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DOUBLE TIME-CONSTANT CIRCUIT FOR DIRECT CURRENT RESTORATION

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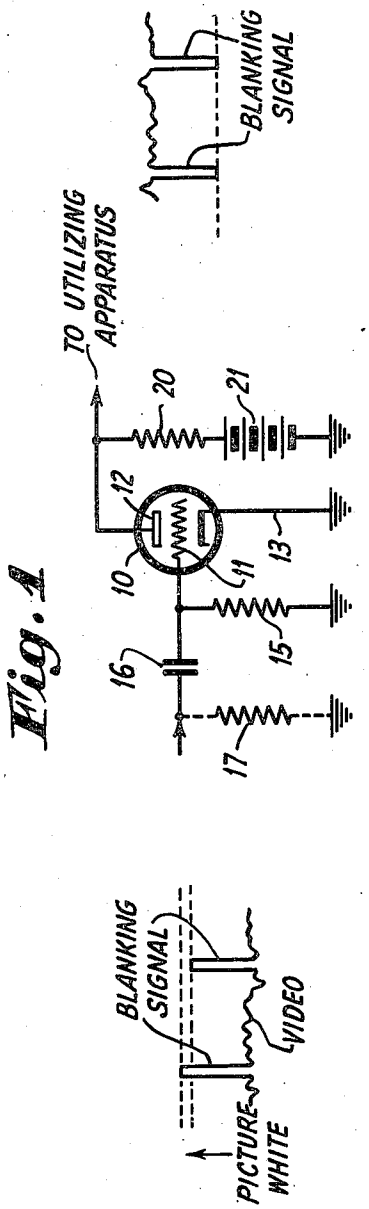


Fig. 1

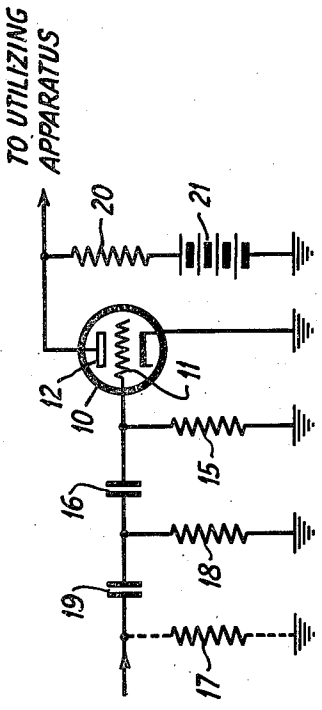


Fig. 2

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DOUBLE TIME-CONSTANT CIRCUIT FOR DIRECT-CURRENT RESTORATION

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1

My invention relates to circuits for television apparatus and more particularly to such circuits as are concerned with the establishment of a definite operating level for some of the components of such apparatus.

It is a well known fact that when signals containing both an alternating current and a direct current D. C. component are transmitted through normal amplifying apparatus, the D. C. component thereof is suppressed or lost. In television apparatus it is necessary, for well known reasons, to re-establish the D. C. component of the television signal in order that the correct and proper brightness of the reproduced picture may be indicated, and that signals such as synchronizing (commonly termed "sync") and blanking signals may have their proper effect. Accordingly it is one of the objects of my invention to provide an apparatus in which this may be accomplished.

Since it is important that the relative background brightness of a reproduced television picture be accurately re-established and since some of the signals generated during scansion of the transmitted picture bear a relationship to what is termed "picture black," it will be obvious that it will be highly advantageous if one of the signals normally developed for transmission can be used to indicate or establish so called picture black. It is, therefore, another of the objects of my invention to provide an apparatus in which this may be done.

Still a further object of my invention is to provide an arrangement which will minimize the effect of spurious signals such as microphonics and the like on reproduced television images or pictures.

Still a further object of my invention is to provide an apparatus which is simple in nature, rugged in construction, and accurate in action.

In accordance with my invention the so called blanking impulse which is used at the television transmitter, and the use of which is well known to those skilled in the art to which this case belongs, is used as a reference to the black level of the image undergoing scansion. In one type of television transmission this may be an impulse which has a direction in the transmitted signal which is either toward picture white or picture black. Normally this component is a measure of true black (or white) level of the picture. This signal along with the video signal is then impressed onto an extremely fast or rapid acting time constant circuit and, in the preferred embodiment of my invention, then onto a second time constant circuit forming part of the normal

2

input to one of the amplifying circuits usually, but not necessarily, associated with the television receiver. The effect of this combination of time constant circuits is such as to reinsert the D. C. component which has been suppressed or lost from an A. C. signal and further has the effect of stabilizing the action of the apparatus.

In another embodiment of my invention the signal is impressed directly onto a time constant circuit having a time constant of a value in the neighborhood of the time of scansion of several lines of the image undergoing scansion. In actual practice this has been about two or three lines per field of the scanned image.

My invention will best be understood by reference to the drawings in which like numerals represent similar parts and in which

Fig. 1 shows one embodiment of my invention;

Fig. 2 shows another embodiment of my invention.

Referring to Fig. 1 of the drawing, there is shown a vacuum tube amplifying apparatus indicative of one of the amplifiers that may be used in a television receiving apparatus, and comprising a vacuum tube 10 having a grid electrode 11, anode electrode 12, and filament electrode 13, one side of the latter being grounded. Connected directly between the grid 11 and ground is a first resistor 15, and also connected between the grid 11 and ground, and connected to the common terminal between the grid and resistor 15 is a series circuit comprising condenser 16 and resistor 17. Resistor 17 may be the plate resistor of a previous amplifying stage.

There has been shown for purposes of convenience a typical line of television scanning from which the D. C. component is lacking and transmitted immediately before the beginning of the line is a signal representative of the blanking signal transmitted at the end of the previous line. For purposes of illustration only, there has been shown a type of signal in which the blanking signal is in the direction of picture white, and because of the lack of the D. C. component from the signal, the height of the blanking signal develops about an A. C. axis in accordance with well known electrical theory (see for instance Figure 7.2 on page 137 of "Television Simplified," by Kiver, 1946 edition by D. Van Nostrand Company). The output wave with the D. C. component restored is shown opposite the plate circuit of tube 10.

The action of the device is such that signals from which the D. C. component is missing will cause the time constant circuit condenser 16 to

charge rapidly, and the effect of lower frequency signals will be minimized. Charging and discharging however, should not be so rapid that the picture brightness can change between lines. Having charged the condenser to a voltage approaching the value of the signal in volts from the plus direction to the A. C. axis of the signal, the reference point of the recurring television line by line signals is held at a fixed point on the E_g—I_p (grid voltage-plate current) curve of the tube.

Referring to Fig. 2 there is shown an alternative and preferred arrangement of my invention. This circuit has been used with the blanking impulses in the black direction. This arrangement is similar to that of Fig. 1 with the exception that an additional time constant circuit comprising resistor 18 and condenser 19 has been interposed between the output circuit of the element feeding into this apparatus and the time constant circuit 15—16. The time constant circuit 18—19 is a low impedance, short time constant, arrangement that might be for instance of the order of .001 seconds. The low impedance of this circuit practically suppresses low frequency phenomena such as microphonics, "bouncing" and the like. Purely by way of example, in an operation where the linear scansion time is 75 microseconds, the values of the time constant circuits have been such that 300 microseconds have elapsed before condenser 16 drops to ⅓ charge. Values used in actual practice have been such that resistance 15 has a value of 4 megohms, condenser 16 has a value of 75 micromicrofarads, resistance 18 has a value of 2 megohms and condenser 19 has a value of 150 micromicrofarads. These parameters were used with a linear scansion time of approximately 75 microseconds. If the time constant be shortened from that indicated and for the assumed scanning rate, it may tend to change picture brightness across one line or between times of charging of the condenser re-establishing the D. C. component.

One of the main reasons for using the two time constant circuits rather than one is that where one is used, the value of the resistance element of the time constant circuit cannot be made sufficiently high adequately to reinsert the direct current component of the signal as the time constant value of the circuit is to be such as to sufficiently eliminate or minimize the undesired low frequency components of the received signal, such as microphonics and the like.

Accordingly since the response of the circuit in re-establishing the D. C. component utilizes a time which may be the scanning time of a few of the lines of the picture, it may be said that the time of several scanning lines per field of the picture or image is the time constant response of the circuit.

What I claim is:

1. In television apparatus wherein there is received recurrent signals indicative of the optical values of an image undergoing scansion and wherein there is received a recurrent signal indicative of the black level of the image undergoing scansion and wherein the direct current component of the signals developed during scansion of the optical image is inaccurately represented, apparatus for restoring a direct current component to said received signals comprising a thermionic tube having anode, cathode and at least one control electrode, a first resistor connected between said control electrode and a point of reference potential, a first condenser, a second resistor connected serially with the control electrode, the first condenser and the point of reference potential, and a second condenser connected serially with the first condenser, the time constant of the circuit formed by the first resistor and first condenser being in the neighborhood of the time of occurrence of several of the recurrent signals and the time constant of the circuit formed by second condenser and second resistor being short as compared to the time constant of the circuit formed by the first resistor and first condenser.

2. In television apparatus wherein there is received recurrent trains of signals each train of which is indicative of the optical values of a line of an image undergoing scansion and wherein there are received recurrent signals spaced apart by a signal train and indicative of the black level of the image undergoing scansion and wherein the direct current component of the signals developed during scansion of the optical image is inaccurately represented in the received signals, apparatus for restoring a direct current component to the received signals comprising a thermionic tube having a plurality of electrode members, a first time constant circuit comprising a serially connected condenser and resistor, the time constant circuit being connected in the circuit of two of the electrodes of the thermionic tube, a second time constant circuit having a time constant value of the order of several times that of the first time constant circuit comprising a serially connected condenser and resistor and supplied by signals from the first time constant circuit, the second time constant circuit being connected in shunt with at least a portion of the first time constant circuit and means for connecting a load circuit to said thermionic tube to derive therefrom signals having the direct current component restored thereto.

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