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(54) IMPROVEMENTS IN AND RELATING TO CINE CAMERAS

(71) We, AGFA-GEVAERT AKTIENGES-
ELLSCHAFT, a body corporate recognised
under German Law, of Leverkusen, Ger-
many, 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 present invention relates to cine
cameras.

The invention provides a cine camera hav-
ing fade means for producing a fade-out
and/or a fade-in, the fade means including
a liquid crystal arranged in the path of the
image-producing rays, the fade-out and/or
fade-in being arranged to take place in re-
sponse to variation in the proportion of the
rays transmitted by the liquid crystal.

Liquid crystals have the advantage that
they can alter their permeability to light
(that is to say, the proportion of a beam
of light that they transmit) almost immedi-
ately the appropriate impulse is applied to
them, and so that fade-out and/or fade-in
operation can take place almost immedi-
ately the appropriate impulse is applied.
The arrangement according to the invention
also has the advantage that no moving parts
need be involved, and the possibility of over-
shooting in a fade-in or fade-out operation
and consequent incorrect exposures after
termination of a dissolve operation, can be
avoided. Further the fade means need take
up only a small space, and be inexpensively
constructed. Examples of suitable liquid
crystals are described in United States Patent
Specification No. 3,476,029 and are referred
to therein as electrochromic cells.

Advantageously, the liquid crystal is such
that the proportion of the rays transmitted
by the liquid crystal varies in response to
variation of an electric signal applied to the
liquid crystal, and preferably in response
to variation in the magnitude of a potential
difference applied across the liquid crystal.
Preferably, the variation in the proportion
of light rays transmitted with respect to the
applied potential difference is such that the

liquid crystal is transparent when the poten-
tial difference across it is zero.

Preferably, the fade means includes a
capacitor and the potential difference across
the liquid crystal varies in response to the
state of charge of the capacitor. The fade
means may include a Miller integrator; thus,
the fade means may include an inverting
direct coupled amplifier and resistive means,
the capacitor being connected between the
input and output of the amplifier and being
capable of being charged and discharged
through the resistive means; this causes the
potential difference across the liquid crystal
to vary in a linear manner. This linear
variation may instead be produced by an
arrangement in which the fade means in-
cludes a constant current source for effecting
the charging and discharging of the capaci-
tor.

The fade means may include an ampli-
fier, in the output circuit of which the liquid
crystal is connected, and a time constant
network so connected to the amplifier that
a varying signal can be applied by the ampli-
fier to the liquid crystal for effecting the
fade-out and/or fade-in. The amplifier may
be an operational amplifier, a capacitor be-
ing connected between an inverting input
and the output of the amplifier, and the
inverting input being connected by resistive
means to a switch arranged so that either
one pole of a battery or a non-inverting
input of the amplifier can be connected to
the inverting input via the resistive means.
The non-inverting input of the operational
amplifier can be connected to a tapping pro-
vided between two batteries.

Advantageously, the camera includes
means for controlling the exposure in rela-
tion to ambient lighting conditions. The
exposure control means may be arranged to
regulate the size of the diaphragm aperture.
Preferably, the liquid crystal is arranged
between the diaphragm aperture and the
exposure plane. The fact that there is no
coupling in the latter arrangement between
the fade means and the camera diaphragm

[Price 33p]

Price 75p

has the advantage that the fade means can have no effect on the control of the diaphragm aperture.

The camera may be capable of performing a dissolve operation.

A cine camera constructed in accordance with the invention will now be described, by way of example, with reference to the accompanying drawing, which shows the camera in diagrammatic form.

Referring to the Figure, the reference numeral 1 indicates part of an objective, the reference numeral 2 a further part of the objective. Between the two parts 1 and 2 of the objective diaphragm leaves 3 can be pivoted which co-operate with a moving coil meter provided with two windings 5 and 6. The winding 5 is connected in series with a rheostat 7 and the winding 6 is connected in series with a photo-resistor 8. Both series circuits are connected to a resistor 9.

The light incident on the photo-resistor 8 is deflected out of the image-producing rays O by means of a prism 10 and a mirror 11.

The cine camera comprises fade means which includes a liquid crystal 12 arranged in the path of the image-producing rays and control means 25 connected to the liquid crystal. The optical density of the liquid crystal can so vary in response to the electrical signal fed to it by the control means 25 that either a fade-out or a fade-in can be produced. The rate at which the fade-out and fade-in take place is arranged to be of the same magnitude to enable dissolve operations to be performed (although they could, if desired, be arranged to take place at different rates). In order for this to be achieved, the control means 25 produces a rising or falling voltage ramp, depending on the position of a switch 20, 21, for controlling the liquid crystal.

The control means 25 may be a Miller Integrator but other means can be used if desired.

An example of a suitable arrangement for the control means 25 for producing the desired rising or falling voltage ramp is described hereinafter and comprises a capacitor 18, a resistor 19 and an operational amplifier 17, which form a Miller Integrator. The liquid crystal 12 has terminals 13 and 14. The terminal 13 is connected to a tapping between two batteries 15 and 16, and the terminal 14 is connected to the output of the operational amplifier 17. The operational amplifier 17 is supplied by means of the two batteries 15 and 16. An inverting input of the operational amplifier 17 is connected via the capacitor 18 to the output of the operational amplifier. In addition, the inverting input is connected by way of the resistor 19 to the switch 20, 21, the actuating arm of which is indicated by the refer-

ence numeral 22. In its rest position 21, the switch is connected to the tapping between the two batteries 15 and 16.

By means of the contact 21 of the switch 20, 21, the inverting input can be connected to a non-inverting input of the operational amplifier, which is connected to the tapping between the two batteries 15 and 16.

A rotary shutter is indicated by the reference numeral 23 and the film (or exposure) plane is indicated by the reference numeral 24.

The method of operation of the apparatus when embodying the particular form of control means (17, 18, 19) described above is as follows. Corresponding to the prevailing brightness, a particular diaphragm aperture is set with the diaphragm leaves 3. When the contact 21 of the switch 20, 21 is closed, both the inverting and the non-inverting input of the operational amplifier are connected to the same potential, so that the voltage between the inputs is negligible, and the voltage across the liquid crystal is negligible. Thus the liquid crystal is transparent.

If a fade-out is to be carried out, the contact 20 of the switch 20, 21 is closed, and the capacitor 18 is charged via the resistor 19. Consequently, the voltage increases at the inverting input of the operational amplifier 17. In the final state this input has the positive potential of the battery 15, and the voltage between the two inputs of the operational amplifier is then equal to the voltage of the battery 15. Thus, under the influence of the time constant circuit 18, 19 and also under the influence of the amplifier 17, a voltage is produced which increases according to the time constants, and the result is that the liquid crystal transmits a slowly diminishing proportion of the image-producing rays until no light is transmitted, and a fade-out takes place.

If a fade-in operation is to be initiated after termination of the fade-out, the contact 20 of the switch 20, 21 is opened and the contact 21 is closed. The result is that the capacitor 18 slowly discharges. In the final state, the inverting input of the operational amplifier has the same potential as the non-inverting input. The capacitor 18 is then discharged. Thus, during a particular period of time, which is determined by the time constant of the time constant circuit and by the amplifier 17, the liquid crystal 12 is changed to its transparent state. The fade-in operation is thus terminated. The timing constant for the charge and discharge process are of the same magnitude.

During the fade-in and fade-out, the diaphragm leaves remain in the position dictated by the lighting conditions.

WHAT WE CLAIM IS:—

1. A cine camera having fade means for

has the advantage that the fade means can have no effect on the control of the diaphragm aperture.

The camera may be capable of performing a dissolve operation.

A cine camera constructed in accordance with the invention will now be described, by way of example, with reference to the accompanying drawing, which shows the camera in diagrammatic form.

Referring to the Figure, the reference numeral 1 indicates part of an objective, the reference numeral 2 a further part of the objective. Between the two parts 1 and 2 of the objective diaphragm leaves 3 can be pivoted which co-operate with a moving coil meter provided with two windings 5 and 6. The winding 5 is connected in series with a rheostat 7 and the winding 6 is connected in series with a photo-resistor 8. Both series circuits are connected to a resistor 9.

The light incident on the photo-resistor 8 is deflected out of the image-producing rays O by means of a prism 10 and a mirror 11.

The cine camera comprises fade means which includes a liquid crystal 12 arranged in the path of the image-producing rays and control means 25 connected to the liquid crystal. The optical density of the liquid crystal can so vary in response to the electrical signal fed to it by the control means 25 that either a fade-out or a fade-in can be produced. The rate at which the fade-out and fade-in take place is arranged to be of the same magnitude to enable dissolve operations to be performed (although they could, if desired, be arranged to take place at different rates). In order for this to be achieved, the control means 25 produces a rising or falling voltage ramp, depending on the position of a switch 20, 21, for controlling the liquid crystal.

The control means 25 may be a Miller Integrator but other means can be used if desired.

An example of a suitable arrangement for the control means 25 for producing the desired rising or falling voltage ramp is described hereinafter and comprises a capacitor 18, a resistor 19 and an operational amplifier 17, which form a Miller Integrator. The liquid crystal 12 has terminals 13 and 14. The terminal 13 is connected to a tapping between two batteries 15 and 16, and the terminal 14 is connected to the output of the operational amplifier 17. The operational amplifier 17 is supplied by means of the two batteries 15 and 16. An inverting input of the operational amplifier 17 is connected via the capacitor 18 to the output of the operational amplifier. In addition, the inverting input is connected by way of the resistor 19 to the switch 20, 21, the actuating arm of which is indicated by the refer-

ence numeral 22. In its rest position 21, the switch is connected to the tapping between the two batteries 15 and 16.

By means of the contact 21 of the switch 20, 21, the inverting input can be connected to a non-inverting input of the operational amplifier, which is connected to the tapping between the two batteries 15 and 16.

A rotary shutter is indicated by the reference numeral 23 and the film (or exposure) plane is indicated by the reference numeral 24.

The method of operation of the apparatus when embodying the particular form of control means (17, 18, 19) described above is as follows. Corresponding to the prevailing brightness, a particular diaphragm aperture is set with the diaphragm leaves 3. When the contact 21 of the switch 20, 21 is closed, both the inverting and the non-inverting input of the operational amplifier are connected to the same potential, so that the voltage between the inputs is negligible, and the voltage across the liquid crystal is negligible. Thus the liquid crystal is transparent.

If a fade-out is to be carried out, the contact 20 of the switch 20, 21 is closed, and the capacitor 18 is charged via the resistor 19. Consequently, the voltage increases at the inverting input of the operational amplifier 17. In the final state this input has the positive potential of the battery 15, and the voltage between the two inputs of the operational amplifier is then equal to the voltage of the battery 15. Thus, under the influence of the time constant circuit 18, 19 and also under the influence of the amplifier 17, a voltage is produced which increases according to the time constants, and the result is that the liquid crystal transmits a slowly diminishing proportion of the image-producing rays until no light is transmitted, and a fade-out takes place.

If a fade-in operation is to be initiated after termination of the fade-out, the contact 20 of the switch 20, 21 is opened and the contact 21 is closed. The result is that the capacitor 18 slowly discharges. In the final state, the inverting input of the operational amplifier has the same potential as the non-inverting input. The capacitor 18 is then discharged. Thus, during a particular period of time, which is determined by the time constant of the time constant circuit and by the amplifier 17, the liquid crystal 12 is changed to its transparent state. The fade-in operation is thus terminated. The timing constant for the charge and discharge process are of the same magnitude.

During the fade-in and fade-out, the diaphragm leaves remain in the position dictated by the lighting conditions.

WHAT WE CLAIM IS:—

1. A cine camera having fade means for



* C L M S *

producing a fade-out and/or a fade-in, the fade means including a liquid crystal arranged in the path of the image-producing rays, the fade-out and/or fade-in being arranged to take place in response to variation in the proportion of the rays transmitted by the liquid crystal.

2. A cine camera as claimed in claim 1, in which the liquid crystal is such that the proportion of the rays transmitted by the liquid crystal varies in response to variation of an electric signal applied to the liquid crystal.

3. A cine camera as claimed in claim 2, in which the liquid crystal is such that the proportion of the rays transmitted by the liquid crystal varies in response to variation in the magnitude of a potential difference applied across the liquid crystal.

4. A cine camera as claimed in claim 3, in which the liquid crystal is transparent when the potential difference across the liquid crystal is zero.

5. A cine camera as claimed in claim 3 or claim 4, in which the fade means includes a capacitor, and the potential difference across the liquid crystal varies in response to the state of charge of the capacitor.

6. A cine camera as claimed in claim 5, in which the fade means includes an inverting d.c. amplifier and resistive means, the capacitor being connected between the input and output of the amplifier and being capable of being charged and discharged through the resistive means.

7. A cine camera as claimed in claim 5, in which the fade means includes a constant current source for effecting the charging and discharging of the capacitor.

8. A cine camera as claimed in any one of claims 2 to 4, in which the fade means

includes an amplifier, in the output circuit of which the liquid crystal is connected, and a time constant network so connected to the amplifier that a varying signal can be applied by the amplifier to the liquid crystal for effecting the fade-out and/or fade-in.

9. A cine camera as claimed in claim 8, in which the amplifier is an operational amplifier, a capacitor is connected between an inverting input and the output of the amplifier, and the inverting input is connected by resistive means to a switch arranged so that either one pole of a battery or a non-inverting input of the amplifier can be connected to the inverting input via the resistive means.

10. A cine camera as claimed in claim 9, in which the non-inverting input of the operational amplifier can be connected to a tapping provided between two batteries.

11. A cine camera as claimed in any one of claims 1 to 10, in which the camera includes means for controlling the exposure in relation to ambient lighting conditions.

12. A cine camera as claimed in claim 11, in which the exposure control means is arranged to regulate the size of the diaphragm aperture.

13. A cine camera as claimed in claim 12, in which the liquid crystal is arranged between the diaphragm aperture and the exposure plane.

14. A cine camera substantially as hereinbefore described with reference to, and as shown in, the accompanying drawing.

ABEL & IMRAY,
Chartered Patent Agents,
Northumberland House,
303—306 High Holborn,
London, WC1V 7LH.

