No. 624,705. Patented May 9, 1899.

J. E. THORNTON.

PHOTOGRAPHIC SHUTTER.

(Application filed Jan. 5, 1899.)

(No Model.) 4 Sheets—Sheet 1.

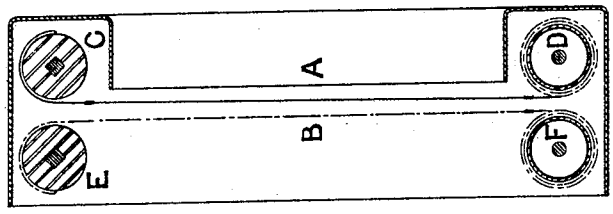


FIG. 3.

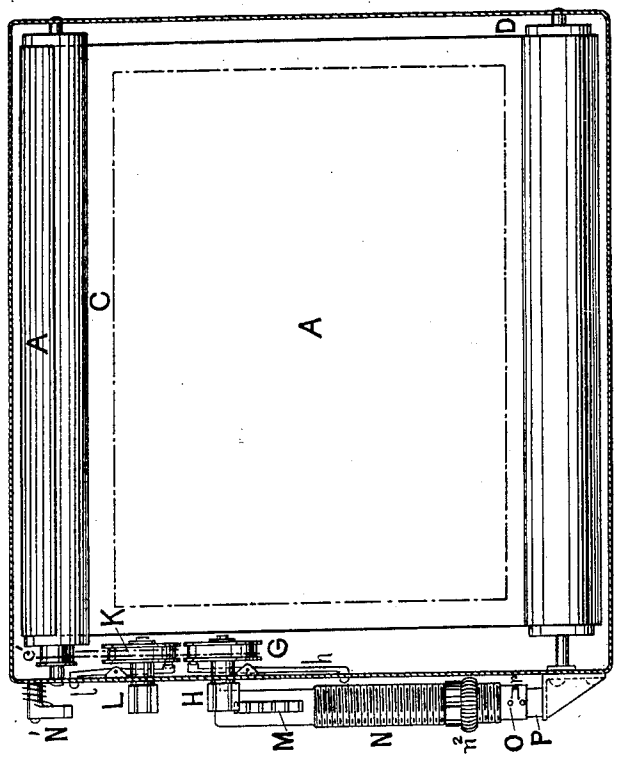


FIG. 1.

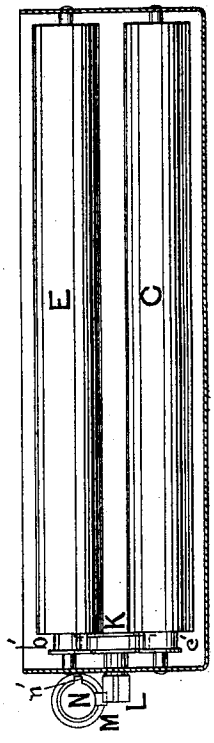


FIG. 4.

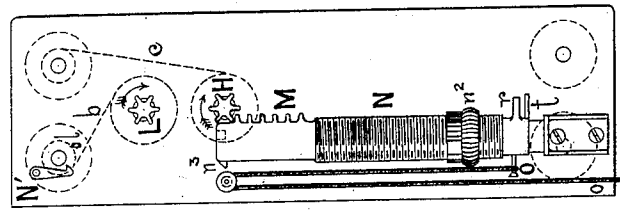


FIG. 2.

WITNESSES.

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by Dowell & Brien

atty.

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No. 624,705. Patented May 9, 1899.

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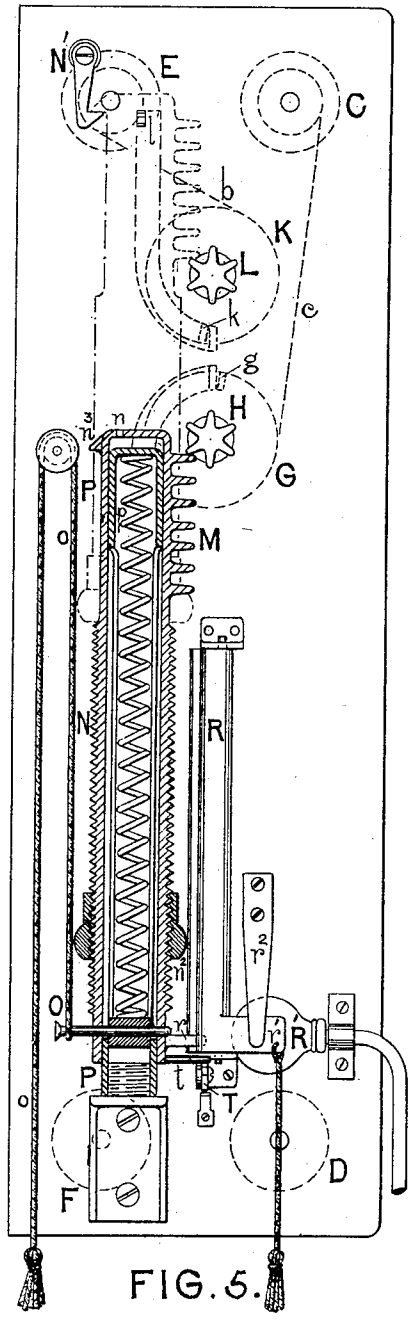


FIG. 5.

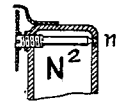


FIG. 9.

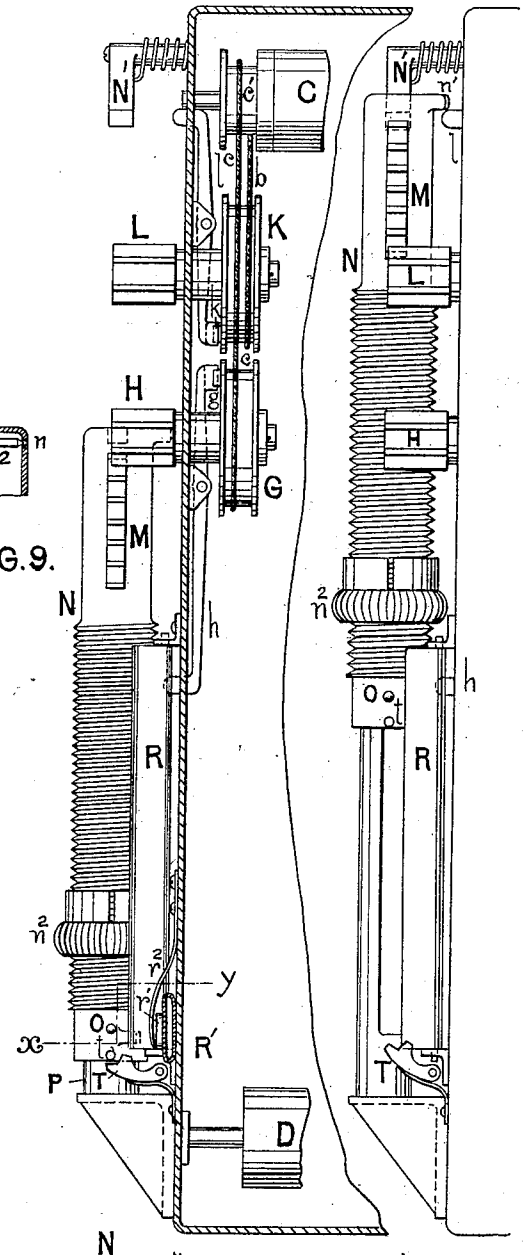


FIG. 6.

FIG. 7.

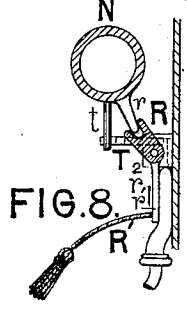


FIG. 8.

WITNESSES.

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No. 624,705. Patented May 9, 1899.

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PHOTOGRAPHIC SHUTTER.

(Application filed Jan. 5, 1899.)

(No Model.) 4 Sheets—Sheet 3.

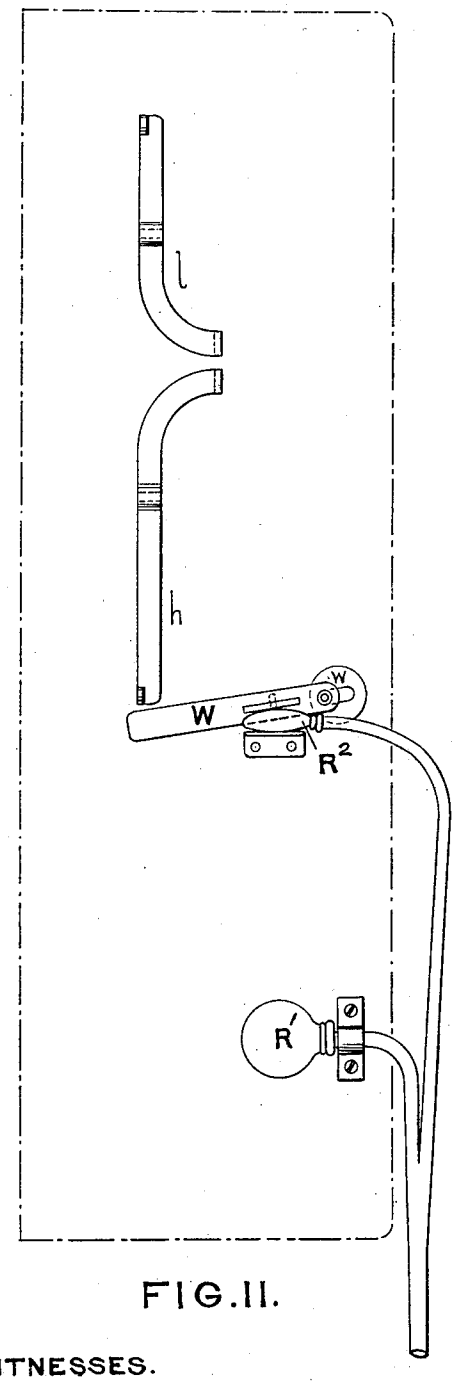


FIG. 11.

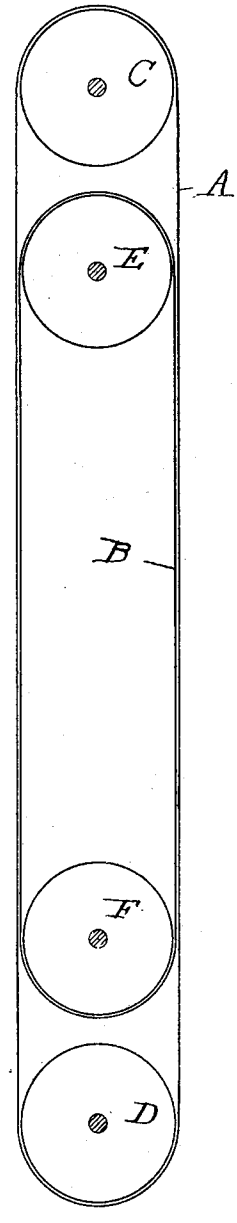


FIG. 10.

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PHOTOGRAPHIC SHUTTER.

(Application filed Jan. 5, 1899.)

(No Model.) 4 Sheets—Sheet 4.

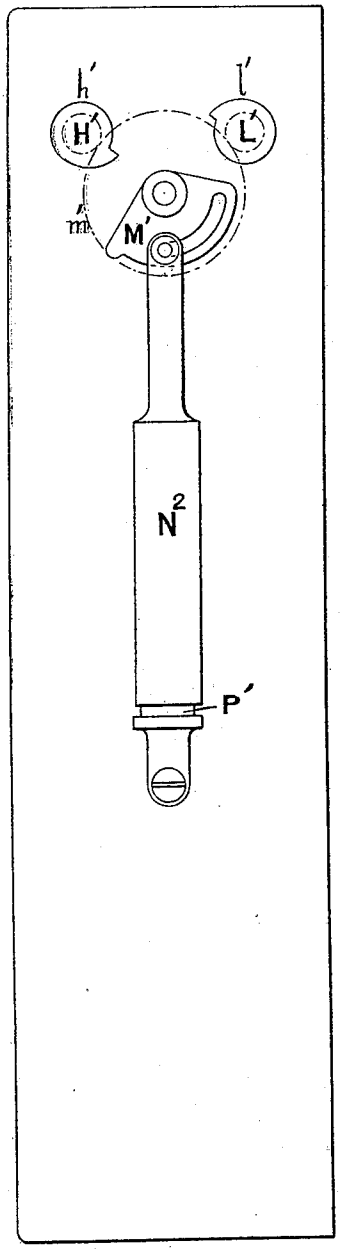


FIG. 14.

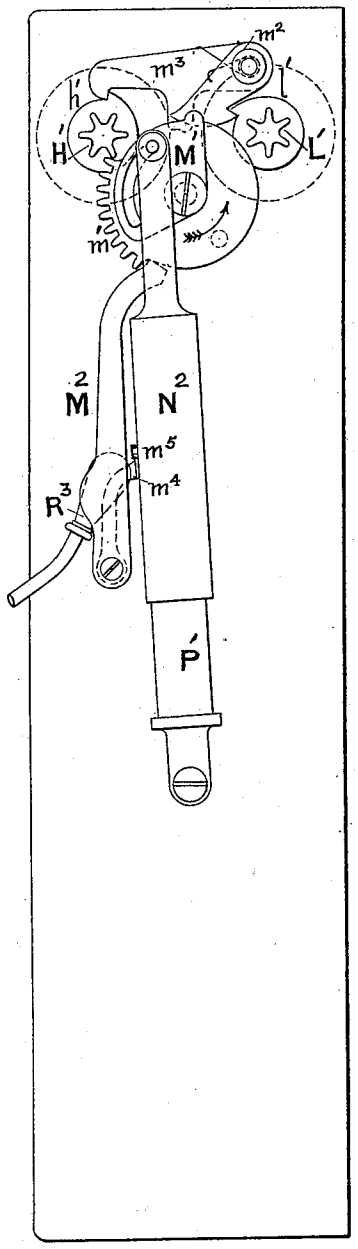


FIG. 12.

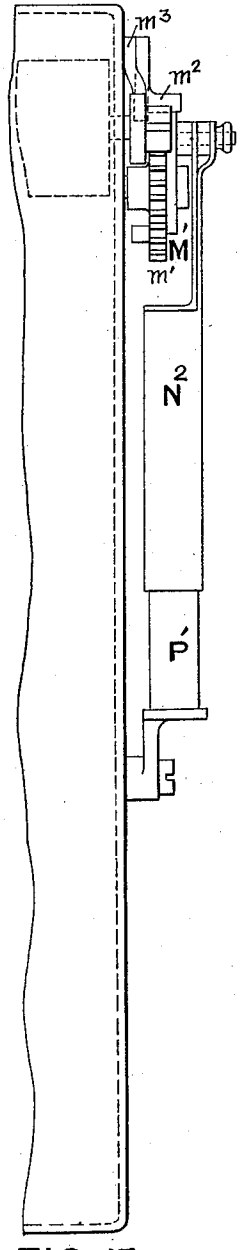


FIG. 13.

WITNESSES.

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UNITED STATES PATENT OFFICE.

JOHN E. THORNTON, OF ALTRINGHAM, ENGLAND.

PHOTOGRAPHIC SHUTTER.

SPECIFICATION forming part of Letters Patent No. 624,705, dated May 9, 1899.

Application filed January 5, 1899. Serial No. 701,286. (No model.)

To all whom it may concern:

Be it known that I, JOHN EDWARD THORNTON, a subject of the Queen of Great Britain, residing at Altringham, in the county of Chester, England, have invented certain new and useful Improvements in Photographic Shutters, of which the following is a specification.

This invention relates to photographic shutters of the roller-blind type and is designed to provide a simple, convenient, and reliable form of shutter whereby an exposure may be given of any predetermined duration of time from a minimum to a maximum required; also, to provide a shutter self-capping during setting or one in which the lens or plate will always be covered or protected during setting and which may be placed in any position in or on the lens-mount or close to the focal plane and be so adjusted as to give more exposure to one part of the plate than another.

In roller-blind shutters as hitherto constructed the length or duration of exposure has been regulated by varying the rate of travel of the blind, so that the aperture therein travels at a greater or less speed across the blind. In this case the shutter opens and closes slowly in comparison with the length of time it remains open.

A shutter should open fully and close in an exceedingly short space of time as compared with the duration of the exposure, and by this invention I can effect this result. For instance, the shutter may open fully in, say, one one-hundredth part of a second and then remain open any desired or predetermined time—say for one one-hundredth of a second to five seconds, more or less, and again quickly close in one one-hundredth of a second.

The invention consists, essentially, in employing two roller-blinds traveling at a quick speed and an adjustable pneumatic cylinder with adjustable mechanism whereby the blinds are successively released with any desired interval between them. It will be fully described with reference to the accompanying drawings.

Figure 1 is a front elevation of a shutter constructed according to my improvements. Fig. 2 is an end elevation of same. Fig. 3 is a longitudinal section. Fig. 4 is a plan of same. Fig. 5 is an end elevation of shutter, partly in section, drawn to an enlarged scale. Fig. 6 is a front elevation of the actuating mechanism, showing the position of the parts after exposure. Fig. 7 is a front elevation of the actuating mechanism, showing the position of the parts when set before exposure. Fig. 8 is a transverse section on line $x\,y$, Fig. 7. Fig. 9 is a sectional detail showing a modification. Fig. 10 is a section showing a modified arrangement of the two blinds. Fig. 11 is an end elevation of details of releasing mechanism. Fig. 12 is an end elevation showing a modification. Fig. 13 is a side elevation of same. Fig. 14 is an end elevation showing position of some of the parts.

The shutter is constructed with two blinds A and B, the blind A being mounted on a pair of rollers C and D and the blind B upon a pair of rollers E and F, the top rollers C and E of the respective blinds being pawl-held winding-rollers and the bottom rollers D and F of the respective blinds being spring-driven rollers upon which the blinds are wound when the top rollers are released. The actuating-springs of the winding-rollers D and F are preferably arranged with a fixed amount of tension to cause the blinds to be driven at a very rapid rate, or they may be capable of adjustment with an indicator to show the degree of tension or rate of travel. The springs may be alike in strength and tension, or one may be stronger than the other to give a longer exposure to one part of the plate than another.

The roller C of the blind A is wound up by a cord c, passing from a pulley c' on the end of the roller to a winding-drum G, rotated by a pinion H and held, when wound up, by a pawl or trigger h, acting against a stop g on the face of the winding-drum G, and the roller E of the blind B is wound up by a cord b, passing from a pulley b' on the end of the roller to a winding-drum K, rotated by a pinion L and held when wound up by a pawl or trigger l acting against a stop k on the face of the winding-drum K.

The winding-pinions H and L are successively actuated by a movable operating member or rack M, which engages first with one and then with the other as it is raised from the position shown in Figs. 5 and 6 to the position shown in Fig. 7.

The operating member or rack M is mount-

ed upon the exterior of a pneumatic cylinder N, which is moved in one direction by a knob or handle O, to which a cord *o* may be attached, and in the reverse direction by a spring *p* or other elastic member in the interior of a piston or plunger P, over which the cylinder is fitted. The rate of travel of the cylinder N is regulated by a small air-hole *n*, through which air enters or is expelled from the interior of the cylinder. The hole *n* may be either in the inner or outer cylinder, or both.

The pneumatic cylinder N is fitted on its exterior with a fixed stop *n'* to engage the pawl or trigger *l* to release the winding-drum K and blind B and with an adjustable stop n^2 to engage the pawl or trigger *h* to release the winding-drum G and blind A. It is also provided with a projection n^3 to engage the pawl N', by which it is held when set in the position shown in Fig. 7. The adjustable stop n^2 is in the form of a nut engaging a screw-thread on the exterior of the cylinder.

The cylinder N is released from the catch N' and permitted to descend with the rack clear of the pinions H and L by rotating it about its axis part of a revolution.

The pneumatic cylinder N is rotated the desired amount by a forked or bifurcated plate R, on which traverses a pin or projection *r* on the cylinder. The fork R is pivoted in suitable bearings and is rotated by a pneumatic ball R', fitting under an arm r', and when the ball is released is returned by a spring r^2, Figs. 5 to 8. A spring-catch T engages the side of the fork to prevent a backward movement before the cylinder N has completed its downward travel. The pin *t* on the cylinder engages the spring-catch T and releases the fork R, permitting it and the cylinder to return to its first position, as shown in Figs. 5, 6, and 8.

The time between the release of the blind B, which is first released, and the blind A determines the duration of exposure, and this is regulated by the position of the movable stop n^2 or the distance it is placed from the fixed stop *n'*.

Instead of or in addition to regulating the release of the blind A and the duration of exposure by a movable stop the speed of travel of the cylinder N may be regulated by a valve N^2, by which the aperture *n* may be more or less closed, as shown in Fig. 9.

Instead of a cylinder having a hole or valve I may use one that is practically air-tight, passing the piston through a stuffing-box or equivalent. As the piston works in the cylinder, its rate of movement is dependent upon the rate at which air may pass from one side to the other, for which purpose the piston may be a tightly-fitting one having a notch or hole in it, or it may instead be a loosely-fitting one. A spring presses upon the piston and so forces it against the air-cushion.

The duration of exposure may be further increased by means of an adjustable and movable latch W, actuated by a second pneumatic ball R^2, connected to the same pneumatic tube as the ball R'. The latch W is pivoted at *w* and is raised and lowered by the pneumatic ball R^2. When the pneumatic balls R' R^2 are inflated, the ball R^2 forces up the latch against the pawl or trigger *h* and prevents the release of the winding-drum G. The depression of the ball R^2 moves the latch W clear of the trigger *h* and permits the movement of the cylinder and stop n^2 to release the winding-drum G. The pivot *w* of the latch W is fitted in a slot, so that the latch may be drawn clear of the trigger *h*.

In the modification shown in Figs. 12, 13, and 14 the pneumatic cylinder N^2 is connected to a disk M', which carries a rack or teeth m' on its periphery to operate the winding of the pinions L' and H' of the blind-rollers. The plunger of the piston is pivoted to allow of an oscillating movement. The raising of the cylinder N^2 carries the disk M' around in the direction of the arrow, the rack m' successively engaging the pinions and rotating them. When wound, the blinds are held by the pawls m^2 m^3 engaging the cams l' and h'. The descent of the cylinder N^2 and further rotary movement of the disk M' is prevented by the lever M^2 engaging the teeth on the disk M'. The lever M^2 is raised by the pneumatic ball R^3 and the cylinder commences its downward stroke, rotating the disk, the fixed stop m^2 releasing the one blind and the adjustable stop m^3 the other blind. The duration of exposure may be further increased by a snug or projection m^4 on the side of the lever M^2 engaging a pin m^5 on the cylinder N^2 when the lever is held raised by the ball R^3. The projection m^4 may be thrown into and out of contact with the pin on the cylinder.

In operation the cylinder N is raised from the position shown in Figs. 5 and 6 to that shown in Fig. 7. To set the blinds, the rack M first engages with the pinion H and winds up the blind A and subsequently engages with the pinion L and winds up the blind B. The setting of the blind A thus precedes the setting of the blind B and keeps the shutter-opening closed or capped during the time of setting, protecting the sensitive surface from light. When the blinds are set and ready for exposure, the cylinder N is held in position by the catch N'. To release the blinds for exposure, the pneumatic ball R' is expanded, operating the fork R and rotating the cylinder until the projection n^3 is clear of the catch N' and the rack M out of the path of the pinions H and L. The cylinder is then caused to travel back by the spring r^2, and the fixed stop *n'* engages the pawl or trigger *l* and releases the blind B, which comes to rest with the aperture opposite the sensitive plate. The movable stop n^2 next engages the pawl or trigger *h* and releases the blind A, which travels down and shuts or covers the aperture in the blind B.

A shutter such as described is suitable for use either before or behind the lens, or in the lens-

tube near the diaphragm, or as a focal-plane shutter in front of the sensitive plate.

In using the shutter in any of the first-named three positions it is desirable to only let the blinds follow each other at such a distance apart that the opening in the shutter is never less than the diameter of the lens. By preference it is better to have the opening one and a half times or twice the size. If the opening is made less than the diameter of lens the coefficiency of the shutter is considerably reduced, although the exposure is shortened; but in using it as a focal-plane shutter before the sensitive plate the aperture may be of any size required and, as a matter of fact, is sometimes required very narrow as compared with the width of the plate in order to give a very short exposure. The width of the opening may be varied by varying the release of the blinds.

Although I have described the invention as applied to blinds that are wound off one roller onto another and rewound in the reverse direction, as ordinarily used, I may instead use two endless blinds which revolve always in one direction or in the reverse direction for setting. These two blinds may be placed one before the other or inside each other, being carried over suitable rollers for the purpose, as shown in Fig. 10.

By making the tension or driving power greater on one blind than the other or by applying a brake or retarding device to one the shutter can be made to give more exposure to one part of the plate than another—for example, more to the foreground and less to the sky.

What I claim as my invention, and desire to protect by Letters Patent, is—

1. In a photographic shutter, the combination with one or more roller-blinds, of a movable operating member, means for moving the same to wind the blinds, and means, against the action of which said member is moved, adapted to automatically return the same to normal position.

2. In a photographic shutter, the combination with one or more roller-blinds, of a movable operating member, means for moving the same to wind the blinds, and a spring for returning said member to normal position.

3. In a photographic shutter, the combination with one or more roller-blinds, of a movable operating-cylinder, an elastic member in its interior, means for moving the cylinder against the action of the elastic member to wind the blinds, said elastic member acting to return the cylinder to normal position.

4. In a photographic shutter, the combination with one or more roller-blinds, of a movable operating-cylinder, means for moving the same to wind the blinds, a spring in the interior of the cylinder compressed by such movement and adapted to return the cylinder to normal position.

5. In a photographic shutter, the combination with one or more roller-blinds, of a movable operating member, means for moving the same to wind the blinds, means for maintaining the same in the position occupied after the blinds are wound, means for releasing the same at will to admit of its return to normal position, and an elastic member for returning the same to normal position.

6. In a photographic shutter, the combination with one or more roller-blinds, of a movable operating member, means for moving the same to wind the blinds, means for maintaining it in the position occupied after the blinds are wound, means for releasing said member at will to admit of its return to normal position, and a spring for returning the same to normal position.

7. In a photographic shutter, the combination with one or more roller-blinds, of a movable operating-cylinder, means for moving the same to wind the blinds, a spring in the interior of said cylinder compressed by such movement and adapted to return the same to normal position, means for maintaining the cylinder in the position occupied after the blinds are wound, and means for releasing the same at will to admit of the spring returning it to normal position.

8. In a photographic shutter, the combination with one or more roller-blinds, of a movable operating member, means for moving the same to wind the blinds, means for maintaining the same in such position after the blinds are wound, and means for partially rotating the member to release the same and admit of its return to normal position.

9. In a photographic shutter, the combination with one or more roller-blinds, of a movable operating member, mechanism engaged thereby to wind the blinds, means for moving said member to actuate said mechanism, a catch for maintaining the member in the position occupied after the blinds are wound, means for partially rotating the same to release it from the catch and to disengage it from the blind-winding mechanism during its return, and means for returning the member to normal position.

10. In a photographic shutter, the combination with one or more roller-blinds, of a movable operating member, means for moving the same to wind the blinds, means for maintaining the same in the position occupied after the blinds are wound, and a bifurcated lever acting upon a pin carried by said member to partially rotate the same for releasing it to admit of its return to normal position.

11. In a photographic shutter, the combination with a roller-blind, of a pulley carried thereby, a winding-drum, operative connections between the winding-drum and pulley, and a movable operating member for actuating the winding-drum to wind the blind.

12. In a photographic shutter, the combination with a plurality of roller-blinds, of a winding-drum for each blind, operative con-

nections between the winding-drums and their respective blinds, and a movable operating member common to all the winding-drums for actuating them.

13. In a photographic shutter, the combination with a plurality of roller-blinds, of a winding-drum for each blind, operative connections between the winding-drums and their respective blinds, and a longitudinally-movable operating member common to all the winding-drums for actuating them.

14. In a photographic shutter, the combination with a plurality of roller-blinds, of a winding-drum for each blind, operative connections between the winding-drums and their respective blinds, a pinion carried by each drum and a movable rack common to all the pinions for actuating them to rotate the drums.

15. In a photographic shutter, the combination with a plurality of roller-blinds, of a movable operating member common to and adapted to wind all the blinds and means for moving said member.

16. In a photographic shutter, the combination with a plurality of roller-blinds, of a movable operating member common to and adapted, when moved in one direction, to wind all the blinds, and mechanism actuated by the reverse movement of said member to successively release said blinds.

17. In a photographic shutter, the combination with a plurality of roller-blinds, of a movable operating member common to and adapted, when moved in one direction, to wind all the blinds, mechanism actuated by the reverse movement of said member to successively release the blinds, and means for regulating the interval between the release of the respective blinds.

18. In a photographic shutter, the combination with a pair of roller-blinds, of a movable operating member, means for moving the same in one direction to wind the blinds, a blind-retaining mechanism for each blind adapted to maintain their respective blinds in wound condition, a part for engaging one blind-retaining mechanism and an adjustable part for engaging the other blind-retaining mechanism, said parts carried by the operating member, and adapted upon its reverse movement to successively release the respective blinds.

19. In a photographic shutter, the combination with a plurality of roller-blinds, of a winding-drum for each blind, operative connections between the winding-drums and their respective blinds, a movable operating member common to and adapted, when moved in one direction, to actuate all the blinds, and mechanism actuated by the reverse movement of said member to successively release the drums.

20. In a photographic shutter, the combination with a pair of roller-blinds, of a winding-drum for each blind, operative connections between the winding-drums and their respective blinds, a movable operating member common to, and adapted when moved in one direction to wind both drums, a lever for each drum adapted to engage and hold the same when wound, and a fixed and an adjustable device carried by said member and adapted upon its reverse movement to actuate their respective levers to successively release the winding-drums.

21. In a photographic shutter, the combination with one or more roller-blinds, of a movable operating member, means for moving the same, mechanism actuated by such movement to wind the blinds, means for returning said member to normal position, and means for moving the same out of operative connection with the blind-winding mechanism during its return to normal position.

22. In a photographic shutter, the combination with one or more roller-blinds, of a movable rack, means for moving the same, pinions engaged by the rack to wind the blinds, means for returning the rack to normal position, and means for partially rotating the same to disengage it from said pinions during its return movement.

23. In a photographic shutter, the combination with one or more roller-blinds, of an operating member comprising a fixed and a movable part, one within the other, an air-opening in one of said parts, means for moving said movable part with relation to the other to wind the blinds and to draw in air, and means for returning said movable part to normal position; whereby the resistance of the air will control the speed of movement of said movable part.

24. In a photographic shutter, the combination with one or more roller-blinds, of a movable operating-cylinder provided with an air-opening, a head or abutment in said cylinder, means for moving said cylinder to wind the blinds, whereby air is drawn into the cylinder, and means for returning the cylinder to normal position; whereby the head or abutment will compress the air and control the speed of movement of the cylinder.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

J. E. THORNTON.

Witnesses:
J. OWDEN O'BRIEN,
R. OVENDALE.