RADIO · TELEVISION · ELECTRONIC

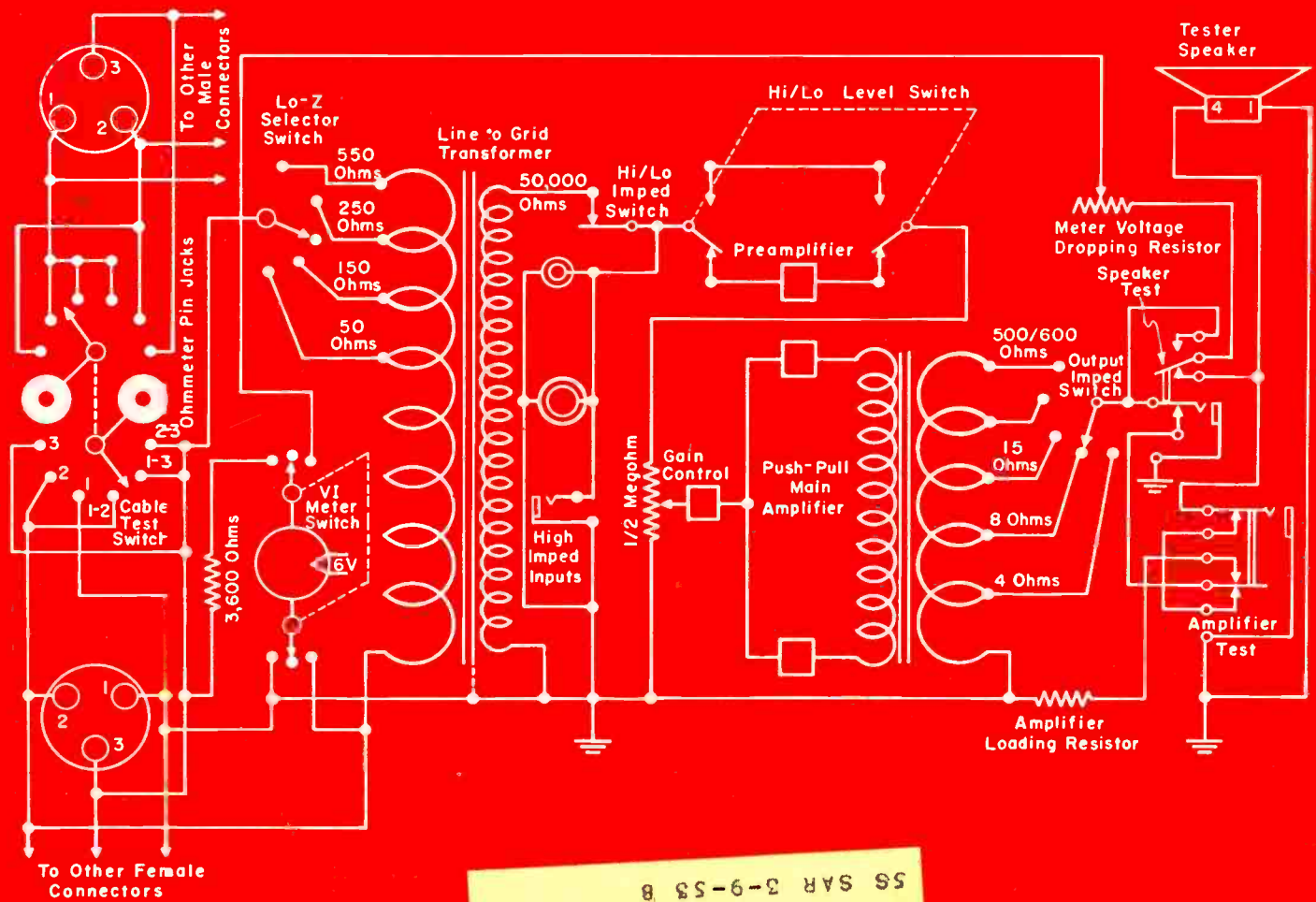
SERVICE

VOL. 24

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

In This Issue: AUDIO FORUM

JUNE
1955



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[See circuit analysis, this issue]

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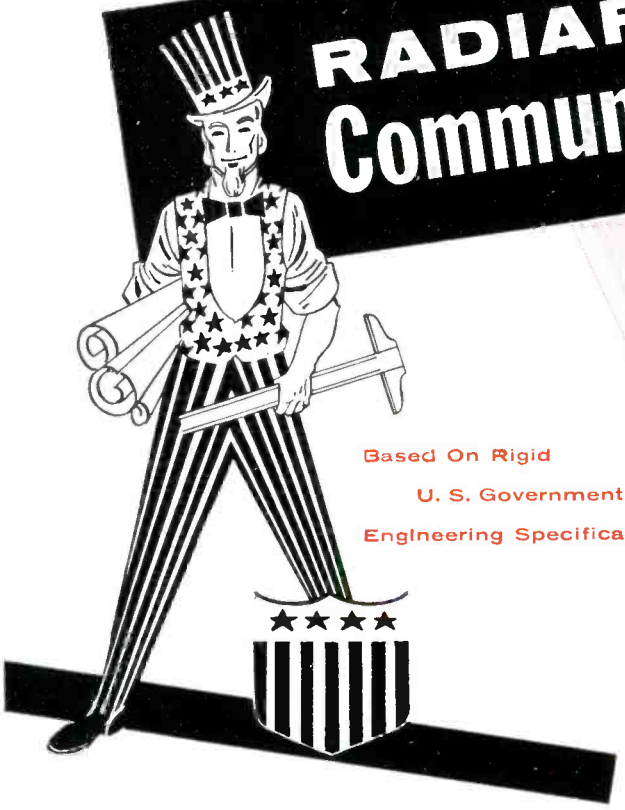

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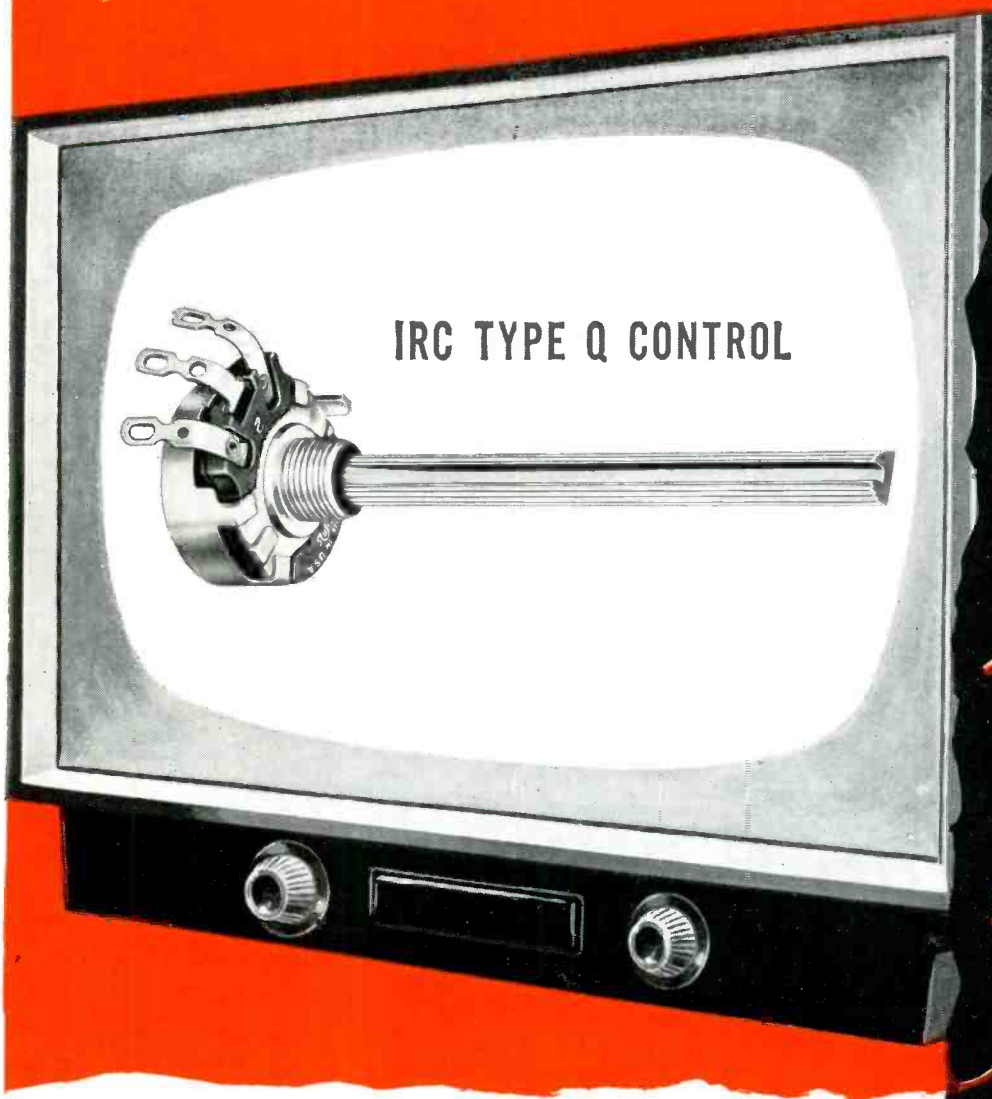

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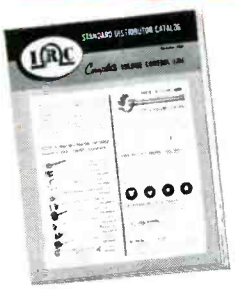

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Wherever the Circuit Says

Vol. 24, No. 6 — June, 1955

RADIO · TELEVISION · ELECTRONIC
SERVICE

LEWIS WINNER
Editor

D. E. PEARSALL II
Assistant Editor

Including SERVICE—*A Monthly Digest of Radio and Allied Maintenance*; RADIO MERCHANDISING and TELEVISION MERCHANDISING. Registered U. S. Patent Office.

Published monthly by Bryan Davis Publishing Co., Inc.

52 Vanderbilt Avenue, New York 17, N. Y. **Telephone: MUrray Hill 4-0170**

Bryan S. Davis, Pres. F. W. Boyd, Secy. and Business Mgr. A. Goebel, Cir. Mgr.

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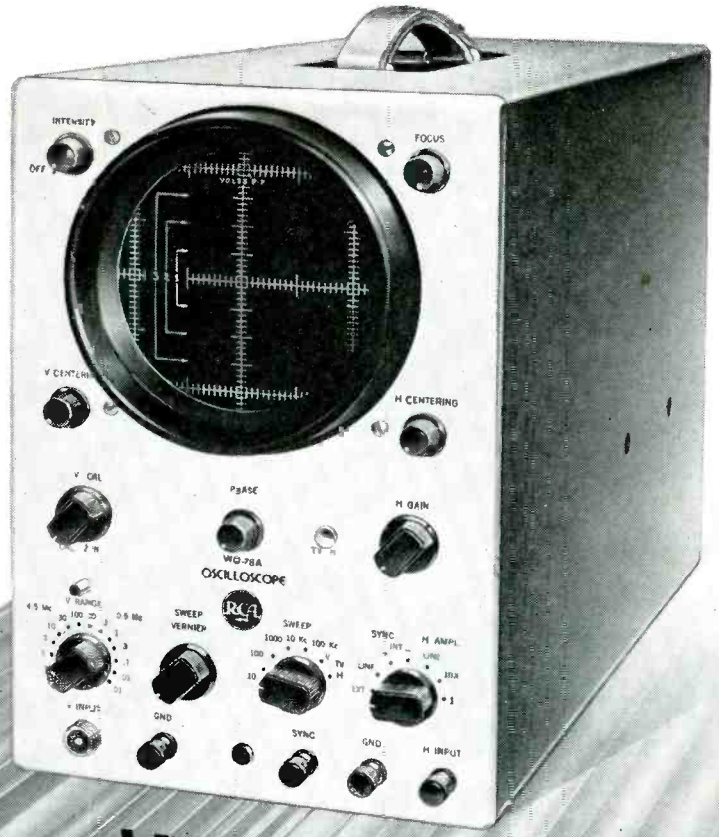
Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., additional entry at the Post Office, Norwalk, Conn., Oct. 22, 1954, under the Act of March 3, 1879. Subscription price: $2.00 per year in the U.S.A. and Canada; 25 cents per copy. $3.00 per year in foreign countries; 35 cents per copy.

RCA WO-78A 'Scope



RCA-WO-78A — 5" Oscilloscope $425.00 (suggested user price) complete with WG-294 direct probe and cable, WG-293 low-capacitance probe, alligator clip, ground cable, insulator, green graph screen, instruction book.

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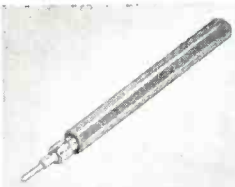

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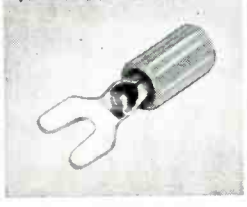

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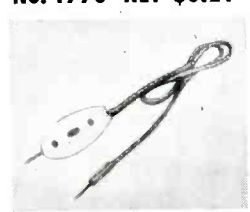

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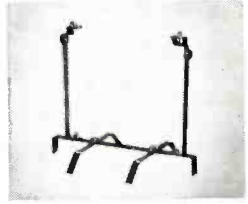

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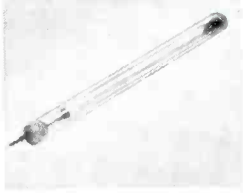

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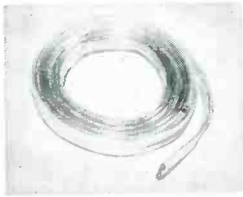

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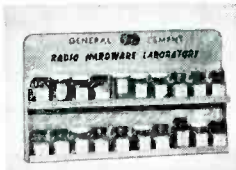

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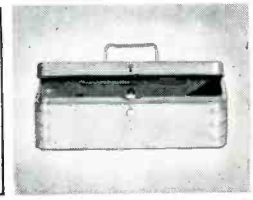

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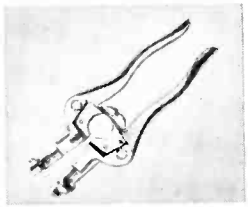

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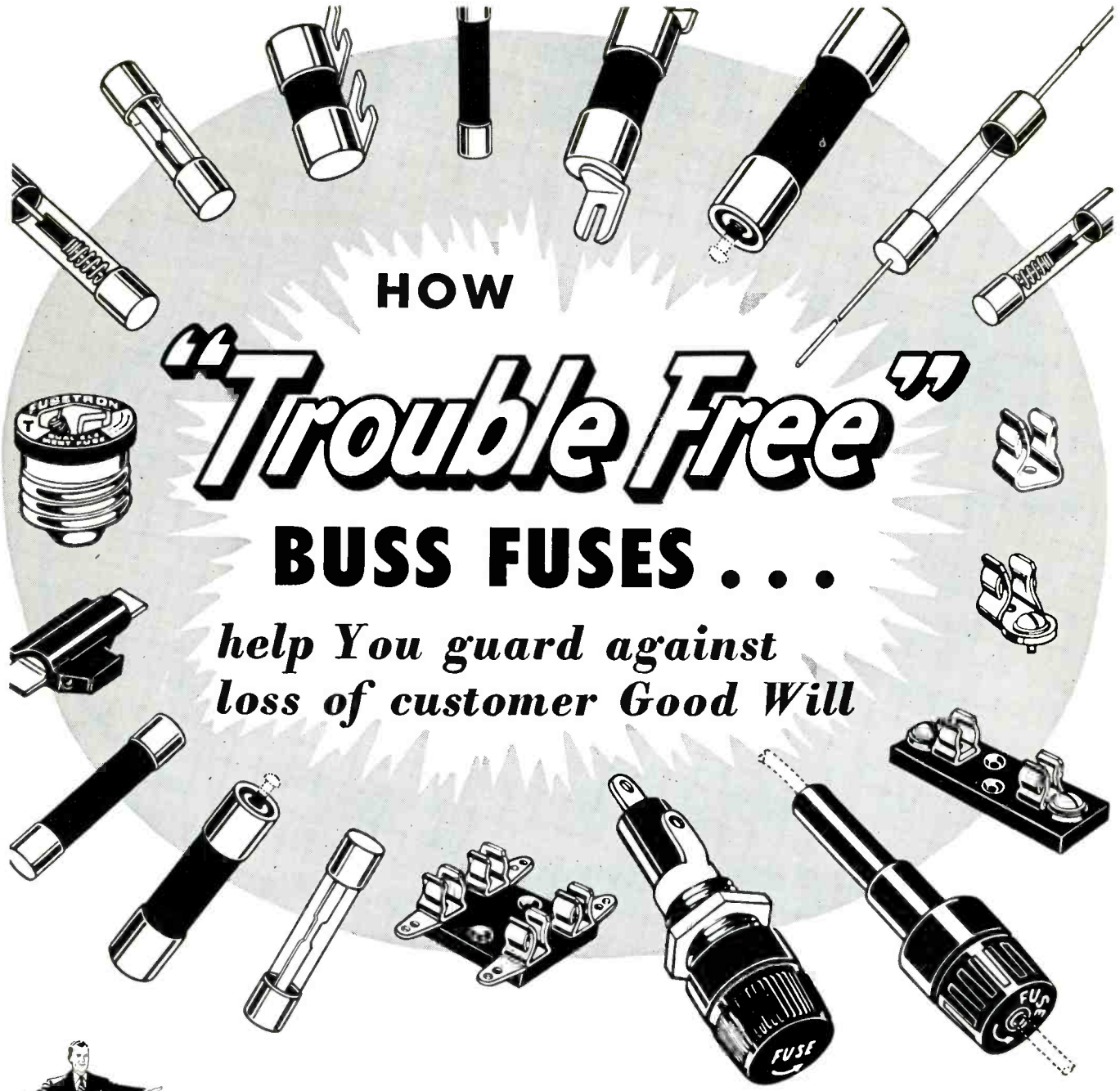

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Dependable BUSS fuses can help safeguard your product or service against loss of user satisfaction because . . .

When there is trouble on the circuit, BUSS fuses open and prevent further damage to equipment—saving users the expense of replacing needlessly burned out parts.

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Capitalize on the BUSS Trademark

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S-655

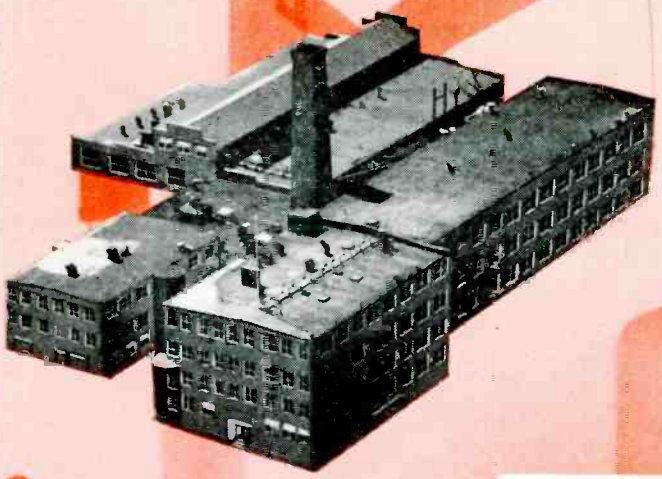
SERVICE...The National Scene

BOUNDLESS HORIZON SEEN FOR REPLACEMENTS BY INDUSTRY HEADS--Reporting on the servicing prospects in industry, during the months ahead, before technical, distributor and management groups in the east and mid-west recently, the prexy of a leading tube-set maker and a sales research specialist pointed out that ours is the fastest-growing industry with a boundless horizon for replacement parts and equipment. . . . To support their views, rows of spectacular statistics were introduced. It is expected, they said, that at least 130,000,000 receiving tubes will be needed to meet the replacement requirements of radio, TV, auto radio and phonos before the year is out. And over 4.5-million picture tubes will also find themselves in the replacement market. The resale value of receiving and viewing tubes should add up to over $150-million for each category, it was pointed out. . . . Commenting on replacement component, and installation and service income, the experts noted that part sales should total nearly $800,000,000 before '55 bows out. And service and installation revenue should hit the billion-dollar mark. . . . These bulging figures were based on the over 200-million receiving and audio units in the field, plus the anticipated sale of over 1-billion dollars worth of TV chassis, $147-million for home radios, $108-million for auto radios and over $60-million for phonos. . . . Analyzing the potential of radios and auto sets, the market pollsters said that even assuming that we no longer can expand the number of radio sets per home, we still have a long way to go in respect to the number of radios that can be placed in operation throughout the nation; in auto radios we should have a long term demand, which should run from 5½ to 7-million per year almost indefinitely.

NOVEL REPAIR-INSTALLATION ITEMS DISPLAYED AT PARTS SHOW--A number of components and accessories developed for special applications were revealed at the recent parts exhibit in Chicago. . . . Included were aluminum electrolytics designed especially for color-TV, small hi-watt resistors for plated-wiring chassis, rotators for indoor antennas, rumpus room needles, anodized antenna elements in assorted colors, and electric-building-code approved antenna mast supports. . . . The metallic-coated antennas were said to have been built for seaboard-area applications to prevent salt-air damage; the coating was described as non-corrosive and impervious to the effects of pitting. . . . The indoor rotators were designed, it was said, for antennas used in the attic or elsewhere. In many areas, it was noted, outdoor antennas are not permitted; this approach offers a solution providing the required orientation to improve reception. . . . Code-okehed antenna feed-throughs were claimed to feature sealed inserts that provide a waterproof entrance for the leadin directly through the roof.

SIXTEEN-TUBE 41-MC VERTICAL CHASSIS HIT MARKET--TV receivers engineered around a vertical chassis for primary reception areas, using a 14-inch picture tube, twelve tubes (six of which are double purpose), plus three rectifiers and a 41-mc if strip, are now coming off the line. Tube complement includes 3BC5, 5X8, 6AU8, 5AN8, 12CA5, 12BH7, 7AU7, 12BQ6GA, 5T8, 12AX4GTA and two 3CB6s. . . . About half of the chassis is made up of plated-circuits and all but a few of the connections in the complete receiver are dip soldered. . . . Models are available for standard band and the ultra-highs; in the latter style a 2AF4 is used.

FCC GIVES GREEN LIGHT TO STANDARD COLOR SIGNAL FOR RECEIVER TESTS--The Federal Communications Commission has notified the Radio-Electronics-Television Manufacturers Association that it has no objection to the transmission of a standard color-TV test signal to enable Service Men to install and check color sets when no color signal is on the air. . . . The FCC said that it hasn't as yet determined the effectivensss of the special signal, but since it has allowed the use of other signals for the same purpose, during the past two years, the currently-recommended signal has their approval, too. They warned though that if alternate signals are also transmitted, confusion may result; thus maximum cooperation on a standard should obtain to insure complete satisfaction. . . . The color bar, provided by the RETMA standard, appears on the right hand edge of the picture during regular black and white transmissions.

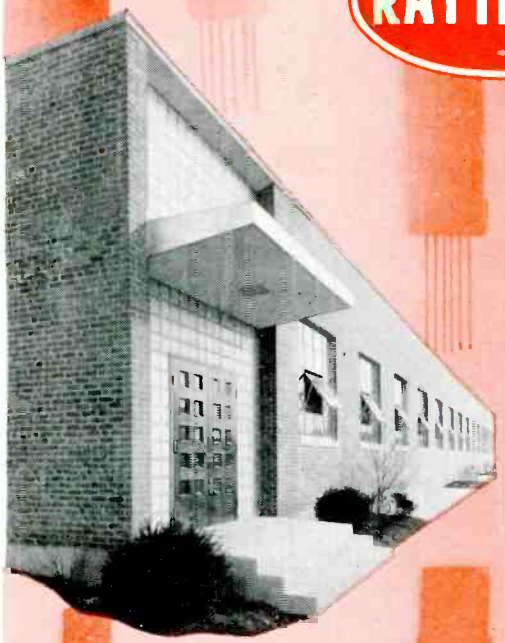


Raytheon's Receiving Tube Plant
No. 1 — Newton, Mass.

Raytheon's Microwave and
Power Tube Plant No. 1
Waltham, Mass.

RAYTHEON LEADS THE WAY

In TUBES and SEMICONDUCTORS



Raytheon's Research Center
Waltham, Mass.

Here are a few reasons why:

RAYTHEON employs 18,000 people. Approximately 10,000 of them work in Raytheon's modern tube and semiconductor manufacturing plants.

RAYTHEON has more than 1,000,000 square feet devoted exclusively to the manufacture of Raytheon quality tubes and semiconductors.

RAYTHEON employs over 500 engineers and scientists who work exclusively in the electron tube and semiconductor fields.

RAYTHEON has had 33 years' experience in the manufacture of electron tubes.

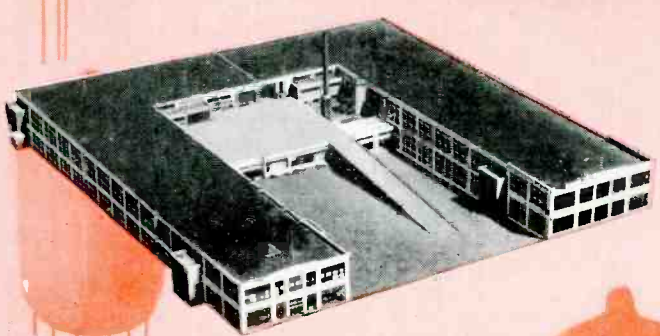
RAYTHEON has made tubes of every type of construction — Standard Glass, "G", GT, Bantal, Lock In, Metal, Miniature and Subminiature Tubes.

RAYTHEON Receiving and Cathode Ray Tube Operations have produced more than a third of a billion tubes and semiconductors.

RAYTHEON perfected the first practical rectifier tube types (BA and BH) to eliminate the need for "B" batteries to operate home radios. This revolutionized the design of home radio sets. Raytheon later developed the cold cathode rectifier tube for auto radios and has produced more of these tubes than all other companies combined.

RAYTHEON developed the famous 4-pillar construction that strengthened internal structure resulting in sturdier tube design.

RAYTHEON developed and was first to mass-produce the octal button stem receiving tube — today's most imitated construction for premium TV performance. Raytheon was first to make millions of these tubes as far back as 1946. These tubes featured a planar button stem and 8 straight leads (8-pillar) which go directly into a standard octal base. Raytheon's Patent Numbers 2310237, 2321600 and 2340879 apply to this invention.



Raytheon's Semiconductor Plant No. 2
and Raytheon's Special Tube Plant No. 2
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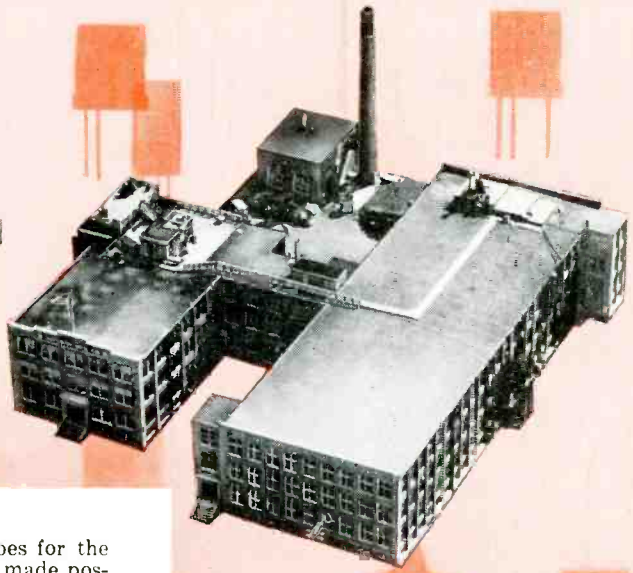
Raytheon's Cathode Ray Tube Plant
Quincy, Mass.

Raytheon's Receiving Tube Plant
No. 2 — Quincy, Mass.



Raytheon's Semiconductor Plant
Newton, Mass.
(Being Assigned to Semiconductor Division starting Dec. 1, 1955)

RAYTHEON developed and first mass-produced subminiature tubes for the hearing aid industry — the forerunners of the fuse tubes which made possible the famous proximity fuses of World War II. There are more commercial Raytheon subminiature tubes in use today than all other makes combined.

RAYTHEON developed a method of mass producing magnetrons (the power tube that is the heart of radar) early in World War II, that broke a serious bottleneck, and continues to produce more magnetrons than all other manufacturers combined.

RAYTHEON is the largest producer of klystrons and has manufactured more than all other companies combined.

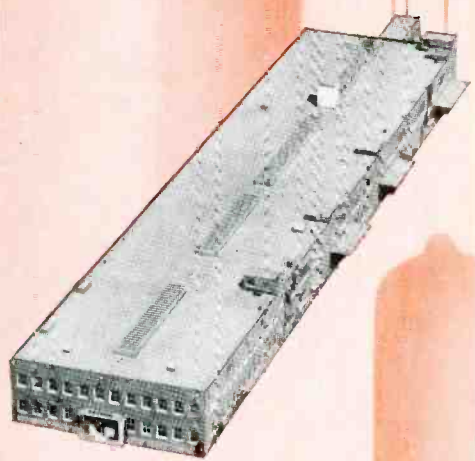
RAYTHEON was the first commercial producer of Transistors — the "mighty m te" — a Raytheon achievement that revolutionized the hearing aid industry.

RAYTHEON first commercially produced fusion-alloy RF Transistors, expected to revolutionize the portable radio, auto radio and computer industries.

RAYTHEON has produced many more transistors than all other manufacturers combined — nearly 2,000,000 in use.

TODAY, RAYTHEON makes Receiving and Picture Tubes, Reliable Miniature and Subminiature Tubes, Semiconductor Diodes and Transistors, Nucleonic Tubes and Microwave Tubes.

These facts and figures show why you can use Raytheon Television and Radio Tubes with complete confidence that they are Right . . . for Sound and Sight — Right for you and your customers, too.



Raytheon's Microwave and
Power Tube Plant No. 2
Waltham, Mass.

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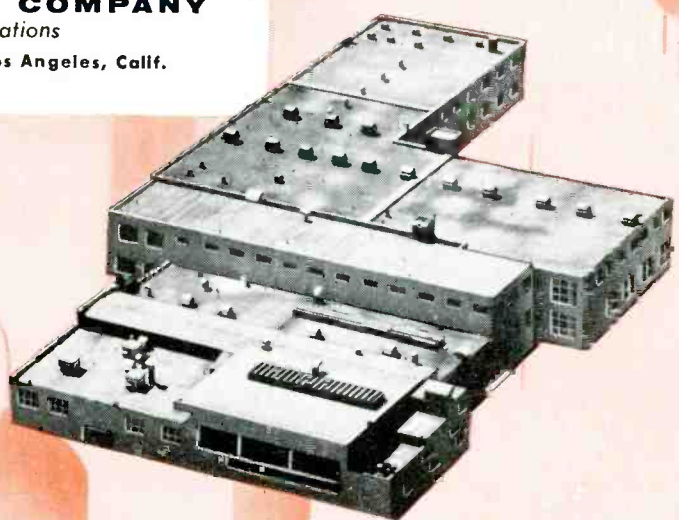
RAYTHEON

RAYTHEON MANUFACTURING COMPANY

Receiving and Cathode Ray Tube Operations

Newton, Mass. • Chicago, Ill. • Atlanta, Ga. • Los Angeles, Calif.



Raytheon's Special Tube Plant No. 1
Newton, Mass.

SERVICE...The National Scene

KNOXVILLE, TENN. LAW DIRECTOR SEEKS TV LICENSING MEASURE--Harassed by an avalanche of complaints describing increased activities of fly-by-night basement service tinkerers who were ruining TV sets, the city law director of Knoxville, Tennessee has asked the City Council to consider a measure which would license TV and radio Service Men. Noting that the unskilled repairmen have created a serious situation, the municipal official said that only legal control would protect the public and the legitimate Service Man, too. . . . An ordinance proposing five categories for licensing was recommended: TV technician, TV apprentice, AM-FM technician, AM-FM apprentice and service operator. A seven-man board would be set up, it was said, to operate the law. Included would be a school teacher, distributor service dealer, Service Man, city electrical inspector, retailer of radio and TV sets and a lawyer. . . . Unlicensed operators would be obliged to pay a fine of $50 per day.

SERVICE POOL FORMED IN CHICAGO--A service pool, to channel service calls through a single telephone number and then distribute them to subscriber members, was organized recently in Chicago. . . . The operation was being promoted in newspaper ads listing all of the firms franchised with their addresses, but with only the telephone number of the pool shown. Ad copy, asking set owners to shop for service with care, and contacting those Service Men who render ethical service, emphasized the point that the program and advertisement had been prepared . . . "in the interest of raising . . . standards . . ." . . . It was believed that franchise membership cost about $100. . . . The centralized plan was criticized by a number of associations. One group said that its membership strongly opposed this type of operation, since it diminishes the value of the independent and destroys his individuality as a shop owner.

PROPOSAL MADE TO USE PORTION OF FM BAND FOR TV--In an effort to solve the stymied uhf-vhf situation, a group in Washington has suggested that two six-megacycle channels be sliced out of the 88 to 108-mc FM band for a pair of new vhf bands that would be known as 6A and 6B. The plan suggests that ultrahigh applicants receive preference for assignment in these FM-band channels, for low-power, minimum-mileage operation. Such installations, it was said, would be similar to community radio-station locals, and it should be possible to include a number of such stations on each of the new channels. . . . Reception would be possible via a tuner strip that could be installed in present TV chassis.

WOMEN'S HELP TO STIMULATE ANTENNA INSTALLATIONS SOUGHT IN TV SCRIPTS--Believing that women can persuade the male master-mechanics at home to call for a Service Man and a new antenna, when trouble brews, an enterprising antenna manufacturer has prepared a series of TV scripts appealing for such help. . . One such announcement offers this message: "Usually at the first sign of snow or ghosts . . . the men rush to the set and start jiggling the dials. . . . This a cue to say that there's probably nothing wrong with the set that a new antenna can't cure. . . . Remember the TV set is only as good as its antenna. . . . If you're getting consistently poor pictures . . . look first to your roof . . . don't waste time twisting dials. . . . Be sure you consult your Service Man. He is trained and experienced in providing the correct antenna for your particular area."

GADGET-PRICED HOME TUBE TESTER SCORED BY ASSOCIATIONS--The appearance of ads in dailies describing a home tube tester that . . . "accurately tests radio and TV tubes at home . . . and saves expensive repair calls . . ." has been sharply assailed by a number of associations. . . . Once again, it was noted, a serious trouble maker is being marketed; this time one that is truly a hazard. . . . The groups were riled at these claims: "Works in seconds . . . for any tube . . . any model . . . any make set . . . Requires no skill or electrical knowledge; even a child can follow the easy directions. . . . No tube manual or test leads necessary." . . . Let's hope that the association's warning is heeded and these dangerous gimmicks are relegated to the junk heap.--L. W.

WIN-TRONIX

LOW COST TV TEST INSTRUMENTS

NEW

Buy Now for BL. & WH. Service —and be ready for COLOR

COMPATIBLE FOR COLOR and BLACK AND WHITE

CHECK THESE FEATURES!

- ✓ *COMPATIBLE ADVANCED DESIGN* PREVENTS OBSOLESCENCE.
- ✓ *LOW COST* WITH *HIGH QUALITY.*
- ✓ *PORTABILITY.*
- ✓ *STANDARD WARRANTY* ON ALL INSTRUMENTS.

SEE YOUR PARTS JOBBER! WRITE TODAY FOR LITERATURE!

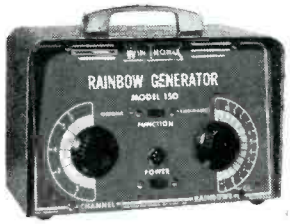
FOR COLOR OR BLACK & WHITE

WHITE-DOT and LINEARITY GENERATOR

▶ **COLOR CONVERGENCE** — A must on every color service call — gives large and small white dots.

▶ **BLACK & WHITE** — Linearity & picture size adjustments.

Model 160 **$79.95**



Model 150 **$49.95**

PATENT PENDING

RAINBOW GENERATOR

This Color Pattern Generator produces New Linear Phase Sweep for faster color TV servicing.

▶ **APPLICATIONS:**

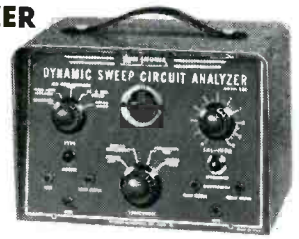
- All chroma circuit tests.
- Color demod. phase alignment.
- Color gain adjustments.
- Matrix test and alignment.
- 3.58 mc traps and coils.

SWEEP CIRCUIT ANALYZER

NEW! *The complete sweep circuit* tester — takes the guesswork out of sweep circuit troubleshooting.

▶ **TWO INSTRUMENTS IN ONE**

1. Horizontal and vertical sawtooth for signal substitution. (15KC and 60 CPS.)
2. Complete flyback and yoke testers.



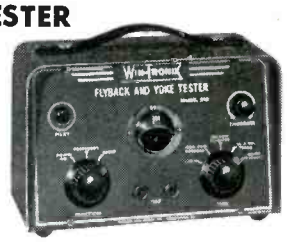
Model 820 **$59.95**

FOR COLOR OR BLACK & WHITE

FLYBACK and YOKE TESTER

NEW! Sensitive circuit checks one *turn shorts* in yokes as *well* as xfmrs.

- ▶ Oscillating neon indicator *more sensitive than a meter.*
- ▶ Advanced design also tests color yokes and xfmrs.
- ▶ Saves time with fast test of —
  - Flyback transformers
  - Deflection yokes
  - Bypass and electrolytic condensers
  - Continuity of coils, xfmrs



Model 810 **$29.95**

FOR COLOR OR BLACK & WHITE

COMPATIBLE FIELD STRENGTH METER

VHF and UHF

NEW! *Here is the FSM that won't be made obsolete by color TV!*

For good antenna installations (color or bl. & wh.) **YOU NEED:**

1. Microvolt testing
2. Bandwidth testing

FEATURES:

- ▶ Tests for color performance on antenna installations.
- ▶ Tests for bandwidth for better bl. & wh. pictures.
- ▶ Reads microvolts *directly* on 5 scales.
- ▶ Channels 2-13; extra coils available for UHF channels.

Model 330 **$129.95**

FOR COLOR OR BLACK & WHITE

COMPATIBLE CRYSTAL CALIBRATOR

NEW! Crystal controlled generator and crystal tester

FOR:

- ▶ Color and bl. & wh. servicing
- ▶ Labs and factories
- ▶ Amateurs and experimenters

FEATURES:

- ▶ Accurate 3.579545MC color subcarrier standard, *factory calibrated* (crystal supplied).
- ▶ Three external crystals* and a crystal switch permit quick selection of precise frequencies.

APPLICATIONS:

- 3.579545MC color oscillator alignment.
- Crystal tester.
- RF and IF marker and calibrator.*
- Color TV 3.58MC generator.
- Microsecond time marker for scopes.*

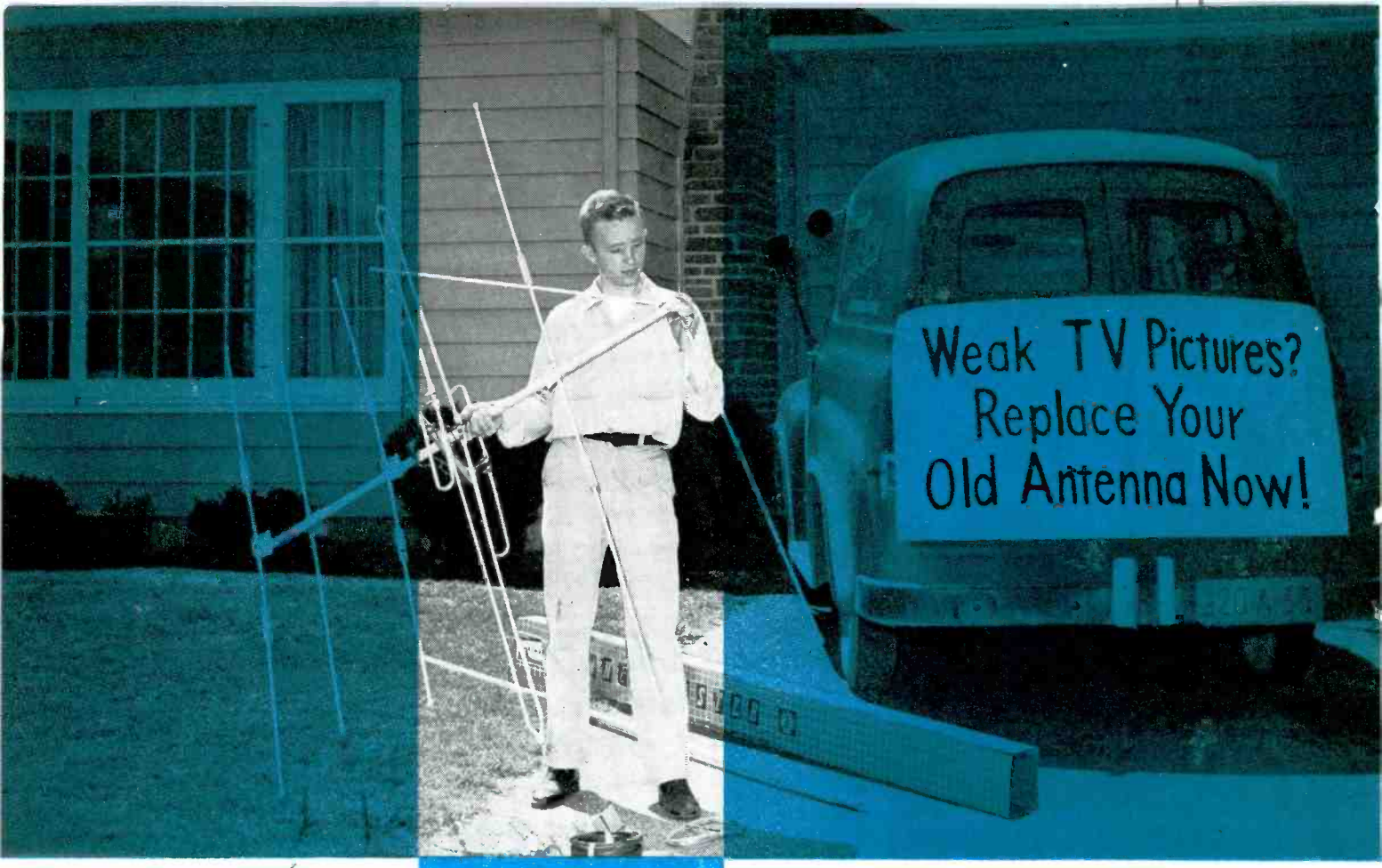
Model 120 **$59.95**

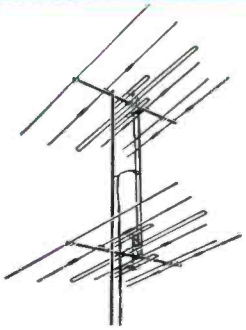
FOR COLOR OR BLACK & WHITE

*These crystals available extra

WINSTON ELECTRONICS, INC.

Dept. No. S-655 **4312 Main St., Philadelphia 27, Pa.**





NEW!
Narrow-space stacking!

Channel Master's RAINBOW and SUPER RAINBOW can now be stacked only 60" apart. These new, extremely efficient, 2-stage, impedance-matching stacking rods permit easier installations with an absolute minimum sacrifice of gain.

model no. 331-7

Champion Rainbow
330 series
Super Rainbow
331 series
Challenger Rainbow
332 series

Warm weather is profit weather!

The weather's warmer! Days are longer! *This* is the time of year to go after that gold mine in your own backyard: the replacement of the antennas in your area that are damaged, worn, and obsolete.

Channel Master's RAINBOW is the favorite replacement antenna of America's TV installation men — and here's why:

- There's a RAINBOW model for every installation . . . for every signal area . . . for every budget.
- Regardless of competitive claims—Channel Master's RAINBOW antennas are *still* the most powerful antenna series available today! Advanced engineering and the exclusive Tri-Pole make the difference!
- Featuring the fastest and strongest of all preassemblies: trigger-fast "Snap-Lock" action, Channel Master's fabulous preassembly that *snaps* open, *locks* open, without hardware or tightening.
- All-aluminum construction. Rugged, durable, reinforced at all stress points.

Today's greatest all-channel antenna value — bar none!

* Patent No. 2,691,738
Other Patents Pending

CHANNEL MASTER'S RAINBOW*

the ideal replacement antenna

CHANNEL MASTER CORP.
ELLENVILLE, N. Y.
The World's Largest Manufacturer of Television Antennas

Community TV Conference Report

by WYN MARTIN

In analyzing TV reception at appreciable distances, it has been customary to divide the distance into three zones.

The first zone, ordinarily considered to be near enough to the transmitting antenna so that one can essentially see the transmitting site from the receiving antenna, is sometimes called the radio optical *or line-of-sight* region.

Somewhat further out we have the diffraction zone. Here the antenna is definitely beyond line-of-sight, and the arriving signal is diffracted around the curve of the earth. In this region the signal decreases quite rapidly with distance. It is in this region that community TV system antennas are most often located.

At still greater distances, it has been found, the signal available through diffraction around the earth becomes extremely weak, and reception might be expected to be non-existent. However, tests have disclosed that signals do exist at distances far greater than one would expect. This zone has been described as the *scatter* or *radio twilight zone.*

Discussing these receiving conditions at the recent National Community TV Association conference in New York, *Lester C. Smith*[1] said that under normal circumstances, the signal strength may be expected to vary with distance; since in the line-of-sight region a signal decreases approximately inversely with distance, in the diffraction region the signal decreases much more rapidly with distance (in the order of .7 db/mile), whereas in the scatter region the decrease of signal strength with distance is much slower and of the order of .1 to .2 db/mile.

The characteristic of the earth's atmosphere, it was emphasized, is the most important single factor in determining the strength and quality of TV signals at distances from 40 to 100 miles; the dominant characteristic of the air is its index of refraction which determines the speed at which TV signals travel.

Since the index of refraction varies with elevation the atmosphere near the earth acts as a very weak prism.

Reviewing index of refraction conditions, the antenna expert said that the key factor is the water vapor in the air. If the air near the earth is quite moist, the waves near the earth will travel at a slightly reduced speed. If this moisture content decreases appreciably with elevation, the television rays will be bent an appreciable amount. Thus when the water vapor content of the air is extremely low, its intluence on the index of refraction is very small, and the index of refraction cannot change very much with elevation. Conversely, when the water vapor content is high, it is possible for the water vapor content to change substantially with elevation.

In a commentary on the varied types of refraction, it was noted that when the index of refraction does not decrease much with elevation, a circumstance most likely to occur with very dry air, the signals are bent only very slightly, and reception appreciably beyond the optical horizon is weak.

With standard refraction the waves are bent a significant amount, and the radio horizon is substantially greater than the optical horizon.

But, it was disclosed, if the variation of index of refraction with elevation, called *refraction gradient,* is comparatively large, the waves may be bent a substantial amount, with the result that the horizon for TV signals may be many tens of miles greater than standard. This can lead to quite strong signals with the signal strength decreasing rather slowly with distance well beyond normal line-of-sight.

Reviewing seasonal problems, Smith said that the variation of signal strength between summer and winter is due almost entirely to the change in the index of refraction. This arises from the fact that the moisture content of air is much less in winter than in summer; consequently the variation of this content with elevation must be much less in winter than summer.

Frequently, it was explained, one has the problem of choosing between an antenna of moderate size on a tall tower, and a higher gain and larger antenna which must necessarily be erected near the ground. In the diffraction zone, signal strength increases fairly rapidly with elevation, and an antenna of moderate gain at an appreciable elevation is attractive. At major distances, the gain with elevation is appreciably less, so that larger antennas nearer the ground give best performance.

Preventive Maintenance

Preventive maintenance of community systems is an important portion of the overall day-to-day operation. Proper methods can save money, insure good service, and maintain good public relations.

In a review of this requirement at the conference, *Caywood C. Cooley, Jr.*,[2] said that the maintenance requirements of any device are dependent somewhat on the basic engineering design; the number of components that make up the design; and the reliability of each of the individual components. And it was noted additional considerations exist: How is the device being used? Is it operating within the normal range of its specifications? If we are considering an amplifier, is there reserve gain available for either manual or automatic control? If we are considering amplifiers and other associated equipment, is the layout considerate of the signal-to-noise ratio requirements such that it will permit the available reserve to compensate for temperature, and age, as these affect cable losses? And further, is the operational output level of amplifiers conservative with respect to its maximum capabilities in order to allow for the additive effects of cascading?

Analyzing the meaning of preventive maintenance, Cooley said that *pm* means a method of finding and correcting trouble before it occurs. While locating trouble before it occurs is difficult, we can approach this, it was said, provided we have sharp tools with which to work. If measuring techniques and equipment sensitive enough to indicate small degrees of error are available, the CT specialist said it is then possible that one could locate and correct these small errors before they become large troubles; before the subscribers become aware of the fact that there are any difficulties whatsoever; and before the confidence and good-will of our public is disturbed.

[To Be Continued]

[1]Chief engineer, Spencer-Kennedy Labs.
[2]Vice President, in charge of field engineering, Jerrold Electronics Corp.

Outdoor Sound System

by MICHAEL ANTHONY

(Left)
Sound system installation at racing park show. (Atlas Sound)

SOUND, since the early carbon-microphone days, has always been an active member of the service family.

Then, of course, its applications were not too broad because of power-distribution difficulties, prompted by a lack of speakers with wide-beam coverage, low-output amplifiers and microphones. Today, we have a complement of equipment that has eliminated all of these problems. A host of amplifiers, tailored to every requirement, is now available. And there are microphones, speakers and phono-players, plus a variety of novel accessories, all designed to provide just the type of performance needed for the occasion.

The outdoors created a flourishing market for sound years ago; today the outdoor prospects are tremendous. The list of possibilities grows daily.

Sound systems depend upon one or more of the following sources for signals which they amplify and reproduce: Microphone(s), phono or radio tuner. The amplifier selected should have put input channels to handle these needs For the simpler requirements an amplifier with two microphone channels and one phono input is adequate. Some amplifiers have a phono built into the top, thus eliminating the need for a separate phono player.

Usually several speakers driven by the amplifier are used, rather than one, to obtain more uniform sound distribution. In permanent installations it is common to use a number of speakers, each operating at a relatively low volume. By contrast portable systems generally use two speakers, each operating at a much louder level.

It has been found that as more speakers (properly placed) are used, less power is required from the amplifier. This is because the loss in energy is less when carrying sound power by wires to the speaker, than when the audible sound power is carried by the air. Most amplifiers are designed to handle any number of speakers, for matching taps covering the entire range of practicable applications are available. Matching is further simplified by the constant-voltage method of power distribution.

The actual choice of style and type of speakers is often dictated by the desired appearance of the finished installation. Indoors, cone-type speakers in small baffles provide for easiest installation. Recessed baffles of numerous styles are also available. While 8" cone speakers require smaller baffles, 12" speakers will provide better bass reproduction and are to be preferred for systems which will be used pri-

(Left)
Portable sound system installation using truck mounted trumpets and phono-amplifier with output of 30 watts. (Bogen)

Based on information supplied by **Mortimer Sumberg, David Bogen Company, Inc.*

Carnivals:	Midways, Fairs Bingo, Raffles
Churches:	Revival Meetings Outdoor Sermons
Sports:	Speedboat Races Community Car Races Boat Concessions
Community Activities:	Bazaars Volunteer Fire Department Fairs Patriotic Gatherings Rallys Elections Concerts
Commercial:	Roadside Markets Summer Resorts Motels Store Anniversaries Drive-In Restaurants Drive-In Theatres

Table 1: List of some of the active outdoor events which require sound systems of the mobile (stationary and moving) and fixed variety.

Installations*

A Report on PA Amplifier, Speaker and Microphone Requirements, and Installation and Servicing Practices

(Right) **Dynamic microphone at a patriotic rally.** (Shure Brothers)

marily for music. For outdoors, where music and voice are involved, trumpet-type projectors and cones or a combination are usually the choice.

A large number of factors determine the power rating of the amplifier needed. These include the number, location, and type of speaker units, the size or volume of the space to be covered, the sound level desired, and the background noise level which must be overcome.

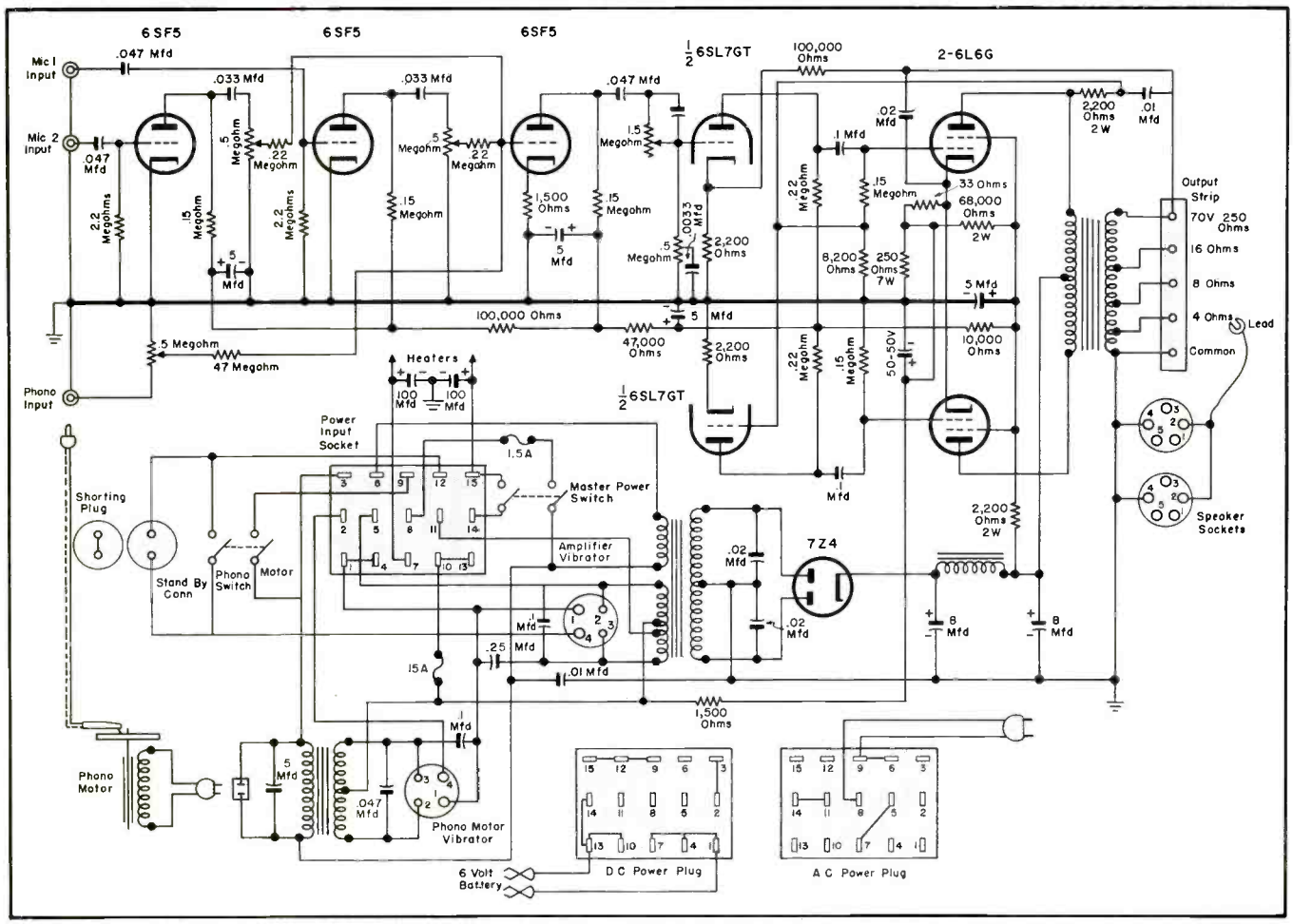
While more than simple rules are needed to determine exactly the power requirements for an amplifier, such exact requirements are not essential in the smaller installations, for extra power can be purchased quite inexpensively in such an amplifier and it can be held in reserve. For this reason it is common practice to use somewhat larger amplifiers than may actually be required.

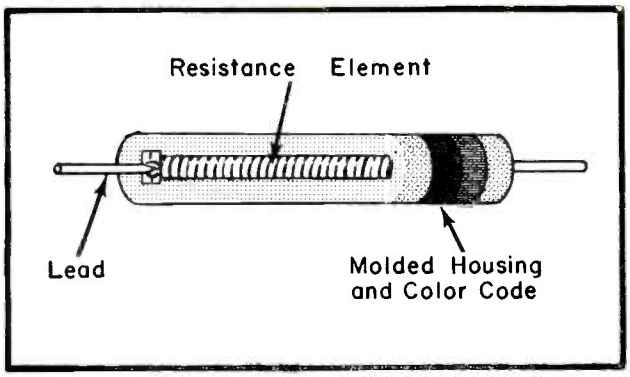
For small gathering places, seating up to 500 persons, with a quiet audience a 15-watt amplifier is suitable. For the same number of people in a noisy area, 30 watts would be a safer estimate. A 30-watt amplifier will usually take care of an area seating 1000 to 2000 persons.

Microphones are available in a multitude of styles and designs employing

(*Continued on page* 28)

Below: **Schematic of battery/ac pa amp and phono designed for use with one or two microphones.** (Bogen 1623)





Molded-Composition

Their Construction . . . Application . . . Tips on Installation

Fig. 1. Molded wire-wound resistor construction.

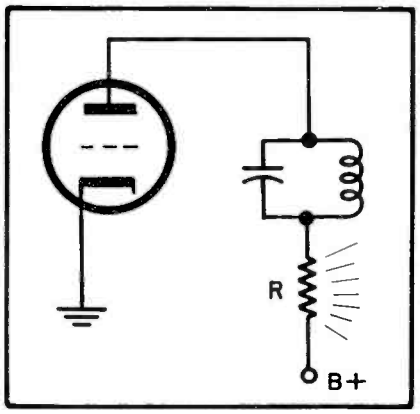
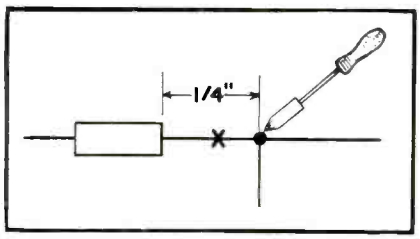


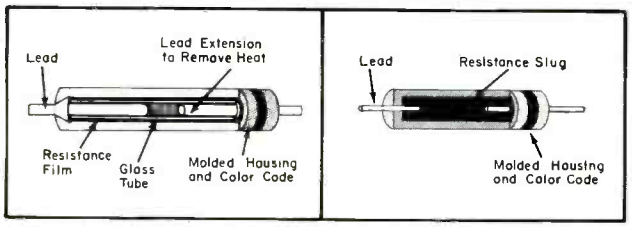
Fig. 2. Circuit illustrating point that one should never use resistors above voltage even though actual wattage is not exceeded. R (load) = .1 w and resistor rating = 1 w, but voltage across R = 350 v and voltage rating of R = 250 v; hence resistor R will break down to over-voltage.

Fig. 3. Resistor soldering suggestion. Resistor lead should be soldered at least ¼" away from end of resistor to prevent damage to resistor. Lead should be supported with pliers (x) between point of heat and resistor body.



(Below)

Fig. 4. Cutaway view of molded-composition resistors showing their construction. Type at left features a resistance film on glass tube. Model at right is a solid-resistance element type. Both units are the same size physically.



In general, there are two types of molded-composition resistors in use today. One uses a film of resistance material applied to the outside of a glass tube for its resistance element and the other uses a solid body of resistance material. A cutaway section of these types, indicating their construction is shown in Fig. 4.

Molded wire-wound resistors have a resistance element which may be made with several different types of resistance wire, depending upon the resistance required, wound around either cotton or fibre glass cords. These windings are then treated to form a solid element that can be cut to proper lengths without fraying, so that terminations can be applied. A cutaway view of this type of resistor, revealing its general construction, appears in Fig. 1.

Circuit Factors

A review of the factors which determine whether molded-composition or molded-wire wound resistors should be used in a circuit, appears in Table 1.

As the table discloses, the choice a manufacturer makes between a wire wound and composition resistance element depends upon: 1) Whether both types can be obtained in the same resistance value; 2) can either type meet the particular circuit requirements; 3) which is the more economical?

Now that we know something of the construction and application of these components, perhaps we will have a little more respect for them when used. While the resistor is not as fragile as the finest china, some care is necessary in their application to insure best performance.

General Service Rules

There are a number of general resistor-use rules that can be used as a guide to better servicing.

1) One should never use a molded wire-wound resistor as a replacement in high-frequency circuits unless the original resistor was this type. The inherent inductance of the winding may give unsatisfactory circuit performance.
2) In *hf* circuits, one should never

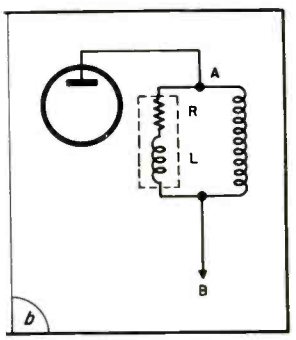
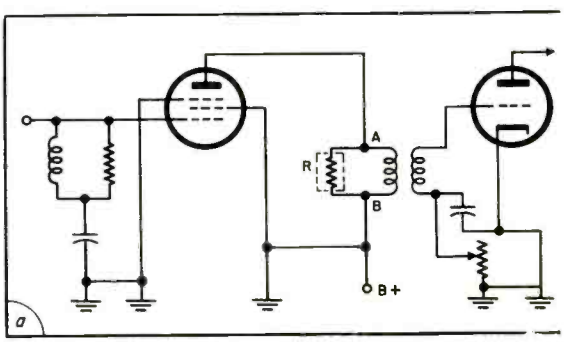


Fig. 5 (below). Gain control in video if circuit: if R is replaced with a wire-wound resistor, circuit AB shown in (a) is changed and characteristics of circuit are radically altered as noted in (b) above. (See Fig. 8 for schematic of this portion of circuit in a typical TV chassis; Coronado 15TV4.)



and Wire-Wound Resistors

by ESMOND E. JOHNSON

Service Engineer, International Resistance Company

replace a resistor with one of different wattage. This is a practice that is sometimes resorted to when the resistor has failed due to a severe overload; this usually is caused by the failure of another component which in itself should be corrected before replacing a resistor. As was pointed out earlier‡ the size of the resistor indicates wattage. Resistors of the same value always have the same color code regardless of size.

3) Resistors should be soldered at least ¼" away from the end of the resistance body. If space does not permit, or if leads must be kept short in *hf* circuits, the resistor's lead should be held with needle-nose pliers between the point of heat and the resistor body. Failure to do this may result in damage to the resistor.

4) One should dress (position) resistors away from other heat-producing components. The rating of a resistor is based upon an ambient-heating temperature; surrounding temperature. If a resistor is operating near other heat-producing components, this ambient temperature may be exceeded and the resistor could become overloaded.

5) One must never use resistors above their voltage rating even though actual wattage is not exceeded. This can either cause voltage breakdown or resistance change due to voltage coefficient.

6) Resistors may be connected in series or parallel to get a desired value. When this is done, both resistors used should be near the

(*Continued on page 43*)

‡SERVICE; February, 1955.

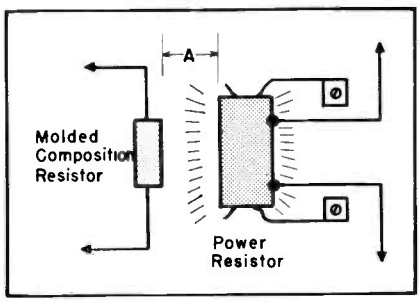


Fig. 6. Drawing illustrating need for keeping molded resistors far enough away from heat-producing components to hold ambient temperature of molded resistor below surrounding temperature, thus preventing overload.

•

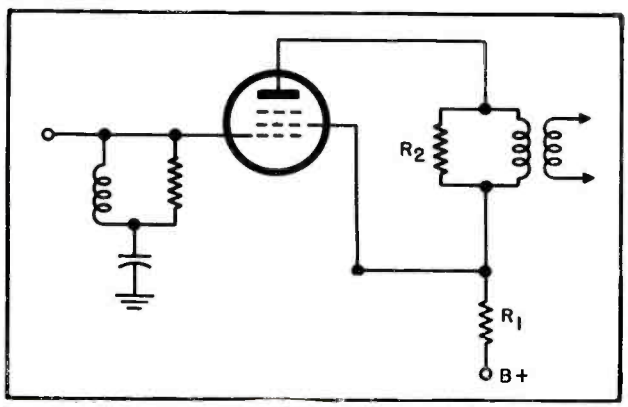
Fig. 7 (below, left). Another section of if circuit illustrating importance of replacement with some wattage resistor to keep band width and gain. Partial grounded or shorted component such as tube if transformer, etc., causes severe overload on R_2. Replace defective component; then R_2.

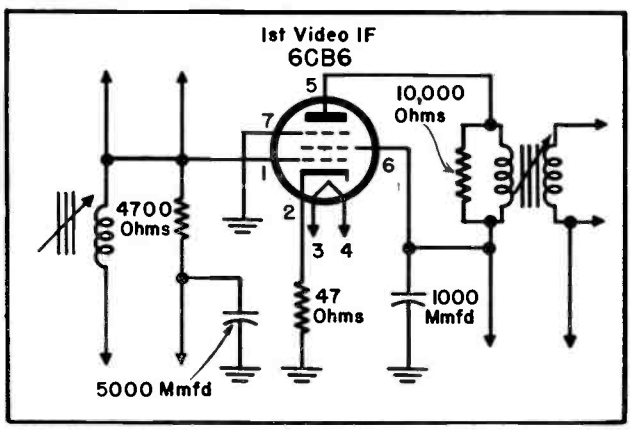
•

Fig. 8 (below): First video if in Coronado TV chassis (model 15TV4) used as a basic circuit in analyzing resistor applications.

Resistors Less Than 10 ohms	Resistors Subject to Severe Overload	Resistors Of Better Stability	Resistors in High-Frequency Circuits	Resistors Above Wire Wound; Max Values	Resistors Least Expensive; For Original Equipment
Wire	*Wire*	*Wire*	*Composition*	*Composition*	*Composition*

Table 1: Resistor characteristics and relation to circuit requirements.





Testing and Repairing Battery-Operated Receivers

by JACK DARR

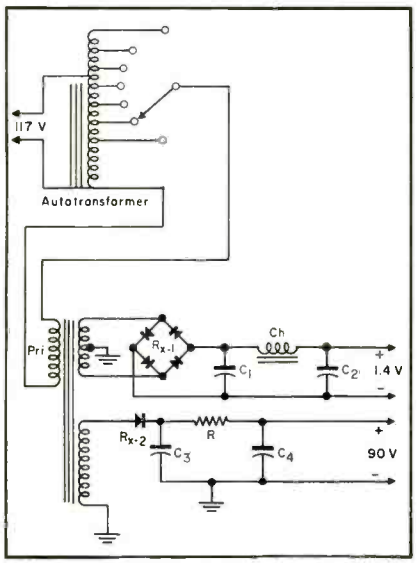


Fig. 1. Autotransformer and power supply used for testing battery radios. R_{x-1} is a bridge type selenium rectifier; R_{x-2} is a half-wave type. C_1 and C_2 are low-voltage filters, usually from 1,000 to 2,000 mfd, at 6 vdc. C_3 and C_4 are high-voltage filters running from 30-50 mfd at 150 v.

Battery receivers, still widely used in rural areas as table models and more popular than ever as portables, are today quite a factor on the field and bench agenda of service shops.

Basically these pack sets use three different sets of tubes; 1A7, 1N5, 1H5, 1A5, 1C5, 3Q5 *GT* series; the *loctal* 1LA6, 1LC6, 1LN5, 1LH4, 1LB4, 3LF series; and *miniatures*, such as 1R5, 1U4, 1S5, 1U5, 1S4, 3Q4, etc.

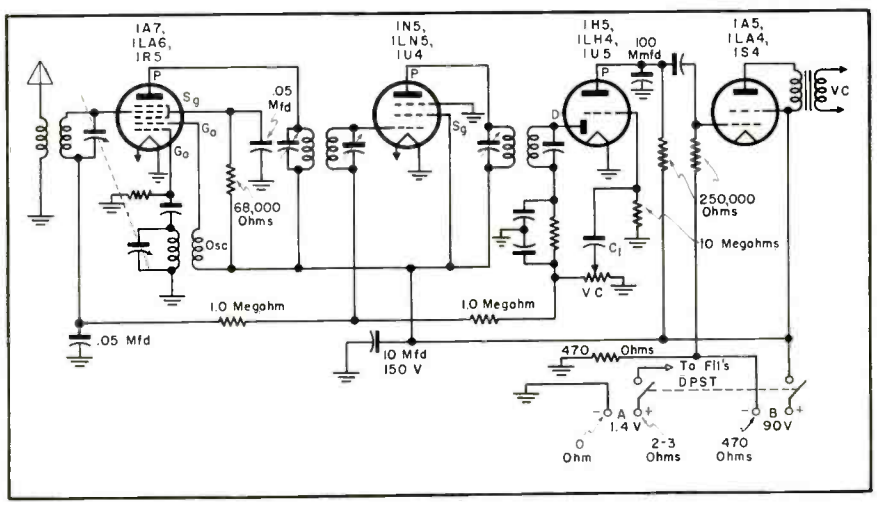
The most critical circuit in the battery set is the mixer-oscillator. Tubes used here are practically all pentagrid converter types (1A7GT, 1LA6, 1LC6, 1R5) with a cutoff rating of 1.1 volts on the filament. This is the *terminal voltage* of a standard dry-cell battery, and these tubes have all been designed with this type of battery in mind.

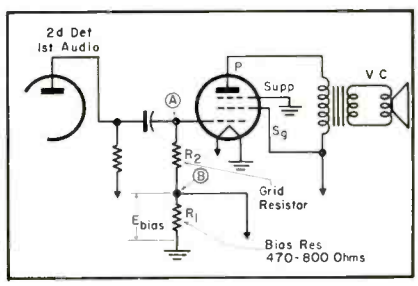
The filament voltage at the oscillator tube represents the most critical voltage of the entire set. If this voltage is below the cutoff point, the mutual conductance of the tube will drop to a point where it will no longer sustain oscillations; if the tube itself is weak, the results also will dip. The actual operating life of a battery is therefore determined by the efficiency of this stage. Most battery packs will provide about 1,000 hours of operation before the filament voltage reaches 1.1 volts, and the high voltage drops to 65. All battery sets should be checked for the actual cutoff point of the oscillator. This involves only some means of controlling the filament voltage, so that the actual cutoff point may be measured. If the set is still operating with the filament voltage down to 1.1 volts, then it is in good shape; if it cuts off at say 1.25 volts, it will not be possible to obtain the rated number of hours of service from the battery.

The test can be made by installing a variable resistor into the filament or *A* lead of the set and applying a battery. But better results will obtain if a power supply with an autotransformer is used.[1] These units use selenium rectifiers in a transformer-type circuit. This serves as a better test than the resistor in the *A* lead because the autotransformer will cause the *B* voltages to drop in step with the *A* voltage, thus giving a perfect simulation of a discharged battery. The voltage is lowered until the oscillator cuts out, and this point measured with a voltmeter. This cutoff point should not be over 1.1 volts. With new oscillator tubes, as low as .95 volt has been recorded before cutoff. Values of 1.05 to 1 volt are satisfactory; if readings of 1.2 to 1.25 *v* are obtained, you should note this on the records, since a

[1]Such as Perma-Power model A.

Fig. 2. Typical schematic of battery-operated receiver. Tube types may be any of those shown. Circuitry will be very much the same for all. Note typical resistance readings below battery connections. These data are invaluable in locating correct wires when wiring battery plug.





(Above)

Fig. 3. Enlarged schematic of bias circuit used in practically all battery radio receivers. Voltage drop E_{bias} across the R_1 bias resistor is used to bias power tube to proper operating point. Improper value of bias resistor will cause set to consume too much current, shortening battery life. Coupling capacitor, should be checked for leakage. Gassy tubes can also cause bias trouble; substitute good tube for test.

[2]Such as those made by Eby.

new tube will be required the next time the set comes in for a battery. Tubes which cut out above 1.25 should be replaced immediately.

Almost all battery models use a pentagrid converter, a pentode *if* amplifier, a diode-triode second detector and first audio, and a pentode power amplifier. Normal currents for this tube combination are 200 ma for the filaments and from 8-10 ma for the *B* drain. Practically the same circuit is used in three-way portables, with the addition of one stage of *rf* amplification in some models, to make up for the loss in gain due to the loop antenna.

Another circuit found is the bias supply for the power stage. The bias resistor is connected in series with the negative return, and a power tube grid resistor is returned to the junction of the bias resistor and the negative lead. As the total *B* current of the set flows through the bias resistor, the voltage drop across it is used as a bias voltage for the power tube, whose filament returns to ground. This chassis design always obtains in straight battery sets; in the 3-way portables isolation is used.

As the power stage alone consumes almost 90% of the total current drawn by the set, this bias voltage *must* be checked whenever the set has to be serviced. A leaky coupling capacitor, gassy power tube, or off-value bias resistor can cause improper bias to be applied to the power tube; this will cause a large increase in current consumption, sometimes without too noticeable an effect on the output, but it will shorten battery life.

The best test for this condition is measurement of the voltage drop across the grid resistor using a *vtvm*. If this drop is over one volt, the circuit should be checked. Correct bias voltages should be checked from the schematic, or from tube manuals.

A common design practice in the circuits is to use only one filter capacitor, usually around 10 mfd at 150 volts. Failure of this capacitor will cause oscillation in the *if* stages, manifested by inability to obtain a peak when aligning, and sometimes sustained audio oscillations. These capacitors seldom short out, due to the low applied voltage; most troubles are due to lowered capacity or opens due to aging. Bridging with a good unit will show up any filter troubles. Low power factor of the capacitor can cause some symptoms; such capacitors must be disconnected and checked.

The wiring of the battery cable and plug must be checked very carefully. Deterioration of the insulation or breakage of the plug, due to rough handling, can cause shorts which can have disastrous effects, ranging from a burnout of the bias resistor to destruction of the full set of tubes. Due to circuitry, a short of the high voltage to ground results in burnout of the bias resistor, which becomes shunted across the whole 90 volts. If this resistor is visibly burned, it should be checked for proper resistance; one should also check for the short which caused the damage.

Battery plugs and sockets are standardized, thanks to the efforts of the Radio-Electronic-Television Manufacturers Association. The standard 1.4-90 volt battery uses such a plug. Standard color code for battery wiring is used by several manufacturers: 1.4 *v* positive, *blue;* 1.4 *v* negative, *black;* 90 *v* positive, *red;* 90 *v* negative, *green*. Sears-Roebuck battery radios for years have used their own color code: 1.4 *v* positive, *blue/yellow;* 1.4 *v* negative, *black/yellow;* 90 *v* positive, *red;* 90 *v* negative, *red/black*. Others do use color codes of their own, so one must be very careful. It is necessary to check out an unknown battery cable before making any connections; some sets use *red* for the 1.4-*v* positive, and *blue* for the 90-*v* positive.

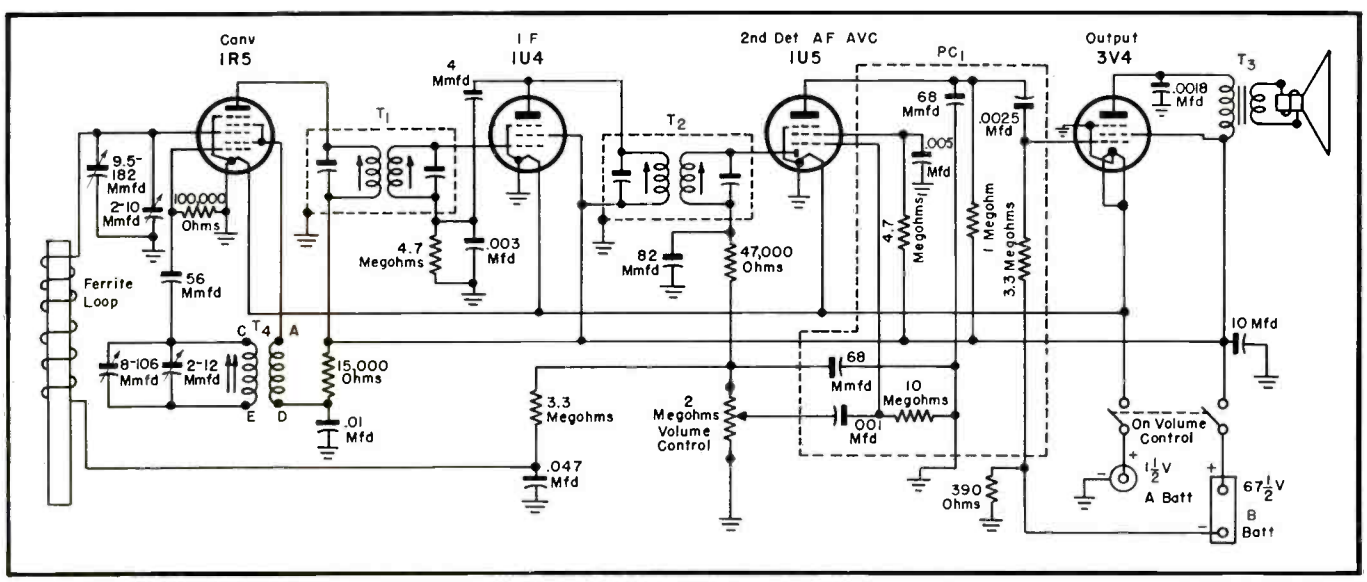
The cable can be easily checked with an ohmmeter, without even removing the set from the cabinet. The filament positive lead will read about 2.3 ohms to chassis, and go through the switch; the filament negative will read a direct short to chassis. The 90-*v* positive lead will read open to chassis, direct short to screen of power tube, and the negative lead will read 470-800 ohms, or whatever the bias resistor's value, to chassis.

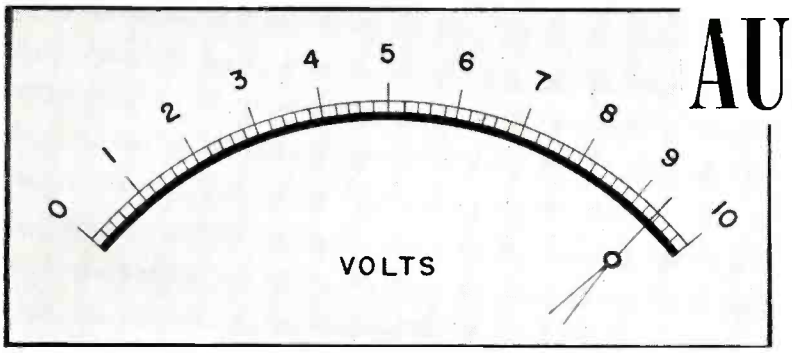
Battery plugs used on original equipment are often quite flimsy. It is recommended that these be replaced by a heavier type plug.[2] These have a body thick enough to enable one to grasp it to pull the battery plug, instead of pulling it at the wiring.

When soldering wiring into the pins, one should be sure that no excess solder is left on the outside. Blobs of

(*Continued on page* 43)

Fig. 4. Circuit of a battery-operated personal receiver; RCA 6-B-4A/4B, 6-B-5. The 1R5 is a converter; 1U4, if amplifier; 1U5, second detector, af amplifier and avc; 3V4, output.





AUDIO Instrument Scale Readings

by NORMAN CROWHURST

Interpretation and Application of Results Obtained In Basic Measurements

IN MAKING ELECTRICAL measurements, many tend to interpret meter readings as one interpolates a reading on a slide-rule scale. Particularly in audio - equipment measurements, where the accent is on response within 1 db is one subconsciously drawn into this practice. In doing so, we bypass the standard of accuracy emphasized in the instrument specifications.

To illustrate this point, let us review the design and operation of an instrument with which everyone is probably more familiar; the clock or watch. If someone asks for the time, the answer would probably be in hours and minutes; one would not bother to be precise about the exact time to the nearest second. Of course, for some purposes of time measurement, it does become necessary to pinpoint the answer down to fraction of a second, possibly a microsecond. But we can readily see how ridiculous it would be generally to specify time as, let us say, 10 hours, 35 minutes, 22.1357964 seconds.

Now, in test instruments, it has become a custom to interpolate fractions that serve no purpose. As an example, let us study the instrument scale shown in Fig. 1. This is the 10-volt scale of a typical 2% accuracy instrument. It will be noted that the divisions have been spaced at precisely 2% intervals, so there are 50 divisions on the scale. This means that if the pointer is exactly at, say, 9 volts, the voltage being measured could be somewhere between the division below and the division above 9 volts; in this case 8.8 or 9.2. Yet, many are inclined to note the reading as, say 9.35 volts. This may be a correct interpolation of the scale, but it must be realized that the true value might actually lie anywhere between 9.15 and 9.55, so that the significance of the decimal figures is vague. In this instance, either 9.3 or 9.4 volts could be accepted as the reading, but with the mental reservation that the voltage is somewhere between, say 9.1 and 9.6 (allowing a margin). The purpose of the decimal is only to give a rough idea how much nearer the voltage is to 9 than to 10.

To convince yourself that this kind of deviation often obtains, we can take any two instruments that cover the same range of voltages, and connect them in parallel, so that they should read the same voltage. Then, we can compare the voltage readings on both instruments at different points up the scale, by using different voltages to measure. You will find invariably that there are some discrepancies between the readings. But, if the instruments are made by reputable manufacturers, the deviations will be found to be within the accuracy tolerance specified.

At first the difference may give you the impression that one or other of the instruments must be *off*. Often, as a result of finding this difference, we are prone to ask which instrument should be trusted. This puzzling situation doesn't necessarily have to hold. The probability is that both instruments are within the specified accuracy, but both may be slightly off the nominal reading.

There is another fallacy connected with making measurements. This is the assumption that the line voltage is exactly 115 volts. Many simply plug an amplifier or whatever equipment is to be serviced into a line socket, assume that the line voltage is automatically exactly 115 volts, and proceed to make voltage measurements of B+, filament voltage, etc. If, for example, the filament voltage reads 6, instead of 6.3, then it is believed that the voltage is too low, although 6 volts represents but a 5% differential. Before making measurements as critically as this, it is important to check the line voltage carefully. If the line voltage is 5% low, which it often may be, then it is not surprising that the secondary voltages on the line transformer are also 5% low. Before checking with such attempted accuracy, one must always be certain that the voltage fed to the equipment conforms with its nominal figure, as accurately as can be measured with the instruments available.

A voltage stabilizer of suitable type should be used to maintian this voltage. The use of a voltage stabilizer automatically takes care of line-voltage fluctuations.

However, whether one does or does not use a stabilizer is not the crux of this problem. The important thing is to be able to interpret correctly the readings one does obtain. It will be sufficient, for example, to check the line voltage; if it is 110, instead of 115, then one must make allowance for this fact in measuring the other circuit voltages. On the other hand, if a line voltage happens to be running high, at say 122, then we must make allowances for this in measuring the other voltages in the circuit.

It must also be remembered that all voltages on a piece of equipment do not necessarily vary in proportion. All the voltages directly connected with the line transformer should vary

(*Continued on page 42*)

(Above)
Fig. 1. A 10-volt scale for an instrument of ± 2% accuracy. Position of pointer illustrates a typical reading.

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Detection and Prevention of Radiation In

Cable-Termination Requirements . . . Amplifier Inner-Shield Design . . .

THE PREVENTION of radiation is essential to the successful operation of any community TV antenna system. If viewers are annoyed by spurious images, ghosts and interference, traceable to radiation from the cables, a tremendous amount of ill-will can easily be generated.

Fortunately, radiation from the *c-t* system can be held to a minimum, by applying proper constructional practices and good equipment. The system must be very thoroughly checked out at the time of installation. And every precaution against excessive radiation must be taken during initial construction.

The basic cause of radiation from any closed system stems from the presence of standing waves on a line or run of cable. An *rf* transmission line which is not terminated in its characteristic impedance will cause the energy being fed into it to *back up* the line toward the source, forming standing waves. A reactive component is introduced into the line, and the signals will radiate from it, just as if it were an antenna. Community TV installations use coax cable entirely, just for this purpose; to prevent as much radiation as possible.

Cable types used in these systems are all of the 72-ohm type; they are generally considered and computed as 75 ohms, for simplicity. Transmission line amplifiers, line splitters, matching transformers, and all other gear used with it must provide 75-ohm terminations. Only at the antenna site itself can open wire or other types of line be used. Radiation here presents no problem; normally there are no sets nearby to pick up stray signals. The town cable system, however, must be a coax line to prevent leakage or loss of signal. Losses engendered by the use of coax can be made up by adding more gain via line amplifiers.

Line amplifiers are installed in sheet-metal boxes, both for weather protection and shielding purposes. In some cases, double shielding may be necessary, following the *screened-room* design available for test purposes. For the *c-t* application, rectangular boxes of copper screen wire are required; they should fit inside of the regular galvanized-iron *pole-boxes*. Usually, these inner shield containers are about two inches smaller than the metal pole boxes. The amplifier is then set up inside of the screen box. The external metal box should be lined with Celotex or a similar material, and the screen box set inside it, grounded at each corner with heavy braid. The amplifier should then be grounded by its fastenings.

The coax cable can then be brought into the box through regular coax fittings[1]; cables use matching plug[2]. The use of these feed-termination units serves to provide a clean, tight seal for the coax cable; and if properly assembled, they'll prevent any leakage of signal at point of entry. In certain cases, it may be necessary to employ double-shielded coax cable. This line is normally identical with the conventional types, except for a dual layer of metallic shielding braid. Both layers of braid must be firmly grounded at both ends.

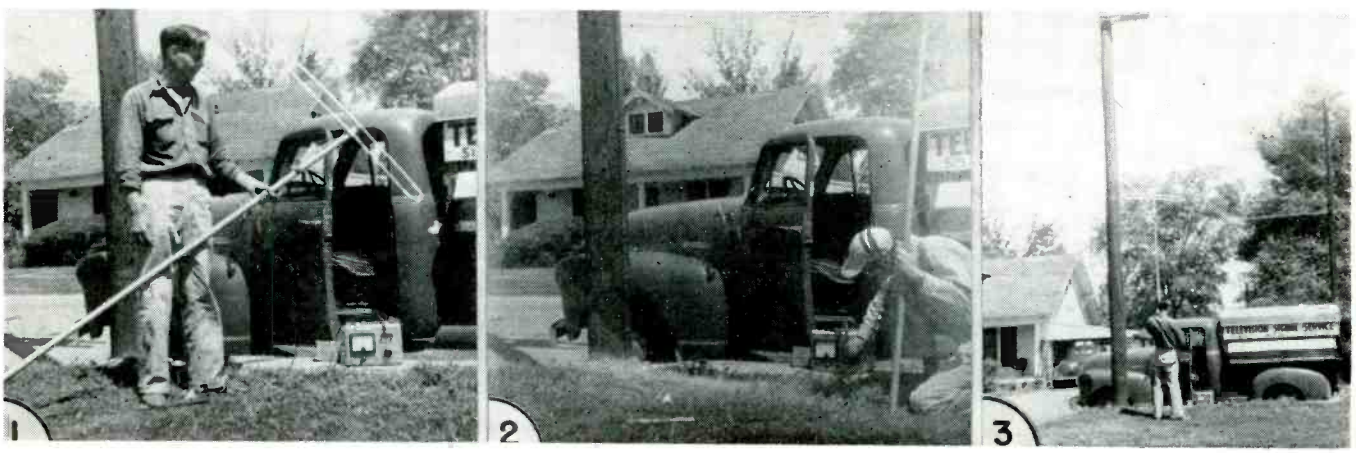
The type of coax cable used is important. Only the better makes of cable will give satisfactory results.[3] When selecting cable, one must be sure that the shielding braid used covers a sufficient area of the cable's surface: in other words, the shielding should be close enough to accomplish the desired result.

Ventilation holes must be placed in the metal cabinets to prevent undue temperature rise of the continuously-operating amplifiers. These may be up to one inch in diameter, baffled to prevent entry of rain or moisture; but they *must* be covered with copper fine-mesh screen, soldered well all the way around, to prevent *rf* leakage.

Matching of impedances is accomplished automatically in most equipment, using 75-ohm cable and 75-ohm input and output terminals of the amplifiers or matching transformers. If a cable run must be left *open* for a time, due to construction work or a temporary disconnection, it must be terminated with a 75-ohm non-inductive resistor, to prevent formation of

[1]Amphenol 83-1R [2]Amphenol 83-1SP.

Figs. 1, 2 and 3. Fig 1 illustrates a 1-meter (39") test dipole antenna designed for probing radiation. The use of a battery-powered field strength meter for radiation probing is shown in Fig. 2. Power pack is behind meter. Earphones serve to distinguish between TV signal and noise. Testing suspected amplifier for radiation is illustrated in Fig. 3. Amplifier box is on pole. Drops run both ways from box, also main cable. Leakage should be measured in several positions, to determine extent of problem.



Community TV Systems

by T. C. MASTERS,
Chief Engineer, Television Signal Service

Probes for Field-Strength Meters to Detect Interference

standing waves on the line. When a multiple-outlet is installed, each tap should be provided with a 75-ohm terminating resistor, and permanently connected. This will prevent mismatching of the line due to connection or disconnection of sets. The signal loss due to this will be negligible, and the resistors will prevent ghosts and radiation from the drop. Two-set couplers designed for home installations can be treated in the same fashion, if necessary.

The level of signals in the lines is an important factor in the prevention of radiation. Excessively high levels will cause radiation; only so much signal as needed to produce clean pictures should be used in any line. All amplifiers designed for *c-t* systems have provisions for adjusting gain, and some utilize *agc* action to maintain the signal level, once adjusted.

Probe Unit

To detect radiation a probe unit can be made up in the shop. For our checks, we selected a folded dipole, one meter long, as the antenna. This was mounted on a ten-foot aluminum mast, and connected to a field-strength meter via a 300-ohm ribbon lead. If a straight dipole is desired, it may have the same construction, but a 72-ohm small coax must be used. The field-strength meter should be powered with a 6-volt battery-operated power supply, so that it can be used away from the power lines. The meter must be calibrated with a *microvolter,* so that some idea of the actual field strength, in terms of microvolts per meter can be obtained.

The FCC has not, at this writing, issued any standards covering allowable radiation intensity from *c-t* systems; from 10 to 20 μv have been proposed; distances of up to 20′ have also been noted.

To take measurements, the probe dipole is held up under the suspected amplifier or run of cable, with the dipole parallel to the cable. The reading on the meter should then be noted; then the dipole can be turned at right

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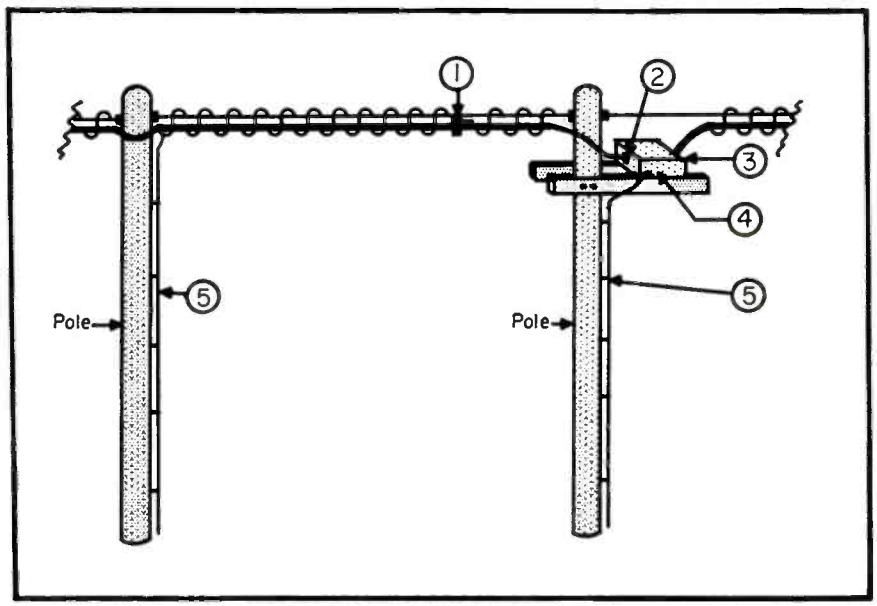
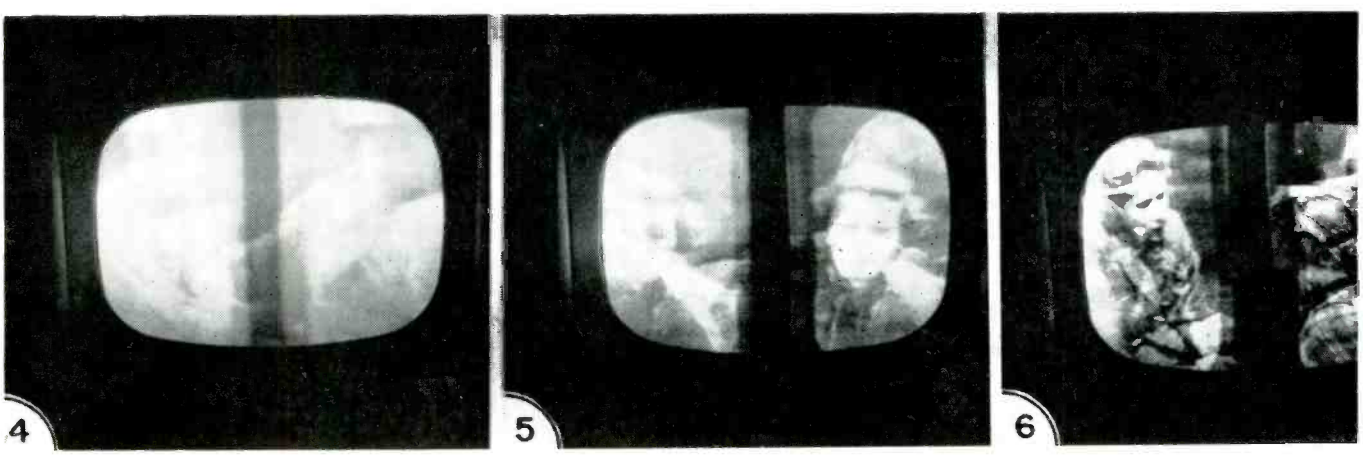


Possible sources of radiation from a typical community-TV line run, involving two poles and a single amplifier box: (1)—splice or plugs in main cable; if loose or corroded, they could be a source of signal leakage. (2)—Plug on cable or socket on amplifier box; corroded or loose joints could cause signal leakage. (3)—Amplifier box; loose lids or cover could allow signal leakage. Defective grounding could also be possible cause. (4)—Excessively high signal level at the amplifier could also be a source of trouble. Lowest level signal, consistent with good picture quality should be used. (5)—Loose ground wire from amplifier box and messenger cable, also connected to shield of main coax cable, could be source of leakage trouble.

[3]In installations in this area Amphenol 21-125 and Federal K-14 have been used for large cable work.

Figs. 4, 5 and 6. Characteristic cable-radiation patterns appearing on TV screen. Picture, caused by radiated signals, causes blanking bar (black or white) to appear in approximate center of screen.



by OLIVER BERLINER

SER-CUITS

[*See Front Cover*]

The Audio Multitester . . . Designed to Check Operation of Microphones, Cables, Phono Pickups, Preamps, Line - Power Amps, Patch Cords And Speakers

THE SERVICE MAN who does a substantial amount of installation, maintenance and repair of public address systems and other audio equipment, much of which may be his own if he is in the rental business, must be prepared to service a large variety of audio devices. In such a category we might find microphones, cables, phono pickups, preamps, line and power amps, patch cords and loudspeakers.

To check the operation of foregoing items the tester shown in Fig. 1 and on the cover was designed. Examination of the circuit will reveal that the device can serve to make a number of tests. To illustrate, it can be used to check 1, 2 or 3-conductor cables (more with additional switching, if required), for both shorts and continuity. To do this, an ohmmeter is connected to the appropriate pin jacks and the *vi* and *lo-z* selector switches are placed in the *off* position. Both ends of the cable to be tested are then plugged in to the appropriate connectors on the tester. Then, by rotating a *cable test* switch through its various positions, every necessary test of the cable may be made.

If the cable is in good condition, the ohmmeter will indicate a complete short (zero resistance) for the continuity tests, and should give no reading for the short tests. Since we are not too concerned over the actual resistance readings on the ohmmeter, a battery and bulb connected in series to the ohmmeter pin jacks may be used instead.

The choice of connectors for use on the test panel is entirely up to the user, and depends upon the cables that he normally uses.‡ Each bank of connectors is wired in parallel.

The circuit has been so designed that the same type of connector need not appear on each end of the cable under test. The only requirement is that terminal *1* of a connector be wired to terminal *1* of the connector at the other end of the cable; terminal *2* to *2;* and so on. In addition, single or double conductor cables can be tested on this 3-conductor system.

As may be seen from the diagram, one of the banks of connectors (your choice) serves also to feed a balanced line of any impedance and any level up to +4 *vu* to the volume indicator and the rest of the tester. Low impedance microphones, preamps and line amplifiers may be connected here for test of frequency response and level. Distortion measurements may be made with suitable external measuring equipment.

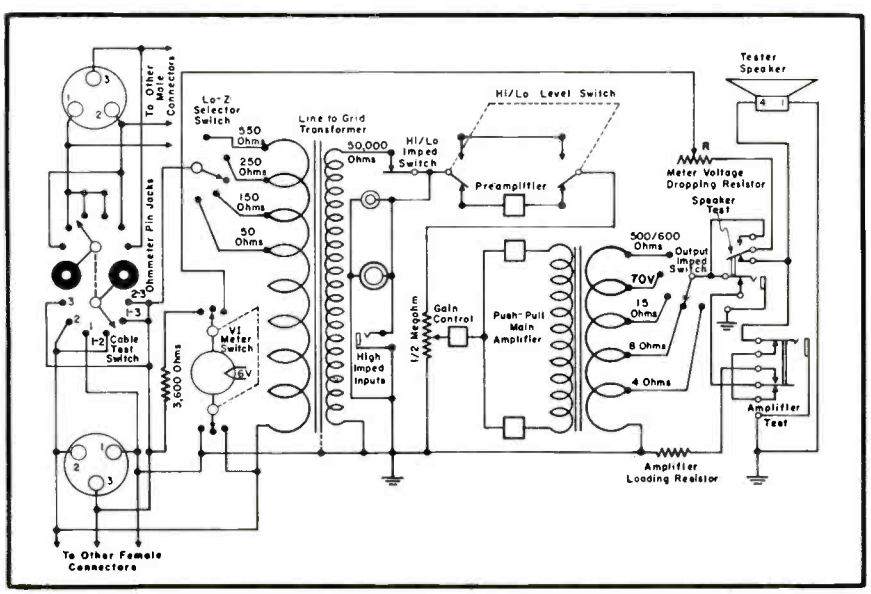
High-impedance devices of low or high level may be fed to the tester through other appropriate jacks on the panel.

A *hi-lo level* switch feeds the low or high-impedance source to either the preamp or the main amplifier. It is advisable to switch the preamp completely out of the circuit when it is not needed to keep noise to a minimum.

As a gain control the popular half-megohm size is used, although anything from .1 to 1 megohm could be used. This is in the grid circuit of the first stage of the main power amplifier. This amplifier here has output impedances of 4, 8, 16 and 500 ohms and a 70-volt tap. The *seventy-volt system* is the new standard for public address work, wherein the amplifier output impedance has been calculated and set in such a way that at full-rated wattage output the volt-

(*Continued on page* 42)

Fig. 1. Schematic of af tester, also shown on cover, that can be used to check a number of items in the audio family. For maximum effectiveness, two accessories should be used with this instrument; an ohmmeter and signal generator.



‡In the model built, Cannon connectors were employed on the mike cables; Amphenol connectors on speaker cables.

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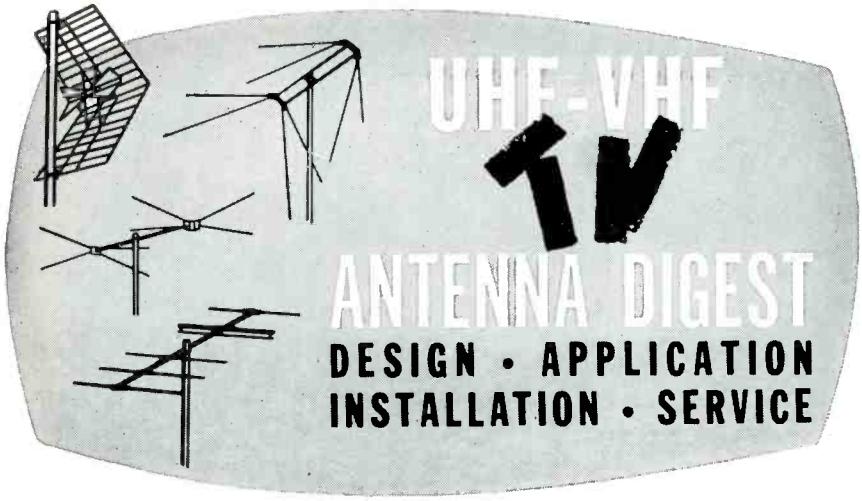
Horn Antennas for Community TV Installations

by JACK BEEVER*



ONE OF THE great problems of community antenna systems has been co-annel interference. This has been a source of constant investigation and a number of solutions have been worked out and applied with some degree of success. Probably the most effective has been the horn antenna at *vhf*.

For those not familiar with the aspects of a horn antenna, let us picture a rectangular waveguide, whose end has been flared out to a funnel. The energy captured by the flare is removed from the waveguide section by means of a probe, which may be a dipole, inserted into the waveguide at a point where the reflected energy from the closed end of the waveguide reinforces the incoming energy.

Such an antenna has the ability to attenuate greatly all signals other than those which enter directly into the open end of the flare. This is due to the electromagnetic shielding afforded the probe by the sides of the waveguide.

In practical design, to reduce wind loading, the flare is usually made of wire screen which behaves like a solid sheet of metal to the frequencies involved.

The greatest misunderstanding about the horn concerns its gain and ability to make a good picture from a weak signal. This is understandable in view of the huge size of these antennas. These antennas are high-gain models, but not necessarily higher gain than other arrays. As is true of all arrays, the gain is a function of the capture area, which in the horn is the area of the front of the flare. The extended length of this antenna is necessary to utilize properly the intercepted energy. The great value of the horn is its ability to reject interfering signals approaching from an angle.

In estimating the necessity for a horn antenna, it is necessary to survey thoroughly the proposed site, determining the antenna gain required to provide a usable signal, and the direction from which the co-channel signal is being received. If the co-channel comes from the same direction, or nearly the same direction as the desired signal, the horn cannot help. This situation is rare, since FCC allocations are such that ranges between stations on the same channel are great. If the co-channel approaches from the sides or rear, the horn can remedy the situation. From the survey results, the desired gain can be determined.

The graph shown in Fig. 1 will then give the size of the horn required. The height and width indicated assume a horizontally-polarized signal, such as television transmissions used. The axial length, *L*, is the dimension from the center of the imaginary surface, bounded by the edges of the mouth of the horn to a point where the sides would intersect if continued into the waveguide. It can be seen from the graph that to get the same gain at a low channel, the horn must be a great deal larger than at a high channel.

The extremely large size of these horns presented an interesting me-

(*Continued on page* 43)

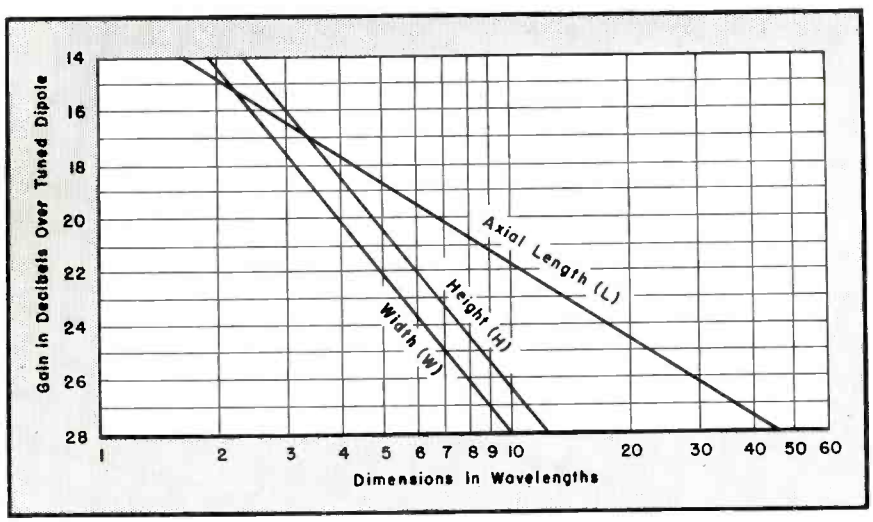
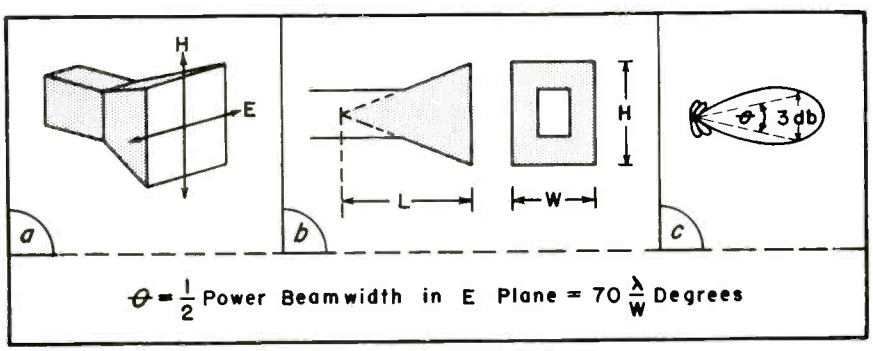


Fig. 1. Plot of axial length, height and width of a horn antenna in relation to gain achieved.

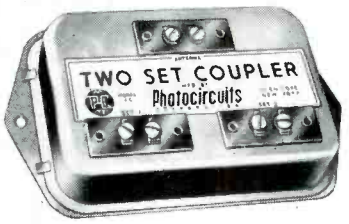
Fig. 2. Mechanical and electrical characteristics of horn. Cross-sectional drawings in b illustrate capture area. In the horn, this is the area of the front of the flare: w x h.



Horn antennas, designed by ***Jack Beever*** *and constructed under his supervision, are now in operation at Richland, Wash. (Ch. 29); Muscle Shoals, Ala (Ch. 13 and 6); and Tupelo, Miss. (Ch. 13 and 5).*

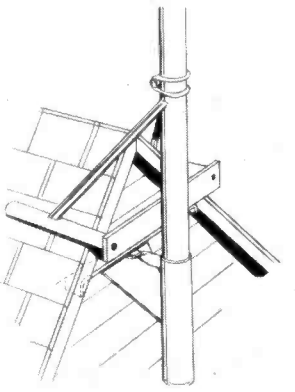
**Jerrold Electronics Corp.*

New Antennas... Accessories for UHF/VHF

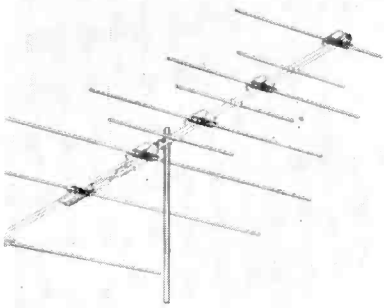


Two-set pc coupler, using wound sections of copper ribbon wire on a fiberglas support, connected to match 300-ohm signal input. (Photocircuits Corp., Glen Cove, N. Y.)

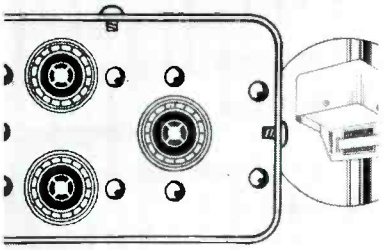
A china planter designed to be used with an antenna rotator. Planter is made of forest green and chocolate brown china. (Crown Controls Co., Inc., New Bremen, O.)



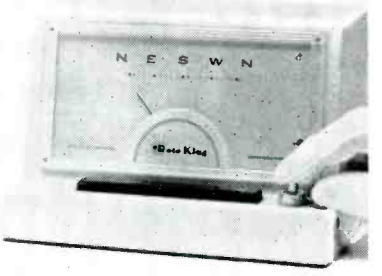
Gable mount designed for gable roofs. Accommodates tubing up to 1½" in diameter. (Rohn Manufacturing Co., 116 Limestone, Bellevue, Peoria, Ill.)



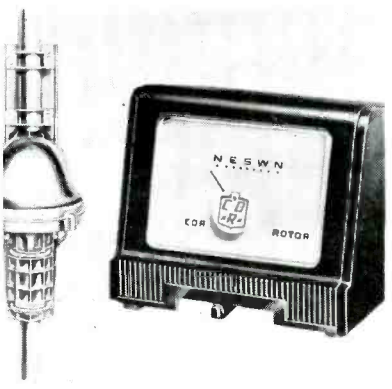
Wide band directive arrays for fringe and sub-fringe areas. Colinear phasing sections employed in both driven and parasitic elements. All aluminum construction; quick-rig assembly. (Thunder Bird series; Telrex.)



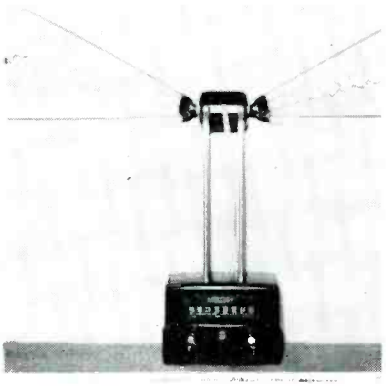
Directional couplers for master TV lines and TV outlets. Models for two and four outlets supply reverse isolation ranging from 14 to 30 db over the vhf band. This permits direct TV outlets as well as branch cables from which tapoffs may be made. Units require no power and may be mast or pole mounted. Impedance matched coax receptacles handle either RG-11/U or RG-59/U lines. (MDC-2 and MDC-4; Blonder-Tongue Laboratories, Inc., 526 N. Ave., Westfield, N. J.)



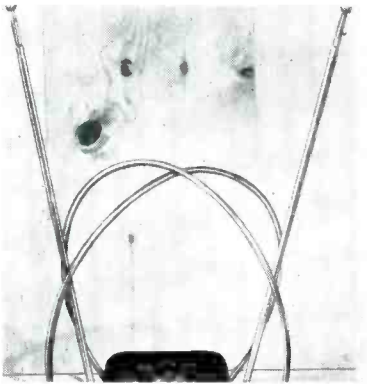
Rotator for use with TV equipment operating on low wattage. Control box has push button and panel light indication to the right of control bar. A depression of the button turns the control box on. (RT 400; JFD Manufacturing Co., Inc., 6101 16th Ave., Brooklyn 4, N. Y.)



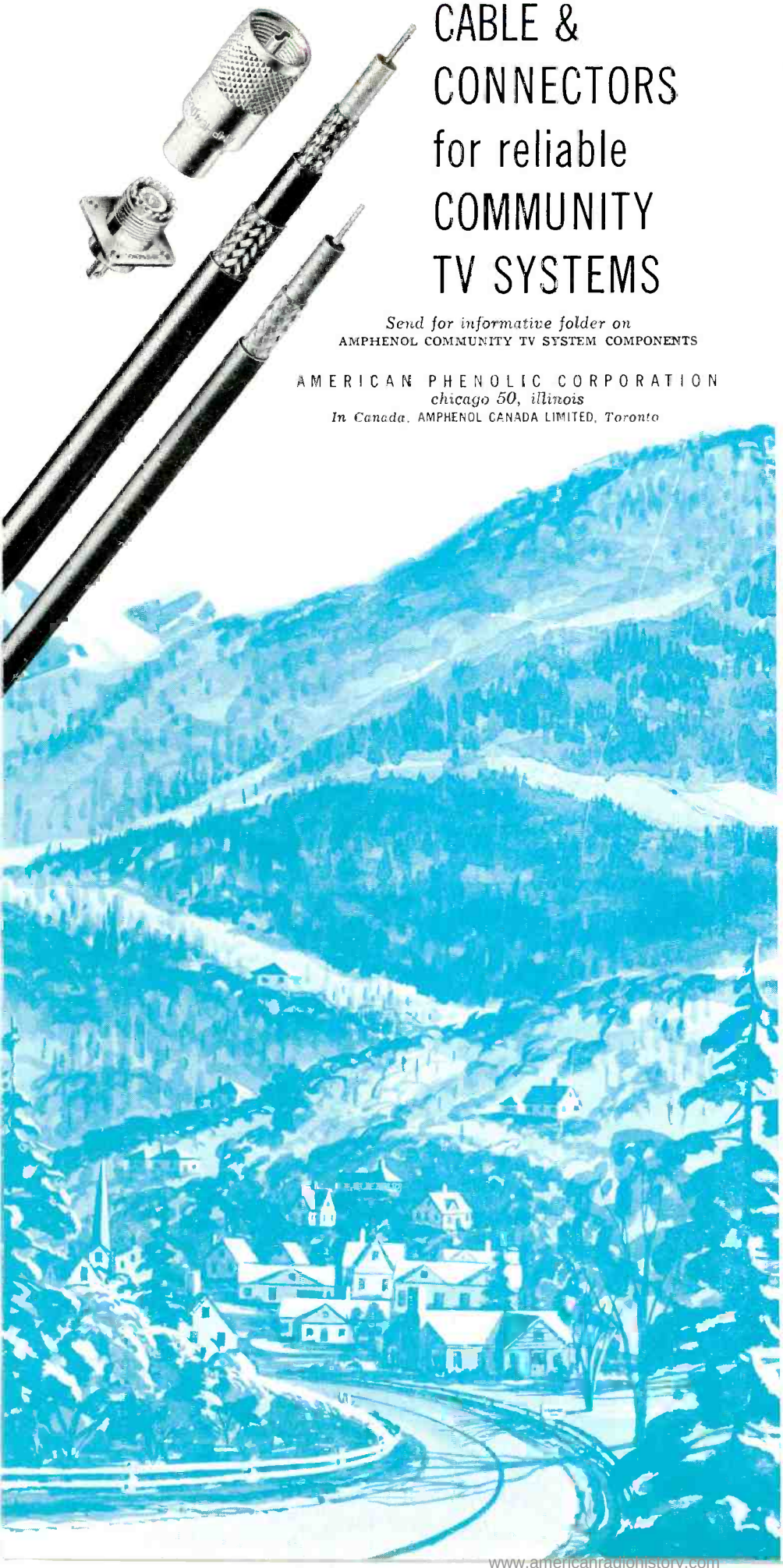
Meter cabinet, designed for rotator, said to offer accurate directional indication, covering all points of the compass. Features of rotator include 12 heavy duty ball bearings in two 6½" ball bearing races; reversible clamps that handle ⅞" to 2" masts; and mechanical brake that is released magnetically. (CDR model TR-4; Corneli-Dubilier Electric Corp. and subsidiary, the Radiart Corp.)



Convertenna which consists of an indoor uhf-vhf antenna mounted on a converter. Originally developed for home uhf-vhf demonstrations. Convertennas are being loaned to dealers as a feature of an audience building program set up by Storer Broadcasting, owners of WGBS-TV channel 23.



Indoor antenna, which, it is said, selectively directs circularly-polarized, electromagnetic loops, and inductively couples them to bi-metallic resonant dipoles. Antenna utilizes a nine-position orientation switch. (All Channel Antenna Corp., 47-39 49th St., Woodside 77, N. Y.)



Outdoor Sound

(*Continued from page* 15)

different principles for converting the sound energy to electrical currents. More difficult installations require specially-designed types such as directional microphones which are employed to eliminate feedback; that annoying howl. Microphones are also available in high- and low-impedance models. For usual applications the high-impedance types are used. Where the microphone cable is longer than 25′, it is usual practice to have a low-impedance microphone. Such a microphone requires that the amplifier have a low-impedance microphone-input channel.

Speaker Installations

Regardless of the amplifier's efficiency, if the speaker installation is incorrectly or poorly arranged, sound reproduction will be correspondingly inferior.

There are numerous factors that must be considered in a speaker installation. But basically, there are four primary considerations:

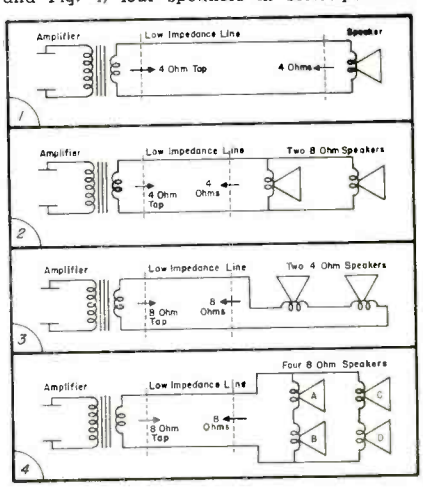
(*1*) What power is available to the speakers?
(*2*) Number of speakers?
(*3*) Type of speakers?
(*4*) Placement and connection of speakers?

The first step is to survey the location of the proposed installation, and carefully determine what situations or questions exist; see table *2*.

There are many different types of speakers available, and the choice of the speaker(s) is dependent upon five main factors:

(*1*) Geometry and acoustical characteristics of the volume to be covered.
(*2*) Ambient sound level in which the speakers must give coverage.
(*3*) Fundamental use of the system;

Figs. 1, 2, 3 and 4. Speaker matching arrangements. Fig. 1 illustrates connection for a single-speaker setup; Fig. 2, two speakers in parallel; Fig. 3, two speakers in series; and Fig. 4, four speakers in series-parallel.



i.e., for speech or music reproduction.

(4) Fidelity and intelligibility requirements.

(5) Economics.

The most complex step in speaker installation is that of the placement and connection of speakers. Of course, conditions, under and in which each system must operate, vary widely.

Outdoor-System Considerations

For outdoor systems, the main considerations are direction of sound and the area to be covered; power required. Here, the brute-force technique is normally used by employing highly directive trumpets. One must bear in mind that sound pressure is reduced approximately 75% below the previous level each time the distance from the speaker is doubled. Also, directional control (amount of power conveyed along the speaker axis) increases with the size of the speaker horn.

In connecting the speakers together, we must consider impedance matching and phase relation.

Speaker Connection

Efficient transfer of power from the amplifier to the speaker(s) is the primary consideration in a sound system installation.

The two methods of transfer of power are: (1) Connection from the amplifier directly to the speaker voice coil(s); and (2) connection from the amplifier to the speaker voice coil(s) through a transformer. The first method is employed when short runs of wire, not over 200′ in length, and simple speaker arrangements involving low impedances are used.

The second method is employed when the wire runs are over 200′; when there are complex speaker arrangements; and when it is desired to have less than 15% power loss in the transmission lines. The use of transformers also simplifies impedance calculations and facilitates changes in complex speaker arrangements.

For the most efficient transfer of power, it is important that the total speaker impedance(s) match the output impedance of the amplifier.

| To Be Continued |

Table 2: Speakers required for different amplifier outputs.

Amplifier Power	Speakers Needed For Outdoor Installation
6 to 8 w	One 12″ speaker
15 to 18 w	One trumpet
25 to 30 w	Two trumpets
45 to 50 w	Three trumpets
60 to 70 w	Four trumpets

by T. L. GILFORD

AUTOMATIC TUNING SYSTEMS for auto radios featuring *signal-seeking* circuitry are becoming a feature of many car sets.

There are many ways that signal-seeking tuning action can be achieved. But basically, pressing a button or lever on a receiver causes the set to search for a new station; this is done by scanning a portion of the spectrum until it encounters a signal strong enough to trigger its stopping mechanism. The scanning action is performed very rapidly so that one can sample a number of programs quickly when making a selection.

Signal-seeking has been found to offer many other advantages. From the standpoint of safety, it is claimed, it is less distracting for a driver to touch the signal-seek button than to give his attention to the conventional tuning operation. Since there are no settings to be made as in the case of push-button tuning, as one travels from one area to another, one does not have to reset the buttons to correspond to the new stations' frequencies.

In practice, the best tuning arrangement is represented by a combination of automatic signal-seeking, conventional manual tuning and push-button controls. The three-way combination is technically more difficult to design and manufacture, but gives one ready access to their *favorite-program* stations as well as the freedom of selection afforded by the automatic tuning system.

Auto Radio Search Tuners†

SEARCH TUNERS depend wholly on the fact that they must be operated in an area which contains listenable radio signals. Areas with steel garages, steel bridges or any other such shielded locations will prevent the tuner from operating satisfactorily. The tuner may re-cycle continuously without stopping on station. To check this type of signal one should tune across the entire frequency range manually. One should also check to see that the antenna trimmer is correctly adjusted, the antenna is at least halfway extended or that the sensitivity control is not set to a low sensitivity position.

In the Motorola MoPar models 900 and 901, the 3-position sensitivity control is located above the search selector bar:

Left—low sensitivity for extremely strong signal areas.

Center—medium sensitivity for average signal areas.

Right—high sensitivity for weak signal areas.

If the tuner stops continuously at the low-frequency end of the dial on the return cycle (including push-button operation) the resistors in this circuit should be checked carefully. It is important to remember this is not an intermittent condition. It is normal for the tuner to stop occasionally on noise, interference or radiated oscillations.

The model 900 chassis installed in Dodge cars will sometimes re-cycle, without stopping on station, because the search selector bar is wedged against the instrument panel. This can be adjusted without removing the radio from the car by bending the search selector bar down.

On models 833 (Dodge), 834 (DeSoto), 836 (Plymouth), 900 (Dodge) and 901 (DeSoto), provisions have been made for a rear seat speaker. The rear seat speaker is plugged into a speaker receptacle on the rear of the radio. If no rear seat speaker is used, the circuit is completed via a shorting bar. When a radio, which has a rear seat speaker, is serviced, you should be sure that a shorting bar is inserted into the speaker receptacle; without this bar, the radio will not have audio output.

When servicing or testing any search tuner radio, one must use a power supply of adequate current capacity, connected through heavy leads to the radio. A poor battery or power supply will result in improper operation.

Troubleshooting G-M Signal-Seekers‡‡

SIGNAL-SEEKER problems, in most installations are due to the antenna being shoved way down in the fender (if the radio can't pick up a station, the automatic tuner will never stop); sensitivity control turned up all the way counter-clockwise (if there are no strong stations in the area, the tuner will never stop); and button depressed.

When operating push buttons, the radio is *alive* only for that split second when the dial pointer touches the tab belonging to the button depressed. If there is no station at that point, the tuner will never stop.

If the radio can't electronically hear a station, the automatic tuner will never stop. In the Delco models, the automatic tuner circuit is dependent upon the first three stages of the radio.

Accordingly, if an automatic tuner won't stop on a station, an isolation test is in order. One should first tune the radio manually. If you can't hear any stations when tuning manually, then there is something wrong with the radio. In the case of the Cadillac set, manual tuning can be simulated by merely tapping the station selector bar and turning the set off immediately. Turning off the set stops the tuner. There'll be no trouble detecting several stations if they are present: that is, if the radio, itself, is working. Better, yet, the 12AU7 can be pulled out. Then the tuner will stop the instant one releases the station selector bar. Tuning, manually, is a good isolation check for both a dead set and a weak set. If the set is weak the automatic tuner will continue to work, but will pick up fewer stations.

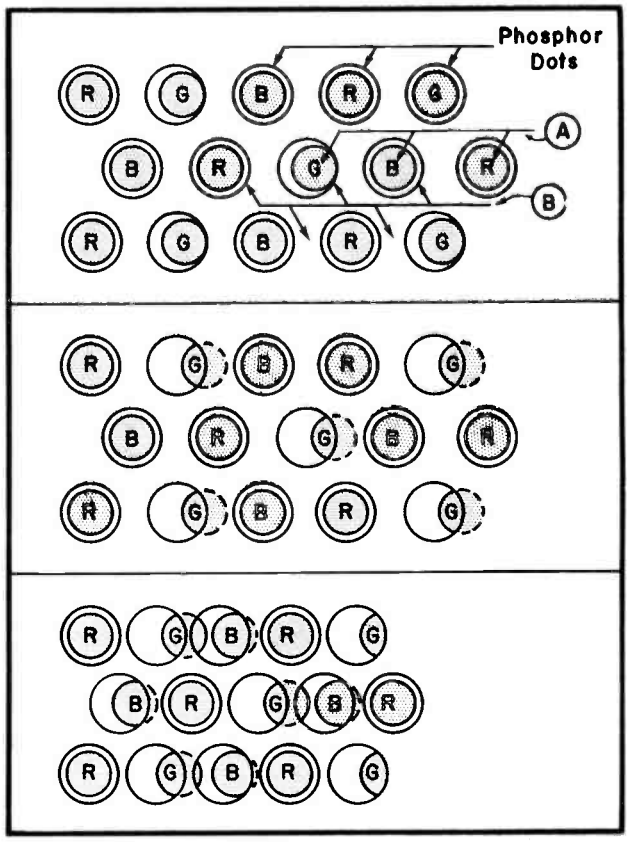
Assuming that there are no faults in the radio, the automatic tuner then should be checked.

There is one tube devoted to the automatic circuit only; the 12AU7. This tube is vital in two functions; stopping the tuner, and holding the re-

†*From* ***Motorola*** *service notes.*

‡‡*From* ***Delco Radio*** *Testing Tips.*

Troubleshooting Signal - Seeking Chrysler and G-M Auto Radios. . . . Servicing 19-Inch Color Tubes



Figs. 1 (top), **2** (center) **and 3** (bottom). **Three defects which can occur in a color picture tube:** off center **(Fig. 1);** clipping **(Fig. 2); and** misregistration **(Fig. 3).** A **in Fig. 1 illustrates portion of the phosphor dot energized by beam.** B **in this drawing shows the breezeway non-luminescent area between the phosphor-dot deposit.**

lay energized after one has release the station selector bar. This tube must keep the tuner moving until a station is received, rather than letting the tuner stop the instant one releases the station selector bar. So, the second thing to check is the 12AU7; but remember this tube is only responsible for *holding* while seeking and *stopping* on station. If the tuner does not start, it could not possibly be due to a bad 12AU7.

Servicing 19-Inch Color Tube

OCCASIONALLY in the Motorola color receivers one may encounter a 19VP22 tube in which excellent individual fields, blue, red, and green, may be obtained, but the white raster appears shaded. *Shading* refers to unwanted color tinting on a white raster and is analogous to the term impurity applied to a single color field. Shading, however, does not include any *color fringing* which may be due to misconvergence.

Such shading may be due to a poor picture tube or a poor yoke. Both the yoke and the picture tube can contribute to the condition together, although it is possible for either one to be at fault alone.

The picture tube defects which give rise to edge shading are those which produce effects described as *off center, clipping,* and *misregistration.*

Off center is illustrated in Fig. 1, where the green beam is *off center.* It represents a microscopic view of the illuminated phosphor dots at screen center.

The apertures of the shadow mask pass beams whose diameters are slightly smaller than the phosphor-dot diameters. In this example the neck purity magnet has been adjusted on a red field. The red phosphor dots have a beam strike which is *dead center.* In this case it happens that the blue beam also has a good beam strike.

The green beam, however, is not striking the phosphor dots dead center. But, because the beam diameter is smaller than the phosphor-dot diameter, all of the green beam passed by the apertures falls on the green dots.

This illustrates an *off center* condition for green at the center of the raster. Some defects which might cause this are:

a). The green deflection center built into the picture tube (location of the light source) was not correctly located relative to the red and blue deflection centers.

b). Inaccuracies in repositioning of the mask during one or more of the photographic operations.

c). Buckling, warping, distortion or movement of mask after picture tube was assembled.

d). A very poor field from the neck purity magnet.

Two-Color Off Center

It is also possible to find picture tubes which exhibit an *off center* condition for two colors.

It would, in the example of Fig. 1, be possible to *center* accurately the green beam by readjusting the neck purity device. Of course, then red and blue would be *off center.*

This might, in practice, turn out to be a better condition and means that, in this case, the neck purity device would be at an optimum setting if adjusted, while observing the green field rather than the red field.

An *off center* condition at screen center by itself would not be serious, except for the fact that at the edges of the screen it readily succumbs to the effects of other faults (mask error —yoke error, etc.), and deteriorates into more serious conditions described as *clipping* and misregistration.

Clipping is illustrated in Fig. 2. This is a microscopic view of a portion of the raster near the edge of the screen.

Here we see that the red and blue are correct, but that only a portion of the green beam passed by one aperture impinges on the green phosphor dot associated with that aperture. The remaining portion of the green beam falls on the non-luminescent area lying between the phosphor dot deposits. This non-luminescent area is called the *breezeway.* It will be noted that in this case the green beam does not strike a wrong color phosphor. At this particular portion of the screen, we would say green *clipping* is occurring.

Therefore, if an *off center* condition exists at screen center, then *clipping* can easily come about at screen edges due to such things as off-tolerance shadow mask; mask warpage due to poor structure, or overheating; shipment stress; etc.

If an actual set exhibited an *off center* condition at the center of the screen and *clipping* at screen edges as illustrated, we would find that:

a). The individual field purity would *appear* to be excellent. However, if a rigid inspection could be made, a decrease in green raster

(*Continued on page* 49)

SYLVANIA SILVER SCREEN 85

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Service Engineering — field and shop notes

by MAXWELL ALBERTS

IN REPAIRING the sound head of a home movie projector, the film transport system must be checked carefully.

The film transports consist of a series of toothed rollers, which engage the sprocket holes of the film, carrying it past the shutter-aperture, over the sound head, and on to the takeup reel. The film must be held under the proper tension at all times; if this is lost, trouble results. For instance, above and below the shutter and lens assembly, there should be a *loop* of five or six frames of film. These are necessary to allow for the intermittent motion of the film past the projection aperture. At the aperture itself, the film slides downward through a channel. It is held firmly in this channel by a *pressure-plate;* a part of the lens assembly. Here, two small teeth, mounted on a dual eccentric, come out of slots in the channel, engage the sprocket holes, draw the film down one frame, then retract into the channel, rise to the top, and repeat the process.

Actually this *dual eccentric* causes the teeth to *skip a frame* every other time. The film is really projected twice before being moved downward. Downward motion of the film takes place while the light is cut off by the revolving shutter. If these teeth become worn, they will snag the edges of the sprocket holes, tearing it badly. Close examination of these teeth with a magnifying glass will show up any wear. If the film shows evidence of snagging after being run, these teeth should be checked closely.

If the film skips, causing the loop to close up, both the teeth and the film itself should be examined. The film itself should be checked on the supply reel, *before* it has passed through the projector. If the sprocket holes are torn, it has been run through a defective machine sometime in the past, and trouble may be expected.

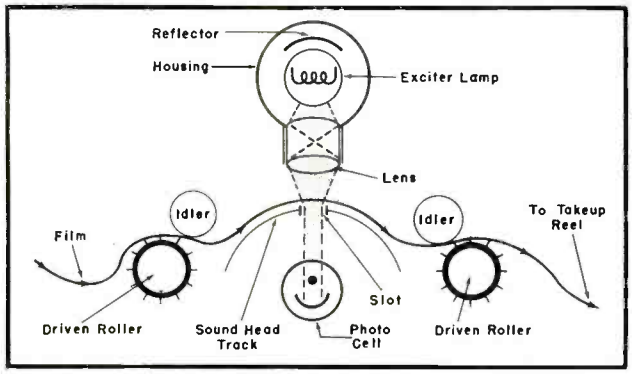
Some projectors make use of a small device known as a *fire-gate.* This is a tiny aluminum shutter, so arranged that it is *blown* up out of the way by a blast of air from the cooling fan, but falls in front on the lamp when the machinery is stopped. This item is perforated, with many small holes, to allow some light through, for projection of single frames, if necessary. The main purpose of this gate is to reduce the intensity of the light to avoid burning the film, which would occur immediately if the film stopped before the aperture.

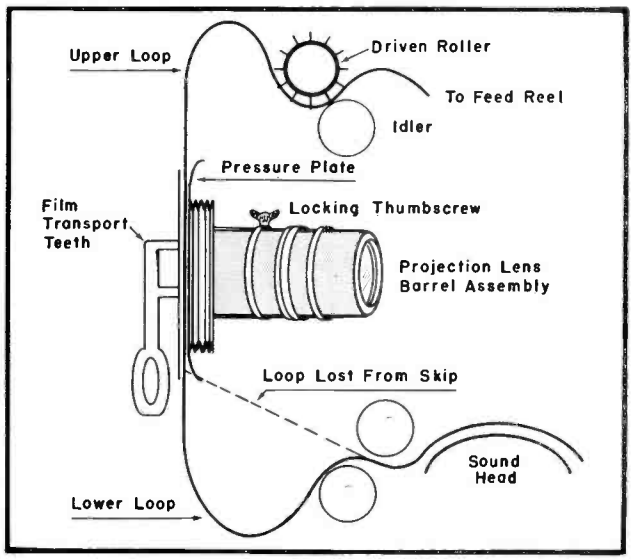
Projection lamps used in these units range from 500 to 750-watt sizes; most are filled with argon, an inert gas, instead of the usual vacuum. This may cause an unusual complaint; inability to remove a burnt-out lamp. On close examination, the glass of the bulb will be found to have swelled out into a large blister, immediately in front of the filament. This protrudes into the light opening toward the film aperture, and will not allow the dead lamp to be removed from the narrow tubular lamp house. Simplest procedure in this case is to loosen the lamp from the socket, then break the glass with a long screwdriver: Be sure to loosen it in the socket first, as the cramped quarters make removal of the base very difficult.

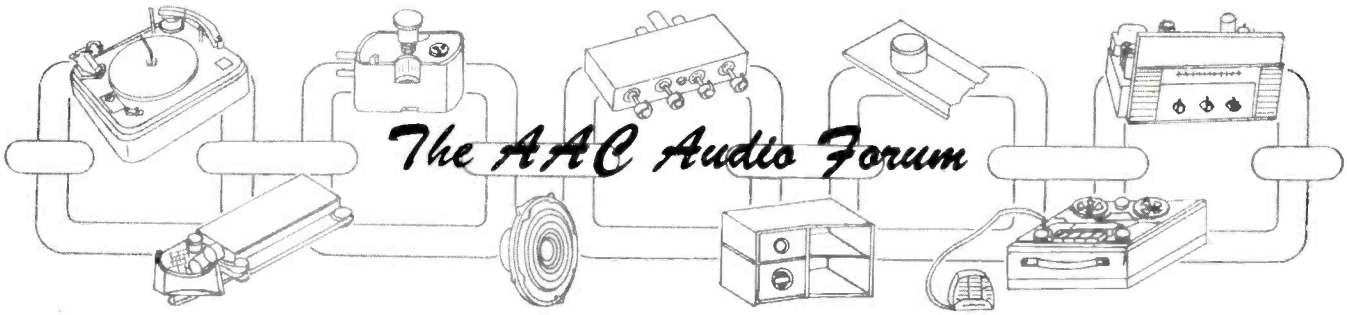
Focusing troubles originate in the projection-lens assembly, which is mounted on a hinged rack, just in front of the film aperture. Most of the difficulty is *operator-trouble,* caused by leaving the lock-screw loose, after focusing. The vibration of the machine while running can cause the lens barrel to shake out of focus. You should check the pressure plate, which holds the film into the channel, for tightness, being certain that the film is not pinched or bound. It must run freely.

Fig. 1 (below). **Sketch of typical sound head. Film at left is coming from projection apertures. It is held firmly down to metal track of sound head by a pair of rollers. Any slack here can cause a flutter in the sound. Beam of light appears in dashed lines.**

Fig. 2 (right). **Sketch of typical projection lens assembly and film path through projection aperture and sound head. Note dotted path of film after skipping caused by worn teeth or defective film.**







Part XI of a Series of System-Component Evaluation and Progress Reports

Ceramic Replacement Cartridges*

WITH THE ADVENT of slow-speed records, a number of new pickup design requirements have appeared.

The microgroove recording medium has amplified the need for minimum resonance in the tone arm, control of tracking error and pivot compliance in the vertical and horizontal plane, and random play in other planes.

The extended-play system has also accented the importance of stylus-suspension control to curb erosive forces at the stylus and prevent skating or groove skipping, and resultant distortion and record wear.

In a continuing effort to meet these specifications, new families of replacement pickups have been developed.

Recently it was found possible to produce low-effective-mass ceramic-type cartridges* with both *lp* and 78 needles in the same plane eliminating turnover of cartridge or needle. To provide such operation the designers have included a lever-operated shift mechanism which moves the needles in and out of play position.

Generally, these cartridges can be connected directly to an amplifier having a one-megohm input resistance. If more bass is desired the input resistance can be increased to as high as five megohms.

The low-frequency equalization circuit shown in Fig. 2 can be employed with the pickup.

The recommended needle point force for these cartridges is 7 to 10 grams, adjustable by a counterbalance spring at the rear of the pickup arm.

Two types of needle assemblies are available for the cartridge. One has two sapphire-tip needles, and the other a 1-mil diamond and a 3-mil sapphire needle.

To replace needles a thumb screw adjustment has been provided.

In installing this cartridge, the screws holding the old cartridge to the pickup arm must be removed. Pin jack connections should next be removed, or if soldered directly to the terminals, the leads should be cut and pin jacks furnished with the cartridge soldered to these leads. Leads should not be soldered, while the pin jacks are attached to the replacement cartridge. Extension leads are provided in case the old ones prove too short.

To provide the proper height for the cartridge, adaptor washers can be used.

**Shure 77C10 series.*

Practical Points On Loudspeaker Use**

THE LOUDSPEAKER is the last link in the sound system and therefore the system's most determining *bottleneck*. And because the loudspeaker is a mechanical device, it is the most capricious component in the chain.

The mechanical loudspeaker with all its simplicity is called on to perform amazing things. The diaphragm of a top-notch speaker must vibrate back and forth up to 22,000 times a second! And at the same time while doing this dizzy dance, it must also vibrate back and forth at frequencies of 50, 500, 1,000, 5,000 and 10,000 cycles, and at every frequency in-between.

Since the major burden is placed on the loudspeaker, this item should receive critical attention in its selection and application.

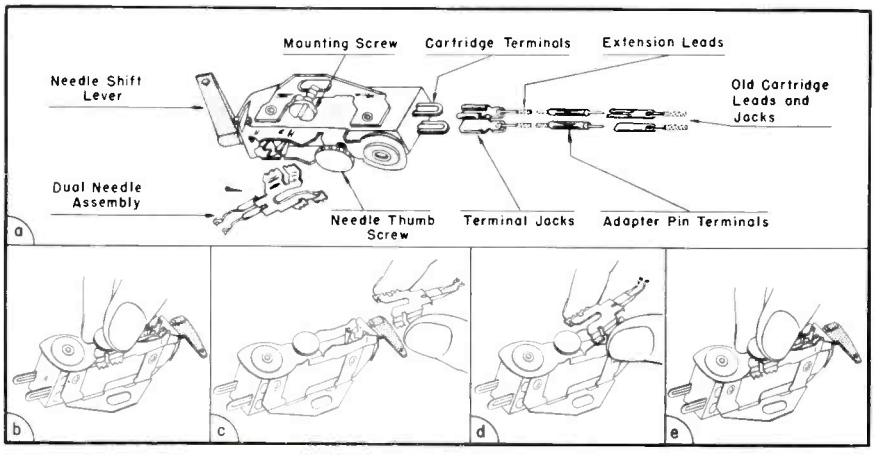
Frequency Response

A limited but *smooth* and *clean* frequency response of say 100 to 5 or 6,000 cycles is more important for pleasant and satisfactory listening than

(*Continued on page* 36)

From notes prepared by* ***H. S. Morris, Altec Lansing Corp.

Fig. 1 a, b, c, d, e. **A detailed view of the ceramic cartridge is shown in** a. **Drawings** b **to** e **illustrate four steps involved in removing and installing needle. To replace, thumb screw is loosened and the needle is grasped by its serrated edges, sliding the needle assembly forward to remove. Then the new needle is grasped by its serrated edges and the needle assembly is slid under the thumb screw as far as possible. The thumb screw is tightened securely. An index on the needle assembly and cartridge provide for proper positioning of the needle.**



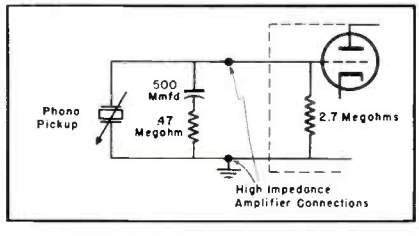
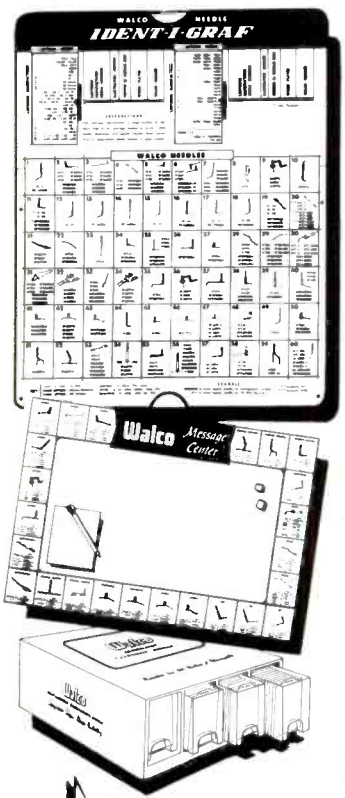


Fig. 2. Low-frequency equalization circuit for ceramic cartridge. The 2.7-megohm input resistance could be a volume control; in many high-impedance amplifiers such controls are employed.

From data supplied by the engineering department of* ***Shure Brothers, Inc.*

Walco STRIPS for Summer Action

Look What You Get When You Sell Walco Replacement Needles



WALCO IDENT-I-GRAF

The newest, most convenient method ever devised for *positive* needle identification. Quick, easy—completely eliminates guesswork. Enables you to identify needles by cartridge number or by phono manufacturer (without cartridge number or phono model). Throw out your charts and Rube Goldberg selectors – the Walco IDENT-I-GRAF – is the complete new answer to needle identification.

WALCO Magnetic Message Center

Magnetized message board, complete with magnets. Hangs on any wall. Best selling needles illustrated and identified around the border – saves you looking them up. You also get note pads, magnetic pencil. Handiest gadget yet!

WALCO Inventory Control Cabinet

Transparent plastic drawers in sturdy cabinet – stocked with the *fastest*-moving needle types! Fingertip index to what you *have*, what you've *sold*, what you *need*. A compact, permanent, self-controlling inventory!

and...up to $120. IN FREE NEEDLES!

During Walco's red hot summer promotion, you get up to $120. in free needles *in addition* to all the free merchandise listed! Now, more than ever, it'll pay you to get on the Walco bandwagon!

Why sell any other needle when Walco gives you *so much* to sell . . . so much to sell *with!* And remember, ***there is no such thing as a permanent needle.*** Every needle *must* be replaced – and replacement business can be *big business* for you. Write us *today* for complete details on how you can become a Walco dealer.

FOR A FULL SIZE PRINT OF MARILYN, THE CURRENT WALCO CUTIE, WRITE:

Walco **Trade Name of Electrovox Co., Inc.**
60 S-6 Franklin St., E. Orange, N. J.

Audio Forum

(*Continued from page* 34)

a wider frequency range that is full of distortion. If a speaker is of poor grade and has distortion, the wider its frequency range the more nasty it will sound.

Where speech only is to be reproduced over relatively short distances and small areas, a good grade of cone speaker, even as small as eight inches is often adequate. However, where a good quality of music with reasonable bass reproduction is required, a larger cone, up to 15" is necessary to push out a greater volume of air at the very low frequencies.

Where sound must be transmitted over an appreciable distance, say over 50', and it is desired to do a good job, a horn type speaker is imperative. And straight exponential or multicell types, have been found to be best; horns that are folded or doubled-back on themselves are usually handicapped because of internal reflections that occur when the sound is reflected back and forth within the folded surfaces.

When a wide frequency range speaker is required, it is well to restrict the speaker to a two-way system. Distortion and fuzziness is common at crossover frequencies where very fine network engineering is required. Therefore, 3 or 4-way speaker systems have more vulnerable crossover points than two-way systems.

Another very important consideration in good musical reproduction is the size of the cavity or cabinet in which the speaker (the low-frequency unit in a two-way system) is mounted. In general, the larger the cubical volume of the cabinet the lower the frequency it will reproduce; just as the large volume of a bass fiddle reproduces lower bass notes than the smaller cavity within the cello or the still smaller cavity of viola, etc. The same applies to drums. For good music reproduction the cavity should be at least 8 cubic feet. Anything less will reduce the ability of the speaker to reproduce good solid satisfying bass notes.

Another practical thing to remember about speaker cabinets is this; there is no point in placing a large speaker in a small cavity. If the cabinet is only one or two cubic feet, an 8" or 10" speaker will do just as good as a 15" speaker. This is because the smaller cabinet holds an insufficient cubical content of air to load the 15" speaker to make it operate appreciably more efficiently than an 8" speaker.

Another important consideration is that the efficiency of the loudspeaker selected can have a profound effect on the overall system cost. Efficiency variations of as much as 6 db or 400% exist between speakers currently offered on the market for commercial sound use. To illustrate, let us consider speaker *A* which is only 3 db more efficient than speaker *B*. An amplifier of given power capacity can drive twice as many *A* type speakers and thus cover twice the area with the same acoustic output than if speaker *B* was used.

In the extreme situation of a 6-db difference in efficiency, the amplifier could drive enough *A* type speakers to cover four times the area that it could if *B* type was used. This means that a smaller and less costly amplifier can be used with speaker *A* than with speaker *B*.

Variable Reluctance Pickup Stylus-Design Change***

A SLIDE-IN needle-installation technique, permitting changing of individual tips, without removal of the entire as-

(*Continued on page* 48)

****From information prepared by special products division,* ***General Electric.***

Assortment of phono and recorder drives included in a counter unit. Available too is a kit which includes 23 different drives, which it is claimed will serve to replace drives for 85% of changers now on the market. Some of the drives use neoprene rubber to negate losses due to hardening or cracking. (Walsco Electronics Corp., 3225 Exposition Place, Los Angeles 18, Calif.)

Five-watt cobra-jector speaker said to provide wide angle of dispersion in areas of high noise level, adverse wind conditions, etc. Main flare has fiberglass construction. Can be used for paging, talkback, intercomm, industrial, marine and mobile applications. (Model CJ-14. Atlas Sound Corp., 145 39 St., Brooklyn 18, N. Y.)

Dynamic microphone which is 1¾" across the top. Housing is die-cast alloy. Said to offer omni-directional pattern. Has a standard 5/8"-27 thread; adaptable for floor stand, desk stand or hand use. Available in high or low-impedance models, with or without an off-on switch adapter. (Dynamike, models M-350 and 352; The Astatic Corp., Conneaut, O.)

AUDIO Maintenance and

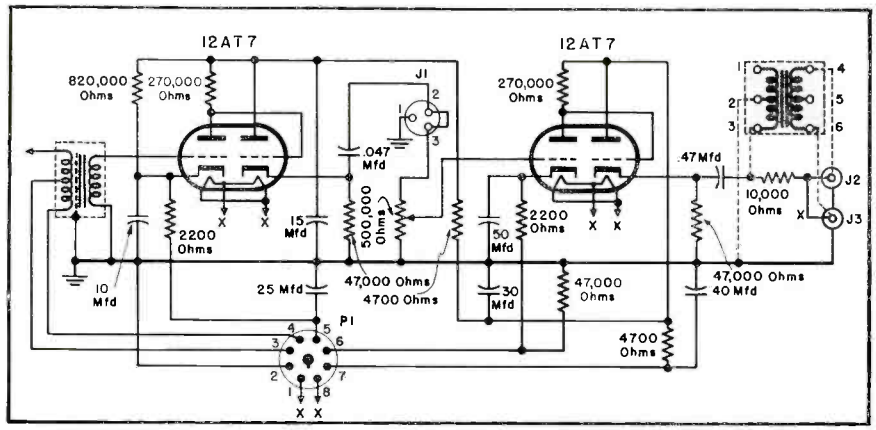


Fig. 1. Schematic of Stromberg-Carlson AV-52 preamp with a pair of twin triodes that serve as voltage amplifiers and cathode followers.

IN THE AUDIO SYSTEM, preamps play an important role. They serve to boost output from cartridges, such as the magnetic type, and they are also used to step up output so that a number of line and power amplifiers can be employed.

For line-power work, the preamps normally employ a pair of 12AT7 twin triodes. In these models, as the Stromberg-Carlson AV-52, one half of the input tube is used as a voltage amplifier and the other half as a cathode follower. The output tube sections perform similarly, except that the operation is reversed; input of tube serves as cathode follower and output as voltage amplifier.

In critical applications where hum and noise caused by mechanical vibration must be kept to an absolute minimum, a 12AY7 can be substituted without other changes for the 12AT7 input tube.

For tone-control purposes two 5-megohm variable-resistors connected in a fixed-capacitor network are used; they have been designed, as illustrated in Fig. 2, to work between a cathode follower and the grid circuit. This assembly has an insertion loss of 12 db.

When line amplifiers are more than 50′ from preamps, the use of shielded microphone cable becomes impractical from an economic as well as an electrical standpoint, if high-frequency loss is to be kept at a minimum. By using 600-ohm output transformers at the preamps, it becomes possible to operate the line between the preamps and the line amplifier at 600 ohms and no frequency discrimination will occur in the line up to several thousand feet. Length limitation on a 600-ohm line is primarily electric noise pickup due to low audio level. A twisted pair is less susceptible to noise pickup. In case there is a large amount of electrical leakage in the vicinity of the line, it may be necessary to shield the line by enclosing it in conduit or by using shielded twisted pair. This line can be run in a conduit carrying shielded microphone cables and unshielded remote volume control wiring, but must never be run in conduit carrying other circuits. A 600-ohm, ½-watt resistor is required across the output of the transformer (or input of the line amplifier) when used with a high-impedance input amplifier.

Loss Pad for Preamp

In systems using these preamps, models not equipped with tone controls will usually require a lower volume control setting to offset the 12-db insertion loss of the tone controls. If this difference in control setting is objectionable, the control settings can be brought closer together by adding a loss pad. The jumper between terminals *2* and *3* of the tone-control receptacle should be removed. A 47,000-ohm, ½-watt resistor should be soldered between terminals *2* and *3*, and a 10,000 ohm, ½-watt resistor between *1* and *3*.

Installations

In selecting a location for preamps, one must avoid proximity to power transformers, chokes or motors which might induce noise in the equipment. The power supply transformer should be kept 8″ to 10″ away when possible. Hum caused by pickup in the input transformers can be reduced by loosening the clamping ring and rotating each transformer to the position of minimum hum. However, you should not rotate an input transformer more than 180° in either direction from its original position or the leads may be damaged.

Speaker-Line Wire Size

When an uneven distribution of audio output power to a number of loudspeakers is desired, line-matching transformers are generally required.

When the audio output power is to be delivered to a single loudspeaker or is to be divided equally among a few speakers and the length of line is not excessive, it is not always necessary to use line-matching transformers. Generally, it is more economical to run speaker lines at voice-coil impedances, unless the total resistance of the speaker line results in a loss in excess of the usual 1-db insertion loss for a *good* quality line transformer. The maximum recommended length of line in feet that can be used, for several wire sizes, at the various output impedances, is shown in table 1. These data, based on a 1-db loss, can be converted to 2-db loss by multiplying the length of the line by two.

When two or more separate speaker lines are brought to the amplifier, the minimum wire size is chosen for each line separately, using the impedance that terminates that line.

Voltage Method of Output Matching

Using line-matching transformers rated in power and voltage it is only necessary to connect the chosen wattage tap on the transformer to the correct voltage tap on the amplifier. Amplifiers will operate correctly, provided the sum of the power drawn by all speakers does not exceed the power output rating of the amplifier. The total power available can be divided equally or unequally among the speakers as desired. Speakers can be switched on or off without the necessity of providing dummy output loads, and as speakers are connected or disconnected, there will be no increase in distortion or apparent change in volume level.

Often transformers are marked in impedance only. They can be converted to a wattage rating by using the formula $W = E^2/R$, where W = watts, E = output line voltage and

Service Tips

by FRED R. SAILES

Obtaining Maximum Efficiency From Stromberg-Carlson Preamps Designed for Line Applications . . . Determining Speaker Line Wire Sizes . . . RCA Record Changer Cycle-Stall Remedies . . . Troubleshooting Motorola Phonos

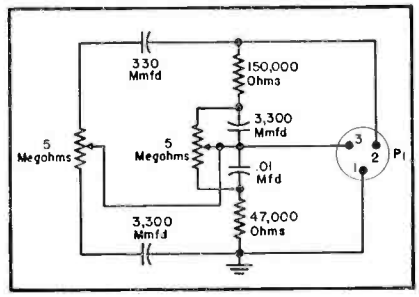


Fig. 2. Tone control developed for use with Fig. 1 preamp; Stromberg-Carlson AK-11.

R = transformer impedance. For example: Using a 25-volt line, $E^2 = 625$ and a transformer with a 625-ohm primary will draw one watt from the amplifier. Using a 70-volt line (actually 70.7 v) $E^2 = 5{,}000$ and a line transformer with a 625-ohm primary will draw 8 watts from the amplifier; 5,000 divided by 625 equals 8.

Impedance Method of Output Matching

When matching speakers by the impedance method, the following method is used. To determine the power into any speaker, the impedance of the amplifier output tap is divided by the impedance of the speaker to be used; or tap on the speaker line-matching transformer. This is the fraction of the total power output of the amplifier delivered to the speaker. For example, if a speaker with a 2,500 ohm line-transformer is connected across the 500-ohm output of an amplifier, that speaker will draw one-fifth of the power delivered by the amplifier. If the amplifier is rated at 25 watts the speaker will draw one-fifth of this value or 5 watts. Thus, by proper selection of loudspeaker (or transformer) impedance, different amounts of power can be delivered to a number of speakers, all connected in parallel to the same amplifier. This rule applies equally well whether the loudspeakers are all connected to the same amplifier output tap, or if connected to several different impedance taps. The sum of all these fractions of total amplifier output power should be equal to one for the best matching. If the impedances of available taps do not permit perfect matching the sum should be less than one.

Cycle-Stall Remedies

Hesitation or tendency to go through mid-cycle with effort in the RCA 930409/930800 series automatic record changers has been found to be due to one or two conditions. The first of these is oil or grease on the rubber tires of the driving mechanism and on the inside of the turntable. These parts should be thoroughly cleaned with carbon tet.

The second problem could appear because the lift arm is jamming in the slot of the cycling slide. In going through the cycle the lift arm is actuated by the cycling slide and in turn actuates the center shaft of the spindle or center post. In some instances the center shaft of the spindle may reach its maximum travel. This results in a jam of the lift arm in the slot of the cycling slide. This can be remedied by bending the lift arm or installing a shim under the end of the lift arm mounting bracket. (Insufficient movement of the center shaft will result in failure to drop records; especially when using the 45 rpm center post.)

Troubleshooting Motorola Record Changers†

The symptom-cause-remedy system has been found very effective in troubleshooting phono changers.

For example, if we have a record changer that fails to cycle when the control knob is turned to the reject position, any one of seven defects might be the cause: Binding of switch assembly, binding of reject shaft, binding of reject lever, stripped reject knob, oil on cam wheel, binding of cam latch or weak or missing reject lever spring.

To correct, first the switch assembly should be examined to see that it operates freely. If it is found to be binding all foreign matter should be cleaned out and the mechanical parts of the switch relubricated, if necessary.

If binding in the reject shaft obtains, the hole in the speed control link assembly should be reamed out until the reject shaft operates freely.

If the reject lever binds, the lever should be cleaned thoroughly with carbon tet or other suitable solvents. A bent lever might also cause trouble; this should be straightened or if the lever is in bad condition, the main slide assembly should be replaced.

A stripped reject knob gives the Service Man little choice. He must repair it, or if this is too time consuming, replace it with a new one.

Oil on the cam wheel requires the removal of the cam assembly. Both this and the turntable hub should be cleaned with naphtha or alcohol.

Next, the cam latch has to be checked. If it is binding it must be cleaned. In many cases the latch will also be bent and must be straightened.

The last step in this servicing routine for cycle-failure is to check for either a weak or missing reject

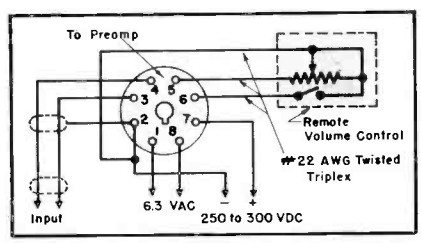
(*Continued on page* 40)

†Model C4RC.

Table 1: Speaker-line loss chart; speaker line distance in feet.

Wire Gauge	Line Impedance in Ohms							
	4	8	16	45	78	156	312	625
22	20	40	80	220	400	800	1600	3200
20	30	65	130	350	500	1000	2000	4000
19	40	80	160	425	650	1300	2600	5200
18	50	100	200	550	800	1600	3200	6400
16	80	160	320	900	1200	2400	4800	....

Fig. 3. Circuit of remote control that can be used with Stromberg-Carlson preamp; model AK-12.



Audio Maintenance

(*Continued from page 39*)

spring. Sometimes a weakened spring may be repairable; otherwise replacement is necessary.

Slow Turntable Speed

In similar fashion we may probe the problems involved if the turntable speed is too slow.

In checking for slow turntable speed one should look for binding turntable bearings, low line voltage, low operating temperature, oil or flocking on inside rim of turntable, or improper seating of the motor grommet, or it may be missing.

After examining the turntable bearings the line voltage should be measured; the changer requires at least 105 v for proper operation. If the mechanism has been stored in a cold place or operated in surroundings at a temperature of less than 60°F slow turntable speed may result.

If there is oil or flocking on the inside rim of the turntable, this must be removed; the idler wheel rubber tire and the oilite bearing in the turntable hub should be cleaned with naphtha or alcohol. The bearing must be relubricated with light mineral oil before it is replaced.

The last step in checking for slow turntable speed is examination of the motor grommet; if not properly seated it must be reset.

The turntable that either stalls or slows down during the cycle represents another problem often encountered in record-changer servicing. Here, there are nine possible causes: Motor idler not fully engaged or covered with grease, binding in the main slide assembly, binding of the tone arm lift pin, oil on the cam wheel, spindle ejector lever adjusted too far, weak motor, turrets unseated from lock ring on turret shaft, motor plate or idler slide bent and weak idler wheel tension spring.

If the turntable fails to turn and the drive spindle is operating properly, the motor-idler assembly must be inspected to determine if it is free to contact the drive spindle and turntable rim. Dirt should be removed from the inside of the rim and rubber tire of the idler wheel, using naphtha or alcohol.

Bent main slide assemblies will either have to be straightened or replaced.

Binding in the tone arm lift pin calls for a cleaning of the hole in the actuating lever assembly; the pin should fall in freely. A set screw that's too tight will collapse the lever assembly and cause the lift pin to bind. A bent lift pin must be replaced.

In case the spindle-ejector lever has been adjusted too far, the spindle-locking nut should be released and the spindle adjustment screw turned until it no longer turns freely and is firmly seated against the push-off shaft of the spindle. It should then be turned approximately 1/6 of a turn more and locked in position with a spindle adjustment locking nut.

A weak motor must of course be replaced. If the turrets are unseated from the lock ring on the turret shaft, they must be pushed back down over the lock ring or the speed turret pulley replaced. A weak idler wheel tension spring must also be replaced.

A common complaint among record changer owners is noise during the playing of the record. One prominent cause of this headache is motor rumble; usually a low-pitched sound coming from the speaker, while the record is being played. One should check the motor grommets to make sure the motor is freely suspended on them. The motor lead wire should have enough slack to allow the motor to float free. An unbalanced motor rotor may also be at fault.

Defective turntable bearings will

also cause the changer to be noisy. Foreign matter in these bearings, defective balls (flat spot or pit marks), uneven and dirty washers and binding between balls and ball retainer may be causing trouble here. The bearings should be cleaned with solvent and lubricated with light oil.

A rapid thumping sound while the motor is running may indicate a flat spot on the motor idler wheel or speed turret pulleys. The Service Man should let the motor run for 15 minutes. If the thumping continues, the turntable should be removed and the rubber on the idler wheel and speed turret pulleys checked. If the rubber tire surfaces are not smooth new tires are in order. Should the bearing be worn or extremely wobbly, replacement of the idler wheel is necessary.

Perhaps a much more frequent cause of noise, than the record changer itself, is a worn or defective record, causing needle scratch and sound distortion. Warped records may slip on other records causing wow, a wavering sound being reproduced. An enlarged center hole can cause the same condition.

Annoying scraping of the turntable is also not infrequent. A wobbly turntable is one source of this noise. In this case the table itself must be repaired or replaced. The motor idler or a bent motor mounting plate are also in the running as the source of trouble as well as improperly-seated motor speed turret pulleys.

Distortion of the reproduced sound or extremely low volume should lead the Service Man to a suspect cartridge, a defective amplifier, or again a defective record.

No sound at all calls for inspection of the cartridge, a check for defective wiring, a faulty amplifier or loose cartridge terminals.

Cartridge replacement kit with 12 cartridges said to be most in demand. Included with kit are a jeweler's screwdriver and an eight-page master cross-index replacement chart, which lists cartridges together with current replacement. (Twelv-Pak; The Astatic Corp., Conneaut, O.)

Audio Instrument Readings

(*Continued from page* 20)

in proportion; for example, if the line voltage is 5% low, all the secondary voltages on the transformer should likewise be 5% low. But voltages in which the action of tubes has an effect, such as the plate voltage of a tube, connected to B+ through the plate coupling resistor, may vary by a percentage more or less than the supply voltage variation, according to the effect that the change in operating voltages has on the tube characteristics. This means that in measuring the performance of equipment we should be more critical of high-voltage secondary windings and B+ voltages, than of plate and bias voltages and the like, on which we might allow a little more tolerance.

Quite apart from considerations of measurement accuracy, more tolerance is permissible on tubes that handle low audio levels, than on tubes where correct operating conditions are necessary to obtain the full signal voltage swing. Thus it is important that output tubes should operate with the bias very close to its correct nominal value, while the bias on input stages may vary by 20 or 30% from the nominal value without making noticeable difference to the performance of the equipment. Filament voltages can also deviate by a fair percentage. Tubes rated at a nominal voltage of say 6.3, will operate successfully down to about 5.5 volts on the filaments and are not likely to be burnt out unless 7 volts is exceeded. Beyond these limits there is the risk, at the low end, that the tubes will fail to perform according to their specified characteristics, although they may still emit to some extent, while at the upper end, there is a risk of overheating the filaments and causing a burnout. However, these data reveal that it is not necessary to be critical if the voltages deviate a little from the nominal value of 6.3.

Most modern instruments are provided with at least one db scale for audio measurements. But one should not trust the instrument too far, and make readings to a greater attempted accuracy than the instrument is capable of giving. Most instrument manufacturers try to discourage you from doing this, by putting the db scale near the center of the quadrant, where the scale length is limited. One should be cautious in interpreting these readings, and allow at least 1-db possible error near the limits of the audio spectrum, particularly the high end. To make readings accurate to within .1 db, which is sometimes required, more advanced techniques are necessary. A review of these techniques will appear soon in SERVICE.

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Ser-Cuits

(*Continued from page* 24)

age at that impedance will be 70.7. Loudspeaker lines meeting this requirement need not be in conduit.

The output of the power amplifier goes to an impedance-selector switch and on to two identical multi-contact jacks and normaled through them to the speaker. The circuitry here is of some importance. When a *pm* loudspeaker is to be tested, it is plugged in to a jack marked *speaker test,* and a switch is rotated to the proper amplifier impedance. Upon the insertion of the phone plug here, the output of the amplifier goes directly to the loudspeaker to be tested; and simultaneously the *vu*-meter high-level measuring circuit is connected across the speaker line. At the same time, an *amplifier-test* jack and the amplifier testing speaker are put out of the circuit.

To check an external amplifier, its output is plugged into the *amplifier test* jack which automatically feeds it to the tester's speaker and simultaneously puts a resistive load across the unit's amplifier, to take the place of the speaker. The *vu* meter will be connected across the output of the amplifier being checked. Also, the circuit is so designed that it permits the checking of an external loudspeaker and an external amplifier simultaneously without interference with each other.

The wattage rating of the resistive load should equal that of the tester's amplifier. However, its resistance is not the same as that of the loudspeaker for which it substitutes; nor is its resistance equal to the *dc* resistance of the loudspeaker. In practice, it is somewhere between the two. An easy way to determine this is to feed a 400 or 1000-cycle signal into the tester's amplifier with the speaker as the load. Then an *ac* voltmeter (or *vu* meter) should be placed across the output terminals. The speaker should now be switched to a variable high-wattage resistor and the resistance adjusted until the voltage reading (with the resistor in the circuit) is the same as that when the speaker is the load.

The preamp must have wide, flat response, and may be either a pentode a twin-triode unit, but should have a gain of at least 35 db.

Battery Receivers

(*Continued from page* 19)

solder will cause spreading of the socket connections, and future intermittent troubles. Wires should be well anchored in the pins. You should strip and tin the wires for at least an inch, pull through the pins until the insulation is deep in the holes, solder, and then clip off excess wire. Wires should never be dipped into solder paste before inserting into the pins; this will cause solder to bubble and result in a defective joint. Wires should be tinned; paste should be applied to the outside only.

One final word of caution. *Always* test all tubes *before* the set is ever connected to a bench power supply; this will eliminate the possibility of that accusation: "*You* blew 'em out; it was all right when I left home!" Battery set servicing can be a lucrative business, if the proper precautions are taken.

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TV Antennas

(*Continued from page* 26)

chanical problem when they were installed at Muscle Shoals, Alabama, and Tupelo, Mississippi. It was necessary to erect these structures in such a way that they would be orientable within small limits. The problem was met by making the structures self-rigid, requiring no other support than their own structures to maintain their dimensions, and then slinging them in a type of cradle which allowed a universal movement.

The problem of design was aggravated by the fact that no internal braces could be used. Another point of note is the wind loading these antennas must withstand. For example, the horn at Tupelo will develop a load of about 23,000 pounds; 11½ tons at a 100 *mph* wind velocity. It is fortunate that 100 *mph* winds are almost never found with icing conditions, which could easily double the weight of the antenna by closing the apertures of the screen, and more than double the wind resistance.

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Resistors

(*Continued from page* 17)

same value so they will divide the load equally. In high-frequency circuits, resistors should not be paralleled.

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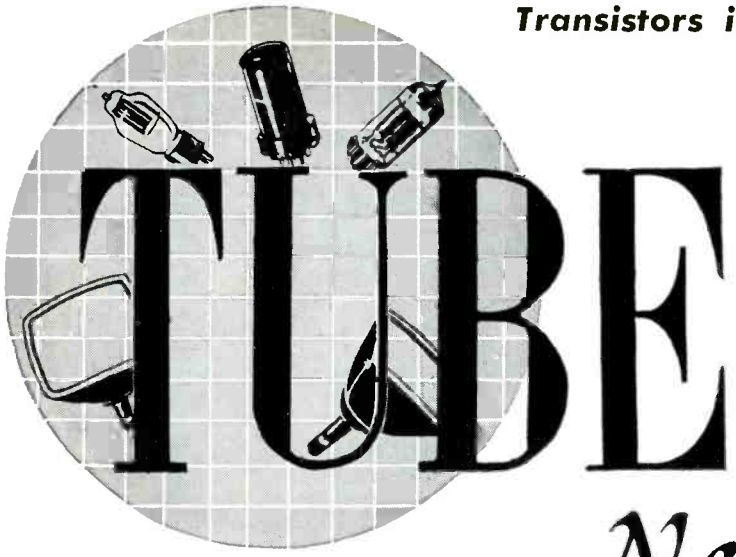
Correction

THE LOW CUTOFF section of the phono filter response curve, on page 69 of the May issue of SERVICE, should have been noted as a frequency cutoff.



Transistors in Amplifiers: Preamps . . .

. . . Dynamic Microphone Units*

News

by A. M. KELWOOD

AS AN AMPLIFYING device, the transistor offers many features. It is nonmicrophonic, mechanically rugged, can be operated in any position and makes extremely efficient use of its *dc* power supply. Transistors can oscillate with only a few microwatts of *dc* input power.

At present two types of transistors are being made; point contact and junction type. Each has particular special areas of application, although either type can be used in many applications.

Junction Transistor Action

The *n-p* and *p-n* junctions, when processed into germanium, form equivalent crystal diodes. When a *dc* voltage is applied to either junction in such a way that the *n* region is made negative and the *p* region positive, a high forward current flows. Conversely, when the *n* region is positive and the *p* region negative, a low reverse current flows. Thus, the junction exhibits the properties of high forward current, low reverse current, and rectification which characterize the crystal diode.

In a transistor, the emitter electrode is so called because this electrode, when *dc*-biased for forward current flow, effectively injects or emits current carriers (electrons or holes) into the center base region of the germanium wafer. The collector receives its name from the fact that this electrode, when *dc*-biased for reverse current flow, apparently collects these carriers, which then increase the reverse current. In the *npn* transistor, the injected carriers are electrons from the *n*-type emitter layer; in the *pnp* type, they are holes from the *p*-type emitter layer.

In the *pnp* transistor, the emitter injects positive holes. These carriers travel through the base region where a few are neutralized by the electrons in the *n*-type germanium found there. But the base is very thin, so most of the holes survive to reach the collector junction where they are attracted by the strong negative field due to the high-collector voltage. They succeed in increasing the collector current from a low cutoff or leakage current value to a higher level. If all of the holes injected by the emitter managed to reach the collector, the final collector current would equal the emitter current and the transistor would be considered to have an emitter-collector current gain (α, alpha) of *1*. However, some holes do recombine with electrons in the base region and thus can contribute nothing to the increase in collector current. In practice, therefore, for a junction transistor, alpha approaches unity, but usually does not reach this value. Practical values range from .80 to .999 in commercial junction transistors. Alpha is comparable to the amplification, *mu*, of a vacuum tube.

The *npn* junction transistor operates in the same manner, except that the injected carriers are electrons which pass through a *p*-type (hole-rich) base region toward a *positively*-charged collector.

Although the foregoing explanation shows the transistor essentially to be a current-operated device, the transistor can display voltage and power amplification as well. Signal-voltage fluctuations cause corresponding fluctuations in emitter current, and in turn in collector current. Although the current gain is slightly less than *1* in this case, the collector resistance circuit level, as previously explained, is higher than the emitter circuit resistance level, and the output-signal voltage is therefore larger than the input-signal voltage. Power amplification also results because of this resistance ratio. The magnitude of voltage power and amplification depends upon various other parameters which must be taken into consideration in accurate calculations. These parameters include load resistance and generator resistance.

The circuit of a 1-stage, common emitter, *rc*-coupled audio-frequency preamp is illustrated in Fig. 1. This amplifier can be built small enough for inclusion, complete with battery, in the handle or case of a dynamic microphone, giving the latter an *af* output voltage comparable to that of a carbon microphone.

Fig. 1. Transistorized preamp designed to operate into a high-impedance load such as the grid-input circuit of a speech amplifier or an ac vtvm.

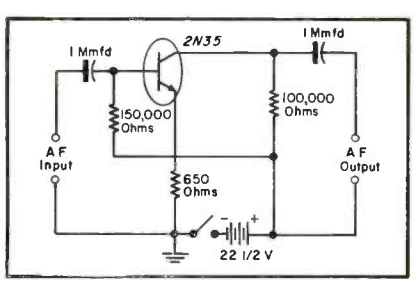


Fig. 2. Single-stage preamp with emitter degeneration.

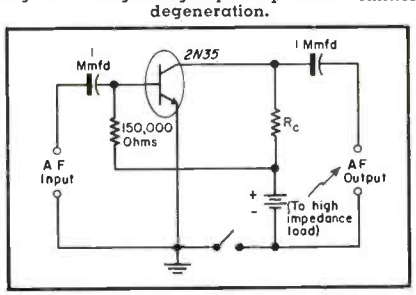
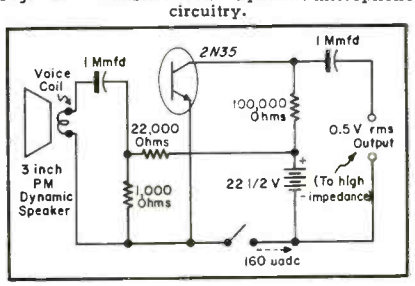


Fig. 3. Transistorized dynamic-microphone circuitry.



*Based on data in **Sylvania** manual on **28 Uses for Junction Transistors.***

Black and White TV • Color TV • Transistor Radios • AM Radios

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7. Transformer winding resistances appear on the schematic.

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TUBE PLACEMENT CHARTS

14. Top and bottom views are shown. Top view is positioned as chassis would be viewed from back of cabinet.

15. Blank pin or locating key on each tube is shown on placement chart.

16. Tube charts include fuse location for quick service reference.

TUBE FAILURE CHECK CHARTS

17. Shows common trouble symptoms and indicates tubes generally responsible for such troubles.

18. Series filament strings are schematically presented for quick reference.

COMPLETE PARTS LISTS

19. A complete and detailed parts list is given for each receiver.

20. Proper replacement parts are listed, together with installation notes where required.

21. All parts are keyed to the photos and schematics for quick reference.

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22. Each Folder includes time-saving tips for servicing in the customer's home.

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24. Tips on safety glass removal and cleaning.

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27. Includes hints and advice for each specific chassis.

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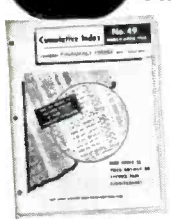

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Rep Talk

GEORGE S. SCARBOROUGH received recently the first annual *representative of the year* award from the Keystone chapter of NEDA. . . . Clarostat presented testimonial plaques to its three top sales reps for '54 recently: *James Millar Associates,* Atlanta, Ga.; *Myers-Young-Foristal, Inc.,* St. Louis and Kansas City, Mo.; and *Henry P. Segal Co., Inc.,* Boston, Mass. . . . *John A. Benz Sales Co.,* 4809 W. Fond DuLack Ave., Milwaukee, Wisc. (Indiana and Kentucky); *Charles M. Furman, Jr.,* 1228 Harding Pl., Charlotte, N. C. (N. and S. Carolina, and Georgia); *Sam Sarrat,* 231 Cedar St., Jackson, Tenn. (Tennessee, Alabama, Mississippi and Arkansas); and *Frank Lebell Co.,* 195 2nd Ave., San Francisco, Cal. (northern California, and northern Nevada) have been appointed reps by Vidaire Electronics Manufacturing Corp. . . . *Joseph Murphy* will rep Cambridge Thermionics Corp. in Indiana and Kentucky. . . . *Heimann Co.,* 1711 Hawthorne Ave., Minneapolis 5, Minn. (Minnesota, N. and S. Dakota and northern Wisconsin); and *Gordon Sales Co.,* 14647 Seymour Ave., Detroit 5, Mich. (Michigan) have been named reps for American Microphone Co. . . . Radio City Products Co. has appointed Jules J. Bressler as rep for metropolitan New York. . . . *Delzell-Maynard Sales Co.,* Dallas, Tex. (Texas, Oklahoma, Arkansas and Louisiana); and *John B. Pepper Associates,* Atlanta, Ga. (southeastern area) will rep for Rogers Electronic Corp. . . . *Ray Ripley,* 6633 4th Ave S., Minneapolis, 23, Minn., has been appointed rep for Clear Beam Antenna Corp. in N. and S. Dakota, Minnesota and western Wisconsin. . . . *J. K. Dooley Co.,* 3606 Magnolia Blvd., Seattle, Wash. (Washington, Oregon and Alaska); and *A. R. Thibau Co.,* 402 Manufacturers' Exchange Bldg., Kansas City, Mo. (Kansas, Missouri, Nebraska and western Iowa) have been named reps by Permoflux Corp. . . . *E. A. Walter,* 3500 Enslow Ave., Richmond, Va., will rep in Virginia, Alabama, Georgia, N. and S. Carolina and Tennessee for Granco Products Inc. . . . The Phaostron Co., 151 Pasadena Ave., S. Pasadena, Cal., has appointed *L. A. Nott and Co.,* San Francisco, Cal.; *Frank C. Nickerson Co.,* Atlanta, Ga.; *G. McL. Cole Co.,* Chicago, Ill.; *Tant Enterprises,* Detroit, Mich.; *Quinn Cunningham and Associates,* Indianapolis, Ind.; *R. W. Farris Co.,* Kansas City, Mo.; and *Henry Lavin and Associates,* New England as reps. . . . *E. W. McGrade Co.,* 213 W. 75th St., Kansas City, Mo., has been named to rep International Rectifier Corp. in Kansas, Missouri and southern Illinois. . . . Seco Manufacturing Co. has appointed *Midwest Sales Co.,* Cleveland, Ohio, to rep in Ohio, western Pennsylvania, W. Virginia, Indiana and Kentucky. . . . *Park and Goodman,* 401 W. Mt. Airy Ave., Philadelphia, Pa., have been named reps for Blonder-Tongue Laboratories in Virginia. . . . Pyramid Electric Co., has appointed *Frank Wedel Co.,* 3215 Western Ave., Seattle 1, Washington, as reps in Oregon, Washington, Northern Idaho, Western Montana, Alaska, and British Columbia. *William Kelly,* 303 Belle Air, Burlington, Iowa, will cover Iowa and Nebraska.

PERSONNEL

GRAMER YARBROUGH has been named sales manager of the American Microphone Co., 370 S. Fair Oaks Ave., Pasadena 1, Cal.

Gramer Yarbrough

Everett W. Olson

EVERETT W. OLSON has been appointed director of public relations and advertising of Webster-Chicago Corp., 5610 W. Bloomingdale Ave., Chicago 39, Ill.

* * *

HAROLD J. SCHULMAN has been named assistant to the president, in charge of coordinating company plans and activities, at CBS-Columbia . . . DANIEL NEWMAN is now director of product service.

Harold J. Schulman

Daniel Newman

* * *

DAVID H. COGAN has been elected chairman of the board of Victoreen Instrument Co.

D. H. Cogan

R. P. Axten

RICHARD P. AXTEN, has joined Raytheon as director of public relations.

* * *

CHARLES GOLENPAUL, vice president, in charge of distributor sales for Aerovox Corp., has been elected chairman of the Sales Managers Club, eastern division. Golenpaul organized the Sales Managers Club in '35, and served for two terms, 1935-7, as chairman.

* * *

G. WARREN KIMBALL has been named manager of battery and renewal components marketing, RCA Tube Division. Kimball will direct market planning and controls for RCA batteries and renewal components, which includes deflection components for television receivers, moulded products, loudspeakers and selenium rectifiers.

* * *

EDWARD F. SHAVER has joined the Jensen Manufacturing Co., 6601 S. Laramie Ave., Chicago 38, Ill., as sales promotion manager.

LOYD DOPKINS has been appointed vice president in charge of sales at Granco Products, Inc., 36-07 20th Ave., Long Island City 1, N. Y. . . . ALBERT BENJAMINSON is now chief engineer.

* * *

G. E. JONES has been promoted to vice president and manager of the Proto Tools division of the Plomb Tool Co., Jamestown, N. Y.

* * *

WILLIAM SEVY has been appointed national field sales supervisor of Crescent Industries, Inc., Chicago 31, Ill.

* * *

JACK SCHWEIGHAUSER has been named assistant to the sales manager of Snyder Manufacturing Co., Philadelphia 40, Pa.

MIRYAM SIMPSON, president; MARK SIMPSON, vice president and secretary; BERNARD ZISMAN, vice president and treasurer; GEORGE WATSON, vice president, distributor sales division; PHILIP S. OPTNER, vice president, manufacturing division; and RALPH AASEN, vice president, engineering, are the new officers of the Mark Simpson Manufacturing Co., Inc.

* * *

LEONARD V. CRAMER, formerly vice president of Avco Manufacturing Co. and general manager of the Crosley division, has been appointed vice president and general manager of the TV radio-phonograph division of The Magnavox Co., Fort Wayne 4, Ind.

Coming Events

Sixth Annual Convention, NATESA

August 19 to 21

Morrison Hotel, Chicago, Ill.

Annual Audio Fair

October 12 to 15

Hotel New Yorker, N. Y.

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Audio Forum

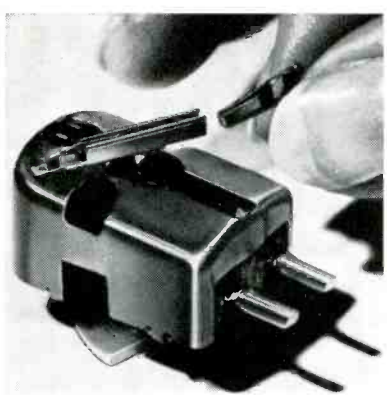
(*Continued from page 36*)

sembly, has been developed for the variable reluctance cartridges.†

In *vr* models designed for these styli, the positioning-knob shaft and stylus holder have been made a permanent part of the cartridge; only the diamond or sapphire tip and its baton need be replaced.

Six slide-in styli are available. Three of these are sapphires and three are diamonds: 1 mil for microgroove; 2.5 mil for NAB transcriptions; and 3 mil for wide groove recordings.

†*G.E. Clip-In Tip.*



Variable reluctance cartridge with clip-in tip which permits changing individual styli by slide-in method. (G.E.)

On Book Row

TECHNICAL DICTIONARY . . . By COYNE TECHNICAL STAFF, R. A. SNYDER, EDITOR: Compact book with 4,000 definitions of radio, TV, electronic, electrical and radar terms. Features a reference data section with charts, graphs, diagrams and symbols. *—160 pages, 5¼"x8½", priced at $2.00; Howard W. Sams and Co., Inc., 2201 E. 46th St., Indianapolis, Ind.*

* * *

PROCEEDINGS OF THE NATIONAL ELECTRONICS CONFERENCE, 1954 . . . VOL. 10: Official NEC book with all of the technical papers presented at the '54 National Electronics Conference. Includes sections on magnetic amplifiers, microwaves, circuit theory, communications, instrumentation, TV, tubes, antennas and computers.*—808 pages, 6¼"x9¼", priced at $5.00; National Electronics Conference, 84 E. Randolph St., Chicago 1, Ill.*

Community-TV Radiation

(*Continued from page 22*)

angles to the cable. By listening to the output with a headset, actual radiation may be distinguished from stray noise. If the station has a strong signal in the vicinity, unlikely in most instances but possible, readings should be taken at different locations, using different orientations of the test dipole, until the station signal can be differentiated positively from the cable radiation.

In the main, radiation troubles will be located through complaints from those set owners who use their own antennas; these antennas are usually pointed directly at a nearby amplifier box. If there is radiation above the normal limits, a characteristic centered black-bar pattern will appear on the TV screen. This bar is the horizontal blanking bar of the same station to which the set is tuned. The displacement is due to the time lag introduced by the difference in propagation speed in the cables and amplifiers of the system, compared with the direct signal. While this is measurable only in microseconds, it is sufficient to cause the horizontal displacement seen. Even a delay of 20-30 microseconds will cause this condition.

Servicing Helps

(*Continued from page 31*)

brightness at the edges of the screen would be noted.

The edges of the white raster would show shading of reddish-blue.

Thus far, we have considered the yoke to be faultless. However, the yoke can cause *clipping* or even gross purity errors such as a beam striking wrong color phosphors (misregistration).

One such yoke condition, for example, occurs when the horizontal-deflection centers do not coincide with the vertical deflection centers. This results in being able to obtain good purity (or a white raster with no shading) at top and bottom of picture, but not at left and right edges, or the reverse condition.

Another occurs when the yoke-deflection center is located too far to the rear and it is impossible to position the yoke mechanically forward enough.

It is difficult to tell whether a yoke or a picture tube is at fault when considering white raster shading. For this reason, the picture tube should always be given the benefit of doubt and a new yoke tried before condemning the picture tube. Of course, we must not neglect the rim and neck purity devices and the magnetic shield.

Misregistration is pictured in Fig. 3 (p. 31). A microscopic view of the edge of the raster is shown. In this case green misregistration is pictured. The red beam is correct.

The green beam is striking a portion of the blue phosphor dot and the blue beam is being clipped. Whenever a beam strikes the wrong color phosphor dot, we have misregistration.

Misregistration occurs for the same reasons that *clipping* occurs except that the causes are more aggravated.

When misregistration occurs it will show up as impurity on the individual fields. In this example the blue and red field will appear correct, but the green field will have cyan edges.

Misregistration does not necessarily mean that the white raster will be shaded, although there will usually be some shading as a result of it.

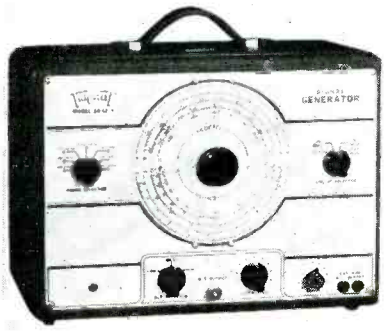
The conditions giving rise to edge shading are closely controlled by tight limits for misregistration and *clipping*.

In some instances the addition of a permanent-magnet rim purity device, properly adjusted, will remove the problem.

Instrument Developments

Universal test speaker designed to eliminate removal of speaker from cabinet when chassis is taken to shop for repair. Accommodates single-ended or push-pull transformers, and direct voice coil outputs; universal transformer allows impedance matching of most tubes. Includes choke and variable bleeder for matching electrodynamic speakers. Features socket and adaptor cable for plugging into the speaker or set. (Unispeak; Authorized Manufacturing Co., 919 Wyckoff Ave., Brooklyn 27, N. Y.)

VTVM with automatic range switching said to eliminate manual selection of appropriate voltage or resistance range before use. Seven ac and dc ranges of 1.5, 5, 15, 50, 150, 500 and 1,500 v; seven peak-to-peak ranges of 4, 14, 40, 140, 400, 1,400 and 4,000 v; and ohmmeter ranges of X1, X10, X100, X1,000, X10K and X100K. Features 4½" meter, 11-megohm input resistance (33 megohms on 1,500 v range). (Volt-Ohmatic; Bergen Labs, 11 Godwin Ave., Fair Lawn, N. J.)



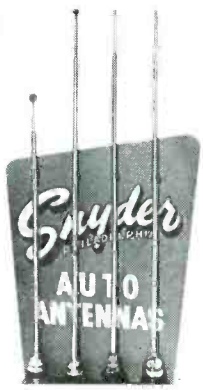
Signal generator covering frequency range from 160 kc to 110 mc in seven directly-calibrated 160° scales for AM-FM. monochrome or color-TV servicing. Features rf circuits, double-shielded with copper steel. Has cathode-follower output, said to provide stability by acting as a buffer to the oscillator. Jacks for internal modulation or audio output are controlled by audio adjustment for variable modulation or af output. Has step-type 3-position attenuator. (Model 3432-A; Triplett Electrical Instrument Co., Bluffton, Ohio.)

Battery tester (kit or factory-wired) for checking portable radio and hearing-aid batteries under operating conditions. Uses rotary selector switch which inserts proper dropping and shunt resistors in meter circuit to reduce terminal voltage. For 1.5 to 90 v. (Model 584; Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y).

ANTENNA COUNTER DISPLAYS

A counter display featuring Ward's Invader fringe antenna. Display has a pocket for condensed catalog on antenna.

A top cowl auto antenna display board, decorated in blue, black and fluorescent green and white, and designed for counter and window display. (Snyder)



Associations

NATESA, Chicago, Ill.

At annual banquet of the recent NATESA spring convention in Buffalo, where Friends of Service plaques were awarded. Left to right: Andrew Ferguson, Sprague Electric; Walter Bieda, chief service engineer, Sylvania Electric; Frank J. Moch, NATESA president; A. C. W. Saunders; Ferdinand J. Lynn, RTSA president and NATESA vice president; H. H. Rainier, Sylvania; and Dan Creato, RCA Service.

* * *

TSA, Detroit, Michigan

AL WEISS has been reelected president of the Television Service Association of Michigan.

Charles Judd was named first vice president; *Karl Heinzman,* second vice president; *Ray Cobbledick,* secretary and *Mel Wright,* treasurer.

Elected to the board of directors were *Hal Chase, Jack Barton, Clay Hibbert, Ed Brown, Bill Mattingly,* and *Vern Everhart.*

* * *

RTA, Fort Worth, Texas

C. E. MOREY has been elected president of the Fort Worth Radio and Television Association. Others named include: *L. Albert Hill,* vice president; *Dean O. Cochran,* secretary-treasurer; and *Will A. Shaw,* executive secretary.

Twelve RTA members were also elected to serve on the board of directors for one and two year terms. Appointed for one-year terms were *Louis T. Harris, L. Albert Hill, John H. Schuller, C. E. Morey, Leonard R. Smith* and *Dean O. Cochran.*

Two-year terms will be served by *James D. Ballard, Tony Elizondo, A. W. Judd, Stanley Taber, Joe M. Aston* and *R. L. McDonald.*

* * *

RTA, Kalamazoo, Mich.

THE TWENTIETH YEAR of continuous activity was celebrated recently by the Radio-Television Association of Kalamazoo, Mich.

At a special meeting, results of recent elections were announced. *William West* was reelected president; *Wayne Moorlag* was named vice president; *Paul Goecke,* secretary; *Clifford Bennett,* treasurer; and *Kenneth Barrett* and *Jefferson Laing,* trustees.

TEN YEARS AGO IN SERVICE

SERVICE MEN WERE SALUTED for their ingenuity in solving replacement parts war-shortage problems through the development of circuit innovations and substitution methods, permitting the use of a number of alternate types of components.... Associations were cited for their vital role in generating interest in this replacement program. . . . A bright future for FM was predicted by the FCC; they reported that between 50 and 100-million sets would be in operation within a few years. . . Miniatures were developed by Sylvania for battery se s and hearing aids. . . . A step-by-step receiving tube assembly chart was released by Hytron. . . . IRC received its fourth white star *E* award. . . . Centralab introduced tubular cera mics.

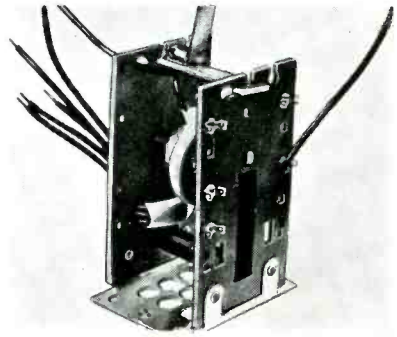
TV Parts... Accessories

STANCOR REPLACEMENT FLYBACKS

Two replacement flyback transformers, *A-8138* and *A-8261*, have been announced by Chicago Standard Transformer Corp., Addison and Elston Sts., Chicago 18, Ill.

The *A-8138* has been designed for Emerson receivers; the *A-8261* for Majestic and Muntz sets.

Complete data in bulletin 505.

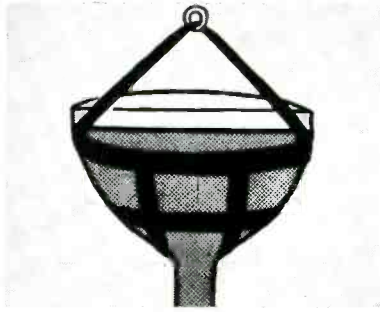


* * *

JACOBSON TV HAMMOCK

A TV chassis and picture-tube carrying device, *TV Hammock*, has been designed by S. I. Jacobson Mfg. Co., 1414 S. Wabash Ave., Chicago 5, Ill.

Constructed of harness webbing, the carrier is available in two models: *18*, for carrying chassis only; and *24*, for carrying chassis and picture tube. Features a neck strap.



* * *

WHITE DOT GENERATOR

White dot linearity generator for black-and-white or color-TV. Features large and small dots for color receiver convergence and vertical and horizontal bars for sweep circuit alignment. Internally generated vertical sync pulses are locked to line frequency for stable operation. Has rf carrier output and external modulation. (Model 160; Winston Electronics, Inc., 4312 Main St., Philadelphia 27, Pa.)

NEWS

WALSCO-CHASE SIGN DISTRIBUTION AGREEMENT

Walsco Electronics Corp. and Chase Manufacturing Co. have signed an agreement authorizing Walsco to act as exclusive distributor for Chase's Pioneer chassis punches, Ham-R-Press and Knurl-Tite wrenches.

William L. Chase (left), president of Chase Manufacturing Co., and Robert Mueller, Walsco sales vice president.

* * *

IRE LEASES N. Y. COLISEUM FOR '56 CONVENTION

The Institute of Radio Engineers signed a lease recently for all four exhibit floors of the New York Coliseum at Columbus Circle for the radio engineering show, to be held March 19-22, '56, in connection with the IRE national convention.

* * *

CHANNEL MASTER ANTENNA REPORT IN BOOK OF KNOWLEDGE

A three-page article written by Harold Harris, vice president of Channel Master Corp., appears in the current edition of the *Book of Knowledge Annual*.

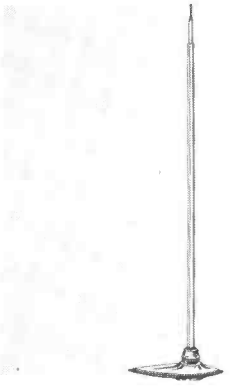
* * *

RCA CHERRY HILL ADMINISTRATION BUILDING PROJECT COMPLETED

A five-building center in Cherry Hill, N. J., that houses administration and engineering facilities for RCA consumer products and the RCA Service Co., was opened recently.

* * *

AUTO ANTENNA



Auto antenna that mounts either at the front or rear of the car and is adjustable 0-25° to match different mounting locations. For front installation, it is equipped with a 4' cable; for rear mounting, it is equipped with a 15' cable. (Nautilus; TENNA Manufacturing Co., 7580 Garfield Blvd., Cleveland 25, O.)

Components

MERIT VIBRATOR TRANSFORMERS

Two 12-*v* auto-radio vibrator transformers, *P-2860* and *P-2861*, have been announced by the Merit Coil and Transformer Corp., 4427 N. Clark St., Chicago 40, Ill.

The *P-2860* is an exact replacement for '55 Allstate and Chevrolet auto radios; *P-2861* for Chevrolet, Oldsmobile, Philco and Pontiac receivers.

* * *

ASTRON SUBMINIATURE ELECTROLYTICS

A subminiature electrolytic, *ET*, for use in portable TV sets, miniature radios, hearing aids, miniature tape recorders and other assemblies using miniaturized tubes and transistors, has been introduced by Astron Corp., 255 Grant Ave., E. Newark, N. J.

* * *

C-D SUPER MICADONS

An encapsulated midget mica capacitor, *Super Micadon*, said to provide five to six times the capacity possible in conventional small units, has been developed by Cornell-Dubilier Electric Corp., South Plainfield, N. J.

Units are claimed to have ten to 35 times higher insulation resistance. Features include parallel plug-in leads, and a hermetically sealed molded-plastic case combination. Complete details in bulletin 160.

* * *

CLAROSTAT POWER RESISTOR DECADE BOX

A power resistor decade box, *240-C*, with universal-type terminals to accommodate plain-wire leads, spade-ends or banana plug-ins, has been announced by Clarostat Mfg. Co., Inc., Dover, N. H.

Box consists of six resistance decades providing any value from 0 to 999,999 ohms in increments of one ohm. Decades one to six handle rated current of 5, 1.5, .5, .15, .05, and .005 amperes respectively. A detent-action knob with dial readings in decimals controls each decade.

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Catalogs-Bulletins

COLUMBIA WIRE AND SUPPLY CO., 2850 Irving Park Rd., Chicago 18, Ill., has released illustrated catalog *105*, describing electrical wire, cord sets, TV wire and cable, and wire accessories.

* * *

ASTRON CORP., 255 Grant Ave., East Newark, N. J., has published a 4-page bulletin *AB-21*, with tables, performance characteristics and test specifications on the *Comet* molded-plastic tubular metallized-paper capacitors.

* * *

CORNELL-DUBILIER ELECTRIC CORP., South Plainfield, N. J., has issued a 16-page twist-prong capacitor cross-index, *UPX-155*, listing more than 1,000 twist-prong types made by original-unit manufacturers and C-D equivalent replacements.

* * *

CHICAGO STANDARD TRANSFORMER CORP., Addison and Elston Sts., Chicago 18, Ill., has issued bulletin *505*, describing replacement flyback transformers for Emerson, Muntz and Majestic sets.

ADVERTISERS IN SERVICE

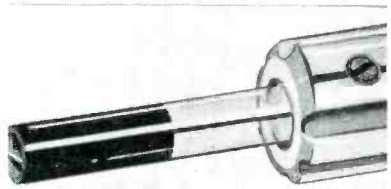
JUNE, 1955

Bench-Field Tools . . .

G-C ADJUSTABLE ALIGNMENT TOOL

An adjustable TV alignment tool, *9090*, for tight-chassis work, designed for use in RCA, Westinghouse and other TV sets, has been developed by General Cement Manufacturing Co., 919 Taylor Ave., Rockford, Ill.

Tool can be adjusted from 1¼" to 2" in length with a handle set screw.



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ROTO-TOP SCREW DRIVER

A screw driver, *Roto-Top*, featuring a handle top that remains fixed as the driver is turned, has been announced by Time Manufacturing Co., Westminster, Mass.

Handles are fluted and made of tenite; blades are of alloy steel. Available in a set consisting of three regular drivers with 4", 5" and 6" blades, and two Phillips head drivers with 3" and 4½" blades.

* * *

FAIRBANKS ELEVATING HAND TRUCK

An elevating hand truck, *A-2*, for aid in delivering, installing and servicing table model TV sets, has been developed by The Fairbanks Co., 393 Lafayette St., New York, N. Y.

Truck is said to permit one to carry set up or down stairs and raise it to any level up to 43" above the floor. Folds into a 32½" x 22½" x 13" package.

* * *

G.E. PORTABLE SPOTLIGHT

A spotlight that plugs into an auto dashboard cigarette lighter, *Servi-Spot*, that can be used for outdoor night work on antennas and leadin lines, has been announced by General Electric Co., Schenectady 5, N. Y.

Unit is said to provide a quarter-mile beam. Has a 12' cord. Lamp draws .5 amp.

JOTS AND FLASHES

TRANSISTORS point the way to new standards of power consumption and reliability, and new concepts of size and weight: So said *Daniel E. Noble,* vice-president of communications and electronics division, Motorola, Inc., recently during an address before railroad communications specialists. Discussing the compactness of transistorized equipment, Noble described a sealed radio pocket clock, fixed-tuned to the Naval Observatory, in Virginia, to give the time every other hour, which uses six transistors including an oscillator. Also included in the pocket-sized radio are a speaker, volume control and an antenna. Another novel transistor unit shown was an electronic golf ball, equipped with a complete transmitter, including a transistor oscillator and miniature batteries. Whenever the golf ball bounds out of sight, Noble said, a pocket receiver, serving as a sensing device, can be rotated to pick up signals sent out by the transmitter. . . . One hundred and nineteen different receiving tube types are being used in 150 different '54 and '55 TV receivers according to a report by *A. F. Dickerson,* product planning manager of the G. E. receiving tube sub-department. He pointed out that the 150 sets surveyed, of various makes and models had a total of 2,950 sockets. . . . Admiral's new line of TV receivers to be introduced late in June, will contain automatically-assembled *pc* panels equivalent to over 75 per cent of all the wiring in the chassis. . . . In anticipation of the rapid growth of color TV that will greatly expand the market for aluminum electrolytics, G. E. has announced it will build a $6,000,000 plant at Irmo near Columbia, S. C., to produce these capacitors. . . . The National Electronic Distributors Association has moved to 4704 W. Irving Park Road, Chicago 41, Ill. . . . To expedite shipment of electronic tubes and related products to those in the midwest, Raytheon has opened an office-warehouse at 9501 Grand Avenue, Franklin Park, Ill. One-sixth of the building is devoted to offices, while the remainder is used for stockpiling receiving and picture tubes, transistors and semiconductor diodes, and a line of industrial tubes. *Alexander E. Blazis* has been named warehouse manager. . . . Olson Radio Warehouse, Inc., has opened a new store at 423 W. Michigan St., Milwaukee, Wis., under the management of *Paul Splinter.* . . . The '55 convention of the Audio Engineering Society and the annual Audio Fair will be held October 12-15 in the Hotel New Yorker, N. Y. C. According to Col. Richard H. Ranger, program chairman for the event, the convention will include panel discussions on transistors, amplifier design and tape recording. . . . The Navy Bureau of Aeronautics and the National Bureau of Standards has announced that hereafter the NBS pilot line for the mechanized production of electronic equipment will be operated by Aerovox Corp.; the program was formerly conducted by the Kaiser Electronics Division of Willys Motors, Inc. . . . Permo has purchased Zim Products and will make and sell Zim record brushes under their regular trade name. Permo will continue to manufacture and sell Fidelitone and Permo record brushes.

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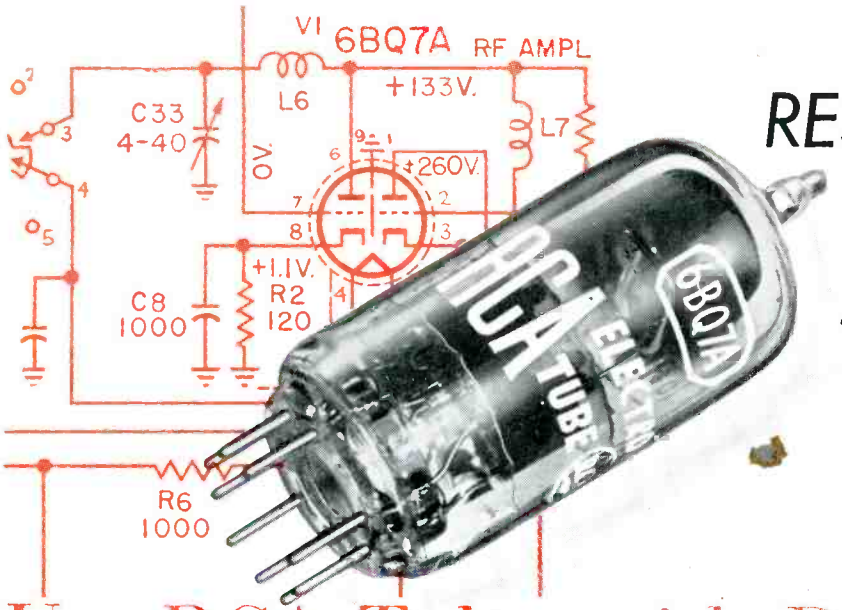
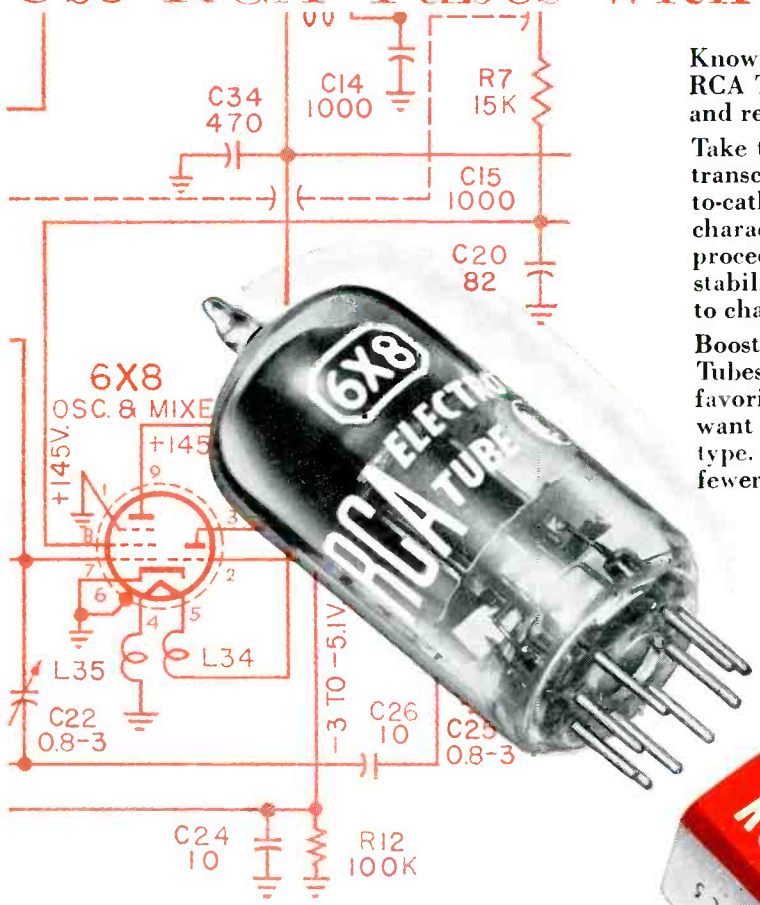


RESTORE THE "HOP" IN TV TUNERS...

Use RCA Tubes with Built-In Quality!



Known for their stability and background "quietness," RCA Tubes help boost the sensitivity of your tuner and reduce tuner noise.

Take the RCA-6BQ7A. Here is a tube having high transconductance, low input capacitance, low plate-to-cathode capacitance, and remarkable uniformity of characteristics—made possible by exacting control procedures during manufacture. Benefits: Greater stability, less receiver noise, higher gain—all the way to channel 13.

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