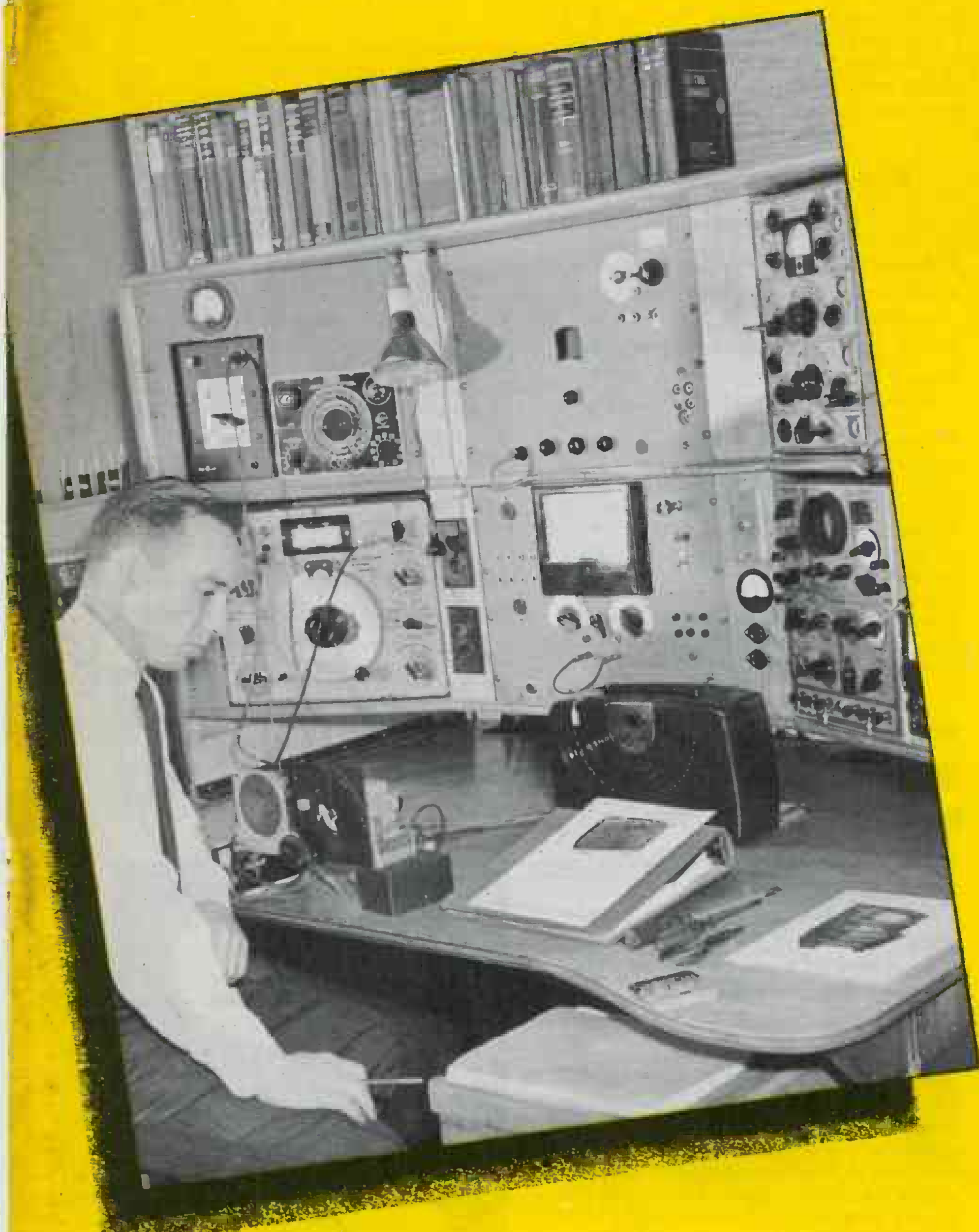
Howard W. Sams

PHOTOFACT

PF INDEX

AND TECHNICAL DIGEST

July • Aug. • 1952
including
INDEX No.
33
COVERING PHOTOFACT
FOLDER SETS 1 THRU 176



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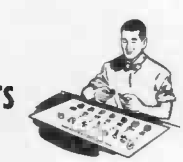

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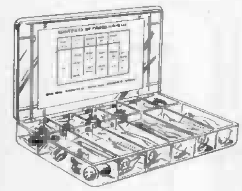

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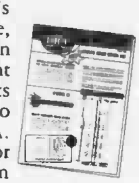

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Pick of the Trade

One billion six hundred and eighty-eight million MECHANICAL parts will go into television sets in 1952. This will call for the melting of a million two hundred thousand pounds of solder, use 82,000 miles of wire, and the electronic components add up to more than a billion three hundred fifty million.

There will be well over a half billion resistors, four and a third hundred million capacitors, and coils will number some 65 million. Eight million metallic rectifiers and well over a hundred million transformers.

Then, there will be a minimum of 7 million civilian radios of all kinds coming off the lines.

The electronic dollar volume in 1952 can be the greatest in the industry's history.

★ ★ ★

Then, too there is the new impetus in industrial electronic instrumentation and control. From 1945 to Korea little progress was made. Inflation of the dollar has made survival of enterprise a matter of doing things by putting more buttons on automatic operations. It is a swing to automatic cycling, measuring, control of remote operations, counting at high speed, electronic (and nucleonic) watching of electric surges, chemical mixtures, gaseous contents.

Not even in the period of 1940-5 have more new names shown themselves in the electronic field. They are from older companies; they are layman-financed organizations of researchers, engineers, and professors; they are offshoots of established companies which had originally grounded themselves as producers of buttons, shootin' irons and airplanes. It is a fast moving business—right now, and the good old survival rule will take its course.

WBB in *Electronic Markets*

★ ★ ★

"THE SECOND U. S. TELEVISION BOOM IS NOW ON. Up to now manufacturers have produced 17,000,000 television sets. Spokesmen assert that when all of the new television stations are operating, there will be over 50,000,000 TV sets in the United States.

Radio technicians who have not had a chance to service television receivers before, now have the opportunity of their lives. They should immediately get ready for the coming boom in their sections of the country if they wish to share in the new prosperity.

★ ★ ★

We have mentioned before, and we now reiterate, that radio technicians in areas soon to be equipped with television must immediately take active steps to become expert in television servicing. The best way to do this is to get a television chassis and go to work on it and familiarize oneself with its intricacies. Nor is it necessary to work on a "dead" set. Even if there is no television station in the neighborhood, many tests can be made with a signal generator, which all service technicians possess. And with a good, high antenna some excellent dx is bound to be received in all parts of the country during the summer season. Nor is it necessary to buy a brand new television set. Many dealers in the larger cities all over the country have second-hand 10-inch chassis for sale at low prices. They are ideal for the purpose.

Hugo Gernsback, Editor in-Chief
Radio-Electronics, June, 1952

★ ★ ★

. . . UNLIMITED VISTAS ARE OPENED FOR TELEVISION. In the past we have been highly optimistic about the future of the electronics industry—and sometimes we have been criticized for it. It appears now that perhaps we held our enthusiasm too firmly in check.

In our November, 1951, issue we predicted that by 1960 the electronics industry would reach a turnover of $10,000,000,000. It now appears that our prediction will probably be found far too conservative.

Hugo Gernsback, Editor in-Chief
Radio-Electronics, July, 1952

PF PHOTOFACT INDEX

AND TECHNICAL DIGEST

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ABOUT THE COVER: The photograph is of Clair K. Fitzsimmons, owner of Fitz Radio and Appliance Company, 206 Main Street, Ames, Iowa. On July 7, 1951, Mr. Fitzsimmons made some very definite suggestions for the improvement of Photofact Folders. On April 19, 1952, Mr. Fitzsimmons wrote us. His letter is reproduced in its entirety as a part of the supplemental Free Literature Offer. His comments are so much to the point that we wanted to share his letter with you.

MILTON S. KIVER
President, Television Communications Institute

Shop Talk

The complexity of the modern television receiver being what it is, most service men understandably lean heavily upon circuit schematic diagrams in their every day service work. From these diagrams they seek, primarily, three things. First, how the circuit is wired; second, the values of the various components and; third, the voltages that are normally present at various points in the receiver. A well drawn diagram, containing all this information, can easily cut servicing time by at least one-half, and frequently more. This is undoubtedly one of the reasons why Photofact Folders have proven so helpful in simplifying and speeding up service work.

From time to time, however, sets are brought into the shop for which, for one reason or another, schematic diagrams are not available. Or, what is often just as bad, service literature is available which has few if any of the operating voltages specified. In the course of tracing through a circuit, to isolate the seat of the trouble, the service man places considerable reliance on the voltage values which he obtains. However, with the wide range of voltages employed in different television sets, it is frequently impossible in a strange set, to determine whether the voltage readings obtained are anywhere near normal. Without this assurance, the service man can very well look for trouble in a section of the receiver where none exists.

Is there anything that the service man can do to help himself in such situations? Fortunately there is, and the reason stems from the ability to compare certain sections of the receiver with similar or identical sections of other receivers previously encountered. Many, many sets, for example, use the Standard Coil tuner and while the voltages fed to the tuner tubes may not all be exactly alike, certainly you will find that they are at least close to one another. Consider the horizontal sweep section of the receiver. A very popular type of circuit is the pulse-width automatic frequency control network and

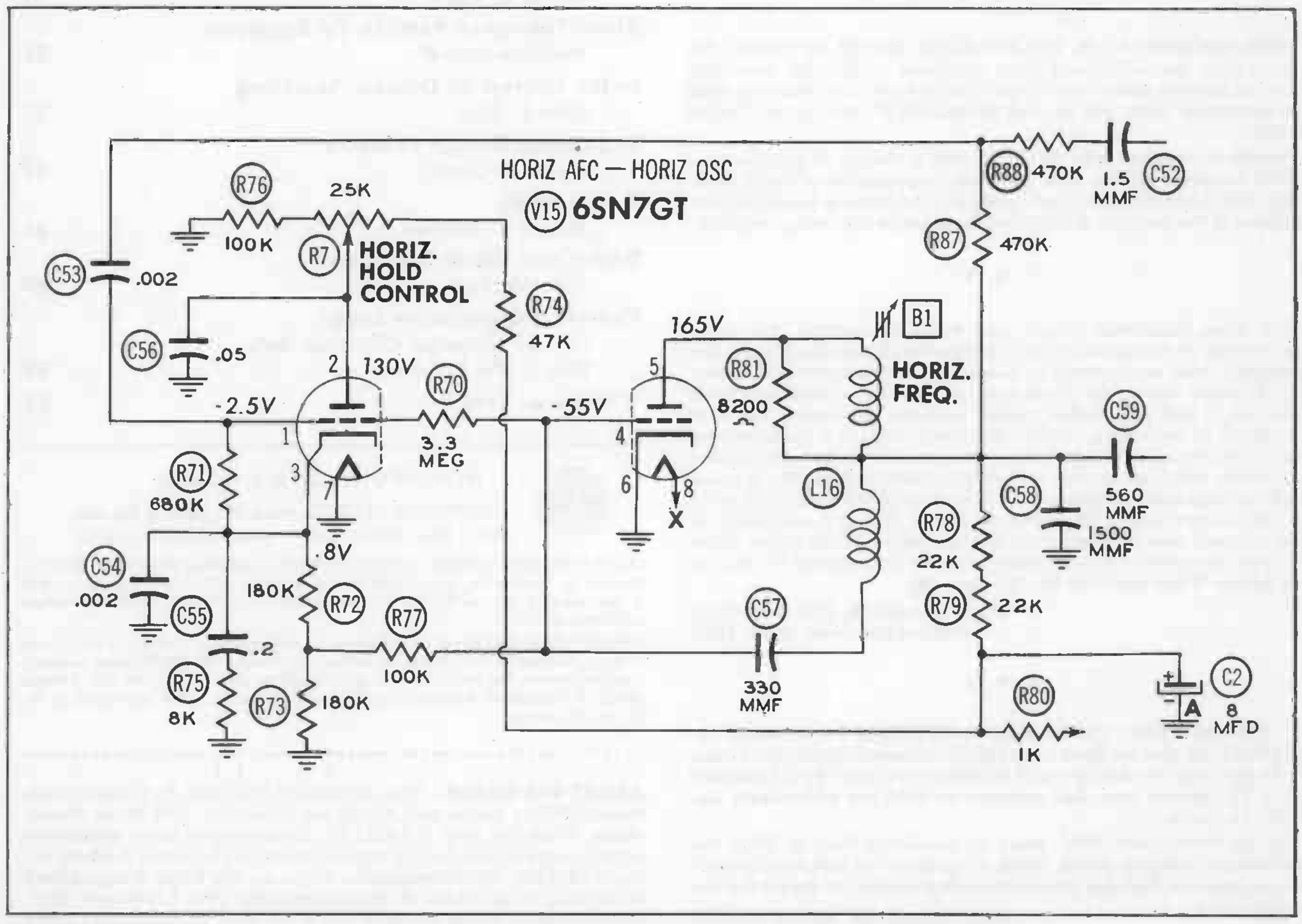

Figure 1. A Representative Pulse-Width AFC Circuit.

stabilized blocking oscillator. Here again you have an ally in models other than the one you are working on. The list of corresponding circuits could be continued further, but the main idea is undoubtedly evident by now. Simply stated it is this; because many sets use similar circuits, the voltages present in one normally operating receiver can frequently be used to judge whether the voltages in a defective receiver are within the range they should be.

To derive the greatest benefit from this method, certain facts should be known and certain precautions should be observed. Considering precautionary measures first, the most obvious one, of course, is to make sure that the set being used as the reference contains a circuit or circuits similar to those in the defective receiver. Secondly, have the reference receiver operating normally. Third, try to set the controls on the defective receiver as they would be for a normal picture. This is important because the setting of certain operating controls will alter the values of some of the voltages in the receiver.

So much for the precautions to be observed. Now let us consider the manner in which the voltages should be measured in order that a proper comparison can be made. In schematic diagrams, voltage values, when given, are frequently listed with reference either to the chassis or to a B minus bus (in transformerless sets). This practice has been employed for many years in radio and is used to a large extent in television.

Unfortunately, making voltage comparisons between different sets can often lead to erroneous conclusions through misinterpretation. The reason for this is not very hard to find. Consider, as an illustration, the two pulse-width AFC circuits shown in Figures 1 and 2. Both are similar in design even though they were taken from receivers made by totally unrelated manufacturers. The socket voltages in both instances are given and if corresponding element voltages are compared, it will be seen that very little similarity exists between them. Pin 5, for example, of the 6SN7 tube has a value of 165 volts in Figure 1. and 0 volts in Figure 2. This, of course, with respect to the chassis. Pin 4, to make another comparison, is -55 volts in Figure 1 and -235 volts in Figure 2. Judging by these figures, there is apparently very little experience that a serviceman can use from one circuit that will help him service the other.

But wait a minute. A long, long time ago we were told that tubes do not operate by the measured voltages applied to the individual elements, but rather by the relative voltages between elements. Grid bias, for example, is not the voltage between grid and ground, but the voltage between grid and cathode. By the same token, the plate voltage that really matters so far as the tube is concerned is not the plate voltage between plate and chassis but, again, the voltage between plate and cathode.

In other words, when comparisons are made, they must be made with relative voltages.

Now let us return to the circuits in Figures 1 and 2 and use this new approach. In Figure 1, the voltage between cathode and plate is 165 volts; the voltage between cathode and grid is -55 volts. In Figure 2, the voltage between cathode and plate is +175 volts since the cathode is more negative than the plate by this amount. Between grid and cathode the voltage is -60 volts.

Can a comparison between circuits be made now? It most certainly can! Plate-to-cathode potential in one case is 165 volts; in the other it is 175 volts. Grid-to-cathode voltages are -55 and -60 volts respectively. The same comparison can also be made between the other section of this 6SN7 triode with corresponding results.

♦ ♦ Please turn to page 73 ♦ ♦

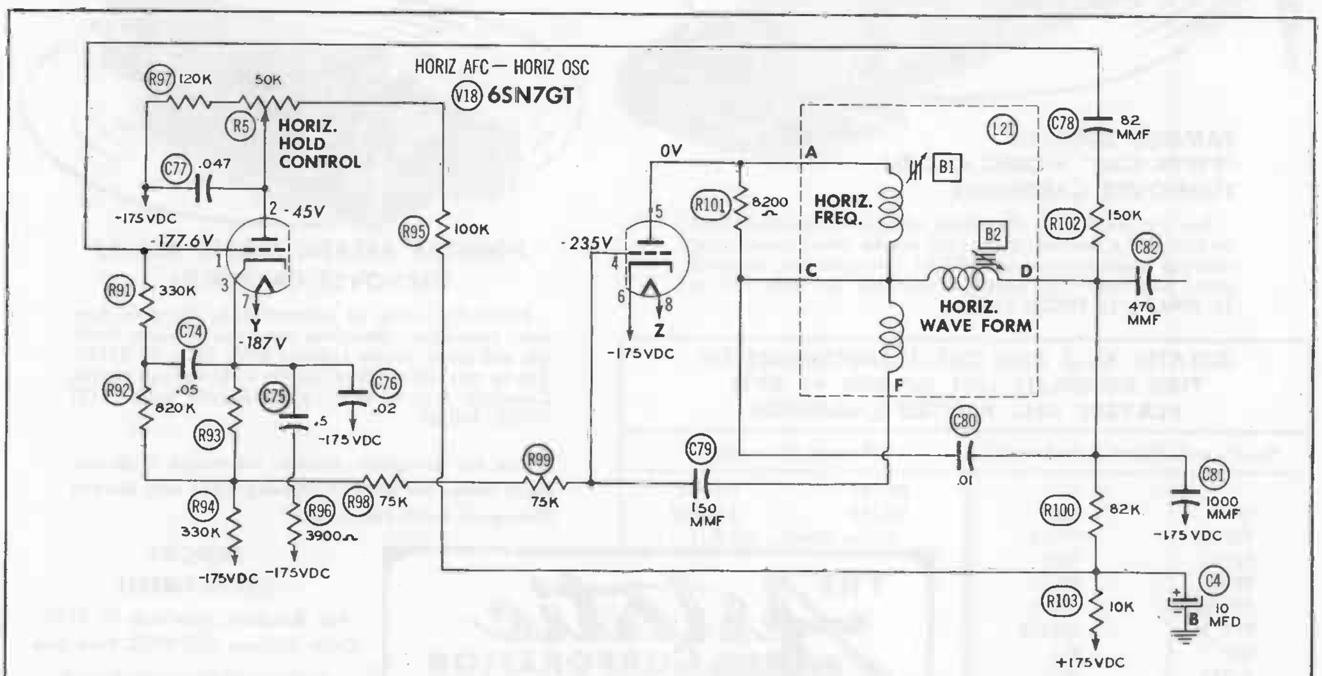

Figure 2. An AFC Circuit Similar to that of Figure 1, but with Apparently Differing Voltage Values.

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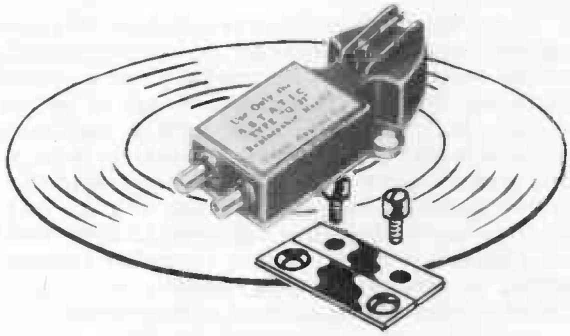

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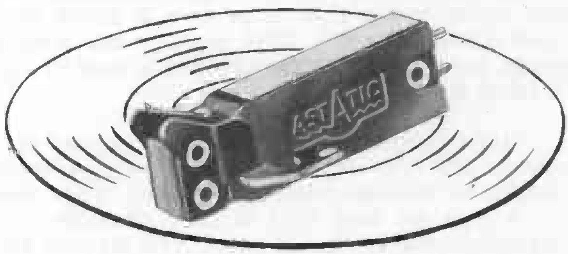

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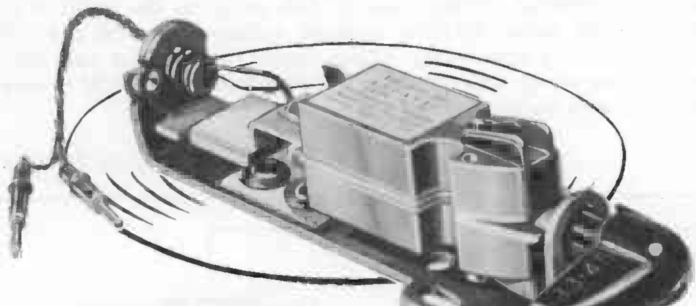

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Signal SUBSTITUTION in Television Servicing

by W. William Hensler

The technique of signal tracing and signal substitution in radio receivers has come to be standard practice with many service technicians. Using this method, trouble shooting is performed by injecting a signal from an RF signal generator or an audio oscillator and tracing the signal until the defective stage is located. Similarly, signal substitution processes may be employed in TV servicing, however the requirements of the signal to be used in TV work are much more demanding than those needed in the radio application. To do an efficient job, signals should be available to check these four main sections of the television receiver.

1. Picture section.

2. Sound section.

3. Synchronizing circuits.

4. Raster formation circuits.

It is also desirable that associated circuits within each of the sections be checked for operation.

From these requirements it can be seen that the following signals should be available for testing sets designed to receive VHF stations.

1. A modulated signal at all twelve channel frequencies which will provide synchronization and produce a type of picture that will be indicative of the quality of picture that can be received. Provisions must be made for attenuating the signal to enable the checking of the receiver at various signal levels. A video signal should also be available for signal substitution in the video amplifier stages.

2. An audio signal for the purpose of checking the audio stages in the receiver. This signal should be such as to allow measurement of the gain and approximate frequency response of the audio stages.

3. Separate horizontal and vertical synchronizing signals which permit testing of the synchronizing circuits of the receiver.

4. Signals of the proper frequency and waveshape which can be applied to either the vertical or horizontal sweep circuits to obtain proper sweep. A crosshatch or dot pattern should be available for purposes of checking linearity in both vertical and horizontal sweeps.

The Hickok Videometer Model 650 is an instrument capable of providing these signal classifications. It is housed in a metal cabinet of a size comparable to the average RF signal generator. (See Figure 1.) Through the use of positive latching type push button switches, a great variety of signals are available at the will of the user. Controls are provided for attenuating both the RF and video signals as well as a meter to enable proper setting of these controls. A tuning control is provided to enable the RF output of the unit to be tuned to all twelve channels.

Figure 1. The Hickok Model 650 Videometer.

Although a complete breakdown of the circuitry of the Videometer is beyond the scope of this article, a brief description of the basic circuits should prove helpful in understanding its operation. The Videometer can be divided electrically into three basic

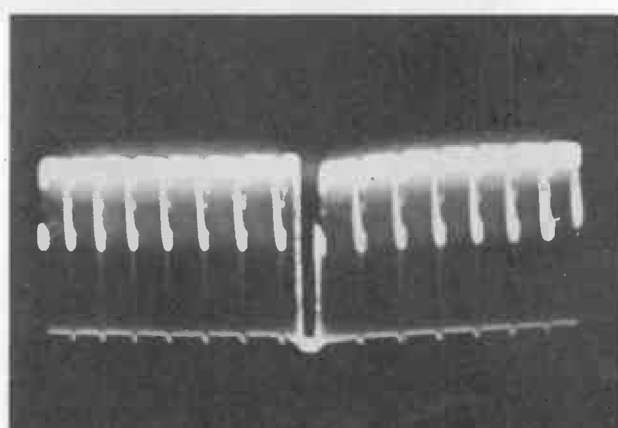

Figure 2. Composite Video Signal at Output of Videometer.

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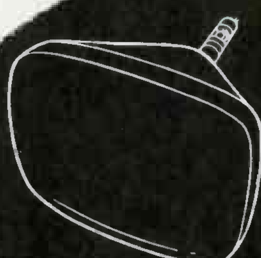

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units; the RF unit, the synchronizing signal generating section, and the modulating signal generating section.

When all three of these sections are in use, an RF signal is provided which is modulated with a composite video signal like that shown in Figure 2. This signal provides for synchronization of the receiver as well as the production of a crosshatch pattern on the picture tube, as shown in Figure 3. If so desired the operator may remove either the vertical or horizontal lines, or both, or by depressing the "dot pattern" button, a dot pattern may be obtained. The composite video signal is also available at the video output jack for use in the video amplifier stages. If only the synchronizing pulses are required, these may also be taken from this jack.

Additionally, a sawtooth waveform of either 60 or 15,750 cycle frequency is available. This waveform can be injected at the sweep output tube grid for checking of the circuit.

Since so many combinations of signals are available from the unit, it would appear that its use would be quite complicated. Supplied with each unit, however, is a chart which shows the exact setting of all controls and switches for any desired output. This virtually eliminates unsatisfactory results which might be caused by improper adjustment of the instrument. After employing the instrument a few times, the user will find it unnecessary to refer to the chart for each setting. After continuous use, there should be no need to refer to the chart other than on rare occasions when a very special type of output signal is required.

The heart of the Videometer is the crystal oscillator operating at 315 kc, which is the basic circuit of the timer section. Included in the timer section are several relaxation oscillators which divide this signal to obtain an output at 15,750 cycles, 900 cycles, and 60 cycles. The signals at 15,750 and 60 cycles are fed to appropriate shaper and mixer circuits and are then used to provide horizontal and vertical synchronizing pulses. Signals at 315 kc and 900 cycles are used to produce horizontal and vertical bars when a crosshatch pattern is desired. Since these modulating signals are derived from the same oscillator which controls the synchronizing pulse frequency, the bars will remain stationary on the crosshatch pattern.

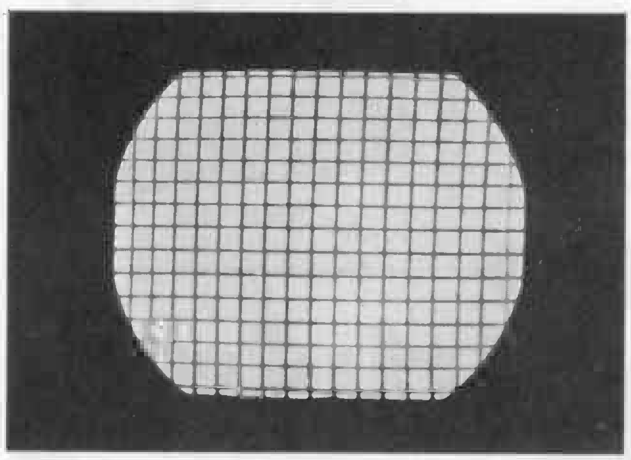

Figure 3. Crosshatch Pattern Produced by Videometer.

The RF oscillator is tunable over all twelve channels in two ranges. Channel markings are provided on a dial scale to allow easy tuning to any desired channel.

The built-in meter performs three functions. By setting the meter circuit selector switch to the correct position, the meter will indicate (1) the peak-to-peak voltage of the composite video signal available at the video output jack (this level is adjusted by means of the video attenuator); (2) the RF level (adjustment to be made by means of the Master RF Attenuator to the proper level as indicated on the meter); and (3) the AC line voltage.

SERVICING PROCEDURES

The use of the Videometer in servicing can be broken down into two major classifications; (1) that of making final adjustments on receivers after repairs have been made (or adjustments in the customer's home) and (2) for signal substitution in a defective receiver to locate defective stages or components. Since servicing procedures in these two classifications are quite different, and are oftentimes performed by different personnel, within the same organization, they will be treated separately in the following discussion.

FINAL ADJUSTMENTS ON THE REPAIRED RECEIVER -

Linearity Adjustments. Linearity adjustments can be made with the receiver mounted in the cabinet by injecting a modulated RF signal at the antenna terminals. The receiver is then tuned to the same channel as the Videometer which should be set to provide a crosshatch or dot pattern. Vertical height, vertical linearity, width, horizontal linearity and horizontal drive controls can then be adjusted to provide the proper size picture with good linearity.

Horizontal and Vertical Frequency Adjustments. The operation of the vertical and horizontal hold circuits can be checked under varying signal strength conditions. In many cases the horizontal frequency adjustments are made accessible at the rear of the chassis, making possible the final adjustment of these circuits.

AGC Adjustment and Test. By adjusting the output level of the Videometer to that corresponding to the strongest signal expected to be received at the point of operation of the receiver, the AGC adjustment (whenever present) can be preset before the receiver is delivered to the customer.

A quick check can be made on the operation of the AGC circuit by varying the output of the Videometer and checking for any overload condition in the picture or any tendency for instability in the synchronizing circuits.

Relative Sensitivity. A check on the relative sensitivity can be made on the set by reducing the output level of the Videometer to an arbitrary value and noting the hold characteristics of the set as well as the amount of contrast available at this signal level. After a few sets are checked in this manner the technician will arrive at a level (50 microvolts, for example) where synchronization is maintained and a fair amount of contrast is obtained. Any set failing to meet these arbitrary conditions can be

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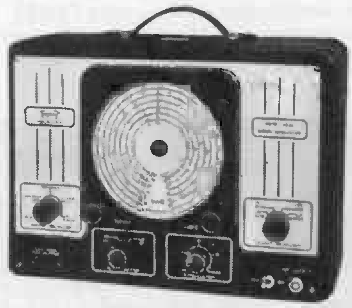

Triplett 3432

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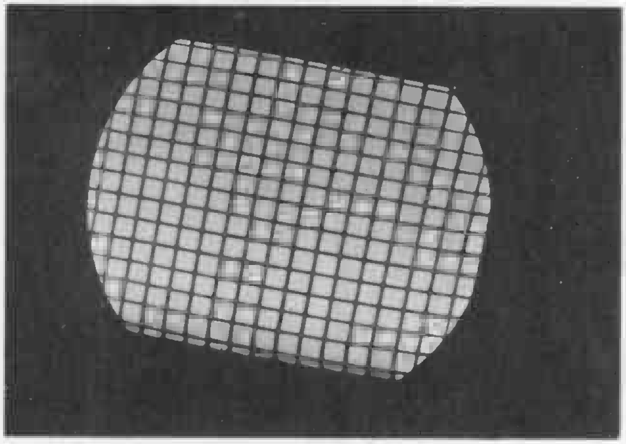

Figure 4. Pattern Resulting from Improperly Positioned Yoke.

suspected of having poor sensitivity. The procedure for determining the actual sensitivity of the receiver will be described later under signal tracing procedures.

<u>Yoke and Anti-Pincushion Magnet Adjustment.</u> Quite frequently after the chassis is reinstalled in the cabinet, it is found that the yoke has been rotated, resulting in a tilted picture as shown in Figure 4. The horizontal lines in the crosshatch pattern can be observed while adjusting the yoke positioning. In this manner the yoke can be adjusted much more easily than when a picture is present on the screen, since horizontal reference lines are normally not present in the picture.

The pattern shown in Figure 5 suffers from a non-linear condition known as pincushioning. This may result when high deflection angles are required to adequately sweep large picture tubes. Some manufacturers are employing small magnets, known as anti-pincushion magnets, which are placed on adjustable arms and suspended around the cone of the picture tube in front of the deflection yoke. While viewing the pattern of Figure 5, the magnets should be adjusted to straighten the lines of the crosshatch pattern.

<u>Twelve-Channel Operation Check.</u> Since an RF signal at each of the twelve channels is available from the Videometer, the operation of the receiver can be checked on all channels in a few minutes. This is extremely desirable when it is necessary to check out a receiver when all of the local stations are not on the air. This type of check eliminates the possibility of the receiver being dead on one or more of the channels, which may not be detected until the receiver has been delivered to the customer's home.

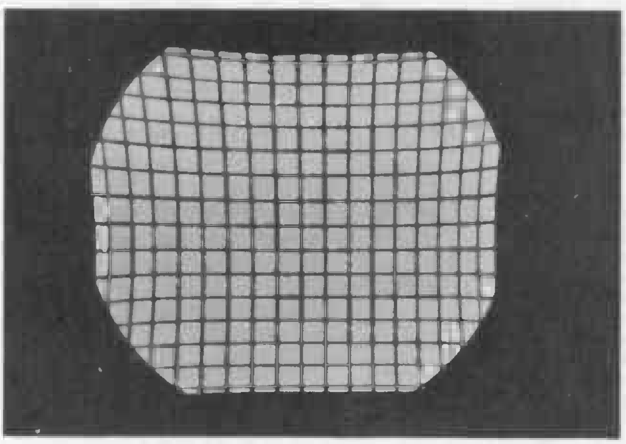

Figure 5. Pincushion Effect.

With the prospects of more VHF stations coming on the air, this type of check is of even greater importance. When a new station comes on the air, the customer rightfully expects that his receiver will receive the new station properly. A check on the receiver's operation on all channels will eliminate the possibility that the set might be dead on one of the new VHF channel assignments in a particular area.

Experience has shown that too great importance cannot be placed upon the final checking of a receiver. Non-linearities or malfunctions which existed before the set was serviced may be noticed if not corrected during the service job, after the set is returned; since the customer will have a tendency to be more critical of its operation. Even though these malfunctions are in no way connected with the trouble which caused the failure of the set, the customer expects the receiver to be in A-1 operating condition. Non-linearities, tilted yoke, shadowy corners, etc., may not only cause expensive call-backs, but it may cause a lack of confidence on the part of the customer.

SUBSTITUTION IN THE DEFECTIVE RECEIVER -

Since the television receiver has two outputs, namely audio and picture, it is possible in most cases to tell in which block function of the set the defective stage is located. In some instances it is even possible to tell which stage is defective, especially where the failure is a complete breakdown. Whenever there is partial breakdown of a component such as a leaky capacitor, a change of value in a resistor, or a weak tube, the symptoms may not be conclusive enough to enable the technician to determine in which stage the failure has occurred without additional diagnosis.

In servicing a radio receiver, an attempt is usually made to determine whether the failure is in the audio system or in the RF-IF section. This is easily accomplished by injecting a hum voltage at the volume control. This in effect splits the receiver in two, which is helpful in determining the cause of failure in the receiver. The greater intricacy of the TV receiver, however, requires a more complex signal for signal substitution. The purpose of this discussion is to outline procedures for quickly diagnosing troubles with the signal substitution method using the Videometer as a signal source.

A block diagram of a typical receiver is shown in Figure 6. The first hurdle in any servicing job is to determine in which block the failure has occurred. For the sake of illustration, let's consider a few of the most commonly encountered troubles and point out how signal substitution can be employed to great advantage. See Figure 6 for all block diagram references.

<u>No Picture, Sound Normal, Has Raster (Non-Intercarrier Set).</u> With normal sound, the trouble must be somewhere in the video IF, video detector

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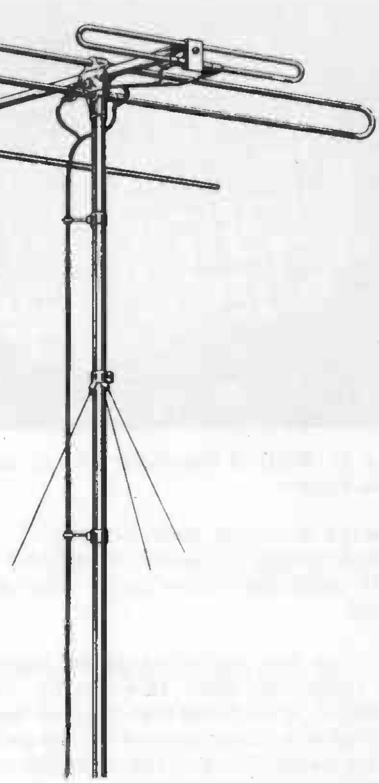
AMPHENOL INLINE TV ANTENNAS

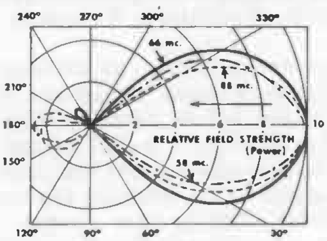


OUTSTANDING MECHANICAL SPECIFICATIONS

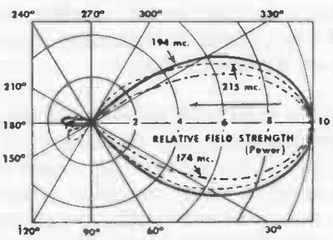
Part	Material	Yield Strength	Size	
		psi	o.d.	Wall
Mast (galv.)	¾" Thinwall Steel Conduit	32,000	0.922"	.049"
Large Folded Dipole	3S ½ H Al.	19,000	.500"	.049"
Small Folded Dipole	3S ½ H Al.	19,000	.375"	.049"
Reflector	3S ½ H Al.	19,000	.500"	.049"
Crossarm	3S H Al.	26,000	.875"	.065"
Center Support & T Casting	Al. Alloy 45,000 psi tensile strength			

EXCELLENT RADIATION PATTERNS

These are the radiation patterns of the AMPHENOL Inline antenna at 58 mc., 66 mc., and 88 mc., in the low band, and 174 mc., 194 mc., and 215 mc. in the high band. Notice the uniformity of these lobes at all frequencies. The lack of lobes off the sides and negligible ones off the back maintains high front-to-back and front-to-side ratios necessary for the rejection of various interferences. The presence of a single forward lobe is usually a very desirable feature, especially when it is wide enough to provide adequate interception area for some differences in transmitter location, changes in the wave front's direction of travel, or physical movement of the antenna in high winds. Furthermore, it is not too critical of orientation. It is necessary only to aim it and forget it.



Horizontal radiation pattern of Amphenol TV Antenna Model No. 114-005.



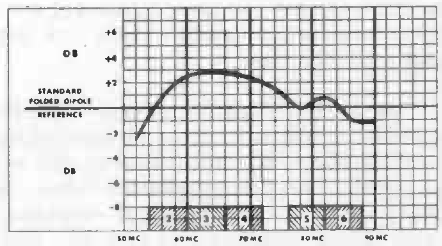
Horizontal radiation pattern of Amphenol TV Antenna Model No. 114-005.

HIGHER GAIN

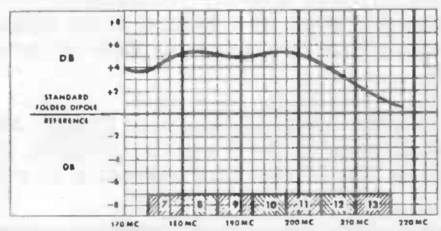
These gain curves of the AMPHENOL Inline antenna represent the intercepted voltage of the AMPHENOL Inline Antenna as plotted against the intercepted voltage of a reference folded dipole cut to the frequency being compared. There is no channel in either the low band or high band where there is more than a three decible change within the channel that can cause picture modulation or "fuzziness." Gain of the AMPHENOL Inline antenna is quite flat over all channels.

You will find more gain designed into the high band because of greater need for it, due to higher losses at these frequencies. Also, notice the drop-off on channel six. This is at the edge of the FM band and is subject to FM interference, so the Inline's gain is purposely held down at that frequency.

The excellent broadband characteristics, impedance match, single forward lobe radiation patterns on all channels, maximum gain, lightning protection, and superior mechanical features of the AMPHENOL Inline Antenna make it the antenna for greatest TV picture quality!



Gain of Amphenol Model No. 114-005 Antenna over a reference folded dipole, 54 to 88 mc.



Gain of Amphenol Model No. 114-005 Antenna over a reference folded dipole, 174 to 216 mc.

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Write for this book containing the characteristics and test performance data of various types of antennas.

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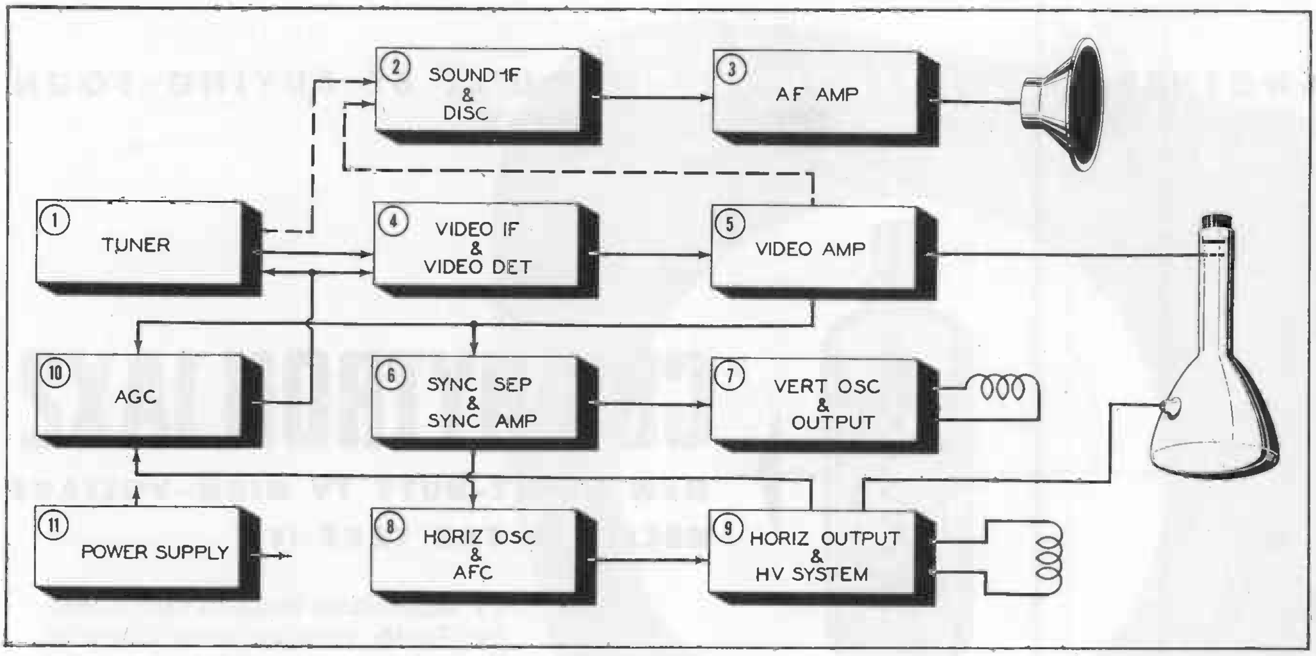


Figure 6. Block Diagram of Typical Receiver.

or video amplifier (blocks 4 and 5), but since several stages are involved, considerable time would be required to make a voltage and resistance check on all of the stages. By injecting a composite signal from the Videometer across the video detector load, it can be determined immediately whether the trouble lies in the video amplifier or in the IF system. If no picture is obtained by injecting the signal at this point, the defect lies somewhere in the video amplifier string. In this case, the next step would be to couple the composite signal to the plate of the first video amplifier. If a picture is now obtained, proceed to the grid and plate of the succeeding stage (or stages) until a picture is obtained. The stage or coupling network immediately preceding the point where the picture is obtained must contain the defective component. Actually the operation just outlined requires less time to perform than it does to tell about it.

One precaution must be observed when using the Videometer in this application. In order to properly couple the low frequency components of the composite signal, an electrolytic capacitor is used internally as a coupling capacitor in the output of the video signal. A "plus" and "minus" switch, located near the output jack, is provided to reverse the polarity of the coupling capacitor. If the video output lead is to be connected to a circuit having a positive polarity, the switch should be in the "positive" position. If the point of connection is negative, the switch should be in the "negative" position. This switch is not to be confused with the polarity reversing switch which controls the polarity of the video signal. When progressing through the video amplifier string, the video polarity switch, which is one of the push buttons on the front panel, should be set to provide the correct polarity signal. Even though this pushbutton switch were not correctly set, however, the defective stage can still be located since a pattern of reversed polarity will be present on the screen as soon as the defective stage is passed.

It is probable that the technician making the service call to the customer's home, substituted tubes in the receiver at that time. This having failed, the set was brought into the shop for repair. Assuming that the symptoms shown by the receiver were conclusive enough to enable the technician to determine which stages were causing the trouble, he probably has already tried tube substitution in the defective stage. If so, further substituting of tubes will not correct the trouble. The signal substitution and tracing method will disclose the defective stage and valuable time need not be wasted in taking measurements on stages that are not defective.

Improper Synchronization. This particular trouble can be very difficult to correct under certain conditions. Many receivers now employ a form of gated AGC which operates only when the receiver is synchronized. Without the proper AGC voltage being applied to the RF and IF stages, compression of the sync pulses may take place in these stages. This would prevent proper synchronization, which in turn causes improper operation of the AGC circuits. This is a vicious circle and may tax the faculties of the service technician to the utmost to locate the defective component. This is especially true if there is a partial failure of a component, such as an off-tolerance resistor, leaky coupling capacitor or weak tube.

The first step, in a signal substitution method of servicing, would be to inject a composite video signal of the proper polarity and amplitude (approximately 1 volt) across the video detector load. If synchronization is normal, under these conditions, the trouble must lie ahead of the video detector. The RF or IF stages may be compressing the sync pulses due to a defective stage or to improper bias.

Another point to keep in mind when using signal substitution in the video amplifier is that the injection of a signal after the sync take-off point will not provide synchronization of the signal. This is of no consequence, however, for as soon as the defective stage is repaired, and the receiver is operated "on

♦ ♦ Please turn to page 79 ♦ ♦

ANOTHER CBS-HYTRON FIRST YOU'LL BE BUYING SOON

CBS-HYTRON 1AX2

NEW HEAVY-DUTY TV HIGH-VOLTAGE RECTIFIER CAN TAKE IT!

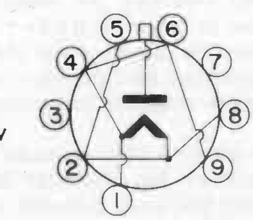
TV high-voltage rectifiers take a beating: Terrific variations occur in applied filament voltage . . . 0.8 to 2.4 volts! Sudden arcs in the rectifying system place destructive electromechanical stresses on the filament. And the increasingly larger TV picture tubes demand peak emission and peak inverse voltage simultaneously. The new CBS-Hytron 1AX2 was especially designed to take such rough treatment and come up smiling.

1AX2 DATA

The CBS-Hytron 1AX2 is a compact, 9-pin miniature TV pulse rectifier. Plate is brought out to top cap and filament is oxide-coated. Absolute maximum ratings are: peak inverse plate voltage, 25,000 volts; d-c load current, 1.0 ma.; and steady-state peak plate current, 11.0 ma.

Typical Operation — TV Pulse Rectifier

Filament voltage	1.4 v ± 10%
Filament current	650 ma
Positive-pulse plate voltage	20,000 v
Negative-pulse plate voltage	5,000 v
Peak inverse plate voltage	25,000 v
D-c output voltage	20,000 v
D-c load current	300 μa



BOTTOM VIEW OF SOCKET

ADVANTAGES OF NEW CBS-HYTRON 1AX2

1. Rugged, high-wattage filament of CBS-Hytron 1AX2 has adequate peak emission for the new, larger TV picture tubes. 1AX2 may be run simultaneously at both its peak inverse voltage and maximum d-c current.
2. Higher load of 1AX2 filament on transformer tends to regulate filament voltage. Eliminates need for limiting resistor. Yet lower plate-to-filament capacitance (0.7 $\mu\mu$f) of 1AX2 prevents loss of high voltage.
3. Insulated tension bar (patent applied for) through center of 1AX2 coiled filament limits destructive movement of filament by electromechanical stresses.
4. Filament of 1AX2 is located in base and shielded to eliminate bombardment of cool ends of filament by gas molecules.
5. An overloaded 1X2A may be replaced with its big brother, the CBS-Hytron 1AX2, by simply removing the limiting resistor. In rare cases, it may be necessary to add another turn to the secondary of the filament transformer to obtain the required 1.4 volts for the 1AX2.

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CBS HYTRON RADIO TUBES

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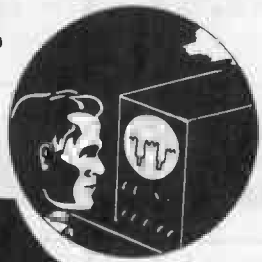
DC Restoration and Sync Separation



by W. William Hensler and Merle E. Chaney

PART II

In the circuit of Figure 6-8 is shown a schematic of a sync separation system employing separate vertical and horizontal sync separator circuits. Incorporated in this circuit is provision for eliminating noise pulses at the grid of the vertical sync separator. The noise eliminating provisions of this circuit operate in such a manner that large amplitude noise pulses are fed out of phase to a common point and thus are cancelled out. The operation of the circuit is as follows. The 4th video IF screen circuit is designed for poor regulation so that a high amplitude noise pulse applied to the 4th video IF stage will result in a negative pulse in the screen grid circuit. This pulse is fed to the vertical sync separator grid. The noise pulse is amplified in the 4th video IF stage in the conventional manner and is fed to the video detector. After rectification, the negative pulse is coupled to the video amplifier stage where the polarity is reversed. This positive pulse is also fed to the grid of the vertical sync separator where the two opposite polarities cancel one another and thus remove noise from the input of the vertical separator tube.

The composite video signal is fed to the grids of both the vertical separator triode and horizontal separator triode as shown in Figure 6-8. Direct coupling is employed in the video amplifiers, which maintains the proper DC level of the composite video signal. In order to keep the level of the sync tips constant, direct coupling is also employed to the separator triodes. Thus the sync tips will always be at the same level, regardless of whether a light or dark scene is being received, providing the AGC circuit maintains a constant level at the video detector.

To insure that sync pulse amplitude is constant at the sync separator output for weak or strong signals, a cathode biasing arrangement is employed. Although a very small amount of cathode bias is applied, the incoming positive-going sync pulses will increase tube current and therefore the amount of the cathode current that flows. The potential drop on the cathode resistor biases the tube to a level determined by the amplitude of the applied signal. The cathode bias voltage is filtered by C9, a .022 mfd. capacitor. The

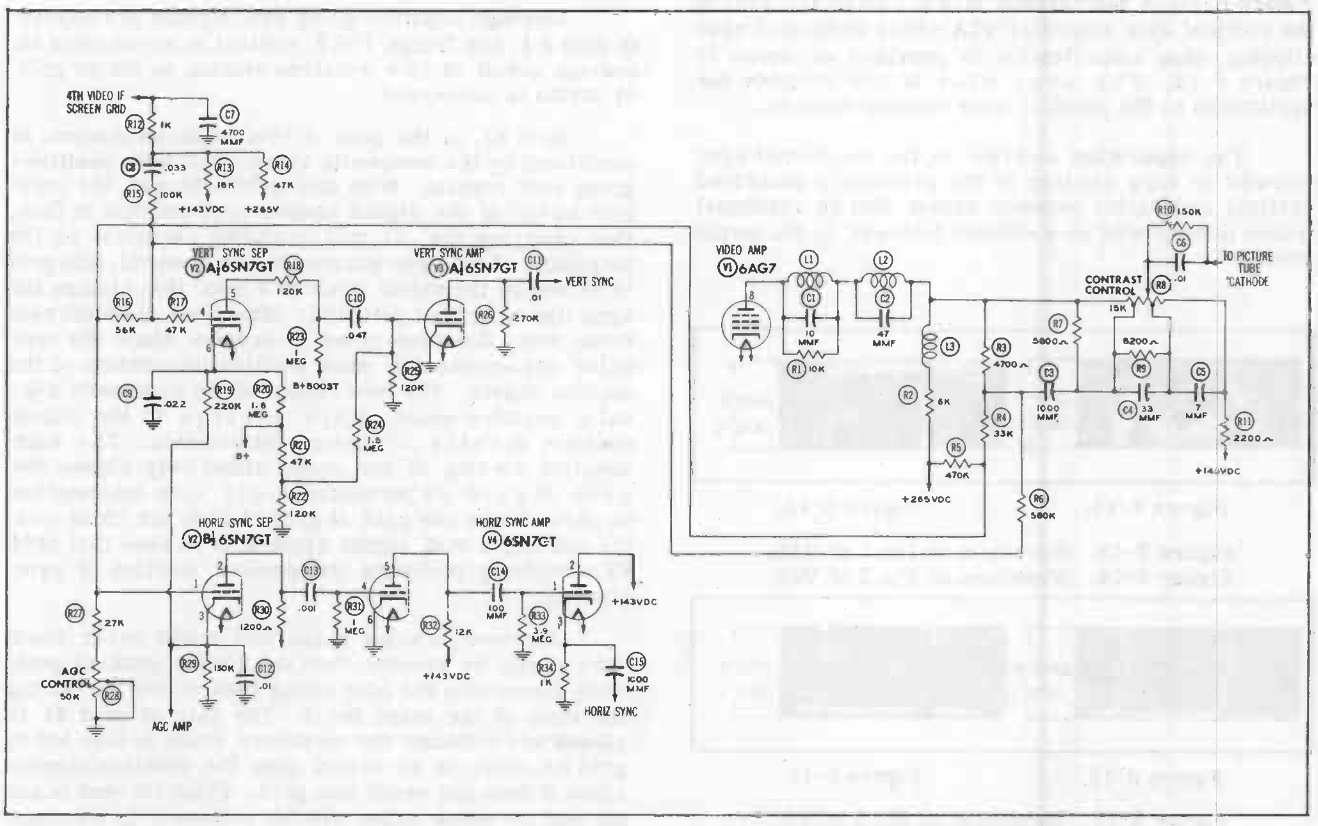
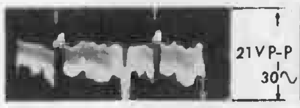


Figure 6-8. Separate Vertical and Horizontal Sync Separator Stages.



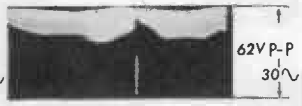
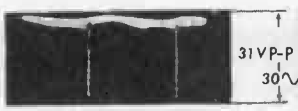


Figure 6-9. Figure 6-10.

Figure 6-9. Waveform at Pin 4 of V2A.
Figure 6-10. Waveform at Pin 5 of V2A.



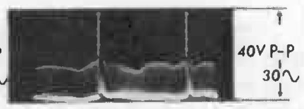


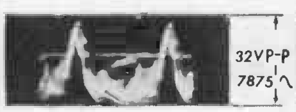
Figure 6-11. Figure 6-12.

Figure 6-11. Waveform at Pin 4 of V3A.
Figure 6-12. Waveform at Pin 5 of V3A.

design of this circuit is such that the tube is biased by the incoming signal to such a level that only sync pulses effect tube conduction. This process of sync separation is illustrated by the waveforms of Figure 6-9 and Figure 6-10. In Figure 6-9 the waveform shows the composite video signal applied to the grid (pin 4) of V2A. In Figure 6-10, the waveform of the signal at the output of the vertical sync separator, taken from pin 5 of V2A, shows the sync separator action to be essentially complete with only sync signals remaining.

The output of the vertical sync separator (See Figure 6-11) is fed through R18 & C10 to the grid of the vertical sync amplifier V3A where additional sync clipping, plus amplification is provided as shown in Figure 6-13. The sync pulse is now suitable for application to the vertical wave shaping circuits.

The separation action in the horizontal sync circuits is very similar to the previously described vertical separation process except that an additional triode is employed as a cathode follower in the output circuit.



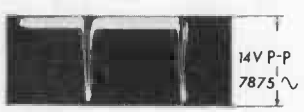
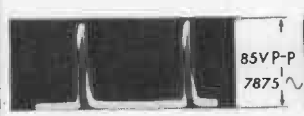


Figure 6-13. Figure 6-14.

Figure 6-13. Waveform at Pin 1 of V2B.
Figure 6-14. Waveform at Pin 2 of V2B.



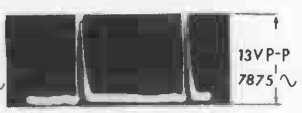


Figure 6-15. Figure 6-16.

Figure 6-15. Waveform at Pin 5 of V4.
Figure 6-16. Waveform at Pin 3 of V4.

The waveforms of Figures 6-13 thru 6-16 apply to the horizontal sync action. Peak-to-peak voltages are shown for each waveform. Observe that the peak-to-peak voltages in the output of a sync amplifier stage may be smaller than that of the applied signal. This results from the fact that limiting or additional clipping action is often provided by a sync amplifier stage.

A circuit employing a single tube for effecting sync separation over a wide range of noise and signal levels is shown in Figure 6-17. A heptode tube, type 6BE6, is used as the sync separator. Through a gate-like action, this tube also prevents undesirable noise bursts from prematurely triggering the sweep oscillator circuits.

The schematic of this circuit shows that the composite video signal from a divider network in the video detector output is fed to grid #1 of the sync separator tube. The normal peak-to-peak signal voltage fed to #1 grid is approximately two volts. The 5 megohm fringe lock control is adjusted so that the bias applied to grid #1 just barely prevents the 2 volt signal from cutting off plate current in the tube.

At the same time an amplified signal of positive going polarity is applied to grid #3. This amplified signal is approximately 40 volts peak-to-peak under normal operating conditions.

Plate and screen voltages to the tube are held to low values for effecting tube saturation to provide sync clipping for limiting of the sync pulses in the output. The sync pulses in the output of the sync separator are fed to the vertical and horizontal sync shaping circuits.

Although negative-going sync signals are applied to grid # 1, the fringe lock control is so adjusted to prevent cutoff of the electron stream as far as grid #1 action is concerned.

Grid #3, in the path of this electron stream, is modulated by the composite video signal with positive-going sync signals. With this grid unbiased, the positive swing of the signal causes grid current to flow, thus charging the .01 mfd. coupling capacitor to the amplitude of the sync pulses. In other words, this grid is biased by the signal itself to a level that clamps the sync tips to ground potential. Maximum plate current flows when the sync pulse is present since the sync pulse represents the most positive excursions of the applied signal. The remainder of the composite signal is negative-going. This portion of the signal consists mostly of picture information. The high negative swing of the signal effectively closes the gate at grid #3 permitting only sync information to pass. Since the gate at grid #1 does not close with the normal 2 volt signal applied, it is seen that grid #3 effectively performs the desired function of sync clipping.

However, a noise pulse that might occur could very easily be greater than the 2 volts peak-to-peak. This means that the tube would then be cut off during the time of the noise burst. The gate at grid #1 is closed and although the amplified noise is also fed to grid #3, there is no action upon the electron stream since it does not reach this grid. Plate current is cut off and no noise pulse will be reflected in the sync separator output.

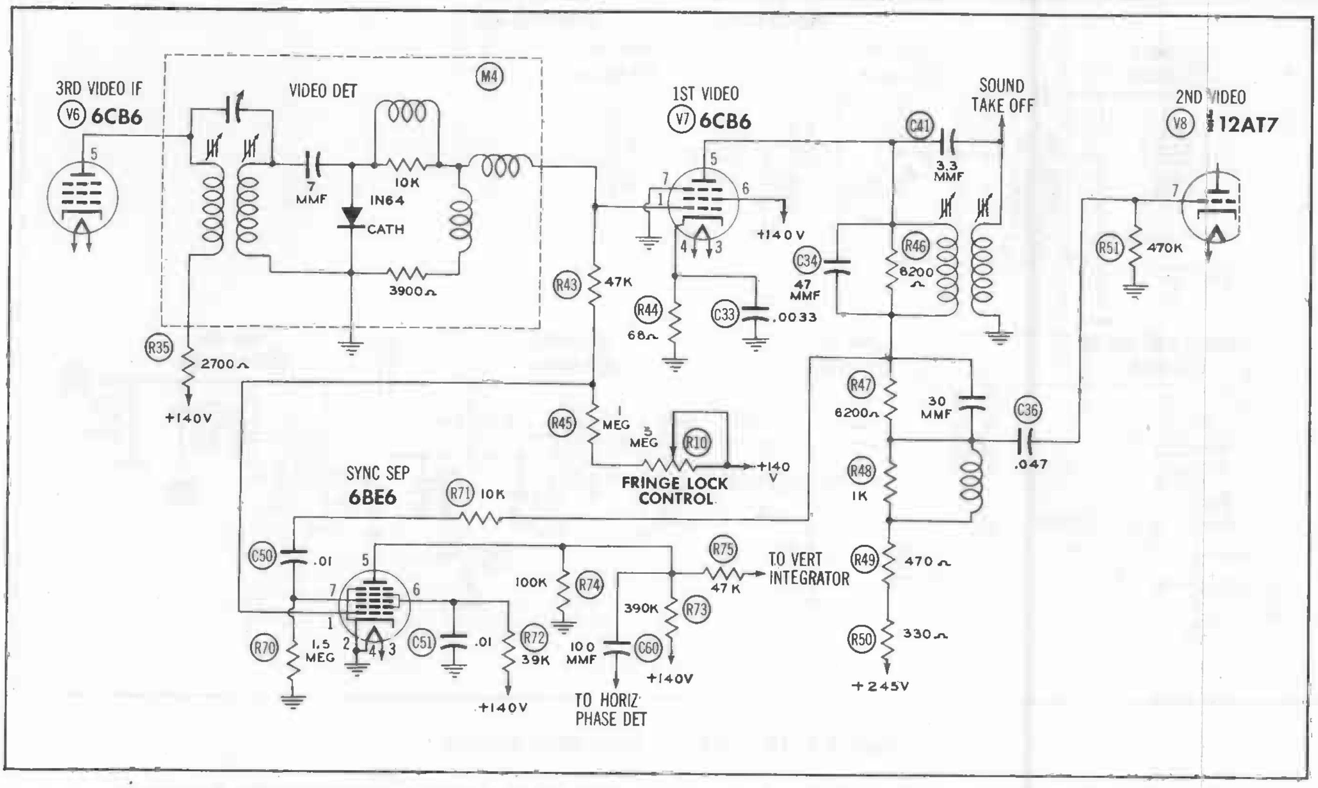


Figure 6-17. Single Heptode Tube Employed for Sync Separation and Limiting.

If the noise burst occurs during the time when a sync pulse is normally present, the tube will also be cut off and the sync pulse will not be fed to the receiver's sweep oscillator circuits. The oscillator circuits will continue to function, however, due to the flywheel action of the circuits. Thus the noise pulse will be ineffective in falsely triggering the oscillator circuits.

In Figure 6-18 is shown a partial schematic of a circuit for achieving sync separation that employs a type 6BN6 tube. The 6BN6 tube, though unconventional in design, is quite simple in operation. This tube was originally designed to be used as a combi-

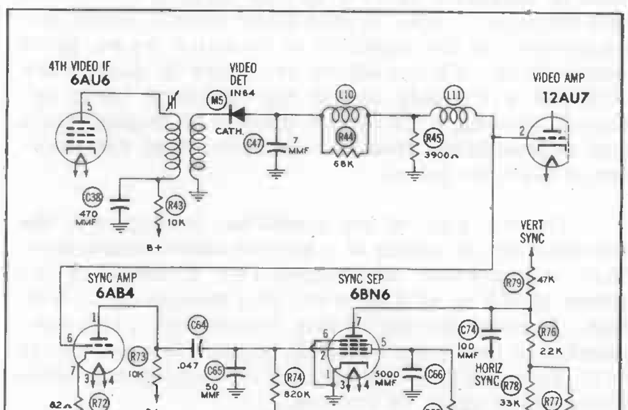


Figure 6-18. Sync Circuit Employing Type 6BN6 for Sync Separation.

nation limiter and detector in FM circuits such as employed in the sound section of television receivers. The unique properties of the tube, however, can be utilized to provide a sync pulse signal free of large amplitude noise pulses. At the same time, the gate-like action of the limiter or signal input grid, which opens or closes over a very samll range of the signal swing, provides a sync pulse level whose amplitude is the same for both strong and weak signals.

In the partial schematic of Figure 6-18, note that the composite video signal is taken from the video detector output and applied to the grid of a type 6AB4 tube connected as an amplifier. This signal, with negative-going sync pulses, is amplified by the 6AB4 and results in positive-going sync pulses in the output. This signal is fed to the sync separator limiter grid element #2 of the tube. Since only small variations of the signal, approximately 1 volt peak-to-peak, are necessary to effect tube saturation and cut-off, signal limiting is achieved.

In order to pass only the sync pulses, the tube circuitry is designed to clamp the positive-going peaks of the signal near ground potential. This is achieved by operating the tube with no bias. Therefore, the positive-going portions of the signal cause grid current to flow, charging the coupling capacitor, by a step function process, to a potential determined by the amplitude of the sync pulses. The characteristics of this tube are such that only small grid current can flow with positive signals applied. However, through a step function, the grid is eventually brought to a level which is governed by signal amplitude. Slight discharge of the .047 capacitor between sync pulses will permit only the most positive peaks of the sync pulse to cause grid current flow and maintain the capacitor

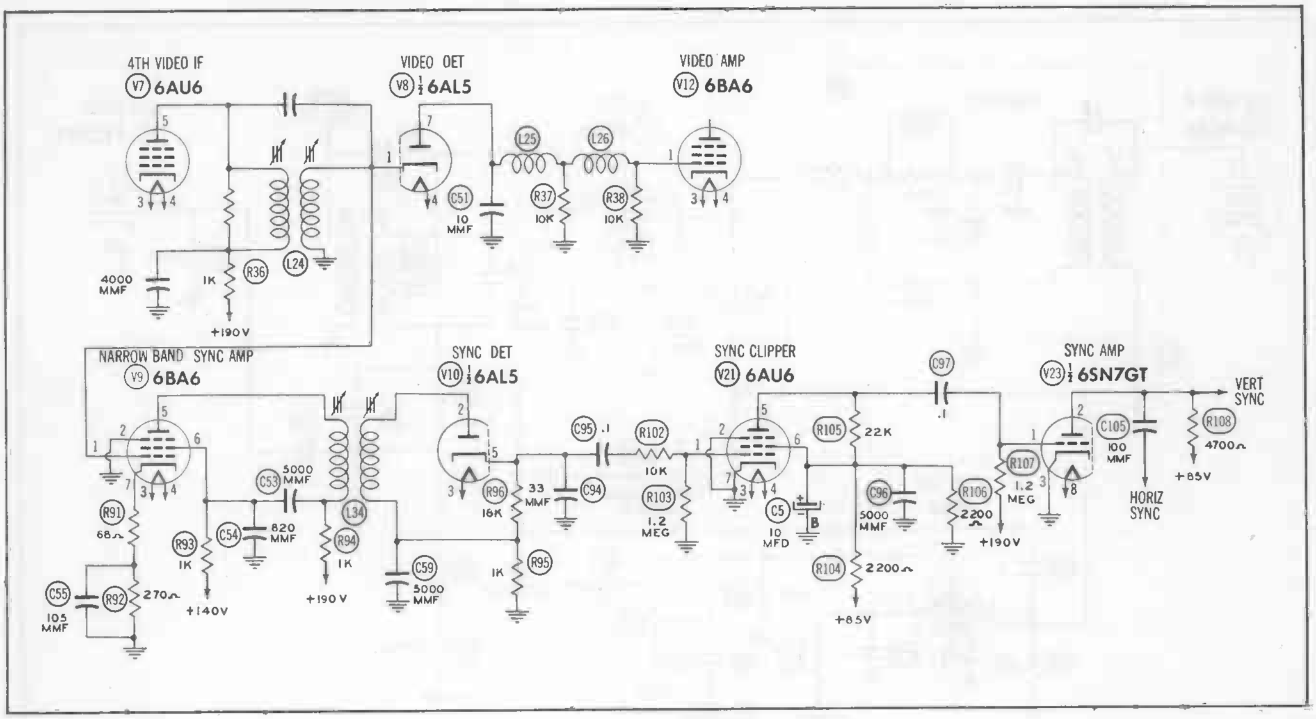


Figure 6-19. Narrow Band Sync System.

charge. The effect then, is to bias this limiter by the signal itself. With the positive peaks of the signal or sync tips clamped at ground potential, the remainder of the composite video signal is in a negative direction. With only about 1 volt required to cut off tube current, it is seen that blanking pulses and picture information drive the tube to cutoff. The pulse type current flowing in the tube then occurs only during sync pulse time. High level noise pulses which might be present, being of periodic nature, are clipped in the same manner as sync pulses and thus little effect from noise is encountered.

Additional amplification of the sync signal is normally not required when a 6BN6 is used as a sync separator. This is due to the fact that an amplified signal occurs in the output of this tube. Although amplification takes place, the saturation and cutoff action of the tube results in only a small portion of the input signal being amplified.

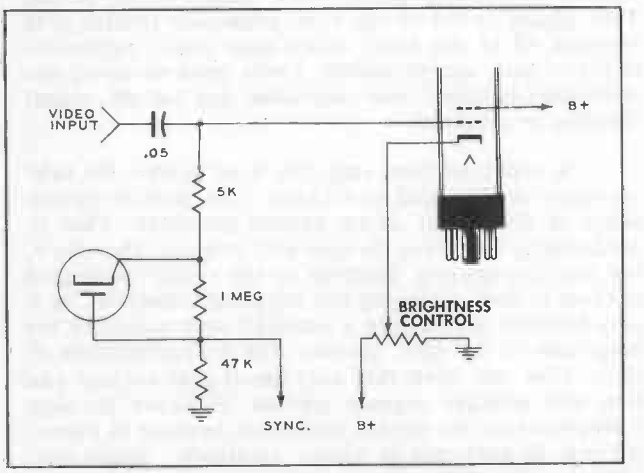


Figure 6-20. Combination DC Restorer and Sync Separator Using Diode.

A sync separation circuit employing a different approach to noise limiting and separation action is shown in Figure 6-20. This circuit is known as a "narrow band sync system." A video IF signal is fed through a narrow band amplifier stage so that high frequency components are eliminated. Noise is usually found in the high frequency portion of a signal, and through the use of the narrow band system the effect of these noise pulses is held to a minimum. The purpose then, of this system, is to provide sync pulses relatively free of noise pulses to the sync circuits.

A video IF signal from the output of the 4th video IF amplifier is fed to the grid of the narrow band amplifier stage. A type 6BA6 remote cutoff tube is employed as the amplifier to reduce sync pulse compression. Two cathode resistors in series are employed with only one of the resistors being by-passed, allowing a certain amount of degeneration. This degeneration also aids in preventing compression of the sync pulses.

The output of the amplifier is coupled to the sync detector by means of a narrow band transformer. This transformer is designed for a frequency response of 700 kc at 3 db down, or 1 megacycle at 6 db down. Through the use of this transformer, high frequencies in the composite video signal are rejected, as well as the high frequencies containing any noise pulses which might be present.

The narrow band signal from the transformer is demodulated by one-half of a 6AL5 tube. The detected signal is developed across an 18,000 ohm diode load resistor (R96) where it is then coupled by a .1 mfd. capacitor (C95) through a 10,000 ohm grid limiting resistor (R102) to the grid of a sync clipper tube type 6AU6. The series resistor (R102) is for the purpose of limiting the grid current during the time of high amplitude noise pulses. In this manner, noise pulses which may have passed through the narrow band sync amplifier stage cannot cause an increase in the charge across C95 which would result in a change of the bias applied to V21.

Separation of the sync pulses from the composite video signal occurs in V21, the 6AU6 sync clipper. This separation action is provided by the low value plate and screen voltages and the dynamic biasing of the grid by the positive-going applied signal.

From the sync clipper output, negative going sync pulses are fed to the grid of V23, the sync amplifier and inverter stage. Note that R107, the 1.2 meg. grid resistor, is returned to +190V. With the low value of plate voltage applied to this stage, the tube operates at saturation between sync pulse periods, thus removing irregularities from the signal. The negative-going sync pulse readily drives the tube to cut-off providing additional sync clipping.

The purpose of V23, the sync amplifier tube, is to provide sync pulse signals of the correct polarity, of constant amplitude, and free of noise and video information.

A combination DC restorer and sync separator circuit is employed in many television receivers. Since a voltage is obtained through rectification of the signal, this voltage is proportional to the signal amplitude and may be applied as a bias to either the picture tube, or to a sync separator tube.

A diode connected as shown in Figure 6-21 provides both DC restoration and sync separation. Since the sync separation action may not be complete in this circuit, and since a diode does not amplify, additional sync amplifier or sync separator stages are required.

With the diode biased, due to diode conduction during sync pulse time, only sync pulses and some video will be developed across the 47,000 ohm resistor. Most of the video signal is of positive polarity for this circuit and will not conduct through the diode. In this manner, partial separation of the sync pulses is obtained plus the DC restoration action. A complete sync circuit employing a diode followed by additional amplification and sync separation stages is given later in the text.

A triode tube is commonly employed as a combination DC restorer and sync separator (See Figure 6-21). The DC restoration action of this tube is similar to that of the diode. A composite signal is applied to the cathode, and the grid is grounded. A 220,000 ohm load resistor is connected between cathode and ground. As far as DC resotration action is concerned, the diode plate may be disconnected. The cathode and grid now act as a diode for charging the coupling capacitor during the period of the negative-going sync pulse. The slow discharge of the .1 mfd. coupling capacitor, through the 2200 ohm and the 220,000 ohm resistors, maintains a bias on the triode. The 2200 ohm isolation resistor also feeds the bias voltage to the grid of the picture tube for reinsertion of DC to the video signal.

Signal cutoff at the blanking level is obtained by maintaining the plate voltage at a low value through the use of a 1 meg. resistor as the plate load.

The advantage of the triode tube over the diode employed as a combination DC restorer and sync separator, is that an amplified sync signal results in the output, plus the fact that more complete sync separation occurs.

Certain characteristics of pentodes make them useful as sync separators. One important property of a pentode is that the output is quite constant over a wide range of input signals. This aids in producing sync pulses of constant amplitude for application to the sync shaping circuits. Usually a pentode having sharp cut-off characteristics is chosen for use as a sync separator. This factor is instrumental in providing sync pulses free of blanking and video signals.

The voltage produced on a cathode of a tube incorporating a high value cathode resistor is often

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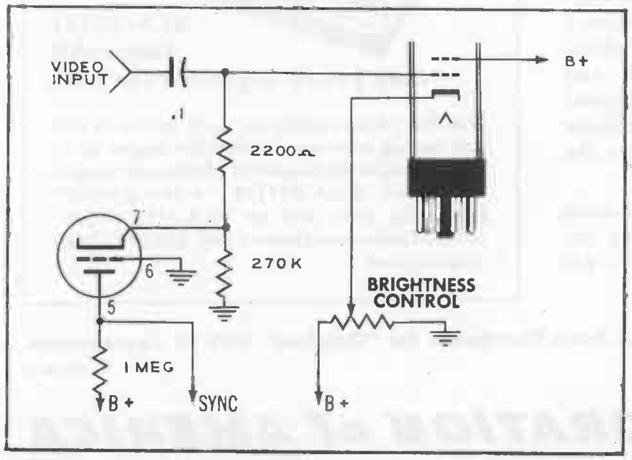


Figure 6-21. Combination DC Restorer and Sync Separator Using Triode.

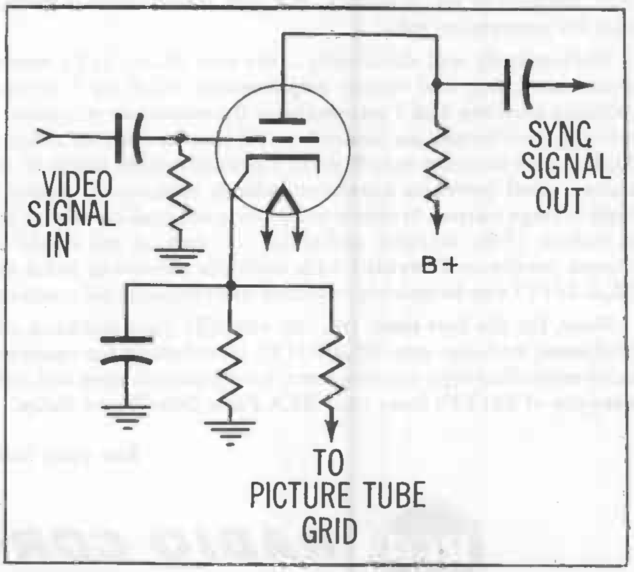
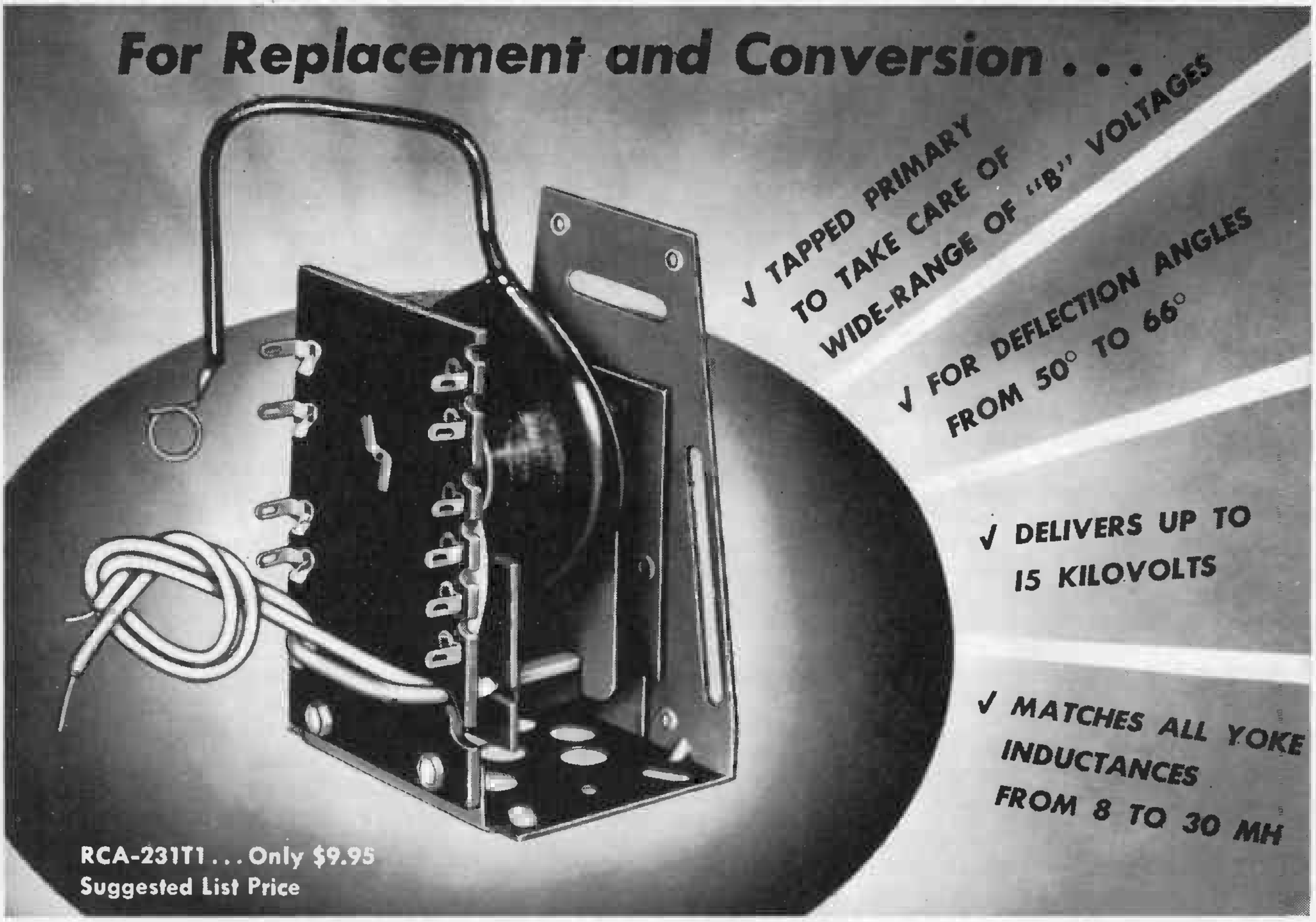


Figure 6-22. Combination DC Restorer and Sync Separator (Cathode Bias Method).



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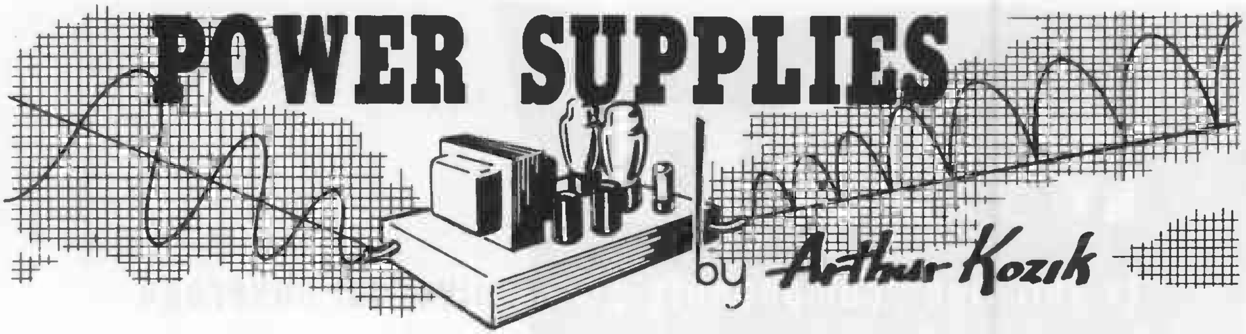

POWER SUPPLIES

by Arthur Kozik

The source of power for the majority of radios, television receivers and associated electronic equipment is the 60 cycle AC power line. Since alternating current is not suitable for plate power, a supply capable of delivering the proper DC voltages and currents must be employed. The AC source must be rectified and filtered, and the supply must maintain ample regulation for the particular application.

RECTIFICATION

The first important factor to be considered is the rectification of the alternating current source. There are numerous circuits that may be employed to convert this AC into a pulsating DC, and the following is a review of some of the more common types that may be encountered.

Half-Wave Rectifier

A half-wave rectifier consists of a single diode such as the 35Z5 found in many small AC/DC receivers. Alternating current, quite often the line voltage, is applied to the plate. During the positive part of the cycle the tube will conduct and allow current to flow. The tube cannot conduct during the time in which the plate is negative in respect to the cathode. Since current can flow only in one direction, a pulsating DC will result. Figure 1 shows a typical half-wave rectifier and the resultant waveforms on either side of the diode. The average voltage output in circuits of this type, without filtering, will be 0.45 times the rms value of the input voltage.

Full-Wave Rectifier

In applications where voltages in excess of the source voltage is desired, a transformer is normally incorporated. Through the use of a center tapped secondary winding and two diodes, full-wave rectification is made possible. This is desirable in many cases where better regulation and greater efficiency

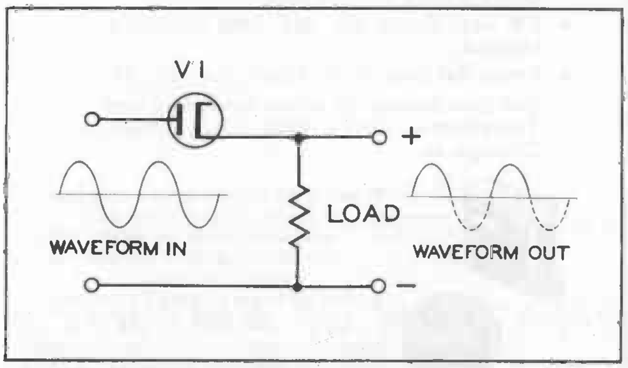

Figure 1. A Typical Half-Wave Rectifier Circuit.

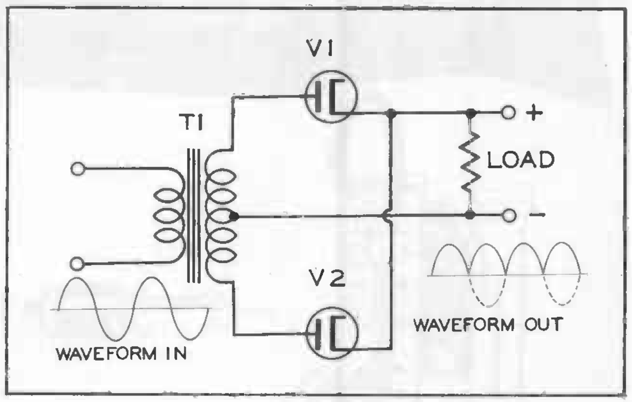

Figure 2. A Full-Wave Rectifier Circuit.

is necessary. Filtering is also easier to achieve due to the 120 cycle output frequency as seen in Figure 2. Each diode has its respective plate connected to opposite ends of the secondary winding. Since the voltages applied to these plates are 180° out of phase, the diodes will conduct in an alternating fashion with the final result being a pulsating DC at a frequency of 120 cycles. The average output voltage of full-wave rectifiers is 0.9 times the rms value of the input voltage across either half of the secondary winding. The current ratings in supplies of this nature are dependent upon the transformer and rectifier tube ratings.

Bridge Type Rectifiers

Bridge type circuits are sometimes advantageous in that the entire voltage developed across the secondary winding may be utilized. Rectification in circuits of this type is accomplished through the use of four diodes. By referring to Figure 3 it can be seen that during the positive part of the cycle, V2 and V3 will conduct allowing current to flow, and during the negative part, V1 and V4 will be conducting. The output pulses will be at 120 cycles, thus making this method full-wave rectification. Bridge circuits offer good regulation in power supplies employing rectifiers of this type.

VOLTAGE MULTIPLIER CIRCUITS

Another method for producing DC voltages in excess of those of the half-wave rectifier, is through voltage doubler and tripler systems. By this means, voltages approximately 2 or 3 times as high as the input level can be obtained without the use of a power transformer. Figure 4A illustrates a half-wave rectifier. During the time the plate is positive, the tube will conduct and allow the capacitor C1 to be charged by the electron current flow as shown by the

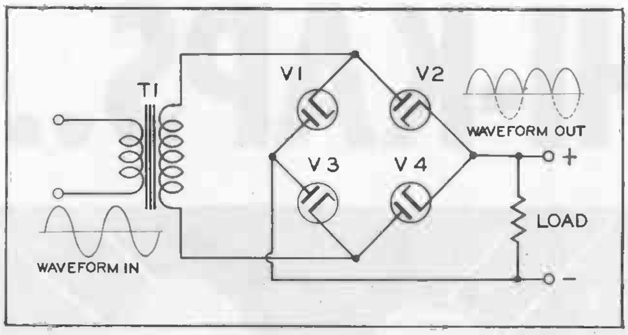

Figure 3. A Bridge Type Rectifier Circuit.

arrows in the illustration. By the addition of another diode and capacitor as shown in Figure 4B, a voltage doubler circuit will result. As the input voltage becomes negative, the charge maintained by C1 is of the correct polarity to be additive to the source voltage. Therefore, as conduction takes place in V2, the charge placed upon C2 is the additive sum of the source voltage plus the charge of capacitor C1. This is approximately twice that of the input level. The ripple frequency of this method is 60 cycles, in conformance with half-wave rectification.

The addition of still another diode and capacitor to the above doubler circuit will enable the supply to deliver approximately 3 times the input level. It can be seen in Figure 4C, that as the input voltage again swings positive that both V1 and V3 will conduct, at which time C1 is being recharged and C3 is being charged with the additive sum of C2 and the source voltage. This constitutes a half-wave voltage tripler circuit.

Another voltage doubler that may be encountered is the full-wave type that is shown in Figure 5. During the positive part of the cycle V1 conducts, charging C1, and during the negative part V2 is conducting, charging C2. Since conduction takes place in an alternating fashion, the ripple voltage is at the 120 cycle frequency common to the method of full-wave rectification. C1 and C2, being connected in series with one another, are additive, therefore the output level is approximately twice that of the input voltage. Regulation is somewhat poorer with these multiplier systems than those of the full-wave rectifier and bridge circuits described earlier. They are normally used in applications where small current drain is required. Care should be exercised in the replacement of components, since losses in voltage, regulation, and efficiency may be experienced if parts of the wrong value are used.

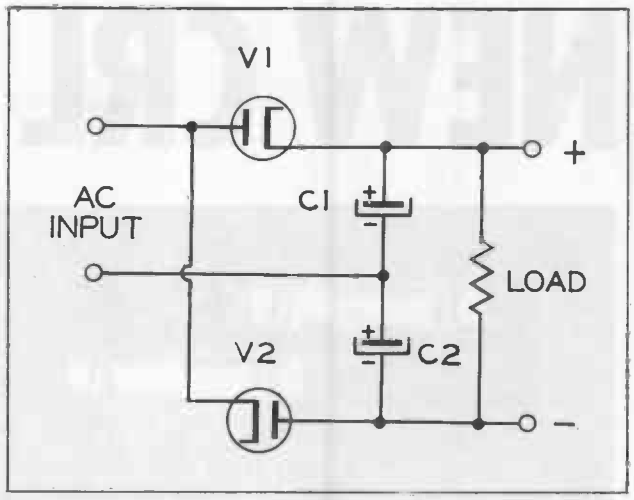

Figure 5. A Full-Wave Voltage-Doubler Circuit.

SELENIUM RECTIFIERS

A selenium rectifier is a device consisting of a metal plate to which a coating of selenium is applied. The selenium, in turn, is sprayed with a layer of low temperature alloy. When AC is applied to this unit, rectification will take place in the following manner. During the time that the alloy is positive, and the metal plate negative, current will readily flow through the unit. However, when the polarity of the applied voltage is reversed, the selenium offers a high resistance to the flow of current, allowing but a minute amount to pass through the unit.

A selenium unit as described above can stand but a small amount of applied voltage, making the stacking of these units necessary when greater voltages are applied. The metal plate of one unit is placed against the alloy of the next and so on. They are then fastened together with soldering lugs provided at appropriate points for the external connections.

These rectifiers are quite compact and are often used in installations where space is a critical requirement. Due to the fact that no filaments are present, the heat dissipation is low, providing they are operated within their limits. This also eliminates the problem of supplying filament voltage. Selenium rectifiers offer good regulation due to their low internal impedance, and may be used in any of the foregoing applications as long as their ratings are not exceeded.

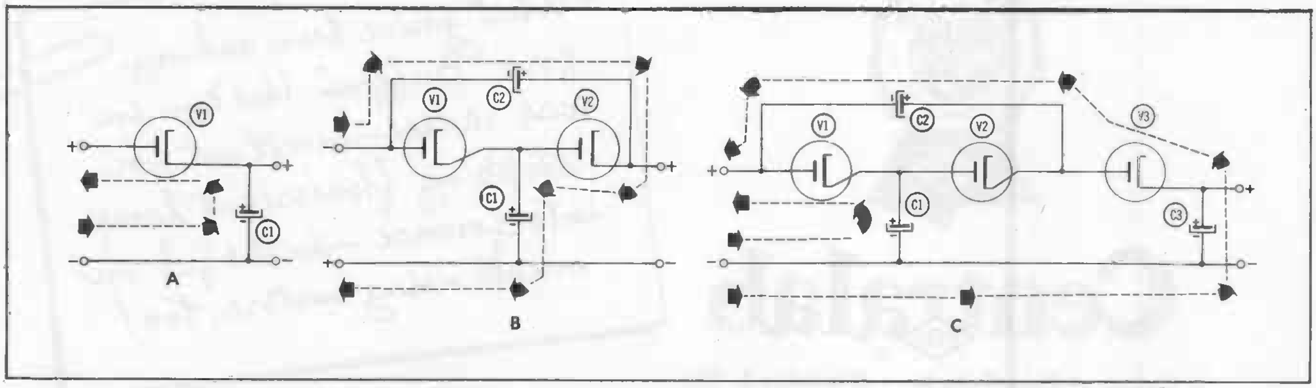

Figure 4. Voltage Multiplier Circuits.

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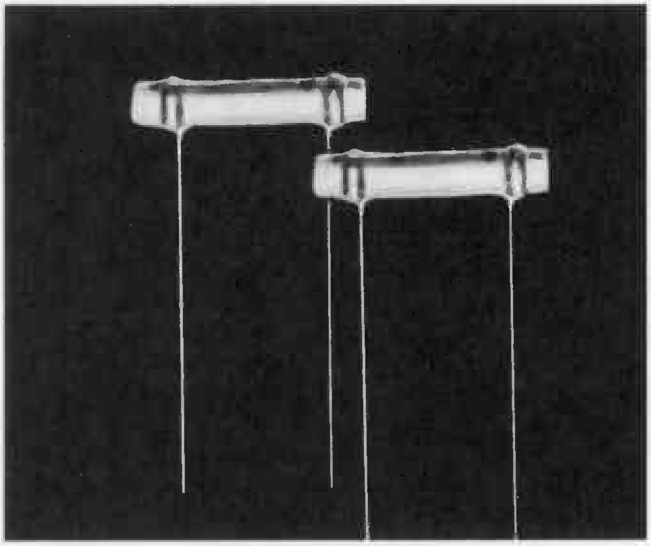

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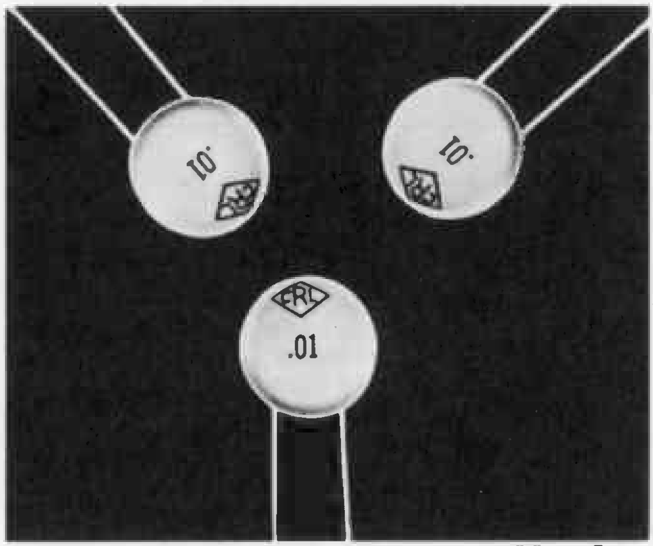

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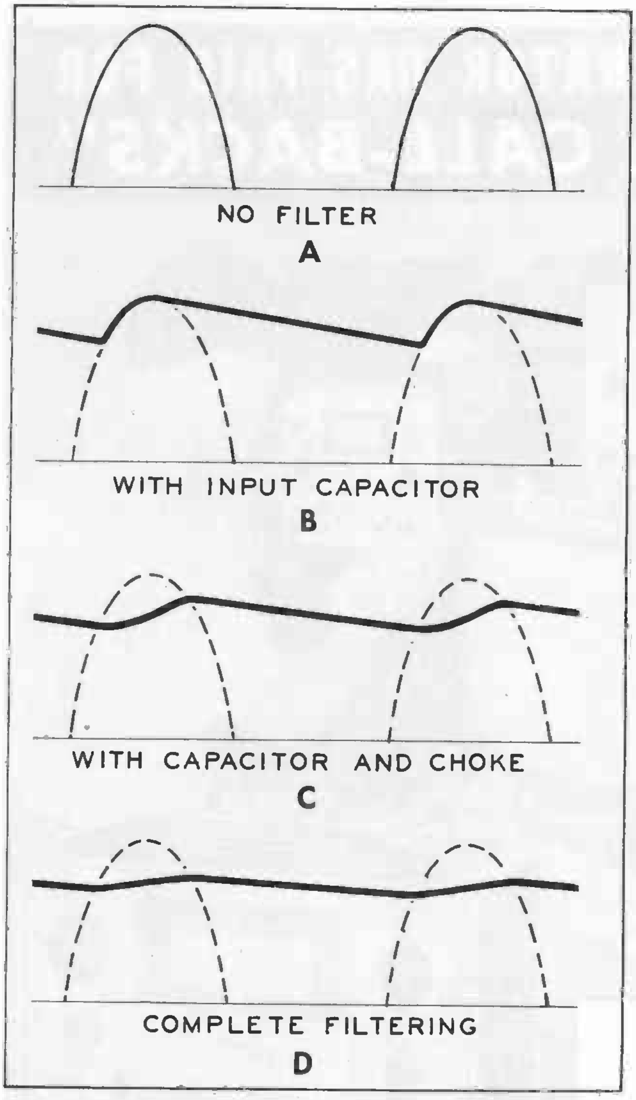

Figure 6. Waveforms with Various Types of Filter Networks.

FILTER CIRCUITS

The next factor to consider in a power supply is the filtering of the pulsating DC after rectification has taken place. (See Figure 6A.) In most cases a capacitor input filter is encountered. By this it is meant that a capacitor is placed directly across the output from the rectifier. During the time that the pulse is being developed, the capacitor is charging, and when the tube ceases to conduct the capacitor will slowly discharge. This creates a very definite slope which fills the space between the pulses as shown in Figure 6B. An inductance is then incorporated to further smooth out these pulses. Due to the induced emf caused by the AC component, the inductance tends to oppose AC from flowing and becomes an inductance of high reactance. However, it offers no opposition to the flow of DC, except for the actual resistance of the wire. In this manner it tends to reduce the peaks of the pulses. Figure 6C illustrates the waveform of a power supply with an input filter followed by an inductance. An output capacitor is then employed to further smooth the remaining ripple as shown in Figure 6D. This completes the filter network and results in a DC voltage with a small percentage of ripple. This type of circuit is shown in Figure 7A.

In those applications where a lower ripple voltage is required, it becomes necessary to provide additional filtering. This may be accomplished through the use of another choke and capacitor as shown in Figure 7B. The additional choke and capacitor further smoothes out the ripple voltage in the same manner as described for the single section filter.

A resonant trap circuit is sometimes employed to increase the impedance of the choke at the ripple frequency. This is accomplished by placing a capacitor, C2 (Figure 7C) of suitable value across L7, which forms a parallel circuit resonant at the ripple frequency. C3 bypasses the harmonics that get through the trap. Resonant circuits are seldom used but are discussed here in order to acquaint the service technician with them, in the event they are encountered.

It is easier to filter the output of a full-wave rectifier than that of a half-wave system since there are twice as many pulses. The capacitors charge twice as often and discharge to a lesser extent before the next pulse takes over and again charge the capacitor. Therefore, with any given filter circuit, there will be less ripple voltage in a power supply employing full-wave rectification.

REGULATION

The regulation of a power supply depends upon its ability to deliver a constant voltage with a change in loading. To accomplish good regulation it is necessary that the source impedance be low. The actual design of the filter network is of great importance. Also, conservatively rated components should be used. Due to losses in the power transformer, it also becomes a contributing factor. Some of this loss is brought about by eddy currents, which are induced into the iron core. These currents are dissipated in the form of heat, which in turn heats the

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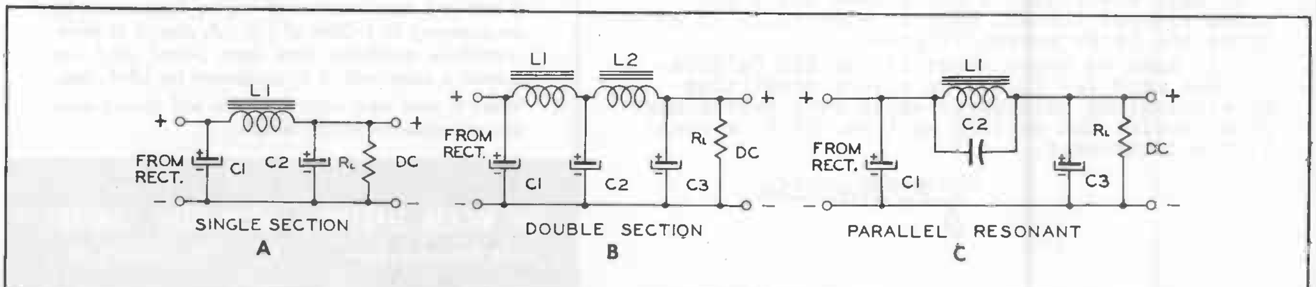
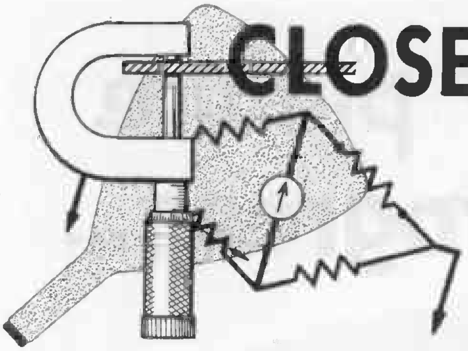


Figure 7. Typical Filter Network Circuits.



CLOSE-TOLERANCE PARTS ... in TV Receivers

by Matthew Mandl

Many parts in a television receiver can be replaced with new units by simply making sure the right value and voltage rating is used. On other occasions, however, this alone is not sufficient to assure good operation. The reason lies in the fact that many circuits have components which are of special design and require almost exact replacement. Such parts have special design features which include negative-coefficient capacitors, extremely close-tolerance resistors, units with special physical construction, etc. For this reason the technician should become familiar with the circuits where such components may be found. In this manner he can be on the lookout for such special items and thus make sure of equivalent tolerance characteristics in the replacement part. Too often, the reason why a replacement, having the usual commercial ratings, does not give satisfactory service, is obscure. Much time is lost vainly checking other parts in an effort to localize the trouble.

While no hard and fast rules can be given here regarding the critical parts in any individual receiver, we can, however, point out those items which probably fall into this category and thus alert the technician to the pitfalls of conventional replacement. Therefore, these discussions will embrace general circuit classifications only i.e. local oscillators, horizontal lock systems, etc.

Local Oscillator

The parts which may be critical in the local oscillator of the tuner depend on circuit design, the type oscillator employed, and whether or not the receiver is of the intercarrier type or the split-sound system. With the intercarrier, local oscillator frequency drift is not as serious as with the split-sound, though good stability is still desired. The degree to which oscillator drift is stabilized, however, depends on the standard of quality to which the manufacturer wishes to adhere. Capacitors which can affect oscillator frequency are usually of the negative-coefficient temperature type. These tend to increase the frequency of the oscillator during warm-up and thus compensate for the decrease in frequency which results when inductances warm up. Heat expands the turns of a coil and the increase in inductance will lower frequency. In general, oscillator resistors should have at least a 5% tolerance rating unless closer tolerance is specified by the manufacturer.

While technicians do not always attempt tuner repairs because of the complexity of some designs, the turret types permit drum removal and therefore greater accessibility to the parts. Thus, repairs are often made on such types. When doing so, however, it is well to watch for close-tolerance components, particularly those marked with (x) in Figure 1.

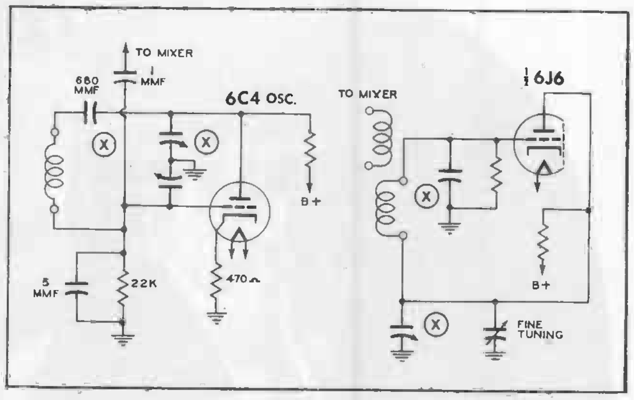


Figure 1. Typical Local Oscillator Circuits.

The tube socket for the tuner oscillator is another critical item. In most instances, the oscillator is worked above the frequency of the incoming signal and for this reason high frequency losses can be severe in this circuit. When the socket is defective and requires replacement, make sure that the replacement type chosen has no greater loss than the original. Tube sockets with high frequency losses may give considerable trouble at the higher channels where the oscillator is generating a signal usually well over 200 megacycles. Lead dress is also quite important and when replacing parts the length or placement of the original wiring should be maintained.

Horizontal Lock System

Another circuit in which several close-tolerance components are to be found is the horizontal lock system. This is particularly true of the Synchroguide control circuit used in a number of the latest receivers. A typical circuit is shown in Figure 2, and again possible close-tolerance parts have been marked by (x). Sometimes the resistors in series with the horizontal hold control are of the negative coefficient temperature type to minimize drift during warm-up. These are close-tolerance units and in some receivers 1 percent tolerance ratings have been specified.

Components in the "anti-hunt" circuit shown in Figure 2 are also critical, because off-value parts here can contribute to weaving and pulling of the picture. This circuit prevents the sweep oscillator from overriding its frequency and causing it to hunt lock-in by swinging above and below synchronization. Other resistors in the cathode of the control tube are also close-tolerance, and 10 or 20 percent ratings are not normally used.

Silver-mica capacitors are sometimes used in the line which feeds back a pulse from the horizontal

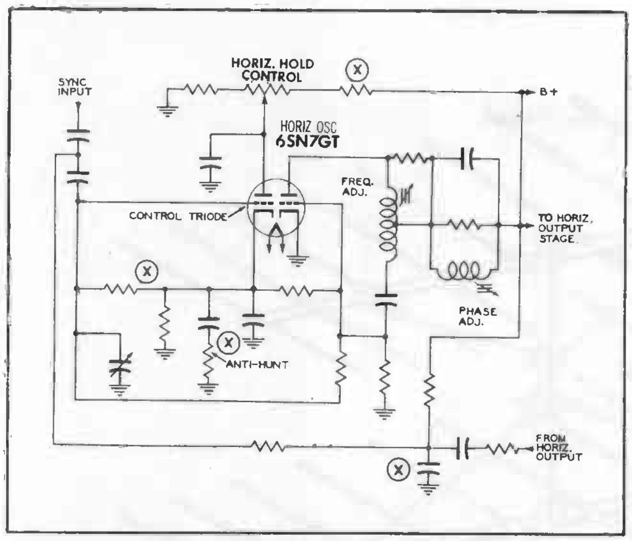


Figure 2. Typical Synchroguide Horizontal Lock System.

output. Changes of reactance during warm-up can cause considerable drift in horizontal frequency and require frequent adjustment of the hold control. A compensated capacitor minimizes this annoyance.

The 6SN7GT tube sometimes assumes critical characteristics, particularly if the system is not adjusted for peak efficiency. As the tube ages, it may contribute to instability even though emission still checks all right in a tube checker. Often technicians will try one of several tubes in order to find the best performer. This is also a good idea if the tube should burn out, for it may save time in terms of having to readjust the entire circuit to compensate for inter-electrode differences. Inasmuch as complete readjustment involves the use of an oscilloscope in conjunction with a rather complex routine, the trouble of trying four or five new tubes in the circuit is well worthwhile. These precautions also hold for the synchrolock type horizontal lock system. Try several 6AL5 duo-diode tubes and also replace the reactance control tube before undertaking extensive parts testing or adjusting procedures.

While on the subject of duo-diode tubes, it is worth emphasizing a point which is sometimes overlooked. For best performance in frequency-modulation detection, the individual diodes of the duo-diode detectors, whether in a TV or FM receiver, should have similar emission characteristics. If one cathode of the duo-diode rectifier has much higher or lower emission than the other, it will unbalance the system. This can give poor performance and make it difficult to get the best alignment. Often inability to secure a well-shaped "S" curve on the oscilloscope during alignment of the detector system is attributable to the abnormal difference in emission between the halves of the duo-diode. Even if each half gives a "good" indication on the tube checker, the tube should be replaced if the readings shown marked differences.

Horizontal Output

Special-type parts are also found in the horizontal output system of a receiver, including the high voltage fly-back section. The parts marked (x) in Fig. 3 require special consideration when replacement is necessary. In some receivers the protective fuse may be of the "delay" type. If a faster acting fuse is used

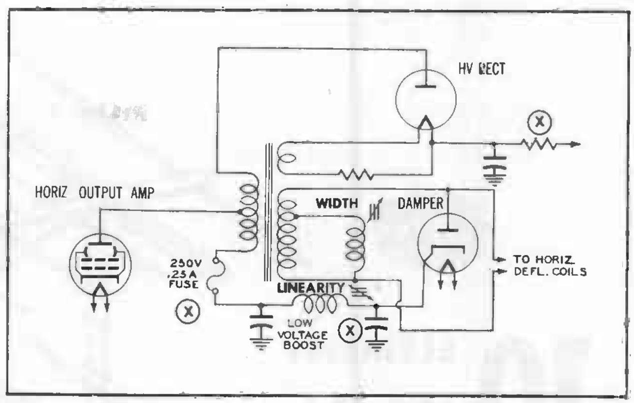


Figure 3. Horizontal Output and High Voltage Supply.

here, repeated replacement may be found necessary. In no instance should a higher current rating be used to avoid frequent burnouts. Make sure the right fuse is used and if it opens too much, check circuit components for defective parts. A gassy horizontal output tube or a misadjustment of the drive control could be the cause.

The filter resistor in the filament (cathode) circuit of the high voltage rectifier usually has a value from approximately 500,000 ohms to 1 meg. The high voltage developed across this resistor can cause corona and arcing and for this reason a unit physically longer than necessary to handle the dissipation requirement is usually employed. The extra length gives additional separation between the ends across which the high potential developes.

Often the capacitors in the voltage boost system are of the oil-impregnated type to assure constant value. Incorrect values here can contribute to fold-over and poor linearity, particularly the one in the cathode leg of the damper tube. Here, again, it is best to use an exact replacement when one of these goes bad.

Other Circuits

Close-tolerance resistors and other parts are sometimes used in circuits other than those mentioned in the foregoing discussion. For this reason a check should be made of the parts list of the receiver to ascertain if critical values or special types should be employed during replacement. Often the schematic will give the values of the various parts, as well as the symbol designation, but will not emphasize that a special type is required.

Next are the peaking coils in the video amplifier stages. The rated fractional henry inductance should be used in order to maintain the proper flat response to 4 megacycles. Many peaking coils are wound around the associated shunt resistor and the value of each should be held for best performance. Of particular importance, too, is lead dress to avoid resonant conditions which establish ringing or "echo" effects in the video amplifiers. This not only sets up repeat lines following fine detail information (such as an abrupt transition from white to black or vice-versa) but can introduce losses which decrease signal gain and, therefore, contrast.

Thus, consideration in selection of replacement parts can save many headaches and assure a post-service performance level equal to the original.

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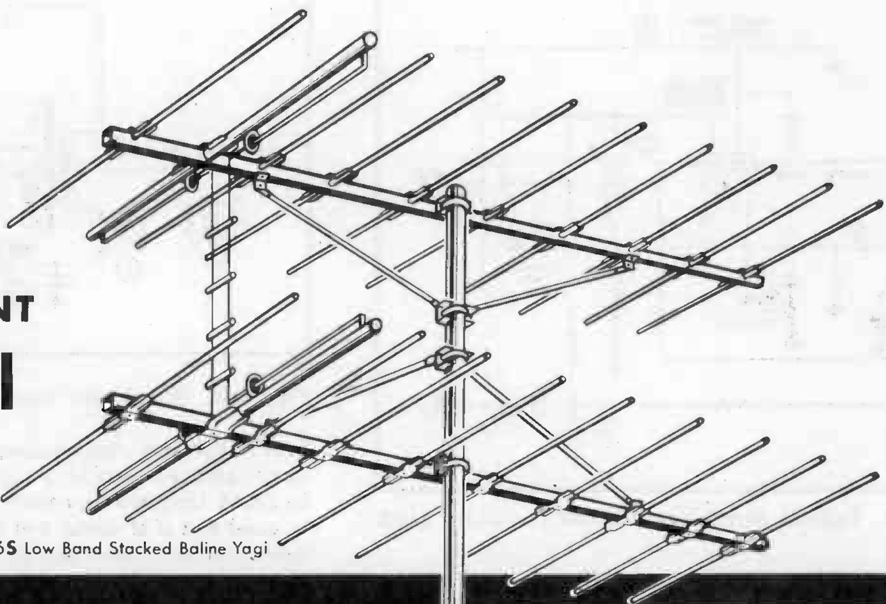

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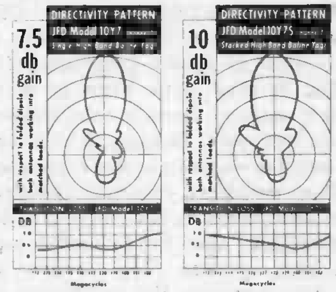

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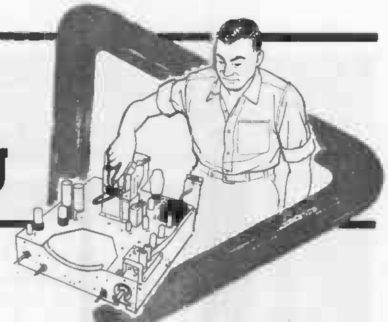

by GLEN E. SLUTZ

Tips in Servicing Portable Radios -

The question is asked, "How can one determine whether or not a dry battery in a portable radio needs replacement?" Before the question can be answered some understanding of the chemical and electrical characteristics of a battery is necessary.

Figure 1 shows a schematic representation of the way a dry cell appears to the circuit into which it is connected. The small "e" stands for the generated, no-load voltage of the battery. The value of this voltage is established by the nature of the chemicals which go to make up the cell. Even when the battery becomes old and "weak" its generated voltage stays at very nearly the same value. The property of the cell which does change with age, however, is the internal resistance, represented by "r" in Figure 1. This resistance builds up as the by-products of chemical action collect around the electrodes within the battery. The older the battery gets, the greater this resistance becomes. Whenever the battery is connected into a circuit and current flows, a voltage drop occurs across the internal resistance of the cell. This subtracts from the generated voltage and the remainder constitutes the voltage available under load at the terminals ("E" in Figure 1.)

When testing a battery to determine its condition, the terminal voltage under normal load should be measured, not the no-load voltage, "e." This means that the battery should be connected to the receiver and that the receiver should be turned on when the measurement is made. It is generally considered that if the terminal voltage of the battery thus tested has fallen to 60% of its rated fresh value, the battery should be replaced.

The appreciable internal resistance which builds up in an aging "B" battery necessitates the use, in many designs, of a large electrolytic decoupling capacitor between B+ and B-. This is to prevent the development of feedback voltage across the internal resistance of the battery and the possible motorboating and squealing which could occur due to feedback in the set. In fact, the decoupling capacitor should be among the components tested in a portable having the above-mentioned symptoms.

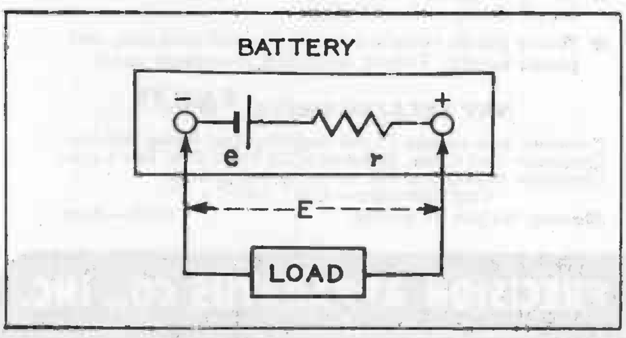

Figure 1. Equivalent Circuit of a Battery.

The filament circuit of a battery-operated radio is a critical one and requires special consideration during servicing. One good rule which has gained general acceptance is never to use an ohmmeter to check filament continuity in 1-1/2 and 3 volt miniature tubes. The ohmmeter current in some meters exceeds the 50 ma. rating of these low drain tubes and might cause the filaments to burn out. Filaments should be checked with a tube tester or by measurement of voltages at succeeding points along the series filament line. Voltmeters of high sensitivity and vacuum-tube voltmeters are preferred for such measurements because meter current is kept to a minimum in these instruments.

Another precaution which ought to be observed is illustrated by the simplified schematic in Figure 2. The filaments in AC-DC battery portables are sometimes supplied through a dropping resistor (R) from the rectifier. A large capacitance (C) is placed across the tube string for filtering. If a tube filament burns out for one reason or another, the full rectified line voltage appears across the filter capacitor. This may cause the capacitor to break down if its voltage rating is not sufficiently high. However, should the capacitor withstand the abnormal voltage, it will proceed to take on a high charge due to its large capacity rating. Then when the defective tube is replaced, even though the receiver may be turned off at the time, the discharge path for the capacitor will be completed through the filament string and the high discharge current might burn out one or more additional tubes. A simple precaution in this case is to discharge the capacitor directly across its terminals before inserting the good tube and turning on the set.

The importance of still another feature of battery-operated filaments warrants mention at this

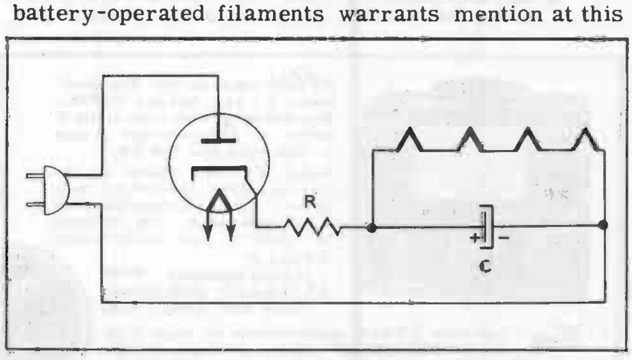

Figure 2. Filament circuit of an AC-DC Battery Portable.

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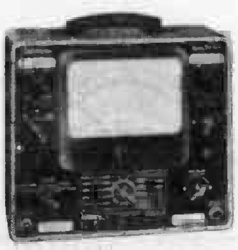

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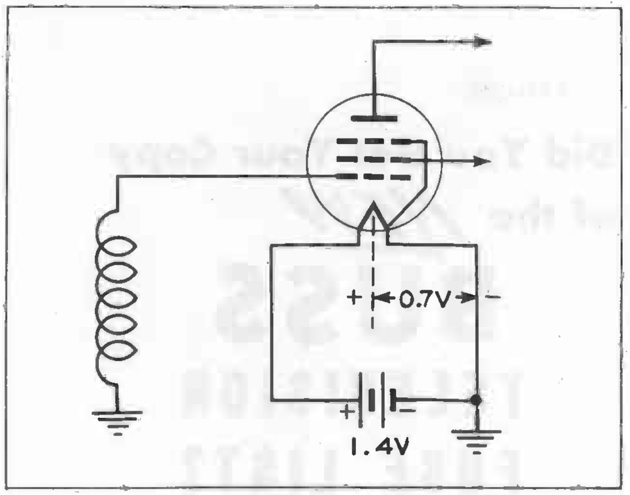

Figure 3. "A" Battery Connections to a 1.5 Volt Tube.

point. The proper polarity of "A" batteries should be observed when making replacements or circuit alterations. This is not necessary for the operation of the filaments themselves because naturally a filament will heat properly no matter which way the current flows in it. The real reason for guarding against pole inversion is that the grids of some of the tubes are biased at least partially by the filament voltage. Figure 3 illustrates this point. Notice that the grid returns to ground and that the negative side of the "A" battery is also connected to ground. The average potential on the filament within the tube is 0.7 volt positive with respect to ground or one-half the total voltage (1.4 v.) across the filament. Thus the grid has a 0.7 volt bias due to the filament voltage alone.

If the "A" battery connections in a set should become reversed, both the operation and the life of the tubes will be materially affected by the improper bias thus imposed on the grids.

Code Your Cables and Test Leads!

Television has brought with it a sharp increase in the number and kinds of test instruments used in the service field. These in turn have caused a problem in service shops having several such pieces of equipment; namely, what to do with all the test leads and cables. Some apparatus comes with as many as four detachable cables and leads. Very often the connectors used on these leads will fit other pieces of equipment. Consequently a mixup of cables becomes a distinct possibility. However, such confusion should be prevented particularly in those instances where components are physically located within the cables (such as the resistors in the DC probes to many vacuum-tube voltmeters), or where the capacity between conductor and shield must be a minimum as in the cables to many wide-band oscilloscopes.

In order to prevent cables and leads from being lost or interchanged, a coding method as shown in Figure 4 has proved very successful. The make and model number of the equipment is typed on a small slip of paper. Then this identification tag is attached to the test lead at a convenient place by means of a strip of cellophane tape. This marking system makes possible immediate identification of a lead or cable and permits its storage with other leads in a separate bin or rack. In this way the sometimes bothersome presence of unused test leads in the work area may be avoided.

Figure 4. An Identification Tag for Test Leads.

A Testing Device for Picture Tubes -

Testing a picture tube by direct substitution of another tube involves an appreciable expenditure of time and labor. Although the substitution method retains its position as the final, conclusive check on the condition of a cathode-ray tube, certain preliminary tests have been devised which help to direct the service technician's investigations toward the source of such troubles as those which follow.

1. No raster.
2. Dim raster.
3. Brightness control has no apparent effect.
4. "Blooming" picture.

One preliminary test calls for measuring the high voltage which is applied to the second anode of the picture tube. A voltmeter equipped with a high voltage probe is necessary for this measurement. A second preliminary test may be made with the device pictured in Figure 5. This piece of equipment is a product of Radio Merchandise Sales, Inc., of New York and is distributed under the name, RMS Pix Eye. The initial step in using this device is to detach the socket from the picture tube base and plug the Pix Eye into the socket. Then with the set turned on, watch the flourescent screen of the eye tube. An image similar to the one shown in Figure 6 should appear. The following is a list of the various socket voltages which are checked by the Pix Eye.

1. If the filament of the eye tube lights with a steady glow, the heater voltage is correct. An internal resistor is incorporated in the Pix Eye, which

Figure 5. RMS Pix Eye.

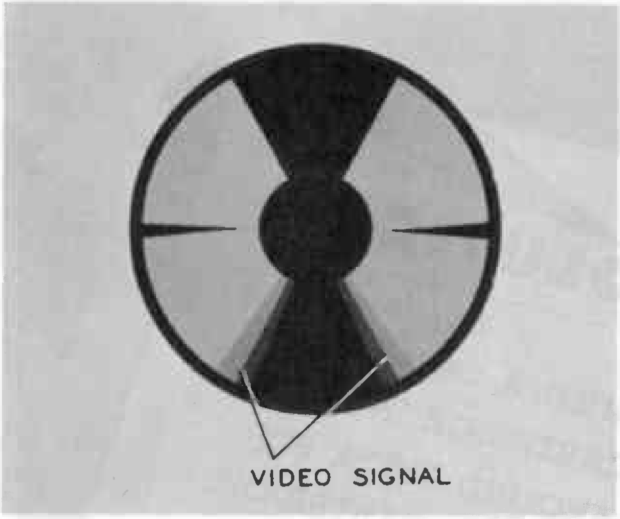

Figure 6. Image on Pix Eye Screen.

is connected across the eye tube filament to prevent burnout of the eye tube when connected in series filament circuits.

2. If the flourescent screen of the eye tube glows bright green after the initial one minute warm-up, the B+ voltage for the accelerating anode is satfactory. However, if the glow is faint, it indicates that a low accelerating voltage is present.

3. If the width of one of the dark wedges varies without overlapping when the brightness control is rotated, the bias voltage between cathode and grid is correct. In the event that overlapping occurs or no width variation is noticed, the circuits which have to do with bias development for the picture tube should be checked.

4. The presence of a video signal will be evidenced by a shading on the edges of one of the dark wedges. (See Figure 6.) With adjustment of the contrast control, the shaded edges will vary in width.

After completing the high voltage check and the test with the Pix Eye and finding that the voltages applied to the picture tube are normal, the service technician can feel reasonably sure that the picture tube is at fault and should be replaced.

Reducing Horizontal Fold-Over -

Occasionally after the horizontal output transformer in a television receiver has been replaced or a conversion job to a larger picture tube has been performed, the problem of horizontal fold-over will arise and threaten to defy solution. Careful checks for defective components in the horizontal oscillator, the horizontal discharge circuit, the sweep amplifier, and the damping circuit, are often fruitless. Readjustment of the horizontal drive control and the phase control in the synchrolock circuit, if used, may help slightly. The fold may be along either the right or left edge of the picture, depending on the setting of the horizontal hold control. This type of fold is due to slow horizontal retrace time. The beam takes longer to move from the right to the left side of the picture than the established interval of blanking, which is approximately ten microseconds. Blanking either begins after the beam has started its retrace or ends before retrace is complete.

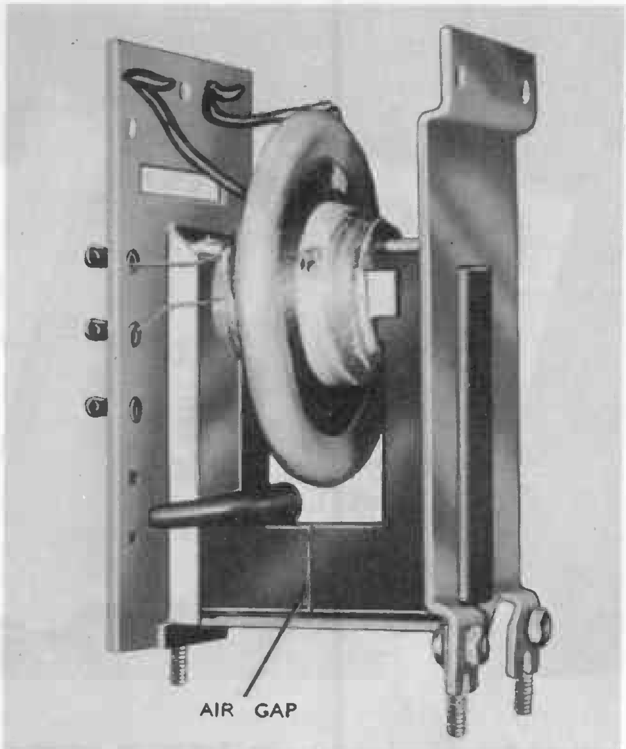

Figure 7. Horizontal Output Transformer.

The speed of the beam during retrace can be increased, in many instances, by increasing the natural resonant frequency of the horizontal deflection circuit. This is true because the resonant frequency of the system determines the rate at which the magnetic fields in the transformer and deflection coils start to collapse after the horizontal output tube cuts off. Theoretically this frequency of resonance should be about 71 kilocycles, but practically it is usually somewhat lower than this. In order to raise the resonant frequency of the system, a convenient method is to decrease the inductance of the transformer.

Figure 7 shows a typical horizontal output transformer. An effective method of decreasing the inductance of this transformer, and thereby speeding retrace, is by slightly increasing the separation in the air gap. Newsprint paper is usually used as the separating material and only one or two thicknesses need to be added to achieve noticeable results. In order to spread the air gap, the clamping bolts must first be loosened. Then the air gap may be opened with a steady pressure outward on the legs of the transformer. Sometimes an adhesive substance holds the air gap closed and it is necessary to exert sufficient force to overcome this connection. Great care must be taken when opening the gap not to break any of the fine wires which link the coil windings with the terminal board. After the gap is open, insert one thickness of paper, reassemble, and try the transformer out in the set.

Sometimes the circuit constants are such that the width of the picture suffers a sharp narrowing due to the change in air gap. In case this should happen and adequate width cannot be regained with adjustment of the appropriate controls, the air gap modification should not be adopted. Generally, however, the fold-over effect should show a decrease or be absent entirely as a result of this operation.

Examining DESIGN FEATURES

by MERLE E. CHANEY

Philco RF Chassis 71 - Deflection Chassis G-1

A number of interesting features are employed in Philco's 71 and G-1 television receiver chassis units. One of these is the use of fixed inductors and variable trimmer capacitors in the 40 mc video IF stages. The inductors and trimmers are shown in the photo of the video IF strip. (See Figure 1.) Occupying no more space than the average 1 watt resistor and with pigtail leads, these video IF inductors are self-supported and soldered directly to the socket pins or appropriate lugs. The small ceramic type trimmer capacitors are fastened through holes in the chassis with a locknut device and are adjusted by means of a threaded brass screw.

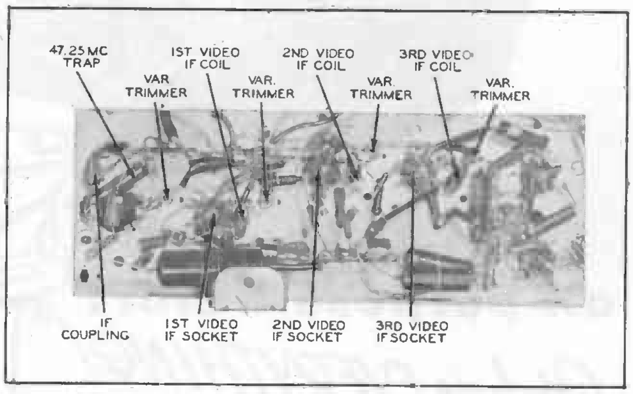

Figure 1. Video IF Strip Employing Fixed Inductors and Variable Trimmers.

Automatic Width and Brightness Compensation -

A method is employed in this dual chassis receiver to compensate for changes of width on the picture tube when the picture brightness control is adjusted. This is accomplished by connecting the network between B+ and ground. The controls therefore are interactive. It can be seen, in the partial schematic of Figure 2, that the picture width is adjusted by varying the screen potential on the horizontal output tube. Also, it can be noted that the brightness control varies the bias voltage on the picture tube.

Ordinarily, a variation of the picture tube brightness, or beam current, affects the picture width. In this circuit, as the brightness control is adjusted for a brighter picture, the horizontal output screen voltage automatically increases, which tends to compensate for the loss in width due to increased beam current.

Variable Noise Gate -

Noise pulses are prevented from entering the receiver's sync circuit through the use of a variable noise gate. The level at which noise is removed varies with the strength of the incoming signal. To achieve this objective, a 6AT6 duo diode-high mu

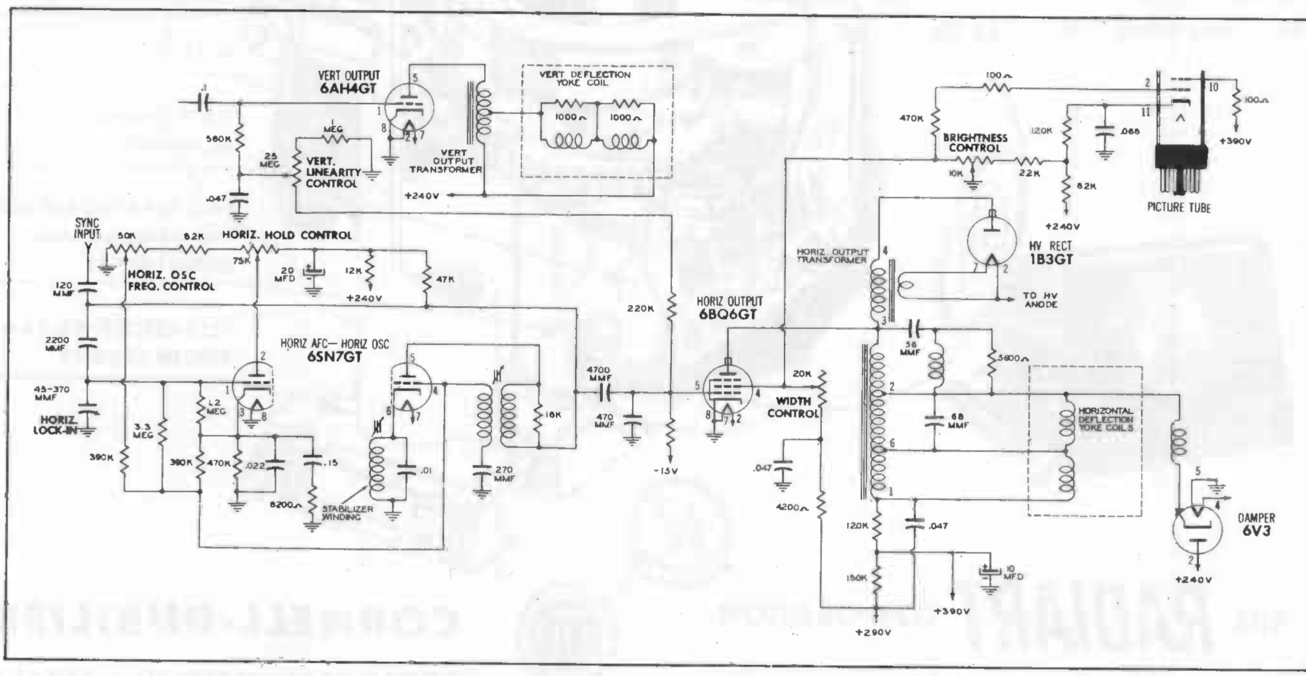

Figure 2. Partial Schematic of Philco Television Receiver Deflection Circuits.

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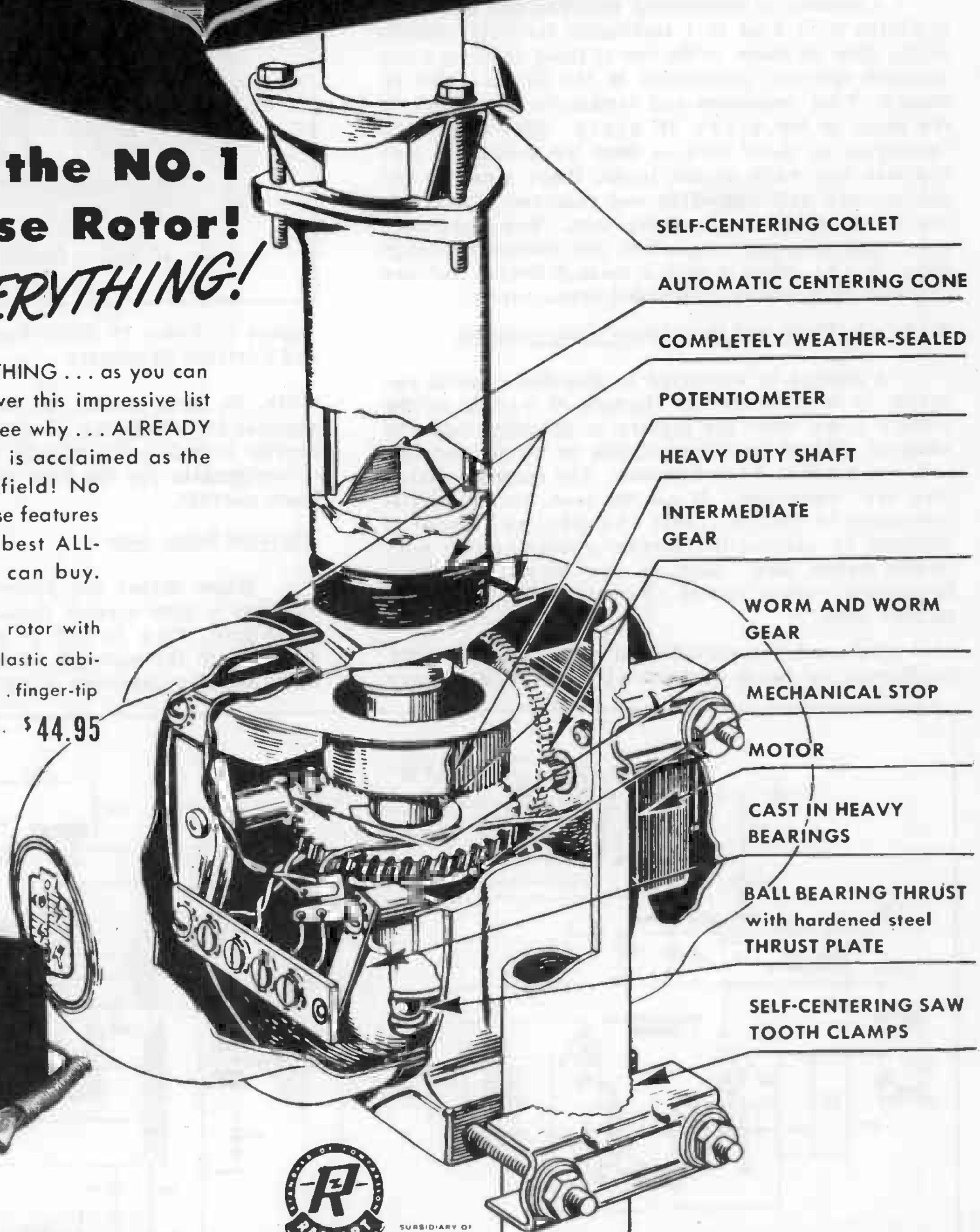

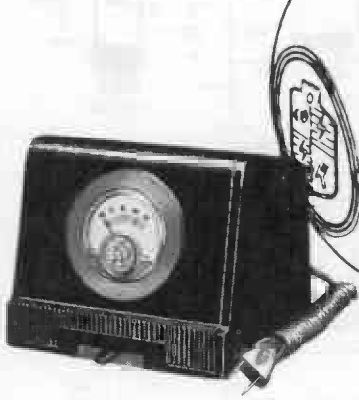

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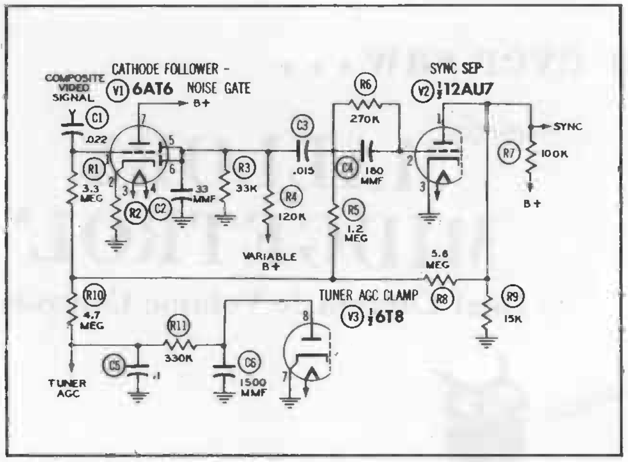


Figure 3. Noise Gate and Tuner AGC Circuits.

triode is employed. A schematic of this circuit is shown in Figure 3.

The composite video signal containing the sync pulses is capacitively coupled from the 1st video amplifier output to the grid of the 6AT6 triode section. The triode section is used to compress the video portion of the composite signal. Since the load for this tube is in the cathode, the positive-going sync signal retains its polarity at the 10KΩ cathode resistor. Positive-going sync pulses, then, are applied to the cathode of the noise gate diode section. (Note that the cathode is common to both tube sections.) In order for the diode to conduct, the diode plates must be more positive than the cathode. A B+ voltage is applied to the diode plates from the load side of a B+ dropping resistor for the video IF stages. This B+ voltage is variable because the video IF tube currents are inversely proportional to the strength of the incoming signal. The strong signals result in large AGC bias voltage being applied to the video IF stages, causing decreased tube currents and less drop across the dropping resistor in the B+ supply. Applying this increased voltage from the dropping resistor to the noise gate diode plates allows much larger signals to pass before gating action occurs.

For weak signals, a similar action occurs, except that the reduced AGC bias voltages result in a larger drop across the B+ dropping resistor. Applying this reduced B+ voltage to the noise gate diode plates decreases the level at which the gating action occurs. Thus, for weak signals, noise pulses readily close the diode gate and prevent noise from triggering the sweep oscillator circuits.

Tuner AGC -

Two sources of AGC are utilized in the operation of the receiver. AGC for the video is obtained by rectifying the video IF signal in one section of a 6AL5 tube (the other diode section is the video detector). This rectified and filtered AGC is applied to the grids of the 1st and 2nd video IF amplifier tubes.

The tuner AGC bias voltage is obtained from a divider network in the sync separator circuit. Positive-going sync signals applied to the sync separator grid cause grid current to flow, developing a voltage across R5, R8, and R9. Since R9 is also in a divider network between B+ and ground, the resultant voltage at the junction of R5 and R8 is the algebraic sum of the two voltages across R8 and R9. The AGC voltage is filtered by R10 and C5 and applied to the tuner.

Damper Tube Type 6V3 -

The Philco deflection chassis G-1 employs a relatively new type tube. This tube, type 6V3, has the cathode routed out the top of the tube to a cap connection. It is a 9 pin based miniature tube, and is particularly useful as a damper because of its ability to handle large currents for small periods of time.

To insure that a positive voltage will not be applied to the tuner AGC circuit, under no signal conditions, a clamper diode (one diode of a 6T8 tube) is connected to the tuner AGC line. Thus the tuner AGC line can be negative or zero but not positive.

AC Line Isolation -

Since this receiver employs a voltage-doubler power supply, no power transformer is used and one side of the AC line connects to the receiver chassis through a voltage-doubler capacitor and speaker field. Precautions should be taken, therefore, in servicing this set to minimize shock hazard and prevent equipment damage. An isolation transformer is suggested in servicing these dual-chassis units.

Horizontal Sweep Oscillator Circuit -

An examination of Figure 2 shows an interesting type of horizontal oscillator circuit. Note that the stabilizer winding connects to the cathode of the oscillator triode section. The type 6SN7GT tube functions with one section as the oscillator portion and the other as a phase comparer. Within the lock-in range of the blocking oscillator, the horizontal frequency is determined by the phase relationship of the sync signal and horizontal sweep signal at the grid of the phase comparer. Adjustment of the stabilizer coil is possible by connecting a scope through a 15 mmf. capacitor to the cathode (Pin 6) of the horizontal oscillator. The stabilizer is then adjusted to obtain the wave shape of Figure 4.

Note, in the waveform of Figure 4, that the conduction point for the oscillator tube occurs during the most rapid change in the sine wave signal. This aids in maintaining a synchronized sweep signal, particularly in areas where signal strength is weak.

With this sine-wave voltage applied to the cathode of the blocking oscillator, greater control is afforded than that which would be obtained if a stabilizer coil were in the plate circuit, since any given voltage applied to the cathode causes a greater control of tube conduction than the same voltage would provide when applied to the plate of the tube.

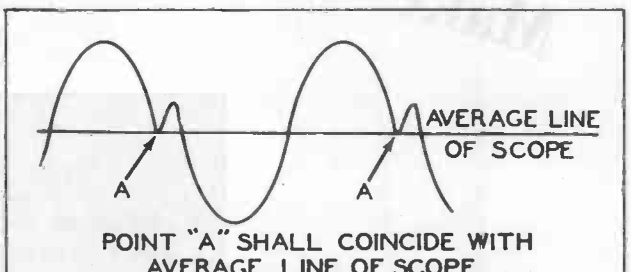


Figure 4. Waveform Present at the Horizontal Oscillator Cathode.

Audio-Facts

by Robert B. Dunham

Some form of preamplifier and control unit is practically a necessity, when listening to the varied program material available on records, tape, AM-FM tuners, etc., if the excellent performance capabilities of power amplifiers such as the Williamson are to be realized. Several preamplifiers are available commercially but the majority of these are designed to be used with, and obtain their operating power from, the associated power amplifier.

The description and specifications for the construction of such units have been given in various publications, one example being the Williamson phonograph preamplifier and tone compensation unit discussed on pages 37 and 38 of the PF INDEX and Technical Digest No. 31, for March-April.

The preamplifier and control unit to be described (Figure 1) was constructed as a self-powered unit with sufficient controls for flexible operation in conjunction with the Williamson amplifier or similar equipment.

The circuit of the complete preamplifier unit, shown in Figure 2, is simple and straightforward, the various sections being mostly conventional and familiar circuits.

The preamplifier and control unit provides for three inputs, and flexibility of operation is maintained through the inclusion of a gain control, a loudness control, bass and treble boost and droop controls, and a separate On-Off switch.

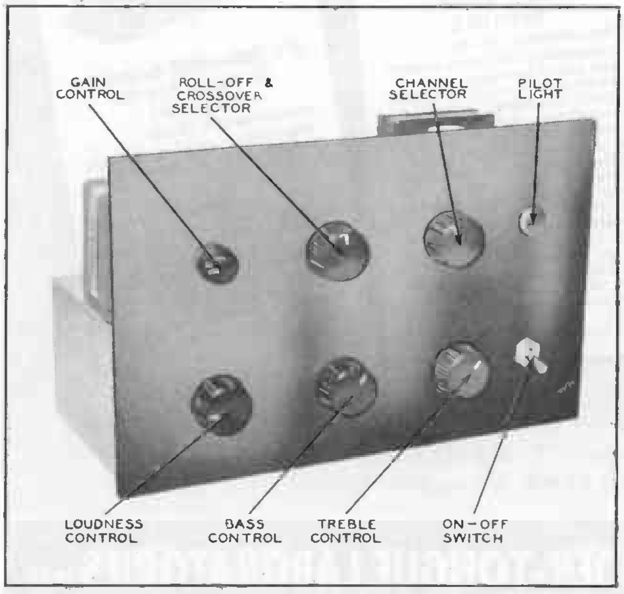


Figure 1. Panel View of Preamplifier and Control Unit.

Input No. 1 connects directly to the grid of the first section of tube V1 for operation with a variable reluctance phonograph cartridge. The phono preamplifier section is a well-known circuit, including a three position switch in the feedback network for selecting suitable equalization for different recording characteristics. No. 1 position of this switch gives a crossover at 500 cps and a rolloff about 1590 cps suitable for most late American made records including the Columbia 33-1/3 rpm and recordings made on the NARTB* curve, as well as the London FFRR 33-1/3 rpm records. Position No. 2, with a crossover frequency of 400 cps and a rolloff above 2500 cps, is suitable for RCA Victor 33-1/3, 45 and late 78 rpm records and recordings made on the AES# curve. Position No. 3, with a crossover at 350 cps and a rolloff above 4000 cps, is a compromise for various older 78 rpm recordings.

The channel selector switch when in No. 1 position connects the output of the phono preamplifier to the grid of V2A through the gain control R1. Positions No. 2 and 3 connect inputs No. 2 and 3 respectively. These are not equalized and are for AM-FM tuners, TV sound, crystal phonograph cartridges, etc.

The gain control R1 is useful in setting the operating level for operation of the loudness control, R2, through its most suitable range. The IRC type LC1 Loudness Control employed maintains a balance in treble and bass throughout the range of loudness levels, adding greatly to the listening pleasure. This compact control is available as a complete unit or can be made up of standard components.

The front section R2A is an IRC type Q11-133 500KΩ control, R2B, the second section, an IRC M13-137 1 meg. multisection, and an IRC M13-128 100KΩ multisection is used as the rear section. One 10KΩ and one 100KΩ 1/2 watt resistor, an 82 mmf. ceramic capacitor and a .03 tubular capacitor are connected as shown in the schematic in Figure 2. In this application of the LC1 loudness control, R2D, a 500KΩ M11-133 IRC multisection is added on the rear as a fourth section to control the output in the last stage, thereby reducing noise when the loudness control is at or near minimum. This is particularly effective when no signal is being applied to the amplifier.

---

* National Association of Radio and Television Broadcasters.

Audio Engineering Society.


Choose B-T
for the BesT
VHF and UHF
TV Amplifiers, Mixers, and
Distribution Units
Designed expressly for the Service Technician to enable him to plan and make any installation . . . whether a single receiver or a complete 2000-set Master Antenna System . . . at lower cost, and without outside engineering.
This is 'Packaged Engineering' . . . at its BesT.
B-T MIXER-AMPLIFIER
Model MA4-1
Operation: Mixes and feeds signals of 5 antennas to 1 TV receiver or distribution system. One input is broad-band for signals requiring no pre-amplification, and the remaining 4 accommodate separate plug-in strip assemblies. Several units may be ganged to serve any number of antennas.
Impedance: 75 & 300 ohms at all terminals.
Isolation: At least 35 db.
Plug-In Strips: CHANNEL STRIP CS-1—single channel, highly selective amplifier. One for each channel. Gain exceeds 17 db. Tubes: 6AB4 and 6CB6
UHF CONVERTER STRIP UC-1 lowers UHF signals to existing TV frequencies.
Installation: Ordinary screw-terminals. Require only a screw-driver and pliers.
Cabinet: Hammertone grey metal, 4 x 6 x 8¾ inches.
List Prices:
MA4-1 (less plug-in strips) $52.50
CS-1 (specify channel) each 19.50
UC-1 to be announced
B-T Distribution Amplifier
Model DA2-1
Terminals: 2 isolated TV outlets, 1 antenna or line input and 1 line output for additional distribution units.
Impedance: 75 and 300 ohms at all terminals, except line output of 75 ohms.
Isolation: At least 35 db.
Losses: None. Amplifies as it distributes.
Controls: None. Factory aligned.
Tubes: 2-6BC5.
Installation: Ordinary screw-terminals. Require only a screw driver and pliers.
Cabinet: Hammertone grey metal, 4 x 5 x 4 inches. Weighs 2½ pounds.
List Price $39.50
B-T Distribution Amplifier
Model DA8-1
Terminals: 8 isolated TV outlets, 1 antenna or line input, and 1 line output for additional distribution units.
Impedance: 75 and 300 ohms at all terminals, except line output at 75 ohm.
Isolation: At least 35 db.
Losses: None. Amplifies as it distributes.
Controls: Screw-driver control for setting uniform signal level at all sets in system. Other operations, factory-aligned.
Tubes: 3-6J6 and 1-6BC5.
Installation: Ordinary screw-terminals. Require only a screw driver and pliers.
Cabinet: Hammertone grey metal, 5¾ x 9 x 5½ inches. Weighs 6¼ pounds.
List Price $87.50
B-T Home Antensifier
TV Signal Amplifier
Model HA-2
Amplification: 24 db.
Impedance: 300 ohms at input and output terminals.
Controls: Amplifier bypass switch. No tuning. All-channel transmission, factory aligned.
Tubes: 3-6J6 and 1-12AV7 in a cascaded, push-pull circuit.
Operation: Fully automatic. Patented thermal switch turns unit on and off with operation of TV receiver switch.
Installation: Ordinary screw-terminals. Requires only a screw driver.
Cabinet: Hammertone Mahogany metal 4 x 4¾ x 7 inches. Weighs 4 pounds.
List Price $57.50
B-T Commercial Antensifier
TV Signal Amplifier
Model CA-1
Amplification: 28 db.
Impedance: 75 ohm and 300 ohms at input and output terminals.
Controls: Screw-driver gain control. No tuning. All-channel transmission, factory-aligned.
Tubes: 2-6J6 and 2-6BQ7 in a cascaded, push-pull circuit.
Installation: Ordinary screw-terminals. Require only a screw driver and pliers.
Cabinet: Hammertone grey metal, 8x4½x5 inches. Weighs 5 pounds.
List Price $77.50
IMAGINE!
You can install a complete packaged, B-T Master Antenna System with only a pair of pliers and a screwdriver.
Available at distributors from coast to coast, or write to our Service Department F for FREE Literature.
Standard RTMA Warranties Apply
B-T LABS
BLONDER-TONGUE LABORATORIES INC.
Mount Vernon 9, New York

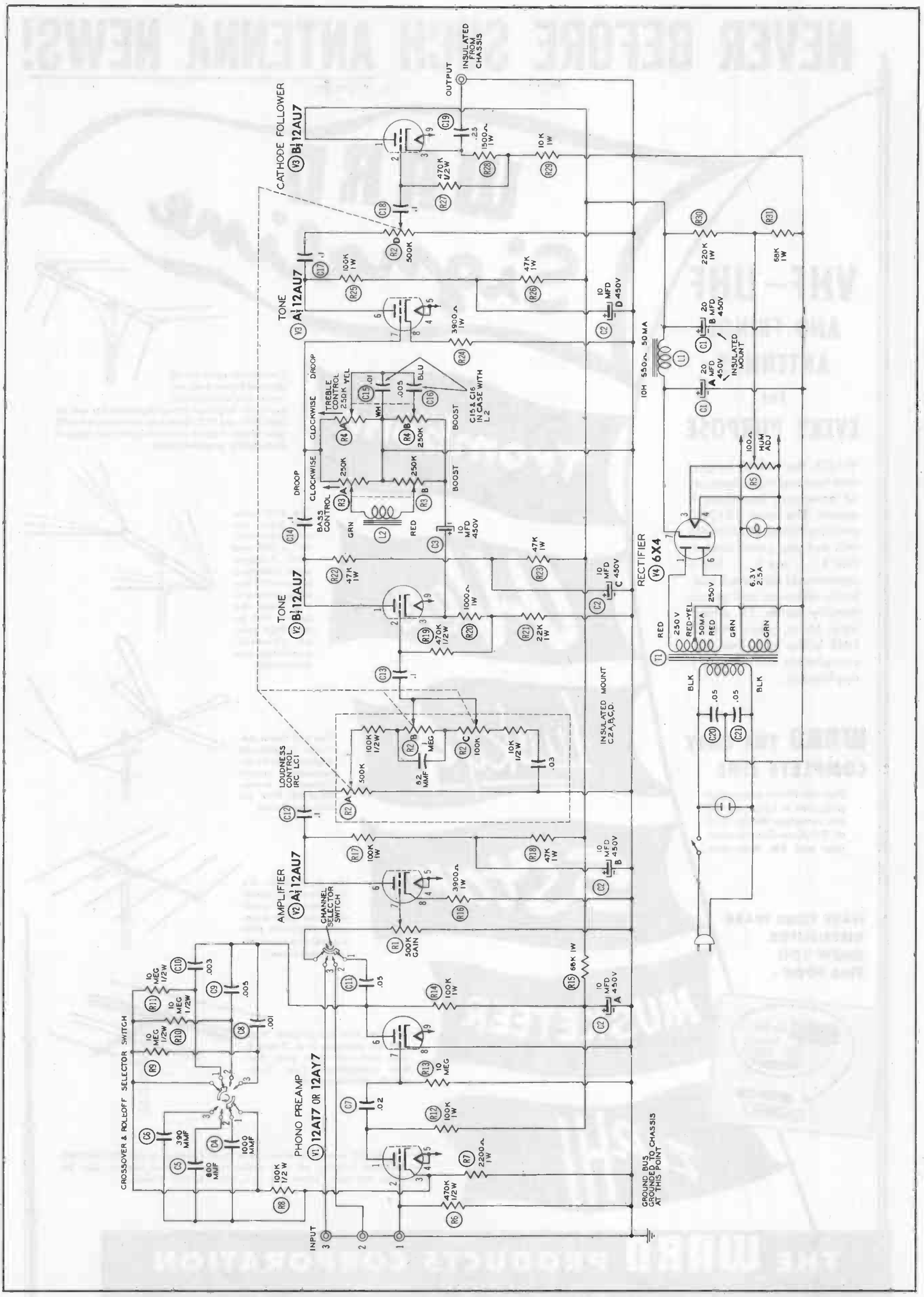


Figure 2. Schematic of Preamplifier and Control Unit.

NEVER BEFORE SUCH ANTENNA NEWS!

WARD Signaline

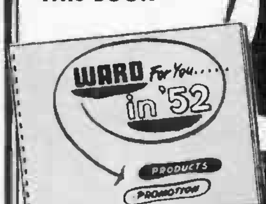
VHF–UHF AND FRINGE ANTENNAS for EVERY PURPOSE

WARD, the oldest, largest and leading manufacturer of antennas, has done it again. The new 1952-53 exciting WARD SIGNALINE will put you years ahead. Not 1 . . . not 2 . . . but 5 ingeniously designed, radically different and sensationally better TV antennas. Now, your WARD LINE is the only line that completely covers every application.

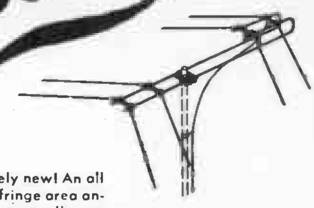
WARD THE ONLY COMPLETE LINE

Plus a brilliant promotion program to help you sell the complete WARD LINE of TV-Auto-Communication and FM Antennas.

HAVE YOUR WARD DISTRIBUTOR SHOW YOU THIS BOOK—

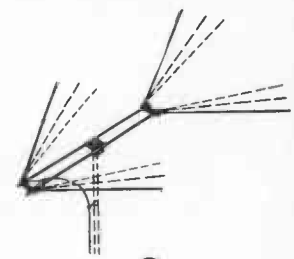


Trombone



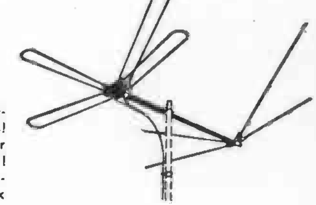
Completely new! An all channel fringe area antenna that actually outperforms Yagis on many channels! For use on both VHF and UHF. Opens up new markets with new ideas of good pictures! Light and rugged! Completely preassembled!

U-Vee



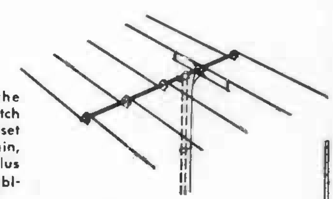
The first and only 3-in-1 antenna—for UHF, VHF — UHF and VHF. Protects your customers on new UHF stations, while giving them the best in VHF today! High gain, all-channel, completely preassembled.

Lucky 4



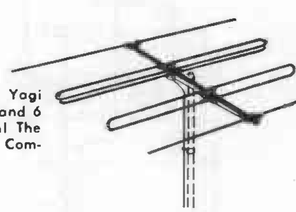
The first major advance in conicals! Higher gain! Better impedance match! Completely preassembled! With six extra features!

5 Star



The Yagi with the radar-proved T match and exclusive offset elements! Extra gain, extra efficiency, plus rugged preassembled construction.

MUSKETEER



The first true broad-band Yagi —covers channels 3, 4, 5 and 6 with uniformly high gain! The first triple-driven Yagi. Completely preassembled!

ZIP-HI

The new WARD telescopic mast made from corrosion-proof PERMATUBE! Four different heights, all with exclusive anti-collapse feature. Can be erected by one man. Comes in 2, 3, 4, and 5 section models.

THE WARD PRODUCTS CORPORATION

DIVISION OF THE GABRIEL COMPANY

1523 EAST 45 STREET • CLEVELAND 3, OHIO

L2, a Stancor C-2332-1 Tone Control Unit, and two Centralab BB-103 dual 250KΩ controls, are employed in the tone control section. This is a widely used non-resonant LCR variable equalizer circuit which allows a wide range of bass and treble boost or droop. The insertion loss of this type equalizer is not as high as those containing only capacitors and resistors. Capacitors C15 and C16 are contained within the case of the Stancor C-2332-1 Tone Control Unit.

The unbypassed bias resistor R20 and the high resistance of R21 in the cathode circuit of tube V2B result in a loss of output signal from this stage. But, in series with blocking capacitor C3, control sections R3B and R4B are in parallel with cathode resistors R20 and R21 to the AC signal. This is a means of varying the loss in this stage according to frequency, thereby varying frequency response.

With the dual control R3 in maximum clockwise position, bass is attenuated due to the high resistance in the cathode circuit of V2B and the shunting of low frequencies through choke L2 to ground, in the grid circuit of V3A. When the bass control R3 is in the maximum counterclockwise position, the bass receives maximum boost because of the low reactance of choke L2 to low frequencies, reducing the degeneration of low frequencies in the cathode circuit of V2B. There is now no loss of lows in the grid circuit of V3A, since choke L2 is now, in effect, removed from the grid circuit of V3A.

With the dual treble control, R4, in the maximum clockwise position, the high frequencies are given a maximum droop due to the shunting of control section 4A by capacitors C15 and C16, and also by the degeneration in the cathode circuit of V2B. Setting the treble control, R4, to maximum counterclockwise position results in maximum treble boost by the shunting of control section R4B by capacitors C15 and C16 reducing the degeneration of high frequencies in the cathode circuit of V2B. Also in this position there is no capacitive shunting in the grid circuit of V3A.

Any degree of boost or droop of the bass or treble between these extremes can be had by adjusting the appropriate control because of the action in both the cathode circuit of V2B and the grid circuit of V3A. Such flexibility of control is very desirable considering the variation of program material encountered. However, because of the wide range obtainable, such control must be used with discretion.

The output stage V3B is a conventional cathode follower permitting a long shielded cable to be used, when connecting to the power amplifier, without loss of high frequencies.

The power supply is also conventional with an AC receptacle, controlled by the On-Off switch, to furnish AC power for the power amplifier, tuner, etc. A 100Ω wirewound potentiometer, with the arm connected to the voltage divider resistors R30 and R31, functions as a hum adjustment.

The complete unit (Figures 3 and 4) was constructed on a standard 5" x 10" x 3" chassis. The placement of parts was given first consideration as hum and stray coupling cause trouble in low level circuits. The electrolytic capacitors and output connector were installed on insulated mounts and all grounds were made to a ground bus which connects to the chassis only at the input jacks. Such a ground bus is worth-while in the construction of audio equipment as it is good insurance against hum caused by ground loops.

As shown in Figures 1, 3 and 4, a temporary Masonite panel is used with no shielding other than the tube shields and that afforded by the open bottom chassis. A bottom shield and a metal panel should be installed to reduce the pickup of hum and noise. The mounting of the complete unit in a metal cabinet or box, constructed preferably of screen or perforated metal, to allow ventilation, would be a great aid in assurring quiet, hum-free operation.

This preamplifier and control unit has given excellent results with various amplifiers and different signal sources, making it a very useful piece of audio equipment.

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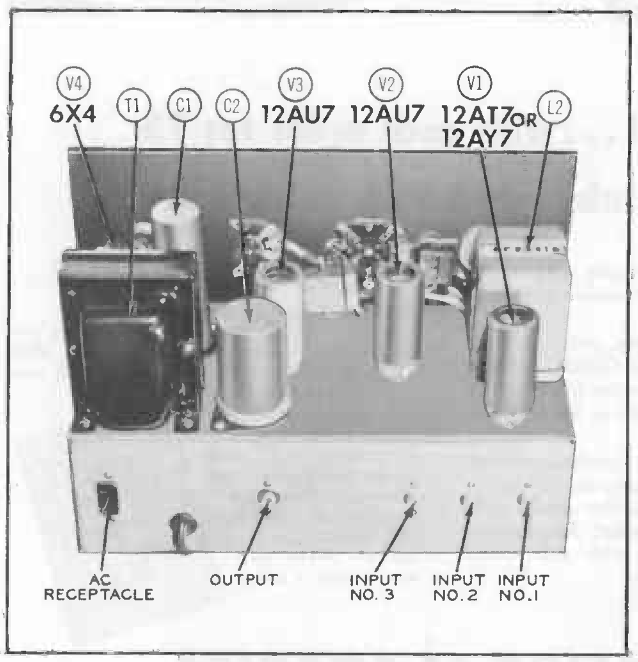


Figure 3. Top View of Preamplifier and Control Unit.

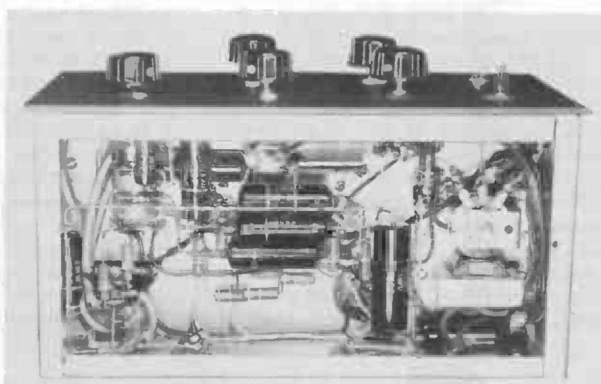


Figure 4. Bottom View of Preamplifier and Control Unit.

YOURS —Vol. I, II, or III . . . with each order for 75 RCA receiving tubes or 3 RCA kinescopes

THE RCA Tube Department proudly announces the publication of Volume III of the famous RCA TELEVISION PICT-O-GUIDE . . . another significant addition to the PICT-O-GUIDE series, recognized as the most useful, practical servicing information in the industry for helping you locate and solve TV troubles by picture analysis.

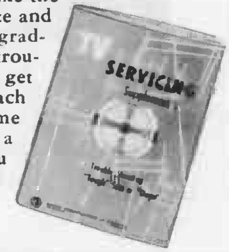
Authored by John R. Meagher, RCA's noted TV Service Authority, Volume III contains completely new data on television interference, built-in and external ghosts, hum troubles, and a host of trouble-shooting techniques applicable to all TV sets. It's information you can't afford to be without.

For a limited time only, you can have your choice of PICT-O-GUIDE Volume I, II, or III with each order for 75 RCA receiving tubes or 3 RCA kinescopes. It's as simple as that.

This is your chance to get the complete set of three matched volumes to bring your library up-to-date. But don't miss out on this limited offer! Place your qualifying tube order with your *RCA Tube Distributor* at once.

PLUS THIS BONUS

"TV Servicing Supplement"—*Trouble Shooting "Tough" Sets or "Dogs."* This indispensable book by John Meagher tells you how to handle the really tough TV sets . . . the ones that take the most time to analyze and repair. It's a "Post-graduate course" in TV trouble-shooting. You get a bonus copy with each Pict-O-Guide volume you earn. This is a bonus offer you won't want to miss!



RADIO CORPORATION of AMERICA

ELECTRON TUBES — **HARRISON, N. J.**

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

Dollar and Sense Servicing

FIRST MAN. On a street in London's Soho district back in 1926, an odd-looking, rather cranky character in baggy flannel trousers, carpet slippers and no socks stopped an office boy and half-coaxed, half-dragged the protesting lad to an upstairs room cluttered with sinister-looking paraphernalia. A proffered half-crown eased the tension a bit.

"Put out your tongue, William," the queer gentleman commanded. "Now turn your head." And then came a triumphant cry: "I saw you, William -- I saw you."

William went back to this house as a grown man a few months ago, to watch the unveiling of a simple plaque which read:

"In this house in 1926 John Logie Baird first demonstrated television."

FUTURE. The 109 existing TV stations serving 55% of our population will in five years be increased to over 500 stations bringing programs to 90% of the people, according to William Balderston, president of Philco. About 40 million sets will then be in use, of which around 10 million will be replacements for obsolete small-screen sets.

SALT. An impedance bridge and twelve tons of salt located a leak in 42-inch concrete pipe deep under the Detriot river after oranges and ping-pong balls failed to locate the trouble. The pipe was being buried in a twelve-foot trench in the river bottom, to serve as a raw-water intake line for Wyandotte, Michigan. During back-filling, a head of 20 feet of water was maintained in the pipe by plugging the river end and pumping in water. After 800 feet of pipe were covered, a leak equivalent to a 12-inch hole developed in the buried under-water portion. To avoid having to uncover the entire pipe, this leak had to be located accurately.

The method chosen involved pumping in water containing various substances and using detection apparatus in boats to determine where the substances first got into the river through the leak. Radioactive carbon, fluorescine dye, chlorine, ping-pong balls and oranges all were tried, but none gave positive results.

Finally a brine solution was pumped into the line after being made up from 12 tons of salt, and the conductivity of the river water was measured with a General Radio type 650-A impedance bridge connected to a test cell immersed in the water. As the boat crew moved out from shore over the pipe line, a pronounced deflection of the galvanometer was obtained about 650 feet off shore. Excavation here by divers verified the test, and repairs were quickly made.

MARTINIS. When unable to hire enough salesmen to cover their area, the Hatboro Appliance Corp. of Philadelphia staged a cocktail party for 100 owners of 10-inch TV sets. The result was sale of 12 new TV sets that evening, plus several range and refrigerator sales and many future leads. Cost of the evening was no more than the price of a good newspaper ad according to Electrical Merchandising.

SQUIRT. Advertising signs placed in show windows on the sunny side of the street generally fade out in a week or two, giving a shabby appearance to the entire shop. To combat this and get more use out of the valuable promotion material furnished by manufacturers, Veteran's Radio Service in Chicago uses Krylon Plastic Spray on the signs before they are put up. This squirted-on spray prevents fading and permits cleaning the signs with a plain dry cloth when they get dusty. The idea rated a $10 award by Philco "Philco Serviceman."

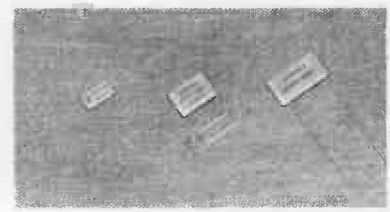
DOUBLES. Even television has gone in for doubles and dubbing. In a recent one-hour NBC operatic show starring Mimi Benzell, the script called for her to make 14 changes of elaborate period costumes, but did not provide enough off-stage time for these changes. One solution was use of an identically dressed double in long shots during dress-changing time, gesticulating properly in synchronism with the star's recorded voice.

When still more time was needed than could be covered with a long shot, the recording was played while the camera picked up the orchestra and director. To avoid a break in the sound when the star came on in new clothes, she sang in pantomime for the camera until the end of that recorded sequence.

BBB. An excellent new 12-page, two-color booklet on the problem of the day, entirely fair to servicemen, is "Things You Should Know About The Purchase And Servicing Of Television Sets." It emphasizes that television sets are not simple, that auxiliary equipment may be needed for best results in some locations, that reception can be affected by many types of interference which cannot always be corrected, and that the fine print in any service or sales contract should always be read and understood before signing. The booklet was prepared by the Service Committee of the Radio-Television Manufacturers Association in cooperation with the Association of Better Business Bureaus. Copies for distribution to your customers may be available from your local Better Business Bureau at approximately $4 to $5 per hundred copies.

CORDLESS. Dangling cords have been eliminated from Acousticon hearing aids by mounting the entire system on a headband that can easily be concealed by a woman's hair or a man's hat. There are two equal-size curved housings, one at each end of the

♦ ♦ Please turn to page 86 ♦ ♦

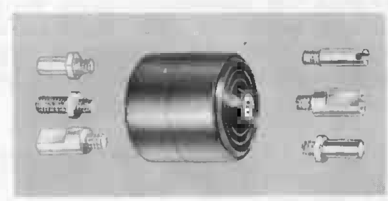


HIGH-VOLTAGE FLAT-PLATE CERAMICS ANNOUNCED BY SPRAGUE

The latest development in the ceramic capacitor field—a complete line of BULPLATE® "flat-plate" types for high-voltage uses—has been announced by Sprague. The amazingly small size of these new units permits them to be used almost anywhere.

Available Sprague BULPLATE types include ratings for 1000, 1500 and 6000 d-c working volts. Values range from 4.7 to 4700 mmf. for 1000-volt types; from 4.7 to 220 mmf. for 1500-volt types; and from 4.7 to 470 mmf. for 6000-volt capacitors. A feature is their extra-heavy moisture-resistant insulating coating. Conservatively rated for 85°C. operation, Sprague BULPLATES are ideal for television sets and other equipment where high temperatures so often wreak havoc with conventional capacitor types.

Bulletin M-479 containing complete details will be sent on request to Sprague Products Company, 105 Marshall St., North Adams, Mass.



THIS ONE HIGH-VOLTAGE TV CAPACITOR REPLACES 12 OR MORE TYPES

The new Sprague Type 20DK-T5 molded-case ceramic capacitor recently announced by the Sprague Products Company, North Adams, Mass. offers a simple solution to a vexing problem faced almost daily by television technicians.

This 500 mmf., 20,000 volt "doorknob" filter has been designed as a truly universal replacement for the dozen or more similar types used as original manufacturer's parts but which differ only in the type of terminal used.

This new capacitor is equipped with female-threaded brass inserts on both faces of the plastic case and is furnished with a complete set of thread-in terminals. From these, the serviceman can select any two he needs to fit the particular receiver he is repairing.

Thus, only one Sprague universal capacitor instead of a dozen or more exact replacements need be carried in the kit to assure on-the-spot repairs.

The new Sprague Type 20DK-T5 ceramic unit has a moisture-resistant, non-flammable case of thermosetting plastic. Molded guard rings surrounding the terminals lengthen the creepage path and protect against troubles from conducting dust particles which may collect on capacitors after installation.

INDEX TO PHOTOFACT

RADIO AND TELEVISION SERVICE DATA FOLDERS

No. 33

Covering Folder Sets Nos. 1 thru 170

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.

	Set No.	Folder No.
ADAPTOL		
CT-1	**48**	1
ADMIRAL		
Chassis UL5K1 (See Chassis 5K1)	**30**	
Chassis UL7C1 (See Chassis 7C1)	**25**	
Chassis 3A1	**2**	24
Chassis 3C1 (See Ch. 20T1) (Also see Prod. Chge. Bul. 15—Set 126-1)	**117**	
Chassis 4A1	**3**	31
Chassis 4B1	**24**	1
Chassis 4D1	**49**	1
Chassis 4H1 (See Chassis 30B1)	**71**	
Chassis 4J1, 4K1 (See Ch. 20A1)	**77**	
Chassis 4L1, 4S1	**100**	1
Chassis 4R1	**108**	3
Chassis 4T1	**143**	2
Chassis 4W1 (See Ch. 4T1)	**143**	
Chassis 5B1 (See Model 6T02)	**1**	
Chassis 5B1 Phono	**4**	24
Chassis 5B1A	**18**	1
Chassis 5B2	**100**	1
Chassis 5D2 (See Ch. 21B1)	**118**	
Chassis 5E2	**139**	2
Chassis 5F1	**57**	1
Chassis 5G2	**137**	2
Chassis 5H1	**26**	1
Chassis 5J2	**136**	2
Chassis 5K1	**30**	1
Chassis 5L2	**160**	1
Chassis 5M2	**157**	2
Chassis 5N1	**31**	1
Chassis 5R1	**59**	1
Chassis 5R2	**165**	3
Chassis 5T1	**68**	1
Chassis 5W1	**79**	2
Chassis 5X1	**76**	3
Chassis 6A1 (See Model 6T01)	**1**	
Chassis 6A2	**103**	1
Chassis 6B1	**48**	2
Chassis 6C1	**53**	1
Chassis 6E1, 6E1N	**6**	1
Chassis 6F1	*	
Chassis 6J2	**140**	2
Chassis 6L1	**26**	2
Chassis 6M1	**25**	1
Chassis 6M2 (See Ch. 6J2)	**140**	
Chassis 6Q1	**78**	1
Chassis 6R1	**54**	1
Chassis 6S1	**107**	1
Chassis 6V1	**62**	1
Chassis 6W1	**71**	1
Chassis 6Y1	**75**	1
Chassis 7B1	**18**	2
Chassis 7C1	**25**	2
Chassis 7E1	**36**	1
Chassis 7G1	**54**	2
Chassis 8B1	*	
Chassis 8C1 (See Ch. 8D1)	**67**	
Chassis 8D1	**67**	1
Chassis 9A1	**32**	1
Chassis 9B1	**49**	2
Chassis 9E1	**68**	2
Chassis 10A1	**3**	30
Chassis 19A1 Tel. Rec. (Also see Prod. Chge. Bul. 5-Set 106-1)	**59**	2
Chassis 20A1, 20B1, Tel. Rec. (Also see Prod. Chge. Bull. 23, Set 140-1)	**77**	1
Chassis 20T1 Tel. Rec. (Also see Prod. Chge. Bul. 15-Set 126-1 & Bul. 26—Set 146-1)	**117**	2
Chassis 20V1 Tel. Rec. (See Ch. 20T1) (Also see Prod. Chge. Bul. 15—Set 126-1 and Bul. 26—Set 146-1)	**117**	
Chassis 20X1, 20Y1, 20Z1 Tel. Rec. (Also see Prod. Chge. Bul. 7 -Set 110-1)	**100**	1
ADMIRAL—Cont.		
Chassis 21A1 Tel. Rec. (See Ch. 20A1) (Also see Prod. Chge. Bull. 23, Set 140-1)	**77**	
Chassis 21B1, 21C1, 21D1, 21E1 Tel. Rec. (Also see Prod. Chge. Bul. 25 Set 144-1)	**118**	2
Chassis 21F1, 21G1 Tel. Rec. (Also see Prod. Chge. Bull. 30, Set 156-2)	**135**	2
Chassis 21H1, 21J1 Tel. Rec. (See Ch. 21B1) (Also see Prod. Chge. Bul. 25 -Set 144-1)	**118**	
Chassis 21K1, 21L1 Tel. Rec. (See Ch. 21F1)	**135**	
Chassis 21M1, 21N1 Tel. Rec. (See Ch. 21F1) (Also see Prod. Chge. Bul. 30, Set 156-2)	**135**	
Chassis 21P1, 21Q1 Tel. Rec. (See Ch. 21F1) (Also see Prod. Chge. Bul. 30, Set 156-2)	**135**	
Chassis 24D1, 24E1, 24F1, 24G1, 24H1 Tel. Rec. (Also see Prod. Chge. Bul. 9 -Set 114-1)	**103**	2
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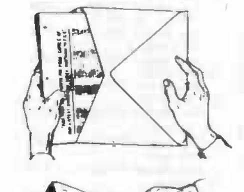
IMPORTANT

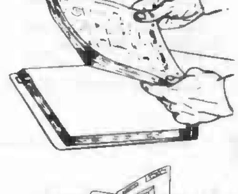
Quick, Easy PHOTOFACT Filing Method

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.

ALWAYS REFER TO THE PHOTOFACT INDEX

RCA VICTOR

IMPORTANT

How to obtain PHOTOFACT Volume Labels

A certificate redeemable for a complete set of Volume Labels for PHOTOFACT *Volumes 1 through 10,* is included in PHOTOFACT *Set No. 62.* A certificate redeemable for a complete set of Volume Labels for *Volumes 11 through 20,* is included in PHOTOFACT *Set No. 102.*

Simply mail these certificates to Howard W. Sams & Co., Inc., for your free Sets of Labels.

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How to obtain Service Data on Pre-War Models

Photo copies of schematics covering pre-war (prior to 1946) receivers can be obtained by regular PHOTOFACT subscribers at 50¢ each (our cost). Additional data can be supplied at a nominal cost per page. When requesting pre-war data, please mention the name of the Parts Distributor who supplies you with your PHOTOFACT Folder Sets.

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(Continued from Page 19)

utilized for re-inserting the direct current component to a video signal. This same voltage functions to bias the tube at a level which permits tube conduction only during sync pulse time. In order for the two described actions to occur in a tube, the bias voltage must be held fairly constant between the time of the sync pulses. This is provided by a cathode bypass capacitor. The time constant of the circuit (determined by the values of the resistor and capacitor) is selected to maintain the cathode voltage constant over the period of one frame of scanning.

This voltage is dependent upon the amplitude of the sync pulses above the average AC axis of the applied video signal. For light scenes the sync pulse amplitude above the AC axis is greater than that for dark scenes.

In the circuit of Figure 6-22, a triode tube employing cathode bias functions as a sync separator and DC restorer. With no signal applied, the tube conduction is held to a minimum, due to the high value cathode resistor. When a video signal is applied to the grid, the positive going sync pulses increase tube conduction and consequently the cathode voltage is increased. Without a cathode by-pass capacitor, the cathode potential would follow in step with the variations of the applied signal. However, the cathode voltage is held constant since the capacitor charges to a level determined by the amplitude of the sync pulses above the AC axis of the applied signal. Through the correct choice of cathode resistor and capacitor values, the tube bias is maintained to allow tube conduction during sync pulse time only.

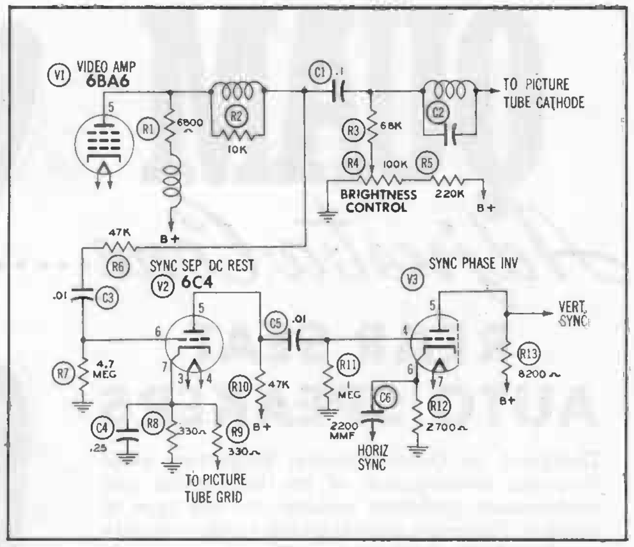

Figure 6-23. A commercial Type DC Restorer and Sync Separator Circuit.

Typical Combination DC Restorer and Sync Separator Circuits -

A popular type circuit functioning as a combination DC restorer and sync separator is shown in Figure 6-23. A signal with positive-going sync pulses is capacitively coupled to the grid of a triode tube. The time constant of the .01 mfd. coupling capacitor and the 4.7 meg. grid resistor is 47,000 microseconds. This means that the bias developed on the grid of this

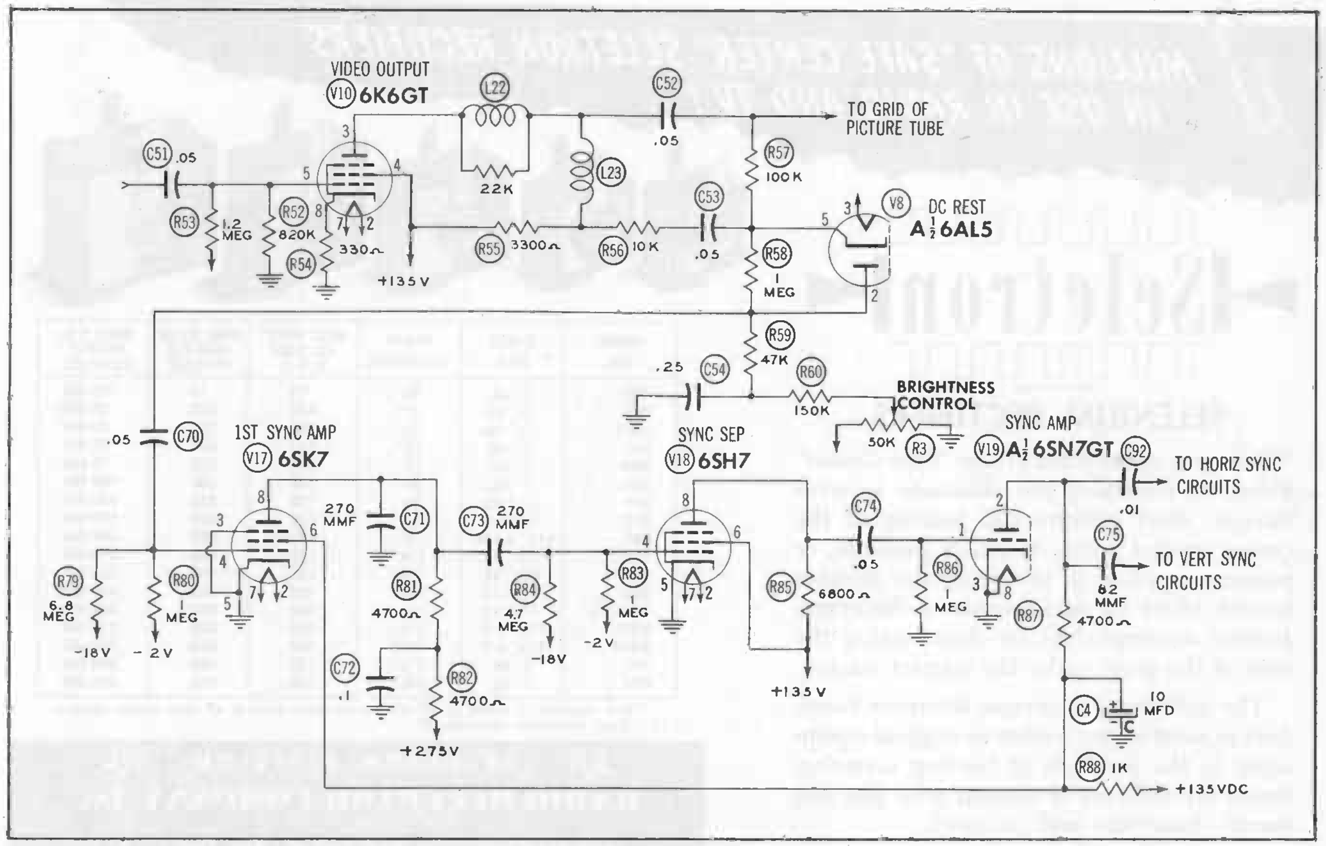

Figure 6-24. Combination DC Restorer and Sync Separator Circuit Used Commercially.

tube will be maintained fairly constant between sync pulses. Only the extremes of the sync pulses or sync tips will be capable of charging this capacitor. The very large 330,000 ohm cathode resistor will effecttively bias this triode to a level approaching cutoff. Thus there will be tube conduction only during the extreme swing of the positive going sync signal. The 47,000 ohm plate resistor also maintains the plate voltage at a low level such that tube saturation is readily accomplished for positive signal swings. Since this tube is biased by both grid leak action, due to the tube drawing grid current, and the self bias developed from the large cathode resistor, the cathode potential developed is a direct function of the amplitude of the sync pulses above the AC axis. The cathode resistor is shunted by a .25 mfd. capacitor which holds the developed cathode voltage at a fairly steady level. The RC time constant of this combination is 82,500 microseconds.

Between horizontal sync pulses, or approximately each 63 microseconds, the discharge of the shunting capacitor will be minute, thus permitting only sync tips to effect conduction. The voltage developed at the sync separator cathode is fed through a 330,000 ohm resistor to the grid of the picture tube. This places a potential on the picture tube grid that is proportional to the brightness of the televised scene.

This tube performs two functions. It produces a variable bias voltage for the picture tube. It also provides a sync signal in the triode output that has most of the picture information removed.

V3, is employed as a sync phase inverter to provide correct polarity sync signals to the appropriate vertical and horizontal circuits. Note that the vertical sync pulses are taken off at the plate of V3, while horizontal pulses are taken from the cathode. Not only are correct polarity output signals obtained but isolation of the horizontal and vertical circuits results.

A very effective sync separation method is employed in the circuit shown in Figure 6-24. Although this circuit is one of the better sync separation circuits used in television receivers, its disadvantage lies in the number of tubes required and its large current requirements.

In this circuit, negative-going sync pulse are taken from the plate of the diode DC restorer and applied through an .05 coupling to the grid of a type 6SK7 remote cutoff tube. Amplification of the signal, with polarity inversion, provides a signal in the output with adequate swing for application to the sync separator tube. A sharp cutoff pentode type 6SH7 is employed as the sync separator tube. This stage is biased to cut off with a fixed bias of 5V. Only the positive swings of the sync signal are sufficient to cause tube conduction.

The sharp cutoff characteristics of the 6SH7 tube cause the sync signal to cut off electron flow in the tube. Signals representing picture information, being more negative than the sync pulse, occur during the period when the tube is cutoff. Thus only sync pulses are present in the output of the sync separator. The following triode section of a type 6SN7 tube is connected as a sync amplifier. With negative sync pulses applied to the grid of this triode the tube is readily driven to cutoff condition. In other words, this triode acts as a clipper to the sync pulses. This means that sync pulses are leveled off so that constant amplitude signals are applied to the horizontal and vertical sync circuits.

"SHOP TALK" (Continued from Page 5)

To repeat, when making voltage comparisons between similar circuits in different receivers, use the voltages between elements.

The foregoing illustration has dealt with the horizontal AFC circuits but identical situations exist in other sections of the receiver. The widespread use of a relatively few types of tuners makes voltage companisons here quite feasible. In the video IF stages, the majority of sets employ voltages which fall between 125 and 140 volts. The latitude is greater in this section since voltages as low as 95 volts and as high as 300 volts will be found. However, the 125 to 140 volt range will be most common.

In the sweep systems, there are two approaches to the problem. One, by comparing DC operating voltages, has already been noted. The other approach, which is, in certain respects, even more reliable, is by the measurement of the peak-to-peak voltage of the deflection wave which is applied to the control grid of the output amplifier. In the horizontal system, peak-to-peak driving voltages, usually in the order of 75 to 100 volts, are used for picture tubes ranging from 16 to 20 inches. 21 and 24 inch tubes may range to approximately 120 volts peak-to-peak driving voltages. When voltage doublers are employed in the high voltage circuit, less than 75 volts peak-to-peak driving voltage may be successfully employed. Lower driving voltages will often be found for the 6CD6G tube. This tube is equivalent to two 6BG6G tubes and it is possible to inject less driving voltage and still obtain the required picture width and high voltage.

In the vertical sweep system, the peak-to-peak voltage which is fed to the grid of the output amplifier ranges in most sets between 80 and 130 volts. This is generally true where the output tube is a triode, or a pentode in which the screen grid and the plate are tied together. This range of driving voltages will be found for 16 to 20 inch picture tubes. For 21 and 24 inch tubes, driving voltages extending as high as 180 volts are not uncommon.

It will also be found that less than 80 volts peak-to-peak may be sufficient for longer picture tubes (such as the 16LP4) and circuits using parallel output triodes. A higher driving voltage may be available in these circuits but sufficient height can be obtained with lower voltages.

As an illustration of how these peak-to-peak voltage ranges may be used, consider a 16-inch receiver in which the picture height is approximately half of what it should normally be. Rotating the height control fails to provide the necessary picture height. When the peak-to-peak driving voltage is measured

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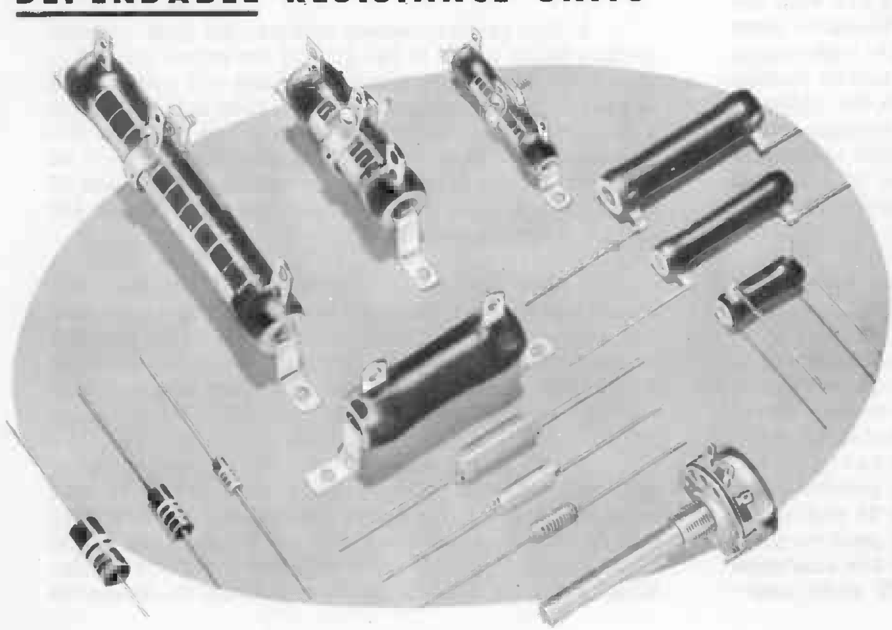

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at the grid of the vertical output tube, its value is found to be 90 volts.

From these facts it would appear that the vertical output tube is receiving enough driving voltage to provide a full picture. Attention should thus be directed toward the vertical output tube and the circuit which follows it. This would be the output transformer and the vertical windings on the deflection yoke. In this particular instance, based on an actual case history, it was found that some of the turns in the vertical output transformer were evidently shorting, because replacing the unit restored the picture to full height.

Had it been found that the peak-to-peak value of the deflection voltage was perhaps in the order of 40 volts, then attention would have been directed to the circuits preceding the vertical output stage.

While the peak-to-peak voltage ranges given may not provide the service man with as exact values as he might desire, still, they will enable him to determine to a large extent how well the circuit is operating. Undoubtedly there will be instances when values less than those given will enable the set to perform satisfactorily. With as many variables as we have on television sets, it is obviously impossible to provide data which will be universally true. What we are attempting to do is to gather enough data to help us deal with most sets. Beyond that, the service man will have to rely upon his judgment and experience.

REVIEW. The preoccupation with television by a large segment of the service industry has almost tended to obscure the fact that there are still many, many more millions of radio sets in use and that these, too, must be serviced. Also, those of us who have been in this service business for some time tend to forget that we were once beginners, eyeing each repair job as an adventure in a strange and somewhat bewildering field. The strangeness has long since left; we are never quite sure about the bewilderment.

To those who are just entering the radio servicing field, the following article touching upon AC-DC receiver troubles, should be of great interest.

"AC-DC Hints for the New
Service Technician"
by Richard Lawrence

Radio Maintenance Magazine
May, 1949

By far the greatest number of radio sets in use are of the transformerless AC-DC variety. The chances are greatest, then, that this will be the type of set the new service man will first be called upon to repair. Consequently, it is to the service man's advantage to be able to recognize and correct typical faults without having to go through time consuming trouble shooting procedures. After all, when a set cost only $15 to $35 originally, the service charge must be held to a minimum.

TUBE FAILURE. In radio - as in television - you will find that tubes are a frequent source of failure. The chief difference, however, is that in AC-DC radio sets there is a greater proportion of burned out filaments. If the receiver will not light up when turned on, you can be almost certain that one of the tube filaments has opened up. The fastest way of locating the defective one is to take out each tube separately and check the continuity of its filament with an ohmmeter.

If the set is fairly new and changing one tube brings it back to life again, your job is substantially finished. But if the set is several years old, it may be wise to test the rest of the tubes in a tube tester - replacing weak ones to insure proper performance. This is especially useful in the case of rectifier and output amplifier tubes. Changes in the operating efficiency of these tubes will have a considerable effect on the quality and volume of the sound output.

DEFECTIVE FILTER CAPACITORS. Another frequent source of trouble is open or leaky filter capacitors. Open filter capacitors are generally easier to spot because their effect on the sound is more pronounced. The hum level will be loud, even with the volume control turned down. Whatever signal reception is heard will be weaker than normal and considerably distorted, as if the broadcast station had a bad case of laryngitis. Filter capacitor values range between 20 and 50 mfd. with 150-volt rating. Multiple section units are most commonly employed, since they are lower in cost than separate units and require less space. Replacements should come as close to the original values as possible although considerable leeway is permissable. For example, a 30 mfd. capacitor can easily be replaced by a 40 or 50 mfd. unit.

Sometimes filter capacitors become leaky instead of open. In this case the hum level will be closer to the normal value, and less distortion will be noticeable; reception, however, will be weaker. Plate and screen voltages may drop 30 to 40 volts. Again replacement is the only remedy.

RECTIFIERS. Weak rectifiers, either vacuum tubes or selenium units, will also cause low B+ voltages. Tubes are readily checked on a tube tester; selenium rectifiers require a somewhat different approach as outlined in this column in the January, 1951 issue, No. 24, of the PF INDEX and Technical Digest. Since it is generally simpler to substitute a new unit, most service men follow this procedure. During this operation, keep in mind that the soldering iron and the solder should not be brought in contact with the plates, nor should the iron be applied to the terminals for long periods of time. Also, in mounting the unit under a chassis, keep the plates in the same plane as the original rectifier and see that there is adequate ventilation.

MODULATION HUM. Modulation hum is another common trouble. This will be heard only when a station is tuned in, and turning down the volume decreases it. A .05 mfd., 600-volt paper capacitor connected from the rectifier plate to B minus will cure nearly every case of this type. Sometimes the chassis is B minus and sometimes it is a common bus wire, isolated from the chassis. However, it will almost invariably be found that the receiver side of the On-Off switch is a B minus point and so connecting the low side of the .05-mfd. capacitor here will do the trick.*

In some sets, the .05-mfd. capacitor is connected between plate and cathode of the rectifier tube. Usually the modulation hum appears when this unit opens up. Should the capacitor in this position be-

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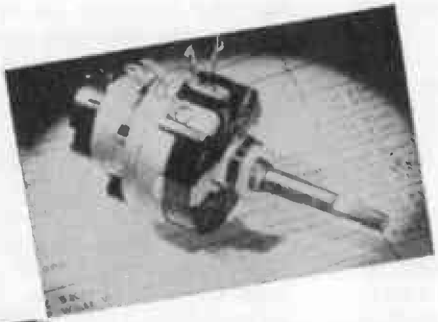

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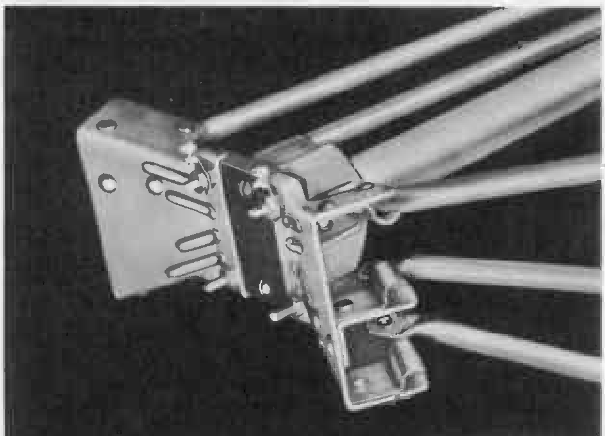

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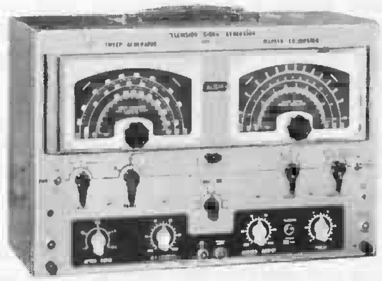

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come shorted, it will burn out the tube. Replacing this tube with another, without correcting the fault, will produce the same result. This is a point to keep in mind when you come across burned out rectifier tubes.

ADDITIONAL TROUBLES. Other assorted difficulties which you will meet in your daily work include noisy volume controls, rubbing speaker cones, and shorted bypass capacitors.

The best remedy for a noisy volume (or tone) control is replacement with a new unit. In some cases, emergency or temporary repair may be made by cleaning the offending unit with carbon tetrachloride or such compounds as "No Noise" or Walsco's "No-Ox."

- - - -

* This is true of AC-DC circuits and not necessarily of transformer operated receivers.

Rubbing speaker cones give a lot of trouble. Here again, replacement rather than repair (when it can be done) works in your favor. A customer may feel unhappy about paying for a new speaker, but charging less for temporary repairs will usually irk him more when he has to bring the set in again.

Shorted coupling or bypass capacitors are not as frequent an occurrence as the previous troubles listed. The operating voltages are low and capacitors do not have to bear any unusual stress. The greatest amount of trouble comes from the coupling capacitor between the first audio tube and the output amplifier or from the bypass between the plate of the output tube and B minus. In the first instance, the set may continue to function but the sound will be quite distorted. In the second case, the rectifier tube will burn out because there is essentially a short circuit being placed across the B+ line. In replacing these capacitors, use those having 400 or 600 volt ratings. It is not recommended that 200-volt capacitors be used, even though these may have been in the set originally.

INTERMITTENT OPERATION. This is, without a doubt, the most difficult trouble of all to solve. And it is difficult because it seldom stays around long enough to get itself identified. Now you see it; now you don't. It is in the same category as colds. No doctor can cure a cold. But if you are fortunate (?) enough to have the cold develop into pneumonia, then the situation becomes entirely different. Now the doctors know what to prescribe.

When you are called upon to fix an intermittent set, your first job is to find out as much about it as you can from the set owner. Find out how long the set has been acting this way. Does it happen at any specific time of day (or night)? Must the set first play for a while or does it appear at once? Can the set be brought back to normal by jarring or striking it? Does it go completely dead or does it merely change volume? How does the set come back to normal? There are many more questions that could be asked but those listed here will serve to indicate what sort of information is desired. Listen to the answers carefully, making notes of pertinent points.

As an indication of what these answers can tell you, suppose it is found that the set acts up only during certain parts of the day. Then the chances are good that line voltage fluctuation is the cause. In many rural and suburban areas the line voltage varies considerably over a 24-hour period and when it drops too low, the set may cut out.

Intermittents that develop after a set has been on for a while usually mean that heat is causing the breakdown. If this is the trouble, many service men have been successful in causing the set to break down completely by applying heat, in turn, to the various components in the set. The heat can be obtained from a soldering iron (placed close to but not on the suspected part) or a heat lamp whose rays are directed by using a wooden board having a small hole. Sometimes, raising the applied voltage to perhaps 125-128 volts by means of a variac will cause the defective part to break down completely. This approach, if followed, should be carried out with care else even good parts will be destroyed.

One procedure for localizing an intermittent trouble to a certain section of the receiver is to connect a VTVM across the AVC line. When the set goes dead, check the VTVM. If its reading is still the same, the trouble lies beyond the second detector; if the reading has changed, the defect lies in, or ahead of, the detector.

Capacitors are a common cause of intermittent trouble. When the set goes dead, carefully bridging each coupling and by-pass capacitor with a good unit may lead you to the culprit. But care must be observed because even the slightest jarring can bring the set back to life. Another common fault is intermittent speaker trouble, caused by the voice coil becoming frayed.

Quite often a badly soldered connection will be the cause of the trouble. Give the radio a very careful inspection, probing all joints and parts with a wood or bakelite rod.

Tube filaments that open up when they become hot and then remake connection on cooling often stump the beginner. Metals expand with heat and when the filaments heat up, the broken ends separate. This opens the series filament circuit and causes the set to cease operating. When the filaments have cooled sufficiently, the broken ends meet; the electrical path is once again complete and the set begins to play. This cycle may be repeated slowly or it may occur with machine gun rapidity.

For the quick acting type, tube substitution is recommended. Try one tube at a time to be sure you get the right one. For the slow acting intermittent, connect an AC voltmeter across the filament prongs of each tube in turn. If there is no reading (with the set dead although the receiver switch is "on"), the tube is O. K. When you find a tube with full line voltage reading across the filament, you have found the open one. The same procedure applies to series dropping resistors if there are any in the receiver.

Books can be written on intermittent troubles and how to attack them. The foregoing will give you some idea of what to expect and how to go about locating the defect. With experience you will soon develop your own approach and, on the really tough ones, your own language.

Good luck!

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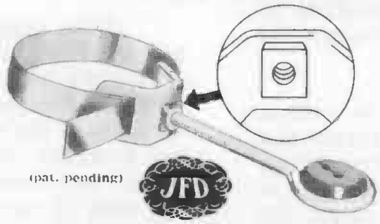

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"SIGNAL SUBSTITUTION" (Continued from Page 13)

the air," sync signals will be present at the take-off point and normal operation will be provided.

Let's return to our initial test at the video detector load and assume that our test at that point provided a picture, indicating that the video amplifier stages were operating properly. It is now evident that the trouble must lie in the video IF stages. To determine exactly which stage is inoperative, couple a modulated RF signal to the antenna terminals, tune the Videometer and the receiver to the same channels and trace the signal through the video IF stages using a detector probe and a scope. When the defective stage is located, substitution of the tube, or a voltage and resistance check should reveal the defective component.

Some technicians may prefer to substitute tubes in the defective block rather than tracing the signal. This procedure, of course, is satisfactory and since there is a great possibility that the trouble lies in a tube, the trouble, in many cases, can be located by this method. However, by considering the time it takes to select the tube from stock, inserting it in the set and allowing for warmup time, for perhaps three or four tubes, the defective stage could have been located much more quickly by the signal tracing method previously outlined. After the stage is located, tube substitution may then be tried. If this fails to correct the trouble, the technician now knows that the trouble is definitely in that stage and may perform whatever servicing procedure is required to locate the defective component.

Next, couple the modulated RF output of the Videometer to the antenna terminals. Set the output at 1000 microvolts. Tune the receiver and Videometer to the same channels and connect a scope across the video detector load. If our original assumption is correct (that overloading is occurring in the RF or IF stages), the sync tips will be compressed or perhaps completely removed. Such a condition is shown in Figure 7. Note that the amplitude of the vertical sync signals is compressed. If the waveform is normal, increase the output of the RF signal from the Videometer while observing the waveform. Watch for any tendency of compression of the sync pulse. If compression occurs, adjust the output level of the Videometer to a slightly greater level than the point where the overloading

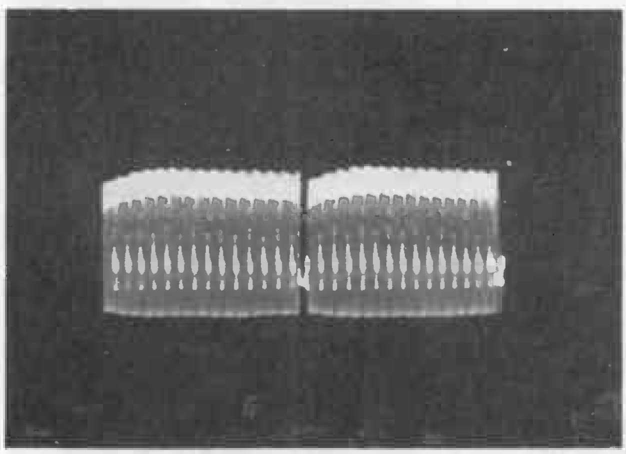

Figure 7. Overloading in RF or IF Stages Causing Sync Compression.

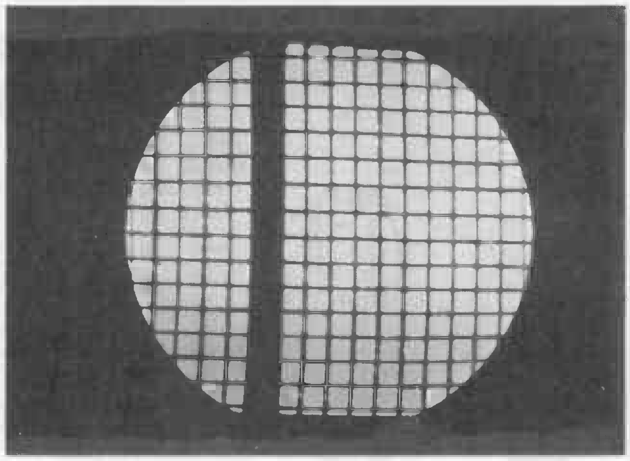

Figure 8. Horizontal Pulling or Phase Displacement.

started. Since this trouble is most likely to be caused by a defective AGC stage, a check on this stage should be made. If operation of the AGC stage seems normal, check the AGC filter network. There may be an open resistor or shorted capacitor.

If the trouble is still present, trace the signal through the IF strip, using a scope and detector probe. After the stage is located it is usually possible to locate the defective component without too much difficulty.

In the majority of cases, synchronization troubles are caused by defective sync separator stages. The overload condition was discussed here, since its cause can be very difficult to find. The injection of the composite video signal at the video detector load showed that the trouble was ahead of this point and considerable time was saved which might otherwise have been used to analyze the correctly operating sync separator stages.

Going back to the initial test at the video detector load, let's assume that synchronization was not obtained with this setup. It is now known that the trouble must lie in some succeeding stage (blocks 5 or 6).

In the case of the particular receiver under test, horizontal pulling was experienced as shown in Figure 8. By varying the amplitude of the video signal, the vertical black bar would shift back and forth and at times would "jitter" and bend wildly. Adjustment of the horizontal frequency and phasing controls did not correct the trouble. Thus it is probable that the trouble lies in the sync separator stages necessitating the tracing of the signal through these stages. A schematic of the circuit is shown in Figure 9.

The video level should be set to approximately 1 volt peak-to-peak. While tracing the signal, the horizontal and vertical lines should be left on (the 900 cycle and the 315 kc buttons). This is done so that the separators can be checked for their ability to remove the picture information (in this case the crosshatch signal) from the signal.

When setting the Videometer for a 1 volt video signal, a voltage calibrator should be used. The meter in the Videometer is rather difficult to read at these extremely low ranges, and since a signal of

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"That sounds serious—do I need a new tuner?"

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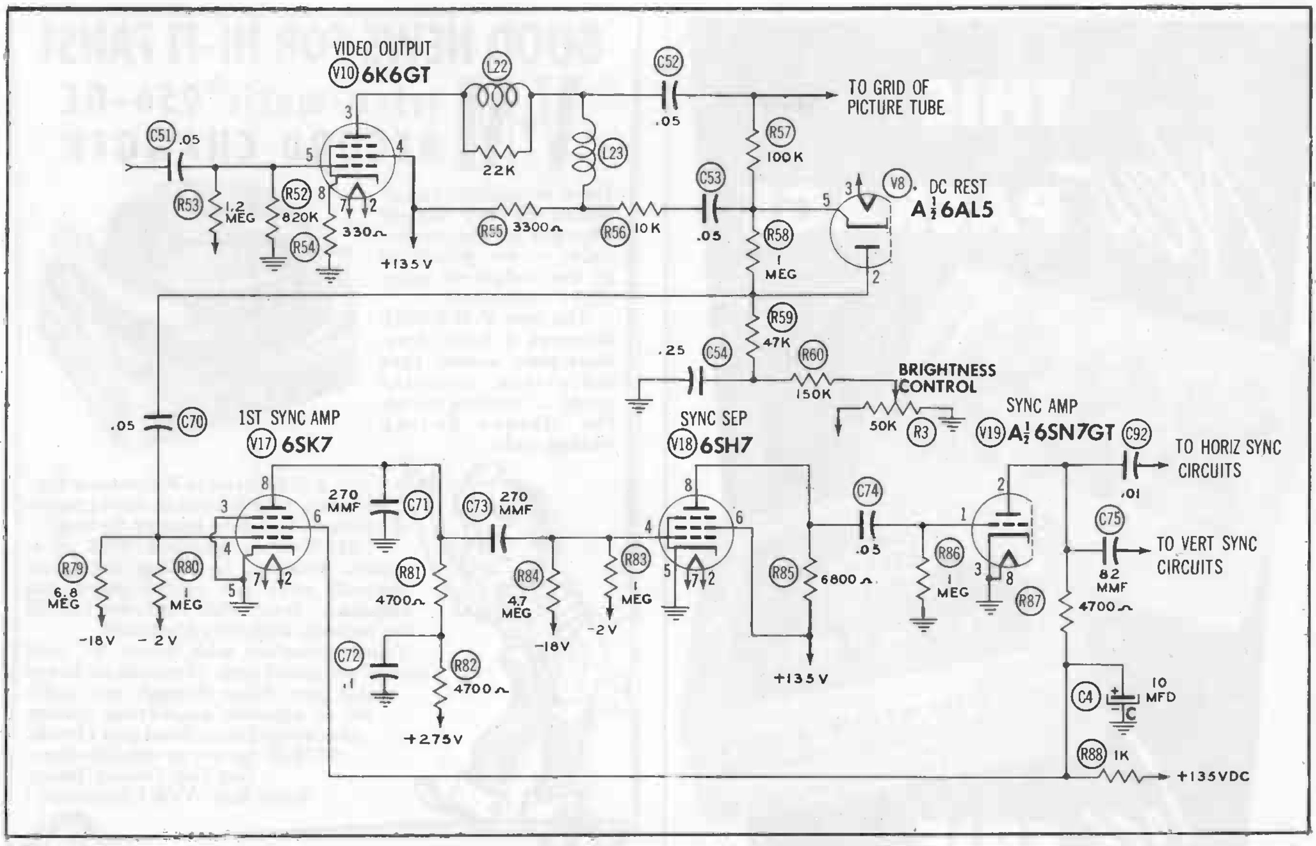

Figure 9. Typical 3-Stage Sync Separator Circuit.

too great amplitude might cause overloading of the normally operating stages, this extra precaution might save considerable time.

An alternate method for signal injection would be to couple the RF output of the Videometer to the antenna terminals and tune the Videometer and the receiver to the same channel. This method should not be used, however, if keyed AGC is employed in the receiver since interaction may result. Also when using this method of signal injection, make sure the Videometer and the receiver are properly tuned. If they are not, a distorted signal may result.

The waveform of Figure 10 is that obtained at the plate of the DC restorer tube, V8A. The amplitude of the signal is 3 volts peak-to-peak. Note that there is some video information present in the signal. This is normal at this point and for some types of video signals an even greater amount of video information will be present.

The signal is then coupled to the grid of the first Sync Amp., V17, where the pulse is amplified. After connecting the scope to pin 4 of the Sync Sep. tube, V18, however, it is found that an improper signal is present at that point. The signal which was obtained is shown in Figure 11. Note that instead of the sharp positive spike which was expected, a wide pulse with a negative-going reversal is obtained. Since this is not the normal signal at this point, the trouble must lie in the previous stage or the coupling components. Changing the 6SK7 had no effect. Measurements of the voltages produced normal readings except for that of the grid of the Sync Sep. tube, V18. This tube was operating with decreased bias. Measurement of the coupling capacitor, C73, disclosed that it had an internal resistance of about 1 megohm. After replacing this capacitor, the operation of the set was normal. The waveform shown in Figure 12 was then obtained on the grid of V18, which is the normal signal. It is interesting to note that the improper signal had an amplitude very near that of the normal signal. Thus it is important that the shape of the waveform be given as much attention as the amplitude.

Sound Normal, No Raster. Assuming the set employs a flyback type system, the trouble must be in either the horizontal sweep circuit, the high voltage

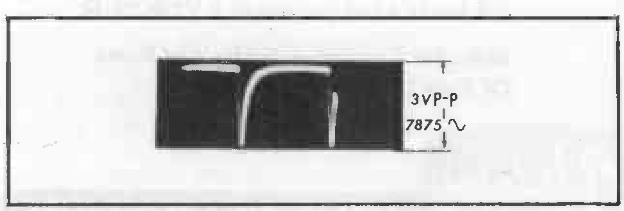

Figure 10. Waveform at Sync Take-off Point (Pin 2 of V8A.)

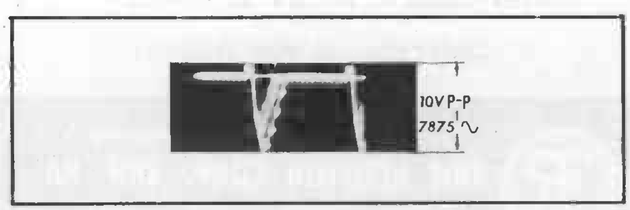

Figure 11. Waveform at Grid of Sync Separator (Pin 4 of V18) (Abnormal Signal).

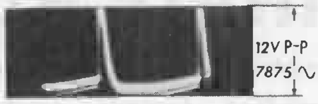

Figure 12. Normal Signal at Grid of Sync Separator (Pin of V18).

circuit, or the picture tube. A check on the high voltage will disclose whether the proper high voltage is being applied to the picture tube. For the sake of illustration, let's say that there is no high voltage. This sometimes gives the technician a sort of helpless feeling since the picture tube, which can normally be used to analyze sweep failures, is now of no value in this connection, due to the absence of a raster.

By applying the 15,750 cycle sawtooth sweep voltage, available from the Videometer, to the grid of the horizontal output tube, it can be determined whether the trouble lies in the horizontal oscillator circuit or in the output stage. If a raster is obtained by injecting this signal, the trouble must be in the horizontal oscillator circuit. If no raster is obtained, the trouble must be in the output stage or high voltage circuit.

In some cases this trouble is particularly hard to locate. By being able to definitely determine which stage failed, considerable time can be saved in servicing the receiver.

A sawtooth voltage at 60 cycles is also available for checking the vertical circuit in a similar manner.

To try to enumerate all of the possible applications of an individual test equipment construction is not the intent and is certainly beyond the scope of this approach to signal substitution procedure. The number of applications of the Videometer, for example, is limited only by the degree of skill, understanding and ingenuity of the technician.

As additional information or techniques are developed in signal substitution procedure, such data will be made available in future issues of the PF INDEX and Technical Digest.

We wish to extend acknowledgement and our deep appreciation to the Hickok Electrical Instrument Company for their action in supplying a good portion of the illustrative content for the "Signal Substitution" series.

"AUDIO FACTS" (Continued from Page 45)

PARTS LIST AND DESCRIPTIONS

CAPACITORS

ITEM NO.	RATING Cap.	Volt	AEROVOX	CENTRALAB	CORNELL DUBILIER	ERIE	MALLORY	SPRAGUE	RATING Cap.	Volt	ITEM NO.
C1A	20	450	AFH2-51		UP2245		FP-234	TVL-2755	20	450	C1A
C1B	20	450							20	450	C1B
C2A	10	450							10	450	C2A
C2B	10	450	AFH4-10		UP111145		FP-434	TV6-4760	10	450	C2B
C2C	10	450							10	450	C2C
C2D	10	450							10	450	C2D
C3	10	150	PRS150/12		BR1015		TC-42	TVA-1406	10	150	C3
C4	1000	500	1467-001	D6-102	2R5D1	GP2L-102	MC255	1FM-21	1000	500	C4
C5	600	500	S1560	D6-601	1W5T6	GP2K-561	UC5356	MS-36	600	500	C5
C6	390	500	1469-0004	D6-391	5R5T4	GP2K-391	MC243	1FM-34	390	500	C6
C7	.02	600	P688-02	DF-203	PTE6S2		PT612	6TM-S2	.02	600	C7
C8	.005	500	1467-005	D6-502	1DR5D5	GP2-333-502	MC465	1FM-25	.005	500	C8
C9	.004	500	1467-004	D6-402	1DR5D4	GP2-333-402	MC463	1FM-24	.004	500	C9
C10	.003	500	1467-003	D6-302	1R5D3	GP2-333-302	MC461	1FM-23	.003	500	C10
C11, C20, C21	.05	600	P688-05	DF-503	PTE6S5		PT615	6TM-55	.05	600	C11, C20, C21
C12, C13, C14, C17, C18	.1	600	P688-1	DF-104	PTE6P1		PT601	6TM-P1	.1	600	C12, C13, C14, C17, C18
C15	.01		IN CASE WITH L2						.01		C15
C16	.005		IN CASE WITH L2						.005		C16
C19	.25	600	P684-25		PTE6P25		PT6025	6TM-P25	.25	600	C19

PARTS LIST AND DESCRIPTION (Continued on Page 85)

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Perfect for TV Focalizer Adjustment!
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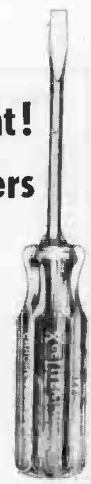

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PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

	RESISTANCE	WATTS	IRC	CLAROSTAT	CENTRALAB	MALLORY
R1	500K		Q13-133	AG-60-Z RS-2	B-60	U-48
R2			LC1			
R2A	500K		Q11-133			
R2B	1 Meg		M13-137			
R2C	100K		M13-128			
R2D	500K		M11-133			
R3A	250K				BB-103	
R3B.	250K					
R4A	250K				BB-103	
R4B	250K					
R5	100Ω	2	W100	A43-100 FKS-1/4	VK-121	C100P

TRANSFORMER (POWER)

	PRI.	SEC. 1	SEC. 2	STANCOR	MERIT	CHICAGO	TRIAD
T1	117V AC	460V CT .05A DC	6.3V 2.5A	PC-8418	P-3147	PV 60	R-4A

FILTER CHOKE

	DC	DC RES.	INDUCTANCE	STANCOR	MERIT	CHICAGO	TRIAD
L1	.05A	550Ω	7H	C-1707	C-2976	R650	C-3X

TONE CONTROL UNIT

L2 STANCOR - C2332-1

TUBES

V1	12AT7 or 12AY7
V2	12AU7
V3	12AU7
V4	6X4

RESISTORS

	RES	WATTS	IRC
R6	470K	1/2	BTS-470K
R7	2200	1	BTA-2200
R8	100K	1/2	BTS-100K
R9	10 Meg	1/2	BTS-10 Meg
R10	10 Meg	1/2	BTS-10 Meg
R11	10 Meg	1/2	BTS-10 Meg
R12	100K	1	BTA-100K
R13	10 Meg	1/2	BTS-10 Meg
R14	100K	1	BTA-100K
R15	68K	1	BTA-68K
R16	3900	1	BTA-3900
R17	100K	1	BTA-100K
R18	47K	1	BTA-47K
R19	470K	1/2	BTS-470K
R20	1000	1	BTA-1000
R21	22K	1	BTA-22K
R22	47K	1	BTA-47K
R23	47K	1	BTA-47K
R24	3900	1	BTA-3900

RESISTORS (Cont'd)

	RES	WATTS	IRC
R25	100K	1	BTA-100K
R26	47K	1	BTA-47K
R27	470K	1/2	BTS-470K
R28	1500	1	BTA-1500
R29	10K	1	BTA-10K
R30	220K	1	BTA-220K
R31	68K	1	BTA-68K

MISCELLANEOUS

Quantity	Description
1	2 Pole 3 Position Switch (Centralab - 1473) Mallory - 1215L)
1	Single Pole 3 Position Switch (Centralab - 1461) (Mallory - 1211L)
1	Single Pole Single Throw Toggle Switch
1	Pilot Light Assembly
1	AC Receptacle
3	9 Pin Noval Tube Socket
1	7-Pin Miniature Tube Socket
4	Phono Jacks
1	AC Power Cord
1	5" x 10" x 3" Chassis
	Terminal Strips, Misc. Hardware, etc.

"DOLLAR and SENSE"
(Continued from Page 47)

headband; these can even be fastened with combs and hairpins, eliminating the band. One section contains the microphone, volume control-switch, and the subminiature-tube amplifier; the other holds the transformer, a 15-volt B battery, a type RM1 midget A battery, and an earphone from which a small plastic tube goes to the earmold.

The new arrangement eliminates clothing noise and permits utilizing the directional qualities of the microphone by cocking the head toward weak sounds. Getting the mike up to ear level also aids listening in theaters, where sounds are usually absorbed by people in front before they reach chest microphone locations. When telephoning, the handset can be held in normal position, instead of upside down so the receiver is over the chest mike.

ROWS. Servicemen installing TV antennas on row-houses may unwittingly choose a location that trespasses on other property, setting off an unneighborly row that will at the very least mean moving the antenna without charge. Check first on ownership of chimneys that are on or near the dividing partitions between these houses. When neighbors wear chips on their shoulders, even a chimney strap on the wrong half of a chimney can mean trouble.

BARKERS. Supreme-Court approval of radio with commercials on busses and street cars paves the way for a new business that will eventually provide many new jobs for servicemen. Opponents claimed that transit radio systems violated Constitutional rights of passengers, but the Court decided there was no violation.

Another just-aborning business is use of side-show barkers on disc or magnetic tape recordings to push certain products in stores. Passing a paint store on the way home the other day, we heard a nice bit of marching music, then a commercial extolling the virtues of a new type of paint. Here again is business for servicemen, on initial sales and installation as well as on servicing. Cutting of disc or recording on endless loops of tape offer still more opportunities for cash business.

SNAFU. Failure of sight and sound just as the Walcott-Charles fight telecast ended was definitely not the fault of equipment or technicians. According to Television Digest, a 12-year-old boy climbed the station fence, stepped on a transformer and touched a power switch, cutting off the signal feed to the NBC network.

FEE-TV. Latest idea for giving first-run movies to television viewers, demonstrated recently by International Telemeter Corp. of Los Angeles, involves attaching a Telemeter coin-box which fits on any TV set. The special for-a-fee movies are sent as scrambled pictures by the station. A supersonic coding signal superimposed on the audio, sets a price-indicating wheel on every coin box to the charge for the picture being shown. The viewer deposits this amount in nickels to half-dollars for a total that can be up to $2, to unscramble the picture.

Instead of scrambling the sound for nonpaying customers, it is cut out and replaced by the voice of a barker giving a continuous commercial on the virtues of the picture being shown or to be shown. The coin box also contains a simple tape recorder which makes a record of events paid for and indicates if overpayment is accidentally made. The new system is said to achieve the desired goals of cash payment, variable price, identification of event, and customer convenience.

REFLECTORS. Chicken wire is going up on the hilltops, along with other types of metal reflectors for TV signals, to reflect signals down into valleys beyond. As yet the FCC hasn't got together on whether this constitutes illegal broadcasting; some members of the Commission feel that these reflectors provide added service without creating new interference and hence should be encouraged. Installations have been reported near Ogden, Utah and Maysville, Kentucky.

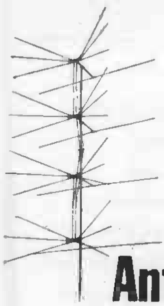
GRIPES. For good tips on how servicemen and parts salesmen can help each other, see John Frye's regular feature in June Radio & Television News. The chief gripes on each side can be summarized thusly:

Servicemen's Pleas: Don't carry tales from one shop to another. Don't knock other salesmen or their companies. Don't butt into our conversations with customers. Don't try high-pressure selling of items that are not wanted or not needed in large quantities. Don't arrive at lunchtime or just as the shop is being locked up for the day. Don't welch on getting a badly needed part. Tip us off when parts will become scarce. Leave handy order blanks and catalogs.

Parts Salesmen's Pleas: Try to have orders made up in advance. Order parts by manufacturer and part number wherever possible. Treat us as you would like to be treated. Order hard-to-get items well in advance. If running a small shop, place most of your orders with two or three concerns instead of half a dozen or so. Don't make collectors out of salesmen; pay by check to the company monthly. Don't expect us to be consulting engineers on your tough jobs.

TUBES. Half of all failures of military electronic equipment are caused by tubes, despite use of ruggedized and premium price tubes, according to a Defense Department spokesman at a recent Washington conference.

HANDIE-TALKIES. Two girl car-hops at a Milwaukee drive-in are doing the work of five by using Motorola "Handie-Talkie" radiophones to radio the orders to the kitchen. The order-taking car-hop writes the order on a special blank, gives the customer a copy, places the order number card on the windshield, broadcasts the order to the kitchen, then goes on to the next car. When the order is ready, a delivery girl takes it to the designated car and collects the money. Customers are pleased with the speeded-up service.



Page 53 of PF INDEX and Technical Digest No. 28 (Sept.-Oct., 1951) included a mention of names thought to be no longer active in the trade. Among them was that of Natalie Kalmus, and we have been recently advised by the supplier, that the name is currently active and that it is expected to so continue.

It is hoped, then, that this note may serve to relieve any existing misapprehension, and express best wishes in behalf of a successful continuation of the Kalmus line.

- Editor

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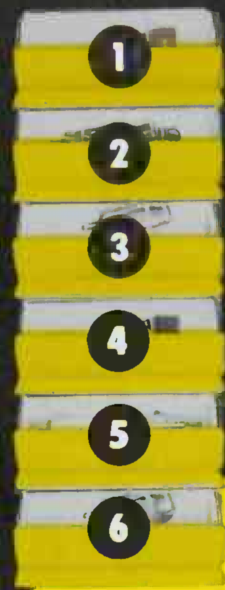

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Send Now for Bulletin CP-1. Gives You the E-V Plan—Tells you How to Make $4.00 Open New Business for You.

"POWER SUPPLIES" (Continued from Page 25)

windings in the transformer, and causes an increase in the resistance of the wire, which reduces the overall power handling capabilities of the transformer Loss due to hysteresis is that caused by the lag of current during the change of voltage to magnetic force and back to voltage in the transformer action. The ability of the transformer to keep this lag at a minimum is dependent upon the core material and actual design.

BLEEDER RESISTORS

Bleeder resistors may be incorporated to establish a minimum load upon the supply and prevent any surges of voltage from occurring when the load is removed. Bleeders should be selected with sufficient ratings to prevent overheating and should be of a value to offer a drain approximately 10 to 25% of the total load.

MERCURY VAPOR RECTIFIERS

Mercury vapor rectifiers are sometimes used in high power applications and offer excellent regulation qualities. The voltage drop across a rectifier of this type remains constant, regardless of load, providing the tube limits are not exceeded. However, they are not normally used in receivers due to the RF transient that may cause interference in reception.

POWER SUPPLY OPERATING CHARACTERISTICS

Peak Plate Current

The peak plate current is the maximum instantaneous current through the rectifier. It can never be less than the load current and is very often several times greater. These peak plate currents are greater when a capacitor input filter is used and care should be exercised in the replacement of the input capacitor since an increase in the peak plate current may effectively shorten the life of the tube. Loading of the supply also increases the peak plate currents. Following is a chart showing the actual measurements taken on a supply using a 35Z5GT and a 20 mfd. input capacitor:

40 ma. Load - 330 ma. Peak Plate Current
60 ma. Load - 470 ma. Peak Plate Current
90 ma. Load - 610 ma. Peak Plate Current

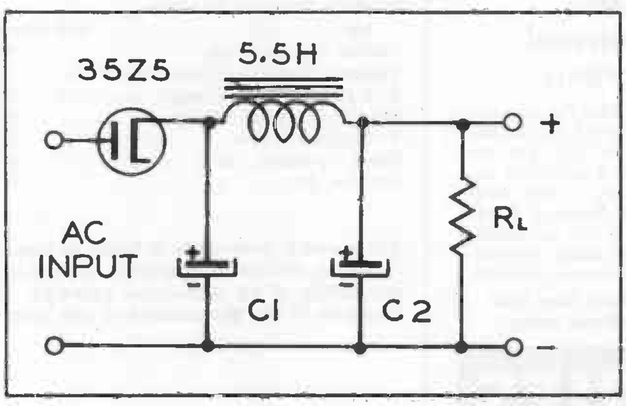

Figure 8. Circuit of Power Supply Used to Obtain Data Included in this Article.

It was found that any further increase in loading had very little effect upon peak plate current since the tube had reached its maximum limits.

Inverse Peak Voltage

The inverse peak voltage rating of a rectifier, is the maximum voltage permissible across the cathode and plate during the negative part of the cycle when the tube is not conducting. When substituting rectifier tubes this factor should be taken into consideration.

Ripple Voltage

The ripple voltage is the AC component remaining superimposed upon the DC after filtering is complete. There are no simple formulas to compute the amount, however the higher the capacitance and inductance of the filter network, the lower the ripple voltage will be. By actual measurements upon a power supply that was built for this purpose, with the schematic as shown in Figure 8, the following voltages were present. A constant load of 50 ma. was placed upon the supply throughout these measurements.

C1	C2	VOLTS DC	RIPPLE
20 Mfd. Input	20 Mfd. Output	117 VDC	1.5 V
40 Mfd. Input	20 Mfd. Output	120 VDC	0.9V
60 Mfd. Input	20 Mfd. Output	122 VDC	0.6V
20 Mfd. Input	40 Mfd. Output	117 VDC	0.9V
20 Mfd. Input	60 Mfd. Output	117 VDC	0.6V

Thus it can be seen that the output capacitor affects only the ripple voltage and that the input capacitor affects many things. Therefore caution should be observed in the replacement of input capacitors. Regulation, DC voltage, peak plate currents, and ripple voltage may suffer from the use of an input capacitor of the wrong value.

Common indications of an open input filter capacitor are low B+ voltage and excessive hum. If the input capacitor should become shorted there will be no B+ voltage available and the rectifier tube may be damaged. In any case, where the rectifier tube is damaged or where rectifier life is inadequate, the filter capacitors should be checked before replacement is made, since the shorted section may cause damage to the new tube. In the event that a capacitor is found to be bad, the replacement should be of an equal or recommended value to assure maximum tube life. A shorted output filter, however, may not cause immediate damage to the rectifier tube, due to the current limiting action of the resistance in the filter network.

As in the case of an input filter, a shorted capacitor section here will result in no B+ output from the supply. An open output filter may produce squeals or motor-boating in addition to excessive hum.

Erratum. Page 13 of Mar.-Apr. issue No. 31 of PF INDEX, "The Value of Waveform Analysis," Part II. The start of the second paragraph in the right hand column should refer to "Point W3" rather than "Point W1" as listed.

PF INDEX AND TECHNICAL DIGEST

INDEX TO ADVERTISERS
July-August 1952 Issue

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.

+ More or Less −

Service technicians have, on many occasions, experienced some rather embarrassing moments when a customer, usually technically uninformed, has insisted on explaining how or why his receiver performs with respect to advertised or sales promotion claims. The technician, with an acute longing to be elsewhere, tries to do a tight-rope act, balancing between the glowing terms which accompanied the instrument sale, and the actual performance, often under adverse conditions or locations.

It is something less than amusing to the technician to be told by the customer that the receiver incorporates a new super-miracle feature which is to provide superb reception on all channels serving the area, without necessity or worry about outside antennas or set location. It is particularly irritating when the technician knows that the miraculous feature consists of a couple of pieces of metal (however oddly shaped) or a length of wire, located at some point inside the cabinet. This is not exactly formidable armament with which he is expected to surmount the electronic facts of life. And it does not help his task any to repeat the escape clause, "in most locations," which appeared in fine print or low voice at the end of the promotion. It didn't penetrate - - its subordinate position suggests that it wasn't seriously intended to do so.

This is an example, not specific, but not lacking some basis in fact either. There have been many others about gadgets or circuitry, however well meant, which have had a rough time living up to their press notices.

It is heartening, then, to note the content of a speech by Mr. Glen McDaniel, retiring RTMA President, for delivery at the annual conference of the Association of Better Business Bureaus. His subject, entitled "Truthfulness in Advertising of Radio and Television Sets" and this writer's impression of some of the more important points discussed, follow.

1. Radio and television advertising, to be effective, must be honest.

2. It is difficult to employ full promotion and advertising to the electronic field without tending to mislead or confuse the non-technical public. Two of the reasons cited for this are the variations in the propagation and reception of electromagnetic waves due to temperature and atmospheric phenomena; and the lack of a standard method for arriving at picture tube active area. The reason for this is, of course, the variation between round and rectangular tube faces and the masking practices employed with them.

3. The industry voluntarily adopted a code of ethics in 1939, covering radio advertising practices, and in 1950 the start of expansion of this code, to cover present day radio and television requirements, was undertaken.

According to Mr. McDaniel the new code, now nearing culmination, will be an extensive one, and will contain many clauses applicable to the particular problems of our industry. If it will serve to temper some of the overly enthusiastic claims of manufacturers, distributors or retailers, it will provide a very real benefit to the service field. It is entirely natural that the manufacturer and seller of a particular brand of equipment be thoroughly convinced of the worth of his product. However, it will make it much easier for the acceptance of his product to be maintained if he limits his promotion to those features or advantages which are clearly demonstrable.

In the final analysis, the service technician is the one responsible for the continued acceptance of the product. The less difficulty that he has in keeping the customer sold on the merits, real or imaginary, of the customer's equipment, the greater the advantage accruing to the manufacturer, distributor, the retailer and the service technician himself.

- J. R. R.

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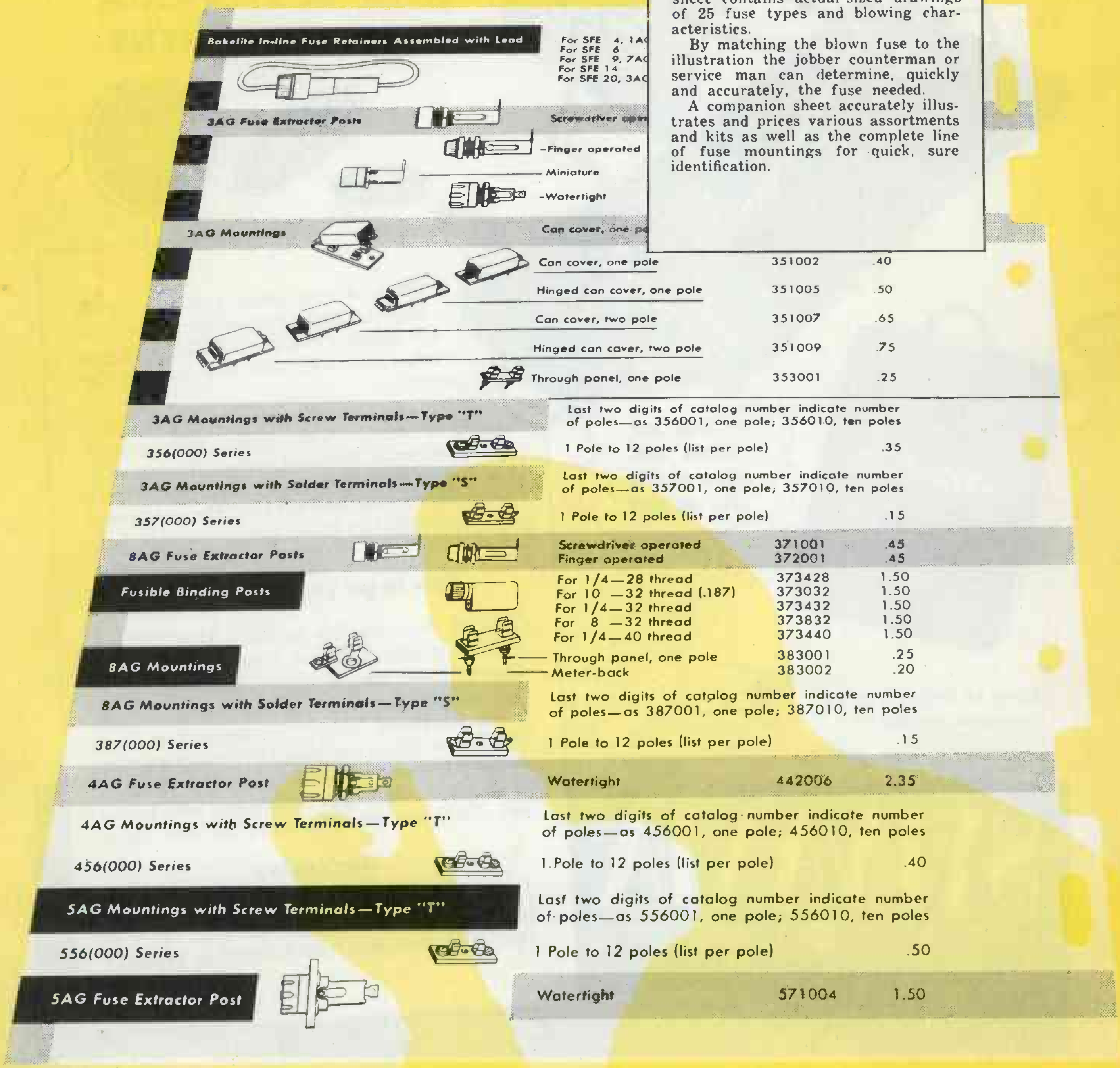
From:

Counterman Sales Aid Released By Littelfuse

The first completely illustrated list price sheet on fuses is published by Littelfuse, Inc., 1865 Miner Street, Des Plaines, Illinois. A four-page sheet contains actual-sized drawings of 25 fuse types and blowing characteristics.

By matching the blown fuse to the illustration the jobber counterman or service man can determine, quickly and accurately, the fuse needed.

A companion sheet accurately illustrates and prices various assortments and kits as well as the complete line of fuse mountings for quick, sure identification.



Bakelite In-line Fuse Retainers Assembled with Lead	For SFE 4, 1A		
	For SFE 6		
	For SFE 9, 7A		
	For SFE 14		
	For SFE 20, 3A		
3AG Fuse Extractor Posts	Screwdriver oper		
	Finger operated		
	Miniature		
	Watertight		
3AG Mountings	Can cover, one po		
	Can cover, one pole	351002	.40
	Hinged can cover, one pole	351005	.50
	Can cover, two pole	351007	.65
	Hinged can cover, two pole	351009	.75
	Through panel, one pole	353001	.25
3AG Mountings with Screw Terminals—Type "T"	Last two digits of catalog number indicate number of poles—as 356001, one pole; 356010, ten poles		
356(000) Series	1 Pole to 12 poles (list per pole)		.35
3AG Mountings with Solder Terminals—Type "S"	Last two digits of catalog number indicate number of poles—as 357001, one pole; 357010, ten poles		
357(000) Series	1 Pole to 12 poles (list per pole)		.15
8AG Fuse Extractor Posts	Screwdriver operated	371001	.45
	Finger operated	372001	.45
Fusible Binding Posts	For 1/4—28 thread	373428	1.50
	For 10 —32 thread (.187)	373032	1.50
	For 1/4—32 thread	373432	1.50
	For 8 —32 thread	373832	1.50
	For 1/4—40 thread	373440	1.50
8AG Mountings	Through panel, one pole	383001	.25
	Meter-back	383002	.20
8AG Mountings with Solder Terminals—Type "S"	Last two digits of catalog number indicate number of poles—as 387001, one pole; 387010, ten poles		
387(000) Series	1 Pole to 12 poles (list per pole)		.15
4AG Fuse Extractor Post	Watertight	442006	2.35
4AG Mountings with Screw Terminals—Type "T"	Last two digits of catalog number indicate number of poles—as 456001, one pole; 456010, ten poles		
456(000) Series	1 Pole to 12 poles (list per pole)		.40
5AG Mountings with Screw Terminals—Type "T"	Last two digits of catalog number indicate number of poles—as 556001, one pole; 556010, ten poles		
556(000) Series	1 Pole to 12 poles (list per pole)		.50
5AG Fuse Extractor Post	Watertight	571004	1.50