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(54) PHOTOGRAPHIC CAMERA

(71) We, FRANKE & HEIDECKE GMBH, a German Body Corporate, trading as Rollei-Werke Franke & Heidecke, of 196 Salzdahlumerstrasse, Braunschweig, 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 present invention relates to a photographic camera with an electronic control device for the control of all processes occurring in the camera when a photograph is taken, with a stepping switch which can be operated by an impulse generator which sets up the individual functions of the camera in succession, e.g. in accordance with British Patent Specification 1433814. When the stepping switch is set to the step "zero", for instance, the diaphragm is closed, thus initiating the exposure measuring operation. At steps 1, 2 and 3 the ambient light and the setting of the diaphragm are measured. At step 4 the actual exposure process is initiated with the opening of the shutter. As the stepping switch progresses through the next stages the individual functions of the camera are set up in the correct order, such as (in the case of a mirror reflex camera) the raising of the mirror on its hinges, the opening of the shutter, the closing of the shutter after the initially determined exposure time, the transport of the film and the adjustment of the mirror to the view-finding position. The individual elements of the camera in these cases are only in operation for as long as they are being actuated via the stepping switch. The latter thus has to be left at one particular stage until the corresponding operation of the camera is terminated, after which the switch is moved on and the next operation thus set up. The impulse generator, which can only provide impulses of a constant frequency, therefore has to be switched off at each stage of the stepping switch and switched on again after the completion of the camera function in question, so that it can move the stepping switch to the next stage. For the sequence of operations in a photographic

camera a certain time is required, made up of the sum of the individual periods involved in the separate processes.

The present invention enables this time required for taking a particular photograph to be considerably reduced, in order, in particular, to enable a series of photographs to be taken in more rapid succession.

According to the present invention there is provided a photographic camera with an electronic control device for the control of all processes occurring in the camera when a photograph is taken, with a stepping switch which can be operated by an impulse generator which sets up the individual functions of the camera in succession, having an electric film transport motor which can be switched on by setting the stepping switch to a certain stage, and by means of a film stepping unit serving to keep the motor switched on as the stepping switch moves to the next stage and to switch the motor off after a predetermined film movement.

This ensures that camera functions not necessarily having to take place in succession can be set up simultaneously. In the present case, for instance, the stepping switch is already able, during the period for the film transport, to actuate the mechanism for opening the camera shutter and for opening the diaphragm, in the subsequent stages. The resulting reductions of the period required for taking a photograph is considerable, amounting to 300 ms out of the total time of 900 ms in the case of a reflex camera with hinged mirror.

One suitable version of the invention comprises a sliding contact which interrupts the current circuit of the film winding motor and which can be bridged by moving the stepping switch to the stage in question and of which the contact springs rest on a conductor path interrupted at intervals, the conductor path and the contact springs being displaceable in relation to each other by the film feed action. The gaps in the conductor path are so arranged that the contact springs of the switch contact enter the gap after the film has been fed forward by a distance corresponding to

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the length of the image field, while the length selected for the gaps in the conductor paths is such that the contact springs will have moved up onto the next portion of the conductor path whenever the bridging of the contact is nullified. The individual conductor path consists of as many such portions as there are individual pictures on the film and can be reduced to the desired number by switching devices in accordance with a further proposal covered by the invention.

Constructional embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawing, wherein:

Figure 1 is a schematic diagram of a photographic camera with an electronic control device, a film transport system operated by an electric motor and a film stepping unit;

Figure 2 is a schematic diagram of the details of the film stepping unit in conjunction with the electronic control device;

Figures 3 and 4 show a variant of the film stepping unit according to Figure 2; and

Figure 5 shows a variant of the film stepping unit according to Figure 2, connected to an image counting unit.

Figure 1 provides a schematic view of a photographic camera with a housing 1, a lens system 2 and a viewfinder 3. An electronic control device 5 fed from the voltage source 4 is connected with the film stepping mechanism via conductors 6 and with the film transport motor 9 via conductors 8. The motor 9 drives the film take-up spool 11 via a cogwheel connection 10. The film is drawn off the film stock spool 12, guided through the film gate 13 and received by the film take-up spool 11. The rear panel of the camera, which can be opened up on its hinges in order to change the film, necessitates electrical connections 14 to the movable parts. In Figure 1a the electric motor is constantly connected with the film take-up spool 11 and is connected to the control device 5 via electric couplings 14, while in Figure 1b the electric motor is constantly connected to the control device and is not connected with the film take-up spool until the rear panel is closed by means of the cogwheel connection 10'.

Figure 2 provides a schematic diagram of details of the device covered by the invention. The electronic control device 5 contains a stepping switch 15 which is actuated by an impulse generator 16 in such a way that on each impulse of the generator the stepping switch 15 emits a signal to one of its outputs 17, in a fixed order of succession. The individual elements of the camera which have to be set in operation when a photograph is taken are connected to the output 17 and are actuated when ever a signal occurs at the output in question and are kept in operation until the impulse generator 16 moves the stepping switch to the next stage. This is

described in detail in British Patent Specification 1433814. In this case the film winding motor is adjusted to stage number nine of the stepping switch.

The step switch 15 and the impulse generator 16 are supplied with current from the voltage source 4. The conductor 6 leading from the electronic control device 5 to the film stepping unit 7 is connected, in the control device, with the positive pole of the voltage source 4 and with the conductor 8 leading from the control device to the electric motor 9. Inside the film stepping unit the conductor 6 is interrupted by a film scanning contact 18 and a sliding contact 19. When the film is inserted the scanning lever 18a of the film scanning contact is closed. If the film is extracted, the contact 18 will be opened, under the effect of the contact spring 18b, owing to the absence of any counter pressure. The sliding contact 19 has two contact springs 19a and 19b which can be interconnected by an electrically conductive contact path 20. The contact path 20 is mounted concentrically on a disc 21 rotatable by a cogwheel 22. The cogwheel 22 engages the perforations of the film track by its lugs 22a and is thus rotated when the film track is fed forward. The contact path 20 is subdivided into portions separated from one another by insulating gaps.

The sliding contact 19 can be bridged by the electronic control device 5, e.g. as a result of the fact that the collector-emitter section of a transistor 23 is connected with the contact springs 19a and 19b and the base of the transistor is actuated by the stepping switch in such a way that the transistor becomes conductive. The film transport motor 9 is connected on the one hand with a contact spring 19b and on the other with the zero potential of the voltage source, via conductors 8 inside the electronic control device 5. The motor 9 drives the film take-up spool 11 via the cogwheel connection 10'. The film track drawn off the film stock spool 12 is guided by the image gate 13 and the cogwheel 22 in order to be taken over by the film take-up spool 11. In the zone of the image gate 13 the film track is guided by the film pressure plate 24.

The system according to the invention operates as follows:

As described in the British Patent Specification 1,433,814, the film transport motor 9 is set in operation when the stepping switch 15 is at stage number nine. This results from the fact that the base of the transistor 23, connected with stage number nine of the stepping switch 15, is positive, so that the collector-emitter section of the transistor becomes conductive. The contact springs situated in an insulating gap of the conductor path 20 are thus bridged, and the motor 9 is connected with the voltage source 4 via the

with a tapping on the 12th portion of the conductor path 38a and is connected with the conductor 6. The interruption is effected by a switch 40 by means of which the image counting unit can be switched over to 12 or to 24 pictures as desired.

The apparatus functions as follows:

If, as a result of the adjustment of the stepping switch to stage number "9", the transistor 23 situated between the conductors 6 is actuated by the stepping switch, then the motor 9 is switched on via the closed film scanning contact 18 and the conductor 8 and rotates the film take-up spool 11. The film transport operation results in the rotation of the roller 34, which sets the worm 32 in operation via the cogwheel connection 33. The worm 32 engages with the cogwheel 30, by means of which, via the entrainment device 31, the toothed disc 27 and thus the contact spring holder 37 and the contact springs 37a to 37c are displaced on the conductor tracks 38a to 38c. By this slight rotation of the contact spring holder 37 the springs 37a and 37b are rotated from a gap onto the conductive portions of the conductor tracks 38a and 38b respectively.

If the switch 40 has been adjusted for 24 pictures, the current supply 38d is interrupted. The current then passes through the conductor 6, the film scanning contact 18, the conductor track 38c of the contact spring 37c, the contact spring holder 37, the contact springs 37a and 37b and the contact track 38b of the conductor 6 to the film transport motor.

If the step switch is now adjusted by the control impulse transmitter 16 to the next stage, the motor 9 is kept in operation until, as a result of the film transport action, the contact springs 37a and 37b enter the next gap. This occurs in accordance with the gaps selected in the present case for 24 image field lengths, as the size of the individual portions of the conductor tracks has been selected to ensure that the feed of the film transport through a distance corresponding to the length of an image field will cause the contact springs 37a and 37b to be rotated from one gap into the next. The counter disc 35 rotates with a toothed disc 27 and indicates the number of images to which the feed movement corresponds. At the end of the 24th image the contact spring 37b moves up onto a longer portion of the conductor track, so that the motor is not switched off by it until the entire film has been transferred to the film take-up spool.

If a film with a smaller number of images, in this case 12, is inserted, then the change-over switch must be so adjusted that the current supply 38d is not interrupted. In this case the current passes through the conductor 6, the closed film scanning contact 18, the conductor path 38c, the contact spring 37c, the contact spring holder 37, the contact

springs 37a and 37b, the conductor paths 38a and 38b and the conductor 6. In this case the method of operation, up to and including image 12, is the same as described before. After the image 12 has been fed forward the contact spring 37a moves up onto the uninterrupted portion of the conductor track 38a and now causes the motor 9 to remain in operation until the spring 37a has reached the end of the conductor path 38a, where it interrupts the current circuit of the motor. The film has thus been transported in its entirety to the film take-up spool 11 after 12 photographs have been taken. When the rear wall of the camera is opened the spring 37 disengages the toothed disc 27 from the entrainment device 31, so that the counter disc 35 now rotates back into the initial position, under the effect of the stressed spiral spring 36. It is held in the said initial position by means of a stop 41. The toothed disc 27 and the contact spring holder 37 are thus likewise moved back via the shaft 38, so that the contact springs 37a to 37c resume their initial position on the conductor tracks 38a and 38c.

WHAT WE CLAIM IS:—

1. Photographic camera with an electronic control device for the control of all processes occurring in the camera when a photograph is taken, with a stepping switch which can be operated by an impulse generator which sets up the individual functions of the camera in succession, having an electric film transport motor which can be switched on by setting the stepping switch to a certain stage, and by means of a film stepping unit serving to keep the motor switched on as the stepping switch moves to the next stage and to switch the motor off after a predetermined film movement.

2. Photographic camera in accordance with Claim 1, having a sliding contact which interrupts the current circuit of the film winding motor and which can be bridged by moving the stepping switch to the stage in question and of which the contact springs rest on a conductor path, interrupted at intervals, the conductor path and the contact springs being displaceable in relation to each other by the film feed action.

3. Photographic camera in accordance with Claim 2, wherein the gaps in the conductor path, are so arranged that the contact springs of the switch contact, enter the gap after the film has been fed forward by a distance corresponding to the length of the image field, while the contact springs will have moved up onto the next portion of the conductor path whenever the bridging of the contact is nullified.

4. Photographic camera in accordance with Claim 3, wherein the conductor path consists of as many separate portions as there are individual pictures on the film.



with a tapping on the 12th portion of the conductor path 38a and is connected with the conductor 6. The interruption is effected by a switch 40 by means of which the image counting unit can be switched over to 12 or to 24 pictures as desired.

The apparatus functions as follows:

If, as a result of the adjustment of the stepping switch to stage number "9", the transistor 23 situated between the conductors 6 is actuated by the stepping switch, then the motor 9 is switched on via the closed film scanning contact 18 and the conductor 8 and rotates the film take-up spool 11. The film transport operation results in the rotation of the roller 34, which sets the worm 32 in operation via the cogwheel connection 33. The worm 32 engages with the cogwheel 30, by means of which, via the entrainment device 31, the toothed disc 27 and thus the contact spring holder 37 and the contact springs 37a to 37c are displaced on the conductor tracks 38a to 38c. By this slight rotation of the contact spring holder 37 the springs 37a and 37b are rotated from a gap onto the conductive portions of the conductor tracks 38a and 38b respectively.

If the switch 40 has been adjusted for 24 pictures, the current supply 38d is interrupted. The current then passes through the conductor 6, the film scanning contact 18, the conductor track 38c of the contact spring 37c, the contact spring holder 37, the contact springs 37a and 37b and the contact track 38b of the conductor 6 to the film transport motor.

If the step switch is now adjusted by the control impulse transmitter 16 to the next stage, the motor 9 is kept in operation until, as a result of the film transport action, the contact springs 37a and 37b enter the next gap. This occurs in accordance with the gaps selected in the present case for 24 image field lengths, as the size of the individual portions of the conductor tracks has been selected to ensure that the feed of the film transport through a distance corresponding to the length of an image field will cause the contact springs 37a and 37b to be rotated from one gap into the next. The counter disc 35 rotates with a toothed disc 27 and indicates the number of images to which the feed movement corresponds. At the end of the 24th image the contact spring 37b moves up onto a longer portion of the conductor track, so that the motor is not switched off by it until the entire film has been transferred to the film take-up spool.

If a film with a smaller number of images, in this case 12, is inserted, then the change-over switch must be so adjusted that the current supply 38d is not interrupted. In this case the current passes through the conductor 6, the closed film scanning contact 18, the conductor path 38c, the contact spring 37c, the contact spring holder 37, the contact

springs 37a and 37b, the conductor paths 38a and 38b and the conductor 6. In this case the method of operation, up to and including image 12, is the same as described before. After the image 12 has been fed forward the contact spring 37a moves up onto the uninterrupted portion of the conductor track 38a and now causes the motor 9 to remain in operation until the spring 37a has reached the end of the conductor path 38a, where it interrupts the current circuit of the motor. The film has thus been transported in its entirety to the film take-up spool 11 after 12 photographs have been taken. When the rear wall of the camera is opened the spring 37 disengages the toothed disc 27 from the entrainment device 31, so that the counter disc 35 now rotates back into the initial position, under the effect of the stressed spiral spring 36. It is held in the said initial position by means of a stop 41. The toothed disc 27 and the contact spring holder 37 are thus likewise moved back via the shaft 38, so that the contact springs 37a to 37c resume their initial position on the conductor tracks 38a and 38c.

WHAT WE CLAIM IS:—

1. Photographic camera with an electronic control device for the control of all processes occurring in the camera when a photograph is taken, with a stepping switch which can be operated by an impulse generator which sets up the individual functions of the camera in succession, having an electric film transport motor which can be switched on by setting the stepping switch to a certain stage, and by means of a film stepping unit serving to keep the motor switched on as the stepping switch moves to the next stage and to switch the motor off after a predetermined film movement.

2. Photographic camera in accordance with Claim 1, having a sliding contact which interrupts the current circuit of the film winding motor and which can be bridged by moving the stepping switch to the stage in question and of which the contact springs rest on a conductor path, interrupted at intervals, the conductor path and the contact springs being displaceable in relation to each other by the film feed action.

3. Photographic camera in accordance with Claim 2, wherein the gaps in the conductor path, are so arranged that the contact springs of the switch contact, enter the gap after the film has been fed forward by a distance corresponding to the length of the image field, while the contact springs will have moved up onto the next portion of the conductor path whenever the bridging of the contact is nullified.

4. Photographic camera in accordance with Claim 3, wherein the conductor path consists of as many separate portions as there are individual pictures on the film.



closed film scanning contact 18. The motor starts up and drives the film take-up spool 11 via the cogwheel connection 10'. The film track, in its turn, drives the cogged disc 22 via the perforations and the lugs 22a, the said disc driving the disc 21, so that the contact springs move up onto the conductive contact track 20 after the disc 21 has performed a slight rotation. While the impulse generator already moves the stepping switch from stage number nine to stage number ten after 10 ms and thus once again blocks the transistor 23, the film transport motor 9 is kept in operation by the contact springs 19a and 19b which are now connected via the contact track 20. The film transport motor now drives the film take-up spool 11 until the disc 21, set in rotation by the cogwheel 22, has moved the conductor path 20 past the contact springs and underneath them and the said springs drop into the next gap. The current circuit of the film transport motor is thus interrupted and the transport of the film comes to a stop. That part of the conductor path 20 which extends from one gap to the next is selected to ensure that the amount of film transported corresponds exactly to the length of one image field. During the transport of the film the impulse generator has already moved the stepping switch 15 from stage number nine to stage number ten, in which latter stage the shutter opening device of the camera is actuated, and in a further 10 ms it has moved the switch to stage number eleven, in which the diaphragm aperture of the camera is opened. This ensures that after the completion of the film winding operation the camera is once again ready for taking a photograph without the need for any additional operations.

According to Figure 3, the contact springs 19 can be replaced by contact 25 of which the spring mounted contact arm 25a scans a curved track 26 provided on the disc 21 in place of the conductor path 20. The curved track is so constructed that on the rotation of a disc 21, owing to the fact that the motor is switched on the initially opened contact 25 is closed via the transistor 23 while after a film feed movement corresponding to the length of an image field and after a corresponding rotation of the curved track the spring mounted contact arm can once again drop into a gap 26a, the contact 25 being opened at the same time.

Figure 4 shows a variant of the film stepping unit. In place of disc 21 with the conductor path 20 and the film scanning contact 18 a break contact 42 is included in the conductor 6. The contact consists of a fixed contact arm 42a and a spring mounted contact arm 42b bearing a lug 43. The lug is so constructed that it can drop into a perforation of the film track and easily slide out of it as the film track is fed in the take-up direc-

tion. Owing to the spring mounted lever arm 42b the lug 43 is continuously pressed against the film track until it is once again able to drop into a perforation. As long as the lug is resting on the film track the contact 42 is closed and the motor 9 in operation. As soon as the lug drops into a perforation the contact 42 is opened and the current circuit of the motor thus interrupted. As the distance between successive perforations is exactly equal to an image field, the film transport motor is kept in operation for the exact period required to enable the film to be transported by a distance corresponding to an image field. The construction and operation of the system are otherwise as described before.

Figure 5 shows a further embodiment of the film stepping unit, additionally connected to an image counting unit. After the insertion of a film in a camera the operation of closing the rear panel of the latter by the film pressure plate 24 causes a toothed disc 27 rigidly connected to a shaft 28 to be pressed against a cogwheel 30 loosely mounted on the shaft 28, in opposition to the action of the spring 29. The cogwheel 30 bears an entrainment device 31 having projections 31a which are so shaped as to engage the teeth of the toothed disc 27. The cogwheel 30 meshes with the worm 32, which in its turn can be driven by a roller 34 via a cogwheel connection 33. The roller 34 rests against the film track and is rotated by the latter during the film feed action. A counter disc 35 is connected in a rotationally rigid manner with the shaft 28 and is engaged by one end of a spiral spring 36 of which the other end is held in a fixed position. To the toothed disc 27 is affixed a contact spring holder 37 by which three contact springs 37a, 37b and 37c are conductively interconnected. The contact springs rest on conductor paths 38 which are situated on a fixed plate 39, concentric with the shaft 28. The contact spring 37a rests on the conductor path 38a, the contact spring 37b on the conductor path 38b and the contact spring 37c on the conductor path 38c. The conductor paths 38a and 38b are subdivided by insulating gaps into separate portions corresponding to the number of images, the first image being preceded by a comparatively long portion to enable the inserted film to be wound up onto the film take-up spool, while the last image is followed by a portion of the same length, to enable the entire film to be rewound onto the film take-up spool. The conductor path 38a is subdivided into 12 portions situated immediately adjacent to the respective first 12 portions of the conductor path 38b subdivided into 24 portions. Adjacent to the second half of the 12 portions of the conductor path 38b subdivided into 24 portions is a closed portion of the conductor path 38a, of which portion the end is provided, via a current supply conductor 38d,



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5. Photographic camera in accordance with Claim 3, wherein the conductor path consists of that number of separate portions which correspond to the maximum number of images, the number being reducible by switching devices.

6. Photographic camera in accordance with Claim 4 or 5, wherein those portions of the conductor path which correspond to the maximum number of images are preceded and followed by a further portion of the conductor path.

7. Photographic camera in accordance with Claim 1, having contacts which interrupt the current circuit of the motor and which can be bridged by adjusting the stepping switch to the relevant stage and of which the movable contact arm scans a curved track movable in relation to the contact arm by the film feed action.

8. Photographic camera in accordance with Claim 7, wherein the curved track is so constructed that by its displacement it closes the contact which was opened when the motor was switched on and releases the contact after the film has been fed forward by a distance corresponding to the length of an image field.

9. Photographic camera in accordance with any one of Claims 2 to 8, wherein the conductor path or the curved track is mounted concentrically on a disc rotatable by the film feed action.

10. Photographic camera in accordance with Claim 9, having a roller which actuates the disc and which is driven direct by the film track itself.

11. Photographic camera in accordance with

any one of the foregoing Claims, wherein the film stepping unit is coupled to an image counting unit.

12. Photographic camera in accordance with Claim 1, for perforated film with one hole for each image field, having a contact which interrupts the current circuit of the motor and which can be bridged by adjusting the stepping switch to the relevant stage and of which the movable contact arm bears a lug capable of dropping into a perforation and so constructed that the film feed movement causes the lug to slide out of the hole onto the film track and rests against the latter with pre-stressing when the contact is closed.

13. Photographic camera in accordance with any one of the foregoing Claims, wherein the film transport motor can be caused to engage the film take-up spool by closing the rear wall of the camera, while the film stepping unit can be coupled electrically to the control device.

14. Photographic camera in accordance with any one of Claims 1 to 12, wherein the film transport motor is rigidly coupled to the film take-up spool, while by closing the rear wall of the camera both the film stepping unit and the film transport motor can be coupled electrically to the control device.

15. A camera substantially as described herein with reference to and as illustrated by the accompanying drawing.

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