Conversion to Color is Simple and Easy

By
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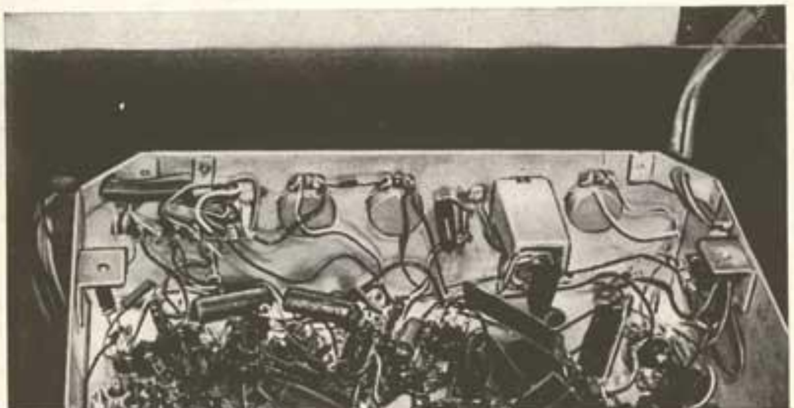
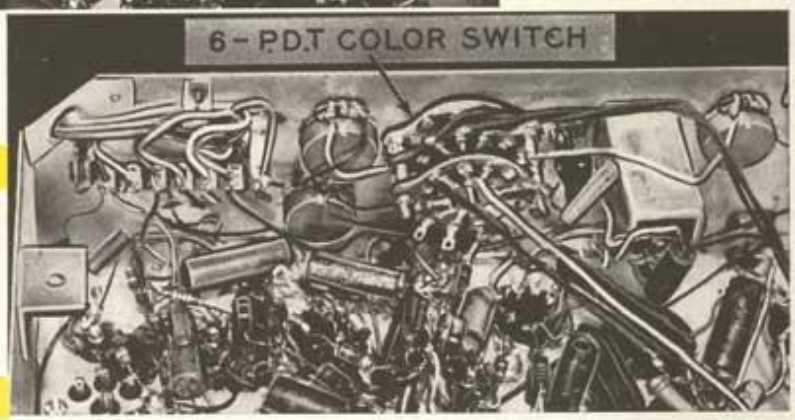


The Admiral 30A1 rear panel before conversion for color is shown in the photo at left.



Note 6-p.d.t. color switch added in photo at right and controls placed as in Fig. 3.

Few parts, slight circuit changes, give you color.

IN adapting television receivers for color reception the vertical-sweep system must be altered to lock in with a 144-pulse-per-second sync, while the horizontal sweep must be changed for 29,160 sync. This is best done by a switch arrangement so that either black-and-white (monochrome) or color can be selected.

The vertical sweep circuits do not present much of a problem because adaptation means only a change of capacitor or resistor values in a blocking oscillator or multivibrator. With the horizontal sweep, however, special problems arise because of the automatic lock systems employed by modern receivers and because the high voltage is usually derived by kickback of horizontal sweep components. Besides, there are three primary lock systems used for horizontal sync, and each requires a different approach for color reception.

To investigate special color adaption problems, the author changed over three receivers, one with a phase-detector horizontal lock system, the second with a synchrolock type circuit, and the third (most commonly used type) the synchroguide. Study all three adaptations because many of the problems are overlapping. Thus, even though you work on an Admiral 30A1 chassis as detailed herein, some of the problems you may run into will parallel those described for the RCA receiver.

Phase detector system

The Admiral 30A1 chassis was chosen because it employs a typical phase detector lock for the horizontal oscillator as shown in Fig. 1. A 6AL5 tube is used for the phase detector (discriminator) which regulates the bias on the control tube. The latter is a reactance circuit which develops an out-of-phase signal across the cathode resistor, which in turn shunts the oscillator coil via C413 and thus acts as a frequency control.

No changes need be made in the sync discriminator stage because it is a phase-detector type with no resonant-frequency sections. Because C413, in series with the signal across the cathode resistor of the 6J6, is a reactance across the oscillator grid circuit, any change will influence oscillator frequency. Therefore C413 was disconnected from the cathode resistor and wired to one section of a six-pole, double-throw wafer switch.

A .004-μf capacitor also was wired into the circuit as shown in Fig. 1. It is a critical value and must be found experimentally if the horizontal sweep is to remain locked in when changing from monochrome to color. Otherwise the frequency control must be adjusted each time the switch is thrown for color or black-and-white. Even with the same model number chassis this capacitor may be .0045 or .003 μf, depending on the circuit characteristics peculiar to your receiver. A fixed capacitor may be used, shunted by a trimmer-type variable to simplify adjustment.

Another section of the switch was used to change over the sawtooth-forming circuit in the discharge stage. Here a 330-μμf capacitor replaces the 680-μμf one when on color, and the 8,200-ohm resistor is replaced by one of 3,000 ohms.

The vertical-sweep oscillator needed only an 80,000-ohm resistor to lock in with the 144-pulse-per-second sweep, Fig. 2-a. This value was found to be the best because it required only slight readjustment of the vertical-hold control when switching to color.

Because the higher sweep rate reduces the high voltage, beam velocity in the picture tube is reduced and the focus control range barely secured good focus. R437 in the focus-control circuit should be shorted out during color reception, as shown in Fig. 2-b. The focus control then gave a sharp picture at center setting and required no change on color.

In some receivers, particularly where tubes in the sweep system are fairly old, full width may not be secured on color. Resetting the drive control may help, but extreme settings may affect horizontal linearity with consequent picture distortion.

Additional sweep is obtained by shunting the 5,000-ohm horizontal oscillator plate resistor (R424, Fig. 1) by another of equal value when on color. One of the two remaining switch sections can be used for this purpose. Use a resistor having at least a 5-watt rating. If more width is needed, R426 (Fig. 1) in the grid circuit of the horizontal-discharge tube can also be shunted by an equal-value resistor for color, using the remaining switch section.

If the two switch sections are not used as above, they can switch two extra potentiometers into the circuit for height and vertical linearity. This will eliminate making slight adjustments on these controls when switching. These were not required on the receiver converted by the author. Duplicate-value potentiometers are used because the difference in the setting of these controls is slight when changing to color reception. This is an added refinement which may not always be necessary or desired.

Layout changes

Additional resistors or capacitors should be placed so that leads are as short as conveniently possible. The longest run necessary was the shunting wire for the R437 focus resistor which had to be wired to the focus control on the front chassis apron and run back to the color switch on the rear chassis apron. The .004-μf (approx.) capacitor for color required only a short run, while the new discharge components were strung halfway across the chassis. Switch capacities or lead dress seem unimportant, though it is best to keep the vertical and horizontal circuit wires an inch or two apart.

To find room for the switch on the rear apron, a new hole was drilled above the vertical linearity control and the height control moved to this place. This left room for the switch to be mounted in the hole left by the height control and cleared the inside of the rear apron for the switch assembly. Fig. 3-a shows the rear apron before the change. Fig. 3-b shows the new layout.

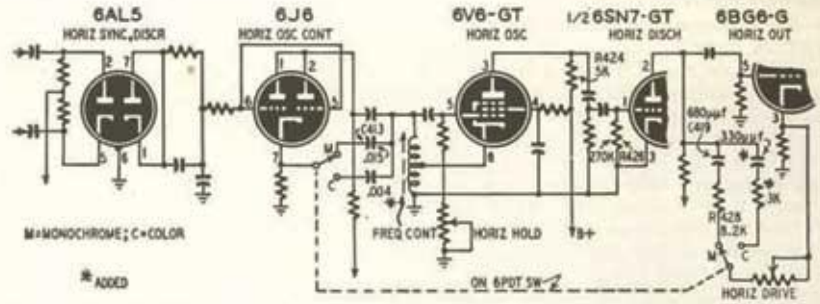


Fig. 1—Color horizontal sweep changes in Admiral 30A1; 6AL5 is phase detector.

Another connection was made from the plate of the vertical oscillator to a newly installed insulated output terminal, Fig. 3-b. This is to secure pulses at the 144 repetition rate for use in the motor control circuit to keep the color wheel or drum rotating at a speed synchronized with the incoming sync.

This layout is included here to illustrate one of the many ways the new units can be placed on the chassis. If height and vertical linearity controls are included, they can be placed near the existing controls. Another method is to use dual type controls with the double shaft (one inside the other). These, while more expensive, save considerable space.

Synchrolock system

The synchrolock horizontal frequency control system is similar to the phase detector system of the Admiral 30A1, except that the discriminator section contains a resonant circuit which must be changed for color reception.

An RCA 8TS30 receiver was used (later model of the 630). This type of synchrolock is found in earlier Emersons as well as DeWald, Zenith, Du Mont, and a host of others. The switch was again mounted on the rear of the chassis and arranged to switch only four circuits.

The changes for the 8TS30, Fig. 4, are:

1. Two .005-μf capacitors were used (Fig. 4-a)—one across the windings of the horizontal sync discriminator transformer primary, and the other across the secondary winding in the reactance tube circuit.
2. A 330-μμf capacitor and a 12,000-ohm resistor were wired into the discharge circuit, Fig. 4-b.
3. The only change in the vertical was to lower the blocking tube grid time-constant by switching in a smaller value grid resistor in the color position (620,000 ohms) Fig. 4-c.

When the switch was first thrown to the color position it was necessary to slightly readjust the horizontal frequency control on the rear chassis to permit lock-in at the color line rate. This did not need repeating during subsequent switching.

As with the Admiral, the value of the horizontal-lock capacitors is critical and several combinations around the .005-μf value may have to be tried to avoid constant readjustment of the frequency control.

When switching between monochrome and color rates the following controls had to be readjusted slightly each time the changeover was made: Horizontal hold, vertical hold, height, and focus. These controls had adequate range and linearity was good. If height and vertical linearity are to be switched in, the circuits can be included as shown in Fig. 5.

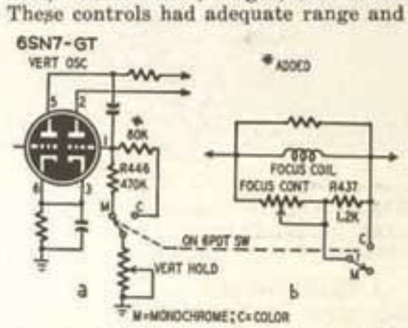


Fig. 2—Vertical sweep and focus circuit changes for color in the Admiral 30A1.

If picture width is inadequate, the following should be tried:

1. Substitute horizontal oscillator and horizontal output tubes to find most effective pair.
2. Decrease horizontal output screen resistor on color position.
3. Decrease value of sawtooth-forming resistor (12,000 ohms). Add more supply voltage to discharge or sawtooth-forming circuit. Add positive to plate side or negative to cathode side (RCA 630 or 8TS30 models).
4. Add more negative supply voltage to cathode of horizontal output tube.

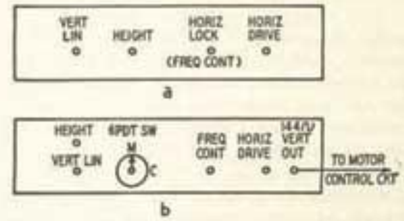


Fig. 3—Admiral 30A1 rear panel layout, (a) before; (b) after. Note 144 c.p.s. output terminal for color wheel sync.

Synchroguide system

For the synchroguide, another RCA (9T246 model) was used with changes as shown in Fig. 6. Here variable trimmer-type capacitors are used and these have the advantage that more accurate adjustment can be made so that lock remains stable during switching. Fixed capacitors can be tried experimentally, though it may mean that adjustments to controls are necessary each time the receiver is switched over.

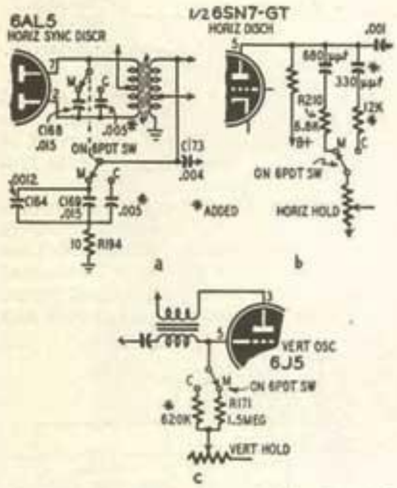


Fig. 4—8TS30 changes, (a) horizontal sync, synchrolock system; (b) horizontal discharge; (c) vertical oscillator.

A Colortone adapter was tried on this RCA receiver, but a variety of adapters are available and include models for the synchrolock and for the phase-detector type horizontal circuits.

Adapter Circuitry

The Colortone adapter uses a circuit similar to that shown in Fig. 6. It is mounted externally and multilead cables are used. All color-position parts are located in the adapter and a few of the monochrome parts are removed from the receiver because they are duplicated in the adapter.

When such an adapter is used locate a clear place in the TV chassis where two holes can be drilled. These should be large enough to accommodate the two cable sections from the adapter. Two plug-receptacles can be used so the adapter can be detached from the receiver for convenience during servicing. (Remember the adapter contains some components removed from the receiver, so the latter will not function without the adapter.)

The adapter duplicates vertical linearity, height, and focus controls. This means standard receiver controls can be preset for monochrome and the adapter controls preset for color. Thus readjustment is not necessary when switching sweep rates. The adapter also has its own color horizontal and vertical frequency controls so they also can be preset on color. In switching only slight (or no) adjustment of hold controls is required.

Besides wiring the cables into the receiver, the following changes are made:

1. Removal of .0047-µf time-constant capacitor (C145) in the grid circuit of vertical blocking oscillator. This capacitor is replaced by a similar capacitor in the adapter plus one of a lower value for the color field rate, Fig. 6-a.
2. Removal of the 180-µµf capacitor (C158) that sets the frequency of synchroguide oscillator. This capacitor is also replaced (at the factory) by a similar one in the adapter and a separate trimmer for color position, Fig. 6-b.
3. The .0022-µf sawtooth-forming capacitor (C161) is removed from the horizontal circuit. This is duplicated by a similar capacitor in the adapter and one of a still lower value is switched in for color, Fig. 6-b.

After the adaptation, the receiver was first adjusted on monochrome by slight readjustment of the horizontal frequency control on the synchroguide transformer. If this control is off too far, *no raster will appear*, as opposed to the other systems previously discussed. If this happens after wiring in an adapter on the synchroguide, adjust horizontal frequency control first before rechecking wiring.

The adapter performs well and a minimum number of adjustments are required when switching rates. Width and brilliancy were adequate, though as with the other conversions, both the drive control and brilliancy had to be advanced. The amount of readjustment depends on the receiver, age of tubes, and general circuit efficiency.

Improving brilliancy

Because existing receivers are designed for maximum efficiency at the 60- and 15,750-c. p. s. sweep rates, it is reasonable to expect that color-adapted circuits will not perform comparatively as well when receiving color as they do on black-and-white. In particular the horizontal width is reduced because of the decline in circuit efficiency and with it there will be a decrease in brilliancy (most receivers utilize horizontal sweep for high-voltage generation.

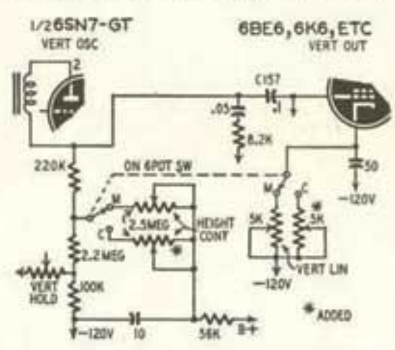


Fig. 5—Optional height and linearity additions to 8TS30 and most TV sets.

A decrease in high voltage affects picture-tube beam velocity, and for this reason focus and *beam bending* (ion trapping) is also affected. Brightness during color reception can be recovered by adjusting the ion trap position. If brilliancy is down to an appreciable extent the ion trap should be readjusted each time a change from monochrome to color is made (and from color to monochrome). If this isn't done the gun structure of the tube eventually may be damaged. The old type ion trap coil can be used and coil current changed when switching between color and monochrome by use of switched resistors.

If picture width is improved by the methods previously detailed, brillancy will also improve. Thus, recovery of proper width means high voltage has also been built up, and readjustment of focus and ion trap position is not required.

To pick up some additional brightness, the first high-voltage filter capacitor can be removed from ground and returned to the top of the damping circuit.

If specially designed horizontal output transformers and deflection yokes are used, little trouble will be experienced with foldover, insufficient width, and brilliancy, or with lack of linearity. These were just coming on the market when we were making our conversions, and we were not able to secure them before this was written. But they no doubt will be readily available soon.

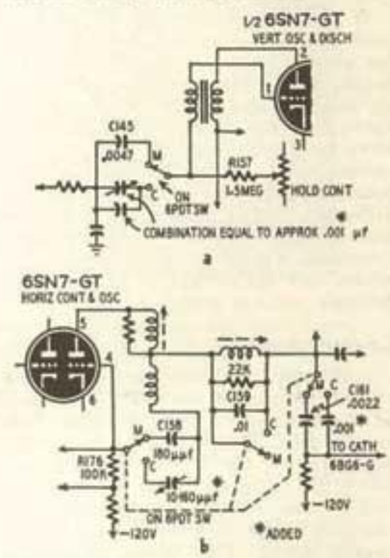


Fig. 6—Color changes, Synchroguide; Colortone unit uses similar circuits.

The same is true about color wheels and motors. The one used in this conversion was a home-built affair, but will soon be replaced by a manufactured job, and synchronized with a circuit which will use a saturable reactor motor control.

(A survey at press time showed that no complete kits were yet available, though some parts, such as a color wheel, were. *Editor*)

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Courtesy of Cliff Benham