July 4, 1944. V. J. DUKE 2,353,018

TELEVISION APPARATUS

Filed Oct. 24, 1942

Fig. 1.

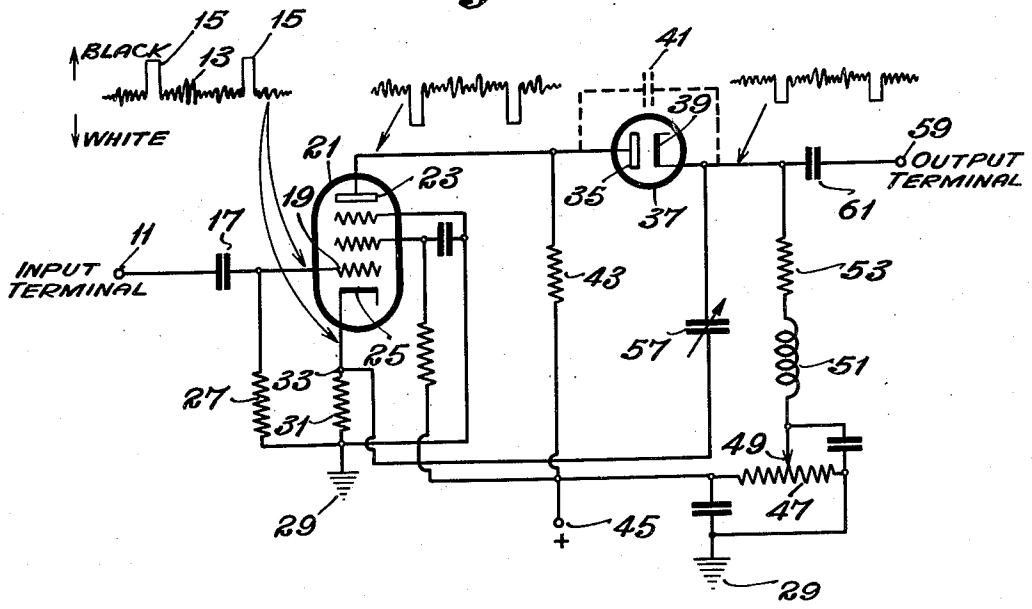
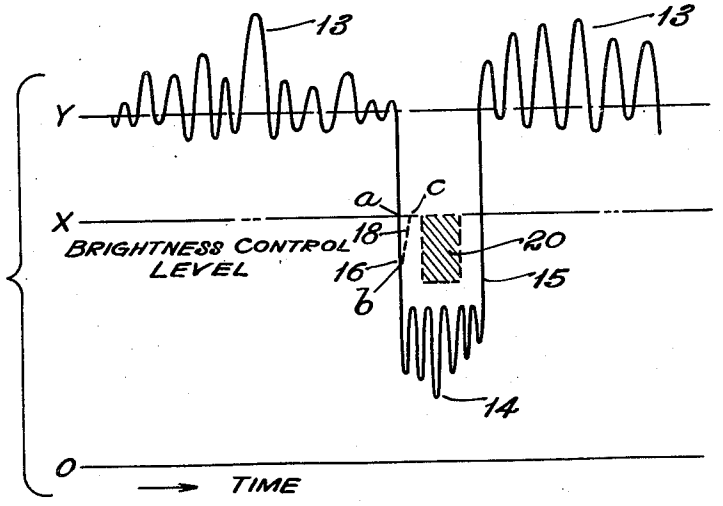


Fig. 2.



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TELEVISION APPARATUS

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5 Claims. (Cl. 178—44)

This invention is directed to television apparatus and is concerned particularly with the transmission of television or video signals which have originated from the scanning of a film, a studio scene or an outdoor scene. Suitable blanking signals are to be combined with the video signals in order to provide for blanking in the receivers and, at the same time, to provide for synchronizing the receivers.

The present invention is particularly concerned with an arrangement which will herein be termed a limiting or clipper circuit which is so designed as to provide a convenient means by which the brightness of the picture, as measured by the signals transmitted, can be set.

In the past, it has been customary to provide circuits in the television transmitting systems by which the brightness has been controlled through the use of limiting tubes and the like, but such circuits have not always provided the necessary accuracy of adjustment that is desirable for optimum transmission efficiency. It has been found that in many cases where the picture or video signals have been mixed with suitable blanking signals, and efforts are made to set the brightness control level, that the diode which serves as the limiting instrumentality to establish the desired level, frequently ceases to conduct, so far as direct current transmission is concerned, but because of the capacitive nature of the tube, the leading edges of the blanking pedestals, which are usually in the nature of a short residual pulse, are transmitted by the capacitive conduction of the high frequency components of the blanking signals after the normal conduction of the tube has ceased, due to the bias. Of course, this is rather undesirable in that it interferes with the synchronizing signals which are to be applied to the pedestal signals developed, and, consequently, it frequently happens that in the receivers, where the transmission has thus been controlled, false synchronization can take place.

The present invention, however, has as its object that of providing a capacitive bridge arrangement in combination with a plurality of resistors, so that complete balancing out of the undesired effects is obtained in a manner which will be described in the specification to follow.

It accordingly becomes an object of the invention to provide a means and apparatus suitable for setting the average brightness of the picture to be transmitted in a relatively simple and convenient way, so as to establish a pedestal control level which will be a measure of the picture transmitted. At the same time, it will provide so that no false synchronizing signals shall be developed in the receivers due to the presence of undesired peaks or residual pulses frequently inherent from clipping.

Other objects of the invention are to provide an arrangement for effecting more stable operation than has heretofore been possible.

Other objects of the invention are to provide a circuit for overcoming the above stated difficulties and one or more other known objections of the prior art in a manner which is relatively simple, easy to construct, easy to operate and relatively simple to install.

The invention has been shown in one of its preferred forms by the accompanying drawing, wherein,

Fig. 1 illustrates schematically a portion of a transmitter circuit wherein the invention has been incorporated, and,

Fig. 2 is a diagrammatic representation of an assumed wave form serving solely for the purpose of explaining the operation of the circuit of Fig. 1.

Referring now to the drawing, input signals are applied at the input terminal 11. Such signals are shown immediately above the input terminal by the wave form designated and comprise, birefly, the video signal portion 13 and a blanking signal portion 15 following a predetermined sequence of video signals corresponding, for example, to the video signals representative of one line of a picture or scene of which the image is to be transmitted. The combination of the video signals 13 and the blanking signals 15, which are applied at the input terminal 11, are then fed by way of the capacity coupling 17 to the control electrode 19 of a suitable amplifier tube 21 which includes the usual plate or anode output electrode element 23, the usual cathode 25, together with one or more other cold electrodes as become desirable and necessary.

In well known manner the usual leak resistor 27 is provided in the path between the control electrode 19 and the cathode 25, which is biased relative to ground 29 by way of a suitable cathode bias resistor 31 across which, if desired, output signals may be derived. It will be seen, accordingly, that the polarity of the signals, as developed at the anode 23, will be opposite that from which they were applied at the input terminal 11, and also opposite the polarity at which they appear across the cathode resistor 31, for instance, at the connection point 33. If it is assumed that the signals applied to the input terminal 11 are such that the blanking pulses 15

are in the upward direction (herein assumed to be "positive") representing black, these same pulses will appear in the output from the amplifier 21 in the downward direction, also representing black, (herein assumed to be "negative") and accordingly are applied directly to the anode or plate element 35 of a diode clipper tube 37 comprising also the usual cathode 39.

A certain capacity exists between the anode 35 and the cathode 39 of the diode and this capacity value is represented conventionally by the capacitor 41 shown in dotted lines. The load resistor for the amplifier 21 is provided by the resistor 43 which connects at its lowermost terminal to a source (not shown) of positive voltage connected at the terminal point 45.

In order to set and adjust the direct current voltage across the diode tube 37, a potentiometer 47 has one outside terminal connected to the source of positive potential connected with the terminal point 45, and the other outside terminal connected to ground 29, and by means of adjustment of the variable tap 49 on the potentiometer, it is apparent that through the connection of this variable tap through the inductor 51 and the resistor 53 to the cathode 39 of the diode, a balance may be maintained by which the cathode 39 is adjusted to a predetermined voltage relative to the plate or anode 35 which, as above stated, connects to the source of positive potential at the terminal point 45 through the load resistor 43 of the tube 21 to whose plate 23 the diode plate 35 is directly connected.

Whenever the signal applied to the plate or anode 35 of the diode is sufficient to overcome the direct current voltage between the anode and cathode, it of course becomes evident that the diode will cease to conduct, and all pedestal or blanking pulses, in excess of the predetermined setting, are cut off.

Accordingly, if reference is now made to Fig. 2, it will be seen that the video signals 13 are represented to be followed by a blanking pulse 15, as explained above. Actually, the blanking pulse 15 persists for a period corresponding to the snapback or return line period during which the scanning beam of the transmitter tube returns to start scanning a new scanning path or line adjacent to the one previously scanned, but since the beam is frequently not completely suppressed during such snapback, there may or may not be picture or video signals 14 (not usable at the receiver) superimposed upon the blanking signal in the direction of black, and after completion of the blanking signal the video signals are again produced. While not herein specifically discussed, it should be borne in mind that a similar vertical blanking period exists following each scanning field. This blanking period is also about 10% of the field scanning period.

If now, the adjustable contactor 49 is set on the potentiometer 47 at a level such as to establish a brightness control level at the level indicated by x on Fig. 2, with the A. C. axis of the video and blanking signal represented by the axis y—y, it is of course apparent that clipping of the blanking signal will occur at the level x, so that all of the signals shown below the line x in Fig. 2 will be suppressed, with the exception of the shaded part 20, later to be explained, which will be added prior to transmission and is not actually present during the clipping action.

Thus, under normal conditions, as was above stated, with the diode arrangement as herein explained and with the capacity 41 represented as being that existing across the diode, it is apparent that the leading edge 16 of the blanking pulse will extend a slight distance below the level x as a sharp residual pulse caused by the capacitive conduction of the high frequency components after the cessation of normal conduction through the tube, and such a pulse might be that represented by the dotted line 18 adjacent the vertical line forming a part of the leading edge of the pulse, so that the residual pulse would be that designated as a, b, c. Consequently it can be seen that if a super sync pulse be added later in the system, which super sync pulse would be represented, for instance, by the pulse occupying the shaded area 20, the leading edge of the residual pulse, identified as a, b, might tend, in the receiver, to cause false synchronization, so that the receiver would be synchronized slightly ahead of the time when the synchronizing pulse 20 actually was received. It is, of course, to be understood also that a false synchronizing pulse will occur following the blanking pulse under many conditions, but this has not been shown since it is not so detrimental to the picture.

However, according to the present invention, the general effect of the residual pulse which is so detrimental in the picture and which is so apt to cause false synchronization in the receiver, can be overcome by a balancing or neutralizing capacity in the form of the adjustable capacity 57, indicated as being connected intermediate the point 33, which is the upper end of the cathode resistor 31, and the cathode 39 of the diode 37. This condenser overcomes the detrimental effects which would otherwise be inherent in the system by adjusting the variable contactor 49 of the potentiometer 47 to set the brightness level, and this is necessary where it is desired to fade out the picture under many conditions.

It becomes apparent, without regard to the capacity 57 for the moment, that as the diode 37 is passed further and further off toward a cut-off position, the ratio of the capacitive conduction to the normal tube conduction, which must be considered as resistive, becomes greater. The result of this effect is that a sort of high frequency or cameo or outline picture results in the transmitters, and consequently, at a complete black-out state, which should be the condition for a complete fade-out where there is no normal conduction within the tube 37, there is still a high frequency picture present.

To overcome these effects, the capacity 57, described as being connected between the cathode 39 of the diode 37 and the cathode 25 of the amplifier 21, has been provided. It is apparent, from the showing hereinabove, that the voltage which is built up across the cathode resistor 31 is 180° out of phase with that voltage which appears at the plate of the amplifier 21, and consequently the condenser 57 connects in such a manner as to utilize this voltage as a compensating voltage.

It can be seen from an inspection of the diagram, Fig. 1, that by adjusting the value of the capacity 57, the detrimental effect of the diode capacity, conventionally represented at 41, may be balanced out.

In explanatory manner, it will be apparent that the arrangement disclosed constitutes a resistance and capacity bridge with the effects of the diode capacity, conventionally represented as 41, being overcome by the adjustable capacity 57. In operation of the system, it is desirable that the

voltages developed at the plate and cathode of the amplifier 21 be somewhat comparable, so that the value of the capacity 57 may be made to be somewhat of the same general order as that represented by the capacity 41, and consequently this effect is easily obtained by a proper selection of the tube used as the amplifier 21.

To provide the bridge arrangement as has herein been disclosed, it is apparent that the system may be so considered that the plate or anode 23 of the tube 21 is considered as connecting to ground through its load resistor 43. Similarly, the cathode 25 of the amplifier 21 may be considered as connecting to ground through the cathode resistor 31, so that the anode and cathode connect to a common point, this being possible because of the connection of the high voltage source, not shown, at the terminal point 45. Likewise, the anode or plate 23 of the tube 21 connects to the diode plate 35, and the cathode 39 of the diode 37 connects to an output terminal 59 by way of a coupling condenser 61, and consequently, if the connection between the plate 23 of the amplifier 21 and the output terminal 59 is considered as constituted by a capacity 41, then it is apparent that the cathode 25 of the amplifier 21 likewise connects to the same output terminal 59 by way of the capacity 57, so that by an adjustment of the capacity 57 it is evident that the voltage supplied through the capacity 57 may be made to counterbalance any effects introduced by the capacity 41. The result is that when the adjustable contactor 49 of the potentiometer is set to different values, the balancing out of the capacitive effect of the diode 37 will overcome and eliminate any effects of any residual pulses, such as those conventionally represented by the pulse *a*, *b*, *c*, for instance, in Fig. 2.

It is, of course, apparent that other modifications of the arrangement herein disclosed may be made without departing from the spirit and scope of the invention.

One other such modification would be that of reversing the diode in the signal input polarity, and also the direct current applied to the diode.

In still a further modification, it is apparent that where necessary, a separate tube might be used to furnish the voltage now described as being developed at the point 33 on the cathode resistor 31.

Having described my invention, what I claim is:

1. A signal amplifying circuit comprising an amplifier tube having at least an input electrode, an output electrode and a cathode electrode, a diode connected to the output electrode, means for applying signalling impulses to the input electrode of the amplifier tube, means for providing variable bias upon the diode to determine the signal level at which signal output from the amplifier is passed through the diode, and capacitive means connected between the load terminal of the diode and the cathode of the amplifier for balancing the capacity of the diode.

2. A signal amplifying circuit comprising an amplifying tube having an input electrode, an output electrode and a cathode electrode, means for deriving output energy from each of the output and cathode electrodes, a diode having one of its electrodes connected to the output electrode of the amplifying tube to receive output energy therefrom, means for applying biasing voltages to the diode to determine the signal level at which signal output from the amplifier is passed therethrough, a capacity element having one terminal thereof connected to the second electrode of the diode and its other terminal connected to the cathode output of the amplifying tube so as to balance the capacity effect of the diode, and terminal means for deriving output energy from the diode.

3. A signal amplifying circuit comprising an amplifying tube having an input electrode, an output electrode and a cathode electrode, means for deriving output energy from each of the output and cathode electrodes, a diode having its anode electrode connected to the output electrode of the amplifying tube to receive output energy therefrom, means for applying biasing voltages to the diode to determine the signal level at which signal output from the amplifier is passed therethrough, a capacity element having one terminal thereof connected to the cathode of the diode and its other terminal connected to the cathode output of the amplifying tube so as to balance the capacity effect of the diode, and terminal means for deriving output energy from the diode.

4. A signal amplifying circuit comprising an amplifying tube having an input electrode, an output electrode and a cathode electrode, means for deriving output energy from each of the output and cathode electrodes, a diode having its anode directly connected to the output electrode of the amplifying tube to receive output energy therefrom, means for applying biasing voltages to the diode to determine the signal level at which signal output from the amplifier is passed therethrough, a capacity element having one terminal thereof connected to the cathode of the diode and its other terminal connected to the cathode output of the amplifying tube so as to balance the capacity effect of the diode, and a terminal for deriving output energy from the diode.

5. A signal amplifying circuit comprising a vacuum tube having an input electrode, an anode electrode and a cathode electrode, means for deriving output energy from each of the anode and cathode electrodes, a diode tube having a cathode and an anode, a galvanic connection between one of the output electrodes of the vacuum tube and one of the electrodes of the diode to supply output energy from the vacuum tube to the diode, means for applying biasing voltages to the diode to determine the signal level at which signal output from the vacuum tube is passed through the said diode, a capacity element having one terminal thereof connected to the other electrode of the diode and its other terminal connected to the other output electrode of the vacuum tube so as to balance the capacity effect of the diode, and terminal means for deriving level controlled output energy from the diode.

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