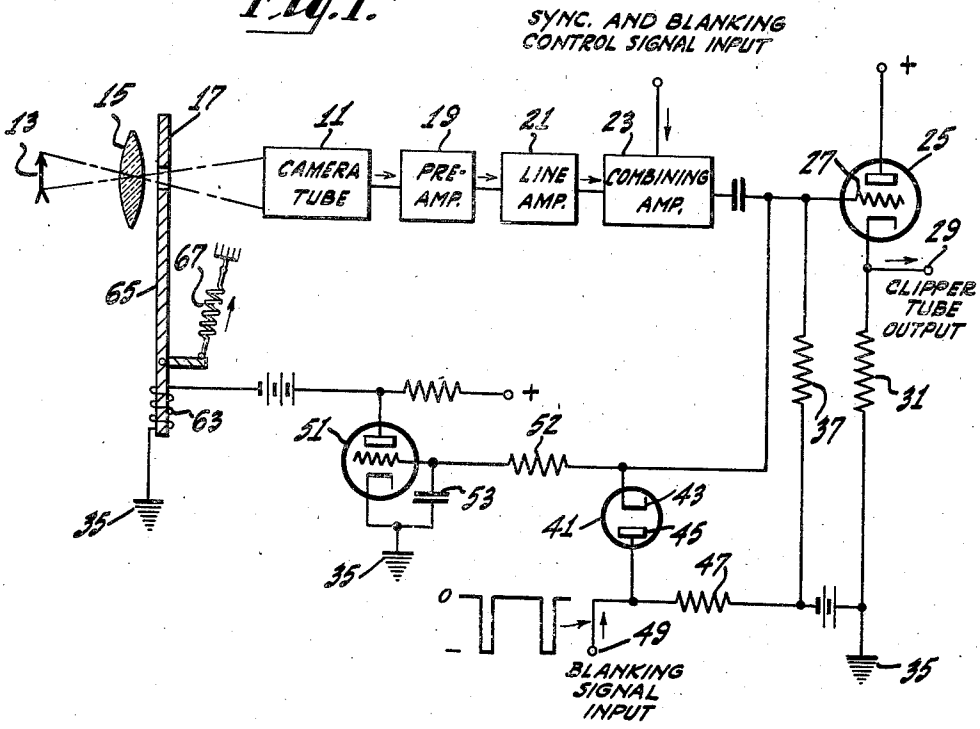
Dec. 2, 1947. W. J. POCH 2,431,824

AUTOMATIC VOLUME CONTROL REGULATION OF LIGHT INTENSITY ON CAMERA TUBE

Original Filed May 13, 1943

Fig. 1.



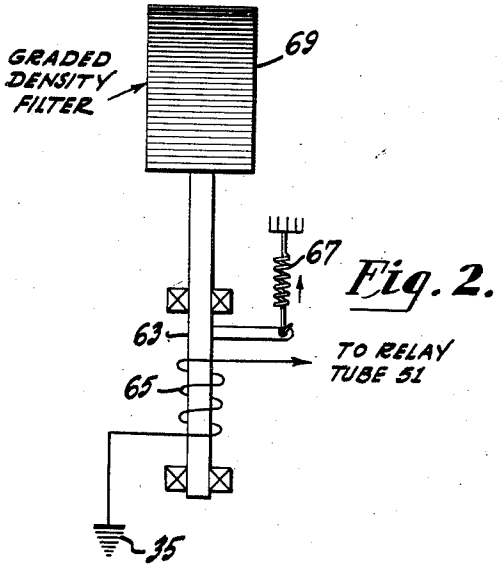


Fig. 2.

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AUTOMATIC VOLUME CONTROL REGULATION OF LIGHT INTENSITY ON CAMERA TUBE

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Original application May 13, 1943, Serial No. 486,788. Divided and this application May 17, 1945, Serial No. 594,245

3 Claims. (Cl. 178—7.2)

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This invention relates to television circuits and is directed particularly to a circuit combination whereby the level of the resultant output video signal is suitably controlled. It is a divisional application of copending application Serial No. 486,788, which was filed May 13, 1943, now United States Patent No. 2,402,444 granted June 18, 1946.

As was mentioned in a patent application of the same applicant and entitled "Automatic volume control circuits," which application is identified as Serial No. 486,789 now Patent No. 2,402,445, it is desirable that the signal level of the television output signal be suitably controlled and that its level be kept substantially constant. In television systems wherein the video signals are developed from a scanning action by a cathode ray tube of the so-called "storage type," it frequently happens that the signal energy produced during non-scanning periods of the television cycle cannot efficiently be used to provide the automatic volume control energy because if there is to be a true automatic volume control system, it is desirable that the control effect be produced only by virtue of the useful video or picture signals. To meet such conditions, the present invention provides a circuit arrangement whereby provisions are made for establishing an automatic volume control which is operating only during the periods when the video signal energy is being radiated, and at other times is keyed to an inoperative state.

Various types of scanning systems have been described in the prior art which utilize a so-called "storage type" cathode ray tube to convert the optical image of the scene to be transmitted into video signal energy. Among the types of scanning tubes for such purposes are those that have become known in the art as the "Iconoscope" and the "Orthicon." Each of these types of tubes has been described in the literature fully by all of Zworykin, Iams and Rose, and others. One of such prior art publications is known as that entitled "The orthicon, a television pick-up tube," which was described by Messrs. Rose and Iams in the "RCA Review" for October, 1939. Accordingly, no detailed reference to the tube per se will be made herein, except for a broad reference and statement that the image of a scene to be transmitted is focused upon the mosaic electrode element of the scanning tube to produce thereon electrostatic charges of magnitudes proportional to the image brightness at its several elemental areas. The produced charges are then neutralized by a scanning cathode ray beam which scans the camera tube mosaic element under the control of suitable deflecting fields. By reason of the charge neutralization, the video or image signals are produced. These signals are then supplied to external utilization circuits, such as suitable amplifying units, and, when adequately amplified, are supplied to wire or radio communication channels to actuate suitable image reproducing units.

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Since the signal energy thus produced is subject to change in level, for various reasons which need not be herein discussed in detail, the present invention has as one of its main objects that of establishing an automatic volume control unit to provide compensation for signal energy level shifts which are not due to the character of the transmission itself.

In this application, as in the mentioned related application, one of the main objects is that of providing a suitable means for controlling the output signal level. The means herein to be described is so constituted as to be made inoperative during periods when the usual blanking and sync signals are being transmitted.

Another object of the invention is to provide an automatically operating output signal level control unit for television apparatus which is keyed to its operative periods by the absence of the blanking control signals and rendered inoperative during the presence of these signals.

A further object of the invention is that of providing a control system of the character described which is effective to modify the general brightness level of the light image impinging upon the camera tube storage elements so as thereby to vary the output signal level.

Other objects are those of providing improved operation of television systems over that form of operation now generally known and, at the same time, to provide an operating unit in which the fidelity of operation is improved.

The invention is schematically shown in one of its preferred forms by Figure 1 of the accompanying drawing with a modification of a portion of the system shown by Figure 2.

By the drawings the "Iconoscope" or "Orthicon" type of camera tube is shown in a schematic representation at 11 to receive the applied light image. In the production of output video signalling energy, the optical image of an object, a scene or a subject 13 is projected by way of a lens or optical system 15 through a suitable diaphragm or iris 17 (and usually then through another lens element not shown) upon the camera tube housed in the unit 11.

When signal output energy is produced from

the camera tube unit 11, it is then supplied to a pre-amplifier unit 19 and a line amplifier unit 21 for amplification purposes. Each of these units 19 and 21 has been described at numerous places in the literature and need not be described herein in detail except, possibly, to state that each may include one or a plurality of separate amplifying tubes or stages, as is known. The line amplifier 21 usually includes a plurality of stages or amplification in order that the necessary signal gain may be achieved.

The signal output from the line amplifier 21 is then supplied to a further amplifier unit 23, which is generally known as a combining or mixing amplifier. The blanking and sync signals, which occur at spaced time intervals, such as at the end of each scanning line and at the end of each scanned field of the picture or scene, are mixed with the video signal output from the pre-amplifier 19 and line amplifier 21 in the combining amplifier 23. The resultant combination of signals is then supplied to a further amplifier tube 25, usually called a "clipper" tube. The current flow in the clipper tube 25 is then varied by the input signals supplied to the control electrode element 27.

Signal output energy from the tube 25, which is connected as a cathode follower stage, is then derived across the cathode resistor 31, which connects between the tube cathode 33 and ground 35. Suitable bias is obtained on the tube by way of the resistor 37 and the bias source 39.

The signal energy which is supplied to the clipper tube 25 is also supplied to a suitable rectifier tube, such as the diode 41, which has its cathode element 43 connected to be energized by the video signals and the plate or anode element 45 connected to ground 35 through the anode resistor 47.

As was disclosed in the companion application Serial No. 486,769, hereinbefore mentioned, it is desirable that the level control established by virtue of the rectifier tube 41 shall not be effective during periods of blanking and synchronizing, in order that the control effect provided shall be one functioning only in accordance with the actual video signal present. To this end, the blanking signals are supplied at the terminal 49, as well as to the combining amplifier 23. When the blanking signals are applied at terminal 49 they are impressed in negative polarity (as indicated) so that the anode 45 of the diode will be carried highly negative and a condition of cut-off established in the tube. In this way the rectifier or diode 41 is keyed to an inoperative state, so to speak, by the blanking signals, and its useful operative period to supply any control effect is thus restricted to the periods of video signal transmission.

The current passing through the diode 41 determines the control potential which is impressed upon the grid or control electrode of the relay tube 51. This control voltage is applied through the resistor 52 and across condenser 53. At the same time, the current flowing in the diode 41 also establishes a bias level upon the clipper tube 25, so that its output may be automatically varied by the control signal.

The current flow through the diode 41 and the relay tube 51 may then be used to establish a control of the video signal level production. This effect would occur, for instance, where the output signal reaches an extremely high level due, for instance, to too much light entering the scanning or camera tube and tending to cause saturation effects therein. The control voltage may then be supplied by way of the conductor 61 (with the control voltage being determined as a result of the current flow through the diode 41) to vary the current flow through the relay winding 63. Increases in current in winding 63 draw the magnetic control element 65 for operating the iris or diaphragm 17 further into the coil, or permits its retraction under the influence of a suitable resilient means 67. The iris or diaphragm 17 is of the ordinary type which is normally held in an open state. Suitable ways and means to control the iris or diaphragm 17 may be provided. These control means may, for instance, comprise racks and pinions and the like, each of which is well known in the art and thus requires no further illustration than the schematic one shown, which serve to close the iris with the control element being drawn into the winding 63 and with a reduction in current in the winding the spring 67 will permit the iris to open to admit more light to the camera tube.

While it has been above suggested that the current flowing in the relay winding 63 is particularly adapted for controlling the opening of the iris or diaphragm 17, it will also be apparent that a somewhat equivalent effect may be achieved by causing a substantial increase in the current in the relay winding to move progressively darker light absorbing filters 69 intermediate the optical system 15 and the opening to the scanning or camera tube 11 through which the light of the optical image enters. Filters of this general type are, per se, generally known and require no specific description. The filters may be arranged on a disk in sector shaped sections and, for varying strengths of current flowing in the relay winding, the filter sections may be moved in stepped manner into the optical path in the manner above suggested to control the iris opening.

Alternatively, as shown by Figure 2, the filters 69 may be arranged in a strip formation and in a plane relative to the optical system 15 and the camera tube 11 which substantially corresponds to that of the iris 17. By virtue of different current strengths flowing in the relay winding 63 the control element 65 is pulled within the winding 63 and the filter 69 is drawn downwardly through the optical path. With decreases in current these elements are caused to move in the opposite direction under the influence of the suitable resilient means 67, for example. It should be borne in mind in this connection that the light enters through a relatively narrow area and by locating the filter 69 closely adjacent the lens the desired light gradations on the camera tube may be obtained without any detrimental effect on the image since the filter is located in an out-of-focus plane.

Having now described the invention what is claimed is:

1. A signal level control system for television apparatus comprising a camera tube having included therein means to convert optical images into wave trains of video signals, means associated with the camera tube to project optical images thereon, light control means to control the quantity of light of the optical image projected upon the camera tube, a source of intermittently occurring control signals for combination with the video signals, a combining unit for mixing the video signals and the control signals, a load circuit to receive the said combined signals, an electronic relay means, a rectifier element connected to receive the combined video and control signals and to be energized thereby to

draw current during the periods of the presence of the said signals, an integrating unit to control the current flow through the said relay means in proportion to the current flow in the said rectifier element, means to control the said light control means to vary the quantity of light of the optical image impinging upon the said camera tube in proportion to the current flow in the said rectifier element, and means to supply the control signals to the rectifier independently of the combined signals to render the said control inoperative during periods of development of the said control signals.

2. A signal level control system for television apparatus comprising an image scanning element to convert optical images into wave trains of video signals, optical means to project optical images upon the scanning element, aperture control means to control the quantity of light of the optical image projected upon the scanning element, a source of intermittently occurring control signals, a combining circuit for mixing the video signal output from the scanning means with the control signals to develop a composite signal, a load circuit to receive the said combined signals, a relay unit, a diode rectifier means connected also to receive the combined video and control signals and to draw current during the periods of the presence of the said signals, a capacity element connected with the diode and the relay unit to control the current flow through the said relay means in proportion to the current flow in the said diode rectifier means, means responsive to the output current of the relay to control the effective aperture of the said optical means to vary the quantity of light of the optical image impinging upon the said scanning means in proportion to the current flow in the said diode rectifier means, and means to supply the control signals to the rectifier independently of the combined signals to render the said diode inoperative to produce a control effect during periods of development of the said control signals.

3. A signal level control system for television apparatus comprising an image scanning element to convert optical images into wave trains of video signals, optical means to project optical images upon the scanning element, light absorbing means to control the quantity of light of the optical image projected upon the scanning element, a source of intermittently occurring control signals, means for combining the video signal output from the scanning means with the control signals, a load circuit including a diode to receive the said combined signals so that the diode will draw current during the periods of the presence of the said signals, means to control the current flow through the said relay means in proportion to the current flow in the said diode rectifier means, means to control the density of the said light absorbing means included instantaneously in the optical path to vary the quantity of light of the optical image impinging upon the said scanning means in proportion to the current flow in the said diode rectifier means, and means to supply the control signals to the rectifier independently of the combined signals to render the said diode inoperative to produce a control effect during periods of development of the said control signals.

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