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(19)

(54) PHOTOGRAPHIC SHUTTER CONTROL APPARATUS

(71) We, POLAROID CORPORATION, a corporation organised and existing under the laws of the State of Delaware, United States of America, of 549 Technology Square, Cambridge, Massachusetts, United States of America, 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 a photographic camera with an automatic shutter latch.

Electrically driven exposure control systems are advantageous in that they minimize operator requirements of shutter recocking, etc. and are particularly suited for electronic control. For conservation of power, such systems require provision of a stable deenergized shutter condition when the camera is not undergoing exposure operations. An exemplary system of this type is described in U. S. Patent No. 3,820,128 wherein a compact, automated single lens reflex camera is described, and which includes a shutter diaphragm system having shutter blades mechanically biased to an open (viewing) position and electrically biased to a closed position. Advantageously, the exposure system of the above-noted patent is electrically sequenced to provide a precise control over the exposure operation. That is, both the initiation and termination of the exposure interval are electrically, rather than mechanically, determined and, accordingly, may be precisely controlled. However, while the system is particularly adapted for through the lens viewing and provides a normally open shutter, it can be understood that it would also be desirable to provide a normally closed arrangement without compromising the system advantages.

Toward this end, there is described in a copending British Patent application No. 8015/76 (Serial No. 1533616) a latching mechanism provided in order to maintain the shutter blade mechanism in its light blocking position without having to maintain a solenoid in its energy consuming energized state. The means described in the aforementioned patent application for latching and unlatching the shutter blade mechanism comprises a forwardly extending finger arranged for reciprocol movement in correspondence with a film advancing mechanism. The finger is adapted to extend into the locus of moement of the blade mechanism when the film advance mechanism is in its forwardmost position. The shutter blade elements are of the so-called "scanning type" embodying a pivotal walking beam whereby the forward end of the finger provides a rearwardly movable stop, in the path of travel, against which the lower and of the walking beam abuts to prevent clockwise rotation of the walking beam under the influence of a biasing spring. The shutter blade mechanism is unlatched in response to the predetermined rotation of the sequencing gear which causes the film advance mechanism and its associated finger latch to move rearwardly under the influence of another biasing spring. This rearward movement retracts the finger from the path of travel of the walking beam thereby permitting rotation of the beam about its pivot towards the shutter open position. During the course of the cycle of camera operation, the film advance mechanism again moves forwardly to cause the finger to extend through the locus of rotation of the

walking beam to relatch the shutter thereby allowing the solenoid to be de-energised.

Another exposure control system utilising electrically controlled shutter blade elements employing a latch for holding the blades in a light blocking position is more fully described in a copending British patent application no. 35760/76 Serial No. 1554924. In accordance with the general concept of the aforementioned invention, the exposure control system includes a reliable shutter latching arrangement which requires shutter actuation for release. Thus, the exposure control system includes a shutter latch released in response to combined electrical and mechanical actuation of the exposure control system. A mechanical shutter latching arrangement is unlocked just before or simultaneously with energisation of the exposure control system and then subsequently released in response to initial shutter blade movement resulting from energisation of the electrical drive element.

A photographic camera according to the present invention comprises: a blade mechanism mounted for displacement between a blocking arrangement precluding transmission of scene light to a focal plane within the camera and an unblocking arrangement in which scene light is transmitted to the focal plane to effect a photographic exposure; latching means for initially retaining the blade mechanism in one of its said arrangements; driving means to effect the displacement of the blade mechanism from its said arrangement wherein it is retainable by said latching means to the other of its said arrangements and then back to its said arrangement wherein it is retainable by the latching means, to define an exposure cycle of the blade mechanism; electrically energisable control means for the driving means; manually actuable means for energising the control means to cause the driving means to effect an initial displacement of the blade mechanism; the latching means being arranged for displacement, responsive to the initial displacement of the blade mechanism by the driving means, to release the blade mechanism to allow the movement of the blade mechanism under the influence of the driving means to define the exposure cycle; and means responsive to the latching means releasing the blade mechanism for maintaining the energisation of the control means throughout the remainder of the exposure cycle subsequent tothe release of the manually actuable means by the camera user.

In the preferred arrangement, the blade is mounted for movement to a third arrangement, in which it is further displaced from its said other arrangement than when in the arrangement in which it is retainable by the latching means; in this form, the release of the blade mechanism by the latching means results from a displacement of the blade mechanism from the arrangement wherein it is retained by the latching means to the third arrangement. In this preferred form, the blade mechanism has two blocking arrangements, the first being that in which the blade mechanism is retainable by the latching means and the second the arrangement to which the blade mechanism moves for release from the latching means. In a exposure cycle, the blade mechanism is initially moved to the second blocking arrangement as a consequence of energisation of a shutter driving means. Following the exposure cycle, the latching means relatches the shutter blades in response to film advancement.

The blade mechanism is also susceptible to sudden movements, shocks or otherwise which cause the blade mechanism to move from its arrangement wherein it is retainable by the latch means to another of its arrangements. In order to inhibit this response of the blade mechanism to shocks, there is provided in the preferred form a shock stabilising or damping means responsive to such shocks of the blade mechanism for prohibiting the release of the blade mechanism by the latch means. In the preferred form, means are also provided for inhibiting the influence of the stabilising means during ordinary operation of the shutter blade elements in the course of a photographic exposure interval.

In order that the invention may be better understood, an example of a camera embodying the present invention, will now be described with reference to the following drawings, in which:-

Figure 1 is a perspective view of a camera embodying the features of this invention;

Figure 2 is a front cross-sectional view of a portion of the exposure control mechanism in a camera embodying this invention;

Figure 3 is a front cross-sectional view of the exposure control mechanism of Figure 1 in a different operational position;

Figure 4 is a front cross-sectional view of the exposure control mechanism of Figure 1 in still another operational position;

Figure 5 is a side cross-sectional view of another portion of the exposure control and film advance mechanism;

Figure 6 is a side cross-sectional view of the exposure control and film advance mechanism of Figure 5 in a different operational position;

Figure 7 is a side cross-sectional view of the exposure control and film advance mechanism of Figure 5 in still another operational position;

Figure 8 is an exploded perspective of another portion of the exposure control mechanism;

Figure 9 is a cross-sectional view of the film advance mechanism;

Figure 10 is a fragmented front view of still another portion of the exposure control mechanism of Figure 2 showing another operational position;

Figure 11 is a schematic diagram of the electronic circuit of the exposure and film advance system; and

Figure 12 is a fragmented front view of an alternative embodiment of a portion of the exposure control system of Figure 2.

Referring now to Figures 1 and 2, it can be seen that the exposure control system is associated with a photographic apparatus 10 contained within a housing shown generally at 12. A baseblock casting 14 is fixedly stationed within the housing 12 and selectively machined to support the various components of an exposure mechanism shown generally at 16. Surrounding the front and top of the baseblock casting 14, there is provided a cover section 17 which includes at least one opening through which extends a manually adjustable focus bezel 24. Centrally disposed within the baseblock casting 14, there is provided a light entering exposure opening 18 which defines the maximum available exposure aperture for the system.

An objective or taking lens 20 is provided in overlying relation to the light entering opening 18. The objective lens 20 may comprise a plurality of elements retained in predetermined space relation by a cylindrical lens mount 22 which is externally threaded for toothed engagement within the internally threaded focus bezel 24. As is readily apparent focus bezel 24 is made rotatable with respect to the front cover section 17 to provide translational movement of the elements of lens 20 aong the axis 26 of the optical path of the housing 12. As is readily apparent, the central optical axis 26 is illustrated in Figures 2-4 as being normal to the plane of the drawing. Thus, rotation of focus bezel 24 may be carried out by manual rotation to provide displacement of the elements of objective lens 20 for focusing of image-carrying rays through the light entering exposure opening 18 to a rearwardly positioned film plane 28 by way of a reflecting mirror 30 all of which are stationed within a suitable light tight film exposure chamber 31 within the housing 12.

Intermediate the objective lens 20 and light entering exposure opening 18, there is provided a shutter mechanism including two overlapping shutter blade elements 32 and 34 of the so-called "scanning type" which will be subsequently described in greater detail herein. Extending from the front cover section 17, there is provided a photographic cycle initiating button 35, the depression of which commences the exposure interval by ultimately effecting the release of the shutter blade elements 32 and 34 in a manner to be subsequently described herein.

The housing section 12 may include an integrally moulded viewfinder housing 36 extending rearwardly from the front cover section 17. The viewfinder housing 36 affords protection to interval components positioned therein and enables a user to use and frame a desired subject of scene through a window 38 included within the front cover section 17.

A film loading access door 40 including a film withdrawal slot 42 transversely disposed therein is pivotally mounted for movement between positions blocking ad unblocking an open end of the chamber 31 included within the housing 12 for receiving and supporting a film cassette or container 44 (Figures 6 and 7) therein. the cassette 44 encloses an assemblage including a plurality of film units 46 and a dark slide 48 superpositioned thereto for preventing exposure of a forwardmost film unit prior to insertion of the film cassette 44 into the chamber 31.

The film units 46 are multilayered structures including one or ore photosensitive image receiving layers arranged in superposed relation and a rupturable pod 45 containing a supply of fluid processing composition attached to a leading end of the film unit 46. The film cassette 44 including te assemblage is similar to that disclosed and defined in U. S. Patent No. 3,874,875. The film units 46 included in the assemblage represent a general class of "integral type" self-developing film units similar to that described in U. S. Patent No. 3,415,644. The film cassette 44 is shown in position within the film receiving chamber 31 of the camera 10 in Figures 6 and 7. The cassette 44 has a general tapered rectangular shape having a forward wall 50 including an exposure aperture (not shown) therein which is generally coextensive with the photosensitive area of the underlying film unit 46 contained withn the cassette 44. Once the cassette 44 has been properly positioned within the chamber 31, the darkslide cover 48 must be removed prior to commencing a first photographic cycle whereupon the forwardmost film unit 46, subsequent to exposure, is advanced through an elongated film exit slot 52 disposed transversely within a leading end wall 54 of the film cassette 44. As the forwardmost member advances through the exit slot 52, it enters into the bite of a pair of juxtaposed pressure applying rollers 56 and 58 mounted adjacent the film withdrawal slot 42.

The film loading access door 40 is pivotally connected to housing section 12 in such a manner so as to allow the access door 40 and

the rollers 56 and 58 to be pivoted downwardly to provide access to the film receiving chamber 31 for loading and unloading a film cassette 44. The rollers 56 and 58 are suitably mounted within the access door 40 by a mounting bracket (not shown).

A pair of scene light admitting primary apertures 60 and 62 are provided respectively in the blade elements 32 and 34 to collectively define a progressive variation of effective aperture openings in accordance with simultaneous longitudinal and lateral displacement of one blade element with respect to the other blade element in a manner as is fully described in British Patent Application No. 26004/75 (Serial No. 1,507858). The apertures 60 and 62 are selectively shaped so as to overlap the light entering exposure opening 18 thereby defining a gradually varying effective aperture size as a function of the position of the blade elements 32 and 34.

Each of the blades 30 and 32 may additionally be configured to have corresponding photocell sweep secondary apertures shown respectively at 64 and 66. Secondary apertures 64 and 66 may be configured in correspondence with the shapes of scene light admitting primary apertures 60 and 62. As is readily apparent, the secondary apertures 64 and 66 also move in correspondence with the primary apertures 60 and 62 to define a small secondary effective aperture for admitting the passage of scene light transmitted through a photocell aperture 68 in front cover section 17 of housing 12, from the scene being photographed.

Scene light admitted by the photocell secondary apertures 64 and 66 is thereafter directed to a light detecting station shown generally at 70. The light detecting station includes a photoresponsive element 72 (Figure 11) which cooperates with a light integrating capacitor 74 together with light integrating and control circuitry 76 as is more fully described in a copending British Patent No. 40848/76 (Serial No. 1559573). In this manner, the exposure interval can be terminated as a function of the amount of light received through the secondary effective aperture defined by the overlapping photocell sweep apertures 64 and 66.

Projecting from the baseblock casting 14 at a location spaced laterally apart from the light entering exposure opening 18, is a pivot pin or stud 78 which pivotally and translatably engages elongate slots 80 and 82 formed in respective shutter blade elements 32 and 34. Pin 78 may be integrally formed with the baseblock casting 14. Blade elements 32 and 34 may be retained in engaging relation with respect to the pin 78 by any suitable means such as peening over the outside end of pin 78.

The opposite ends of the blade elements 32 and 34 respectively include extended portions which pivotally connect to a walking beam 84. Walking beam 84, in turn, is disposed for rotation relative to the baseblock casting 14 by pivotal connection to a projecting pivot pin or stud 86 which may be integrally formed with the baseblock casting 14 at a location spaced laterally apart from the light entering exposure opening 18. The walking beam 84 may be pivotally retained with respect to the pin 86 by conventional means such as an E ring (not shown). In the preferred mode, the walking beam 84 is pivotally connected at its distal ends to the shutter blades elements 32 and 34 by respective pin members 90 and 92 which extend laterally outward from the walking beam 84. Pin members 90 and 92 are preferably circular in cross section and extend through respective circular openings 94 and 96 in respective blade elements 32 and 34 so as to slidably engage respective arcuate slots or tracks 98 and 100 which may be integrally formed within the baseblock casting 14. The arcuate tracks 98 and 100 operate to inhibit this engagement of the blade elements 32 and 34 from their respective pin members 90 and 92 during operation of the exposure control system. Thus, the walking beam 84 and shutter blade elements 32 and 34 collectively define a blade mechanism with the means for mounting the blade mechanism for displacement including pivot pins 78 and 86.

Drive means for displacing the blade mechanism include a tractive electromagnetic device in the form of a solenoid 102 employed to displace the shutter blades 32 and 34 with respect to each other and the casting 14. The solenoid 102 includes an internally disposed cylindrical plunger unit 104 which retracts inwardly into the body of the solenoid upon energization of the solenoid winding. The solenoid plunger 104 includes an end cap 108 at the outsdie end thereof together with a vertical slot or groove 110 within the end cap 108 for loosely engaging a pin 106 extending outwardly from the walking beam 84. In this manner, the solenoid plunger 104 is affixed to the walking beam 84 so that longitudinal displacement of the plunger 104 will operate to rotate the walking beam around the pivot pin 86 so as to appropriately displace the shutter blades 32 and 34. The drive means may additionally include a helical compression spring 107 around the plunger 104 so as to continuously urge the end cap 18 outward of the solenoid 102 thereby also continuously urging the blade elements 32 and 34 into positions defining their largest effective aperture over the light entry and exposure opening 18. As will be readily understood, in some shutter blade arrangements it may be preferable to utilize a tension spring in

place of compression spring 107. Thus, with the spring connection herein described, the exposure control system is biased to continuously urge the shutter blade elements 32 and 34 into an open orientation.

In the present arrangement, the shutter blades 32 and 34 are drawn from their open position to their closed position as shown in Figures 2-4 when the solenoid 102 is energized. Consequently, energization of solenoid 102 prevents the shutter blades 32 and 34 from moving towards their maximum aperture opening under the urging of compression spring 107. However, as should be readily understood, the exposure control system of this invention would be equally applicable to photographic systems where the blades 32 and 34 are spring biased in a normally closed position.

Referring now to Figures 2-4, there is shown generally at 112 latch means including a latch member having an elongated main body portion 114 disposed for rotation about a pivot pin or shaft 116 integrally moulded with the baseblock casting 14. The main body portion 114 includes an integral arm portion 118 extending outwardly therefrom into overlapping relation therewith to ultimately define an integral hook portion 120. Hook portion 120 is adapted for releasable engagement with an integrally moulded pin member 126 extending laterally outward from the side of walking beam 84. More specifically, hook portion 120 defines a first edge surface 122 which engages pin member 126 so as to inhibit clockwise rotation of walking beam 84 about pin 86. In addition, hook portion 120 defines a second edge surface 124 which engages the bottom of pin member 126 to inhibit counterclockwise rotation of latch member 112 about its pivot pin 116. A latch release slot is shown generally at 125 and accommodates release of the walking beam 84 from the hook portion 120 in a manner to be subsequently described. Latch member 112 is resiliently biased for yieldable clockwise rotation about pivot pin 116 to a tension spring 128, one end of which engages an integral hook portion 130 extending laterally outward from the main body portion 114 of the latch member 112. The other end of tension spring 128 is fixed with respect to the baseblock casting 14 by a pin member 132.

Referring now to Figures 5-8, there is shown an actuator member 136 rotatably disposed between a pair of spaced apart first and second side mounting members 138 and 140. The first and second side members 138 and 140 may be joined together by suitable means to provide a sub-assembly to components in the following manner. The first side mounting member 138 includes a laterally extending, integrally moulded shaft 142 for rotatably mounting the actuator 136 thereon. The shaft 142 extends through a bore 144 in the actuator 136, the bore 144 being disposed in general concentric relation to an integrally moulded shaft 146 extending laterally outward from the actuator member 136. The outside end of shaft 146 is inserted for rotation within a receiving aperture on the second side mounting member 140. The actuator arm member 136 additionally includes a laterally extending, integrally moulded arm portion 150 which is resiliently biased into engagement with an edge surface 134 of the main body portion 114 of latch 112. Resilient bias is applied to the actuator member 136 for urging rotation thereof in a clock-wise direction as viewed in Figures 5-7 by means of a tension spring 154, one end of which connects to an integrally moulded hook portion 152 from the actuator member 136 and the other end of which is fixed with respect to the first side mounting member 138 by connection to pin 156.

The camera 10 is also provided with a motor driven gear train shown generally at 158 in Figures 6 and 7. The gear train is driven by an electrically energized motor 160 which may be energized by an electrical battery 162 shown schematically in Figure 11 and preferably included within the film cassette 44, as disclosed in U. S. Patent No. 3,543,662 or from a separate battery source mounted within the camera.

A sequencing gear or wheel 168 is rotatably driven by the motor gear train 158. The sequencing wheel 168 includes a centre bore 172 therethrough disposed for rotation about an integrally moulded shaft 170 extending laterally outward from the first side mounting member 138 into engagement with the receiving aperture 174 in the second side mounting member 140. The sequencing wheel 168 includes a profile cam 176 extending outwardly from the side thereof to drive a film advance mechanism as shown generally at 177 in Figure 9.

The film advance mechanism 177 includes a reciprocating film advance member or device 178 for advancing the forwardmost film unit 46 in the film cassette 44 from the exposure position, through the film exit slot 52, and into the bite of the processing members 56 and 58. The main portion of film advance member 178 is preferably stamped from a thin sheet of metal such as stainless steel and includes an arm 184 attached to and extending rearwardly from a support section 180 to a hook end 182 for engaging a trailing edge of the forwardmost film unit 46. The support section 180 is retained for reciprocal translation with respect to the first mounting member 138 by means not shown. As the film advancing member 178 is advanced forwardly, by means to be described hereinafter, the

trailing hook end 182 pulls on the trailing end of the film unit 46 to advance it through the withdrawal slot 52 and into the bite of processing members 56 and 58. Access for the film engaging hook 182 is provided by an elongated slot (not shown) at a trailing end corner of the film cassette 44. The free forward end of support section 180 defines a right angel bend having an end surface 186 adapted to follow the profile cam 176 on wheel 168. The film advance member 178 is resiliently based to move in a direction away from the processing members 56 and 58 by a tension spring 190, one end of which at 192 connects to the support section 180 while the other end is grounded at 194 with respect to the first side mounting member 138. Thus, the combination of profile cam 176 and biasing spring 190 attached to support section 180 determine the reciprocal translation of the film advancing member 178 with respect to the first and second side mounting members 138, 140.

The shaft 146 of actuator 136 extends through a slot 202 of a slider member 200 so that the slider member 200 may be moved longitudinally within the housing 12 in parallel relation with an inwardly facing surface of the first side mounting member 138 between the limits defined by a semi-circular edge 204 and a vertical edge 206 of the slot 202. Slider member 200 additionally includes a large opening 208 defined vertically by upper and lower edges 210 and 212 respectively which extend longitudinally in the slider member 200 below the slot 202. An integrally moulded prong 214 extend laterally outward from the inwardly facing surface of the first side mounting member 138 and through the large opening 208 to facilitate engagement between an outside hooked end 215 thereof and a corresponding notch in the second side mounting member 140. The slider member 200 also includes a mounting surface 216 to which the actuator button 35 may be fixedly connected to provide a manually actuated, forwardly biased, push button type switch for initiating the exposure of each of a predetermined number of film units 46 included within the assemblage stored in the film cassette 44. Although the slider member 200 will hereinafter be described as having only two operative positions, it should be readily understood that the slider member 200 may include more than two operative positions.

Referring now to Figures 5, 6 and 8, there is shown generally at 218 a switch block arrangement comprising a moulded switch block 220 to which are connected three pairs of spaced apart, resilient terminal leaves defining three switches S1, S2 and S3. Although a fourth switch is also illustrated as part of the switch block arrangement 218, its function is not relevant to the instant disclosure and hence will not be further described herein. Switch S1 comprises an upper resilient terminal leaf 222 in spaced apart relation to a lower resilient terminal leaf 224 which leaves are respectively bent at 236 and 234 for respective engagement with a pair of integrally moulded projections 235 and 237 extending laterally outward from the side of slider member 200 for cooperation in a manner to be subsequently described in greater detail herein. Similarly, switch S2 comprises an upper resilient leaf 226 spaced apart from a lower resilient leaf 228 to define a switch in parallel electrical connection with switch S1 as shown in the schematic diagram of Figure 11. In like manner, switch S3 comprises an upper resilient terminal leaf 230 biased in spaced apart relation to a lower resilient terminal leaf 232 to provide a binary logic input signal from the battery 162 to the exposure sequencing control circuit 76. As is readily apparent, switches S1 and S2 provide the requisite connection for the battery 162 to energize the exposure sequencing control circuit 76 as well as a motor and solenoid control circuit 238 together with its associated solenoid 102 and motor 160.

Referring now back to Figures 7 and 8, there is shown an integrally moulded depending arm portion 240 extending from the actuator 136 for engagement with the upper resilient terminal leaves 226 and 230 of respective switches S2 and S3 upon counterclockwise rotation of the actuator 136 about the shaft 142. Thus, counterclockwise rotation of the actuator 136 against the bias of tension spring 154 operates to deflect the upper resilient terminal leaves 226 and 230 from engagement with their respective lower terminal leaves 228 and 232 so as to open switches S2 and S3. In the preferred embodiment, the leading edge profile of depending arm portion 240 is configured in a manner operating to open switch S3 prior to opening switch S2 when rotated in a counterclockwise direction, while conversely permitting switch S2 to close prior to switch S3 when rotated in a clockwise direction. Actuator member 136 additionlly includes an integrally moulded cam follower portion 242 extending laterally outward from the side thereof for cooperative engagement with a second profile cam 252 (Figure 7) on the internal surface of sequencing wheel 168. Thus, as is readily apparent, clockwise rotation of sequencing wheel 168 operates to rotate profile cam 252 into engagement with cam follower portion 242 to rotate actuator 136 in a counterclockwise direction about the shaft 142 and against the bias of tension spring 154.

Referring back to Figure 2, there is additionally shown a shock stabilizing

means including an inertia member 254 connected for rotation with respect to the baseblock casting 14 by a pivot pin 258. The inertial member 254 includes a main body portion 256 from which extend upwardly an integral arm portion 260, the outward tip of which is located in the locus of travel of the laterally extending pin 126 from the walking beam. Inertia member 254 is biased for rotation in a counterclockwise direction about pivot pin 258 by a leaf spring 262, one end of which engages the main body portion 256 at 264 and the other end of which is fixed with respect tothe baseblock casting at 266. In addition, the main body portion 114 of the latching includes an integral depending arm portion 270 extending downwardy therefrom in overlying relation with respect to the pivot pin 258 so as to inhibit the inertia member 254 from sliding axially off the pivot pin 258 regardless of the latch position.

In order to initiate exposure of the forwardmost film unit 46, the user must depress the actuator button 35 attached to the mounting surface 216 of slider member 200 so as to displace the slider rearwardly along the shaft 146. In this manner, the integrally moulded projections 235 and 237 from the slider member 200, respectively, engage bent portions 236 and 234 at respective terminal leaves 222 and 224 so as to displace the terminal leaves into contact with each other as shown in Figure 6, thereby closing switch S1 and energizing control circuit 76 and 238. Solenoid 102 is also energized in correspondence with the control circuits so as to effect an inward displacement of plunger 104, thereby rotating the walking beam 84 in a counterclockwise direction so as to displace the pin 126 out of engagement with the latching surfaces 122 and 124 and into alignment with the latch release slot 125 as shown in Figure 3. The latch member 12 is thereafter rotated in a counterclockwise direction about the pivot pin 116 by the actuator member 136 of which arm 150 engages the edge surface 134 of the latch. The actuator member 136 is rotated in a clockwise direction by the tension spring 154 so as to overcome the force of tension spring 128.

Clockwise rotation of actuator member 136 also operates to bring the depending end portion 240 thereof sequentially out of engagement with the upper resilient terminal leaves 226 and 230 of respective switches S2 and S3. The upper terminal leaves 226 and 230 are thereafter deflected into respective engagement with the lower terminal leaves 228 and 232 to respectively close the switches S2 and S3. In the preferred mode switch S2, which operates to connect battery power to the control circuits 76 and 238, closes prior to switch S2 which operates to connect a binary input logic signal from the battery 162 to the exposure and sequencing control circuit 76. Thus, as is now readily apparent, with switches S2 and S3 closed, the user may release the button 35 so as to permit the slider member 200 to translate forward under the influence of tension spring 154. The resilient terminal leaves 222 and 224 of switch S1 also spring apart in correspondence with forward translation of sliding member 200. Thus, the terminal leaves 222 and 224 of switch S1 are arranged to be opened and closed in correspondence respectively with the depression and release of button 35 so as to collectively define a pushbutton type switch.

As is now readily apparent, the aforementioned counterclockwise rotation of the latch member 112 under the influence of the actuator member 136 and its associated tension spring 154 also simultaneously operates to unlatch the walking beam 84 to facilitate clockwise rotation thereof under the influence of compression spring 104. Simultaneous application of the binary input logic signal to the exposure and sequencing control circuit 76 by the switch S3 operates to ultimately effect a switching operation by the motor and solenoid control circuit 238 to de-energize the solenoid 102 and thereby commence an exposure interval. The shutter blade elements 32 and 34 are thereafter moved by the walking beam 84 and compression spring 104 in directions which operate to progressively enlarge the effective aperture over the light entering exposure opening 18. Rotation of the walking beam 84 as previously discussed effects a simultaneous linear and angular movement of the shutter blade elements 32 and 34 about the pivot pin 78 so that the photocell sweep secondary apertures 64 and 66 define a corresponding progressively enlarging aperture over the photoresponsive element 72. Thus, from the instant the photographic cycle is initiated upon the deenergization of solenoid 102, the photoresponsive element 72 provides a time varying response corresponding to the intensity of scene light incident thereon. The capacitor 74 operates in conjunction with the photoresponsive element 72 to provide an input signal to the exposure and sequencing control circuit 76 which is representative of the time integration of the scene light intensity incident to the photoresponsive element 72. Upon reaching a predetermined exposure of the forwardmost film unit 46, the exposure and sequencing control circuit 76 signals the motor and solenoid control circuit 238 to again energize the solenoid 102 to retract the plunger 104 therein and rotate the walking beam 84 in a counterclock-wise direction back to the scene light blocking arrangement as shown in Figure 4 to termin-

ate the exposure interval.

Upon termination of the exposure interval in the aforementioned manner, the exposure and sequencing control circuit 76 signals the motor and solenoid control circuit 238 to energize the motor 160 which operates to rotate the sequencing wheel 168 in a clockwise direction by way of the motor driven gear train 158. Rotation of the sequencing wheel 168 operates to rotate the profile cam 176 thereon into engagement with the end surface of 186 defined by the right angle bend at the free forward end of the film advance support section 180. The end surface 186 is held in engagement with the cam 176 by the rearward force supplied to the film advance mechanism 177 by the biasing tension spring 190. As the film advance mechanism 170 is advanced forwardly by the cam 176 on wheel 168, the trailing hook end 182 pulls on the traling end of the film unit 46 to advance it through the withdrawal slot 52 and into the bite of pressure applying members 56 and 58. The film unit 46 is thereafter processed by the pressure applying members 56 and 58 and ejected from the camera apparatus 10 by way of the film withdrawal slot 42 and the film loading access door 40. Continued rotation of the sequencing wheel 168 operates to move the profile cam 176 out of engagement with the end surface 186 of the film advance mechanism 177 thereby permitting the film advance mechanism to retract rearwardly under the influence of tension spring 190.

Continued rotation of the sequencing wheel 168 subsequent to the ejection of a processed film unit operates to rotate the profile cam 252 into engagement with the integral cam follower portion 242 of actuator member 136 so as to rotate the actuator member in a counterclockwise direction as viewed in Figures 5-8 against the biasing influence of tension spring 154. Counter-clockwise rotation of actuator member 136 in turn operates to rotate depending arm portion 240 into sequential engagement with upper terminal leaves 226 and 230 of respective switches S2 and S3. Again in the preferred mode, switch S3, is arranged to be opened prior to switch S2 in order that the binary logic input control signal may be disconnected prior to the deenergization of the control circuits 76 and 238. As is now readily apparent, opening switches S2 and S3 deenergizes the motor 160 which continues to coast until profile cam 252 on wheel 268 has been rotated out of engagement with cam follower 242 on actuator member 136.

Counterclockwise rotation of the actuator member 136 and its associated arm 150 accommodates clockwise rotation of the latch member 112 about pivot pin 116 under the operative infuence of tension spring 128. Thus, the latch release slot 125 is rotated past the laterally extended pin 126 from the walking beam 84 so that the latch member 112 assumes the position as shown in Figure 2. Once the latch is rotated into the latching position, switches S2 and S3 are arranged to open so as to cause the solenois 102 to deenergize and effect a limited clockwise rotation of the walking beam 84 under the operative infuence of compression spring 104 so that pin 126 engages latch surfaces 122 and 124. In this manner, the shutter blade mechanism is automatically relatched in concert with the opening of switches S2 and S3 so as to deenergize the control circuit 76 and 238 together with the solenoid 14 and motor 160. Should the user fail to release the button 35, the exposure and sequencing circuit 76 will nevertheless operate to deenergize the solenoid 102 in motor 160 in the aforementioned manner.

Should the camera apparatus 10 be shaken, dropped or otherwise shocked in a manner causing walking beam 84 to rotate in a counterclockwise direction against the operative influence of compression spring 104, there could occur an unlatching of the shutter blade mechanism in the manner as previously described. Thus, as a precaution against the accidental unlatching of the shutter blade mechanism, there is provided the inertia member 254 for engaging the pin 126 of the walking beam 84 upon a sudden shocking of the walking beam 84. As should be readily understood, the inertia member 254 must either be arranged to initially engage the pin 126 or be slightly spaced apart therefrom to allow the walking beam 84 to move slightly before engaging the inertia member 254. In this manner, kinetic energy imparted to the walking beam upon the shocking thereof is subsequently transferred to the intertia member 254 by the pin 126. Transfer of the kinetic energy from the walking beam 84 to the inertia member 254 operates to stop the walking beam 84, in arrangement where the inertia member is intially spaced apart from the pin 126, while imparting a clockwise rotation to the intertia member 254 is resiliently biased by the leaf spring 262 to rebound back and engage the pin 126 of the walking beam thereby again transferring the remaining kinetic energy from the inertia member back to the walking beam so as to inhibit the walking beam from accidentally moving into the unlatched position.

Under severe or repeated shock the walking beam 184 may again rebound back into engagement with the inertia member 254 causing another reverberation thereof in the above-described manner. The actual number of consecutive reverberations may depend upon the severity of shock to which the

camera is subjected; however, the reverberations will gradually decrease until the walking beam is returned to its latched position as shown in Figure 2.

In this manner, the shutter blade mechanism can be prohibited from accidentally unlatching as a result of sudden shock, while during normal operation the inertia member 254 is simply rotated in a counterclockwise direction out of the way by the walking beam pin 126 upon the energisation of solenoid 102.

As seen in Figures 2-4, means are provided for inhibiting the operative influence of the shock stabilising means on the walking beam 84 during the above described exposure cycle. This inhibiting means comprises an integral member 268 projecting laterally outward from the side of the main body portion 114 of latch member 112 into overlapping relation with the underlying edge of inertia member 254. Thus when latch member 112 is rotated into the unlatched position in the aforementioned manner as shown in Figure 4, projecting member 268 also rotates in a counter clockwise direction in correspondence with latch member 112 so as to engage the underlying edge of the inertia member 254 and thereafter rotate the inertia member 254 in a clockwise direction about the pivot pin 258. In this manner, the inertia member 254 is rotated and maintained out of the locus of travel for the walking beam 84 during an exposure cycle permitting unobstructed rotation of the walking beam 84. Otherwise, the walking beam 84 would strike the inertia member 254 upon closing of the blade elements resulting in undesirable vibrations to the blade mechanism. As is now readily apparent, subsequent clockwise rotation of the latch member 112 into the latched position of Figure 2 permits counterclockwise rotation of the inertia member 254 about its pivot pin 258 under the operative influence of leaf spring 262. In this manner, the inertia member 254 is returned to its initial position as shown in Figure 2.

WHAT WE CLAIM IS:-

1. A photographic camera comprising: a blade mechanism mounted for displacement between a blocking arrangement precluding transmission on scene light to a focal plane within the camera and an unblocking arrangement in which scene light is transmitted to the focal plane to effect a photographic exposure; latching means for initially retaining the blade mechanism in one of its said arrangements; driving means to effect the displacement of the blade mechanism from its said arrangement wherein it is retainable by said latching means to the other of its said arrangements and then back to its said arrangement wherein it is retainable by the latching means, to define an exposure cycle of the blade mechanism; electrically energisable control means for the driving means; manually actuable means for energising the control means to cause the driving means to effect an initial displacement of the blade mechanism; the latching means being arranged for displacement, responsive to the initial displacement of the blade mechanism by the driving means, to release the blade mechanism to allow the movement of the blade mechanism under the influence of the driving means to define the exposure cycle; and means responsive to the latching means releasing the blade mechanism for maintaining the energisation of the control means throughout the remainder of the exposure cycle subsequent to the release of the manually actuable means by the camera user.

2. A camera as defined in claim 1, wherein: the blade mechanism is mounted for movement to a third arrangement in which it is further displaced from its said other arrangement than when in its said arrangement wherein it is retainable by the latching means, the release of the blade mechanism by the latching means resulting from a displacement of the blade mechanism from its said arrangement wherein it is retainable by the latching means to its said third arrangement.

3. A camera as defined in claim 2, wherein: the said other of the blade mechanism arrangements is an unblocking arrangement and the blade mechanism is mounted for movement between two blocking arrangements, the second blocking arrangement constituting the third arrangement of the blade mechanism, the blade mechanism in the second of the blocking arrangements being further displaced from its said unblocking arrangement than when in its said first blocking arrangement and the release of the blade mechanism by the latching means being permitted by a displacement of the blade mechanism from its said first blocking arrangement to its said second blocking arrangement.

4. A camera as defined in claim 2 or 3 in which the driving means includes electrically energisable means for displacing the blade mechanism from its said other arrangement toward its said third arrangement together with resilient means for yieldably urging the blade mechanism toward its said other arrangement; the actuating means additionally including switching means for initiating the energisation of the said electrically energisable means to displace the blade mechanism from its said arrangement wherein it is retainable by the said latching means to its said third arrangement in which the blade mechanism is released by displacement of the latching means; and the means

for maintaining the energisation of the control means subsequent to the release of the manually actuable means includes means operatively associated with the latching means and switching means and responsive to displacement of the latching means for rendering the switching means conductive throughout the remainder of the exposure cycle.

5. A camera as defined in claim 4, wherein: the manually actuable means includes a manually oerated first switch connectable between a source of electrical energy and said electricaly energisable control means, and the means for maintaining the energisation of the control means subsequent to the release of said manually operated first switch includes at least a second switch in a normally non-conductive condition in parallel connection with respect to the first switch, the second switch coming into operative association with the latching means upon the displacement thereof so as to be conductive throughout the remainder of the exposure cycle.

6. A camera as defined in claim 5, wherein the control means comprises an electrically energisable control circuit connectable to a source of electrical energy by the manually operated first swtich and controlled by a binary input signal, and the means for maintaining the energisation of the control means subsequent to the manual release of the first switch additionally includes a third switch in a normally nonconductive condition and responsive subsequent to the closing of the second switch to apply a binary input control signal to the control circuit.

7. A camera as defined in claim 3, 4, 5 or 6 wherein the driving means includes a solenoid.

8. A camera as defined in anyone of the preceding claims, additionally including means for advancing the photographic material from the focal plane subsequent to the exposure thereof during the exposure cycle; and means responsive to operation of the advancing means for positioning the latching means to accommodate return of the blade mechanism back to its said arrangement wherein it is retainable by the latching means.

9. A camera as defined in claim 8, wherein the means for advancing the given photographic material includes: a wheel having at least one cam surface in fixed connection thereto, means for rotatably mounting the wheel with respect to the camera, means for rotatably driving the wheel, and means in operative association with the wheel for displaceably engaging the photographic material upon the rotation of the wheel; and wherein the means for positioning the latching means to accommodate return of the blade mechanism back to its arrangement wherein it is retainable by the latching means includes: means operatively associated with the wheel and the latching means and responsive to engagement with the cam surface of the wheel for displacing the latching means into position accommodating the return of the blade mechanism back to its said arrangement wherein it is retainable by the latching means.

10. A camera as defined in claim 9, wherein the means operatively associated with the wheel and the latching means drives the latching means to release the blade mechanism in response to displacement of the blade mechanism from its said arrangement wherein it is retainable by the latching means to its said third arrangement and is thereafter responsive to the said engagement with the cam surface of the wheel for displacing the latching means to accomodate the return of the blade mechanism.

11. A camera as defined in claim 2 or 3, wherein: the driving means for the blade mechanism include electrically energisable means for displacing the blade mechanism from its said other arrangement toward its said third arrangement together with resilient means for yieldably urging the blade mechanism toward its said other arrangement; the manually actuable means includes a first manually actuable switch to initiate electrical energisation of the blade driving means to displace the blade mechanism from its said arrangement wherein it is retainable by the latching means to its third arrangement in which the blade mechanism is released by displacement of the latching means, the electrically energisable control means thereafter respectively actuating and deactuating the driving means at predetermined times during the exposure and advancement of the photographic material together with at least a second switch in a normally nonconductive condition for connecting the control means to the source of electrical energy responsive to the latch-driving means displacing the latching means to release the blade mechanism, and thereafter responsive to the latch-driving means displacing the latching means into position accommodating the return of the blade mechanism back to its said arrangement wherein it is retainable by the latching means for driving the said second switch back to its normally nonconductive condition thereby disconnecting the control means from the source of electrical energy.

12. A camera as defined by claims 2 and 8 wherein said driving means for said blade mechanism includes electrically energisable means for displacing said blade mechanism in a given direction; the means for advanc-

ing the photographic material includes an electrically energisable motor; the manually actuable means includes a first manually actuable switch to initiate electrical energisation of the blade driving means effecting the release of the blade mechanism, the electrically energisable control means thereafter selectively actuating and deactuating the blade-mechanism driving means and motor at predetermined times during the exposure and advancement of the photographic material; and the means for positioning the latching means to accommodate return of the blade mechanism to its said arrangement wherein it is retainable by the latching means includes an actuator arm together with means for mounting the actuator arm for rotation with respect to the camera, the actuator arm being resiliently biased into engagement with the latching means to rotatably displace the latching means into releasing the blade mechanism responsive to the actuation of the driving means while also rotating into engagement with a normaly non-conductive second switch, connected between the control means and a source of electrical energy to render the second switch conductive, the actuator arm thereafter being rotated against its said direction of resilient bias responsive to operation of the advancing means to render the second switch nonconductive and allow rotatable displacement of the latching means back to its said arrangement wherein it can retain the blade mechanism.

13. A camera as defined in claim 12, wherein the control circuit is connected to a source of electrical energy by way of said second switch and wherein there is further included a third switch in a normaly nonconductive condition responsive to the rotatable displacement of the actuator arm to displace the latching means into releasing the blade mechanism subsequent to the closing of the second switch to connect a binary input control signal from the source of electrical energy to the control circuit and thereafter responsive to rotation of the actuator arm against the said direction of resilient bias to render the third switch non-conductive prior to the second switch being rendered non-conductive.

14. A camera as defined in any one of the preceding claims, in which the blade mechanism is responsive to a sudden shocking thereof for movement from its said arrangement wherein it is retainable by the latching means to another of its said arrangements; and shock stabilising means responsive to the said shocking of the blade mechanism not resulting from the said actuation of the driving means for prohibiting the release of the blade mechanism by the latching means.

15. A camera as defined in claim 14 wherein the shock stabilising means includes an inertial member, together with means for mounting the inertial member for limited displacement with respect to the camera, the inertial member having a portion thereof normally disposed for engagement with the blade mechanism upon the said shocking of the blade mechanism, the shocking of the blade mechanism operating to cause the inertial member to move away from its said normally disposed position and thereafter rebound back into its said normally disposed position to engage the blade mechanism in the said arrangement wherein it is retainable by the latching means when the driving means remains unactuated.

16. A camera as defined in claim 15, wherein the means for mounting the inertial member includes a pivot pin and the latchingmeans includes a depending arm portion overlying the pivot pin to maintain the inertial member on the pivot pin, the camera also including means for resiliently biasing rotation of the inertial member in the direction of the said rebound.

17. A camera as defined in claim 14, 15 or 16, in which the latching means includes means, responsive to the said displacement of the latching means to effect the said normal release of the blade mechanism, for inhibiting the operative influence of the shock-stabilising means on the blade mechanism until the blade mechanism is returned to its said arrangement wherein it is retainable by the latching means.

18. A camera as defined in claims 2 and 17, in which the means for inhibiting the operative influence of the shock stabilising means includes at least one member which is displaceable in correspondence with the latching means when the latching means effects the said normal release of the blade mechanism, for engaging and urging the inertial member to move away from its said normally disposed position to another position wherein the inertial member is at least out of interfering relation with the said third arrangement of the blade mechanism, the said member thereafter operating to maintain the inertial member in its said other position at least until the blade mechanism is returned to the said third arrangement at the termination of the exposure cycle.

19. A camera as defined in claim 18, wherein the inertial member is rotatably mounted and further including means for resiliently biasing rotation of the inertial member in the direction of the said rebound, the said member displaceable with the latching means operating to rotate the inertial member from its said normally disposed position against the resilient bias of the biasing means and the inertial member thereafter being returned to its said normal-

ly disposed position by the biasing means.

20. A camera as defined in claim 17, wherein the latching means includes a latch member mounted for displacement between a first position wherein the latch member retains the blade mechanism and a second position wherein the latch member releases the blade mechanism; the stabilising means include an inertia member mounted for displacement between a first position wherein it is disposed in the path of movement of at least a portion of the blade mechanism as the blade mechanism moves from its said arrangement wherein it is retainable by the latching means to another of its said arrangements and then back to its said arrangement wherein it is retainable by the latching means to define the exposure cycle, and a second position wherein it is disposed out of the said path of movement; and the means for inhibiting the operative influence of the shock stabilising means includes means responsive to the displacement of the latch member from its said first position to its said second position to move the inertia member from its said first position to its said second position and thereafter responsive to the displacement of the latch member from its said second position back to its said first position to move the inertia member from its said position back to its said first position.

21. A photographic camera substantially as herein described with reference to the accompanying drawings.

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1566893 COMPLETE SPECIFICATION

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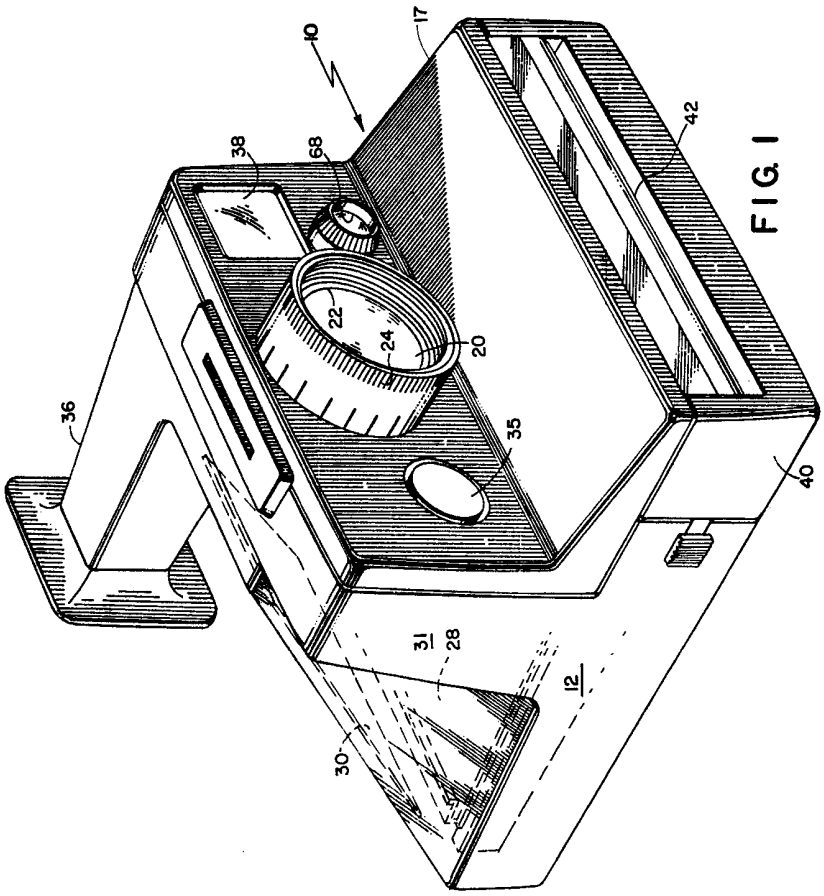

FIG. 1

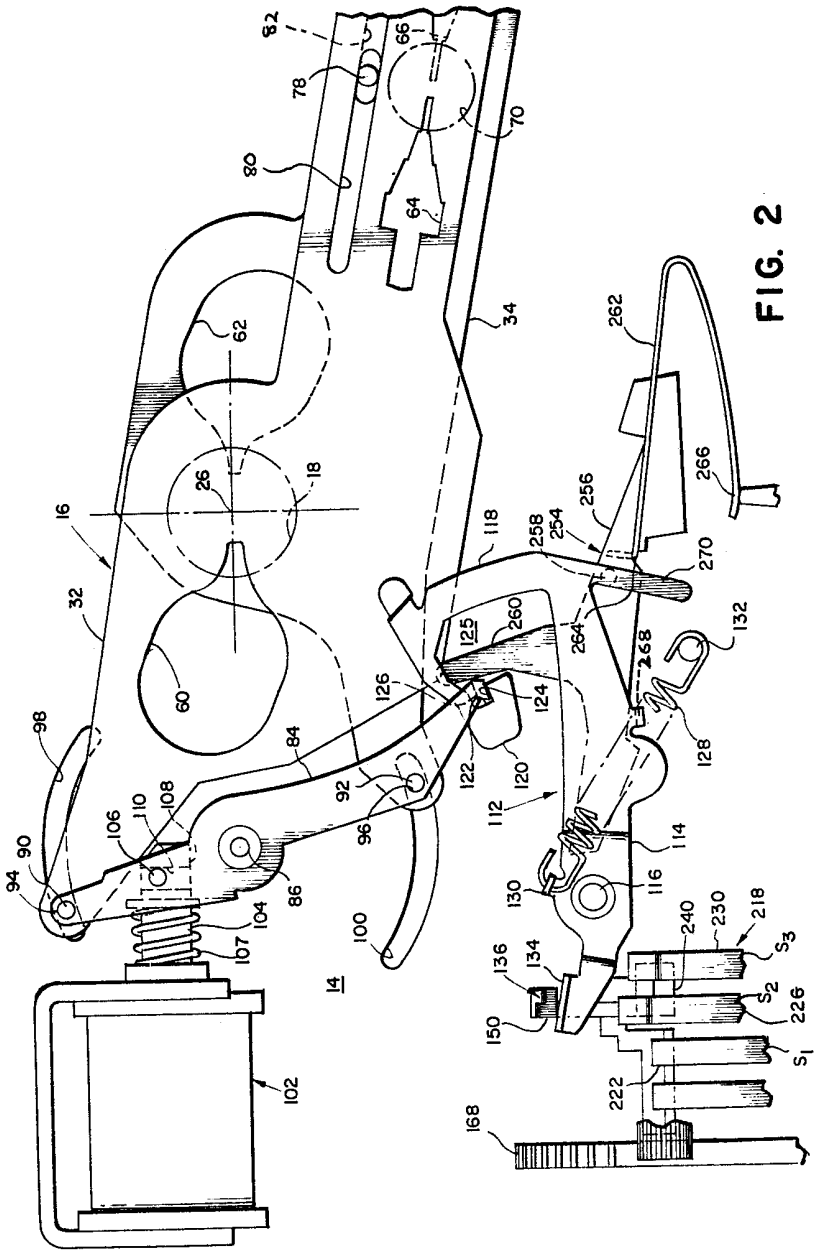
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FIG. 2

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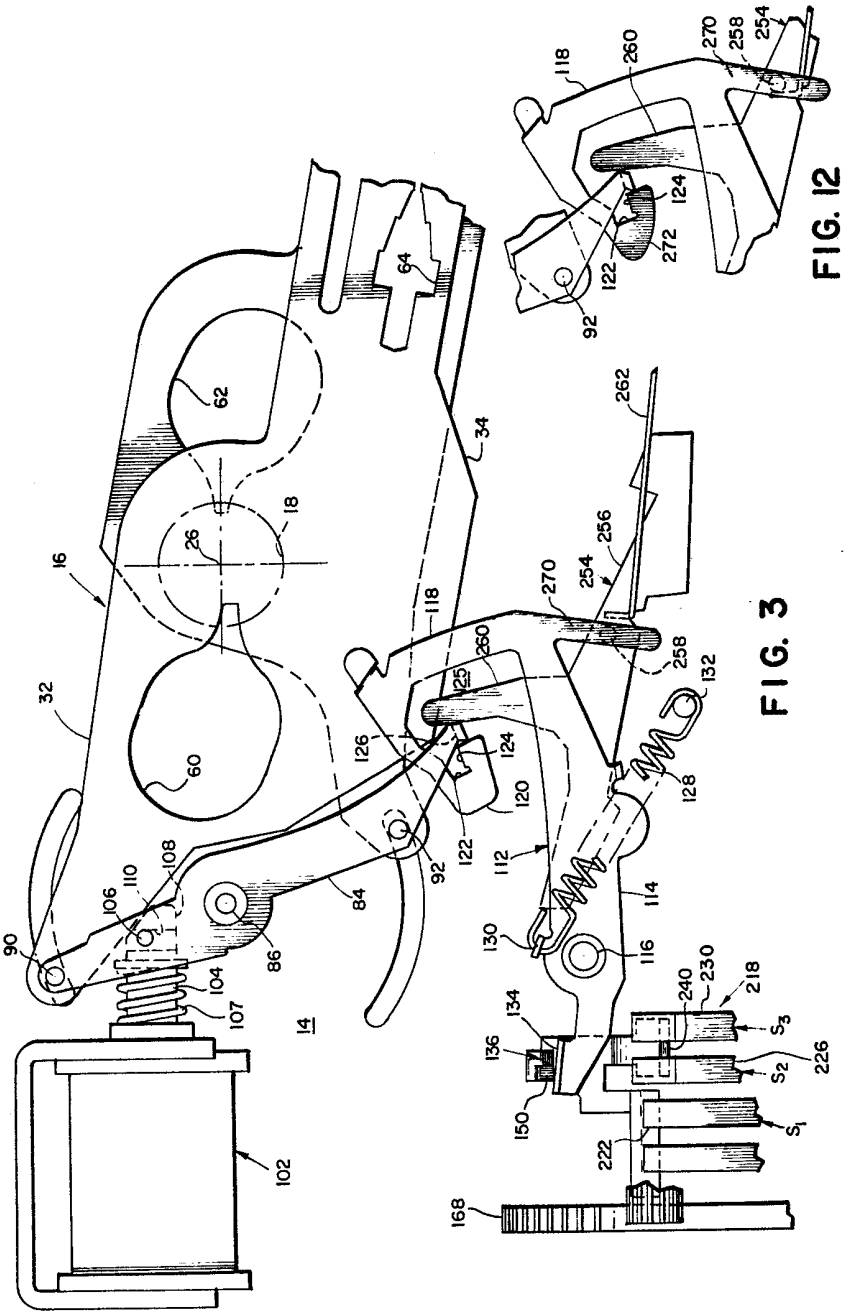

FIG. 12

FIG. 3

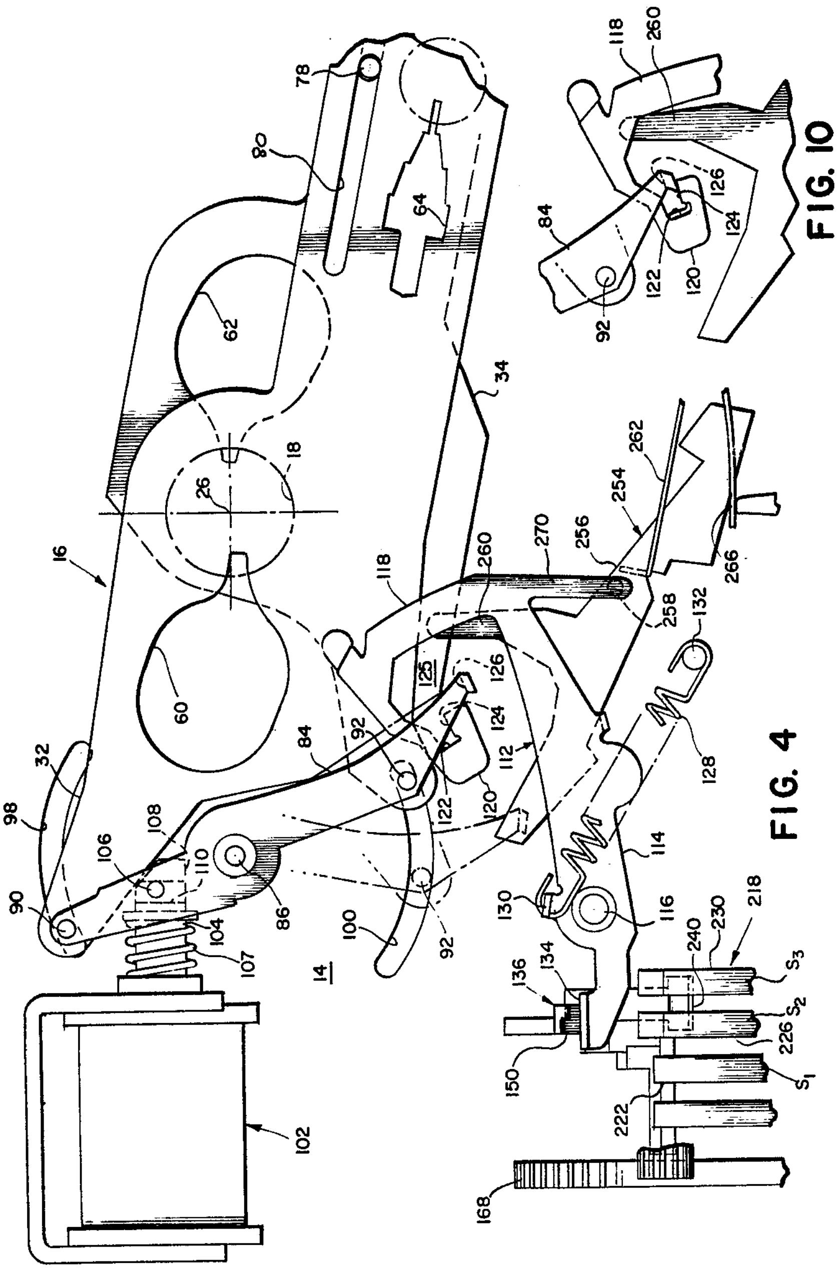

FIG. 4

FIG. 10

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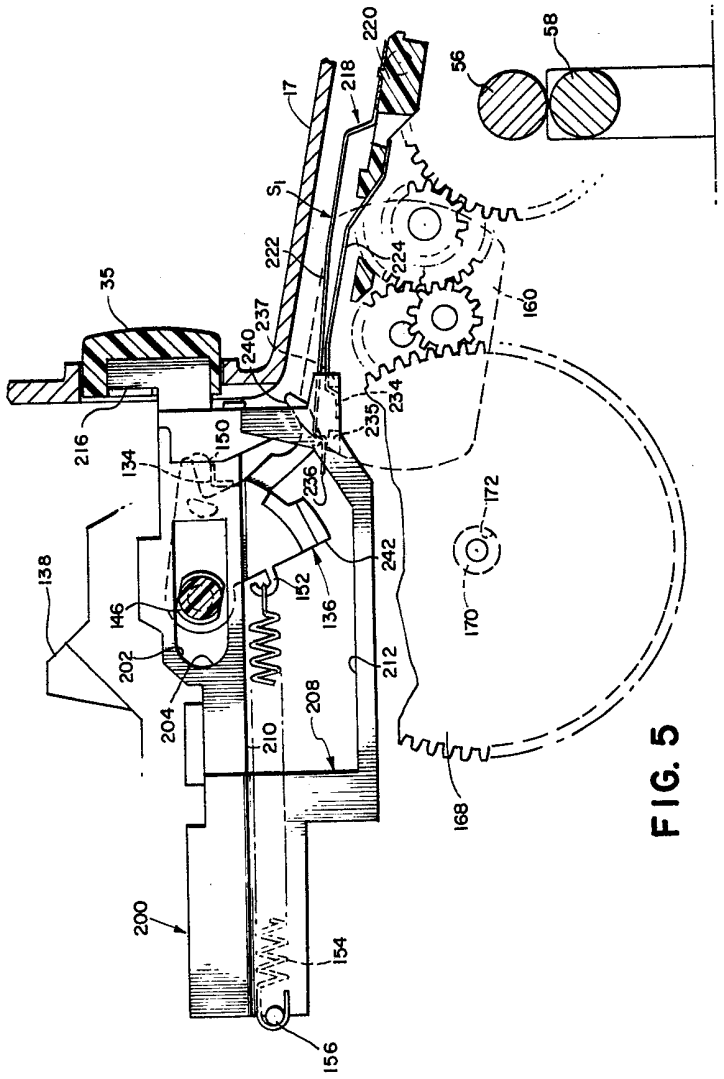

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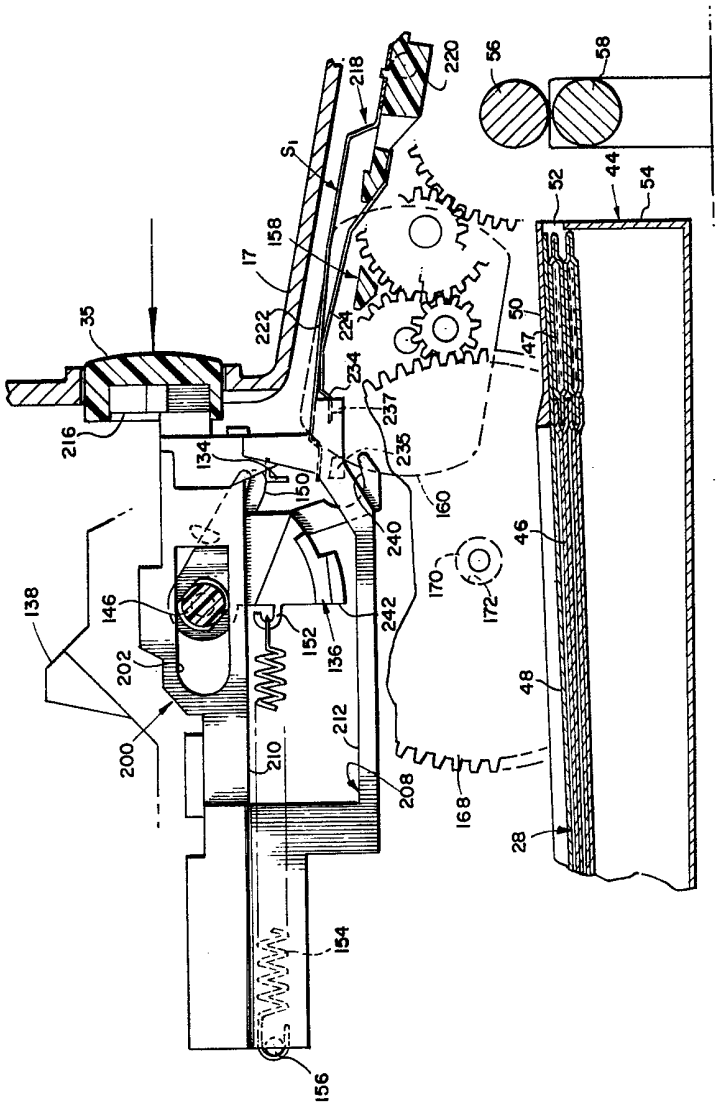
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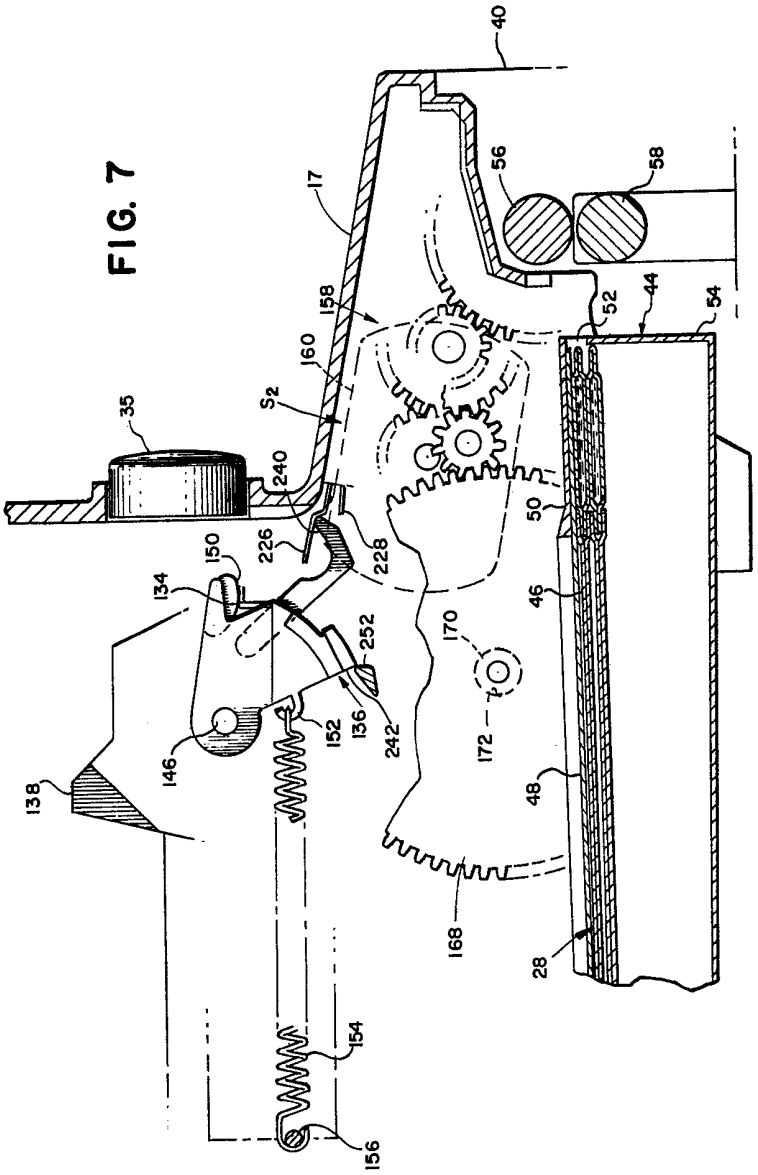
FIG. 6

FIG. 7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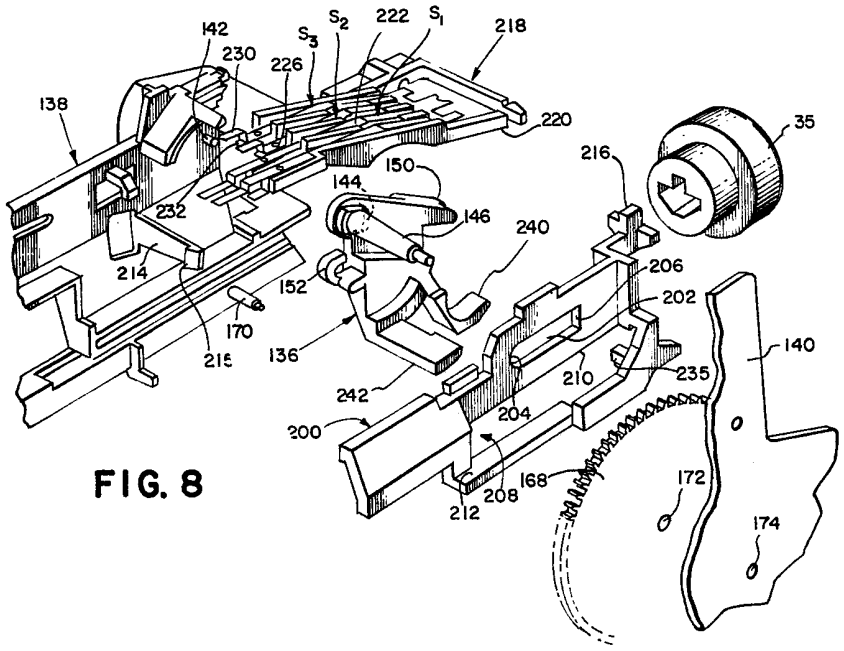
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FIG. 8

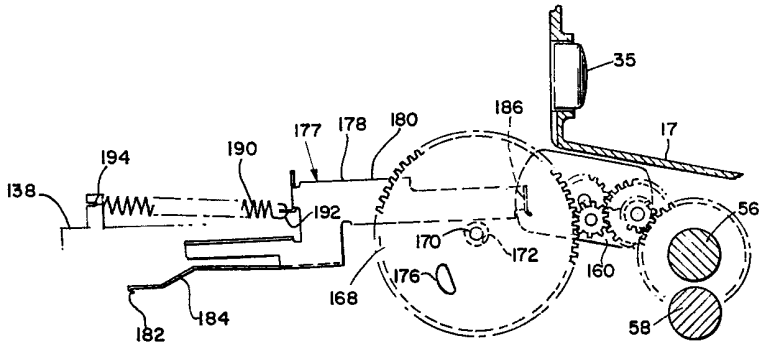
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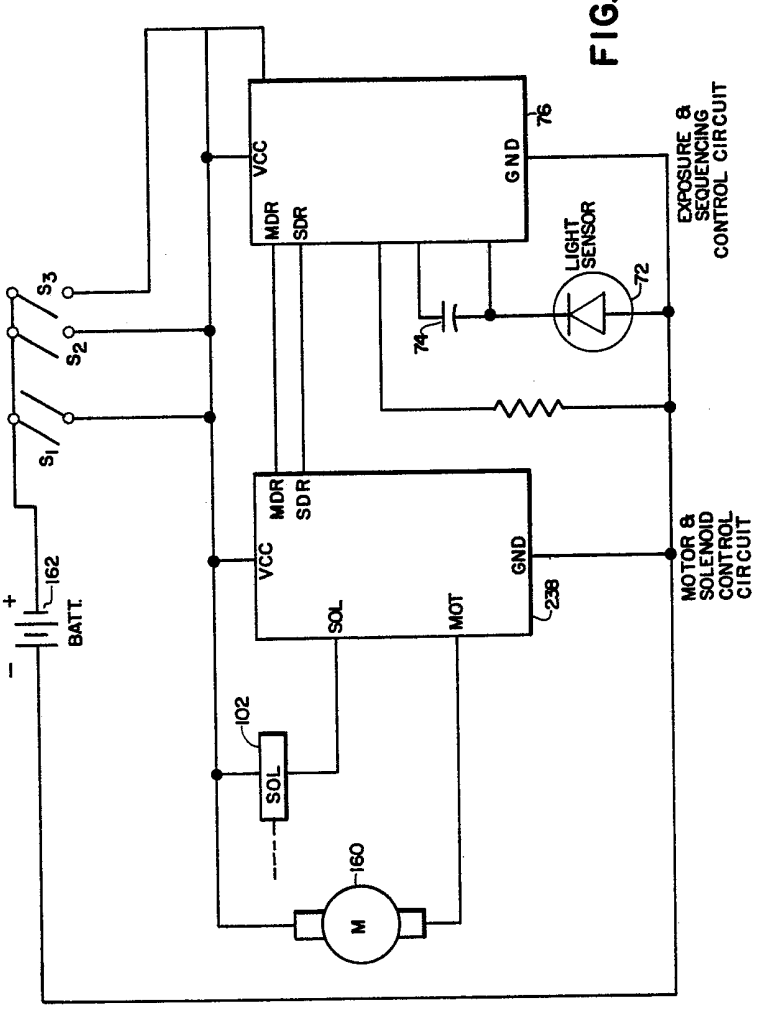
FIG. 9

FIG. 11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SOL
MOT
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MOTOR & SOLENOID CONTROL CIRCUIT
102
SOL
160
M