

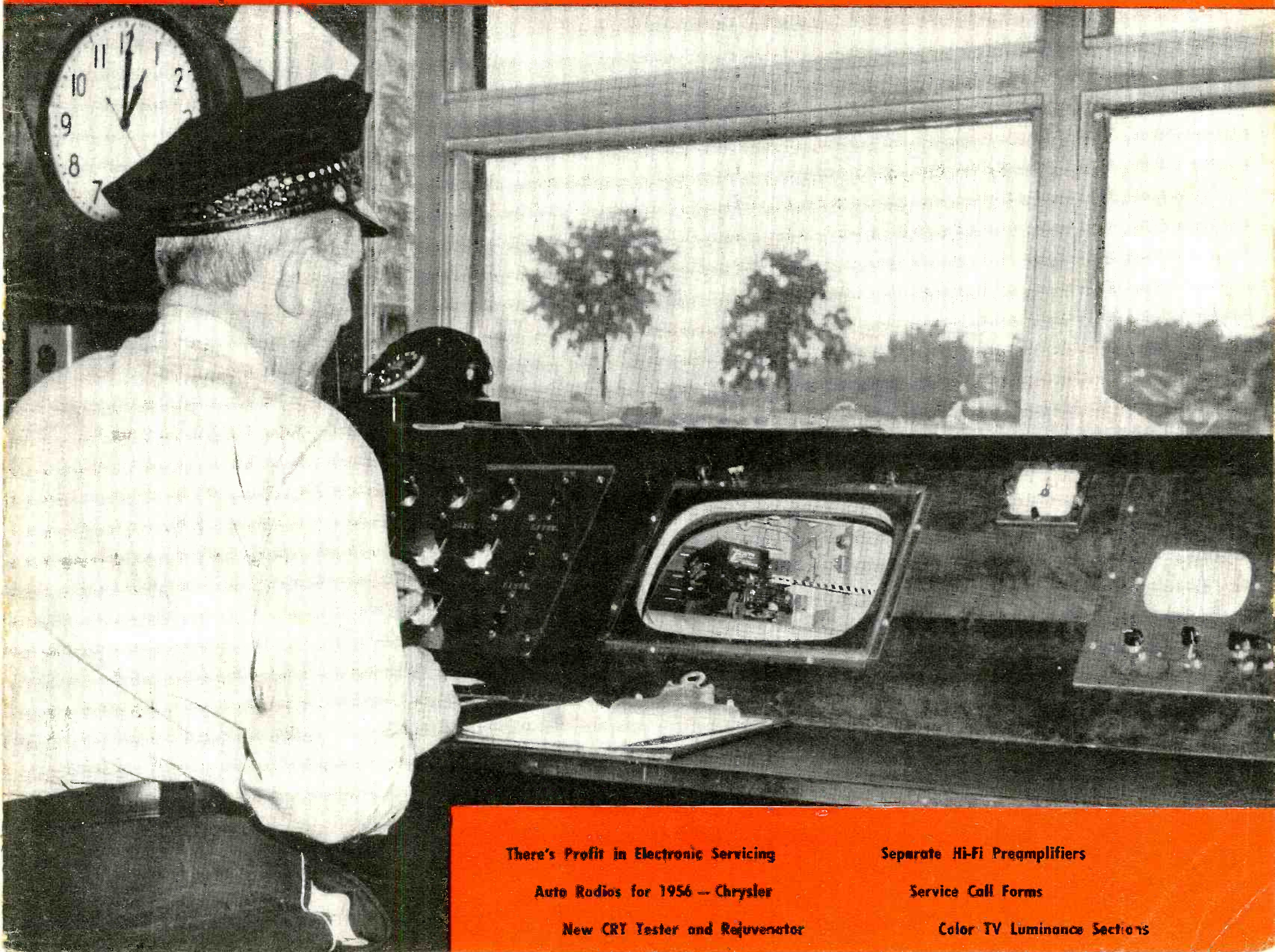
# SERVICE DEALER

SEPTEMBER  
1956

50¢



## and **ELECTRONIC SERVICING**



There's Profit in Electronic Servicing

Auto Radios for 1956 -- Chrysler

New CRY Tester and Rejuvenator

Separate Hi-Fi Preamplifiers

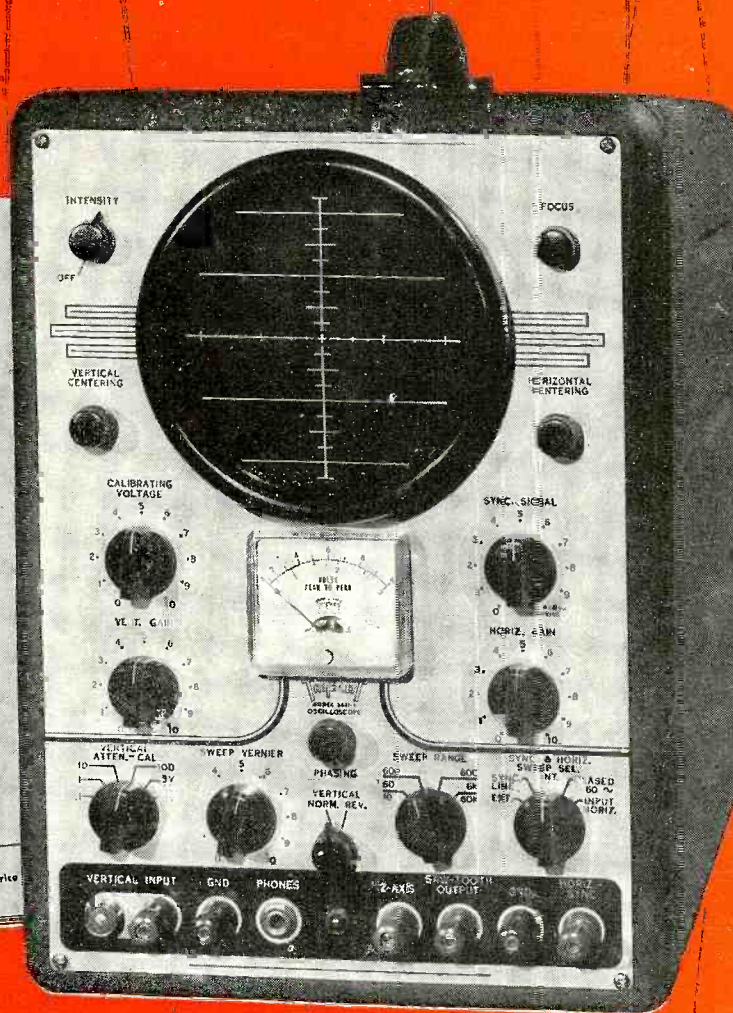
Service Call Forms

Color TV Luminance Sections

## Scope Connections

IF YOU CAN USE A VOM,  
YOU CAN USE A SCOPE

By V. L. Walker, Sales Eng.  
THE TRIPLETT ELECTRICAL INSTRUMENT CO.  
BLUFFTON, OHIO



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# SERVICE DEALER



## and ELECTRONIC SERVICING

VOL. 17, NO. 9

Member



SEPTEMBER, 1956

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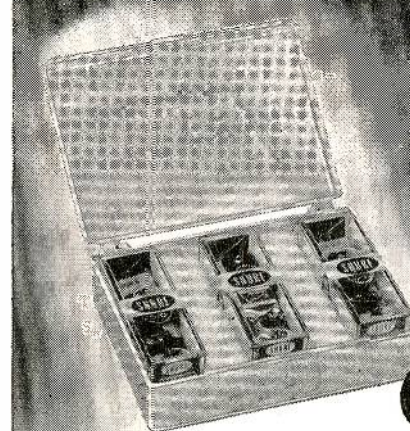
Zenith Radio Corporation plant guard, uses a closed circuit TV system to regulate traffic in and out of the company's main plant on the west side of Chicago.

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\*Model W72 has a slip-on capacitor furnished as an accessory. With the capacitor, output is 2 volts without the capacitor, output is 4 volts.

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S. R. COWAN

## Servicemen Conventions

Several years ago, with the advent of TV, RETMA members opined that it would be wise to "educate" radio servicemen so they would be able to fix the new TV sets which were then being marketed in quantity and thus keep the public in a happy frame of mind. In 1947 or 1948, if memory serves me right, almost \$50,000 was allocated by RETMA for the purpose of holding clinics in key cities. To RETMA's credit let it be said that they candidly admitted then that the future of TV rested heavily on independent servicemen's competency and at the same time they, the RETMA members, were appropriating the \$50,000 to insure their own investment by thus collaborating with servicemen.

In planning the clinics no servicemen or servicemen's associations were contacted by the RETMA committee members and oldtimers who were close to servicemen's problems (such as John Rider or yours truly) were not consulted either.

The service clinics were run as scheduled but unfortunately were not too successful. The reasons for the failure of the project were obvious. In one city a representative from one manufacturer would tell all he knew about his own particular product—in another city another representative from another factory would discourse on his firm's models, and so on. In effect the various clinics did nothing more than teach servicemen in various cities the highlights of some one particular TV brand . . . that brand which just happened to be covered at that time. Again, though RETMA's intentions were good, their execution fell short of its goal.

Regretably RETMA has not followed up its original idea to keep an educa-

# Ad Libs

tional program in force for the benefit of all servicemen everywhere. Now isolated Servicemen's Associations or groups of servicemen find it advisable and worthwhile to hold their own semi-localized technical meetings. For example the 4th Annual Texas Electronic's Assn.'s Clinic and Fair will be held for 3 days, beginning August 24th at the Rice Hotel in Houston.

In like manner the NATESA convention for radio-TV servicemen will be held at the Sheraton Hotel, Chicago, Sept. 14-15-16. Here there will be a combination technical and business management type of seminar. Later this year, on Dec. 6-7-8 The Radio & Television Guild of Long Island, N. Y. will hold their 1st Electronics Fair at the N. Y. State University in Farmingdale. Once again by means of these clinics, conventions or fairs, call them what you will, thousands of dealers and servicemen will be afforded the opportunity to keep abreast of the newest developments and service techniques in TV, color TV, Hi-Fi, test equipment, etc., and at long last even the subject of Industrial Electronics Servicing will be brought to the attention of those who attend.

Summarized: Servicemen's educational meetings are wanted more than ever and are really needed by servicemen. Such meetings will benefit all servicemen who attend. This in turn will prove advantageous to all manufacturers and RETMA members; and in due course the set owning public will benefit too. To that end we propose that RETMA again appropriate funds for the purpose of educating servicemen. However, we propose that such funds should be allocated toward the support of servicemen's conventions such as are mentioned above and which are conducted by servicemen's associations.

[Continued on page 8]

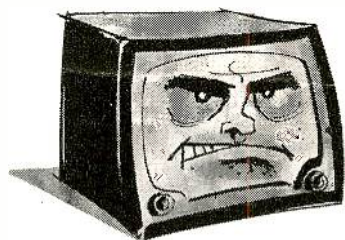
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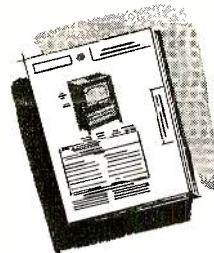
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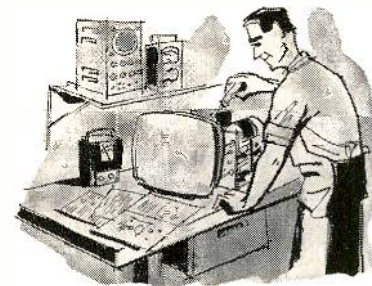
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Fig. 4—Above is shown a picture of the Fisher Model PR-6, a self-powered preamplifier which employs fixed equalization.

The preamplifier, an important component in a Hi-Fi system, is discussed in relation to equalization, hum and noise considerations.

## SEPARATE PREAMPLIFIERS

The first step towards Hi-Fi

by LAWRENCE FIELDING

HAVING analyzed in a very general way some of the elements that make up a high quality home sound system in our last article of this series, we are ready to consider in detail one of the most important electronic components of any high-fidelity system—the phono preamplifier. The first major function of the preamplifier is that of amplification.

It will be recalled from earlier discussions that the output level of most modern cartridges (especially the magnetic variety) is extremely low. The average voltage output from a typical unit would be approximately 10 to 15 millivolts. Such minute signal voltages require at least 30 or 40 decibels of amplification (a gain of from 30 to 100 times) before they can be suitably applied to the main or power amplifier of the system.

What's more, such minute signal levels require very special attention during amplification. A mere ONE millivolt of hum generated at the input of a preamplifier will represent about one-tenth volt of hum voltage after amplification. Such hum voltage fed to an amplifier requiring one volt for full power output would result in an overall signal to hum level of only 20 db, a figure hardly consistent with our previous

hum criterion of 70 db below full output for quality amplifiers.

Noise is another factor which governs the design of high-quality preamplifiers. In many instances, a resistor which would hardly be suspected in high-level voltage amplification stages can often generate minute amounts of noise, which when amplified by sensitive preamplifiers are quite audible to the listener in a quiet room during soft passages of music.

### Equalization

The second major function of the preamplifier is that of equalization. This subject was touched upon previously in a recent article but it would be well to expand upon it a bit at this time. All recordings in popular use today are recorded laterally. That is, the cutting stylus swings from side to side in the groove, depending upon the audio voltages impressed upon it.

The two basic types of phonograph cartridges respond in dissimilar fashion to these groove modulations. Those cartridges belonging to the crystal, or ceramic family are strain sensitive. That is, voltages are produced by virtue of the fact that the crystal element is being deformed or compressed a certain distance. The voltage produced from these

devices is directly proportional to the AMPLITUDE of the groove modulations. On the other hand, magnetic cartridges are sensitive only to VELOCITY. That is, the side to side speed of the moving stylus determines the voltage produced by the associated cartridge.

From the foregoing it can be seen that a recording manufactured with constant relative amplitude of all audible frequencies could be played by a crystal cartridge directly and the result would be flat response. On the other hand, a recording made with constant relative velocity for all frequencies could be played back by a magnetic cartridge with no correction necessary.

The concept of CONSTANT VELOCITY can perhaps be more readily understood by consulting Fig. 1. You will note that in a constant velocity system, amplitude varies inversely with frequency. That is, a 500 cycle note impressed on a record must have twice the amplitude of a 1000 cycle note if the stylus is to travel at the same VELOCITY when following both grooves.

### Recording characteristics

The fact of the matter is that present day recordings employ neither constant

velocity techniques nor constant amplitude, but rather a combination of both. This was not done to make life difficult for electronic equipment designers, but because of very definite limitations forced upon us by the record material, the number of grooves per inch for adequate recording time, the number of revolutions per minute deemed desirable, and the ability of even the best of cartridges to follow wide excursions in a record groove laterally.

What did make life difficult until recently, however, was the fact that no two recording manufacturers could get together on the exact ideal recording curve to follow. It is for this reason that you will be faced with a multitude of switches, levers and knobs all designed to afford flexibility of equalization in high-fidelity systems.

Fortunately, records pressed after 1953 all employ a curve known as the RIAA characteristic (Record Industry Association of America), one which is becoming standard at last. This recording curve is illustrated in Fig. 2. All frequencies below 500 cycles are recorded with constant amplitude (or, what amounts to the same thing, decreasing velocity). Frequencies above 500 cycles are recorded with constant velocity, except that as we approach the

higher frequencies, a certain amount of BOOST is deliberately incorporated to over-ride surface noise, which is most evident in the high-frequency portion of the spectrum.

You will note that this pre-emphasis portion, as it is called, is almost a continuation amplitude portion of the curve below 500 cycles. It is for this reason and this reason only that it has been stated that crystal and ceramic cartridges require no equalization. They are amplitude conscious, and if the recording curve were like the dotted line of Fig. 2, the above statement would be true. Actually, the difference is so slight that most users of ceramic cartridges or crystal pick-ups do not use equalization at all. Therefore, their only requirement is for a good voltage amplifier. Even there the demands are not so difficult, for it will be remembered that a crystal pick-up puts out a great deal more voltage than the equivalent magnetic variety. By far the greatest number of systems in use today employ magnetic cartridges and we shall confine the rest of our discussion to this more popular type.

### The Self-Powered Preamp

With the advent of long playing records, the importance of light-weight cartridges having good frequency response and tracking characteristics became obvious to thousands upon thousands of high-fidelity enthusiasts. As a first step towards achieving high-fidelity they converted their old bulky tone arms to variable reluctance cartridges (such as the GE RPX-050) and light-weight arms. By so doing, they kept the

path open for further modifications in amplifying equipment, speakers, etc. Generally, the simplest preamplifier-equalizer to choose with these new pick-ups were small, self contained preamps such as the GE UPX-003A or the Fisher Model PR-6. Because of their simplicity, we will use one of these two in our study of basic preamplifiers. A schematic & a photograph of the Fisher Model PR-6 is shown in Figs. 3 and 4.

The heart of this self-powered unit is the dual-triode type 6SC7 tube. This tube, quite common among small, ac power units, is noted for its low noise characteristics as well as for the absence of hum.

$R-1$  is not given a specific value for a very good reason. The choice of this resistor depends upon the de-emphasis desired in playback. For records made after 1953, this value should be set at about 6800 ohms. This resistive loading of the cartridge has the desired effect of reducing the output of high frequencies in the exact manner required by the RIAA playback curve shown in Fig. 5. You will note that this curve is exactly opposite to the recording curve shown earlier, so that the net result will be flat response when the two are added together.

If less roll-off of the high frequencies is desired (and many customers will feel that they want more highs, regardless of technical curves) simply substitute a resistor of somewhat higher value. A 47,000 to 68,000 ohm resistor across the input is the maximum limit and will result in no roll-off whatsoever. This value of resistance is only used as a load if provision is made elsewhere in the preamplifier or control

chassis for roll-off of high frequencies by electronic means.

Since the 6SC7 tube has only one common cathode, it is returned to ground and bias is accomplished for each grid through contact potential developed across the 22 megohm resistors in each grid circuit. This low value of bias is permissible because of the small signal voltages involved.

A feedback path is arranged from the second plate to the first, consisting of a 120,000 ohm resistor and a .0027  $\mu$ f capacitor. At frequencies above 500 cycles, the feedback is constant and the frequency response of the system is flat. At frequencies below 500 cycles, however, the impedance of the .0027  $\mu$ f capacitor becomes significant, rising with lower frequencies. The result is an overall reduction of feedback, or a gradual rise in gain. The total response of the preamplifier is shown in Fig. 6, and it will be seen that the bass boost characteristic matches the RIAA response curve.

In installing units such as these, it is often convenient to connect the line cord to the turntable motor switch rather than to the wall receptacle. Simply cut off the molded plug and wire directly to the record changer switch. In this way, the unit will be turned off automatically when the changer is shut off after the last record.

### Servicing One-Tube Preamplifiers

The greatest source of trouble with preamplifiers such as the one described involves hum and noise. In replacing the 6SC7 tube, it is important to specify that the tube shall have spiral wound filaments. It is this filament construction which accounts in great measure

for the tube's low hum characteristic. Unfortunately, a certain number of tubes labeled 6SC7 are available with folded filaments and these will simply not do the job in low level preamplifiers. Excessive noise or hiss, if not traced to the tube directly, will usually be caused by the plate resistor having

[Continued on page 49]

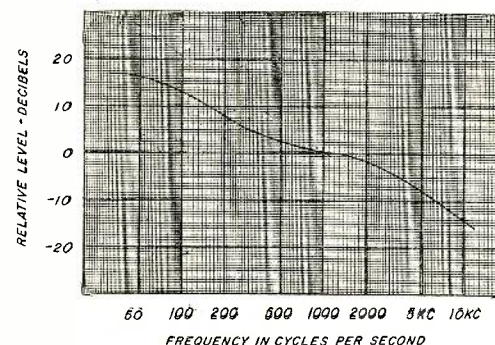


Fig. 5—The Recording Industry Association of America (RIAA) playback characteristics.

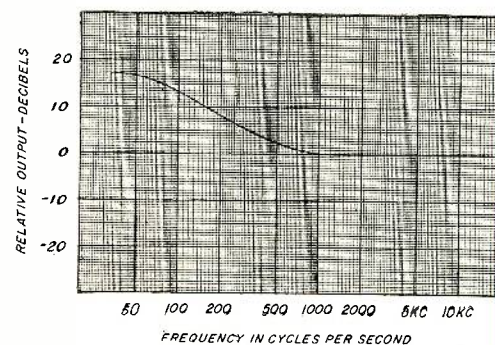


Fig. 6—PR-6 preamp bass equalization curve. Treble roll-off is accomplished externally.

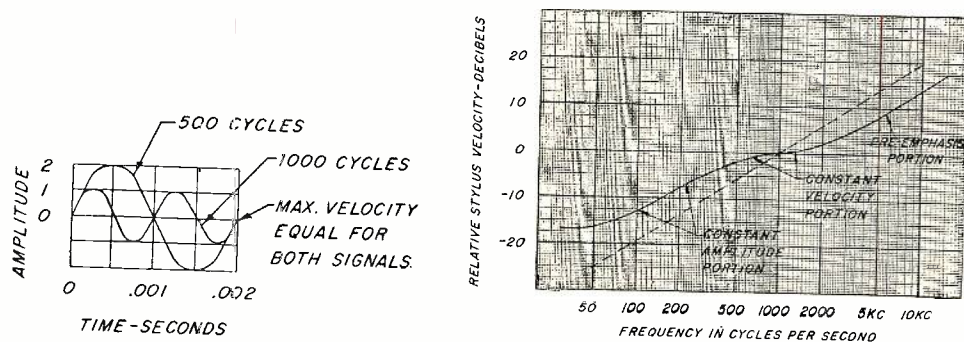


Fig. 1—The relative amplitudes of two sine waves as recorded with constant velocity.

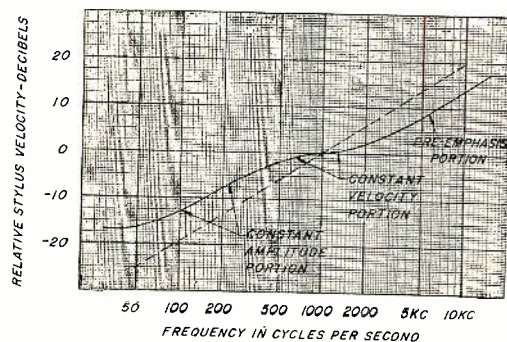


Fig. 2—The Recording Industry Association of America (RIAA) recording characteristics.

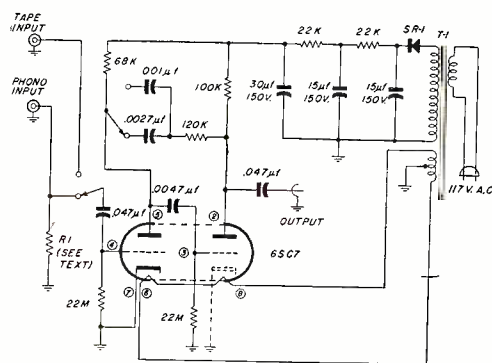


Fig. 3—Fisher Model PR-6. Alternate setting of S1 is for tape-head preamplification.

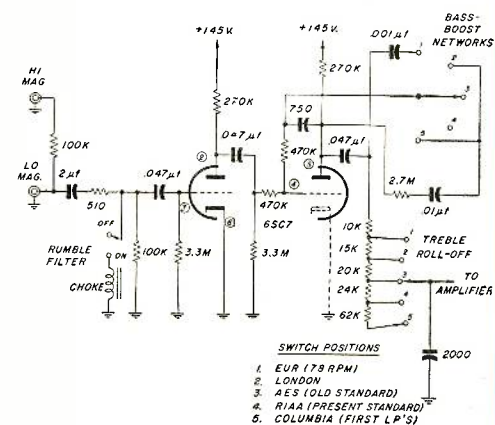


Fig. 7—Partial schematic of G.E. Model A1-320 showing variable frequency equalization

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## ASSOCIATION NEWS

### Radio Television Guild of Long Island

As an initial attempt to advise the industry of the Guild's proposed "Electronics Fair," a brochure was prepared and a sample mailing sent out. With the brochure in the mail only one week, response so far has proved remarkably encouraging. A host of manufacturers have requested additional information. Many asked that space be reserved for them.

In addition to those interested in taking exhibit space, the industry is generally rising to the plans for the Fair with surprising enthusiasm. Distributors who were asked to assist our advertising efforts showed both an interest and an eagerness in helping to promote the Fair.

Trade publications too, requested more details. They congratulated the Guild on its appreciation of the need for such an industry show, and on the efforts being put forth to fulfill that need.

### Associated Radio & Television Servicemen, Illinois

The Associated Radio and Television Servicemen, Illinois announces the commencement of operations of their color television school. The course is being conducted by Mr. Joseph Kalivoda, service manager of Motorola, Chicago, and the general arrangements are in the hands of a two man color committee consisting of Yuki Minaga and William Siegrist, Jr. Wonderful cooperation has been extended by Mr. M. O. Buehring, sales manager for Simpson Electric Company, who has loaned a complete set of the newest Simpson test equipment for the duration of the program.

In addition, Bob Middleton, Field Engineer for Simpson gave the initial instruction in the use of the equipment at the opening lecture and will be available for more advanced instruction.



by SAMUEL L. MARSHALL

**Associated Radio-Television  
Service Dealers,  
Columbus, Ohio**

At a recent association meeting, Ralph Morely introduced Mr. David B. Lane, Crosley Zone Service Manager, who was roundly applauded when he stated: "Crosley Corporation believes that the independent service dealers were doing a good job. As a result the Crosley Corporation did not desire to go into the TV service business like some of their competitors were doing."

**National Alliance of TV and  
Electronic Service  
Associations**

In his editorial in the July, 1956 issue of NATESA, Frank Mock points up an effort by a group "operating under a cloak of anonymity" in the state of Missouri to kill the enactment of legislation that would bring about licensing of TV servicing in this state.

NATESA is vigorously opposed to the action of these so-called "outsiders" and their arguments which are branded as false and misleading.

**Television Service Dealer's  
Association, Philadelphia**

The Television Service Dealer's Association of Philadelphia believes that the time has come to end "deals" such as "catchers' mitts," "golf clubs," "silk stockings" and "fishing trips." The association suggests that the money be used for honest to goodness promotion of their businesses.

[continued on page 10]

# CHANNEL MASTER

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CHANNEL MASTER REVOLUTIONIZES ANTENNA MERCHANDISING! With large-scale national advertising and traffic-building local promotions, Channel Master now places TV antennas on the same retail level as traffic appliances. It's actually a NEW WAY for you to sell antennas — and sell more of them. Climb aboard the Channel Master brandwagon and tie in with these profit-making promotions. Get details from your Channel Master distributor.

NEW MARKETS . . . NEW CUSTOMERS . . . FOR THESE 2 GREAT NEW ANTENNAS

## AD LIBS

[from page 3]

### Association Collaboration

Some time ago we received a photograph. This in itself is not very important, but upon studying the photograph shown below one cannot help but believe that it indicates a duplicity of effort that should not necessarily be required.



Television Service Industry Leaders at Raymond Rosen's dinner for 200 color television servicemen are, left to right: Harrison Neel (President, Television Service Dealers Association), A. M. Haas (President, Television Contractors Association), William Powell (Field Representative, RCA Service Company), Ty Yonker (Manager, Raymond Rosen Electronic Parts Division), Ray Cherrill (President, Northeast Television Service Dealers Association), William Morrow (Television Service Dealers Association of Delaware County) and William Poole (President, Philadelphia Radio Servicemen's Association.)

At Philadelphia one of the big distributors gave a dinner for 200 color television servicemen and the picture referred to above depicts the manager of that Distributors' Parts Division shaking hands with Harrison Neel who is President of the Television Service Dealers As-

# CHANNEL MASTER®

# T-W

the world's first  
"Travelling Wave" antenna

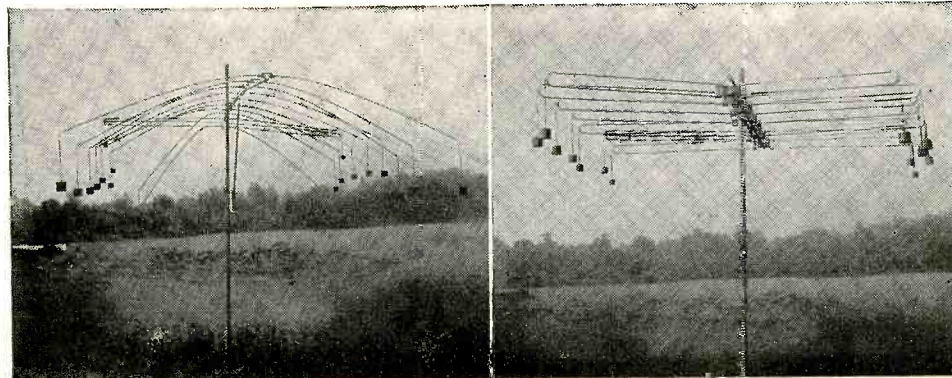
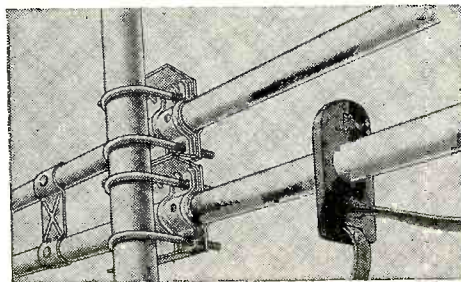
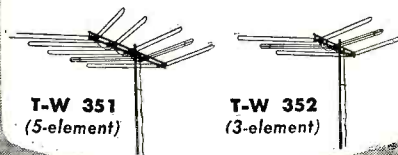
### WHAT THE "TRAVELLING WAVE" PRINCIPLE MEANS—

- ideal phase relationships on all channels
- optimum impedance matching on all channels
- equal flow of current in all dipoles on all channels
- fullest use of transmitted energy on all channels

IN SHORT — FABULOUS PERFORMANCE  
ON ALL CHANNELS

### SENSATIONAL 3- AND 5- ELEMENT MODELS!

Amazing T-W performance for suburban and near-fringe areas, too! Wonderfully compact and rugged!



## revolutionary new design provides picture quality never before possible

After two years of research—a completely new kind of VHF antenna, operating on revolutionary new electronic principles. The T-W is Channel Master's greatest antenna achievement.

### ALL THREE — IN ONE ALL-CHANNEL ANTENNA

#### 1 HIGHEST GAINS

Most powerful all-channel antenna ever developed. A single-bay T-W 350 (7-element) actually **OUTPERFORMS—**



any wide-spaced 5-element Yagi on each low band channel.



any stacked 10-element Yagi on each high band channel.

#### 2 TOP FRONT-TO-BACK RATIOS

##### Low Band:

Better than 10:1 on every channel. **HIGHER THAN ANY 10-ELEMENT SINGLE CHANNEL YAGI ON ALL CHANNELS!**

##### High Band:

From 5:1 to 12:1. **HIGHEST RATIOS OF ANY SINGLE ALL CHANNEL ANTENNA.**

#### 3 GREATEST MECHANICAL STRENGTH

The most rugged antenna ever built. "Twin Truss" design amplifies the strength of every component. And new mechanical features add still greater durability . . .

"Twin Booms" . . . Two full-length crossarms—really rugged and rigid.

2 "Super-Nests" One heavy-duty mast clamp on each crossboom, A TOTAL OF 4 U-BOLTS! Antenna cannot move.

"Line-Lok" . . . . . Twinlead can't possibly tear away from terminals..

### PROOF OF THE SUPERIORITY OF "TWIN-TRUSS" CONSTRUCTION

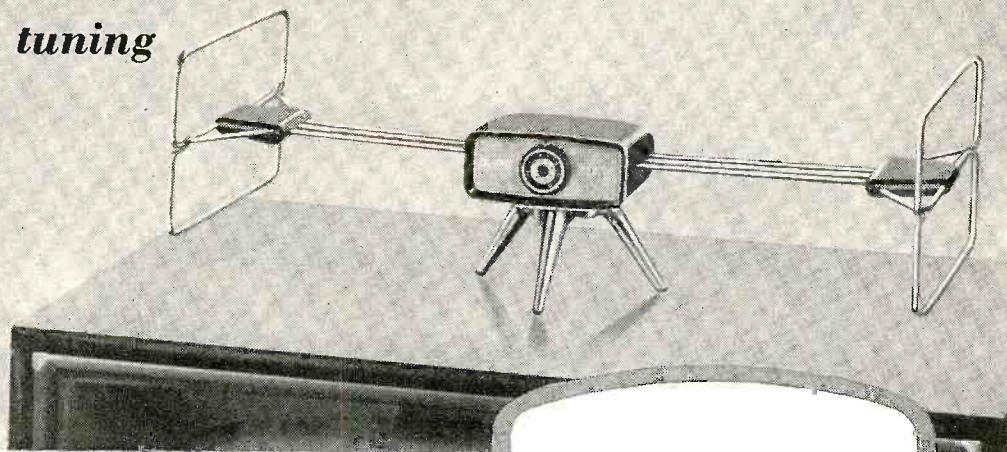
Look at the dramatic result when equal weights are hung on a T-W and a standard 10-element Yagi!

Write for complete technical literature,

© Trade Mark Reg. U.S. Pat. Off.

# CHANNEL MASTER® "Showman"

new "Metro-Dyne" tuning  
obsoletes  
"Rabbit-Ears"



## the first basic indoor antenna improvement in over 10 years

Channel Master sets an exciting new trend in TV antennas with the Showman. In appearance (so important in the sale of indoor antennas) the Showman is in a dazzling class by itself. Yet, it's a complex electronic instrument—the most powerful indoor antenna yet developed by modern science!

The SHOWMAN is perfect for color reception, tops for black-and-white. And, it provides excellent FM reception, too!

### ACTUALLY TUNES OUT "GHOSTS" AND "SNOW"! MORE EFFECTIVE THAN ANY OTHER INDOOR ANTENNA!



With ordinary  
indoor antennas

With the  
Showman

Metropolitan areas, where indoor antennas are most frequently used, are often subject to the most severe "ghosting" problems. Only the SHOWMAN, with its sensational new Metro-Dyne tuning, can overcome this difficulty. You'll be amazed at the job it does on all kinds of interference. Test it for yourself! Demonstrate it for your customers!

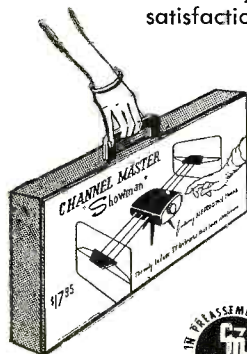
Channel Master stands squarely behind every SHOWMAN you sell. An unconditional money-back guarantee assures your customer of complete satisfaction.

### UNCONDITIONAL MONEY-BACK GUARANTEE

Available in three "decor designs"—  
to blend with any setting.

Mahogany and Gold model no. 3900	Blond and Gold model no. 3901	Ebony and Silver model no. 3902
--	---	---

"High fashion"  
packaging.  
Attractive,  
convenient,  
Ideal for  
display.



**CHANNEL MASTER CORP.** ELLENVILLE, N. Y.

the world's largest manufacturer of television antennas and accessories.

Copyright 1955, Channel Master Corp.

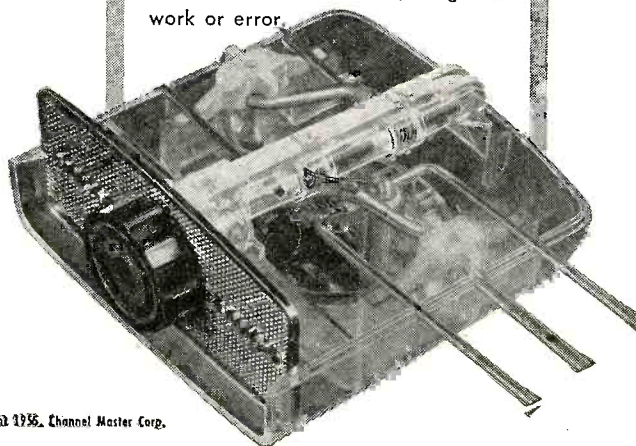
what makes the  
"Showman" different?

## FABULOUS "METRO-DYNE" TUNING!

### The Metro-Dyne 12-Channel "Variable Inductance" Tuner

Ordinary switch-type antennas work by connecting various elements into different combinations. METRO-DYNE tuning, on the other hand, is "variable inductance" tuning, using the same tuning principles as any TV set. It is the first broad band antenna which can be tuned to a specific channel so that it exhibits the band width characteristics of a single-channel Yagi. This selectivity cuts down tremendously on "electronic noise" and interference. A built-in auto transformer maintains a constant 300 ohm impedance match.

**EASY OPERATION:** the Showman is calibrated by channels. Just turn it to the same channel number as the TV set. No arms to adjust; no guess-work or error.



sociation, A. M. Haas who is President of the Television Contractors Association, Ray Cherrill who is President of the Northeast Television Service Dealers Association, William Morrow who is President of the Service Dealers Association of Delaware County and William Poole who is President of the Philadelphia Radio Servicemen's Association. There you have it—in one community such as Philadelphia there were no less than 5 separate and district Service Dealers' Associations' presidents present; and we happen to know that there are several other associations in that area whose executive officers were not in the photograph.

We know not how many service firms and servicemen are members of this array of Philadelphia associations nor do we know how many of those service firm operators maintain membership in more than one of the associations involved. But we cannot help but think that there are simply too many Service Dealers' Associations in some cities and that if they could all pool their resources and efforts, one large association could undoubtedly be much more effective.

We have always been of the opinion that every serviceman, whether or not he is the owner of a shop or an employed technician, should be affiliated with some association. We further advocate that all of these different associations should collaborate with one another. But when there are too many small associations concentrated in one area, and when each group endeavors to go their separate ways, then the purpose of the association itself falls short of its goal.

## ASSOCIATION NEWS

[from page 7]

### Texas Electronic Association of Houston, Texas

The Bayou City will play host to more than one thousand Texas Radio and TV technicians and their families, who will converge on Houston for the Fourth Annual Texas Electronics Association's Clinic and Fair to be conducted at the Rice Hotel for three days.

W. A. Galbreath of Houston, who is



President Van J. Roark (left) and 'Bill' Galbreath, chairman of the Texas Electronics Assoc.

Executive Chairman of the Clinic and Fair, confirms that the keynote address, "Television—Today and Tomorrow," will be given by Dr. Allen B. DuMont, Chairman of the Board, Allen B. DuMont Laboratories, Inc. Well known electronic industry speakers who will address the Texas technicians include: Arthur L. Chapman, Vice President in Charge of Operations, Sylvania Electric Products, Inc.; T. B. Kalbfus, General Sales Manager, Television-Radio Division, Westinghouse Electric Corporation; J. B. "Kip" Anger, National Sales Manager, Radio and Phonograph Division, Motorola, Inc.; W. L. Parkinson, Manager of Products, General Electric Company; Dorm Israel, Executive Vice President in Charge of Engineering, Emerson Radio and Phonograph Corporation and many others. The various speakers will cover every branch and every operation of the electronics business.

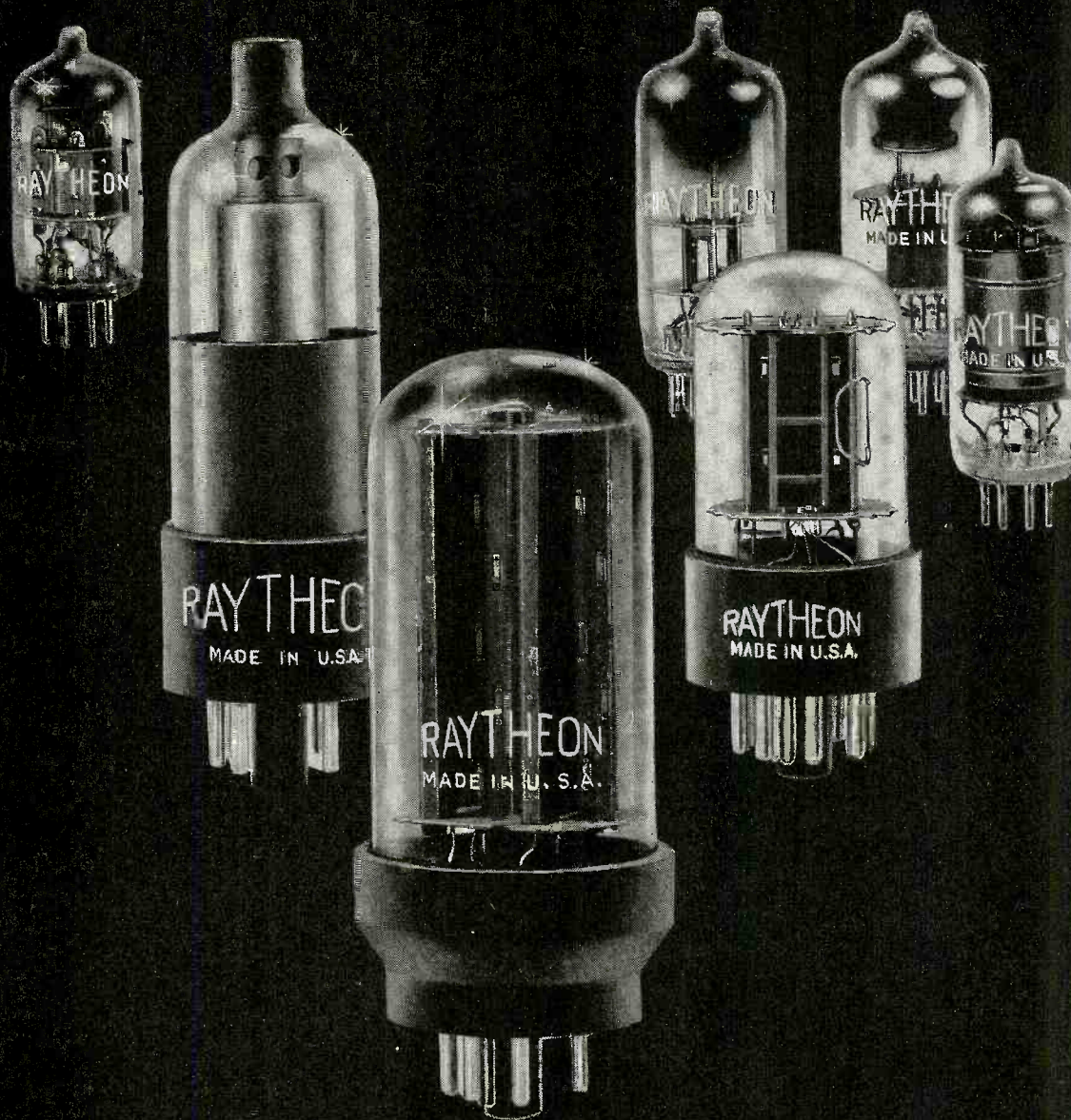
### Society of Radio & Television Technicians (SRTT), Van Nuys, Calif.

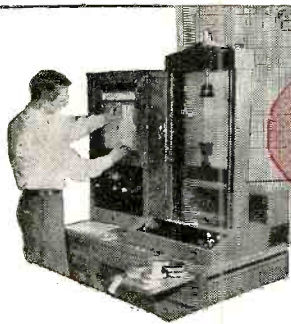
In a ceremony which will follow a dinner, the members of the SRTT will formally take possession of a Dynamic Color Demonstrator. At the same time



# RAYTHEON TUBES

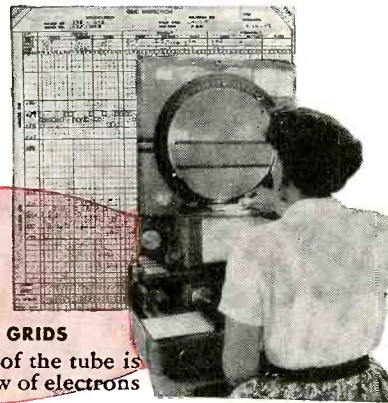
are the best you can buy...





#### INSTRON WIRE TESTING

Testing of grid lateral and filament wire on the Instron Tester for specified physical properties as tensile strength, yield point, breaking point and proportional limit insures better tube quality and uniformity for Raytheon tubes.



#### COMPARATOR INSPECTION OF GRIDS

One of the most critical parts of the tube is the grid which controls the flow of electrons to the plate.

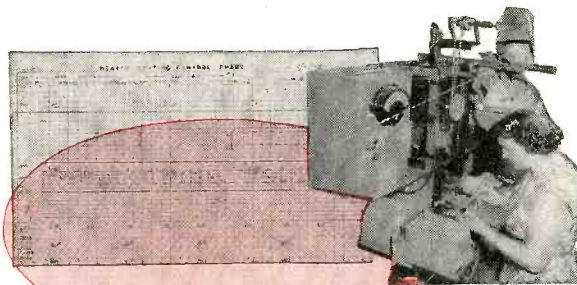
Continuous comparator inspection of critical parts such as the above grid (magnified 20x) supplies information for better quality control and guards against deviations from Raytheon's high quality standards.

# here's why



#### WEIGHING CATHODE COATING

The weight and O.D. of the cathode coating are controlled by periodic measurements with precision instruments. Here, an operator is checking the weight of cathode coating at the operation.



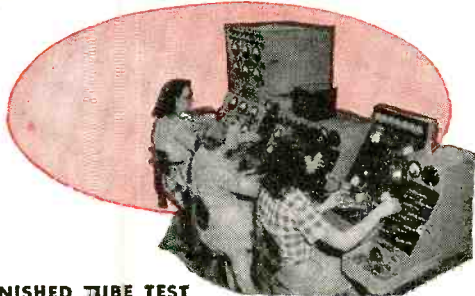
#### HEATER COATING CHECK

Heater wire must have uniform and closely tolerated coating thickness to insure short and uniform warm-up-time and durability. Raytheon makes continuous inspections of the heater wire coating to make certain of uniformity.



#### LIFE TESTING

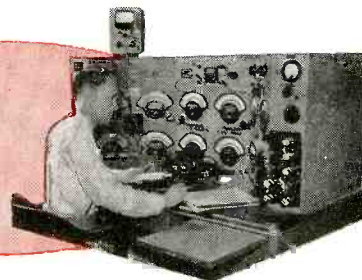
Representative tubes of all tube production lots are put on life test which measures tube performance under simulated actual conditions to ensure original and continuing performance of Raytheon tubes.



#### 1ST FINISHED TUBE TEST

All Raytheon tubes undergo a rigid 100% First Test where they must pass strict requirements on both physical and electrical characteristics.

These girls are testing tubes for excessive noise and microphonics, inoperative tubes, specified electrical characteristics and physical appearance.



#### ENGINEER CHECKS DESIGN CHARACTERISTICS

Behind all these quality activities stands a large group of experienced, capable engineers whose sole concern is maintaining and developing Raytheon tube quality performance. This engineer is measuring tube design characteristics with the purpose of developing a tube for a customer with special applications.

These and many other vital tests and checks add up to  
**UNIFORMITY OF CHARACTERISTICS THROUGH RIGID QUALITY CONTROL**

### RAYTHEON MANUFACTURING COMPANY

Receiving and Cathode Ray Tube Operations

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

Raytheon makes all these: { Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes and Transistors, Nucleonic Tubes, Microwave Tubes.



the color training schedule for the coming eight months will be released to the membership.

One means of group study is to use some form of mockup, or in this case the Dynamic Color Demonstrator. More than a thousand man hours were consumed in building this unit. More than a thousand people saw their first color television program on its screen, and several hundred servicemen received



Left to right are Bob Albright, S.R.T.T. Pres. Arnold J. Meyer, Andy Futchik and Stan Auerback.

their first training on this set, while it was in possession of Dean Electronics, by whom it was built.

#### Radio Television Servicemen of New York (ARTSNY)

As reported by the ARTSNY News: "Sam Marshall, Editor of Service Dealer and Electronic Servicing and well known author, teacher, and lecturer will present the first lecture lesson in Color TV on Wednesday, October 17, 1956 at 8:00 P.M. "This series will continue for almost 12 months and will be an education in the understanding and servicing of Color TV. This first lecture is free for all members and non-members.

"For the first time in the servicing industry, ARTSNY will obtain the most comprehensive and informative picture of the average Radio-Television Dealer and Technician ever gathered. The complete report, when ready, will be published in leading industry newspapers and publications. This information will be available from ARTSNY upon request in booklet form. The data gathered will enable ARTSNY to continue to formulate plans to provide higher standards and professional standing for the service technician and dealer.

[continued on page 38]

In this initial installment the basic requirements of a luminance section are discussed as well as the various types of drive and time delay circuits.

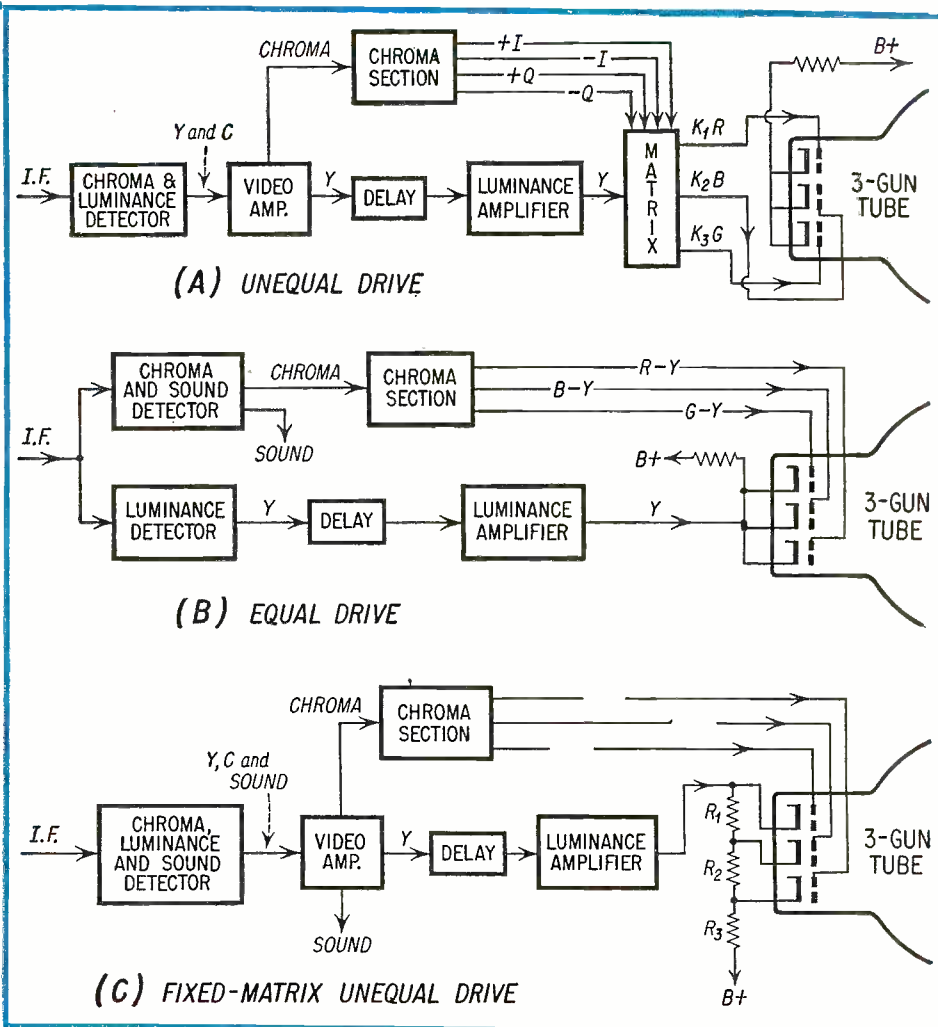
# COLOR TV LUMINANCE SECTION

by BOB DARGAN and  
SAM MARSHALL

From a forthcoming book entitled  
"Fundamentals of Color Television"

## PART 1

Fig. 1—The three basic systems of applying the luminance signal to a color picture tube.



THE luminance section of a color receiver has as its primary function the task of extracting and properly amplifying the video signal information comprising the Y signal and the H and V sync pulses from the composite video signal. These signals are then duly matrixed with the demodulated chroma signals to produce the red, green and blue signals applied to the red, green, and blue guns of the picture tube. In addition, the luminance amplifier plays a major role in the *age* system, and in the H and V sync system.

### Luminance Output Systems

The block diagrams of Fig. 1 illustrate three basic systems of applying the luminance signal to the picture tube. In (A) we observe an Unequal Drive\* system in which the luminance and color grid voltages are adjusted to provide

an identical beam current vs grid voltage characteristic for all three guns. In this case *unequal* R, G, and B signal voltages are applied to the picture tube to compensate for the unequal red, green and blue phosphor efficiencies. These unequal signal voltages  $K_1R$ ,  $K_2G$ , and  $K_3B$  are adjusted in the matrix output circuit which contains R, G, and B amplifiers for this purpose.

In (B) we observe an Equal Drive system in which the luminance and color signals are matrixed in the tube. In this system the screen and control grid voltages are adjusted to provide red, green and blue gun beam current vs. grid voltage characteristics which result in a *constant* beam current ratio for the *equal* voltage R, G, and B signals applied to the red, green and blue guns. In this manner the unequal red, green and blue phosphor efficiencies are constantly compensated for.

A comparison of the two systems just discussed as shown in (A) and (B) can best be effected by recalling that

the luminous efficiency of the red phosphor is much lower than the blue and green phosphors. For this reason a higher density red beam current is required. In an Unequal Drive system an increased red video signal drive effects this increase. This necessitates a comparatively more expensive video amplifier. In an Equal Drive system the *normal* higher density red beam operation produces a loss in red resolution because the red screen and voltage is operating at a reduced level thereby resulting in a larger spot size and consequent reduced resolution.

In the fixed-matrix Unequal Drive system shown in Fig. 1C, the luminance video signal is matrixed by an external fixed voltage divider and combined with the color signal in the tube. Here we effect a sort of compromise on both systems. The matrix  $R_1$ ,  $R_2$ , and  $R_3$  provides unequal signal drives to the three guns of the picture tube. However, although this system is economical and pushes the video amplifier dynamic

range to the limit, it is not adequate enough to provide the complete unequal signal drive provided in Fig. 1A. Therefore, the gray scale adjustments are not as straightforward as they are in the system of Fig. 1A, requiring, as they do, mutual adjustments of the control grid and screen grid potentials (the latter being a characteristic of the Equal Drive system).

### Y/C Ratio

In our discussion involving the processing of the luminance signal the reader is reminded that the instantaneous luminance/chrominance signal ratio (designated as Y/C) which is present in the transmitted signal is assumed to be maintained within an allowable variation of 1.5 db up to the input terminal of circuit where both signals become separated. Referring again to Fig. 1 this would be the final *if* amplifier output circuit in (A), and the video amplifiers in (B) and (C).

\*See July and August 1955 issues of Radio-TV Service Dealer, "Color Output Systems."

Following the separation just referred to, the Y and C signals are processed in their individual sections. The end result of this processing is a recombining of the Y signal and the color signals in the manner shown in Fig. 1. In (A) and (C) the Y signal combines with the color-difference signals to produce R, G, and B. In (B) the Y signal combines with the I and Q signals to produce R, G, and B. In all of these processes the instantaneous ratios of Y, I/Q and R-Y, B-Y, G-Y when applied to the matrix must be the same as those developed at the transmitter. Unless these ratios are maintained the reproduced picture areas will not be correct in hue and saturation.

#### Bandwidth and Response

The response of the Y section should be flat up to about 3.1 *mc* after which it should taper off gradually so that at 3.58 *mc* its response should be about 20 db down. If this taper is too sharp annoying overshoots might result on sharp contrast transitions. This characteristic will assure maintenance of the Y/C ratio for the high as well as the low video frequencies.

The attenuation of the subcarrier is necessary in order to prevent subcarrier interference of the Y signal. The effects of the latter are one or more of the

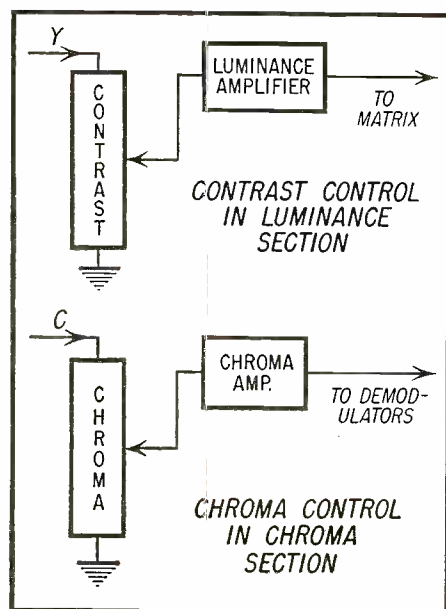


Fig. 2—Method of controlling contrast utilizing a separate control in the luminance channel. A separate control is employed for adjusting chroma.

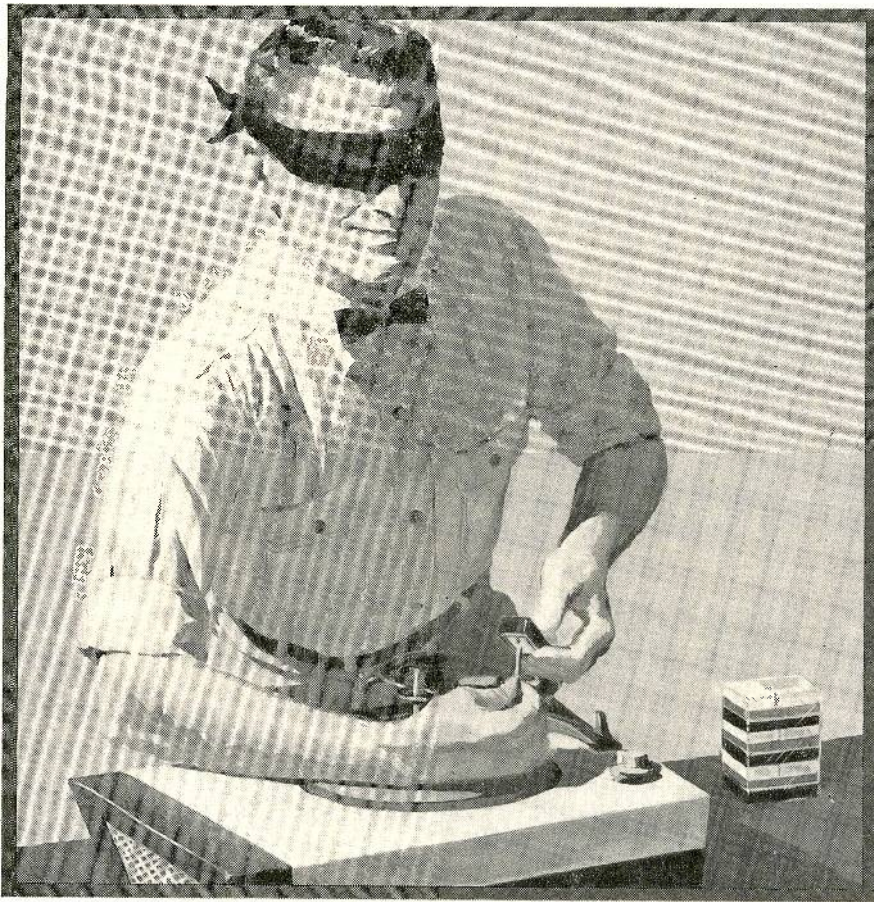
# ON SEPTEMBER 1<sup>ST</sup>, JFD ANNOUNCED TO THEIR DISTRIBUTORS A SPECTACULAR NEW NCB\* COLORTENNA<sup>®</sup> PROFIT-PACKAGE FOR YOU, THE SERVICE DEALER.

This publication went to press before its completion.

The NCB\* COLORTENNA<sup>®</sup> PROFIT-PACKAGE is now available at your JFD antenna distributor.

It will be well worth your while to see it before stocking up on any antennas.

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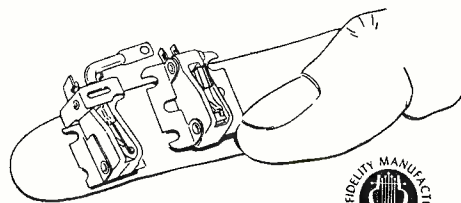


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## SONOTONE CORPORATION

ELMSFORD, N. Y.

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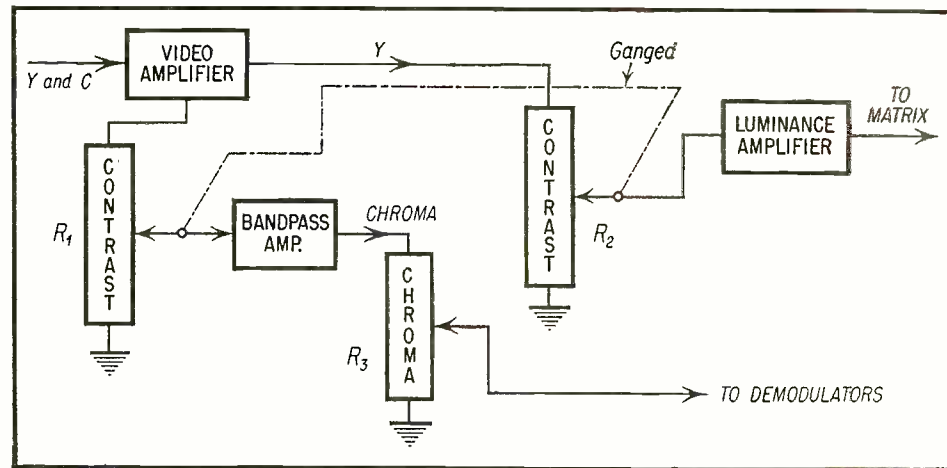


Fig. 3—A method of contrast control using a ganged dual control, one in the video amplifier, the other in the grid circuit of the luminance amplifier.

following: (1) a dot pattern referred to as "subcarrier dots," (2) a crawling dot structure along the colored edges caused by the subcarrier sidebands, (3) a de-saturation of the colored areas due to non-linearity of the picture tube's characteristic curve. In this case the swing of the 3.58 mc subcarrier around any operating point produces a greater light output increase during positive 3.58 mc signal excursions than a light output decrease during negative signal excursions. The net result is an increase in light output with its concomitant effects of desaturation, that is the Y component apparent to the eye becomes greater than the proper amount for the available chroma signal.

### Contrast Control

The contrast control when referred to the luminance section in one type of receiver as shown in Fig. 2 controls the amount of Y signal applied to the picture tube. It may be located in the grid circuit of the luminance amplifier or in the cathode circuit. When located in the grid circuit it functions as a low impedance signal level control. When connected in the cathode circuit it varies the gain of the tube and hence the output level of the Y signal.

Shown also in Fig. 2 is the general manner in which the chroma control is connected up in the chroma section. Recalling that the instantaneous ratio of Y/C must be maintained, once these controls are adjusted for an initial balance contrast and hue, any desired change in contrast must be followed by a suitable readjustment of the chroma

control otherwise the reproduced saturation will be affected.

When a contrast control is connected in the cathode circuit of the luminance amplifier it is necessary that the variation of the resistance in the cathode shall produce a satisfactory variation of stage gain. This means that for any setting of the control the cathode impedance shall not be a function of frequency for the Y pass band (0-3.1 mc). Such a set of conditions requires maintaining a constant cathode to ground impedance at a given setting of the control for the complete range of video frequencies being handled. This requires minimizing shunt capacitance effects in this circuit. It also requires that care be exercised with regard to lead dress.

Another system of contrast control, utilizing a dual contrast control, one control in the video stage which controls the amount of C fed into the band-pass amplifier, and the other control in the luminance section which controls the amount of Y fed into the luminance amplifier is shown in block diagram form in Fig. 3.  $R_3$  is a separate chroma controls which in conjunction with  $R_1/R_2$  provides the correct color saturation. Notice that for a given setting of  $R_3$ , if a change in contrast is desired then by varying  $R_1/R_2$ , the chroma amplitude is changed along with the Y signal amplitude. Thus, if it is desired to increase the amount of contrast in the picture both the Y signal and the C signal will increase without upsetting the Y/C ratio and without recourse to readjustment of the chroma control. Of course, it is necessary that  $R_1$  and  $R_2$  be designed to track correctly over the



complete range of the contrast control.

In defense of the system of Fig. 2 utilizing separate controls, such a system is more economical. Furthermore, should there be a condition where the antenna system produces a deterioration of the chroma signal due to frequency discrimination, one merely turns up the chroma control at the expense of luminance, and the correct ratio will be restored.

### Delay Equalization

The Y section is a broadband circuit as compared to the C section which is relatively narrow banded. The more narrow-banded a circuit is the greater is the delay given to the signal passing through the circuit, that is, a wideband circuit has relatively more delay.

Figure 4W illustrates how a square wave from a square wave generator retains its form as it passes through a broad band filter. Fig. 4X shows how the square wave appears after its passage through a narrow band filter. The delay and deformation of the wave is clearly shown.

Assuming that wave (A) in Fig. 4W  
[Continued on page 47]

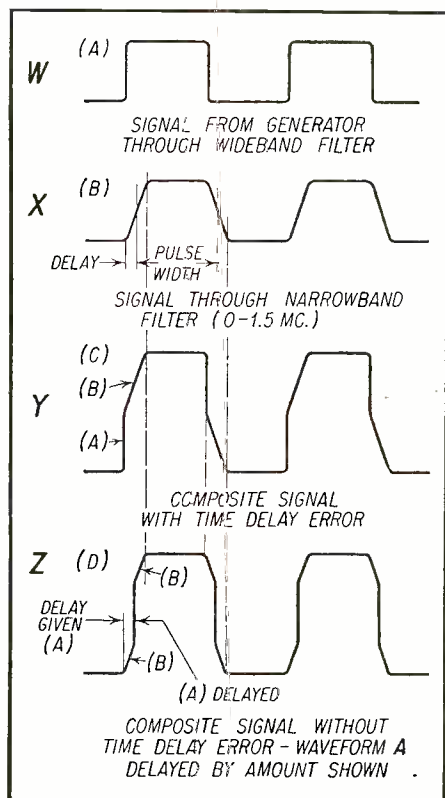


Fig. 4—Voltage waveforms corresponding to a signal with and without a time delay error.

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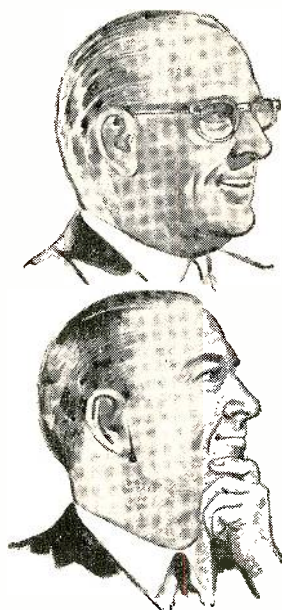
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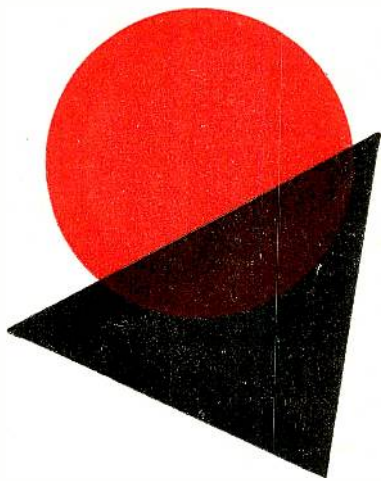
Over the past 41 years, millions upon millions of BUSS fuses have been used in homes, industries and on farms. As a result, BUSS is the known brand of fuses—accepted by the trade and consumer as the finest available. This means sales are easier to make because BUSS quality is never questioned.



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(Div. McGraw Electric Co.)  
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# **There's Profit In Electronic Servicing**

by **ALLAN M. FERRES**

**A**RE you, as a service technician, overlooking an excellent source of income? You are, if you are not servicing communications equipment. Few technicians realize the tremendous growth of non-entertainment and non-amateur radio. By going into the field, you will be engaged in a rapidly expanding branch of electronics which will offer a direct increase in income and furnish valuable contacts to obtain additional radio and television service jobs.

The type of communications work most attractive to service technicians is the maintenance and adjustment of equipment used in what the government designates as "Safety and Special Radio Services."

These services include not only such well known activities as police and fire department, taxi and small boat radio, but also industrial radiolocation, motion picture, relay press, highway maintenance and urban transit installations, and many others.

United States Government figures for January 1st, 1955 show that there were approximately 600,000 transmitters that could well be serviced by trained radio and television technicians. As there are usually more than one receiver for each transmitter, the total amount of equipment involved is extremely impressive. It is also interesting to note that the number of applications from the public to install and use such radio facilities is increasing steadily each year.

\*The material contained in this article was obtained with the cooperation of the Cleveland Institute of Radio Electronics, Cleveland, Ohio.

### **Technicians Must Be Licensed**

In order to reduce interference among the large number of transmitters, and to insure proper use of the assigned frequency channels, the Federal Communications Commission requires that each transmitter meets certain technical specifications and be licensed for its particular class of service. Although some equipment, such as taxicab radiotelephone, can be operated by non-technical personnel, each trans-

class license is sufficient for most of the work a the service technician must hold either a second or a first class radiotelephone operators license. The second mitter must be maintained and adjusted by technicians having certain professional qualifications. To insure that maintenance is handled by properly qualified men, the FCC issues licenses to technicians, and it is required by law that only such licensed technicians service these transmitters.

In order to meet the government requirements,

### **Typical Questions Asked on Radio Operator Examinations**

#### **Element One**

#### **Basic Law**

1. Is the holder of a radiotelephone third-class operator permit authorized to make technical adjustments to the transmitter he operates?
2. Are radio stations subject to inspection by the Federal Communications Commission?
3. How may necessary corrections to the log record be made?

#### **Element Two**

#### **Basic Operating Practice**

1. How can the radiotelephone installation be tested?
2. What precautions should be taken when a radio station is left unattended in a public place?
3. Is it good practice to shield the microphone with the hands when speaking into a microphone in a noisy location?

#### **Element Three**

#### **Basic Radiotelephone**

1. Name four conducting materials in the order of their conductivity.
2. Draw a simple schematic diagram of a radio frequency doubler stage, indicating any pertinent points which will distinguish this circuit as that of a frequency doubler.
3. Neglecting distributed capacitance, what is the reactance of a 5 millihenry choke at a frequency of 1000 kilocycles?

#### **Element Four**

#### **Advanced Radiotelephone**

1. What are the advantages and disadvantages of class B modulators?
2. In a class C radio frequency amplifier, what ratio of load impedance to dynamic plate impedance will give the greatest plate efficiency?
3. During 100% modulation, what percentage of the average output power is in the side-bands?

technician is likely to under take. However he will find it worth the additional effort to obtain a first class license if only for its prestige value and as proof of his higher professional qualifications. The first class license requires more specialized technical knowledge, but the second class licensee may be upgraded to first class at any time by taking a short additional examination.

### How a License Is Obtained

In order to obtain a license, the technician must report to an FCC office and pass a written examination. The ability to speak and understand English and United States citizenship is also required. A license is valid for five years, and under the present regulations, may be renewed without further examination.

The second class license examination consists of three sections or elements. Element one consists of 20 questions on laws and regulations with which every radio operator and technician must be familiar. Element two has 50 questions on radio operating procedures and practices generally followed or required in radiotelephone communications. Element three is made up of 100 questions on technical and legal matters concerning radiotelephone equipment other than broadcast.

The first class examination includes these three sections plus one additional one with 100 questions on technical and legal points particularly applicable to broadcast stations.

None of the questions requires an essay or explanatory type of answer. They are either of the multiple choice type or they involve drawing or cor-

recting a simple diagram or doing a short mathematical problem. No code tests are required for either of the radiotelephone licenses, nor are there any age restrictions.

### Preparing for a License Examination

A service technician who now handles radio and television work should have no difficulty in being able to acquire the additional knowledge necessary to pass a license examination. Most communication equipment is no more complicated than the circuits with which he is already familiar. Additional studying will probably be required, however, on rules and regulations and on specialized transmitter circuits and adjustment procedures.

There are several ways to prepare for the examination. One is to use a copy of "Study Guide and Reference Material for Commercial Radio Operator Examinations" issued by the FCC. This booklet contains several hundred questions of the type used on the examinations. With this book as a guide, answers to the questions can be looked up in various textbooks and in pamphlets containing the current rules and regulations. Generally this is unsatisfactory as the necessary information is scattered among a number of books which may be difficult to locate.

The use of "How to Pass" books which list typical questions and answers is somewhat more satisfactory. This type of book may be of value as review material, however, merely memorizing the questions and their answers found in it will not guarantee the passing of an examination. The best procedure is to take advantage of courses made available in schools.

In almost all large cities there are technical schools which offer courses designed to train students to pass radio operator examinations. If the service technician is near a good school and can take enough time away from his place of business to attend regularly, the course should be well worth the tuition fees charged. However, as technicians now in business have a good practical knowledge of electronics and servicing procedures, and have a very few hours each week to devote to the subject, a home study course offers an excellent method of obtaining a license. These courses have an advantage in that they can be worked on at convenient hours, and time need not be lost going over subject matter with which the technician is already familiar. A good course will furnish all the material necessary for the preparation for the examination and no time will be wasted in looking up obscure points in hard-to-obtain reference books. With a radio and television servicing background, no technician should have any trouble in passing the second class license test after a few months of part-time studying in one of these courses.

A typical example of a school already recognizing the need for such a course is the Cleveland Institute

### Transmitters Authorized to Operate in Activities of Interest to the Radio and TV Service Dealer as of January 1, 1955

Class of Station	Land or Fixed	Mobile	Total
Civil Air Patrol	2,973	6,995	9,968
Agriculture	9		9
Forest Products	758	8,935	9,693
Industrial radiolocation	83	140	223
Low power industrial		8,469	8,469
Motion picture	19	351	370
Petroleum	4,772	24,607	29,379
Power	5,849	69,706	75,555
Relay Press	40	918	958
Special Industrial	4,479	51,136	55,615
Automobile emergency	317	3,499	3,816
Citizens		21,300	21,300
Highway truck	728	10,941	11,669
Intercity bus	50	918	968
Railroad	1,125	22,780	23,905
Taxicab	4,314	92,572	96,885
Urban transit	82	2,348	2,430
Ship group (estimated)		40,000	40,000
Fire	1,590	28,916	30,506
Forestry conservation	2,675	23,281	25,956
Highway maintenance	894	11,170	12,064
Police	6,929	118,682	125,611
Special emergency	1,477	5,424	6,901
Totals	39,163	553,088	592,251

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## THERE'S PROFIT IN ELECTRONIC SERVICING

[continued]

of Radio Electronics, in Cleveland, Ohio. The course it offers includes material that at one time or another has appeared in the various FCC examinations. Many of their graduates are now engaged in responsible positions in the communications field.

The communications equipment field

is a large one and is rapidly expanding. A licensed technician with maintenance contracts with business organizations using the equipment will have a fine opportunity to develop a year-round income from the field which can also offer new contacts for additional radio and television service work. ■■

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# RIDER SPEAKS



by JOHN F. RIDER

"Dean of America's Radio Servicemen"

A LETTER sent to us by a midwestern TV technician contained a very interesting question. He asked, "Do you think that TV servicing was helped or hurt because many in the business considered it to be a profession?"

The answer is not a simple "yes" or "no." The question involves many facets of action on the part of the individual concerned, and a comparison of results founded on either viewpoint is extremely difficult. To treat all of them in one issue of this magazine is impossible.

All we can do is to express our own thinking, with which the reader may or may not agree. Personally, we believe that as far as the overall result is concerned, the servicing industry has suffered because of the attempt to give it a professional status. This does not deny the importance of the technical background which is needed to do TV servicing. Neither are we attempting to lower in any way the stature or dignity of the servicing activity, or to establish it on a basis which would reduce income.

The hurt which we think has occurred to the servicing industry and its personnel over the years from the "professional status" mental attitude has taken many forms. The comparison between the TV technician repairing an ailing receiver and the physician helping an ailing person has not been a judicious one; it has brought on disillusionment and discouragement. The public never could see it that way and

never accepted it. There is nothing wrong in thinking as a professional, provided that it is not at the sacrifice of something else. We believe that the professional status thinking hurt the industry because it reduced the amount of time devoted to the consideration of the commercial requirements. Many organizations consist of professional people, but no matter how dedicated they may be to the profession, the profit motive is kept in the forefront because the business cannot survive otherwise. The large law firms and accounting firms and engineering firms exemplify this.

Proper thinking along commercial lines does not reduce the importance of technical proficiency; in fact it enhances it because it is realized that the greater the competency the more efficient the labors. The servicing industry has not concealed its preference for technology over commercialism. Profitable operation calls for a balance between the two.

If the servicing industry had considered its effort as strictly commercial without any professional thinking at all, it would have gained much and lost nothing. The reason for saying this is in evidence daily. Numerous engineering firms are in business to sell the brain-children of their technical personnel. To do so at a profit, sales rather than engineering must run the business. This does not lessen the importance of technical background and competency—it simply makes the best use of it. The

greater the technical know-how the better for the business, but the fruits of the labors are enjoyed only if commercial motives prevail in the over-all operations of the concern.

All the things which have happened in the servicing industry over the years are not attributable to the professional status thinking. It would be foolish to say they are, but we are attempting to deal here only with the question which was asked.

From our way of thinking every organization which sells a product or a service is a commercial concern. Even those which are tax exempt on the grounds that they are non-profit set prices for their products or services that enable them to break even—they do not take losses. If their cost of operation increases, they increase the price of whatever they sell so that they will continue breaking even.

Every TV service shop owner can consider himself to be a professional if he so chooses. No one can criticize him for it, but if it leads to invalid comparisons with other professionals, then it is not a wise thing to do. If it tends to lead thinking into channels which are contrary to the generally accepted concepts of good business, then it is best to forget the professional thoughts and become thoroughly commercial. Society respects the commercial man as well as the professional.

All the people in the servicing industry didn't think alike relative to professional status. The result was a conflict of ideas. Some thought commercially, and couldn't see eye-to-eye with those who were thinking of the conduct of business along professional lines. In many cases this resulted in loss of the support of successful commercially-minded individuals when any sort of local cooperation among service shops was sought.

It resulted in conflict of ideas in connection with local and state-wide association efforts. Because of the professional status mental attitude greatest emphasis in the training effort by associations was on technology at a sacrifice of commercial ideas. Many men didn't like this because it was not solving one of the major problems—that of setting up conditions that would result in more profitable operation. ■ ■

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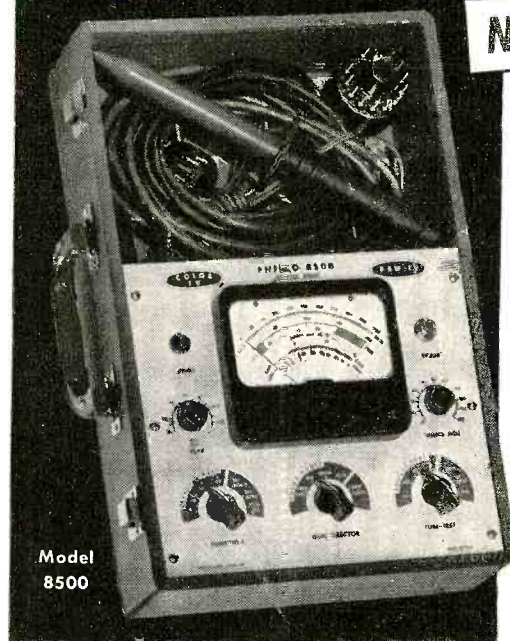
## PHILCO *Service King*

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*Protects customer as well as dealer by emphasizing dangers of keeping old picture tubes.*

*Minimizes unwarranted "charge it" requests. Builds customer good-will with straight forward guarantee statement.*

fact that the set was "just serviced a few weeks ago."

The Picture Tube Release form on the reverse side of Copy #2 can be very important in cases of picture tube replacement where the set owner wants to keep the old one to have it tested to see whether he actually needed a new one. Leaving the "dud" in a customer's possession can be a dangerous practice resulting in injuries to the set owner or his family and you know whom he'll try to shift the blame on if this happens.

Requesting a set owner to sign the Picture Tube Release emphasizes the danger of possessing the tube and causes most set owners to change their mind about keeping the tube. However, if he insists on keeping the tube, his signature on the release makes him the responsible party in any action that might result due to injury from the tube in question.

You may have the idea that the set owner is always responsible because it's his tube, but to clearly understand the possibilities involved, consider these three hypothetical cases.

Let's say that the dealer has put in the new tube and placed the old one on the floor near the set. He goes out to his truck to get a needed part or tube to finish the job, but while he's gone, one of the children breaks the tube by striking it with a wrench or some other object. Is the dealer liable, and has he been negligent? I know you'd hate to find yourself in this position.

Case #2. Mr. Dealer replaces the picture tube and leaves the old one along side the set saying nothing to the set owner about the possible dangers that might result from accidental breakage. He then goes on to the next call. Was he negligent in not informing the set owner of the danger involved and can he be held liable? I'll let you decide that, but I know you'd hate to be in that position too.

Case #3. The job is completed but set owner insists on keeping the picture tube in spite of warning from the service man. Dealer leaves. Accident follows resulting in a costly injury to the set owner or one of his family. It is unlikely to believe that the set owner will try to claim that he wasn't warned about the danger of keeping the tube and try to shift the blame on the service man?

If the set owner had signed the Picture Tube Release, any attempt to hold the dealer liable would be ridiculous.

The Promissory note on the reverse side of Copy #2

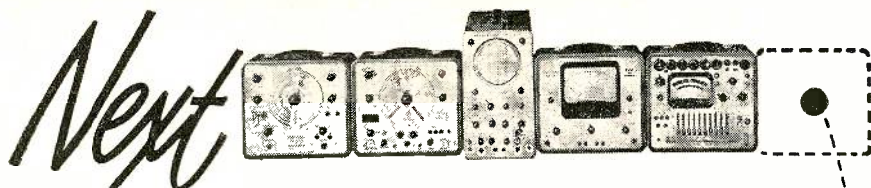
and #3 can help you materially reduce unwarranted "charges." You don't mind "charging" when you know your customer, but you will often be asked to "charge" a service bill by strangers who may not be a good credit risk. Their motive for "charging" in many instances is that Mr. Set Owner has told Mrs. Set Owner, "Don't pay the bill. I want to be sure that the set has been fixed right. Tell him I'll come in and pay the bill in the next few days."

In most cases, this request will be granted because chances are the set has either been serviced in the home or the chassis replaced in the cabinet which puts you in an awkward position and leaves you very little alternative but to "charge" it.

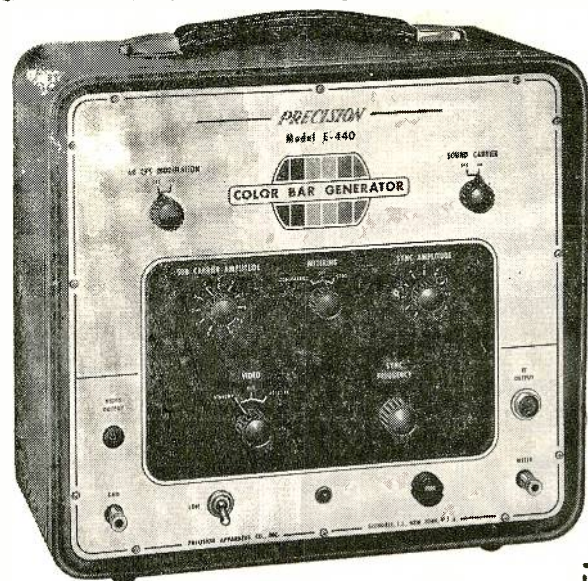
However, if you ask the customer to sign the Promissory Note, saying, "Madam, our terms are C.O.D. and for us to 'charge' a service bill, it is necessary that we have credit references or a credit history on the customer. Where we have no credit information or history, we must ask you to sign the Promissory Note."

Salesbook type form with separate claim checks bound under front cover.

Note completeness of form and space for imprinting or rubber stamping firm name.



**ON YOUR TV SERVICE BENCH...**



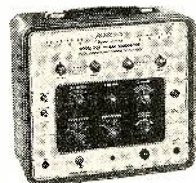
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# THE ANSWERMAN

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BY SERVICE DEALER & ELECTRONIC SERVICING TECHNICAL STAFF

Mr. Answerman:

I have an RCA KCS104F chassis in which there is an intermittent condition. Would you kindly point out which component is most likely to be causing this trouble? I have checked almost everything in the receiver but evidently I am overlooking something.

The intermittent condition is in the horizontal oscillator circuit, in that the oscillator signal cuts out every now and then. The condenser in the grid circuit of the oscillator, C606, has been replaced since this is a frequent failure in this type of oscillator circuit. Also, the blocking transformer has been changed.

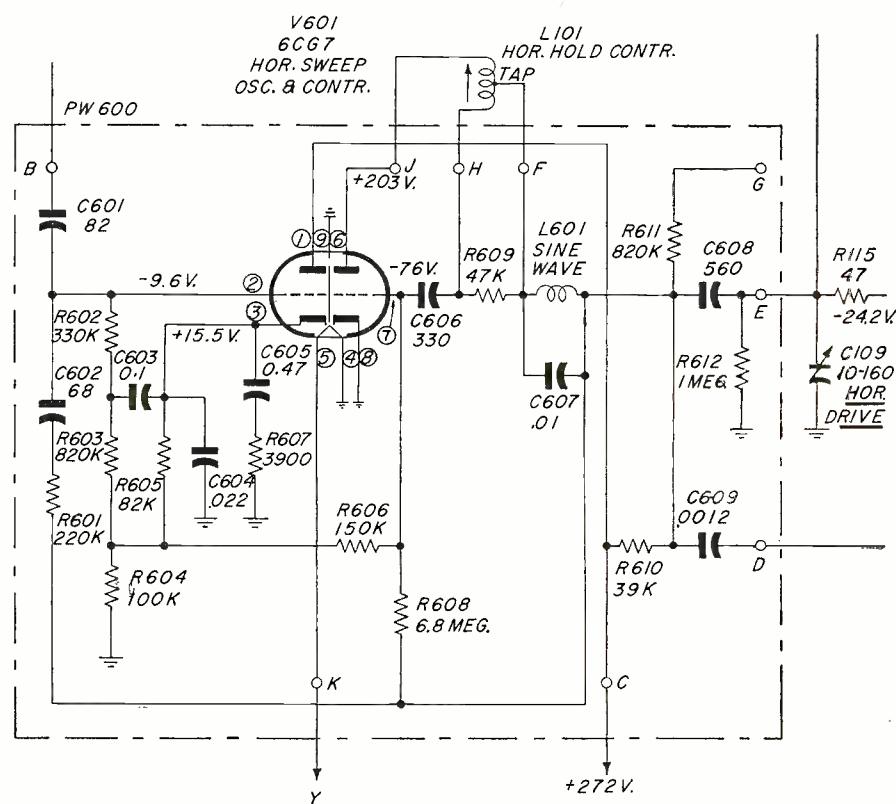


Fig. 1—Partial schematic showing the printed wire panel circuitry of the syncro-guide horizontal oscillator circuit employed in RCA KCS104F chassis.



What do you think I should replace now?

G. S.  
Schenectady, N. Y.

There is one component in the syn-croguide type of horizontal oscillator circuit that will cause a condition such as that described when it becomes defective. The component is C607, the .01  $\mu$ f condenser across the stabilizing section of the transformer, shown in Fig. 1. Frequently, this condenser shorts and causes a loss of horizontal oscillator operation. This little component is often overlooked in troubleshooting for some unknown reason and thus many repairs are delayed. It is suggested that the new condenser have a voltage rating of 600 volts.

On the other hand it has been observed that condenser C607 has in other instances opened up. When this occurs the horizontal lock-in action is not as good as is desired and the circuit is subject to noise disturbances.

Dear Sir:

In a Westinghouse chassis V-2342 I have noticed a slight amount of distortion when the volume control is rotated to a high volume position. The circuit components check out okay.

What might be done to correct this distortion in the audio?

P. L.  
Atlanta, Ga.

The audio amplification system of this receiver employs only a single tube for both amplification and output. As can be observed in Fig. 2 the grid bias

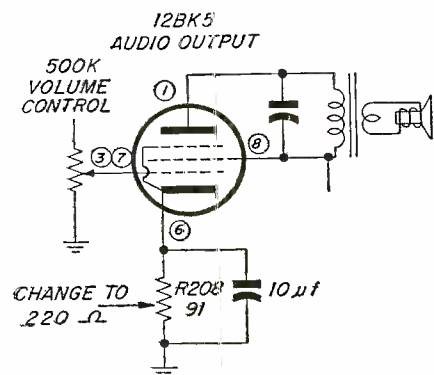
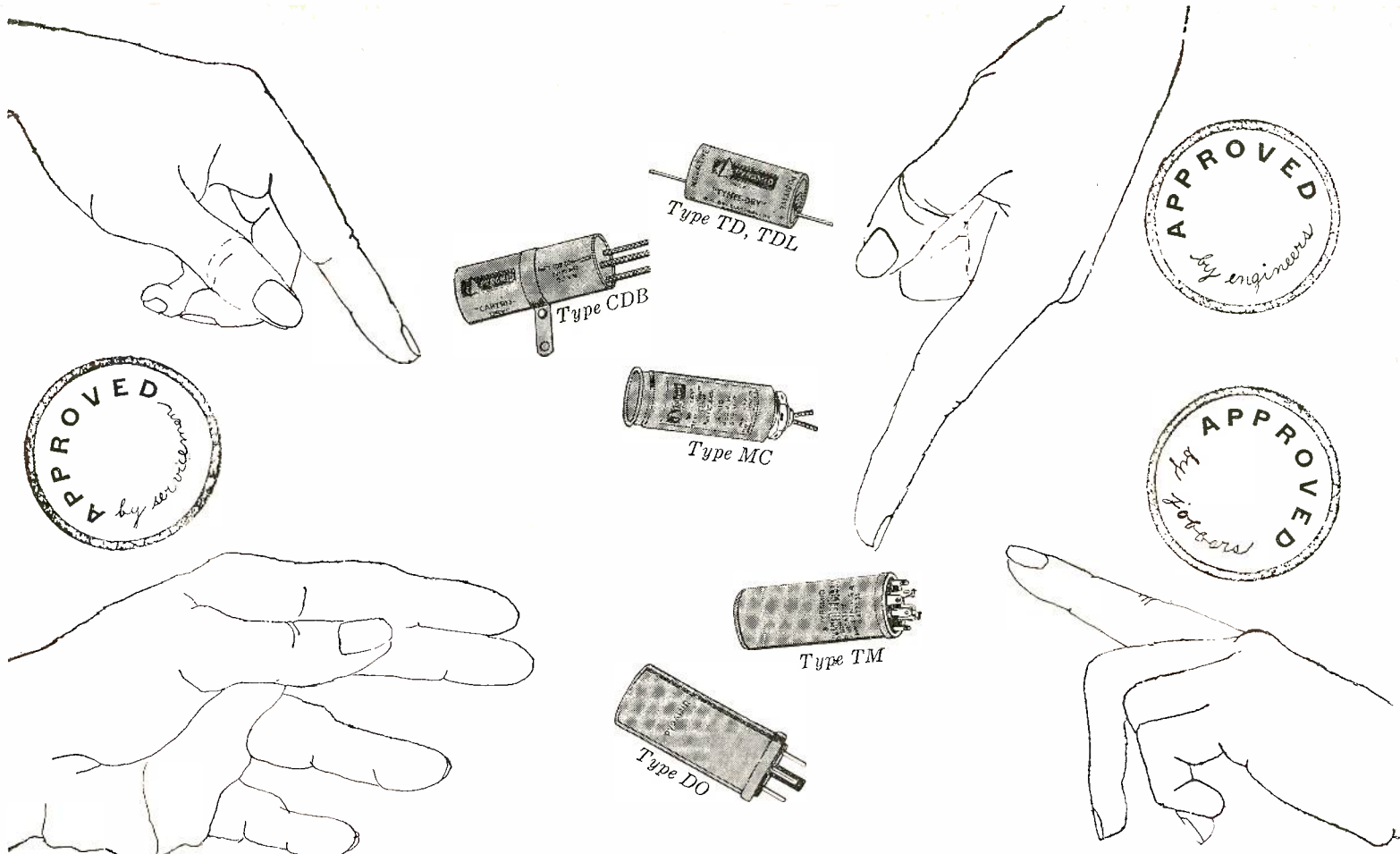


Fig. 2—Partial schematic showing the audio output stage of the Westinghouse V-2342 chassis.



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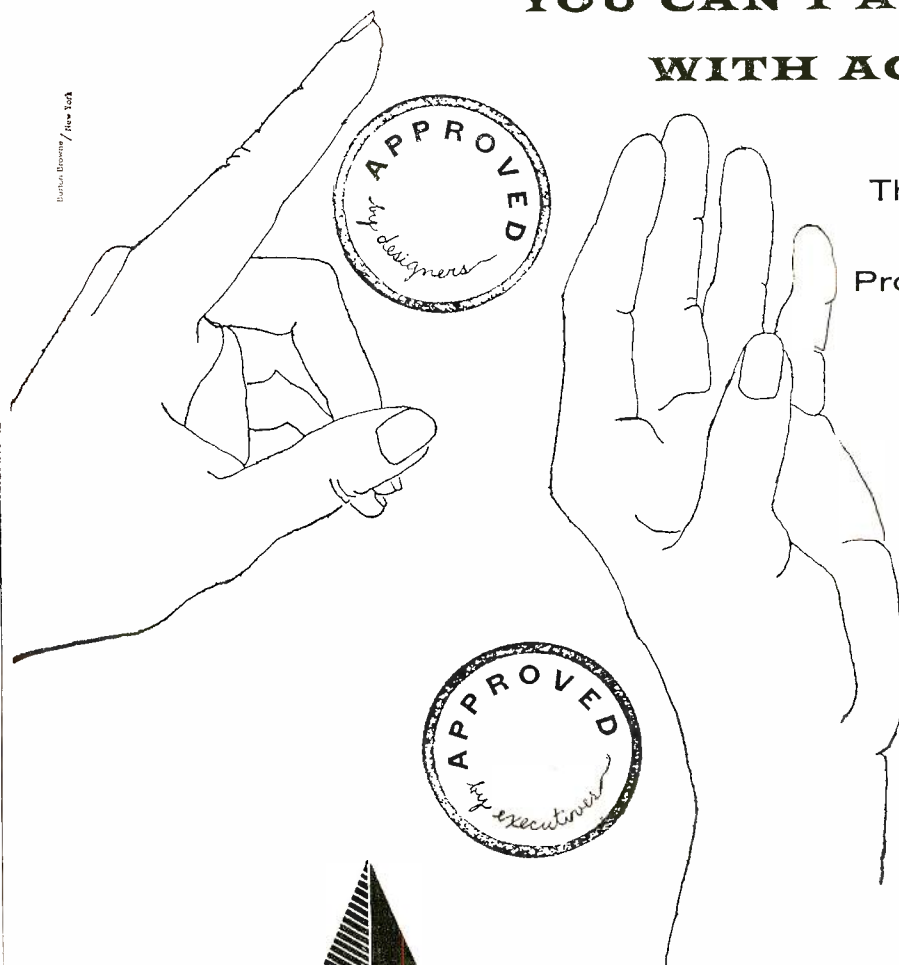
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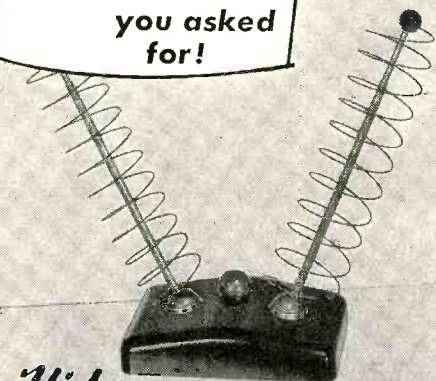
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**NEW INDOOR ANTENNA** that swivels with a gentle touch of your little finger. Dipoles swivel on ball and socket in every direction. Golden spirals and decorative plastic base blend with all furniture. **RECEPTION IS GUARANTEED.** LIST... \$12.95



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for the audio output tube, a 12BK5, is generated by the cathode bias resistor, R208, which is 91 ohms. Very likely this resistor does not provide sufficient grid bias for very large signal swings. Thus, high amplitude audio signals produce saturation in the plate circuit. This distortion condition can also be the result of degeneration in the stage. The distortion can be eliminated by increasing the grid bias and removing the possibility of degeneration in the stage. This is done by increasing the cathode bias resistor from 91 ohms to 220 ohms and bypassing it with a 10  $\mu$ f condenser as shown in Fig. 2.

Dear Sir:

I have recently noticed that tubes such as the 6AU6-A and 6CB6-A are being made available. I would like to know what the difference is between these tubes and the regular 6AU6 and 6CB6 tubes. The filaments of both draw 300 ma. What does the "A" designation mean?

Also, what is the story about the new line of tubes, the 450 milliamper type?

W. T.

Chicago, Ill.

The "A" designation after the above mentioned tubes indicates that they are of the controlled warm-up filament design for employment in series string filament circuits.

In reference to the 450 ma type of tube this is a more recent development for series filament operation also. It was found that although the 600 ma series string tubes were quite satisfactory as far as receiver operation was concerned, they generally required a series dropping resistor to make the total voltage drop equal to the line voltage. To eliminate series resistors or transformers that supplied 90 volts for filament operation instead of using line voltage, the 300 and 450 ma series string type of tube was developed. These tubes permit an improved series filament string arrangement. The new 300 and 450 ma tubes have designed into them the same excellent characteristics as the 600 ma type such as controlled warm-up time and increased cathode to heater insulation but are otherwise identical to their prototype. Some of the latest 1957 TV receivers will use these new series string tubes.

Dear Sir:

I have a strange problem that you may be able to help me with. The customer's complaint is that every now and then horizontal bars will appear in the picture. These bars are not dark, according to the customer's explanation but are evidently full of snow as with a weak picture. I have supplied a sketch (Fig. 3) which the customer agrees is about like the appearance of the bars and their approximate position.

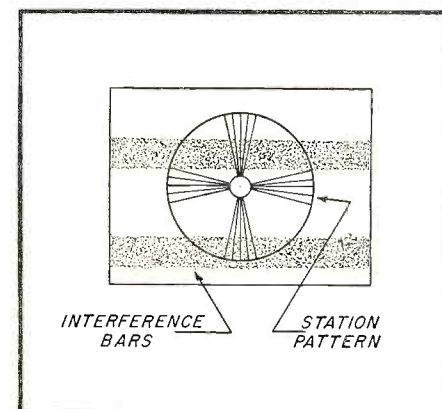


Fig. 3—Interference caused by antenna lead-in being strung in close proximity to a neon lamp.

The strange point about this problem is that I have never witnessed the difficulty when I was at the customer's home during the day and the symptoms didn't show up when the chassis was in my shop for a week.

The interference happens mostly in the evening and not every evening or for the whole period during which the receiver is being watched. It appears on all channels but not on the raster.

Any thoughts you may have will definitely be appreciated.

C. K.

Miami, Fla.

On the basis of your information the problem is evidently local in nature resulting from the pickup of some 60 cycle ac signal in the antenna line. Since the trouble was never witnessed in the shop, I believe it is being introduced into the receiver in this manner, through the antenna system.

Perhaps the best way to consider this problem is in the light of another service company's similar experience. Their interference problem showed up at about the same times as this one and

[Continued on page 39]

# TRADE LITERATURE

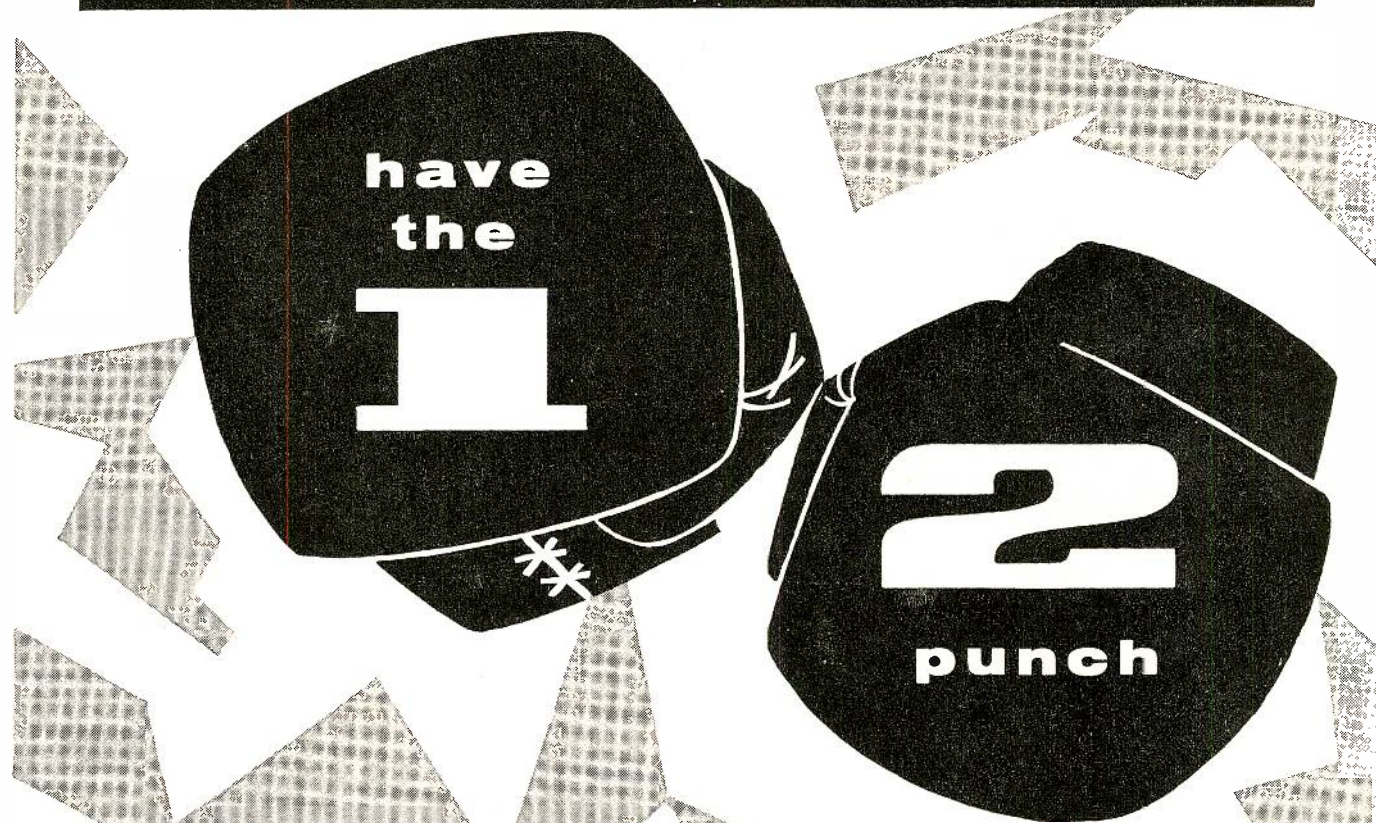
*Picture Book of TV Troubles (Vol. 6) (Horizontal & Vertical Sync Circuits) by John F. Rider Laboratories Staff is Volume 6 of a series of eventually 8 titles devoted to the presentation of troubles in TV receivers in picture form. It deals with two sections of the receiver which are prone to trouble and which can conceivably confuse the technician. The book is practical throughout in that the authors performed the necessary tests to establish the facts presented. The authors have correlated the trouble with the component at fault, and simplified greatly the diagnosis by photographically illustrating the effect of the trouble as seen on the picture tube screen, and by the incorrect signal wave-form. John F. Rider Publisher, Inc. is the Publisher.*

*Audio Control Handbook by Robert S. Oringel is an authoritative handbook for the audio control operator—and for announcers, directors, producers, or all concerned with the techniques of proper audio control in all types of broadcasting. Mr. Oringel gives step-by-step operating directions and, in non-technical language, explains control board equipment, microphones, turntables, tape recorders, tape editing, cueing, playback techniques, program formats, control room communications, remote broadcasts, studio design and construction along with FCC rules and regulations of broadcasting. Hastings House is the Publisher.*

*Transistors in Radio and Television by Milton S. Kiver will give a basic knowledge of how transistors and transistor circuits work and how to service them. It stresses the practical aspects of transistors and their operations, and shows how to coordinate this new information with your own electronic knowledge. Extensive il-*

only

# C·D·R Rotors

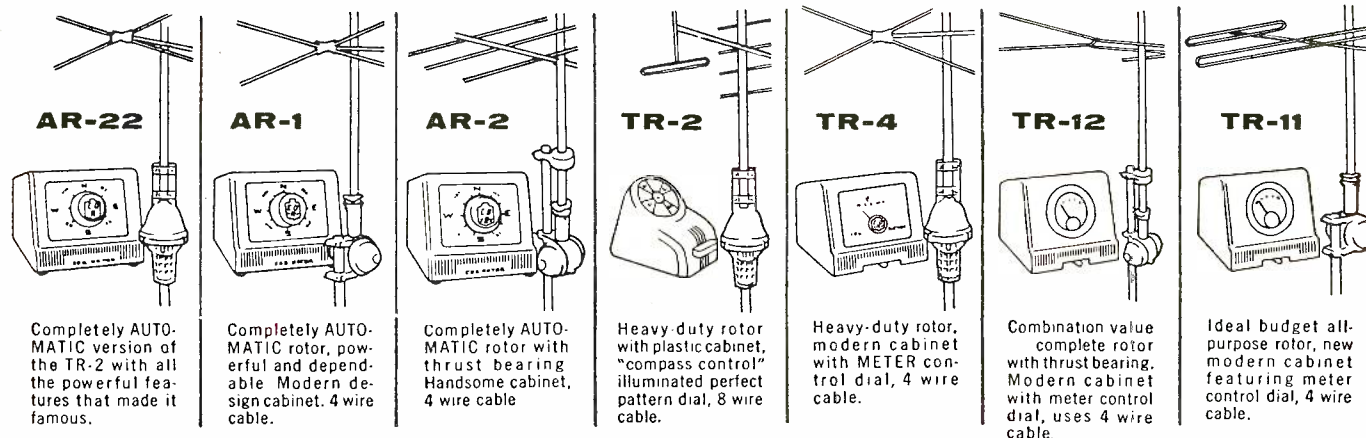


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Completely AUTOMATIC rotor, powerful and dependable. Modern design cabinet. 4 wire cable.

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Heavy-duty rotor, modern cabinet with METER control dial, 4 wire cable.

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Ideal budget all-purpose rotor, new modern cabinet featuring meter control dial, 4 wire cable.



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CLEVELAND 13, OHIO

illustrations, including perspective diagrams, give you a clear insight into the workings of transistors. The book discusses and explains modern electron theory in simple terms, and shows exactly how point-contact, junction and other transistors operate. Published by McGraw-Hill Book Company.

The Howard W. Sams *Color TV Training Manual* is designed to train the monochrome service technician so that he can service color receivers. The

book is divided into three main sections: (1) Principles of the Color TV System, (2) Color Receiver Circuits, and (3) Servicing the color receiver. The first section discusses colorimetry, the requirements of the Composite Color Signal, and the make-up of the color signal. Section Two describes the theory and operation of all color receiver circuits such as the bandpass amplifier, color sync, color killer, demodulators, matrix, the color picture tube and its associated circuits. The servicing section

includes complete data on setup procedure, alignment, and trouble shooting. All material is written so that it can be understood by any technician who is trained and experienced in the servicing of monochrome receivers.

*Superheterodyne Converters and I. F. Amplifiers (Electronic Technology Series)* by Alexander Schure, Ph.D., Ed.D. is Volume 12 in the Rider Electronic Technology Series. It provides a clear explanation of the theory underlying the operation of mixers and converters, and the theory of the *if* amplifier. The various facets of performance and design relating to these portions of the superheterodyne receiver are presented making both the function and design factors clearly understandable. John F. Rider Publisher, Inc.

A 24 page *booklet*, RCA Renewal Products has been made available through RCA distributors or is obtainable directly from Commercial Engineering, Tube division, RCA, Harrison, New Jersey. This booklet covers renewal parts such as picture tubes, semi-conductors, speakers and batteries. Also described are such pieces of electronic test equipment as the RCA color bar generator, the RCA dot-bar generator and many other test instruments and accessories.

A selection chart listing General Electric's 5-Star high-reliability tubes for critical applications now is available from the G-E Tube Department. The chart classifies the 34 tubes, applicable military specifications, heater voltages and currents, and gives average characteristics. The chart (ETD-1276) may be obtained from the General Electric Tube Department, 1 River Road, Schenectady, N. Y.

A new *Technical Manual* describing the complete line of electrical indicating instruments and test equipment has been issued by Simpson Electric Company of Chicago. Profusely illustrated with photographs, wiring diagrams, and dimensional drawings, the 87-page *Technical Manual 17* is printed in two colors on glossy paper. Special indexes make instant reference to any product

easy. The Simpson line of electronic test equipment for radio-TV and refrigeration technicians, and factory analyzers, is described in the second section of the catalog, including new additions designed specifically for color television servicing. Covered in this section are capacitor testers, oscilloscopes, battery testers, line quality testers, multi-range volt-ohm milliammeters, temperature meters, instrument carrying cases, and other accessories.

Comprehensive data on IRC's complete line of resistors and special products is listed in the revised 1956-1957 *Official Resistor Engineering Guide*. Data given includes JAN or MIL Equivalent, Rated Wattage, Standard Tolerances, Temperature Rise, Temperature Coefficient, Maximum Operating Temperature, Ohmic Values Available, Dimensions and Approximate Prices. Write International Resistance Company, 401 North Broad Street, Philadelphia, Pennsylvania, for the *Official Resistor Engineering Guide*.

A replacement guide for printed circuits used in sets made by 95 different TV and radio manufacturers was announced today as the latest of the many service technicians' aids developed by Sprague Products Company. Compact as the other handy manuals in the Sprague family, this 12-page *Printed Circuit Replacement Manual* measures 5½" x 8½". Tables are arranged alphabetically by set manufacturer with original part numbers and descriptions cross-indexed to the recommended Sprague replacements. The back pages of the manual show circuit diagrams of each Sprague replacement, along with values of the resistors and capacitors in each circuit. Copies are available free from all Sprague distributors, or directly from Sprague Products Company, 71 Marshall Street, North Adams, Mass., by asking for *Manual K-350* and enclosing 6¢ to cover postage and handling.

It's easy, positive and profitable to take care of electrolytic capacitor replacements in auto radios by means of the *Aerovox Auto-Radio Replacement Guide Chart* available from the Aerovox distributor or direct from Aerovox

**Always**  
**Specify**  
**Stancor**  
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A-8273	Zenith S-19408 Zenith S-20099	A-8278	Arvin E-40117
A-8274	Zenith S-21317	A-8279	Arvin E-41024
A-8275	Zenith S-22130	A-8280	Arvin E-42721
A-8276	Zenith S-22154	A-8281	Arvin E-24681
		A-8282	Arvin E-41852

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**FREE:** The latest up-to-date  
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log—from your distributor or  
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Corporation, New Bedford, Mass. At a glance, the chart provides trade names, manufacturers' part numbers, AFH (twist-prong electrolytic) catalog numbers, capacitance values, voltages, sizes and list prices for every popular auto-radio on the market. Listings are arranged by make of auto-radio.

Just off the press is a colorful new 80-page catalog describing thousands of radio-television service aids. The orange-and-black brochure is "largest in our history," says the publisher, General Cement Mfg. Co., Rockford, Illinois. Among the new products included for the first time are G-C "Klipzon" self-holding prods and connectors, printed circuit repair kits, and phono drive kits. Copies of the catalog (No. 157) are available without charge through leading parts distributors everywhere or by writing direct to General Cement Mfg. Co., (Division of Textron Inc.), 919 Taylor Avenue, Rockford, Illinois.

The 1956 edition of Triad Transformer Corporation's *Television Replacement Guide* has just been released. The new catalog lists Triad Correct Television Replacement Transformers for more than 100 television set manufacturers and over 6000 models. Copies of the new catalog, TV-56, are available from Triad jobbers, or may be obtained by writing to Triad Transformer Corporation, 4055 Redwood Ave., Venice, California.

The Merchandising Department of Electronic Products Sales, Sylvania Electronic Products Inc., has announced its booklet "A Guide to Good Business" is now available. With chapters compiled by company researchers and members of the Merchandising Department, the booklet devotes sections to such vital phases of the dealer's operations as original planning; surveying market conditions; selecting the best location; window displays; arrangement of service areas; stock and inventory control; insurance; hints on courtesy; analyzing earning power; accounting procedures; legal aid; selling service, and many other helpful hints for the new or prospective electronic service dealer. The booklet is free and may be obtained from Syl-

vania's authorized distributors or by writing to the *Sylvania Central Advertising Distribution Department, 1100 Main Street, Buffalo, N. Y.*

59 new components for use in transistor circuits, have just been announced by Eugene D. Powers, Executive Vice President of Thordarson-Meissner, Mt. Carmel, Illinois, manufacturers of transformers and coils. 36 audio transformers, 10 if transformers, 7 ferrite antenna coils, 5 oscillator coils, and 1 midjet variable condenser, are included.

*Servicing TV Sweep Systems*, by Jesse Dines. Howard W. Sams & Co., Inc. Publishers. This book is a comprehensive text dealing with various types of TV Sweep Systems in down-to-earth language, profusely illustrated with waveforms, components and diagrams that provide the reader with an excellent background on the operation of TV Sweep Systems.

Harry G. Cisin, Publisher provides 3 new booklets entitled *Admiral TV Trouble Indicating Tube Location Guides 1948 to 1956*. Each guide shows the position and type numbers of all tubes and indicates the effect of each tube on the operation of the set.

*TV and Radio Tube Substitution Guide* for the replacement of defective tubes in TV sets, radios and other electronic equipment. All tubes suggested for substitution have characteristics similar to the tubes they are to replace and will fit in the same socket without requiring changes in wiring.

*New 1956 Models TV Trouble Tracer*. Contains tube charts of 1200 models with 40 common TV troubles illustrated and causes and remedies.

*Simplified Radio Servicing by Comparison Method*, by M. M. Beitman, Supreme Publications. A simplified technique of radio repairing. Permits checking of parts and circuits quickly without any special testers. Contains a wealth of information in the form of charts and basic information sheets on various subjects particularly of interest to the beginner.

A completely new Stancor Transformer Catalog has been published by Chicago Standard Transformer Corporation. Included is a reference listing of exact replacement flybacks arranged by original manufacturer and original part number. This new *Stancor Catalog No. S-102* is available without charge from any Stancor distributor, or by writing *Chicago Standard Transformer Corporation, 3501 West Addison Street, Chicago 18, Illinois.*

Perma Power Company, Chicago, announced that its new distributor catalog is available. Modernly designed, multi-colored, the catalog includes illustrations and complete information on the complete line of Perma Power's TV Tube Britener, Perma Power's Voltage Regulator, Radio controlled Garage Door Opener, Battery Eliminator, and Perma Power's line of accessories. Copies of the catalog are available by writing: *Perma Power Co., 4727 N. Damen Ave., Chicago, Illinois.*

**STOP LOSSES** due to inaccurate instruments

**CHECK AND ADJUST**

Your Test Instruments  
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Howard W. Sams & Co., Inc.

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Calibrates VOM, VTVM and other meters, signal, sweep and marker generators and oscilloscopes.

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Avoid instrument errors that cause wrong decisions and time-killing rechecks in receiver testing. With the new, low-cost, laboratory-type Model 750 Calibrator you can quickly, easily check test equipment accuracy and make necessary adjustments.

Provides standard of  $\pm 1\%$  or better in all of its voltage sections—enables you to calibrate your test instruments like the labs do, and give better service at lower cost.

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TUNG-SOL ELECTRIC INC., Newark 4, N. J. Sales Offices: Atlanta, Columbus, Culver City, Dallas, Denver, Detroit, Melrose Park (Ill.), Newark, Seattle.

# trade

Manufacturers sold over one million entertainment and non-entertainment type transistors in June and nearly five million units in the first six months of 1956, the Radio-Electronics-Television Manufacturers Association announced. Total transistor sales in June were reported to be 1,130,756 units with a dollar value of \$3,645,293. Sales of the semi-conductor device during the first half of 1956 totaled 4,758,603 units with a dollar value of \$13,728,111, RETMA said. The half-year figure compares with 1,260,827 units with a dollar value of \$4,471,958 sold during the first half of 1955, an increase of nearly 400 percent, RETMA reported.

A complete new line of receiving tubes for portable or "miniaturized" television was announced by Sylvania Electric Products Inc. Matthew D. Burns, Vice President of electronic tube operations, said that initially 26 types are being placed on the market with additional types to be released shortly. All of the 26 tube types are for 450-mil series string applications. The new line of 450-mil series string types reduces by 150 ma. the heater current for series string designs now in use. Across a 117-volt line, this means a 17.5-watt dissipation savings in new receiver designs. This lowered dissipation, he said, reduces set operating temperatures in large sets and makes possible a new small size in portable television receivers.

CBS-Hytron, as part of its continuing expansion program, announces the opening of its modern 57,000 square foot Chicago warehouse, located on Mannheim Road in Melrose Park. Designed for on-the-spot handling of receiving tubes, television picture tubes and semiconductor devices, the new facilities will make possible better all-around service to CBS-Hytron distributors in the Midwest.

Factory production of television receivers in June was the second highest for any June in TV history—second only to June 1955—the Radio-Electronics-Television Manufacturers Association announced. Radio output also maintained a high level for the five-week month. Television production in June totaled 553,025 receivers compared with 467,913 TV sets produced in May, for an 18 percent increase. TV output in June 1955 had totaled 589,973 units. Radio receiver production in June totaled 1,073,775 compared with 1,060,165 radios produced in May and 1,204,935 radio sets manufactured in June 1955, RETMA reported. TV sets manufactured with UHF tuning facilities totaled 78,512 in June compared

with 58,116 produced in May, while 788 TV receivers containing FM circuits were manufactured in June compared with 773 produced in May, RETMA said.

Mr. Octave Blake (right), president of Cornell-Dubilier Electric Corporation, presenting his company's 35-year Plaque to Mr. A. D. Davis, president Allied Radio Corporation, world's largest electronic parts distributor, who



has been handling the Cornell-Dubilier line without interruption for 35 years. The Plaque was presented at an Allied Management Dinner at Chicago's Sheraton-Blackstone Hotel.

Dr. Allen B. Du Mont, television pioneer and chairman of the board of Allen B. Du Mont Laboratories, Inc., was the principal speaker at the annual banquet of the Texas Electronics Association on August 24 in Houston, Texas. The banquet was held on Friday evening in conjunction with the three day clinic, August 24, 25 and 26, of the association at the Rice Hotel. The Texas Electronics Association is composed of radio-television dealers, service technicians, and electronics specialists. The topic of Dr. Du Mont's address was "Television—Today and Tomorrow."

A second campaign to further unseat the multi-million dollar racket in television and radio receiving tubes was announced by Philco Corporation. Initiated by Philco last year and adopted by other manufacturers, the campaign to smash the unscrupulous sales of worn out and discarded receiving tubes has resulted in a number of tube racketeers being forced out of business, it was said. While efforts to curb tube racketeers have met with success, it is still estimated to cost television and radio users millions of dollars annually. In many instances, it was said, these tubes are completely worthless, although they look like new tubes after being "cleaned up."

# flashes

The appointment of Donald H. Stover, formerly Service Manager of Sentinel Radio Corp. of Chicago, as Service Coordinator of the Radio-Electronics-Television Manufacturers Association was announced by Executive Vice President James D. Secrest. Mr. Stover will assume his duties on August 15. The office has been vacant since the resignation of Al Coumont. Mr. Stover will continue Mr. Coumont's work in coordinating the industry's service activities and, in addition, will undertake an intensive field job of promoting RETMA's vocational training program for radio-TV-electronic technicians in vocational schools throughout the country.

Erie Resistor Corporation of Erie, Pa. announces the building of a large modern ceramic plant in State College, Pa. which will be known as Technical Ceramics. The new plant will house the latest equipment for mass producing quality ceramic dielectrics and other special ceramic parts. Much of the new equipment has been custom designed to meet the specific requirements for Erie's production techniques.

Twenty-four technical sessions and three luncheon addresses of general interest will highlight the 1956 National Electronics Conference in Chicago on Oct. 1-3. The tentative program for the 12th annual conference features approximately 100 papers on electronic research, development, and application, according to L. T. De Vore, program chairman. More than 10,000 persons are expected to attend the three-day technical meeting and exhibition—having "Fifty Years of Progress Through Electronics" as its theme—at the Hotel Sherman.

In keeping with EICO's continuous program of product improvement and modernization, EICO, 84 Withers Street, Brooklyn 11, N. Y., has just released their new 1956 Tube Tester Roll-Chart #625-05. Carefully researched and compiled by EICO's Engineering Dept., this new roll-chart contains hundreds of listings of the latest tubes just newly released by all the leading tube manufacturers. It thus widely increases the utility of all EICO Tube testers. The EICO Roll-Chart is clearly printed on a 6-foot long continuous sheet of durable high quality white paper, to withstand many years of daily use—and it easily fits on the Tube Tester's present roller mechanism.

The Sentinel Radio Company has moved its Service Parts Department from Evanston to 340 East Superior Street, Fort Wayne, Indiana according to R. J. Yeranko, Company Service Manager. A Magnavox subsidiary, Sentinel has moved this department to Fort Wayne where better service can be furnished through a consolidated operation, shipping Magnavox and Spartan as well as Sentinel parts.

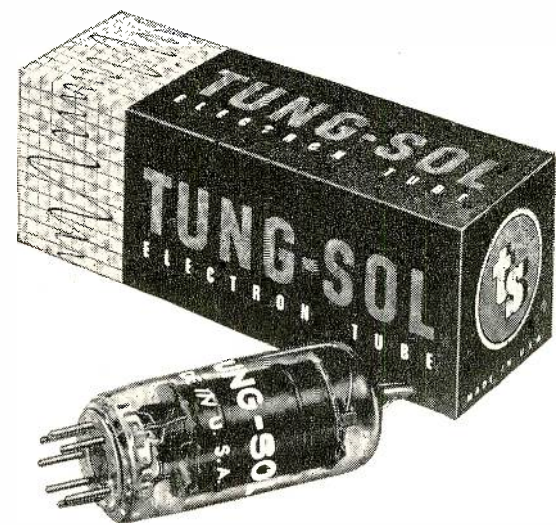
The development of a new disk type television tuner which is 20 per cent smaller yet more sensitive than the conventional turret type was announced by Admiral Corporation. The tuner's automated construction, with all circuitry and components easily accessible, reduces servicing problems to a minimum, according to John B. Huarisa, Exec. V.P.

At the request of two of its distributors, the General Electric Company soon will provide factory service on its major appliances and television sets in three midwestern cities where those distributors are now responsible for service. In metropolitan Columbus and Toledo, Ohio, and Fort Wayne, Indiana, an organization of major appliance and television servicemen will be established, reporting directly to the General Electric Appliance and Television Receiver Division here at Appliance Park. The factory organization will franchise service dealers to cover distributors' outlying areas and will sell parts to independent service organizations.

Disc recording and reproduction, magnetic recording, transistor application problems, audio systems and components, loudspeakers and standards and measurements will be the subjects of sessions at the Eighth Annual Convention of the Audio Engineering Society, to be held September 26-29 in the New York Trade Show Building, N. Y. It will be held concurrently with the New York High Fidelity Show, in the same building. Another feature of the four-day gathering will be a session on the problems and techniques of home music system design.

Servicemen in Canada are now required to obtain a license in order to engage in radio or TV servicing. An identification card is given such servicemen. ■■

# IT'S Tung-Sol



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Tung-Sol receiving tubes for TV, radio and Hi-Fi replacement are exactly the same as those supplied to leading independent set makers. This one quality—Blue Chip Quality—is your assurance of long, trouble-free service that keeps customers with you year after year. Tell your supplier you'd rather have Tung-Sol Tubes.

*Blue Chip Quality*

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TUNG-SOL makes All-Glass Sealed Beam Lamps, Miniature Lamps, Signal Flashers, Picture Tubes, Radio, TV and Special Purpose Electron Tubes and Semiconductor Products.

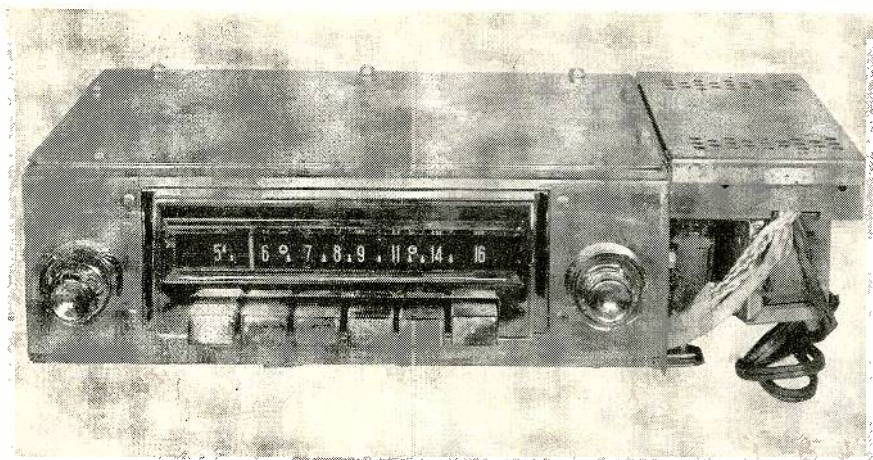


Fig. 1—Model 844, an eight tube mechanical push-button chassis.

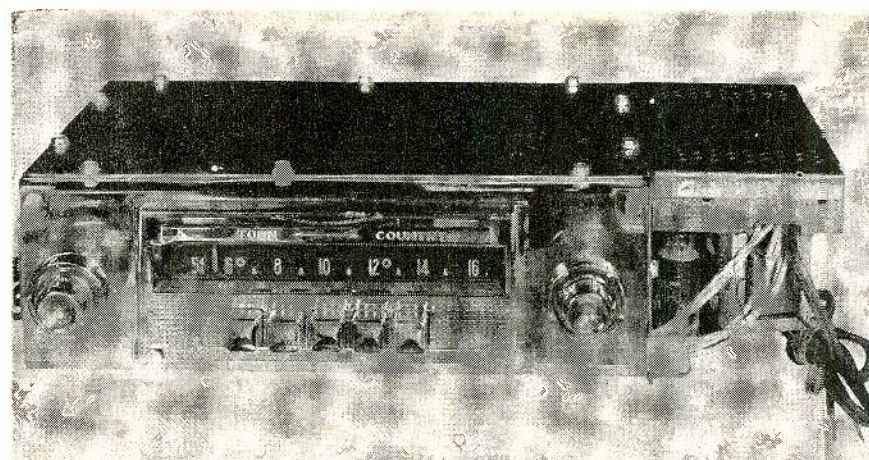


Fig. 2—Model 912, a nine tube automatic signal seeking chassis.

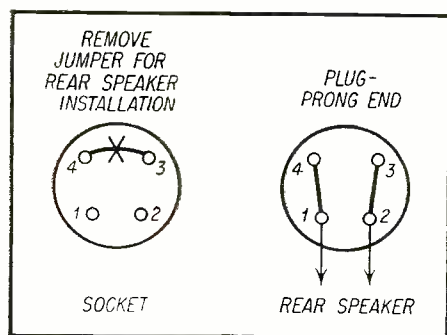


Fig. 3—To connect a rear seat speaker remove jumper and insert cable plug into chassis.

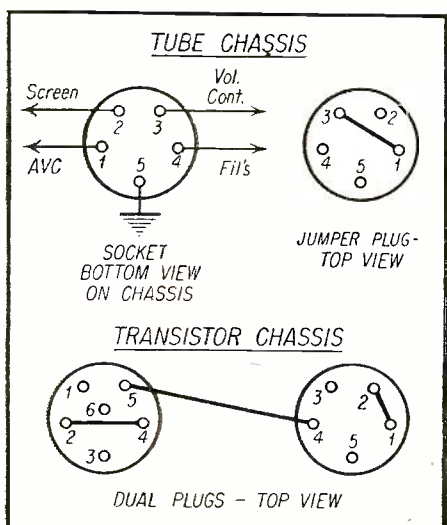


Fig. 4—Jumpers must be connected to phono socket when servicing radios out of the car.

## Auto Radios for 1956 — CHRYSLER

Radios used in the Chrysler autos are discussed along with precautions, and such servicing problems as the removal of the radio from under the cowl and the testing of the transistor type.



by RALPH A. MOSS  
AUTO RADIO SERVICE  
BEARS OF BROOKLYN

**B**ASICALLY, all 1955 & 1956 Chrysler radios employ the same eight tube chassis. However, the '55 models are for 6 volt operation while the '56 are for 12 volt. Where HR is added to the model number, it signifies a phono socket for the addition of a Highway Record-player. Model 844 (Fig. 1) and Model 835 which is similar in appearance, are straightforward eight tube mechanical push-button chassis. Model 912 (Fig. 2) and Model 902 which is similar in appearance, are nine tube automatic signal seeking sets. A twelve transistor chassis. Model 914, similar in appearance to Fig. 2, incorporates the features of the 912 and 902 receivers. Following are the Mopar model numbers and the corresponding Philco model numbers:

1955 Model 835—Philco C-5509  
902— C-5595

1956 Model 844—Philco C-5609  
912— C-5696  
914— C-5690 HR

### Descriptions of Various Models

Model C-5697EHR is the same as Model C-5696HR (Fig. 2), except that an 11-pin plug is provided on the left side of the housing for connecting the Remote Control Unit, which comes equipped with a 16-foot cable. Two additional relays, L9 and L10, are provided in the rf chassis to perform the necessary switching functions when the Remote Control Unit is used.

Still on the subject of the C-5697 EHR, when the radio in the front of the car is off, the Remote Control Unit will turn the radio on or off, select stations when the Remote Control Touch Bar is depressed; control the sensitivity of the Search tuner; and control the

volume and tone of the radio. The rear-seat speaker is the *only* speaker in operation when the Remote Control Unit has control. The rear seat speaker is inoperative when the radio in the front of the car is on. When the Remote Control Unit is turned on, complete control is taken away from the radio in the front and is transferred to the Remote Control Unit. The Touch Bar on both the radio in the front of the car and on the Remote Control Unit can be operated at any time. This radio model is also equipped with a socket for plugging in a short-wave converter.

Facilities are provided on all chassis for a rear seat speaker installation should it be desired. A socket is provided on the chassis for insertion of the cable and plug from the auxiliary speaker, Fig. 3. The circuit is such that both speakers are in parallel. A variable resistor in the circuit acts as a "fader control." The



control can be adjusted so that only one speaker can be heard or so that both speakers are in operation.

If the auxiliary speaker is not installed, a jumper is placed across the socket plug connections so that the receiver speaker is returned to ground to complete the circuit. With single speaker operation the fader control is disconnected from the circuit.

When service is required on any of the models equipped with a phono socket, *Fig. 4*, make sure a jumper is connected.

It is important when servicing any Philco signal seeking or transistor set to observe battery polarity on the bench. 1955 radios have a positive chassis ground while 1956 have a negative chassis ground.

#### Removal from Dash

Before starting removal of any of these chassis from the car, it would be most advisable to first disconnect one cable from the car battery. Many *hot* instruments are situated around the set, *Fig. 5*, and since the radio must be [Continued on page 40]

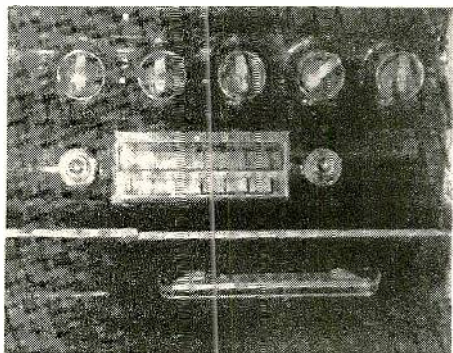


Fig. 5—In removing radio disconnect battery cable to prevent shorts with "hot" terminals.

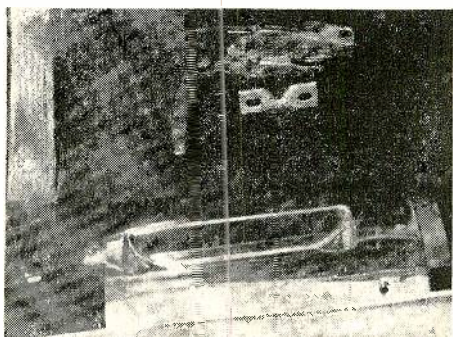


Fig. 6—The cowl vent bracket and cover plate are removed exposing radio bracket screws.

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Chicago, Illinois

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Firm \_\_\_\_\_  
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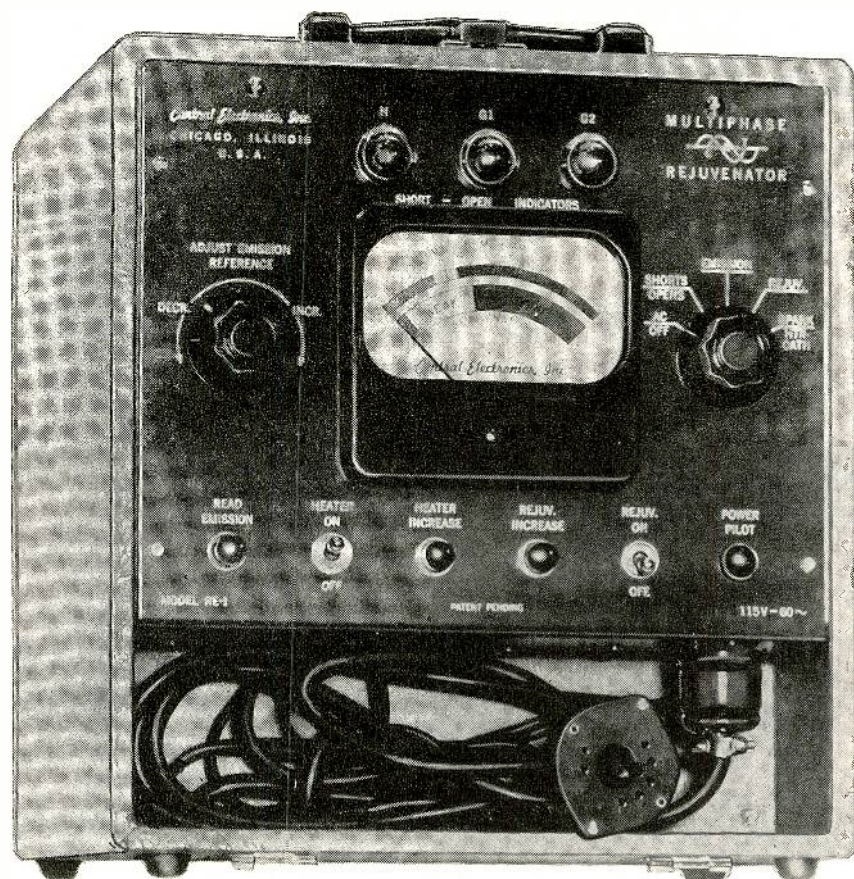


Fig. 1—The "Rejuva-Tube", Model RE-1 picture tube rejuvenator.

Many a serviceman has installed a "booster" for dim picture tubes with a certain amount of misgiving, because it is virtually impossible to ascertain whether the use of such a booster will prolong the usefulness of the tube sufficiently to warrant its use. It is difficult

to explain to a customer, after a few weeks of "booster" use, that the picture tube in question was about "through" as far as its emission characteristics are concerned, and that it was *not* the "booster" which hastened its demise. Furthermore, only extensive testing and removal of the tube itself will ever confirm whether a booster is justified or whether some other aspect of the associated circuit is responsible for a dimming picture.

Central Electronics, Inc., has come up with a brand new piece of test equipment which resolves the above doubts and functions as a CRT rejuvenator at the same time. The "Rejuva-Tube" CRT Rejuvenator, Model RE-1, is, in fact, a complete CRT Testing Instrument with which all the pertinent operating characteristics of a questionable picture tube can be checked in a matter of minutes. A few simple checks indicate whether or not a given tube is a candidate for rejuvenation. If "Rejuva-Tube" indicates that the CRT is beyond help, that fact can

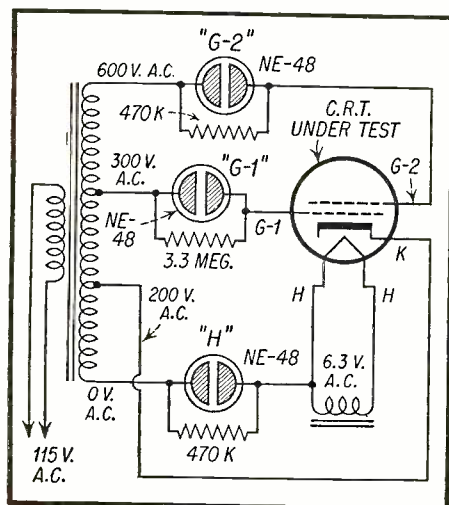


Fig. 2—Simplified schematic of "shorts" and "opens" test circuit.

be easily demonstrated to the customer with confidence to his complete satisfaction.

The unit not only activates cathode emitting surfaces, but meters the action during rejuvenation, so that accidental over-rejuvenation is prevented. In addition, this instrument checks for any possible inter-electrode shorts or opens and accurately measures the emission capabilities of a picture tube both before and after rejuvenation. In this way, an intelligent and fairly accurate estimate of remaining life of the tube can be given to the customer, thereby avoiding subsequent disappointment.

A photograph of the Model RE-1 is shown in Fig. 1. The main function switch at the right of the meter is arranged in convenient order both for use of the instrument and as a basis for the ensuing analysis of its operation.

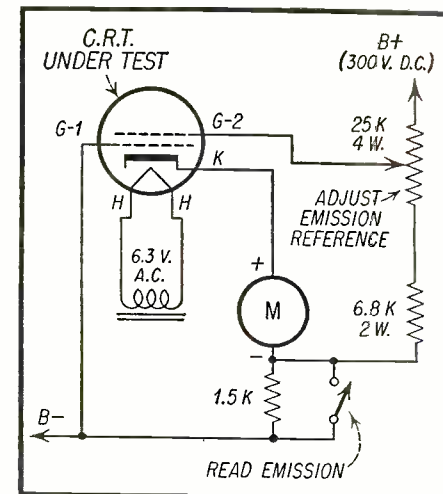


Fig. 4—Simplified schematic of the emission testing circuit

the exception of the cathode have type NE-48 neon lamps in series with their connection to the transformer voltage. The resistors across each neon indica-

## NEW CRT TESTER and REJUVENATOR

The CRT socket (on the end of a four foot cable) is connected to the tube to be measured. The television receiver need not be turned on during all the tests and procedures.

The filament switch is turned on and the main function switch is rotated to the "Shorts-Opens" position. After a few seconds of warmup, the three neon tubes located directly above the meter will present a pattern of light and dark which tells the complete story regarding the elements of the Cathode Ray tube.

You will note from Fig. 2 (which is a simplified schematic of the circuit during "shorts-opens" tests) that the heaters (H-H), the cathode (K), the control grid (G<sub>1</sub>) and the accelerating grid (G<sub>2</sub>) are all connected to taps on the secondary of the power transformer. All the elements mentioned with

tor determine the current required to cause firing of the tube.

It will be recalled that *dc* current causes only one plate of a neon bulb to glow, whereas the passage of AC current causes both plates to glow simultaneously. It is this fact which enables the user to completely establish, at a glance, the conditions of the elements of the CRT.

A chart of possible neon configuration for various conditions of the tube which is supplied with the instrument is shown in Fig. 3. An analysis of two of these sets of conditions (Good tube and H-K short) will illustrate the principle.

Suppose all the elements of the tube are normal. Since the heater itself does not emit electrons, no current flow whatsoever takes place through the neon tube identified as "H" and this

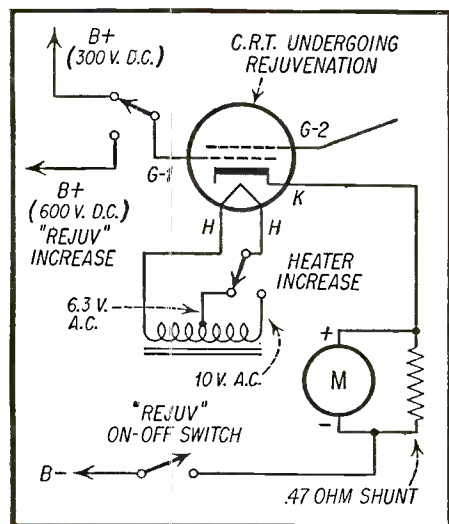


Fig. 5—Simplified schematic of circuit used for rejuvination.

bulb remains unlit. On the other hand, current flows between the cathode and grid because 100 volts is maintained between the grid and the cathode.

short or shorting particle), *ac* current can now flow during both half cycles between cathode and heaters. Under these circumstances, both halves of the neon bulb labeled "H" will be illuminated, in addition to the normal illumination of the G-1 and G-2 lamps. The reader can easily check the remaining sets of conditions illustrated in Fig. 2 by similar analysis.

### Emission Testing

Assuming that no shorts or opens are present, the function switch would next be thrown to the Emission position. The circuit brought into play is shown in Fig. 4. A voltage divider consisting of a 25K potentiometer, a 6.8K resistor and a 1.5K biasing resistor sets up operating voltages equivalent to cut-off of the control grid. The grid-to-cathode bias is about 12 to 15 volts as

**The "Rejuva-Tube", a new test instrument, measures picture tube emission, checks tubes for shorts and opens, removes element shorts and enables cathode emitting surfaces to be rejuvenated.**

by PETER RUGGIERO

However, since this is an *ac* voltage, current will flow only during the half cycle when the voltage at the control grid is positive with respect to the cathode. In other words, the CRT itself acts as a rectifier to current flow. As a result, the neon tube labeled G-1 only has one plate glowing under normal operating conditions. The accelerating grid has still higher *ac* voltage applied to it; but again, current will only flow through the G-2 neon lamp during the half cycle in which G<sub>2</sub> is instantaneously positive with respect to the cathode. Consequently, this lamp will only glow on one plate in a normally operating picture tube.

Next consider the appearance of the neon lamps when an actual short exists between cathode and heaters. Since there is now a direct connection between these elements (by virtue of the

determined by voltage drop across the 1.5K resistor. The accelerating grid voltage is adjusted by means of the "Adjust Reference" control on the front panel so as to set the meter pointer to a reference mark near cut-off (no emission). When the "Read Emission" button is depressed, the 1.5K resistor is shorted out. The cathode and control grid are then at equal potential, or zero bias exists.

Full emission of a good tube should then take place and can be read directly in microamperes on the meter which is in series with the cathode circuit. A reading of more than 600 microamperes will usually be obtained for new tubes under these conditions. A reading below 350 microamperes during this test indicates that the CRT is low in emission and is probably a good bet for rejuvenation attempts.

### The Rejuvenation Process

If rejuvenation is deemed advisable at this point, the function switch is rotated to the next position and the circuit applicable is shown in Fig. 5. It will be noted that the control grid now has positive *dc* voltage of 300 volts applied to it.

The Rejuv On-Off switch is turned on and off by the user intermittently, completing a circuit from B- to the cathode and, by tube conduction, to the control grid and on to B plus. The neck of the tube is tapped gently during this switching process to enable the high control grid voltage to "flake-off" any oxidation on the cathode surface and restore its emission capabilities. The presence of the meter in the cathode circuit provides visual proof of what is going on. As the tube begins to undergo successful rejuvenation, the meter begins to increase its reading each time the Rejuv switch is switched to the ON position. The reading will continue to increase until no further rejuvenation is possible. The operator then knows that the process should be stopped if damage to the cathode is to be avoided.

Occasionally, stubborn CRT tubes require additional inducement to begin rejuvenation. For this reason, a "Rejuv Increase" switch is provided to increase the momentary voltage between grid and cathode from 300 to 600 volts positive. In addition, a "Heater Increase" switch is provided which, when depressed increases the heater voltage from normal 6.3 volts to about 10 volts. This acts as a further inducement for restoring a properly emitting cathode surface by increasing its surface temperature. If none of the above expedients cause rejuvenation to start, one can be fairly certain that the tube is a complete reject and can so assure his customer.

### Clearing Heater-Cathode Shorts

Occasionally, a short between heater and cathode, as indicated by the Shorts-Open test described earlier, is nothing more than a particle of the cathode which has become wedged between these two elements of the tube. The last position of the function switch, "Spark Htr-K," is intended for clearing up this

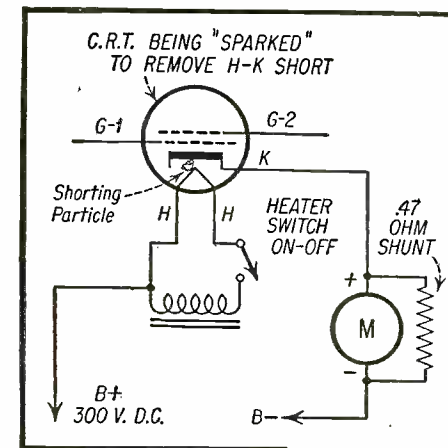


Fig. 6—Simplified schematic of circuit employed in clearing heater-cathode shorts caused by particles of cathode material

type of short. The applicable circuit is shown in Fig. 6. 300 volts of *dc* are applied between heater and cathode. Since the shorting particle is usually of low resistance material, the momentarily large *dc* current flow, in effect, "burns-up" the shorting particle in a matter of seconds and restores the picture tube to normal operation. The

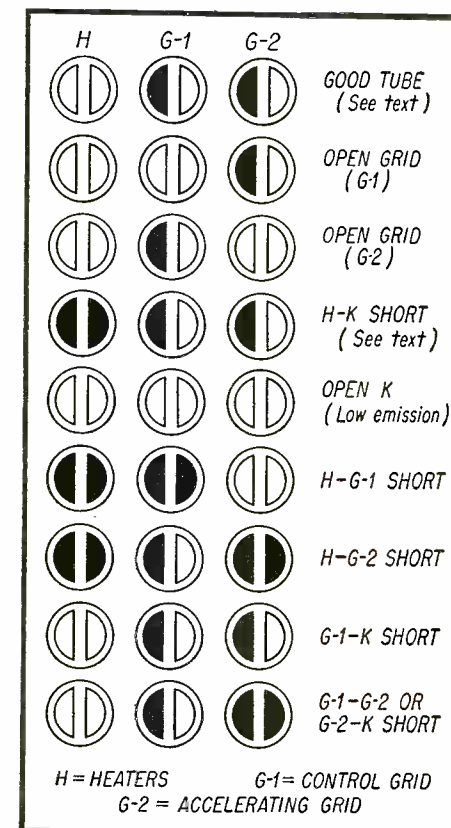
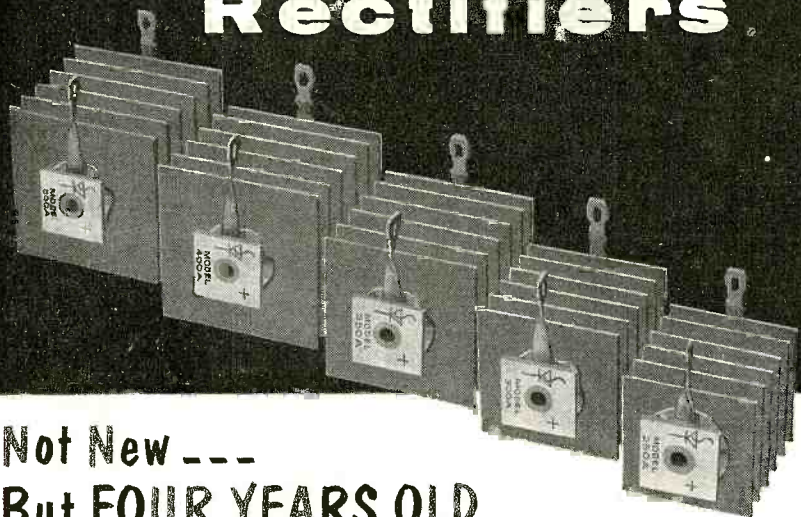


Fig. 3—Various neon bulb indications for element "shorts" and "opens." (Dark portion on bulb indicates section is illuminated.)

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300A	130	300	1.4 " sq.	1 7/8"	300
350A	130	350	1.6 " sq.	2 5/32"	350
400AD	130	400	1.8 " sq.	1 1/4"	400
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meter in the cathode circuit will deflect until the shorting particle is removed.

To accelerate the process, the "heater" switch is turned on and off rapidly during this process. Of course, if the heater and cathode are actually welded together, rather than shorted by a foreign particle, this procedure will not yield successful results.

The Model RE-1 CRT Rejuvenator is available either in kit form or factory wired. It is normally supplied with the proper duo-decal CRT socket for use with all standard base 12-pin electromagnetic or electrostatic picture tubes. The manufacturer informs us that a second cable is also available for adapting the instrument for use with 7" tubes.

ASSOCIATION  
NEWS

[from page 11]

"ARTSNY has been fortunate in obtaining the services of the Nationwide Insurance Co. Starting with the Borough of Brooklyn, all technicians and dealers in the Radio-TV business will be visited soon by one of a specially-trained group of men to obtain the necessary information and help you with any problems you may have."

Indianhead Radio-TV Servicemen's  
Association, Eau Claire, Wisc.

The IRTSA has a new roster of officers, namely: President, Earl Kratch, Bloomer; Vice Pres., Upton St. Clair, Menomonie; Secretary, Richard Presnel, Bloomer; Treasurer, Vernon Christian, Colfax; Board of Directors, Sherwood Stolp, Eau Claire; Earl Struve, Jim Falls.

Kentuckiana Television & Radio  
Technicians' Association, Inc.

A group of Television and Radio Technicians in Louisville, Kentucky have joined together and formed a non-profit corporation known as the "Kentuckiana Television & Radio Technicians Association, Inc."

Board of Directors consists of fifteen members, out of which is elected a president, vice-president, secretary and

treasurer. Five new directors are elected each year and a new set of officers.

The officers for 1956 are as follows: President, Harold Flood, Free Lance Radio & TV Service, Vice-president, Ira Masden, Breckenridge Television Service, James M. Hall, Secretary, Crazy TV & Appliances, Treasurer, Melvin Brown, Mel's TV Service.

Television Electronic Service  
Association of Missouri

The third quarter meeting of TESA-MO. was held at the Daniel Boone Hotel in Columbia, Mo. There were 83 people in attendance which was good considering that many people were on vacation or had employees on vacation which prevented them from attending. To remedy this, an amendment was passed changing the regular meetings of TESA-MO to the second and fourth quarter.

Television Service Association of  
Metropolitan Washington (TSA)

At the last general meeting of the TV Association there was a discussion by the membership about a program of advertising which is intended to publicize the association and its membership. This plan would call for the voluntary participation of association members who are willing to band together for a period of twelve (12) weeks and contribute a proportional part of the over-all contract price, an amount expected to be about \$10.00 per week.

Radio Television Association of  
Santa Clara Valley

To kick off the biggest promotion yet attempted by the RTASCV for this fall is the goal set by the board of directors.

Submitted was an eight hundred dollar budget for each month that will insure that the Association members will get the best possible buy for the dollars spent.

King County (TSA), Seattle, Wash.

In cooperation with the Better Business Bureau, responsible segments of Television Service Industry met last week to take the initial step on a program of establishing minimum standards for television repair shops and tele-

vision repair personnel. At a meeting attended by representatives of the BBB, law enforcement agencies, King County Television Service Association, Northwest Appliance and Television Association, Local 46 of the Electrical Workers, parts suppliers, television distributors, and factory service organizations, a Joint-Industry Committee was authorized to determine the MINIMUM standards of testing equipment and shop facilities as the basis for the issuance of certificates to qualified service shops.

### Minnesota Television Service Engineers, Inc.

Minnesota Television Service Engineers, Inc. would like to invite all members to attend the three day Institute on Problems and Needs of Television Service Establishments at the University of Minnesota. It is strictly non-technical for Service Engineers and Service Managers, and is open to all, whether or not they are from Minnesota.

### Radio and Television Servicemen's Association, Pittsburgh, Penna.

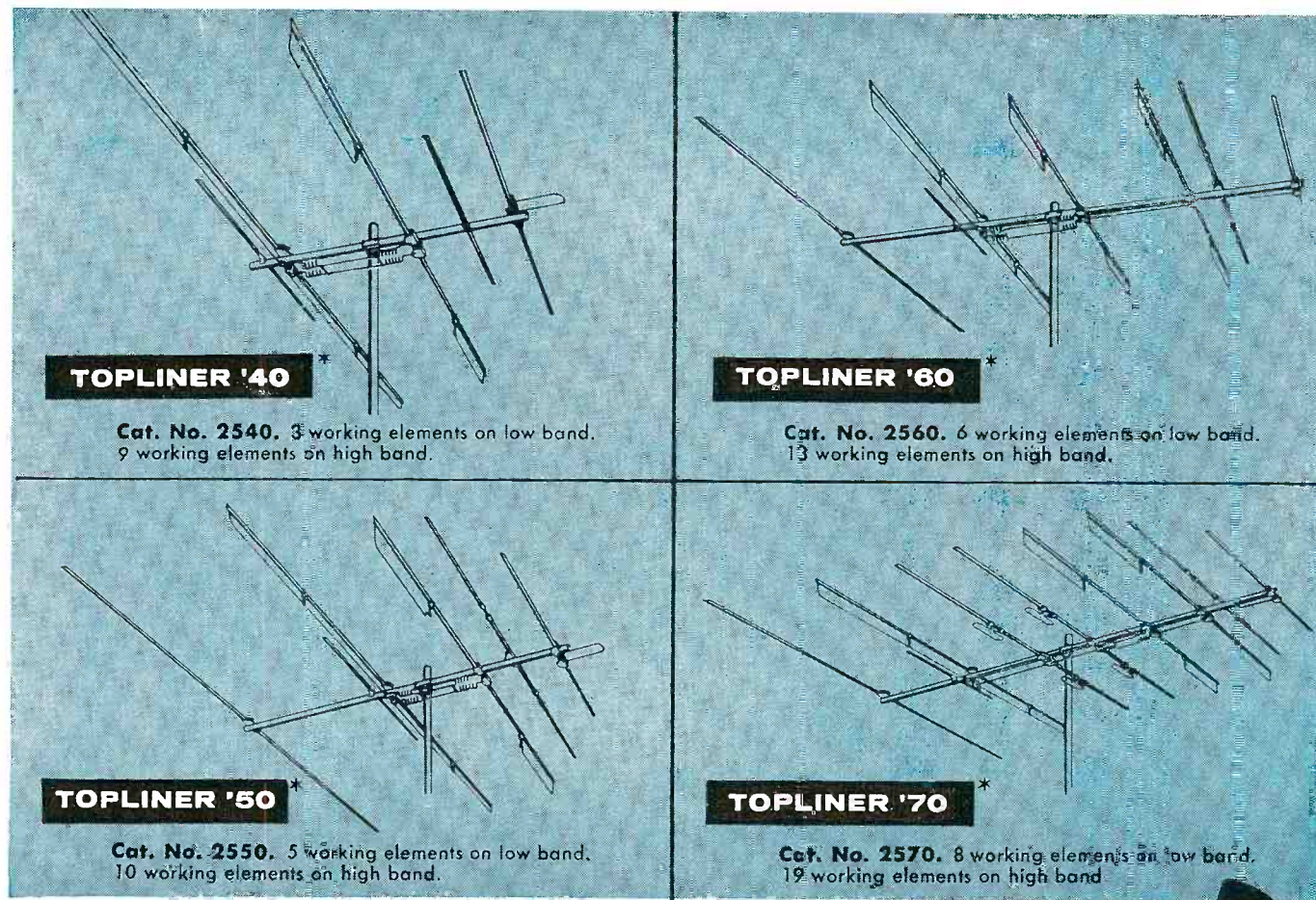
A general meeting for the annual election of officers of the Radio & Television Servicemen's Association of Pittsburgh, Inc., was recently held.

### ANSWERMAN

[from page 10]

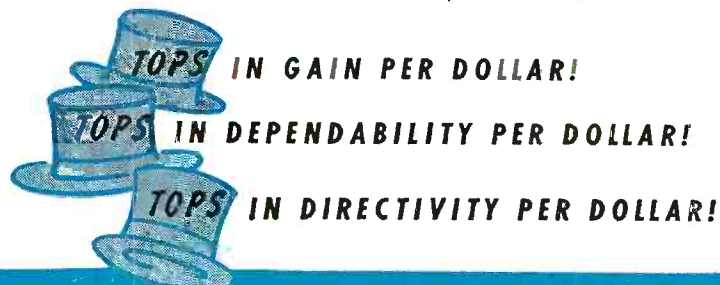
had the same appearance on the screen as has been illustrated. The antenna line was investigated. It was found that the lead-in ran through the cellar. Down in the cellar several work benches were lighted with long neon bulbs. The antenna line passed near one of these bulbs, running along about a foot away from it. The receiver was turned on and the neon light was switched into operation. Immediately the interference appeared, two snowy horizontal bars in the picture. Turning off the bulb removed the bars. The use of the neon bulb light in the cellar proved to be the cause of the problem.

In the problem you have presented I very much believe that you will find the cause of the interference associated with the antenna line, and very probably in the cellar. There may be some



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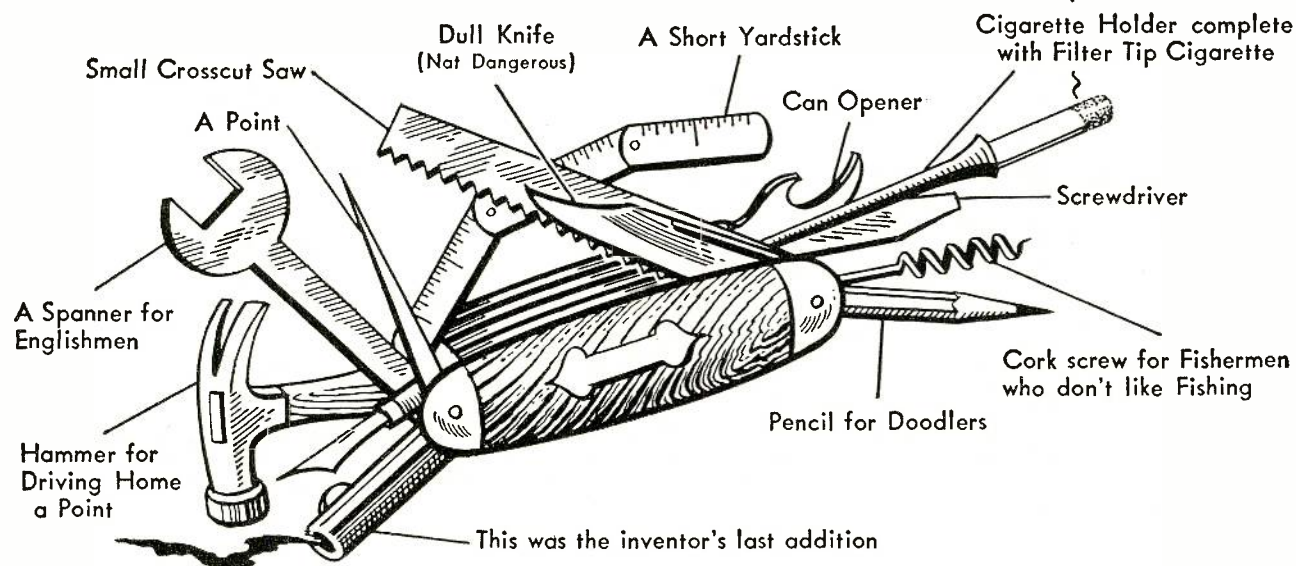
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light, more than likely a neon bulb type that when in operation causes the induction of a large 60 cycle voltage into the antenna line. This large 60 cycle voltage modulates the *rf* amplifier and causes the snowy portions or bars to be seen when the 60 cycle voltage is in its negative swings.

Naturally, it is assumed in considering this problem that the tubes have all been checked. Going further, a point should be made with respect to all types of interference problems that may be encountered. Many of the less expensive TV chassis have no *ac* line bypass condensers. These condensers should be installed as a check for a possible cure for interference problems. It is very possible that the *ac* leads are introducing or radiating interference into the circuits and causing the improper operation. ■ ■

## AUTO RADIOS—CHRYSLER

[from page 35]

turned and maneuvered past them, it would definitely be the safest procedure to disconnect the battery.

Referring to *Fig. 6*, which shows these items dropped to the floorboard, the cowl vent knob and cover plate are removed first, exposing the radio bottom bracket screws. Next, the cowl vent bracket assembly is removed entirely from the dashboard and from the cable itself, *Fig. 7*. It would help at this point to reassemble the small 3/8 nut, bolt and spacers intact in the order removed. The cable tube should be pushed back against the heater duct assembly. After disconnecting all cables from the set, the two Phillips screws into the bottom brackets and the 5/8 nuts under the knobs are removed. The set can now be pushed back to clear the shafts and escutcheon from the dash, turned face upward and pushed past the edge of the dash and downward. Care should be taken to keep the open vibrator and power tubes from catching the edge of the dash.

Whereas the 1955 cowl vent bracket was mounted with the nuts inside the dash, the 1956 cars have the bolts downwards like studs. However, in all cases it is quite a task to assemble the bracket with loosely mounted bolts. It is therefore best to permanently fasten these

[Continued on page 45]

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Mfr. Emersor

Chassis No. 120292

Card No. EM292-1

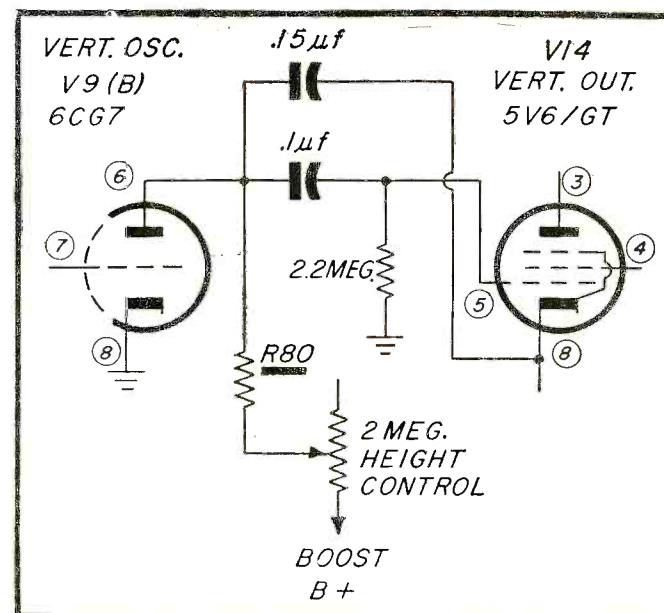
Section Affected: Pix and raster

Symptoms: Insufficient height.

**Cause:** Component failure. The series plate feed resistor from the height control has increased in value, reducing the plate voltage to the vertical oscillator tube.

**What To Do:**

Replace: (R80) 1.5 megohms.



Mfr. Emerson

Chassis No. 120292

Card No. EM292-2

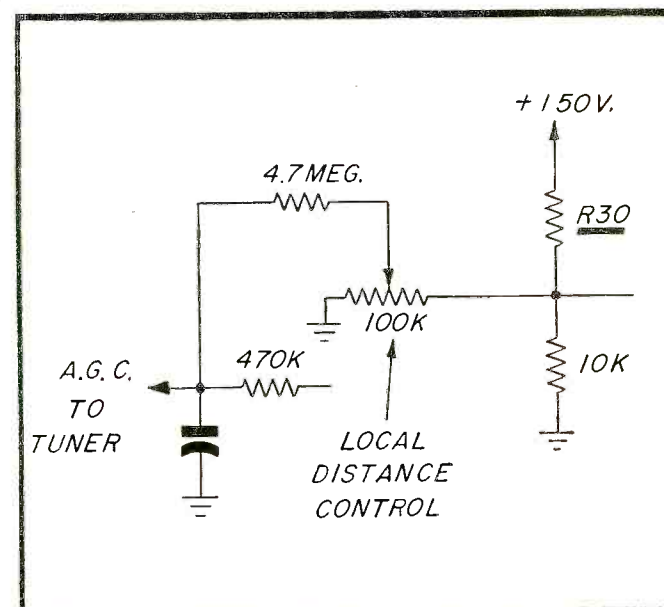
Section Affected: Pix

**Symptoms:** Snowy, weak pictures in semi-fringe and fringe areas.

**Cause:** Component failure. The B plus feed resistor has increased in value, supplying insufficient positive voltage to the local distance control, with the result that correct voltage is not applied to the *agc* line to the tuner. Sound is sometimes pronouncedly affected, also.

**What To Do:**

Replace: R30, 22K ohms, one watt.



Mfr. Emerson

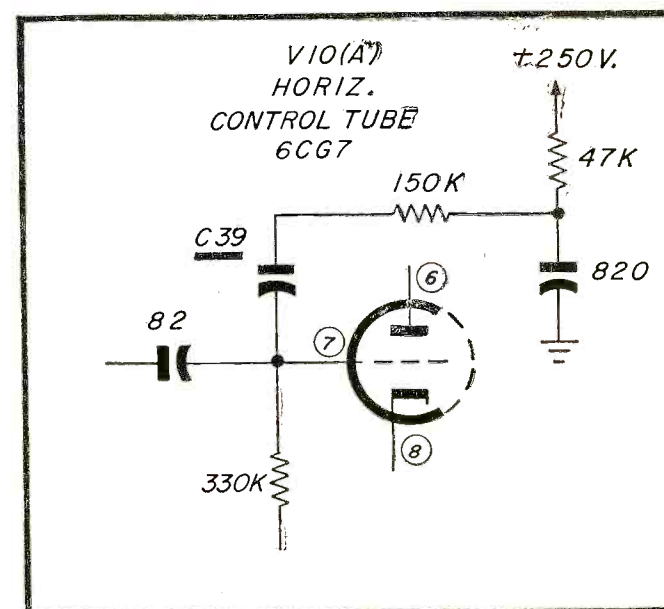
Chassis No. 120292

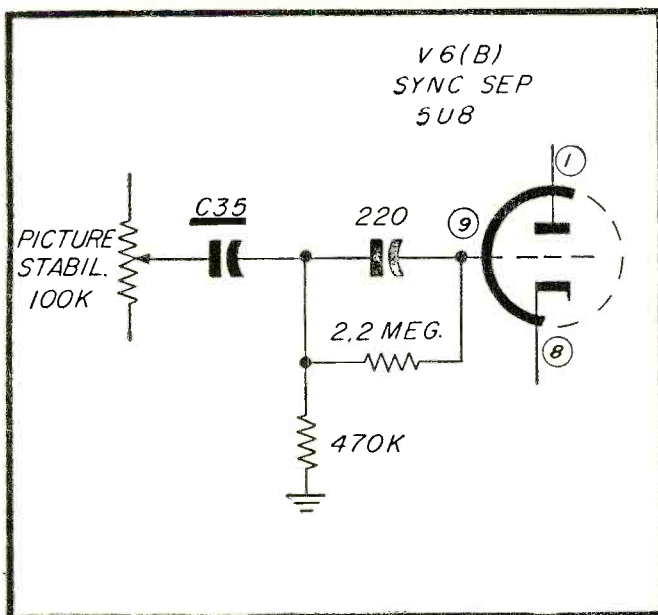
Card No. EM292-3

Section Affected: Pix

**Symptoms:** Critical horizontal hold, vertical hold normal.

**Cause:** Component failure. The sawtooth feedback condenser has developed a leak, altering the bias as applied to the grid of the horizontal control tube, 6CG7.

**What To Do:**Replace: C39 (82  $\mu$ f).



Mfr. Emerson

Chassis No. 120292

Card No. EM292-4

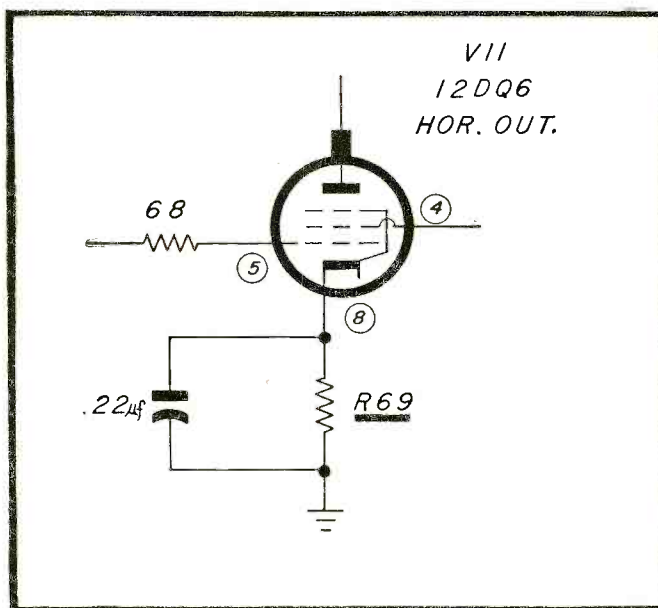
Section Affected: Pix

**Symptoms:** Critical horizontal and vertical sync, picture normal with some picture pulling.

**Cause:** Component failure. Coupling condenser from picture stabilizer control has developed leakage, applying positive voltage to the sync separator grid. This causes incorrect sync separation and video information in sync system.

**What To Do:**

Replace: C35 (.01  $\mu$ f).



Mfr. Emerson

Chassis No. 120292

Card No. EM292-5

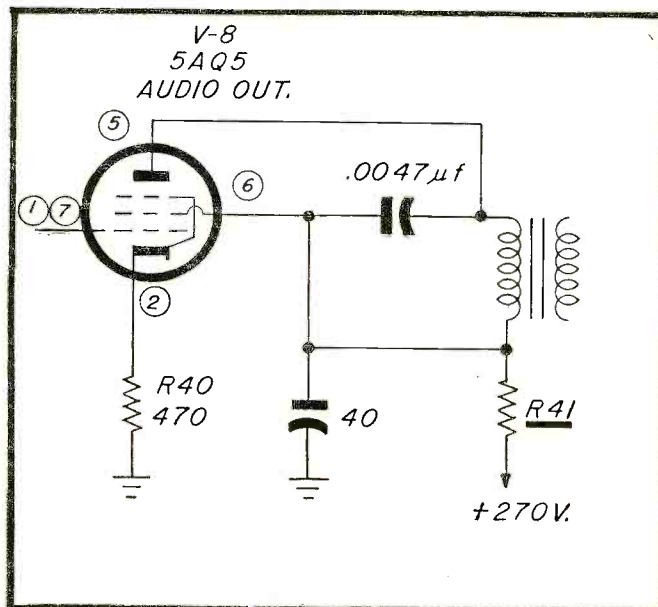
Section Affected: Pix and raster

**Symptoms:** Insufficient width and high voltage.

**Cause:** Component failure. The cathode resistor has increased in resistance, biasing back the horizontal output tube and preventing proper amplification of the grid signal.

**What To Do:**

Replace: R69 (100 ohm) with a two watt size.



Mfr. Emerson

Chassis No. 120292

Card No. EM292-6

Section Affected: Audio

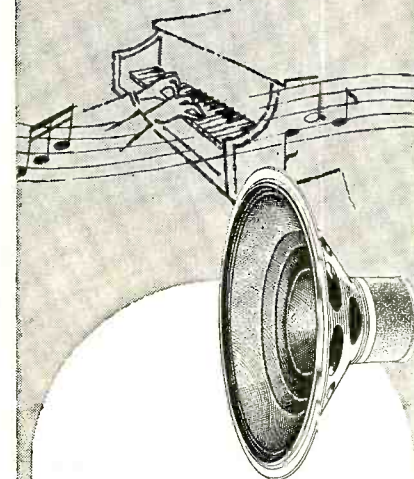
**Cause:** Component failure. The B plus feed resistor supplying 270 volts to the primary of the audio output transformer has increased in resistance so that plate voltage is low.

**What To Do:**

Replace: R41 (1.5K) with a 2 watt size.

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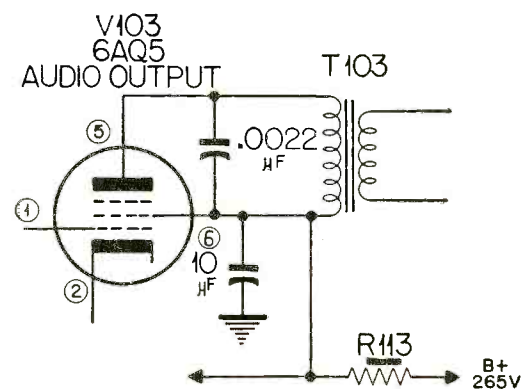
Section Affected: Sound

Symptoms: No audio, picture and raster normal.

Cause: Component failure. B plus feeding resistor supplying voltage to the audio output and amplifier system has opened.

What To Do:

Replace: R113 (3300 ohm) 2 watt resistor.



Mfr. RCA

Chassis No. KCS97

Card No. RC 97-2

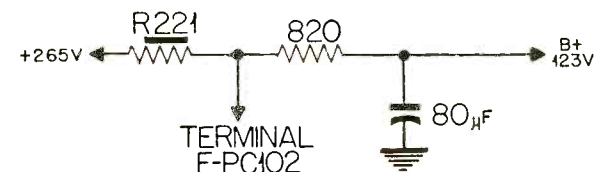
Section Affected: Pix and sound

Symptoms: No picture or sound, raster normal.

Cause: Component failure. Open B plus feeding resistor from 265 volts to terminal E of printed circuit panel and third if circuit.

What To Do:

Replace: R221 (4200 ohm) 7 watt resistor.



Mfr. RCA

Chassis No. KCS97

Card No. RC 97-3

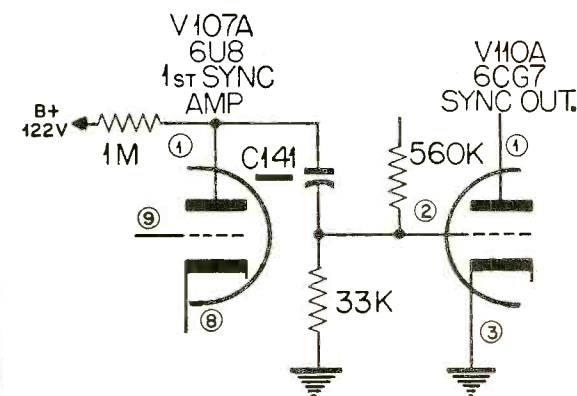
Section Affected: Pix

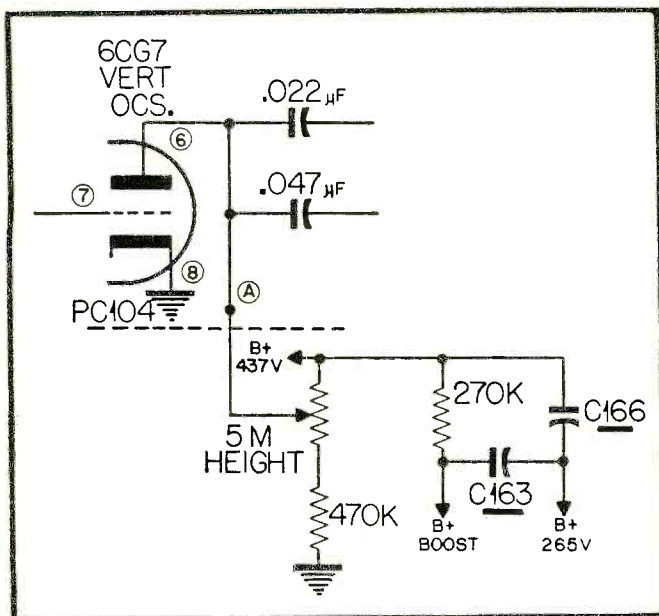
Symptoms: Jittery or poor horizontal and vertical sync, picture and sound otherwise normal.

Cause: Component failure. Coupling condenser from 1st sync amplifier to sync output circuit has shorted.

What To Do:

Replace: Coupling condenser C141 (.033 μf).





Mfr. RCA

Chassis No. KCS97

Card No. RC 97-4

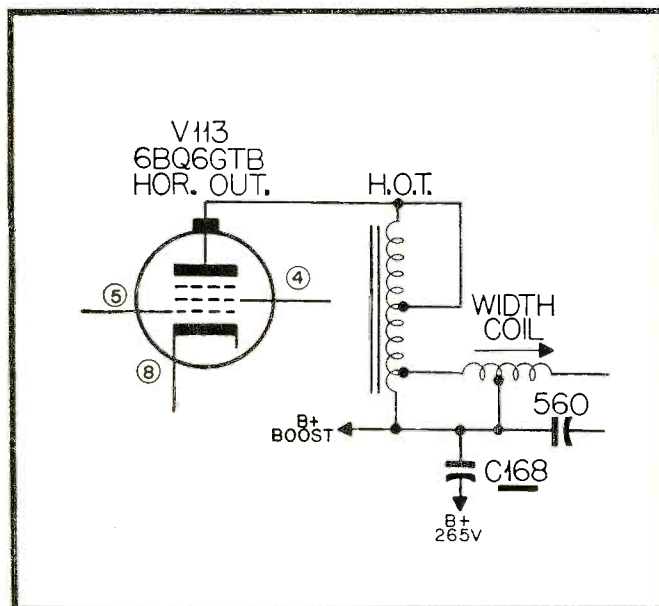
Section Affected: Pix and raster

Symptoms: Insufficient height with possible slight vertical foldover.

**Cause:** Component failure. Leakage in condenser C166 .1  $\mu$ f condenser has reduced B plus voltage to plate circuit of vertical oscillator so that insufficient voltage is applied to circuit producing small deflection voltage.

**What To Do:**

Replace: C166 (.1  $\mu$ f).  
Check: C163 (.1  $\mu$ f) for excessive leakage.



Mfr. RCA

Chassis No. KCS97

Card No. RC 97-5

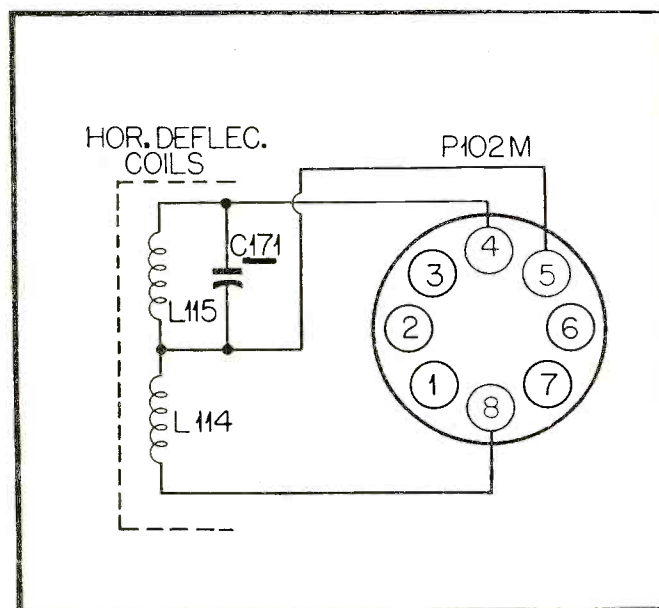
Section Affected: Pix and raster

Symptoms: No high voltage, picture or raster, sound normal.

**Cause:** Component failure. Boost charging condenser C168 has developed sufficient leakage to reduce the boost voltage below a point that will enable the generation of high voltage and sufficient amplitude horizontal deflection pulses in the transformer.

**What To Do:**

Replace: Boost charging condenser, C168 (.047  $\mu$ f).



Mfr. RCA

Chassis No. KCS97

Card No. RC 97-6

Section Affected: Pix and raster

Symptoms: Trapezoidal picture and raster due to improper deflection system.

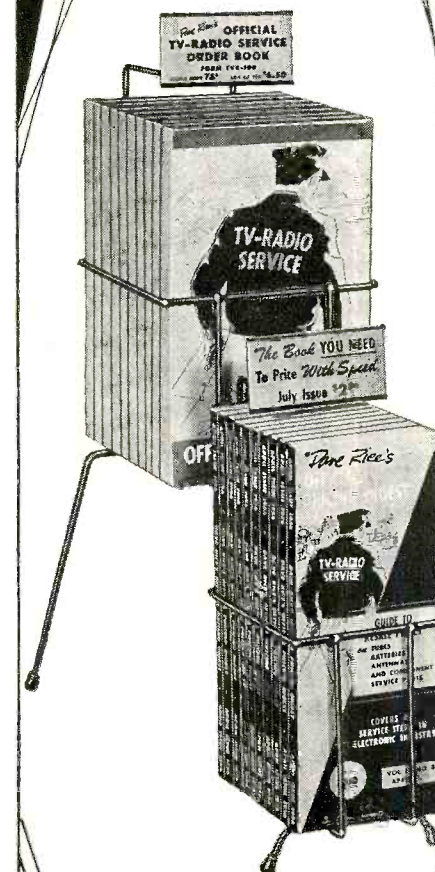
**Cause:** Component failure. Damping condenser across one horizontal deflection coil has shorted. A shorted deflection coil will produce the same symptoms.

**What To Do:**

Replace: C171 (150  $\mu$ f).  
Substitute or replace: Deflection coils.

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## AUTO RADIOS—CHRYSLER

[from page 40]

bolts in the dash while the set is out of the way by adding two new 7/16 nuts so that the bolts will form studs projecting down from the dash. Thus the bracket can be slipped on after replacing the radio without losing the bolts.

### Service Hints

Occasionally, an early production set may be found in which the on-off button does not pop out sufficiently to actuate the on-off switch. This may be caused by the combination of a weak spring and a slightly stiff switch. Operation may be improved and the stiffness remedied by bending the switch mounting bracket backward. This lifts the switch actuating fork up on the ear of the push-button lever so as to gain leverage. Another method of improving the operation is to remove the push-button spring, stretch it so as to increase its power and replace it. The spring may be removed by first removing the two switch mounting screws.

It is possible, when the on-off push-button is depressed too hard, for the end of the switch key to bend and slip into the slot at the inner corner of the latch gate and join. This trouble may be permanently prevented by inserting a length of #10 copper wire vertically in the slot, Fig. 8, filling the remainder of the slot and bonding the wire to the latch with solder and then cutting the wire flush with the face of the latch gate.

If the push buttons are not free mov-

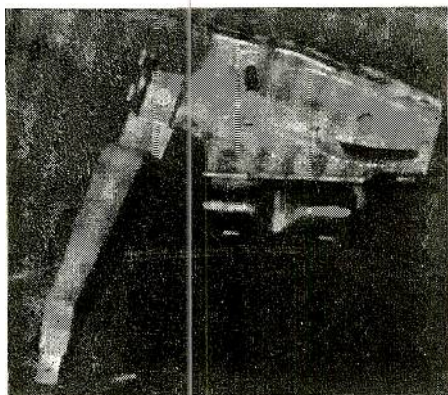
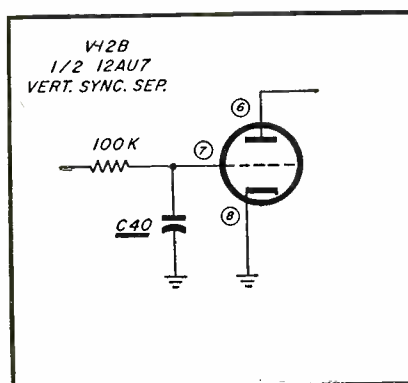


Fig. 7—The cowl vent bracket assembly is removed entirely from the dashboard and cable.



# VIDEO SPEED SERVICING SYSTEMS

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Mfg: Emerson Chassis No. 120162-A  
 Card No. EM162-6  
 Section Affected: Sync.  
 Symptom: Horizontal pulling, and vertical rolling.  
 Cause: Defective component.  
 What To Do:  
 Replace: C40 (47  $\mu$ f), which is leaking.

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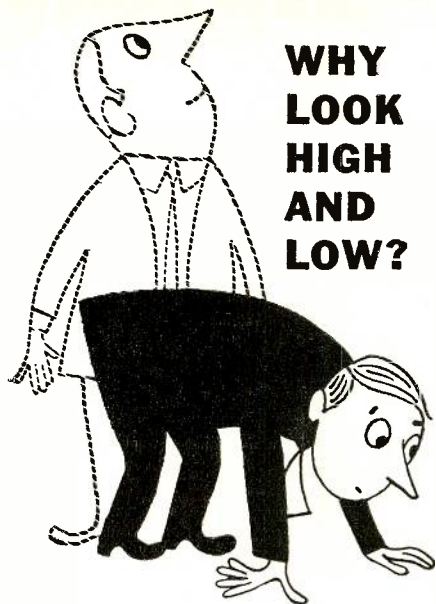
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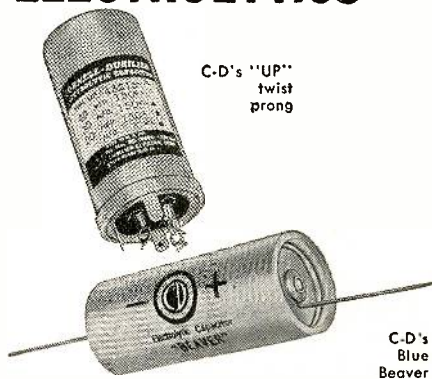
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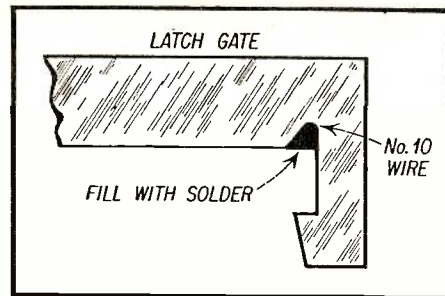


Fig. 8—A length of #10 wire soldered vertically in slot of latch is cut flush.

ing so that they don't return to their full out position there is a possibility that the drive latch will not be sufficiently engaged and the manual tuning will slip. If such occurs, it may be due to binding caused by the anti-rattle felt in the bezel. To improve the operation, the felt may be cut down in thickness at the push button involved. Later production sets have a special anti-rattle spring in place of the felt.

Cases of slippage of the manual tuning, Fig. 9, may be caused by misadjustment of the clutch actuating ear of the clutch gate. This condition also shows up as having no free movement of the push buttons. This may be corrected by bending the ear.

In the 835 and 844 chassis using either a 6AU6 or 12AU6 tube as converter, critical oscillator action can be corrected by trying several new tubes.

### Search Tuning Details

The search tuning system is an automatic device whereby an electric motor is used to drive the tuning system until a station signal is received. When a station signal is received, the automatic system stops and the receiver is tuned to that station. The system is designed to start the tuning action from the low end of the broadcast band. Should the tuning system reach the high frequency limits of the broadcast band, the carriage is released automatically and will rapidly return to the starting point and repeat the search tuning function.

Search tuner push-buttons may be set for any station in any order. However, for convenience in remembering, it is suggested that stations be set up in frequency sequence. *The sequence for push-button adjustment must be followed exactly*, and is as follows:

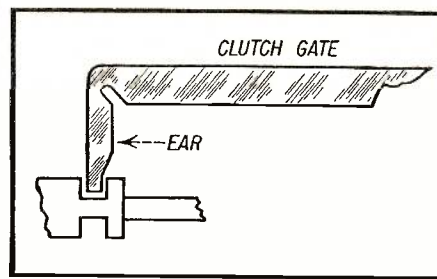


Fig. 9—Slippage of the manual tuning may be caused by misadjustment of the actuating ear.

1. Tune in desired station with manual tuning knob or search tuning.
2. Pull off push button cover.
3. Turn radio OFF.
4. Push in push button.
5. Turn radio ON.
6. Rotate knurled knob of push button until station is heard. No sound will be heard until this point is reached. Do not force knob beyond limit of rotation.
7. Replace push button cover.

Set up other push buttons in the same manner.

### Transistor Radios

The functional operation of a transistorized auto radio is no different than a vacuum tube operated receiver. It is not expected that the use of transistors will present any particular problems to the serviceman. Some of the major points to remember when dealing with transistorized devices are: polarity must be observed; current measurements become more important than voltage; do not ground the base connection of any transistor, and make certain of the key position when replacing a transistor.

Transistors and many of the components associated with them are primarily low current devices. The polarity of the voltages applied to them is therefore very critical. For example, if the battery of a transistor radio were to be placed in opposite polarity to that needed, severe damage would occur. The transistors would have a forward bias and conduct heavily. The transistors could become fused permanently damaged and transistor action cease. The miniature electrolytic capacitors, with reverse voltage supply, could break down and conduct in the opposite direction. This damage is permanent and

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ends the filtering ability of the electrolytic condensers.

Testing of a transistor operated auto radio should be performed while using a battery power supply rather than an electronic supply. The usual battery eliminator does not provide the necessary *ac* isolation that is required for

transistor testing. Resistance and voltage readings may be used to determine the current value. When using test equipment, normal test procedures may be followed with cautious observation toward *ac* isolation. When soldering to any transistor socket lug, turn the receiver off and remove the transistor. ■■

## Color TV Luminance Sections

[from page 15]

corresponds to the luminance signal and wave (B) in Fig. 4X to the chrominance signal, then the composite waveform (C) obtained when Y and C are combined will have the shape shown in Fig. 4Y. This waveform is obtained by adding (A) and (B). With a waveform such as (C) serious distortion in the form of misregistration of the picture element will occur; that is the chroma component of a picture element will be displaced somewhat to the right of the Y component of the same picture element. This will result in incorrect color reproduction.

By providing a time delay to the signal from (A) equal to the time delay produced in (B) as shown in Fig. 4X the waveform (D) shown in Fig. 4Z is produced. Observe that the result is not ideal. Thus, when two signals with unequal bandwidths are added, the resultant waveform cannot have a bandwidth equal to the maximum. However, due to the low amplitude of color information in typical color scenes, waveform errors as indicated by the slanted lines are relatively small.

Since time delay equalization is necessary, it is provided for by introducing a certain amount of signal delay in the Y channel. The amount introduced provides just enough delay of the Y signal to match the inherent delay of the C signal (Fig. 4X) This may be accomplished by the insertion of a wideband delay line in the luminance channel.

A device which provides this delay may be a section of cable of special design. G.E. manufactures a cable of this type (1100 G.E. cable) which has delay of  $\frac{1}{2}$  usec/ft. The amount of added delay required in color receivers varies between .5 to 1.5 usec, so that the length

of cable would vary between 1 to 3 feet.

More practical designs have been developed which simulate the distributed characteristic of this cable in more compact form. These have taken the shape of tubular designs approximately  $\frac{1}{2}$ " in diameter, and from 5" to 9" in length depending on the impedance and the delay required. The manner in which the delay lines are inserted in the circuit is shown in Fig. 1 for various types of receivers.

A convenient test for delay equalization\* is to apply a single color bar to

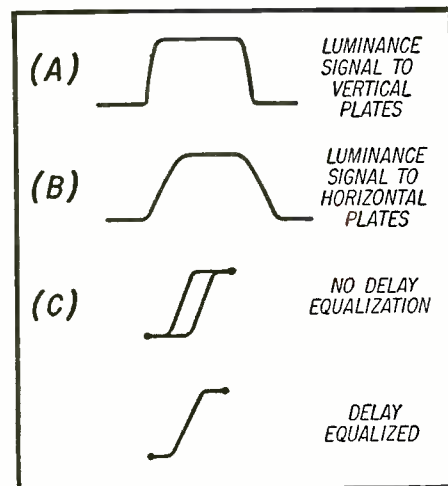


Fig. 5—Waveforms observed by adjusting delay equalization.

the video amplifier and to feed the chroma section output to one set of CRT plates (either H or V) and the Y signal channel output to the other set of plates (See Fig. 5A and 5B). If the delay is not equalized the resultant pattern will appear as shown in Fig. 5C. If the delay is perfectly equalized the resultant pattern will appear as in Fig. 5D. This method requires a scope employing identical wide band amplifiers in both the H and V sections of the scope.

[To Be Continued]

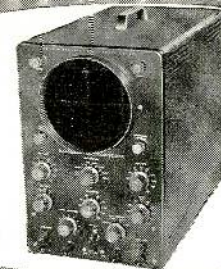
\*Color Television Receiver Practices, by Hazeltine Corp. Laboratories Staff; John F. Rider, Publisher.

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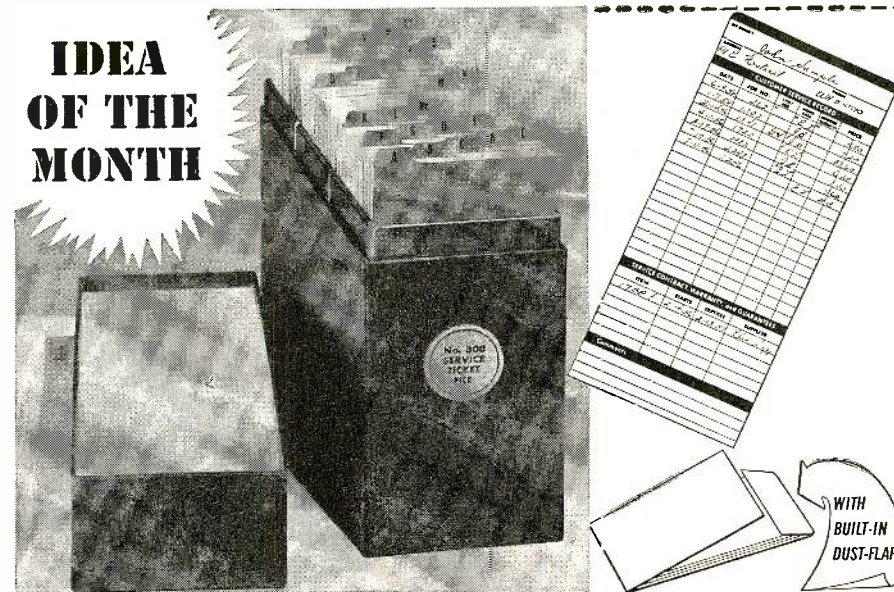
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Erie Resistor Corp.	Erie, Pa.
International Resistance Co.	401 N. Broad St., Philadelphia 8, Pa.

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RCA, (Tube Div.)	Harrison, New Jersey
Raytheon Mfg. Company	Newton, Mass.
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Columbia Wire & Supply Co.	2850 Irving Park Road, Chicago 18, Ill.
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Oelrich Publications	4308 N. Milwaukee Ave., Chicago 41, Ill.
Quietrol Co., Inc.	Spartanburg, South Carolina
Ram Electronic Sales Co.	Irrington, New York
Tele-Scopic Products, Inc.	215 W. 33rd Street, New York 1, N. Y.
Ungar Electric Tools, Inc.	P. O. Box 312, Venice, Calif.
United Catalog Publishers	110 Lafayette Street, New York 13, N. Y.
Vaco Products Co.	317 E. Ontario Street, Grove City, Pa.
Weller Elec. Corp.	160 N. 15 St., Phila., Pa.
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North American Philips Co., Inc.	100 East 42nd Street, New York 17, N. Y.
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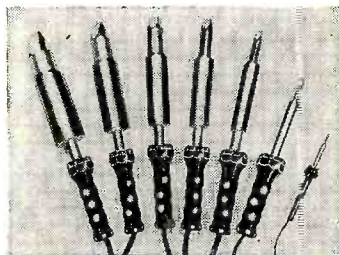
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## SEPARATE PREAMPS

[from page 5]

become noisy with age. Faulty ground connections which have developed high resistance because of corrosion of the plug or jacks are another source of hum. Response of such units can be checked in accordance with methods outlined in the previous article. Some preamplifiers of this type include a small, center-tapped "hum-buck" control across the filaments, the center tap of which is returned to ground. Occasionally, an aging tube, though still adequate as far as emission is concerned, will necessitate readjustment of this control for optimum hum cancellation.

The next logical development in the design of flexible preamplifiers is the addition of VARIABLE equalization facilities to take care of the many recording curves used through the years. Many consumers prefer this extreme flexibility even though, as we have seen, recordings made in recent years generally conform to one standard curve. The reasons for this choice are twofold. Firstly, many record enthusiasts have collections predating this standard technique. Secondly, many people feel that the recommended playback curve does not always sound best to their ears. By having several playback curves from which to choose, the listener can simply select that playback curve which sounds best to him.

There are many such preamplifiers available today, some as separate units, but most as part of an overall control chassis or audio control unit such as the

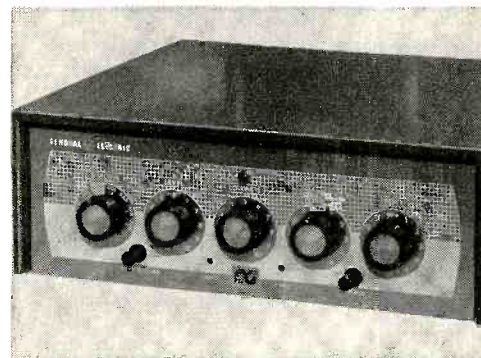


Fig. 8—Front view of G.E. Model A1-320. This unit incorporates variable equalization.



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one pictured in Fig. 8. This unit includes circuitry for such other functions as channel selection, tone controls, loudness compensation, recorded monitoring, etc. All of these latter functions will be considered in future installments of this series. For the moment, however, we are concerned only with the preamplifier section.

A partial schematic of this circuit is shown in Fig. 7. Note that the input circuit is a bit more elaborate than that of the previously discussed preamplifier. A "rumble" (or high-pass) filter consisting of a 2  $\mu$ f capacitor, a 510 ohm resistor and an audio frequency choke is especially useful when the record changer or turntable has high rumble content. The filter effectively attenuates frequencies below 50 cycles very rapidly, with negligible loss of program content.

Low pass filters of suitable configuration are sometimes employed for elimination of record scratch on particularly noisy recordings and these devices will be discussed in the future.

The pickup cartridge is normally connected to the Lo Mag input jack. (The Hi Mag input includes a voltage divider for some magnetic cartridges whose level might possibly overload the first triode of the 6SC7.) This triode is wired for conventional voltage amplification. The second triode section includes a feedback loop between plate and grid consisting of a 470K resistor and a choice of capacitor and resistor combination depending upon the desired bass boost characteristic of the playback curve.

You will note, too, that treble roll-off or de-emphasis is no longer accomplished by direct loading of the cartridge. The de-emphasis network, effectively in the plate circuit, consists of a resistor-capacitor (2000  $\mu$ f) combination to ground. The resistor is chosen by means of the switch so as to duplicate the various roll-off characteristics required in playback. Roll-off accomplished in this manner has the advantage of better signal-to-noise characteristic because the de-emphasis is done after amplification rather than at the input. The selector switch is arranged to afford a total of five separate and distinct playback curves. The resultant response curves are shown in Fig. 9.

Servicing the preamplifier section of such a control chassis or separate preamplifiers of this type is essentially no different from that outlined for fixed-equalization preamplifiers. The added precaution involves the switching circuit itself. The low voltage levels involved, as well as the high gain following the preamplifier dictate that switch sections and rotors be kept clean at all times to afford low resistance contact and prevent noisy switching. The sudden appearance of annoying "plops" when switching from one playback characteristic to another usually means that one of the equalization capacitors (in the feedback loop) or the plate coupling capacitor (.047  $\mu$ f on pin 5 of the 6SC7 in Fig. 7) has become leaky and should be replaced.

### DC Filament Preamplifiers

Very often, preamplifiers which are part of more elaborate control chassis employ *dc* voltage for the heaters. In such cases, the tube type used may be a more conventional 12AX7 or 12AY7. Filament hum induction is no longer a problem, and the tube types mentioned have the added advantage of possessing separate cathodes for the two triode sections. Cathode bias can therefore be utilized and units of this type are generally able to handle higher-level cartridges without overloading of the first stage.

A very common basic circuit configuration of this type is shown in Fig. 10. This time, both low and high frequency equalization are accomplished within one feedback loop and the feedback path is between the plate circuit

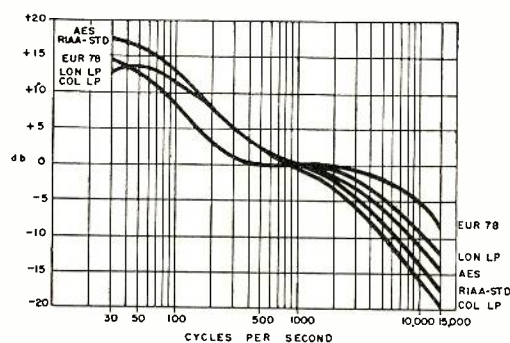
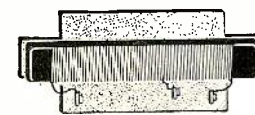


Fig. 9—Five separate playback curves obtainable with the use of a selector switch.

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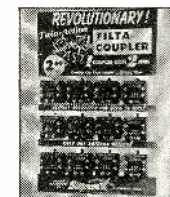
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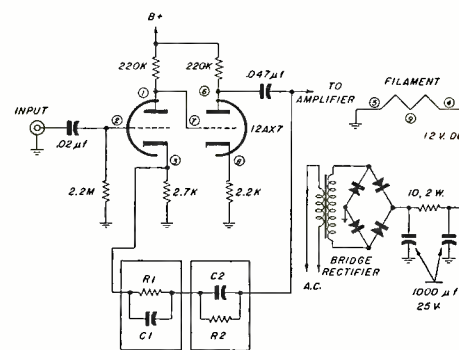
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of the second stage and the cathode circuit of the first stage. Degeneration in both cathode circuits further aids in making this type of circuit overload-proof. Parts represented in the blocks  $R1$ ,  $C1$ ,  $R2$  and  $C2$  are, of course, determined by the characteristic playback curve desired and the number of switching combinations possible is limited only by the cost of the product.

### Servicing DC Filament Preamplifiers

Two additional servicing precautions should be observed with *dc* heater preamplifiers, and these involve the heater supply itself. Usually, a high-current selenium rectifier, followed by heavy *RC* filtering supplies 6 or 12 volts *dc* to the tube filament in question. The sudden appearance of hum in the system, if not correctable by tube replacement and general "ground" checking can often be traced to improper filtering of this *dc* supply. Observe the *ac* ripple content on an oscilloscope, and if it is more than a fraction of one percent of the total *dc* output voltage, some element of this power supply (either selenium rectifier or filter capacitors) may be reasonably suspected.

Secondly, many control chassis of this type utilize *dc* voltage on the heaters of other low-level stages besides the preamplifier. (e.g. tone control stage, first voltage amplifier, etc.) It is usually more convenient to use higher *dc* voltages (say 18 volts for three tubes) and wire the filaments of the three stages so supplied in series. As a result, removal of the preamplifier tube in the course of servicing of any nature is not



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 $R2$  CAUSES PORTION OF CURVE OF FIG.5 BETWEEN 100 AND 30 CYCLES.

Fig. 10—Typical preamplifier employing plate-cathode feedback and a *dc* heater supply.

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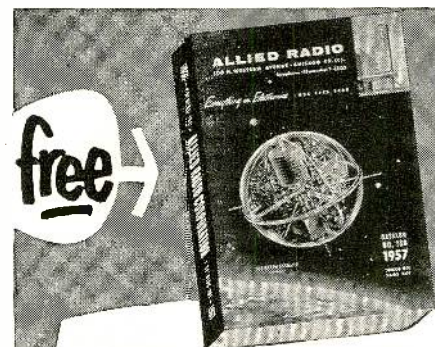
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1NSGT	.....	.95	6BC5	.....	.75	12A6	.....	.75
1OSGT	.....	1.15	6BC7	.....	1.25	12A7	.....	.85
1R4	.....	1.00	6BD5	.....	1.40	12A7	.....	1.00
1R5	.....	.85	6BD6	.....	.75	12AU6	.....	.70
1S4	.....	.90	6BE6	.....	.75	12AU7	.....	.85
1S5	.....	.75	6BF5	.....	.90	12AV6	.....	.65
1T4	.....	.85	6BF6	.....	.70	12AV7	.....	1.05
1T5GT	.....	1.05	6BG6	.....	1.85	12AW6	.....	1.00
1U4	.....	.80	6BH6	.....	.90	12AX4GT	.....	1.00
1U5	.....	.75	6BJ6	.....	.85	12AX7	.....	.90
1V	.....	.95	6BK5	.....	1.15	12AY7	.....	1.75
1V2	.....	.70	6BK7A	.....	1.15	12AZ7	.....	.95
1X2B	.....	1.00	6BL7GT	.....	1.25	12BA4	.....	.90
2AF4A	.....	1.40	6BN6	.....	1.15	12BA6	.....	.70
2D2T	.....	1.00	6BQ6TA	.....	1.45	12B7	.....	.95
2X2	.....	.50	6BQ7A	.....	1.30	12BD6	.....	.75
3A3	.....	1.10	6BX7GT	.....	1.25	12BE6	.....	.75
3A4	.....	.55	6BY5G	.....	1.30	12BF6	.....	.70
3A5	.....	.75	6BZ6	.....	.80	12BH7A	.....	1.00
3AL5	.....	.70	6BZ7	.....	1.35	12BK5	.....	1.10
3AUB	.....	.75	6C4	.....	.60	12BQ6TB	.....	1.45
3AV6	.....	.65	6C5	.....	.80	12B7	.....	.90
3BA6	.....	.75	6CB5	.....	4.50	12BY7A	.....	1.05
3BC5	.....	.80	6CB6	.....	.75	12BZ7	.....	1.10
3BE6	.....	.75	6CD6G	.....	1.90	12CA5	.....	.80
3BN6	.....	1.05	6CF6	.....	.90	12CU6	.....	1.45
3BY6	.....	.90	6CG7	.....	.90	12L6	.....	.80
3BZ6	.....	.80	6CL6	.....	1.20	12SA7GT	.....	1.00
3CB6	.....	.85	6CM6	.....	.85	12SC7	.....	.80
3CF6	.....	.85	6CS6	.....	.75	12S7	.....	.75
3CS6	.....	.80	6CU6	.....	1.45	12SK7GT	.....	.80
3LF4	.....	1.20	6DC6	.....	.95	12SL7GT	.....	1.00
3Q4	.....	.85	6DE6	.....	.80	12SN7GTA	.....	.85
3Q5GT	.....	1.00	6F5	.....	.85	12S7GT	.....	.75
3V4	.....	.80	6FG	.....	.80	12V6GT	.....	.80
4BQ7A	.....	1.30	6J4	.....	3.95	14A4	.....	1.00
4BZ7	.....	1.35	6J5	.....	.75	14A5	.....	1.50
5A8	.....	1.05	6J6	.....	.70	14A7	.....	.85
5AN8	.....	1.10	6K6GT	.....	.75	14F7	.....	1.00
5AQ5	.....	.75	6K7	.....	.90	14G6	.....	.85
5AS8	.....	1.10	6K8	.....	1.20	14G7	.....	1.00
5AT8	.....	1.10	6L6GA	.....	1.30	14E6	.....	1.20
5AY8	.....	1.15	6L6M	.....	1.75	14E7	.....	1.30
5AW4	.....	1.15	6N7	.....	1.20	14F7	.....	1.00
5AZ4	.....	.60	6Q7	.....	1.00	14F8	.....	1.30
5BZ7	.....	1.10	6S4	.....	.70	14H7	.....	1.00
5B	.....	.95	6S6GT	.....	1.10	14J7	.....	.90
5T4	.....	1.75	6SA7GT	.....	1.00	14K7	.....	1.30
5T8	.....	1.10	6SC7	.....	1.00	14R7	.....	1.30
5U4G	.....	.70	6SF5	.....	.75	14S7	.....	1.25
5U4GB	.....	.75	6SF7	.....	.95	14W7	.....	1.35
5U8	.....	1.10	6SG7	.....	1.00	19T8	.....	1.20
5V4G	.....	1.00	6SH	.....	.95	25A56GT	.....	1.30
5V6GT	.....	.70	6S7M	.....	.85	25A44GT	.....	1.10
5W4GT	.....	.80	6SK7GT	.....	.85	25BK5	.....	1.10
5X4G	.....	.30	6SL7GT	.....	1.00	25B06GTB	.....	1.45
5X8	.....	1.05	6SN7GTA/B	.....	.90	25C06GA	.....	1.85
5Y3GT	.....	.60	6SQ7GT	.....	.75	25C06	.....	1.45
5Y4G	.....	.65	6S7	.....	.75	25L6GT	.....	.75
5Z4	.....	.90	6T4	.....	1.30	25W4GT	.....	.85
6A8GT	.....	1.10	6U8	.....	1.10	25Z6GT	.....	.80
6AB4	.....	.70	6V3A	.....	1.50	35A5	.....	.75
6AC5GT	.....	1.15	6V6GT	.....	.75	35B5	.....	.70
6AC7	.....	1.15	6V6M	.....	1.35	35C5	.....	.70
6AD7G	.....	1.35	6W4GT	.....	.80	35L6GT	.....	.65
6AF4T	.....	1.35	6W6GT	.....	.95	35W4	.....	.55
6AF6G	.....	1.20	6X4	.....	.55	35Y4	.....	.75
6AG5	.....	.80	6X5GT	.....	.55	35Z5	.....	.60
6AG7	.....	1.35	6X8	.....	1.20	41	.....	.85
6AH4GT	.....	1.00	6Y6G	.....	.95	42	.....	.75
6AH6V	.....	1.05	7A5	.....	.95	43	.....	.85
6AJ5	.....	1.75	7A6	.....	.80	50A5	.....	.75
6AK5	.....	.80	7A7	.....	.85	50B5	.....	.75
6AK6	.....	.80	7A8	.....	.80	50C5	.....	.75
6AL5	.....	.65	7AG7	.....	1.00	50L6GT	.....	.75
6AL7GT	.....	1.65	7AH7	.....	1.00	50X6GT	.....	.90
6AM4	.....	1.55	7B4	.....	.80	50Y6GT	.....	1.00
6AN8	.....	1.15	7B5	.....	.70	50Y7GT	.....	.90
6AN4	.....	1.30	7B7	.....	1.00	70L7GT	.....	1.55
6AN5	.....	.90	7B8	.....	.80	80	.....	.65
6AN8	.....	1.20	7B8	.....	.90	117L7GT	.....	2.50
6AQ5	.....	.75	7C5	.....	.80	117N/P7	.....	2.00
6AQ6	.....	.60	7C6	.....	1.00	117Z3	.....	.80
6AQ7GT	.....	1.25	7C7	.....	.85	117Z4GT	.....	1.15
6AR5	.....	.75	7EZ	.....	1.20	117Z6GT	.....	1.15
6AS5	.....	.80	7F7	.....	.90	5642	.....	1.00

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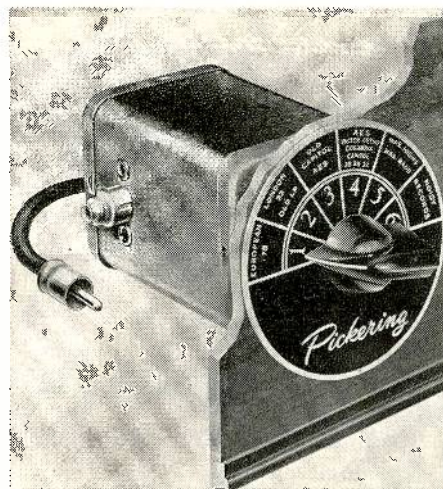


Fig. 11 — Pickering Model 132E record compensator used to provide variable equalization.

valid in such chassis, inasmuch as several other tubes will become inoperative at the same time.

Of course, frequency response and distortion checks may be performed on preamplifiers of all types as outlined in the previous article of this series.

### Passive Compensators

The final type of component to be considered, though not really a preamplifier, is often used advantageously to make a fixed-equalization basic preamplifier capable of variable equalization. Such a compensator, typical of many in use, is pictured in Fig. 11. The unit is interposed between the cartridge and the input to a preamplifier having only one fixed bass-boost equalization response curve. The compensator, containing suitable configurations of capacitors and resistors, supplies six curves having different roll-offs. In

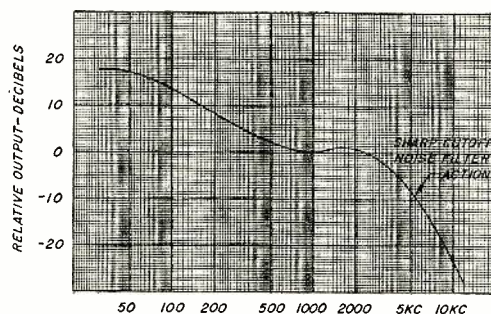


Fig. 12 — Pickering Model 132E response for sixth position of switch for "noisy records."

addition, the unit provides slight modification of the bass-boost curve already present in the basic preamplifier with which it is used. The sixth position of this particular compensator is labeled "Noisy Records." It is used to eliminate the maximum amount of surface noise, with a minimum sacrifice of the musical content of a recording. The resultant curve, shown in Fig. 12, does not correspond exactly to the inverse of any particular recording curve, but is of interest because of its sharp roll-off characteristic above 3,000 or 4,000 cycles. Most older recordings, with which such compensation would be used, hardly ever had much musical content above 4,000 cycles in the first place, so only the surface noise is reduced.

### Installing Compensators

Compensators of the type described can be sold and used successfully in many installations. What's more, they are usually fairly inexpensive considering the audible improvement they often provide. However, a few precautions must be observed here too. Compensators are usually designed to work best with specific cartridges, or at least specific types of cartridges. Factors such as input impedance, output impedance and level are of major importance here. A compensator designed for medium level (10 to 20 millivolts output) cartridges having a required load impedance of 50,000 ohms or so will not function properly when used with a low level cartridge having an output of 2 or 3 millivolts. Not only will the response curves differ from those desired, but in many cases the signal-to-hum ratio will deteriorate as well. Therefore, before installing such devices, make sure you know ALL the elements of the customer's installation and recommend only such accessories that will preserve the hard-to-achieve "matched system" quality of the entire installation.

In the next article of this series we shall discuss all the popular types of tone controls used in High Fidelity systems. We shall also, perhaps, justify the presence of tone controls in a system where the stated objective was FLAT response rather than boost or attenuation of BASS or TREBLE. ■ ■

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Chanrose Electronics, Inc., at 170-16 Jamaica Avenue, Jamaica, L.I., has initiated a "Save Old Selenium" campaign among the Television and Radio Servicemen on Long Island, for the express purpose of benefiting the Damon Runyon Memorial Fund for Cancer Research, Inc.

Under this program all T.V. Servicemen are asked regularly to save and contribute any old selenium rectifiers they may get. These are then processed and sent to a local selenium rectifier manufacturer who reclaims them.

All proceeds from the sale of this used selenium will be forwarded to the Damon Runyon Memorial Fund for Cancer Research, Inc., and the monies so derived will be shown as a regular contribution made possible by the T.V. Servicemen on Long Island.

Any jobber who may wish to set up a similar program to benefit a charity of their choice may write Gerard J. White at Chanrose for any information they desire.

An invitation is also extended to T.V. Servicemen anywhere who may wish to contribute their seleniums to the Runyon Fund. Just mail or bring the old seleniums to the above address and be assured the resultant proceeds will go to a very worthy cause.

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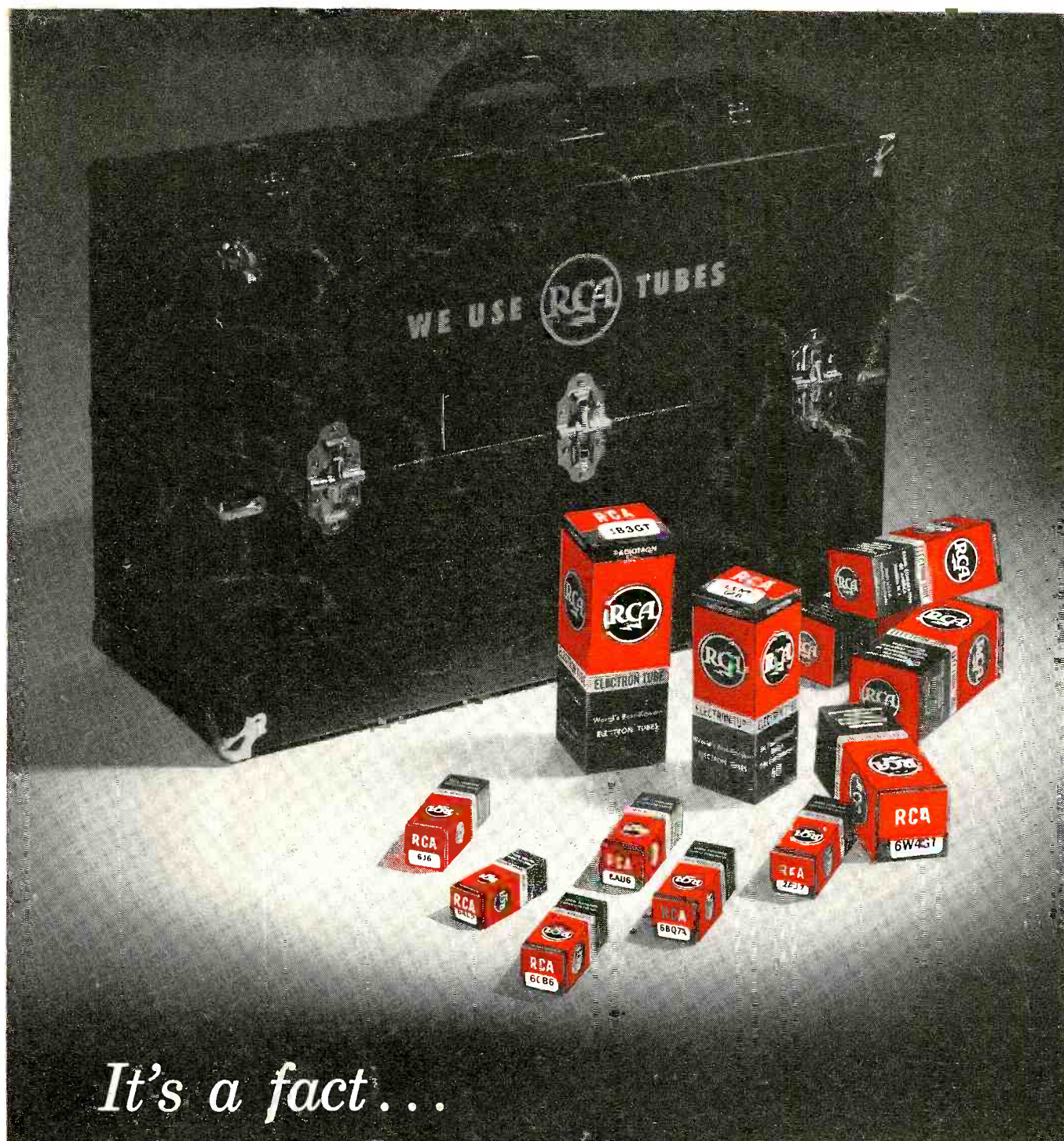
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