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O. BARNACK

FOCAL PLANE SHUTTER

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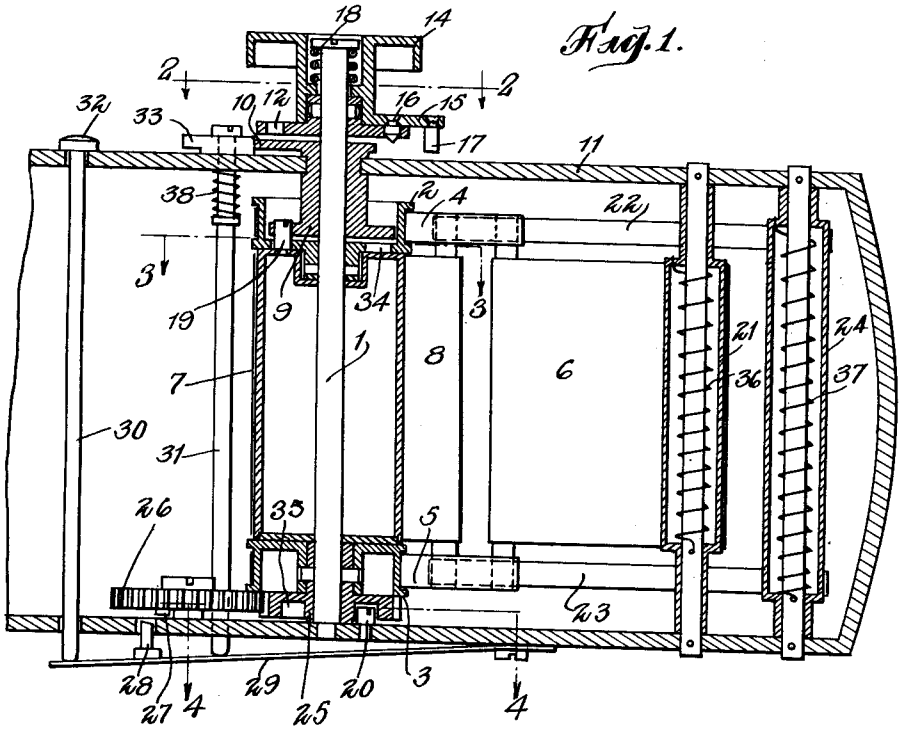



Fig. 1.

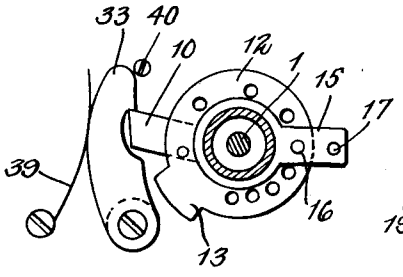



Fig. 2.

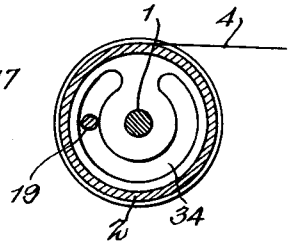



Fig. 3.

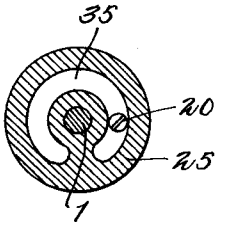



Fig. 4.

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# UNITED STATES PATENT OFFICE.

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## FOCAL PLANE SHUTTER.

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This invention relates to shutters having an adjustable slit between the adjacent ends of the leading and following blind, and has for its object to improve and simplify the construction of such shutters and to obtain a reliable speed especially for use in film cameras or other cameras in which a self-capping shutter is desired, i. e. in which the slit is automatically closed during the re-setting or return movement of the blinds.

According to the invention directly the shutter is released the leading blind passes across the focal plane of the lens in advance of the following blind, the roller (or drum) and reels upon which one blind and the bands of the other are respectively wound being mounted to rotate about a common axis.

Therefore on release of the shutter the leading blind first unwinds a distance equivalent to that of the slit, whereupon the following blind unwinds, both blinds or their bands being wound upon their respective take-up rollers. When the shutter is again set by re-winding the blinds or their bands upon the roller and reels, the two blinds move as a single unit, without a slit between their adjacent ends.

In a preferred construction according to the invention the roller for the following blind and the reels for the driving bands of the leading blind, which are rotatable about the same axis, make less than a complete revolution to effect an exposure, the rotation of the band-reels being limited by a member positively connecting the blind roller to the external parts of the slit adjusting device, which may also be mounted about the same axis. Preferably in this case the circumference of the roller and reels is greater than the length of film or plate to be exposed. Further, a locking lever is provided which is adapted to hold back the following blind until the leading blind has travelled a distance corresponding to the width of the slit required, this locking lever being movable in the direction of the common axis of the roller and reels.

One construction according to this invention is illustrated by way of example in the accompanying drawings in which,

Figure 1 is a sectional elevation of the shutter.

Figure 2 is a sectional plan on the line 1—1 of Figure 1.

Figure 3 is a section through the reel 2 on the line 2—2 of Figure 1.

Figure 4 is a section through the gear wheel 25 on the line 3—3 of Figure 1.

In the drawings a spindle 1 has rigidly secured to it two reels 2 and 3 on which are wound the driving bands 4 and 5 for the leading blind 6, and between these reels on the same spindle 1 is loosely mounted the roller (or drum) 7 for the following blind 8. The other end of the leading blind 6 is wound on a roller 21 and the ends of the driving bands 22 and 23 for the following blind 8 are wound on a roller 24, these rollers being rotatable against the tension of internal helical springs 36 and 37 respectively.

One end of the spindle 1 projects through the wall 11 of the camera and carries a slit adjusting device comprising a knob 14 rotatably mounted on the spindle. Below the knob 14 and also mounted on the spindle 1 is a clutch member 9, one end of which extends through the wall 11 of the camera while the main portion of the clutch lies within the camera casing. The exterior portion of the clutch member 9 carries a stop arm 10 and above the stop arm but below the knob 14 is a perforated disc 12 having a radial projection 13. This disk is keyed to the spindle 1 and the perforations in it can be engaged by a pin 16 projecting from the underside of an arm 15 radiating from and formed integral with the knob 14. On its outer end the arm 15 carries an additional pin 17 adapted to cooperate with the radial projection 13 and thus limit the extent to which the adjusting knob can be rotated, a coiled spring 18 within the knob tending to press the lever 15 against the disc 12 and thus maintain the pin 16 in engagement therewith. In this way a firm but detachable connection is formed between the spindle 1 and the band reels 2 and 3 secured thereto, the clutch member 9 being connected to the roller 7 by means of a screw 19 which also engages a recess 34 in the band reels 2.

A curved leaf spring 39 limits the motion of lever 33 in one direction while a stop pin 40 limits the movement of lever 33 in the opposite direction.

On the lower end of the spindle 1 is mounted a gear wheel 25 having a recess 35 engaging a stop 20. This gear wheel 25 meshes with a pinion 26 which engages with

the film feeding mechanism and re-setting device (not shown in the drawings) and carries a pin 27 against which another pin 28 riveted to a spring strip 29 acts as a ratchet tooth. The strip 29 bears against the end of a rod 30 the opposite end of which constitutes a push-button 32. A second rod 31 also acted upon by the spring strip 29 carries a locking lever 33 at its upper end normally free of the stop arm 10 but adapted to be brought into engagement with it when the push button 32 is pressed. This is effected by means of a spring 38 which keeps the rod 31 pressed against the stronger spring strip 29. Pressure on the button 32 removes the spring 29 from the end of the rod 31 and allows the spring 38 to bring the locking lever 33 into engagement with the stop arm 10.

To set the shutter ready for exposure the toothed wheel 26 is turned by means of the film feeding mechanism thereby causing the spindle 1 to revolve until the stop 20 reaches the end of the recess 35. The rotation of the spindle 1 winds up the bands 4 and 5 and the following blind 8, the joint between the adjacent ends being thus made light tight. The springs 36 and 37 are now in tension and tend to unwind the blinds but the spindle 1 is held against rotation by the ratchet tooth 28, thereby preventing such movement. The width of slit is then adjusted by putting the pin 16 into the correct hole in the disc 12. To release the shutter the button 32 is pressed, thus releasing the ratchet 28. This causes the bands 4 and 5 to unwind so that the leading blind 6 commences to move across the focal plane, while the following blind 8 is prevented from unwinding by the catch 33 which retains the stop arm 10. When the leading blind 6 has moved a distance equal to the width of the slit, the lever 15, owing to its setting relatively to the disc 12, will have rotated with the spindle 1 far enough for the pin 17 to come into contact with the catch 33, thereby pushing it aside and disengaging the stop arm 10, thus releasing the following blind 8. Thereafter the two blinds move across the focal plane of the lens with their adjacent ends a constant distance apart, thus producing a slit of predetermined constant width.

The above action takes place only in the case of instantaneous exposures. For time exposures the lever 15 is set so far back on the perforated disc 12 that the bands 4 and 5 unwind sufficiently for the stop 20 to reach the other end of the recess 35 before the pin 17 comes into contact with the locking lever 33. Thus the blind 8 remains at rest keeping the shutter fully open until the pressure on the button 32 is removed which causes the catch 33 to be pushed up clear of the stop arm 10 and thereby releases the following blind 8.

It will be appreciated that less than a complete revolution of the following blind roller is necessary to effect an exposure, a fact which contributes to the steadiness and lack of vibration of the camera during operation of the shutter.

I wish to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a self-capping focal plane shutter a leading blind, a following blind, a spindle, a knob on said spindle, a mechanism for adjusting the slit between the adjacent ends of the leading and following blind, said mechanism comprising a perforated disk on said spindle adapted to be engaged by a pin on said knob, a pair of bands attached to the leading blind, a pair of reels for winding the bands of the leading blind, a drum for winding the following blind, said spindle carrying the band reels of the leading blind, the drum of the following blind and the slit adjusting mechanism, and means for positively connecting the drum of the following blind to the slit adjusting mechanism.

2. In a self-capping focal plane shutter a leading blind, a following blind, a spindle, a knob on said spindle, a pin on said knob, a mechanism for adjusting the slit between the adjacent ends of the leading and following blind, said mechanism comprising a perforated disk on said spindle adapted to be engaged by the pin on said knob entering one of the perforations of said disk, a pair of bands attached to the leading blind, a pair of reels for winding the bands of the leading blind, a drum for winding the following blind, said spindle carrying the band reels of the leading blind, the drum of the following blind and the slit adjusting mechanism, a clutch member on said spindle, a stop arm on said member, and a locking lever adapted to be brought into engagement with said arm for positively connecting the drum of the following blind to the slit adjusting mechanism, the locking lever being movable in the direction of said spindle.

3. In a shutter-operating mechanism of the class described, a spring strip attached at one end to the camera, a transverse rod slidably mounted in said camera, a push button on said rod, a leading blind, and a follower blind, said leading blind at rest keeping the shutter fully open, means for holding said follower blind against motion, said means adapted to be released for releasing the follower blind upon the removal of the pressure on said button for producing an unrolling of said blinds nonsynchronously.

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