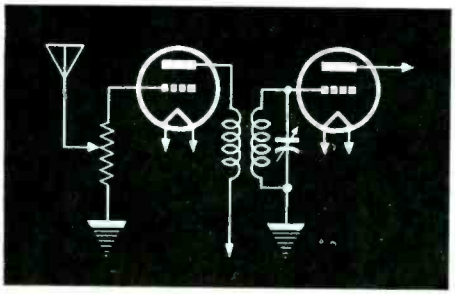


AMPLIFIERS

by ARNOLD D. PETERS

Fig. 1 (above). An untuned input system where the input circuit potentiometer acts as a grid resistance. The potentiometer also attenuates antenna voltage.

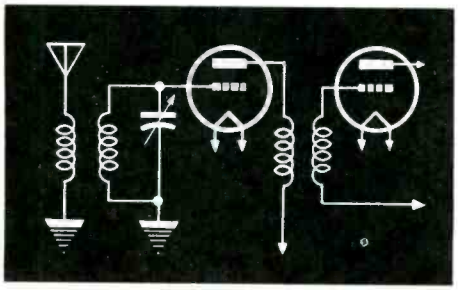


Fig. 2 (above). An early tuned input amplifier. Generally the primary of the second transformer was also tuned with a variable capacitor.

R-F amplifiers are generally tuned amplifiers in which the plate load of the amplifier tube consists of a parallel-resonant circuit. In this type of circuit, the tube capacity and stray circuit capacity act as parts of the tuned circuit and do not appreciably affect the gain. But since these capacities build up the minimum value of the tuning condenser, they reduce the tuning range. It should be recalled that, in untuned amplifiers, the tube and stray capacities act as a shunt, causing a loss in the transmission of the higher frequencies. We are better off than the past generation, however, because pentodes have less input capacity than triodes.

R-f amplifiers are important for increasing sensitivity, increasing selectivity and raising the signal/noise ratio, particularly in superhets where the converter tube requires a good signal for optium performance. Early in the art there was another very important advantage, the isolating of a critical regenerative detector from the antenna circut. This made regeneration practically independent of antenna tuning.

Originally r-f amplifiers had untuned input circuits, Fig. 1, where the tube was of the 201 or 201A battery-type triode. The input potentiometer acted as an antenna attenuator and as a series-grid resistor for dual-volume control action. The next step in the development was the tuning of input and output circuits, Fig. 2. Oscillation then became the problem. Shielding was not generally used in these early amplifiers, but magnetic coupling between input and output transformers was minimized by mounting the coils at a critical angle of 55° to the base, parallel to each other. No attempt was made to minimize electrostatic coupling.

One of the earlier methods used to curtail oscillation involved suppressor resistors, placed as close to the tubes' grids as possible, right at the socket. Since these amplifiers had lower losses at the higher frequencies they would tend to oscillate at these frequencies, but it was found that suppressors were more effective there also; hence, the application. Fig. 3 shows the position of the suppressors. Before considering the other methods of preventing oscillation, let us review some of the theory concerning oscillation.

The early triodes had a substantial grid-plate capacity. Thus when the plate potential changed, the grid potential followed suit due to the coupling by this capacity. If the grid potential were not allowed to change when the

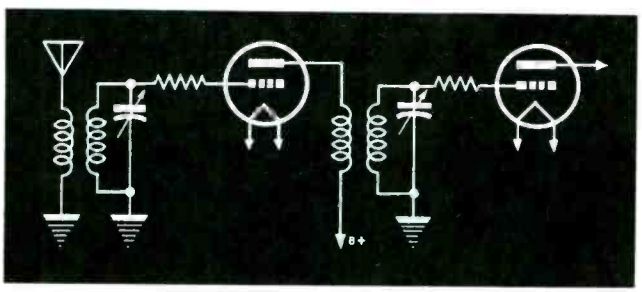


Fig. 3 (left). Here we have one method of controlling oscillation by using grid suppressors.

Fig. 4a (below, left). A triode radio-frequency amplifier with grid neutralization is illustrated here. This is the most popular form of neutralization.

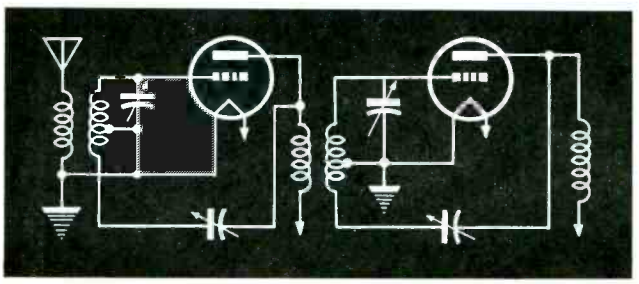
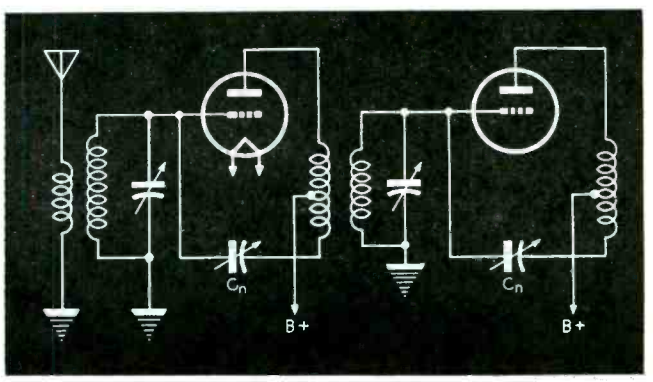


Figure 4b (right). Plate neutralization in a triode radio-frequency amplifier.



F O R R - F

plate potential changed, regeneration could not occur. This happy state of affairs could be accomplished by placing an internal electrostatic shield within the tube which, if grounded, would effectively eliminate the grid-plate capacity. Thus came the shielded grid tube. But, before this momentous development, triodes had to be made to work efficiently. This was done by neutralizng the grid-plate capacity by opposing it with an external capacity of equal magnitude but connected in opposite phase. Thus, the feedback voltage due to the internal grid-plate capacity, was cancelled by an equal and opposite voltage passed by the neutralizing condenser.

Fig. 4 shows two typical methods of neutralization; (a) the most popular grid neutralizaton, and (b) plate neutralization. In both cases, the center of the coil which develops the out-of-phase voltage is effectively grounded at a tap. As in a push-pull circuit, the two ends of the coil are 180° out of phase.

The neutralizing condenser, C_n, is adjusted as follows: The tube's filament is opened and a strong signal applied. C_n is then tuned until a null is obtained, exactly like an a-c bridge being balanced. In fact, the act of neutralizing is just that.

Since the triodes in use had a mu of around 9, quite a few stages were necessary to obtain a reasonable gain. Thus a good r-f amplifier was an expensive item. The '22 was the first screen-grid amplifier to replace the triodes. Although designed as a d-c tube it was used with a-c on the filament in a number of receivers. The '24 soon replaced the '22 and r-f amplifiers became popular. The '24 had one serious defect; it was a sharp cut-off tube and couldn't take a wide range of signal voltages. This led to the *local-distance* switch which could be called an attenuator for strong stations, preventing overloading of the first r-f amplifier tube. If necessity is the mother of invention, this certainly led to the invention of the variable-mu, or remote cut-off tube. This was exemplified by the '35, later the '35-51, which were very popular as r-f and i-f amplifiers in all types of sets, both t-r-f and superhets.

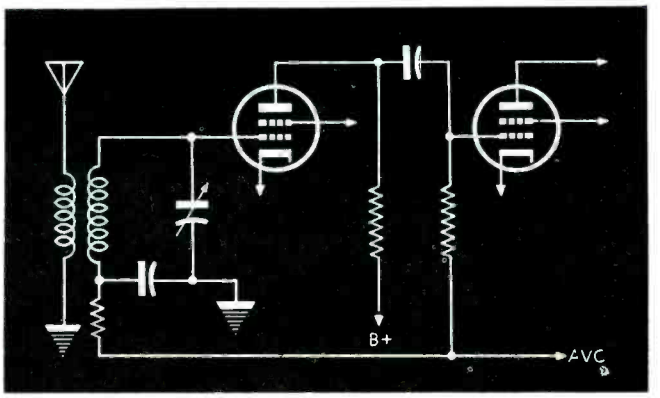


Fig. 5. Resistance coupled r-f amplifier popular in portables, midgets, and loop receivers.

Not all r-f amplifiers are tuned. Fig. 5 shows a resistance-coupled amplifier which gained considerable popularity in portables and small loop receivers where the addition of a tuning condenser section (3-gang) was undesirable because of size, weight, or cost. The gain of this type amplifier is from *5* to *11* in the broadcast band, which is considerably less than a modern pentode-type tuned amplifier, but still useful. Of course, there is no gain in selectivity with such an untuned stage. Frequently, an i-f wave trap is inserted to prevent i-f direct pickup. This is important when using a large external antenna.

We have already considered some of the defects of r-f amplifiers, particularly their instability (when using triodes), and the overloading of sharp cut-off amplifiers. These are now of no consequence but there are other difficulties. One of these is the change of gain with change in frequency. One method of obtaining a constant gain/frequency characteristic involves the use of a complex coupling circuit, where one element favors high frequencies, and the other lows. In Fig. 6, for instance, both inductive and capacitive coupling are used in the first and second r-f stages. The antenna inductor, L_1, peaks at a frequency slightly lower than the low end of the band; the capacitor, C_1, is very small, favoring the high frequencies. Similarly, L_2 and C_2 are designed to favor the lows and highs, respectively. The magnetic coupling between the pairs of coils shown is usually quite loose, but varies in individual designs. The main point is that the gain is substantially constant throughout the band.

Continuing with defects in r-f amplification, we have the problem of distortion. Included here are such complications as the modulating of the desired carrier by the modulation of a second, unwanted station, known as cross modulation; hum modulation or tunable hum due to some stray 60-cycle voltage in one of the r-f amplifier tube grid circuits or heater-cathode leakage; intermodulation of sideband frequencies sometimes producing undesired signals within the tuning range; change of modulation factor. All these defects are caused by non-linearity or curvature of the grid voltage—plate current tube characteristic.

Tracking is another problem in r-f amplifiers of the tuned type. With a

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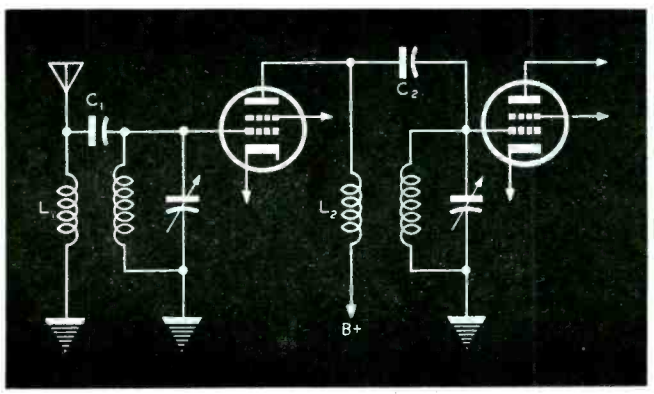
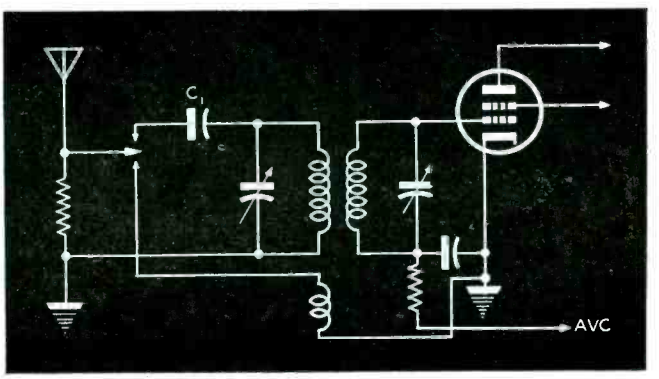
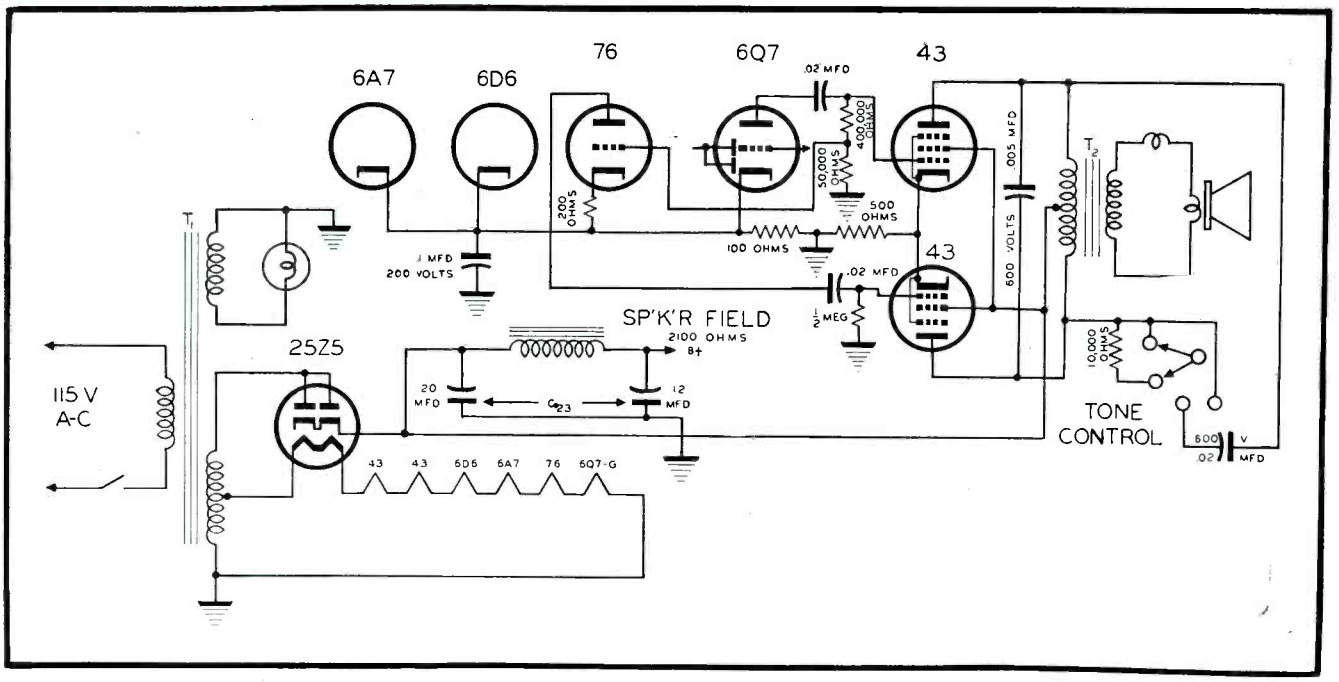




Figs. 6 (left, below) and 7 (right, below). Fig. 6, a combination of inductive and capacitive coupling are used here for constant gain/frequency characteristics. Fig. 7, a double hump band-pass wide-band amplifier.



WARTIME REVISIONS OF CIRCUITS

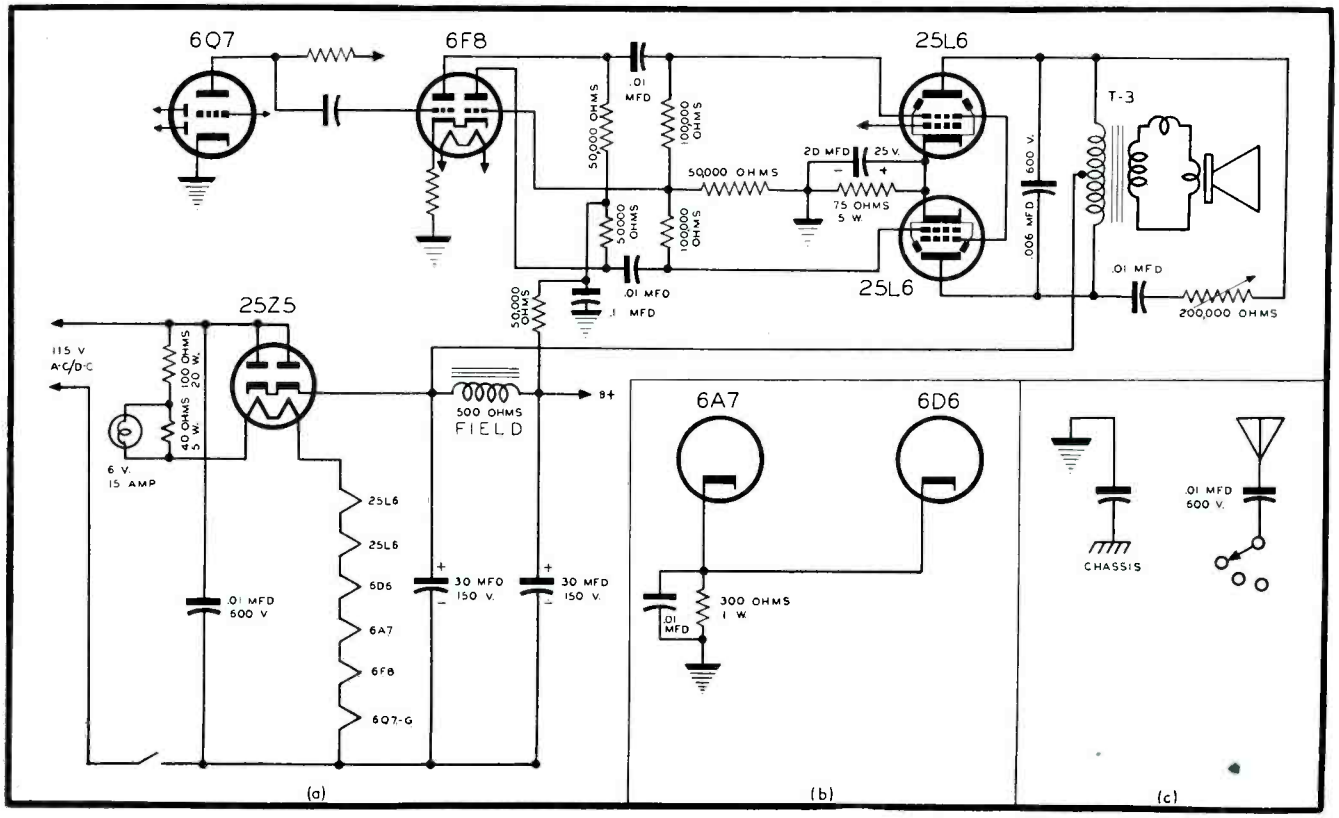
by WILLARD MOODY

THE special power transformer used in the Detrola 223, may be supplanted by direct line operation. That is, the filaments of the tubes may be operated directly from the line through a series dropping resistor, as shown in Fig. 2. Additional gain will be available by using 25L6 tubes, installing a new output transformer and modifying the phase inverter so that balanced inverter operation is secured. The signal potential from each output tube grid-to-ground may be checked with a vacuum-tube voltmeter, feeding into the 6Q7, an audio signal from a generator during the test. Various values of resistor *R* may be tried until equalization is achieved. Series condensers between antenna and ground leads are necessary to avoid shorting the power line.

Figs. 1 (above) and 2 (below). In Fig. 1 we have the original circuit of the Detrola 223, which required a special power transformer. Fig. 2 illustrates how a series dropping resistor may be used to replace this power transformer.

Installing AVC

The original General Electric F-53 shown in Fig. 3, did not have avc. And like any receiver without auto-



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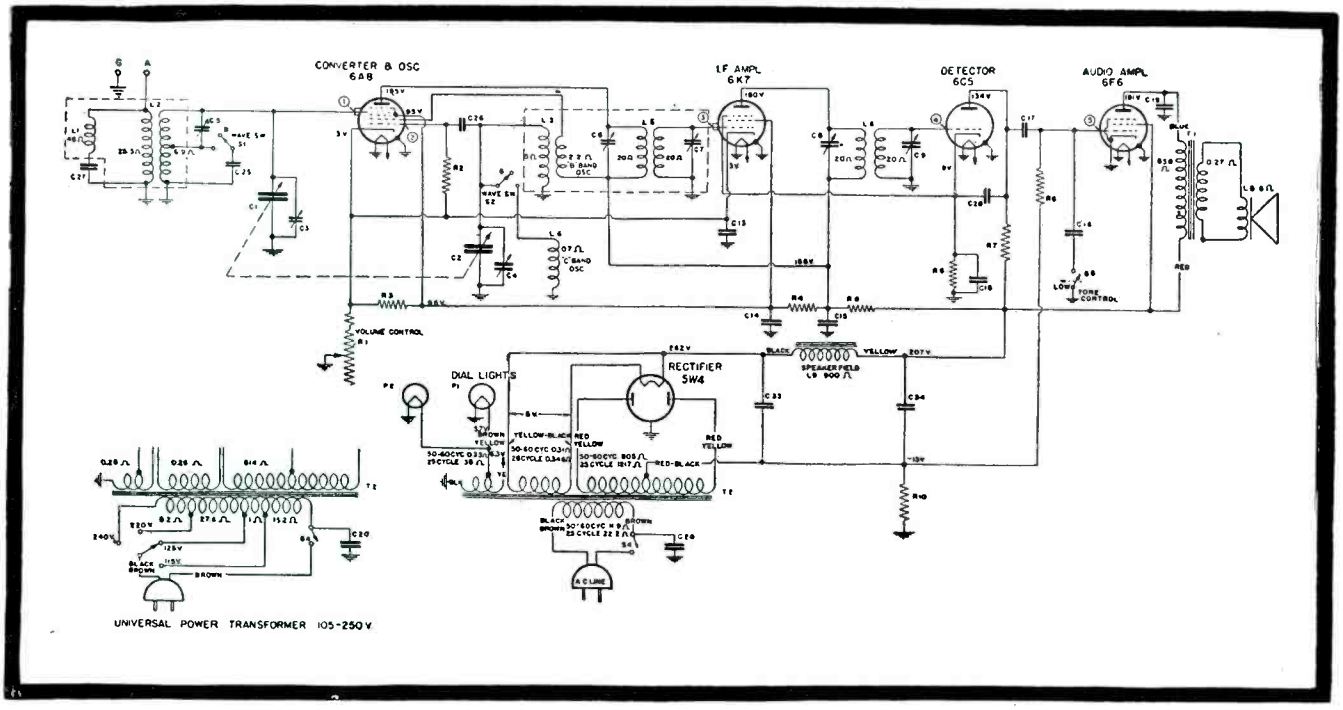


matic volume control, this one will blast on strong stations. Usually, it is inadvisable to add avc, but in this one it seemed to work out satisfactorily, Fig. 4. Another innovation introduced is oscillator stabilization by means of a 10,000-ohm series resistor.

Tone Control Change

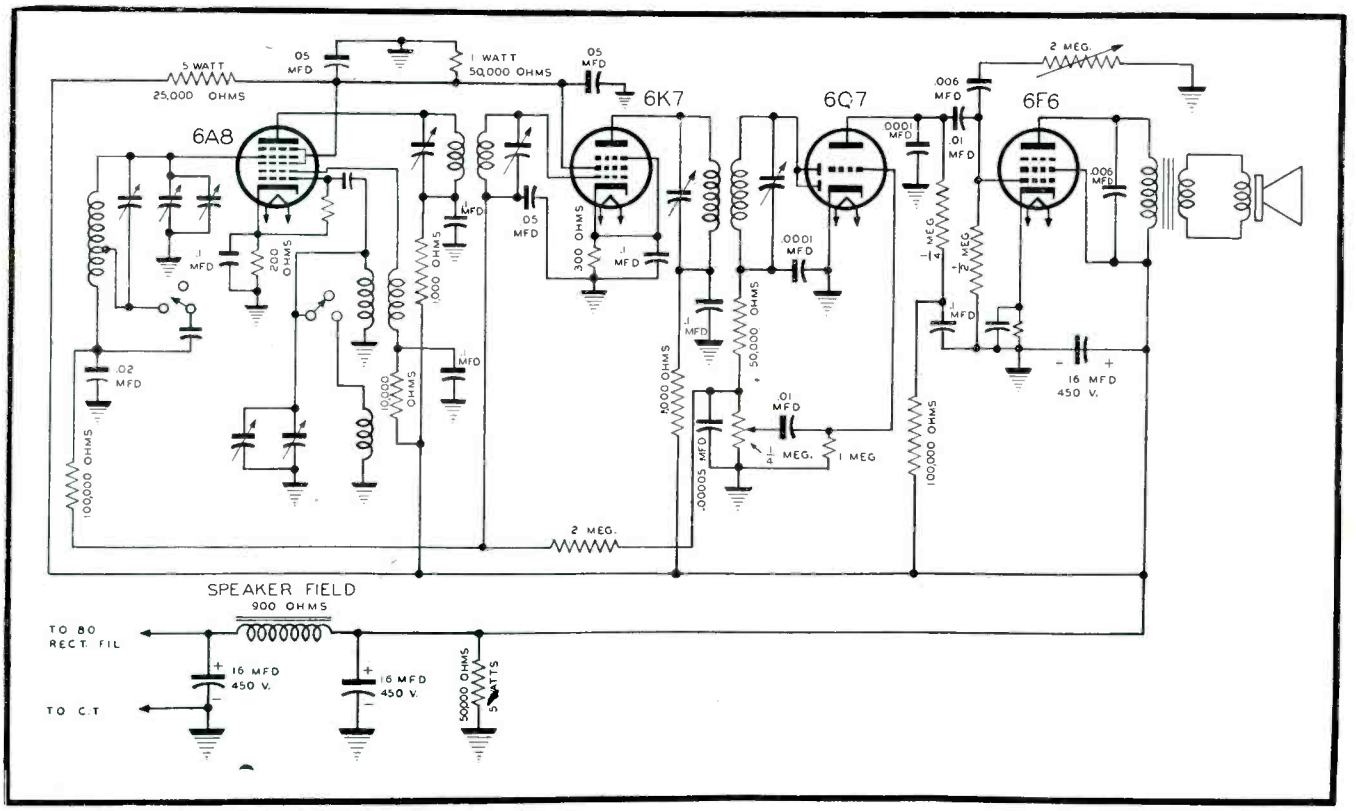
The tone control system also may be modified if desired, as indicated. The 6C5 takes an octal socket as does the 6Q7. A 6SQ7 could also be used. A type 80 was substituted for the 5W4 which, like the 5Z4, is quite temperamental. The 80 seems to be one of the best rectifiers ever made.

Tube Replacements

Incidentally excellent suggestions on tube replacements appear in Alfred A. Ghirardi's *Troubleshooter's Handbook*.

Figs. 3 (above) and 4 (below). Fig. 3, the original circuit of the G.E. F-53, without avc. In Fig. 4, avc has been added. The tone control system has also been revised.

He points out, for instance, that the 27 tube may be directly replaced with the 56, while the 37 may be replaced directly with the 76. In most cases, he says, such a replacement and a realignment of the tuning circuits will add pep to the receiver. Substitution of a 42 for a 41 output tube in auto receivers is also recommended. This change results in higher output. The only difference in operating characteristics is the higher filament drain of the 42. Incidentally both the 41 and 42 can also be replaced with a 6B5. In this case though, it is necessary to ground the cathode terminal, as the 6B5 requires no cathode bias for plate voltages under 325.



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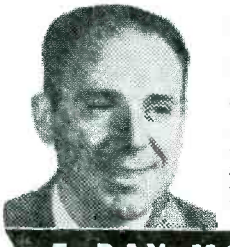

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Surface noise. Scratch. Background noise.	Hissing noise in disc reproduction.	Dust and foreign particles in grooves; aged blank or type of blank used; worn cutting stylus; wrong depth of cut; usually too deep. Incorrect stylus *rake* angle; stylus not straight in cutting head; cutting head not tracking across a radius (approx.) of blank. Type of pickup and needle used. In solid stock pressings, noise is due to their granular structure, processing steps and embraces all frequencies.
Swirl lines.	Curving areas of extra thick coating radiating from centre of certain blanks.	Often present in blanks coated by *dipping;* sometimes causes *skip* patterns.
Thread tangle.	The coating thread, during cutting, becomes tangled at the stylus and if pulled to release or allowed to remain may cause cutting through or uneven groove spacing; also responsible for crackling noises in playback.	Usually due to removed coating thread coming around stylus on outside, i. e., side nearer to outer edge of blank, instead of around inside. Correct by slight biasing (not more than 5°) of stylus cutting face; use brush or other means of thread control; or, an effective method is to cut inside-out.
Twinning. Twin grooving.	Irregular groove spacing, making width of walls or *lands* uneven, generally in pairs, i.e. *land* is alternately wide and narrow.	Faulty action, e. g., binding of traversing (feed) mechanism, or of drive to this mechanism.
Whine.	Fluctuation in apparent loudness and frequency of a reproduced sound. A type of *wow.*	Speed of recording or reproducing turntable varying at a slow rate.
Whistling.	Whistling noise of any kind heard during cutting; usually occurs in conjunction with dull cut and dry, crumbly thread.	Denotes a bad stylus, the wrong cutting angle, or both. Occasionally due to aged blank coating.
Wows.	Rhythmic or arrhythmic change in intensity (up to 6 cycles per second) in reproducing sounds.	Fundamentally arises from speed fluctuations in either recording or reproducing equipment, or in both, but made more apparent by phenomena of stationary waves in an enclosure. If of regular periodicity identifiable with turntable rotation speed it is probably connected with turntable drive system, e. g., slippage due to flat pulley, or oil on pulley (in rim pulley drives); incorrect motor-thrust bearing adjustment; loose set screw; worn gear section or defective gear teeth. Governor trouble. Also produced by blank slippage where no centre hole used; oversize or eccentric centre hole, i. e., a *swinger;* warped blank; warped or out of round turntable. Occasionally binding or non-aligned bearings in feed mechanism.
Gargle.	Speed variations 30 to 200 cycles/sec.	
Whiskers.	Speed variation over 200 cycles/sec. (As a rule not visible in the form of patterns unless associated with vertical vibration.) Stroboscope may reveal certain types of *wow* by appearing to oscillate. Aurally disturbing.	
Waver.	Intermittent fluctuation.	Worn turntable bearing or insufficient tension on drive or idler pulleys.

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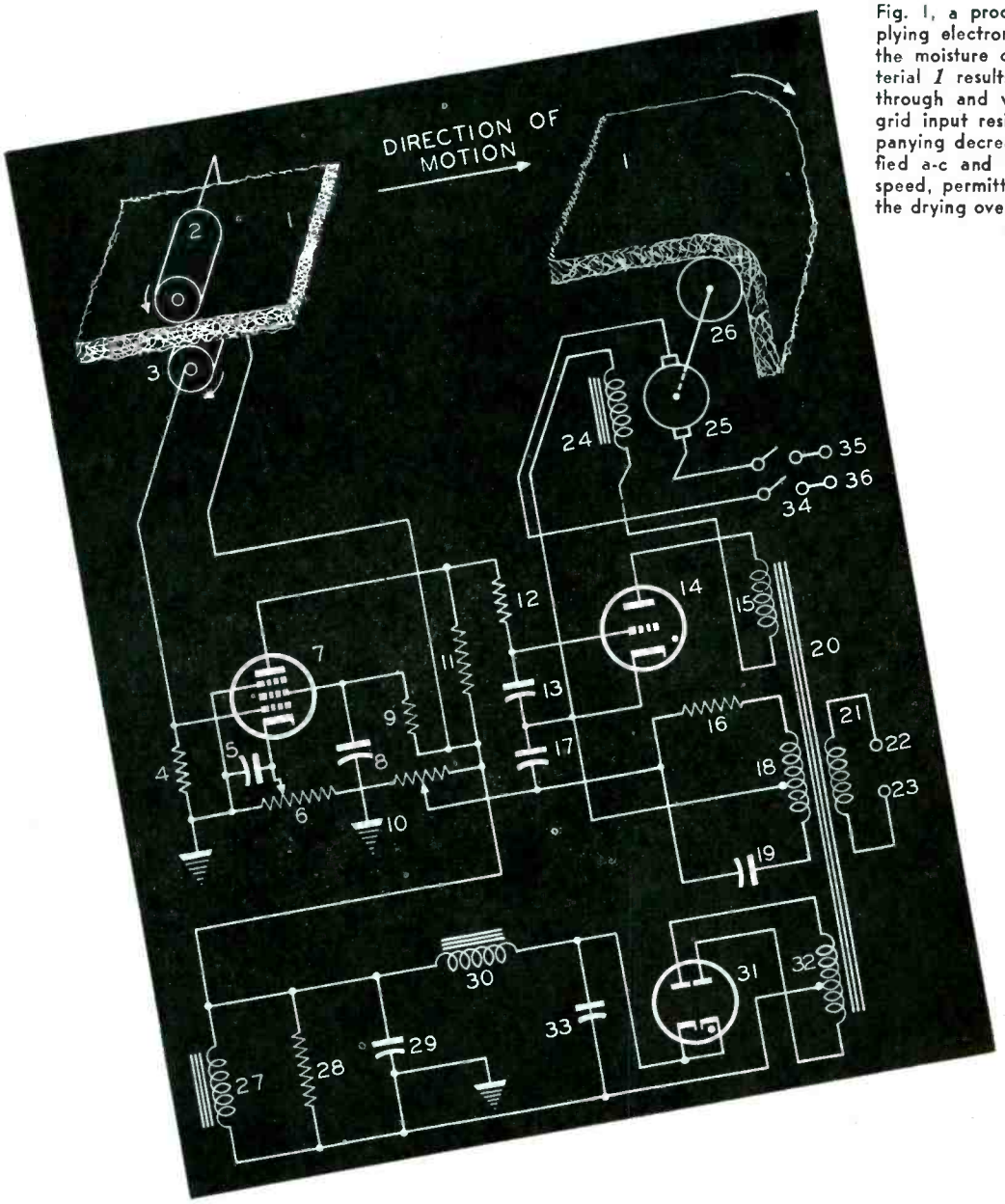


Fig. 1, a production moisture analyzer applying electronic principles. An increase in the moisture content of the processed material *1* results in increases of the current through and voltage developed across the grid input resistor *4*, together with accompanying decreases in the thyratron *14* rectified a-c and the drive-roll motor *25* shaft speed, permitting the material to remain in the drying oven for a greater length of time.

by S. J. MURCEK

ELECTRONIC ANALYZERS IN INDUSTRY

MODERN production testing is a precision operation. This requirement is rendered complex when the permanence of the equipment calibration over long periods of time is taken under consideration. Fortunately, certain electronic testing circuits readily meet these requirements.

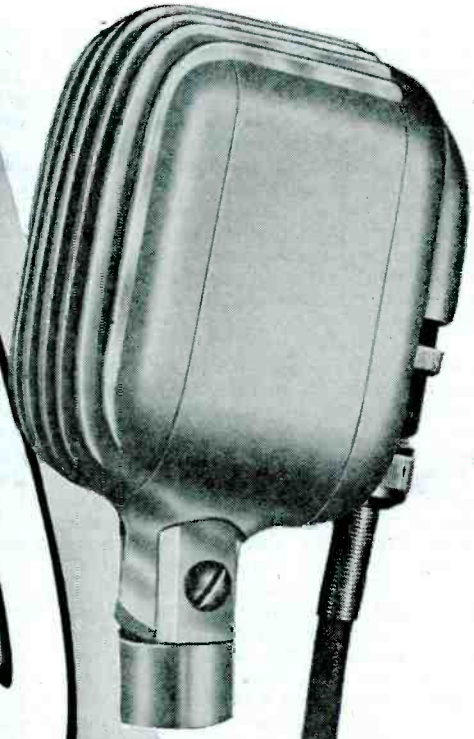
Generally, where precision in measurement is a factor, such electronic circuits are not of the dynamically coupled type, since, in most instances, the electrical characteristics of the product under control are most readily obtainable as d-c voltage or current characteristics. Again, where the end-circuit must have a considerable power capability, thyratron control assumes difficult proportions. Hence, where precision is a circuit requirement, production testing circuits incorporate directly-coupled tube systems together with d-c indicator circuits, such as are to be found in the *moisture content analyzer* and the *electronic precision gauge*. These devices are intended for precision product control under modern mass production methods.

The Electronic Moisture Content Analyzer

During the course of manufacture of either paper or textile products, the material being processed is subjected to considerable immersion in various chemical mixtures containing a high percentage of water. Consequently, prior to the preparation of the finished product for storage or shipment, it must necessarily undergo a drying operation, in which the product moisture content is reduced to an acceptable minimum. Since the prime requisite of mass-production processing is rapidity of completion, it is necessary to provide a means capable of determining the maximum speed at which the drying operation may be accomplished. Further, since the drying speed is dependent, in appreciable measure, on the minimum acceptable moisture level in the finished product before shipment, the drying operation might readily be controlled automatically by an electronic device responsive to the product moisture content.

It is an established fact that water,

D220



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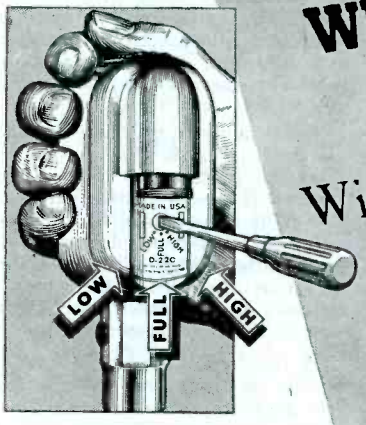

The circuit combines two dynamic generators, each with a specific frequency response. Its ideal quality is produced by coupling the outputs electrically and acoustically. Total band 25 to above 10,000 cps. Broad crossover from 150 to 5,000 cps. Crossover band in the D220 has been designed to eliminate peaks in the middle frequency range.

D220 - Dynamic ..... (30-50 ohms)

D220T - Dynamic (Available in 200-250 ohms, 500 ohms or High Impedance)

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LOW
For pickup systems requiring embellished lows and good intermediate range.
(25 to 5000 cps.).

FULL
For high fidelity requirements where smooth, flat response and broad range are necessary.
(30 to above 10,000 cps.).

HIGH
For all purposes requiring richness in the higher frequencies. Slightly rising characteristic.
(From 150 to 10,000 cps.).

if impure, is a conductor of electricity, its resistivity being inversely proportional to the content of impurities. Therefore, the processing and dyeing baths utilized in the manufacture of paper and textiles are electroconductive, and the moisture content of the cloth or paper is inversely proportional to the product resistivity. Thus, if the resistance, taken transversely through the cloth or paper, is high, the moisture content is obviously very low. It is this principle which determines the operation of the *moisture content analyzer*.

The electrical circuit of the moisture content analyzer is shown in the diagram given in Fig. 1. In this device, the d-c voltage obtained from an industrial type of power filter-rectifier system is impressed across a measuring circuit consisting of a pair of electrodes, which are in contact with product under analysis, and an electrical measuring shunt having a relatively high resistance. The small voltage developed across this resistance by the product leakage current functions to control an electronic system which, in turn, automatically controls the speed of the product drive-roll motor.

In Figure 1, the industrial type of power supply comprises a source of a-c power. This is the winding *32* on the main power transformer *20* core, the industrial rectifier tube *31*, together with a suitable filtering circuit consisting of the smoothing reactor *30* and two capacitors *29* and *33*. The d-c voltage developed by this circuit is impressed across *bleeder* resistor *28*, as well as the product analyzer circuit and the motor main shunt field *27*. The principal function of resistor *28* involves the discharge of the filtering capacitors *29* and *33*, should the d-c circuit load be disconnected before the a-c power supply connected to terminals *22* and *23* of the power transformer is opened. It also serves to suppress the rise of high voltages across the terminals of field winding *27* in event of an abrupt change in the motor operating conditions.

The necessary processing motion is imparted to the product by drive-roll *26*. The product *1* is thereby drawn between the measuring electrodes *2* and *3*, which are in contact with this material. Since the product is then effectively connected in series with the d-c power supply and the resistor or shunt *4*, a leakage current which is proportional in magnitude to the moisture content of the product flows through the resistor *4*. It is further evident, that the voltage thus developed across this resistor is also proportional to the moisture content of the product. This voltage tends to drive the control grid of the amplifier pentode *7*, positive, with respect to the cathode.

The cathode of pentode *7*, in Fig. 1, is maintained slightly positive with respect to the grounded or negative terminal of the d-c power supply by means of a bias control potentiometer, *6*. The resistance element of this potentiometer, together with that of the potentiometer *10*, comprise a voltage divider which is connected in parallel with the d-c power supply. Since a fixed, constant potential is thus established across the resistance element of the control potentiometer, variation of the potentiometer slider arm position determines effectively the voltage which prevails across resistor *4* to drive the control grid of the amplifier pentode positive with respect to the cathode.

When the voltage developed across resistor *4* tends to drive the control grid of the amplifier pentode positive with respect to its cathode, the pentode plate current increases, and the plate-cathode voltage present here decreases proportionately. This is due to the increased voltage drop developed across the pentode plate loading resistor *11*. As a result, the control grid of thyratron *14*, which is effectively connected to the plate of the amplifier pentode in series with the grid current series limiting resistor *12*, swings negative with respect to its cathode. The latter condition is self-evident when it is taken into account that the cathode of the thyratron is held positive with respect to the grounded or negative terminal of the d-c power supply by a voltage approximately one-half that present across the output terminals of the d-c power supply. This condition is obtained by means of a thyratron bias control potentiometer *10*. The slider arm of this potentiometer is so adjusted that the potential existing between the cathode of the thyratron and the negative terminal of the d-c power supply meets these conditions.

Since it is required that the motor-speed control be continuously variable, thyratron tube *14* is operated as a phase-controlled rectifier. To obtain phase-shift control over the thyratron anode current, the grid-cathode voltage applied to this tube is modulated by a voltage wave which is displaced by 90°, with respect to the plate voltage wave. The plate voltage is obtained from the main power supply transformer winding *15*, in Fig. 1. This is shown as E_1 in Fig. A phase-shifting circuit, comprising the transformer winding *18*, the resistor *16*, and the phase-shift capacitor *19*, in Fig. 1, functions to produce a grid-cathode voltage component which is 90° late in phase with respect to the plate-cathode voltage wave E_1, in Fig. *2*. The grid-cathode voltage component is given as E_2, E_{2a}, and E_{2b}, respectively, for various magnitudes of amplifier pentode plate-cathode potentials, which are shown as E_3, E_{3a}, and E_{3b}, respectively.

An increase in the plate-cathode voltage present across these electrodes of the pentode amplifier results in a proportionate increase or phase-advance in the positive a-c half-cycle which the thyratron *14* conducts. Hence, an increase in the pentode amplifier plate-cathode voltage results in an increase in the *average* current conducted by the thyratron.

The current conducted by the phase-controlled thyratron rectifier passes through the auxiliary field winding *24* of the roll-drive motor. This auxiliary shunt field is wound in a direction opposed to that of the main winding *27*, and therefore, their magnetomotive forces or magnetic fields are opposed. In consequence, an *increase* in the current conducted by the thyratron rectifier results in a decrease of the drive-roll motor field strength, and an *increase* in the motor shaft speed, the latter operation being characteristic of a d-c motor having separately excited fields.

In Fig. 1, the roll-drive motor is shown to impart motion to the product under analysis. Here, the product *1* is drawn between the analyzer electrodes *2* and *3* by the drive-roll *26*. The shaft of the drive-roll is shown directly-coupled to the controlled d-c motor. The armature of the drive-roll motor obtains its power supply from a separate d-c power source, *35* and *36*, in series with the disconnect switch *34*. As a direct result of this arrangement, the electronic analyzer device is small, since it functions to supply only a small portion of the power required for the motor operation.

Under normal operating conditions, the amplifier pentode bias-control potentiometer *6* functions as the moisture level control. It is so adjusted that the product moves at a speed which produces or results in satisfactory drying of the material, after which adjustment the device functions to control the speed of the product in accordance with the percentage of moisture present in the material.

A rise in the product-moisture content results in a greater positive swing of the pentode grid with respect to its cathode, increasing the tube plate current. The resultant decrease in the pentode plate-cathode voltage causes the grid of the thyratron to swing negatively with respect to its cathode, the thyratron plate current decreasing as a result.

Since a decrease in the motor auxiliary field current, which is supplied by the thyratron rectifier, results in a decrease of the motor shaft speed, the product rate of motion also decreases, and the drying time increases proportionately.

Conversely, a decrease in the product-moisture content results in an increase in the amplifier pentode plate-cathode voltage. This is accompanied by a rise in the average auxiliary field current

(*Continued on page 28*)

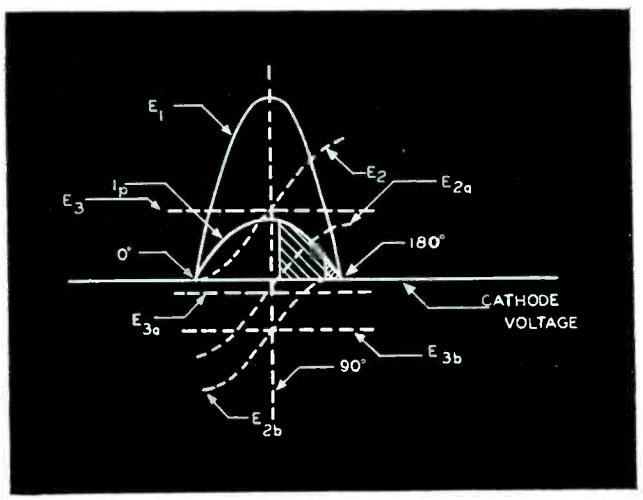

Fig. 2, Thyratron d-c grid control. Thyratron plate-cathode voltage, which is the positive half of the a-c cycle, is shown here as E_1, and the grid-cathode phase-shift a-c component as E_2. When the amplifier pentode plate-cathode voltage is such that the grid d-c component is positive with respect to the cathode, E_3, the thyratron conducts the entire half-cycle I_p from angle 0° to 180°.

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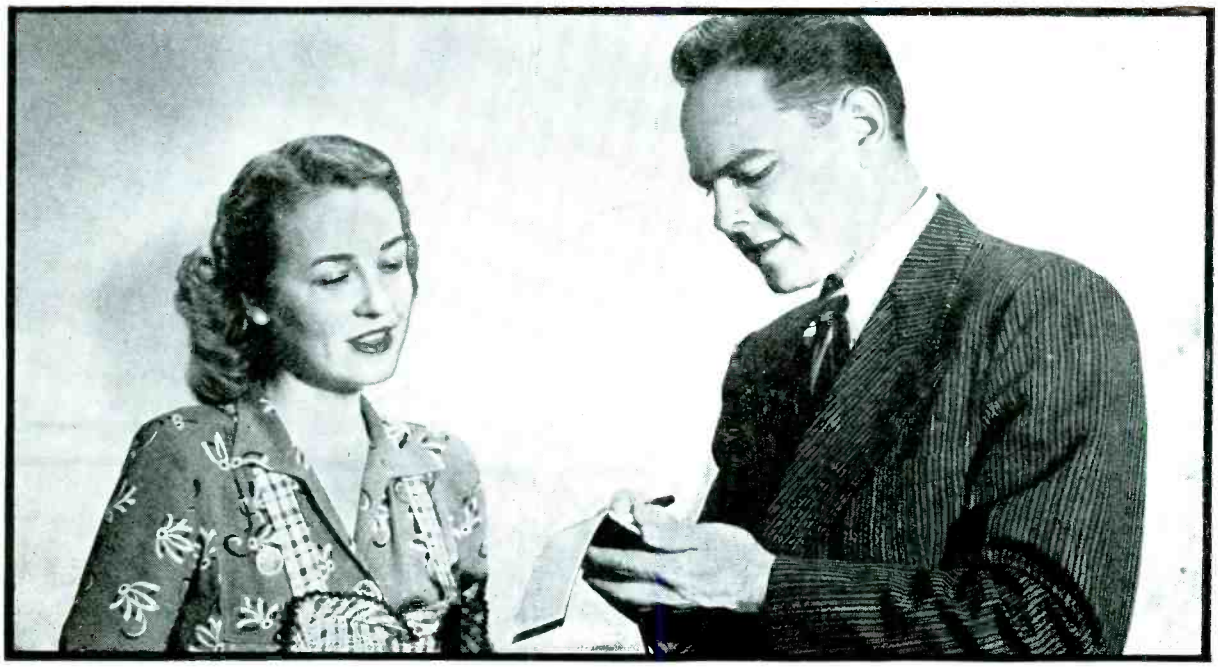

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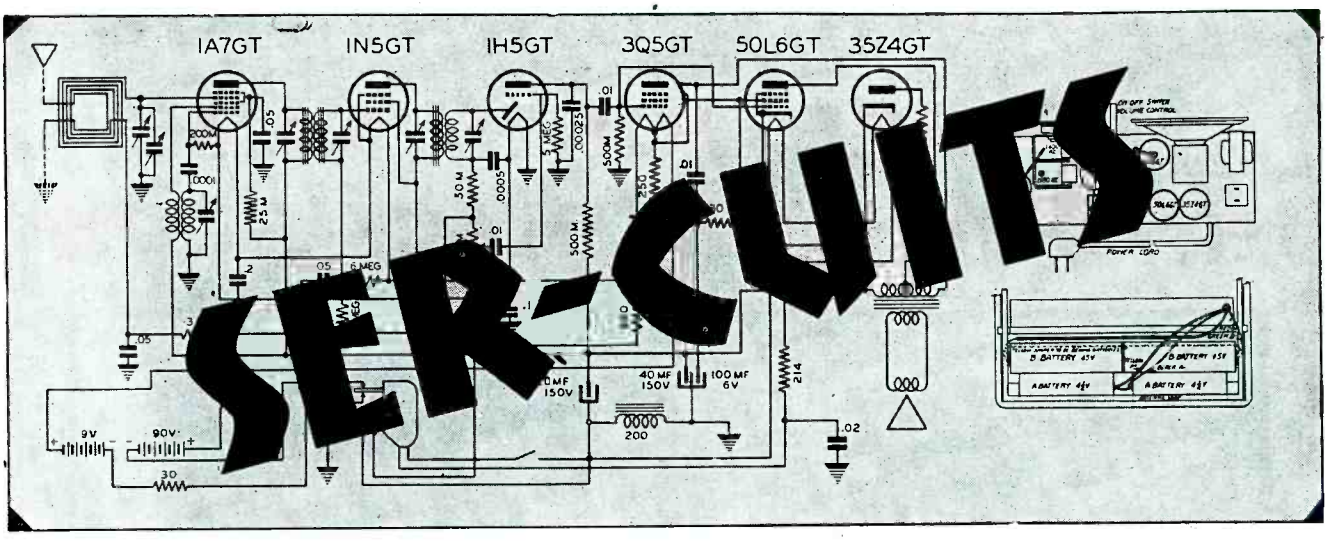
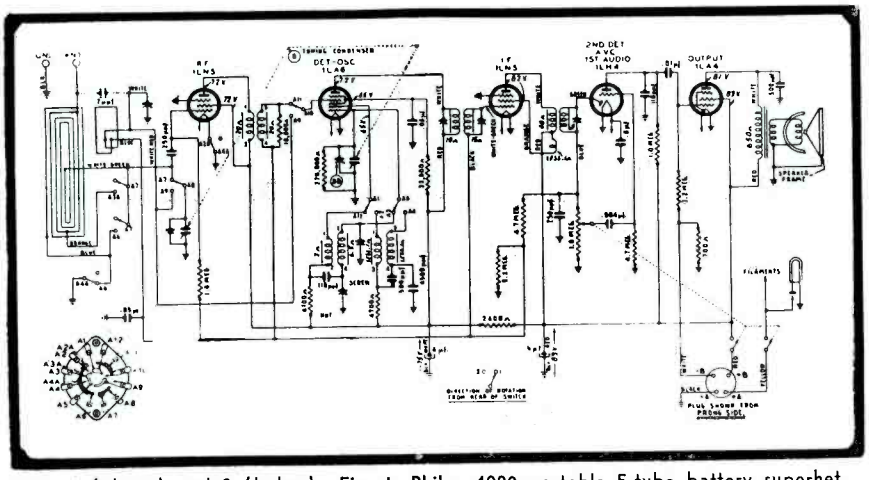


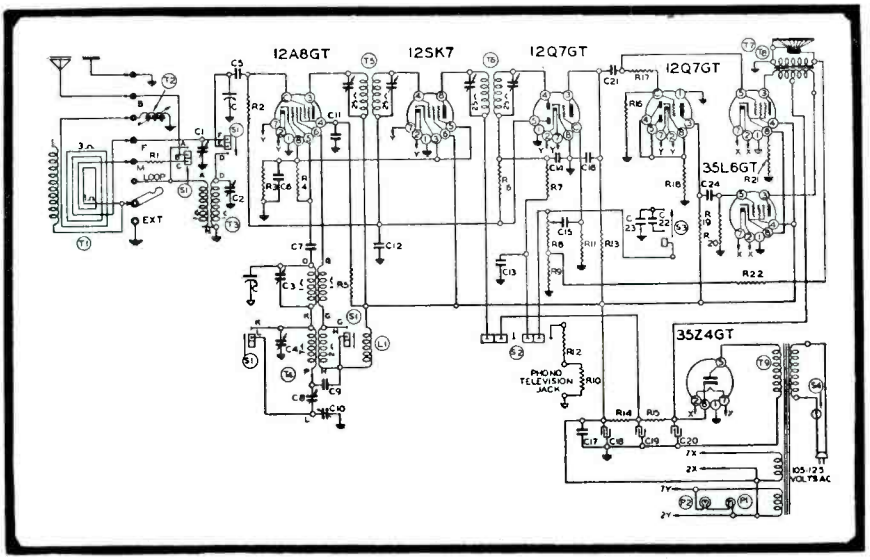
SER-CUITS

by HENRY HOWARD

RECEIVERS using loop-antenna systems ordinarily use specially designed input circuits. The portable 5-tube battery superhet with a short-wave band and twin loops, shown in Fig. 1, uses a broadcast loop with a low-impedance tap for connecting an internal antenna. A dual-shorting switch shorts the ends of the loop and also a separate tap for good measure when switched to short-waves. While grounded for broadcast, the ground is removed in the short-wave position, leaving the loop floating, to act as an electrostatic antenna or antenna plate. This is coupled to the grid of the converter through a

(*Continued on page 26*)





Figs. 1 (above) and 2 (below). Fig. 1, Philco 4080 portable 5-tube battery superhet, using twin loops. Fig. 2, Belmont 794 two-band a-c receiver employing a loop and antenna switching system. At right appears the list of components and their values. In this receiver, oscillator uses two oscillation transformers in series for b-c, the larger being shorted for operation on s-w.

R1	400 ohm—⅓ w.
R2	1 megohm—⅓ w.
R3	100 ohm—⅓ w.
R4	10M ohm—⅓ w.
R5	15M ohm—⅓ w.
R6	3 megohm—⅓ w.
R7	50M ohm—⅓ w.
R8	1 megohm—volume control
R9	10 ohm—⅓ w.
R10	300M ohm—⅓ w.
R11	5 megohm—⅓ w.
R12	3 megohm—⅓ w.
R13	200M ohm—⅓ w.
R14	1200 ohm—⅓ w.
R15	1200 ohm ½ w.
R16	30M ohm—⅓ w.
R17	500M ohm—⅓ w.
R18	5M ohm—⅓ w.
R19	200M ohm—⅓ w.
R20	500M ohm—⅓ w.
R21	200 ohm—1 w.
R22	100 ohm—⅓ w.
C	2 gang variable condenser
C1	B.C. Adj. Trimmer (Antenna)
C2	S.W. Adj. Trimmer (Antenna)
C3	S.W Adj. Trimmer (Oscillator)
C4	B.C. Adj. Trimmer (Oscillator)
C5	.0005 mica
C6	.5 x 100 v.
C7	.00005 mica
C8	B.C. Series pad
C9	05 x 200 v.
C10	S.W Series pad
C11	.1 x 200 v.
C12	.05 x 200 v.
C13	.0001 mica
C14	.0001 mica
C15	.002 x 600 v
C16	.0005 mica
C17	.1 x 200 v.
C18	20 mfd. lytic
C19	20 mfd. lytic
C20	40 mfd. lytic
C21	.02 x 400 v.
C22	.0006 mica
C23	.001 x 200 v.
C24	.02 x 400 v.
T1	Loop Antenna
T2	Loop Adjusting Coil
T3	S.W. Antenna Coil
T4	B.C. S.W. Oscillator Coil
T5	Input I.F.—465 kc.
T6	Output I.F.—465 kc.
T7	10 in. P.M. speaker
T8	Output Transformer
T9	Power Transformer
S1	Band Switch
S2	Phono Radio Switch
S3	Tone Switch
S4	Off-on Switch on volume control
L1	R.F. Choke
P1 & 2	6-8 v. pilot light

C3 and C4 in same unit
C8 and C10 in same unit
C18, C19, C20 in same unit

SYLVANIA NEWS
RADIO RETAILER EDITION

NOVEMBER *Published in the Interest of Better Sight and Sound* 1944

HUNDREDS OF PRIZES FOR RADIO RETAILERS

6th War Bond Drive Keyed to Pacific War

The coming 6th War Bond Drive will be geared primarily to the task facing us in the Pacific, according to Ted Gamble, National Director of the War Finance Division, U. S. Treasury.

"The job of the 6th War Loan," he told the merchant leaders, display experts and press representatives assembled at a luncheon sponsored by the War Advertising Council, "is to sell the war all over again to the people."

Charles W. Alexander, originator of the display plan, stressed the fact that the display contest was designed to give the participants maximum honor, prestige, and prizes.

CONTEST RULES

1. Only displays devoted exclusively to the Sixth War Bond Drive will be considered. And each display must feature a $100 War Bond, or *reproduction thereof.*

2. Photographs of displays should be marked "RADIO DIVISION" on reverse side, followed by the name of the contestant, name and address of the store, dates when and place where the display was on view to the public. Send only photos of displays — not display material.

3. Photographs should be 8" x 10" glossy prints. They may be photographs of a single display, or of a group (in which case, they should be joined together).

4. All photographs become the property of the Contest Committee and will be presented to the U. S. Treasury for its use.

5. Displays will be judged according to sales appeal, originality, attention-value and artistry.

6. All entries are to be mailed to the Sixth War Bond Display Contest, care DISPLAY WORLD, Cincinnati 1, Ohio. The closing date is December 26, and entries must bear a postmark no later than midnight of that date.

Sylvania Sponsors War Bond Display Contest $1000—TOP PRIZE

Hundreds of Radio Service Shops and Radio Retailers from Coast to Coast will have the opportunity to win War Bond prizes totalling $10,500 maturity value, through the Sylvania-sponsored 6th War Loan window display contest. Confined to radio outlets—*and radio outlets only*—the chance of winning will be unusually high for every entrant. What is more, every entrant automatically qualifies for a *state*, *regional* and *national* prize.

JUDGES NAMED TO PICK WINNERS

Panels of judges are being chosen for each state, section, district, and for the nation. The panel will always include one representative of an advertising association, the advertising manager of a concern not competing, a public spirited citizen, a newspaper editor, and a commercial artist.

As the judges will have to make their decision according to what they see on the photographs submitted, Sylvania urges contestants to submit clear, sharp prints.

Ideas Count

Your window may be large or small; your shop may be on the main thoroughfare or a side street but to the judges the decision will be based on the cleverness of the idea and the ingenuity with which it is carried out.

Remember one thing—the window display is to be designed to *sell War Bonds*—not to advertise your services or Sylvania Electric Products, Inc. The more bond selling force you build into your window display, the more chance you have of walking off with one of the really big money prizes.

Who gets the Thousand Dollars

Some radio man is going to get himself a $1000 War Bond. Hundreds of others will get smaller ones. Details are not all complete but write *today* to Sylvania, Emporium, Pa., and get in line for some real dough.

Sylvania will announce complete details of the contest to all dealers and servicemen by means of special mailings.

transformers are used with a high value grid leak, 220,000 ohms. A regenerative 1LN5 i-f stage with a tickler winding on the second i-f transformer provides added sensitivity. A 700-ohm resistor in the B— leg provides bias for the 1LA4 output stage and a dual 6-mfd electrolytic from B+ to ground supplies adequate bypassing.

Belmont 794

A 2-band a-c receiver with a unique loop and antenna switching circuit appears in Fig. 2. In this model, Belmont 794, when the external antenna is not used, a jumper is connected from the loop primary to the short-wave transformer primary. The other end of the loop primary is connected to the antenna post through a 400-ohm series resistor which serves to flatten peaks that exist in long aerials. The antena lead, loop primary and s-w primary contribute to the pickup of the main loop. An iron-core loop-loading coil is used on the ground side. When switched to short-waves, the whole loop structure acts as an electrostatic antenna. When using an external antenna, the jumper is placed from loop primary to ground which gives the proper coupling and stability.

The oscillator uses two oscillation transformers in series for b-c, the larger being shorted on s-w. Both plate and grid windings are shorted and an r-f filter consisting of an r-f choke and a .05-mfd condenser is used in the B+ feed. An unusual but obvious phase inverter is used in connection with the 35L6 push-pull amplifier. This is simply a 12Q7-triode amplifier with a step-down potentiometer, at the input, with a ratio of 30,000 to 530,000 ohms or 1:17.7. This means that the gain of the stage

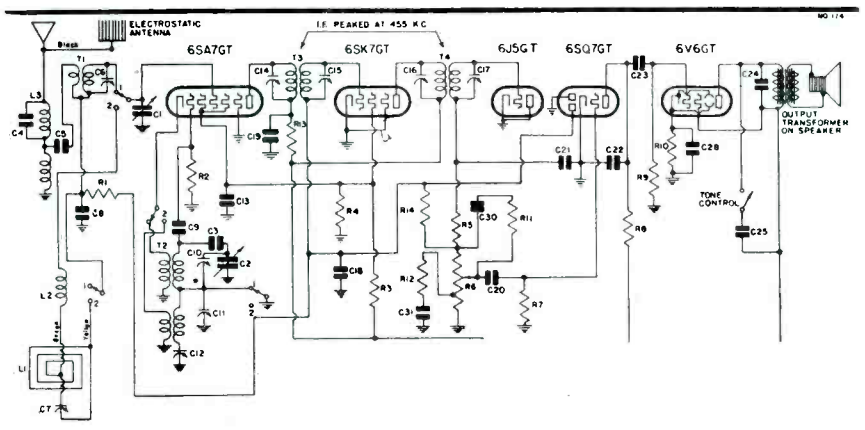
Fig. 3, Emerson EQ-410. A loop and load coil are used on broadcast, and an electrostatic antenna is used on short waves. Component list appears at right.

SER-CUITS

(*Continued from page 24*)

2-mmfd. capacity, supplementing the pickup from the short-wave loop. The 1LN5 r-f stage is used only on the broadcast band.

The first detector is untuned on b-c, a fixed iron-core transformer coupling being used. The transformer secondary is loaded with 10,000 ohms to broaden the response. On both bands the 1LA6 oscillator uses a 4,700-ohm series resistor from B+ to the plate reactor coil. Iron-core oscillation



is just about 17.7 since a gain of 1 is required for a perfect balance. One of the output tubes is driven in parallel with the inverter but a 500,000-ohm isolating resistor separates the grids. The inverter, acting as a stage of audio (even though no amplification is obtained), causes a phase shift of 180° which is necessary for driving the other output tube.

For improved quality this receiver utilizes voltage degeneration from the voice coil to the first audio grid. Tracing the degenerative link, the voltage is picked up from the ungrounded side of the output transformer secondary and fed through a 100-ohm resistor to the low side of the 1-megohm volume control and to ground through 10 ohms. The receiver has a phono switch which connects an input jack to the volume control and simultaneously opens the i-f amplifier plate supply.

Emerson EQ-410

A 2-band receiver, Emerson EQ-410, using a loop and load coil on broadcast and an electrostatic antenna on short-waves, is shown in Fig. 3. An i-f wavetrap is connected in series with the foil and external antennas. Magnetic coupling is used in the short-wave transformer and capacity coupling (across a .003-mfd condenser) in the loop circuit.

T1	Short-wave antenna coil
T2	Two-band oscillator coil
T3	Double-tuned 455 kc first i-f transformer
T4	Double-tuned 455 kc second i-f transformer
T5	Power transformer
L1	Broadcast loop antenna
L2	Broadcast antenna loading coil
L3	Antenna choke and 455 kc wave-trap
R1	100,000 ohm ½ watt carbon resistor
R2	20,000 ohm ½ watt carbon resistor
R3	15,000 ohm 3 watt carbon resistor
R4	40,000 ohm ½ watt carbon resistor
R5	25,000 ohm ½ watt carbon resistor
R6	Volume control .5 megohm with line switch
R7	10 megohm ½ watt carbon resistor
R8	250,000 ohm ½ watt carbon resistor
R9, R11	500,000 ohm ½ watt carbon resistor
R10	240 ohm 1 watt wire-wound resistor
R12	10,000 ohm ½ watt carbon resistor
R13	1000 ohm ½ watt carbon resistor
R14	2 megohm ½ watt carbon resistor
C1, C2	Six-button tuning unit with two-gang variable condenser
C4	0.001 mf mica condenser—Part of L3
C5	0.01 mf, 400 volt tubular condenser
†C6	Trimmer, part of T1
†C7	Trimmer, part of L1
C8	0.003 mf mica condenser
C9	0.00011 mf mica condenser
C10, C11	Dual oscillator trimming condenser
C12	Single adjustable padding condenser
C13, C19	0.1 mf, 400 volt tubular condenser
C14, C15, C16, C17	Trimmers, part of i-f transformers
C18	0.05 mf, 200 volt tubular condenser
C20	0.002 mf, 600 volt tubular condenser
C21, C22	0.0002 mf, 600 volt tubular or mica condenser
C23, C25	0.02 mf, 400 volt tubular condenser
C24, C31	0.005 mf, 400 volt tubular condenser
C26, C27, C28	Multiple dry electrolytic condenser C26, 15 mf—400 volt; C27, 15 mf—350 volt; C28, 20 mf—25 volt
C29	0.01 mf, 400 volt molded condenser
C30	0.00005 mf mica condenser
C3	0.002 mf mica condenser

ELECTRONIC ANALYZERS

(*Continued from page 22*)

conducted by the thyratron. Since the motor field strength is thereby decreased, the motor shaft speed, as also the product rate of motion, increases, decreasing the product drying time.

Maintenance and Servicing Requirements

Since the *electronic moisture content analyzer* is essentially a *production* testing device, speed in its servicing and repair are imperative. However, adequate service or repair are not readily carried out properly when these operations must be carried out hurriedly. The only way in which both may be accomplished without serious loss is the substitution of a spare or emergency unit for the defective device.

Where incorrect operation cannot be readily corrected, the substitution of the spare *analyzer unit* quickly determines whether the defect lies in the electronic device or in the customer's controlled apparatus, which includes the roll-drive motor. Inoperative motor equipment is usually quickly replaced by the manufacturer's own repair staff, again resulting in a further general localization of possible defective equipment. Through application of this substitution method as a means of trouble diagnosis, any continued defect would be rapidly traced to the analyzer electrodes and the associated electrode wiring.

In the event that troublesome operation is due to leaky electrode supports to electrode wiring, as determined with a suitable high-voltage megohmmeter, the most rapid progress in correction of the defect may be effected through replacement of the defective wiring, and thorough cleaning of the electrode supports. Carbon tetrachloride or pentachloride should be used as the cleansing agent, in order to leave a minimum thickness of residual grease film.

Repair of the *anaylzer unit* proper, which consists of the electronic portion of the system mounted in its own integral housing, involves the replacement of defective components, much in the same manner as with public address equipment. Defective tubes, especially thyratrons and gaseous diodes, account for the greatest number of equipment failures. Hence, tube testing is an important phase of the repair or maintenance operation.

The moisture level control potentiometer *6*, in Fig. 1, is of the wirewound

type. Since the *moisture analyzer* is unavoidably in close proximity with a *wet* atmosphere, this potentiometer is subject to corrosion and oxidation. It should be carefully tested and inspected, and subsequently replaced if it shows considerable evidence of rusting. The same procedure applies to the *bleeder* resistor *28,* even though this resistor is coated with a vitreous enamel layer.

Condenser failures are few in equipment of instrument nature, since these are all of the *wet* impregnated types. In event a condenser should fail, however, instrumentation for the defective capacitor is carried out in the manner familiar to radio servicing. Resistors incorporated into the *moisture analyzer* circuit system, other than the moisture level control potentiometer and *bleeder* resistor, are molded-resistance compound units which exhibit no tendency to cause equipment failures. In general, it is evident that the maintenance and repair of precision electronic equipment of instrument grade need present no barrier to the Service Man.

Among the various production testing devices of this nature, the *photoelectronic precision gauge* is of particular interest to the Service Man. This device incorporates nearly all of the principles conventionally applied to electronic production testing devices.

The Photoelectronic Precision Gauge

One of the most difficult operations arising in the mass production of machined or turned plastic or metal machine components involves the inspection of the finished pieces. This inspection must be rapid, yet precise. Prior to the advent of electronic testing devices, various types of fixed mechanical gauges were employed to determine whether the inspected part adhered to the desired specifications. However, these fixed gauges were subject to considerable wear, in addition to the cumbersome nature of their application.

The *photoelectronic gauge* avoids all of the difficulties met in mechanical gauges, since the part under measurement partially intercepts only a narrow beam of light while under inspection. Once this device is calibrated, therefore, it provides unerring measurements over considerable periods of time without further attention. Further, these measurements are accurately made even by unskilled personnel because of the simple nature of this operation. In isolated instances, such as those incident to the inspection of numerous similar pieces, the measurement operation is carried out automatically. Under these conditions, the *photoelectronic gauge* functions to remove from the production line all processed pieces which do not adhere to the specified tolerances.

Usually, the *photoelectronic gauge* is a relatively simple device, and is so designed as to be utilized in multiple arrays. Here, one of the basic gauge units is adjusted to reject measurements having less than a given minimum tolerance, and another rejects, of the remainder, those items which exceed the given maximum tolerance. When these two inspections are completed, the processed pieces which were inspected without causing either unit of the inspection array to operate are obviously within the

(*Continued on page* 33)

AVC SYSTEMS

(*Continued from page* 11)

from 5% to over 20% at 400 cycles.

The time constant is the next important factor. In an *RC* circuit

$$T \text{ (seconds)} = R \text{ (megohms)} \times C \text{(microfarads)}$$

It should be noted that the time constant is a function of all the *RC* circuits in the avc system. This is important in the design of avc systems, since the effect of large signals must be transferred instantly to the r-f section to prevent blasting. It will be noted that the values of the resistors and condensers are influenced by two more factors. The total permissible resistance introduced into the grid circuit of a tube is limited by its rated input load. For example, in Fig. 1, the total R in the grid circuit of the r-f tube is the sum of R_{F1}, R_{AVC}, and R_L. Again, the avc bypass condensers must be sufficiently high so that no detuning effects are introduced into the tuning circuits. Note the position of C_F and C_{F1} in Fig. 1.

To minimize the loading effects of the avc system on the audio response, the voltage is sometimes taken from the plate of the previous i-f stage, Fig. 2. While some distortion is introduced into the detector by this method, the audio loading effect is reduced, and the avc voltage is increased. This increase is due to the higher r-f voltage across the primary of the last i-f stage.

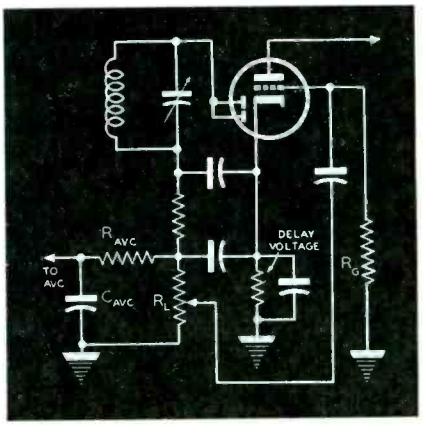
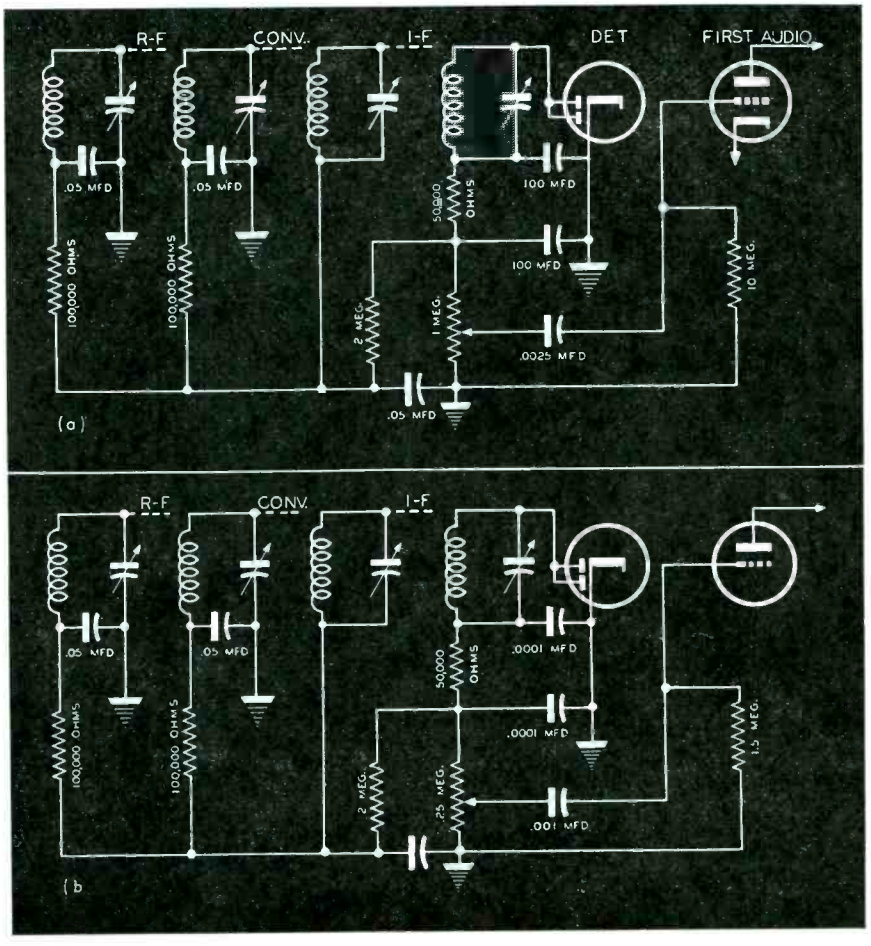


Fig. 3. A simple form of delayed avc. No avc action takes place until the signal voltage is greater than the delay voltage.

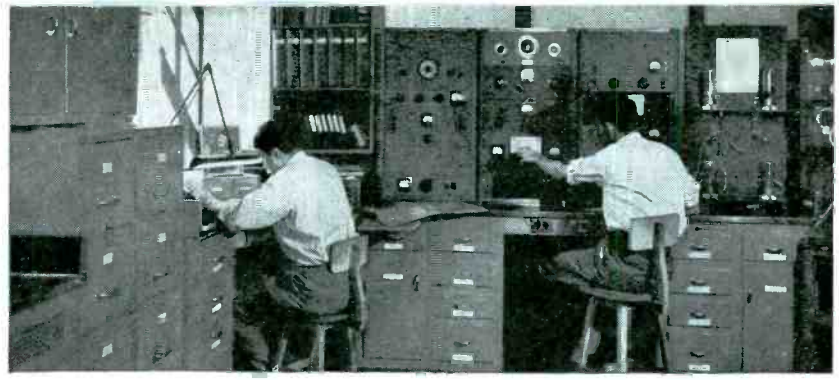
Delayed avc is used where it is desirable to have no avc bias applied to

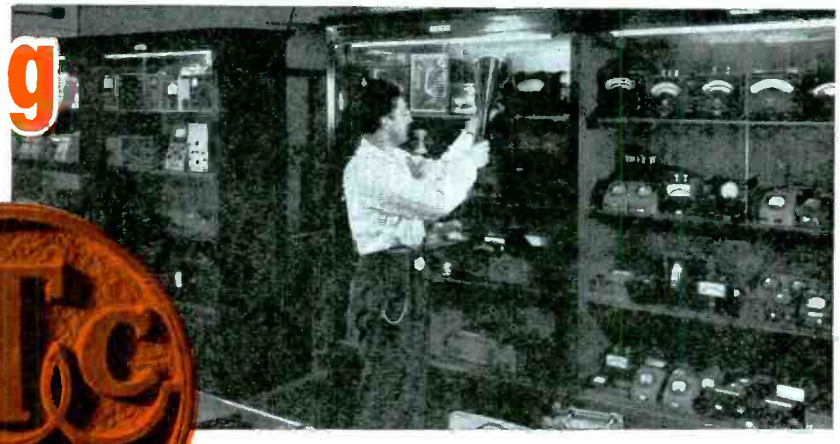
(*Continued on page* 32)

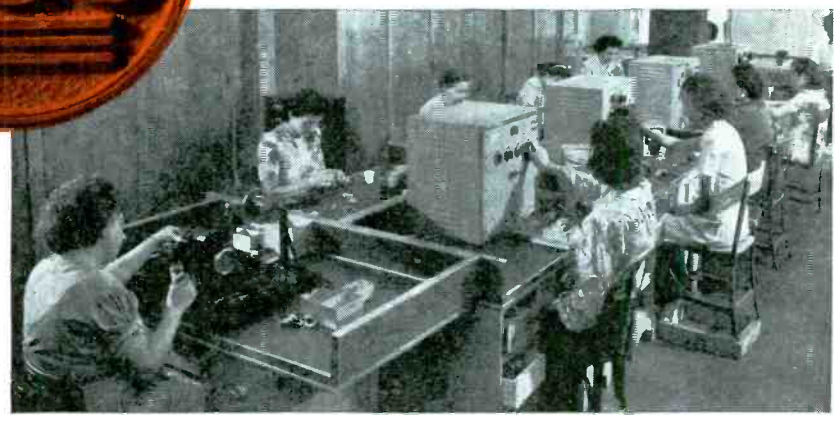
Fig. 4. Two typical avc systems. Note that component values in the audio portion follow a definite pattern in both systems.

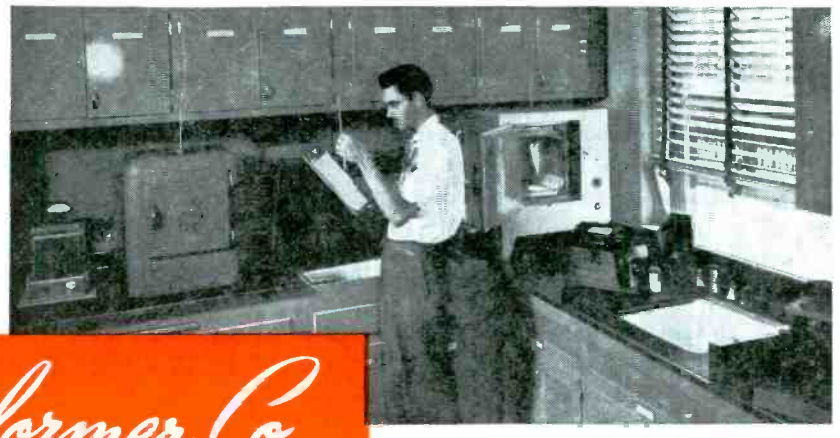


Engineering at UTC









A

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(*Continued from page* 30)

the r-f section until a predetermined signal level is attained, Fig. 3. Here the delay voltage is the bias voltage in the cathode return of the duo-diode triode, usually 2 to 3 volts. In addition, the delay voltage has a tendency to improve the avc action so that a flatter characteristic is obtained for an increase in signal strength.

The time constant of the avc system bears an important relationship to the operation of the receiver. A fast time constant is best for short-wave reception, since a faster reaction is obtained to a fading signal. On the other hand, a fast acting avc tends to reduce the bass response. All band receivers usually are a compromise between these two factors, and operate at a time constant of .1 to .3 seconds. High-fidelity receivers use time constants of .2 to .5 seconds.

Figs. *4a* and *4b* show two typical avc systems as used in b-c receivers. It will be noted that the volume controls are respectively 1 megohm and .25 megohm. If, in Fig. *4a*, the 1-megohm volume control were replaced with a .25-megohm control, the circuit constants would be adversely affected. The time constant would be materially increased, the avc voltage would be considerably reduced, and the previous i-f stage would tune more broadly, due to the increase in loading effect. All these factors had been considered by the design engineer. Fig. *4b* is used to demonstrate the other extreme. Here, the circuit has been designed to use a .25-megohm volume control. If this control were replaced with a 1-megohm control, other faults would be introduced. The loading effect of both the avc system and the grid circuit of the following stage would be increased. The total resistance in the grid circuit of the tubes in the r-f section may go beyond their recommended value. The time constant may increase to such value that if the set had a short-wave band, the fading of signals would be audibly affected. Another common practice is to increase the value of the audio-coupling condenser to improve the bass response. True the bass response will increase, but the additional loading effect on the detector will increase the harmonic distortion a good deal faster.

With the high-power stations operating today, the usual r-f voltage fed to the diode, if measured with a v-t voltmeter would be found to be in the neighborhood of 10 to 20 volts. Using this as a reference, the avc system may be readily checked for correct operation by measuring the bias voltages applied to the various tubes. The avc system is also a frequent offender in fading cases, particularly the bypass condensers. Increases in the value of the filter resistors to the various r-f stages tend to cause distortion. The same is true of the volume control, and quite often it will be found that this control has risen considerably in resistance due to wear.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of SERVICE—A Monthly Digest of Radio and Allied Maintenance published monthly at New York, N. Y., for October 1, 1944.

State of New York } ss.:
County of New York }

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared B. S. Davis, who, having been duly sworn according to law, deposes and says that he is the Business Manager of SERVICE—A Monthly Digest of Radio and Allied Maintenance, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, Bryan Davis Publishing Co., Inc., 19 East 47th Street, New York, N. Y.; Editor, None; Managing Editor, F. Walen, Union City, N. J.; Business Manager, B. S. Davis, Ghent, N. Y. 2. That the owners are: Bryan Davis Publishing Co., Inc., 19 E. 47th St., New York 17, N. Y.; B. S. Davis, Ghent, N. Y.; J. C. Munn, Union City, Pa.; A. B. Goodenough, Port Chester, N. Y.; P. S. Weil, Great Neck, N. Y.; F. Walen, Union City, N. J.; G. Weil, Great Neck, N. Y.; L. Winner, New York, N. Y. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities, are: None. 4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock, and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) B. S. DAVIS, Business Manager.

Sworn to and subscribed before me, this 19th day of September, 1944.

(Seal) FRANKLIN B. GOOLD, Notary Public.

Commission expires March, 1946.

ELECTRONIC ANALYZERS

(*Continued from page 29*)

specified limits, and therefore acceptable. Such an inspection arrangement is known as a *go-no-go array*.

An interesting electronic circuit is used in the *photoelectronic gauging* unit. A departure from conventional *industrial* electronic system practice is here represented in the thyratron control of signal lamps as a means of measurement tolerance indication.

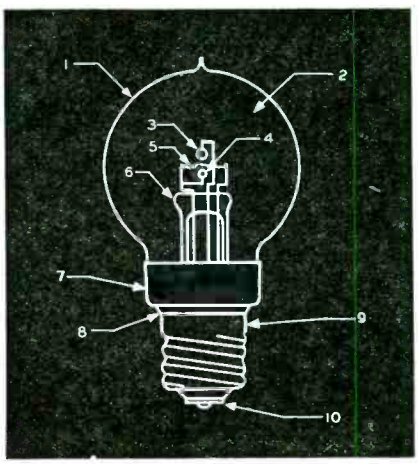
In order that the measurements accomplished with the aid of this device be precise, it is necessary that the light beam focus, above the inspected item *1*, be concentrated to the minimum diameter possible. This diameter is, however, dependent on the dimensions of the light source filament. Lamps intended for photoelectronic applications are usually provided with filaments having a small overall area. Despite this design precaution, the filament area is still too great for accurate light beam gauge systems, and added care must be taken in the selection of the light source lamp.

The light source is a special form of the incandescent lamp, known as the *Point-O-Lite*. Its glass envelope contains, in addition to a filament which has a low operating temperature, a small tungsten sphere and a rarefied inert gas atmosphere. A detailed illustration of the construction of this lamp is given in Fig. 3.

When the *Point-O-Lite* lamp is in operation, an ionized arc path is developed between the filament and the second electrode which is actually an anode, or *plate*. Due to the intensity of the current in the arc path, the temperature of the plate sphere is raised to incandescence. However, since the lamp filament operates at a relatively low temperature, serving merely to provide an electron stream required for the ionization of the gas atmosphere, the actual source of illumination in the lamp is the plate sphere. This, in the *Point-O-Lite*, the actual area of the light

(*Continued on page 36*)

Fig. 3, Point-O-Lite, with a brilliant light source of small emitting area, plate sphere *3*. The glass envelope *1* contains a rarefied inert gas atmosphere *2*. An intense arc, developed between the filament *5* and the plate sphere, heats the latter to incandescence. The filament is connected to the plug shell *9* and solder knob *10*, the sphere to auxiliary shell *7*. An auxiliary sphere *4*, directly connected with the filament leg, serves to protect the filament in event of over-voltage surges.



THE EPEI CONFERENCE

A RECORD attendance of over 1400 was established at the first Electronic Parts and Equipment Industry Conference held in Chicago on October 19, 20 and 21, at the Stevens Hotel. Distributors, representatives, manufacturers and allied radio and electronic specialists from all over the country registered. Informative papers were presented by such authorities as John Creutz, Chief of the Domestic and Foreign Branch, Radio, Radar Division, WPB; Edward Butler, manager of the marketing division, P. R. Mallory & Co., Inc.; Herbert Clough, vice president, Belden Manufacturing Company; Dr. W. R. G. Baker, vice president in charge of electronics, General Electric Company; R. C. Sprague, president, Sprague Electric Company; K. C. Burcaw, Radiart Corporation; William J. Halligan, Hallicrafters Company; Commander W. C. Eddy, USN (Ret), Commanding Officer of the radio training schools in Chicago; Brig. Gen. J. V. Matejka, Chief of Personnel and Training Service, Office of Chief Signal Officer; Whipple Jacobs, president of Belden Manufacturing Company; and William O. Schoning, president of the Lukko Sales Corporation, who was elected president of the National Electronic Distributors Association (NEDA) for the 1944-45 period.

The future of the radio parts industry was effectively analyzed by R. C. Sprague. He said that the conference represented action in the right direction at the right time. He pointed out, too, that the meeting was a big step towards the mutual solution of many problems common to the industry.

Analyzing the prospects of the industry, Mr. Sprague said:

"One always hesitates to introduce statistical figures. They can be taken too seriously or can be misunderstood. However, I would like to give you just a few facts. No one but the world's worst pessimist can deny they indicate substantial business for some time to come, without any wishful hoping for the early introduction of the many new electronic products that will come on the market during the post-war years.

"In 1922, there were only 60,000 radio-equipped homes. The industry, growing by leaps and bounds, reached an estimated 30,000,000 radio-equipped homes in 1943. The grand total of radio sets in the United States in 1943 has been estimated as approximately 60,000,000 sets.

"From several reports which I have seen, the estimated number of these radio sets which are out of commission at this time, range all the way from 4 to 15,000,000. My personal opinion leads me to believe the latter figure to be more nearly correct, with that number increasing daily.

"In 1941, 130,000,000 tubes were manufactured, of which 31,000,000 were sold as replacements. In the same year, $65,000,000 worth of radio replacement parts and supplies, not including tubes, were sold at retail.

"Some estimates have placed postwar manufacture of civilian sets—i.e., after the end of the German and Japanese wars—and after all Government restrictions have been lifted and reconversion completed, at 16 to 17,000,000 sets per year

In the exhibit hall at the EPEI Conference, left to right: Brig. General J. V. Matejka; H. W. Clough; Lt. Kay Snyder, WAC; Commander W. C. Eddy, USN (Ret.), and William J. Halligan.

for the first few years. This will naturally mean increased production for parts manufacturers and a widely-expanded market for replacement parts of all types as soon as repair men become available.

"Another authority estimates postwar production of tubes and replacement parts as follows: In the year, 194-x, 200,000,000 tubes for new sets and for replacement. In the same year, 194-x, $100,000,000 worth of replacement parts, not including tubes, 195-x is defined as the first *full* production year following complete victory over Germany and Japan.

"Back of this latant demand is the prospect of new developments too numerous to list. If only a small fraction are ever realized, we are assured that our radio-electronic industry will be kept young, alert, and continually looking ahead to new and greater fields. The saturation point is not yet in sight. We are only at a new beginning of greater public usefulness and resulting greater business!"

Paying tribute to the jobber, Mr. Sprague said:

"That 45 to 50,000,000 of the nation's 60,000,000 radio sets have been kept going can be chalked up to your everlasting credit. Equally important, is the cooperative service rendered by you jobbers in constantly advising manufacturers of your needs, and in keeping on hand inventories from which to supply manufacturers and government laboratories with urgently-needed equipment and parts."

Mr. Sprague also revealed that a radio parts industry coordinating committee had been formed, with J. J. Kahn as chairman. Describing this committee, Mr. Sprague said: "Its purpose is to help solve problems common to manufacturers and distributors of radio parts. The membership of this committee consists of three members from the parts division of the RMA; two members from the Association of Electronic Parts and Equipment Manufacturers (formerly the Sales Managers Club, Western Division): two members from the Sales Managers Club, Eastern Division; and six members from the National Electronic Distributors Association. These four sponsoring organizations represent in the aggregate, 189 radio parts manufacturers, and 325 radio parts jobbers. I have no economic radar with which to penetrate the future and tell you exactly what is ahead for all of us in the radio parts industry, but I feel sure that we can make of it what we will, and, therefore, it seems to me that this committee has great future possibilities. It is the first time there has been an opportunity for parts manufacturers and jobbers to sit down around the table together and work out their common problems."

(*Continued from page 33*)

source proper, which is the anode sphere, is comparatively small.

Since, in any tightly-focussed light projection system, comprising a light source and a suitable lens, such as the convex lens, the cross-section of the light beam at the point of focus is directly dependent on the area of the source of light. Hence, in the system employing the *Point-O-Lite*, the cross-section of the beam at this point is very small.

The transmitted light is arranged to fall, if it is unobstructed, on the photoelectronic camera lens in such a manner that a considerable portion of the phototube cathode is illuminated. If the height of the measured part, inclusive of that introduced by the interposition of the gauge cradle, above the true surface, is such that a portion of the light beam is obstructed, the illumination falling on the photoube cathode is proportionately decreased. As a result of these conditions, a small change in the height of the measured component above the true surface affects a considerable change in the illumination incident on the phototube cathode.

Inasmuch as the phototube anode-cathode resistance is inversely proportional to the illumination incident on the phototube cathode, a change in the illumination of the phototube cathode results in a proportionate change in the flow of the tube plate current.

Then the voltage appearing across the phototube plate-loading resistor is directly proportional to, and varies directly with, the phototube illumination. Consequently, an increase in the height of the measured object reduces the phototube illumination, and in consequence voltage apparent across the plate loading resistor.

The voltage appearing across the phototube plate loading resistor is, in the *precision electronic gauge*, compared with a constant pilot or standard voltage. This voltage difference is subsequently amplified by a high-gain static voltage amplifier. The voltage standard is developed by the gaseous glow regulator tube under the control of the calibration potentiometer. That is, the calibration potentiometer is arranged as a voltage divider, connected in parallel with the regulator tube in such a manner that a suitable constant potential is secured between either of its resistance element terminals and the slider arm. Here, the voltage component existing between the positive terminal of this potentiometer and its slider arm is designated as the pilot or standard potential. The ohmage of the resistance element of this potentiometer is low in comparison to the series resistance of the phototube and the phototube plate loading resistor. This, together with the fact that the current in the phototube circuit at any time is small, effects a virtually negligible change in the standard potential regardless of the phototube current variation.

It has been shown that an increase in the height of the measured object results in a decrease of the voltage appearing across the phototube pate loading resistor. As a result, the grid of the pentode static voltage amplifier pentode swings negatively with respect to the cathode, resulting in a reduction of the tube plate current. As a further result, the voltage drop across the pentode plate loading resistor decreases and the pentode plate-cathode voltage increases. Hence, an increase in the height of the measured machine part results in an increase in the plate-cathode voltage of the pentode.

The slider arm of the potentiometer is permanently adjusted in such a manner that the potential between the slider arm and the cathode of the pentode is exactly one-half that existing between the positive terminal of the d-c power supply and the cathode of this tube. If, therefore, the potential between the pentode anode and cathode is exactly one-half that existing between the positive terminal of the d-c voltage supply and the cathode of this tube, the grid-cathode potentials of the thyratron tubes are zero, and both tubes tend to conduct. These thyratrons, however, are tetrodes, and, as such, require that the control grid be positive with respect to the cathode on the order of several volts in order that the tube conduct.

Signal Lamp Assembly

A suitable signal-lamp assembly is connected in series with each thyratron anode. These lamp assemblies are provided with removable color lenses or caps, usually red and green, depending on the position of the gauge unit in the inspection array. The lamps may be provided with either a red or green lens, which will be discussed in a later paragraph. It should be observed here that the a-c voltage developed by the windings is slightly more than twice the normal lamp filament voltage. The excessive voltage across either of these windings is necessary since the illumination emitted by the filament of the signal lamp is directly proportional to the *temperature* of the filament. In addition, the thyratron tube is a *half-wave* rectifier, which indicates that the true power in the rectified output is slightly less than half the product of the a-c voltage and the normal lamp filament current.

Conventional Arrays

In the conventional *go-no go array*, two of these inspection gauge units are employed, the first having the red lens cap on the lamp assembly which indicates excessive height, and the second incorporating the red lens cap in the lamp assembly, which indicates a deficiency in the object height. In addition, the standard test object used to calibrate the first unit is machined to slightly less than the maximum desired tolerance, and the test object used in the calibration of the second unit is slightly more than the minimum desired value. Thus, if the objects to be measured are gauged in the cradle of the first unit, each lighting the red indicator lamp, they are rejected for excessive height. If neither, nor the green indicator lamp is illuminated, the objects are then gauged in the cradle of the second unit, wherein either lamp is dark, or the green lamp is illuminated, if the objects are of the correct height. Such an inspection array may be operated in a rapid and correct manner by relatively unskilled hands, though the array is usually incorporated into an automatically-controlled inspection system when the number of objects to be measured is great.

The gauge circuit is so adjusted, by means of a calibration potentiometer, that the indicator lamps are dark when the height of the measured unit is at the correct level. A subsequent decrease in height results in illumination of one of the lamps.

R-F AMPLIFIERS

(*Continued from page* 13)

little plate bending and the valuable assistance of a trimmer we get by in most cases. At one time copper slugs were inserted in broadcast-band coils for tuning the low frequency end.

No discussion of r-f amplifiers could afford to omit the double-tuned band-pass type of amplifier which is so popular in fixed-tune i-f amplifiers. Fig. 7 shows a double-tuned antenna input circuit with two types of antenna coupling. With close coupling, double tuning can be made to give a double hump resonance curve approximating a flat topped band-pass characteristic, valuable for high fidelity reception and even more valuable for wide-band amplification as in television. In all-wave receivers where a single antenna goes through all kinds of resonance points the 2-method antenna coupling will prove valuable.

On short waves r-f amplification is very difficult. Special tubes with very high mutual conductance and low capacities are necessary to realize a high gain. Since the war, many of these type tubes have been designed. These will benefit short-wave reception of the future, involving v-h-f (television and f-m) and, perhaps, also u-h-f.

RECEIVER-RECORDER

(See Front Cover)

INCREASED interest in recording prompted the development of complete recording systems for combination radio-phonos that are comparable to many special individual unit types. An interesting example of this advanced design appears on the cover this month. This combination radio-phono-recorder, Belmont 797, is a two-band chassis with dual loops. A 2-stage microphone pre-amplifier drives the 6V6 output stage which powers a high impedance crystal cutter. The microphone is also a crystal.

The mike amplifier uses two 6SQ7 triodes in a resistance-coupled amplifier with grid-leak bias. None of the diodes are used but they are grounded to prevent undesired pickup from static fields such as hum, clicks, etc. The first stage uses a 5-megohm grid leak, a 500,000-ohm plate load and a 50,000-ohm 8-mfd decoupling and hum filter. The second stage has a 1-megohm volume control, 10-megohm grid leak, and 500,000-ohm plate load. No switch is provided to kill the amplifier. Thus the volume must be turned down when not in use.

A 6SQ7 detector-first audio operates independently of the mike amplifier. A crystal phono pickup switches into the high side of the regular receiver 1-megohm volume control for playback. The tone-control, consisting of a .006-mfd condenser and 1-megohm rheostat, is connected from plate to ground. This control will also influence the mike channel.

Two output circuits are used in the final audio stage, the usual output transformer for the speaker and an impedance coupling for the crystal cutter with the primary of the output transformer serving as the impedance. The coupling circuits are switched in the following manner: In *radio* or *playback* position, the speaker represents the full load, the cutter being disconnected. In *recording* position, a 6-ohm, 5-watt resistor is placed across the output transformer secondary and a 150-ohm, 1/3-watt resistor is connected in series with the speaker for muting.

A 2-lamp neon recording level indicator is connected in parallel with the cutter, one lamp being marked *normal level,* the other *overload.* The *normal* lamp is connected in series with a .2-megohm resistor, while the *overload* lamp is connected to a potentiometer consisting of two .2-megohm resistors in series. These indicators serve the purpose very well. And they are inexpensive and take little power.

OLD TIMER'S CORNER

by SERVICER

ALWAYS get a kick out of watching the boys use some of the newer test equipment. Gosh! What's it going to be after the war releases the flood of specialized test units which are supposed to tell you in just so many words what is wrong with the set under investigation?

Remember an old doctor who was grabbed out of retirement when the War took the younger men away. He came into the house and looked down my youngster's throat, stuck a thermometer in him, listened to his chest and heart then gave the youngster a lollypop!

"Nothing wrong with that kid that a good dose of castor oil won't fix!", he said. I thought about all that our doctor had said about that sort of treatment, and the fancy drugs beginning with "sulfa," which I had paid through the nose to obtain, and I asked the old timer what about that.

"Well," he opined, "it's this way. There are times when those new drugs are the only thing that will do. But that does not say that the old-fashioned remedies are not still being used quite a bit when they, too, will give us the answer!"

Common Sense

That's the way it is with the new test equipment. There's no doubt that it will do a job, and a very good one, too. But the test rig has not yet been built which will take the place of *good old common sense!* The screwdriver and the earphones with a battery and the ohmsifter still have their place on the Service Man's bench, if coupled to an active noggin!

Watched one young medical dischargee of the Signal Corps tussling an RCA chassis with a signal chaser, an electronic voltmeter and a 'scope. Seemed the set didn't work and the voltmeter showed voltage at all the plates of the tubes. But nary a sound came from the set. Tubes checked OK, as did the resistors and the coils. Finally one of the local oldsters, who had been servicing sets before the youngster was out of three-cornered pants, ups and makes a comment. "Why not check the screens of those tubes?" Yep, that was the answer. Bad connection to one of the screens. With no juice at that point, there was voltage at the plates, but little current. The remedy could have been found *without* any tools, just a good pair of eyes, properly used!

See what I mean?

Television

Then there're the things that are in the offing. When *television* comes of age, and *f-m* gets around more than it does right now, the radioman will be much in demand to make the rigs work. And the secret is going to be in the antenna installation. You can't expect just any old sky-hook to work just because it is insulated and the wire put up on the roof. No, sir! It will require a bit of knowledge on the subject of antennas, their resonant qualities, and the short-wave spectrum and its foibles. This information will doubtlessly be furnished by many manufacturers. But it will, of necessity be stylized and not meet every situation which will arise when you finally climb that last rickety fire-escape ladder and let yourself out on that dirty roof!

Books and Study

It will pay the Service Man to get next to some of the very books which he has been avoiding for, lo, these many years. Here is one place where the old common sense ideas which we mentioned earlier won't work. You just will have to know what length to make that dipole, how many feet of lead-in you can use, where the best place for mounting is, and why the set does not work after you have all that figured out. But I can assure you that it is not hard. The mathematics are not more complicated than the average income tax return. Only addition, subtraction and division are needed to complete a very respectable installation.

Well, gotta go now, but will be seeing you very soon again. Meanwhile, keep plugging!

NEWS

AARON ELECTED PRESIDENT OF THE REPRESENTATIVES

At the annual meeting of The Representatives held at the Hotel Stevens in Chicago on October 20, Irvin I. Aaron was elected president; Royal A. Stemm was named vice president; and David Sonkin, secretary-treasurer.

Members of the new board of governors are: Sam MacDonald, chairman, Philadelphia; Dan Bittan, New York, Perry Saftler, New York; Leslie M. Devoe, Indianapolis, and Earl Dietrich, Cleveland.

On the nomination committee are: J. T. Hill, Los Angeles; Russ Hines, San Francisco; Samuel Jeffries, Philadelphia; Vernon MacNabb, Indianapolis; and Hal Corry, Dallas.

The industry relations committee now consists of: Bob Breuer, chairman, New York; Bob Campion, Dallas; Dan Marshank, Los Angeles; Ray Perron, Boston; and Art Baier, Cleveland. Ben Joseph of New York was named advisory publicity counselor.

Five new members-at-large accepted, are: Richard A. Hyde, 4253 Quitman St., Denver, Colorado; Gail Halliday, 1526 Ivy St., Denver, Colorado; Leonard D. Allen, 135 Spring St., and Marshall T. Ball, 135 Spring St., Rochester, N. Y.; and Franklin Y. Gates, 19 West South Temple, Salt Lake City, Utah.

A new chapter in the Seattle, Washington, district, *Pacific Northwest Chapter*, was inducted. Officers are: Dave M. Lee, president; Don C. Burcham, vice president; Lloyd D. Marsh, secretary-treasurer. Other members of the chapter include A. S. Detsch, Merton A. Dobbin, James J. Backer, R. C. James, Jr., Verner O. Jensen and George D. Norris.

The Representatives, now 9 years old, has a membership of 230.

* * *

BILL SHAW NOW TAYLOR TUBE CHIEF INSPECTOR

William Shaw, W9UIG, formerly engineer for G. E. X-Ray Company has been appointed chief inspector of Taylor Tubes, Inc., 2312 Wabansia Avenue, Chicago.

* * *

BERLIANT JOINS CONCORD RADIO

Ed Berliant has been named manager of the Atlanta branch of the Concord Radio Corporation of Chicago and Atlanta.

From 1933 to 1941, Mr. Berliant was in charge of the amateur and industrial departments of the Sun Radio Co., Mr. Berliant was general manager of the Aeronautical Radio Mfg. Co. from 1941 to 1944.

* * *

WALKER-JIMIESON MONTHLY AVAILABILITY LISTS

A 32-page *Industrial Availability* booklet has been issued by Walker-Jimieson,

311 South Western Avenue, Chicago. This issue lists such items as tubes, test equipment, industrial sound systems, timers, relays, constant voltage transformers, condensers, resistors, flashlight storage batteries, pencil soldering irons, industrial switches, photoelectric units, fluorescent lamps, plastic wiring systems, steel tool room equipment, die-less duplicating tools, electric drills, saws, grinders and other tools available *from stock*.

* * *

SYLVANIA TUBE BULLETIN

Nine types of electronic tubes for specialized applications are described in a new 24-page bulletin, 202, published by Sylvania Electric Products, Inc., Special Products Division, 60 Boston Street, Salem, Mass. Products described include strobotrons for the study of reciprocating and rotating motion; Pirani and thermocouple tubes for measuring vacuum; voltage regulator tubes; facsimile tubes; germicidal tubes; black light and near ultraviolet lamps. Technical sections of the bulletin give specifications, basic circuit diagrams and suggested applications for products and accessories.

* * *

RAYTHEON ON BLUE NETWORK

The Raytheon Manufacturing Company recently launched a coast-to-coast program over the Blue network, featuring the famous All-Navy program, *Meet Your Navy*.

Broadcasts come from the huge Great Lakes Naval Training Center at Great Lakes, Illinois. Featured are talented bluejacket soloists, 65 bluejacket musicians who in civilian life played for some of the best *name bands* in the country, a choir of 200 bluejacket vocalists, Navy heroes recently returned from victorious Pacific battles, and many other star acts, making up a total cast of approximately 275.

At the first of the Raytheon series of coast-to-coast "Meet Your Navy" broadcasts. Left to right: L. K. Marshall, president of Raytheon; Rear Admiral Arthur S. Carpender, Commandant of the Ninth Naval District, and Burton Browne, of the agency handling the program.

* * *

HAINES CATALOG

A 1945 catalog covering wire-wound resistors with ratings, characteristics and bracket and terminal schematics, has been issued by Haines Mfg. Corp., 246 McKibbin street, Brooklyn 6, N. Y.

* * *

CROSLEY ADVANCES RASMUSSEN

James H. Rasmussen has been appointed general sales manager of the manufacturing division of The Crosley Corporation. He will have the responsibility for all sales activities of the manufacturing division.

Mr. Rasmussen has been with the Crosley Corporation since 1941 and had been commercial manager of the manufacturing division before his promotion to his present post.

* * *

DU MONT APPOINTS CANADIAN DISTRIBUTOR

Cyclograph Services Ltd., 12 Jordon Street, Toronto, Ontario, has been named distributor for Du Mont cathode-ray tubes, oscillographs and cyclographs in Canada.

The Canadian appointee will function not only as sales and field engineering organization, but also in the maintenance and repairs of Du Mont equipment in the Dominion, succeeding Burlec, Ltd.

* * *

BAGGS NOW IRC MERCHANDISING MANAGER

Robert N. Baggs has been appointed manager of the merchandising division of International Resistance Company.

Mr. Baggs was formerly advertising and sales promotion manager of the tube division of the Radio Corporation of America.

* * *

SANDSTROM WINS N. U. PROMOTION

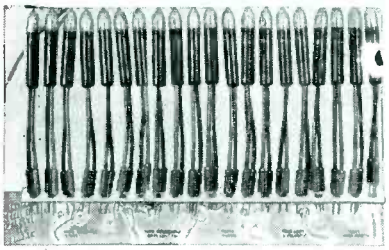
Ejnar O. Sandstrom has been appointed controller of National Union Corporation. Mr. Sandstrom joined National Union

(*Continued on page* 43)

NEW PRODUCTS

NE-O-LITE TESTER

For testing a-c lines, blown fuses, polarity of a-c or d-c, and tracing ground lines in a-c circuits, General Cement Mfg. Co., 919 Taylor Avenue, Rockford, Illinois, have announced an improved Neo-O-Lite electric test set. Can also be used as a r-f indicator, spark plug and cable tester, etc. Can be used on voltages from 60 volts a-c to 500 volts a-c or d-c. Has clear plastic tip and shell and insulated test points.



* * *

MECK POSTWAR RECEIVERS

A postwar line of receivers which includes table models, table radio-combinations, console combination, portables and farm sets in addition to three phonograph models was announced by John Meck, president of John Meck Industries, Plymouth, Indiana, at the recent EPEI conference in Chicago. Receivers will be distributed through a *Preferential Distributors Plan* which, according to W. W. Montgomery, sales manager, guarantees deliveries to jobbers of their first year's receiver's requirements.

* * *

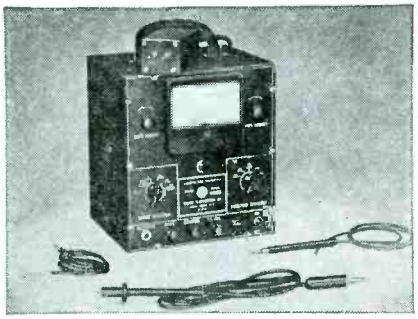
REINER VACUUM-TUBE VOLTMETER

A vacuum-tube volt-ohm-milliammeter, with a wide-frequency range a-c voltmeter, which measures from 50 cps to 50 mc has been developed by Reiner Electronics Co., Inc., 152 West 25 Street, N. Y. 1, N. Y.

The a-c voltage ranges are: 0-2.5-10-25-100-250, linear scale all ranges. Input resistance is said to be 1 megohm at 1000 cps all ranges; input capacitance, 10 mmfd. Diode probe at end of 4-foot cable. Maximum frequency error to 500 megacycles is said to be 5%. Single zero adjust for all ranges.

D-c voltage ranges are 0-2.5-10-25-100-250-1000. Linear scale. Input capacitance is said to be less than 2 mmfd; input resistance, 11 megohms all ranges. The d-c current ranges are: 0-2.5-10-25-100-250-1000 milliamperes. Effective resistance at 1 ampere is said to be 0.45 ohm; at 2.5 milliamperes, 180 ohms.

Ohmmeter ranges are .1 ohm to 1000 megohms. Center scale resistance: 10, 10^1, 10^2, 10^3, 10^4, 10^5, 10^7 ohms.



* * *

G. E. LECTROFILM CAPACITORS

Lectrofilm capacitors, which are mechanically interchangeable with mica capacitors types CM60, 65 and 70 as listed in American War Standards spec. C75.3, have been announced by G. E. Lectrofilm is a new synthetic dielectric developed especially for capacitors.

Lectrofilm capacitors can be used for r-f blocking and bypass applications. Capacitors are supplied in green, low-loss plastic cases. Lectrofilm capacitors are described in bulletin GEA-4295.

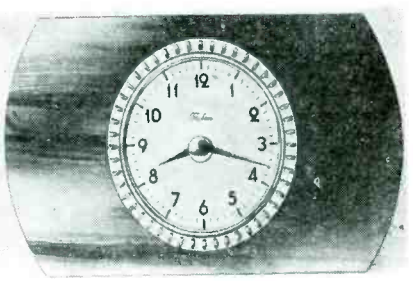
* * *

TELECHRON SET TIMER

A timer that pre-selects any program on a given band, and turns the radio on and off, has been announced by Warren Telechron Company.

The timer is said to be completely automatic. Has a self-starting telechron motor of the sealed-in, reservoir type.

There are 48 keys to indicate 15-minute time intervals. Settings can be made as long as 10 hours in advance.



* * *

UTC INTERSTAGE FILTERS

Two interstage filters, types BPI and BPL, for 200 to 10,000 cycles, have been developed by United Transformer Co., 150 Varick Street, New York 13, N. Y. These filters are sharply peaked, having approximately a 2 db attenuation of frequencies plus or minus 3% from the mean frequency, and attenuations of approximately 40 db per octave. They are adjusted to zero phase shift at the mean frequency.

The BPI type has a primary impedance of 10,000 ohms; for operation from the plate of a triode tube to a succeeding grid. Gain is approximately 2 to 1. Type BPL filters are designed to operate from a line impedance of either 500 or 600 ohms to the grid of a tube. The gain is about 9 to 1.

* * *

GUARDIAN MIDGET RELAY

A 1.2-ounce, single-pole single-throw midget relay has been produced by Guardian Electric Manufacturing Company, 1623 West Walnut Street, Chicago 12, Illinois. Measures 1 9/32" x 1 5/32" x 29/32".

Operates on d-c only, and is said to have a switch capacity of double pole, double throw with 1.5 ampere contacts.

NEWS

(*Continued from page* 41)

Radio Corporation as an auditor in 1930. He was elected assistant secretary in 1935, assistant treasurer in 1937, and secretary in 1941. He will continue to serve as secretary.

* * *

WALTERS JOINS MECK INDUSTRIES

Fred E. Walters has been appointed plant manager of the John Meck Industries, Plymouth, Indiana.

Mr. Walters was formerly with International Detrola Corporation, as production manager.

* * *

CENTRALAB CAPACITOR FOLDERS

Two 4-page bulletins covering tubular ceramic capacitors and silver mica capacitors have been released by Centralab, 900 East Keefe Avenue, Milwaukee, Wisconsin.

The tubular ceramics are discussed in bulletin 819, and bulletin 586 covers the silver micas.

Types included in the ceramic literature are the 920, 923, 924, 930, 931, 932 and 933. There are dimension drawings and a capacity chart for the various temperature coefficients. Power factor, tolerance, voltage rating and humidity are also explained. The method of complete vacuum wax impregnation is also described.

The silver-mica bulletin describes capacitors with ranges from 6 to 2400 mmfd and various types of terminals now in production on special orders.

* * *

WARTIME CARE BOOKLET

A 4-page booklet entitled, *War-time Care of Your Radio,* has been published by Northwest Radio Laboratory, 6509 Germantown Avenue, Philadelphia, Pa.

The booklet covers general operating tips, data on a-c/d-c receivers, etc. Price, 10c a copy.

* * *

ALTEC-LANSING AUDIO REACTOR REPRINT

An 8-page article on *High-Q Audio Reactor Design and Production,* is being distributed by Altec-Lansing Corporation, 1210 Taft Building, Hollywood 28, California. The article was written by Colin A. Campbell, plant engineer, for the March issue of COMMUNICATIONS.

* * *

G. E. BOOKLET ON POSTWAR RADIO-TELEVISION

A 28-page booklet, *Your Coming Radio,* has been released by General Electric Company, 1 River Road, Schenectady, New York. The booklet illustrates and describes several radio and television sets which G.E. is planning for the postwar consumer market.

* * *

A. J. HALL NOW U. M. C. RESEARCH ENGINEER

A. J. Hall has been appointed production and research engineer for the Universal Microphone Co., Inglewood, Cal.

He was formerly with the Kellogg Switchboard and Supply Co., Chicago, as engineer in charge of design, research and development laboratories.

JOTS AND FLASHES

L. C. TRUESDELL appointed sales manager Bendix home radio receiver division . . . Nate Hast ditto for Lear, Inc. . . . Insuline Corp. of America appoints Ed. J. Cohen a director and also names him secretary-treasurer of firm . . . congratulations, Ed. . . . recent surveys show that over 75% of the radio Service Men will stock and sell home and auto radios as soon as they are available . . . more and more receiver manufacturers are including service men in their merchandising program . . . Al D. Leban, 5716 Nassau Rd., Philadelphia, has been made factory representative for Universal Microphone Co. . . . Sixth War Loan Drive is now at its peak . . . let all of us buy more than our share of bonds and help wind up the war quickly and victoriously . . . fourth Army-Navy "E" for continued production excellence awarded to Sprague Electric Co. . . . Rola Co. earns second white star for its "E" pennant . . . Lloyd Dopkins named Eastern manager by Majestic Radio and Tel. Corp. . . . General Industries Co. "E" emblem now graced with a well earned white star . . . second white star awarded to Amperex Electronic Corp. . . . hats off to Hallicrafters . . . first exclusive shortwave radio manufacturer to receive a fifth "E" award . . . Ben Miller, 43 E. Ohio St., Chicago, now representing General Hardware Mfg. Co. line in Illinois . . . Carter Motor Co., Chicago, makes J. Bertschi chief design engineer . . . Walter Evans, vice-president of Westinghouse, announces acquisition of Hazeltine license . . . Raytheon sponsoring "Meet Your Navy" program every Saturday night over entire Blue Network . . . Worner Electronic expands manufacturing facilities to handle increased production demands . . . say, servicers . . . how about sending in some interesting case histories or servicing hints and shortcuts which you've used to advantage . . . we'll pay you for those published in SERVICE and you will be helping other Service Men throughout the country . . . plenty credit to Sylvania for their 6th War Loan window display contest for radio dealers and Service Men . . . in planning your post-war operations be certain to read all literature offered by manufacturers . . . ask your distributor or write direct to the manufacturers for all that's available . . . stick to standard, advertised, well-known lines . . . don't fall for so-called surplus buys . . . you'll lose much more in future goodwill and prestige than the few quick dollars you might make are worth.

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Thanks

MR. TROUBLE-SHOOTER

Thanks, Mr. G. I. You're close to our thoughts. All of us in radio know the world-wide job you're doing in the Signal Corps.

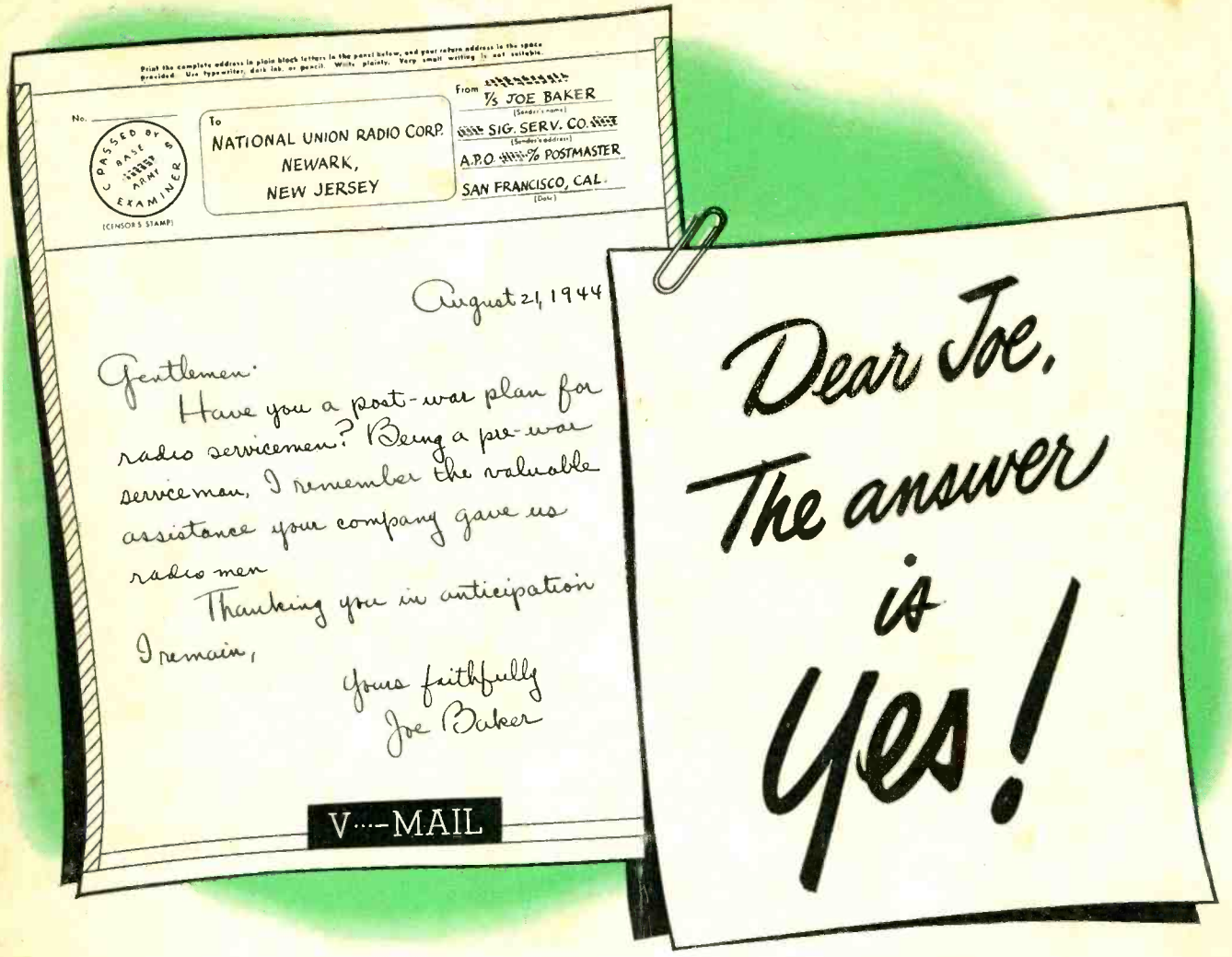
We know who you are. You're the radio ham across the street, the boy home from college who burned the midnight oil in the attic and rigged his aerial from the highest mast. You're the telephone man. You're the obliging young fellow from the lighting company. You're the serviceman who fixed our radio set the day before the World's Series. You're the radio engineer who added brains to that set.

We don't know where you're *seeing* action but we know that you are *helping* it. Crawling out ahead of artillery. Scrambling from one fox-hole to another. Rolling up telephone wire almost to the muzzles of enemy guns. Operating and servicing communication systems so that the attack may roll forward. Hunting booby traps. Saving lives.

Come back, Mr. G. I., just as soon as your trouble-shooting is done. Radio will need you—your skill—your sureness. Radio will not forget your part in victory. Solar Manufacturing Corp., 285 Madison Ave., New York 17, N. Y.

SOLAR

CAPACITORS AND RADIO NOISE-SUPPRESSION FILTERS



YES—and this National Union post-war plan for radio service men will be a bigger, better plan, with more of everything it takes to help you equip your shop and get the service business of your community.

Yes—from National Union you will again be able to get the finest shop and testing equipment on the famous N. U. Plan and we will make it even easier for you to get it, than before the war. There will be more free N. U. Technical literature—more advertising—more of those simplified forms and records to help you manage your business and make every possible dollar of profit out of it.

Yes—you can count on N. U., with its greatly increased resources, for more of everything you need. Count on National Union—"After the War, MORE than Before!"

NATIONAL UNION RADIO CORPORATION, NEWARK 2, 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