

PATENT SPECIFICATION

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(54) CINE CAMERAS

(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:—

The invention relates to cine cameras.

The invention provides a cine camera comprising means for generating pulses in synchronism with film advancement, a counter for receiving the pulses, and a plurality of indicators responsive to the counter, each indicator being arranged to respond visually when a respective different pulse count is reached, thereby indicating the number of frames run through.

The use of such an electronic construction of film (or footage) counter enables cameras to be constructed with footage counters of a greater accuracy and greater reliability of operation and smaller tolerances than the known footage counters. Since the pulses are generated in synchronism with the advancement of the film, the pulse counts indicated by the counter will correspond to the respective numbers of frames advanced, and the respective lengths of film run through will be indicated. The indicators can be so arranged as to be visible in the viewfinder and/or externally.

Thus, by means of the footage counter according to the invention, particular numbers of frames run through can accordingly be indicated in the viewfinder of a cine camera. Although the number of frame indicators could in principle be equal to the number of frames on the film, in practice each indicator will be arranged to respond only when a number of frames have run through. For example, the first indicator may be arranged to respond when 600 frames have run through, the second when 1200 frames have run through etc. The actual frame numbers (that is, 600,

1200 etc.) may be arranged to be visible in the viewfinder, but this is not essential; for example, the proportion of the film run through could instead be indicated. The footage counter may also be in the form of one unit. It is also possible to integrate the footage counter into another unit in the camera executing control and regulating functions. It is further possible to drive from the footage counter control signals dependent on the number of frames advanced, such as a signal to terminate film transport when the indicator corresponding to the end of the film responds.

Advantageously, the pulses are derived in operation from the film drive mechanism, or from a member driven thereby, for example, the pulses may be derived from rotation of the shutter; the pulse generating means may be arranged to generate at least one pulse per frame advanced.

Advantageously, the counter is a digital counter, and there is provided a plurality of logic stages associated with the different pulse counts at which the indicators are to respond, the logic stages being so connected to the outputs of the counter that only the appropriate logic stage is activated when each of the said pulse counts is reached, to cause the respective indicator to respond. Preferably, the logic stages are connected to triggering stages which control the indicators; the storage properties of the triggering stages are useful since then an indicator that responds will remain visible to the camera user at least until the next one responds, making it unnecessary for the user to memorise the length of film previously indicated. Even if the indicators are controlled by means other than the logic stages and/or triggering stages specified, it may be advantageous to employ such a storage arrangement for the indicators. The triggering stages may be JK-master-slave flip flops, one flip-flop being provided for each indicator, and the control inputs of the flip-flops being connected to the outputs of the logic stages; for example, the control inputs may be connected to

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AND-gates of which the inputs are connected to corresponding output circuits of the digital counting stages. The clock input of each JK-flip-flop may be connected to the output of an associated AND-gate of which one input is connected to the J input and the other input is connected to the pulse generating means.

The indicators are advantageously arranged adjacent to each other. They may respond by lighting up. It is possible for such individual indicators to be arranged adjacent to each other in the viewfinder and to be switched on one after the other as the frame number advances. It is also possible, however, that only the indicator, for example, a light-emitting diode, associated with the respective frame responds, whereas the remaining indicators remain switched off. The illumination one after the other of light-emitting diodes which may be used as indicating means is advantageous since the increasing frame number will be visible to the user as a luminous strip which becomes longer.

According to an advantageous further development, the arrangement is such that the film drive motor is arrested when an indicator corresponding to the end of the film responds; for example, when triggering stages are employed, a control line may extend from the output of the triggering stage indicating the last frame, to the control device of the film drive motor, wherein upon connecting through this triggering stage the film drive motor is arrested. This switching feature is possible as a result of the accurate counting of the exposed frames.

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

Figures 1a and 1b show an electronic counting device and;

Figure 2 shows the logic table of the connected counting stages as a function of the different frame areas.

Referring to Figure 1a, a rotary shutter is indicated by 1, and a cam 3 is mounted in the same shaft 2 as that on which the shutter is mounted, the shaft being driven by a transport motor 57. The cam 3 actuates, via a connection 4, a switch 5, 6 for generating pulses. Since the cam 3 rotates with the shutter, which is in turn coupled with the film advance mechanism, the pulses generated by the switch 5, 6 are in synchronism with the film advancement. One pulse per frame is generated. Connected in series after the pulse switch 5, 6 are two NAND-gates 7, 8 which serve to remove any spurious pulses caused by contact bounce. The output of

the NAND-gate 8 is connected to the input of a counting stage Z1 of a digital counter Z. The counting stage Z1 has connected after it further counting stages Z2, Z3 and Z4. R indicates resetting inputs of the counting stages Z1 to Z4. Each counting stage Z1, Z2, Z3 and Z4, has four outputs 1 to 4 and is in the form of a binary decimal counter. The numbers 0 to 9 are detected by means of the counting stage Z1, the numbers 10 to 99 by the counter Z2, the numbers 100 to 999 by the counting stage Z3 and the numbers 1,000 to 9,999 by the counting stage Z4. Since it is not desired to indicate footages of less than 100 frames by means of the footage counter, the outputs of the counting stages Z1 and Z2 are not connected in circuit.

The output circuits L1 to L4 of the counting stage Z3 and the output circuits L5 to L8 of the counting stage Z4 lead to logic stages 9, 10, 11, 12, 13 and 14. The logic stages 9 to 14 each have an AND-gate for those output circuits of the counting stages Z3 and Z4 which have the potential "1", and a NAND-gate for those output circuit of the counting stages Z3 and Z4 which have the potential "0". The outputs of both gates of each pair are connected to a further AND-gate. The first-mentioned AND-gates of the individual logic stages 9 to 14 are indicated by 15, 16, 17, 18, 19 and 20. The NAND-gates of the individual logic stages are indicated by 21, 22, 23, 24, 25 and 26. The further AND-gates of the individual logic stages are indicated by 27, 28, 29, 30, 31 and 32.

It is assumed that a motion picture film comprises approximately 3,600 frames. An indication of footages which comprise respective 600 frames lengths may be regarded as sufficiently accurate. The logic table according to Figure 2 shows the potential distribution of the outputs of the counting stages Z3 and Z4 and of the output circuits L1 to L8 for frame lengths of 600 frames each. Whereas when the frame number $n=0$ all output circuits L1 to L8 have the potential "0" in the case of the frame number $n=600$, the output circuits L2 and L3 have the potential "1", whereas the remaining output circuits L1 and L4 to L8 have the potential "0". Consequently the output circuits L2 and L3 for the logic stage 9 are connected to the AND-gate 15 and the remaining output circuits L1 and L4 to L8 are connected to the NAND-gate 21. At the 600th frame the potential "1" is therefore established at the output of the AND-gate 27 of the logic stage 9. In the case of the frame number $n=1,200$, the output circuits L2 and L3 have the potential "1" and the remaining output circuits have the potential "0". Accordingly, the output circuits L1 and L6 are connected to the AND-gate 16

and the remaining output circuits are connected to the NAND-gate 22 of the logic stage 10. The corresponding applies for the remaining logic stages 11 to 14. At the 1,200th pulse or frame the potential "1" appears at the output of the AND-gate 28. The corresponding applies, when the frame numbers $n=1,800, 2,400, 3,000$ and $3,600$ are reached, at the outputs of the AND-gates 29, 30, 31 and 32 respectively.

The outputs of the logic stages 9 to 14 are connected to J-inputs of JK-master-slave flip-flops 33, 34, 35, 36, 37 and 38, respectively.

The clock inputs of the JK-flip-flops are connected to the outputs of AND-gates 39, 40, 41, 42, 43 and 44, the first inputs of which are connected to the output of the NAND-gate 8 (where the pulses generated by the pulse switch 5, 6 appear) and the second inputs of which are connected to the outputs of the logic stages 9 to 14. The K-inputs of the JK-flip-flops 33 to 38 are connected to the negative pole of a battery 45 that supplies the circuit. The positive pole of the battery 45 can be connected via a switch 46, closable on closing the camera lid, to the counting stages Z1 to Z4. By means of the switch 46, it is also possible to connect the potential "1" to inputs, indicated by R, of the JK-flip-flops 33 to 38. A potential "1" applied to the inputs R also appears at the outputs Q of the JK-flip-flops as a "1" potential.

The individual outputs Q of the JK-flip-flops 33 to 38 are connected to light-emitting diodes 48, 49, 50, 51, 52 and 53, respectively which together with a further light-emitting diode 47 form indicators which light-up and are visible in the viewfinder. The light-emitting diode 47 can be connected on the one hand directly to the negative pole of the battery 45 and on the other hand, via a switch 54 which is closed on insertion of a cassette, to the positive pole of the battery 45.

The light-emitting diode 47 is permanently lit when a film cassette is inserted and the switch 54 is closed.

When the 600th frame pulse is reached, the potential "1" is supplied from the pulse stage 5, 6, 7, 8 directly to the first input of the AND-gate 39 and, via the output of the AND-gate 27 of the first logic stage 9, to the second input of the AND-gate 39. The J-input of the JK-flip-flop 33 likewise receives the potential "1". In addition, the clock input of the JK-flip-flop 33 receives the potential "1". The potential "0" appears at the output Q so that the light-emitting diode 48 lights up to indicate the 600th frame to the user of the camera.

When the 1200th frame is reached, there accordingly appears at the output Q of the JK-flip-flop 34 the potential "0", so that the

light-emitting diode 49 lights up. This is repeated at the light-emitting diodes 50 to 53 when, respectively, the 1,800th, the 2,400th, the 3,000th and 3,600th frame pulse are reached, respectively.

The output Q of the JK-flip-flop 38 is connected via the terminal 55 to the input of a control circuit 56 (Fig. 1b). The film transport motor 57, is connected in series to the control circuit 56. The supply voltage of the battery 45 is transmitted by the terminals 58 and 59. When the pulse number $n=3,600$ is reached, the potential at the output Q of the JK-flip-flop jumps to the value "0". Consequently the output circuit of the control circuit 56 is blocked and as a result the film transport motor 57 is arrested.

When the camera lid is opened, the switch 46 is opened. As a result of this pulse all counting stages Z1 to Z4 are returned into their initial position by means of the resetting inputs. The same applies to the JK-flip-flops 33 to 38. On the closure of the switch 46 again, the potential "1" is transmitted to the outputs Q via the inputs R of the JK-flip-flops 33 to 38. Consequently all the light-emitting diodes 48 to 53 are switched off. Only the light-emitting diode 47 remains illuminated, indicating to the user that there is a cassette in the camera.

WHAT WE CLAIM IS:—

1. A cine camera comprising means for generating pulses in synchronism with film advancement, a counter for receiving the pulses, and a plurality of indicators responsive to the counter, each indicator being arranged to respond visually when a respective different pulse count is reached, thereby indicating the number of frames run through.

2. A cine camera as claimed in Claim 1, wherein, in operation, the pulses are derived from the film drive mechanism or from a member driven thereby.

3. A cine camera as claimed in Claim 2, wherein in operation, the pulses are derived from rotation of the shutter.

4. A cine camera as claimed in Claim 2 or Claim 3, wherein the pulse generating means is arranged to generate at least one pulse per frame advanced.

5. A cine camera as claimed in any one of Claims 1 to 4, wherein the counter is a digital counter, and there is provided a plurality of logic stages associated with the different pulse counts at which the indicators are to respond, the logic stages being so connected to the outputs of the counter that only the appropriate logic stage is activated when each of the said pulse counts is reached, to cause the respective indicator to respond.



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and the remaining output circuits are connected to the NAND-gate 22 of the logic stage 10. The corresponding applies for the remaining logic stages 11 to 14. At the 1,200th pulse or frame the potential "1" appears at the output of the AND-gate 28. The corresponding applies, when the frame numbers $n=1,800, 2,400, 3,000$ and $3,600$ are reached, at the outputs of the AND-gates 29, 30, 31 and 32 respectively.

The outputs of the logic stages 9 to 14 are connected to J-inputs of JK-master-slave flip-flops 33, 34, 35, 36, 37 and 38, respectively.

The clock inputs of the JK-flip-flops are connected to the outputs of AND-gates 39, 40, 41, 42, 43 and 44, the first inputs of which are connected to the output of the NAND-gate 8 (where the pulses generated by the pulse switch 5, 6 appear) and the second inputs of which are connected to the outputs of the logic stages 9 to 14. The K-inputs of the JK-flip-flops 33 to 38 are connected to the negative pole of a battery 45 that supplies the circuit. The positive pole of the battery 45 can be connected via a switch 46, closable on closing the camera lid, to the counting stages Z1 to Z4. By means of the switch 46, it is also possible to connect the potential "1" to inputs, indicated by R, of the JK-flip-flops 33 to 38. A potential "1" applied to the inputs R also appears at the outputs Q of the JK-flip-flops as a "1" potential.

The individual outputs Q of the JK-flip-flops 33 to 38 are connected to light-emitting diodes 48, 49, 50, 51, 52 and 53, respectively which together with a further light-emitting diode 47 form indicators which light-up and are visible in the viewfinder. The light-emitting diode 47 can be connected on the one hand directly to the negative pole of the battery 45 and on the other hand, via a switch 54 which is closed on insertion of a cassette, to the positive pole of the battery 45.

The light-emitting diode 47 is permanently lit when a film cassette is inserted and the switch 54 is closed.

When the 600th frame pulse is reached, the potential "1" is supplied from the pulse stage 5, 6, 7, 8 directly to the first input of the AND-gate 39 and, via the output of the AND-gate 27 of the first logic stage 9, to the second input of the AND-gate 39. The J-input of the JK-flip-flop 33 likewise receives the potential "1". In addition, the clock input of the JK-flip-flop 33 receives the potential "1". The potential "0" appears at the output Q so that the light-emitting diode 48 lights up to indicate the 600th frame to the user of the camera.

When the 1200th frame is reached, there accordingly appears at the output Q of the JK-flip-flop 34 the potential "0", so that the

light-emitting diode 49 lights up. This is repeated at the light-emitting diodes 50 to 53 when, respectively, the 1,800th, the 2,400th, the 3,000th and 3,600th frame pulse are reached, respectively.

The output Q of the JK-flip-flop 38 is connected via the terminal 55 to the input of a control circuit 56 (Fig. 1b). The film transport motor 57, is connected in series to the control circuit 56. The supply voltage of the battery 45 is transmitted by the terminals 58 and 59. When the pulse number $n=3,600$ is reached, the potential at the output Q of the JK-flip-flop jumps to the value "0". Consequently the output circuit of the control circuit 56 is blocked and as a result the film transport motor 57 is arrested.

When the camera lid is opened, the switch 46 is opened. As a result of this pulse all counting stages Z1 to Z4 are returned into their initial position by means of the resetting inputs. The same applies to the JK-flip-flops 33 to 38. On the closure of the switch 46 again, the potential "1" is transmitted to the outputs Q via the inputs R of the JK-flip-flops 33 to 38. Consequently all the light-emitting diodes 48 to 53 are switched off. Only the light-emitting diode 47 remains illuminated, indicating to the user that there is a cassette in the camera.

WHAT WE CLAIM IS:—

1. A cine camera comprising means for generating pulses in synchronism with film advancement, a counter for receiving the pulses, and a plurality of indicators responsive to the counter, each indicator being arranged to respond visually when a respective different pulse count is reached, thereby indicating the number of frames run through.

2. A cine camera as claimed in Claim 1, wherein, in operation, the pulses are derived from the film drive mechanism or from a member driven thereby.

3. A cine camera as claimed in Claim 2, wherein in operation, the pulses are derived from rotation of the shutter.

4. A cine camera as claimed in Claim 2 or Claim 3, wherein the pulse generating means is arranged to generate at least one pulse per frame advanced.

5. A cine camera as claimed in any one of Claims 1 to 4, wherein the counter is a digital counter, and there is provided a plurality of logic stages associated with the different pulse counts at which the indicators are to respond, the logic stages being so connected to the outputs of the counter that only the appropriate logic stage is activated when each of the said pulse counts is reached, to cause the respective indicator to respond.

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6. A cine camera as claimed in Claim 5, wherein the logic stages are connected to triggering stages which control the indicators. 20
- 5 7. A cine camera as claimed in Claim 6, wherein the triggering stages are JK-master-slave flip-flops, one flip-flop being provided for each indicator, and the control inputs of the flip-flops are connected to the outputs of the logic stages. 25
- 10 8. A cine camera as claimed in Claim 7, wherein the clock input of each JK-flip-flop is connected to the output of an associated AND-gate, one input of which is connected to the J-input of the associated JK-flip-flop and the other input of which is connected to the pulse generating means. 30
- 15 9. A cine camera as claimed in any one of Claims 1 to 8, wherein the arrangement is such that the film drive motor is arrested when an indicator corresponding to the end of the film responds.
10. A cine camera as claimed in any one of Claims 1 to 9, wherein the indicators respond by lighting up. 25
11. A cine camera as claimed in Claim 10, wherein the indicators are light-emitting diodes. 30
12. A cine camera substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.
- ABEL & IMRAY,
Chartered Patent Agents,
Northumberland House,
303—306, High Holborn,
London, WC1V 7LH.

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