RCA COLOR CAMERA, TK-40A

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The development of the first color television camera equipment of commercial design was begun by the RCA Victor Division in the early part of 1950, as part of the color television activity of RCA. For several years prior to this time, basic development of simultaneous camera equipment for live pick-up of television programs in color was in progress at RCA Laboratories. Several developmental type color camera chains were produced and successfully demonstrated in connection with this work early. The experience gained was utilized in designing the first "commercial-type" cameras.

A number of color camera chains of the experimental commercial design previously described elsewhere, were produced and made a part of the NBC experimental color television operations in their New York studios. Months of daily operational tests, incorporating a number of experimental programs, made it possible to rigorously test that equipment for all of the qualities required for good commercial operation, already well established in Monochrome equipment. The need for improvements in a number of areas, particularly in the color camera, became evident during this period.

Described here is color camera chain equipment which will be part of the color television studio broadcasting equipment supplied by RCA to Broadcasters in the early part of 1954, for commercial color television broadcasting using FCC Color Signal Specifications.

Color Camera Chain Components

The color camera chain is similar in many respects to the Monochrome camera chains now in use in that it includes a live pick-up camera and several signal processing and control units. The block diagram of Fig. 2 shows a complete camera chain as it is related to the units to be described.

The color camera proper contains an image divider or light splitting optical system, three separate image orthicon tubes to provide red, blue and green signals, three video preamplifiers, horizontal and vertical deflection circuits for the image orthicons, and a high voltage supply derived from the horizontal deflection unit. The electronic viewfinder is comprised of a 7TP4 kinescope with necessary deflection and video circuits to provide a picture for the camera operator. The frequency response of the camera output signals is corrected in the aperture compensator. The camera control or color channel amplifier performs processing operations on the camera signals. These operations include the insertion of standard blanking pulses, shading correction and pedestal control. Operating controls and selected set-up controls are available on a remote control panel mounted in a standard console which is also used for shading operations. A modified Master Monitor and auxiliary switching unit are mounted in an adjacent console unit as shown in Fig. 3. This unit provides both kinescope and CRO displays of the processed color camera signals for the video operator.

Optical System

Viewed externally, the lens turret portion of the color camera optics is quite similar in appearance to the lens turret of the RCA Monochrome camera. However the similarity ends there. The light splitting optical system of the color camera comprises a number of special optical elements interposed in the image light path between the objective or taking lens and the photocathodes of the three image orth-

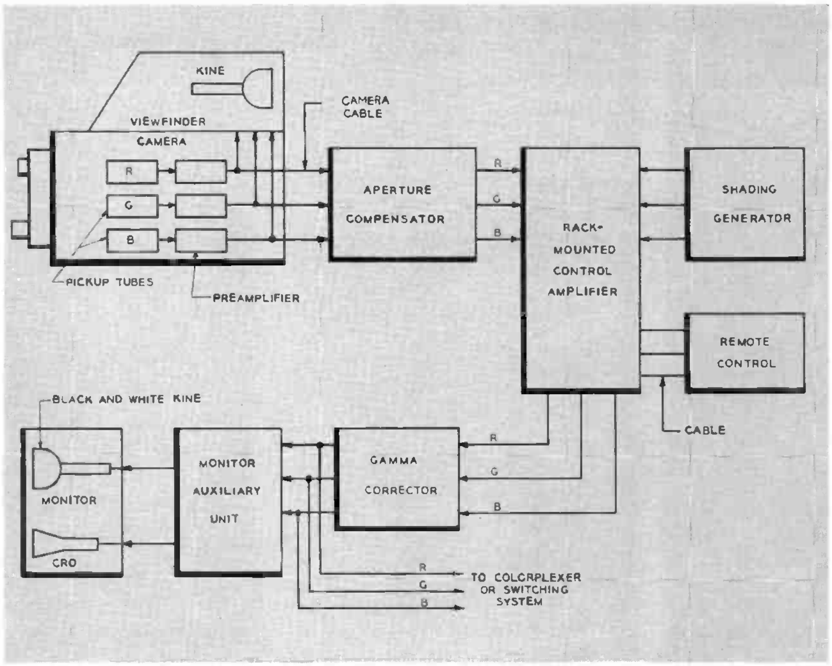
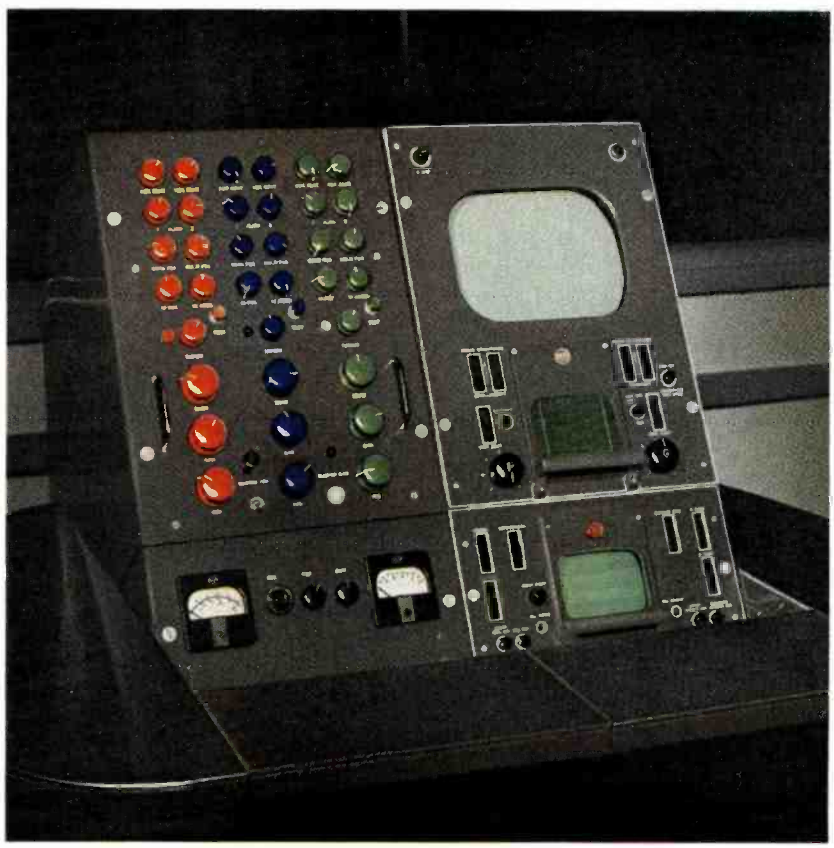


FIG. 2. Block diagram showing the arrangement of units in an RCA Color Camera Chain.

FIG. 3. Remote control panel and master monitor mounted in a console housing in development engineering studios at Camden. Note color-coded banks of controls for red, green and blue channels.



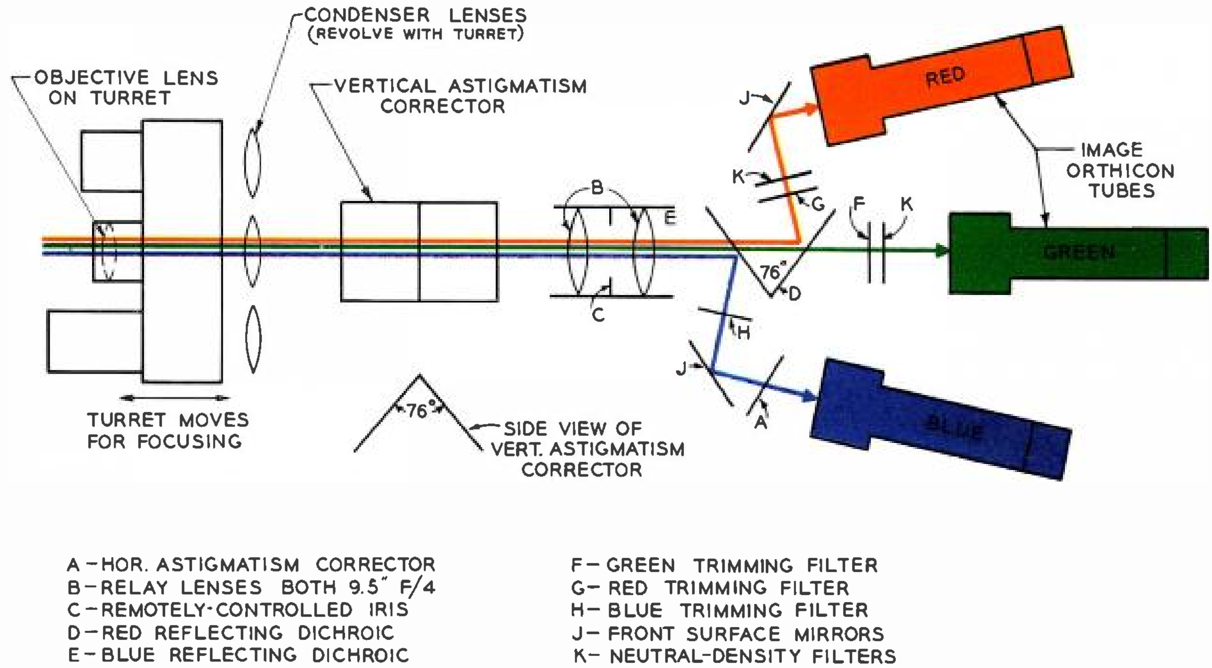


FIG. 4. Sketch of the optical system used in the RCA three-tube Color Camera showing the action of dichroic mirrors in separating the red, green, and blue components of the color spectrum.

icons. Location of these optical elements is indicated in the diagram of Fig. 4. The rotatable lens turret accommodates four objective lenses of different focal lengths. These lenses provide the program director with the same degree of programming flexibility which he is accustomed to having in Monochrome operations. The camera man is able to change lenses rapidly by rotating a turret positioning handle at the rear of the camera. Accurate positioning of the lens turret is insured by a positive detent mechanism.

Since the distance between the objective lens mount and the image plane of the lenses used is limited to approximately 1⅛ inches, a fixed relay lens system is required in order to provide sufficient working space for the dichroic mirror light splitters. Field lenses designed for each of the objective lenses used are mounted on a spider located directly behind the lens turret support drum. This spider rotates with the lens turret as lens positions are changed. All the field lenses are designed with identical thickness and location to avoid changes in the position of the primary image as lenses are interchanged. The field lens functions to redirect all of the light reaching the image plane from the objective lens so that it will enter the relay lens system and insure uniform illumination of the relayed image. The size of the primary image is not changed by the field lens. In general the field lenses must have a different power characteristic for each objective lens used. In some cases it has been found that the same field lens can be used satisfactorily with different objective lenses. The relay lens system transfers the real or primary image from its focal plane in the field lens to the photocathodes of the image orthicons.

Light reaching the dichroic mirror light splitter, following the relay lens, is divided into its red, green and blue components as predetermined by the spectral characteristics. Astigmatism is introduced in the light path by the dichroic-mirror assembly since the displacement of rays passing through the mirrors differ in the horizontal and vertical directions. To correct for this astigmatism, two optically ground plates are mounted ahead of the relay lens. These plates introduce a negative astigmatism, thus balancing the system. A single plate astigmatism corrector is also mounted in the blue channel so that the light rays in the red, green and blue channels will pass through the same total thickness of glass. All glass surfaces are coated to minimize reflections.

A remotely controlled iris located between the two relay lenses acts as the major overall gain control for the entire camera chain. Dyed-gelatin Wratten type filters and glass filters are used in conjunction with the dichroic mirrors to adjust the overall spectral sensitivity curves as desired for the camera. Neutral density filters are inserted in the light path to adjust the relative sensitivity of the three image orthicons so that they all operate over the same portion of their transfer characteristics. Since it is only necessary to reduce the sensitivity of two of the channels to match the least sensitive, only two neutral-density filters are required. In studio use of the camera where the illumination is obtained from tungsten lamps, the blue channel is usually the least sensitive, because of the deficiency of blue energy in the light source. Therefore, neutral density filters are generally used in the red and green channels.

Color Camera

Fig. 5 shows an RCA color television camera, with viewfinder attached, mounted on a TD-1A RCA Studio Camera pedestal. A special swivel type friction head with 200-pound control spring and necessary locking devices provides the panning and tilting action required. The height of the camera proper is 15 inches—27 inches with viewfinder. The width tapers from 16 inches at the front to a maximum of 21 inches at the rear edges of the side door covers. A hinged ventilation hood ahead of the viewfinder offers accessibility to parts of the optical system that lie beneath it in the camera proper.

Two blowers on the rear panel and one on the side panel near the rear of the camera are used to move cool air along each of the three image orthicons in their respective yoke assemblies. A similar blower is centrally located in the viewfinder to exhaust air from the body of the camera. These blowers plus ample louvres in the viewfinder hood comprise the ventilation system of the camera. All external areas of the camera and viewfinder which are subject to absorption of radiant heat energy, have an aluminum finish to further aid in maintaining optimum temperature conditions within the camera.

An adjustable panning handle is attached at the left rear corner of the camera base; at the right rear corner is attached a focus handle. The panning handle is used by the camera man to pan or tilt the camera, while rotation of the focus handle moves the lens turret longitudinally to adjust the focus of the objective lens.

Three standard RCA camera cables are plugged into receptacles mounted in such a manner as to permit the cables to be conveniently brought toward the front of the camera, drawn through a special cable clamping bracket, and then draped in a gradual curve to the floor. In this manner the cables can be effectively kept from interfering with the movements of the camera man. Camera tally lights are shown on the front panel beneath the lens turret.

In Fig. 6 a rear view of the color camera shows the viewing hood attached to the viewfinder. The eyepiece of the viewing hood is adjusted to accommodate variations in height of camera men and angles of tilt of the camera. The assembly may be removed easily by releasing a captive screw on either side. The lens turret rotation control handle, the lens position indexing plate and the intakes for two of the image orthicon blowers are also visible. The blower intake for the third channel appears on the small side panel near the rear of the camera. The panning handle at the left and the focusing handle on the right are in normal operating position.

The high degree of accessibility to all units and component parts in the RCA Color Camera for electrical or mechanical

FIG. 5. Side view of "all electronic" RCA Color Camera and Viewfinder.

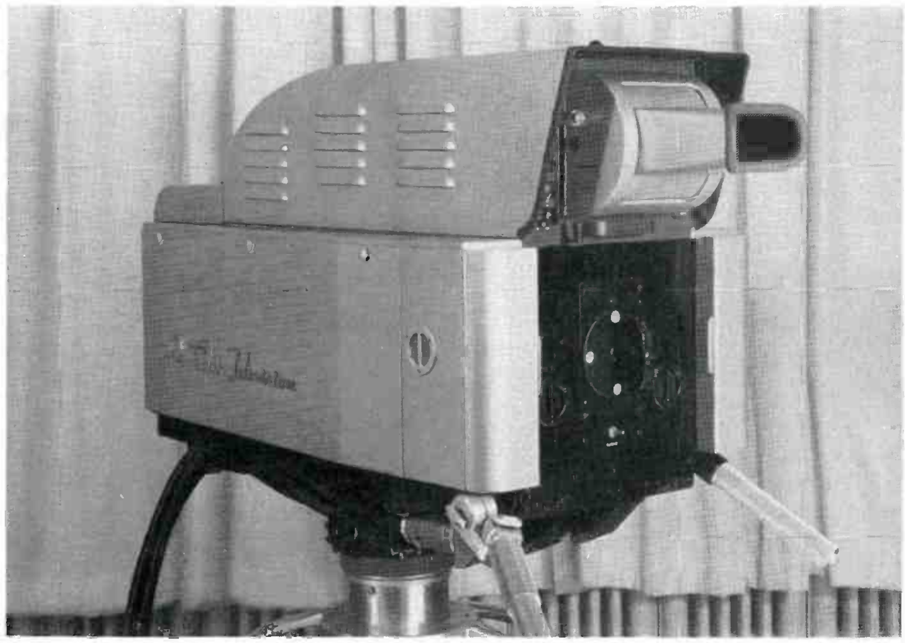


FIG. 6. Rear view of RCA Color Camera with viewing hood in place.

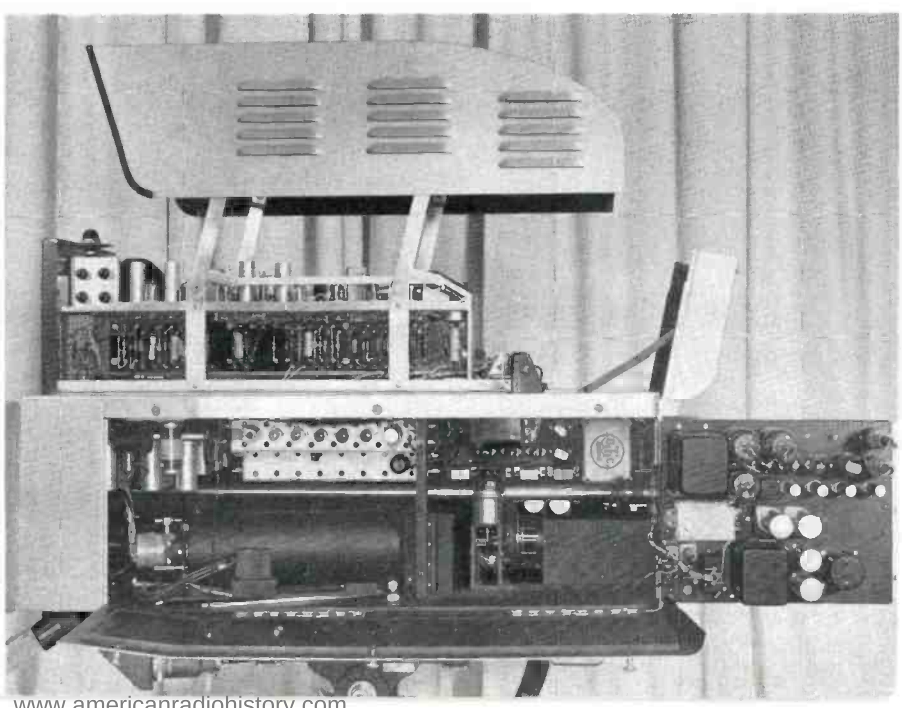


FIG. 7. View of RCA Color Camera showing extreme accessibility of components for ease of adjustment and repair.

FIG. 8. Workmen assemble RCA Color Television Cameras. These cameras and other items of Color Television Broadcast Equipment have been made available to Broadcasters everywhere.

adjustments, or service testing or replacements, is emphasized by Fig. 7. The right side door of the camera is dropped in order to expose the yoke assembly of the red channel and the tube side of the red channel video preamplifier. The hinged horizontal deflection chassis is swung outward 180° from its normal position, permitting replacement of tubes, access to the remote iris synchro motor driving mechanism and other parts of the optical system or perhaps complete removal of the optical plate assembly, if necessary. The same degree of accessibility to video preamplifiers, deflection yoke assemblies and optical assembly is obtained by opening the left side door of the camera. Swinging the hinged vertical deflection chassis on the left side outward by 180° permits further access to elements of the optical plate assembly.

The type 1854 image orthicons can be replaced by removing a single holding screw on each yoke assembly and swinging the assembly out the side of the camera. The center yoke is accessible once the left yoke has been swung outward. It can be released in the same manner and will swing outward over its set of yoke assembly rest plates.

Raising the ventilation hood at the front of the camera gives access to the connections of two heater transformers in this area as well as the relay lens and vertical compensator elements of the optical system. The elapsed time indicator showing hours of operation of the camera may also be read easily when the hood is raised. Viewfinder component and circuit tests together with tube replacements may be made with the viewfinder hood in the raised position. The viewfinder itself is removed by simultaneously releasing the locking catch on its control panel and sliding the viewfinder toward the rear of the camera. This provides access to wiring of the shelf type chassis at the rear of the camera as well as easy replacement of any of the camera preamplifiers.

Rotation of the lens turret and its longitudinal movement for adjusting optical focus is accomplished by the use of two concentric shafts and mechanical linkages which extend through the center of the camera. The outer (focusing) shaft does not rotate, but is moved horizontally through the mechanical linkage driven by the focusing handle. Rotation of the focus handle is transmitted to the focusing shaft through a set of beveled gears in the base of the handle to a toothed composition belt and pulley combination, and a gear box and lead screw which couples to, and actuates, the focusing shaft.

Details of the lens turret assembly are shown in Fig. 9. The lens turet rotates over a stationary drum turret support attached to the front plate of the camera frame. This drum acts as a light trap for the lens turret as it is moved in or out for focusing. On the lens turret is mounted a spindle which passes through a bearing in the turret support drum and is keyed to the inner or lens turret rotating shaft inside of the focusing shaft. A spider which mounts the field lenses fits inside the turret support drum as shown at the left in Fig. 9. This assembly is driven from the turret spindle by a long stud and fork coupling, thereby permitting the field lens to be changed simultaneously with the objective lens. The outer or focusing shaft is attached to the turret spindle by a collar so that longitudinal focusing motion can be obtained by sliding the turret spindle in the slot of the indexed lens rotating shaft. One of the field lenses may be seen through the elliptical slot of the turret support drum as viewed from the front. Since each objective lens requires a particular field lens, provision is made for convenient change by the partial removal of two retaining screws and a half turn of rotation of the field lens holder.

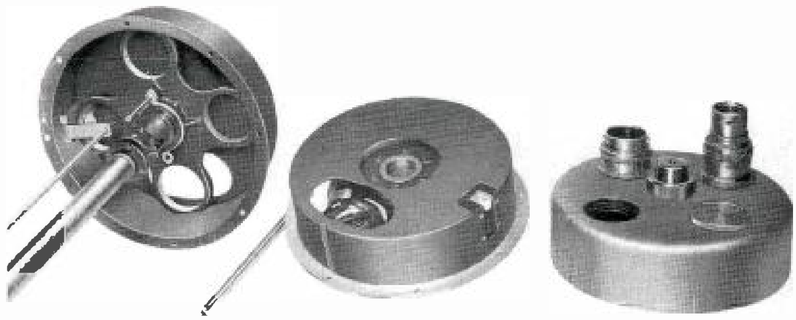


FIG. 9. Details of the lens turret assembly showing the rotating turret drum, the stationary turret drum and the lens turret assemblies.

Registration

While the attainment of good registration of three images required for color television may be considered the most difficult part of the color camera chain adjustment, experimental operations over a considerable peroid of time indicate that a high degree of skill can be developed as familiarity with the equipment and operating experience is gained. Electrical, mechanical and optical adjustments are made available to make good registration possible. The complexity of electrical registration adjustments is reduced in a large measure by connecting the deflection yokes in parallel and driving them from common deflection circuits. Electrical registration controls on the rear plate of the camera are shown in Fig. 10. They include the following independent controls: red and blue skew (with polarity reversing switch), height, width and the horizontal Q adjustment (see Page 16). A "vertical Q" controls bracket is mounted just inside the left side cover near the blower motor.

Thumb screw adjustments for yoke rotation and yoke assembly adjustment for focusing are available for convenient adjustment of the red and blue yoke assemblies. Adjustments for the green yoke assembly can be made with a screwdriver from the rear control panel of the camera. Adjustment of the individual size control is accomplished by the variation of small impedances in series with the respective deflection yokes. In the case of the indi-

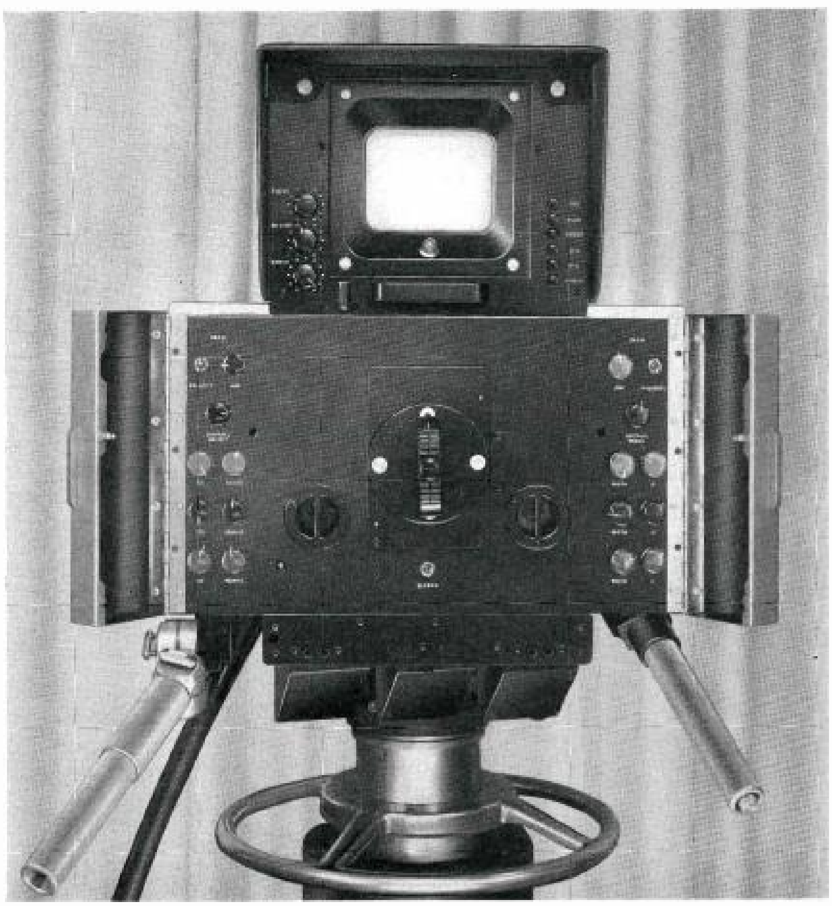


FIG. 10. Rear view of camera showing the location of registration controls.

vidual horizontal deflection circuit, the width is controlled by variable inductances. Therefore, to maintain constant linearity of deflection as the width control is varied, it is necessary to adjust the resistance component of the circuit by means of the variable resistance horizontal Q control. Since the vertical yoke impedance is largely resistive at the 60 cycle field frequency, individual height adjustments are obtained by variable resistors. As in the case of the width control, adjustment of the variable resistor height control likewise requires readjustment of the Q of the individual deflection circuit by variation of the vertical Q control reactance.

The skew control is an unconventional control which has been found essential in obtaining good registration of the three color images. Because of the tendency of some deflection yokes to produce slightly rhombic rasters under optimum conditions of adjustment, it is necessary for best registration to match two yokes with the third by means of the skew control. This correction is obtained by introducing a very small amount of vertical deflection sawtooth deflection current in series with the individual horizontal deflection circuits. A "T pad" adjusts the amplitude applied and a polarity reversing switch selects the polarity required.

During program operations in the studio, the electrical controls at the rear of the camera are enclosed by hinged covers. The camera operator is only required to move the camera as directed (via headphones connected to the intercom panel directly below the rear panel of the camera), select the proper lens and keep the picture in optical focus by observing the viewfinder image.

Located on the left side of the viewfinder control panel are focus, brightness and contrast adjustments for the viewfinder kinescope. On the right side of this control panel, a series of six push buttons, mounted vertically in a row, permit the camera operator to observe a black and white image of any single channel, combinations of the red and green or blue and green channels or all three channels combined. The latter combination is used by the camera operator working with the video control operator in making final registration adjustments.

The turret rotating handle with indexing tabs, the intercom panel for headsets of the camera and dolly operators, off-on switch for blower motors, two of the air intakes for the blowers and the body of the camera are also shown in Fig. 9.

Three rack mounted signal processing units—the aperature compensator, color channel amplifier and the gamma corrector —follow the color camera in the sequence named.

Color Camera Aperture Compensator

The function of the aperture compensator is to compensate for the loss in the high frequency response of the video signal generated in the color camera and thereby avoid impairment in the fine detail of the image to be reproduced. The loss of high frequency response is inherent in all television pick-up devices because of the finite size of the scanning aperture and the limit of resolution capabilities imposed by the particular optical system being used.

The effective frequency response curve in the lower left of Fig. 11 graphically indicates the extent of this loss in a typical image orthicon-lens combination. A simplified block diagram of one channel of the aperture compensator is shown in the upper part of Fig. 11. A typical frequency response curve for one channel of the aperture compensator is shown at the lower right of Fig. 11.

Several sections of a lumped-constant delay line (designed to have an electrical length of one half wave length [180°] at 10 mc) provide high frequency amplitude boost with linear phase shift vs. frequency over the entire video band. The sending end of the delay line is terminated in its characteristic impedance, while the receiving end is open circuited. The voltages at each end of the delay line are the same in phase but different in amplitude, since the voltages at the open circuited end remain substantially constant with change of frequency. The terminated end varies with frequency because of the effect of the reflected signal from the open circuited end of the line. The signals appearing at each end of the line are subtracted in a differential amplifier to obtain a difference signal, which follows a 1-cos θ response (θ being the electrical length of the line in terms of frequency). Two potentiometers, mechanically connected in tandem, operate as variable plate loads of the differential amplifier and provide the frequency boost control. This control is capable of adjusting the boost over a wide range of frequencies. A maximum boost of about 10:1 is available with the peak occurring at 10 mc.

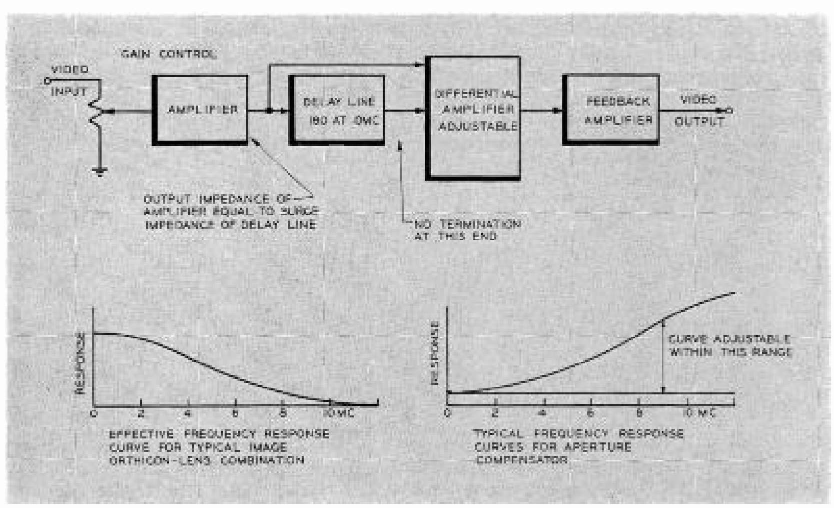
The aperture compensator unit requires four tubes per channel. The signal input from the camera video preamplifiers is received at 0.3 volt peak to peak level in the first or gain control stage. The output stage is a two tube feedback amplifier designed to provide sending and termination of a 51 ohm line. Each channel is normally adjusted to overall gain of unity. A switch is also available to permit each channel to be cut in or out of the camera chain for convenience in making this adjustment. Pin jack test points for input and output signals are provided for each channel.

Functions of the Aperture Compensator as applied to the Color Slide Camera are discussed in W. E. Tucker's "Color Slide Camera," Page 56. The Aperture Compensator is pictured in this article.

Color Channel Amplifier

The color channel amplifier of the color camera chain is functionally the equiv-

FIG. 11. Block diagram of the constant delay line aperture compensator.



alent of a camera control amplifier unit of the Monochrome camera chain. As indicated in the block diagram of Fig. 12, it contains three identical channels designed to receive the red, blue and green video signal from the aperture compensator, (or the color camera preamplifiers when the aperture compensator is by-passed), process and amplify them from a 0.3 volt peak to peak signal across 51 ohm input impedance (camera cable impedance) to 1.0 volt peak to peak output in 75 ohms terminating impedance.

Additional amplifiers referred to as the common channel in the block diagram, provide common horizontal driving and blanking signals to each color channel. Horizontal and vertical driving signals for the deflection circuits of the color camera terminated in 51 ohms, are also provided by these amplifiers. An input connection is available for a step wedge signal used for testing the amplitude linearity and setting the gain of each channel to the same level. Provision is made for clipping noise from the reference black level of the video signals received from the color camera and the addition of blanking in an amount determined by the setting of the pedestal control on the remote control panel. Signals from the shading generator, also located at the remote control position, are mixed with the video signals in each channel to correct for shading in the image orthicons.

The functions performed by one color channel are indicated in the block diagram of Fig. 12.

A similar channel amplifier is utilized in the operation of the RCA Color Slide Camer. This amplifier is discussed in detail in W. E. Tucker's "Color Slide Camera," Page 56.

Circuits and Operation

The first video amplifier has a bias control in the cathode circuit to set the line output level to 1.0 volt peak to peak when 0.3 volt is applied at the input. By monitoring the output and keeping this level at or below 1.0 volt peak-to-peak, the output of the camera preamplifier is maintained at or below 0.3 volt peak to peak. If the output of the preamplifier is greater than 0.3 volt peak to peak, compression of the signal occurs in the preamplifier and the input to the preamplifier must be reduced. The input level of the preamplifier is controlled by the dynode gain control of the image orthicon. (This control is located on the camera remote control panel which is illustrated in Fig. 3, Page 63.)

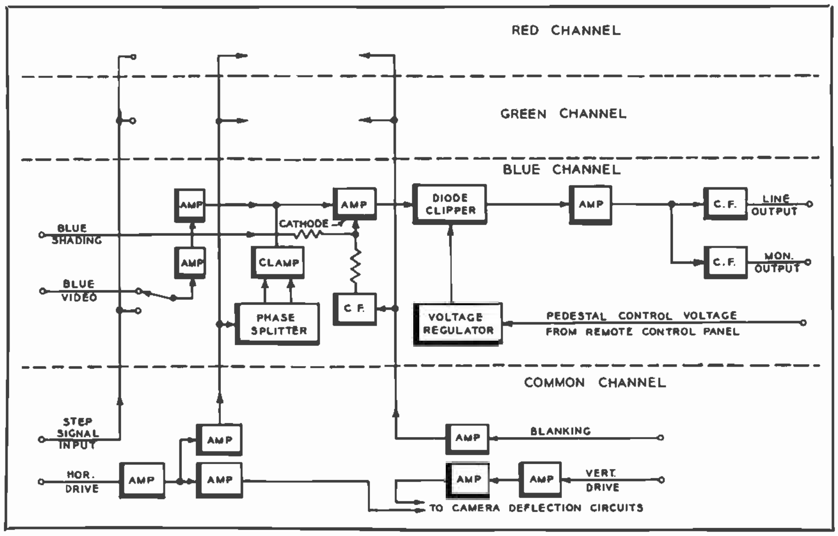


FIG. 12. Block diagram showing the functions of a Color Television camera control amplifier.

The second video amplifier contains a cable length switch to change the by-pass capacity across the cathode resistance an amount necessary to compensate for losses of high frequencies in the camera cable. Such losses are a function of cable length.

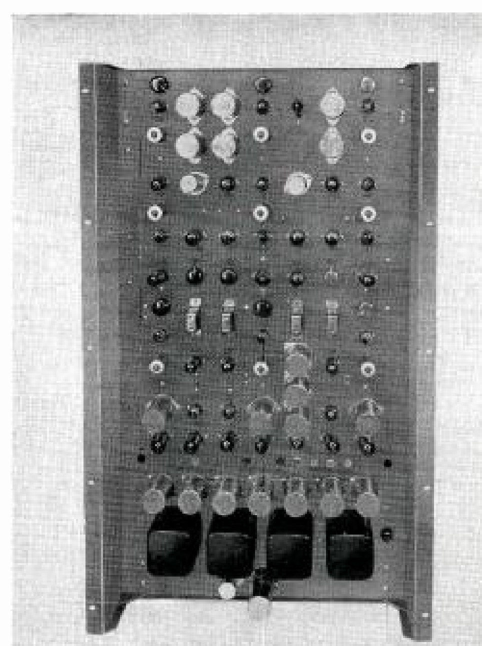
The signal is then clamped to ground potential during camera blanking. This is to present a fixed reference point to the linear clipper. The balanced clamper is operated from clamp pulses derived from the phase splitter fed with horizontal drive pulses that have been amplified in the pulse amplifier.

The video amplifier following the clamper has mixed in its cathode circuit both blanking and shading signals. The blanking is fed to the grid of the blanking mixer tube which has a common cathode resistor with this video amplifier. The shading signal from the shading generator is isolated with a 3300 ohm resistor and also applied at this same cathode. The addition of blanking at this point serves to push the camera blanking (containing noise) down below black level so that it may be clipped to the desired level.

The plate of this video amplifier is directly connected to a linear clipper and transient suppressor. The linear clipper clips the camera blanking noise from the signal at a point determined by the potential on the plate. This potential is taken from the cathode of the pedestal control tube which is set by the pedestal control voltage (from the remote control panel) and applied to the grid of this control tube. This cathode potential is also applied to the screen of the video amplifier ahead of the linear clipper to serve as a low impedance series regulator voltage source and provide isolation from the B+ supply. The cathode potential of the transient suppressor is set with the transient suppressor potentiometer in a voltage divider network to a positive value just low enough to by-pass to ground any positive spikes introduced by the linear clipper.

The output of the linear clipper is capacitively coupled to the grids of the two

FIG. 13. Channel amplifier chassis.



output tubes. A d-c restorer is connected to these grids for operation of the tube over the linear portion of its transfer characteristic. The line output is used as the reference for setting the level, and a bias control potentiometer is inserted in the cathode of the monitor output tube to balance the two outputs.

All signal and power cables of the color camera and equipment at the remote video control position are connected to their associated rack mounted equipment through a single terminal chassis usually mounted below the channel amplifier. Fig. 13 shows the physical appearance of the channel amplifier.

Color Camera Gamma Corrector

An important requirement for good fidelity in a color television system is that the overall transfer characteristic from the light input at the pick-up device to the light output of the reproducing device shall be linear. This means that in the case of the color camera chain, the light output at the color kinescope screen will vary in direct proportion to the input at the photocathode of the image orthicon pick-up tube. In other words, the exponent of the overall transfer gradient, or gamma, shall be unity in order for the equipment to meet the requirements of FCC signal specifications. In these specifications, the kinescope transfer gradient is specified as 2.2. Since the gamma of the image orthicon transfer characteristic has been found to be approximately .7, some compensation toward an overall gamma of unity is required. This additional compensation required to obtain unity gamma is accomplished by the gamma corrector.

As shown in the block diagram of one channel of the gamma corrector, Fig. 14, an amplifier stage precedes and follows the single non-linear gamma correction stage to maintain a suitable signal level to drive the feedback pair in the output stage, which in turn supplies the gamma corrected signal to the Colorplexer and control monitor at the video operator's control position. To accommodate the requirement of all non-linear operations, a driven clamp is used to restore the d-c component before the gamma correction is applied to the signal.

Gamma correction in the Color Camera Chain is somewhat different from that encountered in the operation of the Color Slide Camera. Gamma correction in the camera is explained in W. E. Tucker's "Color Slide Camera," Page 56.

A simplified schematic of the non-linear amplifier is also shown in Fig. 14. The necessary curvature of the transfer characteristic required to supplement the transfer characteristic of the image orthicon, and to produce an overall gamma of unity, is obtained by means of a non-linear, diode controlled, feedback circuit which is shunted across a cathode resistor in a conventional amplifier stage. As indicated in the schematic, the diodes are biased through series resistors so as to conduct at various voltage levels, thereby varying the feedback gain over the signal range from zero or black level to peak white level. An arrangement of diodes, with individual bias adjustments for each, permits greater ease of adjustment and provides adjustments to stretch the black and to compress the white regions of the transfer curve. The polarity of the signal input to the non-linear amplifier is such that black is in the positive direction. Controls are indicated for adjustment to the desired curvature in both the black and white regions.

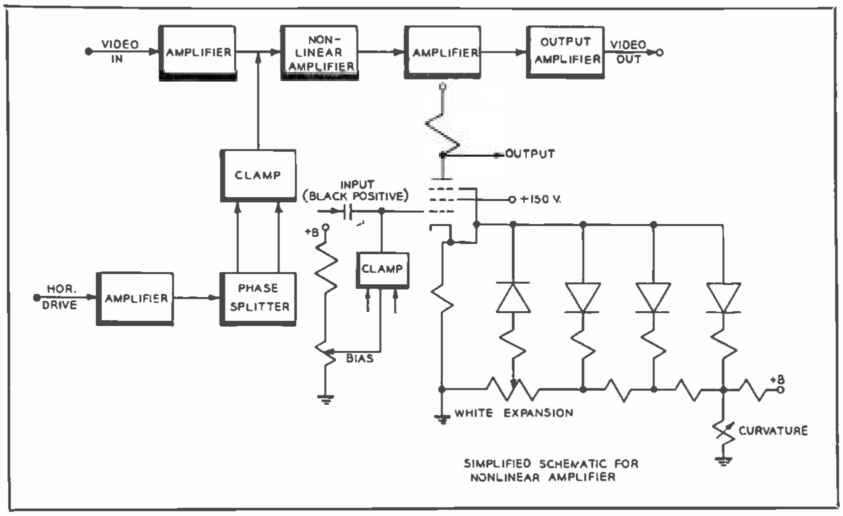
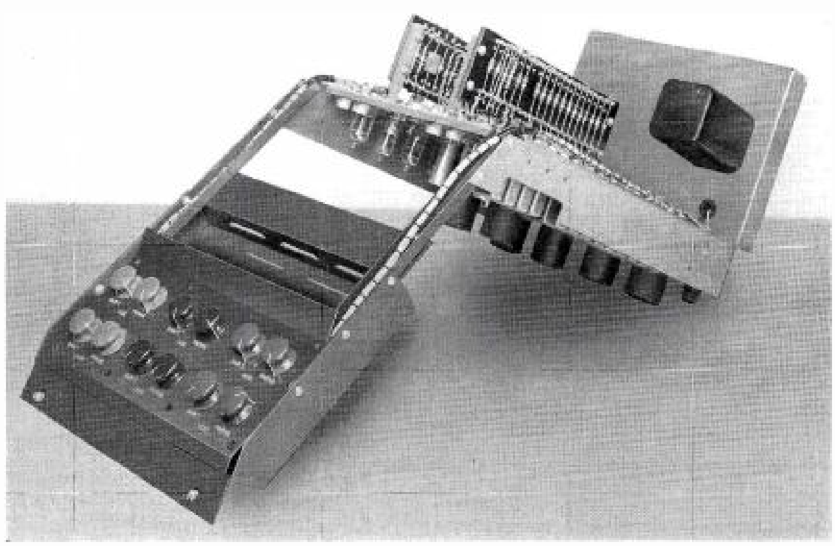


FIG. 14. Block diagram of one channel of a gamma corrector for a color camera.

Shading Generator

The shading signals introduced into each channel of the channel amplifier are needed to correct for the non-uniformity in signal sensitivity over the area scanned in each of the three image orthicons. The shading generator unit shown in Fig. 15 is mounted

FIG. 15. Shading generator assembly with control panel.



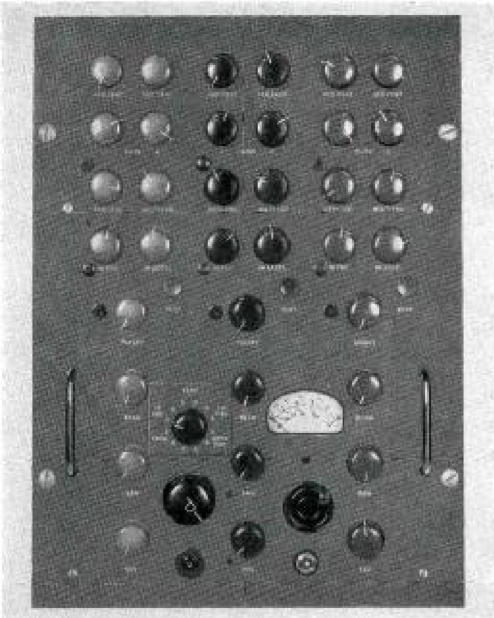
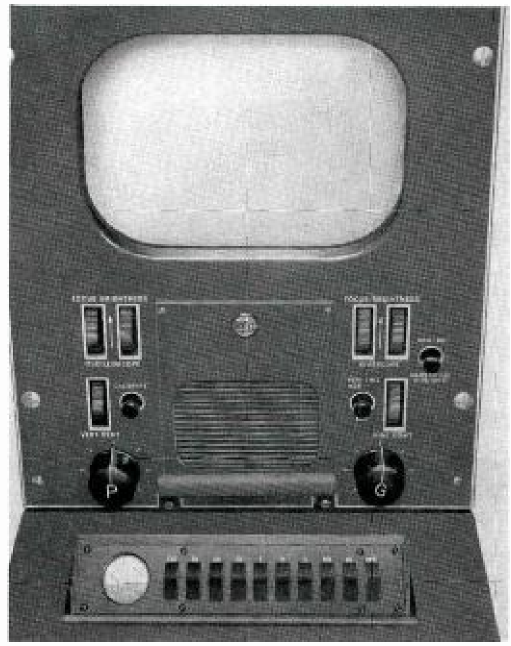


FIG. 16. Remote Control Panel mounts in a console housing next to the modified TM-6B Master Monitor.

FIG. 17. The Modified TM-6B Master Monitor. An auxiliary switching unit is mounted in the panel below monitor.



in the lower section of a standard console section at the video control operator's position. Horizontal and vertical shading signals of sawtooth and parabola shape are available for each color channel. These controls are mounted on the sloping portion of the console shelf and are identified with the respective channels by knobs of the same color. The sawtooth signal is generated in the conventional manner and the parabolic signal is obtained by shaping the sawtooth wave in an integrating circuit. While the undesirable shading effects which originate in the image orthicon are kept to a minimum in its manufacture, the adverse effects on color balance due to the presence of shading in the video signal, requires that careful attention be given to correction by adjustment of the shading generator. Normally the adjustments are required only at the time of the overall set-up of the color camera chain or when an image orthicon is replaced.

Video Operator's Control Console

The video operator's control position for a single color camera chain is comprised of control and monitoring equipment housed in two standard RCA console sections. The camera control panel on which the remote control adjustments of the color camera are mounted is located in the upper part of the left hand console section while the shading generator unit is located in the lower portion. A Monochrome control monitor is located in the upper part of the right hand console section. A monitor auxiliary unit is mounted directly beneath it.

Fig. 16 shows the remote control panel comprised of a group of symmetrically arranged operating controls for each of the three image orthicons. Colored knobs identify the controls with their respective channels. The individual channel controls include horizontal and vertical centering alignment (image orthicon beam), orthicon focus. image focus, multiplier focus, image accelerator voltage, target voltage, beam current, multiplier gain and pedestal. Button type switches adjacent to the target control knob provide a convenient means of adjusting the target two volts above cut off. A selector switch and pin jacks permit the metering of the target, orth focus, image focus and multiplier focus voltage settings in each color channel.

Also included on the camera control panel is a synchro control for operating the remote iris located between the two relay lenses in the camera optical system. Mounted directly above this control is the iris *f* stop indicator meter. In normal operation. the remote iris control performs the function of overall gain control for the complete color camera chain. A master pedestal control provides simultaneous adjustment of the pedestal voltage in the three channels.

The color control monitor is a modified Master Monitor with minor modifications necessary to permit its CRO to display in sequence. side by side, the scanned lines or fields of the red, blue and green channels. This is accomplished by adjusting the sweep rate of the CRO to 20 and 5250 CPS for the field and line frequencies respectively, instead of the 30 and 7875 CPS rates originally used in this unit. For color control monitor use, the modified Master Monitor deflection circuits are driven directly by horizontal and vertical driving pulses as compared with similar triggering signals derived from a composite sync signal in Monochrome practice. The color control monitor and control panel of auxiliary unit are shown in Fig. 17.

The monitor auxiliary switching unit located below the control monitor in the console is comprised of a number of electronic video switching circuits which provide either field sequential or line sequential display of the three color signals on the CRO of the color control monitor. Also provided are switching facilities which permit the video control operator to select for viewing on the kinescope of the control monitor red, blue or green images separately, the red or blue superimposed on green or all three images superimposed. These signals may be monitored in the camera chain before and after the gamma correction circuits. The output signal of the Colorplexer may also be monitored. The push button switches which permit this selection of signals appear below the color monitor in Fig. 17. By means of an adaptor plate, this unit mounts in the sloping section of the console.