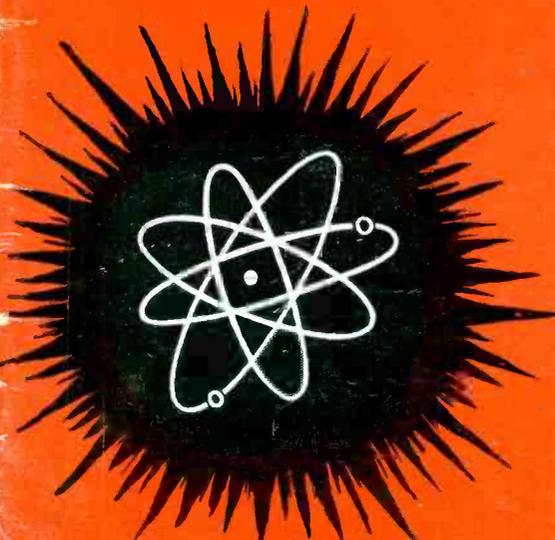




radio
service
dealer

JUNE, 1947



IN THIS ISSUE:

SIMPLIFIED SET CHECKING
THE NEW VARIABLE RELUCTANCE PICKUP
PA SYSTEM DESIGN
SERVICING 3-WAY PORTABLE RECEIVERS

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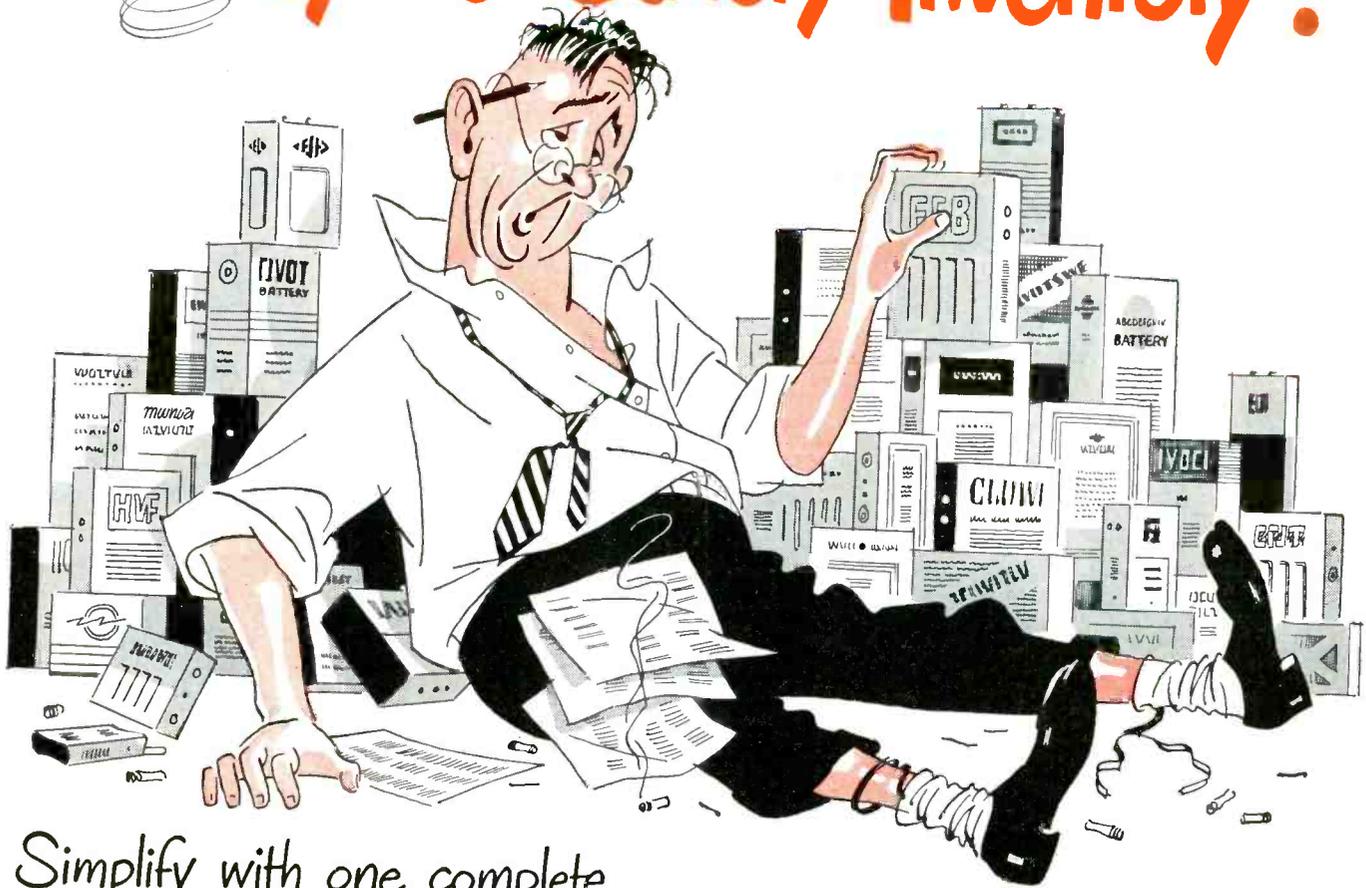
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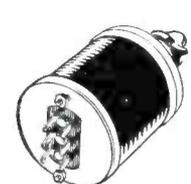
2 watt

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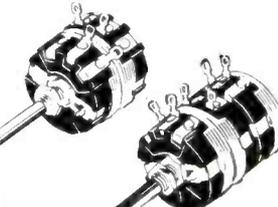


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EDITORIAL

Trade Show Review

Nearly two hundred manufacturers exhibited their new wares at the Chicago Trade Show May 10-17th. No one product can be selected as having been the outstanding show item. However, all products and lines displayed have built-in and basic improvements in comparison to their prewar counterparts. For example—test equipment is more versatile, covers wider ranges, is easier to use; component parts and tubes are more rugged, have closer tolerances, are more efficient and dependable; sound equipment and all types of accessories have been redesigned, improved technically and made more eye-appealing and thus more easily saleable.

Jobbers Reported:

Retail radio stores are in too many cases overstocked with not well-known name brands which is now slow-selling and subject to being 'dumped' if money gets tight. Jobbers proclaimed that in general Service Dealers are enjoying bangup business and still need more replacement tubes and parts than manufacturers can deliver and that *prospects for Service Dealers are brighter than ever before*. Throughout the country television and FM sets are avidly wanted by the public and because of the technical knowledge required for the installation and maintenance of these complex units the Service Dealer's position is more firmly entrenched than ever before.

Jobbers decried the fact that too much obsolete test equipment is still in use. (Service Dealers should immediately take a critical look at their gear, Ed.). Further, the fact that Service Dealers are the logical ones to handle sound equipment sales, installations and servicing has not yet been fully appreciated by many—and they can't afford to let opportunity pass them by. Even firms that specialize in sound only are doing mighty well.

RMA on FM Production

Nearly 8,000 television sets and over 112,000 FM-AM models were produced in April. That is almost 10% of the total output. On the average two new television stations are going on the air each month now, and before year end there will be almost 700 FM stations operating. Therein lies the reason for our emphatic reiteration that the Service Dealer must immediately take cognizance of the trends... whether or not you are sold on FM and/or television, whether or not there will soon be an FM or television transmitter in your locality... both FM and television are here in a big way, and they're here to stay. Upwards of ten years may pass before the new arts make old AM sets obsolete. But they'll be in time, and in the interim, there's always more money available to those who ride with the bandwagon. S. R. COWAN, Publisher



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SANFORD R. COWAN

Editor & Publisher

June, 1947

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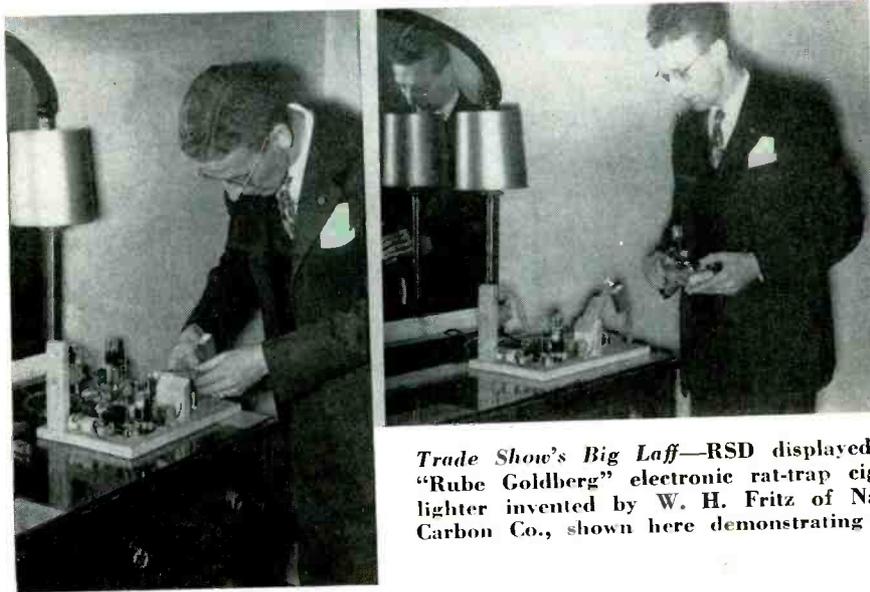
Adv. Production Manager

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COWAN PUBLISHING CORP.

In & Around the Trade

Being a condensed digest of production, distribution and merchandising activities in the radio and appliance trade.



Trade Show's Big Laff—RSD displayed a "Rube Goldberg" electronic rat-trap cigar lighter invented by W. H. Fritz of Nat'l Carbon Co., shown here demonstrating it.

Karet Becomes "Rep"

Bob Karet, Sales Manager of the Thordarson, Meissner and Radiart divisions of Maguire Industries, Inc., and former Sales Manager of the wholesale and sound divisions of The Utah Radio Products Company, has resigned to enter the manufacturers' representative field and will join with Ray R. Hutmacher under the firm name of Salescrafters, Inc. The firm is located at 510 North Dearborn Street, Chicago.

Automatic Drops Prices

Automatic Radio Manufacturing Co., Brookline, Mass., has reduced list prices from 10% to 25% on its complete line of radio sets.

Walsco Contest Winners

Walter L. Schott Co., manufacturers of Walsco radio parts and repair items, have announced the winners in the national contest designed to get suggestions for needed parts and tools for the radio trade.

"Winners were selected on a basis of merit of their suggestions. This contest, which resulted in the design and development of many time and labor saving items, will materially benefit the entire trade," said Walter L. Schott, company president.

The four major winners, their suggestions and awards are: Felix Jamuss, Los Angeles, Cal. (top right), first prize for submitting several valuable ideas, including a new type of speaker

cone patch, a novel magnetic probe, etc. He won a Remington Noiseless Portable Typewriter. Eugene M. Beck, West Los Angeles (lower right), second prize for a neon light device for checking turntable speeds, etc. He was awarded a set of Rider's Manuals. M. Saltzman, Jamaica, New York (lower left), third prize for an automobile aerial installation tool idea, prize—a 17-jewel man's wrist watch. Gene Kwartz, Newport, Oregon (upper left), for suggestions covering automobile radio installation tools was awarded two Norwalk 5-ply tires.



Walsco Winners

Galvin Now Motorola

The corporate name of the Galvin Manufacturing Corporation, makers of Motorola Home and Car Radios and Motorola Car Heaters, was officially changed to Motorola Inc., effective May 15th.

Columbia Changes Name

Columbia Recording Corporation has changed its name to Columbia Records, Inc.

S-W Appoints Luria

Appointment of L. Luria & Sons, Inc., of Miami as exclusive distributor of Stewart-Warner radios for the southern half of Florida was announced by Floyd D. Masters, sales manager for the Radio Division of Stewart-Warner Corporation. L. Luria & Sons, Inc., is located at 400 S. W. Second Avenue in Miami.

Selenium Moves

Selenium Corporation of America, manufacturers of selenium power and instrument rectifiers and self-generating photo-electric cells, is now located at 2160 E. Imperial Highway, El Segundo, Calif.

Temple Joins Winchester

L. M. Temple, radio battery engineer of national prominence, has been appointed chief engineer of the battery division of the Winchester Repeating Arms Company division of Olin Industries, Inc. The announcement was made by W. S. Allen, Winchester sales manager.

Awarded Standards Certificates

For contributing their time and experience to the war committee work of the American Standards Association, Roy S. Laird, vice-president in charge of sales, and Herbert E. Lense, Laboratory Director of Ohmite Manufacturing Company, were recently presented with an award from the A.S.A.

The engineering knowledge and experience of both Laird and Lense contributed much to the establishment of standards for heostats and resistors.

Test Equipment Catalog

New catalog issued by Metropolitan Electronic Instrument Co. lists meters, testers, sig. generators, dynamic signal tracers, oscillographs, etc. Items are described fully. Copies, from the company—6 Murray St., New York 7, N. Y.

G.E. Distribution Change

General Electric Appliances, Inc., a new corporation, has been organized to carry on the business formerly conducted by the nine G-E Appliance Distributing Branches, Charles E. Wilson, president of General Electric, has announced. Headquarters are at Bridge-

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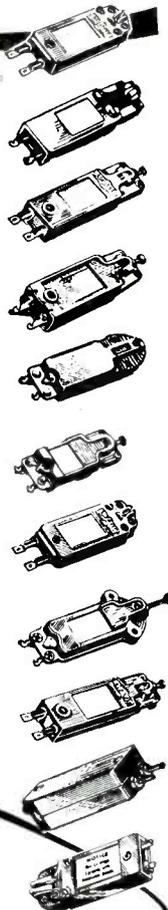
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... to accept a lift from a stranger

WHILE AT FIRST it may seem a quick and easy way of reaching some destination . . . experience shows that it is not alone risky . . . but often dangerous . . . to accept help from a stranger. When you have a phonograph pickup cartridge to replace, you'll be playing it safe to duplicate the original cartridge . . . the one you know . . . the cartridge selected by the engineers and manufacturers of such equipment for the most satisfactory results. Cartridge characteristics, ideal for one instrument, may be entirely unsuitable for another. For exact, duplicate replacements in a majority of Phonographs now in use, Astatic Crystal Pickup Cartridges are available at your Radio Parts Jobber's.



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port, with branches in Boston, New York, New Jersey (Bloomfield), Philadelphia, Pittsburgh, Florida (Jacksonville), Cincinnati, St. Louis and Los Angeles.

Management and operating personnel of the branches remains unchanged, as does their location, Mr. Wilson said. Officers of the new corporation are: H. L. Andrews, chairman of the board; P. A. Tilley, president; W. D. Wood, vice-president; Merrill Brown, secretary; L. E. Walkley, treasurer; W. E. Swinton, assistant treasurer; W. H. Pickett, assistant secretary; and R. F. Wieneke, assistant secretary and treasurer.

Cushway Promoted

Charles P. Cushway has been elected Executive Vice-President and a director of Webster-Chicago Corporation, manufacturer of record changers, phonographs, and wire recorders, R. F. Blash, President, announced recently.

Cushway is well-known, having spent over 25 years with such concerns



as Belden Manufacturing Co., All American Radio Corp., Thordarson Electric Manufacturing Co. and the Rauland Corp.

W. S. Hartford has been appointed General Sales Manager of Webster-Chicago and now embraces all sales and merchandising activities of the company.

Book on Sound

A 24 page booklet which describes 20 essentials for perfect amplification is offered by Amplifier Corp. of America, 396-9 Broadway, New York 13, N. Y. Some of the unusual features covered include direct-coupling, scratch-suppression, increased musical range, signal-expansion, power requirements, noise, higher fidelity, extended dynamic range, "presence", hum elimination, distortion reduction, microphonics, response control, grid-current, delayed plate-voltage, fixed-bias, balanced audio signals. voice [see page 23]

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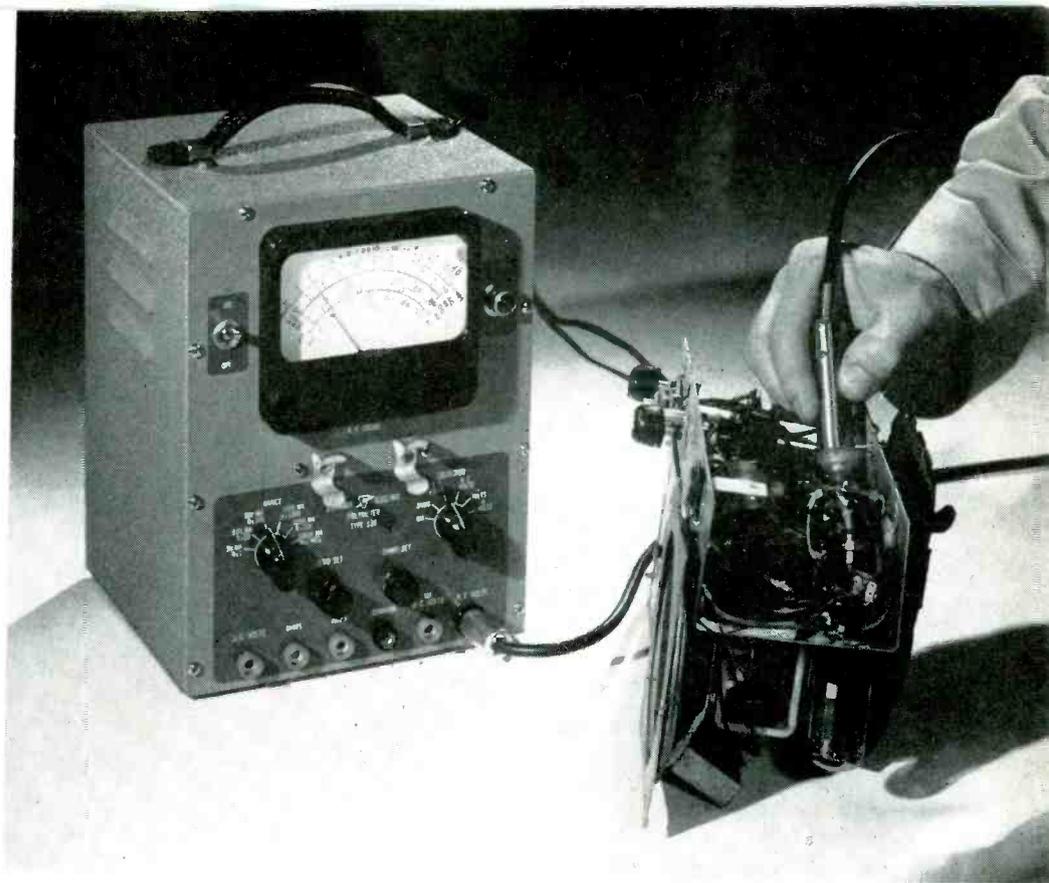
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RADIO SERVICE DEALER • JUNE, 1947



by RUFUS TURNER*

Simplified Set Checking

THE busy radio service dealer finds it advantageous to make as many trouble-shooting tests as possible with one instrument. This efficient practice reduces physical movements, as well as the shifting of the operator's attention. At the same time, a single instrument occupies small bench space; and, when it is line-powered, lowers instrument operating cost.

Of the various test meters used in radio receiver servicing, the vacuum tube voltmeter unquestionably offers the greatest single-instrument utility. Because of its high d-c input, resistance and a-c input impedance, the vacuum tube voltmeter enables measurements to be made in circuits where a conventional multimeter of the non-electronic sort would be useless. The electronic d-c voltmeter-ohmmeter has been in wide use for several years in radio repair shops. Its usefulness and dependability now are well established. However, few shops are equipped also with a-c vacuum tube voltmeters for the direct measurement of audio and r-f voltages.

The *universal* VTVM has all of the features of the electronic d-c voltmeter-ohmmeter plus a-c and r-f operation, milliamperes, and ampere ranges. A complete test meter of this type combines the features of a col-

lection of other meters, and makes possible complete diagnosis of receiver with a single meter.

The Sylvania Type 134 Polymeter (*Figure 1*) is a universal VTVM designed to give single-instrument utility in both a-f and r-f, as well as d-c applications. By exploiting the electronic VTVM circuit to the fullest extent, this instrument provides the following useful variety of ranges:

D. C. VOLTS. 0-3-10-30-100-300-1000.

A. C. VOLTS (20 to 15,000 cycles). 0-3-10-30-100-300.

R. F. VOLTS (10 kc. to 300 Mc.). 0-3-10-30-100-300.

DIRECT CURRENT. 0-3-10-30-100-300 milliamperes. 0-1-10 amperes.

RESISTANCE. 0-1000-10,000-100,000 ohms. 0-1-10-1000 megohms.

Regulation-size test prods are employed for a-c and d-c measurements, and an extremely small cable-end probe for r-f tests. The probe is ingeniously constructed to permit the shortest possible connections to the measured circuit.

The input characteristic of the instrument, as "seen" by the circuit under test, is 16 megohms on all of the d-c voltage ranges, 2.7 megohms and 40 $\mu\text{fd.}$ on all a-c ranges, and 2.7 megohms and 3 $\mu\text{fd.}$ on all r-f voltage ranges. Unlike the oxide rec-

tifier-type voltmeter used in most set testers, the a-c vacuum tube voltmeter permits accurate measurements to be made of audio signal voltages within the receiver circuit.

It is easily seen that a single meter providing the ranges just listed and having high input impedance can be used in the complete, critical examination of radio receiver performance. This article will enumerate the various important tests which can be made in a standard superheterodyne circuit with the universal vacuum tube voltmeter. Space does not permit listing the entire multitude of possible uses. However, numerous applications other than those described will occur to the alert radio service dealer.

A standard superhet circuit diagram is given in *Figure 2*. The key points in this circuit have been numbered, and are referred to in the following listing of tests. The operator may make tests and measurements in the order listed, or may make any single test or measurements in any other sequence as may be demanded by individual situations.

D. C. Measurements

(A) NEGATIVE D-C PROD CONNECTED TO GROUND (CHASSIS). TOUCH POSITIVE D-C PROD TO THE FOLLOWING CIRCUIT POINTS TO CHECK

[see next page]

*Engineer, Industrial Electronics Division, Sylvania Electric Products, Inc.

THE VOLTAGES INDICATED.

R. F. Amplifier.

7, cathode voltage. 8, plate voltage. 9, screen voltage.

1st Detector.

13, plate voltage. 14, screen voltage. 22, cathode voltage.

1st I. F. Amplifier.

19, plate voltage. 20, screen voltage. 21, cathode voltage.

2nd I. F. Amplifier.

27, plate voltage. 28, screen voltage. 29, cathode voltage.

2nd Detector-A. V. C.-1st Audio.

35, cathode voltage. 39, plate voltage. 40, screen voltage.

Output Audio.

42, cathode voltage. 43, plate voltage. 44, screen voltage.

Oscillator.

54, input voltage to oscillator voltage divider network. 55, screen voltage. 66, plate voltage.

Power Supply.

58, full output voltage of rectifier before filtration. 62, full output voltage of filter. 63, intermediate d-c voltage delivered to low-level stages of receiver.

(B) POSITIVE POLARITY OF METER CONNECTED TO GROUND (CHASSIS). (THAT IS, METER POLARITY SWITCH THROWN TO *NEGATIVE*). TOUCH "HIGH" D-C PROD TO THE FOLLOWING CIRCUIT POINTS TO CHECK THE VOLTAGES INDICATED.

With signal generator connected to 1 and 2, and receiver tuned to generator signals 5, a-v-c voltage at r-f amplifier stage. 18, a-v-c voltage applied to 1st i-f amplifier. 26, a-v-c voltage at 2nd i-f amplifier. 36, a-v-c voltage delivered by 2nd detector combination stage. These same voltages will appear at points 3, 16, and 25 if the corresponding grid coils are continuous.

With signal generator disconnected: 3, grid voltage, r-f amplifier. 11, grid voltage, 1st detector. 16, grid voltage, 1st i-f amplifier. 25, grid voltage, 2nd i-f amplifier. 67, grid voltage, 1st audio amplifier. 41, grid voltage, output audio amplifier. 52, oscillator grid voltage. This last test also is a measure of the strength of oscillation. A no-voltage indication at this circuit point reveals oscillator failure.

A. C. Measurements

TOUCH THE A-C TEST PRODS TO THE FOLLOWING PAIRS OF CIRCUIT POINTS TO CHECK THE VOLTAGES INDICATED.

6-38, audio signal voltage delivered by the 2nd detector. 6-67, action of volume control. 6-41, audio signal delivered by the 1st audio amplifier. 45-46, audio signal voltage delivered to the

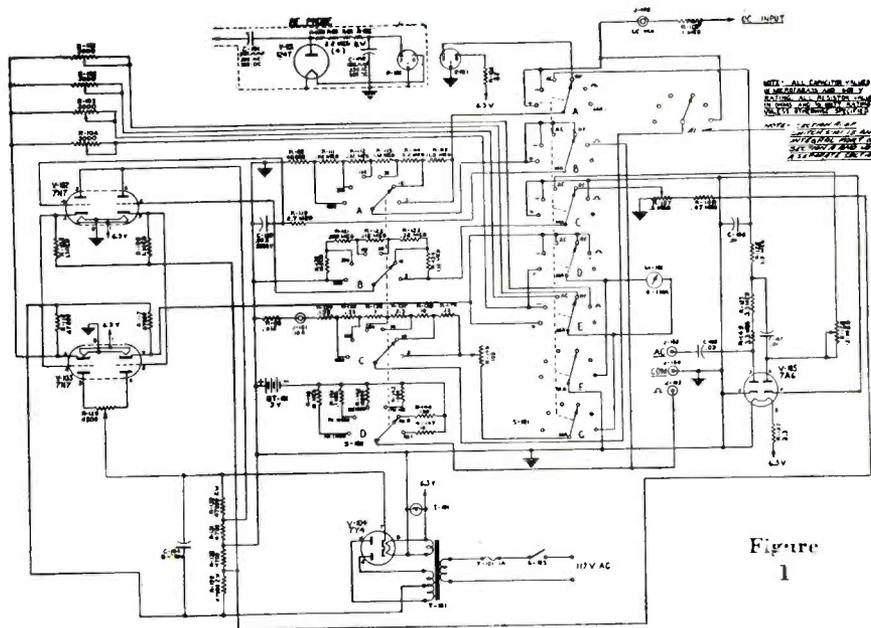


Figure 1

speaker. For each of the above tests, the receiver must be tuned to a modulated signal. (Set signal generator to 1000 kc. when checking broadcast receivers. Use 400-cycle amplitude modulation. Set receiver volume control for maximum undistorted output, with signal generator connected to terminals 1 and 2.

Audio power output of the receiver (in watts) may be determined from the a-c voltage measured between circuit points 45 and 46, simply by squaring this voltage and dividing by the speaker voice coil impedance (in ohms).

A test from 58 to 59 shows rectifier filament voltage. 60-61, heater voltage for all other tubes. 6-64, voltage across first half of transformer high-voltage winding. 6-65, voltage across second half of transformer high-voltage winding. Add the two latter voltages to determine the total voltage delivered by the high-voltage winding.

R. F. Measurements

For all r-f tests in the receiver circuit, connect an amplitude-modulated signal generator to terminals 1 and 2, and tune the receiver to the generator frequency. Reduce the signal when required. For most measurements in the first receiver stages (r-f amplifier and 1st detector), the signal generator output must be increased to its highest level. For all r-f tests, the r-f probe tip and ground clip are connected to the circuit points. Connect these two pick-up terminals to the following circuit points to check the voltages indicated. 3 probe tip, 4 ground clip—resonant voltage across antenna transformer secondary (Adjust trimmer C₁ for resonant peak). 11 probe tip, 12 ground clip—resonant voltage across detector input secondary (Adjust

trimmer C₂ for resonant peak). 16 probe tip, 18 ground clip—Adjust i-f trimmers C₃ and C₄ for resonant peak. 25 probe tip, 26 ground clip—Adjust i-f trimmers C₅ and C₆ for resonant peak. 31 probe tip, 33 ground clip—Adjust i-f trimmers C₇ and C₈ for resonant peak. 52 probe tip, 6 ground clip—oscillator output voltage. This latter test, like the d-c test between circuit points 6 and 52, indicates strength of oscillator signal.

Current Measurements

The milliamperage ranges of the universal vacuum tube voltmeter enable the operator to check various tube and circuit currents and to determine thereby the condition of tubes and other circuit components. In order to make current measurements, the appropriate circuit must be interrupted temporarily and the meter test leads connected for insertion of the meter in the circuit. For example; to measure plate currents, interrupt the following leads and insert the meter (with the *common* terminal connected to the tube electrode in question: Plate Current: A, C, E, G, I, K, and O. For screen currents: B, D, F, H, J, L, and P. Total plate and screen currents of the audio output stage are measured with the meter inserted at M. Total plate and screen currents of all stages other than the audio output stage may be obtained by inserting the meter at N. The sum of the readings obtained at M and N will indicate the total drain, including voltage dividing networks within the receiver circuit proper.

Resistance Measurements

Resistance of any of the circuit components may be checked with the

VTVM switched to an appropriate resistance range. In very nearly every case, it will be necessary to disconnect at least one lead of the component temporarily from the rest of the circuit before checking resistance. Circuit continuity likewise may be checked by means of the ohmmeter. However, the operator must examine the circuit of the receiver under test closely to appraise the effects of parallel circuits and series components. All power should be removed from the receiver before undertaking resistance measurements.

Signal Tracing & Alignment

When an amplitude-modulated signal generator is connected to terminals 1 and 2, a signal may be traced with the VTVM through the entire receiver. R-F tests, described earlier in this article, are employed in the r-f amplifier, 1st detector, 1st and 2nd i-f amplifiers, and 2nd detector. A-C tests (audio signal voltage) are employed in the 1st audio and output audio stages.

The VTVM makes an efficient resonance indicator in alignment operations. The signal generator is connected to terminals 1 and 2, and the a-v-c voltage monitored between circuit point 6 and any one of the a-v-c voltage points such as 5, 18, 26, or 27. The a-v-c voltage rises to a peak at resonance, and is a very sensitive alignment indication.

Tube Condition

Tube operation also may be appraised by means of the r-f test in the r-f amplifier, 1st detector, i-f ampli-



Do our sets speak Chinese?

fier, and 2nd detector stages, and a-c test in the two audio stages. By taking the ratio of the signal voltage measured between grid and ground to the signal voltage measured between plate and ground, the amplification afforded by the tube may be determined. In this way, defective tubes may be spotted and defective components, associated with the good tubes may be isolated. In the d-c tests, when a positive voltage is found at the grid of a tube, the tube is gassy.

Rules for Meter Use

The rules of good laboratory practice, as regards meters, apply to the use of the universal VTVM as well. The progressive radio service dealer will make these rules a part of his consciousness. Following are the principal pointers of importance:

1. In order to prevent damage to the meter when checking voltages of unknown value, observe habitually the

custom of switching the instrument first to its *highest* voltage range before touching the test prods to the circuit under test. This applies to *all* a-c, d-c, and r-f measurements. The meter then may be switched, step by step, to each successively lower range until an accurate reading is obtained. For best accuracy, when making the *final* reading, use the voltage scale on which deflection is obtained near the upper end of the scale.

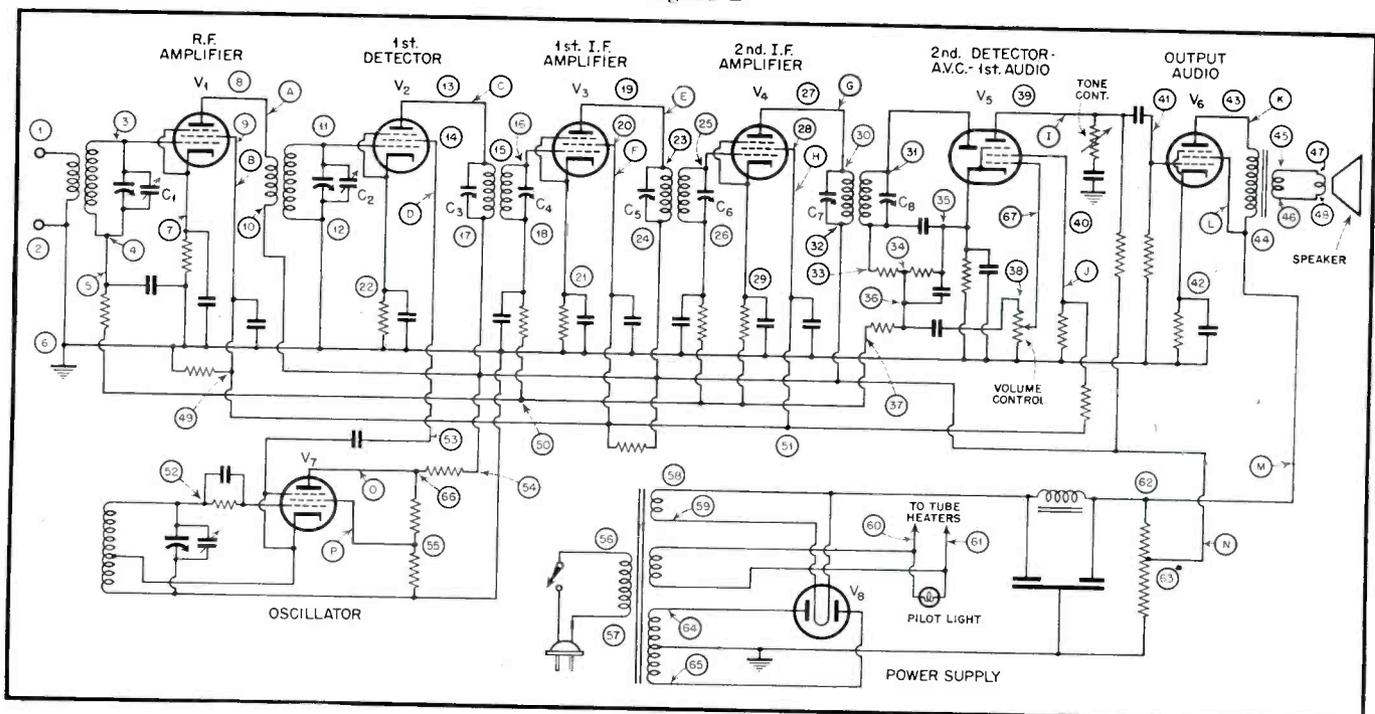
2. Be sure that all power has been switched off in the receiver before using the ohmmeter ranges for checking circuit components or continuity of wiring.

3. When checking a-c voltages in a circuit in which d.c. also is present (such as in the plate circuit of an amplifier), if your a-c meter does not already have a series blocking capacitor, isolate the d.c. from the meter by connecting a 0.5- to 1- μ fd. fixed capacitor in series with the "high" test lead. The Polymeter has such capacitors in both the a-c and r-f circuits.

4. Respect all high-voltage circuits! Circuits carrying more than 100 volts are potentially dangerous. Familiarize yourself with the circuit of the receiver or system under test. When using the meter to check high d-c voltages, keep the COMMON terminal of the meter connected to the ground (B-minus) terminal of the circuit under test. This keeps the instrument case and panel at ground potential and protects the operator from electric shock.

5. When using the r-f probe, keep its GROUND lead as short as possible, to reduce shunt capacitance.

Figure 2



The Much-Discussed New VARIABLE RELUCTANCE PICKUP

**Phonograph owners want and usually can be sold
an improved reproducing system at a profit**

General Electric Co.'s new variable reluctance pickup, a magnetic type phonograph reproducer now available through distributors, features reduced hum, low mechanical impedance, smooth high-frequency response and low wear on records. A sapphire stylus is built in.

Low needle scratch with the pickup is accomplished by the fact that the device responds to vibrations only in a lateral direction. Elimination of the resonant response in the unit's design makes possible low distortion while loud needle talk is eliminated by mounting the jewel tip on a soft spring.

Electrical Impedance

The D.C. resistance of the windings is approximately 300 ohms; the inductance approximates 100 millihenries. The equivalent circuit is the open circuit voltage in series with this resistance and inductance. The natural sapphire tip has an included angle of 45° to 50° and a tip radius of .003" plus or minus .0002". Mechanical impedance—

dynamic mass of stylus— 8×10^{-3} gm
cm

suspension compliance— $.87 \times 10^{-6}$ —
dyne

Impedance at arm resonance varies

with various arm designs, but with well designed spring counterbalanced arms it will be well below 10,000 dyne sec/cm. Since the bearing weight upon the record is dependent upon this impedance, this, too, will vary with arm designs. In most cases $\frac{3}{4}$ to $1\frac{1}{4}$ oz. is adequate.

The cartridge is designed to mount on two 3.16" diameter bosses $\frac{1}{4}$ " long on $\frac{1}{2}$ " mounting centers, and tapped for No. 3-48 machine screws. Two screws are held in position within the

cartridge and may be driven through holes provided in the case. For outline dimensions of the unit see Fig. 1. Fig. 1-A shows the unit actual size. Hum pickup in the unit is reduced to a very small level due to the shielding of the case and the balance provided by the double coil construction. This balance is not perfect for skew fields, however, and the cartridge should not be operated too near power transformers or chokes. Fig. 2 gives typical installation instructions.



Fig. 1A (above) is the pickup head actual size. Fig. 1 (right) shows its internal construction

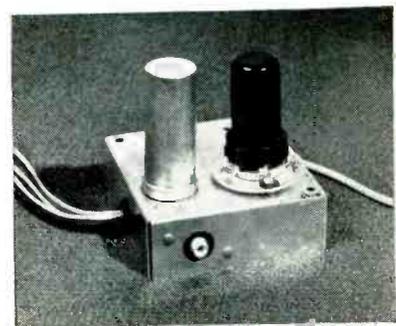
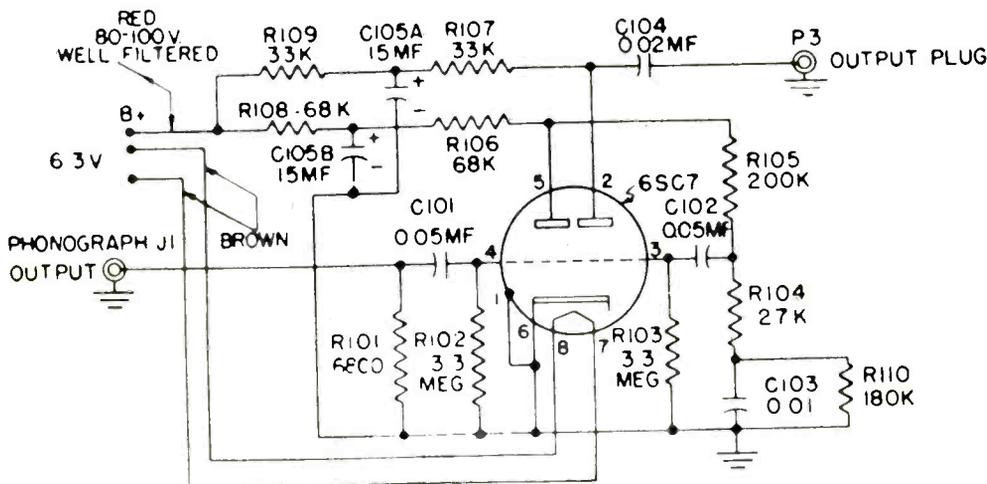
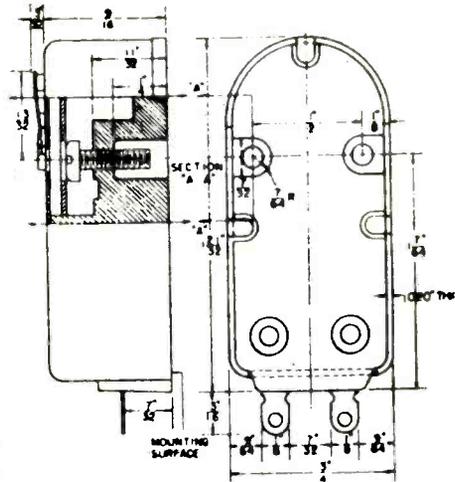


Figure 2 (left) is the schematic of the factory assembled pre-amplifier shown above

MAKING TUBES IS EASY..

If YOU KNOW HOW!



ΚΑΤΑΦΟΡΗΣΙΣ
*...filament coating
made Easier... Better*

HYTRON CATAPHORESIS COATING MACHINE—Filament wire proceeds from the large spool at top center through oxidizing oven, cataphoresis coating bath, and two small ovens. Finally, the coated wire is wound on the cylinder at the left.

A jawbreaker from the Greek, cataphoresis means simply "the movement of suspended particles through a fluid under the action of an applied electromotive force." At Hytron, filaments are not *sprayed* with electron-emissive coating, because that way precise control cannot be achieved. Rather, coating is electrically deposited by the cataphoretic movement of the carbonate molecules.

Drawn through a special coating solution, the filament wire itself serves as the anode; and a metallic plate, as the cathode. The solution consists of a triple precipitate of barium, calcium, and strontium carbonates plus a binder—all suspended in a special organic medium. A precisely adjusted electromotive

force uniformly deposits and bonds the electrically-charged salts onto the filament wire. Baking problems are simplified; coated wire is spooled directly on a cylinder, ready for use.

This new Hytron method of filament coating is so simple, so precise as to texture, weight, and adhesion. One wonders why it is not universal. The answer is simple. Cataphoresis coating is easy *only* if you possess the trade secret of the Hytron coating formula. Also, the applied voltage, timing, and resultant control of texture and emissive qualities in mass production represent months of persistent research. You profit by superior performance from all Hytron coated-filament tubes.

SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921

HYTRON

RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS



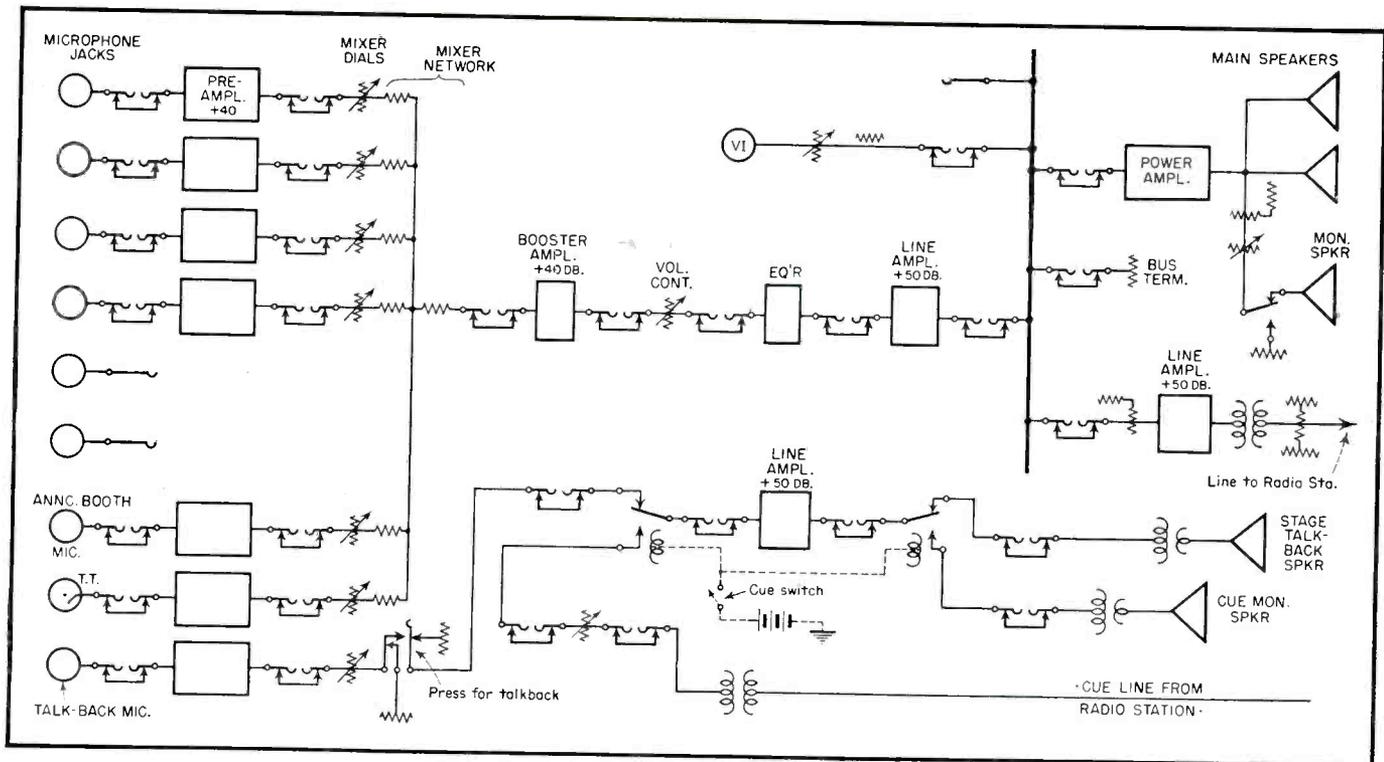


Fig. 2. Block schematic of professional type system for concert hall installation.

designed for such connection. An "bridging" amplifier, and uses an input transformer which has an input impedance of at least ten times the impedance of the circuit across which it is connected. In the absence of such an amplifier, an ordinary amplifier can be used provided that it is preceded by a "bridging pad" to reduce the loading occasioned by the connection of the amplifier across the bus.

With a bridging bus of known and constant program level, it is possible to arrange the circuit so that the amplifiers that are connected across the bus have the required amount of gain necessary for their respective circuit applications.

LEVEL DIAGRAM ANALYSIS

Returning to the level diagram, we note that the output indicated is +36 vu, whereas we have previously determined that the maximum output from a 40-watt amplifier is +46 vu. This safety factor is provided so that at no time will the maximum output of the power amplifier be exceeded, even on peaks. It is generally considered that the peaks of program material exceed the normal program level by approximately 10 db, therefore it is desirable that the average program level out of the power amplifier shall not exceed +36. Working back from there to the already established bus level of +8 vu, we find that the power amplifier must have a gain of 28 db. Immediately preceding the bus is the "line amplifier" with a gain of 50 db,

with an indicated input level of -32 vu. At this point, we would insert any equalizers that might be required, and for purposes of calculation, we will allow loss of 10 db for equalizers. Immediately preceding the equalizers, we should place the main volume control. For calculation purposes, we will set the volume control at a loss of 10 db, which allows some factor of safety with respect to gain, and, in the usual type of volume control known as a "ladder" pot because of its configuration, there is a fixed loss of 6 db when the dial indicates no loss. This makes a total loss for the volume control of 16 db, bringing the level at the input of the volume control to -16 vu. Immediately preceding the volume control is the "booster amplifier" and to determine the gain required, we will now start from the microphone input.

High quality microphones have a relatively low output level, and for purposes of calculation, we are safe in assuming this level to be approximately -64 vu. Following the microphone with a pre-amplifier with a gain of 40 db, we arrive at a level of -24 vu. The next element in the circuit is the mixer dial, which must be set at a loss of 10 db for calculation, and it also has a fixed loss of 6 db due to the construction of the potentiometer. Since we are using six mixer dials, all of the same impedance, a mixer network must be employed to couple all of these dials together and match them to the input impedance of the booster amplifier, maintaining at the same time suitable termination to each of

the mixer dials. Mixer networks vary in loss, but the most satisfactory coupling method for six dials necessitates a loss of approximately 16 db. We have now returned to a level of -56 vu, which is only 8 db above the output of the microphones. However, we have accomplished suitable mixing and combining of the various input circuits, and are now able to feed the assembled program to a system of amplifiers and speakers with no further treatment than an overall control of the volume, and any necessary equalization.

Having determined the output from the booster amplifier to be -16 vu, and the input to the booster amplifier to be -56 vu, it is obvious that the required gain of the booster is 40 db. It will be noted that we are using gain in four "packages" of fixed amounts, though the gains of the various packages are not necessarily the same. However, in order to reduce the total number of different kinds of amplifiers, we may use the same type for pre-amplifiers and for the booster, as their output requirements are low and within the same range, and the noise level from both must be relatively low. We then need a "line amplifier," with a gain of 50 db, and a power amplifier with a gain of 28 db.

With all of these requirements in mind, we can now take a look at the talk-back and cue circuits to determine the characteristics necessary for these functions. Figure 4 shows the level diagram for this branch of the circuit, with the solid line serving to

indicate the talk-back values, and the dotted line representing conditions in the cue circuit.

We may safely assume that the power required for the stage speakers for the talk-back system is one-half watt, which corresponds to a level of +27 vu. Preceding this is the line amplifier with a gain of 50 db, a volume control with a loss of 16 db, and a pre-amplifier with a gain of 40 db, which brings us to a level of -47 vu, which is well within the limits of microphones used for this purpose, or for practically any microphone when used in "close-talking" application.

For cue-line monitoring, a level of +10 vu is sufficient, and with the line amplifier gain of 50 db, and a volume control loss of 16 db, we arrive at a value of -24 vu, which is the minimum level acceptable from the cue line in normal operation. If less level than that is available, it might be necessary to change the cue volume control to a different type of pot having no insertion loss thus increasing the overall gain in the cue system by 6 db. However, a level of -24 vu is quite reasonable from a cue line under normal conditions.

It will be noted that the volume indicator is connected across the bus, together with its potentiometer to adjust the operating level, and further that the bus is terminated by means of a resistance of 600 ohms.

In order to feed the broadcast station, another "line amplifier" is used, preceded by a bridging pad to reduce its input level to that required for the particular installation. As the bus is operating at +8 vu, and as the line should be fed at a level of approximately +4 vu, it is necessary to insert some 54 db of attenuation in this circuit. This may best be done by using a 10-db H-pad following the output transformer, and a 43-db bridging pad in front of the amplifier. This figure assumes a loss of 1 db in the transformer. The H-pad is used following the transformer in order to isolate the line from any reactive elements at the source.

Having made a complete layout of the required system, we may now take a look at the components. It will be noted that we have used three different types of amplifiers—eight of the pre- and booster-amplifier type, three of the line-amplifier type, and one power amplifier. This high degree of interchangeability will provide flexibility so that in case of failure of any of the amplifiers, another may be "patched in" to permit the continuation of the program, at the possible expense of some of the facilities. No spare is indicated for the power amplifier, but it is certain that if the system were to

be used a large percentage of the time, another power amplifier should be installed, and its input terminals available on jacks, and suitable provision made for output circuit switching. The trend towards standardization is continued with the use of identical types of variable attenuators in all of the input circuits and for the volume control and cue circuits. All such steps towards a reduction of the different types of equipment make an efficient and flexible system.

LARGE SYSTEM

Having discussed the design of a medium-sized sound system of the highest quality, we come finally to the largest system we are to consider—a 150-watt installation intended to serve as the PA system for a baseball field seating 10,000 people.

Quality requirements are considerably less exacting for this type of system, as far as fidelity of reproduction is concerned. In addition, less inputs are to be provided, and there is to be no need to feed a radio station.

These requirements, as stated to our hypothetical PA operator, are as follows:

- 2 Microphone inputs
- 1 Turntable input
- 1 Radio Receiver input
- 4 Speakers, mounted at a single location.

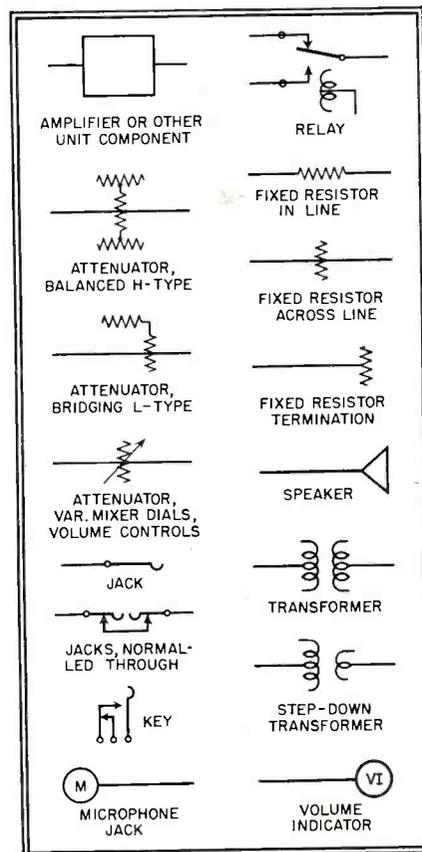


Fig. 3. These symbols used in block schematics differ from those used in ordinary circuit diagrams.

From standard handbooks on sound systems we learn that a system capable of approximately 150 watts of output power would be required to cover an audience of this size in an outdoor stadium, assuming that speakers of reasonable efficiency are used.

There are a number of ways in which this type of system could be planned, each of which has its advantages and limitations. However, in order to keep the cost to a minimum, it is advisable to avoid the "professional" type of installation, such as the 40-watt system previously described. While this type of system is by far the most flexible, it is not necessary to have such flexibility for this particular requirement, and the added expense is not justified in most cases.

With all these considerations in mind, it is probable that the most logical design would include the use of a commercial type of amplifier, with from 15 to 30 watts of output, and perhaps one which is equipped with a phonograph motor and pickup as an integral part of the amplifier, together with some type of power amplifier to bring the total power up to the required amount.

An inspection of catalogs of available equipment points to the use of two 100-watt amplifiers for this latter application, as units of this size are readily available, and there is no harm in having the extra power. This also gives another advantage. With the use of four speakers, it is possible to drive two of them from each power amplifier, so that in case of failure of either of the amplifiers, there will still be some coverage, and even though it might possibly be insufficient, it would be better than none. Further inspection of the catalogs will indicate that 50-watt speaker units are also available, so the plan to use two speakers for each amplifier will work out well in practice.

Having made these preliminary decisions, we may now construct the level diagram shown in Fig. 5.

By the methods previously discussed, we can determine that the output level corresponding to a power of 150 watts is approximately +52 vu, the actual value being +51.76 vu. Inasmuch as we are using two power amplifiers, the output power required from each is one-half of the total, which corresponds to a reduction of 3 db. Therefore, for calculation purposes, the output level is +49 db. The gain of the particular amplifier as described in the catalog is 17 db, which brings us down to a level of +32 vu, which must be supplied by the main amplifier unit. This represents a power of approxi-

[see page 32]

SYLVANIA NEWS

RADIO SERVICE EDITION

JUNE

Prepared by SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa.

1947

IT PAYS! — IDENTIFY YOUR STORE WITH THESE FREE AND LOW-PRICED SELLING AIDS

Take full advantage of these specially prepared sales aids—it pays! High quality store identification is one of the best means of indicating the type of service you're prepared to offer.

And when these attractive display pieces show that you're selling the finest line of radio tubes made—well, you have the ideal way of building up sales! Note eye-catching variety below.

FREE— This attractive display stands approximately 3½ feet high. Available in 10-inch size for counters.

FREE— Decal for store doors or windows; and dummy cartons in standard and 20" sizes.

Get this low-priced weatherproof service banner—46" x 28". For truck-shop, window! 40¢ each; 3—\$1.00.

Wonderful new 15" diameter clock, in color. Telechron movement sealed in oil; case in brown crinkle finish with silver-colored rim. Only \$8.50.

14½" high by 10¾" wide by 7" deep, this colorful display is fitted with flasher unit that lights message every other second! A must for your window. Only \$2.00.



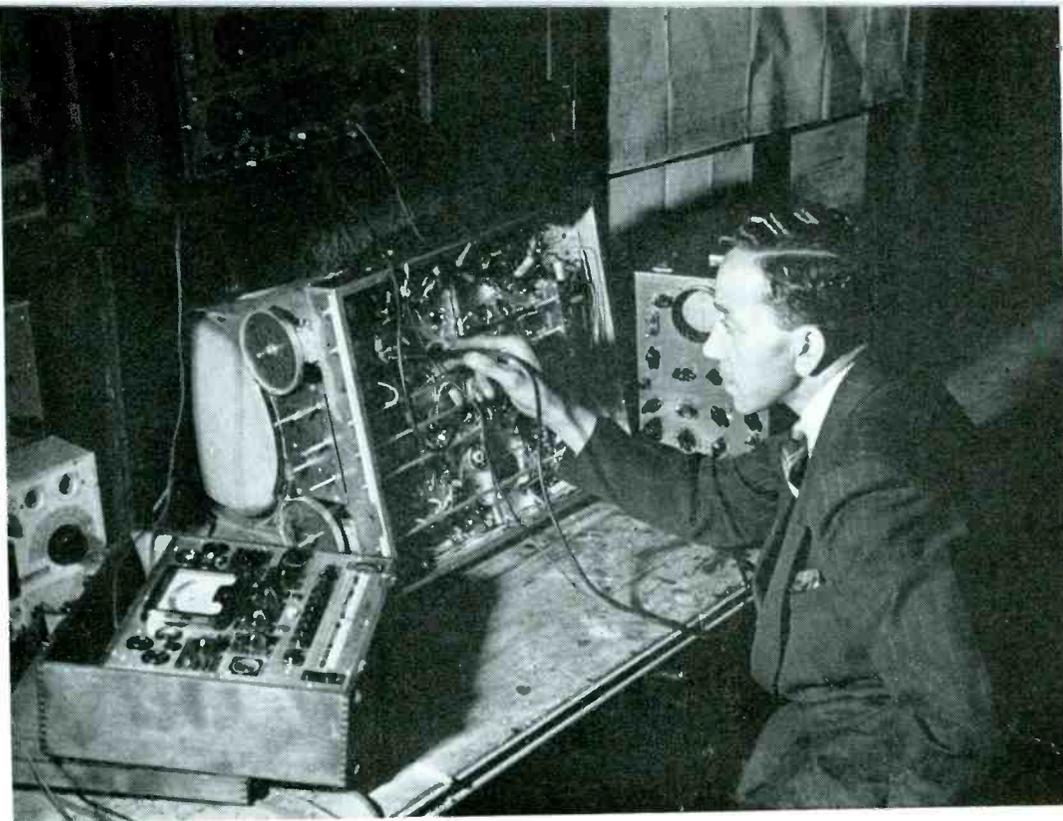
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with the sales aids shown. Life, Collier's, Saturday Evening Post, with a combined weekly circulation of close to 12,000,000, carry ads that sell you, your product and service. To profit from this national campaign use these tested, "on the spot" selling aids.

Order from your Sylvania Distributor or write Sylvania Electric Products Inc., Emporium, Pa.

SYLVANIA ELECTRIC

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS



This discussion of the technical and economic aspects of television receiver installation and service is based on the experience of an organization (Amie Associates) which has been investigating the many associated technical and operational problems for a number of years. This organization has tested and discarded several theories and plans before arriving at the conclusions here presented. Photo shows an Amie technician checking teleset.

By W. J. JONES

TELEVISION SET INSTALLING

is a specialty business

THE main thing that we have learned is that television receiver maintenance is an expensive proposition. There are few, if any, repair jobs which can fall into the \$2.50 to \$9.00 class.

Television receivers cannot be safely or adequately serviced in the customer's home. This means that a pick-up and delivery service for large heavy, expensive pieces of furniture must be maintained. The delivery and installation crews have to be bonded and insured.

As for installations, each one, whether in a dealer's store or in a customer's home requires separate consideration. There are no one or two standard arrangements which can suffice for all locations. It is unwise to suppose that one or two single fixed installation fees can be established which will suit the majority of conditions.

We have found it necessary to inspect the premises of each prospective owner and to attempt to place the particular installation problem in one of four categories ranging from the simple condition which is a line-of-sight location high field intensity with no reflection, and short-lead-in, to the more complex type which requires a high-gain, highly-directive antenna with long low-loss transmission lines and/or special antenna towers or mountings.

It has been necessary to establish fixed fees for the first three classes. These are proportionate to averages of materials and man-hours required. Installations falling in the fourth class are those which have to be estimated separately. *Installations charges should be shown separately from the cost of the set.*

Insurance for installation personnel, and insurance against liability due to damage to the home, property occupants or the general public as a result of an installation must be carried.

Repair Costs

We believe that repair charges must be based on the cost of material used and the number of man-hours required. It must be realized that parts (power transformers, filter condensers, i-f transformer) are considerably more expensive than those used in conventional broadcast receivers. There are numerous critical parts which must be replaced by exact duplicates if top performance is to be regained.

For this work the formal technical training and experience required of servicemen is of a high level. Dependable, precision-made test equipment must be available. We estimate that cost of special television repair equipment is in the order of \$4,000 as a minimum

with a figure of \$5,000 being more desirable. The several types I shall later mention.

The fixed rate includes all costs plus a small margin of profit.

Service calls of the inspection and estimate types are made for a fixed fee.

Antenna system repairs and other types of on-the-spot service are charged for on the same fixed shop labor rate.

If the dealer or distributor elects to have his service and installation handled by an outside concern, an agreement as to who pays for parts and labor during the warranty period must be made.

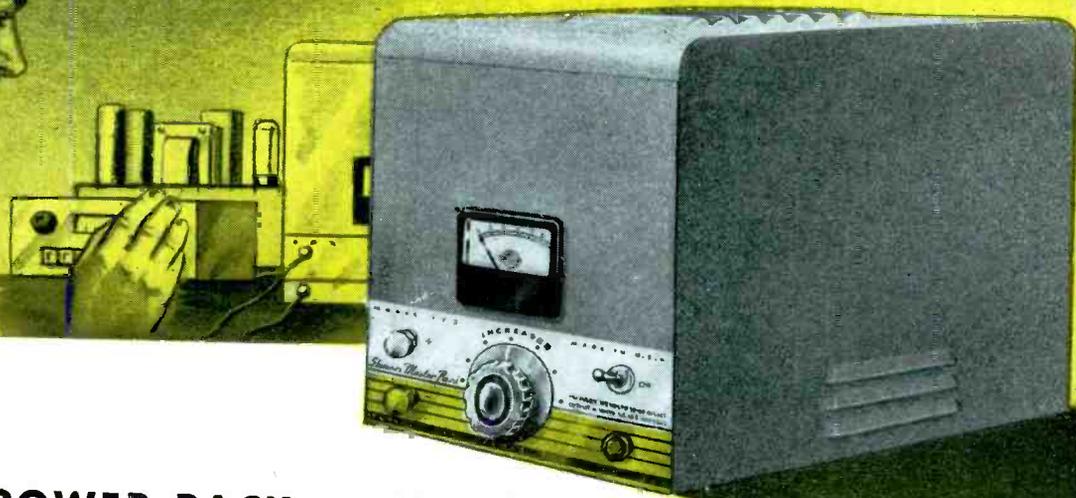
For warranty period service there are two possible arrangements. In one, the dealer pays separately for each service call made. In the other, the dealer deposits with the service organization and "insurance fee" for each set sold by him. The service organization then provides, during the warranty period, all necessary service without additional charge. The size of the fee must be based on the type and quality of the sets to be covered and a figure of maximum percentage of total sets covered by the insurance that may require service.

Installation Problems

Installation problems have been subdivided into two categories, simple and

STANCOR

really has something
to meet your servicing needs



POWER PACK . . . Model 752

The Model 752 power pack provides a well filtered 6 volt - 12.5 ampere D.C. supply from any standard 115 volt, 60 cycle source. Replacing messy and troublesome storage batteries for numerous types of service it is ideal for automobile radio sales demonstration or service test bench, effectively operating most push button tuning auto sets. Useful apparatus for industrial or laboratory testing. Best all purpose low voltage pack. All controls, knobs, voltmeter and terminals are visible and accessible on plainly marked escutcheon panel. Pack may also be used for auto accessories testing, battery charging, magnetic field exciting, electroplating, etc.

**FOR DEMONSTRATING
AND SERVICING**

**AUTO RADIOS AND
OTHER AUTO
ACCESSORIES**

BATTERY CHARGING

**OPERATING RELAYS
AND SOLENOIDS**

**REPLACING STORAGE
BATTERIES**

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ask your jobber for the **STANCOR 752**

STANDARD TRANSFORMER CORPORATION

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complex. Simple installations are those in suburban, residential and rural areas. Complex installations are those in built-up city areas.

The FCC considers as necessary minimum values field strength intensities of 5000 micro-volts per meter for built-up city areas and 500 micro-volts per meter for residential and rural areas. While there is practically no disturbance due to "natural static", man made interference does, however, impose severe conditions. Thus, built-up areas necessitate high field strength intensity.

To minimize interference, reflections, etc., the highest part of the building should be selected for the antenna location. The antenna must be attached securely to the mast and the mast rigidly fastened. Guys may be necessary sometimes. The transmission line must be secured firmly and protected from physical damage. It must be as short as possible.

For proper orientation of the antenna, two installation men are necessary. One on the roof, the other at the set observing the picture on the screen. The antenna is rotated and moved in vertical or horizontal position for the best overall results on all stations. Communication between the two men is accomplished by means of hand telephone sets.

How to Install in Large Cities

The problems to be overcome in the installation of television receivers in a highly urbanized area are many, and unless they are properly approached the results will be most confusing and detrimental to volume sales of receivers.

How can one install more than two or three antennas for the hundred or so television receivers that may be owned by the residents of a single apartment house in New York City.

We have spent considerable amounts of money and engineering time in attempts to find a suitable solution.

We have devised a practical system whereby a maximum of about 20 receivers may be operated independently of each other from a single antenna. Briefly, the antenna is coupled to a wide-band r-f amplifier. From cathode follower stages connected in parallel across the output, separate r-f transmission lines are connected to the individual receivers.

One major phase of the problem is getting enough power out of the amplifier without cross-modulation. In apartment houses a lead-in 500 feet long would be commonplace. What with attenuation in cable and the power requirements of each set, a fairly high level is required instead. The amplifiers must have extremely wide band coverage with uniform gain and introduce no troubles because of phase shift.

Servicing

The design of a television receiver is based upon many considerations which differ from those encountered in sound receivers. The carrier received is extremely complex containing three signals, video, sound and synchronization.

In order adequately to service television receivers, the following things are absolutely necessary: a) Data. b) Personnel. c) Parts. d) Test equipment. Complete engineering data must be obtained from the receiver manufacturer; it has to include:

1. Circuit diagrams
2. Functional block diagrams
3. Detailed explanations of operation of the various circuits
4. Alignment information
5. Performance specifications
6. Sensitivity (signal-to-mask voltage ratio)
7. Voltage and current figures
8. Engineering notes

It is not sufficient to be supplied with figures like "250 volts microvolts sensi-

tivity and gain of 700". Detailed information as to the measuring equipment (generators, connectors, detectors) gain settings, and techniques employed is mandatory. If possible, factory test conditions should be duplicated by the service station.

Personnel should be well grounded in mathematics and electronic theory. They should be permitted to become familiar with the receivers at the manufacturers' plant. Constant liaison of design and production engineers with the servicemen is desirable.

The serviceman must always bear in mind the high voltages present and of the seriousness of accidental implosions of the cathode ray tubes.

Exact replacement parts should be available from the instant a model becomes available on the market. Manufacturers are urged not to use all components for manufacture, but to earmark a certain percentage for service. The amounts of each component would vary in accordance with anticipated fatality rate.

The requirements for test equipment are extremely rigid. The instruments must be accurate and dependable. The minimum types of equipment necessary for proper installation of receiving equipment are as follows:

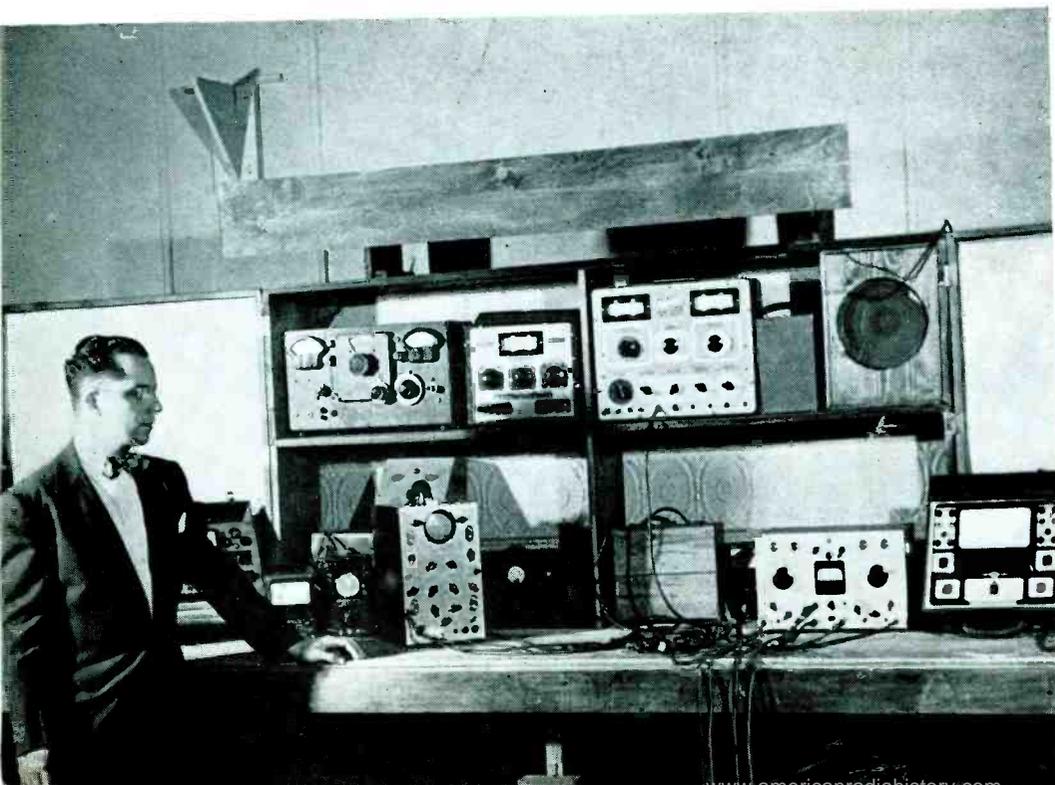
- a) Test antennae (different types)
- b) Rigging equipment (ladders, hoists, etc.)
- c) Hand telephones and wire
- d) Plumber's "snakes" for pulling coaxial lines through walls, down shafts
- e) Tools
- f) Field intensity measuring instrument is desirable.

The minimum types of equipment necessary for proper servicing are as follows:

- a) voltmeters
- b) ammeters
- c) resistance bridge
- d) capacitor bridge
- e) inductance bridge
- f) D.C. (vacuum tube voltmeter)
- g) A.C. (to 400 mas) vacuum-tube voltmeters
- h) Signal Generators
 - (1) AM
 - (2) FM wobblometer
 - (3) Crystal controlled oscillators for adjustment of the local oscillator.
- i) Connecting cables
- j) Bias boxes
- k) High voltage condenser breakdown test sets
- l) Safety eye glasses
- m) Connecting cables
- n) Frequency meters
- o) Oscilloscope (with wide-band amplifier)
- p) Audio oscillator
- q) Square-wave generator
- r) Pulse generator
- s) Monoscopes (image-signal generator)

[see page 32]

Showing some, but not all, of the test equipment which is required for servicing television receivers.

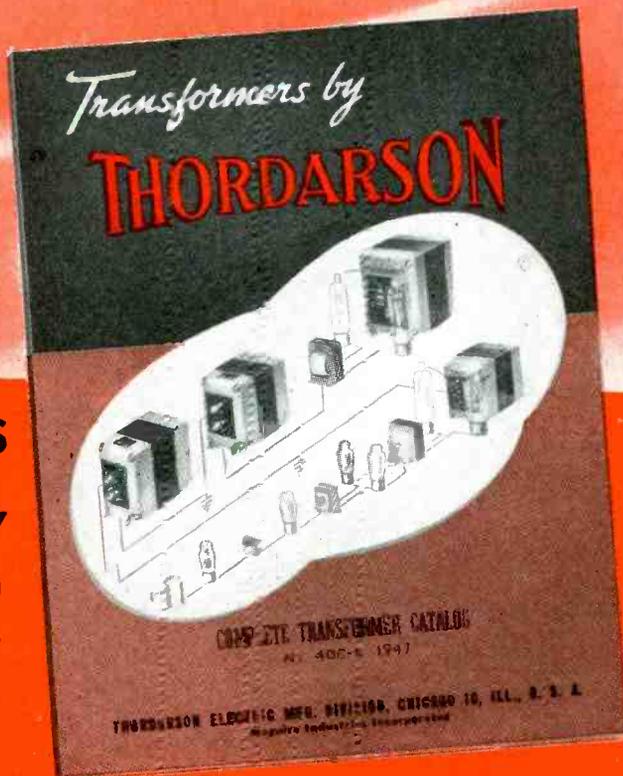


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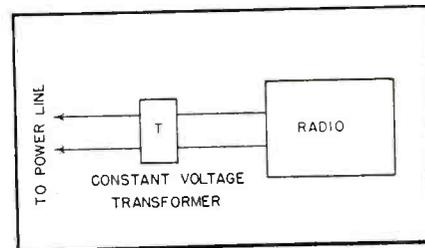
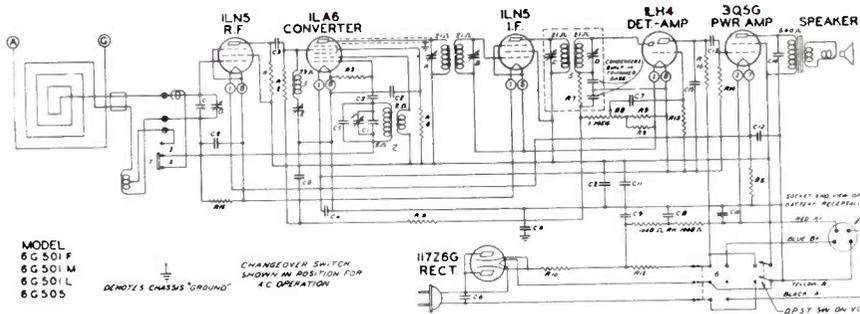
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EXPORT: SCHEEL INTERNATIONAL, INCORPORATED
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Left—Figure 1
Above—Figure 2

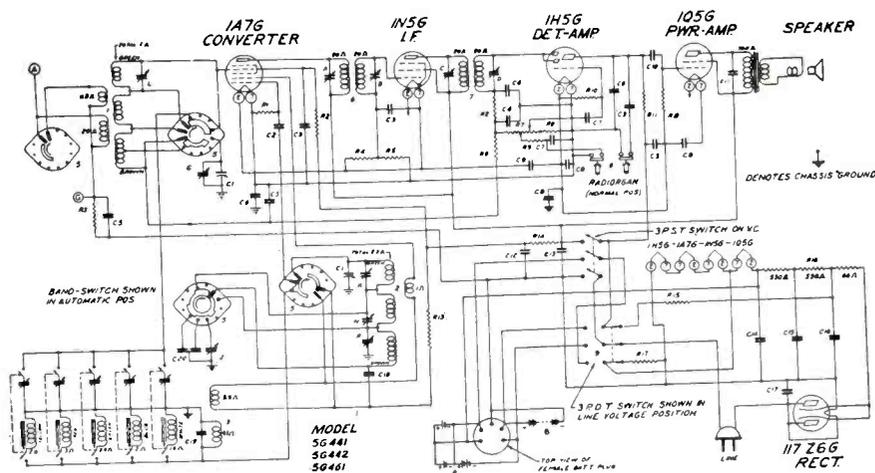
A typical 3 way portable of modern design is shown in *Fig. 1*. The faults are those of any set of this type, which servicemen know, but intermittent operation quite commonly is caused by a loose connection in the loop antenna circuit, off-center loud-speaker cone or loose voice coil connection, defective C13 or volume control. If the set plays on batteries but not on a. c. the trouble obviously is localized to the power supply. Under certain conditions, oscillation at the end of the band may be removed by shorting R4, but this results in a higher than normal screen potential. C2 may be defective or the leads to it may be too long. Shorting R4 makes it possible for C2 and C11 in the plate return circuit to function as screen bypass units, cutting the oscillation.

If the 2nd i.f. is replaced and the exact replacement cannot be obtained, the condensers across R7 may be uni units. R13 is very high and may cause a guttural quality if the 1LH4 is slightly gassy. Cutting the gridleak to 2 megohms or 5 megohms seems to work out in practice, clearing the distortion. Unstable operation may be due to a poor ground on the shielding of the ILA6 plate lead. Line voltage fluctuations may cause trouble. One possible solution is the use of a constant voltage transformer for ac circuits as shown in *Fig. 2*.

A more elaborate circuit is that in *Fig. 3*. The alignment is more difficult than for the usual 3-way job and is tabulated in *Fig. 4*. The band-switch contacts may require cleaning; there is a greater chance for loose connections to develop, etc. The radio organ tone control switching is a little unusual. Closed, one switch shorts out C7 and the other connects C9 across C6. The filament circuit is standard and is redrawn in simplified form as *Fig. 5*. What happens when a tube is burned out can easily be seen. If the 1H5 burns out, E will be applied to the condensers and since tube filament current does not flow, the condensers will be charged up practically to the value of E. If, now, a new tube is installed, the condensers will

Servicing 3-WAY PORTABLE Receivers

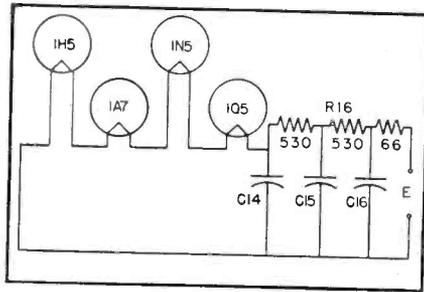
by WILLARD MOODY



Above — Figure 3

Below — Figure 4

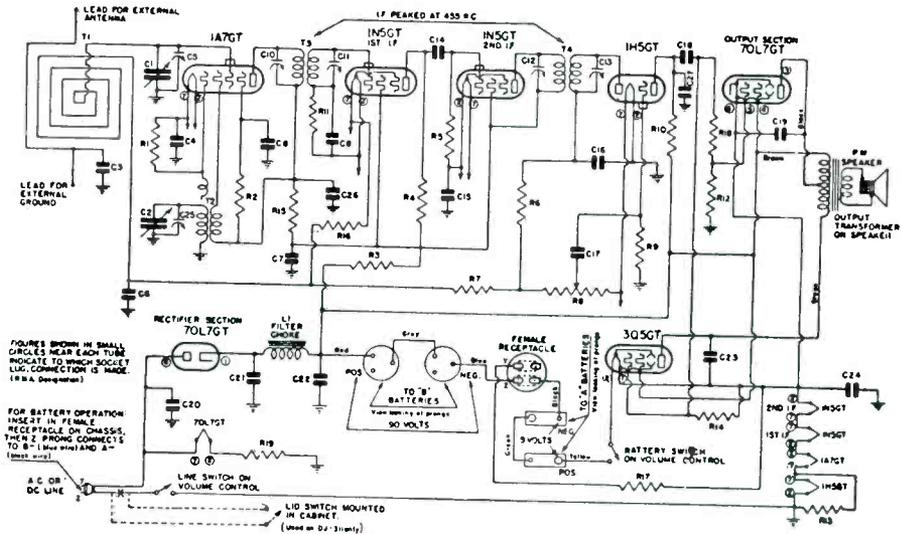
Operation	Connect Test Oscillator to	Dummy Antenna	Set Test Oscillator to	Band	Set Dial At	Adjust Trimmers	Purpose
1	1st Det. Grid	1/2 mfd.	455	Br'dc't	600	A B C D	I. F. Alignment
2	Rec. Ant. Wire	400 ohms	18000	S. W.	18000	K	Set. Osc. to Scale
3	" " "	400 ohms	18000	S. W.	18000	L	Rock gang & adj. for max. output Alignment of Ant.
4	" " "	400 ohms	6000	Police	6000	N	Rock gang & adj. for max. output
5	" " "	200 mfd.	1400	Br'dc't	1400	F	Rock gang & adj. for max. output
6	" " "	200 mfd.	600	"	600	J	Rock gang & adj. for max. output
7	" " "	200 mfd.	"	"	"	Repeat F & J	



Above — Figure 5
Right — Figure 6

discharge and the new tube or others in the string may burn out. Therefore, as many have found out, it's not a good idea to pull tubes out and put them back in when the power is on if the set is a 3-way type. In cases of burned out tubes it's a good thought to short the condensers and check the circuit with an ohmmeter before again turning on the power. The short is temporary of course.

Still another set which was widely sold is the RCA BP-55, and many of the troubles center about the change-



over switch, faulty contacts, loose connections, etc. An open in C22 may cause instability and oscillation. Another popular receiver is the Emerson DJ-310 shown in Fig. 6. The filaments are in series with the cathode of the beam power section of the 70L7GT. Loss of emission in the tube obviously

will prevent normal filament operation. Leakage in C18, C19, or C23 may cause filament failure and leakage in C24 pulls down the filament voltage. The output transformer is a peculiar type and may be replaced with an ordinary type if the set is to be operated on a. c. exclusively.

IN AND AROUND THE TRADE

[from page 6]

accentuation, reduction of thermal agitation, and cross modulation. Some of the semi-technical descriptions of those 20 fundamental features have never before appeared in print. The booklet was written by Chief Engineer, A. C. Shaney, and is available to senders of a 3¢ stamp to cover postage.

Para-Flux Reproducers

Three types of reproducers for vertical lateral and universal uses, para-flux reproducers, have been announced by Radio-Music Corporation, East Port Chester, Conn.

Vertical head, VL-1DA, has a diamond stylus with a 2-mil radius.

Lateral head, LL-1DA, uses a 2.5-mil radius stylus.

Universal head, UL-1DA, employs a diamond stylus, 2-mil radius.

Response of all models is said to be linear from 40 to 11,000 cps.

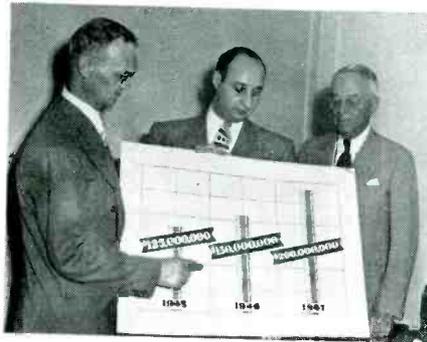
Vertical, lateral and universal heads use same arm and equalizer. Head can

be removed and replaced via a plug connection.

Bulletin PR34 mailed upon request.

Clough's Bright Outlook

H. W. Clough, president of the Radio Parts and Electronic Equipment Shows, Inc., which held its first postwar conference at the Stevens hotel in Chicago May 10-17, predicts



that the radio parts manufacturing industry will do a \$200,000,000 business at the consumer level in 1947. Above, he indicates by chart how this compares with 1945 and 1946 levels. With him are Kenneth C. Prince, general manager of the show, center, and Bond Geddes, executive vice-president of the Radio Manufacturers' association.

G. E. Speakers

Largest and smallest loudspeakers in the line of speakers which the Spe-

cialty Division of General Electric Company's Electronics Department is shipping to distributors and initial



equipment manufacturers are displayed here by a G-E employee. Like all G-E speakers, these twelve-inch and four-inch models utilize aluminum bases for voice coils, a feature which enables the speaker to handle higher wattages and have longer life, G-E engineers say.

Test Equipment Catalog

New catalog issued by Metropolitan Electronic Instrument Co. lists meters, testers, s.g. generators, dynamic signal tracers, oscillographs, etc. Items are described fully. Copies, from the company—6 Murray St., New York 7, N. Y.

Radio Dial Belts Lower

The JFD Mfg. Co., Brooklyn, New York, announces reduced prices of all JFD Radio Dial Belts and Belt Kits.



NEW PRODUCTS

Jewel Case Display

The new "jewel case" display piece for the Stewart-Warner "Air Pal" midget radio, ideal for small windows and counter display by radio and appliance dealers, is now available.

The display measures 11¾ inches wide and 10 inches high, is of gold carboard and white satin. It opens up just like a jewel case and is easel-backed for self-standing.



J. R. Brandenburg, Assistant Sales Manager, Radio Division of Stewart-Warner Corp., inspecting new "jewel case" display.

The "Air Pal" is a 4 miniature tube plus rectifier AC-DC plastic set weighing only 3¼ pounds, with a coverage of 535-1600 kc. It has a permanent magnet dynamic speaker and vernier planetary drive for accurate, easy tuning.

Pons Approves

Lily Pons, star of the Metropolitan Operat Company, plays one of her favorite recordings on the new General Electric Model 417 AM-FM radio-



phonograph combination for Paul L. Chamberlain, manager of sales for G-E's Receiver Division. "This is the most perfect record reproduction I have ever heard," she said.

DeLuxe New Hallicrafter

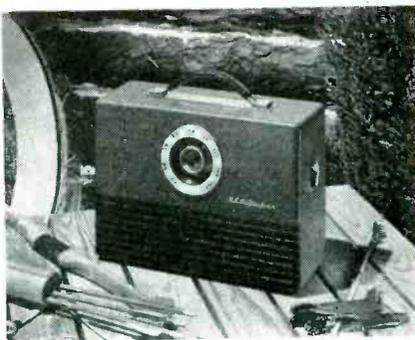
The new Hallicrafters handcrafted custom built radio console, featuring timecontrol wire recorder, record changer and an interchangeable re-



ceiving unit. It has a revolutionary new feature (shown at top left in photo)—the wire recorder which may be preset to record any radio program, to be played back whenever the listener wishes. The set is adaptable for use as amateur (ham) equipment, with choice of several Hallicrafters precision-built receivers and space for transmitter controls. The record changer intermixes 10 and 12 inch records.

New Rechargeable Set

"The Escort," RCA Victor's new portable radio with a self-contained 2-volt battery which is said to afford 30

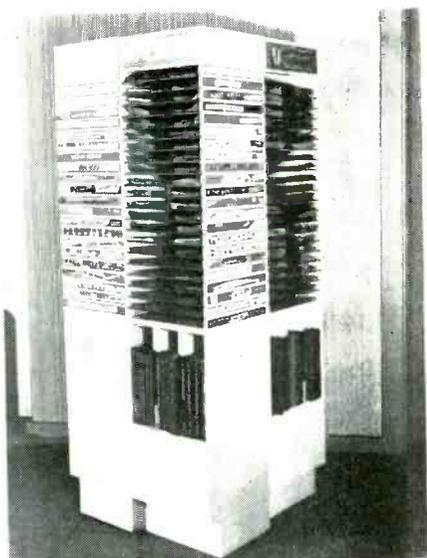


percent longer playing time between recharges than comparable portables. Suggested list price is \$89.95. Vinyl plastic coated luggage type covering, leather covered handle and fuse built into the set to prevent damage to the battery in case of mishandling. This instrument can be operated either from its self-contained battery or from household current.

RCA Stimulates Sales

RCA Victor's "island cluster", a fixture with plate glass shelves enables dealers to feature eighty-eight different single record selections in four square feet of floor space.

Major advantages of the merchandisers are economy of space. The clusters are constructed so as to provide storage space for albums or additional singles at the bottom of each



unit, and a large quantity of records can be given prominent display at one time.

It is proving to be the best method of selling twelve-inch Red Seal singles, according to tests made.

Air King Minstrel

Here is the latest addition to the Air King line, the Model A 400, "Minstrel". Available in Ivory and Walnut



plastic cabinets, its features are: 4 tube Superheterodyne (including rectifier); range 540-1600 Kilocycles; Stepped up beam power stage for increased volume; 4 inch PM Loudspeaker—Alnico 5 speaker; AVC; List price \$17.95 in Walnut, and \$19.50 in Ivory.

Wire Recorder Foundation

A wire recorder mechanism only, known as Model 79 Foundation Unit, was announced by the Webster-Chicago



Corporation, Chicago 39, Illinois. Deliveries are scheduled for July. Model 79 consists of a simple, efficient wire transporting mechanism equipped with a triple-purpose recording head which

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Yes, that's all you need do. Nothing to buy, nothing on which to beat your brains out.

Anyone of the tens-of-thousands of servicemen who have enjoyed the many benefits of RIDER MANUALS during any of the past seventeen years has the answers at the end of his pencil, ready for placing on the official entry blank available at all jobbers. And, a newly established serviceman has an equally good chance of winning by merely going over RIDER MANUALS at his jobbers' and reading the RIDER MANUAL ads appearing in national radio publications every month. You don't need to be a fancy writer, even spelling and grammar are unimportant. Just, in plain, everyday conversational English, write us 100 words or less on why you believe "RIDER MANUALS mean SUC-

CESSFUL SERVICING." The first thing you write may win you one of the many substantial cash or servicing equipment prizes.

Note the rules which have been kept easy in order to promote the purpose of the contest, i.e., to quickly acquaint as many servicemen as possible with the many time-saving, profit-making features of RIDER MANUALS.

Entries should be submitted on the official RIDER MANUAL CONTEST entry blanks which are available at your local parts jobbers. It is designed to make it still easier for you to win one of the 224 valuable prizes. Do it today. Send in your entry early!

**DON'T PUT IT OFF—WRITE IT DOWN!
SEND IN YOUR ENTRY TODAY**

SUCH EASY CONTEST RULES!

1. Nothing to buy. Just send in 100 words or less giving your reasons why "Rider Manuals mean Successful Servicing," and indicate on the official form, the name of your preferred parts jobber.
2. Mail entry on the official contest entry blank obtainable from parts jobbers, or write direct to John F. Rider Publisher, Inc. for blank.
3. Entries must be postmarked no later than Sept. 15, 1947.
4. Entries will be judged on completeness, compactness and originality of expression of reasons. Judges will be John L. Stoutenburgh, Executive Editor of "Radio Retailing"; Herman L. Finn, C.P.A.; Lansford F. King, Advertising Agent. The decision of the judges will be final. Duplicate prizes will be awarded in case of a tie. All entries become property of John F. Rider Publisher, Inc.
5. Contest open to anyone interested in radio servicing, living in continental U.S., its possessions and Canada, except employees (and their families) of John F. Rider Publisher, Inc., its advertising agency, accounting company, the principals and executives of Rider jobbers, or Caldwell-Clements, Inc., publishers of "Radio Retailing."

LOOK AT THESE PRIZES!

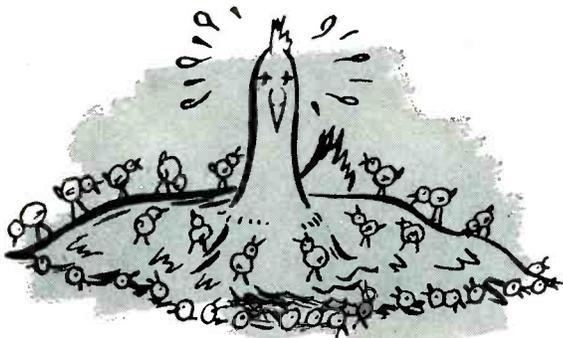
For Contestants

1st Prize	Cash	\$500
2nd Prize	Cash	300
3rd Prize	Cash	200
4th Prize	Cash	100
5th Prize	Cash	75
6th to 10th Prizes (\$50 each)	Cash	250
11th to 40th..... (30 equipment Prizes worth \$25 each)		750
41st to 80th..... (40 equipment Prizes worth \$15 each)		600
81st to 140th..... (60 equipment Prizes worth \$10 each)		600
141st to 224th..... (84 equipment Prizes worth \$7.50 each)		530

For Jobbers of Winning Contestants

1st Prize	Cash	\$100
2nd Prize	Cash	75
3rd Prize	Cash	50
4th Prize	Cash	25
5th Prize	Cash	20
6th to 10th Prizes (\$10 each)	Cash	50
Total		\$4,325

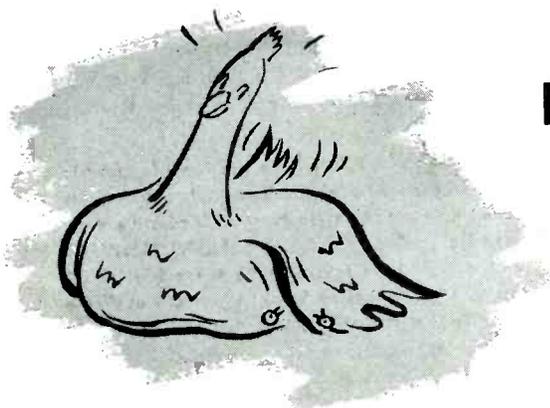
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records, erases and plays back. It is powered with a self-starting, induction-type motor giving the uniform speed essential to wire recorder operation; records at 2 feet per second and re-winds at 7 times that speed. A standard size spool of wire is used which permits continuous recordings of one hour in length. Shorter length spools in ¼ and ½ hour sizes are also available.

New Disc Recorder

A new portable disc recorder is announced by E. W. Applebaum of Audar, Inc., Argos, Indiana.



Audar Model RE-8 includes a high output amplifier, neon recording level indicators, 6½" heavy duty PM dynamic speaker, and hand microphone with seven feet of cable. All switching from recording to play-back is governed by a single control which automatically makes the proper tone compensation adjustments. Entire unit furnished in two-tone leatherette carrying case measuring 15 7/8" x 17 5/8" x 9 3/4". Retail price \$129.95.

Burgess Sales Builder

A "Vacation Kit" of popular "A" and "B" batteries made expressly for personal portable radios is announced

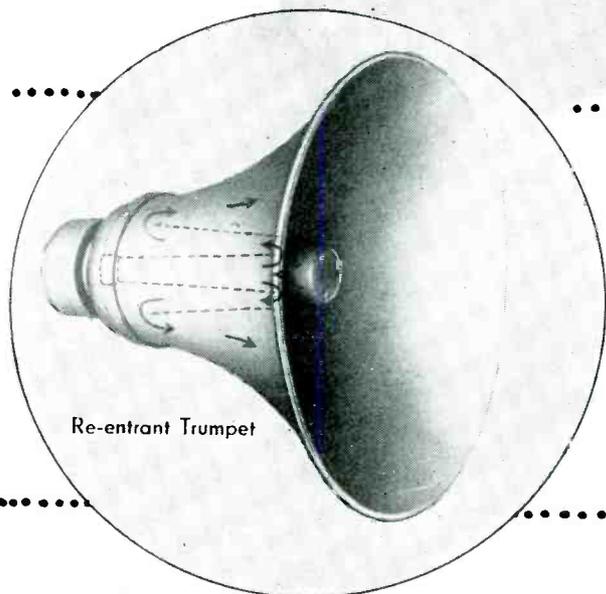


by Burgess Battery Company, Freeport, Ill. Six of the popular new 2R "A" batteries and the long-lived 67½ volt "B" No. XX45 are packed in an attractive display carton to prompt unit sales to the thousands and thousands of personal portable radios.

This new kit is attractive to vaca-

AUDIO ENGINEERING SUPREMACY

is built into every RACON Sound Reproducer



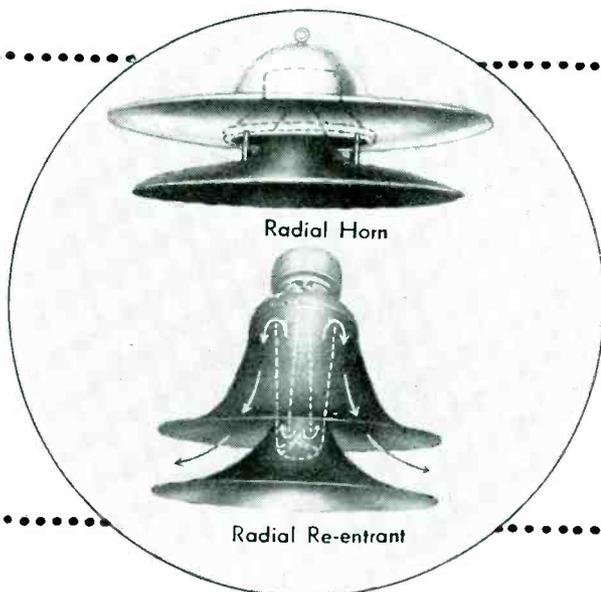
Re-entrant Trumpet

ACOUSTIC & STORMPROOF MATERIAL

Only RACON makes speakers with Racon Acoustic Cloth which is processed by a patented method which gives a non-vibratory wall, thereby increasing the output of the horn without loss due to wall vibration. Supplied as a part of all re-entrant horns, and on all straight horns when so ordered. Stormproof types are guaranteed for life in all kinds of weather and temperature, regardless of climatic conditions.

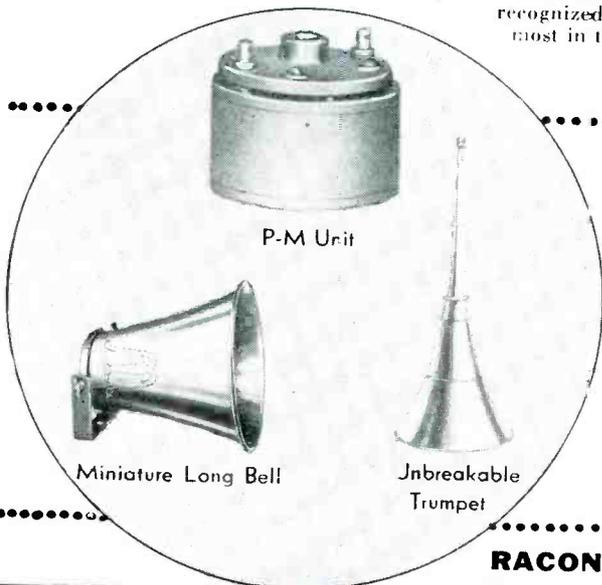
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RACON'S leadership in sound reproducer engineering has been recognized for almost three decades. RACON driver units have a rated output for peak and continuous performance far in excess of any other brands — continuous operating capacity 30 watts, peak capacity 60 watts. RACON speakers and driving units require less energy input yet they deliver more efficient sound reproduction output. All claims made by RACON as to cutoff frequencies and acoustic lengths of speakers, power handling capacity, efficiency and frequency range of driver units are substantiated by tests made at laboratories recognized as the foremost in the industry.



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Radial Re-entrant



P-M Unit

Miniature Long Bell

Inbreakable Trumpet

COMPLETE LINE TO CHOOSE FROM

There is a RACON driving unit, trumpet or speaker for every conceivable sound application — also the accessories (brackets and housings) that may be required for special purposes. Soundmen know that it pays to choose and use a speaker line that is complete. Yes — RACON makes every kind of sound reproducer from the giant 7 foot length auditorium horn down to the small 4 inch intercom cone speaker — from the super giant P.M. driving unit to the tiny driver for paging horns.

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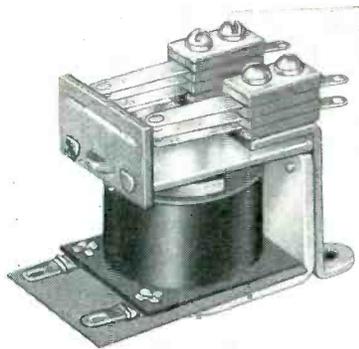
tionists and traveling men for its slim and trim, easy to pack in a suitcase. The "B" battery provides plenty of power to bring the customer back for more of the long-lived new "A" batteries to build repeat business for the dealer.

Snap-Action Switches

A complete line of Snap-Action Switches is available in conjunction with standard Guardian relays.

The snap-action feature is particularly suited to control applications that involve slow-moving, mechanical devices or where a given stroke is required to provide quick, positive "make" or "break" contact action.

The tension of the hair spring retains the contact assembly in either the



Guardian Snap Action Switch

"open" or "closed" position until the armature has completed its travel. Then the contacts will make or break with a sharp precise motion. (Circuit

diagrams are available).

For additional information write Dept. SA, 1637 West Walnut Street, Chicago 12, Illinois.

BUY MORE BONDS

Sangamo Plastic Tubulars

A new paper tubular capacitor, designated as type 30, molded in plastic, is announced by Sangamo Electric Company, Springfield, Illinois. San-



gamo were first in 1923 to design molded mica capacitors. The development of paper tubulars in a thermosetting plastic case offers advantages such as: complete sealing against humidity, secure anchoring of leads, unchanging capacity values, low power factor, application at higher temperature and a smooth, molded, non-dust catching finish.

Rider's Improved Manual

"Clarified Schematic" diagrams in the new Rider Manual, Volume XV, save the radio trouble-shooter hours



of time. Postwar receivers in this giant volume are broken down into separate, individual schematics for each band of every multi-band set. In addition, an extra 200-page "How It Works" supplement comes with Volume XV, to explain the theory behind 1946 sets.

Novel New Appliance

The Morton "Singette" does dozens of jobs from singeing chickens to browning casserole dishes, grilling



cheese sandwiches, removing paint, rapid defrosting of refrigerator coils, thawing pipes, grilling bacon and hot dogs, toasting marshmallows, basting eggs, heating hors d'oeuvres, quick drying of all kinds of articles, etc. Singette, which lists at only \$7.45

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Rapid, correct measurements of ohms, volts, current and decibels. Meter and terminal resistance accurate to within $\pm 2\%$; precision resistors accurate to within $\pm 1\%$.

EASY TO READ

4 1/2" meter with clear graduations shows readings at a glance.

SIMPLE TO OPERATE

All functions available without

changing test leads, except 50 microamps and output meter capacitor. Single rotary selector switch controls all functions and ranges. Two position switch used to select AC or DC volt ranges.

COMPLETELY PORTABLE

Weighs only nine pounds, gray wrinkle finish. Dimensions 10 1/4" x 9 3/4" x 4".

NEW FREE BOOKLET ON FM SERVICING AVAILABLE

For complete information, write: General Electric Company, Electronics Department, Syracuse 1, New York.

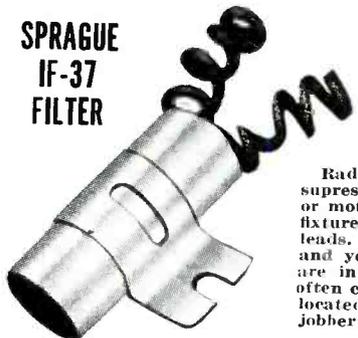
GENERAL ELECTRIC

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RADIO SERVICE DEALER • JUNE, 1947

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IF-37
FILTER**



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RADIO NOISES FROM FLUORESCENT LAMPS!

Radio noises caused by fluorescent lamps CAN be suppressed—easily, quickly and effectively. No lost time or motion. Just install a Sprague IF-37 Filter on each fixture, connecting it directly across the incoming leads. IF-37's are especially designed for the job—and you'll be pleasantly surprised how effective they are in suppressing "hard-to-stop" interference that is so often conducted down the power lines, even to remotely located receivers. Buy them from your nearest Sprague jobber today.

WRITE for a copy of the complete 40 page Sprague Catalog of capacitors, resistors, interference filters & test equipment.



FOR SALE—5" scope part of radar unit SCR-268, with or without metal tube. A. Saul, 18 E. Philadelphia Ave., Boyertown, Pa.

POSITION WANTED—Radio service student at Cass Tech. graduating in June wants employment as apprentice in Detroit shop. Familiar with service equipment. Have sig. tracer and V.O.M. Robert Klepazky, 20029 Spencer, Detroit 12, Mich.

FOR SALE—8325 Precision V.O.M. also Variton V.O.M. and 0-150 volt-meter. Need field strength meter. H. A. Barnes Jr., 1946 E. 28 St., Oakland 6, Calif.

WANTED—Electronic engineering manuals vols. 1 and 2. McGraw-Hill. State price. Jos. Fratuyik, 718 Atlantic St., Bethlehem, Pa.

FOR SALE—60% off list: 1R5; 1T4; 1S5; 3A4; 3Q5; 117Z3; 50B5; 12AT6; 12BA6; 50% off: 12SK7/GT; 12SA7/GT; 12SQ7/GT; 12Q7/GT; 35W4; 45Z3; 50L6; 70L7; 32L7; 117Z6; 6J5; 1N5; 1LN5; 6K5/GT. Send for list of parts. E. J. Mangeri, 41-13 10th St., L. I. City, N. Y.

FOR SALE—Philo sig. generator 070 in like new condition; Silvertone phonograph, Astatic pick-up in Bakelite cabinet in new condition; 3 1/2" meters, a-c in all ranges, new. E. Vockerath, 1746 N. Campbell, Chicago 47, Ill.

FOR SALE—RCA Aud o Chanalyst 170-A. In perfect condition. Value \$345, will sell for \$285. Manuel Rubio, Cuscaden Park Supply Co., 3002 15th St., Tampa 5, Fla.

FOR SALE—Silver Vomag new; RCP 802N tube and set tester new; Solar CE-1-60 capacitor and resistance bridge used. Express prepaid in U. S. for \$150, or sell separately. C. E. Muck, 1915 N. Russett St., Portland 3, Ore.

WANTED—Tube tester, any make or model for popular tubes. Must be in working, or near-working condition, with instructions. Price must be right. L. S. Hastings Jr., Stony Point, N. Y.

WANTED—Urgently! Vet radio student needs several old and discarded radio sets to practice and experiment with at home. F. Fuller Jr., 23-23 15th Walk, Jackson Hts., N. Y.

FOR SALE—Immediately: large stock fresh 6 1/2" Wilcox-Gay Recordio high quality paper discs. All A-1 shape. 6 per package. \$4 per 100; \$40 per 1000. 1/3 down, balance C.O.D. Carl B. Younger, 3788 Wisconsin St., Los Angeles 7, Calif.

WANTED—Triumph 850 5" oscillograph. W. W. Marsh, 509 E. 27th St., Minneapolis, Minn.

WANTED—Western Electric wire recording magazine consisting of recording, play-back and erasing heads, timing device, auto stop and gears, less motor and amplifier, used with K-S-12009 recorder. State price. M. J. Paterson, Box 9226, Johannesburg, South Africa.

WANTED—Rider manuals 6 to 14. State price. Peter J. Schuck, Radio & Refrigeration, Hillsboro, N. Dak.

SWAP - BUY - SELL

WANTED—Radio City Products analyzer unit 504C, must be in good condition. Shugert Radio Service, 528 N. Broad St., Lancaster, Ohio

FOR SALE—Complete repair stock, including tube tester; analyst; oscillator; VOM; excellent stock of tubes; replacement parts; complete Rider's; window display; Sprayberry course; reference books; etc. E. A. Fogelberg, Jr., 700 Marion Ave., Wilmington, Del.

WANTED—Complete set Gernsback manuals, 1 to 7; good sig. gen.; Rider manuals 1 to 11; 110V a-c battery eliminator for 6V auto radios; 16mm sound or silent film and printer editor. Send list of what you have with price and examination privilege. N. C. Gibbs, Rt. 1, Box 407, Dinsmore, Fla.

FOR SALE—Triplett 3212 tube tester, \$47; E-200 sig. gen., \$47; Solar capacity analyzer model CB, \$25; Rider's vols. 7-12-14, \$10 each; RCA vols. 1 and 2, \$5 each; Rider automatic record changer vol. 5. Wm. R. Gifford, Kittery Point, Maine.

FOR SALE—New: 2" sq. foundation meter VOM scales, \$5 ea; Triplett 2" round 0-1 ma. scale 0-100 ma., \$4 ea; Block steel cabinet 6 x 6 x 6", 75¢; 8 x 10 x 7", \$1.85; chassis 7 x 9 x 2", 80¢; 140 mfd. var. cond., \$1.50. Many other items. D. A. Welton, % Gulf Radio Service, 739 Mandville St., New Orleans 12, La.

FOR SALE—RCA 195 Volt-ohmyst, fine condition, \$58.50; Poverstat variable x'former 116, 7.5 amp. 0-135 V., fine condition, \$12.50. Robert Greenen, 518 Liberty St., Aurora, Ill.

FOR SALE—Triplett 1610 tube checker, push button operated. Fair con-

dition, \$15. C. A. Heroux, 300 Main St., Woonsocket, R. I.

FOR SALE—RME-45, excellent condition, \$150 f.o.b. F. M. Hughes, Star Rte., La Grande, Ore.

FOR SALE—Sacrifice: German lab. microscope, 3 objective turret lens, condenser, sub-stage, extra lens, etc., 35-1500 power; Clough-Brengle VTVM; 13" Jensen auditorium spkr., 15 watts; low power x-ray tube. Other items. Woodward Radio, 478 Woodward Ave., Brooklyn 27, N. Y.

FOR SALE—RCA cathedral table radio R-28-P, \$11; RCA record player unit with home built wireless osc. in one cabinet, \$15; new Slure 1 oz. pick-up, \$4; all in working condition. Wm. I. Clark, 18 West St., Newburgh, N. Y.

SELL OR SWAP—Electronics Development Lab. model 41 scope, slightly used. Ortego Radio Repair, 336 N. 7th St., Baton Rouge 8, La.

WANTED—Radio Maintenance Magazine Sept. 1946 and October 1946. Will pay reasonable price. Lloyd E. Reed, 414 Post St., Boonville, N. Y.

FOR SALE—14-tube BC-1068A VHF receiver 115 V. 60cy. a-c. Ideal for ham use. \$700 receiver at \$41.50, August C. Schlepp, Java, S. Dak.

FOR SALE—10-watt hi-fi amplifier with record player, inverse feed-back circuit, beam power output, freq. response 20 to 10,000 cps, humless operation, fine tonal quality. Sell outright or trade for home recording equipment. Larson's Radio Service, Madison, Minn.

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FOR SALE—NC-46 radio, \$95; power pack for 634 tubes; Stancor chokes 1420; Stancor x'former 300 V. \$10; Hammerlund condensers, double 100 mfd, single 100 mfd, single 50 mfd. Lots of other equipment. J. K. Parquhar, 590 Eagle Ave., New York 55, N. Y.

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FOR SALE—AKT inverter, model RSA, type 6. Input 6 V d-c, output 110 V a-c 50-60 cy. 85 watt intermittent, 75-watt continuous. Used only few times \$20. Neil Skinner, 12844 Military Rd., Seattle 88, Wash.

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SELL OR SWAP—Model 301 d-c ammeter 50-0-50, zero adjustment, A-1 condition. Koch Radio Co., 1401 19th St. So., Clinton, Iowa

FOR SALE—6 V. light plant, almost new rings in motor, etc; 2-tube battery operated talkies, telescopic ant., Mark II x'mitters and receivers, brand new with extras; all kinds radio parts; channel analyzer. Lewis Burton Radio Service, Brodhead, Ky.

FOR SALE—Radio City Products 801M tube and set tester, \$35; Precision 510 tube tester, \$20; Cornell-Dubilier BP-50 cond. tester, \$30; Clough-Brengle sig. gen., \$20; all in good condition. Johnny's Radio Service, 608 Kelly St., Charles City, Iowa

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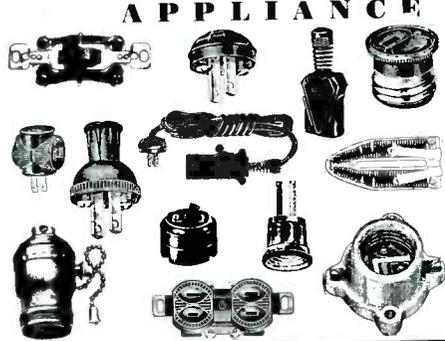
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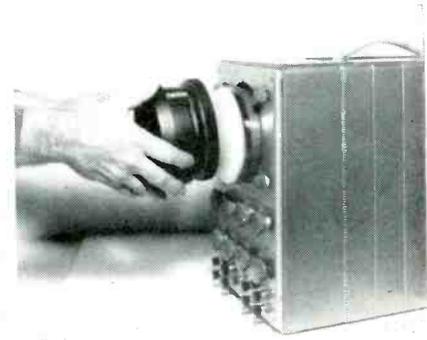
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(including stand) is composed of a high temperature heating element shielded with a streamlined bright chrome plated hood insulated from the handle by a heat-barrier, can be used with either AC or DC. Rated at 650 watts, the heating element is of chrome-nickel resistance wire coiled in a refractory porcelain base. For complete details, write Henry J. Morton Associates, Inc., Boulevard Building, Detroit 2, Mich.

Improved RCA Scope

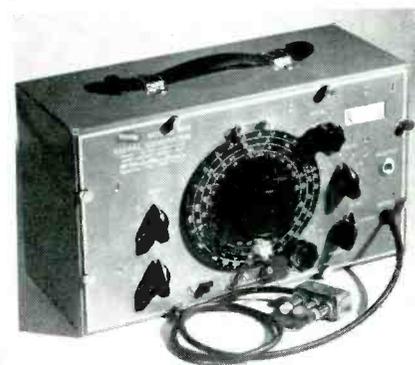
Quick "plug-in" interchange of cathode-ray tubes through the front panel of this newly developed RCA Oscilloscope can be accomplished by



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The new Silver Model 906 AM/FM Signal Generator employs an eight-range rotary turret-type oscillator to cover the range of 90 kc. through 170



mc. on fundamental frequency output. All eight ranges are directly calibrated to plus/minus 1% accuracy upon the 10:1 vernier-driven main dial. Amplitude modulation at 400 cycles, variable from zero to nearly 100%, is pro-



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	14-056	300 Ohm
	14-023	75 Ohm

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The new brown Amphenol Twin-Lead is available in 75 ohm, 150 ohm and 300 ohm impedances for receiving use, and in 75 ohm type for transmitting. Write today for full data on electrical characteristics and prices.



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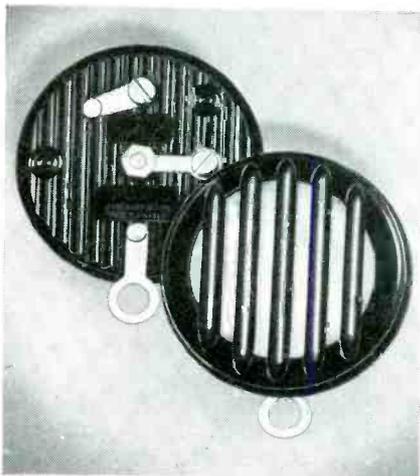
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vided. Frequency modulation output is available at any frequency between 90 kc. and 210 mc. by panel switch bringing into operation a 40 mc. fixed-frequency oscillator which beats with the variable frequency oscillator to produce any desired carrier frequency possible to the combination of the two oscillators. Sweep rate is 60 cycles, with frequency sweep (total swing, or 2 x deviation) variable from zero to over 500 kc.

The output attenuator system is, like the oscillators, multiply shielded within the overall shield comprised by the steel cabinet, to reduce stray radiations to a minimum. Strays are stated to be so low as to be unmeasurable up to 20 mc. rising to not over 2 microvolts at 30 mc. This feature, plus output microvolt meter, dual variable and ladder 4-step attenuator assures extraordinary output voltage accuracy. Additional details from McMurdo Silver Co., Inc., 1249 Main St., Hartford, Conn.

Universal A174 Mike

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weighs 3/4 ounce. This compact, lightweight size, together with highly sensitive response, recommends it for detectaphone, midget transmitter, low cost paging and call systems, and experimental and special uses.

The A174 utilizes a single button construction and is fully insulated. Its impedance rating is 200 Ohms and the output level is given as 12 db below 6 milliwatts for 100 bar signal. Stationary setup is provided for by an adjustable metal ring hook at the back. The list price is \$4.00. Additional Microphone Co., Inglewood 2, California.

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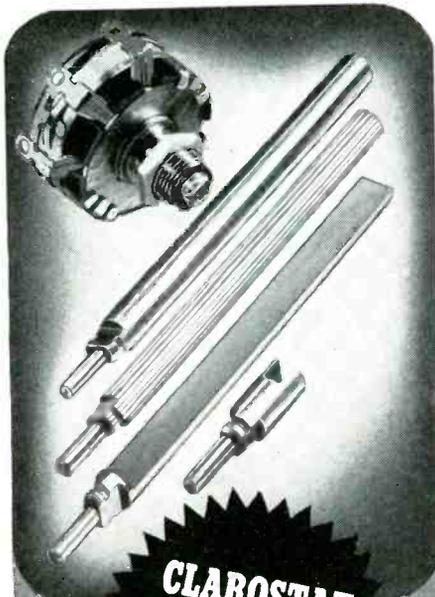
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New Olson catalogue, obtainable from Olson Radio Warehouse, 73 East Mill St., Akron 8, Ohio.

TELEVISION
[from page 20]

- t) Device for measuring ripple voltage in the high voltage supply
- u) Voltage divider
- v) Screen room

Only with such an array of equipment can the servicing of television receivers be done adequately. Of course the mere possession of the equipment isn't going to guarantee that one is going to locate all faults easily. It took some time for us to realize that such things as the small amount of solder, which rubs off the bottoms of the pins of tubes as they are rotated on a socket, in order to insert it properly, can cause serious trouble by providing leakage paths between tube elements.

Television servicing will be expensive and because of certain characteristics will require a system of price calculation which has not been used in connection with broadcast receiver servicing. The importance of satisfactory television receiver installation and servicing facilities makes it mandatory that the receiver manufacturers and distributors see to it that the facilities do exist.

PA SYSTEM DESIGN
[from page 16]

mately 1.6 watts, which is easily supplied by any of the amplifiers rated at 15 watts, which is about the lowest rating for a general purpose PA amplifier. There are many good 15-watt units available with provision for two microphones and a turntable input, and the operator should be governed by his own preferences as to the particu-

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lar one he selects. However, it is well to give some thought to the output characteristics of the amplifier, the amount of feedback, the hum level, and the distortion. These factors take on additional importance when it is remembered that hum or distortion is amplified by an additional 17 db, so the main amplifier should be as good as it is possible to obtain.

One other consideration that is worth discussing is the advisability of using a high-pass filter in the speech circuit to reduce the amount of power required from the amplifiers. Practically all horn-type speakers become less and less efficient as the frequency goes down, and there is no economy in pouring large quantities of power at 100 cps into a horn that cannot radiate any frequency below 200 cps, since this additional power at the lower frequencies is wasted in the form of heat in the voice coil of the speaker unit. Therefore, for the microphone inputs, the low frequency response should be reduced quite appreciably to effect this saving, both in power and in possible damage to the speaker units. This may be done by reducing the capacitance of the coupling capacitor between the second and third stages of the amplifier, so that the response at 150 cps is down by approximately 10 db from that at 100 cps. This will effect the required saving in power and wear-and-tear on the speakers, and, in addition, will make reproduction more crisp and intelligible when used with horns.

The final requirement for the PA system to be used in the baseball field was that it be able to reproduce radio programs picked up from the air. This may be solved easily by the use of practically any good radio receiver, and feeding the PA amplifier from a low-level, high-impedance source, best obtained by connecting a shielded lead from the arm of the volume control in the radio set to a plug which may be inserted into the jack used for turntable input. It is not probable that both radio and turntable input will be required at the same time, though if such ever became necessary, it could be arranged in a variety of ways. Some PA amplifiers have provision for an input of higher level than a microphone or phonograph, and these amplifiers are well suited for just such an installation as this.

THE SPEAKER SYSTEM

The speakers for this type of system are a very important consideration, and their choice and arrangement will contribute greatly to the success of the entire installation. With a coverage of 10,000 people, distributed throughout a grandstand which subtends an angle

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of approximately 90 degrees, as viewed from the speaker location, it is advisable that the horns selected be especially efficient. For this type of application, a flat-bell trumpet is recommended, with a length of six feet and a mouth opening about 12 inches high by 50 inches wide. A stack of four of these arranged in pairs and staggered sufficiently to cover the entire grandstand will serve very nicely for the installation we are discussing. Each of these horns should be equipped with a 50-watt unit, of permanent magnet design.

In this type of installation, the lines feeding the speakers are necessarily quite long, and the speaker units have an impedance of approximately 15 ohms. Since it is necessary to connect these units in parallel, preferably in pairs with each pair operated from a separate amplifier, the problem of transmission lines must be considered. The reason for connecting the units in parallel is so that in case of failure of one of the units, one will still be

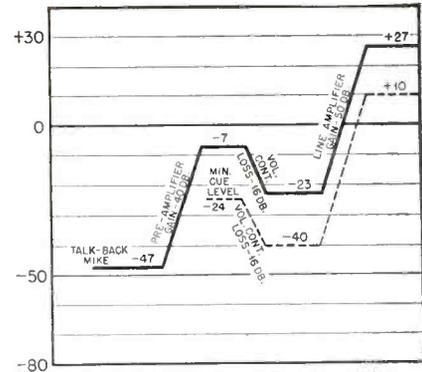


Fig. 4. Level diagram for talk-back and cue circuits of concert hall installation

operating. If they were connected in series, failure of one unit would open the circuit, and no sound could be reproduced.

With a power of 75 watts in a line whose impedance is 7.5 ohms, we find that the current in the line could be 3.16 amps, since $I = \sqrt{P/Z}$. Assuming the use of #14 copper wire, and a run of 500 feet from amplifier to speaker, the power loss in the line alone



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amounts to approximately 19 watts, resulting in a useful power to the speakers of only 56 watts. If, however, we take the output of the amplifiers at an impedance of 500 ohms and feed the line at this impedance, still using #14 wire, the loss in the line is but 0.38 watts, which is an infinitesimal amount. At the speakers we then install a 500 ohm to 7.5 ohm transformer, which will contribute some loss, though it is doubtful if a good transformer would lose more

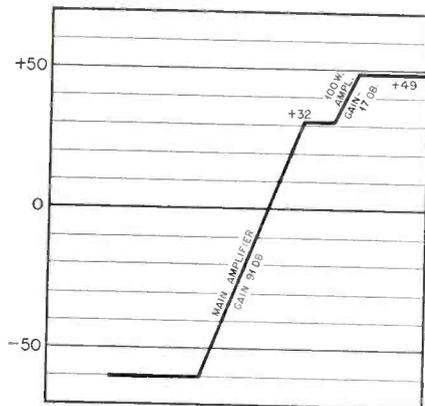


Fig. 5. Level diagram for outdoor PA system in ball park seating 10,000

than five watts at this point. On the whole, therefore, it is much more economical to use #14 wire and transformers than to use a much larger wire. To obtain equivalent losses, it would be necessary to use wire not smaller than #8. This condition becomes even more troublesome as the distance becomes greater, and in an average-sized ball park, a run of 500 feet is about the minimum that could be expected. The problem would be simplified considerably if it were possible to erect the speaker tower just behind the pitcher's box, but that practice is frowned upon by baseball authorities.

While the system as outlined for the ball park is undoubtedly the most economical solution of the problem, it is also possible to construct a system of the same general type as that outlined for the concert hall. The fidelity requirements for the ball park are not as great, however, as for the concert hall, and only in rare instances will the added flexibility be warranted. While there are a number of ways of fulfilling the requirements of any sound system, there is no great advantage in complicating the installation unnecessarily, and in most cases price will be an important factor.

COMPARATIVE COSTS

The cost of installations of the types described in this article may be of interest to the reader. Without making any provision for labor costs, it may



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PA SYSTEM DESIGN

[from page 35]

be safely stated that the cost of components for the 40-watt concert hall installation will run in the range from \$3000 to \$3500, and the cost of the 150-watt installation for the baseball park, along the lines described, will range from \$800 to \$1200. These figures, while not definite (the writer would certainly not contract to make any such installation at these prices) will serve to indicate the range that may be expected for material alone. They will show further the difference in cost for the two types of construction—the professional system costing around \$85 per watt and the commercial system about \$7 per watt. Installation of speaker tower and wiring must be taken into account when thinking of the baseball park, and the overall construction of the control console and the amplifier rack, together with jack wiring, microphone and speaker lines, and other such items must be added to material costs for the concert hall system. As a final suggestion, therefore, be sure that you bid enough on such a job—it is better not to take such a contract than to take one and lose money on it.

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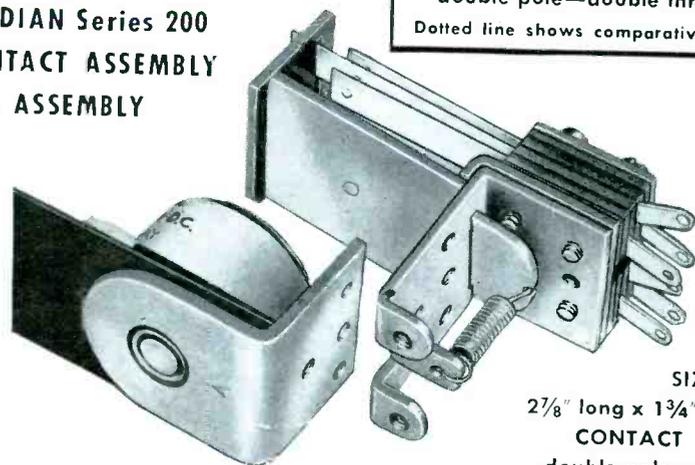
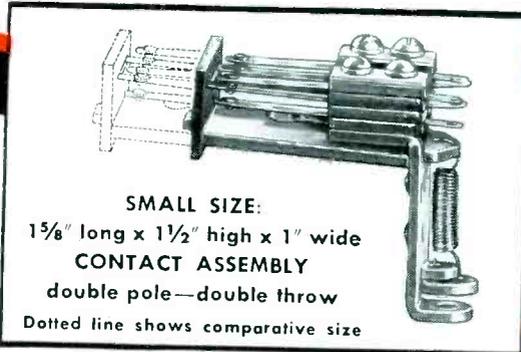
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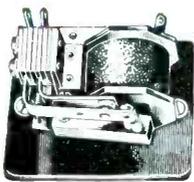
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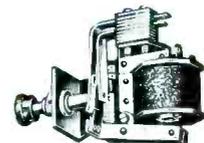
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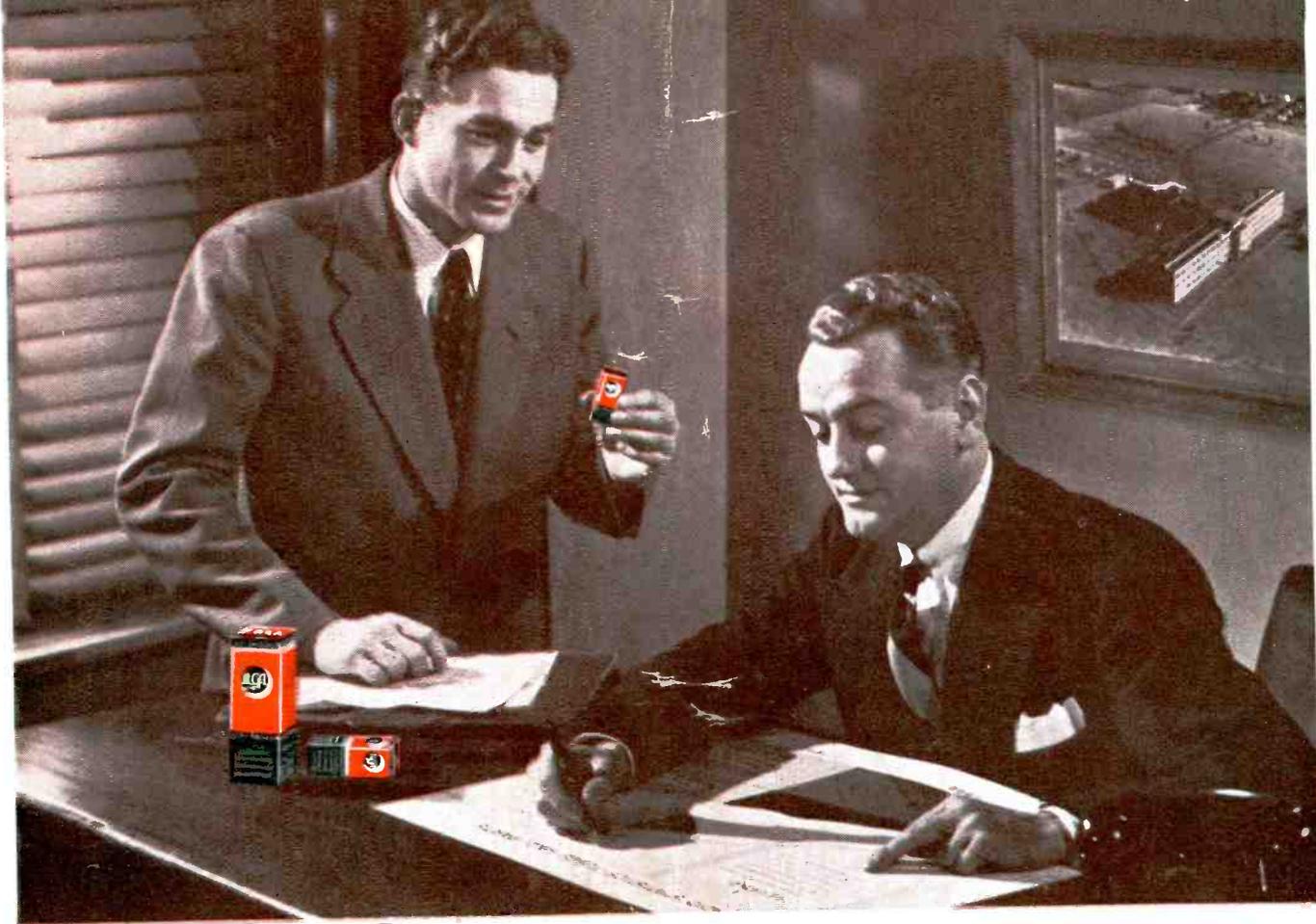


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