JAN.—FEB., 1958
Vol. 10, No. 1

Techni-talk
on AM, FM, TV Servicing

Color Receivers—IV

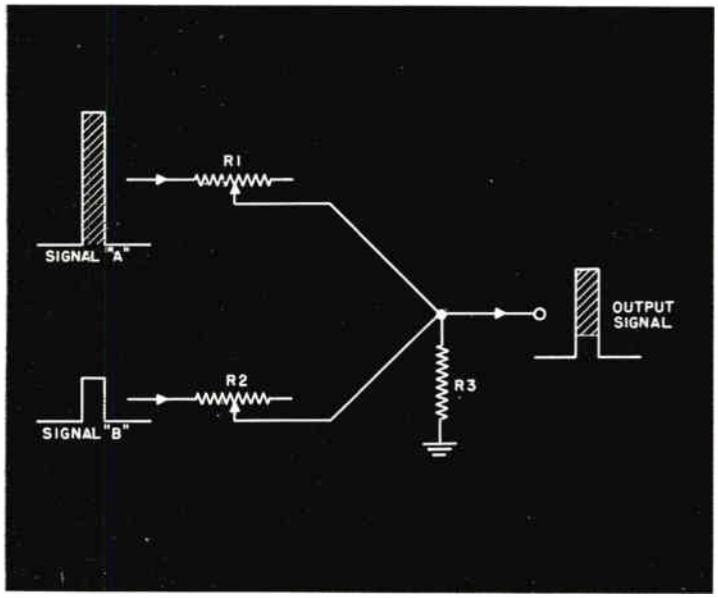


Fig 1. Resistor type adder circuit.

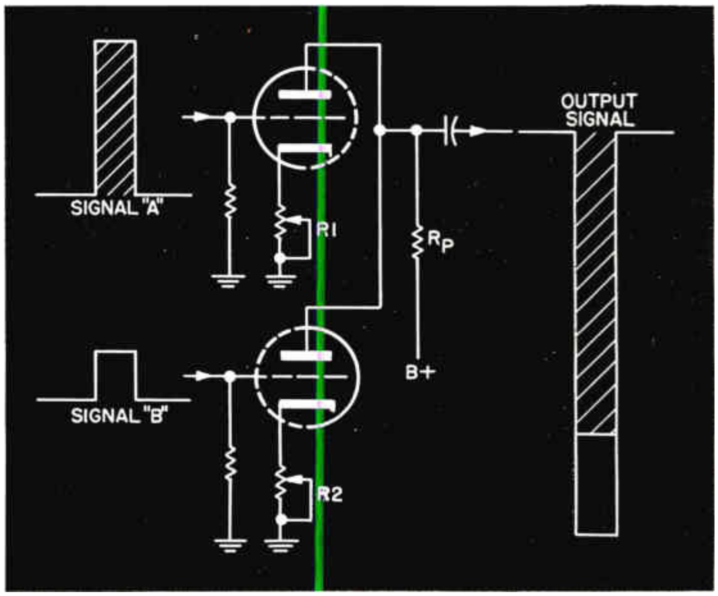


Fig. 2. Vacuum tube type adder circuit.

In previous issues the NTSC system as well as some of the receiver circuits were covered. The composite video signal has been followed through the various signal amplifier and separation circuits right up to the color picture tube.

In the output circuit of each chroma amplifier tube, either the R-Y, G-Y or B-Y signal voltage is present. Each of these voltages must be added to the "Y" or brightness signal voltage in order to reproduce the original E_R, E_G or E_B signal voltages (R-Y + Y = E_R, G-Y + Y = E_G and B-Y + Y = E_B).

Adder or Matrixing Circuits

Two signals such as "R-Y" and "Y" may be combined in a resistive adder circuit illustrated in Fig. 1. In this circuit R_1 and R_2 provide a degree of isolation between the sources of signals "A" and "B." These two signals add together across the common load resistance R_3. Signal "A" is shaded for ease of explanation.

The circuit shown in Fig. 2 uses two triodes in a vacuum tube adder circuit. As in Fig. 1, the two signal voltages are added together across a common load resistance R_P. In the vacuum tube adder the signal is reversed in polarity within the tubes. The vacuum tube adder circuit assures better isolation between the signal sources and, in addition, provides amplification. The proportion of signals "A" and "B" across the load resistance may be varied by adjusting R_1 and R_2.

The circuits shown in Figs. 1 and 2 provide the basis for matrixing ahead of, or outside of, the picture tube. In this type of matrixing, three individual circuits, one for each color, are required to add the "Y" signal to the chrominance signals and obtain red, green and blue signal voltages.

Most receivers manufactured a few years ago used separate tubes to combine the "Y" signal with each color signal. Receivers now on the market usually use the picture tube for this function as can be seen in Fig. 3. In this circuit, the "Y" signal is fed to all three picture tube cathodes. The "R-Y," "G-Y" and "B-Y"

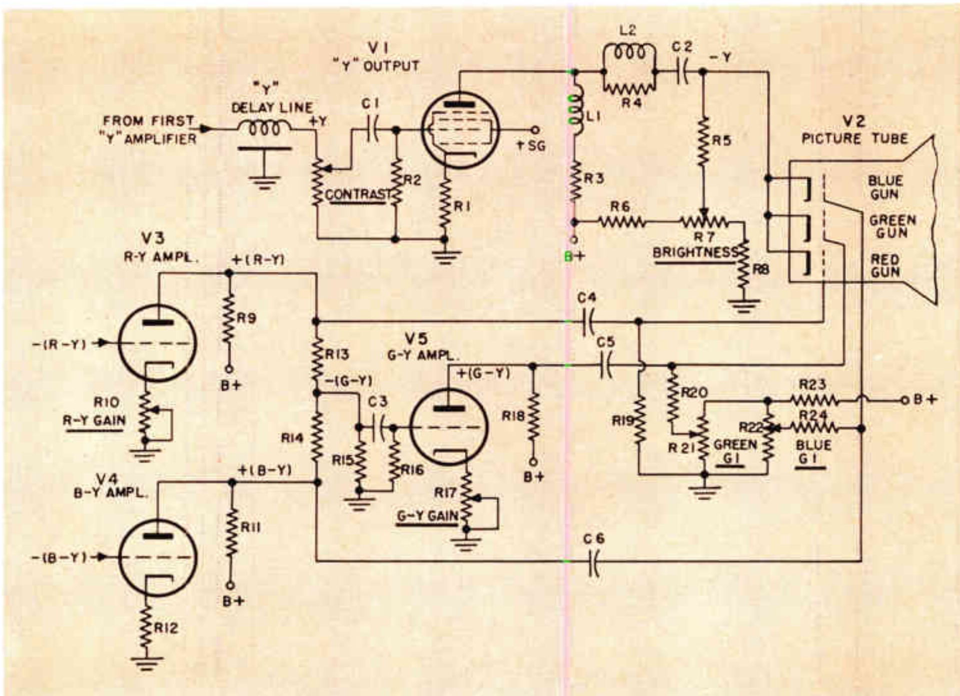


Fig. 3. Picture tube type adder circuit.

Vol. 10 No. 1

TECHNI-TALK

on AM, FM, TV Servicing

published bi-monthly by
ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

SCHENECTADY 5, N. Y.

In Canada
CANADIAN GENERAL ELECTRIC CO., LTD.
189 Dufferin St., Toronto 3, Ontario

R. G. KEMPTON, Editor

signals are fed to the red, green and blue picture tube grids, respectively. The matrixing or adding of the signal voltages occurs within the picture tube.

Fig. 4 shows the signal voltages on each picture tube gun as 100% saturated red, green and blue bars are scanned. When the red bar is scanned, .30 units of "Y" are fed to *all three* picture tube guns. Therefore, .70 units of "R-Y" are fed to the red gun to form 1.0 unit of "E_R." The green and blue guns are each fed minus .30 units of "G-Y" and "B-Y," respectively to offset the plus .30 units of "Y" and cut them off completely. When the green bar is scanned, the green gun receives a total of 1.0 unit of signal and the other two guns are shut off. The same conditions exist when the blue bar is scanned in that only the blue gun receives any resultant signal voltage. Inasmuch as plus or minus voltages are fed simultaneously to the picture tube guns, the voltages are added or subtracted instantaneously. Matrixing is thereby accomplished with a minimum of circuitry. It should be noted that the signal amplitudes shown in Fig. 4 have not been attenuated to reduce overmodulation and are based on the formula $Y = 0.30R + 0.59G + 0.11B$.

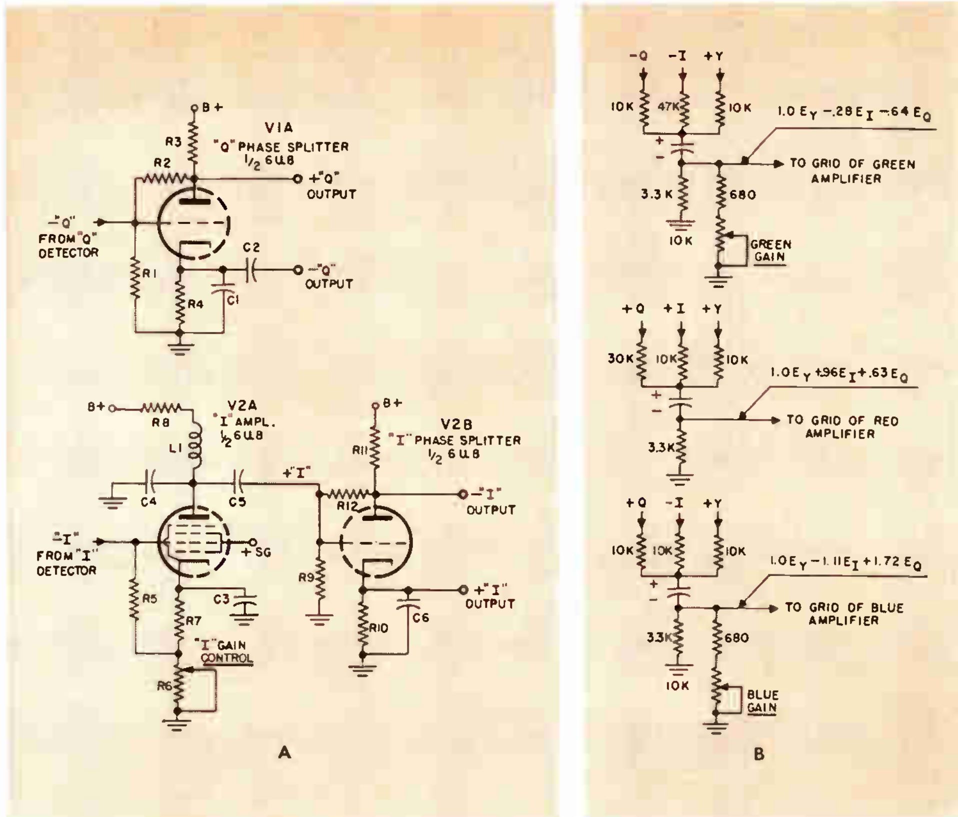


Fig. 5. I, Q type adder circuit.

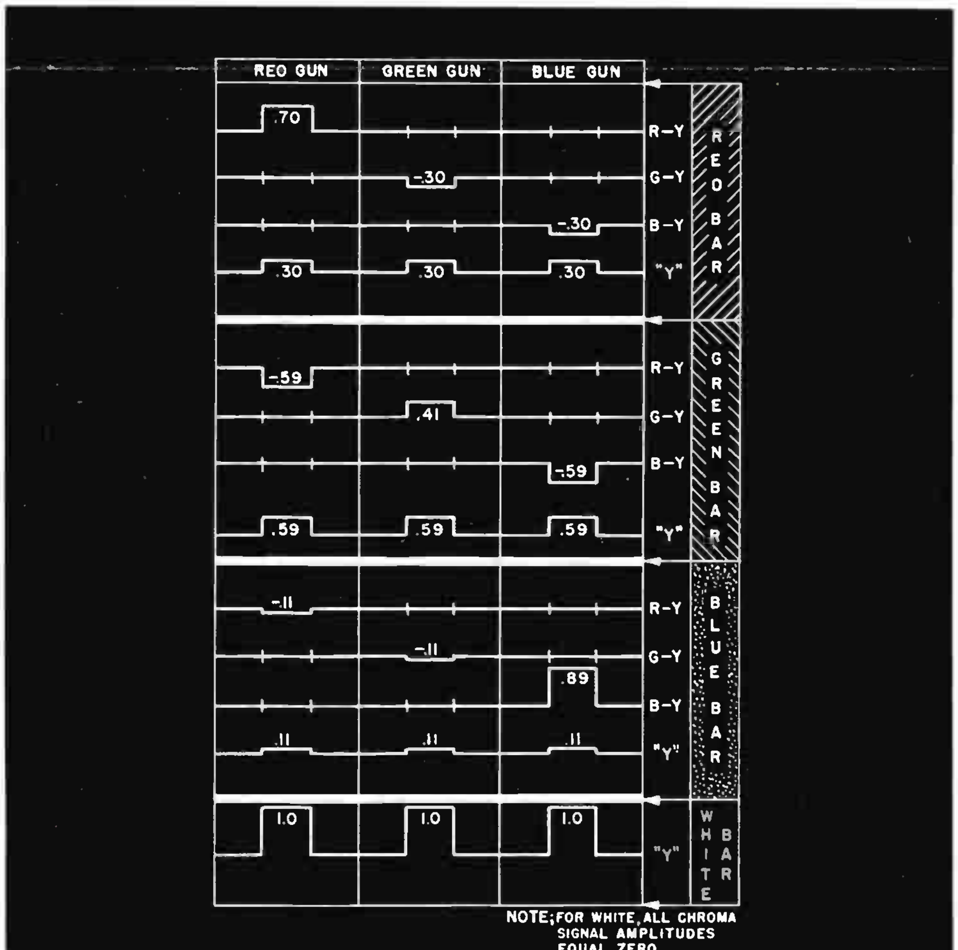


Fig. 4. Signal voltages on picture tube guns as red, green and blue bars are scanned.

It should also be pointed out that matrixing of this type does not lend itself conveniently to receivers of the "I" and "Q" variety but is a "natural" for equal bandwidth receivers employing "R-Y," "G-Y" and "B-Y" chrominance signals. The "A" portion of Fig. 5 illustrates one method of obtaining positive and negative "I" and "Q" signal voltages, whereas the "B" portion shows how either positive or negative "I" and "Q" voltages are combined in a resistive matrix circuit to produce "E_R," "E_G," and "E_B" signal voltages. The output voltages from the circuits shown in the "B" portion of Fig. 5 are usually fed to individual voltage amplifier tubes before application to their respective guns in the picture tube.

The Color Picture

During a black and white program each gun must "paint" a complete picture. If only the red gun is operating the mono-

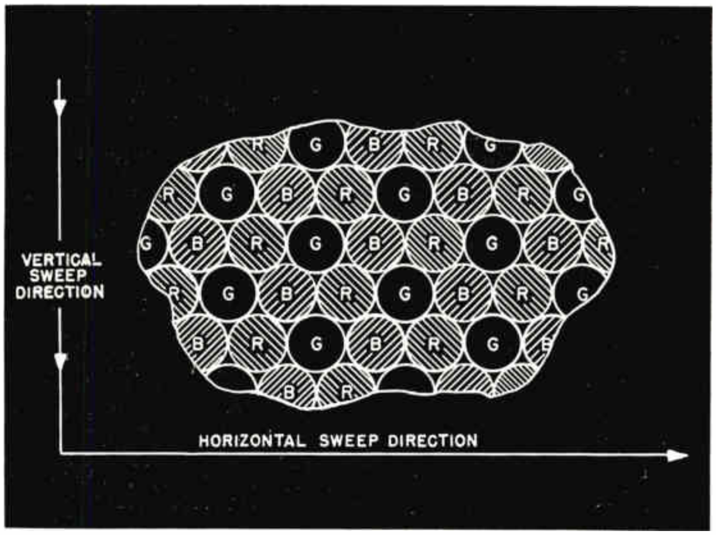


Fig. 6. Triads of color dots printed on faceplate of color picture tube.

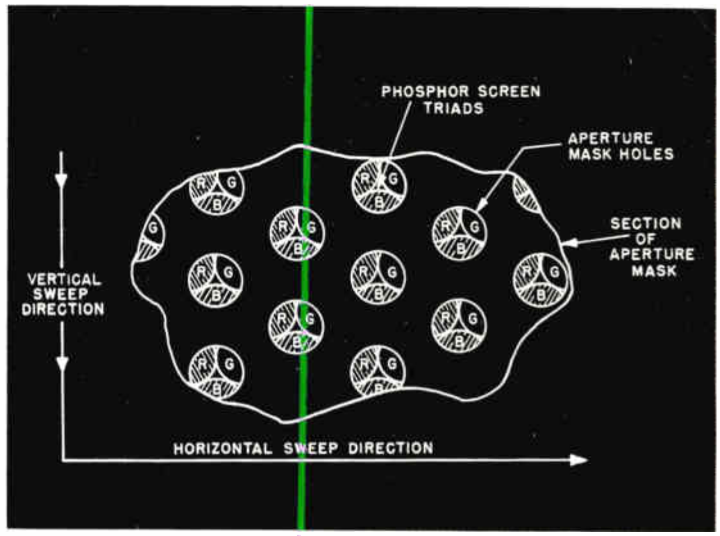


Fig. 7. Position of triods in relotion to aperture mask holes.

chrome picture will appear as black and red instead of black and white. The green gun will produce a black and green picture and the blue gun a black and blue picture. During a color program each gun will only "paint" that portion of the picture which contains its respective color. Since three separate pictures are produced simultaneously, it is important that each picture be superimposed directly over the other two pictures. This is necessary in order to produce a "clean" picture without color "fringing."

The circuits used to produce a color picture reasonably free from color fringing will now be described. Before doing so, however, it should be pointed out that it is possible for a color television receiver to present a picture without noticeable color fringing. Actually the color picture tube, as well as the circuits and components used with it, have been designed with this objective. When any item is made, however, there are certain specified tolerance limits. As these tolerances are made more exacting the number of "rejects" increase and the unit cost increases. In order to produce and market a receiver at a price consumers can afford some of the components used in the color receiver cannot be manufactured with the most desirable tolerances. The service technician as well as the customer should understand that some of the adjustments that must be made may be time consuming but are necessary; otherwise the receiver price might be prohibitive.

The Aperture Mask Tube

The aperture mask tube operation is based on the use of about 357,000 sets of phosphor dots printed upon the inside of the picture tube faceplate. Each set of phosphor dots, called a triad, is composed of one green, one red, and one blue dot precisely spaced as illustrated in Fig. 6. The aperture mask made of thin metal (about .003″ thick) and perforated with about 357,000 precisely spaced holes, is located directly in back of the phosphor dotted faceplate and positioned so that each aperture mask hole is in line with a triad as shown in Fig. 7.

Each electron beam generated by the three guns should converge at the aperture mask and strike the correct color phosphor dot as illustrated in Fig. 8. All of the adjustments which affect the three electron beams are specifically made to direct the beams through single aperture mask holes as shown in Fig. 8. It is possible for the beams to converge and go through more than one hole as is illustrated in Fig. 9. When this happens the purity will be all right and the red and green pictures will be superimposed; however, the blue picture will be displaced resulting in color fringing. There are a number of adjustments which affect the three electron beams and these adjustments as well as their effect will be described in detail.

(*To be continued*)

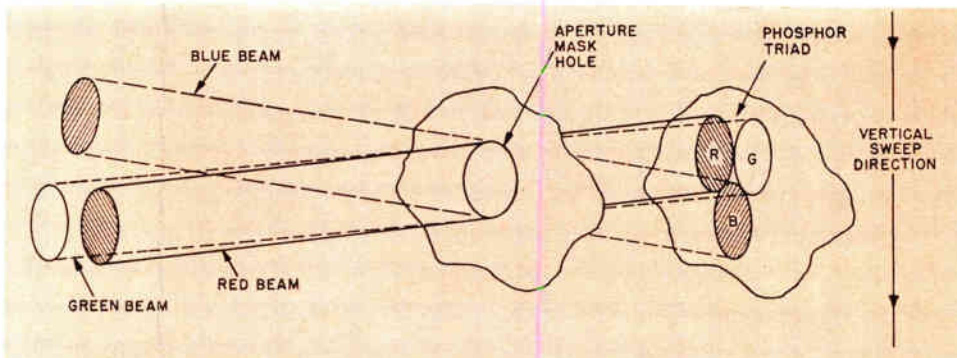


Fig. 8. The three electron beams converge at aperture mask and strike respective color dots.

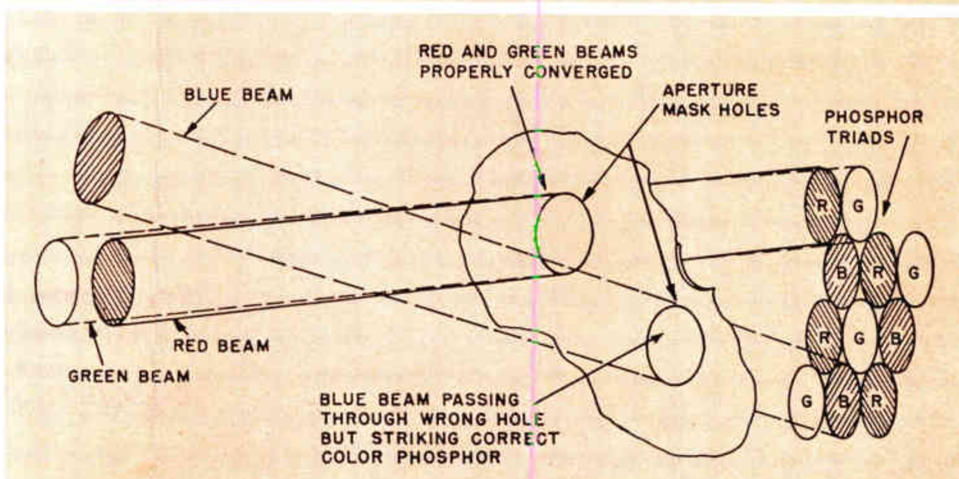


Fig. 9. Blue beam misconverged but strikes correct color dot.

BENCH NOTES

Contributions to this column are solicited. For each question, short-cut or chronic-trouble note selected for publication, you will receive $10.00 worth of electronic tubes. In the event of duplicate or similar items, selection will be made by the editor and his decision will be final. The Company shall have the right without obligation beyond the above to publish and use any suggestion submitted to this column. Send contributions to The Editor, Techni-talk, Electronic Components Division, General Electric Company, Schenectady 5, New York.

SQUEALING PORTABLES

I have had several General Electric transistor portables, Model P-711A and others, that had this same trouble. These sets squealed and motor-boated similar to a set with an open filter, but the trouble was due to bad battery contacts. These sets use Mercury type pen-lite cells and just cleaning the contacts doesn't help for long because they soon become tarnished again.

My solution has been to clean them and tin them with solder. I suspect the trouble is caused by an electrochemical action.

Milton Neser
835 Brentwood
Louisville 15, Kentucky

Editor's Note: Since excessive heat will take the temper out of the spring contacts, a minimum amount of heat should be used when tinning these contacts. Later model receivers use contacts which are cadmium plated.

DUST ELIMINATION

On the "S" line of G-E Receivers using the beige plastic mask, the plastic apparently builds up a static charge that attracts any dust that may be stirred up in the receiver.

Cleaning the mask with various soaps, cleansers and detergents proved of little value as the dust soon accumulated.

About 4 months ago, after cleaning, I have been spraying the mask with a record anti-static spray and to date have received no further complaints.

C. T. Simmons
Leatherman Electronics
4014 Bardstown Rd.
Louisville 18, Kentucky

HEAT LAMP

Receiver: Emerson #129D chassis.
Complaint: Horizontal pulling then loss of horizontal and vertical sync after about two hours of operation.
Cure: A General Electric heat lamp was applied under the chassis without any noticeable change. The heat lamp was then used on top of the chassis and after about two minutes the pulling appeared. The trouble was caused by the second video IF amplifier tube.

The heat lamp has been used as a fast and effective tool to localize trouble in a number of receivers.

S. Hony TT
75 Tremont
Hartford, Connecticut

"PIN-CUSHION" CORRECTION

I recently corrected a "pin-cushion" effect on a late model G.E. TV #21C141. This set *does not* employ compensator magnets.

I dismantled an old double magnet ion-trap I carried in my tool chest and by carefully noting the effect of the magnets on the raster, I was able to eliminate the "pin-cushion."

When the proper spot was found on the pix tube where the magnets eliminated the distortion, I secured them with a piece or two of masking tape to the pix tube.

The results were very satisfactory.

E. Bruno
1370—41st St.
Brooklyn 18, N. Y.

CHASSIS ILLUMINATION

Miniature tube replacements near tuners or towards the front part of any TV chassis has always been a tedious problem. Sometimes a spotlight is not handy and even if it were the light may be blocked by the hand. The remedy: increase the brightness of the C.R.T. until enough light is diffused over the chassis to illuminate the socket and insert the tube.

J. J. Schalit
1674 Pennsylvania St.
Denver 3, Colorado

What's new!

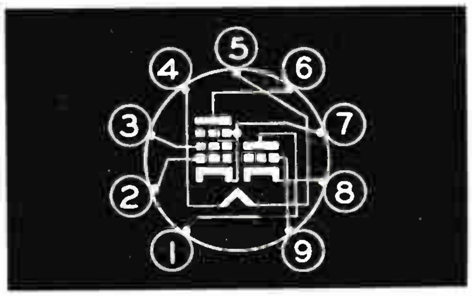
6EA8 TRIODE-PENTODE

FOR VHF CONVERTER APPLICATIONS

Type 6EA8 is a 9-pin miniature triode-pentode interchangeable with the 6U8 and 6U8-A but having higher gain.

The 6EA8 contains a sharp-cutoff pentode and a triode in one envelope. Each section has a separate cathode and is electrically independent. The tube is primarily intended for service as a combined triode oscillator and pentode mixer in television receivers. Incorporation of a controlled heater warm-up characteristic makes the tube especially suited for use in television receivers that employ series-connected heaters.

Heater Voltage, AC or DC........... 6.3 Volts
Heater Current.................... 0.45 Amperes
Heater Warm-up Time............... 11 Seconds

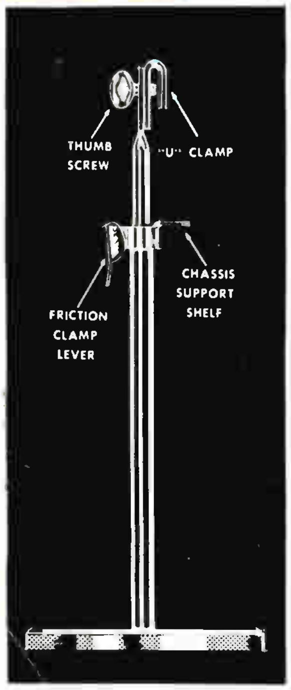


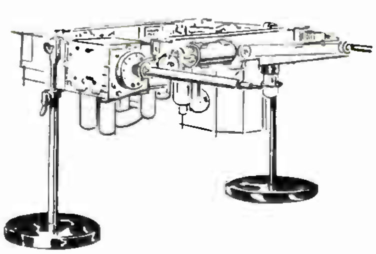
CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

	Pentode Section	Triode Section	
Plate Voltage	125	150	Volts
Screen Voltage	125	....	Volts
Grid-Number 1 Voltage	−1.0	....	
Cathode-Bias Resistor	....	56	Ohms
Amplification Factor	....	40	
Plate Resistance, approx.	80000	5000	Ohms
Transconductance	6400	8500	Micromhos
Plate Current	12	18	Milliamperes
Screen Current	4.0	....	Milliamperes
G_1 Voltage, approx.	−9	−12	Volts

I_B = 10 Microamperes.





ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.

BULK RATE
U.S. Postage
PAID
Schenectady, N. Y.
Permit No. 148

Mr. Thomas F. Boyd
415 Fredericksburg Rd.
San Antonio 1, Texas
E-250/HOU-23

5-18-54

Form 3547 Requested