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(54) CINE CAMERAS

(71) We, AGFA-GEVAERT AKTIEN-GESELLSCHAFT, a body corporate recognised under the laws of the Federal Republic of Germany, of Leverkusen, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to cine cameras.

The invention provides a cine camera comprising a bridge circuit including photo-sensitive means in one arm and resistive means in an adjacent arm, wherein the bridge circuit is so connected that, in use, it adjusts at a constant rate, the quantity of light passing to the photo-sensitive means and to the film, the bridge circuit being in balance at the desired exposure, and wherein means is provided for suddenly producing a voltage offset at the junction point of the photo-sensitive means and the resistive means, the voltage offset being such as to cause the intensity of illumination on the film to change by a predetermined amount to produce a fade-out but such that the control capacity of the bridge circuit is maintained in the fade-out state, and the means also being capable of producing a voltage offset at the junction point such as to cause the intensity of illumination in the film to change by the same amount to produce a fade-in.

The sudden voltage offset at the junction point can be produced by actuation of a fade control. The resulting bridge circuit imbalance causes the quantity of light passing to the photo-sensitive means and to the film to vary to cause a fade-out. When the fade-out state is reached, the bridge circuit is in balance and exposure regulation in accordance with the ambient lighting conditions can take place. A fade-in operation may be then performed by producing a

further voltage offset to cause the intensity of illumination to change back by the same amount, for example the same number of stops: the bridge circuit will then again be in balance. This makes it possible for dissolve operations to be performed in a simple manner which are substantially independent of changes in the ambient brightness between fade-out and fade-in. Since the quantity of light passing to the film is adjusted at a constant rate, the fade-out time and the fade-in time will be constant and equal to each other.

The quantity of light passing to the film can advantageously be affected by controlling the diaphragm aperture, behind which the photo-sensitive means may be placed.

In operation, the quantity of light passing to the photo-sensitive means and to the film may be controlled by an electromagnetic drive, for example, a motor, and the motor may be controlled via a gate which is open only when the bridge circuit is out of balance. The motor may be a stepping motor and a pulse generator may be provided for controlling the motor, to provide a constant speed of alteration of the light flow.

The voltage offset means may comprise means for altering the resistance value of an arm of the bridge not containing the photosensitive means. The means for altering the resistance value may comprise means for altering the resistance of the resistive means, for example, by switching in an additional resistor, which may be achieved by switching in a resistor which was previously short-circuited. Thus, for example, the resistor may be switched in to produce a fade-out and short-circuited to produce a fade-in.

The junction point of the resistive means and the photo-sensitive means may be connected to the non-inverting input of an operational amplifier which has its inverting

input connected to the tapping between the other two arms of the bridge.

The photo-sensitive means may be photo-sensitive means, for example, a photo-resistor, or may be photo-voltaic means, for example, a voltage-producing photo-diode.

A cine camera constructed in accordance with the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows the circuitry arrangement of a dissolve device of the camera; and

Figure 2 shows a graph of the light illumination as a function of time.

Referring to Figure 1, photo-resistive means comprising a photo-resistor 2 is arranged in a first arm of a bridge circuit 1. In an adjacent arm of the bridge, resistive means comprising two series-connected resistors 3 and 4 are provided, and the resistor 4 is bridged by means of a fade (or dissolve) control 5. A resistor 6 is arranged in the third arm and a resistor 7 in the fourth arm. The junction between the arms 6 and 7 provides a reference voltage with which the voltage at the junction point between the photo-resistor 2 and the resistors 3 and 4 can be compared. The difference between the voltage at the junction point and the reference voltage controls an aperture diaphragm 15.

The junction between the photo-resistor 2 and the resistor 3 is connected to the non-inverting input of an operational amplifier 8, which has its inverting input connected by way of a resistor 9 to the junction between the resistor 6 and the resistor 7. The inverting input of the operational amplifier 8 is also connected by way of a resistor 10 to its output. In the output circuit of the operational amplifier 8 a gate circuit 11 is arranged which has its input connected to a pulse generator 12. Two output leads of the gate circuit are connected to a stepping motor control device 13 for forward and reverse control. The stepping motor SM is connected by way of a mechanical connection 14 to the aperture diaphragm 15. Two batteries are indicated by 16 and 17.

The dissolve control 5 is connected by way of a mechanical connection 18 to an actuating device 19.

The method of operation is as follows:

It is assumed that the bridge circuit 1 is balanced and therefore the stepping motor SM is stationary. The resistance of the photo-resistor 2 is equal to that of the resistor 3. The diaphragm aperture is set at an appropriate value to give the desired exposure under the lighting conditions obtained. There is therefore a particular intensity of illumination on the film B1 (Figure 2).

If the actuating device 19 is now operated by a camera-user to bring about

the opening of the dissolve control 5, the resistance of the appropriate arm of the bridge is very suddenly increased by the resistance value of the resistor 4 to produce a voltage offset at the junction of the resistor 3 and the photo-resistor 2. This means that the bridge circuit 1 is suddenly thrown out of balance, and a regulating voltage occurs between the two inputs of the operational amplifier 8. The gate circuit 11 is therefore switched through, so that the pulses from the pulse generator 12 can reach the stepping motor control device 13 by way of the input controlling the stepping motor SM, and cause the closing of the diaphragm aperture 15 for a fade-out.

During the fade-out phase the exposure regulating means operates effectively independently of the prevailing lighting conditions. When the bridge circuit 1 reaches its state of equilibrium as a result of an increase in the resistance value of the photo-resistor 2, the gate circuit 11 is blocked and consequently the supply of control pulses to the stepping motor control device 13 is interrupted. When the bridge circuit 1 is in this state of balance, there is an intensity of illumination B 2 (Figure 2) on the film which corresponds approximately to a light stage reduction by 6 light stages, which means that the aperture has been reduced by six stops. The illumination intensity B 2 is sufficiently low for an adequate fade-out effect to be obtained. However, besides the achievement of an adequate fade-out effect, the diaphragm 15 can be regulated satisfactorily in accordance with prevailing light conditions in the faded-out state.

Referring to Figure 2, the illumination intensity B 2 is reached after a time t_n associated with the image n. In a manner which is not shown, the film is then wound back by the fade-out length, and the fade-in operation can then be initiated. Due to the fact that the regulating capacity is not eliminated, the illumination intensity B 2 is maintained independently of the brightness of the scene being photographed. Thus, if the lighting conditions now alter before commencement of the fade-in phase, for example, if the camera is to be faded-in on a brighter scene than that on which fade-out was performed, then before commencement of the fade-in the exposure is automatically reduced until the regulating voltage across the bridge returns to zero.

If the control 5 is now closed for a fade-in operation, the resistance value of the corresponding bridge branch is reduced by the resistance value of the resistor 4 to the resistance value of the resistor 3. After the time t_n , the illumination intensity B 1 is reached again. The bridge circuit 1 is now restored to its original state of balance.

The illumination of the film which is being

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exposed has, independently of the prevailing lighting conditions, a first value before the fade-out and, after the fade-out, a second value which is reduced by a constant amount. The ratio of the intensities of illumination is therefore independent of the brightness of the subject, and the illumination intensity difference $B_1 - B_2$ or the light flow difference or the light stage difference, respectively, is constant.

WHAT WE CLAIM IS:—

1. A cine camera comprising a bridge circuit including photo-sensitive means in one arm and resistive means in an adjacent arm, wherein the bridge circuit is so connected that, in use, it adjusts at a constant rate the quantity of light passing to the photo-sensitive means and to the film, the bridge circuit being in balance at the desired exposure, and wherein means is provided for suddenly producing a voltage offset at the junction point of the photo-sensitive means and the resistive means, the voltage offset being such as to cause the intensity of illumination on the film to change by a predetermined amount to produce a fade-out but such that the control capacity of the bridge circuit is maintained in the fade-out state, and the means also being capable of producing a voltage offset at the junction point such as to cause the intensity of illumination on the film to change by the same amount to produce a fade-in.

2. A cine camera as claimed in claim 1, in which the quantity of light passing to the photo-sensitive means and to the film is, in operation, controlled by a motor, and the motor is, in operation controlled via a gate which is open only when the bridge circuit is out of balance.

3. A cine camera as claimed in claim 2, in which the motor is a stepping motor and a pulse generator is provided for controlling the motor.

4. A cine camera as claimed in any one of claims 1 to 3, in which the bridge circuit

has an operational amplifier connected to its output terminals.

5. A cine camera as claimed in claim 4, in which the non-inverting input of the amplifier is connected to the said junction point and the inverting input is connected to the tapping between the other two arms of the bridge circuit.

6. A cine camera as claimed in any one of claims 1 to 5, in which the voltage means offset comprises means for altering the resistance value of an arm of the bridge not containing the photo-sensitive means.

7. A cine camera as claimed in claim 6, in which the means for altering the resistance value comprises means for altering the resistance of the resistive means.

8. A cine camera as claimed in claim 7, in which the means for altering the resistance comprises means for switching in and out an additional resistor.

9. A cine camera as claimed in any one of claims 1 to 8, in which the photo-sensitive means is photo-resistive means.

10. A cine camera as claimed in any one of claims 1 to 9, in which the quantity of light is controlled, in use, by controlling the diaphragm aperture.

11. A cine camera as claimed in claim 1, in which a stepping motor is used for controlling the quantity of light passing to the photo-sensitive means and to the film.

12. A cine camera as claimed in any one of claims 1 to 5, in which the resistive means comprises two resistors connected in series, one of which can be selectively bridged to alter the ratio of the resistances.

13. A cine camera substantially as hereinbefore described with reference to, and as shown in, Figures 1 and 2 of the accompanying drawings.

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WHAT WE CLAIM IS:—

1. A cine camera comprising a bridge circuit including photo-sensitive means in one arm and resistive means in an adjacent arm, wherein the bridge circuit is so connected that, in use, it adjusts at a constant rate the quantity of light passing to the photo-sensitive means and to the film, the bridge circuit being in balance at the desired exposure, and wherein means is provided for suddenly producing a voltage offset at the junction point of the photo-sensitive means and the resistive means, the voltage offset being such as to cause the intensity of illumination on the film to change by a predetermined amount to produce a fade-out but such that the control capacity of the bridge circuit is maintained in the fade-out state, and the means also being capable of producing a voltage offset at the junction point such as to cause the intensity of illumination on the film to change by the same amount to produce a fade-in.

2. A cine camera as claimed in claim 1, in which the quantity of light passing to the photo-sensitive means and to the film is, in operation, controlled by a motor, and the motor is, in operation controlled via a gate which is open only when the bridge circuit is out of balance.

3. A cine camera as claimed in claim 2, in which the motor is a stepping motor and a pulse generator is provided for controlling the motor.

4. A cine camera as claimed in any one of claims 1 to 3, in which the bridge circuit

has an operational amplifier connected to its output terminals.

5. A cine camera as claimed in claim 4, in which the non-inverting input of the amplifier is connected to the said junction point and the inverting input is connected to the tapping between the other two arms of the bridge circuit.

6. A cine camera as claimed in any one of claims 1 to 5, in which the voltage means offset comprises means for altering the resistance value of an arm of the bridge not containing the photo-sensitive means.

7. A cine camera as claimed in claim 6, in which the means for altering the resistance value comprises means for altering the resistance of the resistive means.

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9. A cine camera as claimed in any one of claims 1 to 8, in which the photo-sensitive means is photo-resistive means.

10. A cine camera as claimed in any one of claims 1 to 9, in which the quantity of light is controlled, in use, by controlling the diaphragm aperture.

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