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(54) EXPOSURE REGULATING CIRCUIT AND DEVICE

(71) We, AGFA-GEVAERT AKTIENGESELLSCHAFT, a body corporate organised according to 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:—

This invention relates to devices for regulating exposure for photographic apparatus, especially for cine cameras.

The invention provides an exposure regulating circuit suitable for photographic apparatus, comprising:—

(i) a four-arm d.c. bridge circuit having a light-sensitive element in one arm,

(ii) a differential amplifier having its gain set by external resistors and having a first input terminal connected to a corner of the bridge circuit adjacent to the light-sensitive element, a second input terminal connected to the corner of the bridge circuit opposite the corner to which the first input terminal is connected, and an output terminal,

(iii) first and second trigger stages connected to the output terminal of the amplifier and arranged to have respective first and second threshold levels which are such that, in operation, for a certain range of amplifier output values, only the first trigger stage is triggered, and, when the amplifier output value lies outside that range, neither trigger stage is triggered or both trigger stages are triggered,

(iv) an output control circuit having input terminals connected to the trigger stages and arranged to sense the respective states of the trigger stages, the output control circuit having at least one pair of output terminals and being arranged to provide, in operation, an output voltage difference between the said output terminal pair, in a first sense, when both trigger stages are triggered and in the opposite sense when neither trigger stage is triggered, and no voltage difference between the said output

terminal pair when only the first trigger stage is triggered.

The exposure regulating circuit in combination with a diaphragm arranged to control the amount of light reading the light-sensitive element and a motor arranged to move the diaphragm, provides an exposure regulating device which may be installed in a camera, for example.

By tuning the amplification of the differential amplifier to the threshold values of the two trigger stages it may be arranged that the motor is not energised until a point is reached, in either direction, at which the bridge voltage deviates from balance by a value which corresponds to a predetermined partial value of a stop setting of the diaphragm. By this means oscillation of the balancing circuit and of the diaphragm setting, is avoided.

Advantageously, there is connected after the second threshold trigger stage, which is the threshold trigger stage with the higher threshold value, an inverter stage, and a control signal for the running direction of the motor is derived from the output of the inverter stage. In an embodiment of the invention, the output control circuit includes an input sensing circuit arranged to perform the AND function, and a further inverter follows this.

Advantageously, the regulating device is used for the step-wise adjustment of a diaphragm aperture arrangement by means of a stepping motor.

An oscillator in the form of a pulse generator may be included in the output control circuit, when, in an advantageous manner, there is provided between the input sensing circuit and the pulse generator, as an electronic switch, a gate stage arrangement, to the control input of which there is applied by means of a switch actuable by the diaphragm on reaching the greatest, and if necessary the smallest, diaphragm opening, a blocking voltage which in dependence on the blocking state of the trigger stage with the lower threshold value causes, via a

corresponding control line, blocking of the gate stage arrangement (which is otherwise passable). This produces the advantage that on reaching the greatest aperture diaphragm opening, any possible damage to the diaphragm arrangement is avoided by switching off the stepping motor. Otherwise, if the brightness was reduced to such an extent that the greatest possible aperture opening was set, and bridge equilibrium was not yet achieved, the stepping motor would continue to be energised for the purpose of further regulation.

If now the brightness increases to such an extent that a smaller diaphragm aperture is to be set, the blocking of the gate stage arrangement is lifted, so that the stepping motor is supplied with current and the diaphragm contact can be opened.

According to a further arrangement, the gate stage arrangement has an AND-gate, in one control circuit of which there is arranged an OR-gate, the first input of which is connected to the output of the input sensing circuit of the output control circuit, and the second input of which is connected to a further OR-gate, one input of which is connected to the output of the first trigger stage (with the lower threshold value) and the other input of which is connected to the diaphragm switch on the actuation of which the potential at the associated input of the OR-gate is changed. By this means the AND-gate is blocked.

The windings of the motor may be connected to the output terminals of the output control circuit by way of power switches. The power switches are then arranged to be switched off when the bridge circuit is balanced and no output signal appears on the output terminal of the output control circuit. The output signal from the output control circuit may be made zero by arranging controllable switches to short-circuit adjacent output terminal pairs or to open-circuit each output terminal. The power switches and controllable switches may all be transistors.

The control inputs of the controllable switches can either be connected to the output of the pulse generator or to the input of the same. In the first case, the stepping motor is advantageously also without current during the balancing process in the pulse intervals, without its method of operation being impaired by this. As a result there is an additional saving of current. In the other case the transistors associated with the motor coils are only blocked in the case of there being balance.

It is to be understood that a trigger stage being triggered means that its threshold has been passed, in either direction.

The said range of values of the difference voltage corresponds to differences of

exposure that are within the latitude of the photographic material to be exposed. Preferably the said differences of exposure are such that the corresponding intensities of the images produced are substantially the same as each other.

The inverter stage connected after the trigger stage with the higher threshold level, and the input sensing circuit and its inverter with a NAND function together with the threshold trigger stages provide an arrangement whereby the NAND stage gives a "L" output when neither, and when both, trigger stages are triggered, but not in the equilibrium region when only the one with the lower threshold level is triggered.

Preferably an AND gate, is arranged to switch off and to disable the system if the diaphragm reaches full aperture.

A differential amplifier with variable amplification factor is provided for amplifying the difference voltage, the output of which amplifier is fed to the inputs of the trigger stages. The amplification determines by how much the bridge circuit can be brought in one or other direction from its state of balance without the outputs of the trigger stages being such that the electromagnetic means is energised. This adjustable bridge deviation determines, from the aperture set when the bridge is balanced, the allowable positive and negative diaphragm deviation for which readjustment does not occur.

Different film sensitivity may be taken account of by a grey foil or an additional diaphragm.

If the film sensitivity is taken into consideration by a grey filter arranged before the light sensitive receiver, the bridge balance is at first disturbed. By readjustment of the aperture, however, bridge balance is produced again, so that after reaching the equilibrium state, as a result of a changed film sensitivity the aperture is readjusted by the appropriate value. When there is only a slight change in brightness while the bridge-circuit is balanced, there is no readjustment of the aperture since a slight change in brightness does not result in the non-triggered trigger stage being energised. The amplifier which is variable in its amplification determines the admissible equilibrium range. This admissible aperture range is obviously so small that correctly exposed photographs appear on the film. This is possible because each film has a certain sensitivity tolerance range within which incorrectly exposed photographs do not occur.

The light flow can be adjusted by adjusting a diaphragm (for example, the diaphragm of a camera behind which the photosensitive means is arranged), but it could, in the case of a cine camera, be

adjusted by adjusting the size of opening on a rotary shutter of the camera.

The photographic apparatus may be a still or cine camera.

Four forms of regulating device constructed in accordance with the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figures 1 and 2 show a first form of regulating device, and

Figures 3 to 5 show second to fourth forms, respectively.

Referring to Figure 1, a bridge circuit contains a first voltage divider which has a photoresistor 1 and two resistors 2 and 3, in which the resistor 3 can be bridged by means of a switch 4, and a second voltage divider which has two fixed resistors 5 and 6. A voltage supply source is indicated by 7. From a bridge point A of the light-sensitive voltage divider 1, 2, 3 there is a connection via a resistor 8 to the inverting input of an operational amplifier 9, the non-inverting input of which is connected to a tapping B of the reference voltage divider 5, 6. The difference between the voltage at A with the reference voltage at B is thus fed across the inputs of the operational amplifier 9.

The amplification of the operational amplifier 9 may be adjusted by means of a feed-back resistor 10.

The difference voltage (between A and B), amplified by the amplifier 9, controls a pair of trigger stages 11-13 and 15-17. From the output C of the operational amplifier 9 there is a connection to the first trigger stage, consisting of two regeneratively-coupled inverter stages 11 and 12 and a feed-back resistor 13. A separate connection leads from the output C of the operational amplifier 9 to the potentiometer 14, the tapping of which is connected to the second trigger stage comprising two inverter stages 15 and 16 and a feed-back resistor 17. The two trigger stages 11-13 and 15-17 have different threshold values. The threshold values of the two trigger stages are symmetrical about the effective voltage at the output C of the operational amplifier 9 when the bridge circuit is exactly balanced. The trigger stage 11, 12, 13 has the lower threshold value and the trigger stage 15, 16, 17 the higher threshold value. An inverter stage 18 is connected after the trigger stage 15, 16, 17. The two trigger stage branches are connected to an AND-gate 19, 20, 21, which forms an input sensing circuit to the remainder of the circuit.

The output E of an inverter stage 24 connected after the AND-gate 19, 20, 21 is connected to one input of an AND-gate 25, the second input of which is connected to the output of an OR-gate 26. The first input of the OR-gate 26 is connected to the output

of the AND-gate 19, 20, 21, while the second input of the OR-gate 26 is connected to a further OR-gate 60. One input of the OR-gate 60 is connected to the output of the trigger stage 11, 12, 13, while the second input of OR-gate 60 is connected to a switch 27 which may be actuated by a diaphragm 28 when it has reached the largest aperture (that is, largest opening). A resistor 29 is connected in series with the switch 27, the resistor 29 being connected to the positive pole of the battery 7.

From the output of the AND-gate 25 there is a connection to a terminal H. The output of the AND-gate 25 is also connected to a pulse generator comprising an inverting trigger stage 30 and a time constant circuit 31, 32. The output of the pulse generator 30, 31, 32 is connected to a terminal F. The potential at the terminal F determines the state of a stepping motor 33 (that is, whether it is running or stationary). A switching point D is connected to a terminal G, the potential of which determines the direction of running of the stepping motor 33.

Referring to Figure 2, a forwards and backwards counter indicated generally by the reference numeral 34 has a first master-slave flip-flop 35 and a second master-slave flip-flop 36. The two clock inputs T of the two flip-flops 35 and 36 are both connected to the terminal F.

The terminal G is connected via a connecting lead to the first inputs of two AND-gates 37 and 38. It is also connected to the input of an inverting trigger stage 39. The second input of the AND-gate 37 is connected to the output Q of the flip-flop 36 and the second input of the AND-gate 38 is connected to the output Q of the flip-flop 35. The output of the AND-gate 37 is connected to the first input of an inverting OR-gate 40 and the output of the AND-gate 38 is connected to the first input of an inverting OR-gate 41. The second input of the inverting OR-gate 40 is connected to the output of a further AND-gate 42 and the second input of the inverting OR-gate 41 is connected to the output of a further AND-gate 43. One input each of the AND-gates 42 and 43 is connected to the output of the trigger stage 39, while the second input of the AND-gate 42 is connected to the output Q of the flip-flop 36 and the second input of the AND-gate 43 is connected to the output Q of the flip-flop 35. The output of the inverting OR-gate 40 is connected first directly to the K-input of the flip-flop 35 and second via an inverting trigger stage 44 to the J-input of the flip-flop 35. A corresponding connection leads from the output of the inverting OR-gate 41 to the J-input of the flip-flop 36 and via an inverting trigger stage 45 to the K-input of the flip-flop 36.

From the outputs Q and $\bar{Q}$ of the two flip-flops 35, 36 there are connections *via* output terminals A1, A2, A3, A4 and *via* resistors 46, 47, 48 and 49 to the bases of transistors 50, 51, 52 and 53. In the collector-emitter circuits of the transistors 50 to 53 there are excitation coils 54, 55, 56 and 57 of the stepping motor 33, the permanent magnetic armature (not shown in detail) of which is denoted by the numeral 58. A mechanical connection 59 leads from the armature 58 to the diaphragm 28, which is arranged in front of the photoresistor 1.

The terminal H is connected to the bases of transistors 61, 62, 63 and 64, the collector-emitter paths of which are connected in parallel with the corresponding base-emitter paths of the transistors 50 to 53.

The operation of the first form of regulating device is as follows.

It is assumed that the bridge circuit is out of balance to such an extent and in such a sense that the voltage at the output C of the operational amplifier 9 lies below the threshold values of the two trigger stages 11 to 13 and 15 to 17. Each trigger stage 11 to 13, and 15 to 17, is arranged to provide the potential "L" when its input signal exceeds the threshold value, and the potential "O" when its input signal lies below the threshold value. Because one input to the input sensing circuit consisting of 19, 20, and 21 is "O", the potential at the junction of 19 and 21 is "O", and the potential at the switching point E is accordingly "L". The output of the AND-gate 25 is "L" only when its further input also has the potential "L". This happens when the switch 27 is open (and when the threshold of the trigger stage 11 to 13 is not exceeded). When this happens, the pulse generator 30, 31, 32 is then switched on. The forwards and backwards counter 34 is set into operation by this pulse generator. In this particular case the potential at the terminal G which determines the running direction, is "L". The potential is "L" at all bases of the transistors 61 to 64 due to the connection with terminal H, so that all these transistors are blocked, and the transistors 50 to 53 can be excited.

Shortly before the bridge circuit has reached the state of equilibrium, the amplifier output level exceeds the threshold value of the trigger stage 11 to 13, the potential level at the junction of 19 and 21 rises to "L", the potential "O" occurs at the output E of the inverter stage 24, and the output level of the AND-gate 25 falls to "O". Consequently the pulse generator 30 to 32 is switched off, and the potential "O" is applied to all bases of the transistors 61 to 64, which then short-circuit the output terminals of the output control circuit. The

coils 54 to 57 of the stepping motor 33 are therefore not supplied with current, since the transistors 50 to 53 are switched off.

As long as the switch 27 is open the output of the OR-gate 60 is "L", since one input of the OR-gate 60 is then connected to a potential "L" through the resistor 29. Consequently the output of OR-gate 26 is also at potential "L". The other input of the OR-gate 60 is connected to the output of the trigger stage 11 to 13, which either has the potential "O" when the threshold value is fallen below or the potential "L" when the threshold value is exceeded.

The function of the switch 27 is to prevent the motor being driven when lighting conditions are so low that the "equilibrium" condition where only the trigger stage 11 to 13 has its threshold value exceeded cannot be achieved even with the largest aperture. The switch 27 is arranged to be closed by the diaphragm 28 when the largest possible aperture is reached. When the lighting level is low, the output of the trigger stage 11 to 13 has the potential "O", so that at the corresponding input of the OR-gate 60 the potential is "O". When the switch 27 is closed by the diaphragm 28, the other input of the OR-gate 60 also has the potential "O". Consequently the output of the OR-gate 60 is maintained at the potential "O" which results in the output level of the OR-gate 26 becoming "O", and so the "stop" potential "O" occurs at the output of the AND-gate 25. Thus it is ensured that both the pulse generator 30 to 32 is disconnected, and the transistors 50 to 53 are blocked. These reductions in the brightness can occur, for example, if the light-sensitive receiver 1 is completely darkened when not in use when the cinematographic camera 6 is still switched on.

If the light-sensitive receiver is subjected to ambient lighting, and the brightness is at least sufficient for the largest possible diaphragm aperture set to correspond to balance, the switch 27 remains open. When the threshold value of the trigger stage 11 to 13 is just exceeded both inputs of the OR-gate 60 have applied to them the potential "L". Consequently the output potential of the OR-gate 60 is also "L", with the result that the output of the OR-gate 26 is "L". As a result of this the corresponding input of the AND-gate 25 is held at the potential "L". If the aperture setting is correct the potential level at E is "O", and the AND-gate 25 is switched off. The potential level at H is "O", and the output terminals of the output control circuit are short-circuited. If the brightness now rises to such an extent that a smaller aperture must be set, then amplifier output level exceeds the threshold of the trigger stage 15 to 17, the AND-gate

19 to 21 goes to the potential "O", the potential level at E goes to "L", raising the corresponding input of the AND-gate 25 to the potential "L". The pulse generator 30 to 32 is switched on and the transistors 50 to 53 are unblocked by the transistors 61 to 64.

The second form of regulating device described with reference to Figure 3 is similar to the first form. Corresponding parts have been given the same reference numbers. The only difference between the first and second form is the arrangement of the transistors 65, 66, 67 and 68 which correspond to the transistors 61 to 64. The transistors 65 to 68 are arranged with their collector-emitter paths in the base circuits of the transistors 50' to 53'. The bases of the transistors 65 to 68 have a common connection to the terminal H.

The third form of regulating device, the circuit of which is shown in Figure 4 is also similar to the first form, and like parts have like reference numerals. The only difference with the form of Figure 4 is that AND-gates 69, 70, 71 and 72 are provided instead of transistors 61 to 64. One input of each of the AND-gates 69 to 72 is connected to a corresponding resistor 46", 47", 48" and 49", and the other inputs of the AND-gates 69 to 72 have a common connection to the terminal H.

In the fourth form of regulating device, in Figure 5 the parts corresponding to parts shown in Figure 1 are given the same reference numbers. The only difference between this form and the first form is that the terminal H' is connected to the output of the pulse generator 30' to 32', with the result that the corresponding coils of the stepping motor are without current during the intervals between pulses. The corresponding excitation coils are only supplied with current during the effective phase of each pulse. This has the advantage that current consumption is reduced even further.

WHAT WE CLAIM IS:—

1. An exposure regulating circuit suitable for photographic apparatus, comprising:—

(i) a four-arm d.c. bridge circuit having a light-sensitive element in one arm,

(ii) a differential amplifier having its gain set by external resistors and having a first input terminal connected to a corner of the bridge circuit adjacent to the light-sensitive element, a second input terminal connected to the corner of the bridge circuit opposite the corner to which the first input terminal is connected, and an output terminal,

(iii) first and second trigger stages connected to the output terminal of the amplifier and arranged to have respective first and second threshold levels which are such that, in operation, for a certain range

of amplifier output values, only the first trigger stage is triggered, and, when the amplifier output value lies outside that range, neither trigger stage is triggered or both trigger stages are triggered,

(iv) an output control circuit having input terminals connected to the trigger stages and arranged to sense the respective states of the trigger stages, the output circuit having at least one pair of output terminals and being arranged to provide, in operation, an output voltage difference between the said output terminal pair, in a first sense, when both trigger stages are triggered and in the opposite sense when neither trigger stage is triggered, and no voltage difference between the said output terminal pair when only the first trigger stage is triggered.

2. An exposure regulating circuit as claimed in claim 1, wherein the output control circuit includes an input sensing circuit arranged to perform the AND function, the first trigger stage is connected to the said input sensing circuit, and the second trigger stage is connected to the said input sensing circuit via an inverter.

3. An exposure regulating circuit as claimed in claim 2, wherein the input sensing circuit is followed by a further inverter.

4. An exposure regulating circuit as claimed in claim 2, or 3, wherein the signal from the output of the inverter which is connected to the second trigger stage is arranged to control the sense of the output voltage difference of the output control circuit.

5. An exposure control circuit as claimed in claim 3 or 4, wherein the output control circuit includes an oscillator which is arranged to be switched on and off by the output signal from an AND-gate.

6. An exposure regulating circuit as claimed in claim 5, wherein a first OR-gate is arranged to be controlled by the first trigger stage and a mechanical switch, a second OR-gate is arranged to be controlled by the first OR-gate and the input sensing circuit, and the AND-gate is arranged to be controlled by the second OR-gate and the inverter following the input sensing circuit.

7. An exposure regulating circuit as claimed in any one of claims 1 to 6, wherein one of the external resistors arranged to set the gain of the differential amplifier is a variable resistor.

8. An exposure regulating circuit as claimed in any one of claims 1 to 7, wherein each pair of output terminals of the output control circuit is provided by the respective output terminals of a JK flip-flop.

9. An exposure regulating circuit as claimed in claim 8, wherein each JK flip-flop is arranged for control by the inverted output signal from the second trigger stage.

19 to 21 goes to the potential "O", the potential level at E goes to "L", raising the corresponding input of the AND-gate 25 to the potential "L". The pulse generator 30 to 32 is switched on and the transistors 50 to 53 are unblocked by the transistors 61 to 64.

The second form of regulating device described with reference to Figure 3 is similar to the first form. Corresponding parts have been given the same reference numbers. The only difference between the first and second form is the arrangement of the transistors 65, 66, 67 and 68 which correspond to the transistors 61 to 64. The transistors 65 to 68 are arranged with their collector-emitter paths in the base circuits of the transistors 50' to 53'. The bases of the transistors 65 to 68 have a common connection to the terminal H.

The third form of regulating device, the circuit of which is shown in Figure 4 is also similar to the first form, and like parts have like reference numerals. The only difference with the form of Figure 4 is that AND-gates 69, 70, 71 and 72 are provided instead of transistors 61 to 64. One input of each of the AND-gates 69 to 72 is connected to a corresponding resistor 46", 47", 48" and 49", and the other inputs of the AND-gates 69 to 72 have a common connection to the terminal H.

In the fourth form of regulating device, in Figure 5 the parts corresponding to parts shown in Figure 1 are given the same reference numbers. The only difference between this form and the first form is that the terminal H' is connected to the output of the pulse generator 30' to 32', with the result that the corresponding coils of the stepping motor are without current during the intervals between pulses. The corresponding excitation coils are only supplied with current during the effective phase of each pulse. This has the advantage that current consumption is reduced even further.

WHAT WE CLAIM IS:—

1. An exposure regulating circuit suitable for photographic apparatus, comprising:—

(i) a four-arm d.c. bridge circuit having a light-sensitive element in one arm,

(ii) a differential amplifier having its gain set by external resistors and having a first input terminal connected to a corner of the bridge circuit adjacent to the light-sensitive element, a second input terminal connected to the corner of the bridge circuit opposite the corner to which the first input terminal is connected, and an output terminal,

(iii) first and second trigger stages connected to the output terminal of the amplifier and arranged to have respective first and second threshold levels which are such that, in operation, for a certain range

of amplifier output values, only the first trigger stage is triggered, and, when the amplifier output value lies outside that range, neither trigger stage is triggered or both trigger stages are triggered,

(iv) an output control circuit having input terminals connected to the trigger stages and arranged to sense the respective states of the trigger stages, the output circuit having at least one pair of output terminals and being arranged to provide, in operation, an output voltage difference between the said output terminal pair, in a first sense, when both trigger stages are triggered and in the opposite sense when neither trigger stage is triggered, and no voltage difference between the said output terminal pair when only the first trigger stage is triggered.

2. An exposure regulating circuit as claimed in claim 1, wherein the output control circuit includes an input sensing circuit arranged to perform the AND function, the first trigger stage is connected to the said input sensing circuit, and the second trigger stage is connected to the said input sensing circuit via an inverter.

3. An exposure regulating circuit as claimed in claim 2, wherein the input sensing circuit is followed by a further inverter.

4. An exposure regulating circuit as claimed in claim 2, or 3, wherein the signal from the output of the inverter which is connected to the second trigger stage is arranged to control the sense of the output voltage difference of the output control circuit.

5. An exposure control circuit as claimed in claim 3 or 4, wherein the output control circuit includes an oscillator which is arranged to be switched on and off by the output signal from an AND-gate.

6. An exposure regulating circuit as claimed in claim 5, wherein a first OR-gate is arranged to be controlled by the first trigger stage and a mechanical switch, a second OR-gate is arranged to be controlled by the first OR-gate and the input sensing circuit, and the AND-gate is arranged to be controlled by the second OR-gate and the inverter following the input sensing circuit.

7. An exposure regulating circuit as claimed in any one of claims 1 to 6, wherein one of the external resistors arranged to set the gain of the differential amplifier is a variable resistor.

8. An exposure regulating circuit as claimed in any one of claims 1 to 7, wherein each pair of output terminals of the output control circuit is provided by the respective output terminals of a JK flip-flop.

9. An exposure regulating circuit as claimed in claim 8, wherein each JK flip-flop is arranged for control by the inverted output signal from the second trigger stage.



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10. An exposure regulating circuit as claimed in any one of claims 1 to 9, wherein each pair of output terminals of the output control circuit is connected together by way of switch means which is arranged to short-circuit each pair of output terminals when the first trigger stage alone is triggered.
11. An exposure regulating circuit as claimed in any one of claims 1 to 9, wherein each output terminal of the output control circuit is connected in series with a respective switch means which is arranged to be open-circuit when the first trigger stage alone is triggered.
12. An exposure regulating circuit as claimed in any one of claims 1 to 11, wherein the output control circuit has two pairs of output terminals.
13. An exposure regulating device including an exposure regulating circuit as claimed in any one of claims 1 to 12, a diaphragm arranged to regulate exposure of the light-sensitive element to light, and a motor coupled to the diaphragm and arranged to adjust it, wherein the motor is connected to the output terminals of the output control circuit by way of power switches and is arranged to so adjust the diaphragm in response to the output signal from the output control circuit that the four-arm bridge circuit is balanced and the said output signal is removed.
14. An exposure regulating device as claimed in claim 13, wherein the diaphragm is arranged to actuate a switch when the largest aperture is reached, and the output control circuit is so arranged that the output signal is removed when the said switch is actuated.
15. An exposure regulating device substantially as herein described with reference to and as illustrated by Figs. 1 and 2, or Figs. 1 and 3, or Figs. 1 and 4, or Figs. 5 and 2, or Figs. 5 and 3, or Figs. 5 and 4, of the accompanying drawings.
16. Photographic apparatus incorporating an exposure regulating device as claimed in any one of claims 13 to 15.
17. Apparatus as claimed in claim 16, wherein the apparatus is a cine camera.

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