Simple changes in the sweep circuits often suffice to convert to CBS color. Circuits for converting popular makes of receivers are described in this article.

While the industry makes up its mind whether to go along on color TV as authorized by the FCC, you can still enjoy the CBS broadcasts on your own receiver by making simple changes in the sweep circuits.

Don't misunderstand me ... you can get an enjoyable picture for your own use, but it may be unwise to offer to convert a customer's set on a commercial basis. To get a picture of exactly the same brightness, size and with the same scanning linearity as the original 525-line picture is an engineering feat of the first order, and may call for replacing important parts in many receivers.

A 7-inch electrostatically deflected set will be easiest to convert. Larger sets with r.f. power supplies are often simple to handle. TV receivers with flyback high-voltage systems will call for complex circuit switching. For a commercially acceptable job, it would probably be necessary to replace the flyback transformer and yoke in many of these.

The frequencies of the deflection oscillators in present black-and-white (monochrome) TV transmissions are 60 cycles per second for vertical and 15,750 cycles for horizontal sweep frequencies. For the CBS field-sequential color TV broadcasts these oscillator frequencies must be changed to 144 cycles for vertical deflection and 29,190 cycles for the horizontal line generator.

The hold control resistance must be adjusted to a smaller value in the multivibrator or blocking oscillator used to generate the sweep frequencies. The ratio of change will be the reciprocal of that between the monochrome and color sweep frequencies. For verti-

black-and-white receiver. For horizontal the new value for color will be 1/1.851 times the black-and-white value. With these fractions you will be able to determine the values for any receiver different from those in the circuits illustrated.

In most of the circuits there is a limiting resistance connected between the frequency-determining grid of the sweep oscillator and the hold control. This connection is broken and a switch inserted. In some of the very early receivers there is only a hold control and in some cases no change is necessary other than the proper adjustment

Convert Your TV Set For Color Reception

By NORMAN L. CHALFIN

Fig. 1—Converted 7-inch sweep circuit.

Fig. 2—Hew the changeover switch was installed on the Teletone TV 149 chassis.
of the hold control. Whether new resis-
tors are switched into the circuit or an
adjustment is made directly, the higher
sweep frequency usually comes from the
oscillator at a lower amplitude than
black and white on an existing receiver.
These, in effect, are circuits the manu-
facturers would have had to include in
sets to meet the bracket standards
originally proposed by the FCC last
fall.

Several circuits similar

A general similarity in the circuits of
the Teletone TV 149 deflection circuit in
which the horizontal and vertical oscil-
lators are identical with only the values
of some components changed to estab-
lish the vertical or horizontal oscillator
frequency. For this reason only one of
the circuits is shown with the switching
data that is required.

The photograph (Fig. 2) shows the
placement of the switch on the chassis
of the TV 145. It is a four-pole, double-
throw unit which in one position retains
the original circuit components and in
the second position gives the color
values their place in the circuits.

Fig. 3 shows the wiring arrangement
for adapting the Motorola TV 71 7-inch
tv sets so that they can receive the
CBS color transmissions in black and
white. Note, here, that there is no de-
deflection amplifier in the horizontal
sweep circuit. The horizontal blocking
oscillator is very cleverly arranged to

the original black-and-white sweep fre-
quency. This will result in a smaller
image and will require adjustment of
the size control each time a change is
made from monochrome to color recep-
tion, or back again. This problem is
overcome by switching separately ad-
justable size controls (see Fig. 1) at
the same time as the hold control values
are switched. In some cases it may be
advisable also to arrange to switch in
separate linearity adjustment controls
if they are present in the receiver.

Reference to the several circuits that
accompany this article will clearly show
the methods that have been developed
by the author for making the color
images broadcast by CBS visible in

Fig. 4—The Hallicrafters T34 sweeps
with alterations for receiving color.

Fig. 5—A converted blocking oscil-
lator of the type used in 630 chassis,

deliver push-pull deflection voltages
directly to the cathode rays tube plates.
The vertical system resembles the Tele-
tone previously described. The hold
control is in the grid as in the Teletone
circuit. The size control is in the plate
load circuit. A four-pole, double-throw
switch will cover this adaptation as
for the Teletone.

In case insufficient horizontal voltage
is supplied, however, it may be neces-
sary also to switch the output trans-
former (Motorola No. T-5) with one
that will tend to resonate with the two
500-megafarad capacitors at the new
frequency. The daring experimenter might
even consider switching another pair of
coils in parallel with the present
two to cut down the inductance.

The Hallicrafters T54 deflection oscillator circuits as shown in Fig. 4,
are basically identical with the Tele-
tone. There is a slight variation from
the Teletone in size control placement.
Horizontal size control in the T54 is
connected in potentiometer fashion in-
stead of as a rheostat. It is part of a
B-supply bleeder system. The vertical
color control is in the grid of the vertical
deflection amplifier. The latter con-
nection necessitates an extra switch posi-
tion, as can be seen in the circuit dia-
agram (Fig. 4) thus requiring a 5-pole,
double-throw switch. The horizontal
color size control is connected in paral-
lel across the original control and is
in series with the horizontal amplifier.
A series change in operation takes place as
a result of halving the total resistance
value. For those who prefer to retain
the original operation, a sixth position
can be added to the switch. With it, the
connections for switching of the hori-
zontal size controls can be made in
similar manner to the vertical, by break-
ing two of the connections to the
controls.

The circuit shown in Fig. 5 is the type of blocking oscillator used in the
vertical deflection system of many re-
ceivers. The commercial variations of
the RCA 630 TS use this circuit.
RCA's own 630 uses a 6J5, and the
discharge action is accomplished in the
cathode circuit instead of a second
Triode, as shown. The 9T246, a similar
arrangement, is seen in Fig. 6.

Other receivers

As previously indicated, the 7-inch
sets and those with r.f. power supplies
are easily adapted to meet the require-
ments of monochrome color programs in
black and white. Sets that have
the flyback type of high voltage
supply working from the horizontal
deflection system will require more
complex switching arrangements. Par-
specifically, sets with horizontal a.f.c.
systems fall into the more-difficult-to-
convert category.

There is shown in Fig. 7 the switch-

ing of components of the horizontal a.f.c. system employed in the 659 T9 type of set. For this alone, three switch points are required: discriminator frequency adjusting capacitance is changed, horizontal oscillator reactance-tube frequency adjusting capacitance is changed, and the values of horizontal drive R-C network are changed. The right side of Fig. 8 shows the rest of the horizontal system changes that will be required for the 6BG6-G and flyback-output transformer system. Fig. 8 shows a typical Synchroguide system as adapted to the 20,100-cycle sweep frequency switching for color from the black-and-white 15,750-cycle sweep. Fig. 9 is a new horizontal output transformer with separate taps for the monochrome and color horizontal output connections to the deflection coils. The changes are necessary because, when the original system is used, there is a deterioration in horizontal output linearity, and sweep amplitude in the color position. The new transformer has more turns for the color secondary connection to the horizontal deflection yoke than for the monochrome connection.

The transformer is wound on a square ferrite horizontal output transformer core, with a gap of .015 inch in each leg. The primary (1-2) is wound with 860 turns of No. 28 single-silk enamel insulated wire. The high-voltage winding in series with it consists of another 860 turns of 10-44-litz or No. 36 single-silk or single nylon enamel wire. The secondary is also wound with this wire. Position of the windings is the same as on the transformer it replaces, as is the method of winding. It will be practically impossible to wind such a transformer by hand, but they may become available commercially in the near future.

The modifications indicated in Figs. 6, 7, 8 and 9 were worked out by CBS engineers, to whom thanks are due for supplying the information.

The color converter

If the above changes are made, you will be able to receive color broadcasts in black and white. To see them in color you will need a rotating disc. The most effective disc diameter should be a little more than double the width of the picture to be received. Six sectors are arranged on the disc with the three colors in this order: Red, Blue, Green, Red, Blue, Green. This is shown in Fig. 10. This disc must rotate at a speed of 1,440 r.p.m. before the screen of your set. For three segments (120° each) motor speed would be 2,880 r.p.m. A standard 1,800 r.p.m. phonograph motor would have to be geared or friction-driven to lower the speed. Several methods of synchronization are possible. One of these would be to drive the motor with a 48-cycle oscillator synchronized by some frequency-dividing circuit deriving its sync pulses from the 144-cycle vertical sweep sweep of the receiver when set for color TV.

When observing the test pattern transmitted by CBS in New York, you will find it moving in a circular path at a rate of about one revolution in 20 seconds. This was done to prevent the test pattern from burning into the image orthicon on the color camera.

Several plastics suppliers make available colored sheet plastic suitable for color discs. Eastman Kodak is expected to put out a set of color television filters in the near future.

Good results can be obtained with Watten No. 20 for the red; No. 47 for the blue, and No. 58 for the green. Approximately equivalent Flexiglas numbers are: No. 150 or 160, red; 262, blue; and 260 or 2004, green; and Lucite: No. 10539, red; No. 7466, blue; and No. 3526, green.

A commercial disc is on the market at a cost under $20. This is the Celonat unit and has a manual speed adjustment. It will hold synchronization for reasonable periods but does require frequent re-adjustment. It is intended that you look at the screen of your adapted TV set through this device where it is nearer to you than to the set. The larger the screen, the farther away you will be. Used in this way the color disc has a particularly humorous deficiency. After getting the Celonat device into synchronization, so that flesh tines are of the proper hue, if you move to the left or right of the viewing position in which you first adjusted synchronization these tones turn to a predominantly blue or green tint. Possibly this effect can be used to add proper eeriness to mystery shows.

Fig. 11—The adjustable size controls.