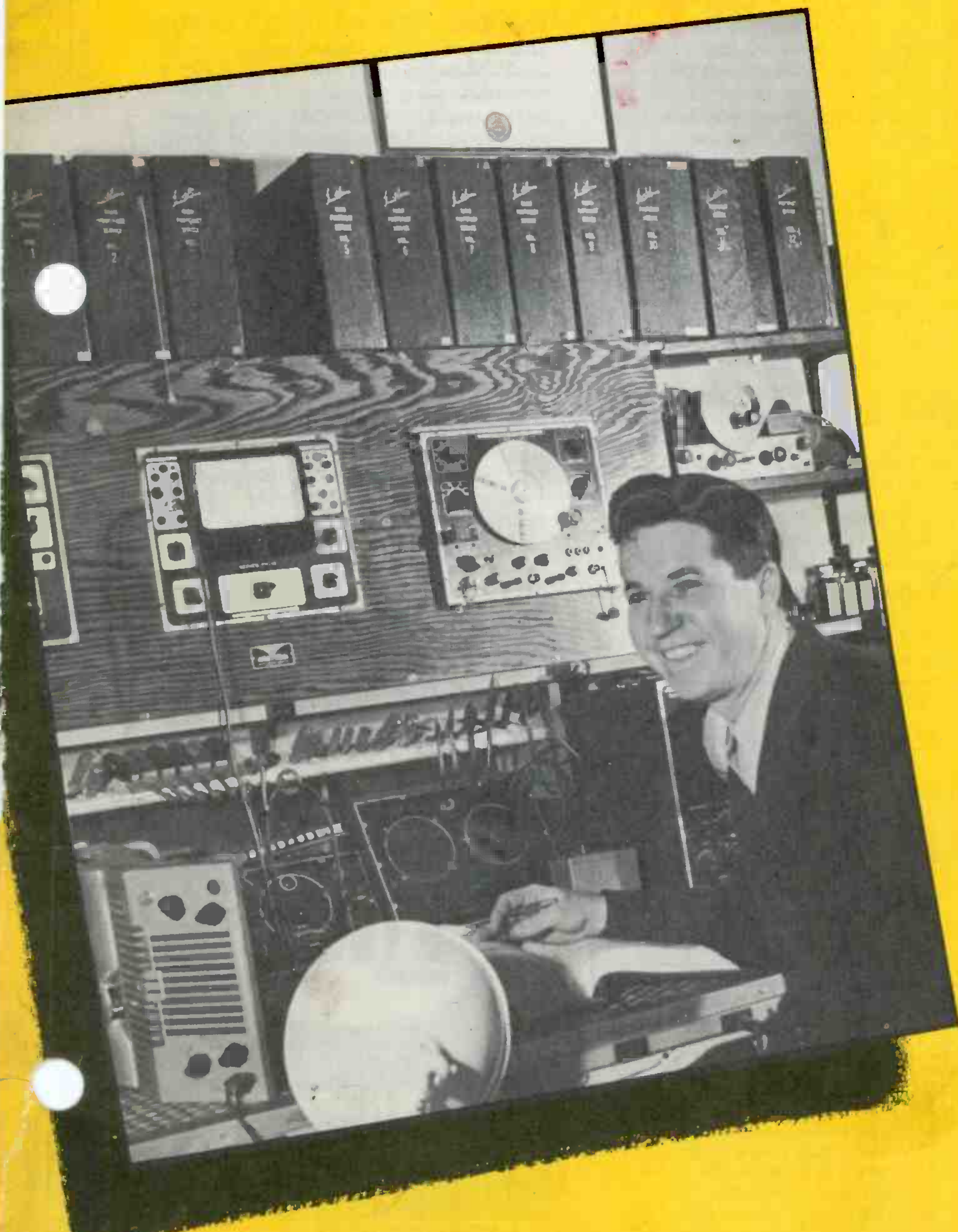
Howard W. Sams

PHOTOFACT

INDEX

AND TECHNICAL DIGEST



July • August • 1951
including
INDEX No.
27
COVERING PHOTOFACT FOLDER SETS 1 THRU 140

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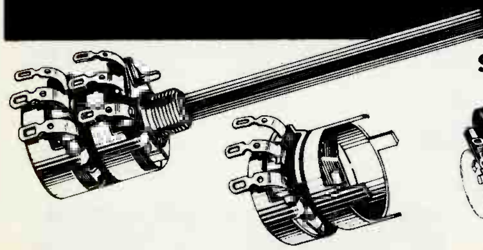
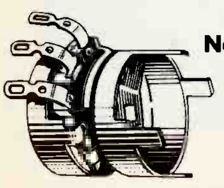
HOW TO ASSEMBLE NEARLY 19 MILLION VARIATIONS OF DUAL, TRIPLE AND QUADRUPLE CONTROLS WITH IRC'S VERSATILE Q CONTROLS AND MULTISECTIONS

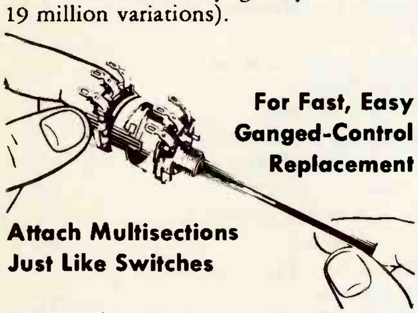


Ever go looking for hard-to-find special ganged controls—for service replacements—test equipment—L and T pads—even for screw-ball ideas of the down-the-street hobbyist? You can stop looking now. Such special controls are readily assembled—simply by adding IRC Multisections to standard Q Controls!



New Multisections Give Widest Coverage 20 Stock Values Provide Nearly 19 Million Variations

IRC Multisections actually are rear or intermediate control sections—each complete in itself. You can add them to standard Q Controls as easily as you'd attach a switch—and just as quickly. With Multisections, you can assemble almost any standard ganged control (20 stock values actually give you almost 19 million variations).

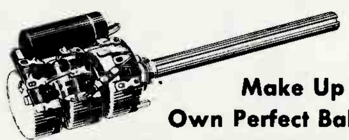


For Fast, Easy Ganged-Control Replacement

Attach Multisections Just Like Switches

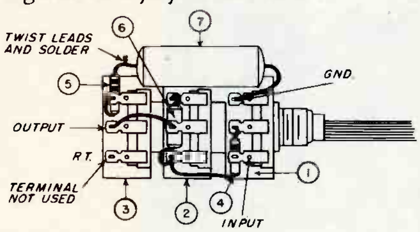
To assemble a dual control, here's all you do:—Select panel-section resistance in IRC Q, PQ or RQ Control—then pick out the wanted rear-section value of the IRC Multisection. Remove the control cover by bending up cover tabs. Locate the drive arm of the control in the shaft arm of the Multisection. Bend over Multisection cover lugs. *Finished!* It's just that fast and that easy. No special tools needed. No valuable time wasted. You can add Multisections to Multisections in the same manner, too, making up triples and quadruples as needed.

Suggested Special Applications



Make Up Your Own Perfect Balance Loudness Controls with IRC Multisections and IRC Q Controls

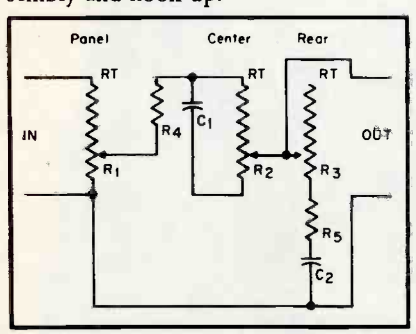
Want an effective, continuously compensated loudness control that provides better-balanced tone at any listening level? With IRC Multisections, a Q Control and a couple of Type BTS resistors and capacitors, you can put it together in a jiffy. Here's how . . .



Assemble to the "Q" Control the two specified Multisections, in the order shown by the Pictorial Schematic above, using instructions included with each Multisection.

Assemble the additional parts and make all required connections as shown in Pictorial Schematic and solder.

Cut shaft to required length and assemble and wire into any high gain audio amplifier. Chart shows simplicity of assembly and hook-up.



Here are all the parts you'll need to assemble the Loudness Control:—

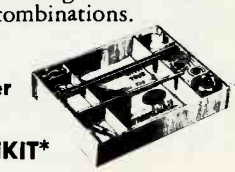
Pictorial Schematic No.	Description
1.	IRC Type "Q" Control—Q11-133
2.	IRC Multisection—M13-137
3.	IRC Multisection—M13-128
4.	IRC BTS 0.1 Meg ±10%
5.	IRC BTS 10 K ±10%
6.	82 m.m.f. capacitor
7.	0.03 m.f.d. capacitor

Special L and T Pads

Multisections and Q Controls afford wide opportunity for making up all kinds of small L and T Pads for use in low power circuits—audio input—TV antenna circuits—low level line pads—audio test circuits—and many other applications.

Other Accessories Available

The versatility of Multisections is increased by other accessories of the Type Q Control Line. Interchangeable Fixed Shafts, Extension Shafts and Couplers, Sleeve Bushings and Switches provide limitless combinations.



Another Member of the Family—IRC CONCENTRIKIT* Lets You Assemble Your Own Concentric Duals

With IRC's original CONCENTRIKIT, you can assemble almost any concentric dual control in just a few minutes. Eleven universal parts combine with separate base assemblies and shaft-ends to give you the specified concentric dual. Service Technicians call CONCENTRIKIT the most practical, convenient answer to special TV control requirements and auto set replacements.

IRC Covers Your Switch Needs, Too

Designed to fit IRC small Q Controls, IRC's Type 76-1 (single pole) and Type 76-2 (double pole) units give you substantial coverage of all switch needs. Q Control has been so designed that switch throw takes place after contactor reaches terminal adjacent to switch toggle. Thus, electrical rotation of control is the same with or without switch.

Send For Free Reference Data

A penny postal card will bring you any of the following: Data on L and T Pads—Information on LCI Loudness Control (DC10) or Catalog DC1B, the latest issue on the Q Control Line.

*IRC trademark for a kit of parts for concentric dual controls.

IRC

Wherever the Circuit Says —

INTERNATIONAL RESISTANCE CO.

423 N. Broad Street—Philadelphia 8, Pa

Pick of the Trade

"Corruption in government makes most people boiling mad, and there certainly has been plenty in recent months to get mad about—buyable cops and crooked sheriffs and mysteriously well-off figures connected with the Federal Government.

"It is, of course, proper to get sore at crime and graft, but aim your anger at the right targets. If some city or county or Federal employe is dishonorable, he ought to be dishonored. But let us not dishonor ALL government people for the sins of the very few, unless we are ready to dishonor government itself—which is us."

CHANGING TIMES—*The Kiplinger Magazine*
June 1951

★ ★ ★

"The new allocation plan will introduce a new era in TV . . . an era which will be resplendent with opportunities for everyone, particularly Service Men. Planning for that era can begin now in a careful manner, unaccompanied by flamboyant promises. Service Men can be of help to set owners by offering an explanation of the time cycle situation, and the accompanying problems existing now and destined to be with us for awhile."

LEWIS WINNER, Editor
Service
May 1951 Issue

★ ★ ★

"We have stated many times that the public may be the deciding factor in the final choice of a color television system —and we still believe that to be so, regardless of legal entanglements and publicity gimmicks.

"One thing is certain—if the TV set owner has not had the opportunity of witnessing good color television, he has missed the thrill of a lifetime in video enjoyment."

OLIVER READ, Managing Editor
Radio & Television News
June 1951 Issue

★ ★ ★

"In connection with the new Empire State Building multistation TV antenna, it is interesting to note that in the gale which buffeted New York last fall there was sufficient movement in the building to crack plaster out of the ceiling in offices in the upper middle portion of the building. A tenant who was in the building on the day of the gale said his office moved sufficiently to give the feeling of a ship at sea. He also showed us holes in his ceiling where plaster had fallen. While this is an indication of the safety 'give' factor of the building, it also makes one shudder at the thought of being up there with the TV men near the top of the tower in a similar gale!"

Tele-Tech
June 1951 Issue

★ ★ ★

"Telecasting is beginning to pay off. Fifty-four of the nation's 107 television outlets reported a profit last year. Of the fifty-four who earned more than they paid out, more than half disclosed an income of more than $100,000, and eight stations topped $400,000."

Electrical Dealer
May 1951 Issue

★ ★ ★

"New set sales are important to the continued growth and success of our own segment of the industry. Once distributors and manufacturers realize that every set is visited at least six times a year by service company technicians . . . who can be either ambassadors of goodwill or vice versa . . . then, we think, many of the problems which have sprung up will be solved."

MAL PARKS, Publisher
What's New in Television
April 1951 Issue

★ ★ ★

"THE SERVICE DEPARTMENT IS THE BUSINESS life-saver, a great many heavily-inventoried TV dealers are finding out. TV service volume continues to run high in most shops. An Eastern merchant reports that his store is operating in the black right now because of profits he makes in maintenance."

Radio & Television Retailing
June 1951 Issue

PF PHOTOFACT INDEX

AND TECHNICAL DIGEST

VOL. 1 • NO. 4 JULY-AUGUST, 1951

JAMES R. RONK, *Editor*

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HOWARD W. SAMS, *Publisher*

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ABOUT THE COVER: The photograph is of James E. McClung, proprietor of a service shop in Clarksburg, W. Va. Mr. McClung writes: "Under separate cover I'm sending you a picture of my service shop showing your Photofact Service Volumes, 'Handy as a pocket in a shirt.' I wish to thank you very kindly for the wonderful service you are giving us servicemen, and hope you are able to continue doing so. I value your Photofact as a *must* for the serviceman."

MILTON S. KIVER
President, Television Communications Institute

Shop Talk

Every television serviceman is called on, from time to time, to check or correct the alignment of a television receiver. The job, if it is to be done properly, requires the use of an oscilloscope, an AM generator, and a sweep signal generator.

The actual performing of the alignment requires a working knowledge of these various test instruments plus a familiarity with the type of response that can be expected of the stages under test. If you stop to think about this for a moment, you will readily appreciate how much must be known in order to carry out an alignment. So it is understandable when a good many television technicians have difficulty with this particluar phase of their work. For these men the following hints may prove helpful. Each suggestion has stood the test of experience and can be relied upon.

1. The bandwidth and sensitivity of a television receiver is governed largely by the video IF system. Hence, in most instances, it is not necessary to carry out a visual alignment of the RF stages. Just align the video IF system, the audio IF system, and touch up the oscillator in the RF section.

After you have performed this alignment, check the receiver performance on a received test pattern against its bandwidth as determined by you at the time of the visual alignment. If you find that the two differ noticeably, and that by further juggling of the video IF tuned circuits the receiver performance with the test pattern can be improved, the chances are very good that one of two things is responsible. Either the video IF system was not properly aligned, or, the alignment of the RF section of the receiver is considerably off.

This last paragraph was added because the author has heard the remark sometimes made in the shop that a set almost always has to be retouched (using the test pattern) after an alignment in spite of every precaution that is taken. Investigation revealed that usually the cause of this was due to one of the two aforementioned reasons.

2. In receivers using the so-called conventional system of reception (in contrast to Intercarrier sets), it is a good practice to align the audio IF system first. Then, without changing the generator dial setting, switch the instrument into the video IF system and adjust the sound traps located here. In this way, you are certain that the sound traps in the video system are at exactly the same frequency. This procedure is especially useful when the accuracy of your AM generator is not too good.

3. You hear a lot about impedance matching the sweep generator to the circuit under alignment. As long as you are not running a visual check of the RF stages, there is little need to accurately match the impedance of the signal generator to the receiver input terminals. If you wish to send a signal through the front end (for the purpose of adjusting the oscillator), merely connect the ungrounded (or hot) lead of the signal generator to one of the ungrounded antenna terminals of the set. Then connect the generator ground lead to the receiver chassis.

4. Many servicemen feel that the RF response of the receiver should be checked on all channels. In view of suggestion No. 1 above, this is seldom necessary. However, if you feel that the RF response should be checked, you will usually lose little by confining this check only to those channels which are in operation in your locality. This is true even when the RF tuning system is such that every channel depends upon the inductance of the next higher channel for its frequency.

5. Whenever a set has AGC (and nowadays, most sets do), make yourself a small bias box containing a 100,000 ohm potentiometer, and a 3-to 4.5-volt battery. This will provide you with the necessary bias voltages you will need for application to the video IF stages in place of the AGC potentials.

In strong signal areas, the suggested bias voltage is -3 volts. In fringe areas, it frequently is -1 volt. Watch this carefully because it makes a big difference in the response curve.

6. A very convenient way of injecting AM and sweep signals into the IF system is by slipping a tight-fitting ungrounded shield over the converter tube and clipping the hot lead of the generator to this shield. Ground lead from chassis goes to receiver chassis, of course.

7. Make absolutely certain that the scope deflection voltage has the same shape and frequency as the sweeping voltage of the generator. This means that where the sweep generator frequency is varied by a 60-cycle sine wave (the usual method), the beam in the scope should be driven by a 60-cycle sine wave, too. You can get some awful looking patterns if you use mixed driving voltages.

8. Be sure when aligning any of the IF stages (audio or video) to kill the local oscillator of the receiver. Where the oscillator uses a separate tube, you simply remove the tube. But since most designs incorporate the oscillator and mixer tubes in one envelope, this poses somewhat of a problem. Where the Standard Coil tuner is used, the solution is simply achieved by carefully rotating the tuner turret until it is resting on the "hill" between the "valleys" where contact is made between the channel strips of the tuner

♦ ♦ Please turn to page 50 ♦ ♦

The CBS Color Television System

by Walter H. Buchsbaum

Author of Television Servicing, (Prentice-Hall, 1950)

EDITOR'S NOTE. We are including this color television writeup to help familiarize the readers of the PF INDEX and TECHNICAL DIGEST with the system which has now obtained approval as a standard.

We have purposely withheld color television material from the PF INDEX and TECHNICAL DIGEST awaiting some formal decision that would indicate types of receivers or receiving equipment which may well require the attention of service technicians.

We specifically requested that Mr. Buchsbaum make the article of an introductory nature, intended, as stated above, simply to familiarize service technicians with the overall principles of the system, with no attempt at this time to outline the detailed operation and application. This we feel he has done exceedingly well.

In conclusion, we would like to second the last paragraph of this article, which states, in essence, that color television developments are certainly not complete enough at this time to represent a fixed or final state of the art.

The recent decision of the U.S. Supreme Court to uphold the FCC has effectively approved the field sequential color television system. This system is the one proposed and developed by the Columbia Broadcasting System during the past 15 years. Before discussing the technical requirements of the CBS system a few words concerning its influence on black-and-white television might be appropriate.

The CBS color transmissions cannot be received by the ordinary black and white TV set without suitable modification. Because the scanning frequencies are different, only incoherent groups of lines will appear on the single color or monochrome receiver. This probably means that a great majority of the more than 12 million sets now in use will not receive the CBS color telecasts in black and white.

When a CBS station transmits color, its present audience is therefore limited to those experimenters or enthusiasts who have changed over their sets to the new scanning frequencies. In addition to changing the sweep section, they must add a color wheel with suitable motor and control mechanism. In view of the foregoing CBS expects to transmit color only in the early morning and late evening hours for the time being.

During the regular program time CBS stations will continue to transmit on black and white standards to keep their present large TV audience. If anyone wants to buy a color TV set or adapt and convert his present set to the CBS standards he can watch color telecasts early in the morning or at night after the regular programs are over. In other words, it is not likely that black and white telecasting will become obsolete soon, nor is a sudden surge of color receivers likely to appear on the market.

How colors are created for television

In color printing it is possible to use three differently colored plates to produce a color picture which resembles the original pretty closely. This process is based on the fact that all colors can be represented by a mixture of the proper quantities of three spectral colors. Spectral or saturated colors are those found in the rainbow, in the light refraction through a quartz crystal or on the edges of a thin oil slick. These represent the colors of the spectrum and are considered pure. All other colors are mixtures. For example, a pastel green can be shown to be made up of a portion of spectral green, spectral red and spectral blue. The theory of colorimetry is quite involved, but for our purpose it is sufficient to realize that three basic colors can be arranged so that suitable mixtures will produce most of the visible colors.

Just like the printer prints first the plate containing the red portions of the picture, then the blue and finally the green plates, the CBS color TV system scans first the red, then the blue and green portions. This is accomplished by scanning one complete picture with a red filter in front of the camera, then putting a blue filter in front and scanning the picture again and finally repeating with a green filter. In practice, a disk made up of red, blue and green filters rotates in front of the camera at such a speed that the electron beam scans an entire picture while one particular color filter is in front of the lens. In each of these frames the picture contains different levels of brightness corresponding to the amount of red, blue or green present in the original scene.

At the receiver the process is reversed. The individual frames appear on the picture tube in the original sequence, producing a black and white picture on the screen. Each frame will vary in brightness according to the color content in the original picture, but this variation is not apparent without another color disk. The color disk in front of the picture tube must be of the same shade of red, blue and green as the one at the camera, and the screen must light up with the white as the lighting on the original scene to reproduce true colors. Furthermore, the same color filter must be in front of the screen as was in front of the camera when that particular frame was scanned. In other words, the color wheel must be in absolute synchronism with the camera equipment.

The entire process of scanning and switching differently colored filters in front of the screen must be performed so fast that the human eye cannot detect any change, but sees only smooth continuous motion. In black and white TV, one complete picture appears on the screen each 1/30 of a second. We therefore speak of 30 frames per second, each having two fields, one of the odd and one of the even numbered lines to give an interlaced picture. The vertical scanning frequency in black and white TV is 60 cycles and the horizontal frequency is 15,750 cycles giving a total of 525 lines for each complete frame.

In the CBS color TV system none of these frequencies are retained. One complete color picture appears on the screen each 1/24 of a second. It consists of three complete frames representing the three primary colors. Each color frame is interlaced and has two fields, the odd and the even numbered lines. The vertical scanning frequency therefore is 144 cycles. Unlike black and white TV, the CBS color picture consists of only 405 lines and the horizontal scanning frequency is 29,160 cycles per second.

From the above data we can see at once that in order to adapt a regular TV set to receive the CBS color transmission in black and white, the vertical and horizontal sweep sections must be changed. Basically only the frequencies of both sections are different, but on closer inspection we find that changing them is not quite so simple. The vertical 60 cps sawtooth can be changed to run at 144 cps by changing the R-C network in the vertical sawtooth generator. The vertical output transformer, however is designed for maximum efficiency at 60 cycles and the vertical retrace time is calculated for a 60 cycle sawtooth When changed over for 144 cycle operation the vertical sweep will give less height and fold-over on top of the raster as a result of the shorter retrace time of the color picture. Increasing the B plus voltage or using a different vertical output tube will give proper height. Some of the vertical output transformers will give fold-over on the top of the picture because of their longer time constant. The later types, especially the auto-transformer types, work satisfactorily on 144 cps.

The horizontal sweep frequency is harder to change since most receivers use some type of automatic frequency control for the horizontal oscillator. Several circuit modifications are required and they will vary with the type of horizontal AFC used. The main difficulty, however, arises in operating the flyback circuit at the new frequency. To get some efficiency out of a flyback system, the components must be designed as close to the resonant frequency as possible. The flyback transformer and the deflection yoke especially are quite critical. For use at 29,160 cps instead of 15,750 cps it would be desirable to use an entirely different flyback and yoke, but since this is impractical in converting present receivers, a set of taps and a switch are used. Because of the high pulse voltages that must be switched, ceramic wafer switches are recommended. Even with a tapped transformer the high voltage generated is usually less than for black and white, and the horizontal retrace time is too long, resulting in foldover. Because of the difficulties of adapting a present TV set to the CBS system, most manufacturers plan on using a separate slave unit, designed for the CBS standards. Only the composite video signal is used from the main TV set, the slave unit having its own power supply, sweep circuits and picture tube.

We mentioned that the rate of rotation of a color wheel or drum must be exactly in synchronism with the vertical sweep. To accomplish this the motor speed should be controlled automatically. One widely publicized system uses a small AC generator on the wheel itself to supply pulses to a phase detector where they are compared with the vertical synchronizing pulses. An error voltage is developed and applied to the grid of a pentode amplifier. The plate current of this tube passes through a saturated reactor in such a manner that changes in plate current change the inductance of the reactor. This reactor is in series with the driving motor and any change in the inductance of the reactor will change the AC voltage at the motor. Since the motor speed is dependent on the voltage, the error voltage from the phase detector effectively controls the speed of the color wheel.

In addition to the color wheel, several other devices are under consideration for providing color. One is a drum made of flexible plastic rotating like an endless belt around the entire picture tube. Another, under development by a small TV manufacturer reportedly utilizes vibrating crystals. The ultimate solution most probably is the tricolor tube which is now in the stages of pilot production. Since it is possible to use the tricolor tube with the CBS as well as any other color television system, it will be one feature almost certain to be used in color TV receivers.

A few serious drawbacks will be encountered in the CBS color system which are inherent in the system itself. One is the loss of detail compared with black and white pictures. Since only 405 lines per picture are used, less detail is possible than with the 525 lines of the black and white transmissions. Another drawback is color break-up, or the appearance of three primary colors when glasses are shifted or the observer blinks his eyes. This is due to the field sequential system of color injection. Color fringing is the appearance of different colors for a certain object when it undergoes rapid motion. For example, the red stockings of a whirling dancer may appear in different shades of green, blue and purple while in motion. This is due to the rather slow color sequence which may not be fast enough to include the entire motion in one complete 3-color picture. Flicker may be annoying when bright pictures are observed. The reason for that lies in the slow speed of only 24 frames per second and the fact that flicker is far more objectionable in brighter pictures.

The problems of color television are not even near a solution but it is hoped that the introduction of the CBS system will stimulate the development and improvement of this branch of television until it reaches the perfection and performance of our present black and white system.

Ceramic Capacitors

by Veral M. Shields

A treatment of their construction, identification and use

Ceramic capacitors are used extensively in radio and television receivers. The most common body styles are the tubular, disc, and flat plate types. The general classifications of ceramic capacitors are: temperature compensating, general purpose, guaranteed minimum value and NPO (negative-positive-zero) types.

Several problems confront the service technician when replacement of a ceramic capacitor becomes necessary. The identification of the unit and reading of the color code are sometimes major issues. The following discussion describing the various types of ceramic capacitors, their characteristics and method of color coding, should be helpful in identification and in selecting proper replacements.

In order that the ceramic capacitor may be more thoroughly understood it might be well to review capacitors generally.

A capacitor has three essential parts, namely: two metallic plates and an insulating material, called a dielectric, which separates the plates. This dielectric insulator may be in a gaseous, solid, or liquid state. The total capacity is dependent on the size and spacing of the metallic plates and the kind of dielectric insulator used between the plates.

The simplest form of capacitor is that of two metallic plates separated by air (gaseous dielectric). If we measure the capacity of this unit and then insert a dielectric material, such as ceramic, between the plates, keeping the same spacing, we find that the capacitance is several times greater. This is because the ceramic insulator has a higher dielectric constant than air, which is usually considered 1.

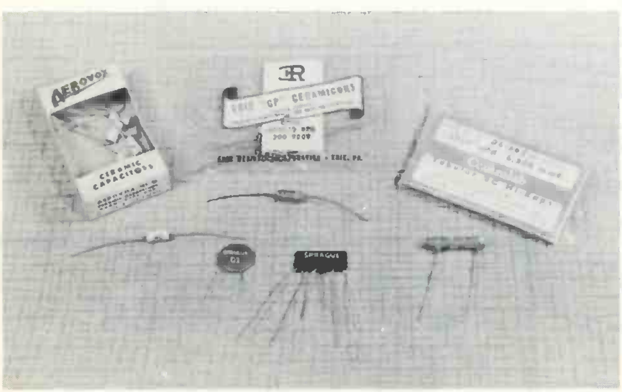


Figure 1. Typcial Ceramic Capacitors.

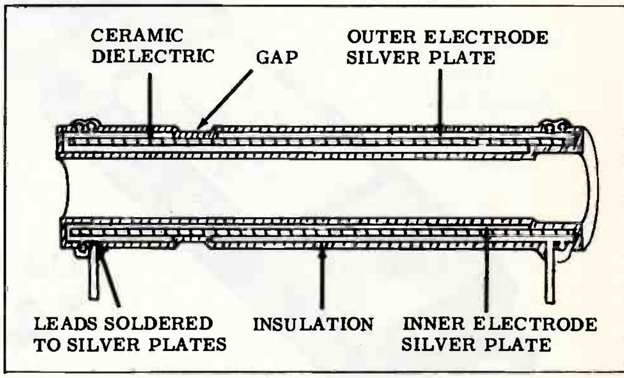


Figure 2. Construction Detail of Typical Radial Lead Type.

The dielectric constant of an insulating material is the ratio of the capacity (C_x) of a capacitor, using the material as the dielectric, to the capacity (C_a) of the capacitor using air as the dielectric, or

Dielectric Constant

$$K = \frac{Cx}{Ca}$$

The dielectric constant of a material is not exactly a constant for it is dependent on the conditions under which it is operating. It will vary with temperature, moisture content, frequency, etc.

The capacity is directly proportional to the dielectric constant of the dielectric material being used. A ceramic dielectric material has been developed which has a high dielectric constant. The use of this ceramic dielectric has enabled capacitor manufacturers to produce desired values of capacitors in very small physical sizes.

Typical tubular ceramic capacitors are shown in Figure 1. The tubular capacitor uses either the radial or axial lead terminals. The capacitor consists of two silver plates fired at a very high temperature on a tubular ceramic body. Typical constructional detail of the radial lead type is shown in Figure 2 and that of the axial lead type in Figure 3.

Astatic PRODUCTS DATA

NEW ASTATIC L-12 CRYSTAL CARTRIDGE OFFERS HIGH OUTPUT, LOW COST

Approximately 1½ Times Actual Size

List Price $4.45

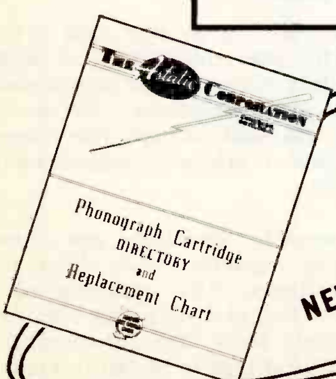
Astatic's ability to engineer peak performance quality into a low-cost pickup cartridge has never been more sharply demonstrated than in the new model L-12. It is designed for standard 78 RPM record reproduction, has universal needle chuck to receive standard needles, is furnished without stylus. Performance data appears below.

SPECIFICATIONS

Model	Element Type	Min. Needle Pressure	Output Voltage 1,000 c.p.s. 1.0 meg. load	Frequency range c.p.s.	Needle Type	Net Wgt.	Code
L-12	Crystal	1 oz.	4.0 volt Audiotone 78-1	50 to 5000	Optional	19 grams	ASWSG

THIS IS WHERE TO REPLACE WITH THE ASTATIC L-12 CARTRIDGE

SHURE		WEBSTER	ELECTRO-VOICE
Model No.	Model No.	Model No.	Model No.
W42A	P35	N10	50
W42B	P35S	N10P	60
W42H	P88	N6P	H60
W56A	P88S	W.S.	
W59A	P89		
	P89S		



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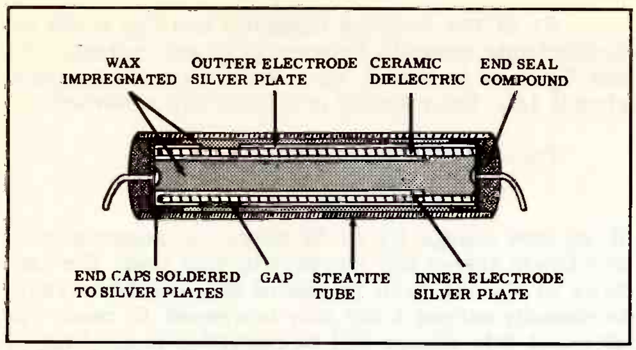


Figure 3. Construction Detail of Typical Axial Lead Type.

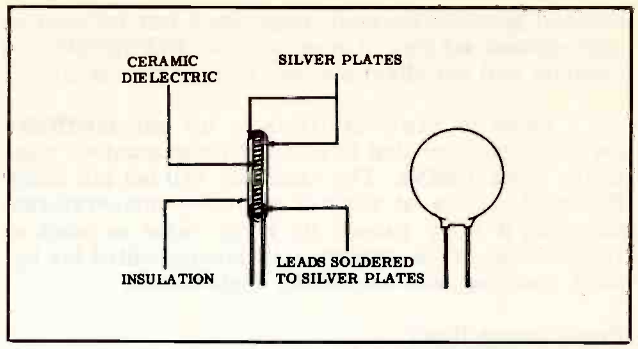


Figure 4. Construction Detail of Typical Disc Type.

Another commonly used type is the flat plate or disc ceramic capacitor. A typical disc capacitor is shown in Figure 1 and its constructional detail appears in Figure 4. The disc and plate type are readily adaptable for construction of dual and multi-section units.

Temperature Compensation

By varying the composition of the ceramic dielectric, a wide range of temperature characteristics have been obtained. That is, the capacity of a unit having a ceramic dielectric of a certain composition will vary as its operating temperature changes.

The approximate amount of capacity that a temperature compensating capacitor will change with temperature can be determined from the temperature coefficient of the capacitor. The temperature coefficient is based on a measurement of capacity at +25°C. and another at +85°C. with the assumption of a straight line function between the two points. The temperature characteristics of a ceramic capacitor are non-linear, however the deviation from the straight line function is small. The nominal temperature coefficient is equal to:

$$TC = \frac{\Delta C}{C \times \Delta T}$$

Where -
TC = Temperature coefficient
ΔC = Change in capacity in mmf. from capacity measured at +25°C. and at +85°C.
C = Capacity at +25°C.
ΔT = Degrees centigrade change in temperature.

For example, the value of a capacitor at +25°C. was 100 mmf. The capacity of the same unit measured at +85°C. was 95.5 mmf.

$$TC = \frac{\Delta C}{C \times \Delta T} = \frac{100-95.5}{100 \times 60^{\circ}C} + \frac{4.5}{6000^{\circ}C.}$$

$$= \frac{.00075}{^{\circ}C.} = 750/1{,}000{,}000/^{\circ}C.$$

Temperature coefficient is expressed in parts per million per degree centigrade. The temperature coefficient for the capacity in the example above would be N750, the N indicating that the capacitor decreased with a rise in operating temperature 750 parts per million per °C.

From the temperature coefficient it can be determined approximately how much a capacitor will change from the time a set is first turned on until it reaches its normal operating temperature. The change in capacity is equal to:

$$\Delta C = TC \times \Delta T$$

where
ΔC = Change in capacity
TC = Temperature Coefficient
C = Capacitor value in mmf.
ΔT = Change in temperature from +25°C. to operating temperature.

For example, an N750, 100 mmf. capacitor operating at 65°C. will decrease in value approximately 3 mmf. from the time the set is turned on until it reaches 65°C.

$$\Delta C = 750/1000000/^{\circ}C \times 100 \text{ mmf.} \times 40^{\circ}C. = 3 \text{ mmf.}$$

In other words, the capacitor will have decreased to 97 mmf. by the time the set reaches operating temperature.

It would first seem that this would be an undesirable characteristic. To the contrary, however, this characteristic can be utilized in the design of electrical circuits. Circuit elements, such as coils, transformers, resistors, tube capacitances, etc., change in value with changes in temperature. In frequency determining circuits, these changes are usually such that as a set heats up to operating temperature, it takes less capacity to maintain the same resonant frequency. If we trimmed these frequency determining circuits with a capacitor that decreases in value as its temperature increases, the circuit would tend to maintain the same frequency characteristics at all operating temperatures.

In circuits where a change in capacity with change in temperature is undesirable, a very stable ceramic capacitor of NPO (negative-positive-zero) temperature coefficient is available.

Although temperature compensation was the primary purpose of the ceramic capacitor, they have found wide usage in other applications. The growing demand for smaller units has placed added emphasis on ceramic capacitors. General purpose units, ranging from 5 mmf. to .1 mfd., are now available to the service field. These capacitors are readily adaptable for uses where changes in capacity with change in operating temperature are not critical, such as bypass, coupling, etc. The temperature characteristics of general purpose capacitors are varied. In general, the capacity will not decrease more than 20% nor increase more than 10% from their value at +25°C.

General purpose ceramic capacitors can be used in applications where a maximum of 20% variation in capacity will not affect the operation of the circuit.

There is also available to the service field a ceramic capacitor that is rated at its guaranteed minimum value (GMV). The capacitor will not fall below its rated value at normal operating temperatures, however, it may exceed its rated value as much as 100 percent. This capacitor is ideally suited for bypass, coupling, and decoupling applications.

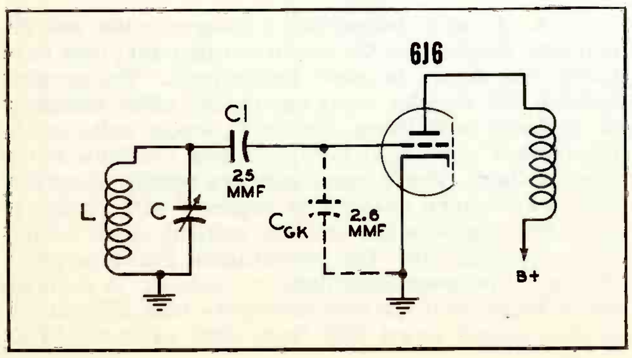
Replacement Hints

In television tuners physical size, temperature characteristics, lead lengths, capacity tolerance, etc., must be considered. Ceramic capacitors are used almost exclusively in television tuners. In some tuners it is extremely difficult to make replacements without disturbing the alignment of the tuner. If the service technician is not equipped to properly realign the tuner, he should not attempt to replace capacitors that are not easily accessible. It would probably be more advisable to procure an exchange tuner if available.

However, when the defective component is accessible, general purpose capacitors may be used for replacement of capacitors used in such applications as cathode bypass, filament bypass, screen bypass, decoupling, AGC filters, and RF bypass. For these applications care should be taken to insure that the replacement capacitor is of the same value, and that location and length of leads are approximately the same as those of the original component.

In the case of ceramic capacitors used as RF coupling, fixed-trimmers, fixed padders, oscillator coupling, oscillator feedback, IF coupling, etc., particular attention must be given to the temperature characteristic and tolerance of the replacement. Not all these applications require a temperature compensating capacitor, but extreme care must be used not to change the frequency compensating characteristics of the circuit with the replacement capacitor. Tolerance is also an important consideration in frequency determining circuits. The replacement capacitor should be of as close or closer tolerance than the original capacitor so as to insure that the tuned circuit will have the same frequency range.

Tube interelectrode capacities are used to a large extent as a part of tuned circuits in TV tuners. Whenever a capacitor is used between the tube element and the tuned circuit, and its capacity is much larger than the interelectrode capacity (more than 10 times larger) a general purpose capacitor of the same value or larger may be used. This may be illustrated by the following example:



C_1 is the coupling capacitor and C_{gk} is the interelectrode capacity between grid and cathode. C1 and C_{gk} are in series and are a part of the tuned circuit LC. The capacity of C1 and Cgk in series is:

$$C_T = \frac{C_1 \times C_{gk}}{C_1 + C_{gk}} = 2.36 \text{ mmf.}$$

If we now change C_1 to 30 mmf., the capacity of C_1 and C_{gk} in series will increase to 2.39 mmf. The capacity of C_1 has been increased 20% and the increase in capacity across L has only increased .03 mmf. The effect of this change will be negligible in most applications. A general purpose ceramic capacitor would be suitable for an application of this kind. As the coupling capacitor C_1 approaches either the value of C or C_{gk}, it will have more effect in changing the total capacity across L. It might then become necessary to take temperature coefficient and tolerance into consideration when a replacement is made.

The following rule should be followed when replacing a capacitor used in the above applications. Use a capacitor with the same temperature coefficient, the same or closer tolerance rating, and the same capacity as the original unit. The exception to the rule would be those cases where the service technician is reasonably sure that a general purpose capacitor will not change the temperature characteristic or frequency range of the circuit. It must be kept in mind that the general purpose ceramic capacitor value will probably decrease as the receiver heats up to operating temperature.

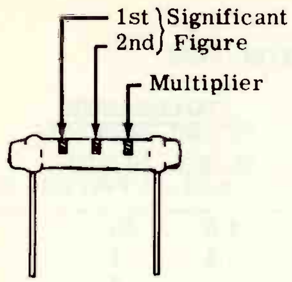
Ceramic capacitors, both general purpose and temperature compensating, are widely used in the video and sound IF sections. Temperature compensating capacitors are often used in the traps and tuned circuits. When making replacements for capacitors used in those applications, replace with capacitors of equivalent characteristics. General purpose and guaranteed minimum value ceramic capacitors can be used for replacement of capacitors used in such applications as cathode, filament, and screen bypass, decoupling, RF bypass, AGC filter, and video IF coupling.

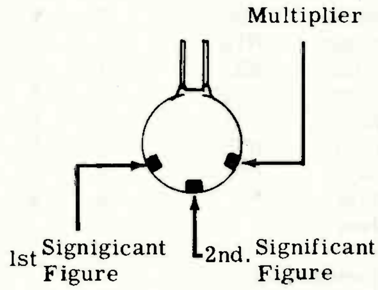
Special high voltage rating capacitors are sometimes encountered in the horizontal deflection and high voltage circuits. The service technician is usually confronted with the problem of distinguishing between the high voltage unit and the regular 500 volt ceramic capacitor. These high voltage units are generally marked with the capacity and "HV" for high voltage. For actual voltage ratings of these units, the service technician should refer to published service information regarding that particular receiver. When replacing a defective unit in this section, be sure that the new component has a voltage rating comparable to the original unit.

There is a wide range of temperature compensating capacitors being used, ranging from N030 to N750. It would require a considerable inventory for a service shop to stock capacitors in all the preferred temperature coefficient ranges. However, when space permits, most temperature coefficient capacitors within this range can be duplicated by paralleling NPO and N750 units.

For example, a 27 mmf. capacitor with a temperature coefficient of N470 will change in capacity:

♦ ♦ Please turn to page 28 ♦ ♦

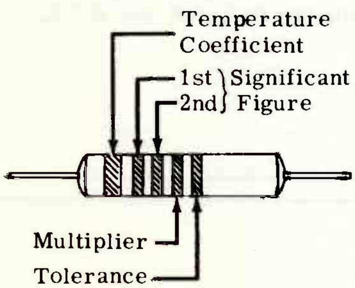


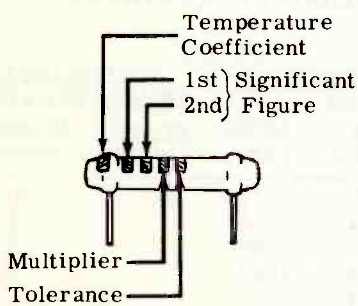


3 DOT OR BAND COLOR CODE

Color	CAPACITY Significant Figure 1st	2nd	Multiplier
Black	0	0	1
Brown	1	1	10
Red	2	2	100
Orange	3	3	1000
Yellow	4	4	10000
Green	5	5	
Blue	6	6	
Violet	7	7	
Gray	8	8	
White	9	9	

EXAMPLE:
A capacitor color coded Brown-Black-Red is a 1000 mmf. Capacitor.



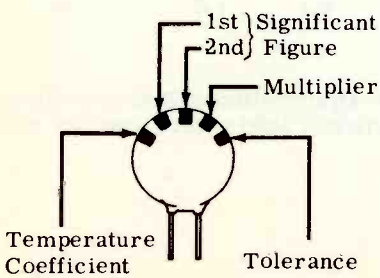


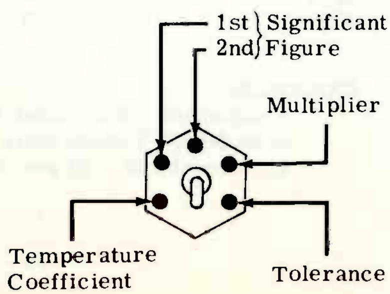
4 OR 5 DOT OR BAND COLOR CODE

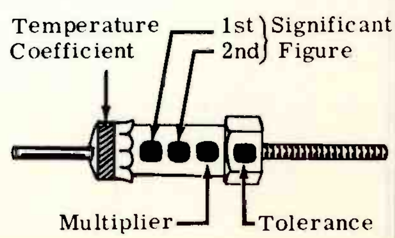
Color	Temperature Coefficient PPM/°C.	CAPACITY Significant Figure 1st	2nd	Multiplier	§TOLERANCE 10 mmf. or less ± mmf.	More than 10 mmf. ± Percent
Black	NPO	0	0	1	2.0	20
Brown	N030	1	1	10	0.1	1
Red	N080	2	2	100		2
Orange	N150	3	3	1000		2.5
Yellow	N220	4	4	10000		
Green	N330	5	5		0.5	5
Blue	N470	6	6			
Violet	N750	7	7			
Gray	P030	8	8	0.01	0.25	
White	*	9	9	0.1	1.0	10
Silver	#					
Gold	P100					

* General Purpose
# Bypass and Coupling
§ Some Manufacturers omit fifth dot or band when unit is rated at guaranteed minimum value.

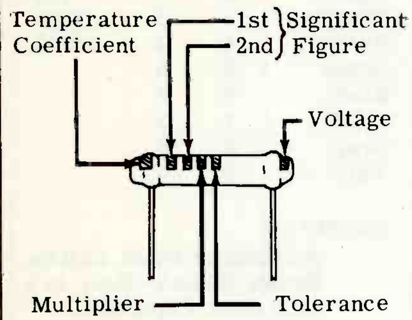
EXAMPLE:
A capacitor color coded Violet-Yellow-Violet-White-Green is an N750 Temperature Coefficient 4.7 mmf. Capacitor with a Tolerance of ± 0.5 mmf.







6 DOT OR BAND COLOR CODE



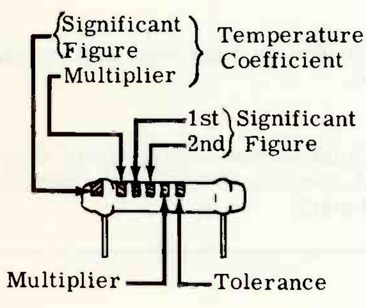
Color	Temperature Coefficient PPM/°C.	CAPACITY Significant Figure 1st	2nd	Multiplier	TOLERANCE 10 mmf. or less ± mmf.	More than 10 mmf. ± Percent	Voltage
Black	NPO	0	0	1	2.0	20	
Brown	N030	1	1	10	0.1	1	150
Red	N080	2	2	100		2	
Orange	N150	3	3	1000		2.5	350
Yellow	N220	4	4				
Green	N330	5	5		0.5	5	500
Blue	N470	6	6				
Violet	N750	7	7				
Gray	P030	8	8	0.01	0.25		
White	*	9	9	0.1	1.0	10	
Silver	#						

* General Purpose
# Bypass and Coupling

EXAMPLE:
A capacitor color coded Violet-Yellow-Violet-White-Green-Orange is an N750 Temperature Coefficient 4.7 mmf. Capacitor with a Tolerance of ±0.5 mmf. and a Voltage Rating of 350 **WVDC.**

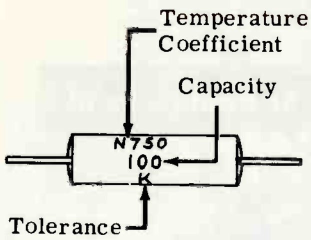
6 DOT OR BAND COLOR CODE

EXTENDED RANGE TEMPERATURE COEFFICIENT



Color	Temperature Coefficient Significant Figure	Multiplier	CAPACITY Significant Figure 1st	2nd	Multiplier	TOLERANCE 10 mmf. or less ± mmf.	More than 10 mmf. ± Percent
Black	0	-1	0	0	1	2.0	20
Brown		-10	1	1	10		1
Red	1	-100	2	2	100		2
Orange	1.5	-1000	3	3	1000		2.5
Yellow	2.2	-10000	4	4			
Green	3.3	+1	5	5		0.5	5
Blue	4.7	+10	6	6			
Violet	7.5	+100	7	7			
Gray		+1000	8	8	0.01	0.25	
White		+10000	9	9	0.1	1.0	10

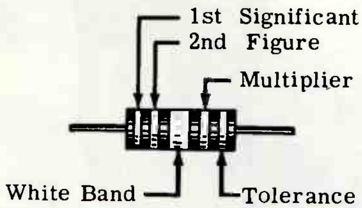
EXAMPLE:
A capacitor color coded Blue-Orange-Brown-Red-Red-Black is an N4700 Temperature Coefficient 1200 mmf. Capacitor with a Tolerance of ± 20 percent.

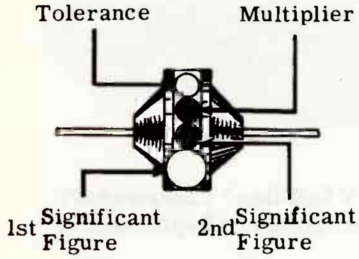


TYPOGRAPHICALLY MARKED
CERAMIC CAPACITORS

JAN Letter	TOLERANCE 10 mmf. or less ± mmf.	More than 10 mmf. ± Percent
C	0.25	
D	0.5	
F	1.0	1
G	2.0	2
J		5
K		10
M		20

Tolerance may be in either ± mmf., ± Percent, or Equivalent JAN Letter.





MOLDED CERAMIC CAPACITORS

(USING STANDARD
RESISTOR COLOR CODE)

Color	CAPACITY Significant Figure 1st	2nd	Multiplier	Tolerance
Black	0	0	1	
Brown	1	1	10	
Red	2	2	100	
Orange	3	3		
Yellow	4	4		
Green	5	5		
Blue	6	6		
Violet	7	7		
Gray	8	8		
White	9	9		
Silver				10%
Gold				5%

The White Band in center distinguishes the Capacitor from the Standard Resistor.

EXAMPLE:

A Capacitor color coded Brown-Black-Brown-Silver is a 100 mmf. capacitor with a Tolerance of 10%.

MOLDED CERAMIC CAPACITORS

Capacity	Color Coding 20% Tolerance
.5	Green-Gold
.68	Blue-Gray-Silver
1.0	Brown
1.5	Brown-Green
2.2	Red
3.3	Orange
4.7	Green

MERIT

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Converting the Motorola VF103

by **Robert B. Dunham**

The space available in the Motorola model VF103 (Figure 1) is insufficient to allow the mounting of a 19" rectangular picture tube directly on the chassis, but there is enough room in the phonograph compartment for the tube alone, as shown in Figure 2. A 14" rectangular tube can be mounted on the chassis and such a conversion will be discussed later under cabinet changes. The electrical conversion and chassis changes should be made before the cabinet is altered.

A partial schematic of the circuit before conversion is shown in Figure 3. To convert to the use of a larger picture tube, the horizontal output transformer, width coil, high voltage filter capacitor and deflection yoke were replaced with new components; and the circuit rewired as shown in Figure 4.

Since a 16" rectangular tube was to be used in this conversion, the chassis was taken out of the cabinet and the front mounting bracket removed. This bracket also supported the AM-FM radio dial and could have been sawed off above this dial so as not to disturb its position. To keep from destroying the original bracket, a new bracket was made out of a 2" x 2" piece of 20 guage sheet metal. The four holes for the self tapping sheet metal screws were drilled, using the original bracket as a template. The dial was then remounted, using the four original screws.

Figure 1. Receiver Before Conversion.

Figure 2. Receiver After Conversion.

The leads to the deflection yoke and focus coil were unsoldered, where connected in the chassis. (A notation should be made of the points where these leads are removed, as this will be helpful in rewiring the circuit.) The two 8-32 machine screws holding the mounting bracket were then taken out and the complete assembly was removed.

At this time an octal socket was installed on the chassis to serve as a connector for the yoke and focus coil. This socket was placed in the unused hole in front of the horizontal oscillator transformer (see Figures 5 and 6) and held in place with two 6-32 machine screws and nuts. In wiring the socket it was found that most of the wires could be kept short. A socket for this purpose is very convenient although not actually necessary as the deflection yoke and focus coil leads can be wired directly to the proper terminals in the chassis.

The leads to terminals 1, 2, 4, 5, and 6 of the horizontal output transformer were unsoldered and the four screws mounting it to the chassis were removed. After removing the two screws holding the HV rectifier socket to the chassis and the screw mounting the HV filter capacitor, these three components were lifted out. The rectifier socket assembly, less the metal angle bracket was used in the conversion but the transformer and capacitor were replaced.

TRIPLETT

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MODEL 660

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Power consumption measurement has long been proved by auto-radio servicemen as a rapid method of localizing troubles in auto radios. But Triplett's new LOAD-CHEK is the *first* Wattmeter to be produced *at moderate cost*, and with the *proper ranges*, to bring this short-cut method within the reach of *every* radio and TV service man.

Basis of the LOAD-CHEK method is the tag or label on every radio and TV chassis which shows the normal power consumption. The following examples are only two of many time-saving uses of this new instrument.

LOCATING A SHORT—The chassis tag may show a normal consumption of 225 Watts. Simply plug the power cord of the chassis into LOAD-CHEK (there are no loose ends to connect or be in the way). Note the reading—which should be possibly 350 Watts. By removing the rectifier tube you can determine at once which side of the tube the short is on. With a soldering iron and long-nosed pliers you can check through the chassis, locate and correct the trouble without having to lay down tools or to check with lead wires!

REPLACING BURNED OUT RESISTORS—With the chassis to be repaired plugged into a LOAD-CHEK MODEL 660, note the wattage reading with the burned out resistor circuit open. Now replace the resistor. Should the increase in watts be greater than that of the resistor rating being installed, it indicates that an extra load has caused the trouble which has not been cleared.

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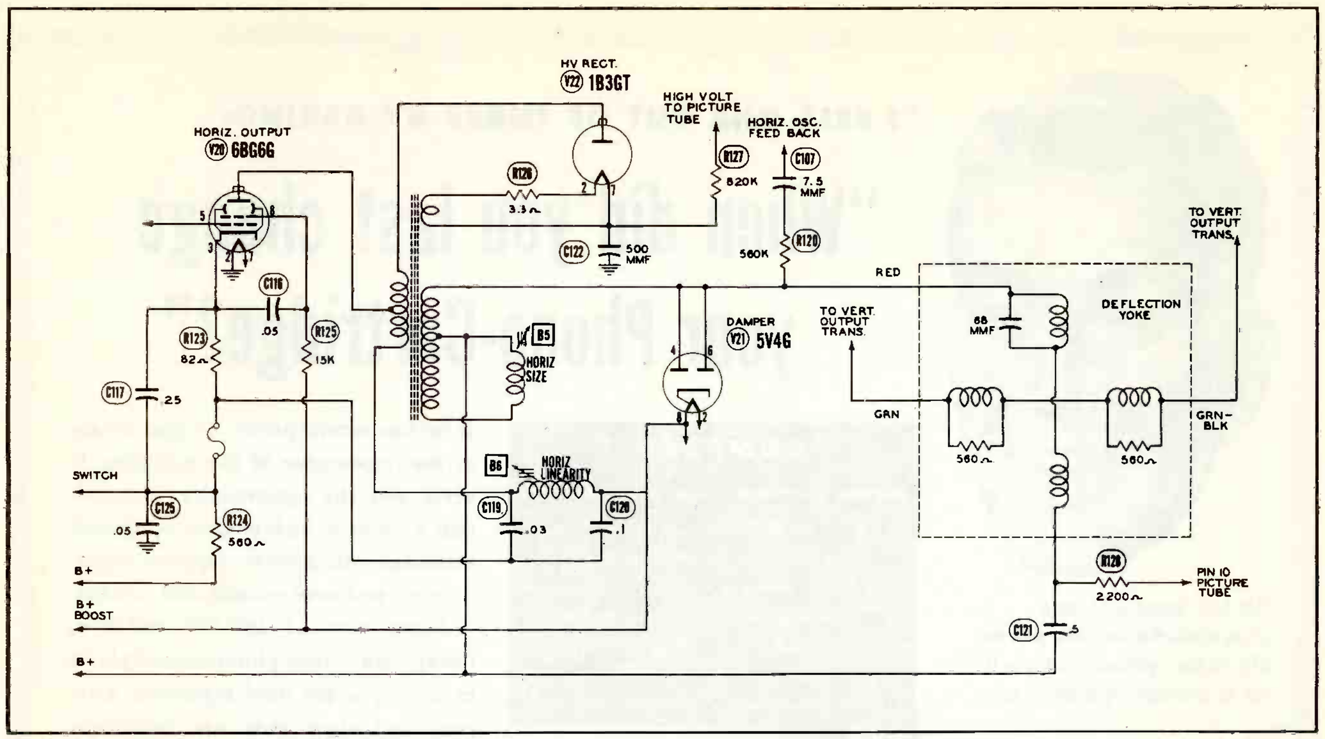

Figure 3. Original Horizontal Circuit.

A new angle bracket (see Figures 7 and 8) was made to increase the height of the HV rectifier tube above the chassis and also to be used for mounting the horizontal output transformer. Before mounting the Merit HVO-6 transformer, used in this conversion, a 1/2 inch section of its metal base was sawed off, as shown in Figure 7. If this is not done the high voltage will arc over from the HV rectifier socket through this metal base to the chassis. Also, since the rectifier filament leads were not long enough to be used in this application, the one turn winding was removed completely. The original HV lead was unsoldered from the corona ring and the connector unsoldered from the other end. This piece of high voltage cable was then looped around the base end of the transformer core (see Figure 7) to form a one-turn filament winding of sufficient length to connect to the proper terminals on the rectifier tube socket.

After the conversion was completed the chassis was installed in the cabinet and the metal rear cover of the receiver compartment secured in place. It was then found that the high voltage arced over to the cover from terminal No. 3 of the HVO-6 transformer.

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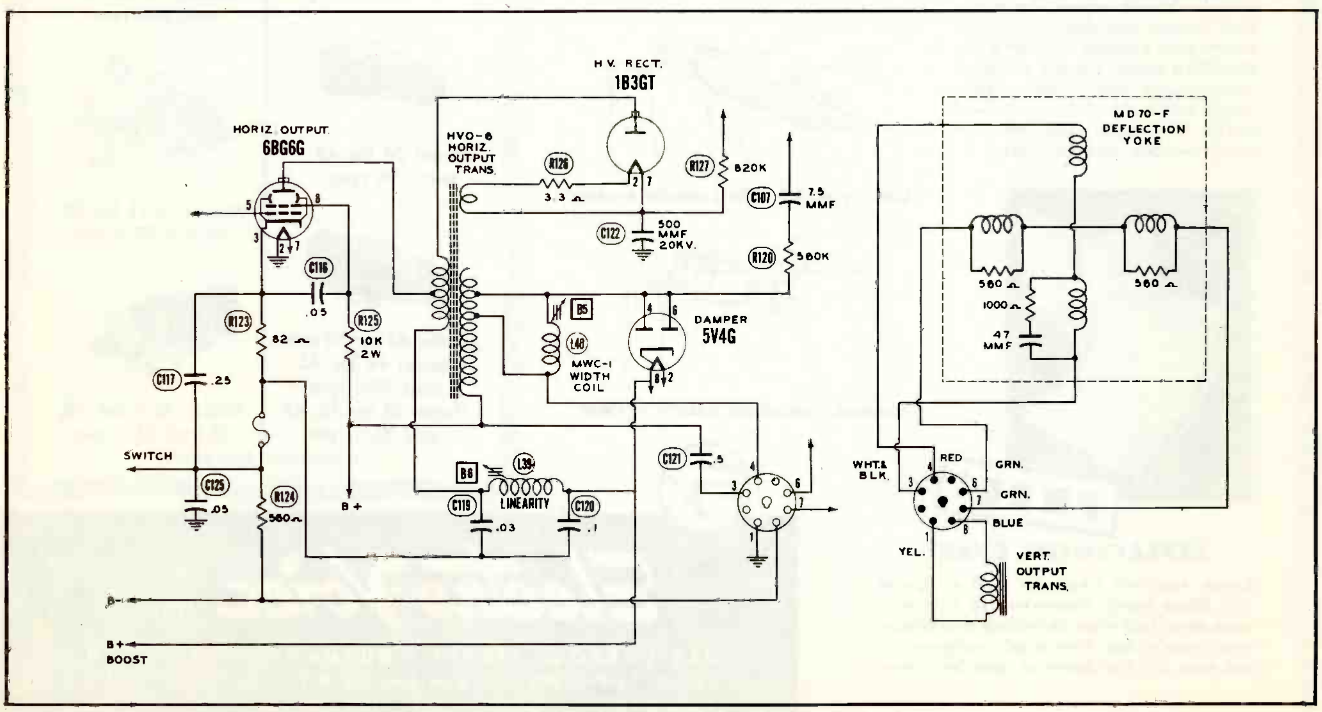

Figure 4. Horizontal Circuit After Conversion.

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FULL REPRODUCTION	LIMITED REPRODUCTION
LOW NEEDLE TALK	AUDIBLE NEEDLE TALK
LESS RECORD WEAR	MORE RECORD WEAR
LESS NEEDLE WEAR	MORE NEEDLE WEAR

It makes record-player owners aware of the importance of the cartridge. It gives you the opportunity to prove that a *modern, lightweight, compliant* cartridge will greatly improve reproduction and save records and needles.

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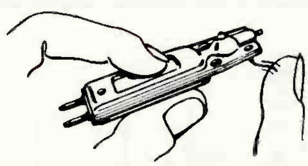
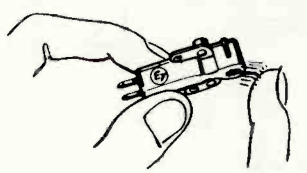
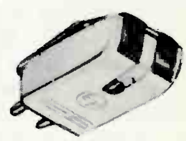


Old style, stiff-acting needle system



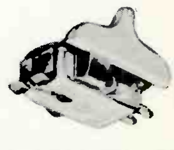
Modern, compliant needle system

Model 32 for 78 rpm
Model 33 for 78, 45 and 33⅓ rpm



Model 12 for 78 rpm
Model 14 for 45 and 33⅓ rpm

Model 34 for 45 and 33⅓ rpm



Model 16-TT for 78, 45 and 33⅓ rpm

Model 42 for 78 rpm
Model 44 for 45 and 33⅓ rpm
Model 43 for 78, 45 and 33⅓ rpm

Model 96-T for 78, 45 and 33⅓ rpm

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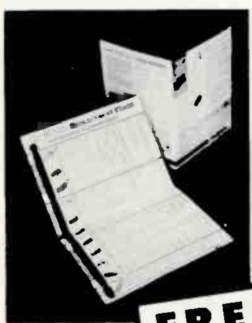

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ELECTROSTATICALLY FOCUSED
PICTURE TUBES

by MERLE E. CHANEY

A recent addition to the present line of television picture tubes is the electrostatic focus - magnetic deflection type. The engineering of these tubes has been accelerated largely due to the search for new methods to conserve critical materials. Electrostatically focused tubes are being produced by several manufacturers on a commercial basis and many new receivers now incorporate them.

To insure that these new tubes could become commercially practical it was necessary to engineer a tube that functions as well as the magnetically deflected type. The end result was an electrostatically focused tube whose spot size, overall focus, and resolution are equal to that of the magnetically focused type. Variation of the focus control does not cause appreciable lateral or rotational motion of the raster; normal line voltage variation does not affect focus; and picture quality is maintained at the same level as the electromagnetically focused tubes.

The gun structures used in the electrostatically focused and the magnetically focused tubes are basically similar in design. The control grid, accelerating anode, and the first HV anode of the electrostatically focused tube function in the same manner as those of the magnetically focused type. Provision for focusing in the electrostatic focus tube requires the use of two additional electrodes, a focus anode and the second HV anode. The elements are mounted in front (screen side) of the first HV anode, as shown in Figure 1. The focus anode is positioned between the first and second HV anodes which makes it possible to have the last electrode of the gun structure operating at the highest potential available so that the beam will be properly accelerated toward the picture screen.

The electrodes making up the gun structure are securely held in position by means of two insulating rods. The rods are usually constructed of ceramic or glass. If ceramic is used there are extensions from each electrode formed around the ceramic rods, and spot welded to give rigidity to the structure. If glass rods are used as supports, the procedure is to weld wire-like extensions to the electrodes and fuse them onto a glass rod on each side.

The gun structure is supported in the neck of the tube by the leads extending from the electrodes to the glass base at the socket end of the tube. Additional support is provided for the gun structure by the spring-like contacts from the HV anode which press against the coating inside the neck of the tube. The primary purpose of these contacts is to pick off the high voltage for the high voltage anode.

In reviewing the theory of operation of cathode-ray tubes employing electrostatic focus, it is seen that the beam of electrons leaving the cathode are acted upon by the control grid to cause a crossover point or point of focus slightly beyond the control grid aperture. The beam tends to widen out after passing this point. The accelerating anode speeds up the beam in its travel toward the screen. Further acceleration of the beam is provided due to the high positive potential present on the HV anodes.

Since the focus and HV anodes operate at a different DC potential, an electrostatic field is established between these electrodes. The beam, which has been diverging after leaving the first crossover point, enters the electrostatic field and is caused to converge.

By varying the potential on the focus anode the effect of the electrostatic field on the electron beam is controlled so that it is possible to obtain a crossover point, or point of focus, at the surface of the tube screen.

The variation in circuitry in a receiver employing an electrostatically focused tube involves the addition of a high voltage focus supply, so the required voltage can be obtained for the focus anode.

There are two basic methods which have been tried for obtaining the focusing voltage. The first method used is a bleeder network in the high voltage supply. However, there were troubles encountered, caused by arcing and corona difficulties and the fact that an appreciable amount of current flowed thru the bleeder with a resultant decrease in high voltage. A variation of this method used a bleeder network from the first rectifier of a voltage doubling circuit. Arcing and corona was not so serious a problem here,

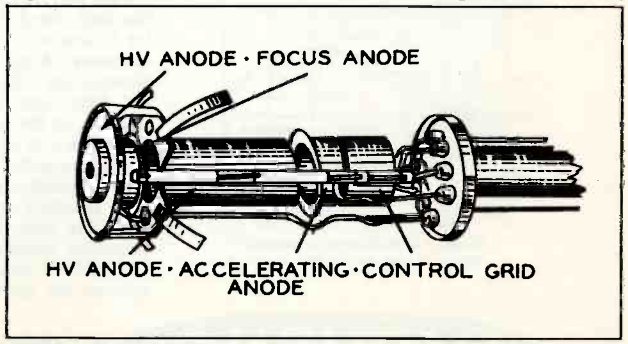


Figure 1. Gun Structure of Electrostatically Focused Picture Tube.

for Greatest TV Picture Quality

AMPHENOL -INLINE*

*Reissue Patent No. 23,273

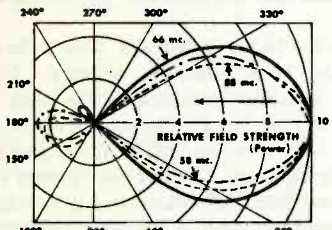
TV ANTENNAS

OUTSTANDING MECHANICAL SPECIFICATIONS

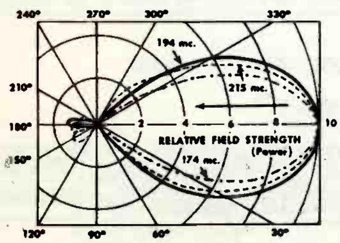
Part	Material	Yield Strength	Size	
		psi	o.d.	Wall
Mast (galv.)	¾" Thinwall Steel Conduit	32,000	0.922"	.049"
Large Folded Dipole	3S ½ H Al.	19,000	.500"	.049"
Small Folded Dipole	3S ½ H Al.	19,000	.375"	.049"
Reflector	3S ½ H Al.	19,000	.500"	.049"
Crossarm	3S H Al.	26,000	.875"	.065"
Center Support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



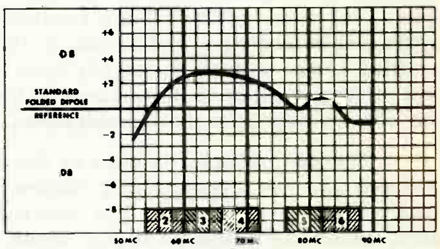
Horizontal radiation pattern of Amphenol TV Antenna Model No. 114-005.

HIGHER GAIN

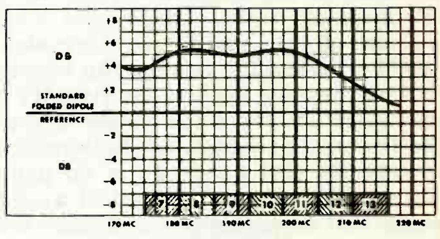
These gain curves of the AMPHENOL Inline antenna represent the intercepted voltage of the AMPHENOL Inline Antenna as plotted against the intercepted voltage of a reference folded dipole cut to the frequency being compared. There is no channel in either the low band or high band where there is more than 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.

YOURS FOR THE ASKING

Send for "The Antenna Story" — a sincere discussion of TV antennas based on actual field tests.

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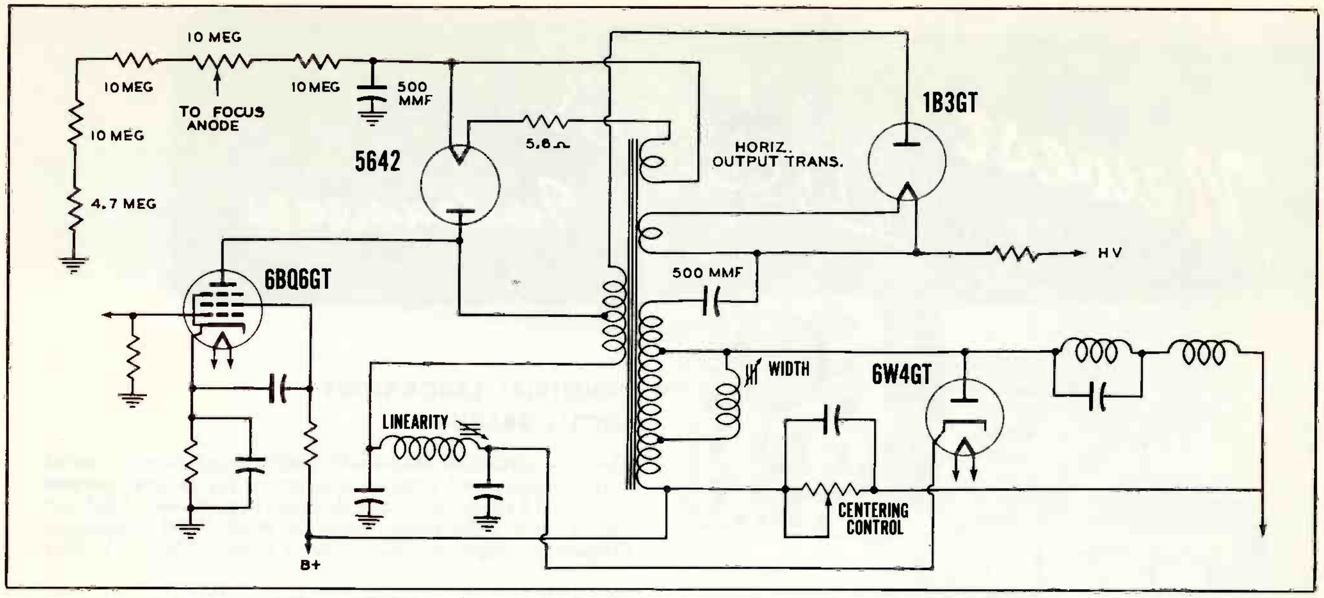

Figure 2. Circuitry Used by Sylvania to Obtain Focusing Voltage.

and deriving the focusing voltage in this manner was possible provided the bleeder current was not too high. A second method tried, which was found to be more practical, was to rectify the positive pulse voltage present on the plate of the horizontal output tube.

Figure 2 shows a schematic of a horizontal output circuit with the additional components to provide the focus anode voltage. The circuit of Figure 2 uses a centering control to center the raster since a focus coil or magnet is not used for this purpose. The horizontal output circuit is a standard type and except for the addition of the focus supply remains essentially the same. In this circuit a miniature type 5642 rectifier tube is used to rectify the positive pulses from the plate of the horizontal output tube. An additional winding on the transformer provides filament voltage for the 5642 tube. A series network made up of three 10 meg resistors, a 4.7 meg resistor and a 10 meg potentiometer, is connected from the

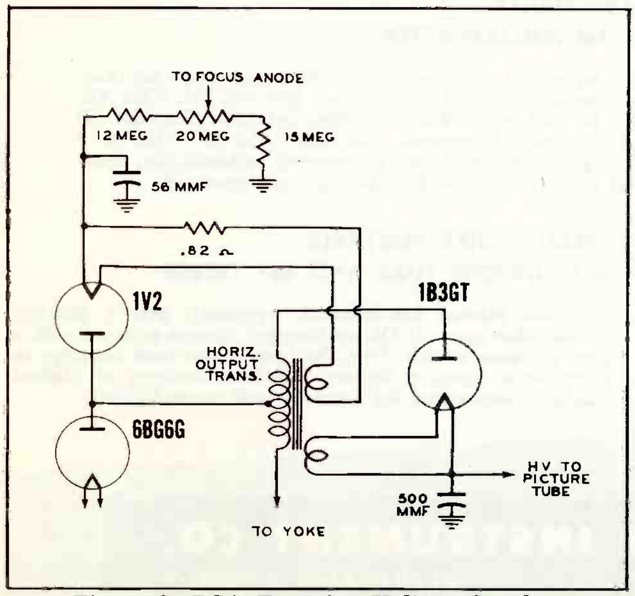

Figure 3. RCA Focusing Voltage Supply

5642 filament to ground. A 500 mmf. HV filter capacitor filters the focus rectifier voltage. A 5.6 ohm resistor in series with the 5642 filament holds the filament voltage within the desired limits. In this circuit the values of the components were selected so that a focus anode range of voltage from 2250 to 2900 volts was obtained from a 3900 volt source. When other horizontal output transformers are used it may be necessary to change the values of the resistors in the bleeder string.

Figure 3 is a partial schematic of a horizontal output circuit and focus supply used in late production RCA sets employing the electrostatically focused picture tube, type 17GP4. Early production 17" RCA sets employed the magnetic focus tube type 17CP4. When the 17GP4 tube is used the receivers will be identified by the letter "B" following the model number. In the late version receivers a centering device consisting of two magnetic rings on the neck of the tubes makes it possible to position the raster. Rotation of the rings effects shifting of the picture. When the gaps in the rings are together maximum shifting occurs, and when the gaps are 180^{o} apart little or no shifting takes place.

In the circuit of Figure 3 the focus voltage is also obtained from the plate of the horizontal output tube. The focus rectifier is a type 1V2 tube. The filter capacitor is 56 mmf. and the bleeder consists of a series network of a 12 meg and a 15 meg resistor and a 20 meg focus control. The movable arm of the focus control is connected to the focus anode, pin 6, of the 17GP4 picture tube.

It is still necessary to employ an ion trap on the neck of the electrostatically focused tube and the adjustment of the trap should be performed in the same manner as for magnetically focused tubes. Since the location of the ion trap affects the position of the raster, it should be adjusted for maximum brightness and centering should be done only with the centering rings or centering control. Should the ion trap be used to center the raster with a resultant decrease in brightness, the gun may be damaged.

♦ ♦ Please turn to page 58 ♦ ♦

An Impedance Measuring Device

by W. William Hensler and Merle E. Chaney

Equipment of assistance in determining component impedance within the audio ranges

How many times have you wanted to measure the impedance of a speaker voice coil or the special type primary impedance of an output transformer? Following is the description of a device which enables you to make these measurements.

In order to obtain the maximum transfer of energy from the output tube to the speaker with a minimum of distortion, it is imperative that the output tube "work into" the proper load. Since the output transformer acts as an impedance matching device to properly couple the output tube to the speaker, its constants are very important. The impedance which is presented to the tube is dependent upon the impedance of the speaker and the turns ratio of the output transformer (assuming that the transformer is operated within rated load conditions so that core saturation, etc., would not be factors). Since the impedance cannot be measured directly there may be a doubt as to what the proper replacement should be when it is necessary to replace the speaker or output transformer. After constructing the device shown in Figure 1, measurements can be taken to insure proper replacement, in cases where age, obliteration, or previous repair precludes the availability of accurate service literature.

Figure 2 is a simplified schematic showing the basic components in the unit. Two ranges are provided, the low range from 0 to 25 ohms, and the high range from 0 to 25K ohms. A 400 cycle signal is applied to the 400 cycle input terminals. The unknown impedance is so connected in the circuit that it is in series with either the high or low range variable resistance, depending upon the setting of the switch. With the 400 cycle signal applied to this series network, the variable resistance is adjusted so that the signals developed across the resistance and the unknown impedance are equal. At this point the amount of resistance in the circuit equals the impedance of the component under test. The resistance can then easily be measured with a bridge or an ohmeter.

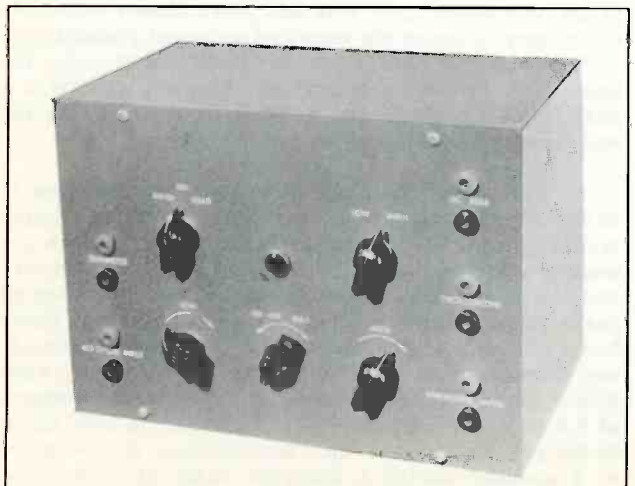

Figure 1. Impedance Measuring Device.

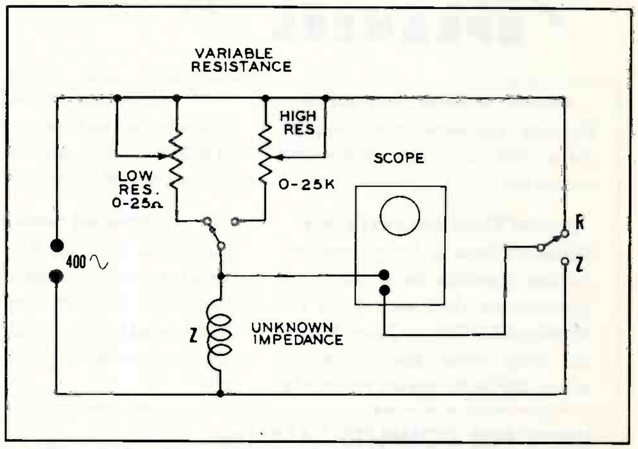

Figure 2. Simple Impedance Measuring circuit.

For greatest accuracy, a high impedance device must be used to measure the amplitude of the signal developed across the resistance and the unknown impedance. Loading either of the components with a low impedance device, such as a 1000 ohm per volt AC meter, would unbalance the network and produce an error in the measurement. A scope is shown in Figure 2 as the measuring device. The use of the scope proves to be more satisfactory than any other type of instrument since it presents a minimum of loading on the circuit making possible a greater degree of accuracy in the measurements. A vacuum tube AC voltmeter can also be used in this application but care should be taken to see that the AC section of the meter is actually a vacuum tube type instrument. Many vacuum tube meters do not operate on the vacuum tube principal on the AC range, and a meter of this type does not work satisfactorily.

Again referring to Figure 2, it can be seen that the "Z" and "R" switch alternately switches the scope across the variable resistance and the unknown impedance. This switching arrangement is incorporated in the finished unit to simplify the mechanics of operation. The device can be said to be in "balance" when an equal indication is obtained on the scope with the switch in either the "Z" or "R" position. Since, the signals across each leg of the circuit are equal in amplitude, the impedance must be equal.

So far our discussion has not taken into account the current which is flowing in the primary of the output transformer. In the case of a push-pull output stage, the current flowing in the two halves of the transformer are flowing in opposite directions and the field generated by this static current is effectively zero. When a single output stage is used, however, the conditions are quite different. The current flowing through the primary generates a field in the transformer and tends to decrease its effective impedance. In order to see why this is true, consider the two following explanations, either of which is applicable.

With a current flowing in the transformer, it can be assumed that a certain flux density is established in the core. Any core has a saturation point, and this current flowing in the primary lessens the amount that the current can be increased (under signal conditions) before saturation is reached. In other words, the signal appears to be working into a transformer having less iron in the core, which presents less impedance to the signal.

Another approach is to consider that the transformer presents maximum impedance when no current is flowing and minimum impedance when saturation is reached. Obviously, the transformer should not be operated at the saturation point, and since current is flowing, the impedance value must lie somewhere between the minimum and maximum limits of the transformer.

Consequently this flow of current must be taken into account when making measurements to arrive at the correct reading. Figure 3 shows the basic unit of Figure 2 with a power supply added. A 6V6GT tube is used to control the current through the component under test. By adjusting the bias control, R1, the amount of current flowing through the circuit can be controlled. With this setup the transformer can be measured while under normal operating conditions.

The power supply is a conventional full wave type having the tap of the high voltage winding returned to ground through resistor R5 to obtain a B- supply. This B- voltage is used to bias the current tube through the adjustment of the bias control, R1. The inductance value of L1 is very important since it is placed in parallel with the component under test. L1 should be at least a 15 henry unit, which has an impedance of approximately 37,700 ohms at 400 cycles. Since most of the measurements on single ended output transformers are below 5,000 ohms, the shunting effect of L1 is slight. The use of a choke having a lower inductance value, however, would present considerable loading on the unknown impedance and introduce an error in the measurement.

The top schematic of Figure 4 is the schematic of the completed unit with all jacks shown which are necessary to make the required external connections. This schematic should be used when constructing the unit. The lower schematic of Figure 4 is that of a null indicator which may be added if desired. Its use and construction will be discussed later.

The most important use for this instrument is in determining the proper replacement for output transformers. Replacement output transformers are usually identified as to the impedances of the primary and the secondary. As an example, one replacement parts manufacturer lists an output transformer which has a primary impedance of 2000 ohms and a secondary impedance of 3.5 ohms. This transformer, when connected to a speaker having a voice coil impedance of 3.5 ohms, will present an impedance of 2000 ohms in the primary. When this transformer is connected to a speaker having a different value of impedance, however, a different value of impedance is presented by the primary. In a great many cases the listing of

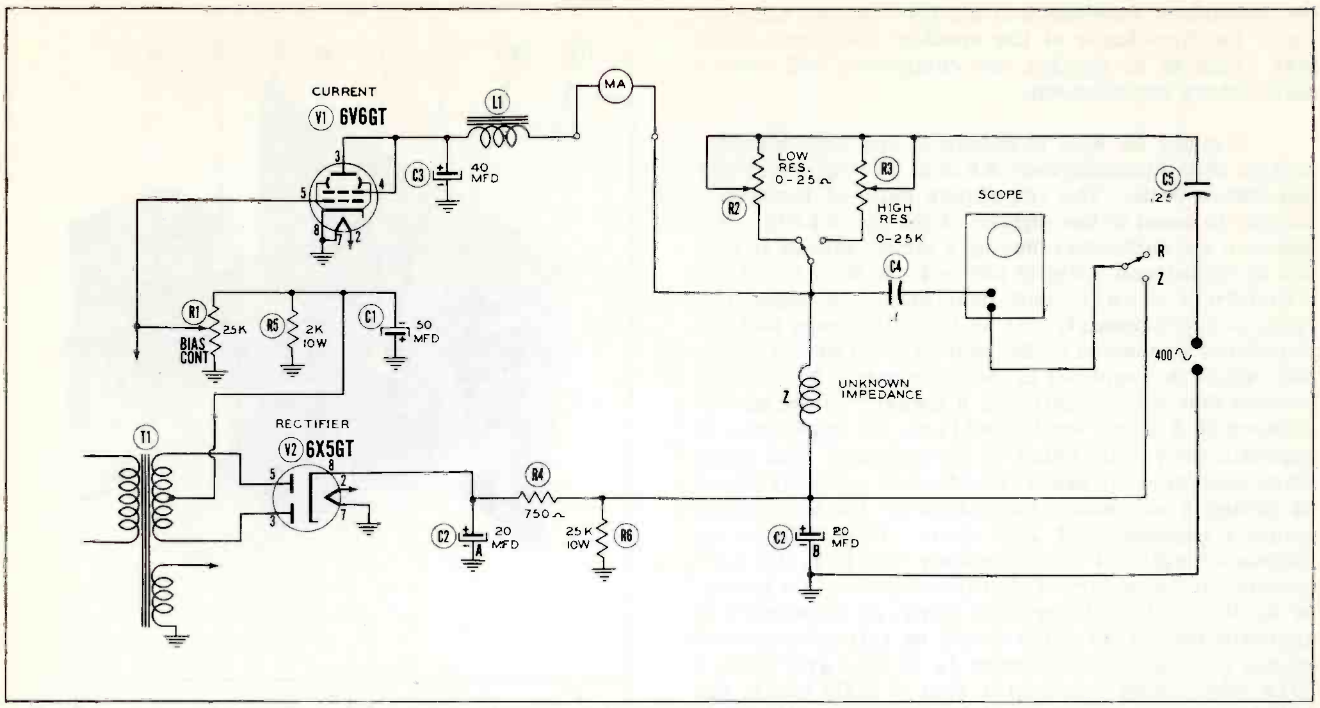

Figure 3. Impedance Measuring circuit with power supply.

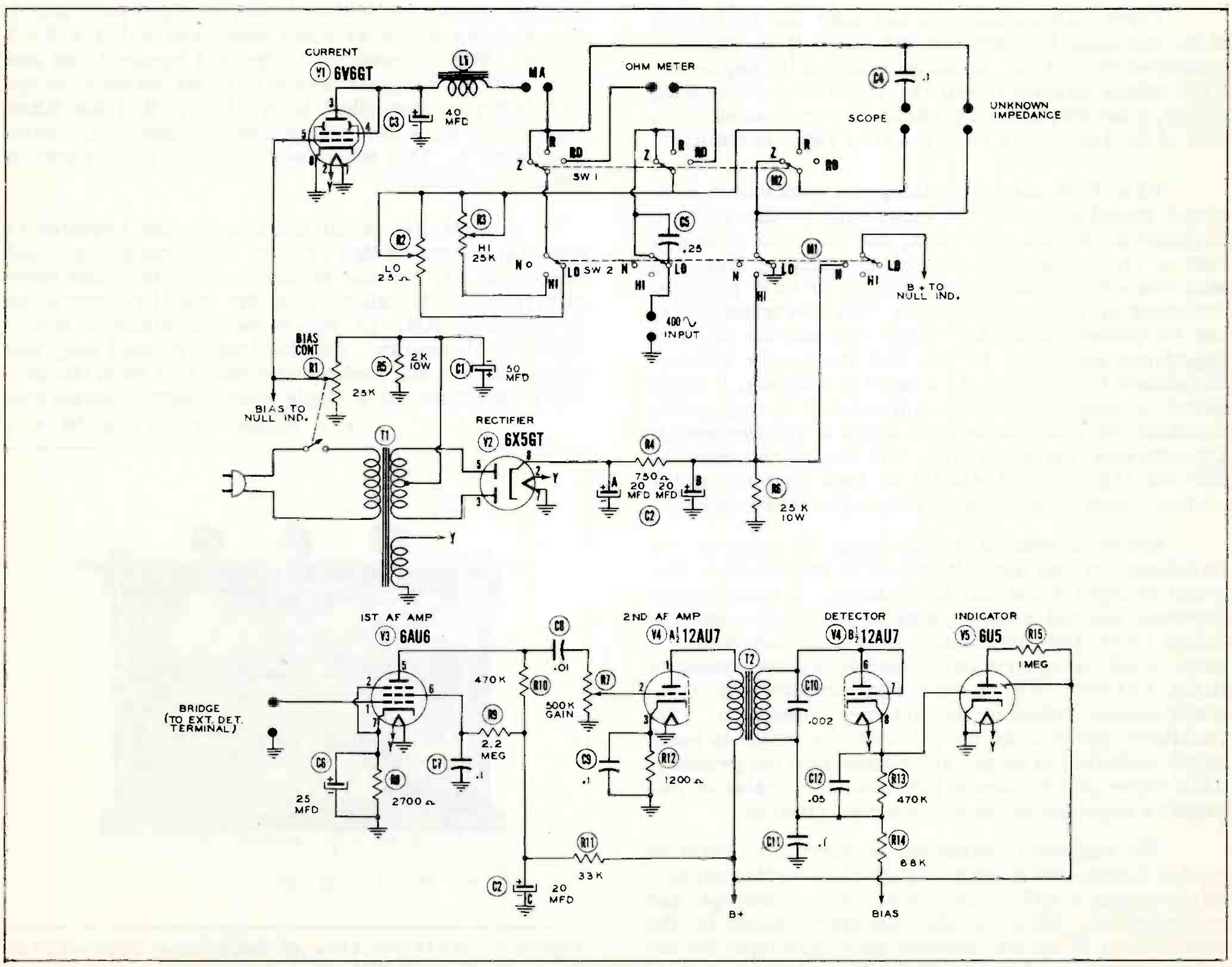

Figure 4. Schematic of the complete Impedance Measuring Device and Null Indicator.

the secondary impedance of the transformer does not equal the impedance of the speaker and some doubt may arise as to whether the component will make a satisfactory replacement.

It might be well to review at this time the properties of the transformer which bring about this impedance ratio. The impedance ratio of the transformer is equal to the square of the turns ratio. For instance a transformer having a turns ratio of 10 to 1 has an impedance ratio of 100 to 1. In the case of the transformer mentioned previously, the impedance ratio is approximately 571 to 1. This means that the impedance presented by the primary will be 571 times that which is connected to the secondary. Thus it can be seen that the connection of a speaker having an impedance of 3 ohms would reflect an impedance of approximately 1700 ohms in the primary. The same manufacturer also has a transformer which is listed as having a secondary impedance of 3.5 ohms and a primary impedance of 2500 ohms. This unit has an impedance ratio of approximately 715 to 1. By connecting the secondary of this transformer to a speaker having an impedance of 3 ohms, an impedance of approximately 2140 ohms would be reflected into the primary. If this transformer is to be used with a 50L6 tube, which requires a load of 2000 ohms, the latter would work more satisfactorily, even though it is rated at 2500 ohms. The reduction in primary impedance is caused by the reduction of the speaker impedance from 3.5 to 3 ohms.

These calculations did not take the resistance of the windings into account but since it is small as compared to the total impedance, it can be neglected. When taking readings with the impedance measuring device, however, this resistance is measured as a part of the impedance so that a true value is obtained.

The first step in making a replacement of an output transformer is the measuring of the speaker impedance. From this data, and the recommended load of the output tube, which is obtained from the tube manual, the impedance ratio of the required transformer can be computed. The new transformer can be connected to the voice coil and the primary impedance measured to see that the proper value of impedance is obtained. As a word of warning, it might be well to point out that in many cases it is impossible to obtain the exact impedance which is recommended. Considerable variation from this amount is permissible but its rating should be held as close to the correct value as possible to obtain the best results.

When a speaker replacement is required, the impedance of the old unit should be measured so that a unit of equal value can be obtained. In some cases, however, the old speaker may be damaged to such an extent that the impedance cannot be measured. If such is the case, a resistive load should be connected to the secondary of the output transformer and a measurement taken of the primary impedance. This resistive load can be varied until the value is found which reflects the proper impedance into the primary. This value of resistance indicates the value of impedance required in the replacement speaker.

The auxiliary equipment required for operation of this instrument is an audio signal generator capable of producing a 400 cycle signal, an oscilloscope, and an ohmmeter. One possible exception would be the substitution of an AC vacuum tube voltmeter for the scope as previously described. The placement of parts in the unit is not critical and the layout of parts may be varied from that shown in Figures 5 and 6. The chassis which we used measured 8-1/2 x 6 x 3 inches. This allowed us to make a compact unit and still provide adequate space for the addition of the null indicator described later. Note that the filter capacitors were mounted below the chassis as shown in Figure 6. This was done to provide more room on top of the chassis.

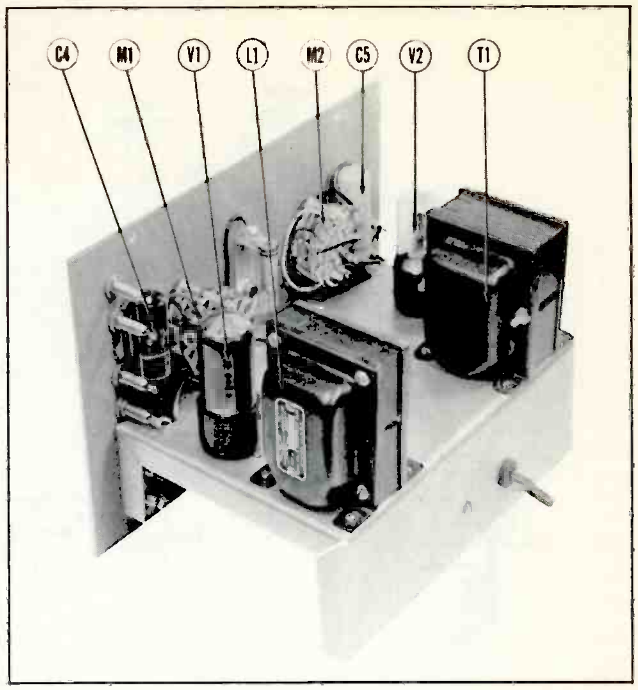

Figure 5. Top view of Impedance Measuring Device, without Null Indicator.

A parts list of all the components required is given at the end of this article. The components used for items L1, R2 and R3 are quite critical and there should be no deviation from the specifications given in the parts list. L1 should have a minimum inductance of 15 henrys. As previously pointed out, this choke shunts the component under test when the primary impedance of a single ended output transformer

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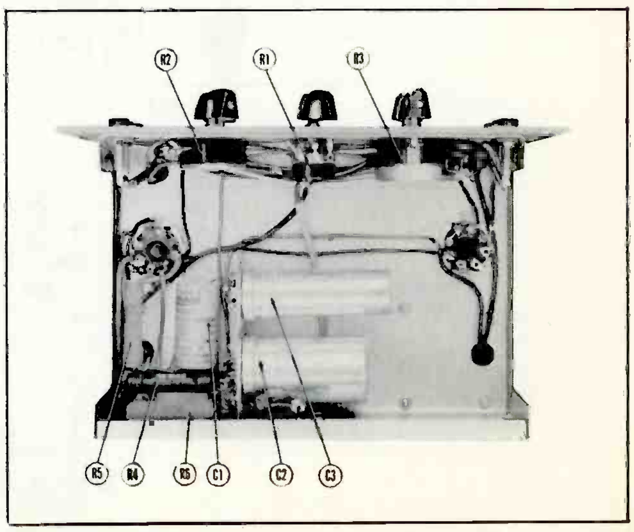


Figure 6. Bottom view of Impedance Measuring Device, without Null Indicator.

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

Dollar and Sense Servicing

REPLACEMENT PARTS. All in all, the repair parts situation appears to be clearing up. Practically all types of television tubes are plentiful. Even tubes for universal a-c/d-c sets are reappearing here and there.

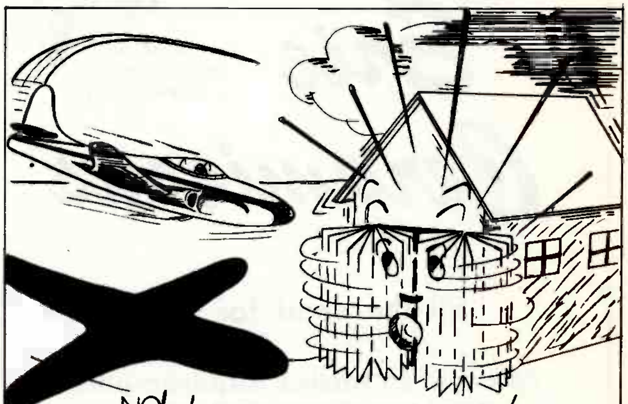
Electrical supply firms are starting to list scarce wiring supplies that haven't been seen above the counter since last August. Bit by bit, those who took the Korean outbreak as a signal for hoarding are disgorging the scarce stuff, in fear that they are overstocked and might be holding the bag.

SIGNS OF THE TIMES. Of the 95 radio and television service organizations listed in the Dayton, Ohio, classified telephone directory, only 41 have TELEVISION or TV in their name. Forty-two of the others indicate in various ways after their name that they do television servicing, but exactly one dozen shops in Dayton will have nothing to do with television if we judge from their telephone directory listings. Is your own business name in line with the times?

LABOR AND MATERIALS. For each dollar a civilian spends for a typical 17-inch television set, 86% goes for materials and only 14% for labor and engineering. For each dollar the military spends for a modern airborne fire-control radar, however, only 49% represents materials, with 51% for labor and engineering. This is one reason why men with electronic know-how are in demand today.

UHF? It looks like years rather than months before more than a handful of UHF TV stations can get on the air. Even if FCC opens up the UHF allocations before unfreezing VHF, it can't start granting station licenses before early fall. Few stations can get on the air this year regardless of the number of construction permits granted, because the only UHF transmitters available for delivery are a few experimental units. Manufacturers need at least 9 months after receipt of a firm order to make the big transmitters. Receiver manufacturers claim they'll be ready for UHF when it comes, either with separate tuners or with UHF strips that fit in existing turret tuners. Claims for present UHF tuners range from fair to good, but all manufacturers assert better ones will be ready when people are ready to buy them. People won't buy until enough UHF stations are on the air or at least definitely in the offing to justify the extra cost, extimated at anywhere from \$10 to \$50 per set.

COMMUNITY TV. Coax for the Pottsville, Pa. community system is strung on electric and phone poles rented from the utilities for \$1.50 per year per pole. For the homes now served, this amounts to half a pole per home. Signals from a hundred-foot antenna on 1,390-ft. Sharp Mountain are piped about 3 miles through RG/11U, with amplifiers about every 2,500 feet, and RG/59U is used for feeders to homes. Channel 6 signals traveling 75 miles from Philadelphia at about 1,500 uv/m are converted to Channel 5 for community distribution. An equally good Channel 3 signal is converted to Channel 2, and a 500 uv/m on Channel 10 is converted to Channel 4. Conversion to low-band channels reduces line loss and minimizes oscillator radiation problems.



NO, NO! — THERE MUST BE SOME MISTAKE!

JETS. At two homes in Dayton, Ohio, the garage doors opened each time a jet plane from nearby Wright-Patterson Air Force Base swooshed past overhead. These homes had ultrasonic door-opening systems, adjusted to react to a silent untrasonic whistle operating off the intake manifold of the auto engine. Jet planes apparently blanket a large part of the ultrasonic spectrum with their whistle, for no amount of filtering by engineers could make the microphones immune to the ultrasonic whine of supersonic-speed jets. The door opening systems finally had to be yanked out.

AT SEA. To keep crews happy, Sun Oil has installed TV sets on eight of their tankers plying Gulf and east coast waters. Boosters and antenna rotators used with 12-1/2-inch RCA receivers result in good pictures right up to fringe limits as the ships cruise past coastal TV stations one after another.

NEXT SIZE. According to Corning Glass, the picture-tube hit-parade leader will be the 27-inch all-glass rectangular, now just getting into production. It gives a much better break cabinet-wise than the 24-inch round and is a logical step-up from the 20 and 21-inchers.

BEGGING FOR BUYERS. Of the three million television sets made up to June 1 this year, some two million are still unsold. About 600,000 are in factory inventory and the rest at distributors and dealers. Wheels of TV production are slowing to lowest level of the year, but on June 1 the rate was still over 200,000 new sets per month. And yet, according to RTMA chairman Robert Sprague, there's no slump in

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♦ ♦ Continued from page 10 ♦ ♦

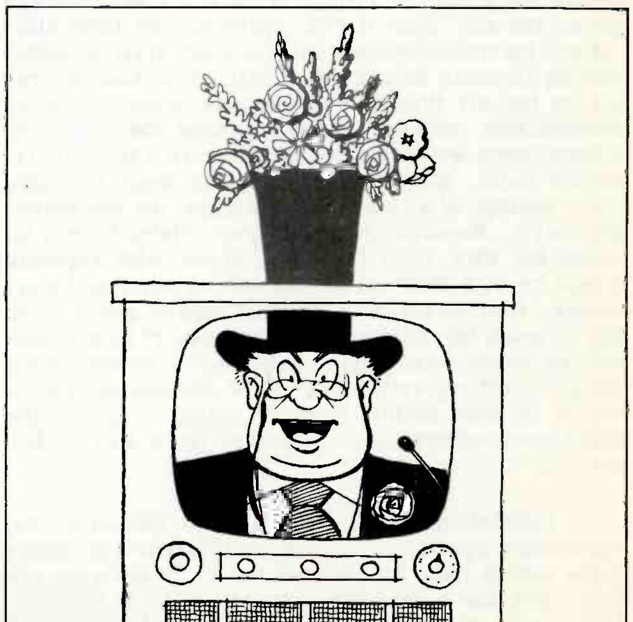
$$\Delta C = TC \times C \times \Delta T$$
$$= 470/1000000/^{\circ}C. \times 27 \text{ mmf.} \times 1^{\circ}C.$$
$$= \frac{12690}{1000000} \text{ mmf.}$$

That is, the capacitor will change 12690/1000000 mmf. per degree Centigrade change of temperature. It is possible to replace this capacitor with a parallel NPO and N750 combination provided we keep the same total capacity and temperature compensating characteristic of the original capacitor. An N750 unit that will provide the same temperature compensation must have less than 27 mmf. capacity. We can compensate for this difference in capacity by paralleling an NPO unit with the N750 capacitor. The procedure for determining the value of N750 and NPO units for any particular substitution is outlined below:

1. Desired Capacity (mmf.)
2. Desired Temperature Coefficient ____ (PPM/°C.)
3. Multiply Line 1 and 2.
   Example: Desired capacitor 27 mmf., TC N470
   27 x 470 = 12690
4. Value in mmf. of N750 capacitor to be used.
   Divide product of line 3 by 750
   12690/750 = 17 mmf.
5. Value in mmf. of NPO capacitor to be used.
   Line 1 minus line 4
   27 mmf. -17 mmf. = mmf.

For practical purposes, the closest standard preferred value capacitors may be selected. Where extremely close tolerance is necessary, capacitors of standard values may be paralleled to obtain the exact value given in lines 4 and 5.

There are several methods of color coding ceramic capacitors. The color codes and the representative types of ceramic capacitors that are most commonly used in radio and television receivers are shown on pages 11, 12, and 13.



---"and if elected, I pledge that I will uphold the dignity of my office."

Tracking down TV Receiver Intermittents . . .

by Matthew Mandl

Co-author: Television & FM Antenna Guide (Macmillan)

Intermittent television receivers, like radios, present an aggravating service problem to the busy technician because so much time is often consumed before the offending part is found. Common practice is to put the offending receiver in an out-of-the-way corner of the work bench and let it play in the hope that the intermittent part finally breaks down entirely. With this method too much time is not lost because other sets can be worked on in the interim.

Some servicemen try to hasten the process by using a Varitran or other voltage control device and raising the AC input in excess of the rated 110-115 volts. This will tend to hurry the breakdown because it overloads the part. Such practice is not recommended, however, because the overload is applied to all circuits and may develop other troubles and cause unwarranted damage. A better method is to set the receiver chassis in the original cabinet if available, or place it in an old packing carton. This creates the temperature which the set undergoes during usage and will help in hastening breakdown. Running the uncased chassis alone often delays breakdown or fails to show up the intermittent because of parts running cooler owing to better air circulation.

Often, however, the intermittent takes considerable time to break down completely, or simulates a total breakdown only to start again when the chassis is moved or test prods applied to one of the circuits. For these reasons it would be well if some means were employed to give an indication of where the trouble is when the intermittent occurs without touching the receiver. This will save considerable time because it will give clues to the probable location of the trouble before actual breakdown occurs.

The best way of doing this is to attach instruments to those circuits which are indicated by symptoms in sound and picture. By this method a minimum of test equipment is required because the localization setup does not include circuits which are obviously not at fault. Thus, the set can be placed aside and allowed to play while the test equipment is attached to strategic circuits. When the intermittent occurs, an immediate indication will be visible and general location of the trouble will be shown. Specific parts can then be checked to find the offending component. Recommended equipment and procedures for various symptoms in picture and sound follow:

Picture Intermittent - Sound Normal

If the picture is intermittent, but the sound normal, the defective circuit is obviously the one between sound takeoff and the picture tube. With intercarrier-type receivers this gives virtual immediate localization, for the trouble would have to be between detector and picture tube. Here, a check of the components associated with the video amplifier and picture tube is all that need be done.

With the split video-sound IF type receivers, the defective circuit may be in the video IF amplifiers following the sound takeoff, in the video detector, or

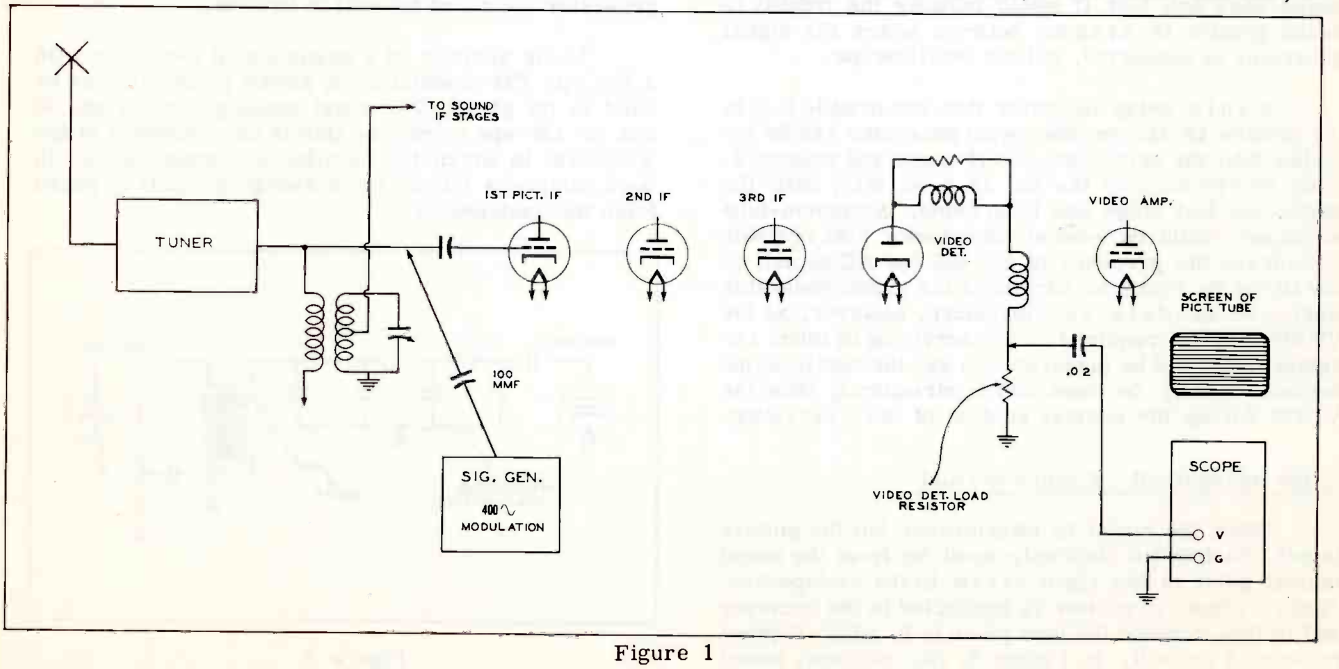


Figure 1

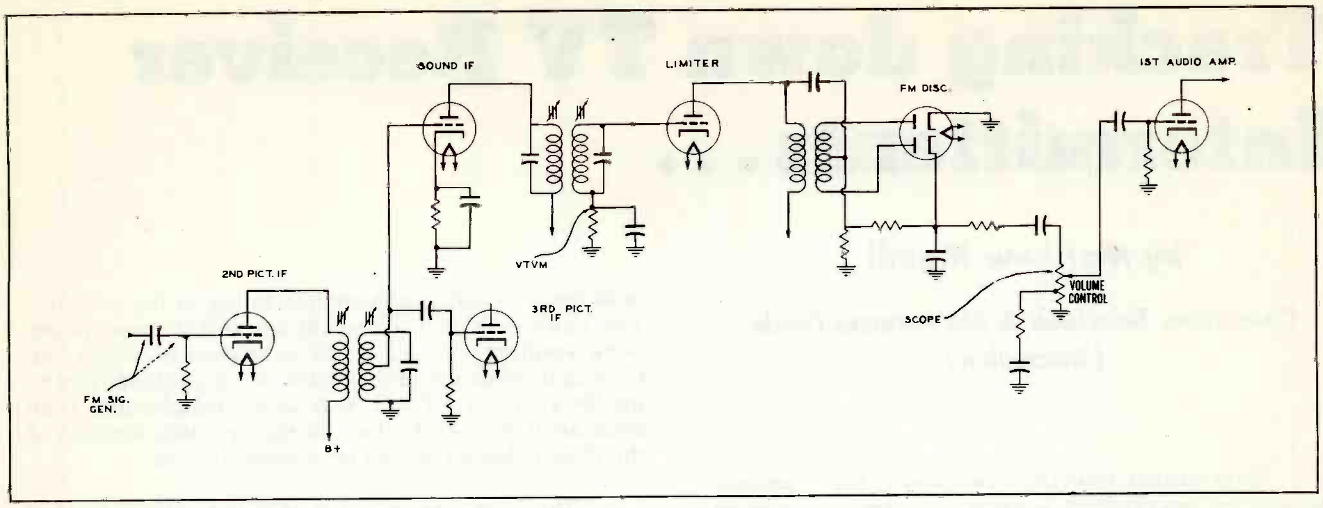


Figure 2

in the video amplifier circuits following the detector. In order to get a general localization, a signal generator and oscilloscope can be used as shown in Figure 1. The signal generator can be of the single-signal type with internal modulation. This is placed at the output of the tuner, before the coupling capacitor or transformer secondary of the first picture IF tube. If the sound takeoff is after the first or second IF stage, the signal generator can be attached at these places.

The signal generator should be set to the IF picture frequency for the receiver under test, and an oscilloscope should be placed across the video detector load resistor as shown in Figure 1. Turn on the 400 cycle internal modulation (AM) of the signal generator and set the oscilloscope to receive the 400 cycle sine-wave signal developed across the detector load resistor. Adjust contrast control and signal generator frequency slightly until sound bars appear on the picture tube screen.

If the intermittent now occurs in the video amplifier section of the receiver, the sound bars on the picture tube screen will disappear, but the scope pattern will still be present. If both scope pattern and sound bars are lost, it would indicate the trouble is in the picture IF stages between where the signal generator is connected, and the oscilloscope.

If this setup indicates that the trouble lies in the picture IF stages, the signal generator can be injected into the grid of the 3rd IF stage and progressively moved back to the 2nd IF grid, etc., until the particular bad stage has been found. A vacuum-tube voltmeter could be used at the detector load resistor to indicate the presence of the 400 cps AC signal, or the DC of the rectified carrier if the signal generator were not modulated. Inasmuch, however, as the VTVM may be required in the servicing of other receivers, it would be preferable to use the oscilloscope because it may be used more infrequently than the VTVM during the normal routine of daily servicing.

Sound Intermittent - Picture Normal

When the sound is intermittent, but the picture is not, the trouble obviously must be from the sound takeoff point in the video strip to the loudspeaker. Again a signal generator is connected to the receiver and in this instance the best place is to attach it prior to sound takeoff. In Figure 2, for instance, sound takeoff is between the 2nd and 3rd picture IF, and the generator is placed at the grid of the 2nd picture IF stage. Internal modulation should now be of the FM type and the oscilloscope is placed across the volume control at the FM detector. In this position the oscilloscope will show the 400 cycle FM signal derived through the detection process. The same 400 cycle signal will develop a tone from the loudspeaker as an extra indication of whether or not the intermittent occurs in one section or another.

If, for instance, the intermittent occurs in the audio amplifier section of the receiver, the sound would stop from the speaker but the waveform would still be visible on the scope across the volume control. If, however, the trouble lies in the sound IF or detector system, the scope waveform would be gone when the intermittent occurs. If this is the case, a further check can be made by placing a VTVM across the grid leak of the limiter if the set is using a limiter-discriminator combination instead of a ratio detector. The loss of DC voltage across the limiter grid leak would indicate that the generator signal is not arriving at this point and this would indicate trouble between here and the place where the signal generator (or sound takeoff) is located.

In the absence of a single signal generator with a 400 cps FM modulation, a sweep generator can be used in its place. The usual sweep generator has 60 cps or 120 cps sweep and this is the frequency of the waveform to which the oscilloscope must be set. In such instances the 60 cycle sweep rate will be heard from the loudspeaker.

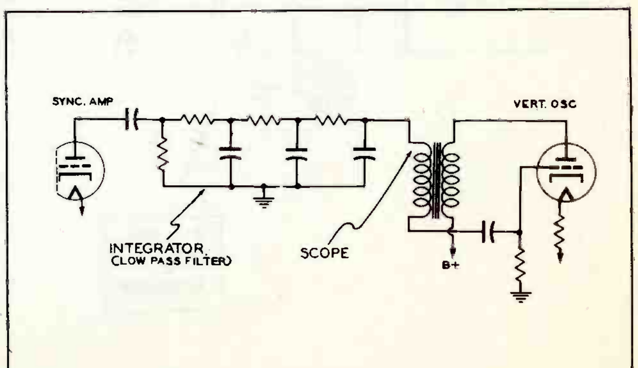


Figure 3

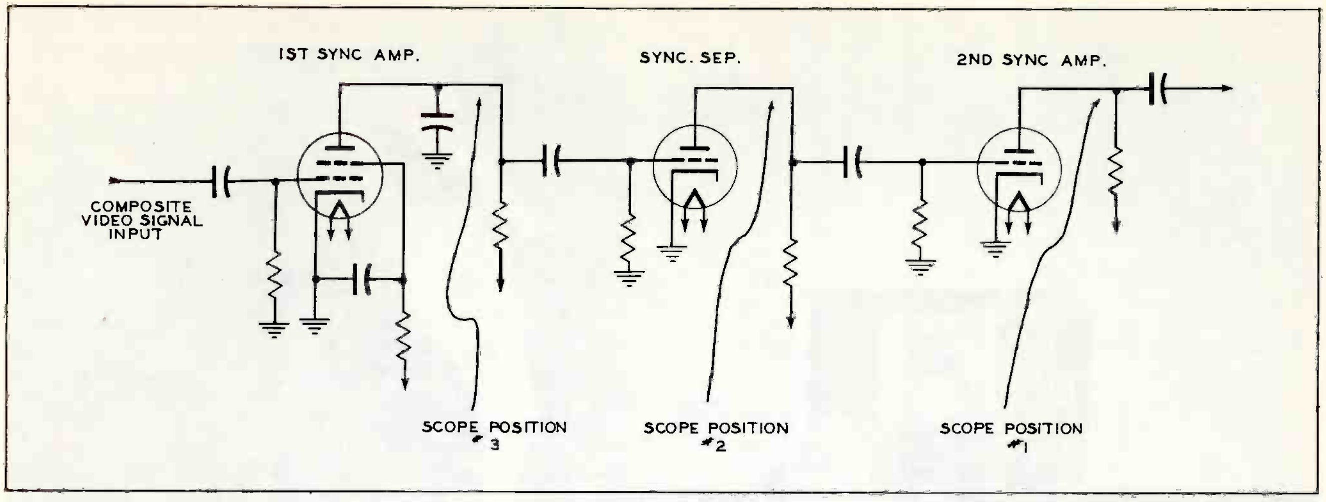


Figure 4

Sync Intermittent - Sound and Picture Normal

With intermittent loss of either vertical or horizontal sweep synchronization (or both) the method of localization again depends on the exact symptoms. If only vertical synchronization is intermittent, a scope may be placed as shown in Figure 3 to ascertain whether or not the integrator circuit is faulty.

The horizontal sweep of the oscilloscope should be set to observe the spike pulse waveform present at the output of the low-pass filter network. When vertical synchronization is lost, the presence of a signal at the scope would indicate the integrator is not at fault, but that the trouble lies in the vertical blocking oscillator. (If the vertical output stage were at fault, it would mean loss of vertical sweep, not synchronization. With minor defects in the vertical output, linearity and height would be affected and in some cases interaction between this stage and the oscillator could affect synchronization. As a general rule, however, loss of sync is definitely attributable to the vertical oscillator circuit or its plate output).

If only horizontal synchronization is intermittent, it would not be worthwhile to connect instruments to localize the fault, because the most likely cause would be a defective horizontal sweep oscillator, or control circuit. In such instances the frequency control circuit may be misadjusted and critical, in which case noise pulses would cause an intermittent condition. A check of alignment, tubes and parts will usually correct the trouble.

When both vertical and horizontal synchronization are intermittent, the method shown in Figure 4 will aid in finding the trouble. Here, the oscilloscope is first attached to the output of the 2nd sync amplifier (or clipper as the case may be).

This will establish definitely whether or not the sync separator-amplifier stages are contributing to sync instability. The scope could also be placed in the 2nd position shown and if the waveform is lost when the intermittent occurs, it would establish the trouble location to the separator or 1st amplifier. The oscilloscope can now be placed in the third position shown in order to ascertain whether the trouble is definitely in the sync amplifier or the separator. If the signal does not disappear at the third position with the intermittent, but does in the second position, the

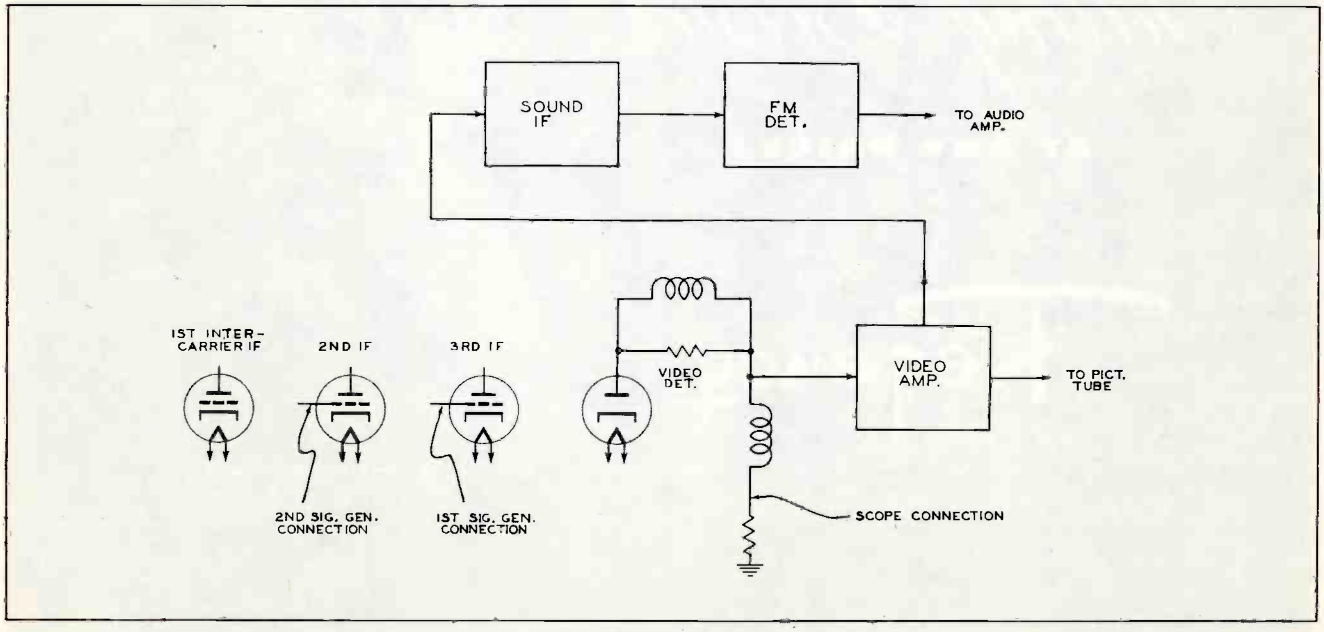


Figure 5

♦ ♦ Please turn to page 61 ♦ ♦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INDEX TO PHOTOFACT

RADIO AND TELEVISION SERVICE DATA FOLDERS

No. 27

Covering Folder Sets Nos. 1 thru 140

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ADDITIONAL BENEFITS FROM PHOTOFACTS

From time to time, PHOTOFACT Folder Sets include valuable "bonus" materials, as well as useful data of a special nature. The following useful materials are extra benefits available in the Sets indicated at no additional cost.

	Set No.
1—RMA Production Source Code (July 1, 1946)	**5**
2—RMA Production Source Code (Jan. 1, 1949)	**20**
3—RMA Production Source Code (Revisions as of July 1, 1949)	**92**
4—TRADE DIRECTORY— Parts Manufacturers	**12**
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6—Record Changer Cross Reference by Manufacturer and Model	**118**
7—Mica Capacitor Color Codes	**48**
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14—Photofact Television Course appearing serially in	**38-51, 54**
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(CM-1) indicates service data *also* available in Howard W. Sams 1947 Record Changer Manual. (CM-2) indicates service data available in Howard W. Sams 1948 Record Changer Manual. (CM-3) indicates service data available in Howard W. Sams 1949, 1950 Record Changer Manual.

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Sincerely,

Howard W. Sams

"SHOP TALK" continued from page 4

circuit. When the tuner turret is resting on the "hill" it is between channels.

9. By all means keep output of marker and sweep generator as low as possible, consistent with obtaining a suitable response curve on the scope screen.

10. Use an alignment tool which contains as little metal as possible. It doesn't take very much external disturbance to throw these high frequency circuits out of alignment.

11. Never align a set unless it has been given a chance to reach operating temperature. Generally this means a warm-up period of 15 minutes or so.

12. Should you or should you not remove the picture tube when performing an alignment? We have found that it makes little difference, either way. So do what is most convenient for you.

13. A good time saving practice is to check the service manual covering the receiver, to see whether it recommends any special adaptors or alignment tools for such work. Zenith and Philco (among some others) go in for this sort of thing and if you have occasion to work on many of either type set, contact the manufacturer's service department for the special tools.

REVIEW: The current freeze which prevents new television stations from appearing will be ended some time this year, we are informed by Wayne Coy, Chairman, Federal Communications Commission. At that time, spectrum space for some 1800 new stations will become available and will, in time, be fully occupied. Since most of these new stations will operate in the ultra high frequency portion of the radio spectrum, any advance information that can be obtained now will go a long way towards helping the television technician prepare himself technically for the problems which are peculiar to these frequencies.

Those of us who have been intimately associated with VHF television since its inception in 1946 know what trials and difficulties were faced during these first two years. And yet then we were operating at what is now recognized to be comparatively low frequencies. When UHF television service commences, with its frequencies ranging from 500 mc to 900 mc (roughly), we can expect to have our hands full just bringing the signal in useable quantity down to the set--let alone all the problems which will arise in the UHF circuits, themselves.

It is because of these expected difficulties, coupled with a desire to prepare ourselves for them as fully as possible that the review this month deals with a report on UHF experience. The report is as follows:

INVESTIGATION of ULTRA-HIGH-FREQUENCY TELEVISION TRANSMISSION and RECEPTION in the BRIDGEPORT, CONNECTICUT AREA

by Raymond F. Guy

RCA REVIEW - March 1951, Volume XII, No. 1

Published quarterly in March, June, September, and December. Subscription Price $2.00 per year, $3.50 for 2 years, or $4.50 for 3 years in United States and Canada

For more than a year now, RCA and its affiliate, the National Broadcasting Company, have been operating an experimental UHF television station KC2XAK in the Bridgeport, Connecticut area. The pictures and sound used to feed KC2XAK are those used by station WNBT, the NBC New York outlet which operates on Channel 4 with its antenna atop the Empire State Building. The video signals from WNBT are received by KC2XAK via a special 2000-mc relay between the two areas; the sound via direct off-the-air pickup.

This is done to insure good picture quality of all signals broadcast by KC2XAK in its tests.

To evaluate the service area potential of this UHF television station, 100 receivers were located at distances up to 20 miles from the transmitter. Fifty of the receivers were VHF sets with UHF converters and 50 complete receivers equipped to receive VHF or UHF signals.

Each of the receivers was installed by experienced servicemen who were carefully selected for technical knowledge, diplomacy, and experience. In addition, every installation having less than optimum picture ratings was visited by an engineering team to determine whether the fault lie with the installation.

Four different types of receiving antennas were employed for UHF reception. These included:

1. Fan dipole
2. Rhombic
3. Stacked Vee
4. Parabola

Each of these antennas is shown or illustrated in Fig. 1. Types 1 and 3 have been used in modified form for VHF reception. Type 2 is sometimes used, although not frequently; type 4 is never used primarily because of its bulk at lower channels.

Here is what was found concerning these four types of antennas.

1. Fan Dipole -- This is similar in its electrical characteristics to the ordinary two rod dipole so common today at VHF. Its gain is low and it is useful only in installations located within a five to six mile radius of the station. The directivity of the fan dipole is so poor that it is unable to eliminate reflections or ghosts. Its chief advantage lies in its low cost.

2. Rhombic Antenna -- This antenna, shown in Fig. 1B, has a gain of 3.6db over the dipole. Because of this it was able to provide noticeably better pictures than the aforementioned fan dipole. As you can surmise from the illustration, the rhombic antenna costs more than the fan dipole and requires a longer time to install. Its best feature is its extremely sharp horizontal directivity. In the Bridgeport tests, the

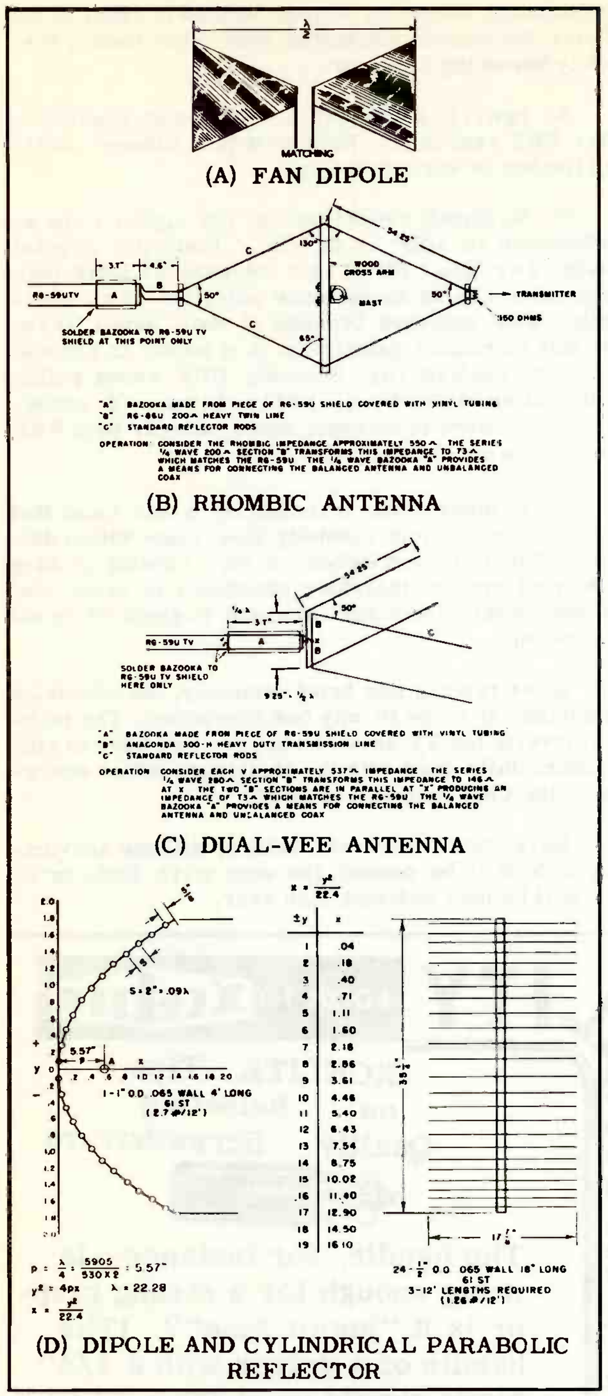


Figure 1. The various types of antennas used in the Bridgeport, Connecticut UHF tests.

rhombic was always able to completely eliminate ghosts.

3. Stacked Vee -- This was the favorite antenna in the Bridgeport project because of its high gain (5.7 db greater than a dipole), economy, and relative ease of installation. It was found that this antenna will also perform well on VHF if the elements are cut to a length of 52 inches.

4. Parabola -- This array has the highest gain of the group (7.5 db above a dipole). However, it is the most expensive to manufacture and the bulkiest array to erect. The response characteristic of the parabola is fairly broad in the horizontal plane, but quite sharp vertically. As a result of this latter property, it was sometimes found that the stacked-vee outperformed the parabola.

Once the installation of the 100 test receivers was completed, a number of facts were brought to light. It was found, for example, that the service range of a UHF station was considerably smaller than for a VHF station. This meant that your so-called "fringe" areas would be a lot closer to the station than they are now on VHF. It also meant that considerable care had to be taken to see that all losses normally occurring in the installation of the antenna had to be kept as low as possible. As the article points out, a receiving antenna with 3 db less gain than could reasonably be obtained, a transmission line loss 3 db higher than necessary and a receiver noise factor 4 db higher than it should be, add up to a 10 db loss. This has the same effect as reducing the transmitter power by a factor of 10.

Of considerable importance in obtaining usable pictures is the choice of the transmission line. The various types of lines which were tried in the Bridgeport tests are listed in Table 1. They are, on the whole, lines having characteristic impedances of 300 ohms; one coaxial cable was used, RG59U. It is unbalanced and its impedance is 75 ohms.

Indicated in Table 1 are the losses, in db per 100 feet, for each transmission line, assuming that each is connected into a system that is properly matched, i.e., there are no standing waves existing on the line. If the transmission line should be mismatched, principally at the receiving end, the losses will rise, sometimes by as much as 2 db. Since every db of signal is important, the transmission line should be carefully chosen for minimum attenuation and carefully matched to the receiver. If, for example, it is found that due to surrounding noise, RG59U is needed, and

Type	Nominal Impedance (Ohms)	Loss per 100 feet at 530 megacycles (Decibels)	Cost per foot (Cents)
Flat Twin	300	3	3
Amphenol tubular Twin for receiving	300	3	7
Amphenol tubular Twin for transmitting	300	2.5	9.6
ATV225	225	7.6	21
K-111	300	8.0	21
RG59U	75	9.5	12.8

Table 1. Transmission lines used in Bridgeport, Conn. UHF tests by RCA.

the set input impedance is 300 ohms, then a special converter (a balun or bazooka) should be used to achieve the match.

With the special emphasis on maintaining low attenuation, more than ordinary care must be taken in routing the transmission line from antenna to set. It was found that twin 300-ohm line gave rise to standing waves and reflections when improperly routed over roofs, gutters, around pipes, etc. Furthermore, even the weather had its effect on line loss and had to be reckoned with. The attenuation of twin 300-ohm line rose appreciably when it became wet from rain or sleet.

Here, in summary form are other discoveries made in the Bridgeport tests.

1. Effect of Foliage. Installations made in the winter time were found to be affected by the growth of foliage on surrounding trees, especially so when the trees were on the same level or higher than the antenna. In one instance, a receiver located twenty-five miles from the transmitter lost its signal entirely with the growth of foliage in late spring. At another installation, fifteen miles from the transmitter, the picture quality was degraded from excellent to fair when the foliage appeared.

2. Heavy rain, such as encountered during a cloudburst, as well as an intense snow storm will attenuate UHF signals noticeably.

3. In strong signal areas close to the transmitter, indoor antenna provided only fair results. Furthermore, whenever anyone walked in front of the antenna, the signals fluctuated over wide limits, frequently becoming unusable.

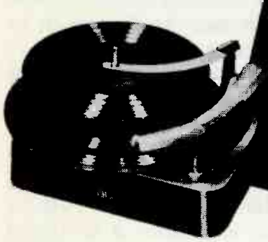
4. Ignition interference does not apparently affect UHF receivers. Neither does summer lightning flashes or even diathermy.

5. Multipath reflections do not appear to be as troublesome on UHF as on VHF. There are several reasons for this. First, the antennas at ultra-high frequencies can be made more selective than comparable VHF antennas because of their small size. With this increased selectivity, it is easier to exclude all but the desired ray. Secondly, UHF waves suffer greater attenuation at each reflection and, consequently, decrease in strength more sharply than VHF waves following similar paths.

6. In many of the installations it was found that large changes in field intensity take place within distances of feet or even inches. A very careful probing of the roof area is therefore necessary in order that the point where the signal strength is greatest is not overlooked.

After reading this brief summary, the television technician can come to only one conclusion. The technical level of the TV service industry will have to rise to successfully cope with the challenges which operation in the UHF band will present.

Here, more than ever before, will the serviceman with skill be needed; the man with little or no skill will be less welcome than ever.



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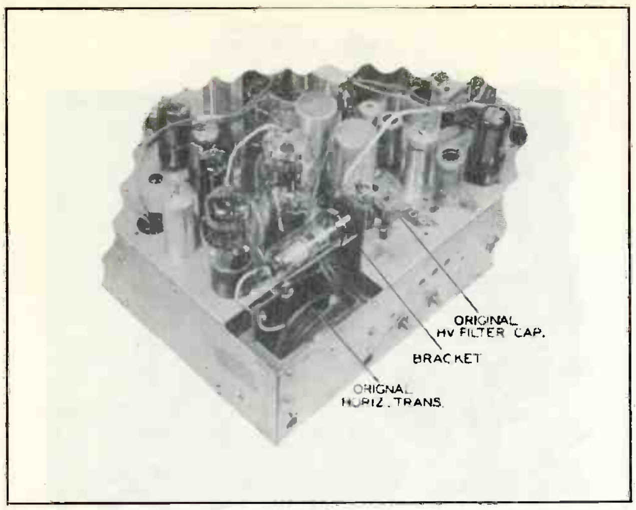

Figure 5. Mounting Detail of Original Horizontal Transformer.

To overcome this a modification was made of the installation shown in Figure 8 to that illustrated in Figure 9. Terminal No. 3 was removed from its position on the side of the transformer and mounted on an insulated bracket at a point directly under the cap of the 1B3GT high voltage rectifier. The lead to the rectifier cap was made as short as possible.

Two machine screws were used to secure the transformer and socket assembly to the bracket, which was then bolted into place on the chassis as shown in Figure 8.

A new 500 mmf. capacitor of 20KV rating was installed in a hole drilled in the chassis near the transformer mounting bracket. (See Figure 8.) The grounded pin of the capacitor was securely soldered where it protruded through on the under side of the chassis. Care was taken when the connection was made to the top pin, to be sure that a smooth soldered joint was made, with no sharp points or angles, to eliminate the possibility of corona discharge.

The width coil was then removed from its mounting bracket. (See Figure 10.) The original coil

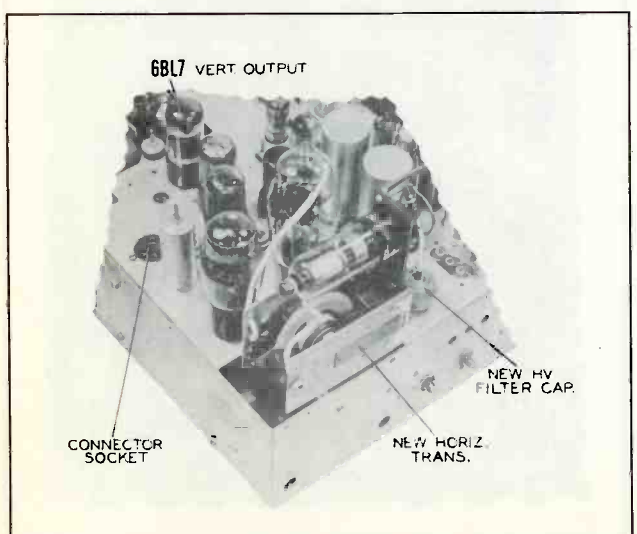

Figure 6. Location of Connector and New Components.

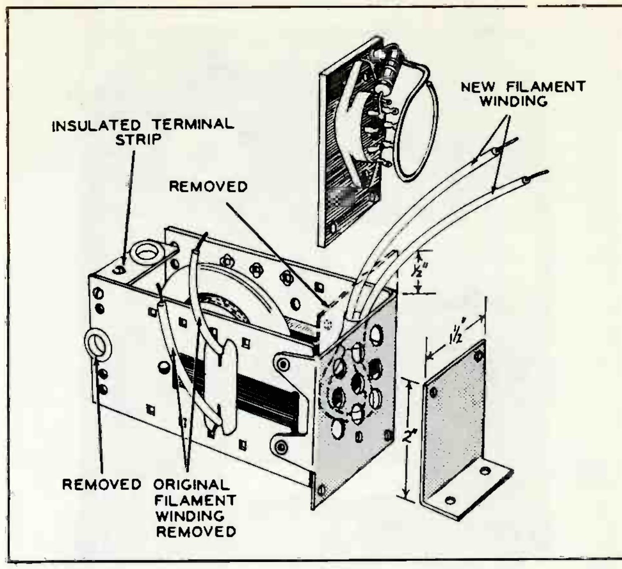

Figure 7. Construction Detail of Horizontal Transformer and HV Rectifier Mounting Brackets.

required a square mounting hole and as the Merit MWC-1 width coil, used to replace it needed a round hole and also had an indexing tab, the square opening was reshaped to the correct size with a round file and the small hole drilled in the bracket to take the indexing tab on the coil. The new coil was then snapped into place (Figure 11) and the circuit wired as shown in Figure 4. Note that the horizontal output screen resistor R125 was changed from 15,000 ohms 2 watt to obtain correct voltage.

A Merit MD70-F deflection yoke, which was designed to operate with picture tubes requiring 70 degree deflection, was used to replace the original yoke. After the damping capacitor and resistors were installed in the yoke, following the manufacturer's in-

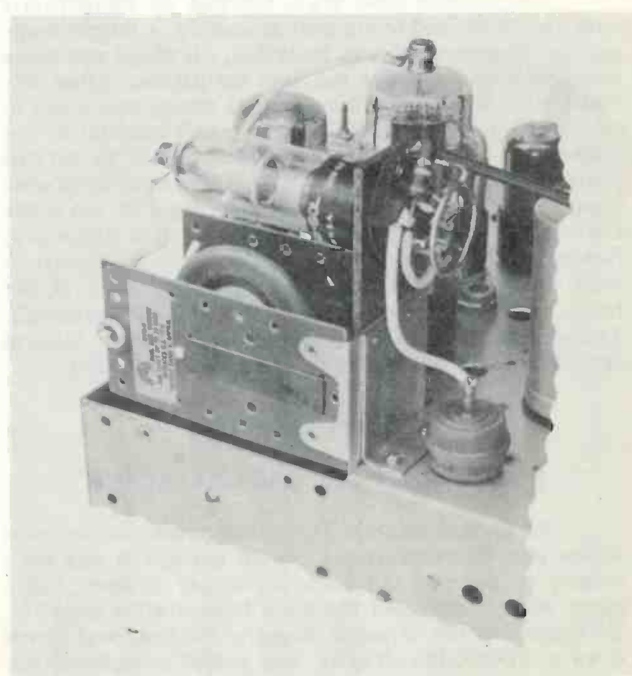

Figure 8. Mounting Detail of HV Rectifier and Horizontal Transformer.

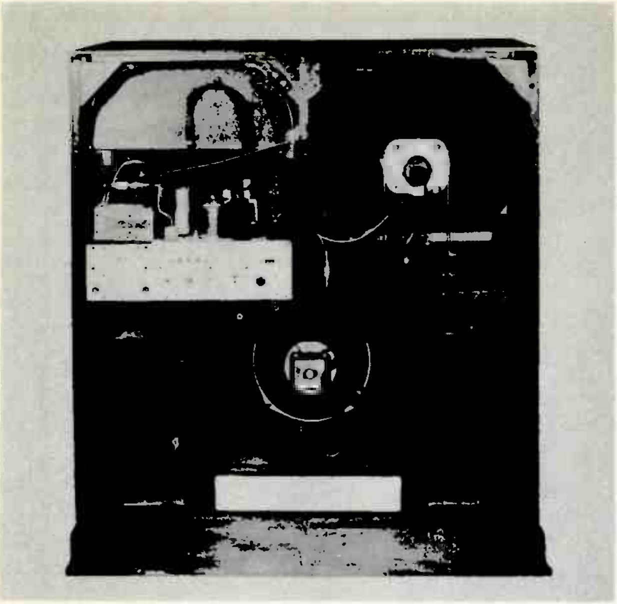

Figure 9. Rear of Cabinet After Conversion.

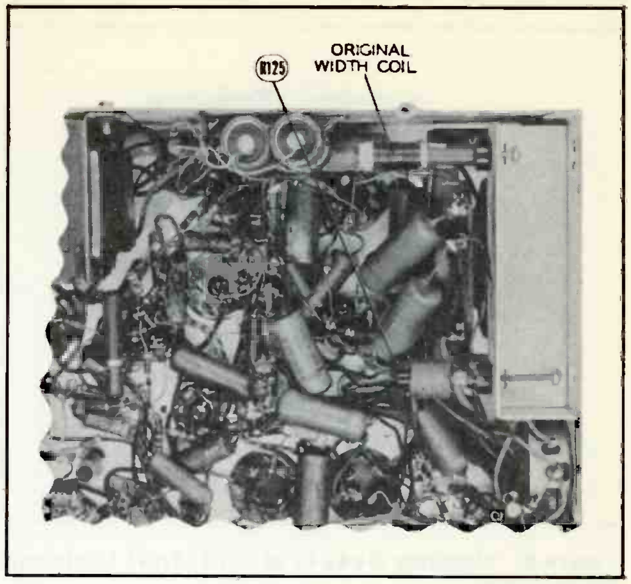

Figure 10. Original Wiring of Horizontal Sweep Components.

structions, leads of sufficient length to connect from the chassis to the new location of the picture tube were soldered to the proper terminals. Long leads were also attached to the original focus coil and these along with those from the yoke were terminated in an octal plug to fit into the socket installed on the chassis.

The leads to the picture tube socket were also lengthened and a new longer high voltage lead connected to the output terminal of the high voltage supply, where the original lead had been removed. A lead was connected to a convenient point on the chassis to the yoke and focus coil mount to ground the outer coating of the picture tube.

The picture tube was blocked up temporarily with the yoke and focus coil assembly, a single magnet ion trap magnet was installed, all plugs and leads connected, and the set put into operation. After adjustments were made the vertical sweep was found to be insufficient. The 6SN7GT vertical oscillator and output tube was replaced, directly with no circuit changes made, with a type 6BL7GT which furnished plenty of sweep. To improve the range of the focus control, the 560 ohm and three 3900 ohm resistors, connected to the focus control arm, were removed. A lead was then connected from the "high side" of the focus coil to the focus control arm (center terminal). This connection can be made at the focus control terminals. No other circuit changes are needed.

CABINET CHANGES

FOR 16" RECTANGULAR CONVERSION

To accommodate a 16" rectangular picture tube in the phono compartment of the cabinet it was necessary to remove the record changer drawer, complete with slides, and the shelf immediately above it. By removing the triangle stops in the rear end of the drawer slides, the drawer was pulled completely out of the cabinet and the remaining tracks removed by taking out the wood screws holding them to the sides of the compartment. The shelf was mortised into the cabinet and had to be removed with care to guard against any damage or weakening of the cabinet. The vertical strips fastened to the back edge of the middle cabinet divider, used as screw blocks for the back cover, and the changer drawer stop block were also removed. A bottom for the compartment was then made of 1/2" plywood and fastened with wood screws to the bottom rails. A 15-1/4" x 16" piece of 3/8" mahogany veneered plywood, cut to fit the opening, was used for the front panel. This was set flush with the other front panel and held in place by wood screws into strips at the top and bottom of the opening. A 10" x 12-1/2" opening, with 1-1/2" radius corners, was cut out of the panel for the picture tube. The dimensions of this opening will depend upon the type mask used and the position of the picture tube, which will vary due to the material used. A plastic mask was centered on the opening and secured to the back of the panel with four 3/8" wood screws. A 12" x

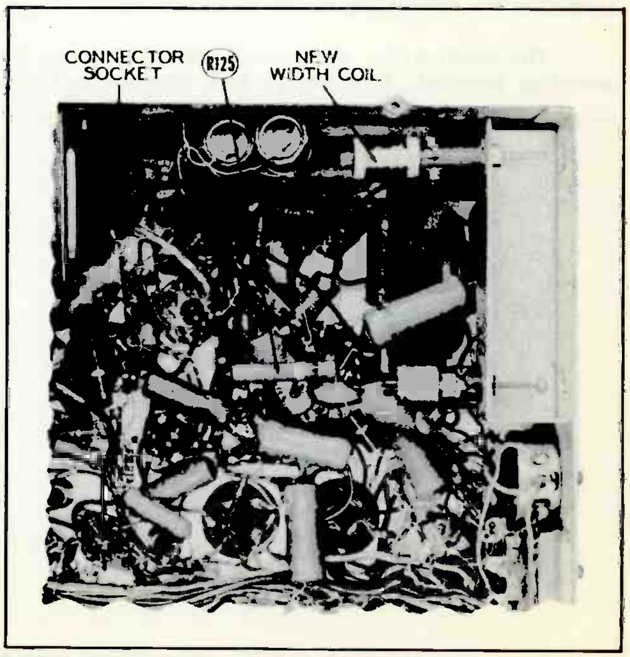

Figure 11. Revised Wiring Showing New Horizontal Sweep Components.

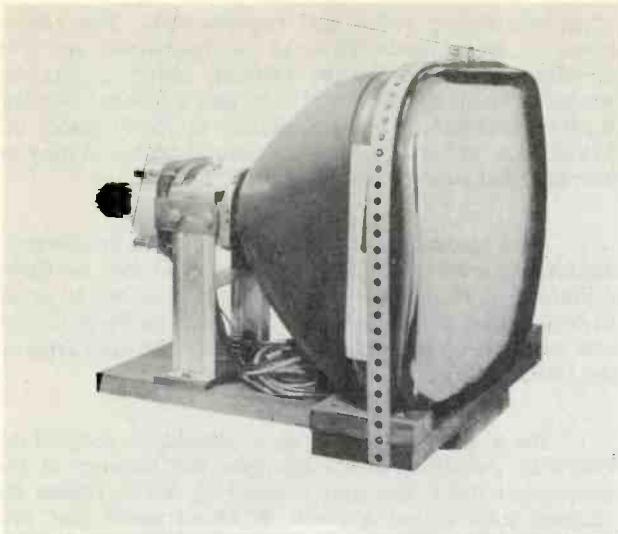

Figure 12. Mounting Assembly for 16" Tube.

15" piece of 1/4" safety plate glass was installed on the front with four wood screws using felt washers and decorative rosettes as shown in Figure 2.

A cradle for the picture tube was constructed of 3/4" wood and a band made of hanger strap as shown in Figure 12. A piece of 3/4" wood was placed under the cradle (see Figure 9) to raise the tube to the correct height. Two holes were drilled for two 1/4" bolts. These bolts should be 2-1/2" long and were run up through the compartment bottom, 3/4" spacer and cradle base to hold the picture tube in place. Washers should be used under the nuts. In constructing this assembly all dimensions are determined by the material used in each individual case.

To make space for the record changer in the receiver compartment, the mask and safety glass for the 10" picture tube were removed. By sawing along a line 1/2" above the lower edge of the opening, and carefully removing the glue blocks, the upper portion of the front panel was removed. Since the inside surfaces of this compartment, where the blocks and panel were removed, is visible, their removal was done with care to hold damage to a minimum. These spots and the new panel were finished to match the remainder of the cabinet. The top of the changer drawer backboard was sawed off to a height level with the changer spindle in its highest position. The tracks for the drawer were mounted on the sides of the compartment, as high as possible, but allowing space for the top of the spindle to clear the cabinet top with the changer unloaded and floating free on its mounting springs. The stop block was installed, on the center cabinet divider, in a position which would allow the drawer to be pushed in far enough to bring the front flush with the edge of the cabinet, but no farther. The position of the stop block is important, for if the drawer is pushed in too far, the back edge will strike the 6BG6G horizontal output tube. A strip of 3/8" veneered wood was cut and fitted 1/8" under the front end of the drawer (see Figure 2) to cover the top edge of the remaining portion of the front panel. This strip was finished to match the drawer front and panel.

The leads and cables were run through slotted holes in the cabinet center divider panel (see Figure 9) and secured with insulated staples and straps. They were carefully dressed away from hot tubes, high voltage and clear of the changer drawer travel.

CONVERTING VF103 TO 14" RECTANGULAR

The front picture tube mounting is changed to accommodate the 14" rectangular tube. The yoke and focus coil mounting need not be changed, other than adjusted forward or backward, according to the type of mask used.

The larger opening for the 14" picture tube is centered on the original one for the 10BP4 and cut in the front panel to the correct size for the mask used. The usual mask opening for a 14BP4 picture tube is approximately 8-1/4" high and 11-3/8" wide.

After the conversion is completed it is advisable to operate the set for at least two hours, as a final check. Also it is a good idea to plug the set into the line through a variable transformer and operate it at various line voltages. Line voltage has a great effect upon sweep and high voltage. Low line voltage can be the cause of insufficient width and high voltage, while high line voltage can raise the anode voltage to such a value that the possibility of arc over is greatly increased.

PARTS LIST

1 - Horizontal Output Trans.	(Merit HVO-6 (Stancor 8130
1 - Width Coil	Merit MWC-1
1 - Deflection Yoke	(Merit MD70-F (Stancor DY-7
1 - HB Filter Cap 20KV 500 mmf.	(Centralab TV1-502 (Aerovox HV20A (Erie 410-501
2 - 560 ohms 1/2 watt Resistor	IRC BTS 560
1 - 1000 ohm 1/2 watt Resistor	IRC BTS 1000
1 - 10,000 ohm 2 watt Resistor	IRC BTB 10,000
1 - 46 mmf. Capacitor	(Aerovox SI47 (Centralab D6-470 (Cornell-Dubilier 5W5Q5 (Erie GP1K-470 (Sprague 5GA-Q47
1 - Octal Socket & Plug	
1 - Single Magnet Ion Trap	
1 - 16TP4 or 14BP4 Picture Tube	
1 - 6BL7GT	

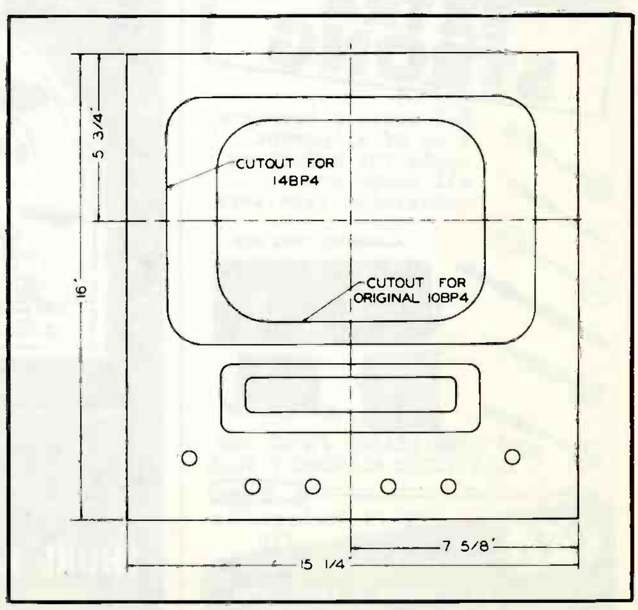

Figure 13. Dimensions of Panel Cutout for 14" Tube.

♦ ♦ Continued from page 26 ♦ ♦

is being measured. A low inductance value of L1 would introduce considerable error in the reading.

Items R2 and R3 must be wire wound controls since these units must dissipate considerable power when measurements are being taken. Carbon controls do not work satisfactorily because of change in value while making measurements.

Banana jacks were used to terminate the leads at the front panel. These work satisfactorily, making positive connection and providing an easy means of making connections to the unit. A complete set of leads should be made up, a total of five pairs. The leads should be terminated at one end with a banana jack; and with a pin connector, spade lug or alligator clip at the other end, depending on the type connectors used in your particular brand of test equipment. The pair of leads which connect to the component under test should have alligator clips to provide for easy connections. A black and red banana jack should be used on each pair leads as well as a corresponding color of insulation on the wires to prevent reversal of the leads when making the connections. We used regular test lead wire which is available with both black and red rubber insulation. The length of the leads is not critical and should be cut to provide for easy connection to the auxiliary equipment. The leads for making connection to the ohmmeter, however, should be kept as short as possible. Although the resistance in these leads will seldom run over .1 or .2 ohms, their resistance must be taken into account when measuring voice coil impedances. The resistance of these leads should be measured and this amount deducted from the reading which is obtained whenever making voice coil impedance measurements. If after measuring the resistance of these leads, the resistance is found to be less than .1 ohms, it may be disregarded in all measurements.

The operation of the unit is simple and impedance measurements can be made in two or three minutes. A step by step operating procedure is given near the end of this article. It should be helpful until you become completely familiar with the operation of the unit.

As a word of warning, it should be pointed out that a B+ potential exists between the cases of the scope and the impedance measuring device, when the current tube is being used. It would seem that this would be highly objectionable, but after continuous use of an identical piece of equipment for several years in our lab, it has caused no trouble. This is due to the fact that the current tube is employed in less than half of the measurements and that both the scope and the measuring device have insulated knobs.

NULL INDICATOR

When the impedance measuring device is constructed as previously described, a null indicator can be added on the chassis or, if desired, built as an entirely separate unit. The null indicator is a device for showing the absence of a signal voltage or the con-

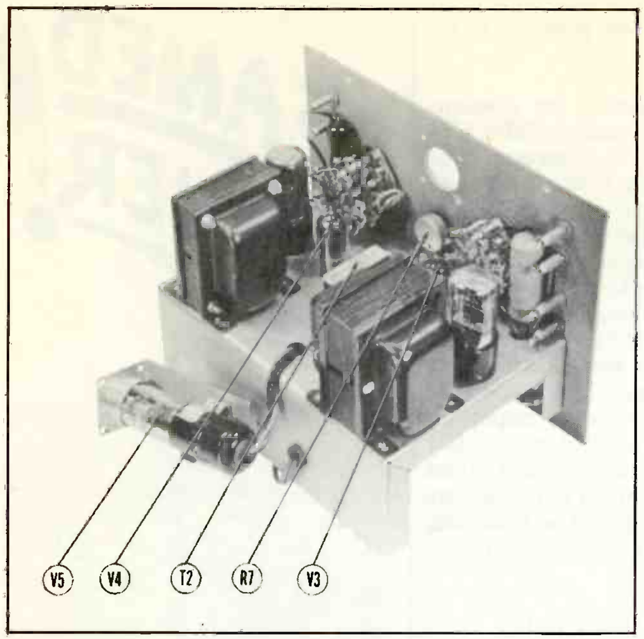

Figure 7. Top view of Impedance Measuring Device, with Null Indicator.

dition of balance in a bridge-type measuring circuit. Although not specifically designed for use in conjunction with an impedance bridge, it is probable that the null indicator described here will find its greatest value as an adjunct to the bridge.

Electrically, the null indicator consists of a two-stage audio amplifier, which is transformer-coupled to a detector tube and the rectified signal than fed to the grid of a tuning indicator type tube. This indicator tube provides a visual means of accurately determining when a no-signal or null condition exists.

A schematic for the null indicator is shown in the lower part of Figure 4. A type 6AU6 tube operates as the first audio amplifier, while the second amplifier is one triode section of a type 12AU7 tube. The other section of the 12AU7 tube is connected as a diode and functions as a detector. The amplifier output is coupled to the detector by means of an interstage transformer with a turns ratio of 1 to 3. The transformer is connected to provide a step-up voltage, giving additional gain.

Another function of the transformer is to isolate the detector circuit from the plate of the second amplifier. This permits a variable voltage to be applied to the detector circuit for closure of the eye under no-signal conditions. The secondary of the transformer is tuned to resonance by means of a capacitor of the correct size. The value of this capacitor is determined experimentally by applying a 1000-cycle signal at the grid of the 6AU6 tube and measuring the voltage developed across the detector load with a vacuum tube voltmeter. Various size capacitors are shunted across the primary secondary until a maximum indication is read on the VTVM. When the correct value capacitor is determined, it is then connected permanently across the transformer secondary. Figures 7 and 8 show top and bottom views of the impedance measuring device with the null indicator included.

Following is an example of how the null indicator can be used in actual practice. An AC-DC set, using a filter choke in the B+ circuit, is used as an illustration. The choke is connected to the appropriate terminals of the impedance bridge. The input terminals of the null indicator are connected to the earphone terminals of the bridge. The power supply for the null indicator is then turned on and the low-high null switch is turned to "null" position. The gain control is turned to minimum and the bias control is adjusted until the eye of the indicator tube just closes. The gain control is then adjusted to the point where the eye completely opens. As the bridge is adjusted for a balanced condition, the gain control is advanced to provide sharper and more positive indication.

A similar procedure is used when making measurements requiring any AC signal input to the bridge.

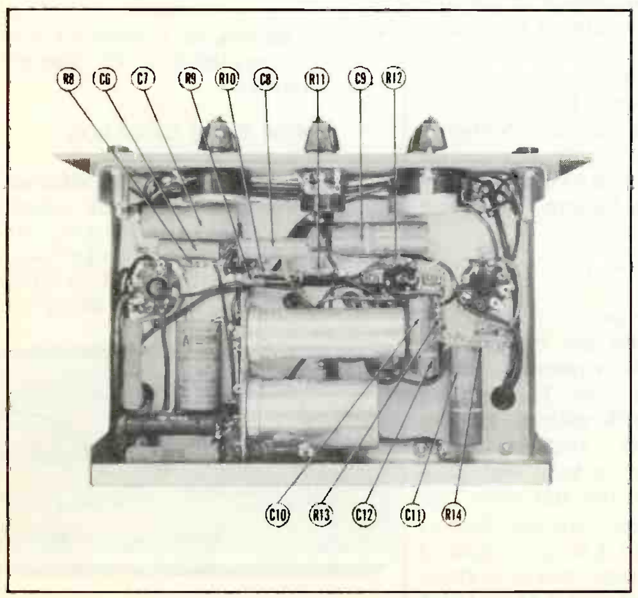

Figure 8. Bottom view of Impedance Measuring Device with Null Indicator.

Figure 9. Completed view of Impedance Measuring Device with Null Indicator.

♦ ♦ Continued from page 21 ♦ ♦

In many respects the electrostatically focused picture tube has exhibited several advantages over that of the magnetic type. It has resulted in a definite conservation of copper used in focus coils and cobalt used in focus magnets. In addition to this it has been found that focusing is actually better in many instances than that of the magnetically focused tube. The fact that a wide range of line voltage has negligible effect upon focus is an important contribution. The electrostatically focused tube is not a makeshift effort to accomplish a desired purpose with a minimum expenditure of material, but actually has great merit in its own right.

SELF FOCUSING TUBE

Another type of electrostatically focused, magnetically deflected picture tube recently announced is the self-focusing type which does not require any external provisions for focusing.

It is designed to function over the entire operating range of the picture tube which means that focusing is independent of anode voltage of line voltage variations.

The use of this tube in standard television circuits does not require the changing of original circuitry. It actually makes it possible to eliminate various components when sets employing this type tube are produced.

The main advantage of the use of the self-focused tube at the present time lies in the fact that critical materials have been conserved by the elimination of external focusing components.. The other qualities designed in this tube are highly important, however, and its development is another step in the forward progress of television.

* * * *

One Sunday morning an old Quaker and his wife got ready to go to church when he remembered he hadn't milked his cow. He decided that he could milk without getting his good suit dirty. Just as he got thru, the cow gave a kick and milk spilled all over the old man. He looked at his ruined suit and then at the cow. Then he said, "I shall neither beat thee nor strike thee, but, by the grace of God, I shall twist thy tail."

CAPPER'S WEEKLY

"DOLLAR AND SENSE" Continued from page 27

TV sales; sales are at about the same level as for this time last year, and glutted dealer storerooms are the result of overloading out of all proportion to seasonal patterns.

A lot of dealers are counting heavily on Santa Claus to clear their stocks, even though he's a long way off; hope for a break before then is just wishful thinking. This means that service organizations must get their businesses on a paying basis independent of new service contracts and antenna installation jobs--or go under.

Many dealers who stocked up to the hilt in anticipation of war-produced shortages are being squeezed as banks call in loans. Stunned and frantic because the golden goose of TV has stopped laying, they blame everyone but themselves. They blame the manufacturers who made the sets, the distributors who sold them the sets, the bankers who loaned the money to buy the sets, and the competitor who dumped his goods because he was in a worse mess. Older dealers, familiar with the eternal feast-or-famine reversals of the radio industry, are hit just as hard yet take the situation more philosophically. Zenith's vice-president H. C. Bonfig explained things thusly: "Growth of the television market has been so lush that there has been a temporary suspension of many rules of good business practices."

ROSE-COLORED GLASSES. Success or failure in business depends far more on mental attitude than on mental capacity.

USED-TV AUCTIONS. When used 7-inch TV sets failed to move at $29.95 through radio and newspaper advertising, R. H. Television Sales in Chicago staged an auction of traded-in sets. The entire lot of 94 sets was sold in about three hours, with some of the scorned seven-inchers going for as much as $80. Average prices realized, according to an article in June Electrical Merchandising, were $36.74 for 13 of the 7-inch sets, $64.85 for 47 of the 10-inch sets, and $121.43 for 24 of the 12-inch sets. Auctioneer's charges were about 10 per cent plus labor and advertising. A crowd of over 700 was attracted by two newspaper ads and a number of radio spot announcements. Good for color conversion, was pitch that moved many of the small-screen sets.

MIRROR IMAGE. A flat-on-the-back invalid can view television comfortably in an overhead mirror if the set is placed behind the head of the bed and connections to the horizontal deflection coil are reversed. This reverses the picture on the screen, so it will look right when viewed in the mirror. A flat mirror supported at 45 degrees about three feet from the patient's face has worked well for iron-lung patients.

BILLS. Left the car at a garage the other day for checking-over and greasing. Bill was $28.05, made up of 13 separate entries, and not a single one could be challenged. For a free lesson in making out servicing bills so they get paid with a smile, take your car to a DeSoto agency the next time it needs preventive maintenance. Their printed statement could readily be modified to apply to television servicing. Most other automotive service organizations have equally good billing technique.

FM. About 2.25 million of the radio and TV sets made in 1950 had FM facilities. This amounted to 10% of the 7.5 million TV sets made that year and 18% of the 14.7 million home radios. This is convincing proof that FM is still alive.

DIP SOLDERING. Though there's been little if any publicity in the trade press as yet, GE has been using mechanized dip soldering for some time in wiring their radio and television receivers. Doughnut-shaped shields around the tubes in their clock radios indicate use of this new technique. Special tube sockets were used, in which terminal lugs are replaced by cone-shaped metal pieces pointing upward and going right through the wafer sockets. In assembly, under-chassis wires and leads of parts are pushed into these holes one after another until all wiring is in. The inverted chassis is then dipped in molten solder, so that all the projecting leads are soldered to the socket tubulations simultaneously. The doughnuts protect prying fingers from these exposed leads, since some have plate voltage.

In the GE TV receivers, similar conical terminals are used on insulating sheets that serve as subassemblies. Leads of dozens of parts are pushed into the terminal holes from one side, along with necessary connecting wires, and the other side of the insulating sheet is immersed in molten solder. This solders as many as a hundred connections at once, with no possibility of missing one. The technique saves manpower, but may be shelved for the duration because the required terminals involve use of more scarce metals than does conventional wire-by-wire soldering.

WOMEN. They're not all like this but be on guard when a woman knows she's made a mistake. A typical situation is a service call that turns out to be a dry run because of some obvious error on the part of the housewife. Perhaps it was transmitter trouble that cleared up right after she called, a line cord plug that she knocked out with the vacuum cleaner, or plain misadjustment of controls. An embarrassed lady will very often fight on slightest pretext. If the policy of your firm is to make a nominal charge for dry runs, don't rub it in by mentioning the charge then. Just sympathize with her--point out that such things can happen to anyone--and send the bill a few days later.

DEFERMENT. A revised critical-occupation list, issued to draft boards as a guide for considering deferments and delays in calling up reservists, now includes electrical instrument repairmen, electrical engineers, and electronic technicians. There is as yet no recommendation for deferment of television and radio transmitter and receiver repairmen.

FOCUS. Picture tubes with automatic focusing built into the electron gun are now in production at DuMont, GE and other tube plants. This means that new sets using these tubes will have no focus coil, no focus control and no special focus-correcting circuits. Thus is the history of radio repeating itself in TV as receiver controls are eliminated one by one.

JUICE. Cost of electricity for the average TV set in the average home is about $15 per year. This assumes a 250-watt set operated 4 hours a day, with electricity costing 4¢ a kwh. With 12.5 million sets now in use, this means that television has boosted the income of electric utilities some $187,000,000. Sounds fantastic, but check the figures yourself.


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♦ ♦ Continued from page 31 ♦ ♦
sync separator will have been isolated as the trouble maker.

Sound and Picture Intermittent - Raster Remains

When both sound and picture are intermittent, but the raster remains, it is reasonable to assume that low and high voltage supplies are functioning properly and that the trouble lies in a stage prior to sound takeoff in the video strip. This would limit the trouble to the tuner and one or two IF stages in the split sound-video receivers. With the intercarrier receivers, however, many more stages are involved and the use of instruments will again facilitate localization. Figure 5 shows the connections for finding the defective stage, with the signal generator connected to the grid input of the last video IF stage. When an intermittent occurs, loss of signal on the oscilloscope would indicate trouble in the third IF or video detector.

If the intermittent does not show up in a reasonable length of time, the signal generator can be moved in progressive steps back toward the tuner until the intermittent shows up as loss of waveform across the detector load resistor. With a 400 cps AM modulated tone in the signal generator, the loss of sound bars on the screen but the waveform present on the oscilloscope would indicate the faulty stage to be the video amplifier where sound take-off occurs.

Intermittent Raster - Sound Normal

When the picture and raster both are intermittent but the sound normal, instrument connections as shown in Figure 6 will help in localization of the difficulty. Here a vacuum-tube voltmeter is placed between the picture tube grid and cathode circuit in order to check for the loss of bias when the intermittent occurs. Any abrupt change between the grid and cathode in terms of meter readings would call for additional checks of voltages, resistance and capacitor values. With average setting of the brilliancy control, a constant negative voltage should be present at the grid of the picture tube.

As a further check on raster intermittency, an oscilloscope should be placed at the grid of the horizontal output tube for those receivers using the inductive kick-back type of high voltage system. Failure of the modified waveform here during an intermittent isolates the trouble to a prior stage.

With most modern receivers this would mean that the horizontal sweep oscillator has failed, or that trouble has developed in the discharge circuit between the horizontal oscillator output and the input to the 6BG6 stage. In older receivers a separate discharge tube is often used, in which case the trouble may be either in that circuit or the horizontal oscillator. Again, the oscilloscope can be moved back to the grid of the discharge tube in order to find out whether the oscillator is at fault, or whether only the discharge tube is failing.

The foregoing methods are applicable to virtually any receiver on the market and the technician need only evaluate circuit layout in order to utilize the localization methods described herein. With the visual indications thus available, servicing of the defective stage can be done immediately the intermittent occurs. In this manner completion of intermittent servicing is expedited and the customer does not have to wait as long for his receiver as he would if the set were just left to "cook" until the bad part went completely out.

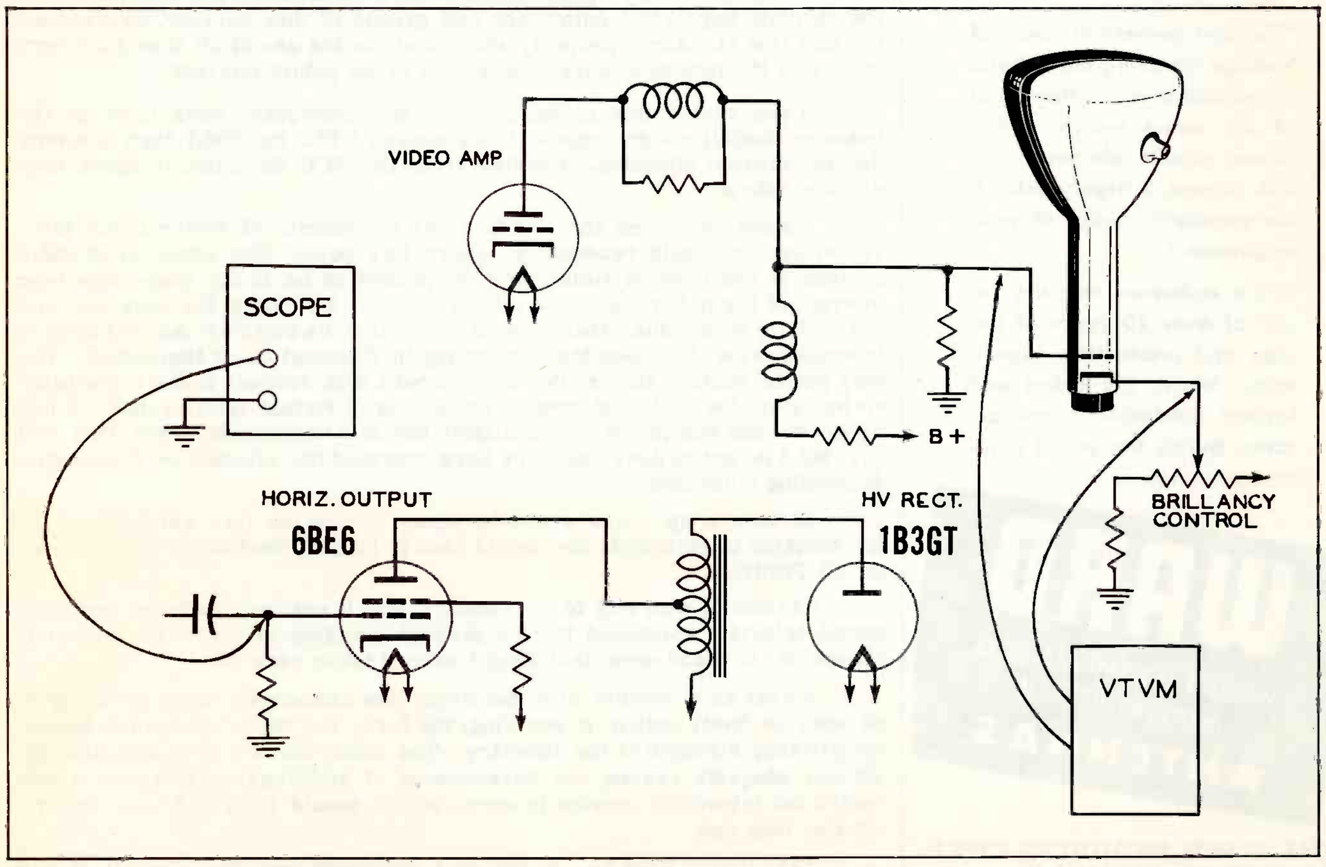

Figure 6

+ More or Less −

It is inevitable that, sooner or later, this column must comment on the subject of color television. Once color television arrives as a successful commercial service, it will not only greatly enhance televiewing enjoyment, but it will also have a steadily increasing effect upon operations and equipments of the service technician, with eventual probability of complete dominance.

Although the immediate tendency is to shrug off the controversy and feel that we can enter into this field when a final decision has been reached, it should be borne in mind that we of the industry, on our own behalf as well as on behalf of our customers, have a stake in the shape of things to come. Therefore, regardless of whether your feeling is pro or con (assuming reasonably intelligent consideration), perhaps it would be a good idea to get a little vocal about it. It is admittedly difficult to be completely objective in the present situation, so fire away without restraint.

The technical aspects of the competing systems have been rather well defined and illustrated in a number of technical articles published in the last 18 months; so for a change, we would like to turn our attention to some of the other factors which we believe to be involved.

If memory serves correctly, the Radio Corporation of America, prior to World War II, broke a full advertising campaign in the Metropolitan New York area on the introduction of television service. Immediately following the release of this publicity, James Lawrence Fly, then Chairman of the Federal Communications Commission, made an address over national radio networks, discussing what he believed to be a precipitate action in that it tended to establish, through commercial exploitation, standards for operation which were not necessarily in the best public interest or agreeable to the industry as a whole.

Pointing out that synchronism of all transmission and reception was the absolute key to full enjoyment and growth of this service, he stressed the fact that standards properly arrived at for the use of all manufacturers supplying the industry, were a necessity in the public interest.

If you accept this philosophy and the subsequent work later by the industry itself, through organizations such as NTSC and RMA, then it seems that the present situation, resulting from the FCC decision, is more than slightly askew.

I doubt that even the strongest proponents of either color television system could reasonably assure the public that adoption of their system at the present time could be proved to be in the long-range best interest of the public. So why all the hurry? Certainly the only hue and cry audible here, other than that of television receiver merchandisers inventory-wise, has been that emanating in Washington, or thereabout. The only public attitude this writer can discern with respect to the color television situation is that of apathy, amounting to virtual indifference. If full programs and equipment are available and at a reasonable price, they will buy, but I do not believe that they have stormed the citadels of Washington demanding color now.

To sum it up, there would be three categories into which pressure for adoption of standards now would have to fall; (1) Technical, (2) Economic, (3) Political.

Certainly, with 90% of the industry which created, fostered and promoted television, opposed to the present adoption of color TV technical standards, it would seem that Item 1 is well taken care of.

As far as economic considerations are concerned, there certainly is no need for hasty action; if anything, the furor has hurt rather than helped the growing strength of the industry. The color controversy has tied up, without adequate reason, the development of additional markets; it has restricted television service in areas which should have had such opportunities long ago.

That leaves Item 3 . . as far as I am concerned, that is as it should be - - - left.

J.R.R.

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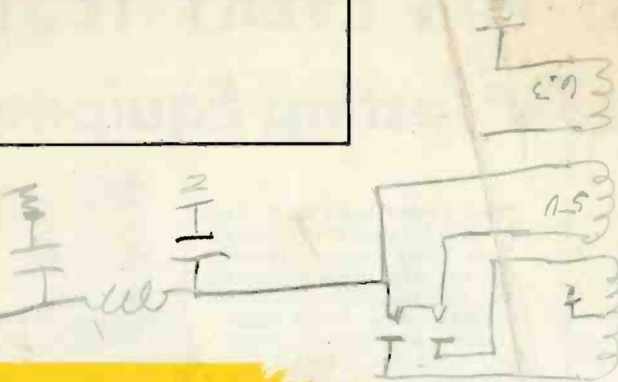

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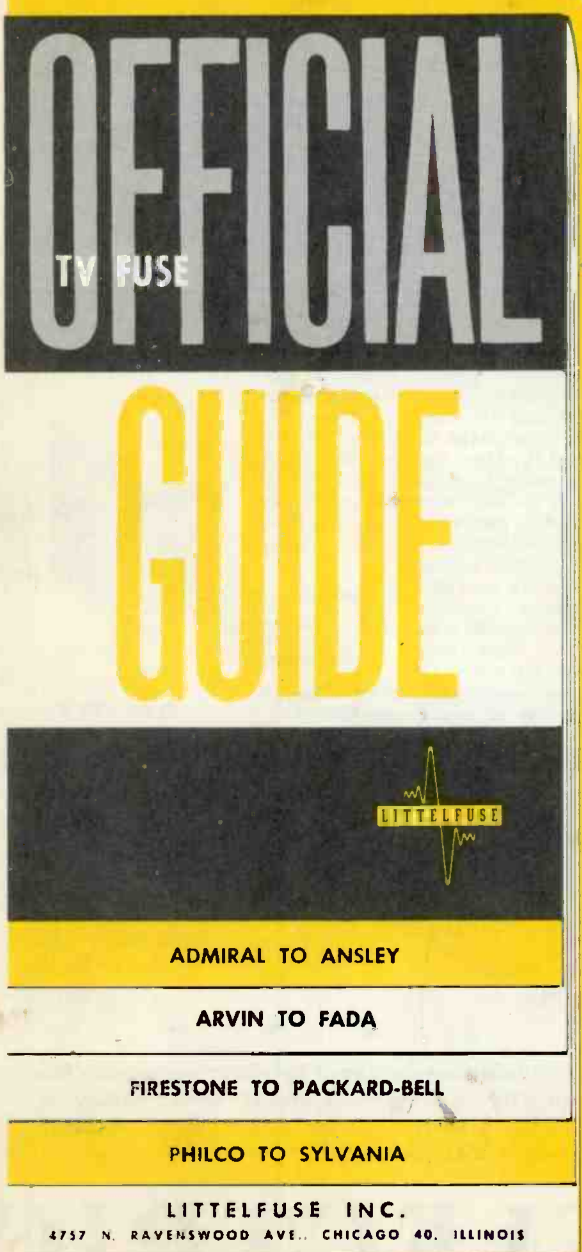

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