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(54) APERTURE SETTING FOR PHOTOGRAPHIC OR CINEMATOGRAPHIC CAMERA

- (71) We, AGFA-GEVAERT AKTIEN-GESELLSCHAFT, a body corporate organised according to the laws of Germany, of Leverkusen, 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 a photographic or cinematographic camera of the kind having a diaphragm regulating means responsive to an exposure control means which includes a photo-sensitive receiver.
- It is an object of the present invention to improve the accuracy and speed of operation of diaphragm aperture setting devices for cameras of this kind.
- The present invention provides a photographic or cinematographic camera which includes exposure control means having a photosensitive device and arranged to determine whether the actual aperture is the aperture appropriate to the prevailing illumination, and to cause pulse production means to emit pulses while the actual aperture differs from the aperture appropriate to the prevailing illumination, there being provided diaphragm regulating means arranged to adjust the actual aperture in response to said pulses so that the actual aperture tends towards the appropriate aperture.
- Alteration of the diaphragm aperture by means of a setting device in accordance with the present invention can be made to occur quickly, accurately, and without undesirable oscillatory movement. Further, the setting device can be made less impact-sensitive than the moving coil meter arrangements used hitherto for aperture regulation.
- Advantageously, the diaphragm regulating means includes electromagnetic stepping means which is arranged to effect stepwise adjustment of the aperture in response to pulses from the pulse production means.
- The exposure control means may include adjustable circuit means, for example, a rheostat, and means for connecting the adjustable circuit in place of the photo-sensitive device, in order to enable the aperture to be adjusted externally, that is to say, independently of the amount of light incident on the photosensitive receiver.
- There will generally be a prescribed number, which may be integral or non-integral, of control pulses associated with each aperture stage. An aperture stage corresponds to that change in aperture which is required to change the exposure, at a fixed shutter speed, by a particular factor. In the case of cameras having more than one shutter speed, these are usually arranged to be related by this factor.
- In operation of a setting device according to the invention, if the actual aperture deviates from the aperture appropriate to the prevailing illumination the pulse production device produces a particular number of control pulses, dependent on the magnitude of the deviation, and that control pulse or pulses causes the diaphragm regulating means to vary the aperture by the required amount and in the required sense.
- In the case of stepwise aperture variation, if the adjustment stages for the diaphragm are made sufficiently small in relation to a complete aperture stage, overshooting of the diaphragm members can be avoided. Further the possible error between the appropriate aperture and the aperture actually set can only amount at most to one stage step of the stepping means.
- Preferably, each pulse is arranged to produce a change in aperture corresponding to a fraction of an aperture stage. Advantageously, between eight and twelve pulses correspond to a change in aperture of one aperture stage.
- It will be appreciated that the appropriate aperture may be determined by the photo-sensitive device or, if desired when external control is provided for, by external control means. Such external control means may comprise externally adjustable circuit means and means for switching the adjustable circuit means into the place of the photo-

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price 75p

sensitive device in order to enable the aperture to be adjusted independently of the amount of light incident on the photosensitive device.

5 Advantageously, the pulse device comprises a pulse generator and a gate circuit, and the photo-sensitive receiver forms part of a differential amplifier by means of which the gate circuit can be controlled. The gate
10 circuit is connected to the pulse generator, the pulses from which only occur at the output of the gate circuit when the two input voltages of the differential amplifier differ from one another.

15 Preferably, the gate circuit has two gate stages with inverse behaviour: one gate stage is switched through when there is a positive voltage at the output of the differential amplifier, and the other gate stage
20 is switched through when there is a negative voltage at the output of the differential amplifier. The pulse device can then be connected to a first control stage of the diaphragm regulating means by one gate
25 stage, and to a second control stage of the diaphragm regulating means by the other gate stage.

A stepwise diaphragm regulator may comprise a prescribed number of magnet coils arranged radially about a motor armature and lie in the current circuits of controllable
30 semiconductors, which, in the manner of a ring counter, can be switched through individually one after the other in the opposite direction by means of the pulses from one
35 gate stage, and coupling means are provided which when one controllable semiconductor is switched through cause the semiconductor which was previously switched through to
40 be blocked.

An astable multivibrator is preferably used as the pulse generator.

Advantageously, two series-connected voltage sources are provided to supply the differential amplifier (which is preferably an
45 operational amplifier), and the pulse generator, and the supply connections of the gate circuit are connected on the one hand to the output of the pulse generator and on the
50 other hand to a tapping between the two voltage sources.

The gate circuit advantageously comprises two emitter followers having mutually complementary transistors. Diodes are preferably
55 provided in the collector/emitter branches of the two emitter followers. According to a further embodiment, the number of magnet coils of a stepwise diaphragm regulator is such that at each pulse from the
60 pulse device the aperture is adjusted by a fraction of one aperture stage, for example, by one-tenth of an aperture stage.

Two forms of aperture setting device in accordance with the invention will now be
65 described, by way of example, with reference

to the accompanying drawings, in which:

Fig. 1 shows the circuit diagram of the first form of device;

Fig. 2 is a diagrammatic view of a stepping motor included in the devices;

Fig. 3 is a section through the stepping motor along the line III—III of Fig. 2; and

Fig. 4 shows the circuit diagram of the second form of device.

Referring to Figure 1, the first form of aperture setting device comprises an exposure measuring means 1, a pulse generator 2, a gate circuit 3, and a stepping
70 means 4. The mechanical parts of the stepping means are indicated in block form by 5. A diaphragm aperture 7 can be adjusted by way of a direct or mechanical connection
80 6. The diaphragm 7 may be the aperture diaphragm itself or it may be an auxiliary diaphragm, in which case a further connection must be provided from the stepping
85 means 5 to the main aperture diaphragm.

The exposure measuring means 1 includes a photo-resistor 8 which is arranged behind
90 the aperture diaphragm 7 and is connected in series with a fixed resistor 9. From the tapping between the photoresistor 8 and the resistor 9, a connection leads to the inverting input of an operational amplifier 10. The
95 non-inverting input of the operational amplifier 10 is connected to a resistor 11. A resistor 12 serves for feedback. The supply connections of the operational amplifier lead to two batteries 13 and 14 connected in
100 series.

The pulse generator 2, includes an astable multivibrator which is supplied by the two
batteries 13 and 14. The multivibrator has two transistors 15 and 16. The collectors,
105 of these transistors are connected to resistors 17 and 18 respectively. The collector of the transistor 15 is connected to the base of the transistor 16 by way of a capacitor 19. Similarly, the collector of transistor 16 is
110 coupled to the base of transistor 15 by a capacitor 20. A time constant may be associated with the combination of the capacitor 19 with the resistor 21, and similarly for the combination of the capacitor 20 with the
115 resistor 22. The astable multivibrator oscillates producing a square wave pulse train at a frequency which is determined by values of both of these time constants. The collector of the transistor 16 is connected by way
120 of a resistor 23 to an output transistor 24 which has a resistor 25 provided in its emitter circuit.

The gate circuit 3 includes two emitter followers. One emitter follower includes a
125 NPN transistor 26, the emitter of which is connected, through a resistor 27, to the tapping between the batteries 13 and 14. The collector branch of the transistor 26 is connected, through a diode 28, to the emitter of
130

the transistor 24. From the base of the transistor 26, a connection leads by way of a resistor 29, to the output of the operational amplifier 10.

5 The second emitter follower includes a PNP transistor 30, that is to say, of the opposite type to the transistor 26. Its emitter resistor 31 is also connected to the tapping between the two voltage sources 13 and 14. 10 The collector of the transistor 30 is connected, through a diode 32, to the emitter of the transistor 24. The base of the transistor 30 is connected through a resistor 33 to the output of the operational amplifier 10.

15 The emitter of the transistor 26 is connected, by way of a diode 34, to a first input E1 of the stepping means 4. A connection leads from the emitter of the transistor 30, by way of a diode 35, to the base of a transistor 36. A resistor 37 is arranged in the collector branch of the transistor 36. A connection leads from the collector of the transistor 36 to a second input E2 of the stepping means 4. The voltage produced by the astable multivibrator 2 fluctuates between the positive potential of the voltage source 13 and the negative potential of the voltage source 14. The reference potential of the gate circuit 3 is therefore at zero. Therefore, when the transistor 26 is switched on, only positive pulses, in relation to the reference potential of zero, are fed to the input E1 of the stepping means 4. When the transistor 30 is switched on, only negative pulses occur at its emitter, and these are converted by means of the transistor 36 into positive pulses which then are fed to the input E2 of the stepping means 4. However, since 40 only one of the two transistors 26 and 30 is switched on, at a given time, depending on the voltage present at the output of the operational amplifier 10, pulses occur either at the input E1 or at the input E2 of the stepping means 4.

45 The stepping means 4 has three coils 38, 39 and 40, which are connected in series with the anodes of thyristors 41, 42 and 43 respectively. The cathode contacts of the thyristors 41 to 43 are brought together and connected, by way of the parallel connection of a capacitor 44 and a resistor 45, to the tapping between the two voltage sources 13 and 14. From the anode of the thyristor 41, a connection leads by way of a coupling capacitor 46 to the anode of the thyristor 42. A connection leads from the anode of the thyristor 42, by way of a coupling capacitor 47, to the anode of the thyristor 43. The anode of the thyristor 43 is connected, by way of a coupling capacitor 48, to the anode of the first-mentioned thyristor 41.

50 The gate electrodes of the thyristors 41, 42 and 43 are connected by way of resistors 49, 50 and 51 respectively to the tapping

between the two voltage sources 13 and 14. The input E1 is connected to the gate electrodes of the thyristors 41, 42 and 43 by way of coupling capacitors 55, 56 and 57 respectively, and diodes 52, 53 and 54 respectively. The diodes 52, 53 and 54 are also each connected to the anodes of the adjacent thyristors 42, 43 and 41 respectively, by way of resistors 58, 59 and 60 respectively.

70 From the input E2, connections lead, by way of diodes 61, 62 and 63, and by way of capacitors 64, 65 and 66 respectively to the gate electrodes of the thyristors 42, 43 and 41 respectively. From the diodes 61, 62 and 63 connections also lead, by way of resistors 67, 68 and 69 respectively to the anodes of the thyristors 41, 42 and 43 respectively.

75 Diodes 70, or 71 and 72 are arranged in parallel with the coils 38, 39 and 40 respectively.

Pulses, which may for example be fed to the stepping means 4, by way of the input E1, bring about step-by-step closing of the aperture 7, whilst the pulses arriving by way of the input E2 cause step-by-step opening of the aperture 7.

80 According to Figure 2, the coils 38, 39 and 40 are arranged so that they are mutually off-set by 120°, and are wound round soft iron cores 75, 76 and 77 respectively. By way of a magnetizable plate 78, a magnetic return leads to the armature 79. Beneath the armature 79, which is made of magnetizable material, a permanent magnet 80 is provided, which is polarized substantially in the axial direction of the armature 79. The armature 79 is substantially square in cross-section. When one of the coils 38, 39 or 40 is energized, the armature 79 105 rotates until one of its lateral faces is substantially normal to the magnetic field lines of the energized coil, whilst the sides of the armature 79 in the region of the remaining two coils which are not energized, 110 form an acute angle with the possible magnetic field lines.

The method of operation of the first form of aperture setting device is as follows:

115 It is assumed that when the camera is put into operation the nominal aperture corresponding to the prevailing lighting conditions differs from the diaphragm aperture actually set. Consequently, there is a potential difference between the two inputs of the operational amplifier 10. Depending on the direction of this potential difference, a positive or negative voltage is set up at the output of the operational amplifier. The polarity of this voltage is a measure of whether the aperture actually set is larger or smaller than the nominal aperture.

120 By means of the astable multivibrator 2, pulses are produced with a frequency determined by the time constants of the com- 130

binations of the capacitors 19 and 20 with the resistors 21 and 22 respectively. With reference to the tapping between the two voltage sources 13 and 14, positive or negative pulses occur alternately at the emitter of the output transistor 24 of the astable multivibrator 2.

It is now assumed that a positive voltage is applied to the output of the operational amplifier 10. As a result, the transistor 26 of the gate circuit 3 is then switched on, whilst the transistor 30 is switched off. The positive pulses of the astable multivibrator 2 produce, at the emitter resistor 27 of the transistor 26, positive voltage pulses, which are fed to the stepping means 4 by way of the input E1.

It is assumed that the thyristor 41 is switched on whilst the thyristors 42 and 43 are switched off. Consequently, current then flows through the coil 38, whilst the two other coils 39 and 40 are de-energised. If a pulse now reaches the input E1, this pulse produces no effect at the thyristor 41, since it is already switched on.

After the thyristor 41 has been turned on, the capacitors 46 and 48, connected with its anode, become charged. The capacitor 47, however, was uncharged. The positive pulse at E1 previously mentioned, reaches the gate electrode of the thyristor 42 by way of the diode 53 and by way of the coupling capacitor 56. The result is that the thyristor 42 is switched on. The voltage at its cathode consequently jumps suddenly from a positive value to the zero voltage value. This negative pulse produces a change in potential at the capacitor 46, so that a negative pulse occurs at the cathode of the thyristor 41. This has the effect of turning the thyristor 41 off.

The positive pulse at E1 mentioned initially does not however reach the gate electrode of the thyristor 43 by way of the coupling capacitor 57, since the diode 54 is cut off and, in addition, at the moment when the thyristor 42 is switched on, the thyristor 43 is short-circuited by means of the coupling capacitor 47 and the thyristor 42. The capacitor 47 charges itself to the battery voltage of the battery 13, whilst the capacitors 46, 48 discharge themselves. At a further positive pulse, the thyristor 43 is switched on and the thyristor 42, which was previously switched on, is switched off. At a further pulse, the thyristor 41 is switched on again whilst the thyristor 43 is switched off.

A magnetic field which rotates through a third of a revolution with each applied pulse, and which is followed in its revolution by the armature 79, is thereby obtained. Consequently, the aperture diaphragm 7 is closed step-by-step by way of the mechanical connections 5 and 6. It is assumed that the

aperture diaphragm 7 alters by a tenth of one aperture stage at each pulse.

If the actual aperture setting is equal to the required setting, the voltage at the output of the operational amplifier 10, is equal to zero. As a result, the transistors 26 and 30 of the gate circuit 3 are both turned off. Thus the pulses from the astable multivibrator 2 cannot be transmitted to either of the two inputs E1 and E2.

If the actual aperture setting now differs from the required aperture setting in such a way that a negative voltage is present at the output of the operational amplifier 10, the transistor 26 is turned off, whilst the transistor 30 is turned on. Consequently, the negative pulses reach the emitter of the transistor 30 by way of the diode 32. These negative pulses are inverted and occur as positive pulses at the collector of the transistor 36, and at the input E2 of the stepping means 4. The continuing excitation of the coils 38, 39 and 40 now takes place in the opposite direction, so as to cause the aperture diaphragm 7 to be opened.

It is again assumed that the thyristor 41 is switched on, whilst the other two thyristors 42 and 43 are switched off. The two capacitors 46, 48 are charged up, the capacitor 47 being uncharged. The positive pulse from E2 does not reach the thyristor 42, since the diode 61 is cut off. However, the positive pulse reaches the gate electrode of the thyristor 43 by way of the diode 62 and the capacitor 65. The thyristor 43 is then switched on. When the thyristor 43 is switched on, a negative pulse flank reaches the anode of the thyristor 41 which is therefore switched off. At the same time the capacitor 47 is charged up. In addition, at the moment of the commencement of charging, the capacitor 47, and the thyristor 43 short-circuit the thyristor 42. Upon the arrival of the next positive pulse at the input E2, the thyristor 42 is switched on, while the thyristor 43 is switched off. At each further pulse at the input E2, the armature 79 rotates through one third of a revolution, and thus the aperture diaphragm 7 is opened by one step for each pulse, until the voltage is zero at the output of the operational amplifier 10. The gate circuit 3 is then blocked so that no pulse can reach the stepping means.

In the second sample embodiment according to Figure 4, parts corresponding to those in Figure 1 are provided with the same reference numerals, which, however, have indices for emphasis. This embodiment differs from that represented in Figure 1 in that the photoresistor 8¹ is not arranged behind a diaphragm. A voltage divider is made up of a fixed resistor 90, and a variable resistor 11¹, and is connected across the battery 13¹. The adjustable tapping of the variable re-

sistor 11¹ is mechanically coupled to the mechanical component 5¹ of the stepping means 4¹ by way of the connection 6¹. The mechanical component 5¹ of the stepping means 4¹ is itself connected to the aperture diaphragm 7¹ by way of a direct or mechanical connection 91. A potential, which is influenced by the setting of the variable resistor 11¹, is applied to the non-inverting input of the operational amplifier 10¹. This potential is therefore influenced by the size of the aperture bounded by the aperture diaphragm 7¹. When a voltage is present at the output of the operational amplifier 10¹, the variable resistor 11¹ is altered step-by-step in one direction or the other by means of the armature 79 of the stepping means 4¹. At the same time, the aperture 7¹ is adjusted step-by-step by way of the connection 91. The method of operation is substantially the same as for the first sample embodiment.

WHAT WE CLAIM IS:—

1. A photographic or cinematographic camera which includes exposure control means having a photo-sensitive device and arranged to determine whether the actual aperture is the aperture appropriate to the prevailing illumination and to cause pulse production means to emit pulses while the actual aperture differs from the aperture appropriate to the prevailing illumination, there being provided diaphragm regulating means arranged to adjust the actual aperture in response to the said pulses so that the actual aperture tends towards the appropriate aperture.

2. A camera as claimed in claim 1, wherein a predetermined integral number of control pulses is effective to cause a change of aperture corresponding to one aperture stage.

3. A camera as claimed in claims 1 or 2 wherein the diaphragm regulating means includes electromagnetically-operated means for effecting stepwise adjustment of the diaphragm aperture in response to pulses from the pulse production means.

4. A camera as claimed in any one of claims 1 to 3, wherein the pulse production means includes a pulse generator and a gate circuit, and wherein the exposure control means includes an amplifier for receiving a signal indicative of the change in diaphragm setting required, the said amplifier being connected to control the gate circuit so that the gate circuit will transmit pulses from the pulse generator only when the or an input voltage of the amplifier differs from a predetermined value, or there are two inputs to the amplifier and the voltages at those inputs are different.

5. A camera as claimed in claim 4 wherein the amplifier is a differential ampli-

fier, and the gate circuit is arranged to transmit pulses from the pulse generator only if the two input voltages of the differential amplifier are unequal.

6. A camera as claimed in claim 4 or claim 5 wherein the amplifier is an operational amplifier.

7. A camera as claimed in any one of claims 4 to 6 wherein the pulse generator comprises an astable multivibrator.

8. A camera as claimed in any one of claims 4 to 7 wherein two series-connected voltage sources are provided to supply the amplifier and the pulse generator, and wherein a supply for the gate circuit is derived from a tapping between the two voltage sources and the output of the pulse generator.

9. A camera as claimed in any one of claims 4 to 8 as appended to claim 3 wherein the gate circuit includes two gate elements, one of which is effective to transmit pulses from the pulse production means only when the voltage at the output of the amplifier is greater than a predetermined value, and the other of which is effective to transmit the pulses only when the output voltage is less than the predetermined value, the outputs from the two gate elements being separately connected to the stepping means.

10. A camera as claimed in claim 9 wherein the predetermined value of the output voltage is zero.

11. A camera as claimed in claim 9 or claim 10 wherein the gate elements include respectively a first emitter follower circuit having an NPN transistor, and a second emitter follower circuit having a PNP transistor.

12. A camera as claimed in claim 3 or any one of claims 4 to 11 as appended thereto wherein the stepping means includes a plurality of magnet coils which are arranged radially around an armature, and a number of current control circuits for the magnet coils, each of which circuits includes a controllable semiconductor device.

13. A camera as claimed in claim 12 wherein the semiconductor devices comprise thyristors.

14. A camera as claimed in claim 12 or claim 13 as appended to any one of claims 9 to 11, wherein the magnet coils may be successively energized in one direction of a cyclic sequence if stepping pulses are received from a first of the gate elements, and in the other direction of the cyclic sequence if the pulses are received from the second of the gate elements, and wherein the current control circuits are so coupled together that, when a semiconductor device is switched on, the semiconductor device preceding it in the direction of energization is switched off.

15. A camera as claimed in any one of



sistor 11¹ is mechanically coupled to the mechanical component 5¹ of the stepping means 4¹ by way of the connection 6¹. The mechanical component 5¹ of the stepping means 4¹ is itself connected to the aperture diaphragm 7¹ by way of a direct or mechanical connection 91. A potential, which is influenced by the setting of the variable resistor 11¹, is applied to the non-inverting input of the operational amplifier 10¹. This potential is therefore influenced by the size of the aperture bounded by the aperture diaphragm 7¹. When a voltage is present at the output of the operational amplifier 10¹, the variable resistor 11¹ is altered step-by-step in one direction or the other by means of the armature 79 of the stepping means 4¹. At the same time, the aperture 7¹ is adjusted step-by-step by way of the connection 91. The method of operation is substantially the same as for the first sample embodiment.

WHAT WE CLAIM IS:—

1. A photographic or cinematographic camera which includes exposure control means having a photo-sensitive device and arranged to determine whether the actual aperture is the aperture appropriate to the prevailing illumination and to cause pulse production means to emit pulses while the actual aperture differs from the aperture appropriate to the prevailing illumination, there being provided diaphragm regulating means arranged to adjust the actual aperture in response to the said pulses so that the actual aperture tends towards the appropriate aperture.

2. A camera as claimed in claim 1, wherein a predetermined integral number of control pulses is effective to cause a change of aperture corresponding to one aperture stage.

3. A camera as claimed in claims 1 or 2 wherein the diaphragm regulating means includes electromagnetically-operated means for effecting stepwise adjustment of the diaphragm aperture in response to pulses from the pulse production means.

4. A camera as claimed in any one of claims 1 to 3, wherein the pulse production means includes a pulse generator and a gate circuit, and wherein the exposure control means includes an amplifier for receiving a signal indicative of the change in diaphragm setting required, the said amplifier being connected to control the gate circuit so that the gate circuit will transmit pulses from the pulse generator only when the or an input voltage of the amplifier differs from a predetermined value, or there are two inputs to the amplifier and the voltages at those inputs are different.

5. A camera as claimed in claim 4 wherein the amplifier is a differential ampli-

fier, and the gate circuit is arranged to transmit pulses from the pulse generator only if the two input voltages of the differential amplifier are unequal.

6. A camera as claimed in claim 4 or claim 5 wherein the amplifier is an operational amplifier.

7. A camera as claimed in any one of claims 4 to 6 wherein the pulse generator comprises an astable multivibrator.

8. A camera as claimed in any one of claims 4 to 7 wherein two series-connected voltage sources are provided to supply the amplifier and the pulse generator, and wherein a supply for the gate circuit is derived from a tapping between the two voltage sources and the output of the pulse generator.

9. A camera as claimed in any one of claims 4 to 8 as appended to claim 3 wherein the gate circuit includes two gate elements, one of which is effective to transmit pulses from the pulse production means only when the voltage at the output of the amplifier is greater than a predetermined value, and the other of which is effective to transmit the pulses only when the output voltage is less than the predetermined value, the outputs from the two gate elements being separately connected to the stepping means.

10. A camera as claimed in claim 9 wherein the predetermined value of the output voltage is zero.

11. A camera as claimed in claim 9 or claim 10 wherein the gate elements include respectively a first emitter follower circuit having an NPN transistor, and a second emitter follower circuit having a PNP transistor.

12. A camera as claimed in claim 3 or any one of claims 4 to 11 as appended thereto wherein the stepping means includes a plurality of magnet coils which are arranged radially around an armature, and a number of current control circuits for the magnet coils, each of which circuits includes a controllable semiconductor device.

13. A camera as claimed in claim 12 wherein the semiconductor devices comprise thyristors.

14. A camera as claimed in claim 12 or claim 13 as appended to any one of claims 9 to 11, wherein the magnet coils may be successively energized in one direction of a cyclic sequence if stepping pulses are received from a first of the gate elements, and in the other direction of the cyclic sequence if the pulses are received from the second of the gate elements, and wherein the current control circuits are so coupled together that, when a semiconductor device is switched on, the semiconductor device preceding it in the direction of energization is switched off.

15. A camera as claimed in any one of



claims 1 to 14, wherein the photosensitive device is so located behind the aperture diaphragm, or behind a light attenuating means cooperating therewith, that the amount of light incident on the photosensitive device is dependent on the actual aperture at any instant.

16. A camera as claimed in claim 5 as appended to claim 3 or in any one of claims 6 to 14 as appended to both claims 3 and claim 5, wherein the photosensitive device is connected to one input of the differential amplifier, and a resistor which is variable by the stepping means to correspond with the actual aperture at any instant, is connected to the other input of the differential amplifier.

17. A camera as claimed in any one of claims 1 to 16 including externally adjustable circuit means and means for switching the adjustable circuit means into the place of the photosensitive device in order to enable

the aperture to be adjusted independently of the amount of light incident on the photosensitive device.

18. A camera as claimed in any one of claims 1 to 17, wherein each pulse is arranged to produce a change in aperture corresponding to a fraction of an aperture stage.

19. A camera as claimed in claim 18, wherein between eight and twelve pulses correspond to a change in aperture of one aperture stage.

20. A camera as claimed in claim 19, wherein ten pulses correspond to a change in aperture of one aperture stage.

21. A camera substantially as hereinbefore described, with reference to, and as shown in, the accompanying drawings.

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