

Oct. 31, 1950

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2,527,780

SHUTTER CAM DRIVING MEANS AND CONTROL THEREFOR

Filed March 26, 1947

5 Sheets-Sheet 1

FIG. 5

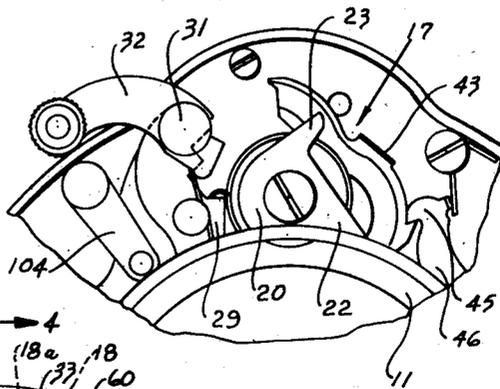


FIG. 1

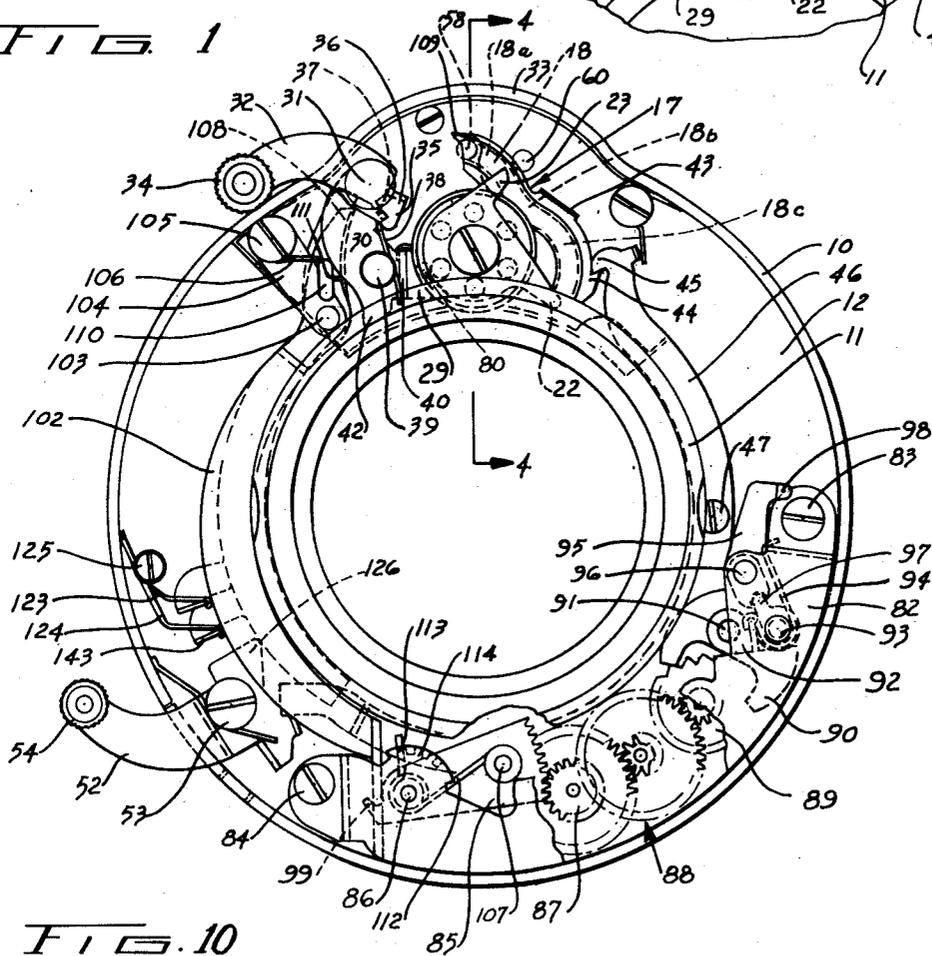
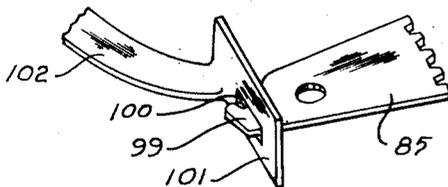


FIG. 10



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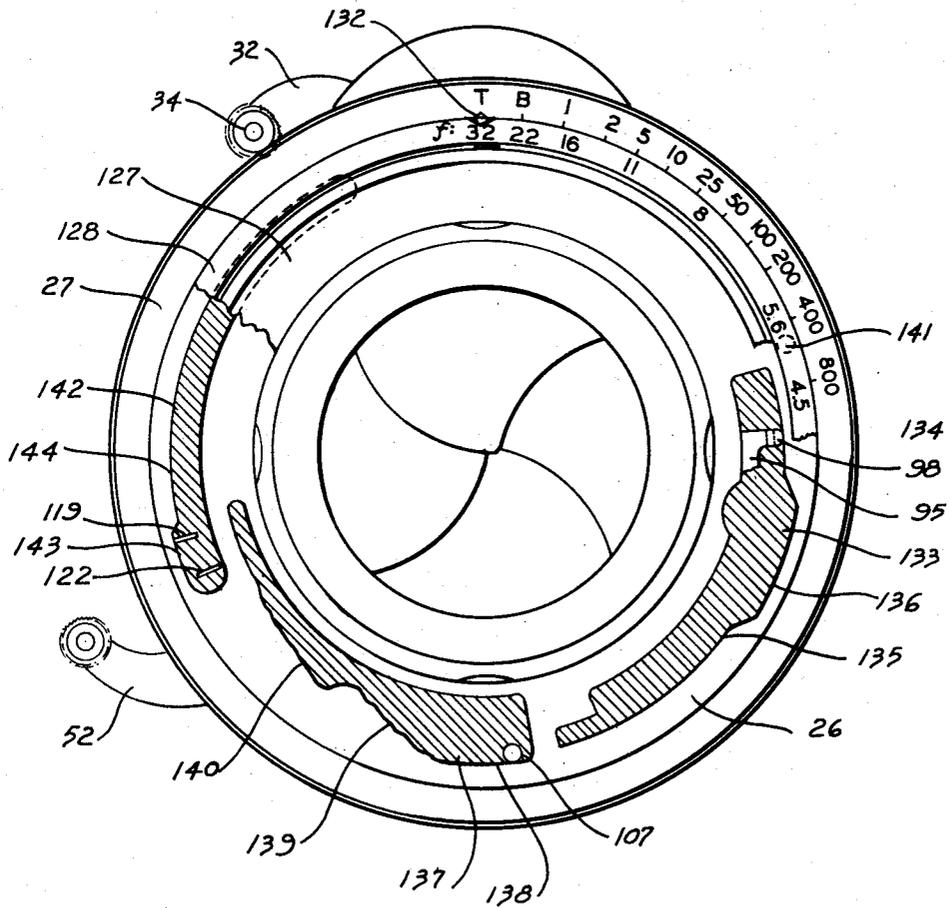
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SHUTTER CAM DRIVING MEANS AND CONTROL THEREFOR

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5 Sheets-Sheet 2

FIG. 2



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SHUTTER CAM DRIVING MEANS AND CONTROL THEREFOR

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5 Sheets-Sheet 4

FIG. 5a

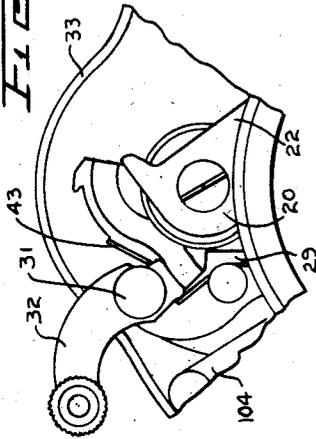
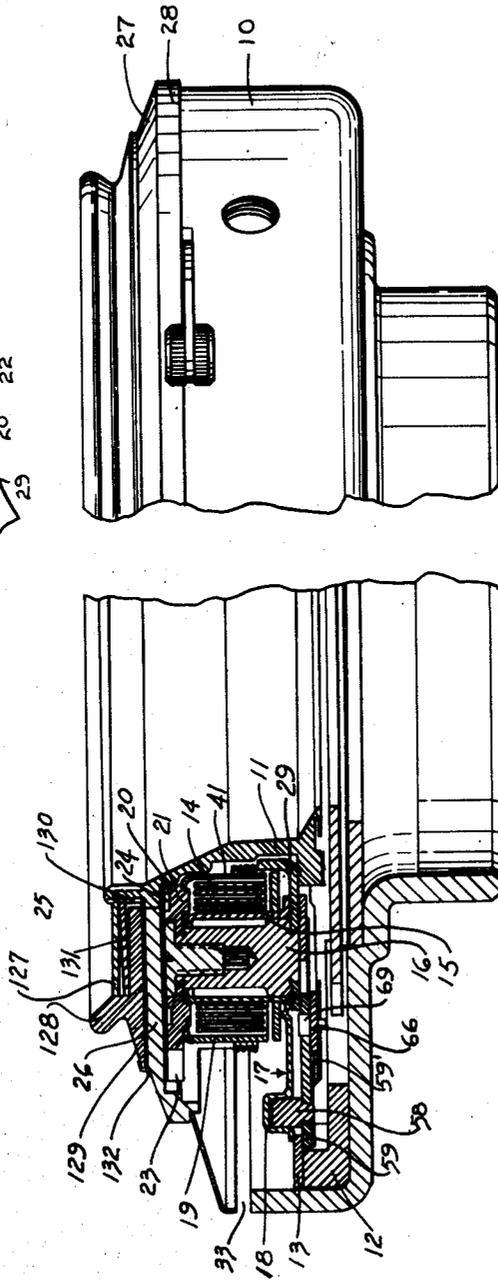


FIG. 4



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SHUTTER CAM DRIVING MEANS AND CONTROL THEREFOR

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5 Sheets-Sheet 5

FIG. 6

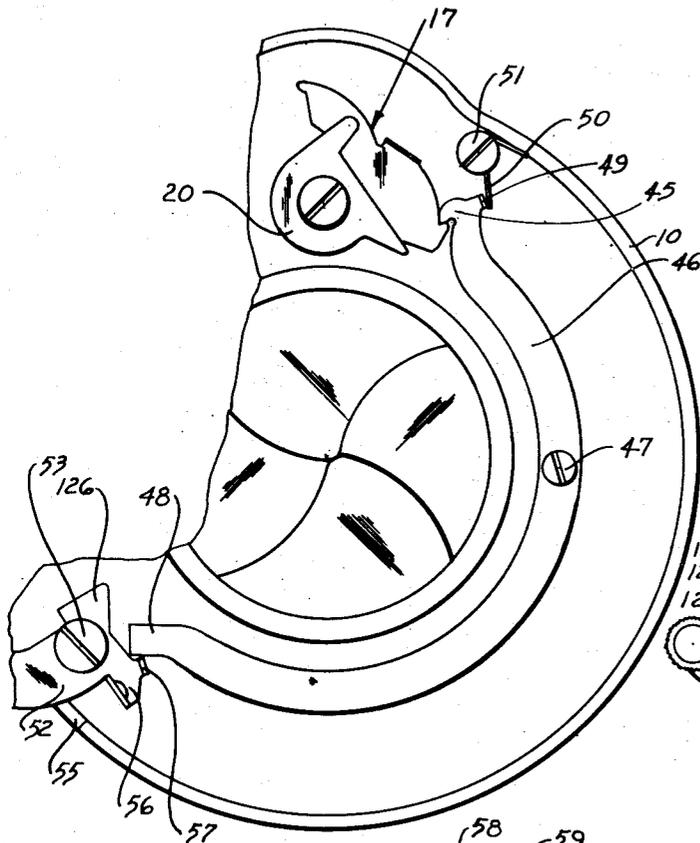


FIG. 7

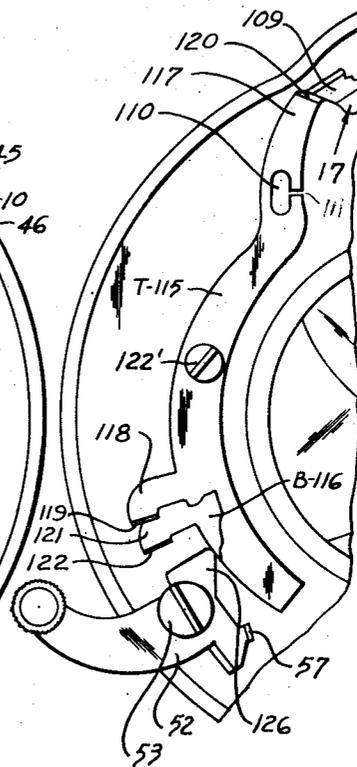


FIG. 8

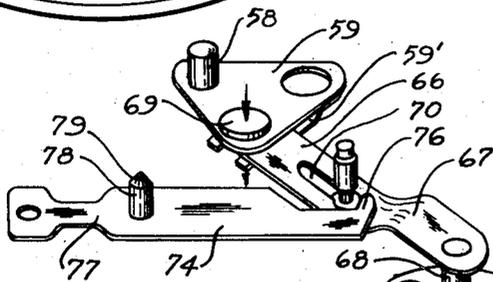
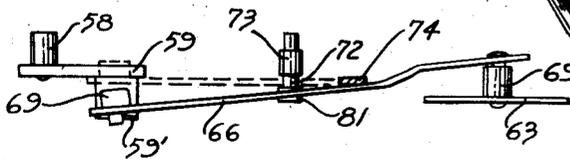


FIG. 9



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SHUTTER CAM DRIVING MEANS AND CONTROL THEREFOR

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Application March 26, 1947, Serial No. 737,277

5 Claims. (Cl. 95—53)

1

This invention relates to photographic shutters of the type frequently referred to as "between-the-lens" shutters, or as symmetrically opening shutters.

Among the objects of the invention is that of devising a shutter of the type above mentioned which shall be adapted to operate efficiently at higher speeds than are considered practicable with the present day, commercial shutters of this type.

Another object of the invention is that of devising a shutter in which the shutter blades shall be opened with a constantly accelerated and then a constantly decelerated motion and closed in a similar manner.

Another object of the invention is that of providing a cam mechanism to open and close the shutter blades of a symmetrically opening shutter wherein a relatively long period is realized during which the blades remain in nearly open position but wherein the blades and blade-opening mechanism move continuously and the mechanism does not provide for the usual dwell period during which the blades themselves are stationary at a fully open position.

It is another object of the invention to devise a shutter of the type described in which the operating parts shall have low mass, and although moved at a relatively high speed, the moments of inertia of the parts shall not exceed safe and easily controllable limits.

Another object of the invention is that of providing a folding priming lever which, in cooperation with the shutter blade operating cam, shall serve as an indicator to show whether or not the shutter has been cocked. This mechanism is adapted to function as an indicator when the priming lever has been returned to normal position in the shutter in which it is unnecessary for the shutter power means to return the priming lever as the shutter is actuated.

Another object of the invention is that of providing increased tension of the cam operating spring at higher speeds.

Another object of the invention is that of providing a concentrically arranged cam and power unit which is compact thereby leaving as great a proportion of space as possible for other elements within the casing.

Other objects of the invention will be apparent from the following disclosure.

According to the invention, a between-the-lens type shutter having a convenient number of blades is housed within the conventional type and size of shutter casing and is provided for opera-

2

tion at varying speeds from low speeds such as $\frac{1}{16}$ to a full second and also for higher or instantaneous speeds up to approximately $\frac{1}{500}$ of a second or better. The blades are interconnected for simultaneous actuation by a blade ring, interconnecting cranks and links or by other convenient means, and a motor or power mechanism of novel construction serves to impart the necessary motion to the blade interconnecting and actuating means.

The power mechanism comprises a spring motor, preferably of the clock spring type which is placed under initial tension and which may be additionally tensioned prior to effecting opening and closing of the shutter blades for making an exposure. The power derived from the spring motor is conveyed to the blade interconnecting and actuating means through a sector-shaped cam which has a contour adapted to impart to the blades, taking into consideration inertia and other resistances, a constantly accelerated opening movement which is changed to a constantly decelerated movement prior to the time when the blades reach their fully open condition. The acceleration and deceleration of the blades as they are closed are correspondingly provided for and it is a characteristic of the cam of this application that no extended period of dwell, as the blades are completely opened, is provided. Instead of and in order to make it possible to operate without shock or unnecessary stressing of the parts and to reach the extremely high speed of $\frac{1}{500}$ of a second or better, the cam pathway imparts only a momentary or instantaneous dwell as the blades reach their fully open position. In other words, the only dwell of the blades is that at the point of changing motion from an opening to a closing one. The cam pathway actually decelerates the opening of the blades during the last five or ten percent of the opening movement and correspondingly accelerates them at a uniform rate immediately after completion of the decelerating movement for about the same percentage of the complete movement. The blades are actually opened slightly beyond the maximum aperture opening and the amount of movement of the blades during the change from opening to closing is so small that the equivalent of a photographically effective dwell is obtained. By eliminating a dwell in the cam, less steep cams may be used with a more rapid cam travel so that a quicker opening movement and a quicker closing movement is realized when considering the total portion of those phases of the cycle.

The spring motor is adapted to impart the re-

quired amount of power for efficient operation up to speeds of $\frac{1}{200}$ to $\frac{1}{400}$ of a second, but in order to provide for additionally higher speeds, and to save the mechanism from unnecessary shock or stresses due to employment of more power than is necessary at the lower speeds, a booster tensioning means comes into play automatically upon setting for the higher speeds. That booster mechanism increases to a predetermined amount the tension in the spring motor as higher speeds are set and removes the tension automatically upon return to speeds for which the additional tension is not required.

In order to keep at a minimum the mass of moving parts, the priming lever is returnable to its initial or uncocked position after it has been employed for setting the tension of the spring motor. In order to increase the effective leverage and to streamline the general external appearance of the shutter and to constitute the priming lever as an indicator, it is jointed at an intermediate point so that the extending part of the lever may be folded downwardly against the outer part of the shutter casing itself. The construction is such that when the shutter has been cocked, the returned lever will automatically assume its folded position. When the sector cam is in uncocked position, an extension or part thereof prevents folding of the lever thereby causing it to extend outwardly of the casing in position to be gripped and actuated for the priming movement.

To an extent, the retarding mechanism of geared type having a star wheel engaged by a pallet is conventional. However, an adjustment of the actual retarding effect to be derived from the train is provided, that adjustment being possible for use during initial setting of the mechanism at assembly or for bringing the actual speeds into conformity with the indicated speeds at any later period during use of the mechanism.

The invention will be described in greater detail by reference to the accompanying figures of drawing, wherein:

Fig. 1 is an assembly view of the shutter, the front part of the shutter casing having been removed to expose the enclosed parts.

Fig. 2 is a front view of the shutter showing the general appearance of the shutter and diaphragm setting rings and the details of the cams which serve to set the shutter speeds, etc.

Fig. 3 is a view showing the part of the shutter located behind the mechanism plate which includes the blades and blade actuating and inter-connecting members.

Fig. 4 is a partial section taken through the shutter at the line 4-4, Fig. 1.

Fig. 5 is a detail view of parts of the power mechanism and the priming means for setting the shutter.

Fig. 5a is a view similar to Fig. 5 but showing the parts in untensioned position.

Fig. 5b is a detail view of the priming lever itself.

Fig. 6 is a view showing in detail the shutter releasing mechanism.

Fig. 7 is a view in detail of the time and bulb control levers.

Fig. 8 is an isometric view showing means for disconnecting the power mechanism from the shutter blades when the shutter is being set.

Fig. 9 is a view of the parts shown in Fig. 8, but showing them moved to disconnected position.

Fig. 10 is a view showing in detail the inter-

connecting means between the blade actuating cam and the retarding mechanism sector.

Now referring to Fig. 1, the shutter includes, among other parts, a casing having an outer cylindrical portion 10, an inner wall 11 within which the lens is mounted, and a mechanism plate 12. In Fig. 1, those parts of the shutter which are located at the front of the mechanism plate have been shown in set or cocked position and include the power means or motor, a cam for imparting power from the motor to the shutter blades, a cocking or setting means and the various control elements including a trigger, releasing mechanism, levers for effecting the time and bulb exposures and a retarding mechanism. These parts will be described in greater detail as each of the units and its function are disclosed.

Now referring to Figs. 1, 4, 5, and 5a, the power unit is mounted upon the mechanism plate 12 and is actually attached as a unit to the plate 13 in turn secured to plate 12. Power is derived from a spring motor 14 of the clock spring type, although it is to be understood that instead of a fiat spring, circular wire or other types of spring may be employed. That spring is fixed at its inner end to a core 15 rotatable upon a bearing in the form of a stud 16 attached by riveting or otherwise to the plate 13. The core 15 has, either formed integrally therewith or attached thereto, a sector cam 17 having therein a cam groove or slot 18 which will be described in greater detail in a later part of this description.

The outer end of spring 14 is attached to spring casing 19 which is freely rotatable upon the stud 16 except as it is retained in a set or adjusted position by the spring locking crank 20. This crank 20 has lugs 21 which engage within opposed holes in the upper part of the spring casing 19. There are a plurality of such holes and the initial tension in the spring is set by turning the casing 19 thereby to wind the spring after which the crank 20 is pressed into place until the lugs 21 engage within the said holes.

Rotation of crank 20 is prevented by a projecting arm 22 which bears against the outside of the inner cylindrical part 11 of the shutter casing. The crank has a second projecting lug or arm 23, the purpose of which will be described later.

This crank, as more clearly shown in Fig. 4, has a plurality of spaced indentations 24 to be engaged by a special wrench or other tool for imparting the necessary initial adjustment to this member and to the spring motor.

When the parts have been assembled, a locking screw 25 is used to complete the assembly and to retain all parts in operative position on the stud 16, the head of this screw 25 fits in a cooperating counterbore in the locking crank 20. These parts are all housed within the shutter casing and are generally contained at the top of the shutter when the same is in operative position, in front of the mechanism plate and behind the speed setting ring 26. This ring is beveled at 27 and has a serrated or knurled edge 28 by means of which it may be turned for setting the shutter speeds. The shutter speed graduations are cut in the beveled surface 27 as more clearly shown in Fig. 2.

For setting the shutter, a lever or arm 29 is freely rotatable about the core 15. This arm 29 has an angularly disposed portion 30 which terminates in a pivot 31, that pivot being a center about which the projecting lever 32 which is actually the manually engageable priming lever

may be swung. The lever 32 projects through a slot 33 in the casing member 10 and at its outer end has the usual knurled ring 34 by which the operator secures a firm grip.

The lever 32 projects to the opposite side of the pivot 31 in a short extension 35 which has an angularly turned lug 36 engageable against a corresponding shoulder or ledge 37 on the part 30 of the priming lever. A spring 38 coiled about a shouldered stud 39 contacts at one end the extension 35 of lever 32 and at its other end is bent under and turned backwardly to engage behind an offset part 40 of the lever 29, the said offset serving to change the plane of the lever from that illustrated in Fig. 4 to one closer to the front of the shutter so that the pivoted portion 32 may project outwardly at slot 33.

A coil spring 41, Figs. 1-4, is wound about the spring casing 19, is fixed at one end to that casing or to any other suitable part of the mechanism, and then is turned to hook about the offset 40 to the arm 29 as shown in Fig. 1. This spring 41 is under sufficient tension and exerts its force in such direction, that the priming lever is always urged in a counterclockwise direction, and, unless it is being turned against the tension of spring 41 for its intended function of setting the cam 17, the lever rests in the position of Figs. 1 and 5 at which time a small abutment 42 bears against the adjacent surface of the ring 11.

The cam 17 is normally urged by the spring motor in a counterclockwise direction and the forwardly turned projection 43 normally bears against the bent part 36 of the lever 32. The tension in the spring motor is much greater than that of the small coil spring 38 and when in its unset position, the cam 17 through the parts just described, will press the lever 32 so that it rotates about pivot 31 to project upwardly more or less radially from the shutter casing, Fig. 5a. In that position, the priming lever is easily gripped for setting the shutter and the position of the extension 32 always indicates that the shutter has not been tensioned.

As the setting mechanism is employed for rotating the sector cam 17, it is merely turned clockwise as far as it will go. A latch portion 44 on the cam engages beneath a cooperating hooked end 45 of the shutter cam latching lever 46. This lever 46 is pivoted at 47 and extends in more or less a concentric arc about the mechanism to terminate in angularly disposed end 48, Figs. 1 and 6. The lever 46 adjacent the hooked end 45 has a bent part 49 which is engaged by one end of a spring 50 coiled about spring retaining stud 51 and having an opposite end bearing against the inner side of the casing 10 or against any other fixed part. The trigger 52 pivoted at 53 is of more or less conventional design and has the usual finger gripping portion 54 at the end of that part which extends through an appropriately placed slot 55 in the casing. That trigger has an extension 56 at one part of which projects an angularly bent abutment 57 positioned to engage beneath the angular extension 48. As the trigger is pressed in a counterclockwise direction, the arm 46 is obviously rotated about pivot 47 until the hooked end 45 disengages the latch 44 on the sector cam thereby permitting it to be moved under the influence of the spring motor for opening and closing the blades in accordance with the setting of other parts hereinafter to be described.

Now referring to Figs. 3, 4, 8, and 9, the cam 17 having the slot 18 effects opening and closing of

the shutter blades through mechanism presently to be described. The cam slot engages about a cam follower 58, this follower 58 is in the form of a pin riveted or otherwise attached to project from a bell crank type lever 59 pivoted at 60. The lever 59 is swung through a predetermined arc under the influence of the cam as it engages follower 58 and during the return or counterclockwise movement of that cam after release from said position.

The shutter blades 61 are pivoted at 62 having a triangular or sector-shaped plate 63 serving as a reinforcement and also as a means for anchoring certain pins 64 and 65 by means of which each of the blades and its reinforcing plate 63 is connected to those adjacent blades. One of these plates 63 serves as a master member and is connected through link 66 to the bell crank lever 69. A plurality of links 67 impart corresponding movements from the master plate to the other blades which may number four as herein illustrated or may comprise any convenient number depending upon the size of the shutter and the maximum speed to be attained.

Now referring more particularly to Figs. 8 and 9, mechanism will be described by means of which the link 66 is disconnected from the blade operating mechanism during setting of the sector cam, that being essential since otherwise the blades would be opened and closed during the setting movement thereby bringing about unintended exposure.

The link 66 is offset as at 67 and connects to the plate 63 by means of a pin 68. The pin 68 may be fixed in one member but is freely rotatable in the other. At the opposite end, the link 66 connects for actuation by the bell crank 59 by means of a short projecting pin 69. The pin 69, as shown in Fig. 9, may be disconnected from the bell crank lever by pressing against and deflecting the link 66 against the tension of spring 59', from its operable or dotted-line position. The spring 59' is pivoted at 60 as a center and is forked to engage the lower reduced end of the pin 69. When connected, movements of the bell crank are imparted through the link to the plate 63 and then through links 67 to correspondingly actuate each of the shutter blades. When in that position, a slot 70 having an enlarged end portion 71 engaged about a reduced part 72 of a guide pin 73. The guide pin 73 is permanently connected at its upper end to any convenient fixed member within the shutter casing.

For disconnecting the link so that the pin 69 and the link are moved to the full-line position, Fig. 9, a finger 74, Figs. 3, 8, and 9, is pressed downwardly thereby to flex the link and move it to the position of Fig. 9. The finger 74 is attached by a suitable connecting means 75 to the back of the mechanism plate, or to some other suitable fixed member within the shutter casing and extends inwardly to terminate in a nose 76 which overlies the link 66. The finger is attenuated at 77 so that it is more easily and mainly flexed at that portion only. A pin 78 is fixed in the finger 74 and has a conical or rounded end 79 which may be engaged by a similarly shaped indentation 80 in the lower surface of the priming lever 29. When the priming lever is in the position of Fig. 1, that pin 78 engages indentations 80 as just described, and the finger is unaffected so that link 66 remains in attached relationship to the bell crank lever 59. Just as soon as the priming lever is moved clockwise throughout a very small angular extent, that

movement really acts to take up a slight amount of slack between the abutment 35 and extension 43, the point 79 of the pin is forced from the indentation and as that point rides on the smooth surface of lever 29, the finger, as shown in Fig. 9, disengages pin 69 from the opening in the bell crank lever 59. Pin 69 is rounded or beveled so as to engage the bell crank when the priming lever is returned to its extreme position in the counterclockwise direction. As the priming lever is used to force cam 17 to the fully cocked position, the link 66 is held in flexed and disconnected position and at that time the lower enlarged end 81 of the guide pin 73 engages in the enlarged portion 71 of slot 70 thereby preventing the link and, thus, the shutter blade assembly from being disturbed. That also assures that after cocking the shutter, the pin 69 will align with its opening in bell crank 59 so that reengagement between the parts shall be effected with certainty.

Now referring to Figs. 1 and 10, the retarding mechanism is mounted between the mechanism plate 12 and a plate 82 attached by screws 83 and 84 to the mechanism plate. A sector 85 is pivoted at 86 and has teeth which mesh with a pinion 87 at one end of a gear train generally indicated by numeral 88 and which terminates at the other end in the star wheel 89 engaged by a pallet 90 pivoted at 91 on a link 92. The link 92 is pivoted at 93 and is urged by a spring 94 in such direction that the pallet will engage the star wheel. A second lever 95 is pivoted at 96 and engages a short arm 97 extending from the link 92 so that as the lever 95 is moved in a counterclockwise direction about the pivot 96, the link 92 is correspondingly moved, but in the reverse direction about its pivot 93. That withdraws the pallet from the star wheel thereby removing its retarding influence from the train. The arm 95 terminates in an angularly directed toe portion 98 which is engaged by a suitable cam slot in the speed setting ring as will hereinafter be described more thoroughly.

The sector 85 extends to the opposite side of pivot 86 and terminates in a notched portion 99 engaged within an opening 100 in an angularly directed terminal plate 101 of the arcuate bar 102 by means of which the retarding mechanism is connected through to the cam 17.

The bar 102 extends about the shutter at one side thereof and is pivoted at 103 to a link 104 which is in turn pivoted at 105. A spring 106 is coiled about pivot 105 and engages the link 104 in such manner as to swing it clockwise about its pivot and thereby to urge the bar 102 in a direction to rotate the sector 85 counterclockwise. The initial position of the sector 85 and of bar 102 is controlled by engagement of a pin 107 projecting upwardly from the sector to be engaged by a cam in the speed setting ring. The bar 102 extends beyond the pivot 103 to terminate in a nose portion 108. This nose 108 is in proper position to be engaged by the front edge 109 of the sector cam 17. That front edge 109 of the cam is widened considerably so as to engage the nose 108 and also other parts incidental to effecting time and bulb exposures.

As shown in Fig. 1, the bar 102 is slotted at 110, that slot being cut through at 111 so that the material constituting the bar is materially weakened at that point thereby providing a certain amount of resilience and to take up or absorb some of the shock incident upon contact between

the parts as they are engaged after the cam 17 has built up considerable momentum.

A spring 112 is coiled about the pivot 86 for the sector 85 and has one end hooked around pin 107 while its other end 113 engages within some one of a series of slots 114 placed along an arcuate portion of the fixed plate 82, said arcuate portion being concentric with the center of pivot 86. By moving the end 113 to different holes of the slots 114, the tension in the spring may be adjusted thereby to compensate or initially to set the retarding mechanism so that the exact shutter speeds intended to be provided may be more exactly attained.

Now referring to Figs. 1 and 7, time and bulb exposures are effected by proper control of the time and bulb exposure levers 115 and 116, respectively. Time exposure controlling lever 115 has a nose 117 which is engaged by the end 109 of the sector cam. As that cam moves partway through its arc of travel, and assuming that the lever is in the position shown in Fig. 7, the lever 115 is also provided with an extension 118 which has an offset or bent lug 119 which projects to the front of the shutter casing to be engaged by a cam in the setting ring hereinafter to be described.

The bulb exposure controlling lever 116 which is directly behind lever 115 has a nose 120 which projects to the right or in a clockwise direction to a slightly greater extent than does the nose of the time lever. This time lever also has a projection 121 terminating in a bent, forwardly extending lug 122. Both levers are pivoted at 122'. Springs 123 and 124, Fig. 1, are coiled about the stud 125, have an end projecting outwardly to bear against the casing member 10, and at their other ends extend inwardly to hook about the lugs 119 and 122. These springs tend to maintain the levers 115 and 116 in such position that the noses 117 and 120 will engage the end 109 of the sector cam. They remain in that position except as controlled by the speed setting mechanism later to be described, or by the trigger.

The trigger 52 has a contact lug 126 in alignment with and engageable with the end of lever 116. The lever 115 extends a somewhat greater distance in a counterclockwise direction and is engageable by the lug 57, previously described, and which also actuates the release lever 46, Fig. 6. Each of the levers 115 and 116 is slotted as is lever 102 and, therefore, is slightly resilient in a manner to take up or absorb the initial shock attendant upon contact of the end of the cam with the noses of the levers.

Now referring to Figs. 2 and 4, the speed setting ring 26 is shown with the front plate 127 broken away at those parts where extended cam paths are to be found in the ring. The inclined or beveled surface 27 is graduated as illustrated with the letters "T" and "B" for time and bulb exposures and some non-consecutive numerals 1-800 indicating fractions of a second or durations of shutter opening. The inner ring 128 graduated with the *f*-marks is employed for setting the diaphragm, that mechanism between the ring and the diaphragm itself not being illustrated in this case since it forms no essential part of the present invention. A washer 129 is interposed between the diaphragm setting ring and the speed setting ring and is prevented from rotating by engagement of keys in the washer with keyways 130 in the inner shutter casing member 11. A dished spring washer 131 between the plate 127

9

and the ring 128 imparts a certain amount of pressure against the latter and thereby maintains pressure and frictional engagement between the speed and diaphragm rings and the non-rotatable washer 129. At the top of the shutter the washer 129 terminates in bent index members 132 against which the diaphragm stop numbers and the shutter speed graduations may be set. The ring 26 has a slot 133, the outer edge of which acts as a cam surface against which the toe 98 of the pallet controlling lever engages. That toe is spring pressed against the cam surface by the spring 94, and so long as the toe contacts the concentric surfaces 134 and 135, the pallet will be disengaged from the star wheel. When the toe 98 moves outwardly as permitted by the part 136 of the cam which is at a greater radial distance from the center of the shutter, the pallet is permitted to move toward the star wheel to be engaged and actuated thereby.

The part 134 of the cam path functions during the making of time and bulb exposures while the path 136 permits the pallet to engage a star wheel for the slower exposures, that is, from one full second to 1/10 of a second. The remainder of the pathway at 135 serves to move the pallet away from the star wheel for all exposures including 1/25 of a second and those faster.

The cam slot 137 has its outer surface which constitutes the cam pathway engaged by the projecting pin 107 extending outwardly from the sector gear 85. The first part 138 of the pathway is concentric and permits the sector gear to swing radially outward under the influence of spring 112 so that it is fully effective to convey the entire retarding influence of the gear train itself to the cam 17 during the time and bulb exposures, and of the train as affected by the pallet for exposures of one full second. The pathway 139 is preferably stepped, each of which steps is progressively closer to the center of the shutter. The cam is adapted through contact with pin 107 to move the sector gear 85 toward the center of the shutter thereby to permit a shorter travel of the gear and less effect from the retarding gear train. This pathway 139 is effective throughout the slower or longer exposures of from one full second to a tenth of a second.

Between 1/10 and 1/25 of a second, the pallet is removed from active engagement with the star wheel and the sector gear is also permitted to move outwardly to the point of the cam pathway 140 which is at a greater radial distance from the shutter center. This pathway 140 like pathway 139 is stepped from controlling the speeds from 1/25 of a second to the next shortest exposure of 1/400 of a second at which later speed the effect of the retarding train is entirely removed. The shutter is then actuated under the full influence of the tensioned spring motor 14 there being no retardation other than the natural friction and inertia of the parts.

To time the shutter for effecting an exposure of 1/800 of a second, a pin 141 extending inwardly from the ring 26 is adapted to contact the arm or extension 23 to the shutter motor booster crank. Movement of the speed setting ring to the 800 mark causes pin 141 to rotate the booster crank throughout a predetermined angular extent. That adds sufficient tension to the spring 14 so that upon release of the shutter, the opening and closing movements are considerably accelerated. Setting and releasing the

10

shutter while the parts are thus set causes the shutter to effect an exposure of minimum duration. Whenever the setting ring is moved back to 1/400 or to a lesser speed, the booster crank is permitted to rotate clockwise until the extension 22 rests against the outside of the cylindrical casing 11.

For effecting a bulb exposure, the speed ring is turned until the letter "B" is opposite the index mark 132 at which time the cam 142 releases the lug 122 for movement radially outwardly to the cam surface 143. The lug 122 may not move outwardly at that time since the part 126 of the trigger presses against the bulb lever and will hold the adjacent end thereof inwardly thereby holding the lever nose 120 outwardly so it will not engage the end 109 of cam 17. That is because the spring at the trigger is stronger than the spring which tends to move the bulb lever outwardly against the trigger action. As soon as the trigger is pushed downwardly to release the cam 17, previously set to the position of Fig. 1, the bulb lever will change its position under the influence of spring 124 so that the toe 120 assumes a position in the pathway of cam 17. It will hold that position until the trigger is permitted to return to its original position at which time the pressure of the part 126 will swing the lever about its pivot until the nose 120 is removed from contact with the front part 109 of the cam 17. Thus, a bulb exposure is effected, the blades opening during the movement of the cam throughout a part of its angular extent until stopped by the lever nose 120, the blades closing and terminating the exposure as the trigger is permitted to return to its original or inactive position.

When a time or bulb exposure is to be made, the pallet is out, pin 107 is against the cam surface 138 thereby bringing into action the full effect of the gear train itself. The sector gear 85 would be in the position opposite that shown in Fig. 1 so that the bar 102 would swing upwardly or in a clockwise direction as influenced by the swinging pivot arm 104 until the toe 108 would be engaged by the end of the cam 17 prior to engagement of that same end with the toe of the bulb lever. That slows down the rapidly moving cam mechanism so that the shock with which the cam strikes the bulb lever is considerably lessened.

To effect a time exposure, the ring 26 is moved to the position of Fig. 2 whereupon both the lugs 119 and 122 are released for movement toward the cam 143. The nose 117 of the time lever is somewhat nearer the pivot 122' than is nose 120 of the bulb lever. Upon releasing the shutter mechanism at this setting, pressure downwardly on the trigger allows the bulb lever nose to move to the position of Fig. 7, the time lever already being in that position. The cam 17 will be released and will move until stopped by the nose of the bulb lever. Movement of the trigger to its initial position will then withdraw the bulb lever permitting cam 17 to move a very slight distance until stopped by the time lever. A second movement of the trigger in a counterclockwise direction will, through contact between the lug 57 and the adjacent end of the time lever, move the toe 117 of the lever 115 away from the cam thereby permitting it to complete its movement and to close the shutter blades. At all times except when the speed ring is set at "T" or "B", the part 144 of the cam slot 142 holds the time and bulb levers in a position where

the cam 17, upon release, will make a complete movement from one extreme position to the other affected only by the friction and inertia of parts and the retarding influence of the train and pallet.

In Fig. 1, the bar 102 and the connected retarding mechanism are in a position in which the cam 17 would not be affected thereby. The point or nose 108 of the bar in the position shown is somewhat below a level at which it could effectively prevent movement of the cam 17 by contact with the point 109 thereof. The swinging lever 104 serves to move the nose 108 in such a direction, if there is to be some retarding effect, that there will be engagement between the nose and point of the cam. That lever when moved to the position of Fig. 1, not only permits movement of the bar 102, but swings it out of the pathway of the cam point 109 at the termination of the retarding movement.

The cam 17 has been discussed generally and the cam pathway itself will now be briefly described. The follower 58 is actually controlled by the cam pathway 18 which, at the portion 18a, has such a contour that the blade movement resulting is one in which the blades are first opened with a constant acceleration, and then as they approach the fully opened position are constantly decelerated. At the cam portion 18b, the constantly decelerating motion is changed in direction rather gradually until the portion 18c of the cam pathway is encountered. That pathway provides for the closing movement of the blades. At that part 18c, the contour is such as to start the closing movement with a constant acceleration, and thereafter changes to a constantly decelerated movement whereupon the blades are eventually brought to rest. A short terminal portion of the cam pathway is concentric so as to permit the cam to rebound slightly without affecting the blades which, once they reach their closed position, remain at rest in that position.

The shutter has been described by a rather detailed description of one specific embodiment. Certain detailed parts have been mentioned and the functioning of the apparatus has been explained by reference to definite speeds and to other limiting characteristics which have been set forth by way of example and which are not by any means to be interpreted as the only possibilities of the mechanism which is open to considerable change without departing from the scope of the original inventive concept.

The blade mechanism and the linkage by which the blades are caused to effect their simultaneous opening and closing movements merely constitute one form which that part of the shutter assembly may take. The blades may be interconnected by other means such as the usual blade ring, and the cam movement imparted to the plate 63 and from that to the remaining blades may, instead, be applied through the blade ring.

While one embodiment of the invention has been disclosed, it is to be understood that the inventive concept may be carried out in a number of ways. This application is, therefore, not to be limited to the precise details described, but is intended to cover all variations and modifications thereof falling within the spirit of the invention and the scope of the claims.

I claim:

1. In a camera shutter having interconnected blades operable from a master member coupled to an actuating lever, spring motor means for im-

parting power to said actuating lever, a power transfer member between said motor and said lever comprising a sector cam having a slot of predetermined configuration, a bell crank having a follower pin engaging said slot, said crank being linked to said actuating lever whereby the opening and closing sequence of said blades is determined by the configuration of the slot in said cam constraining said pin, mechanism for tensioning said motor including a setting arm and a latching lever and means for releasing said last-mentioned lever for actuating said shutter.

2. In a camera shutter having interconnected blades operable from a master member coupled to an actuating lever, spring motor means for imparting power to said actuating lever, a power transfer member between said motor and said lever comprising a sector cam having a slot of predetermined configuration, a bell crank having a follower pin engaging said slot, said crank being linked to said actuating lever whereby the opening and closing sequence of said blades is determined by the configuration of the slot in said cam constraining said pin, mechanism for tensioning said motor including a setting arm engaging said cam and a latching lever and means for releasing said last-mentioned lever for actuating said shutter.

3. In a camera, a shutter and a housing therefor, said shutter having interconnected blades operable from a master member coupled to an actuating lever, spring motor means for imparting power to said actuating lever, a power transfer member between said motor and said lever comprising a sector cam having a slot of predetermined configuration, a bell crank having a follower pin engaging said slot, said crank being linked to said actuating lever whereby the opening and closing sequence of said blades is determined by the configuration of the slot in said cam constraining said pin, mechanism for tensioning said motor including a setting arm extending from said housing and having a setting position, an intermediate position, and a released position, a latching lever and means for releasing said last-mentioned lever for actuating said shutter, and spring means cooperating with a portion of said arm for urging said arm to assume said released position upon tensioning of said motor.

4. In a camera, a shutter and a housing therefor, said shutter having interconnected blades operable from a master member coupled to an actuating lever, spring motor means for imparting power to said actuating lever, a power transfer member between said motor and said lever comprising a sector cam having a slot of predetermined configuration, a bell crank having a follower pin engaging said slot, said crank being linked to said actuating lever whereby the opening and closing sequence of said blades is determined by the configuration of the slot in said cam constraining said pin, mechanism for tensioning said motor including a setting arm of arcuate shape extending from said housing and foldable thereagainst and having a setting position, an intermediate position, and a released position, a latching lever and shutter release arm for releasing said last-mentioned lever for actuating said shutter, and spring means cooperating with a portion of said arm for urging said arm to assume said folded position upon tensioning of said motor.

5. In a camera, a shutter and a housing therefor, said shutter having interconnected blades

operable from a master member coupled to an actuating lever, spring motor means for imparting power to said actuating lever, a power transfer member between said motor and said lever comprising a sector cam having a slot of predetermined configuration, a bell crank having a follower pin engaging said slot, said crank being linked to said actuating lever whereby the opening and closing sequence of said blades is determined by the configuration of the slot in said cam constraining said pin, mechanism for tensioning said motor including a setting arm of arcuate shape extending from said housing and foldable thereagainst and having a portion within said housing cooperating with said cam, said arm being pivotably mounted on said portion and having a setting position, and intermediate position, and a released position, a latching lever and means for releasing said last-mentioned lever for actuating said shutter, and spring means coop-

erating with said portion for urging said arm to assume said folded position upon tensioning of said motor, and means for urging said arm with respect to said portion to assume said intermediate position upon actuation of said shutter.

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