MAY—JUNE, 1958
JULY—AUGUST, 1958
Vol. 10, Nos. 3 and 4

GE Electronic TUBES

Techni-talk
on AM, FM, TV Servicing

Color Receivers—VI

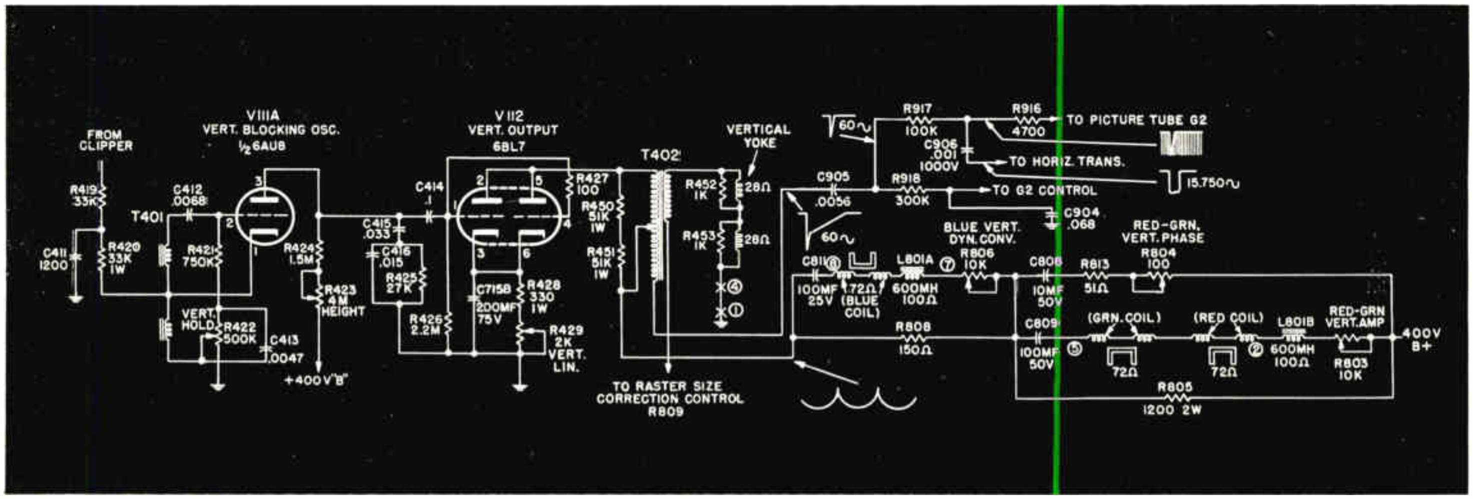

Fig. 1. Vertical oscillator, output and convergence circuits.

Vertical Sweep

The vertical sweep system is essentially the same as used in monochrome receivers. The vertical oscillator is of the blocking type locked on frequency by vertical sync pulses obtained from the clipper circuit as shown in Fig. 1. The sawtooth voltage generated in V111A is fed to the grids of the parallel connected 6BL7-GT vertical output tube V112. The vertical output transformer couples deflection energy to the vertical coils of the deflection yoke.

The vertical output circuit is also the source of the vertical retrace blanking pulse. This pulse at the transformer is a spiked sawtooth as shown in Fig. 1. A shaping network composed of C905, R917 and R916 differentiates the pulse to remove the sawtooth. The horizontal blanking pulse obtained from the horizontal transformer is fed to C906 and combined with the vertical blanking pulse before application through R916 to G_2 of the picture tube.

The vertical output circuit also provides energy for vertical convergence. This circuit is shown at the right of Fig. 1. In order to better understand this circuit, suppose we illustrate the effect on a cross hatch pattern when both static and dynamic convergence correction are removed.

Removal of Static and Dynamic Convergence

Fig. 2 illustrates this condition which was produced by disconnecting the dynamic convergence assembly plug and removing the permanent magnets from the red, green and blue convergence assemblies on a General Electric "CL" receiver. It will be noted in Fig. 1 that the lower end of the vertical yoke windings is connected to ground through the raster size control R809. It was necessary to connect a jumper wire across pins 1 and 4 on the dynamic convergence assembly socket to obtain normal vertical deflection.

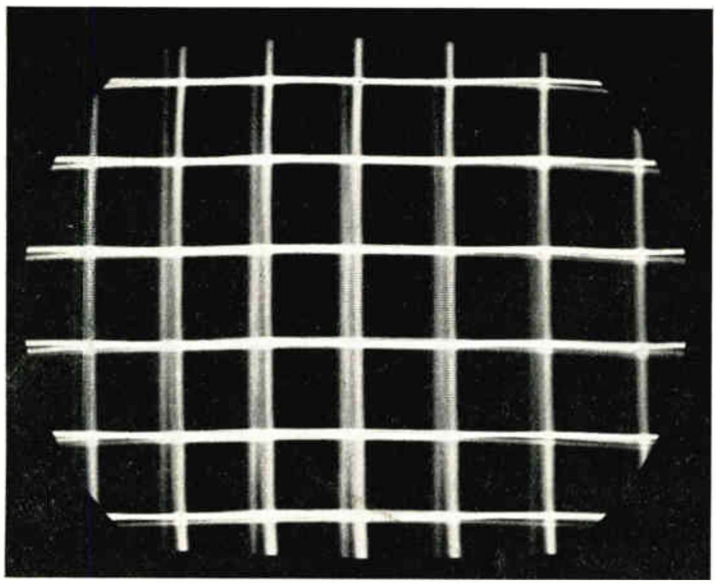

Fig. 2. Cross hatch pattern on color picture tube with both static and dynamic convergence removed.

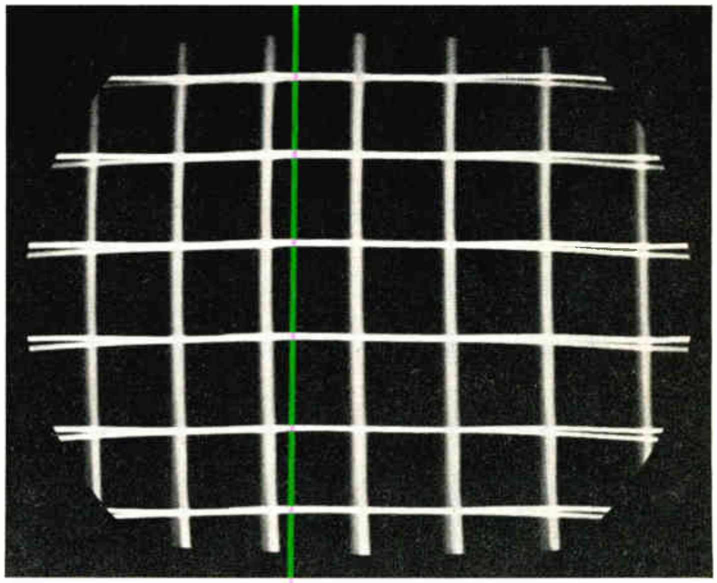

Fig. 3. Cross hatch pattern with dynamic convergence removed and static convergence adjusted for proper convergence at center.

Vol. 10 Nos. 3 and 4

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

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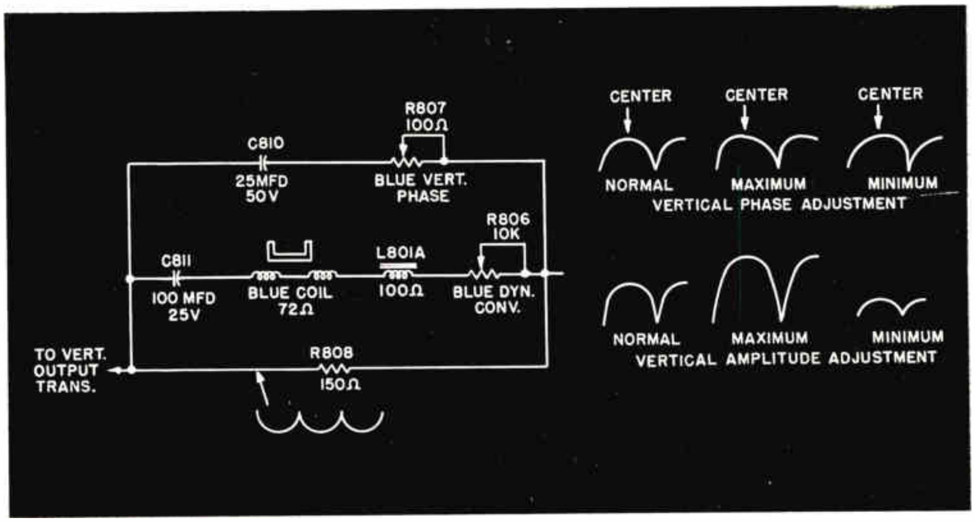

Fig. 5. Blue vertical convergence circuit.

Since Fig. 2 is reproduced in black and white instead of red, green and blue it may be helpful to identify the colors as they appear on the face of the color picture tube. The vertical lines are separated somewhat with blue on the left, green in the center, and red on the right. The horizontal lines are reasonably close over most of the center area with red on top and blue on the bottom. This photograph illustrates the amount of correction that must be obtained from the static and dynamic convergence circuits.

Removal of Dynamic Convergence

Fig. 3 shows the effect with only "static" convergence. These magnets were adjusted for proper convergence at the center of the picture tube with the dynamic convergence circuit still disconnected. This photograph clearly shows the amount of correction required from the dynamic convergence circuits. It also shows that both static and dynamic correction are necessary. Static convergence is required to get the three separate colors together at center of screen as shown in Fig. 3. Dynamic convergence is necessary to "straighten" all three colors after they are superimposed by static convergence adjustments. The reason dynamic convergence correction is required was illustrated in the Vol. 10, No. 2 issue (Fig. 5) which showed why curvature appeared near the edges of the picture tube screen.

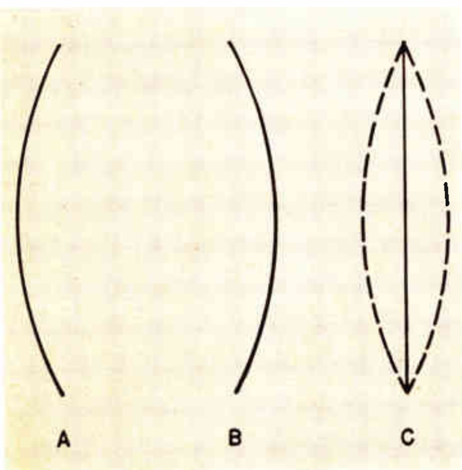

Fig. 4. Illustration of normal curvature in A, dynamic correction waveform in B, and resultant in C.

Dynamic Convergence Waveform

Fig. 3 shows that straight horizontal lines are curved when dynamic convergence is not present. If the exaggerated curve shown in Fig. 4A is considered as the normal curve without dynamic convergence correction and a parabolic waveform such as shown in Fig. 4B is used for dynamic convergence correction, the result will be a straight line as shown in Fig. 4C. Since each gun does not produce a line with the same curvature as the other guns, as illustrated in Figs. 2 and 3, it is necessary that the correcting waveform be adjustable both in amplitude and phase. The circuit shown at the right of Fig. 1 provides this type of correction. It should be pointed out that one of the reasons for the wider separation near the edges of the horizontal lines as compared with the vertical lines in Fig. 3 is due to the masking off of top and bottom areas on the round color tube.

Illustrations and actual photographs have been used to show the type and amount of convergence correction needed. The circuits used to develop waveforms with the correct amplitude and phase will now be described.

Blue Vertical Convergence Circuit

The parabolic waveform obtained from the vertical output circuit is shown in Fig. 5. Notice that this circuit is for blue convergence only. The circuit used for red and green convergence is practically the same as can be seen in Fig. 1. The d-c input for the vertical output circuit is through R-808. The pulse developed across this resistor is shaped into the required parabolic waveform by the remainder of the circuit elements. C-811 blocks flow of d-c current through the blue coil. Parabolic current flows through the blue coil, however, and it is this current flow that provides the magnetic effect required. The inductance value of L801A is high enough to impede the flow of horizontal currents but low enough to have negligible effect upon the vertical pulse current. Since R806 has a value of 10,000 ohms the adjusted value determines the amplitude of the parabolic waveform.

The effect of C810 and R807, which are parallel connected across the blue dynamic convergence circuit, is to adjust the phase of the parabola with respect to the deflection yoke sweep current. It will be noticed that this particular portion of the blue convergence circuit does not appear in Fig. 1. Early model receivers used the circuit shown in Fig. 5 but it was found that the convergence procedure could be simplified without materially affecting performance by eliminating C810 and R807.

It will also be noticed in Fig. 1 that the red and green coils have common phase and amplitude controls. This is another feature that simplifies the convergence procedure on the General Electric color receiver.

(To be continued)

DELTA SOUND SYSTEM USED IN NEW GENERAL ELECTRIC "Q-3" RECEIVERS

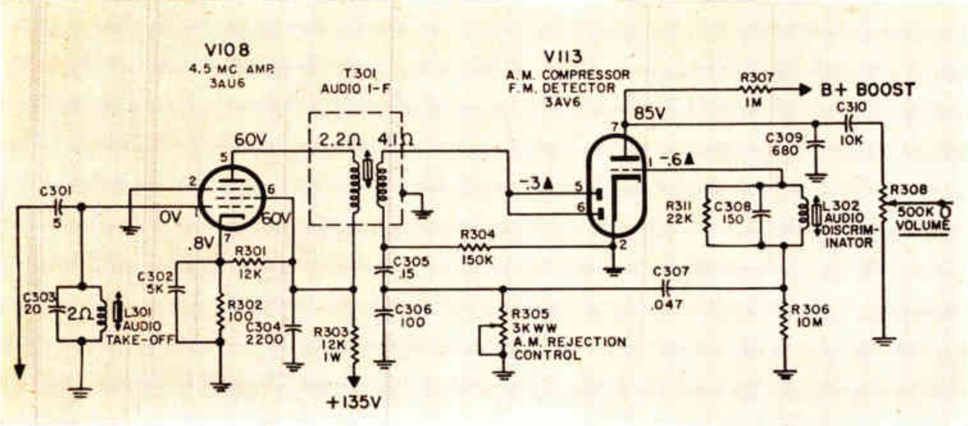

Fig. 1. Delta sound system circuit used in "Q-3" line of General Electric receivers.

The Q-3 series of portable receivers employs the new audio detection circuit shown in Fig. 1. This is known as the Delta Sound System. In this system, the conventional ratio detector is replaced by an FM discriminator circuit and a triode power detector. The FM detection process consists of converting the FM signal to an AM signal having the same modulating frequency. This AM signal is then detected by the well known plate detection method.

Since this method of detection is responsive to both amplitude and frequency modulation components of the 4.5 MC signal, it is necessary to provide for the required AM limiting in another manner. The output of the 4.5 MC amp is delivered to a diode detector as well as to the FM discriminator. The percentage of AM modulation of the composite 4.5 MC signal is reduced to small fraction of the original through compression of the signal envelope. This compression is the result of the diode loading presented to the 4.5 MC amp. The small percentage of AM still remaining on the 4.5 MC signal after compression is removed by means of the cancelling principle: a small amount of the audio fundamental obtained from the compression diode is inserted in the grid return circuit of the power detector. When this voltage is of correct phase and amplitude, it cancels the remaining AM fundamental at the detector output. The phase of this voltage is governed by the circuit, while the amplitude is adjustable by means of the AM rejection control.

The audio IF signal is delivered to the grid of the 4.5 MC amp in exactly the same manner as in the "Q2" chassis. The output of the 4.5 MC amp is coupled through a bifilar type transformer which is peaked at 4.5 MC. The composite 4.5 MC signal is rectified by means of the diode plates of V113. Conduction by the diode circuit results in compression of the signal envelope and the AM fundamental obtained passes through C305 and R305 to ground.

Discriminator Frequencies

Since C305 and C306 appear in the tuned circuit of T301 secondary, the 4.5 MC IF current flows through them. As a result of this current flow, a pre-determined amount of the 4.5 MC compressed signal appears across C306. This is coupled through C307 and excites the grid and cathode of V113 through the medium of the tank circuit L302, C308. The resonant circuit and the input capacity of V113 form a frequency discriminating circuit where the amplitude of the 4.5 MC signal at the grid is a function of frequency. This characteristic is obtained by tuning the discriminator circuit slightly higher than 4.5 MC in frequency, or approximately 4.563 MC. By referring to Fig. 2, it will be seen that by tuning the circuit to place 4.5 MC at the center of the linear portion of the curve, a deviation of ±25 kc in the FM signal will result in a linear change of amplitude of the signal fed to the grid of V113. Thus the FM modulation of the 4.5 MC signal is converted to an AM signal of the same modulating frequency. This signal is rectified in the grid circuit of V113. The resulting DC component appearing across C307 is bled off to ground through R306 which has a value of 10 megohms, establishing the correct operating bias for plate detection. This negative bias is stabilized by the relatively large value of C307, allowing the tube to act as a bias detector since the 4.5 MC envelope changes at an audio rate. The audio output at the plate of V113 is coupled to the high side of the volume control through C310. Capacitor C309 at the detector plate, together with the volume control, the plate load resistor R307 and the internal plate resistance of V113 form the correct de-emphasis network for proper FM audio.

AM Rejection

The low percentage of fundamental AM modulation remaining after compression of the 4.5 MC envelope will appear in the output of the plate detector as follows. On a positive going AM pulse, plate current in the detector will increase causing a negative pulse to appear in the output. The same positive going pulse in the 4.5 MC envelope will appear in the diode compressor circuit and through rectification will cause a negative going audio pulse to appear across R305 in series with C305. Since the detector grid is coupled to this point by capacitor C307, the grid receives a negative going pulse. Due to phase inversion within the detector, a positive going pulse appears in the output. By correctly adjusting R305, the AM rejection control, to provide just the right amount of cancelling voltage, the fundamental of the interfering AM may be removed. Obviously, this adjustment is for cancellation of buzz and should be made in accordance with published instructions. The control should never be set at full clockwise position, since this would short most of the 4.5 MC signal to ground and prevent exciting voltage from reaching the discriminator circuit.

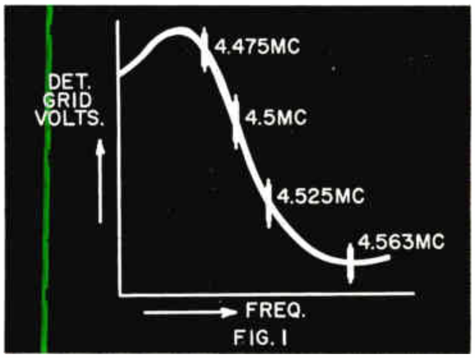

Fig. 2. Placement of frequencies on audio discriminator curve.

BENCH NOTES

Those desiring to have letters published in this column should write the Editor, Techni-Talk, Electronic Components Division, General Electric Company, Schenectady 5, New York. For each such letter selected for publication you will receive $10.00 worth of General Electric 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 unlimited right without obligation to publish or otherwise use any idea or suggestion sent to this column.
Caution: The ideas and suggestions expressed in this column are those of the individual writers. These ideas and suggestions have not been tried by the General Electric Company and therefore are not endorsed, sponsored or recommended.

SNOW REMOVAL

A G-E TV Model 21T055 came to the shop with snow, indicating tuner trouble. No defect could be found in the tuner, but upon replacing the 22 meg. resistor connected from A.G.C. line to B+ the set functioned normally. This bias resistor is used in a number of other makes of TV sets also.

Al Collar
Rt. 8, Box 241
San Antonio, Texas

Editor's Note: This condition is illustrated in Tele-Clue M-234.

SERVICING PRINTED CIRCUITS

To remove the old solder from the eyes of a printed circuit type chassis of a radio or TV receiver after a multiple terminal part has been removed, simply take your soldering iron in one hand and an ordinary pipe cleaner in the other. Apply heat to the solder left in the eye on the PC board with the soldering iron until it melts, then quickly push the pipe cleaner through from the top side of the chassis with the other hand, pull back through and you've swept the eye clear of all solder. Do likewise with the remaining eyes needing cleaning.

Urban B. Reiff
c/o Al Johnson Radio & TV
1067 S. Gaylord
Denver, Colorado

REMOVING YOKES

Most servicemen sweat and pull their hair when trying to remove a defective yoke that seems welded to a picture-tube neck. They usually end up by snipping it off with a pair of cutters. The solution is so simple that many never think of it. I tilt the face of the set down, squirt 3-in-1 oil into the yoke, and it slips off like magic, even past the picture tube socket.

James M. Garrison
Jim's Radio Service
22 Ellis St.
Bridgeton, N. J.

PRINTED CIRCUIT—INTERMITTENT

The radio was a printed circuit variety, Arvin model 951T, chassis RE391. The complaint was intermittent performance. After several hours of bench air-test with the set out of its cabinet, there was no indication of the intermittent characteristics.

A complete run-down of all the usual causes for cutting-out failed to give a solution. However, reinstalling the printed circuit board into the grooves that holds the board in place in the molded plastic cabinet caused the intermittent operation to reappear. The slightest vibration or pressure applied anywhere would cause erratic reception. It was finally discovered that conductive dust in the groove was shorting the printed terminal connection of the oscillator stator plates (on the tuning condenser) to the common ground printed wire. A little scotch tape around the edge of the printed circuit board cured the trouble and operation was again normal.

Walter S. Malecky
1146 Beardsley St.
Akron 1, Ohio

SOLDERING IRON TIP REMOVAL

Should the copper tip of a soldering iron seize through oxidation, squirt a little household ammonia around the tip and in the recess and let the liquid soak in for a few seconds. This makes removal easy and does not damage the iron.

E. Mayover
1601—14th St. W. (U.S. 41)
Bradenton, Florida

What's new!

SERVICE-DESIGNED 1J3

TV HIGH-VOLTAGE RECTIFIER

The 1J3 is a filamentary diode designed for use in television receivers as the high-voltage rectifier. Due to NEW SPIRAL-SHIELD DESIGN shown below the 1J3 requires different tube tester settings, otherwise it is directly interchangeable with 1B3-GT.

Cathode—Coated Filament
Filament Voltage, AC or DC............1.25 Volts*
Filament Current.....................0.2 Amperes

NEW G-E 1J3

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Peak Inverse Plate Voltage
DC Component....................22000 Volts
Total DC and Peak................26000 Volts
Steady-State Peak Plate Current.....50 Milliamperes
DC Output Current...............0.5 Milliamperes
Tube Voltage Drop, Approximate
Ib = 7.0 Milliamperes DC............225 Volts

* Under no circumstances should the filament voltage be less than 1.05 volts or more than 1.45.

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