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F. R. NORTON

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TELEVISION RECEIVER

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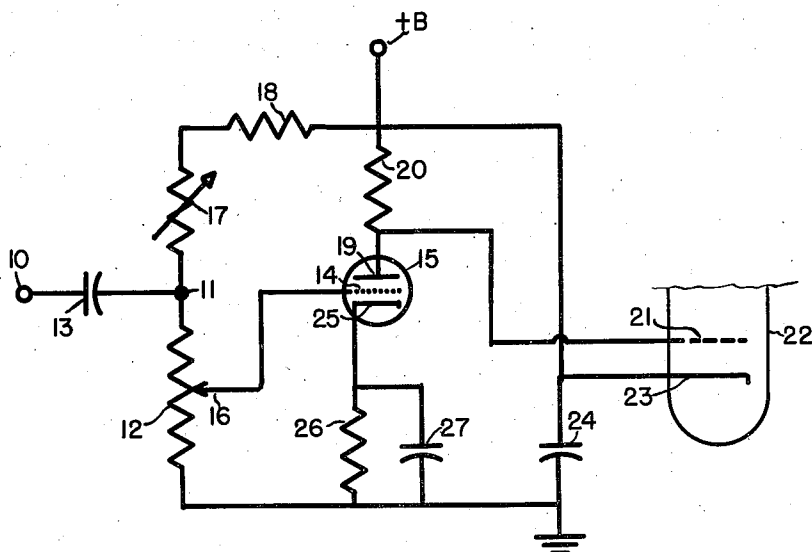


FIG. 1

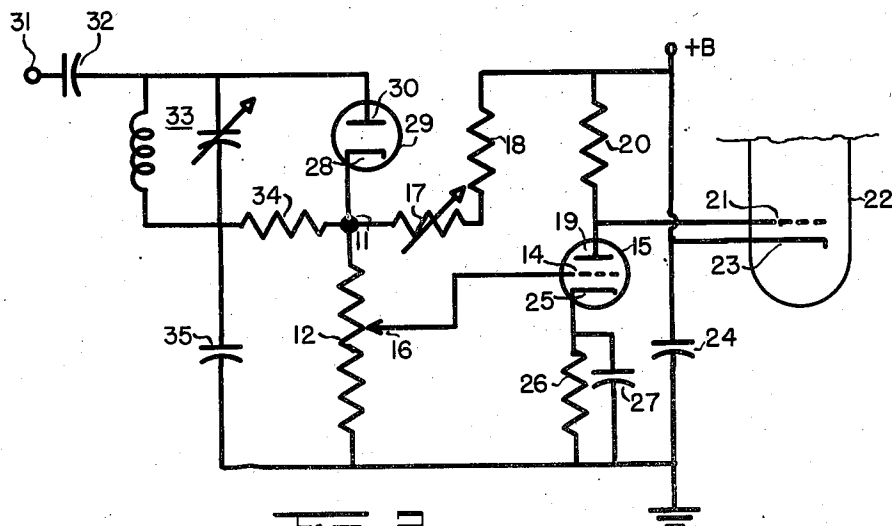


FIG. 2

Inventor

FRANK R. NORTON

By *Robert J. Killman*

Attorney

UNITED STATES PATENT OFFICE

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TELEVISION RECEIVER

Frank R. Norton, Towson, Md., assignor to Bendix Aviation Corporation, Towson, Md., a corporation of Delaware

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This invention is directed to television receivers. More specifically it is directed to a combination video gain and contrast control for television receivers.

It is customary, in television receiving systems, to provide separate controls for picture contrast and for brightness control. The brightness control normally varies the control electrode bias on the cathode ray tube and thus affects the background brightness. The contrast control then varies the video or picture signals gain to change the amplitude of the video signal applied to the picture tube. Conventional contrast controls operate by varying the radio-frequency, intermediate-frequency, or video-frequency gain, or a combination of these.

The manipulation of these two controls in order to maintain a satisfactory picture under changing signal conditions requires a skill which is often beyond that of the average person who purchases a television receiver. It would, of course, be an advantage to have a single control which would perform the two functions, and which would maintain a standard contrast under all signal conditions.

It is an object of this invention, therefore, to provide a single control to control both the intensity of the television picture and the contrast thereof as viewed on a conventional cathode-ray type of picture tube.

It is a further object of this invention to eliminate one or more of the shortcomings of prior art arrangements.

The above and further objects and novel features will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings which illustrate two embodiments of the instant invention. It is to be expressly understood, however, that the drawings are for purposes of illustration only, and are not intended as a definition of the limits of the invention, reference for this purpose being had to the appended claims.

In the drawings:

Fig. 1 illustrates a final video amplifier stage in accordance with the invention; and

Fig. 2 illustrates a second embodiment of the Fig. 1 arrangement.

Referring now to Fig. 1, there is illustrated a terminal 10 connected to the ungrounded end 11 of a potentiometer 12 through a condenser 13. The control electrode 14 of an electron discharge tube 15 is connected to the variable arm 16 of the potentiometer 12. The end 11 of the potentiometer 12 is connected through a series com-

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bination comprising a variable resistor 17 and a fixed resistor 18 to a source of potential indicated +B. The anode 19 of the tube 15 is connected to the same source +B through a fixed resistor 20, and directly to the control electrode 21 of a cathode ray tube 22. The cathode 23 of the cathode ray tube is connected directly to the source of voltage, and through a condenser 24 to ground. The cathode 25 of the tube 15 is connected to ground through a parallel combination comprising a resistor 26 and a condenser 27.

Considering now the operation of the illustrated arrangement, it will be seen that the bias between the control electrode and the cathode of the cathode ray tube is equal to the voltage drop across the resistor 20 due to current drawn by the anode-cathode circuit of the tube 15. It will also be seen that this voltage is also the output signal voltage of the tube 15 because the resistor 20 is the plate load resistor of the tube 15. Therefore, it will be seen that the dynamic range of signal voltages appearing between the control electrode and cathode of the cathode ray tube will be dependent on the average bias applied to the control electrode 14 of the tube 15.

The input terminal 10 is now connected to a source of video-frequency signal (not shown). It will be manifest that the amplitude of the video signals applied to the control electrode of the tube 15, and, consequently, to the control electrode 21 of the cathode ray tube, will be determined by the setting of the variable arm 16 of the potentiometer 12, much as is the case in conventional arrangements. These video signals applied to the control electrode of the cathode ray tube will, however, have accompanying them a direct current component produced by the constant D. C. voltage drop across the resistor 20 due to the space current of the tube 15. By Ohm's law it will be obvious that the greater the space current through the tube 15 the greater will be the D. C. component of signal applied between the control electrode and cathode of the cathode ray tube.

This space current through the tube 15 will be determined, in part, by the amount of bias on the control electrode 14 thereof, and this bias may be changed both by the manipulation of the arm 16 on the potentiometer 12, and by variation of the resistance presented by the resistor 17. By proper selection of components it is easily possible to arrive at a condition where by properly adjusting the variable resistor 17 at the factory for the desired degree of contrast, variation of position of the arm 16 on the po-

tentiometer 12 will change both the level of the video signals and the amount of bias on the cathode ray tube control electrode in such a fashion that optimum contrast conditions exist for all levels of video signal.

That this is true can be seen from a consideration of the operation of the circuit. Assume as a reference condition that the background of the image on the screen of the picture tube 22 is bright. An increase in bias in the tube 22 decreases the brightness of the background and vice versa. An increase in space current flow through tube 15 increases the bias on the tube 22 and thus darkens the background. Such an increase in space current flow through the tube 15 is caused by moving the contact 16 upward. Since this darkens the background of the picture tube, it calls for a rise in the level of video signal to maintain a constant contrast. It can be seen that raising the contact 16 provides such an increase in video signal level. Whether this increase is sufficient to retain the contrast at a constant value depends upon the amplification factor of the tube 15 and the circuit parameters including the values of the various resistors.

Referring now to Fig. 2, there is illustrated a second embodiment of the instant invention wherein the arrangement of Fig. 1 is connected conductively to the output of the second detector circuit of the video channel of a television receiver. The control electrode 14 of the tube 15 is connected to the arm 16 of the potentiometer 12 as in the Fig. 1 arrangement. The ungrounded end 11 of the potentiometer 12, however is directly connected to the cathode 28 of a diode electron discharge tube 29, the anode 30 of which is connected to a source 31 of intermediate-frequency wave signals through a condenser 32. A parallel resonant circuit 33, tuned to the frequency of the intermediate frequency source 31, is connected between the anode 30 and a load resistor 34. The load resistor 34 provides a connection from the resonant circuit 33 to the cathode 28 of the diode tube 29. A relatively large by-pass condenser 35 is connected from the lower end of the parallel resonant circuit 33 to ground.

In operation, the arrangement shown in Fig. 2 provides a method of connecting the video output stage illustrated and described previously to a second detector circuit in such a manner that the direct current component of video signal is not lost by passage through a condenser. This retention of the D. C. component of the video signal is desirable in high-quality equipment to insure the proper relationship of the various picture intensities to the no-signal screen illumination. The condenser 35 provides a ground for the video signals being translated without developing a bias voltage from the source +B through the resistors 17 and 18. In all other respects the Fig. 2 arrangement is conventional in operation.

Although only two embodiments of the present invention have been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. For example, a triode tube has been shown as the driver for the cathode ray tube; this could, of course, be

replaced by any one of a number of other types of tubes without changing the basic principle of operation of the instant device. For a definition of the limits of the invention reference will be had primarily to the appended claims.

What is claimed is:

1. In a television circuit comprising a video amplification channel and a picture tube, said amplification channel comprising a final stage having a control electrode, an input circuit and an anode circuit and said picture tube having a control electrode and a cathode; a load impedance in said anode circuit; means connecting said control electrode and cathode of said picture tube across said impedance; a source of plate supply voltage for said final stage and a voltage divider in said input circuit, said voltage divider being connected between said source and the control electrode of said final stage and being variable to simultaneously vary the amplitude of the video signal and the magnitude of the control electrode bias of said stage, thereby controlling the contrast of the picture on said picture tube while maintaining constant the black level thereof.

2. In a television circuit: a video amplifier; a potentiometer in the input circuit of said amplifier; means applying the envelope of a video signal across said potentiometer; an impedance connected in the output circuit of said amplifier; a picture tube having a control electrode and a cathode; means connecting said control electrode and said cathode across said impedance, a source of plate supply voltage for said amplifier, and a variable impedance connected between said source and said potentiometer.

3. In a television receiver: a video amplifier; a potentiometer in the input circuit of said amplifier; a video detector circuit, a load impedance in said detector circuit, a source of plate supply voltage for said amplifier; a variable impedance connected between said source and said potentiometer; means directly connecting said load impedance to a point between said variable impedance and said potentiometer; a picture tube having a control electrode and a cathode, a load impedance connected in the output circuit of said amplifier and means connecting said control electrode and cathode across the last named load impedance.

FRANK R. NORTON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,141,343	Campbell	Dec. 27, 1938
2,240,136	Geiger	Apr. 29, 1941
2,245,409	Miller	June 10, 1941
2,252,746	Willans	Aug. 19, 1941
2,308,997	Miller	Jan. 19, 1943
2,363,809	Schade	Nov. 28, 1944

FOREIGN PATENTS

Number	Country	Date
477,433	Great Britain	Dec. 20, 1937