Remote Controls for TV

Popular electromechanical and electronic units for simplified viewing

By HENRY O. MAXWELL

DURING the past 7 years or so manufacturers have sporadically introduced and then discontinued remote controls in some of their TV receivers.[1,2,3] In any one year hardly more than two or three brands had this feature. Now it looks like 1956 will be remote-controlled TV's big year. Almost every major manufacturer offers it in some form.

The control systems may be divided roughly into three basic types: electromechanical, electronic and split-chassis. The electromechanical system has a motor-driven tuner for channel selection and may or may not include remote control of volume, brightness and fine tuning. The electronic type includes those systems that permit controlling the set from a remote point without running wires or cables from the receiver. The split-chassis type has the tuner, and possibly if circuits, on the remote-control chassis along with other controls that may be needed. The electronic and electromechanical types are described in this article. Further electromechanical, and the circuitry and novel features of several split-chassis types will be discussed in subsequent ones.

The Zenith Flash-Matic

This system enables the viewer to control the TV receiver with the beam of light from a small flashlight. Four cadmium-sulfide photocells are mounted behind bezels in the four corners on the front of the TV cabinet. A momentary flash of light on the lower-left photocell turns the power on and off, on the lower-right one mutes the sound. The cells in the upper left and right corners turn the channel selector counterclockwise and clockwise, respectively. Thus, by turning the motor to the left you can flip immediately from channel 2 to 13 or from 5 to 4 without having to switch through all other channels. A large illuminated numeral on the manual channel selector shows the channel in use.

The circuit of the Flash-Matic is shown in Fig. 1. Its functions can be broken down into on–off and motor-control operations.

Cadmium-sulfide photocells are a resistive type in which the resistance varies inversely as the light intensity. In the absence of light the resistance may be as high as 100 megohms; in bright light it may drop to around 25,000 ohms.

The power supply in the control unit supplies 117 volts ac for the plates of the 6BX7-GT motor-control tube, 145 volts ac for the plates of the 2D21 thyratrons controlling the on–off and audio-mute circuits and −25 volts dc bias for the 6BX7-GT and 2D21's.

The basic thyratron control circuit is shown in Fig. 2. The grid of the

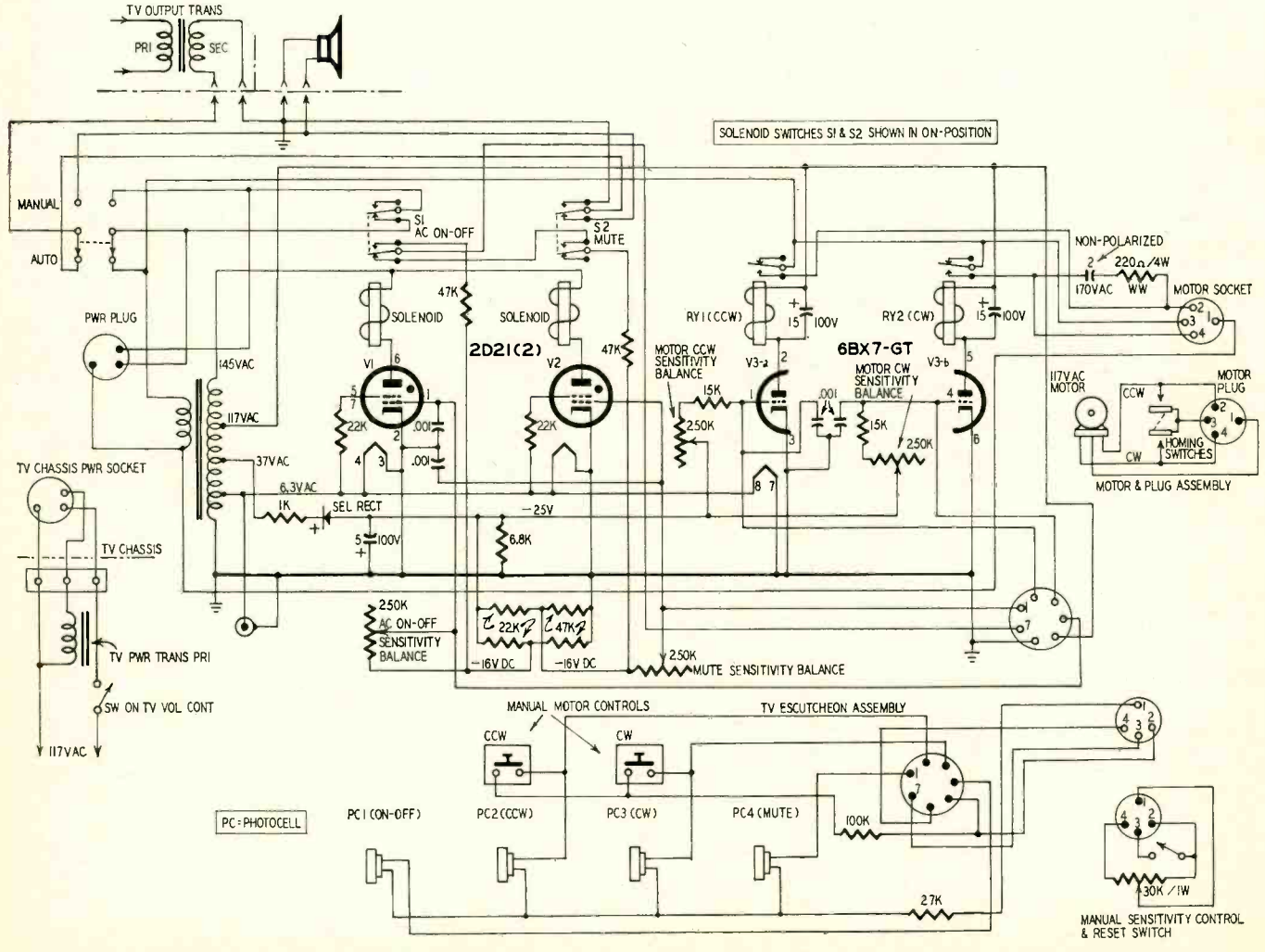


Fig. 1—Schematic diagram of Zenith's Flash-Matic remote tuner. Unit triggered by light falling on four photocells.

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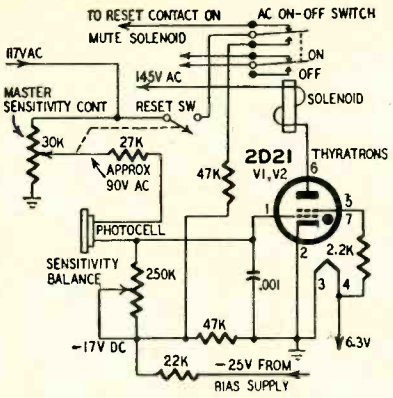


Fig. 2—The thyratron control circuit.

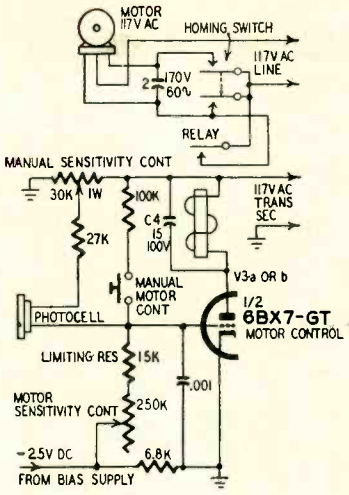


Fig. 3—Zenith motor control circuit.

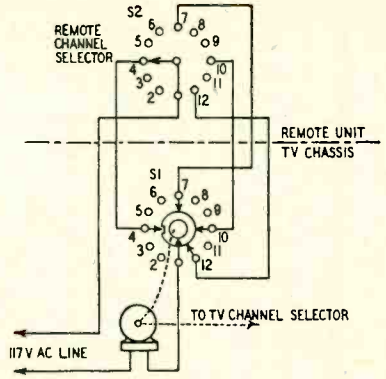


Fig. 4—Basic motor control circuit.

2D21 is biased to cutoff by a negative voltage from the power supply. The plate is supplied with 145 volts ac through the solenoid coil and the grid is supplied with ac through the photocell. The ac voltages on the plate and grid are in phase. The amplitude of the ac voltage on the photocell is determined by the setting of the MANUAL SENSITIVITY CONTROL (Fig. 1) and the ac on the grid is determined by the light on the photocell.

When light of sufficient intensity—as from the flashlight—strikes the cell, its resistance drops and applies a high ac voltage to the 2D21 grid. If the positive peaks of the ac voltage are high enough to override the negative grid bias, the thyratron conducts and the solenoid operates the switch. This switch is a latching type. One operation of the solenoid throws it in one direction and the next operation returns it to its original position. The 2D21 cuts off on the next negative half-cycle of the line voltage after the flashlight is turned off.

When the MANUAL–AUTO switch (Fig. 1) is set to AUTO (for remote control), the switch operated by the solenoid in V2's plate circuit is in series with one side of the speaker voice coil. Similarly, S1, controlled by the solenoid in V1's plate circuit, breaks or makes one side of the ac line to the main power transformer. The second set of contacts on S1 and S2 interlock V1 and V2 so that they fire *only* in sequence.

There is a possibility that the TV set will be turned off manually when S1 is in the OFF position or S2 is set to MUTE. With S1 off, the line voltage does not reach the primary of the TV power transformer and with S2 thrown to MUTE, the speaker circuit is open. To avoid having to use the flashlight to reset S1 and S2, a reset switch is ganged to the MANUAL SENSITIVITY CONTROL so that, when it is turned momentarily to its extreme counterclockwise position, the switch closes and applies a 117-volt ac pulse to the thyratron grids. This pulse overcomes the bias on the 2D21's and returns S1 or S2 to the desired position.

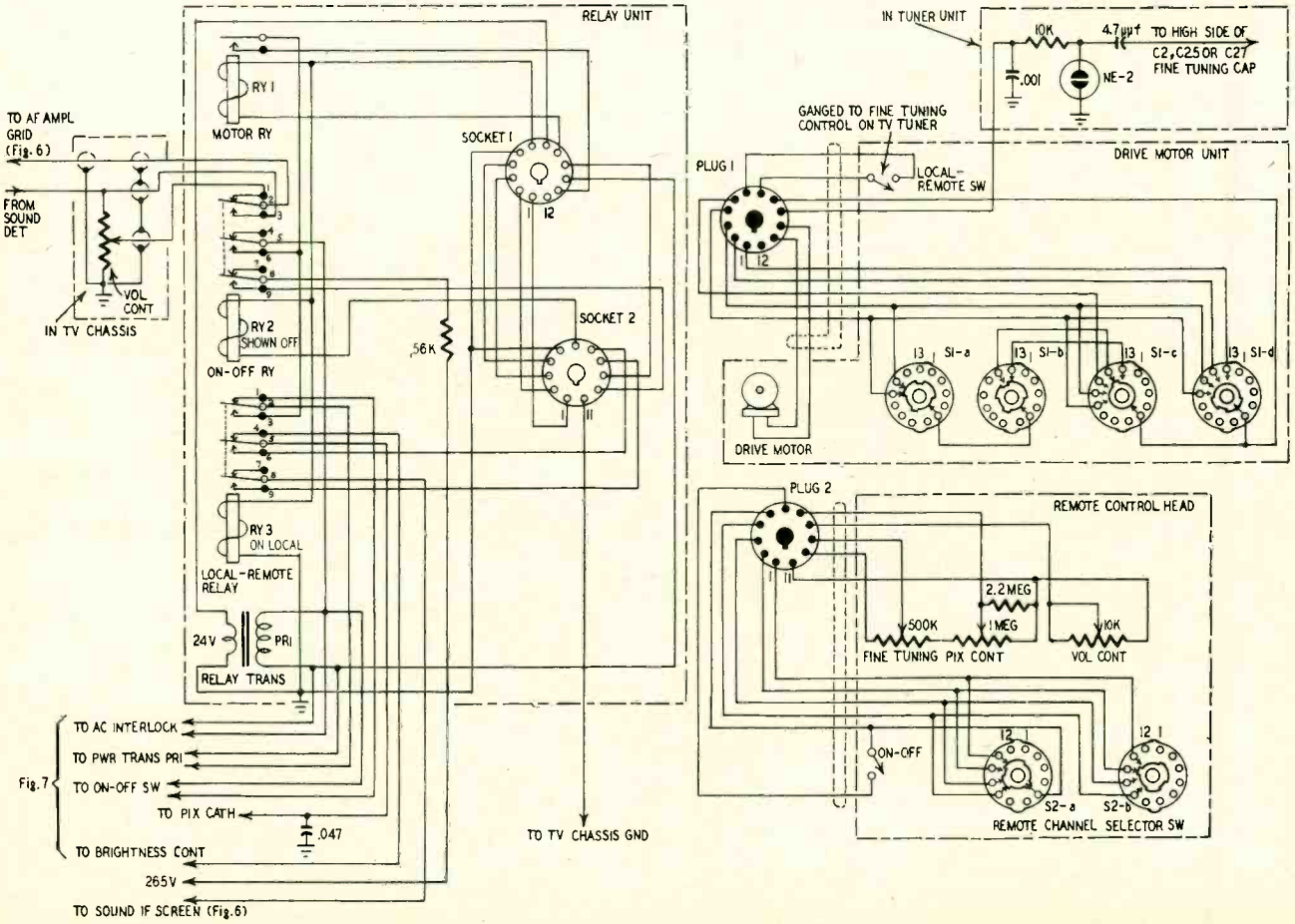


Fig. 5—Schematic diagram of the RCA Magic Brain TV control system. Unit is typical electromechanical control.

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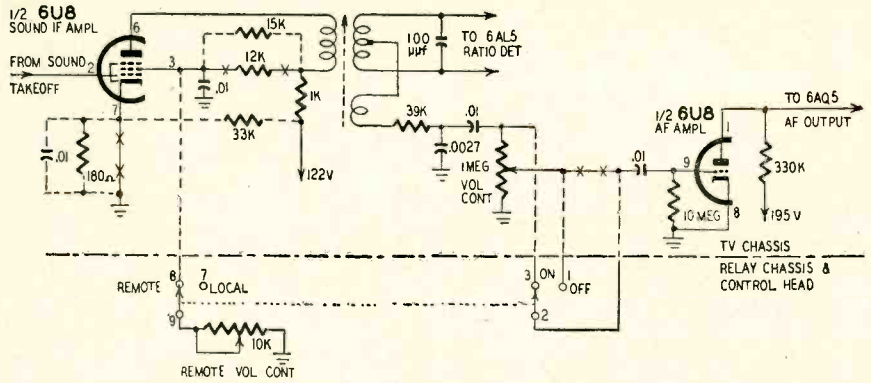


Fig. 6—Schematic of circuit for volume control from the remote panel.

The motor control circuit

A 117-volt induction type ac motor drives the channel-selector shaft of the tuner. Its direction is controlled by V3. The motor has two series-connected windings with one side of the ac line tied to the junction. The ends of the windings are connected to the other side of the ac line through the contacts of RY1 and RY2 in the plate circuits of V3-a and V3-b, respectively.

Fig. 3 is the basic motor control circuit. V3 is biased to cutoff by a voltage supplied through the MOTOR SENSITIVITY CONTROL. When light strikes the photocell, its resistance drops and applies an ac voltage to the grid, causing the tube to conduct on positive half-cycles. The relay pulls in and remains closed as long as the light beam is on the photocell.

Two cam-operated homing or interlock switches insure that the motor always stops with the tuner centered on a channel. One switch is across clockwise relay RY2 contacts, the other across counterclockwise relay RY1 contacts. The homing switches are operated by two index cams that make one revolution per channel. The cams are positioned so both switches are open when the turret is exactly on a channel. Thus, a short pulse of light will start the motor and the homing switch keeps it running until the cam breaks the circuit.

Electromechanical control

Sets with electromechanical control have the control box or head connected to the chassis through a multiconductor cable. Controls on the box permit the viewer to select channels and adjust volume, brightness and fine tuning. Like the Zenith, the tuner's channel selector is driven by a small motor. The circuit is shown in Fig. 4. S1 is the channel selector on the control box and S2 a switch that rotates with the tuner shaft driven by the motor.

When S1 is moved to any new position, the circuit to the motor is completed through the corresponding contact on S2. The motor runs until the wiper on S2 moves around and breaks the circuit. In this basic arrangement, the control cable would have to have 13 conductors for the channel selector alone and additional conductors for the other circuits.

In practice, the number of conductors needed for channel selection is greatly reduced by using a more complex switching system like that shown in Fig. 5 of the RCA Magic Brain TV Control. S1 is a rotary switch ganged to the tuner shaft and S2 the remote channel-selector switch on the control head. These switches are shown in the channel-2 position and the motor circuit is open.

Rotating S2 right or left to another channel completes the circuit to motor relay RY1 and starts the motor. The channel-selector shaft on the tuner rotates to the desired channel, breaking the circuit through S1 and S2 and releasing RY1 and stopping the motor.

Volume control

A simplified circuit showing the method of controlling volume from the remote panel is shown in Fig. 6. The dashed lines indicate wiring and components added to the KCS96 chassis to adapt it for remote control. The dpdt switch is actually made up of parts of RY2 and RY3 (Fig. 5). The switch section labeled ON–OFF is a part of RY2 and the REMOTE–LOCAL section is a part of RY3.

One section of this switch opens the circuit to the arm of the master or local volume control on the TV set and connects the high side directly to the grid of the first af amplifier. The other section connects the remote volume control between ground and the screen grid of the sound if amplifier.

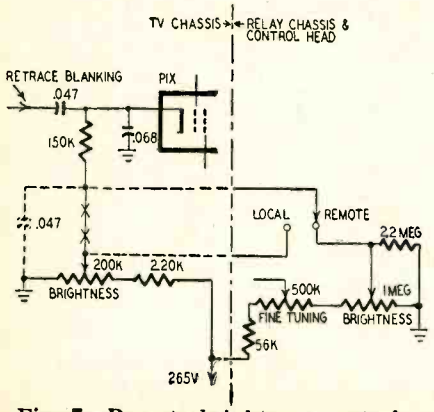


Fig. 7—Remote brightness control.

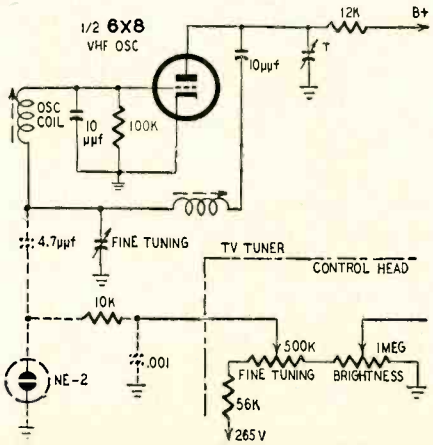


Fig. 8—Control of the vhf oscillator.

Brightness and fine tuning

In Fig. 7 the contacts of RY3—shown as an spdt switch—transfer the cathode return of the picture tube from the arm of the local brightness control to the arm of a similar control in the remote-control head.

Fig. 8 is a simplified circuit of the vhf oscillator in the tuner and its connection to the remote fine-tuning control. Added components are shown in dashed lines. In this arrangement a 4.7-μμf capacitor and NE-2 neon lamp are in series across the fine-tuning capacitor in the tuner. A positive voltage, tapped off the fine-tuning potentiometer, is applied to the neon lamp through an R-C filter network. The neon lamp acts as a capacitor whose capacitance increases as the current through it. Thus, the oscillator frequency can be controlled within limits by varying the voltage on the lamp.

The lamp may also be considered as a variable resistor in series with the fixed capacitor. When the applied voltage is low, the lamp resistance is high and the 4.7-μμf capacitor has little or no effect on the oscillator frequency. Increasing the voltage decreases the resistance and raises the effective circuit capacitance. Regardless of the method of circuit analysis, the oscillator frequency decreases as the lamp voltage and current increase.

Power on–off circuit

When the receiver is modified for remote control, the 24-volt transformer in the relay unit floats across the ac line. To operate the receiver remotely, the local fine-tuning control is turned clockwise to throw the local–remote switch and apply 24 volts to the coil of RY3. Closing the on–off switch on the control head applies 24 volts to the coil of RY2 to switch the volume-control circuits and complete the circuit to the primary of the power transformer in the TV set.

TO BE CONTINUED

References

1 "Extension Viewers and Remote Control for TV," Radio-Electronics, March, 1949.

2 "Remote Controls for TV Promote Viewer Comfort," Radio-Electronics, November, 1951.

3 "Two Remote TV Control Units," Radio-Electronics, March, 1954.

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