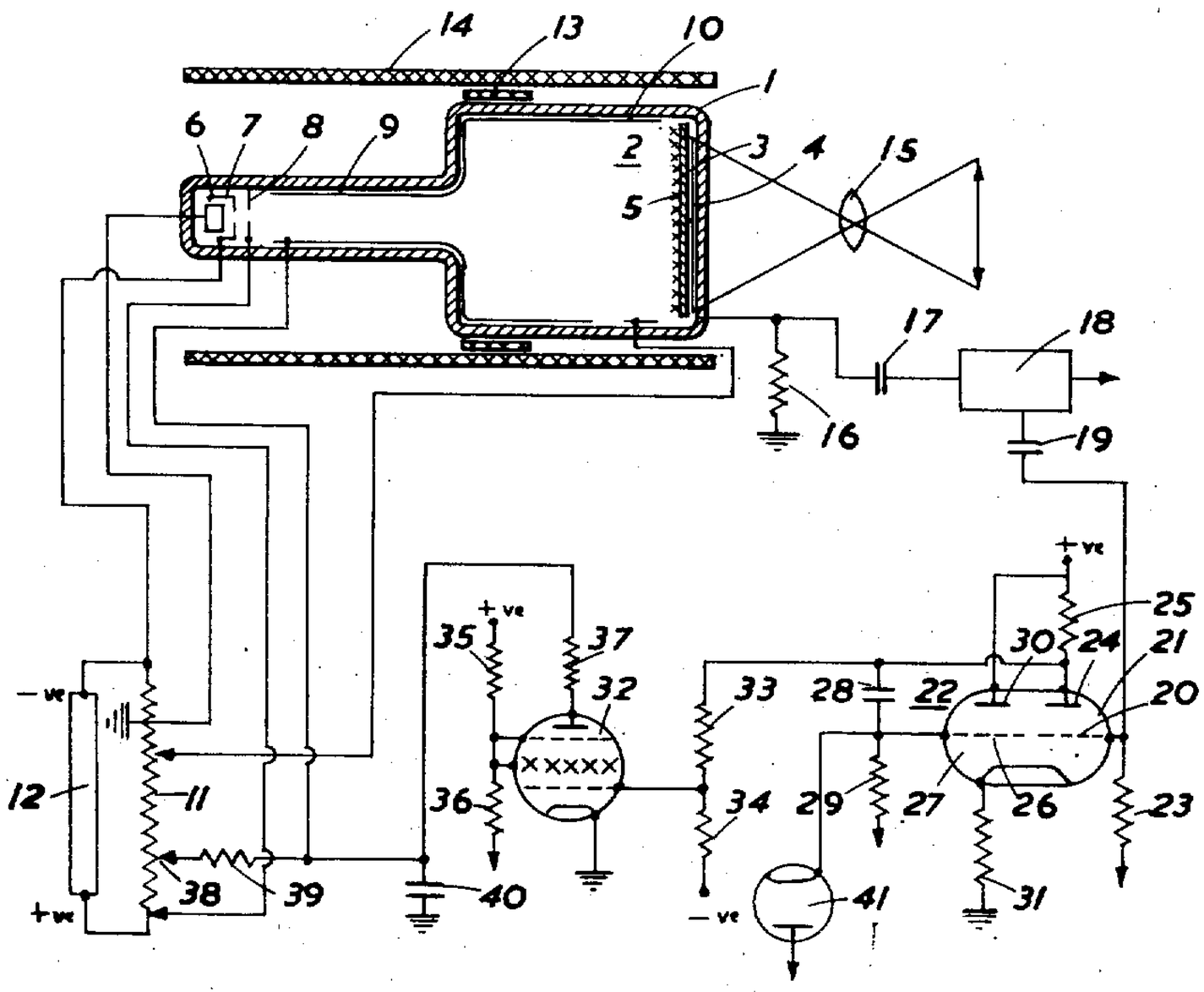
Sept. 29, 1953 J. D. McGEE ET AL 2,654,048

CIRCUITS EMBODYING CATHODE POTENTIAL STABILIZED ELECTRON DISCHARGE DEVICES

Filed May 23, 1950



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Patented Sept. 29, 1953

2,654,048

UNITED STATES PATENT OFFICE

2,654,048

CIRCUITS EMBODYING CATHODE POTENTIAL STABILIZED ELECTRON DISCHARGE DEVICES

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Application May 23, 1950, Serial No. 163,642
In Great Britain June 3, 1949

5 Claims. (Cl. 315—11)

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This invention relates to circuits embodying cathode potential stabilised pick-up tubes.

Cathode potential stabilised pick-up tubes are used in television transmission systems and comprise a target electrode on to which an optical or electron image of a subject for transmission is projected, the target electrode being scanned to generate picture signals by a low velocity electron beam so that the equilibrium potential of the target electrode corresponds substantially to the potential of the cathode from which the scanning beam is derived. Such tubes, however, suffer from the disadvantage that they become "unstable" when subjected to sudden increases in illumination or when one part of the picture is intensely illuminated. For example, when such tubes are employed for transmitting pictures, if a flashlight bulb is ignited for photographic purposes the whole scene becomes intensely illuminated and the electron emission from the target electrode becomes so intense that the potential of the target electrode rapidly increases well above cathode potential with the result that the tube becomes unstable. The intense emission from the target electrode in this case gives rise to a signal excursion in the blacker-than-black direction. If part only of the picture is intensely illuminated it is again found that the tube may become unstable but in this case the intensely illuminated part of the picture gives rise to a signal excursion which extends in the whiter-than-white direction.

The object of the present invention is to provide an improved circuit arrangement embodying a cathode potential stabilised pick-up tube which is adapted to cause the tube to be rapidly restored to a stable condition after being rendered unstable.

According to the present invention there is provided a circuit arrangement embodying a cathode potential stabilised pick-up tube in which the signal output of the tube during operation contains signal excursions in the blacker-than-black or whiter-than-white direction when the tube becomes unstable and wherein means are provided for utilising said signal excursions for varying the normal operating conditions of said tube for a predetermined time so as to reduce electron emission from the target electrode of said tube which gives rise to said signal excursions and for thereafter restoring said normal operating conditions. Preferably, the normal operating conditions of said tube are varied by reducing the potential which is applied to an electrode of said tube which is employed to collect electron emission from the target electrode, said former electrode being preferably the usual wall anode. By reducing said potential the electron emission from the target electrode is suppressed, the wall anode potential being reduced for a sufficient time to allow the electron beam to discharge the charges which were built up on the target electrode by the excessive light and hence allows the target electrode to be restabilised at cathode potential.

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In order that the said invention may be clearly understood and readily carried into effect, it will now be more fully described with reference to the accompanying drawing which illustrates a circuit arrangement according to the invention.

As shown in the drawing, the pick-up tube 1 comprises a target electrode 2 composed of a sheet 3 of transparent insulating material, such as mica, on one side of which is deposited a semi-transparent signal electrode 4 which is in contact with the sheet 3, whilst on the other side of said sheet 3 is a mosaic of photo-electric conducting elements 5. The side of the target electrode having the mosaic elements 5 is arranged to be scanned by a low velocity scanning beam which is generated by a suitably disposed electron gun. The electron gun comprises a cathode 6, a cathode shield 7, an apertured anode 8 and a further electrode 9 consisting of a metallic wall coating and forming the usual wall anode. The cathode 6 may be maintained at earth potential, the shield 7 at a negative potential thereto, the anode 8 at a positive potential and the electrode 9 usually at a slightly lower positive potential than the anode 8. Near to the target electrode 2 is a decelerating electrode 10 which is maintained at a less positive potential than the electrode 9. The electrodes 6 to 10 are conventionally shown as deriving their potentials from a potentiometer 11 connected across a source of potential 12. The electron beam from the gun is accelerated by the anode 8 and decelerated by the electrodes 9 and 10 and is scanned over the surface of the target electrode 2 at line and frame frequencies by scanning coils indicated at 13. The electron beam is

focussed by and is arranged to scan the surface of the target electrode in the presence of a longitudinal magnetic field set up by a solenoid 14 and the arrangement is such that the beam is caused to impinge on the target electrode substantially normally throughout the whole scanning cycle in known manner. An optical image for transmission is projected by an optical system 15 through the signal electrode 4 through the sheet 3 on to the photo-electric mosaic elements 5. Photo-electrons are thereby caused to be emitted from the elements 5 and are collected by the electrode 9 causing positive charges to be accumulated on said elements according to the intensity of elementary areas of the optical image. The target electrode is then scanned at line and frame frequencies with the low velocity scanning beam emanating from the cathode 6, in known manner. Scanning of the target electrode with the scanning beam restores the elements of the target electrode to a potential corresponding substantially to that of the cathode 6, restoration of said charges serving to set up across a signal resistance 16 connected to the signal electrode 4 picture signals which are fed by condenser 17 to an amplifier 18.

As stated above, when the pick-up tube 1 becomes unstable signal excursions occur which extend in either the blacker-than-black or whiter-than-white direction and in accordance with the present invention these signal excursions are utilised in order to restore the pick-up tube rapidly to a stable condition. For this purpose the signal excursions which appear in the amplifier 18 are fed through a coupling condenser 19 to the control electrode 20 of one valve 21 of a multivibrator indicated generally at 22, the control electrode being provided with a leak resistance 23. The anode 24 is connected to a source of positive potential through a resistance 25 and is also connected to the control electrode 26 of the other valve 27 of the multivibrator through a time constant circuit comprising a condenser 28 and resistance 29. The anode 30 of said valve 27 is connected to said source of positive potential whilst the common cathode of the two valves of the multivibrator is provided with a cathode resistance 31. The operation of the multivibrator is such that it is arranged to be triggered by a signal excursion extending in the blacker-than-black direction so as to cause a further valve 32 to be rendered conducting so as to cause variation in the normal operating conditions of the tube 1. These normal operating conditions in the embodiment of the invention shown are varied by causing a reduction in the potential of the electrode 9 which normally serves to collect electron emission from the target electrode 2. The electrode 9 may be normally maintained at a potential of about 150 volts and the operation of the circuit according to the invention may be arranged to reduce this potential to about 4 volts for a sufficient time which is determined by the time constant of the circuit comprising condenser 28 and resistance 29 and which may be about one-tenth of a second, so that it no longer collects the emission from the target electrode but still allows the scanning beam to reach the target electrode with low energy and for sufficient time to stabilise the target electrode to cathode potential. The valve 32 is arranged to be rendered conducting when the multivibrator is triggered by said signal excursions for which purpose the control electrode of said valve 32, which is shown as a pentode,

is connected to the anode 24 through a coupling resistance 33, said control electrode being connected to a suitable source of negative potential through a resistance 34. The screening electrode and suppressor electrode of the valve 32 are connected together and are maintained at suitable potentials by resistances 35 and 36. The anode of the valve 32 is connected through resistances 37 and 39 to the tapping point 38 on the potentiometer 11, the electrode 9 being connected to the junction of resistances 37 and 39. The electrode 9 is decoupled to earth by a condenser 40. When the valve 32 is rendered conducting the potential of the electrode 9 is reduced to a potential of a few volts, determined by the ratio of resistances 37 and 39 and is restored to its normal operating potential when the valve 32 is rendered non-conducting. The multi-vibrator 22 is so arranged that the valve 21 is normally conducting and is rendered non-conducting as soon as a signal excursion occurs in the blacker-than-black direction. When said valve 21 is rendered non-conducting the potential of its anode 24 rapidly rises, which rise of potential is applied to the control electrode 26 so that the valve 27 is rendered conducting for a time depending on the time constant of the condenser 28 and resistance 29. The valve 32 is also then rendered conducting so as to reduce the potential of the electrode 9 as aforesaid. When the charge in the time constant circuit above-mentioned falls to a predetermined value the valve 27 is rendered non-conducting and the valve 21 is rendered conducting. When the valve 21 thus becomes conducting the potential of its anode falls, such fall of potential being communicated to the valve 32 so that this valve is rendered non-conducting thereby restoring the potential of the electrode 9 to its normal operating value. The fall of potential of the anode of valve 21 is also communicated to the time constant circuit 28 and 29 and in order to reduce the decay time of said circuit so that the potential of the control electrode 26 is brought rapidly to a condition to be rendered conducting when a further excursion occurs in the blacker-than-black direction the junction point of the condenser 28 and resistance 29 is connected to a diode 41 which is arranged to be rendered conducting as soon as the potential of the anode 24 is reduced when the valve 21 is rendered conducting.

It will thus be appreciated that in accordance with the invention the signal excursions which occur in the blacker-than-black direction as a result of a sudden change in illumination cause the operating conditions of the pick-up tube to be so varied that the target electrode can be stabilised rapidly so that the effect of the tube becoming unstable is rendered less noticeable in a television receiver.

The anode of the diode 41 may be taken to a point which is driven positive on the occurrence of other events which make it desirable to reduce the wall anode potential, e. g., the failure of either or both of the scan generators. Such event will then hold the multivibrator permanently tripped and produce the desired result as long as the scan failure persists.

The circuit will also operate on whiter-than-white signal excursions of sufficient amplitude, since these will be reversed in phase by valve 20 and rectified by diode 41, causing the multivibrator to trip immediately following such an ex-

cursion. Alternatively, the signal input to valve 20 may be reversed in phase.

Although the invention has been described above as applied to a pick-up tube in which the target electrode is photo-sensitive and adapted to receive an optical image, it will be appreciated that the invention can be applied to pick-up tubes in which an electron image is adapted to be projected on to the target electrode. Furthermore, in some types of cathode potential stabilised tubes, electrons of the scanning beam which are not required for stabilising the potential of the target electrode are sometimes employed for generating the picture signals and it will also be appreciated that the invention can be applied to pick-up tubes operating in this manner.

What we claim is:

1. A circuit arrangement embodying a cathode potential stabilized pick-up tube having a signal output electrode and a target electrode with said tube rendered unstable under the influence of excessive electron emission due to abnormal changes in illumination, whereby signals developed in said output electrode contain signal excursions exceeding a predetermined desired level, said tube having a further electrode disposed in a position near said target electrode to control electron emission therefrom, and means coupled to said output electrode responsive to signal excursions exceeding said predetermined level to apply a potential to said further electrode for a predetermined time to reduce electron emission from said target electrode.

2. A circuit arrangement embodying a cathode potential stabilized pick-up tube having a signal output electrode and a target electrode with said tube rendered unstable under the influence of excessive electron emission due to abnormal changes in illumination, whereby signals developed in said output electrode contain signal excursions exceeding a predetermined desired level, a further electrode disposed in a position near said target electrode to control electron emission therefrom, means to maintain said further electrode at a potential to collect said electron emission, and means coupled to said output electrode and responsive to signal excursions exceeding said predetermined level to vary said potential for a predetermined time to reduce electron emission from said target electrode.

3. A circuit arrangement embodying a cathode potential stabilized tube having a signal output electrode and a target electrode with said tube rendered unstable under the influence of excessive electron emission due to abnormal changes in illumination, whereby signals developed in said

output electrode contain signal excursions, exceeding a predetermined desired level, said tube having a further electrode disposed in a position near said target electrode to control electron emission therefrom, a trigger device and means coupled to said output electrode responsive to signal excursions exceeding said predetermined level to trigger said device, and means controlled by said trigger device to apply a potential to said further electrode for a predetermined time to reduce electron emission from said target electrode.

4. A circuit arrangement embodying a cathode potential stabilized tube having a signal output electrode and a target electrode with said tube rendered unstable under the influence of excessive electron emission due to abnormal changes in illumination, whereby signals developed in said output electrode contain signal excursions exceeding a predetermined desired level, a wall anode, means to maintain said wall anode at a potential to collect electron emission from said target electrode, and means coupled to said output electrode responsive to signal excursions exceeding said predetermined level to apply a potential to said wall anode for a predetermined time to reduce electron emission from said target electrode.

5. A circuit arrangement embodying a cathode potential stabilized tube having a signal output electrode and a target electrode with said tube rendered unstable under the influence of excessive electron emission due to abnormal changes in illumination, whereby signals developed in said output electrode contain signal excursions exceeding a predetermined desired level, a wall anode, means to maintain said wall anode at a potential to collect said electron emission, a trigger device and means coupled to said output electrode responsive to signal excursions exceeding said predetermined level to trigger said device, and means controlled by said trigger device to apply a potential to said wall anode for a predetermined time to reduce electron emission from said target electrode.

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