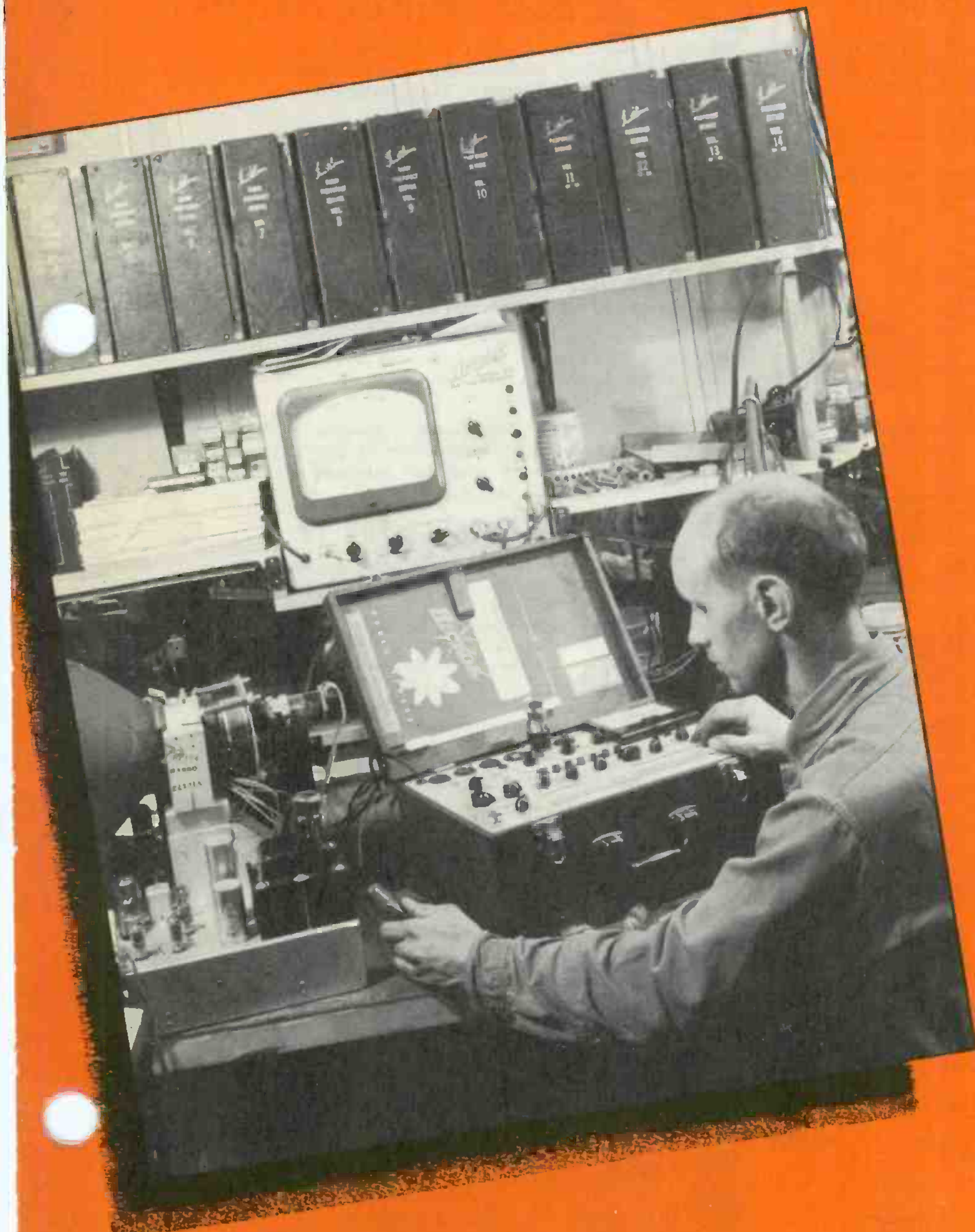
Howard W. Sams

PHOTOFACT

INDEX

AND TECHNICAL DIGEST



Mar. • April • 1952
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COVERING PHOTOFACT FOLDER SETS 1 THRU 164

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Pick of the Trade

TWAIN'S SPIDER: This story about Mark Twain may be old hat to you but the sentiment's right timely. Twain, while editor of the Virginia City Enterprise, received a letter from a subscriber who had found a spider in his paper. "Was this a sign of good or bad luck?" the reader asked.

Twain's reply: "Neither good luck nor bad. That spider was merely looking over our pages to find out what merchant was not advertising, so that it could spin its web across his door and lead a free and undisturbed existence forever."

Electronics Markets—December, 1951

★ ★ ★

HEARING-AID RECEIVER units in the past were manufactured along the lines of conventional headphones. Because of their smaller size, their impedance ranged between 50 to 120 ohms. Recent achievements have permitted the attainment of 400-ohm impedances in units about the diameter of a nickel. Current development is directed toward a 9000-ohm impedance in a unit smaller than a dime. No. 42 wire is being used experimentally.

Tele-Tech—January, 1952

★ ★ ★

SIGHTLESS PERSONS are finding new spheres of usefulness. One foreign station has begun to use blind men as radio monitors in its main studios. The suggestion is sensible since a blind man's sense of hearing is much more acute than a sighted person's and as a result he will be more critical of the audio signals reaching his ears.

Tele-Tech—February, 1952

★ ★ ★

NEWS HIGHLIGHTS: The NBC TV Sales Planning and Research Department reported that as of January 1st, a total of 15,777,000 TV sets were installed in the U.S. The RTMA reported that 5,348,798 TV sets had been produced during 1951 as compared with 7,463,800 in 1950. Radio output was estimated at 12,299,146 as against 14,589,900 for the previous year.

Radio Electronics
Weekly Business Letter
February 4, 1952

★ ★ ★

PEANUTS will not pay for a new television station. Complete very-high-frequency television stations using 100 kilowatts on channels 2 to 6 and 200 kilowatts on channels 7 to 13 would cost $593,500 in the first case and $587,500 in the second, including remote-pickup truck and double-hop microwave relay equipment. Ultra-high-frequency stations will cost at least $1,500 more.

Electronics—February, 1952

★ ★ ★

Point-contact transistors will be mass-produced in 1952. These units display uniformity and reliability comparable to the vacuum tube. The new "junction transistor" with advantages of high gain per stage, low noise, and extremely small power consumption (one-millionth watt) is held back by limitations in the higher frequencies and in pulse circuits; so that considerable experimental work lies ahead. Transistors' simple construction, sturdiness, long life, low power drain, resistance to shock and vibration make them ideal for many applications.

Radio & Television Retailing—January, 1952

★ ★ ★

The advent of "upstairs" TV will inaugurate a bright new era, teaming with possibilities for broadcasters, manufacturers, dealers and Service Men.

Technically, the arrival of channels 14 to 83 will introduce many intriguing factors. Receivers may find themselves equipped with transittime tubes, crystals in many circuits and vacuum tubes as substitutes for coils and capacitors. Many of the design techniques acquired during the development of radar will undoubtedly find their way into transmitters.

Commenting on the significant expansion that the ultrahighs will provide, Dr. DuMont said recently that in the 1239 communities scheduled to have TV, 897 will feature ultrahigh stations exclusively; quite a contrast to the limited number of uhf's now in operation.

L.W. in *TeleVision Engineering*—January, 1952

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VOL. 2 · NO. 2 **MAR.-APRIL, 1952**

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Printed by: The WALDEMAR Press; Joseph C. Collins, Mgr.

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HOWARD W. SAMS, *Publisher*

2201 East 46th Street • Indianapolis 5, Indiana

The PF (PHOTOFACT) INDEX and Technical Digest is published every other month by Howard W. Sams & Co., Inc. at 2201 East 46th Street, Indianapolis 5, Indiana—and is included as a part of PHOTOFACT folders from PHOTOFACT Distributors without additional cost.

SUBSCRIPTION DATA: For those desiring the convenience of delivery to their homes or shops, Howard W. Sams & Co., Inc. will mail each issue of the INDEX direct, promptly upon publication. The subscription charge is $2.00 for eight issues in the United States and U. S. possessions. Acceptance under Section 34.64 P. L. & R. authorized at Indianapolis, Indiana.

ABOUT THE COVER: The photograph is of William J. Schneider, owner of Fairview Radio & Television Service, Fairview Park, Ohio. Mr. Schneider writes: "My two employees and myself find that your folders are a definite requisite to expediting the service and repairs of radios and TV sets. They are indispensable in the present day trend for accurate, prompt and profitable radio and TV service."

MILTON S. KIVER

President, Television Communications Institute

Shop Talk

There is an old and venerable expression to the effect that, "the best things in life are free," and while you may or may not agree to this (depending upon how many "best" things you have received free in your life), it is true that many good things are free. Take the television service industry as one example in point. Public acceptance of the products that the television manufacturers produce depends not only on how well this product is designed and merchandised but, to a great extent, upon the facilities available for installing and maintaining this product in operation after it has been bought. Capehart, in a very excellent movie, calls this the "sale after the sale." Other manufacturers, while not going to the extent of making a special movie, do recognize that their well-being is intimately tied in with the capabilities of the men who service their sets. And because they fully appreciate this relationship, many of the more progressive manufacturers have special departments whose only job is to keep you - Mr. TV Serviceman - fully informed about TV in general and their sets in particular.

These manufacturers put out well-edited monthly, bi-monthly, or quarterly publications containing news of their newer products, circuit explanations of their receivers, servicing suggestions, and comments on the field in general.

As a guide to some of the more informative and important literature available, the following list has been prepared. Most of this information can be obtained merely by sending your name to the firm mentioned and indicating that you want to have your name placed on their mailing list for the particular material involved. For some of the others there is small nominal charge designed to defray the cost of mailing the piece to you. In each instance the information you receive is worth many times what you have to pay for it.

1. Sylvania News - Obtainable from the Sylvania Electric Products Company of Emporium, Pennsylvania.

2. Radio Service News and Radio Phono Television Service Tips - both available from your local RCA parts distributor.

3. DuMont Service News published monthly by the Teleset Service Control Department of the Allen B. DuMont Laboratories, Inc., 35 Market Street, East Patterson, New Jersey. A year's subscription to this monthly publication is only $1.00.

4. Tele-Clues and Techni-Talk are two General Electric publications. They can be obtained from:

Advertising & Sales Promotion Section
Tube Division, Electronics Department
General Electric Company
1 River Road
Schenectady 5, New York

5. Philco has several small monthly publications covering a variety of subjects from servicing to customer relations. The yearly subscription payment for these must be made to your local Philco distributor.

6. The Aerovox Research Worker - A formidable title for a publication that has been widely used by radio and television servicemen for many, many, years. To receive it, simply send your name to the publication in care of the Aerovox Corporation, New Bedford, Massachusetts.

All of these publications carry information of particular interest to radio and television servicemen. There are other publications which are not slanted specifically to the service industry and these were not included. In this group there are such papers as The Hewlett-Packard Journal, the Amphenol Engineering News, and The Audio Record, just to name a few. Also, no attempt has been made to list those radio and TV manufacturers who do not issue house organs (such as the above) but who do send out, from time to time, service bulletins on their sets indicating specific remedies for certain abnormalities.

Just to show you what you have been missing by not receiving the aforementioned six publications, Sylvania News, in December, 1951 issue, contains an excellent article by H. Allen White on "Servicing a TV Set with Pull at Top of Picture." Radio Service News of RCA contains a very informative TV servicing article by John R. Meagher in almost every issue. (John is the fellow who was respônsible for the RCA Pict-O-Guides.)

"Using the Oscillograph for Television Servicing" is the title of several articles by Walter Boiko in recent issues of the DuMont Service News. For those who seek information on small screen to large screen conversion, recent issues of the G. E. Techni-Talk will be of considerable interest. And, ways and means of tracking down sync troubles accurately and quickly will be found in the Philco

Service publication. From this quick glance of what these bulletins offer, their value to every practicing TV serviceman is manifestly obvious.

* * *

TUBE KITS. The man who is just breaking into the television service field, either on a full time or part time basis, is confronted with many organizational problems. First and foremost is the problem of instruments and this has been covered in a previous issue of the Photofact Index (May, 1951). Next is component stock, and since tubes are the most frequent replacement, the proper balance of this portion of your stock is an important consideration. To those who are faced with this problem, the following listing will be of interest. Taken from the files of Central Television Service of Chicago, it is broken down into three categories: Tubes carried by the Shop Man at his bench, tubes carried by the Outside Service Man, and finally, tubes carried by the men who install the antennas and otherwise prepare newly arrived sets for operation. Central Television services a wide variety of receivers and these tube lists were compiled so that the men carrying tube assortments could perform the maximum of service.

SHOP MAN

1 - 6W4	2 - 6C4	2 - 19BG6G
2 - 1B3/8016	2 - 5U4G	2 - 6AH6
2 - 6SN7GT	2 - 5Y3GT	2 - 6J5
4 - 6J6	2 - 6AT6	2 - 6AB4
2 - 6AU6	2 - 5V4G	1 - 6AG7
2 - 25L6GT	2 - 6V6GT	1 - 7F8
4 - 6AC7	3 - 12AU7	1 - 7F7
1 - 12AT7	2 - 6AK5	3 - 12SN7GT
1 - 25Z6GT	2 - 6K6GT	1 - 50B5
2 - 6SL7GT	2 - 6AK6	1 - 35W4
7 - 6AG5	1 - 12AU6	1 - 6SQ7GT
3 - 6BG6G	1 - 6AV6	1 - 6BQ6
1 - 6AS7	2 - 6AQ5	1 - 25BQ6
1 - 7W7	1 - 12AX7	1 - 6AQ7
2 - 6BA6	1 - 7Z4	1 - 6SJ7
1 - 6H6	1 - 19T8	2 - 6X4
1 - 6T8	2 - 6BE6	1 - 7N7
1 - 6SK7GT	1 - 6C5	1 - 6SG7
1 - 6X5GT	2 - 6BH6	1 - 6S8
2 - 6AL5	2 - 6SC7	

OUTSIDE SERVICE

1 - 1V2	2 - 6AK5	1 - 6W4
1 - 7B4	2 - 12AV6	1 - 6BD5
2 - 6C4	1 - 6SB7Y	2 - 6BG6G
1 - 5V4G	1 - 12BE6	1 - 14F8
1 - 7C7	2 - 1B3/8016	2 - 6SN7GT
1 - 6H6	1 - 7B5	2 - 6AU6
2 - 6AC7	1 - 6CB6	1 - 25W4
1 - 7X7	1 - 5W4	2 - 6X4
1 - 6L6	1 - 7F7	1 - 6AR5
1 - 6AK6	1 - 6J5	1 - 19BG6
2 - 12AU7	4 - 6AG5	1 - 6SQ7QT
1 - 6SC7	1 - 7Z4	1 - 6AV5
2 - 6BJ6	1 - 6N7	1 - 25Z6GT
1 - 1X2	2 - 6AL5	1 - 6X5GT
1 - 7B6	1 - 12BA6	1 - 7A7
1 - 6CD6	1 - 6AQ5	1 - 6AS5

1 - 5Y3GT	1 - 6BN6	1 - 19T8
1 - 7F8	1 - 2X2	1 - 6T8
4 - 6J6	1 - 7C5	1 - 6BA6
1 - 6AG7	1 - 6F5	1 - 35W4
2 - 12AT6	1 - 5Y4G	2 - 6SJ7
1 - 6S4	1 - 7N7	1 - 6AS7
1 - 6AL7	1 - 6X5	1 - 25BQ6
1 - 6SG7	1 - 6AH6	2 - 6V6GT
1 - 7AF7	2 - 12AT7	3 - 6BC5
1 - 6BQ6	1 - 6SA7GT	1 - 50C6
4 - 5V4G	1 - 6AQ5	1 - 6BH6
1 - 7C6	1 - 6SH7	1 - 6BE6
1 - 6F6	1 - 12SN7GT	1 - 7AD7
2 - 6AB4	1 - 6SA7GT	1 - 6Y6G
1 - 7W7	1 - 6AT5	
1 - 6K6GT	1 - 25L6GT	

INSTALLATION

2 - 1B3	1 - 5Y3	1 - 6AG7
1 - 6T8	1 - 12AT7	1 - 25BQ5
1 - 6BQ6	1 - 6BQ6	1 - 6AK5
2 - 6AB4	1 - 6AH6	1 - 25W4
1 - 12AU7	2 - 1X2	1 - 6SJ7
1 - 6C4	1 - 6V6	2 - 6J6
1 - 6AQ5	1 - 6BH6	1 - 6AL5
2 - 5U4	1 - 6AG7	1 - 6AL7
1 - 6W4	2 - 12SN7	1 - 25L6
1 - 6BJ6	1 - 6CB6	1 - 6S4
2 - 6AG5	2 - 6AV6	1 - 6AK6
1 - 19BG6	1 - 5V4	1 - 25Z6
1 - 6SN7	2 - 6X4	1 - 6K6
1 - 6BA6	1 - 6BN6	

GERMANIUM DIODE DETECTORS. An old and time tested saying among servicemen is that new circuits bring with them new troubles. One of the latest circuit innovations that is taking more than its apparent share of servicing are germanium diodes employed as video second detectors. These components, when defective, have been found to reduce the video output unduly or else open up. Weak output manifests itself by a picture lacking adequate contrast, accompanied by a vertical roll due to insufficient sync pulse. If you look closely at the picture, you will note that although the picture is held in horizontal sync, there is frequently a bend at the top of the picture and the hold-in range of the horizontal hold control is not as wide as it normally is.

To check a germanium diode, disconnect one side of the unit from the circuit and check the front-to-back ratio with the ohmmeter range of a VTVM. A relatively low resistance (several hundred ohms or less) should be obtained in one direction and a relatively high reading (about 1,000 to 1,500 times as much) should be noted in the other direction as the ohmmeter leads are reversed.

When these rectifiers are replaced, it is extremely important that the proper polarity be observed. Also care should be taken to see that the leads are not pulled so tight as to cause excess tension. Finally, remember that germanium diodes are easily ruined by heat. When soldering, grip the wire leads between the body of the diode and the solder point with a pair of long nose pliers to conduct away some of the heat which would normally be absorbed by the diode itself.

♦ ♦ Please turn to page 67 ♦ ♦

Video Detection and Amplification

by W. William Hensler

A discussion of requirements and commercial application of Video detectors and amplifiers.

Part II

Direct Coupled Video Amplifiers

Through the use of direct coupled amplifiers the resistance-capacitance coupling network can be eliminated in the video amplifier. Since this coupling network is the source of most of the low frequency distortion, the use of direct coupled amplifiers makes possible the design of a video amplifier having good low frequency response, with fewer components than are required in the conventional resistance-capacitance coupled amplifier. Since fewer components are required, it would seem that this type of circuit would be employed exclusively.

There are several design problems that arise in using the direct coupling principle, however, which prevent widespread usage. The most important of these is the fact that successive stages are effectively in series, which necessitates a high B plus voltage. Figure 4-10 is a simplified schematic showing the requirements of the power supply when two direct coupled stages are used. Note that if a B plus voltage of 200 volts is required for each stage that 400 volts are required to supply both stages. This is somewhat higher than the voltage supplied by the conventional power supply. As a result, the power supply must be designed to provide a higher output voltage, the added cost of which is considerably higher than the saving afforded by the elimination of the coupling components in the video amplifier. As a result direct coupled amplifiers are seldom employed when more than one stage of video amplification is required.

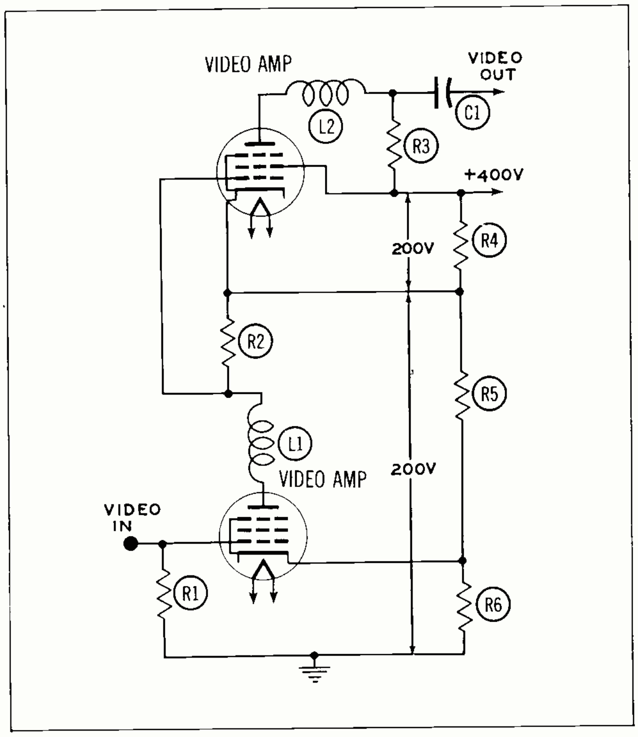


Figure 4-10. Simplified Schematic of Direct-Coupled Amplifier.

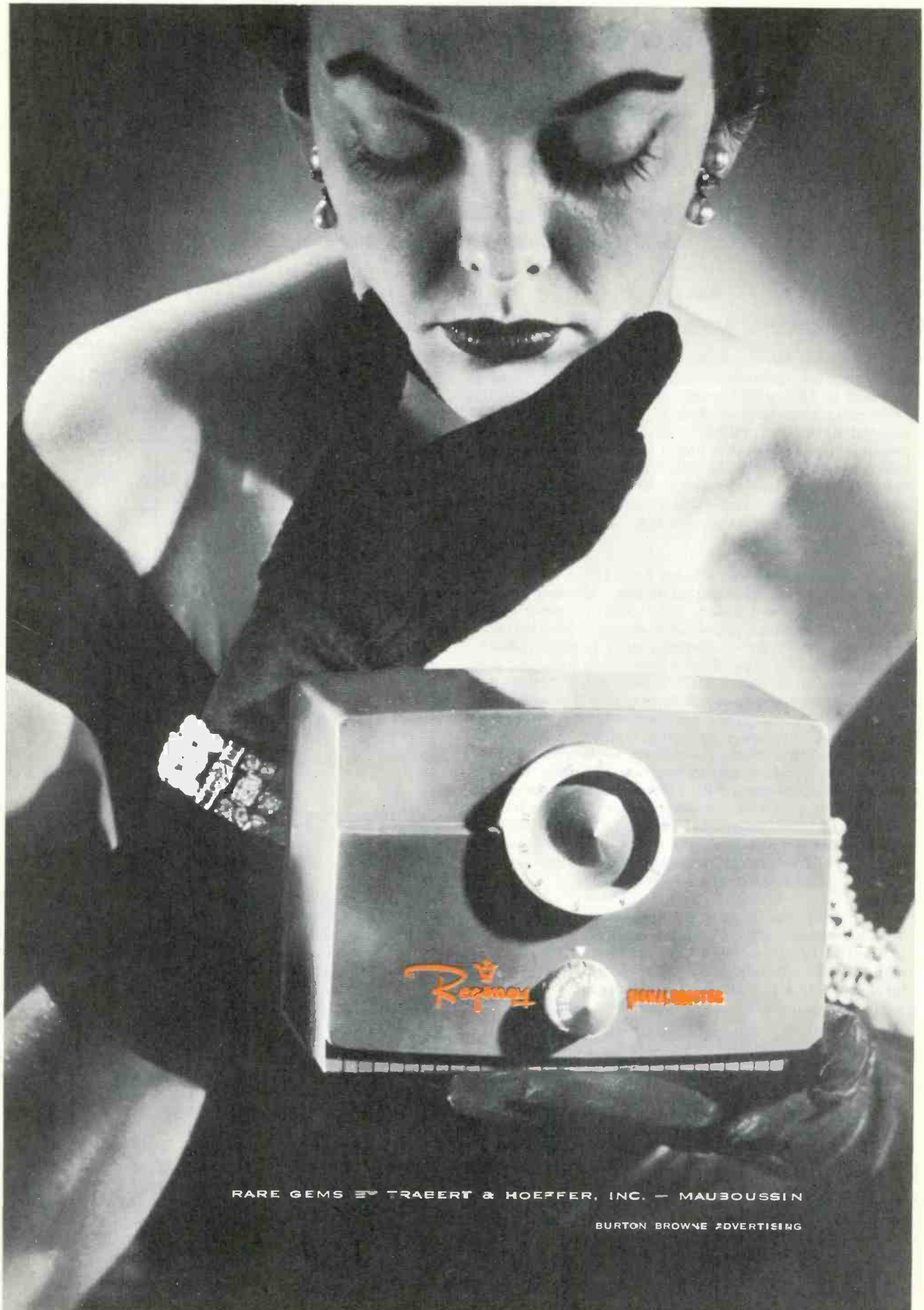
In addition to good low frequency response, the direct coupled video amplifier has another advantage in that no DC restoration is required. A direct coupled amplifier is in effect a DC amplifier. The DC referance level of the video signal, therefore, is not lost as is the case in the resistance-capacitance coupled type.

The limiting factors for good high frequency response in the direct coupled amplifier are the same as those of the conventional resistance-capacitance coupled amplifier. The peaking circuits, therefore, are the same as those employed in other circuits.

A direct coupled video amplifier is shown in Figure 4-11. The detector is a conventional series detector employing a series peaking coil. The network of C2 and L3 make up a 4.5 mc filter which will be discussed later. R2 is the resistive load of the detector. Note that the grid of the video amplifier is directly connected to the junction of R2 and the 4.5 mc trap. The voltage drop across R2, caused by the conduction of the detector, and a small amount of self bias developed across R3, make up the bias for the stage. Since the response of a direct coupled amplifier is essentially flat down to DC, partial degeneration is obtained in the cathode circuit of the video amplifier through the use of a rather small bypass capacitor. By allowing a small amount of degeneration at the low frequencies to take place, a more uniform response can be obtained over the entire frequency range.

A 10 mfd. electrolytic capacitor (C4) is used in the screen circuit to prevent degeneration. The plate circuit employs both series and shunt peaking to extend the high frequency response of the amplifier.

The network comprised of R6 and R7 forms a voltage divider, the purpose of which is to obtain the correct bias for the picture tube which is direct coupled to the junction of the resistors. C5, which shunts R6, prevents the loss of the high frequency components of the video signal. The reactance of C5, however, is rather high at the extremely low frequencies, and it is the function of R6 to couple the very low frequencies to the picture tube grid. With the values of R6 and R7 equal, as is the case in Figure 4-11, only one half of


Regency
RARE GEMS BY TRABERT & HOEFFER, INC. — MAUBOUSSIN
BURTON BROWNE ADVERTISING

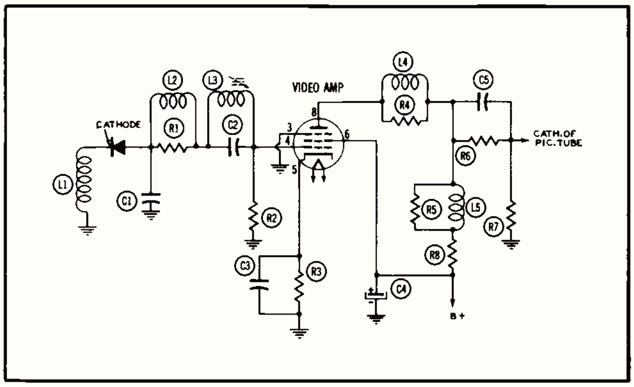


Figure 4-11. Single Stage Direct-Coupled Amplifier.

any change in the average voltage level at the plate of the video amplifier will be coupled to the picture tube grid. The absence of such a network might cause excessive "blooming" or "black-out" due to too great a change in the picture tube bias. The ratio of the divider network is governed to a great extent by the gain of the video amplifier stage.

Through the use of high transconductance tubes, one stage of amplification provides sufficient gain for full modulation of the picture tube. This makes possible the use of direct coupling without placing critical demands on the power supply. The type 6AG7 tube which has a high transconductance rating, is being used quite frequently as a video amplifier. Its transconductance is sufficiently high so that considerable gain is realized even though a low plate load is used.

Figure 4-12 is a partial schematic of a direct coupled video amplifier employing a type 6AG7 tube. This stage is so designed that a gain of approximately 27 is realized. Note that the grid of the stage is directly coupled to the output of the detector. Also that the contrast control is directly coupled to the output of the stage. The arm of the contrast control is connected to the cathode of the picture tube through the appropriate peaking coils. The unusual feature of this circuit is that the gain of the stage is not varied. Instead, the desired signal level is selected by means of the contrast control in the plate circuit. The contrast control is a low resistance, frequency compensated unit. By means of the multiple feed network and the divider composed of R5 and R6, very little voltage is dropped across the contrast control. This allows adjustment of the contrast control over its full range wihtout changing the voltage applied to the picture tube cathode any great amount. Thus under normal conditions no adjustment of the brightness control is required. Since direct coupling is employed throughout, no DC restoration is required.

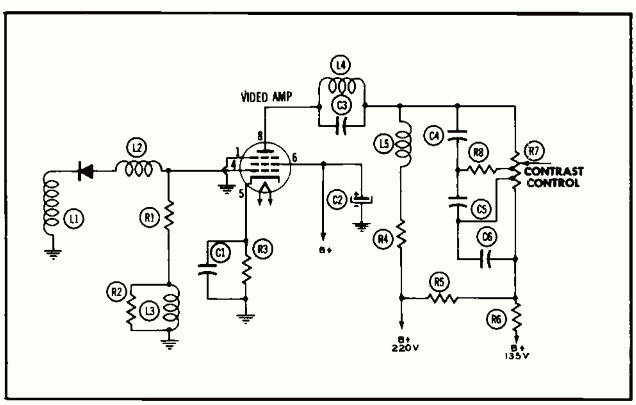


Figure 4-12. Constant Gain Video Amplifier.

Noise Clipping

The majority of video detectors are so designed that their output is of a negative polarity; that is, the sync pulse is negative going. This signal is then coupled to the grid of the video amplifier. Any noise pulses of greater amplitude than the sync pulses will drive the video amplifier stage to cutoff, thus effectively eliminating the high amplitude noise peaks. If these noise pulses were allowed to pass through the circuit, there is a possibility that it might trigger the horizontal or vertical oscillators and thus cause erratic operation. Again referring to Figure 4-12, it can be seen that this stage is designed to provide a negative going signal at the video amplifier grid. Since the gain of the stage is not varied, as previously pointed out, it is possible to design the stage so that the cutoff point is just at the peak of the sync pulses. The amplitude of the signal at the video detector is held within limits by means of the AGC circuit.

In some receivers a rather elaborate bias system to obtain this noise clipping may be employed. Figure 4-13 is partial schematic of a video amplifier employing this circuitry. Since a triode is used, the cutoff point of the stage can be varied by changing the plate supply voltage. This is the theory of operation of the circuit.

R6 is a dropping resistor that is common to the B plus supply of both the video amplifier and the video IF amplifiers. With this arrangement the available supply voltage for the video amplifier can be varied by the amount of current being drawn by the video IF amplifiers. Under weak signal conditions the video IF amplifiers will draw maximum current since very little AGC bias will be applied to the stages. This reduces the supply voltage to the video amplifier which in effect changes the cutoff point of the stage so that noise clipping is accomplished.

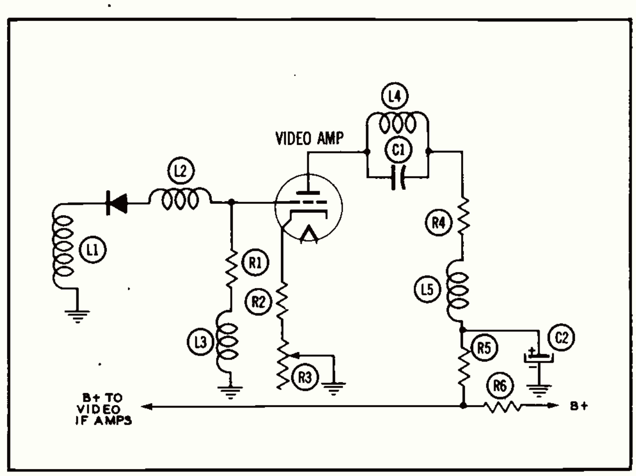


Figure 4-13. Variable Plate Supply Video Amplifier.

Under strong signal conditions, more AGC bias is applied to the IF amplifiers which reduces the current flow in these stages. This increases the plate voltage of the video amplifier which prevents clipping of the video signal which is now at greater amplitude.

Control of Gain

Most of the early television receivers employed a manually operated control to vary the bias on the video IF amplifiers for controlling the contrast of the receiver. When AGC is employed, the AGC bias is automatically set at a level which provides proper bias for the signal being received. Since this bias level is not controllable by the operator, a different type of contrast circuit must be used.

There are four basic methods employed for varying the gain of the video amplifier. These are accomplished by varying:

1. The bias of the stage.
2. B+ supply voltage.
3. The amount of signal applied.
4. The value of the plate load.

Following is a description of these various circuits:

Circuit A of Figure 4-14 employs a contrast circuit which varys the bias of the stage. When the arm of the contrast is moved to the top, no voltage is developed across the contrast control. At this setting maximum gain is realized in the stage. When the arm is moved to the bottom the voltage developed across the control increases the bias of the stage which reduces the gain. This is the simplest of control circuits and is used quite frequently.

The circuit B of Figure 4-14 combines items 1 and 2 above as a means of varying the gain of the stage. The grid resistor R1 is returned to the bottom end of the cathode resistor R2. Thus the voltage developed across R2 is the bias for the stage. The contrast control R3 is added in the cathode circuit. As the arm of the control is varied, the voltage across the control will vary. Any voltage developed across R3 produces the same results that would be obtained if the B plus supply were lowered, since the difference voltage between the lower end of the cathode resistor and B plus is lessened. This type of circuit provides very smooth control over the full range and is also used in many receivers.

Another method for varying the B plus supply voltage is shown in circuit C of Figure 4-14. In this circuit the contrast control, in series with appropriate resistance, is placed across the B plus supply voltage. The plate and screen returns are then connected to the arm of the control. As the control is varied, the gain of the stage will also vary because the supply voltage will be increased or decreased depending on the setting of the control. Due to the fact that all the tube current plus the bleeder current flows through the control, this type circuit places additional requirements on the power handling capabilities of the control and as a result is used only occasionally.

A circuit which varies the amount of signal input to the video amplifier stage is shown at D in Figure

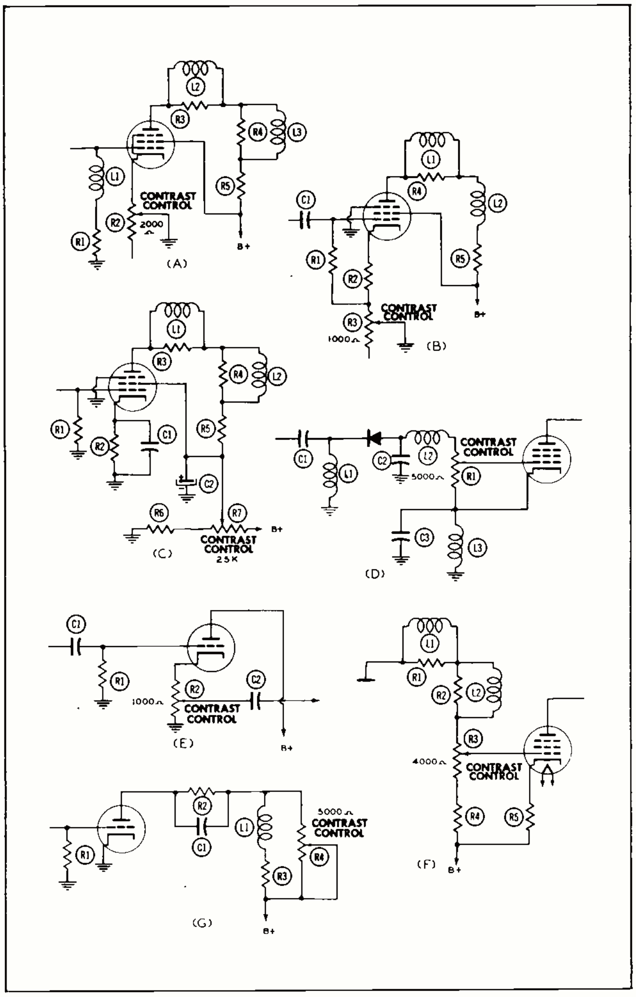


Figure 4-14. (A-G) Various Types of Contrast Control Circuits.

4-14. This basic circuit can be recognized as the one which is employed as a volume control circuit in most audio amplifiers. The contrast control, R1, is the resistive portion of the video detector load. As the arm of the control is moved up, a signal of greater amplitude is picked off the same as is done in the conventional volume control. Note that in this particular circuit the control is uncompensated.

Two other contrast control circuits employing this principle are given in E and F of Figure 4-14. The contrast control of circuit E is in the cathode circuit of a cathode follower which was added in the circuit to provide a point where the low resistance, uncompensated control can be used. In addition to the added cost of the extra stage, another disadvantage lies in the fact that care must be taken in the design of such a circuit to prevent overloading. The contrast control of circuit F in Figure 4-14 is placed in the plate circuit of the first video amplifier. The amount of signal input to the next stage is governed by the setting of the control. The control in this circuit is also a low resistance, uncompensated unit.

Circuit G of Figure 4-14 is probably the least used of all. The contrast control, R4, shunts a portion of the plate load of the video amplifier stage. With the arm of the control at the top, no signal is deve-

♦ ♦ Please turn to page 79 ♦ ♦

The Value of Waveform Analysis

by W. WILLIAM HENSLER and GLEN E. SLUTZ

Part II

In a previous article in PF INDEX No. 30, the characteristics of waveforms which can be used in trouble-shooting were identified and discussed. Also the various pieces of equipment associated with the observation and analysis of waveforms were reviewed. These included the oscilloscope, the voltage calibrator, and a cathode follower attachment. This article will point out a few specific instances when analysis of waveform characteristics is helpful in trouble-shooting.

For a beginning, let us take up a typical vertical sweep system consisting of a blocking oscillator and output amplifier. The schematic for this circuit is shown in Figure 1. The waveform at point W1, which represents the sync input as it arrives from a sync amplifier and separator system, is pictured in Figure 2A. The scope's horizontal sweep frequency is set at 30 cps for this pattern, and therefore the horizontal sync pulses show only as a hazy band across the screen. The vertical pulses, however, appear as widely spaced, sharp spikes. The trailing edges of these vertical pulses are partially formed by the action of the vertical oscillator itself. With an inoperative oscillator the sync information at point W1 would look like Figure 2B, and at the same time, of course, there would be no vertical deflection on the picture tube, just a bright horizontal line.

The waveform at point W2 under normal operating conditions is pictured in Figure 3A. This is very similar to the normal waveform at the input W1 with the exception that the horizontal pulses are absent at W2 due to the action of the integrator network. If there are horizontal pulses showing at point W2, some trouble is likely in the integrator network. Again, a considerable part of the wave pattern at W2 is due to the operation of the blocking oscillator. The actual sync pulse is visible only as a slight positive pip on the leading edge of the waveform. If this pip is not present, it means that the sync pulse is not reaching the grid of the oscillator and there is, as a result, nothing to "hold" the picture vertically. The picture will roll either up or down depending upon the setting of the vertical hold control. Figure 3B is the waveform at point W2 with capacitor C1 open. The loss of sync is evidenced by the missing pip. Some sets become afflicted with weak vertical hold; in other words, the picture will hold vertically over only a very small range of the hold control. A possible cause for this trouble is a low amplitude sync pulse which may be detected by examination of the waveforms at points W1 and W2. Frequently, the source of such trouble is in stages preceding the integrator network; however, it may be due to a defect in the integrator if the sync is normal at point W1.

Point W1 on Figure 1 is a check point for vertical oscillator operation. The waveform at this point is reproduced in Figure 4 and is typical of the normally operating blocking oscillator. The peak-to-peak voltage is approximately 50 volts, which brings us to the reason for checking the waveform at point W3 rather than directly on the grid of the oscillator.

In short, the voltage on the grid is usually in the range of 100 volts peak-to-peak. This is too high

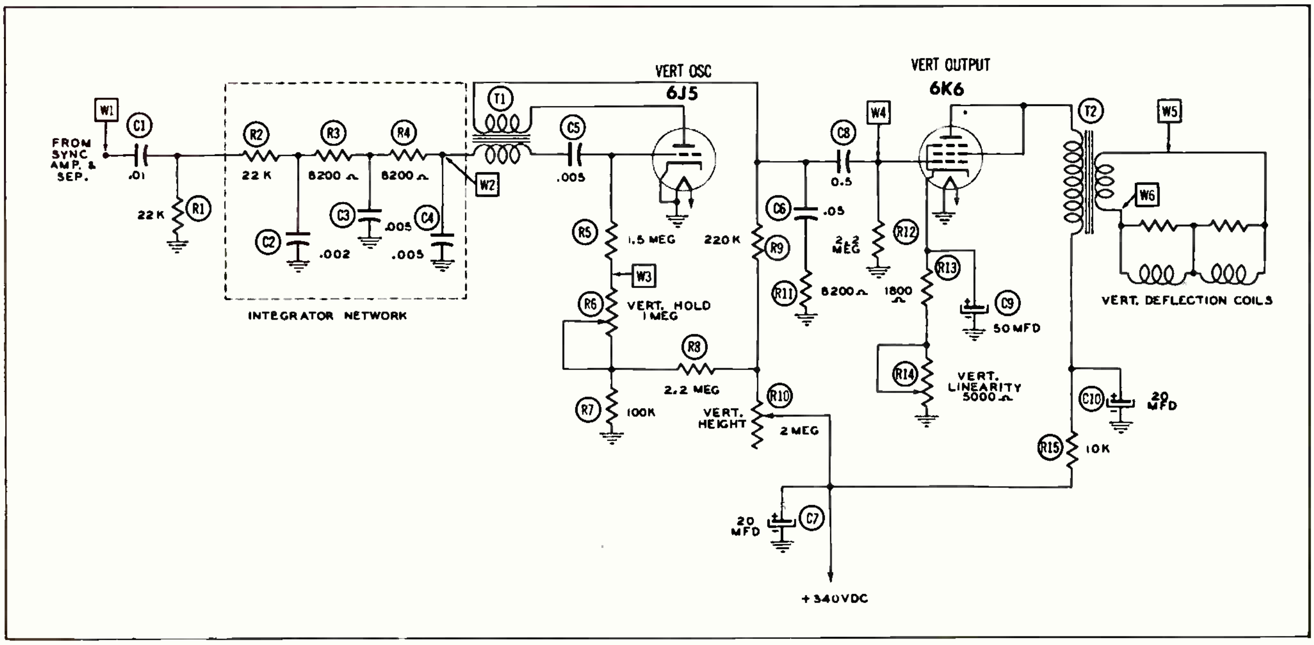


Figure 1. Typical Vertical Sweep System.

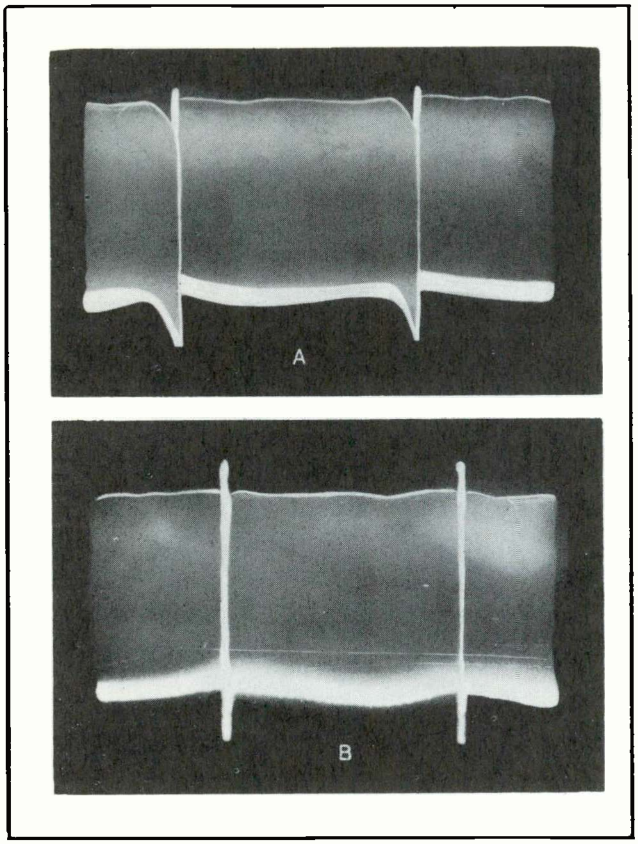


Figure 2. Waveforms at Point W1. (A) Normal. (B) With Inoperative Blocking Oscillator.

for serviceable use of the cathode follower attachment (see PF INDEX No. 30). Yet placing the scope leads directly on the grid has a loading effect which interferes with the normal operation of the oscillator. Consequently, the waveform at point W3, which is identical to that on the grid in every respect except amplitude, is ordinarily preferred in oscillator checks.

The control grid of the 6K6 vertical output amplifier is the next point of interest in our investigation. The symbol W4 denotes this point in Figure 1. With normal operation of the sweep system, the waveform obtained at this point is shown in Figure 5A. Its peak-to-peak amplitude is approximately 80 volts. The wave shape is characterized by the sharp pulse during retrace followed by the linear rise of voltage that causes the beam to move downward over the picture screen as it traces the field. Should the coupling capacitor C8 become open, the waveform of Figure 5A would be absent at point W4 but would be found on the oscillator side of C8. Also, of course, an open in C8 would result in complete loss of vertical deflection on the picture tube.

The circuit comprised of C6 and R11 is essential for the proper formation of the trapezoidal sawtooth at point W4. The voltage across the resistor determines the characteristics of the square wave portion of the pattern while the discharge curve of the capacitor shapes the sawtooth part of the pattern. With a leaky capacitor C6 the waveform at W4 assumes a shape identical to that shown in Figure 5B. By close inspection, the bending of the leading edge of the sawtooth away from a straight line can be detected; this is an indication of poor vertical linearity. Much more evident is the change in peak-to-

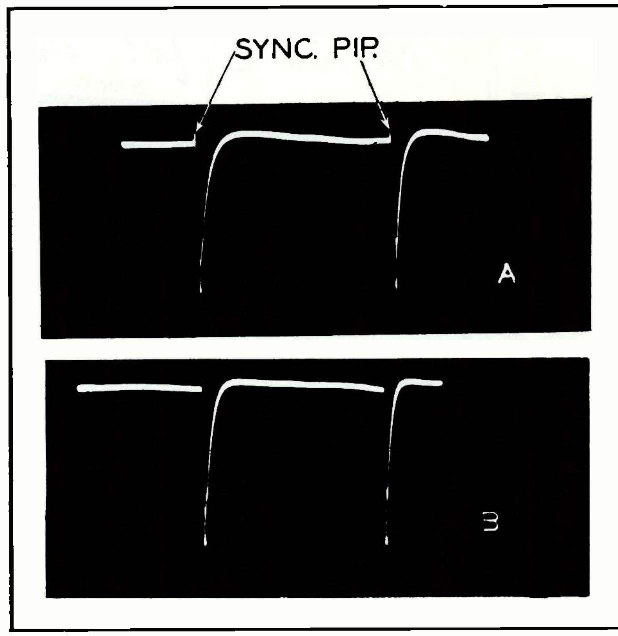


Figure 3. Waveforms at Point W2. (A) Normal. (B) With Open Capacitor C1.

peak amplitude of the waveform, only 40 volts as compared with the normal 80 volts of Figure 5A. As would be expected, the picture on the kinescope suffers a loss of vertical height and linearity under the above condition.

If C6 should open, an entirely different effect is produced. The vertical oscillator changes frequency abruptly to nearly 20 or 30 times its normal rate. The wave pattern at point W4 assumes the shape shown in Figure 5C. Since the oscilloscope horizontal frequency is still only 30 cycles per second, the increase in the vertical oscillator frequency is readily apparent on the waveform. The amplitude of the voltage is very high, upwards to 130 volts peak-to-peak, and the image on the kinescope screen is just an unintelligible cross-hatch of lines moving wildly about. From this evidence, it must be concluded that the discharge capacitor plays an important role in the correct operation of a blocking oscillator sawtooth generator.

The waveform of voltage which is present across the vertical deflection coils is not always measurable with respect to ground, as was the case with the waveforms discussed above. Such would be true with the circuit of Figure 1; neither side of the secondary of the output transformer T2 is grounded or by-passed through a capacitor to ground. Therefore it would be necessary to measure the voltage

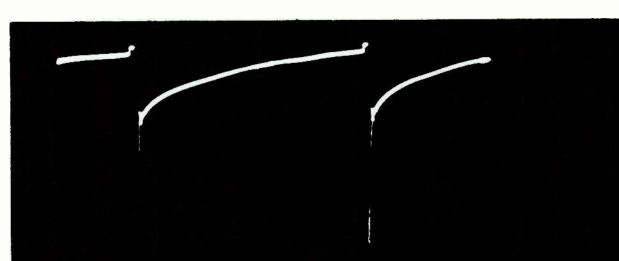


Figure 4. Waveform at Point W3 with Normal Operation.

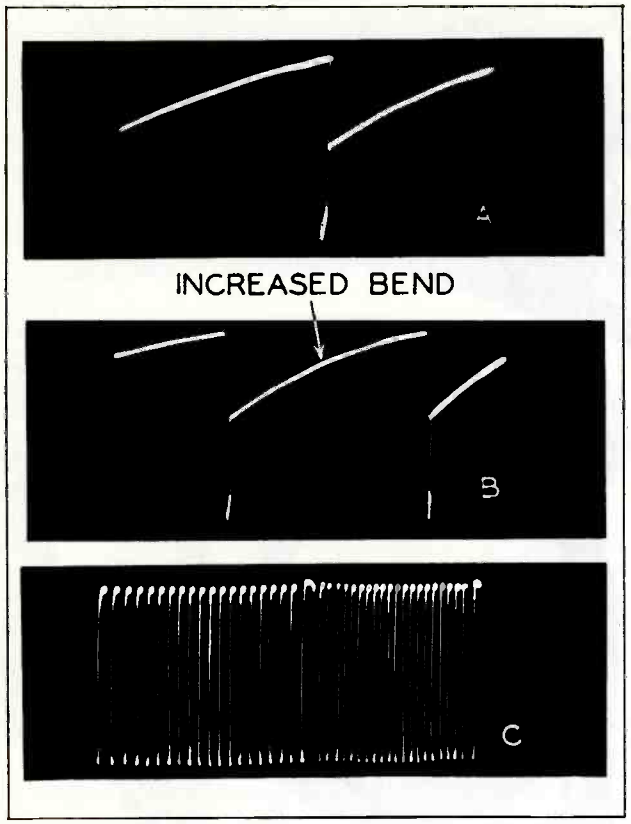


Figure 5. Waveforms at Point W4. (A) Normal. (B) With Leaky Capacitor C6. (C) With Open Capacitor C6.

waveform directly across the transformer secondary (Points W5 and W6 on the schematic). If either point were grounded or by-passed to ground through a capacitor the waveform on the deflecting coils could be measured with relation to ground in the same manner as the other waveforms.

Figure 6A is a photograph of the waveform between points W5 and W6 when the set is operating normally. The leading edge of the sawtooth is more nearly the ideal straight line than the corresponding portion of Figure 5A; this is due to the compensating action of the vertical linearity control in the cathode circuit of the output tube.

Sometimes the coupling capacitor C8 develops a leaky condition, allowing a bias shift in the output tube. The waveform on the deflection coils under such a condition is illustrated in Figure 6B. The clipping on the peaks of the sawtooth indicates overloading in the 6K6 due to the decreased bias. The picture tube screen shows an image that is expanded at the top and has a pronounced foldover at the bottom. An abnormal increase in the height of the picture also occurs. The peak-to-peak voltage of the waveform changes very little; the normal is 47 volts as compared with 41 volts in Figure 6B. This amplitude measurement includes the negative retrace pulses and therefore is not a determinant factor in picture height. The rate of rise in voltage represented by the slope of the leading edge of the sawtooth governs the height of the picture. By close inspection of Figure 6B it can be noted that the voltage rises a slightly greater amount and in a shorter time than the corresponding voltage in Figure 6A. This is the reason for the increased picture height under the abnormal conditions of Figure 6B.

If decoupling resistor R15 suffers considerable overheating, its value is liable to increase and bring about a condition of insufficient height and poor vertical linearity in the picture. Figure 6C shows the waveform on the deflection coils when R15 is 33,000 ohms instead of the correct 10,000 ohms. The slow initial rise of the sawtooth voltage accounts for the squeezing at the top of the picture. Also note the low overall rise in the sawtooth which is responsible for the lack of picture height.

An open cathode bypass capacitor C9 may cause degeneration in the output stage, and a very compressed picture may result. The waveform on the deflection coils with such a condition existing looks like Figure 6D. This waveform illustrates extreme lack of height. One or two shorted turns in the output transformer produces an effect very similar to this one produced by an open cathode capacitor.

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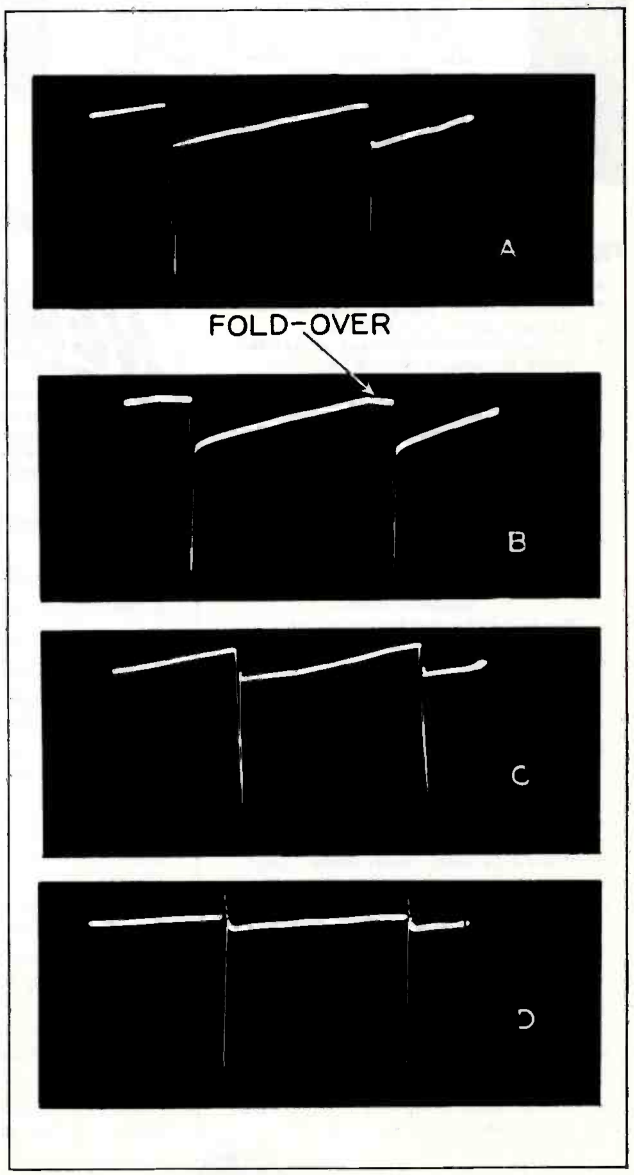

Figure 6. Waveforms Across Vertical Deflection Coils. (A) Normal. (B) With Leaky Capacitor C8. (C) With too Great a Decoupling Resistor R15. (D) With Open Capacitor C9.

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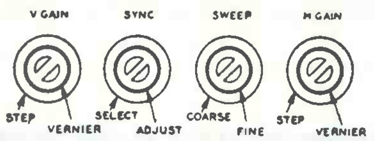

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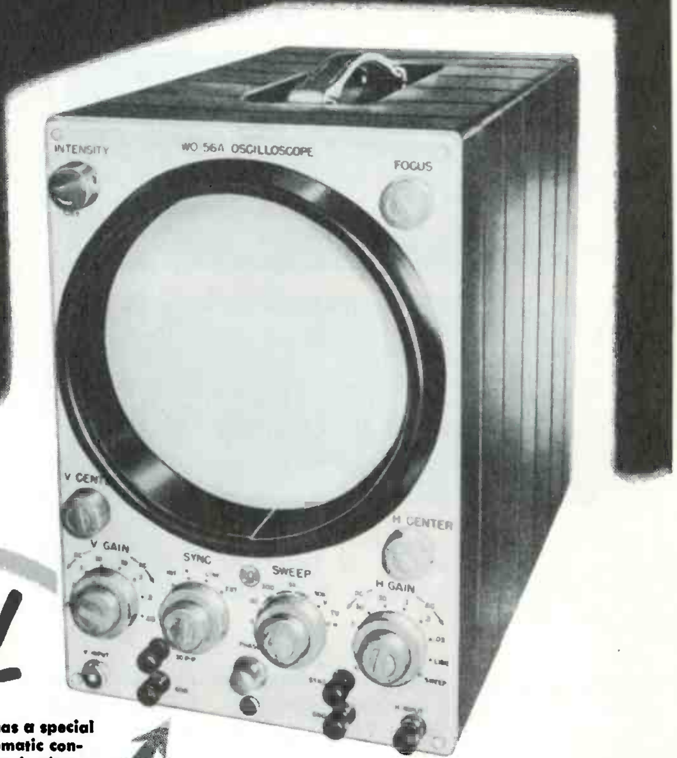

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Routine vs Infrequent TV Troubles

By MATTHEW MANDL

During the daily routine of television servicing, the technician encounters a number of receiver defects which are of a common nature. Usually the symptoms are such that it is easy to ascertain which stage is giving trouble because the technician becomes familiar with cause and effect. The lack of a raster would indicate high voltage failure; absence of picture, sound, and raster might be caused by failure of the low voltage supply; and horizontal pull or tear may mean troubles in the horizontal sweep oscillator.

On occasion, however, troubles develop in one stage which influences the behavior of another. In some instances symptoms might be typical for troubles in one section of the receiver, but are caused by defects in another stage. Localization of the exact cause may thus become a time-consuming process because of the misleading character of the symptoms which are present on the screen or from the loudspeaker.

No hard or fast rules can be given to help find the exact defect under such conditions. Description of typical cases will, however, help the technician identify similar situations should he encounter them in the future. He can also keep a loose-leaf file of those he encounters himself. A description of the symptom and its cure will be of material aid when that particular "tough one" is encountered again at a later date.

Interstage Influences

The interaction of stages gives rise to many false symptoms. One such condition is the slight instability which sometimes causes the horizontal or vertical sweep systems to be critical with respect to synchronization. Often this is more readily apparent with the horizontal circuits encountered in modern receivers using the synchroguide type of horizontal lock. This stabilizing system is easily upset by a decrease in sync amplitude. Thus, sync instability, or a slight weaving effect at the top of the picture would normally indicate that the horizontal lock system has developed some defect or needs readjustment. This would, of course, have to be checked first but if found to be all right the trouble may lie elsewhere and not in the sweep systems where the symptoms seem to point.

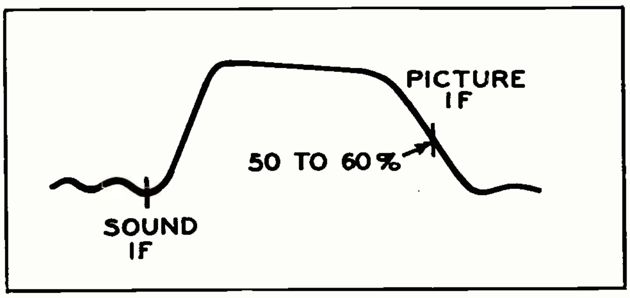

Figure 1. Picture Carrier IF Should Be at Least on the 50% Point of Slope.

Normally the sync separator stage would also be checked, but if this proves to be operating properly the trouble may lie in a stage which handles the composite video signal. Thus, if a tube characteristic changes slightly in a video IF or video amplifier stage, it could cause some sync clipping. This would tend to have a pronounced effect on the synchroguide type of lock system because it would decrease sync amplitude. Often a slight change in characteristic occurs in a tube as it ages, though this may not show up in an emission type tube checker. Under such conditions the faulty tube may be difficult to find unless direct substitution is undertaken. The trouble could also be caused by excessive sync clipping and in most instances the picture quality would still be good and so would contrast and brilliancy.

Another contributing cause could be improper alignment. In the split-sound type of receivers utilizing the IF bandpass characteristic shown in Figure 1, it is essential that the picture IF be placed at the 50% or 60% point on the slope.

If it is lower on the slope of the curve it would mean a decrease in the amplification of the lower sideband frequency components of the signal. Inasmuch as these contain the sync pulse information, it would result in a lower amplitude sync than required for good stability. It is better to set the picture carrier somewhat higher than 50%, particularly in fringe areas where sync stability would be influenced by weak signals.

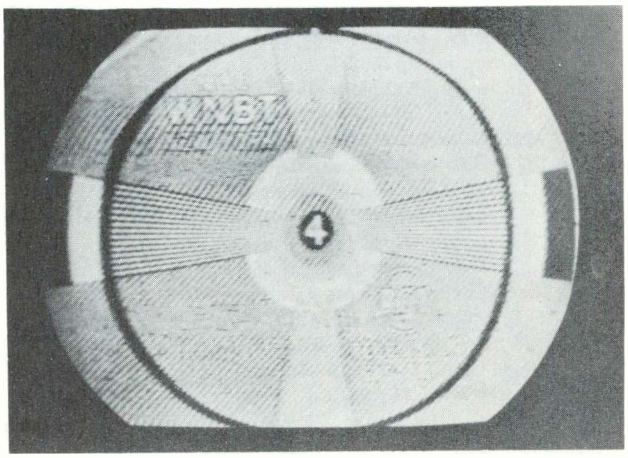

Figure 2. Diagonal Line Interference.

The same holds true, of course, with the inter-carrier type of response curve and the service bulletin of the particular receiver should be consulted. The receiver should be aligned so that the response curve conforms to that recommended.

The AGC system could, of course, influence sync stability and this is another circuit which should be checked.

Diagonal Bar Interference

The diagonal bar interference shown on the pattern of Figure 2 usually indicates that the receiver is picking up an interfering signal from a nearby RF source and the heterodyne thus produced will give the slanting and weaving line interference shown. Usually this is caused by a poor front-end in another nearby receiver where the local oscillator energy feeds into the antenna and radiates.

This type of interference can also be obtained from adjacent channel spillover. If the adjacent channel interference is that from the next higher station the diagonal line pattern may be very severe. If, however, this occurs for every station, it would indicate that the trouble lies in the receiver itself. In one instance, this diagonal bar interference was found to be caused by an oscillating first sound IF stage. Here, an open screen bypass capacitor caused the trouble and sufficient oscillating energy was produced to feed into the picture circuits and give the interference shown. The clue here, however, was that the sound was very weak and distorted.

It will be noted in Figure 2 that the linearity was not quite correct. On the bench the linearity of the receiver was corrected to give a perfectly round circle as well as a perfectly round center hub to which the wedges converged. When this receiver was installed in the cabinet the picture distorted as shown in Figure 3. Upon inspection it was found that the limitations of the table model cabinet size for this particular receiver caused the speaker field to be too near the picture tube. The speaker was mounted facing toward the top of the cabinet and the picture tube was a round glass type. Obviously the linearity had initially been adjusted while the receiver was in the cabinet and the magnetic fields which were influencing the linearity adversely, had been compensated for by the controls.

Despite this, however, perfect linearity could not be secured and Figure 2 represented the best compromise. In this instance, the speaker was moved over 1/2 inch and this was sufficient to prevent the magnetic fields of the alnico slug from distorting the top right section of the picture. This meant that a small portion of the speaker cone was not directly under the speaker grill but this did not materially decrease sound output.

Obviously, this is a matter of initial design but it illustrates the conditions which are sometimes encountered if the technician desires to put the receiver in the best operating condition. The magnetic fields of transformers can also influence picture linearity and additional shielding may have to be employed in receivers where component parts are crowded too closely together. Metal tubes, in particular, can prove troublesome in this respect. During bench servicing the PM speaker must not be allowed to touch the metal-sided cone section of the picture tube because it will magnetize that portion and cause picture distortion.

Degenerative Effects

Often, what appears as a misadjustment of the controls can be caused by troubles within the circuit itself. This applies to picture width, picture height, focus, brilliancy, etc. One of the causes for incorrect width or height is the degeneration which is produced when a defect occurs in either a cathode capacitor or a screen bypass type. The same holds true, of course, with reduced emission from either the vertical or horizontal output tube. Figure 4 shows a condition where a capacitor across the cathode resistor of the vertical output tube developed a defect. Gradually the picture shrunk over a period of several weeks and this necessitated an advance of the height control. Eventually the height control was ineffective in filling the mask and finally the picture height reduced to that shown in Figure 4.

Thus, if the height or width controls have to be advanced to their extreme setting in order to fill the mask, or if the height and width are beyond where correction can be made by the controls, the tubes and associated parts must be checked for degenerative effects which might be present. Reduced drive could also cause a decline of sweep amplitude and thus de-

Figure 3. Linearity Affected by Presence of Undesired Magnetic Field.

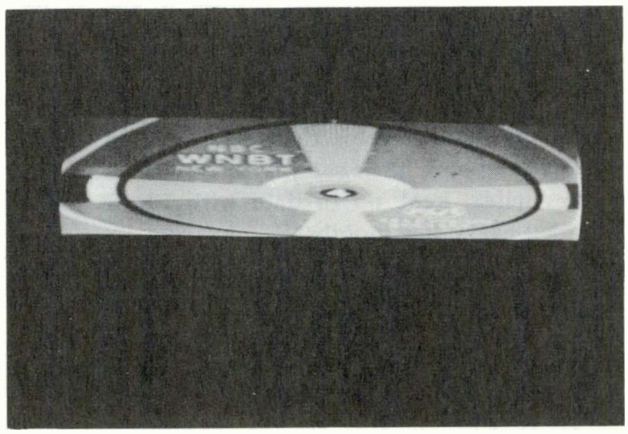

Figure 4. Shrinkage Caused by Degenerative Effects.

crease the height or width. For this reason the drive circuit should be checked. Excessive drive can cause output tube overload and shorten its life expectancy. Grid drive should not be greater than that necessary for proper width (or height) consistent with good linearity. In the horizontal system excess drive manifests itself by extending the left side of the picture abnormally.

Drive circuits for the vertical and horizontal sweep are shown in Figure 5 and are typical of those

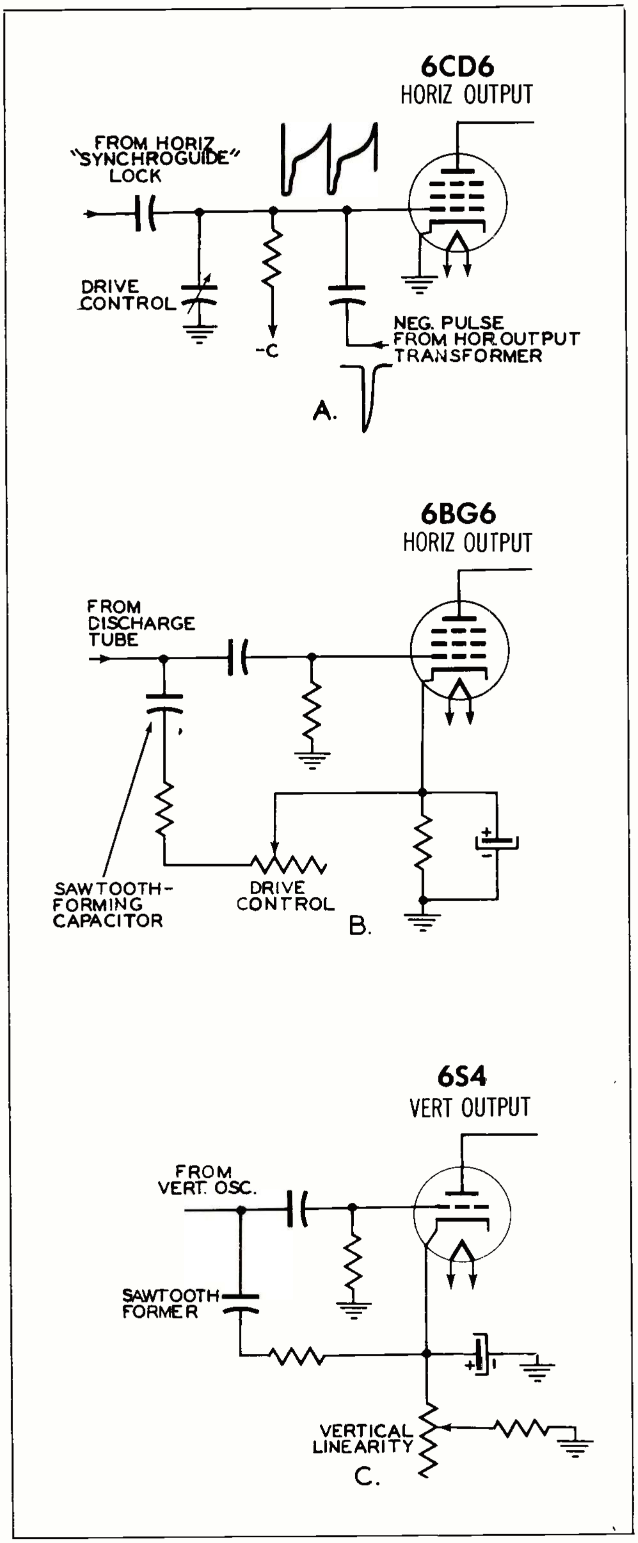

Figure 5. Typical Drive Circuits.

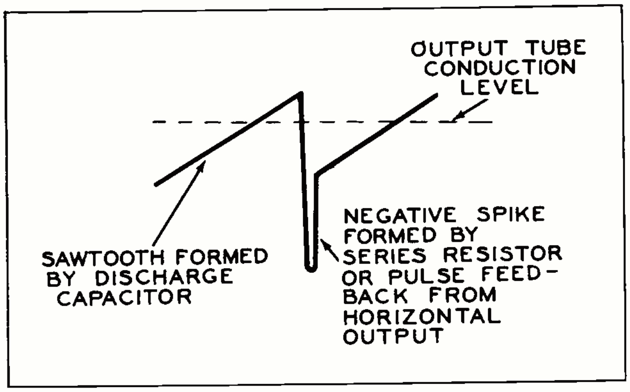

Figure 6. Horizontal Output Grid Waveform.

used in modern receivers. Values here should be within that specified by the manufacturer or in the absence of specific instructions to the contrary, they should be within 10% of rated value. This applies to both the sawtooth forming capacitor as well as the associated resistor.

Often insufficient drive is caused by a defect which has developed in the stage following the drive circuit. This is particularly true where the discharge capacitor network is attached to the cathode resistor as shown in Figure 5B. Insofar as design goes, this is done to give the sawtooth a more rapid discharge and to form the negative spike shown in Figure 6. The amplitude of the negative spike will establish the grid drive because it sets the conduction level of the tube as shown. Thus, a decline of voltage across the cathode resistor of the horizontal output tube would influence the drive to a considerable extent. A reduction in horizontal drive will not only reduce the width, but will also reduce the high voltage and cause picture blooming.

Outside Interference

Often outside interference of a severe nature can simulate the type of trouble which could be developed in the receiver itself. This is particularly true where bar interference is encountered.

A 60-cycle hum introduced into the video amplifiers would generate the dark bar pattern shown

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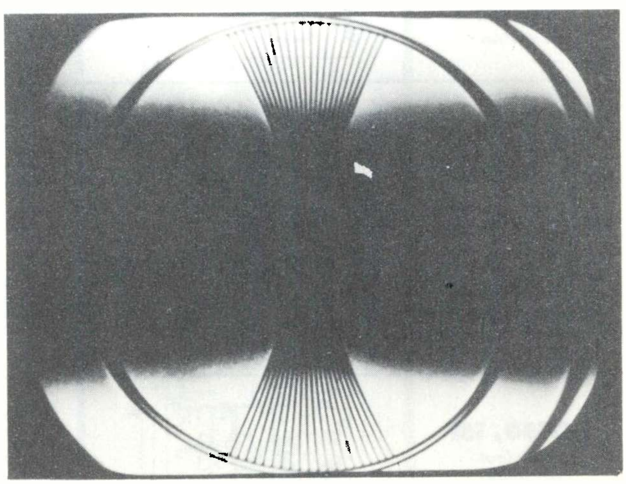

Figure 7. A 60-Cycle Hum Video Section.

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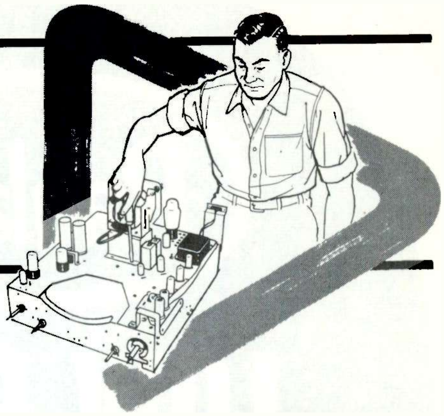

by GLEN E. SLUTZ

Safety Ball for High Voltage

At first glance, the hollow, rubber ball pictured in Figure 1 would seem to be out of place in an article about radio and television servicing. A ball such as this would more likely be sought in a child's playbox than on a television service bench.

However, this one has undergone a simple operation which has converted it into a very useful and handy service aid. It was sent to us by John W. Hill of Long Beach, California. The ball measures approximately 2-3/4 inches in diameter and has had a small 3/16 inch hole cut through its surface.

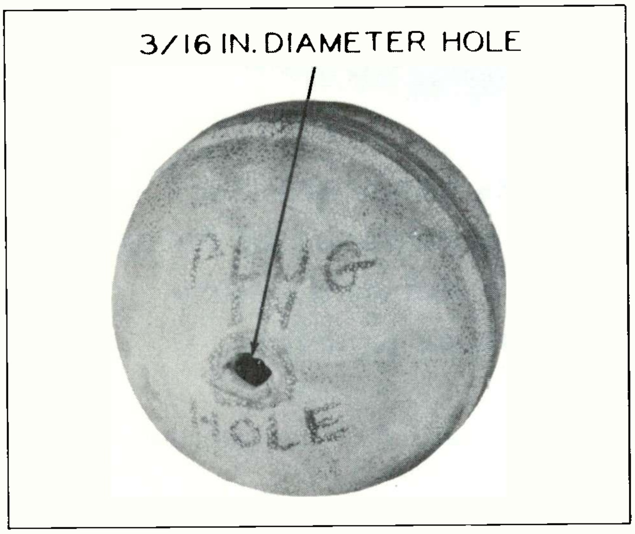

Figure 1. Safety Ball.

Whenever a television receiver is being serviced without the picture tube connected, the high voltage lead should be fixed so that there is no danger of it shorting or of the service technician coming in contact with it. The ball performs this function simply and effectively. The clip on the end of the high voltage lead snaps securely into the hole in the ball, and then the ball may be allowed to roll freely at the end of the lead during the servicing procedure. Figure 2 shows the safety ball with the high voltage clip in place. The danger of shock to the operator is greatly reduced and the possibility of the high voltage shorting to the chassis is minimized by this novel measure. Thank you, John, for this useful service suggestion. We welcome the opportunity to pass along any service practices which might be of general interest to our readers.

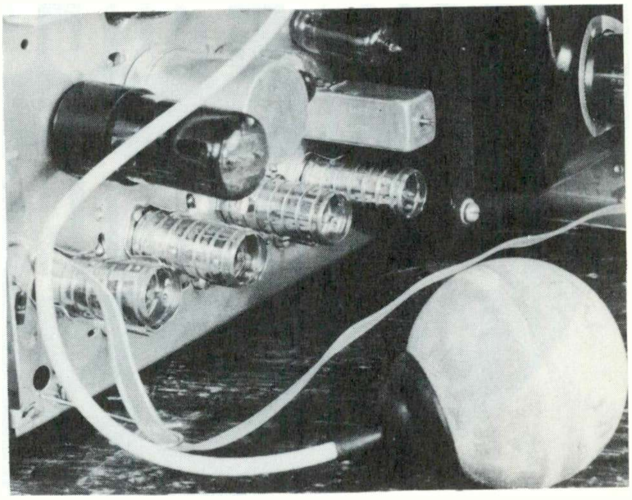

Figure 2. Safety Ball with Anode Lead Clipped in Place.

Power Consumption Measurement

The meter pictured in Figure 3 is a Triplett Model 660 "Load-Chek." It is a combination wattmeter and voltmeter which has proved itself in helping to locate hidden shorts and overloaded circuits. The meter plugs into the power line and the test receiver connects into the outlet on the face of the meter.

The voltmeter records the line voltage and the wattmeter registers the power consumption in the test set. In this way the instrument is capable of detecting low line voltage as well as abnormal power consumption in the receiver. A "hi-lo" switch permits the use of two wattmeter ranges.

As an example of the usefulness of this meter, let us suppose that we have a set which registers a power consumption of 300 watts, yet its rated power is listed at only 1.8 amps at 115 volts, or approximately 210 watts. By removing the rectifier tube we may determine on which side of the tube the short exists. If the short were on the rectified side of the tube, the wattmeter would show a decided drop upon removal of the tube. In the case of a power transformer with shorted turns or shorted filament winding, the removal of the rectifier would cause only a slight drop in the wattmeter reading. In some instances, a tube drawing too much current can be detected by observing the wattmeter as the tube is removed. The same is true of shorted capacitors; if unsoldering one end of a capacitor results in the

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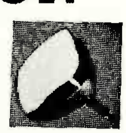

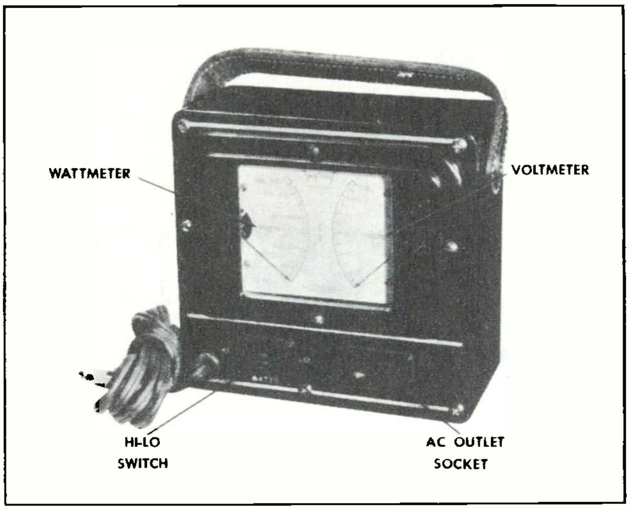

Figure 3. Power Consumption Meter (Triplett Model 660).

wattmeter reading dropping to near normal level, the capacitor is probably shorted and causing the overload.

After a set has been repaired, it is good practice to check the power consumption again to make sure that no excessive power drain remains. This will help insure against "come-back" service calls.

Antenna Pointers

Several types of TV and FM antennas such as the simple dipole, the conical, and the fan, normally present an open circuit to direct current, and hence to an ohmmeter measurement. In case the lead-in from one of these antennas should develop a break

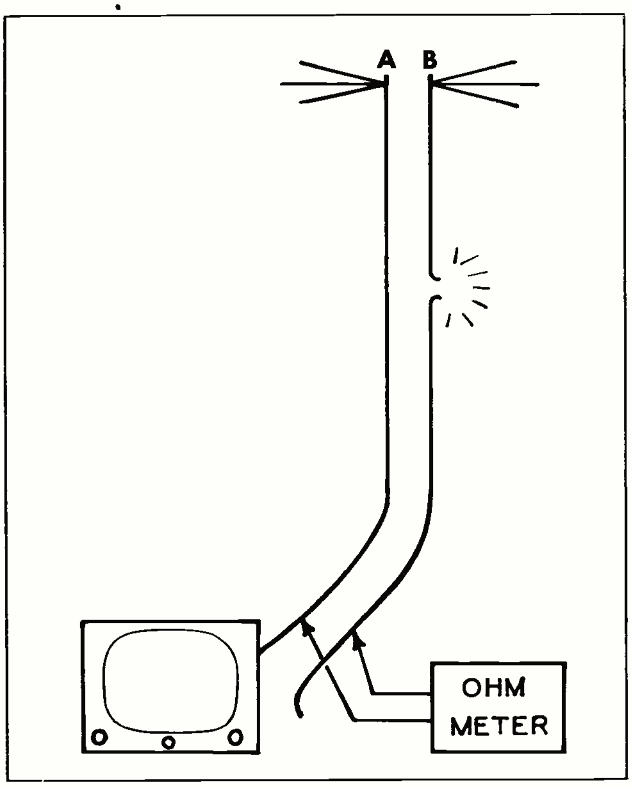

Figure 4. Setup for Checking an Antenna with an Ohmmeter.

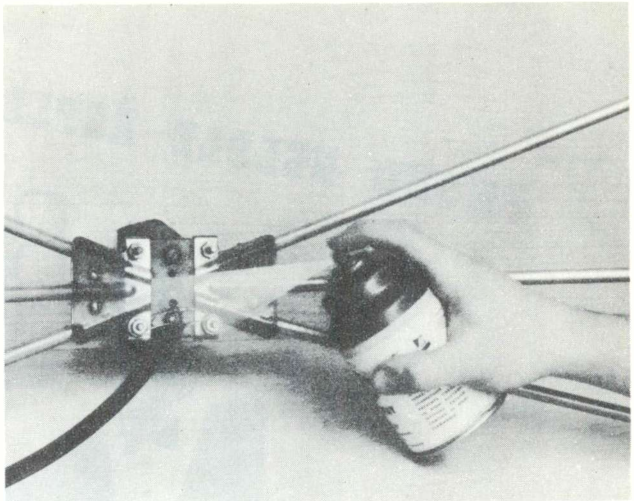

Figure 5. Spraying the Antenna Resistor with Plastic.

somewhere along its length, the detection of this open circuit would not ordinarily be possible with an ohmmeter check at the receiver-end of the lead-in. (See Figure 4.) An open circuit in a ribbon twin-lead, resulting from strain or wear of one kind or another, is frequently not visibly apparent. Therefore if it were possible to determine the condition of an antenna system by a simple ohmmeter check, a saving of time and work would be achieved.

A slight circuit addition has been devised to make an ohmmeter check meaningful in these cases. At the time of installation of the antenna a 100,000 ohm, 1/2 watt resistor may be connected across the antenna terminals of the transmission line (between points A and B of Figure 4). This resistor is of such a high value that it will not affect the operation of the antenna. Yet it will endow the circuit with a finite DC resistance and thus make a continuity check significant.

The resistor must, of course, be protected from the effects of weather. After it has been mounted in place, a generous coating of plastic from a spray bomb may be applied as shown in Figure 5. This serves very well as weather protection. At the same time the plastic may be sprayed over all exposed bolts, nuts, and joints in the antenna assembly. By inhibiting the formation of rust and corrosion, this

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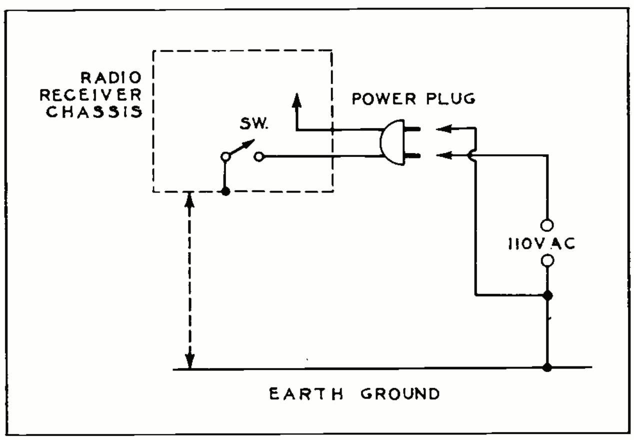

Figure 6. "Hot" Chassis in an AC-DC Receiver.

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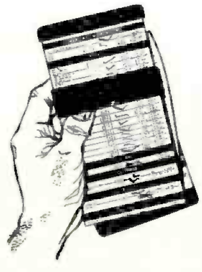

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INTERCOMMUNICATION SYSTEMS

By ARTHUR KOZIK

An Explanation of the Basic Requirements
of These Systems and Considerations
for Installation

Through the ever increasing importance of communication within an organization, which is essential to its efficient operation, the intercommunication system is becoming more prominent as an indispensable item. With systems of this type, communication can be complete to any key point in the organization with just a flick of the finger. Conversation can be carried on, orders issued, questions asked and answers received in a matter of seconds.

Schools, offices, factories, and even homes may employ an intercommunication system. These systems may vary from a simple two-station arrangement, to very complex installations incorporating many stations. The nature of the system will depend largely upon the actual requirements that the system may be compelled to fulfill. These intercommunication systems are inexpensive and dependable. They do, however, require service occasionally as do radios, television sets and other related electronic equipment. Since these systems do require service, and due to their ever-increasing popularity, the service technician should have a basic understanding of their operation.

An intercommunication system is composed of master stations and remote units so connected that

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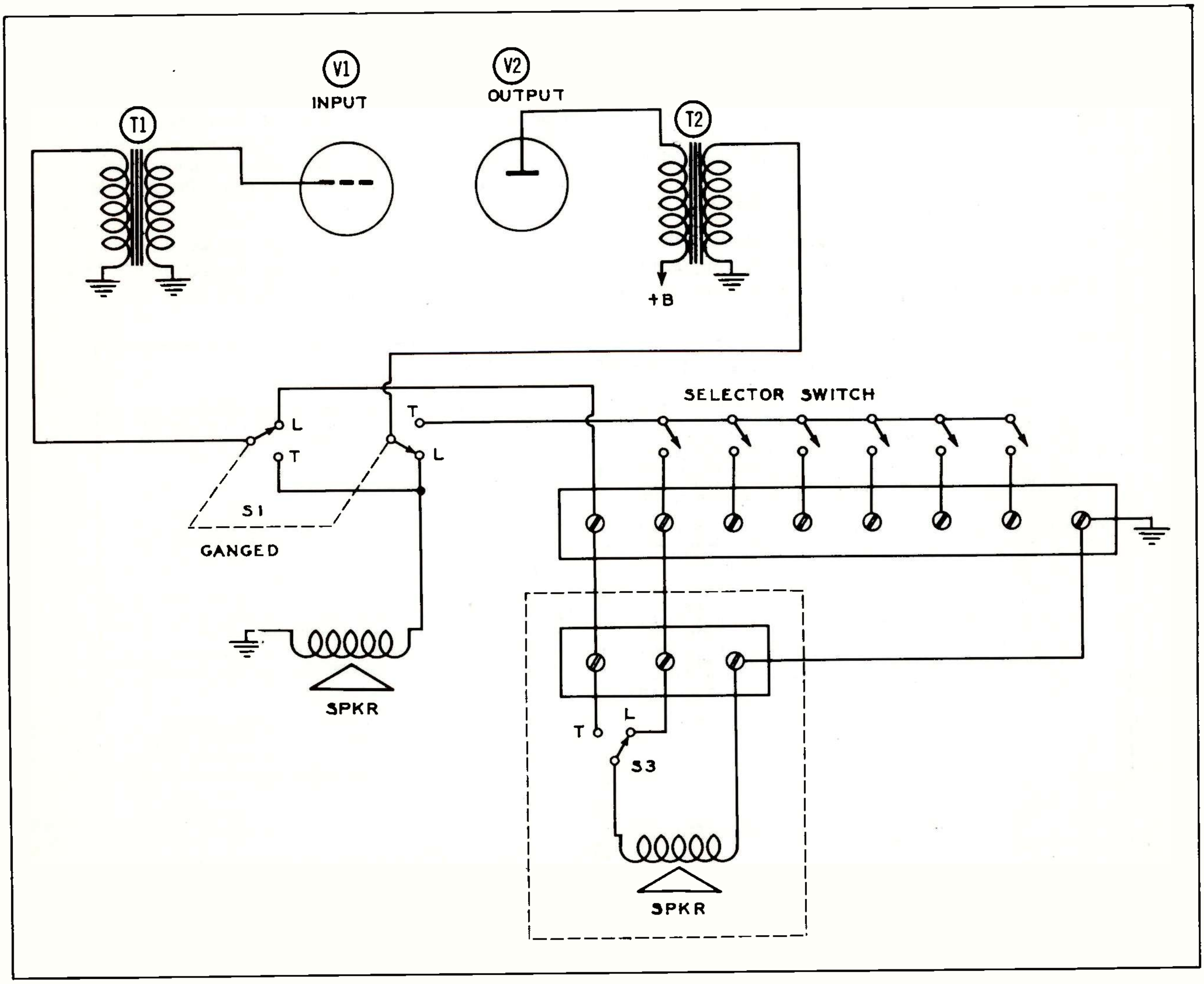
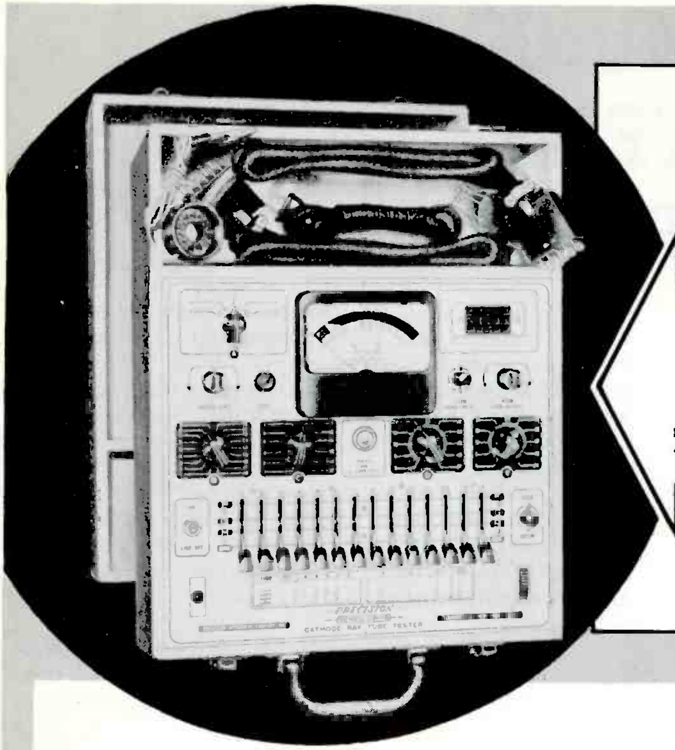


Figure 1. Typical Intercommunication System With Remote Unit.



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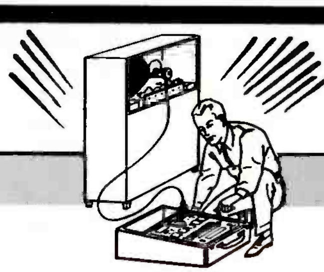

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Tests CR Picture Tubes Without Removal from TV Set or Carton!

The Precision CR-30 fills an obvious gap in the test equipment facilities employed by TV service and installation technicians.

Because of the absence of a reliable cathode ray tube tester, up to 50% of so-called "rejected tubes" are found to be fully serviceable and should rightfully never have been "pulled out."

Proven product of extended development, the CR-30 has been specifically engineered to answer the question, **"Is It the TV Set or is it the Picture Tube?"**

The *Precision* CR-30, a complete and self-contained *Electronic Instrument*, incorporates a TRUE BEAM CURRENT Test Circuit. The CR-30 checks overall electron-gun performance for *proportionate picture brightness* as well as additional direct testing facilities for accelerating anodes and deflection plate elements.

The Precision CR-30 should not be confused with mere adapters connecting to ordinary receiving tube testers which were never designed to meet the very specialized needs of CR tube checking. Similarly, it is not to be confused with neon-lamp units or similar devices of limited technical merit and which do not check all CR tubes or all tube elements.

GENERAL AND TECHNICAL SPECIFICATIONS

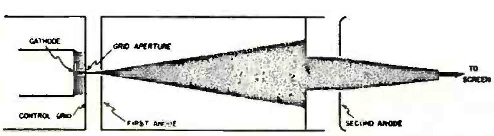
★ **Tests All Modern Cathode Ray Tubes:**—Magnetic and Electrostatic, 'Scope Tubes and Industrial Types.

★ **Tests All CR Tube Elements:**—Not just a limited few.

★ **Absolute Free-Point 14 Lever Element Selection System,** independent of multiple base pin and floating element terminations, for Short-Check, Leakage Testing and Quality Tests. Affords maximum anti-obsolescence insurance.

★ **True Beam Current Test Circuit** checks all CR Tubes with Electron-gun in operation. It is the **Electron Beam** (and NOT total cathode emission) which traces the pictures or pattern on the face of the CR tube.

Total cathode emission can be very high and yet Beam Current (and picture brightness) unacceptably low. **The CR-30 will reject such tubes** because it is a true **Beam Current** tester. Conversely, total cathode emission can be low and yet Beam Current (and picture brightness) perfectly acceptable. **The CR-30 will properly pass such tubes** because it is a true **Beam Current** tester. The significance of the above rests in the fact that Beam Current (and picture brightness) is primarily associated with the condition of the **center** of the cathode surface and not the overall cathode area. (See illustration below)



★ **Voltage Regulated, Bridge Type VTVM** provides the heart of the super-sensitive tube quality test circuit. Such high sensitivity is also required for positive check of very low current anodes and deflection plates.

★ **Micro-Line Voltage Adjustment** **Meter-monitored** at filament supply.

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Examining DESIGN FEATURES

by MERLE E. CHANEY

GENERAL ELECTRIC MODEL 24C101

The General Electric Model 24C101 television receiver possesses several features that are of interest. A 24" tube type 24AP4 is employed as the picture tube. It is of the round metal type requiring a sweep angle of 70° and a high voltage anode potential of around 12,500 volts.

Deflection Circuits

The demand for greater sweep for the 24" picture tube is met by parallel tubes in both the vertical and horizontal deflection circuits. A type 6BL7GT dual triode tube with sections paralleled is used as the vertical output tube. The horizontal output stage employs two 6AV5GT tubes in parallel to provide the necessary sweep horizontally. In addition the damper stage also has paralleled type 6W4GT tubes.

Examination of both vertical and horizontal output transformers shows that air gaps are provided in each transformer core. Their purpose is to prevent saturation of the transformer during the time of high peak current. The air gap is formed by a thin insulating material inserted in the core legs.

To make possible the elimination of any wiggle at the beginning of each horizontal line, an adjustable trimmer is inserted from ground to the junction of two halves of the horizontal deflection yoke coils. Wiggle results from an unbalanced condition between the distributed capacity of the two horizontal coils. Adjustment of the trimmer to compensate for unequal distributed capacities will aid in eliminating this trouble.

Vertical Blanking

Blanking of the picture tube during the time of vertical retrace is accomplished through the use of one section of a dual triode tube. A positive-going pulse voltage from the plate of the vertical output tube is connected to the grid of the blanking triode. This triode shapes the pulse and inverts polarity. Since conduction in the blanking tube occurs only during vertical retrace time, the resulting negative pulse applied to the picture tube accomplishes picture tube blanking and elimination of vertical retrace lines.

Sound Circuits

Intercarrier sound is employed in the Model 24C101 receiver. However, the sound takeoff is at the plate of the second video IF amplifier. This is a departure from the usual method wherein the sound takeoff is subsequent to the video detector. In this set the signal from the plate of the second video

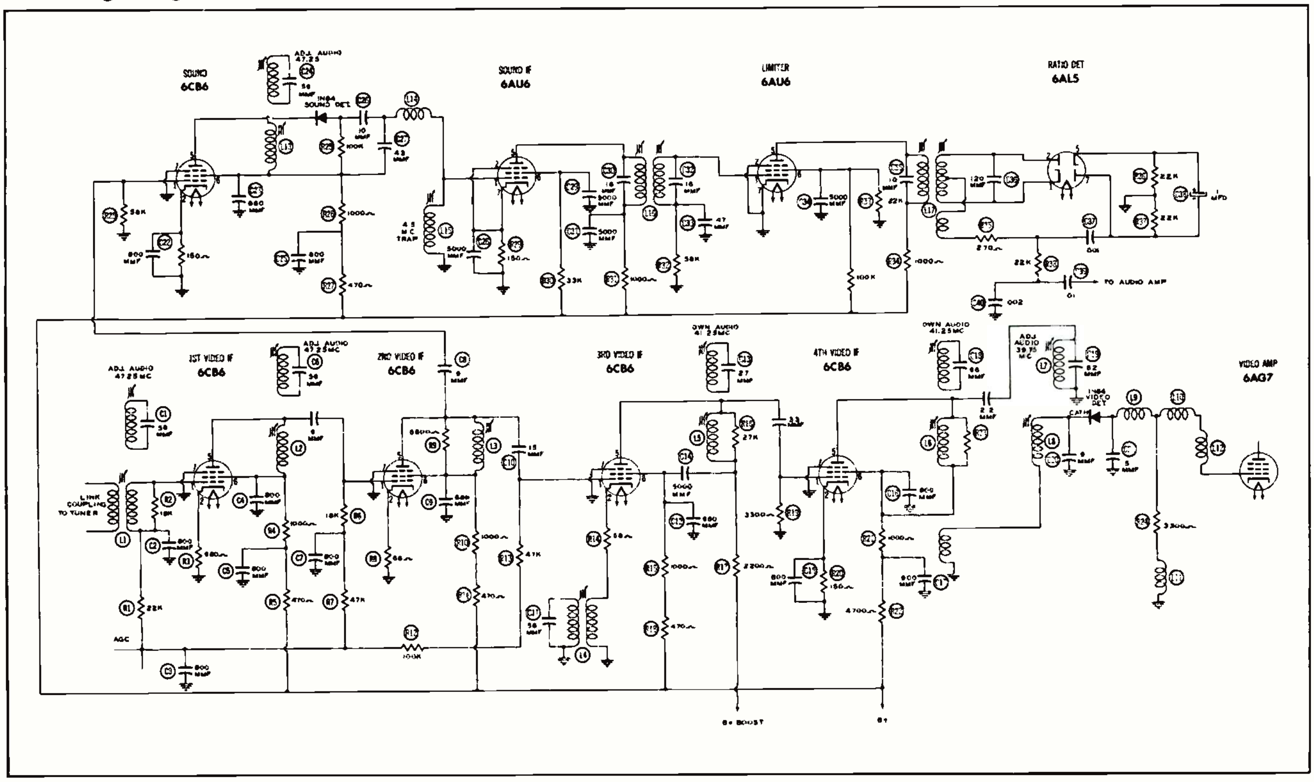


Figure 1. Partial Schematic of General Electric Model 24C10 Showing Sound Take-off Circuit.

detector is fed to a separate sound takeoff amplifier tube. The output of this stage is tuned and detected by a series-connected crystal detector type 1N64. A beat note at 4.5 mc is obtained and is accepted by a 4.5 mc trap in the grid circuit of the following stage. This sound intermediate frequency of 4.5 mc is amplified by the first sound IF amplifier and then fed to a limiter stage for removing peaks of amplitude modulated components. Audio is detected through the use of a ratio detector which also functions to remove any remaining amplitude modulated frequencies. One section of a dual triode amplifies the audio and the other section acts as a phase inverter for coupling the signal to a push-pull audio amplifier stage.

Alignment of the sound stages first necessitates correct alignment of the video IF stages. After the video IF stages are aligned a response curve for the sound takeoff amplifier is observed by a scope connected to the detector load. Marker generator settings of 47.25 mc, 45.75 mc, and 41.25 mc establish the points to which the desired response curve must conform. With the sweep generator set at 43 mc and a bandwidth of 9 mc, L13 (Figure 1) is tuned until the 45.75 mc marker is 7 times the amplitude of the 41.25 mc marker. Some variations in response curve shape may exist from one set to another, but the determining factor for correct alignment of this stage is the 7 to 1 ratio in amplitude between the video and IF markers.

By employing this type of sound IF system, the tuning advantages of the intercarrier system are retained. The video IF can be aligned for proper response without regard to the sound signal since it is picked off in the early stages. Since the sound signal is not passed through the video detector or the video amplifier, there is no chance of introducing amplitude modulation and the sound IF signal in these stages, thus minimizing chances for the introduction of "sync buzz." Also the attenuation of the sound IF signal ahead of the video detector reduces the amount of 4.5 mc beat present in the video amplifier. This makes possible complete "trapping" of this beat signal ahead of the picture tube.

ZENITH CHASSIS 20J21

Electrostatic Focus Circuit

Zenith Chassis 20J21 employs a low voltage type electrostatically focused picture tube. For correct operation, the focus element requires a voltage between 0 to 400 volts DC. This is obtained by connecting a 7.5 megohm control as a bleeder on the B+ boost circuit and applying the voltage from the control arm to the focus element, pin 6, of the picture tube. See Figure 2 for a partial schematic of the focus control circuit.

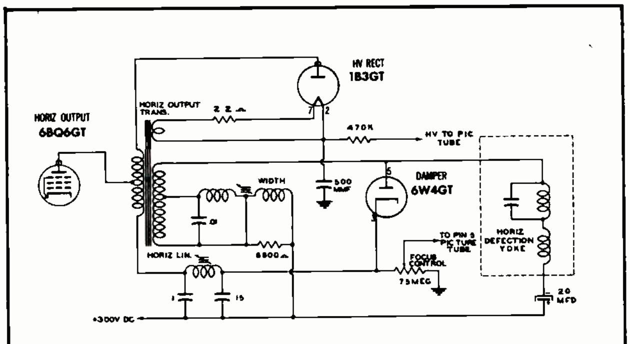


Figure 2. Low Voltage Focus Control Circuit.

Centering Magnet, Ion Trap and Magnetic Shield

Figure 3 is a photo of the centering magnet, ion trap and magnetic shield in place on the neck of the electrostatically focused picture tube. A single type ion trap is employed and its operation and adjustment remain the same as that used for magnetically focused tubes.

Close to the deflection yoke is the centering unit for positioning the raster. In appearance it is similar to the single type ion trap. However, the magnet has a knurled rod welded on for rotating the magnet while the pole pieces remain stationary. Maximum shifting in one direction is accomplished by turning the knurled extension through 180°, while maximum shifting of the raster occurs in the opposite direction during rotation of the magnet from 180° to 360°.

An alternate centering device may be used in this chassis for centering the raster. This unit consists of two magnetized rings mounted on the neck of the tube. Either ring may be rotated in relation to the other, or both rings rotated simultaneously until the raster is properly centered. Tabs formed on the ring mounting device facilitate the centering adjustment.

The magnetic shield occupies a position on the picture tube neck mid-way between the ion trap and the centering unit. Its purpose is to shield the electron beam from stray magnetic fields from the power transformer, thus preventing hum distortion of the picture. In those chassis where the magnetic field from the power transformer is small, the magnetic shield is not employed.

Gated Beam Audio Detector Circuit

The modulation on the intercarrier sound IF signal is detected by a method different from that commonly used. A single tube type 6BN6 functions as a limiter, audio detector and 1st AF stage.

Special circuitry is required for the 6BN6 tube to accommodate its unconventional design. A drawing of the internal construction of the tube is shown in Figure 4. The tube is designed to provide a thin

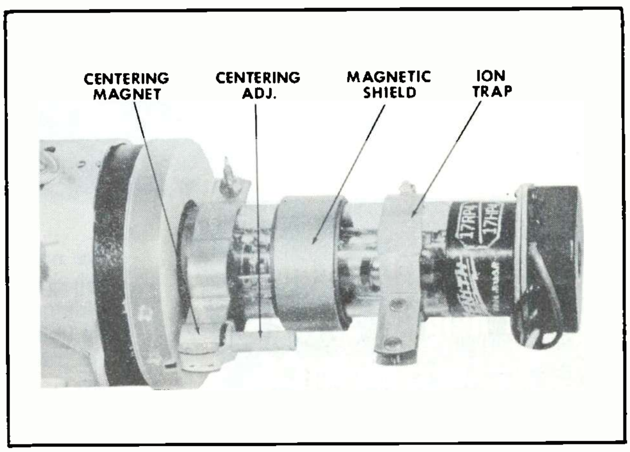
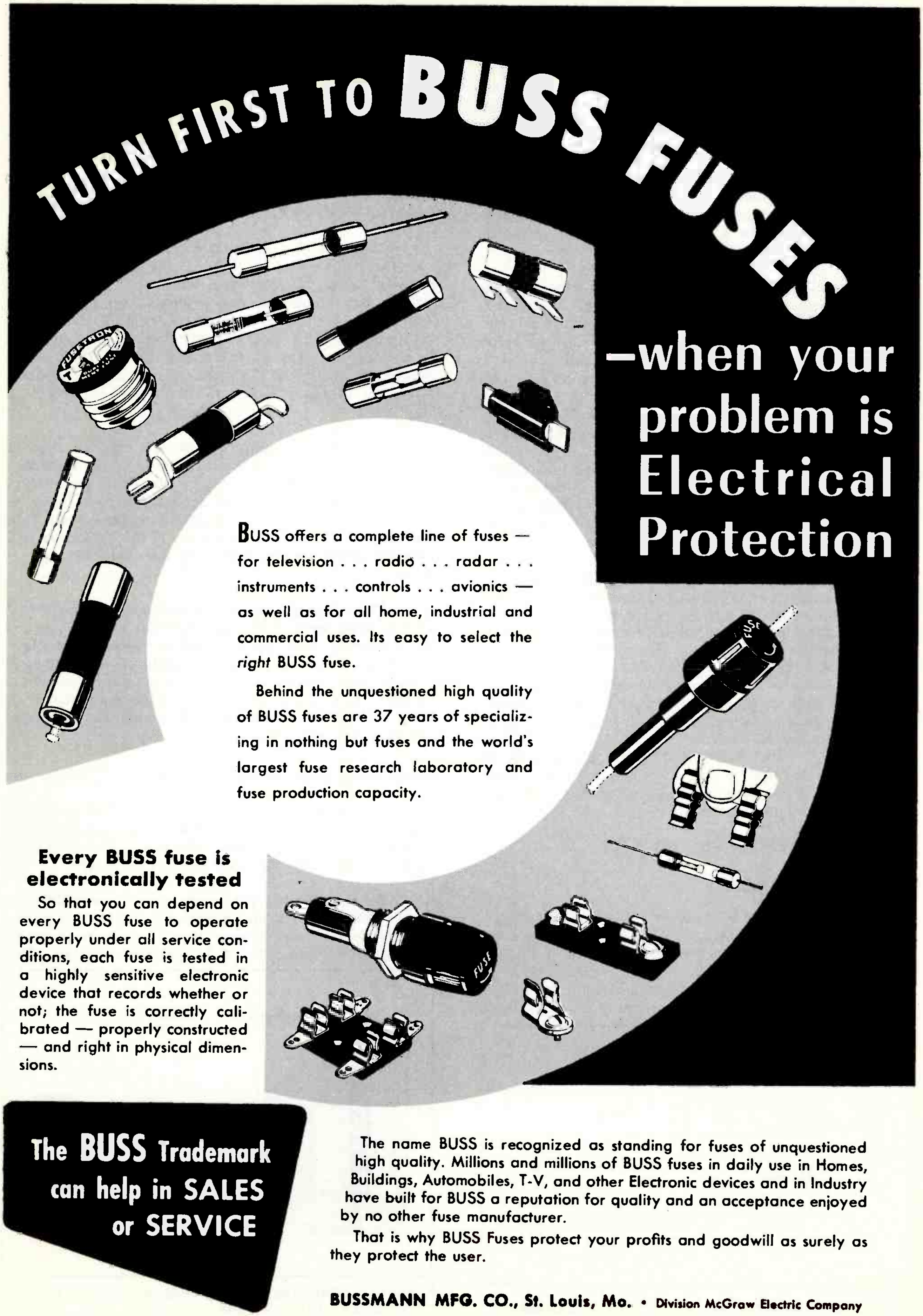


Figure 3. Centering Magnet, Magnetic Shield and Ion Trap Used on Picture Tube.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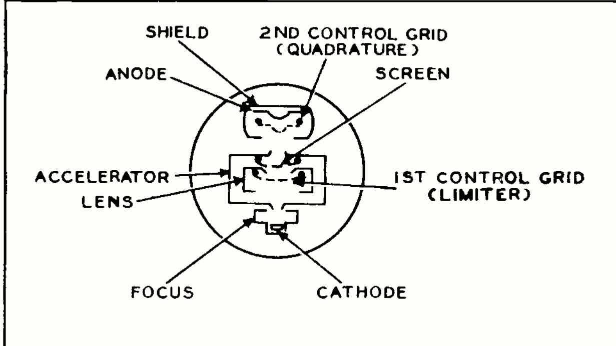

Figure 4. Internal Construction of 6BN6 Tube.

stream of electrons that are guided or focused toward the anode or plate. In the path of the electron stream is a limiter or first grid and a quadrature or second grid. These grids act as gates in the electron path. Either grid can cut off the electron stream.

Another feature of the tube is that only a small variation of signal voltage can produce maximum plate current or effect current cutoff. Therefore, limiting of the signal is accomplished, since large positive signal components have no greater effect over plate current than do the smaller positive signals.

The negative portion of a cycle of a strong signal applied to the limiter grid stops the electron flow toward the quadrature grid and plate. Likewise the positive portion of the signal results in maximum current flow, or saturation. Thus limiting is accomplished.

Connected to the quadrature grid is a resonant circuit tuned to the sound IF center frequency. A voltage is produced on this grid by means of space charge coupling. The quadrature grid is so named because the voltage produced on this grid is 90° out of phase with that on the limiter grid when the incoming signal is unmodulated. Since the quadrature grid can also cause plate current cutoff on negative portions of its resonant frequency it is seen that only about one-fourth of the electron stream originating at the cathode finally reaches the plate. When the incoming signal is modulated, the phase difference between the limiter and quadrature grid voltages changes, which changes the length of time the grid gates are open, resulting in a change in the amount of time that plate current flows. Since plate current changes with the modulation on the incoming signal audio detection is achieved.

Figure 5 is a partial schematic showing the audio detector circuit used in the Zenith 20J21 chassis. L1, in the plate circuit of the 1st video amplifier, is tuned to the intercarrier frequency of 4.5 mc which is applied through a 47 mmf. capacitor to the grid of the 1st sound IF amplifier, one triode section of a 12AT7 tube. The 4.5 mc IF signal developed across the sound IF amplifier plate load R13, 220KΩ, is coupled by a .01 mfd. capacitor to a tap on the limiter grid coil L5, which is tuned to 4.5 mc.

Oscillation in the 1st sound IF amplifier V3, is prevented by neutralization of the grid by means of a feedback voltage from the limiter grid coil L5 through a 6 mmf. coupling capacitor, C8, to the grid of V3. The quadrature grid coil L6, shunted by a 10 mmf. capacitor is resonated at 4.5 mc. The voltage developed in this circuit is aided by a small amount of feedback obtained from the use of a 690Ω resistor in series with the plate lead of the 6BN6 detector. A 330KΩ resistor, R17, functions as the detector load.

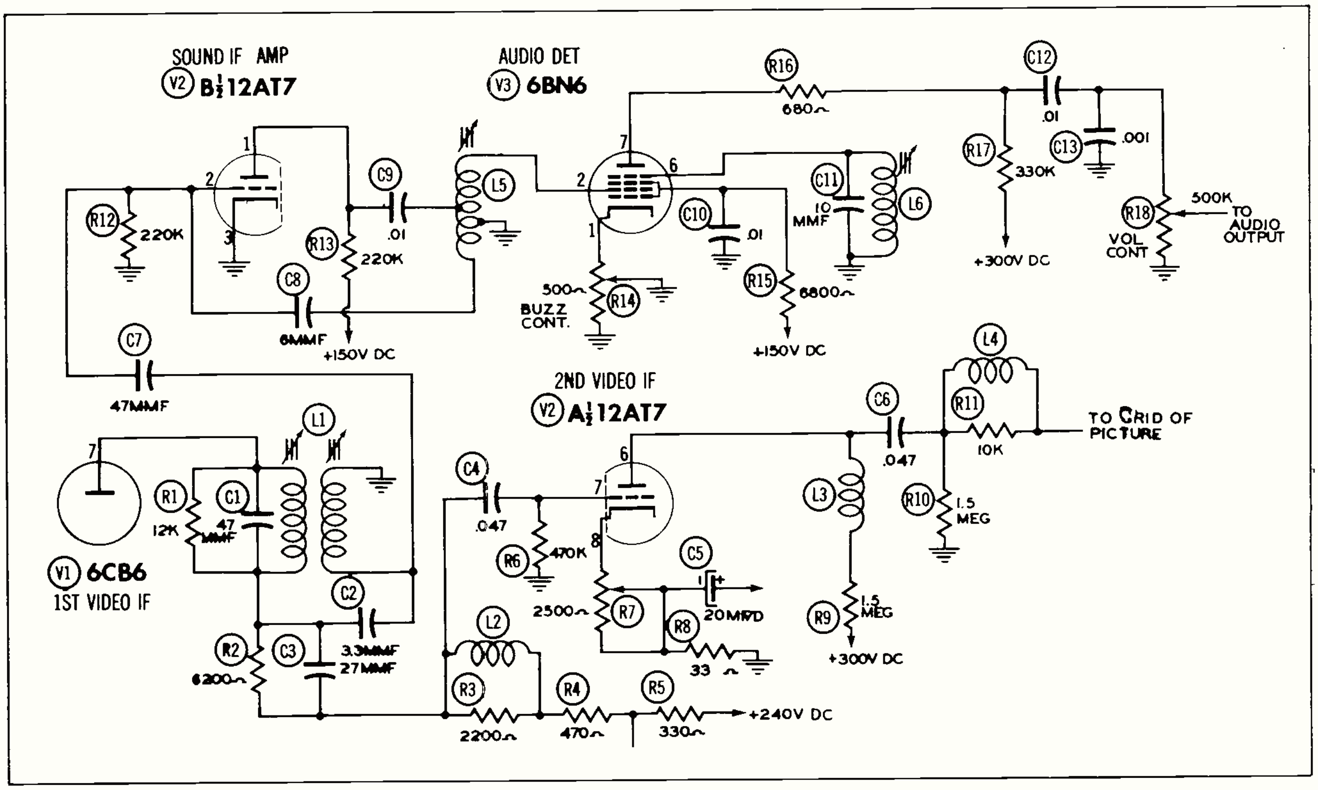

Figure 5. Gated Beam Audio Detector Circuit.

The audio signal developed is coupled through a .01 mfd. to the volume control. De-emphasis is obtained by a .001 mfd. capacitor across the volume control.

R14, a 500Ω buzz control is for the purpose of establishing the limiter grid bias and consequently is instrumental in enabling the 6BN6 to reject amplitude modulated components which might be present in the incoming signal.

The video signal from the 1st video is further amplified by the 2nd video amplifier, V2A. The 2500Ω contrast control in the cathode leg of the 2nd video amplifier controls the gain of V2A. L3 and L4, peaking coils in the video output, help to maintain high frequency response of the signal applied to the picture tube grid.

NORELCO TV RECEIVER PROTECTION SYSTEMS

Norelco television receivers, Models 588A and 1200A employ a protection system against burning of the picture tube screen, in the event that either the horizontal or vertical sweep should fail. This provision also insures that the picture tube beam is cut off during the warmup period until both sweeps are functioning properly.

Two protection circuits are used, one for each sweep system. The horizontal protection circuit functions to cut off the picture tube if failure occurs in either sweep.

Figure 6 is a partial schematic of the Norelco television receiver showing the two protection circuits. Note that the brightness control is connected in series with a triode section of a 6SN7GT tube forming a section of a voltage divider network. If the triode is not conducting, one end of the brightness control is connected to an infinite impedance. The voltage present at the junction of R18 and R19 is then applied to the picture tube, cutting off the beam. When the triode conducts, the voltage divider circuit is completed and the required range of voltages are provided at the arm of the brightness control.

The circuit constants are selected so that the triode will not conduct without a signal applied to the cathode. Tube bias is provided by connecting the cathode to a voltage divider network between +335 VDC and ground. With the grid grounded in this circuit, negative swings of an AC signal obtained from the junction of two damper resistors effect tube conduction. Since pulse type signals are applied to the tube, conduction occurs only a fraction of the time. A charge is then developed across C10, a .01 mfd. capacitor connected to the plate of the tube. The RC time constant of this capacitor, the brightness control, and R18, a 47K resistor, is designed to hold the potential of the low end of the brightness control to a fairly steady level.

If failure occurs in the horizontal sweep, the triode becomes non-conducting and the voltage applied to the picture tube cathode jumps to around +100 VDC, immediately cutting off the beam.

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Audio-Facts

by Robert B. Dunham

WILLIAMSON PREAMPLIFIER

The Williamson Amplifier discussed in PF INDEX No. 30 will amplify faithfully the output of a radio tuner, phonograph pickup, etc., when properly connected directly to the amplifier input. A signal of approximately two volts will drive the amplifier to full rated output. But for several reasons it is much more satisfactory and at times necessary to employ some means of preamplification, control or compensation between the signal source and the amplifier input.

This can be accomplished by the use of a separate preamplifier containing the necessary amplifier stages, filter circuits, switches, so-called "tone controls," and such, to compensate for the low voltage output of a magnetic pickup, the preemphasis of high frequencies in some recordings, deficiencies of the speaker system, or acoustics of the room, to name a few. The preamplifier is usually constructed in such a way that it can be mounted in a location for convenient operation of the controls and connected to the amplifier through suitable cables.

While a separate power supply is to be preferred, power for operating the preamplifier can be obtained from the Stancor-Williamson amplifier, if certain precautions are taken. The 6.3 volt winding of the Stancor PC 8412 power transformer has a rating of 5 amperes. Since the drain of the 6SN7GT and 807 tubes is only 3 amperes, the remaining 2 amperes should be sufficient for most any preamplifier. While the B+ drain of a preamplifier is usually only a few milliamperes, care must be taken when connecting to the amplifier power supply, since the decoupling problem is critical due to the excellent low frequency response of the Williamson amplifier. Any added current drain through the decoupling resistors results in a definite drop in voltage on the plates of the 6SN7GT tubes, disrupting the operation of these circuits. The possibility of feedback and motorboating will be reduced if the B+ supply for the preamplifier is connected at the 435 volt end of the 150 ohm 10 watt filter resistor.

Many preamplifiers, to do some or all of the previously mentioned functions, have been designed with their circuits described and discussed in various publications. Several suitable units are available commercially.

In the October and November 1949 issues of "Wireless World," Mr. Williamson gave specifications and schematics for the construction of a phonograph preamplifier and a tone compensation and filter unit for use with the Williamson amplifier. They are rather elaborate pieces of equipment but are very good examples of thorough design to achieve the desired results. The schematic for the phonograph preamplifier is shown in Figure 1 and for the tone compensation and filter unit in Figure 2. The EF37

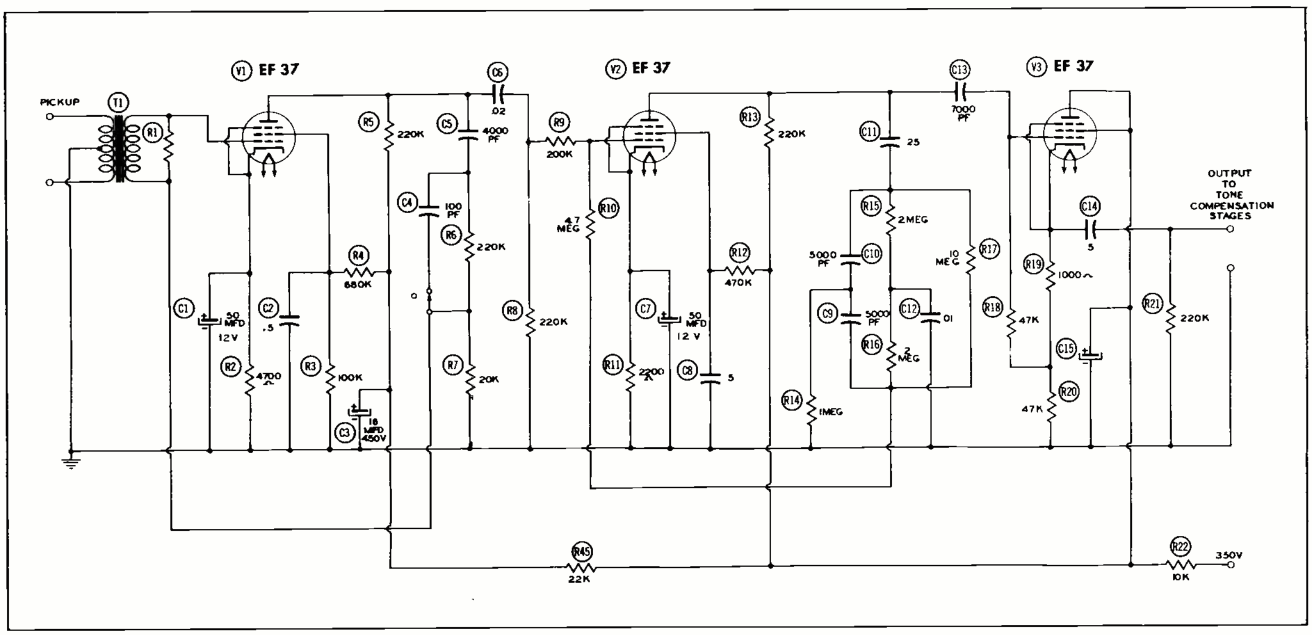

Figure 1. Phono Pre-Amplifier.

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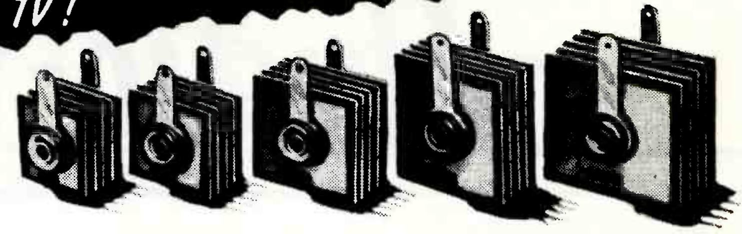

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8Y1	1/2" sq.	9/16"	130	380	20 MA*
16Y1	1/2" sq.	15/16"	260	760	20 MA*
8J1	11/16" sq.	9/16"	130	380	65 MA
5M4	1" sq.	11/16"	130	380	75 MA
5M1	1" sq.	7/8"	130	380	100 MA
5P1	1 3/16" sq.	7/8"	130	380	150 MA
6P2	1 3/16" sq.	1 3/16"	156	456	150 MA
5R1	1 1/2" x 1 1/4"	7/8"	130	380	200 MA
5Q1	1 1/2" sq.	1 1/8"	130	380	250 MA
6Q1	1 1/2" sq.	1 1/8"	156	456	250 MA
6Q2	1 1/2" sq.	1 3/8"	156	456	250 MA
6Q4 (†)	1 1/2" sq.		130	380	300 MA
5QS1	1 1/2" x 2"	1 1/8"	130	380	350 MA
6QS2	1 1/2" x 2"	1 1/4"	156	456	350 MA
5S1	2" sq.	1 1/8"	130	380	500 MA
6S2	2" sq.	1 3/8"	156	456	500 MA

* This rectifier is rated at 25 MA when used with a 47 ohm series resistor.
(†) Stud mounted—overall: 2"

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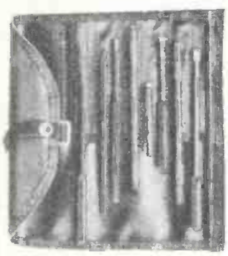

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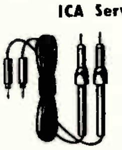

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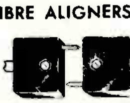

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English tubes are low noise pentodes similar to the 1620 and 6J7.

An input transformer, selected to match the particular magnetic pickup employed, is used for the input of the phonograph preamplifier. The value of resistor R1 depends upon the transformer used. The feedback circuit formed of C4, C5, R6 and R7, in the plate circuit of the first EF37 tube V1, feeding back to the grid provides correct equalization for Decca and EMI records. C4 is switched out of the circuit when EMI records are played. A parallel T network composed of C9, C10, C11, C12, R14, R15, R16 and R17 feeds back from the plate of V2 to the grid, giving a sharp cutoff of frequencies below 20 cps to eliminate turntable rumble.

V3 is a cathode follower stage, permitting the use of a long output lead, thereby allowing the preamplifier to be mounted near the turntable.

In the tone compensation and filter unit of Figure 2, controls R27 and R31, with switches S2 and S3 form a variation of a well known bass and treble boost and droop circuit. With switch S2 in boost position, C19 is shunted out of the circuit and the low frequencies are boosted as control R27 is rotated clockwise toward maximum. If R27 is turned counterclockwise to minimum, C20 is effectively shunted and the bass boost is reduced to the normal flat response. When S2 is switched to droop position C20 is shunted out and if R27 is turned clockwise toward maximum the bass is attenuated. Now, rotating R27 counterclockwise to minimum will return the low frequency response to normal due to the effective shunting of C19.

With switch S3 in boost position, capacitor C21 is in the circuit and C22 is switched out. If treble control R31 is turned clockwise toward maximum, the high frequencies are boosted. R31 rotated counterclockwise to minimum will reduce the high frequencies to the normal flat response. Switch S3 in the droop position cuts C21 out of, and C22 into, the circuit. Treble control R31 rotated clockwise toward maximum will reduce the high frequencies. The high frequency response is returned to the normal flat response when R31 is rotated counterclockwise to minimum. The maximum level of the treble boost can be set by C21, an adjustable trimmer type capacitor.

Following tube V5, an interesting circuit is used to control the high frequency cutoff. The really sharp cutoff of 30 to 40 db per octave, which is obtained here with a five position switch, capacitors and resistors, would usually require the use of resonant circuits with one or more chokes. A circuit such as this one, is very useful in eliminating objectionable noise with a minimum loss of response when playing records, listening with a radio tuner, etc., since most of the noise is located in the extreme high frequency end of the sound spectrum.

Resistor R34 with the capacitors on section A of switch S4, and R35 with the capacitors on section B, form a two-stage RC network in the grid circuit of V6. In the plate circuit of V6 the capacitors and resistors on sections C, D and E of switch S4 form a parallel T network with the output fed back to the grid through resistor R36. This cascading of filter networks on switch S4 results in a very sharp cutoff or rolloff of frequencies in its five positions of:- 1. 5000 cps; 2. 7000 cps; 3. 10,000 cps; 4. 13,000 cps and 5. Linear.

This preamplifier, with its flexible control, is capable of giving great satisfaction to the discriminating listener who really knows what he wants to hear.

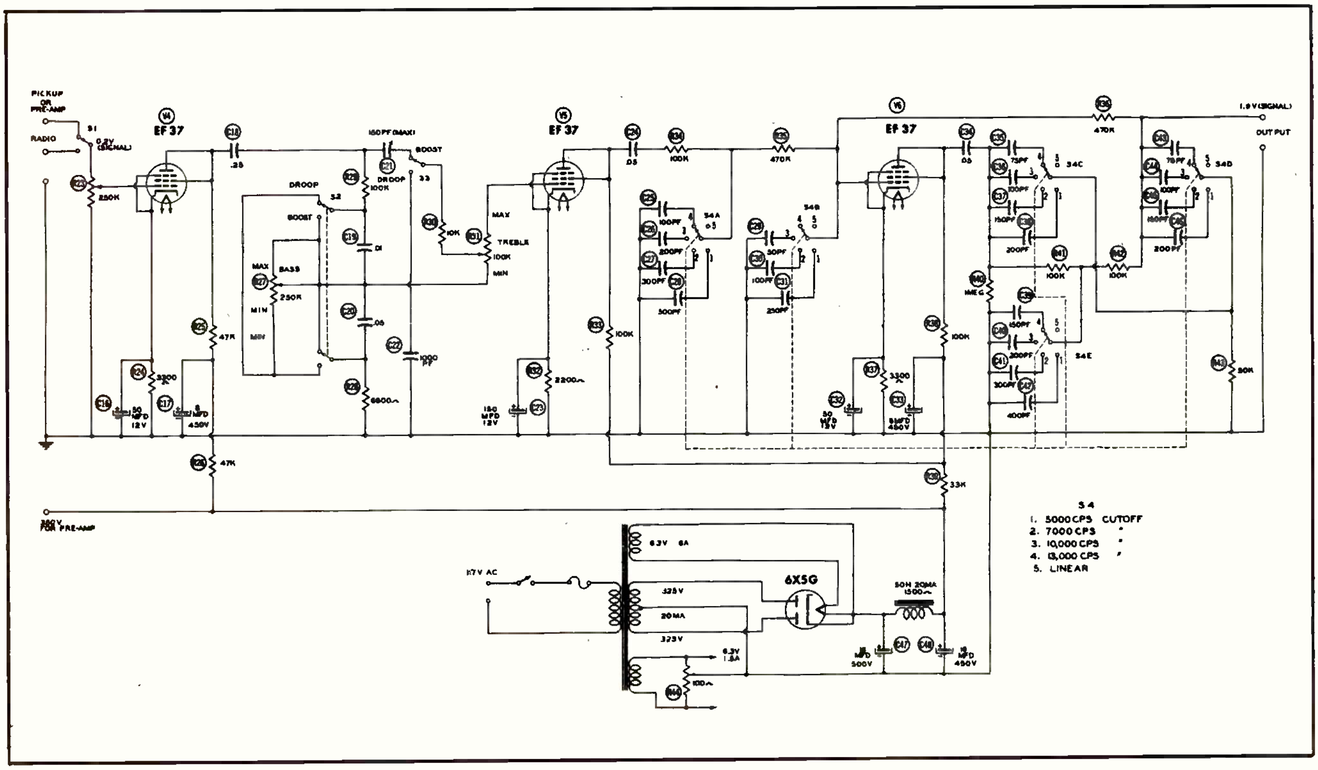


Figure 2. Tone Compensation and Filter Unit.

db

THE DECIBEL

By ARTHUR KOZIK

The prime purpose of this article is to acquaint the service technician with the decibel, a term which may be encountered quite frequently. At one time, unless you were a sound technician, you had little or no use for it, but it has since become more prominent in all phases of service work. A knowledge of its application should be very helpful in the service shop.

The decibel, most commonly used in the audio field, is a unit of measure to determine the ratio between two powers, two voltages or two currents. A decibel is one-tenth (1/10th) of a bel, which was named in honor of Alexander Graham Bell, the inventor of the telephone. The decibel (db) and the human ear have similar patterns of linearity, each being of a logarithmic nature. The human ear is unable to determine any given amount of power, but can readily detect the differences of power. One decibel is the amount of difference that can just be detected by the normal ear.

The unit "phon," also associated with sound, is the actual measure of a given level of sound and should not be confused with decibels. Decibels are used to express the "difference" of powers, voltages and currents. To illustrate this, the output of an amplifier delivering 1 watt of power is increased to 2 watts. If we were to say that we had a gain of 1 watt it would be meaningless, unless we also stated that the original level was 1 watt. In this instance we have doubled our power. However, a gain of 1 watt, if the original level were 50 watts would only be a small percentage of the total power. In this case the power is far from being doubled. Thus it can be seen why a method need be incorporated to express the difference. The decibel can be used to express huge differences of power without the use of large figures, and can also express the smaller ratios effectively. Caution must be exercised, however, for they are both plus and minus and must be totaled algebraically. If we were to have -5 db at the grid of a tube and +5 db at the plate, it would be expressed as 10 db gain, which is the algebraic difference.

- 6 db	- 6 db	+ 6 db	+ 6 db
- 2 db	+ 2 db	- 2 db	+ 2 db
+ 4 db (gain)	+ 8 db (gain)	- 8 db (loss)	- 4 db (loss)

A minus sign ahead of the amount indicates a power loss, and a plus sign indicates a power gain. Many voltmeters have a db scale that can be used to measure the gain or loss of power. For information as to the use of this scale on your meter consult the instruction book that covers the specific piece of equipment.

Microphones are sometimes rated in terms of decibels below 1 volt. The following chart can be used to calculate the voltage output, basing 0 db at 1 volt.

- 50 db = 0.003162 volt rms.
- 55 db = 0.001778 volt rms.
- 60 db = 0.001 volt rms.
- 65 db = 0.00056 volt rms.
- 70 db = 0.00032 volt rms.

The following formula is used to find decibels when powers are known:

$$db = 10 \log \frac{P1}{P2}$$

Example:

The difference between 10 watts and 40 watts expressed in decibels is as follows -

$$db = 10 \log \frac{P1}{P2} \qquad db = 10 \log \frac{40}{10}$$

$$db = 10 \log 4 \qquad db = 6.02$$

Therefore, the power difference is 6.02 db

To express voltage or current differences in db, use the formula -

$$db = 20 \log \frac{E1}{E2} \quad \text{or} \quad db = 20 \log \frac{I1}{I2}$$

Example:

To find the difference between 10 volts and 40 volts -

$$db = 20 \log \frac{E1}{E2} \qquad db = 20 \log \frac{40}{10}$$

$$db = 20 \log 4 \qquad db = 12.04$$

Thus the voltage difference is 12.04 db. The above is true only if both E1 and E2 are measured across impedances of equal value.

To simplify the use of the decibel and to reduce the need of computing by formula, the following partial table is included. Note that this table is given in intervals of one db, and for further breakdown into fractions of a db, a more complete chart should be employed.

To find ratios beyond the range of the table (when the quantity of db is greater than 20) subtract +20 db successively until the remainder falls within the limit of the table. Then multiply the value in the column under Voltage Ratio by 10 for each time you subtracted 20 db, and by 100 if Power Ratio is desired. (See examples of this procedure following the table.)

♦ ♦ Please turn to page 71 ♦ ♦

John Markus

Editor-in-Chief, McGraw-Hill Radio Servicing Library

Dollar and Sense Servicing

PIGEON ROOST! Because pigeons persistently roost on the BBC microphone mounted about twenty feet away from the Big Ben Westminster clock in London, the cloth wind-breaking cover on the microphone has to be replaced every three months. The microphone is high up on the famous steeple, just above the public gallery in the tower. The familiar tolling of this famous clock can be heard regularly on short-wave broadcasts from England.

ALIGNMENT AID. Bouquets to CBS-Columbia, who are making all alignment adjustments accessible from the top of the chassis in their newest television receivers. Last of the adjustments to get up top was for the discriminator transformer; it'll have two concentric screws, requiring two different sizes of screwdrivers. Other set manufacturers who're doing the same, or plan to, deserve equal credit from servicemen - provided they make it possible to connect alignment instruments from the top of the chassis also.

17 IS MINIMUM. Picture tube sizes are settling down to 17, 20 and 21-inch rectangular glass. Just a few 24, 27 and 30-inch rounds are being made. Metal-coned tubes appear to be on their way out. Newest development is the cylindrical-face tube, which minimizes reflections from room lights. Practically all the 17 and 21-inch rectangulars being made now by DuMont are cylindricals, and Sylvania is also making some of them.

ERSATZ. Not much evidence of conservation of metal as this is written, though a few new sets do show it in use of cloth webbing to hold down picture tubes, in composition-board backs for sets, in plastic or composition picture-tube end cups, and in finer-gage hookup wire.

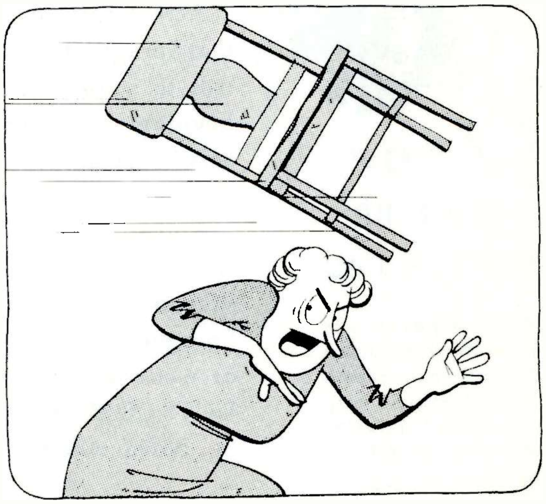
At the factories, resistor and capacitor leads are being cut shorter and the scrap pieces saved for salvage worth around 20 cents a pound today. Amazingly, this salvage piles up to thousands of pounds in just a few months when a large television factory has all its production lines running.

LAST OF THE MOHICANS. Atlanta's WLTV went on the air near the close of 1951 as the 108th and last of the FCC-authorized vhf television stations in this country. Add to this XELD-TV in Matamoros, Mexico, which serves a Texas audience, and we have 109 stations dishing out programs and commercials to U. S. viewers. As of year-end, 95 of these were receiving network programs by coaxial cable or microwave relay. By the end of 1952, only four are expected to be without network service, Albuquerque, Phoenix, Seattle and Matamoros.

SKIM MILK. Regions served by television stations are estimated to contain 27.5 million families, of which some 15.5 million now have TV sets. These represent the cream of the market and quite a bit of the skim milk too.

The trend among set manufacturers is toward super-fringe receivers that will open up new markets. Sensitivity in many of these new sets is 20 microvolts or better, as compared to 100 microvolts or higher for the average set of a year or two ago. One manufacturer even guarantees 150-mile reception in his advertisements. The sets will generally have a FRINGE-LOCAL switch or its equivalent, since such high sensitivity can give picture troubles when used on strong nearby stations. In some of the new sets, the gain reduction is achieved simply by cutting plate voltage of the video IF amplifier strip from 180 volts to 90 volts; this had the advantage of giving full bandwidth and hence full picture detail at both settings.

MEN. In Memphis, a man threw a chair at his wife, then ducked her head in a bathtub when she blocked his view of their TV screen. In Bridgeport, a man put his TV aerial up after dark each night and took it down at bedtime, so he could stay in a low-rent housing project yet keep his forbidden TV set.



BEEFSTEAK. Black eyes get a dose of electricity in place of steak at a Long Island VA hospital. If the electrical juice is applied within an hour or before much blackening has occurred, results are claimed to be very good. Voltage and current figures have not been released, but the picture-tube second anode lead of a TV set probably has too many volts for the purpose.

FLUORINE. If your local water company starts using fluorine in the water to prevent tooth decay, better stop using that water in storage batteries. Use distilled water instead, as fluorine can make a battery go dead quick.

♦ ♦ Please turn to page 81 ♦ ♦

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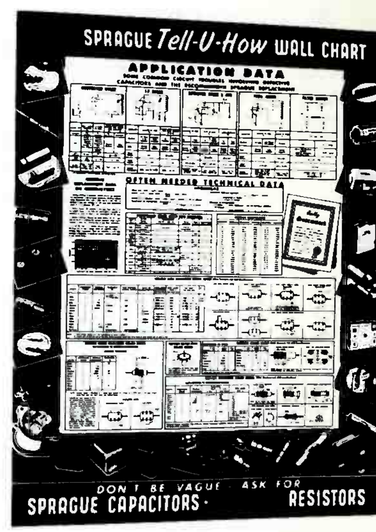
Special section lists capacitor "Service Packages" which contain all the electrolytic capacitors necessary to service any brand of TV set. Sprague jobbers will supply these kits for over 22 of the most popular brands of TV receivers.

Free copies of the new manual M-481, are available from local Sprague distributors, or may be obtained from Sprague Products Company, North Adams, Mass. Send 10c to cover mailing and handling.



WALL CHART SOLVES CAPACITOR PROBLEMS

A giant wall chart for use in busy service shops is now being offered to servicemen by Sprague Products Company, North Adams, Mass. Beautifully lithographed in colors, size 22" x 28", the chart includes handy service application data; details of common circuit troubles and their remedies; replacement data on electrolytics; formulas; transformer, resistor and capacitor color codes; schematic symbols, and other related information. Everything is arranged for quick, easy reference. Popular types of Sprague Capacitors and Koolohm Resistors are illustrated.

The Wall Charts are now available free from Sprague distributors.

INDEX TO PHOTOFACT

RADIO AND TELEVISION SERVICE DATA FOLDERS

No. 31

Covering Folder Sets Nos. 1 thru 164

HOW TO USE THIS INDEX

To find the PHOTOFACT Folder you need, first look for the name of the receiver (listed alphabetically below), and then find the required model number. Opposite the model, you will find the number of the PHOTOFACT Set in which the required Folder appears, and the number of that Folder. The PHOTOFACT Set number is shown in bold-face type; the Folder number is in the regular light-face type.

IMPORTANT—1. The letter "A" following a Set number in the Index listing, indicates a "Preliminary Data Folder." These Folders are designed to provide you *immediately* with preliminary basic data on TV receivers pending their complete coverage in the standard, uniform PHOTOFACT Folder Set presentation.

2. Models marked by an asterisk (*) have not yet been covered in a standard Folder. However, regular PHOTOFACT Subscribers may obtain Schematic, Alignment Data or other required information on these models without charge. (When requesting such data, mention the name of the Parts Distributor who supplies you with your PHOTOFACT Folder Sets.)

3. Production Change Bulletins contain data supplementary to certain models covered in previously issued PHOTOFACT Folders, and are listed in this Index immediately following the listing of the original coverage of the model or chassis. These Bulletins should be filed with the Folders covering the models to which the changes apply.

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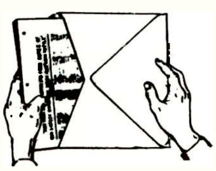
IMPORTANT

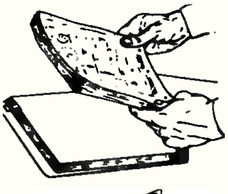
Quick, Easy PHOTOFACT Filing Method

The preferred 30-Second method for filing PHOTOFACT Folders

Your PHOTOFACT Folder Sets come to you in convenient envelopes. When you remove a Set from its envelope, you will find the Folders already arranged in proper filing order, and preceded by an Index Separator. This Separator lists each receiver covered in the Set, and has an index tab showing the Set number. To file, here's all you do:



1. Remove the Index Separator and the Folders from the envelope. The Folders and manila TV Jackets are already arranged in proper numerical filing order except the TV folders, which are placed last in the Set.



2. Open your binder and place the entire contents, taken from the envelope, behind the preceding Set of folders, laying aside the TV folders.

3. Now, insert the TV folders in their respective manila jackets and your filing is complete.

To locate the folder you want, refer to instructions on the first page of this index listing.

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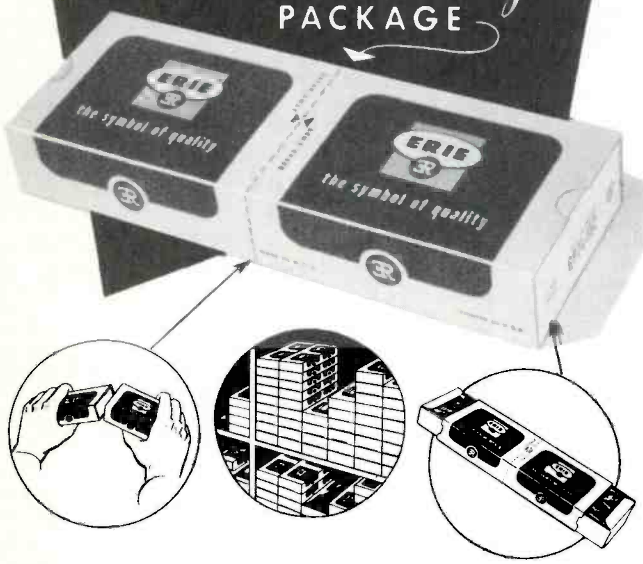

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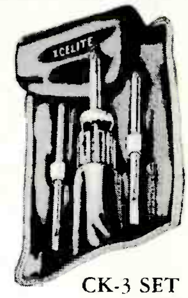

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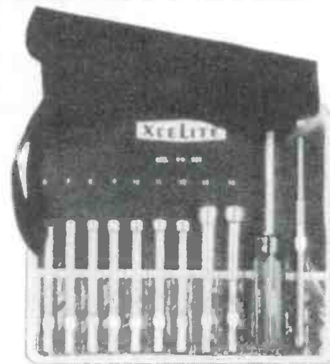

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"SHOP TALK" (Continued from page 5)

REVIEW. The review this month is concerned with an explanatory article on filters with the intriguing title of:

"Filter Facts and Faddle"
by James R. Langham

Radio-Electronics
November 1951
Copyright 1951 by
Radcraft Publications, Inc.
Erie Avenue F to G Streets
Philadelphia 32, Penn.

Subscription Price $3.00 per year
U. S. A., Possessions, and Canada

RCA, in describing their new receiver line, makes reference in their technical servicing literature to a new type of input filter in the antenna matching unit which is designed to provide extremely high attenuation to signals of all frequencies below 47 mc. Thus far, this is fairly straightforward. But then the explanation continues (with not so much as a byword) to state that the filter circuit consists of a high-pass M-derived filter with a pi intermediate section and terminating half sections. (This, believe it or not, is precisely the language employed.)

A statement of this type is at once a compliment and a challenge to the service technician. It is complimentary in that, for a change, it speaks to the service technician in engineering parlance, placing him on the same plane as the design engineer. It is a challenge because it indirectly stipulates that if the technician is to be given more information of this calibre, that he maintain and extend his technical know-how.

Descriptive statements like that made by RCA make articles like "Filter Facts and Faddle" so timely and so much of interest to the alert serviceman. For it is surprising how much haziness and uncertainty exists concerning some of the fundamental concepts upon which radio and television are built. And with the direction of TV circuitry design veering more and more toward increasing complexity, now is the time to relearn fundamentals so that an understanding of the circuits to come will be based upon a firm and well constructed foundation.

Filter action in any circuit depends primarily upon the fact that

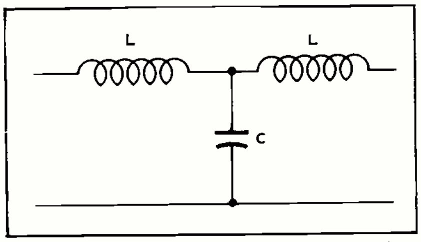

Figure 1. A Low-Pass Filter. (T-Type.)

the impedance of a capacitor decreases with frequency while that of an inductor increases with frequency. In combination, these two diverse actions can be united to aid each other perform a specific task. Thus, a low pass filter combines inductances and a capacitor in the manner shown in Figure 1. The coils will offer low impedance to DC and to low frequency AC currents but will oppose the higher frequencies with increasing force. Whatever high-frequency signal does pass by the first inductance will find another trap existing at the shunt capacitor. As a result, high frequency signals, passing through a filter of this type, suffer a certain amount of loss or attenuation. On the other hand, DC and low frequency signals see little impedance in the inductance and a very high impedance in the capacitor. There is thus little compulsion for them to leave the signal path and they continue on into successive circuits. Their attenuation is relatively small.

The main classes of filters are: T, Pi, and half sections. See Figure 2. There are additional classes but for the most part they represent extended versions of these basic types. The T and Pi filters are so named because their physical structures resemble the letter T or the Greek symbol π. The half sections are also known as half-tees, half-Pi's, and ladders.

The simple T or Pi type filters shown in Figure 2 are useful in permitting certain frequencies to pass and in attenuating others. However, a single filter section, like a single tuned circuit in a receiver, does not possess sufficient selectivity. In other words, there is no sharp line of demarcation between the desired and undesired frequencies. To permit the desired frequencies to pass easily but to heavily attenuate all other (i. e. undesired) frequencies requires perhaps three, four, or five filter sections connected one after the other or in tandem. Usually, this is a costly procedure. However, by using a special filter which is so designed that it imposes a high

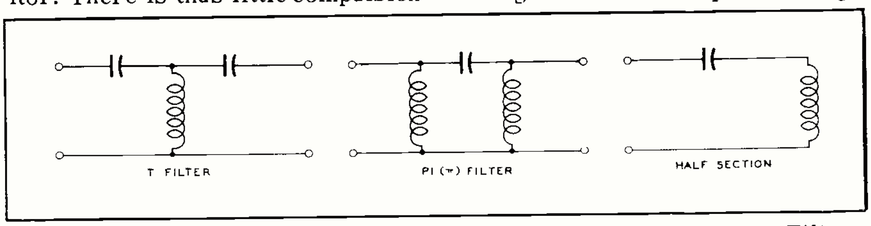

Figure 2. The Three Classes of Filters. While all Are High-Pass Filters, They Could Just as Well Have Been Low-Pass by the Interchange of Capacitor and Inductor Positions.

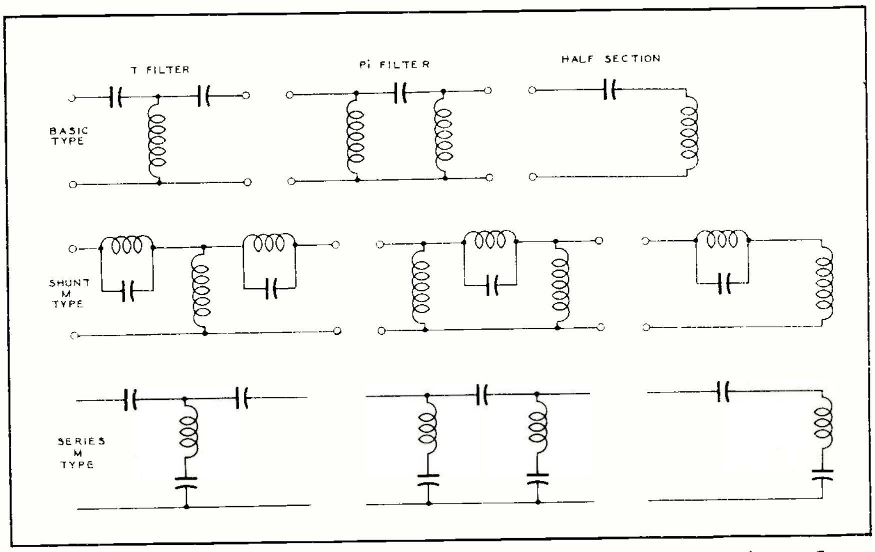

Figure 3. Three Classes of High-Pass Filters: T, Pi, Half Sections. Low-Pass Filters also Fall Into These Three Classes.

attenuation at one frequency - say near the cut-off frequency of the single filter section - and then combining this unit with the single filter section, we can obtain essentially the same results as we would have by placing many simple filter sections in tandem.

The name of a special filter which is capable of achieving the foregoing conditions is the M-derived filter. It, too, consists of capacitors and inductances, but these are combined in somewhat different fashion than the simple filter of Figure 2. A comparison of the basic and the M-derived filters is shown in Figure 3 and it can be seen that the high attenuation at a specific frequency imposed by the M-derived filters, stems from the parallel and series resonant circuits which these networks contain.

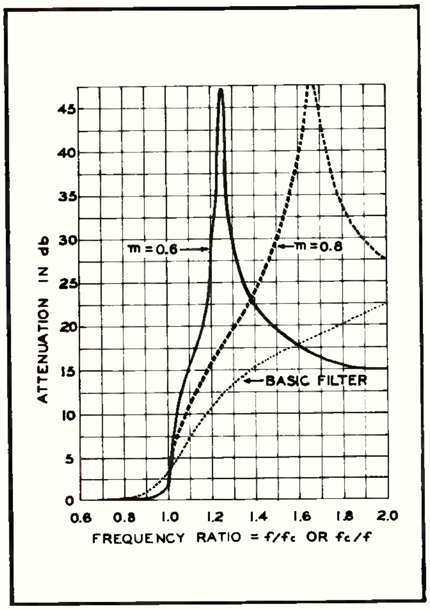

Figure 4. A Comparison of the Effectiveness of Basic and M-Derived Filters.

Some appreciation of the greater effectiveness of the M-derived filter (at a specific frequency) over the single filter is shown by the curves in Figure 4. The attenuation of the simple filter rises gradually beyond the cut-off frequency but with the M-derived filter, it skyrockets. However, as we move deeper and deeper into the cut-off range, the attenuation of the M-derived filter decreases and it is soon overshadowed by the attenuation of the simple filter.

In view of this behavior, it is common practice to combine the two to form a filter unit possessing a fairly steep and well defined line of demarcation between the pass band (where the frequencies pass freely) and the stop band (where the frequencies are attenuated). Such a combined filter might appear as shown in Figure 5.

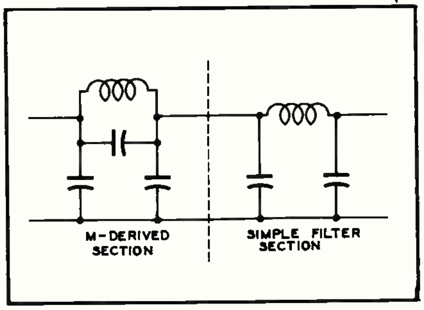

Figure 5. Combined M-Derived and Simple Filter Sections.

Some readers are undoubtedly wondering about the significance of the letter M. There is no particular reason why the letter M was chosen (say in preference to P, Q, R, etc.) but M itself has a value between 0 and 1 in the design equations for the M-derived filter. And as M approaches 0, the attenuation curve becomes steeper and the frequency of peak attenuation moves in closer to the cut-off frequency of the simple filter. In the design of these filters, the value of M chosen is used in the calculation of the capacity and inductance values for that filter.

The combined filter unit in Figure 5, while substantially complete, still requires the addition of what are known as end sections or, as RCA states, terminating half sections. The reason for including these two half sections stems from the fact that the characteristic impedance either of the basic low pass filter or its M-derived companion varies with frequency. To achieve a uniform and maximum transfer of power over the band of frequencies which is passed, it is desirable that the impedance of the filter section remain as constant as possible. Now, it has been found that when an M-derived filter is designed using a value of 0.6 for M, that the characteristic impedance of this section remains fairly constant over the pass band. Another fortunate feature is the fact that splitting this M = .6 section in two does not affect the value or the constancy of its characteristic impedance.

Thus, to achieve the desired matching of the filters shown in Figure 5 to the circuit into which it is connected, another M-derived filter (with M = 0.6) is split in two, and each half section is placed at one end. The completed unit now appears as shown in Figure 6.

♦ ♦ Please turn to page 70 ♦ ♦

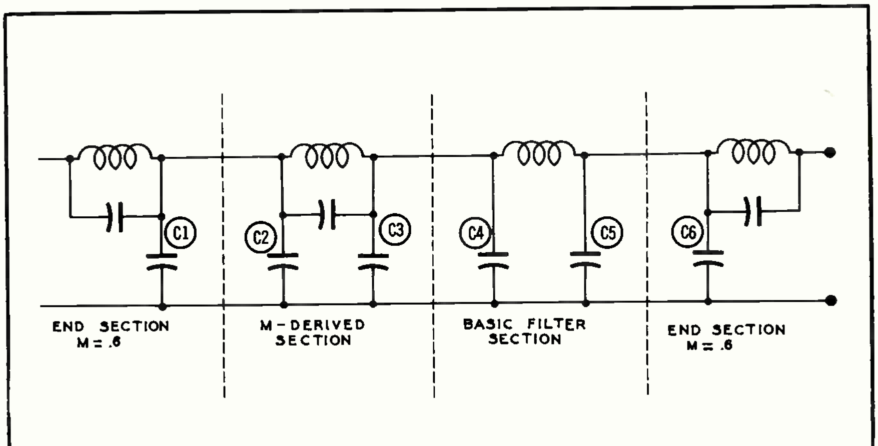

Figure 6. The Complete Filter, Containing Two End Sections, an M-Derived Section, and a Basic Filter.

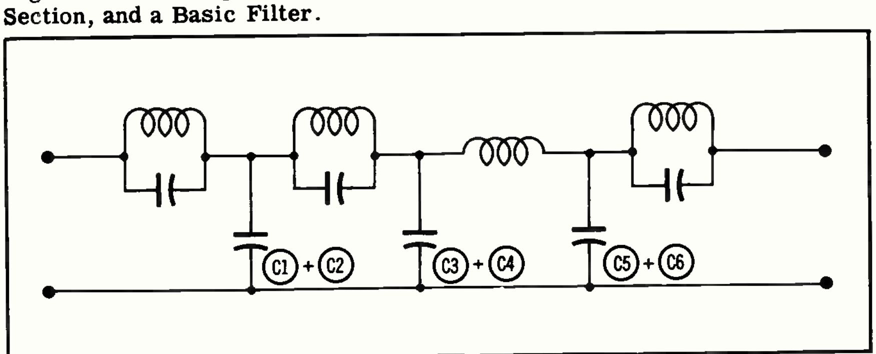

Figure 7. The Filter Network of Figure 6 in More Compact Form.

Note that the first M-derived filter section which was combined with the low pass (or high pass) filter itself can (and usually does) have values of M other than .6. What the actual value is will depend upon where we want the peak attenuation frequency to fall, and this, in turn, depends upon what frequency we particularly wish to get rid of most. In the article, the author wanted the filter to fit in a 500-ohm speaker line and to attenuate a strong 10 kc whistle that his set had developed due to the interference of two received signals. In the RCA M-derived filter, rejection of frequencies below 47 mc is desired.

In the final formation of the complete filter network (containing all sections and half sections), parallel capacitances along the line are combined into single units. See Figure 7. The same sort of combination would occur if adjacent inductances were shunting the circuit. This makes for compactness in construction, although to the novice it frequently results in some confusion.

For those readers who desire specific formulas for the various filters, reference should be made to the original article.

"TV TROUBLES"
(Continued from page 23)

in Figure 7. Such interference may be caused by heater-to-cathode leakage in a video IF or video amplifier stage. A full-wave rectifier ripple voltage (120 cycles) would develop bar interference.

If pronounced interference of any type is present, the transmission line from the antenna can be disconnected from the receiver terminal post and the selector switch rotated through all the channel positions. If the diagonal bar interference is still present it would indicate that the trouble is in the receiver and is not being picked up externally.

There are other such symptoms which often occur to give false indications of the defects because of their deceptive characteristics which hide the true identity of the fault. Inasmuch as they are often unusual occurrences, they are beyond the ordinary experience of the technician and are sometimes difficult to localize. For this reason the television technician must always be more alert in servicing than he would have had to be in the case of radio receiver servicing. A knowledge of general circuitry and a suspicion of cause and effect will usually be of material aid.

"THE DECIBEL" (Continued from page 41)

Minus (-)			Plus (+)	
Voltage Ratio	Power Ratio	Db	Voltage Ratio	Power Ratio
1.00	1.00	0	1.00	1.00
.8913	.7943	1	1.122	1.259
.7943	.6310	2	1.259	1.585
.7079	.5012	3	1.413	1.995
.6310	.3981	4	1.585	2.512
.5623	.3162	5	1.778	3.162
.5012	.2512	6	1.995	3.981
.4467	.1995	7	2.239	5.012
.3981	.1585	8	2.512	6.310
.3548	.1259	9	2.818	7.943
.3162	.1000	10	3.162	10.00
.2818	.0794	11	3.548	12.59
.2512	.0631	12	3.981	15.85
.2239	.0501	13	4.467	19.95
.1995	.0398	14	5.012	25.12
.1778	.0316	15	5.623	31.62
.1585	.0251	16	6.310	39.81
.1413	.0199	17	7.079	50.12
.1259	.0158	18	7.943	63.10
.1122	.0126	19	8.913	79.43
.1000	.0100	20	10.000	100.00

Example of finding ratios beyond range of the above table:

1. Given 55 db
55 db -20 db -20 db = 15 db

Voltage Ratio:
15 db = 5.623 x 10 x 10 = 562.3

Power Ratio:
15 db = 31.62 x 100 x 100 = 316200

If the number is a minus figure add +20 db successively until the sum falls within the limits of the table. Then to find the voltage ratio divide the value from the left column by 10 for each time you added 20 db, and by 100 to find power ratio.

2. Given -43 db
-43 db +20 db +20 db = -3 db

Voltage Ratio:
-3 db = .7079 divided by 10, divided by 10
= .007079

Power Ratio:
-3 db = .5012 divided by 100, divided by 100
= .00005012

The above table is but a portion of a complete table and is included to help illustrate the use of the decibel. More complete tables are readily available in many handbooks and various publications. The use of a table will minimize the use of mathematics and formulas; and should be quite useful in the shop.

When referring to the decibel it should be noted that no standard level has been adopted upon which to base the unit. However, a base of 6 milliwatts (.006w) as zero db is used in the majority of cases.

It can be seen by using the above tables that 3 db is one-half power, and that 6 db is one-half voltage.

Some television manufacturers use the decibel to indicate the correct positioning of the markers on the overall pattern during alignment. As an example, a manufacturer states that the sound carrier be at -26 db to -29 db. By this it is meant that the sound carrier be from .035 to .05 up the slope of the overall pattern. It is also stated that the video carrier should be placed at -6 db. Since 6 db equals one-half the voltage, this would place the video carrier at 50% on the response curve. The most frequently used values, used in alignment work, are 3 db, 6 db and 26 db. A mental memorandum of these three values, and their respective ratios, should be quite helpful in normal service work.

3 db = .707 voltage ratio

6 db = .501 voltage ratio

26 db = .05 voltage ratio

Thus the decibel may be frequently encountered by the service technician. The preceding discussion is intended to help in providing a better understanding of the decibel and its use.

"INTERCOM." (Continued from page 29)

communication between key points may be established. The remote unit ordinarily consists of a permanent magnet speaker, enclosed in a suitable cabinet, and a press-to-talk switch, usually of the rotary type. This switch, having a single pole with a double throw, incorporates a spring return to keep it at the "Listen" position at all times when no pressure is being applied. Normally a terminal board is present on the rear of the cabinet to allow the connection of a cable from the master station.

The master station is composed of an audio amplifier, a selector switch, and a volume control. A press-to-talk switch and permanent magnet speaker is employed in the master station also. The press-to-talk switch in this case, is also normally a rotary type, but has a double pole with double throw, and a spring return as in the case of the remote unit. Pole No. 1 selects the signal to be coupled to the input of the amplifier (see Figure 1) by selecting the speaker of the master station or that of the remote unit. Pole No. 2 controls the output of the amplifier, by selecting the opposite speaker to be coupled to the output. Thus if the speaker of the master station is coupled to the input, the remote unit will be coupled to the output, and if the remote unit is driving the amplifier, the master station speaker is receiving the output.

The selector switch may be of a non-shorting rotary type, or possibly a series of push buttons. These switches have very definite positions which are numbered 1, 2, 3, 4, 5, 6, etc. In the case of the rotary type, one position will normally be marked, "Silent," and one may be marked, "All." With this switch in the "Silent" position, no remote unit can be heard unless the press-to-talk switch of the remote unit is depressed to the "Talk" position. The master station must have the selector switch placed to the corresponding position of that remote unit, before an answer can be conveyed to that remote unit. The "All" position is so designed that the master station may talk to all remote units simultaneously. The volume control is to control the volume or "loudness" of the system.

The audio amplifier may be of the AC-DC type, or an AC type, depending upon the power required. The input of the amplifier couples through the special transformer of the voice coil-to-grid design. This provides proper impedance match for coupling a speaker voice coil to the grid of the input tube. The rest of the amplifier is of a standard design, with the exception of the output transformer being coupled to the selector switch. Once again a terminal board is normally placed on the rear of the cabinet for the cable connections.

Systems incorporating one master station may have as many remote units as there are positions on the selector switch, or may use any part of this quantity. In the case of a two-station system, the selector switch may be completely removed. Figure 1 illustrates a typical system and the function of the selector switch.

Problems other than those encountered in servicing the equipment may arise if the technician is called upon for installation. If the directions that accompany this equipment are followed, little or no trouble should be encountered. The cables should also be selected only after an examination of the manufacturer's specifications. These cables may be of many types. Cables of one twisted pair may be used depending on the installation. In all cases twisted wires should be used. A certain amount of pickup may be introduced into these lines either by cross modulation from adjacent pairs or from 60 cycle power lines. By the twisting of these lines, the signal that is picked up on the lines tends to be canceled. If these lines are not twisted hum is almost sure to occur. Another advantage of the twisted pair is that in many systems, lines from one or more remote units are run side by side for a certain distance. Due to capacitive coupling between these lines, "Cross Talk" may develop. Therefore each pair of lines to each remote unit are twisted to reduce this "Cross Talk" and other disturbances to a minimum.

Some master stations are equipped with center tapped transformers which allow a balanced line to be used. The tap is grounded and therefore each line is an equal amount above and below ground which also helps to minimize any "Cross Talk" or other interference that may be introduced into the line. This does not, however, eliminate the twisted lines. Twisted pairs should be used in every installation. Ordinary wire is not recommended for these lines, for a leakage as high as 20,000 ohms per 100 feet may prevail in humid weather. In some cases, shielded cable may be used, and when a line is run outdoors, cables with weather proof insulation should always be employed.

These cables, upon installation, may be made to terminate in a multiple contact socket. Each unit may also be equipped with a polarized plug for its

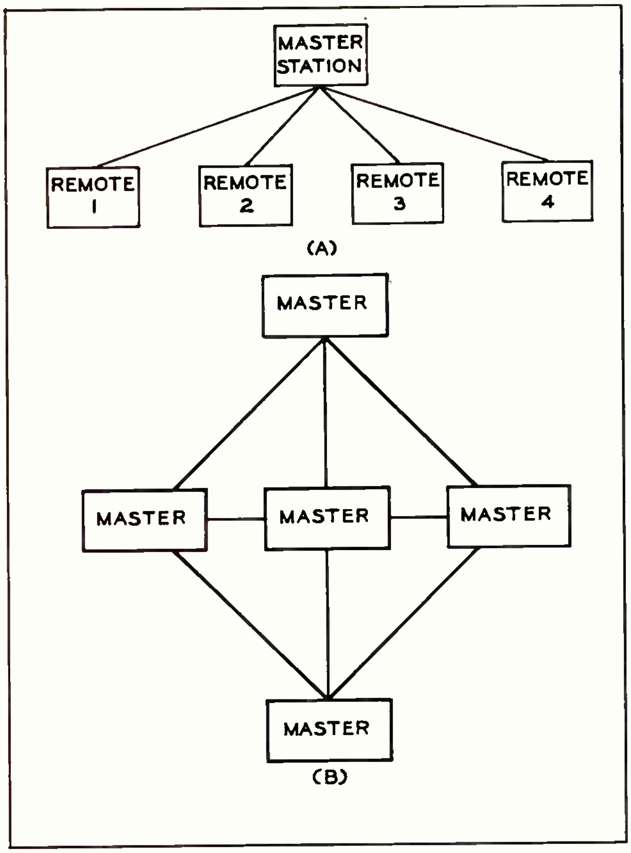

Figure 2. Intercommunication Unit Arrangements. (A) Master and Remotes. (B) All Master Units.

respective socket. In this manner a substitute unit may be readily installed in the case of unit failure, allowing more time for service requirements without the inconvenience of having stations, or the complete system, inoperative during service time.

In some installations, master stations are used entirely throughout the system. The block diagram for this system is shown in Figure 2B. By incorporating master stations exclusively it is possible for any station to call any other station or all stations as desired. With remote units, communication is between any remote unit of the system and the master station only, as shown in Figure 2A. One remote unit may not communicate with another.

As a further refinement to the multiple master system, remote units may be employed also, with hookup to any master of the system. This remote unit will be able to communicate only with the master station to which it is attached. Any combination of master stations and remote units may be used, the various hookups too numerous to cover completely. A system to cover each application and give the service desired can be accomplished. Some typical hookups are shown in Figure 2.

Since these systems are becoming more numerous and popular as a method of communication within an organization, and essential for the smooth operation of these concerns, the necessity of fast and dependable service is becoming greater. More and more calls will be had by the technician for installation and servicing of these systems. It is hoped that the above article will be helpful in the better understanding of this subject.

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While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this Index.

"DESIGN FEATURES" (Continued from page 36)

The vertical sweep failure protection circuit is designed to load down the horizontal oscillator sufficiently to stop its operation. This stops the horizontal sweep and removes the signal from the horizontal failure protection circuit, which in turn causes picture tube cutoff.

In detail, a signal from the vertical output transformer secondary winding is applied through a .25 mfd. capacitor to a triode, V4A, connected as a diode. This diode acts as a peak voltage rectifier. Positive pulses are conducted through the diode to ground, charging C12 to the peak voltage of the applied signal. This voltage is developed across R23, a 1 megohm diode load resistor. An integrating network, composed of R24, R25, C13 and C14, filters the signal which is then applied to the grid of a triode section of a type 6SN7GT tube, V5A. A large negative bias is formed on the grid which prevents tube conduction. Although the plate is connected across the horizontal multivibrator triode, no loading occurs since the tube is non-conducting. As soon as the sweep signal from the vertical circuit ceases, the charge on C12 rapidly bleeds off through R23. With V5A unbiased, a heavy current flows, which loads the horizontal oscillator plate circuit with about 5000 ohms, thus stopping its operation.

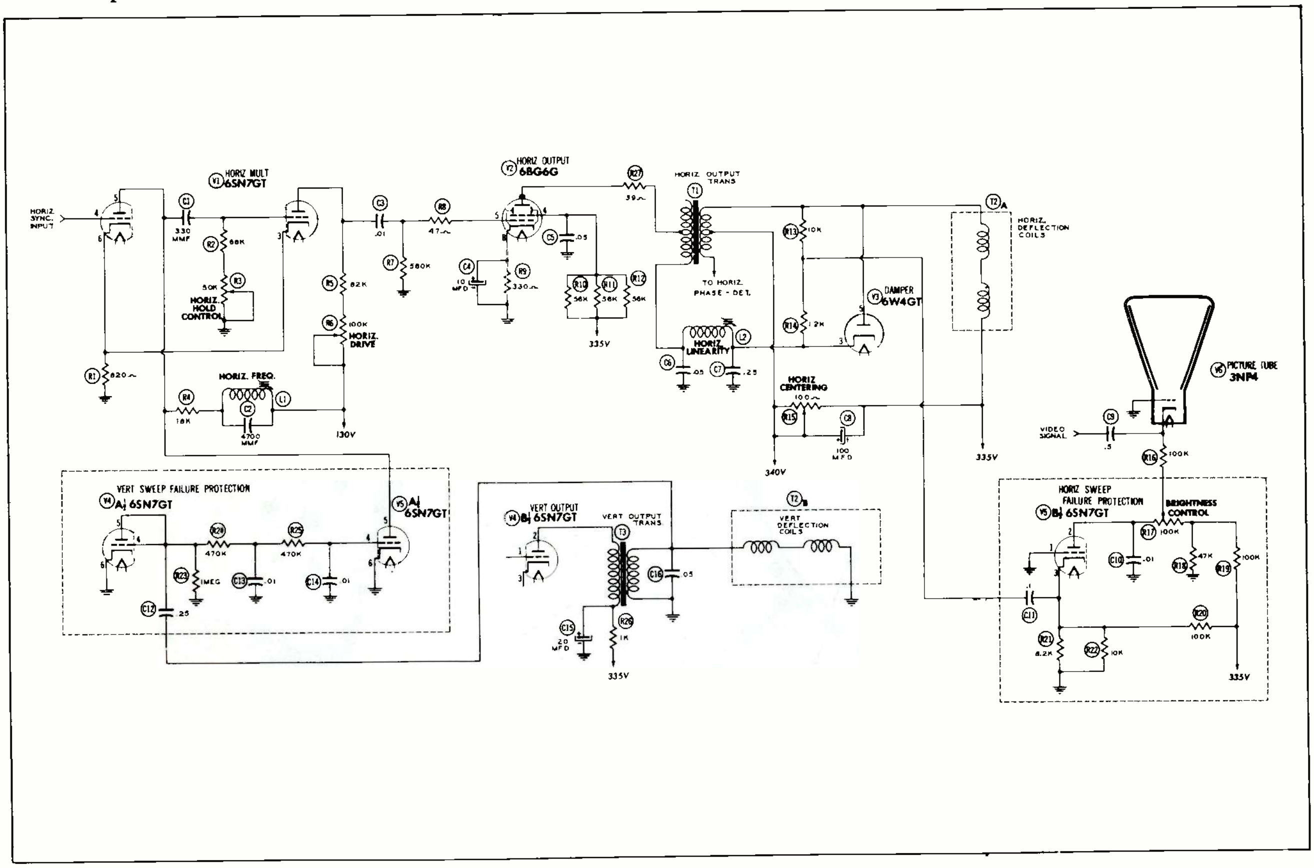

Figure 6. Norelco Deflection System.

"WAVEFORM ANALYSIS" (Continued from page 17)

If it is desired, the waveform of the current through the deflection coils may be observed on an oscilloscope. This is done by inserting a small resistor (15 or 20 ohms) in series with the vertical deflecting coils and applying the voltage developed across the resistor to the scope terminals.

This voltage is a true picture of the current through the coils. It would look very much like the sketch in Figure 7 and would describe the actual vertical movement of the electron beam in the picture tube.

In a future article, we shall continue discussing the applications of waveforms in other television circuits.

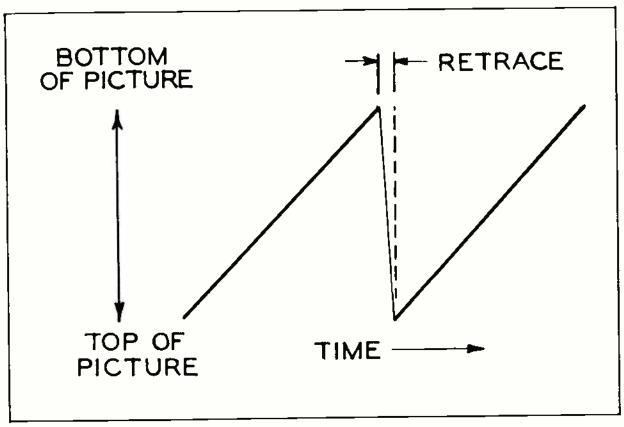

Figure 7. Current Wave in Vertical Deflecting Coils Showing its Relation to Movement of Electron Beam on Picture Tube Screen.

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"QUICKER SERVICING" (Continued from page 27)

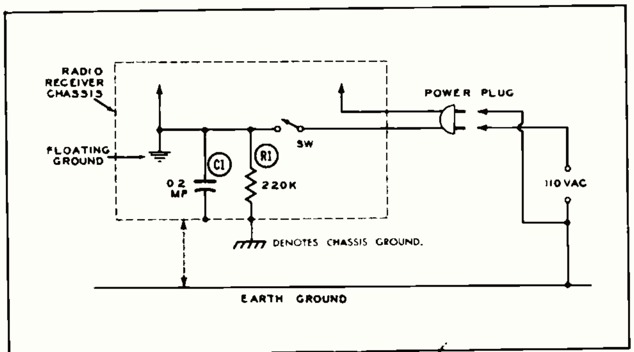

Figure 7. Floating Ground in an AC-DC Receiver.

plastic coating appreciably lengthens the life of the antenna.

Phono-Jack Installation in AC-DC Receivers

There continues to be a demand for the installation of phonograph jacks in AC-DC radio receivers. The problem itself is relatively simple; but there are one or two associated points which merit more consideration than they frequently receive.

An AC-DC receiver ordinarily has what is known as a "floating ground." In other words, the negative sides of the filter capacitors and the cathodes of the various tubes, instead of being connected to the chassis, are returned to the power switch by leads. This lead network is called a "floating ground" or "common B-" to distinguish it from the chassis. The floating ground has been adopted as a safety measure. Figure 6 shows what is liable to happen when the chassis of an AC-DC set is permitted to function as the ground return to the power plug. Since one side of the 110 volt line is connected to earth ground, it is possible to insert the power plug in such a way that the chassis of the set is "hot" with respect to earth ground.

Any contact (represented in Figure 6 by the dotted line with the double arrow) between earth ground and the chassis will result in a virtual short circuit of the 110 volt line. When a floating ground is employed, this is not so prone to happen since a

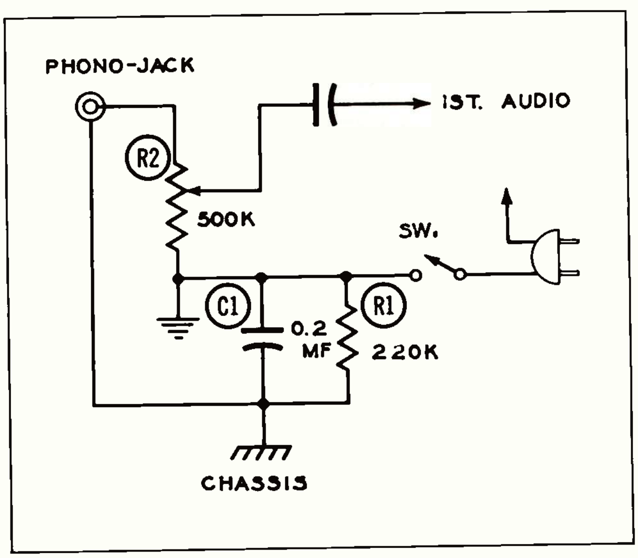

Figure 8. Phono-Jack; Low Side to Chassis.

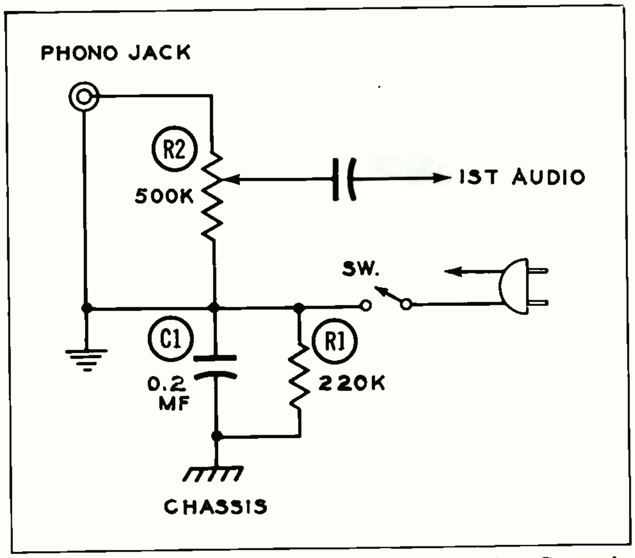

Figure 9. Phono-Jack; Low Side to Floating Ground.

sizeable impedance is effectively in series with the line. In Figure 7 this impedance consists of a 0.2 mfd. capacitor (C1) shunted by a 220,000 ohm resistor (R1). The resistor is generally, but not always, in the circuit and the capacitor may be any value between .05 and 0.2 mfd. With this impedance in series with the power line supply, the probability of a dangerous shock is greatly reduced.

When it is desired to install a phonograph jack in a receiver having a floating ground such as described in the preceding paragraph, the choice of a connecting point for the low side of the jack is important. Connecting the low side of the jack to the chassis is the most convenient procedure. This circuit is equivalent to that shown in Figure 8. From the point of view of safety, the circuit is satisfactory. However, sometimes hum appears in the output of this circuit due to voltages between chassis and floating ground. The remedy for this hum would seem to be in the circuit of Figure 9. Here the jack is insulated from the chassis and the low side is directly connected

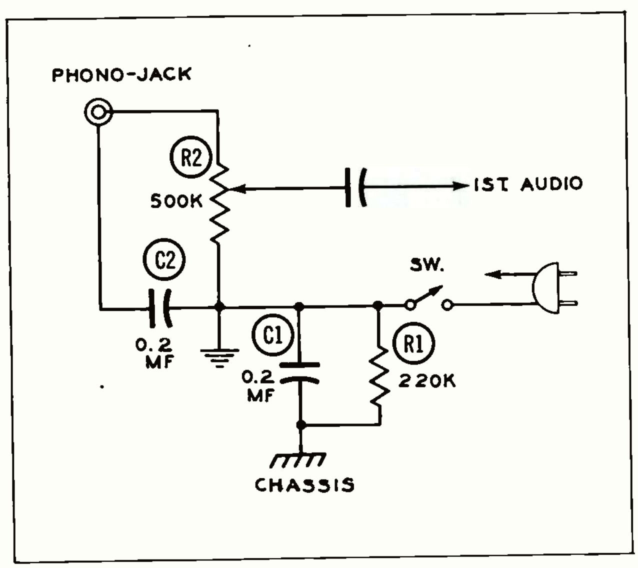

Figure 10. Phono-Jack; Low Side Through Capacitor to Floating Ground.

to floating ground. The hum disappears very nicely with this setup, but the danger of shock is increased since the phonograph pickup is now connected directly to one side of the AC line. If the set owner should happen to insert the power plug with a polarity that made the phonograph "hot" with respect to earth ground, he might suffer a serious shock in the event he placed his body between the pickup and, say, a radiator or water pipe. For that reason, the circuit of Figure 9 is not recommended.

An alternative circuit arrangement is shown in Figure 10. A capacitor (C2) is placed between the low side of the jack and floating ground. Some hum remains with this setup, but there is a reduction over the hum content of the Figure 8 circuit. At the same time the phono-jack is isolated from the power line and the shock hazard is thereby reduced. The larger the capacitance of C2, the less hum will appear in the output. Mounting space, of course, dictates the upper limit of the capacitance which may be used. The voltage rating of the capacitor should be at least 400 volts to provide an ample safety factor. The inclusion of this capacitor does not completely eliminate the possibility of shock. A shock may occur even with an isolating capacitor in the circuit but the current flow will be harmlessly small. If the user should complain, however, a simple reversal of the power plug in the wall socket is all that is required.

The primary windings of antenna transformers are frequently isolated from floating ground in the same manner and for much the same reason as phonograph jacks. An external antenna is very liable to make contact with earth ground. Without isolation this could result in 110 volts across the low impedance primary. So either the low side of the primary connects to the chassis, which is isolated, or a capacitor is found between the primary and the common B minus line. If this capacitor is sufficiently large, it may be used as the isolating capacitor for the phono-jack as well as the antenna primary.

The suggestions in the preceding section relative to the installation of phono-jacks are possibly already very familiar to many radio technicians. However, procedures and methods which have to do with safety cannot be overemphasized, especially in this accident-ridden society of ours.

"VIDEO DET. & AMP." (Continued from page 11)

loped across R3. When the arm is moved to the bottom, maximum gain is realized from the stage. R2 is shunted with a 100 mmf. capacitor to prevent loss of high frequency components.

Another method of controlling the gain of a stage is that wherein the screen voltage is varied. The circuit for obtaining this variable voltage is very similar to that shown in circuit C of Figure 4-14 except that only the screen voltage is varied. Since only the screen current flows through the control instead of the total tube current, less power need be dissipated in the control. Consequently this circuit is used more frequently than that of circuit C.

Regardless of the circuit used for controlling the contrast of the receiver, sufficient range should be provided so that a picture of proper contrast can be obtained. As a rule the normally operating receiver will, when receiving a good strong signal, produce a picture having excessive contrast at one extreme of the control and too little contrast, or a "washed out" picture, at the other extreme. The frequency response should remain essentially constant over the full range of the control.

Elimination of 4.5 mc Beat

Although the video amplifier is designed to pass signals up to 4 mc, signals of a higher frequency are also amplified. If the sound IF signal is not sufficiently attenuated before it reaches the video detector, a 4.5 mc beat will be produced. This beat note will be further amplified by the video amplifier producing interference in the picture. In the case of intercarrier receivers the sound IF signal is purposely fed to the video detector so that the 4.5 mc signal is produced. In either case traps must be employed to prevent interference. Both parallel and series resonant traps are employed for this purpose. Figure 4-15 shows some of the basic circuits employed in television receivers.

Circuit A of Figure 4-15 employs a series resonant trap which shunts the video detector load. With C1 and L3 tuned to resonance at 4.5 mc, the beat frequency is effectively shorted to ground thus preventing the beat note from passing through to the picture tube and causing interference. C1 has a value of 5 mmf. and L3 is a tunable choke having sufficient range to tune the circuit to resonance. This circuit employs the very minimum of components and enables the manufacturer to incorporate an efficient trap circuit at a minimum of cost.

Circuit B also incorporates a series resonant trap similar to that of circuit A except that it is placed in the plate circuit of the video amplifier instead of the detector circuit. In addition to the low cost of this type of circuit, it has another distinct advantage in that it can be placed practically anywhere in the video amplifier circuits between the signal path and ground. In fact the distributed capacity which it adds to the circuit can be used to an advantage in balancing the input and output capacitance of the video amplifier stage. This type of series resonant trap is especially suited for use in non-intercarrier sets where it is desirable to eliminate all 4.5 mc interferance without the need of a take-off point.

The circuit at C of Figure 4-15 incorporates a parallel resonant trap placed in series with the video detector circuit. When L3 is properly tuned so that it resonates with C1 at 4.5 mc, the trap circuit presents maximum impedance at this frequency. This circuit is very frequently used in receivers having separate sound IF systems.

In circuit D of Figure 4-15 a transformer type trap is used. The primary of the transformer is placed in the plate circuit of the video amplifier. This winding is shunted with a 47 mmf. capacitor which allows the circuit to be tuned to resonance at 4.5 mc. The secondary is also shunted by a capacitor of proper value. Since the secondary is inductively coupled to the primary, the secondary can be used as a take-off point in the intercarrier type receiver.

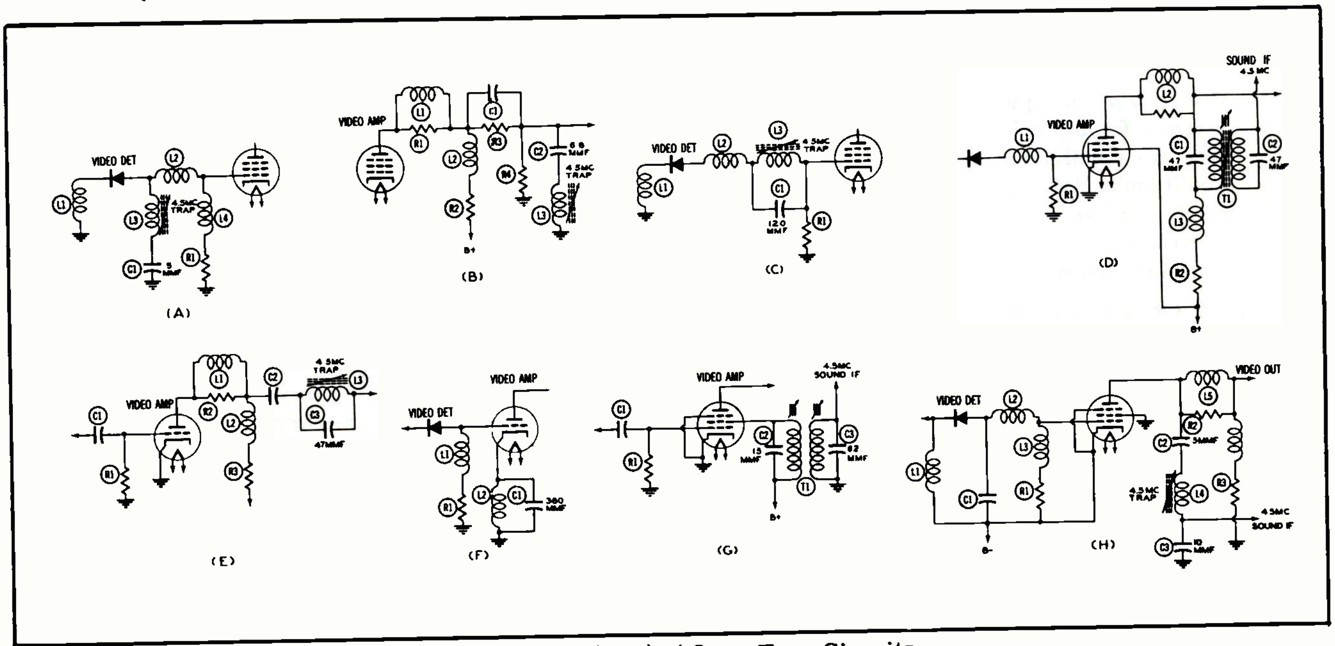

Figure 4-15. (A-H) 4.5 mc Trap Circuits.

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RCA *quality-line* speakers employ *full-size Alnico V magnets* for top efficiency and performance . . . yet they are popularly priced for replacement needs. You'll find a PM or field-coil type to meet virtually every requirement for home and auto radios, for television receivers, as well as for public address and high-fidelity systems.

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Another method of employing a sound take-off with this type of trap is the use of capacitive coupling from the plate of the video amplifier. With this method a tuned choke is placed in the plate circuit of the video amplifier. With this choke tuned to resonance at 4.5 mc, maximum signal at this frequency will be developed at the plate of the video amplifier. Through the use of a very small coupling capacitor the sound IF signal can be coupled from the video amplifier to the sound IF stages. Since the value of this capacitor is so small (usually 1 to 3 mmf.) the response of the video amplifier is not affected. Actually the video amplifier is designed to allow for this added capacity. When making replacement of this coupling capacitor, the new unit should have exactly the same value or the video response may be affected.

Another point where a parallel resonant trap may be placed in the circuit is in the lead connecting to the modulated element of the picture tube as shown in E of Figure 4-15. Since the circuit L3-C3 presents maximum impedance at 4.5 mc, a minimum of this signal will be coupled to the picture tube. This circuit is oftentimes employed as the second trap. Its purpose is to eliminate any 4.5 mc beat which was allowed to pass the first trap.

Another circuit which is very effective in eliminating an unwanted signal is that incorporating degeneration. Circuit F of Figure 4-15 employs this principle. L2 and C1 form a parallel resonant trap which is placed in the cathode circuit of the video amplifier. With these components resonating at 4.5 mc, maximum degeneration takes place in the stage which prevents passage of the undesirable signal.

Another degenerative circuit is shown in circuit G. In this case a transformer is employed to provide a sound IF take-off point. When the primary of T1 is resonated at 4.5 mc with C2, minimum gain of the unwanted signal will be had in the stage due to the degeneration in the screen circuit. Since the 4.5 mc signal is developed across the primary of T1, the signal is inductively coupled to the secondary. The low side of the secondary is grounded and the high side is connected to the sound IF system. Although less power is developed in this circuit than that of circuit D, it has the advantage that no distributed capacity is added to the plate circuit of the video amplifier.

The circuit H of Figure 4-15 is unique in that it is a series resonant circuit with provisions for a sound IF take-off. Instead of having only one capacitor as was the case of circuit B, two capacitors are used. C3 is a part of the tuned circuit, therefore a part of the 4.5 mc signal will be developed across it. Thus the 4.5 mc signal can be coupled from across this capacitor and fed to the sound IF amplifiers.

Proper adjustment of the 4.5 mc traps is very important. This is especially true in the intercarrier receiver or in those sets which have a minimum of sound IF trapping in the video IF amplifier.

One of the simplest methods of adjusting these traps is that of injecting a 4.5 mc signal across the video detector load and adjusting the trap or traps for minimum output at the modulated element of the picture tube. When two traps are employed it is sometimes difficult to adjust the second trap since most all the signal is removed by the first trap. It is recommended that a tuning wand be inserted in the coil of the trap not being adjusted. By doing this only one trap is effectively in the circuit. This allows much more accurate adjustment of the traps.

"DOLLAR AND SENSE" (Continued from page 43)

HUM. If hum is excessive when a variable-reluctance pickup is used in place of a crystal pickup, it's most likely due to induction from the magnetic field of the drive motor, according to RCA service data. The remedy proposed is shielding the motor with a 0.02" steel box having a nonmagnetic metal lining. This, however, raises the impedance of the motor and reduces its torque, making it necessary to raise the voltage applied to the motor.

An alternative solution is adding a 1/8" steel plate between the mechanism and the motorboard.

WIND POWER. To ease the loneliness of life on a canal or river barge when there's no electrical connection to the tugboat, some of the boys have put in auto radios operating from storage batteries that are charged by a wind-driven generator. With no ignition noise, no vibration and no tire static, it's a life of leisure for the auto radio too.

SHOCK. Though serious effects from electric shock are rare in television and radio servicing work, they can and do occur. Much more common, and still within the scope of activity of the serviceman, are accidents in homes from contact with ordinary power-line voltage. The important thing to remember in any case is that electric shock often produces only apparent death.

Prompt application of artificial respiration is now recommended, to be continued until the patient breathes by himself or there are definite signs of rigor mortis. Trained men have carried on to success after eight hours of effort, even though conventional stethoscope tests indicated no heart beats and the pulse could not be detected. Prompt manual artificial respiration is far more important than rushing the victim to a hospital. These recommendations are abstracted from a comprehensive survey article, "Electric Shock," by Wills Maclachlan in the October 1951 issue of Electrical Engineering.

BUGS. The brown-banded cockroach has taken a liking to TV sets, according to the National Pest Control Association. Heat from the tubes keeps the roaches warm while they feast happily on the glue that holds the cabinets together. Some have got between the picture tube screen and the safety-glass window, precipitating urgent service calls by housewives. Control of the pests is difficult because squirting tubes and wires with liquid insecticides can ruin the set.

FEDERAL COMMUNICATIONS COMMISSION CHANGES

Wayne Coy resigned as chairman of the F. C. C. on Friday, February 21. Although Mr. Coy had frequently expressed a desire to return to private business, his resignation at this particular time came as somewhat of a surprise. It was generally felt throughout the industry that Mr. Coy was determined to stay with the commission until the allocation freeze was lifted, and policies instituted under his leadership of the commission be proven out, one way or the other.

Commissioner Paul A. Walker succeeded to the chairmanship of the F. C. C. by presidential appointment on February 27th. Initial industry reaction has been very favorable. Not only is Mr. Walker highly regarded; additionally, his familiarity with present issues and processes in the commission would seem to mitigate against further delay in implementing the F. C. C. program to lift the freeze.

Robert T. Bartley of Texas was named to the commission vacancy. Mr. Bartley has had previous experience with the commission, serving as director of its Telegraph Division from 1934 till 1937.

"DOLLAR AND SENSE" (Continued from page 81)

DEFINITION. "Near as I can tell," says my elderly RFD uncle, Doug Johnson, "this television is a dingus to let you see radio shows. But they haven't perfected it yet. You can still hear 'em." --Seen in "The Man Next Door," in January Better Homes and Gardens.

AGING. Neatest idea yet for aging TV sets at the factory is the new overhead conveyor line at one Brooklyn plant. Here they put each finished chassis on a sort of platform swinging below the conveyor line, and plug the chassis into a power outlet at the top of the platform support. About a dozen such platforms have their outlets hooked together by zipcord, with the group getting power from a caterpillar-tread trolley that rides on one of the platforms and contacts a 117-volt power rail. The sets get a two-hour ride up near the ceiling of the plant, entirely out of the way. During this ride, power gets cycled off and on three times automatically just as in actual use. The conveyor line dips down to bench level at the half-way point so an inspector can see if there is still a raster on the screen. If not, the chassis gets pushed off and repaired before finishing its aging.

CUSTOMERS. A month after a technician was dismissed for being discourteous to television repair customers, he was seen in a police uniform by the shop foreman.

"I see you've joined the force, Tom," said the foreman.

"Yes," replied Tom. "This is the job I've been looking for. On this job the customer is always wrong." - - Seen in November 1951 Radio and Television Maintenance.

DXING. With a two-stack array cut for channel 6, a rotator and a booster, appliance dealer Howard McKee of Longmont, Colorado, has logged two dozen television stations even though he's over 500 miles away from the nearest station. Many came in as reflections from nearby 14,000-foot Longs Peak, and one even came as a reflection from a black thundercloud.

Achievements like this make good publicity stories for local newspapers in areas not yet served by television, and establish the reputation of the dealer or serviceman in the television field without a penny of advertising expenditure.

CENTERING MAGNET. Some sets are coming out now with magnetic mechanical centering devices, which fit around the neck of the picture tube right behind the deflection yoke. These have rotating and tilting adjustments that make centering of the picture on the screen quite easy in sets having electrostatic-focus picture tubes. The device is a combination of circular steel washers and small permanent magnets.

PAPER MOONS. Single-turn loops punched out of foil-coated cardboard are serving as built-in television antennas. It's fascinating to see how quickly and ingeniously these are installed in cabinets at the television factories. The antennas come as square sheets in which two, three or even four concentric loops have been punched almost through the cardboard. The operator first pokes out the loops by hand, like poking paper dolls out of a cutout book. This gives different sizes of loops but nobody worries about it.

At a punch press, connecting leads and lugs are quickly riveted to the two ends of a loop. After this, it takes only a few seconds to staple the loops to the inside of the wood cabinet with an air-actuated stapler. This handy production tool spits and drives staples as fast as the operator can pull the trigger.

A refinement with added eye-appeal is a loop with a little circle inside, presumably for high-band reception. The two paper-foil loops are in parallel; even with this, they still get three sets of loops out of each sheet. A technical extra feature on this one is a length of hookup wire about two feet long, connected to one loop terminal to serve as a matching stub.

BREATHLESS. If you hear on phonograph records a singer who seems to keep it up for three full minutes without taking a breath, chances are that the recording was made first on magnetic tape. The singer sings till he runs out of breath, rests a bit, then backs up a few bars for a new start. The tape is then cut and spliced to eliminate overlap, giving the effect of continuous singing, then re-recorded conventionally on a record. Some people like the result.

ON ICE. Though performers on skates move in all directions at high speed during performances of the Ice-Capades, vocal numbers pour out of the speakers smoothly at constant level. Such flawless pickup would require a forest of microphones, but none are used. Instead, all vocal work is recorded beforehand on magnetic tape. During each performance the orchestra plays the live accompaniment and the skating vocalists pantomime their parts while the recording is piped to the arena amplifiers. Illnesses or accidents merely call for new faces to pantomime the songs on the tape.

TARDINESS. Dave Garroway's new 7 to 9 morning program on the NBC television network is good enough to make a lot of people late for work. Who can resist when he puts one camera down at Bolling Field in Washington to cover the takeoff of a jet interceptor, and has another at Mitchell Field on Long Island ready to pick up its arrival there just twenty-odd minutes later. Next to the Kefauver hearings, this is the best use we've personally seen for Washington-New York coax.

Another early-morning attention-getter was the camera set up to catch the starting of the money-making presses at the Bureau of Engraving in Washington.

When the weather's lousy, we get a lift by looking at Garroway's charts and noting that it's a lot worse somewhere else.

HALF-WAY POINT. Though textbooks and articles still laboriously describe signal-tracing procedures starting from the speaker and going step by step to the antenna, or vice versa, few indeed are the servicemen who do it that way. They head instead for the half-way point - the top terminal of the volume control - and make a finger test which isolates the trouble immediately to half the set.

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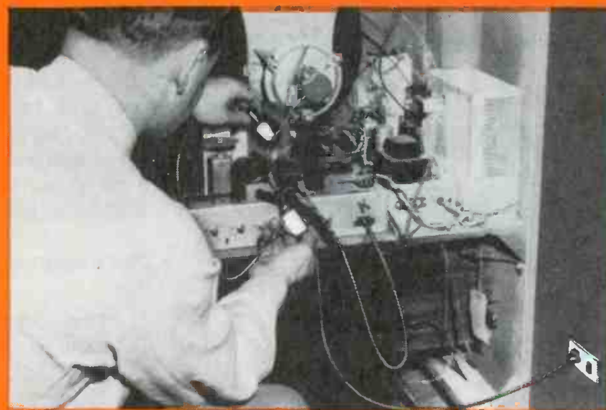

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Tele-lead

Handiest TV servicing aid yet. Permits power connection to receiver chassis when safety interlocking switch is broken by opening protective back. At the same time, it provides a trouble light to see what's what.

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Replaces those bulky and seldom-at-hand charts and booklets formerly necessary to find correct replacements. Merely dial the type to be replaced—presto! there's the correct Teletron replacement. Also electrical and mechanical characteristics for those profitable conversion jobs!

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Colorful decal easily transferred to store window, doors, inside displays, or on your truck or car. Immediately marks you as a quality-wise service organization. Ties right in with Du Mont fame!

Geared to your TV servicing! It's up to you to get these aids from your Du Mont Teletron distributor. They represent *plus* values above and beyond that biggest bonus—Du Mont's reputation for *quality, progressive engineering* and *customer satisfaction.* Drop in on your Du Mont Teletron distributor today. Ask for the aids. And get in on the fastest road to more profitable TV servicing.

DUMONT

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+ More or Less –

A recent report on "The Impact of TV Expansion," released by the Radio-Television Manufacturers Association, contains a tremendous amount of information valuable to service technicians and organizations.

This report was prepared at the direction of Dr. W. R. G. Baker, Chairman of RTMA Television Committee, by a task force consisting of: Admiral Edwin D. Foster, representing RCA, C. Wesley Michaels, representing General Electric, Keeton Arnett, representing Allen B. DuMont Laboratories, and Committee Chairman William H. Chaffee, of the Philco Corporation. It is primarily intended for the guidance of RTMA members, and, further, to assist governmental units, such as the F. C. C. and N. P. A., in calculating the effect of TV expansion on the economic, productive, and material situations. Many of the estimates included will also be of value to the service field generally, and data for those which follow has been abstracted from the report, courtesy of the RTMA.

The report contains three major sections, as follows:

1. The Development of Time Tables. These are concerned largely with the starting date and rate of construction permit grants by the F. C. C.
2. Television Station Requirements. These, of course, are basically dependent upon F. C. C. allocations for projecting further into the availability of material and manufacturing facilities for transmitters, studio equipment and buildings, and towers.
3. Potential Television Receiver Demand. Although this is largely interdependent with Sections 1 and 2, preparatory action by receiver manufacturers is certain to produce a considered minimum even if estimates under Sections 1 and 2 are too optimistic.

One of the major assumptions in the report is that the F. C. C. will act to provide television service in areas not presently served before directing its attention on improvements in television facilities for areas already served by one or more stations. These improvements, of course, would be power increases and greater antenna height.

This indicates the creation of a demand for television installation and service in areas practically untouched to date. It is true that we cannot identify the areas to be immediately affected, since it is not known where the F. C. C. will start geographically to allot construction permits. Remember, however, the estimate figures in the report indicate a probability of 22 new VHF stations on the air by the end of 1952, with an additional 100 VHF and 60 UHF stations on the air by the end of 1953. Couple these figures with probable increases in existing facilities to cover wider areas, and you have a potential market far in excess of TV service requirements at the present time.

Additionally, it is interesting to note that it is the opinion of the task force committee, which prepared the report, that there will be no serious drawback in the obtainment of materials and manufacturing facilities which would prevent completion of the fairly conservative schedule indicated above.

As a final point, consider the estimate of potential increased demand for television receivers. In the third quarter of 1952, this approximates 25,000 units, with the fourth quarter accounting for another 100,000. The first quarter of 1953 approaches 250,000, with the second quarter believed to be approaching the 400,000 mark. Please note that these are increases above the present existing demand.

Even if 50% of the foregoing estimates were not to be realized (which is considered unlikely short of a full-scale war), there still is going to be a tremendous demand for new television servicing facilities, and alert technicians will benefit by preparing themselves now for the activity which is sure to come.

\- J. R. R.

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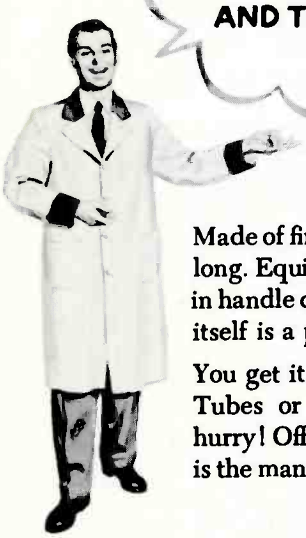

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Made of fine tool steel, this slim-shaft driver is 8½ inches long. Equipped with 2 Phillips and 2 slotted bits, (3 bits in handle compartment and one in shank). And the shank itself is a power driver for ¼-inch hex-head screws.

You get it FREE when you buy 4 Sylvania TV Picture Tubes or 100 Sylvania receiving tubes. But, better hurry! Offer closes May 15th. Your Sylvania Distributor is the man to see... TODAY!

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