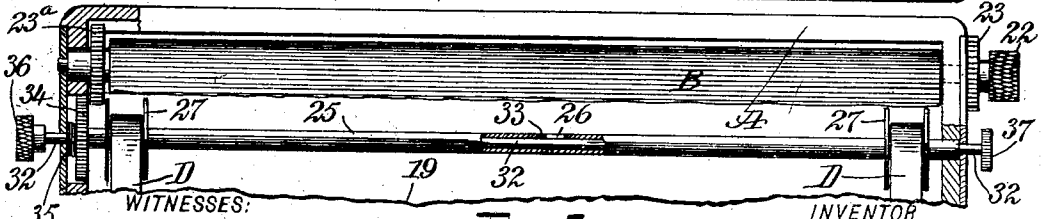
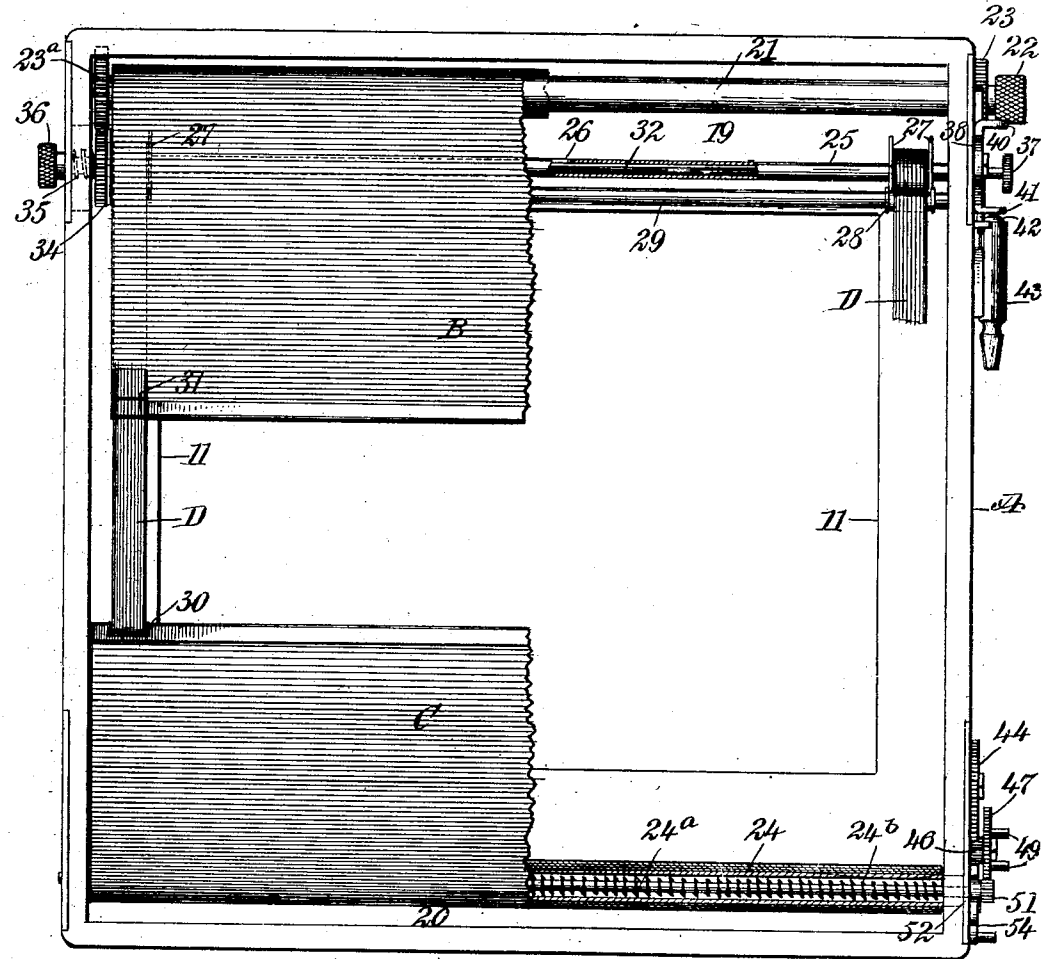


W. F. FOLMER,
FOCAL PLANE SHUTTER.
APPLICATION FILED MAR. 26, 1904.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

INVENTOR

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Fig. 5.

William F. Folmer

BY *Wm. F. Folmer*
ATTORNEYS

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NO MODEL.

2 SHEETS—SHEET 2.

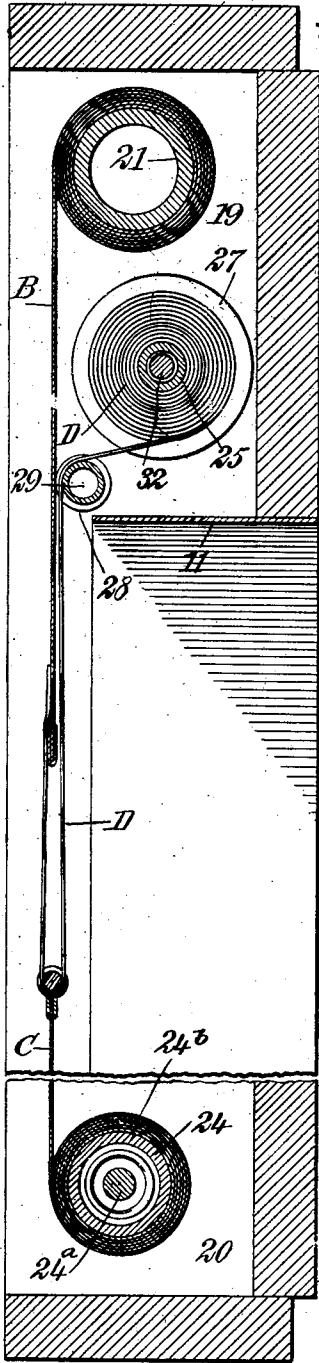


Fig. 2.

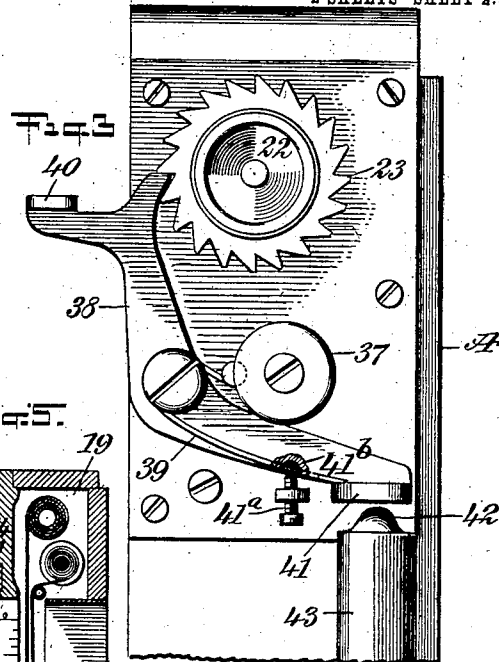


Fig. 3.

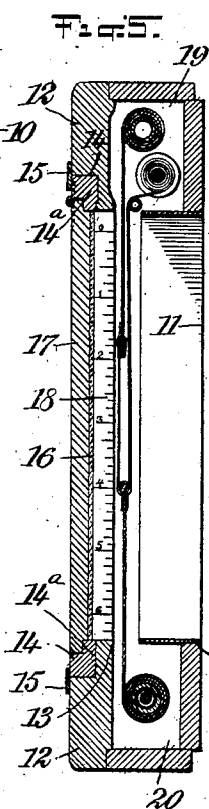


Fig. 5.

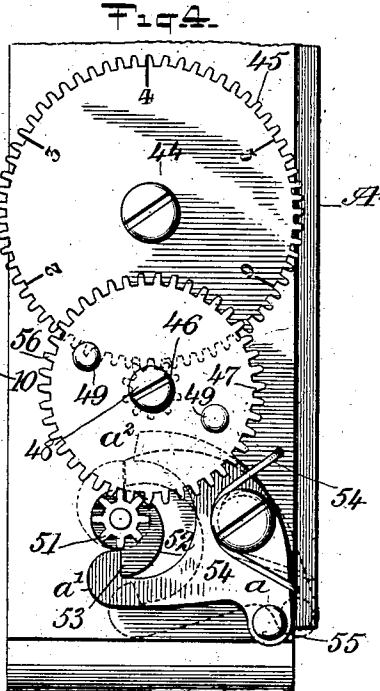


Fig. 4.

WITNESSES:

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UNITED STATES PATENT OFFICE.

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

FOCAL-PLANE SHUTTER.

SPECIFICATION forming part of Letters Patent No. 763,173, dated June 21, 1904.

Application filed March 26, 1904. Serial No. 200,207. (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 a new and Improved Focal-Plane Shutter, of which the following is a full, clear, and exact description.

My invention relates to an improvement in focal-plane shutters; and the special purpose of the invention is to provide a construction whereby the alinement of the shutters to each other and the alinement of the connecting-tapes for the shutters with respect to the reeling device will be maintained under all conditions of adjustment and operation of the shutters.

A further purpose of the invention is to provide a tension device for the shutters under perfect control, being so constructed that the tension on the shutters may be increased or decreased with accuracy one or more numbers or points and wherein after adjustment such adjustment will be maintained until purposely disturbed, whereas in all other shutters of the same type of which I have knowledge when tension is to be decreased or even increased the tension-spring is apt to fully unwind, necessitating a complete take-up or adjustment from a relaxed position to the point or number desired, and, furthermore, to embody in one mechanism a compensating tension and a winding device for the members of the shutters.

The invention consists in the novel construction and combination of the several parts, as will be hereinafter fully set forth, and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional rear elevation of the improved shutter. Fig. 2 is an enlarged vertical section through the shutter drawn on an enlarged scale, the shutter being horizontally broken away, the section being taken near the central portion of the shutter. Fig. 3 is an enlarged side elevation of the shutter-frame,

illustrating the winding and adjusting mechanism for the curtains of the shutter and likewise the exposing-trip. Fig. 4 is an enlarged side elevation of the lower portion of the shutter-frame, illustrating the tension device employed to control the rapidity of the movement of the shutter-curtains. Fig. 5 is a complete vertical section through the shutter drawn on a small scale and illustrating the application of a scale to the shutter-frame whereby to render accurate adjustment between the curtains of the shutter, and Fig. 6 is a vertical section and vertical rear elevation of the upper portion of the shutter.

A represents the frame of the shutter, which is of the usual rectangular formation, and the front of the frame is provided with an opening 10, through which the cone of light from the lens is adapted to pass to the focusing-glass or to the plate in the plate-holder, whichever is employed. This opening 10 is surrounded by a throat-piece 11 of any suitable description, (shown best in Figs. 2 and 5,) which throat-piece extends rearward within the frame and is of less dimensions than the outer dimensions of the frame, as is apparent from Fig. 5. The opening at the rear of the frame is much larger than at the front, and at the rear opening of the main frame A an auxiliary frame 12 is secured. This auxiliary frame 12 has an opening therein which practically corresponds to the opening at the front of the main frame and, if anything, is somewhat larger. This opening is designated in the drawings as 13, and at the rear portion of the auxiliary frame 12 a rabbet 14 is formed, (shown in Fig. 5,) and this rabbet is adapted to receive a frame 14^a, which frame is held in position in the rabbet of the auxiliary frame 12 by means of the usual springs 15, as the frame 14^a is a focusing-frame and is adapted to be forced outward after focusing to receive the plate-holder, one end (the right-hand end) of the auxiliary frame 12 being open to communicate with the rabbeted portion 14. This focusing-frame 14^a is provided with the usual focusing-hood 17 and with the ground glass 16 in front of the focusing-hood, as is also shown in Fig. 5, and

a scale 18 in inches is secured to the left-hand side of the auxiliary or take-up frame 12, and by means of this scale it is possible to readily determine the distance required between the
 5 opposing curtains for the shutter, which curtains will be hereinafter specifically referred to. Under this construction of the frame it will be observed that an upper chamber 19 is formed and a lower chamber 20. A shaft 21
 10 is journaled in the sides of the main frame within the upper chamber 19, and at the right-hand end of this shaft, which extends beyond the right-hand side of the main frame, a thumb-nut 22 is secured, so that the shaft
 15 21 may be readily turned. A ratchet-wheel 23 is secured at the outer right-hand portion of the upper shaft 21, while within the said main frame at the left-hand side of the shaft 21 a gear-wheel 23^a is fastened in any suitable
 20 or approved manner.

The upper curtain B of the shutter is secured to the upper shaft 21 in any approved manner and may be readily wound thereon by turning the thumb-nut 22, and, as will be hereinafter stated, by a certain releasing mechanism the upper curtain will be unrolled from the shaft 21. The upper curtain B is connected with a lower curtain C by means of tapes D, located at the side edges of the curtains and applied in a manner to be hereinafter specifically stated. The lower curtain C is secured to a spring or tension controlled roller 24. This roller is shown as hollow and is provided with a central shaft 24^a, around which the controlling-spring 24^b is coiled, attached to the body of the roller and to the said shaft.

Within the upper chamber 19 and at a point between the upper portion of the throat-piece 11 and the upper shaft 21 a tubular shaft 25 is
 40 mounted to revolve in the side portions of the main frame. This tubular shaft 25 is provided about centrally between its ends with a longitudinal slot 26 and near each end of a reel 27, the reels being securely fastened to the said tubular shaft. One end of each tape D, above mentioned, is secured to a reel 27, and such ends of the tapes are adapted to be wound upon or unwound from these reels. The tapes are then carried down between flanges 28, formed near
 50 the end portions of a guide-shaft 29, mounted to turn also in the sides of the main frame A at a point below and in front of the tubular shaft 25, and said guide-shaft 29, as is shown in Fig. 2, is preferably located just above and quite close to the rear edge of the upper portion of the throat-piece 11. The spaces between the flanges 28 on the guide-shaft 29 correspond to the spaces between the heads of the reels 27, and the flanges on the shaft 29 likewise correspond in position to the position of the heads of the said reels. The tapes D after having been passed over the guide-shaft 29 between the flanges 28 are carried downward and are passed loosely over bearings 30, located in

the upper edges of the lower curtain C near
 65 the side edges of said curtains, and such bearings may be roller-bearings, if so desired. Finally, the tapes are passed upward from the bearings 30 and are secured in any suitable or approved manner to the lower side portions of
 70 the upper curtain B, as is shown at 31 in the drawings. Thus it will be observed that the tapes travel in uninterrupted and direct vertical line from the reels to the lower curtain and from the lower curtain upward to the up-
 75 per one.

A shaft 32, preferably a solid shaft, is mounted to slide in the tubular shaft 25, and this inner or solid shaft 32 extends outward beyond both sides of the main frame A. These
 80 two shafts are compelled to turn together by reason of a pin 33 being secured to the inner or solid shaft extending out through the slot 26 in the outer tubular or reel-carrying shaft; but the inner or solid shaft 32 has end move-
 85 ment within the tubular shaft 25 to the extent of the length of the slot 26 in the said tubular shaft. Within the upper chamber 19 of the main frame a gear 34 is secured to the left-hand end of the inner or solid shaft 32,
 90 and this gear is normally held in mesh with a gear 23^a on the winding-shaft for the upper curtain B through the medium of a spring 35, as is best shown by dotted lines in Fig. 1 and in positive lines in Fig. 6.

At the left-hand end of the inner or solid shaft 32 a button 36 is secured, whereby to turn the said solid shaft, and thus turn the outer shaft 25 also. At the right-hand end of the solid shaft 32 a button 37 is loosely
 100 mounted, so that the button will turn on the said shaft, and this button may be termed a "push-button."

By turning the upper curtain-winding shaft 21 the upper curtain will be wound upon the
 105 upper shaft 21 and the lower curtain C will be unwound from the spring-controlled shaft 24 against the tension of its controlling-spring, and after the curtains have been carried to their upper position prior to an exposure they
 110 are held in such position by means of a pawl 38, preferably of angular construction, as is shown in Fig. 3, one member of the pawl engaging with the ratchet-wheel 23, slipping over the teeth of the said ratchet-wheel as the upper curtain is wound on the said shaft 21,
 115 but holding the ratchet-wheel 23 from turning in a contrary direction until purposely released from the ratchet-wheel. This retaining contact is brought about by the application of a spring 39, as is shown also in Fig. 3. This pawl 38 may be released directly by hand from engagement with the ratchet-wheel 23 through an extension 40, which is carried in direction of the rear of the frame, as is
 120 shown best in Fig. 3, or this pawl 38 may be released pneumatically through the medium of a foot-piece 41, extending from its lower
 125

member into the path of the plunger 42 of an ordinary pump 43, operated by a compression-bulb or the like. The movement of the pawl is limited in one direction by a set-screw 41^a, which has bearing against a cushion 41^b in the pawl.

The shaft 24, to which the lower curtain C is attached, having been placed under suitable tension and the lower curtain raised by turning the shaft 21 and at the same time the upper curtain B and the tapes D being wound on the upper shaft 21 to the desired extent, the shutter is then in condition for operation, and upon carrying the pawl 38 from engagement with the ratchet-wheel 23, either by direct hand-pressure or through the medium of a bulb and pump described, the spring or tension device in the lower roller will immediately act to draw the two curtains downward and roll them on the lower roller 24 in about the same proportion that they were rolled upon the upper roller 21. The distance between the opposing edges of the two curtains B and C of the shutter will regulate the degree of exposure, and the extent to which the spring in the roller 24 is placed under tension will regulate the rapidity of the movement of the curtains in making an exposure.

The space between the opposing edges of the two curtains B and C is regulated by the combined action of the telescopic shafts 25 and 32, and this is accomplished in the following manner: The upper curtain having been placed at its lower edge in the desired position relative to the scale 18 by being wound on or unwound from the upper roller 21 the inner or solid shaft 32, or that shaft contained within the tubular reel-shaft 25, is forced to the left by applying pressure to the push-button 27 at its right-hand end against the tension of the spring 35 at the left-hand end of the said shaft, and at such time it will be observed, especially by reference to Fig. 6, that the gear 34, which is attached to the left-hand end of the inner shaft 32, will be carried out of mesh with the gear 23^a on the winding-shaft 21 of the upper curtain B, so that while the shaft 32 is thus pushed to the left by turning the button 36 in one or the other direction the lower curtain will be carried to or from the upper curtain, and so the space between the two curtains may be increased or decreased while the upper curtain-shaft 21 remains stationary; but the reel-shaft 25 will turn with the adjusting-shaft 32 in such a manner as to take up the slack of the tape or to permit the tape to unwind proportionately to the space desired to be obtained between the two curtains. Immediately upon releasing the adjusting-shaft 32 at its right-hand end the spring 35 will act to restore that shaft to its normal position and cause the gear 34 again to engage with the gear 23^a, thus causing the curtains when set and dropped for exposure to move downward and the reel-shaft to move with the curtains

to permit the tape carried thereby to readily unwind, and also when the curtains are to be carried up to the position they should occupy before exposure the upper curtain will be rolled proportionately upon the upper shaft 21 to the unreeling of the lower curtain C from the tension-controlled shaft 24.

In most focal-plane shutters when the tension on the tension-roller is to be increased or decreased to increase or decrease the rapidity of the movement of the curtains the moment that the tension-controlling mechanism is operated to effect such an increase or decrease the tendency of the tension-controlled roller is to entirely unwind and have no operating influence on the curtains, necessitating a re-winding of the spring in the controlling-roller, so as to bring the said spring to the tension desired to effect the desired rapidity or slowness of the exposure. I aim to overcome this difficulty through the mechanism shown in detail in Fig. 4, which mechanism is so constructed that a winding of the spring can be effected by it and the tension controlled step by step or point by point, according to given numerals or characters on a dial-wheel 44, which dial-wheel is mounted to turn at the lower right-hand side portion of the main frame A and is shown as marked off into a number of divisions, each indicated by a numeral, and in the drawings these numerals read from "1" to "6." The dial-wheel 44 is provided with peripheral teeth 45, and these teeth are engaged by a pinion 46, which is attached to what I term a "winding-wheel" 47, the pinion and the wheel being mounted to turn on a suitable shaft or a pin 48. The winding-wheel 47 is provided with one or more (preferably two) studs 49, oppositely disposed, so that the thumb and fingers of a hand may be applied thereto, so as to turn the said wheel. The winding-wheel 47 is provided with peripheral teeth 50, and these teeth engage with a pinion 51, which is secured to the right-hand outwardly-extending end of the spring-controlled shaft 24^a for the tension-roller 24, and a cam 52 is either secured to the said pinion or to the end of the shaft 24^a, to which the pinion is attached, which cam has one well-defined striking-shoulder 53. In connection with this cam an escapement 54 is employed, fulcrumed on the outer face of the said main frame opposite the pinion 51, and this escapement has usually somewhat of an L form and consequently consists of a body *a* and upper and lower branches from the body, terminating in heads *a'* and *a''*. This escapement is controlled by a spring 54, applied in such manner as to cause the lower head *a'* to normally engage with the striking-shoulder 53 of the cam 52, as is shown in positive lines in Fig. 4. This escapement is provided with a handle 55, so that it can be readily operated, and when the handle is grasped and pushed outward, for example, the lower edge *a'* will be carried away from the striking-

face 53 of the cam 52, and the tension of the spring will then cause the cam to revolve, and the aforesaid outward movement of the escapement will also cause the upper head a^2 to be brought in the path of the striking-surface 53 of the cam, thus permitting the cam when released to make but one-half of a revolution, and this half-revolution will cause the dial-wheel 44 to turn exactly the distance of one point through the medium of the gear connection between the said dial-wheel, the winding-wheel, the pinion carried thereby, and the pinion on the spring-controlled shaft, so that gradually and accurately the tension on the curtains may be increased or decreased, and at each operation of the escapement 54 the tension will be affected to a greater or lesser degree and step by step, according to the marking of the dial. When it is desired to wind up the spring in the tension-roller 24, it is simply necessary to turn the winding-wheel 47, which is readily accomplished in the manner that has been stated.

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

1. In a focal-plane shutter, a frame, an upper winding-roller, a lower tension-controlled winding-roller, a curtain attached to each roller, a shaft journaled in the frame below the upper winding-shaft, reels carried by the latter shaft, and tapes secured to the reels, having free movement through the curtain carried by the tension-controlled roller and attachment to the upper or opposing curtain, thus insuring a predetermined alinement of the tapes and the true operation of the curtains under all conditions in the operation of the shutter, and a guide-shaft below the reel-shaft, provided with guide divisions corresponding in direction and location to the wheels, over which guide divisions the forward stretches of the tapes pass, as described.

2. In a focal-plane shutter, a frame, curtains, winding-rollers therefor, a tubular shaft, reels thereon, connecting-tapes for the curtains, secured to the reels and passed loosely through one curtain, being attached to the other, an adjusting-shaft having end movement in the tubular shaft, a connection whereby the two shafts turn together, a gear connection between the adjusting-shaft and one of the winding shafts or rollers, which gear connection is broken when the adjusting-shaft is given end movement, whereby at times the winding-rollers and the tubular adjusting-shafts will coöperatively act, and whereby also such gear connection as stated can be broken and one curtain may be adjusted up or down without disturbing the position of the opposing curtain.

3. In a focal-plane shutter, an upper winding-roller, a lower tension-controlled roller, a curtain attached to each roller, a tubular shaft mounted to turn below the upper winding-roller, reels on the tubular shaft, tapes secured

to the said reels, passed loosely through the curtain attached to the tension-controlled roller and secured to the opposing curtain, a spring-controlled adjusting-shaft having end movement in the tubular shaft, a connection between the adjusting-shaft and the tubular shaft, whereby the two turn together, means for exteriorly operating the adjusting-shaft, a gear carried by the upper winding-roller and a gear carried by the adjusting-shaft, the two gears being normally in mesh, as described.

4. In a focal-plane shutter, an upper winding-roller, a lower tension-controlled roller, a curtain attached to each roller, a tubular shaft mounted to turn below the upper winding-roller, reels on the tubular shaft, tapes secured to the said reels, passed loosely through the curtain attached to the tension-controlled roller and secured to the opposing curtain, a spring-controlled adjusting-shaft having end movement in the tubular shaft, a connection between the adjusting-shaft and the tubular shaft, whereby the two turn together, means for exteriorly operating the adjusting-shaft, a gear carried by the upper winding-roller and a gear carried by the adjusting-shaft, the two gears being normally in mesh, a guide-shaft journaled below the combined adjusting and tubular shafts, and flanged divisions on the guide-shaft, corresponding in position and located beneath the said reels, over which divisions of the guide-shaft the forward stretches of the said tapes are passed, as set forth.

5. In focal-plane shutters, a tubular shaft having reels thereon, a support for the said shaft, the said reels being adapted for attachment to one end of the curtain-connecting tapes of such shutters, and a tension-controlled adjusting-shaft having end movement in the tubular shaft, means for causing the said two shafts to turn together, a winding-shaft adapted to carry one of the curtains of the said shutters, and a gear connection between the adjusting-shaft and the said winding-roller, for the purpose described.

6. In a focal-plane shutter, the tension-controlled roller adapted to carry a curtain of such a shutter, a cam connected with the tension-controlled roller, and operated thereby, the said cam being provided with a predeterminedly-placed striking-face, and a pinion operating with the said cam, a spring-controlled escapement, the arms of which are adapted to engage alternately with the striking-face of the cam, and means for operating the said escapement, as described.

7. In a focal-plane shutter, the tension-controlled roller adapted to carry a curtain of such a shutter, a cam connected with the tension-controlled roller and operated thereby, the said cam being provided with a predeterminedly-placed striking-face, and a pinion operating with the said cam, a spring-controlled escapement, the arms of which are adapted to engage alternately with the striking-face of the

cam, means for operating the said escapement, a toothed dial-wheel, and a train of gearing imparting movement to the dial-wheel from the movement of the pinion carried by the tension-controlled roller, as described.

8. In a focal-plane shutter, the frame, a tension-controlled roller, a curtain attached to said roller, a cam located at the exterior of the frame and operated by the movement of the tension-controlled roller, the said cam being provided with a striking-face predeterminedly arranged, and a tension-controlled escapement exteriorly located on the frame, the arms of which curve in the same direction, one above and the other below the cam, one arm being normally in the path of the striking-face

of the cam in one position of the escapement, the other arm in the other position of the escapement being brought likewise in position in the path of the said striking-face of the cam, whereby the cam is permitted to have but one-half of a revolution and the movement of the tension-controlled roller is regulated step by step, for the purpose described.

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

WILLIAM F. FOLMER.

Witnesses:

JNO. M. RITTER,
J. FRED. ACKER.