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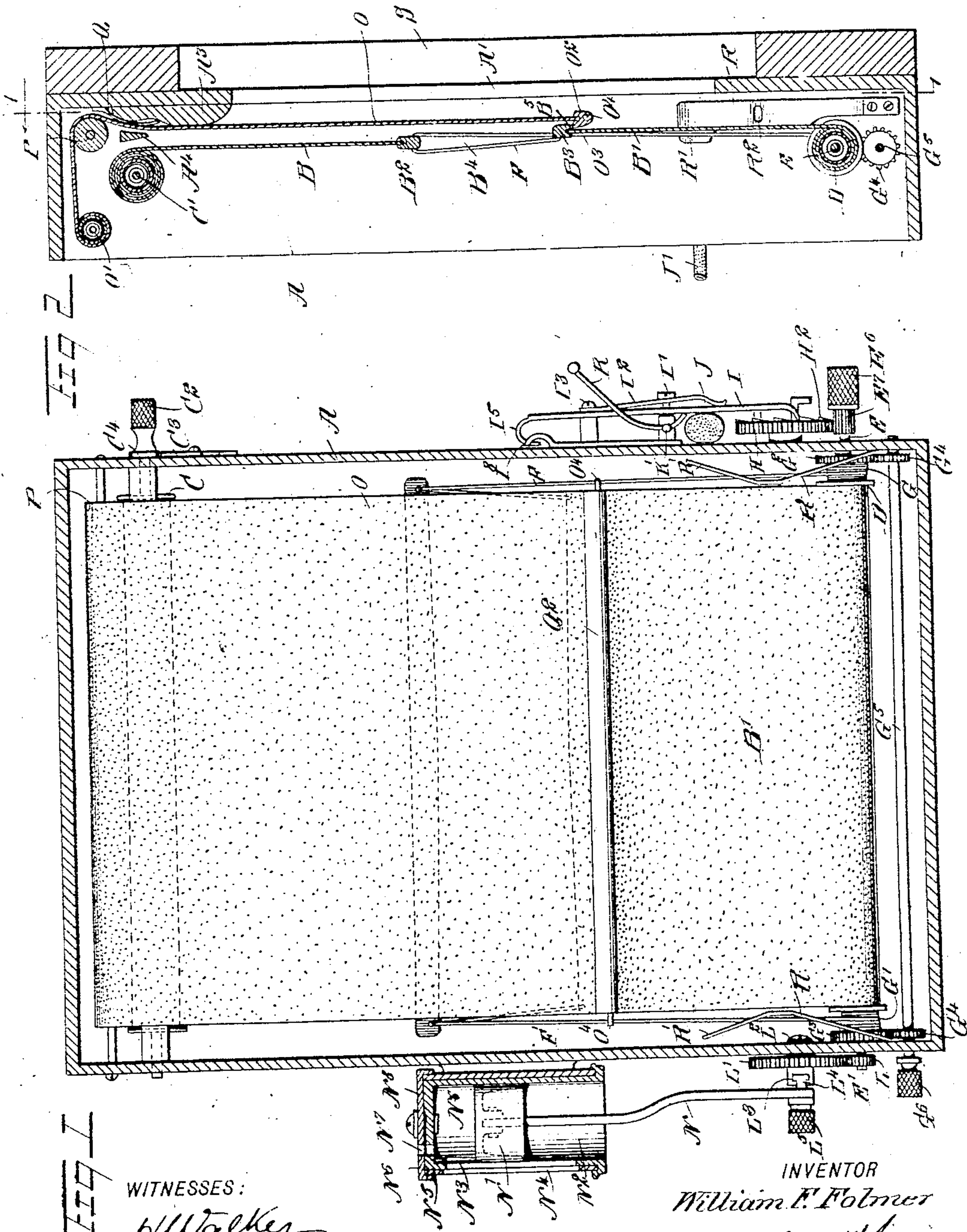
Patented Nov. 5, 1901.

W. F. FOLMER.  
CURTAIN SHUTTER.

Application filed June 29, 1901.

2 Sheets—Sheet 1.

(No Model.)



WITNESSES:

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INVENTOR

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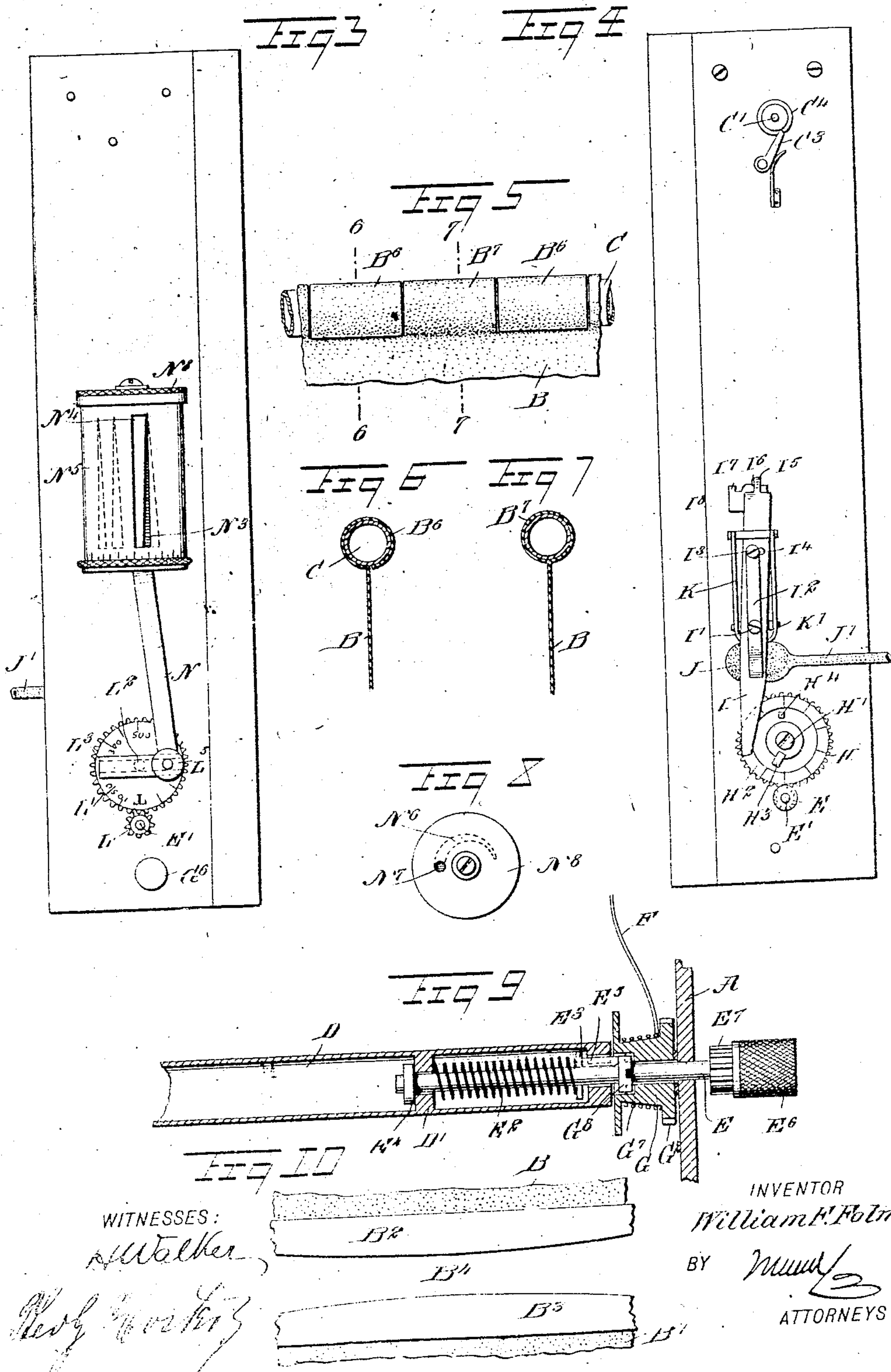
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2 Sheets—Sheet 2.

(No Model.)



WITNESSES:

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## UNITED STATES PATENT OFFICE.

WILLIAM F. FOLMER, OF NEW YORK, N. Y.

## CURTAIN-SHUTTER.

SPECIFICATION forming part of Letters Patent No. 686,045, dated November 5, 1901.

Application filed June 29, 1901. Serial No. 66,496. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM F. FOLMER, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented new and useful Improvements in Curtain-Shutters, of which the following is a full, clear, and exact description.

The invention relates to photographic cameras; and its object is to provide a new and improved curtain-shutter adapted to be set for time or instantaneous work and arranged to give a continuous or time-varying exposure of the plate, according to the intensity of the light on the subject. Thus for a land-and-sky subject, for instance, the darker land foreground is longer subjected to the actinic action of the rays of light than the sky portion, and the whole exposure is continuous and uniformly graduated in time to insure uniform or gradual exposure of the plate.

The invention also consists of novel features and parts and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

A practical embodiment of my invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference represent corresponding parts in all the figures.

Figure 1 is a transverse section of the improvement on the line 1 1 of Fig. 2. Fig. 2 is a longitudinal sectional elevation of the same with the plate-holder frame in position. Fig. 3 is a rear elevation of the same. Fig. 4 is a front elevation of the same. Fig. 5 is an enlarged face view illustrating the attachment of a curtain on its roller. Fig. 6 is a sectional side elevation of the same on the line 6 6 of Fig. 5. Fig. 7 is a similar view of the same on the line 7 7 of Fig. 5. Fig. 8 is a plan view of the dash-pot. Fig. 9 is an enlarged sectional elevation of the lower-curtain rollers and the pulleys for the cords, and Fig. 10 is a face view of a modified form of the adjacent ends of the main curtains.

The curtain-shutter is mounted in a suitably-constructed casing A, having an opening A', adapted to be opened and closed (for focusing or for making the exposure) by a main curtain consisting, essentially, of an upper curtain B and a lower curtain B', having

their adjacent ends B<sup>2</sup> B<sup>3</sup> arranged such a distance apart as to form an exposure-opening B<sup>4</sup>, through which the light passes from the lens to the plate during the time the curtains B and B' move from the bottom of the casing in an upward direction to move the said opening through the field of exposure. The size of the opening B<sup>4</sup> can be increased or diminished, according to the subject under treatment and as hereinafter more fully described, and the said opening B<sup>4</sup> varies automatically in size during this movement through the field of exposure—that is, the opening increases gradually during the time it traverses the field of exposure from the bottom to the top, so that the upper portion of the field is more exposed than the lower portion, whereby in the case, for instance, of a land-and-sky subject the foreground, which appears on the top of the plate, is subjected longer to the action of the actinic rays of light than the sky portion, which is on the lower portion of the plate, and consequently a better picture will be the final result.

The upper curtain B winds on the spring-actuated roller C, of any approved construction and having its shaft C' journaled in suitable bearings in the sides of the casing A, and on one outer end of the shaft C' is arranged a knob C<sup>2</sup>, under the control of the operator, for turning the shaft C' by hand to increase or decrease the tension of its spring, the shaft being normally locked in position by a spring-pressed pawl C<sup>3</sup>, engaging a shoulder C<sup>4</sup> on the shaft, as is plainly indicated in Figs. 1 and 4. The lower curtain B' winds on and unwinds from an ordinary roller D, attached at its ends to shafts E E', mounted to turn in suitable bearings in the sides of the casing A. (See Figs. 1 and 9.) A flexible connection connects the curtain B with the curtain B', so that when the curtain B' is wound up by the operator turning the shaft E then the curtain is drawn along in a downward direction against the tension of the spring in its roller C, and when the exposure is to be made and the roller D is unlocked, as hereinafter more fully described, then the spring in the roller C winds up the curtain B and by this action draws the curtain B' in an upward direction to unwind this curtain B' from its roller D. The flexible connection



tion referred to consists, essentially, of cords F and F', located at the sides of the curtain, the free ends of the cords being secured to the end B<sup>3</sup> of the curtain B' and then extending loosely through the end B<sup>2</sup> and then downward to wind on the cone-pulleys G and G', mounted on the shafts E and E', respectively. The pulleys G and G' are provided with gear-wheels G<sup>2</sup> and G<sup>3</sup>, in mesh with gear-wheels G<sup>4</sup>, secured on a shaft G<sup>5</sup>, journaled in suitable bearings in the sides of the casing A, so that when the pulley G is rotated the other pulley G' rotates positively with it. A knob G<sup>6</sup> is secured on the outer end of the shaft G<sup>5</sup> to permit the operator to turn the shaft and gear-wheels G<sup>4</sup> to rotate the gear-wheels G<sup>2</sup> and G<sup>3</sup> and the cone-pulleys G and G' to wind up or unwind the cords F and F' whenever it is desired to increase or diminish the size of the opening B<sup>4</sup> between the ends of the curtains. The pulley G normally rotates with the shaft E and roller D, while the pulley G' is mounted to rotate loosely on the shaft E'. The pulley G may be disconnected from the shaft E by the operator, and for this purpose a clutch is provided, consisting, essentially, of a clutch member G<sup>7</sup>, formed on the pulley G and adapted to be engaged by a clutch member G<sup>8</sup>, secured on the shaft E, the latter being movable longitudinally in its bearing in the casing A and in a bearing D', formed in the roller D. (See Fig. 9.) A spring E<sup>2</sup> is coiled on the shaft E within the roller D, its inner end resting on the bearing D' and its outer end pressing against a pin E<sup>3</sup> to normally hold the shaft E in an outermost position and the clutch member G<sup>8</sup> in mesh with the clutch member G<sup>7</sup>. When the shaft E is pressed inward against the tension of the spring E<sup>2</sup> by the operator, then the clutch member G<sup>8</sup> moves out of engagement with the clutch member G<sup>7</sup>, and the pulleys G and G' can now be turned independently of the roller D and the shafts E and E' by the operator turning the knob D<sup>6</sup>, as previously explained.

A stop-collar E<sup>4</sup> is secured on the inner end of the shaft E and is adapted to abut against the bearing D' to limit the outward movement of the shaft E to prevent the clutch member G<sup>8</sup> from creating undue friction when engaging the clutch member G<sup>7</sup>, so that the shaft E and the parts connected therewith rotate freely to insure proper closing of the curtain-shutter. The roller D is rigidly secured on the shaft E', and a key E<sup>5</sup> on the shaft E engages a keyway on the corresponding end of the roller D, as is plainly shown in Fig. 9, so that the shaft E is at all times connected with roller D whether the shaft is pressed inward, as previously explained, or extends in an outermost position, as shown in Fig. 9.

In order to set the curtain-shutter for instantaneous or time work, the following arrangement is provided: On the outer end of the shaft E is secured a knob E<sup>6</sup>, adapted to be taken hold of by the operator for turning the shaft E and roller D, together with the

pulleys G and G', to wind up the curtain B' on the said roller D and to draw the curtain B downward in front of the opening A', as previously explained. A pinion E<sup>7</sup> is secured on the shaft E adjacent to the knob E<sup>6</sup>, and this pinion is in mesh with a gear-wheel H, mounted to rotate loosely on a stud H', secured to one side of the casing A. The face of the gear-wheel H is formed with ratchet-teeth H<sup>2</sup>, adapted to be engaged by the free end of a pawl I, mounted to swing on a stud I', carried by the side of the casing A. A spring I<sup>2</sup> presses the free end of the pawl I to hold the same in engagement with the ratchet-teeth H<sup>2</sup>, the said spring I<sup>2</sup> being attached to a guide-pin I<sup>3</sup>, extending through an elongated slot I<sup>4</sup> in the upper end of the pawl I. (See Fig. 4.) The extreme upper end I<sup>5</sup> of the pawl I is adapted to engage either of the notches I<sup>6</sup> or I<sup>7</sup> in a spring-plate I<sup>8</sup>, secured to the side of the casing, as shown in Figs. 1 and 4. The lower or free end of the pawl I is also adapted to engage a time-stop H<sup>3</sup> and a limiting-stop H<sup>4</sup>, formed on the face of the gear-wheel H, inside of the teeth H<sup>2</sup> thereof. (See Fig. 4.) Now when the pawl I is in the position shown in Fig. 4 and the end I<sup>5</sup> of the pawl is in engagement with the notch I<sup>6</sup>, then the free end of the pawl engages the ratchet-teeth H<sup>2</sup>, so that when the operator turns the knob E<sup>6</sup> to wind up the curtain B' on the roller D then the pawl I glides at its free end loosely over the teeth H<sup>2</sup> of the ratchet-wheel H, and when the curtain is wound up the desired distance and the operator releases the knob E<sup>6</sup> then the pawl I locks with the ratchet-teeth H<sup>2</sup>, and consequently locks the gear-wheel H, the pinion E<sup>7</sup>, the shaft E, the roller D, and the pulleys G and G' against return movement. When the pawl I is now pushed outward out of engagement with the corresponding ratchet-tooth H<sup>2</sup> of the gear-wheel H, then the parts mentioned are unlocked and the curtain B' flies upward, being pulled in this direction by the cord F, and the curtain B winds up on its roller C by the action of the spring thereof. In order to swing the pawl I outward, an inflatable bulb J is employed, connected by a pipe J' with a hand-bulb under the control of the operator, the said bulb J being interposed between the side of the casing and the rear face of the pawl I, as will be understood by reference to Figs. 1 and 4. If desired, the pawl I may be swung out of engagement with the ratchet-teeth H<sup>2</sup> by a hand-lever K, fulcrumed at K' on the stud I' and adapted to engage the inside of the pawl I adjacent to the bulb J. (See Figs. 1 and 4.) When it is desired to make a time exposure, the pawl I is swung on its fulcrum I', so as to engage the end I<sup>5</sup> with the notch I<sup>7</sup> and to bring the free end of the pawl into the paths of the stops H<sup>3</sup> and H<sup>4</sup>. For the purpose mentioned the knob E<sup>6</sup> is turned until the curtains are set (with the curtain B' wound up on roller D) and the stop H<sup>4</sup> is opposite the free end



of the pawl I, engaging a ratchet-tooth H<sup>2</sup> on the wheel II. The operator now swings the pawl over against the stop-pin H<sup>4</sup>, and on releasing the pawl I by inflating the bulb J or working the lever K the curtains move upward by the action of the spring on the roller C until the free end of the pawl I abuts against the stop-pin H<sup>3</sup>. The opening B<sup>4</sup> now coincides with the opening A', and the exposure is made for such a length of time as is desired, and then the operator on releasing the bulb J or lever K allows the pawl I to swing inward out of engagement with the stop-pin H<sup>3</sup>, and the curtains now move to closed position.

In order to govern the winding up of the curtain B and the unwinding of the curtain B' when making the exposure, the following device is provided. On the outer end of the shaft E' (see Figs. 1 and 3) is secured a pinion L, in mesh with a gear-wheel L', mounted to rotate loosely on a stud L<sup>2</sup>, carried by the casing A, and on the said gear-wheel L' is secured or formed a diametrically-extending guideway L<sup>3</sup>, engaged by a wrist-pin L<sup>4</sup>, secured in place on the guideway by a clamping-screw L<sup>5</sup>. The wrist-pin L<sup>4</sup> is pivotally connected by a pitman N with a piston N', mounted to reciprocate in a dash-pot cylinder N<sup>2</sup>, attached to the casing A, the said cylinder being provided in its side with different-sized slits N<sup>3</sup>, gradually increasing in size from the top to the bottom, as is plainly indicated in Fig. 3, the said slits being adapted to register with a rectangular slit N<sup>4</sup>, formed in a sleeve N<sup>5</sup>, mounted to turn on the outside of the cylinder N<sup>2</sup>. Now by turning the sleeve N<sup>5</sup> the slits N<sup>3</sup> may be uncovered more or less, so as to admit more or less air to the upper end of the cylinder to regulate the downward movement of the piston N' in the said cylinder and govern the unwinding speed of the roller D. The dash-pot cylinder N<sup>2</sup> is provided on its top with an aperture N<sup>6</sup>, gradually decreasing in size, as is plainly indicated in dotted lines in Fig. 8, and the said aperture registers with an aperture N<sup>7</sup>, formed in a cap N<sup>8</sup>, mounted to turn on the upper end of the cylinder N<sup>2</sup>. Now by turning the cap N<sup>8</sup> the aperture N<sup>7</sup> connects with a wider or narrower portion of the aperture N<sup>6</sup>, so that more or less air is admitted to the cylinder to control the movement of the piston therein.

The gear-wheel L' previously mentioned is graduated on its face, as shown in Fig. 3, to permit of setting the cylinder N<sup>5</sup> to govern the unwinding speed of the roller D. By adjusting the wrist-pin L<sup>4</sup> in the diametrical guideway L<sup>3</sup> the throw of the piston N' in the cylinder N<sup>2</sup> is regulated, it being understood that after the adjustment of the wrist-pin the latter is secured in place by the screw L<sup>5</sup>. The gearing L L' is so proportioned that the wrist-pin does not make more than one-half a turn for the entire closing travel of the curtains.

In order to cover the opening B<sup>4</sup> during the time the said opening is moved downward through the field of exposure, a safety-curtain O is provided, winding on a spring-actuated roller O', journaled in the upper portion of the casing A, as is plainly shown in Fig. 2. The safety-curtain O extends from its roller O' over an idler P and then over a spring Q, held on a bearing A<sup>3</sup>, secured to the inside of the casing, the said bearing A<sup>3</sup> forming with a cross-bar A<sup>4</sup> a slot for the passage of the curtain O in front of the roller C. The end O<sup>2</sup> of the curtain O is in the form of a cross-bar having a lip O<sup>3</sup>, adapted to be engaged by a corresponding lip B<sup>5</sup>, formed on the end B<sup>3</sup> of the curtain B', so that when the curtain B' is in an uppermost position and the operator turns the knob E<sup>6</sup> to wind up the curtain B' on the roller D, then the said lip B<sup>5</sup> engages the lip O<sup>3</sup>, and thereby moves the safety-curtain O down with the curtain B', the safety-curtain then unwinding from its spring-actuated roller O'. It is understood that normally the end O<sup>2</sup> of the safety-curtain O abuts against the cross-bar A<sup>4</sup>, so that the end B<sup>3</sup> is above the end O<sup>2</sup> at the time the curtain B' is unwound and the curtain B is wound up on its roller, and hence when the knob E<sup>6</sup> is turned, as previously explained, the lip B<sup>5</sup> engages the lip O<sup>3</sup> for the purpose mentioned.

On the end O<sup>2</sup> of the safety-curtain O are formed pins O<sup>4</sup>, adapted to engage the inclined ends R' of spring-arms R, secured to the inside of the casing, in the lower portion thereof, the said spring-arms R having elongated slots R<sup>2</sup>, adapted to be engaged by the said pins O<sup>4</sup> at the time the curtain moves into a lowermost position and the safety-curtain O has been drawn clear across the opening A'. It is understood that when the curtain B' is wound up and the curtain O moves down with it then the pins O<sup>4</sup> finally move into engagement with the inclined ends R' of the spring-arms R, so as to press the latter apart until the pins O<sup>4</sup> finally snap into the openings R<sup>2</sup>, thus locking the curtain O in an extended position. On further winding up the curtain B' the lip B<sup>5</sup> pulls on the lip O<sup>3</sup>; but as the pins O<sup>4</sup> now engage the apertures R<sup>2</sup> it is evident that the end O<sup>2</sup> turns with the said pins as trunnions and the lip B<sup>5</sup> finally moves out of engagement with the lip O<sup>3</sup>. On the further winding up of the curtain B' on the roller D and the drawing of the curtain B downward in the rear of the safety-curtain O the projecting ends of the cross-bar forming the end B<sup>3</sup> of the curtain B finally move in engagement with the inclined ends of the arms R, so that the latter are pressed outward and finally move out of engagement with the pins O<sup>4</sup>, so that the safety-curtain is automatically released and immediately flies upward owing to the action of the spring in the roller O', which latter now winds up the safety-curtain. This releasing of the safety-curtain takes place at the time



the end B<sup>2</sup> has well passed the lower end of the opening A', so that there is no danger whatever of light passing through the opening A'. From the foregoing it is evident that the safety-curtain O is actuated when setting the curtains B and B'.

In order to insure a secure fastening of the curtains B and B' and their rollers C and D, I provide the arrangement shown in Figs. 5, 6, and 7—that is, the roller end of each curtain is formed with eyes produced by lips B<sup>6</sup> and B<sup>7</sup>, bent in opposite directions and cemented or otherwise secured to the rollers C and D, so that in winding up and unwinding a pull is always exerted against either of the eyes B<sup>6</sup> or B<sup>7</sup> to prevent the same from becoming loose on the rollers.

The ends B<sup>2</sup> B<sup>3</sup> of the curtains B B' are preferably curved, as indicated in Fig. 10, to make the opening B<sup>4</sup> smaller at the middle than at the sides to admit more light to the sides of the sensitive plate than at the middle thereof. This is done to equalize the power of the lens, which is more intense at the center of the field than at the sides thereof.

The operation is as follows: When the casing A is placed in position on the rear end of the camera and in front of the plate-holder and it is desired to set the shutter for instantaneous work, then the operator moves the pawl I into the position shown in Fig. 4 and then turns the knob E<sup>5</sup>, so as to wind up the curtain B' on the roller D and to unwind the curtain B from its spring-actuated roller C. During this movement of the curtains B' and B the safety-curtain O is drawn along, as previously explained, and when the curtain B' has been completely wound up on its roller D and the curtain B has been extended completely over the opening A' then the safety-curtain O is automatically released and flies back to its normal position with the curtains B and B' locked in place by the pawl I engaging a ratchet-tooth H<sup>2</sup> on the gear-wheel H. Now when it is desired to make the exposure the operator either inflates the bulb J' or presses the hand-lever K to move the pawl I out of engagement with the ratchet-tooth H<sup>2</sup>, so that the roller D is free to rotate, and with it the friction-rollers G G', to permit the curtains B and B' to move upward, the curtain B being wound up by its spring-actuated roller C. During this upward movement of the curtains B and B' the cords F and F' unwind from their cone-pulleys G G' at a differential rate of speed from that of the curtain B', so that the opening B<sup>4</sup> increases in size during the upward travel of the opening through the field of exposure. It is understood that at the beginning of the unwinding of the curtain B' the cords F F' are at the smallest diameters of their pulleys G G', and as the unwinding takes place toward the large diameters of the pulleys it is evident that more is unreeled in proportion to the unwinding of the curtain B', so that the upper curtain B gradually winds up faster than

the lower curtain B' unwinds, and consequently the opening B<sup>4</sup> between the ends of the curtains gradually becomes larger. Thus when exposing, for instance, for making a land and sky picture more light is admitted to the plate for the land portion of the picture, which appears at the top of the plate, than is given to the sky portion, which appears at the bottom of the plate, at the time the opening B<sup>4</sup> is smallest. The dash-pot mechanism graduates the winding up of the curtain B and the unwinding of the curtain B', and as the piston N' is positively connected with the shaft E' and roller D, as previously explained, it will be understood that more or less air can be admitted to the upper end of the cylinder, so that the downward movement of the piston N' is faster or slower, according to the amount of air admitted.

From the foregoing it will be understood that when the exposure is made more time is given to the foreground of the subject than to the sky; but as this action is gradual no demarcation-line will be produced on the plate, as would be the case if the opening were intermittently enlarged. Thus a uniform exposure takes place all over the plate, according to the intensity of the light on the subject.

It is evident that by the arrangement described the curtains B B' may be moved so far apart as to allow full focusing, or the opening B<sup>4</sup> may be diminished to leave but a narrow slit between the ends of the curtains to allow of using the shutter for very high speed work. By the use of the dash-pot controller the time of the exposure is graduated from one part of the plate to the other.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A curtain-shutter having an exposure-opening adapted to be gradually increased in size while moving over the field of exposure, as set forth.

2. A curtain-shutter having an exposure-opening adapted to be gradually increased in size while moving over the field of exposure in the direction from the bottom of the field to the top thereof, as set forth.

3. A curtain-shutter having a plurality of curtains moving at a differential rate of speed, with the adjacent ends spaced apart, as set forth.

4. A curtain-shutter having a plurality of curtains forming an exposure-opening between adjacent ends, and means for moving the curtains at a differential rate of speed to vary the size of the opening while traversing the field of exposure, as set forth.

5. A curtain-shutter having a plurality of curtains forming an exposure-opening between adjacent ends, the said opening being adapted to be gradually increased in size while moving over the field of exposure and one of the curtains being adjustable relative to the other to increase or diminish the size of the exposure-opening, as set forth.



6. A curtain-shutter having a plurality of curtains forming an exposure-opening between adjacent ends, the said opening being adapted to be gradually increased in size while moving over the field of exposure, winding-up means for one of the curtains, and means for connecting the curtains with each other to unwind one curtain while winding up the other one, as set forth.

7. A curtain-shutter having a plurality of curtains forming an exposure-opening between adjacent ends, winding-up means for one of the curtains, and means for connecting the curtains with each other to unwind one curtain while winding up the other one, the said connecting means being arranged to wind up the first curtain at a differential speed from that of the unwinding one, as set forth.

8. A curtain-shutter having a plurality of curtains forming an exposure-opening between adjacent ends, winding-up means for one of the curtains, and means for connecting the curtains with each other to unwind one curtain while winding up the other one, the said connecting means being arranged to wind up the first curtain quicker than the other curtain is unwound, as set forth.

9. A curtain-shutter having a plurality of curtains forming an exposure-opening between adjacent ends, winding-up means for one of the curtains, means for connecting the curtains with each other to unwind one curtain while winding up the other one, the said means comprising flexible connections attached at one end to the unwinding curtain and extending loosely through the other curtain, and cone-pulleys on which wind the said flexible connections, as set forth.

10. A curtain-shutter having a plurality of curtains forming an exposure-opening between adjacent ends, winding-up means for one of the curtains, means for connecting the curtains with each other to unwind one curtain while winding up the other one, the said means comprising flexible connections attached at one end to the unwinding curtain and extending loosely through the other curtain, and cone-pulleys on which wind the said flexible connections, the said cone-pulleys turning with the roller of the unwinding curtain, as set forth.

11. A curtain-shutter having a plurality of curtains forming an exposure-opening between adjacent ends, winding-up means for one of the curtains, means for connecting the curtains with each other to unwind one curtain while winding up the other one, the said means comprising flexible connections attached at one end to the unwinding curtain and extending loosely through the other curtain, cone-pulleys on which wind the said flexible connections, and means for setting the winding-up curtain relative to the other curtain, as set forth.

12. A curtain-shutter having a plurality of curtains forming an exposure-opening between adjacent ends, the said opening being

adapted to be gradually increased in size while moving over the field of exposure, a spring-actuated roller for the upper curtain, a roller for the lower curtain, and a variable connection between the adjacent ends of the curtains, as set forth.

13. A curtain-shutter having a plurality of curtains forming an exposure-opening between adjacent ends, a spring-actuated roller for the upper curtain, a roller for the lower curtain, a flexible connection attached at one end to the free end of the lower curtain and extending loosely through the free end of the upper curtain, and cone-pulleys mounted to turn with the roller for the lower curtain, as set forth.

14. A curtain-shutter having a plurality of curtains forming an exposure-opening between adjacent ends, a spring-actuated roller for the upper curtain, a roller for the lower curtain, a flexible connection attached at one end to the free end of the lower curtain and extending loosely through the free end of the upper curtain, cone-pulleys mounted to turn with the roller for the lower curtain, and manually-controlled means for connecting and disconnecting the cone-pulleys from the lower roller, as set forth.

15. A curtain-shutter having an upper curtain provided with a spring-roller, a lower curtain provided with a roller, a connection between the curtains, to wind up the upper curtain faster than the lower curtain unwinds, and a dash-pot for the lower roller, to graduate the winding up of the upper curtain and the unwinding of the lower curtain, as set forth.

16. A curtain-shutter having an upper curtain provided with a spring-roller, a lower curtain provided with a roller, a connection between the curtains, to wind up the upper curtain faster than the lower curtain unwinds, and a dash-pot for the lower roller, to graduate the winding up of the upper curtain and the unwinding of the lower curtain, the dash-pot having a variable inlet, as set forth.

17. A curtain-shutter having an upper curtain provided with a spring-roller, a lower curtain provided with a roller, a connection between the curtains, to wind up the upper curtain faster than the lower curtain unwinds, a dash-pot for the lower roller to graduate the winding up of the upper curtain and the unwinding of the lower curtain, and a variable connection between the dash-pot and the said lower roller, as set forth.

18. A curtain-shutter having a shutter-curtain provided with an exposure-opening adapted to be gradually increased in size while moving over the field of exposure and a dash-pot for controlling the speed of the shutter-curtain, as set forth.

19. A curtain-shutter having a shutter-curtain provided with an exposure-opening adapted to be gradually increased in size while moving over the field of exposure and a dash-pot for controlling the speed of the



shutter-curtain, the dash-pot having a variable inlet to vary the speed, as set forth.

20. A camera-shutter having a dash-pot for controlling the speed of the shutter, and comprising a cylinder having slits in its side wall, a piston in said cylinder and connected with the shutter-curtain, and a cut-off sleeve having a slit and movable on the said cylinder to regulate the inlet of air, as set forth.

21. A camera-shutter having a dash-pot, comprising a cylinder provided with a gradually-tapering slot in its head, a piston in the said cylinder and connected with the shutter-curtain, and a regulating-cap movable on the said cylinder and having an opening registering with the said slot, as set forth.

22. A curtain-shutter having a safety-curtain automatically picked up while setting the shutter and automatically released as soon as the shutter is set.

23. A curtain-shutter having a main curtain and a safety-curtain adapted to be automatically picked up by the main curtain while setting the shutter and automatically released as soon as the shutter is set.

24. A curtain-shutter having a main curtain, a spring-actuated safety-curtain and means on the said curtains for engaging the said safety-curtain by the said main curtain to move the safety-curtain into an extended position on setting the main curtain, as set forth.

25. A curtain-shutter having a main curtain, a spring-actuated safety-curtain, means on the said curtains for engaging the said safety-curtain by the said main curtain to move the safety-curtain into an extended position when setting the main curtain and

means for automatically releasing the safety-curtain as soon as the main curtain is set, substantially as described.

26. A curtain-shutter having a main curtain, a spring-actuated safety-curtain, a connecting device on the main curtain to engage the safety-curtain to move the latter into an extended position, a holding device for holding the safety-curtain in an extended position, and a releasing device for opening the said holding device to release the said safety-curtain at the time the main curtain is set, as described.

27. A curtain-shutter having a main curtain having an engaging device, a safety-curtain provided with a spring-actuated roller, and adapted to be engaged by the said engaging device, and a spring for pressing the said safety-curtain to bring the engaging device into positive engagement with the said safety-curtain, as set forth.

28. A curtain-shutter having a main curtain, a spring-actuated safety-curtain adapted to be moved into a closed position by the said main curtain, spring-arms having openings for engagement by pins on the said safety-curtain, and means on the said main curtain and adapted to engage the said spring-arms to release the said pins and thereby the said safety-curtain, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM F. FOLMER.

Witnesses:

THEO. G. HOSTER,

EVERARD B. MARSHALL.