

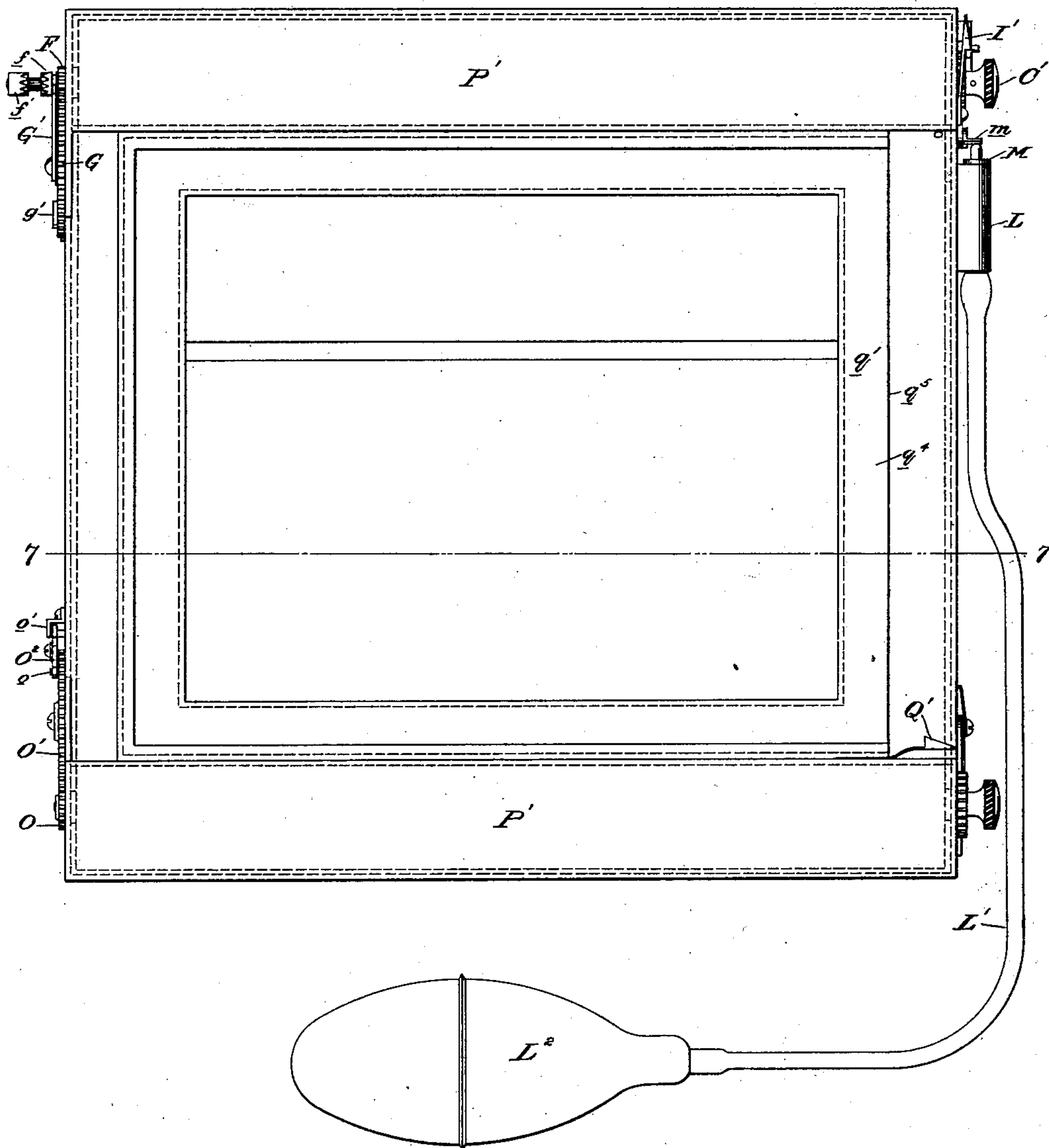
L. BORSUM.  
PHOTOGRAPHIC FOCAL PLANE SHUTTER.

APPLICATION FILED APR. 25, 1902.

NO MODEL.

4 SHEETS—SHEET 1.

*Fig. 1.*



*Witnesses:*  
L. L. Browning  
W. H. Stahl

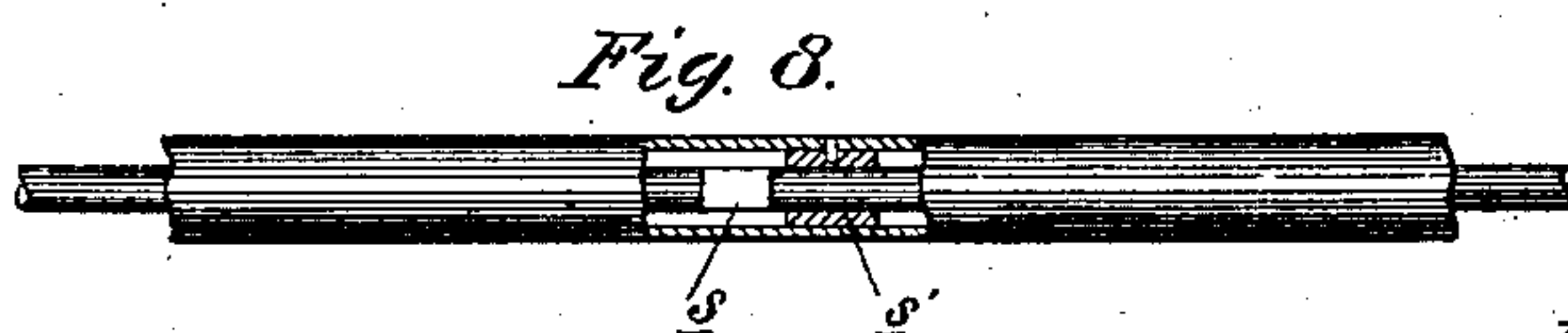
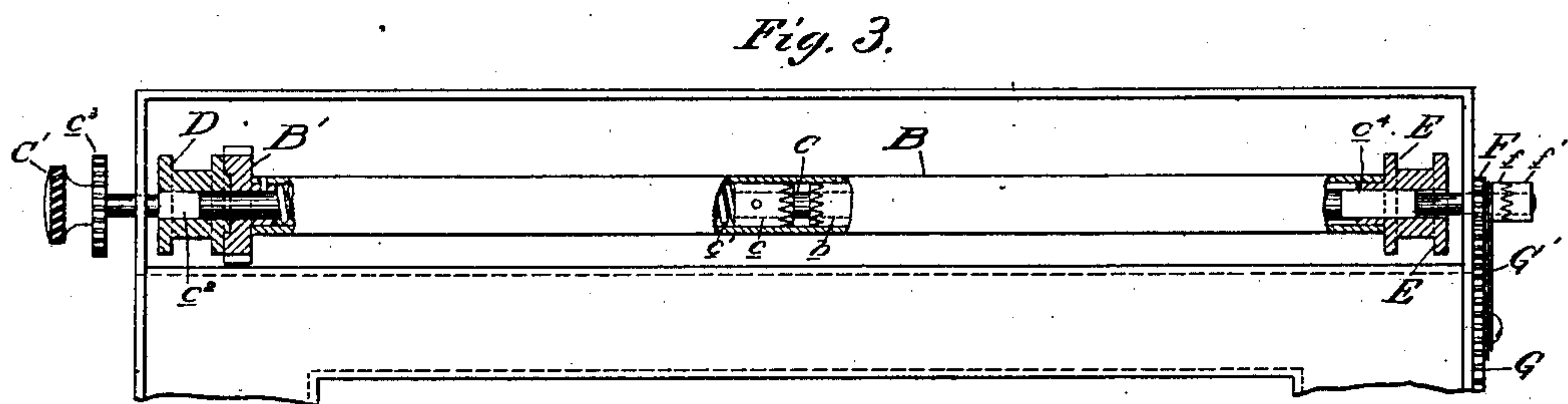
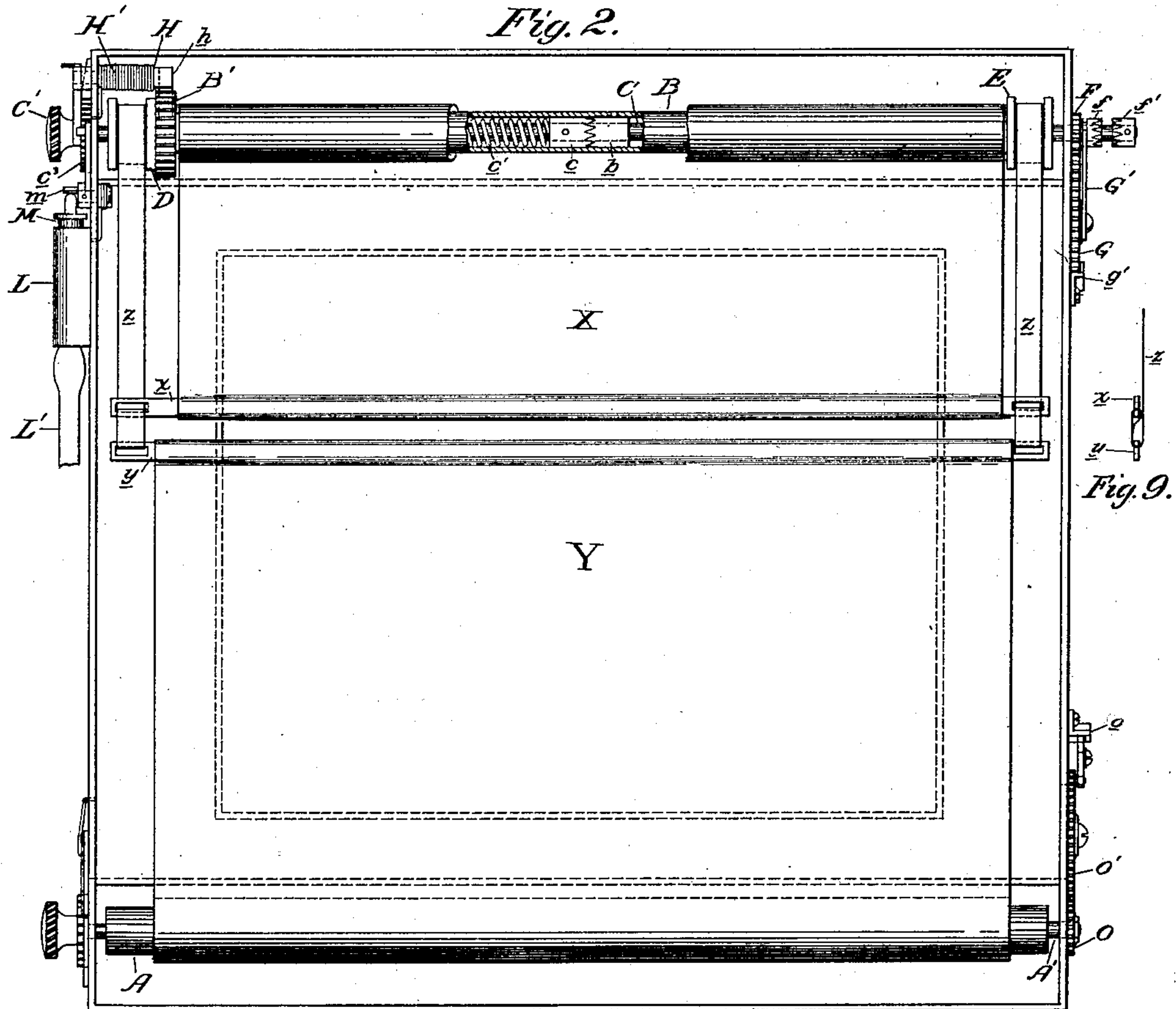
*Inventor:*  
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Attorneys.

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4 SHEETS—SHEET 2.



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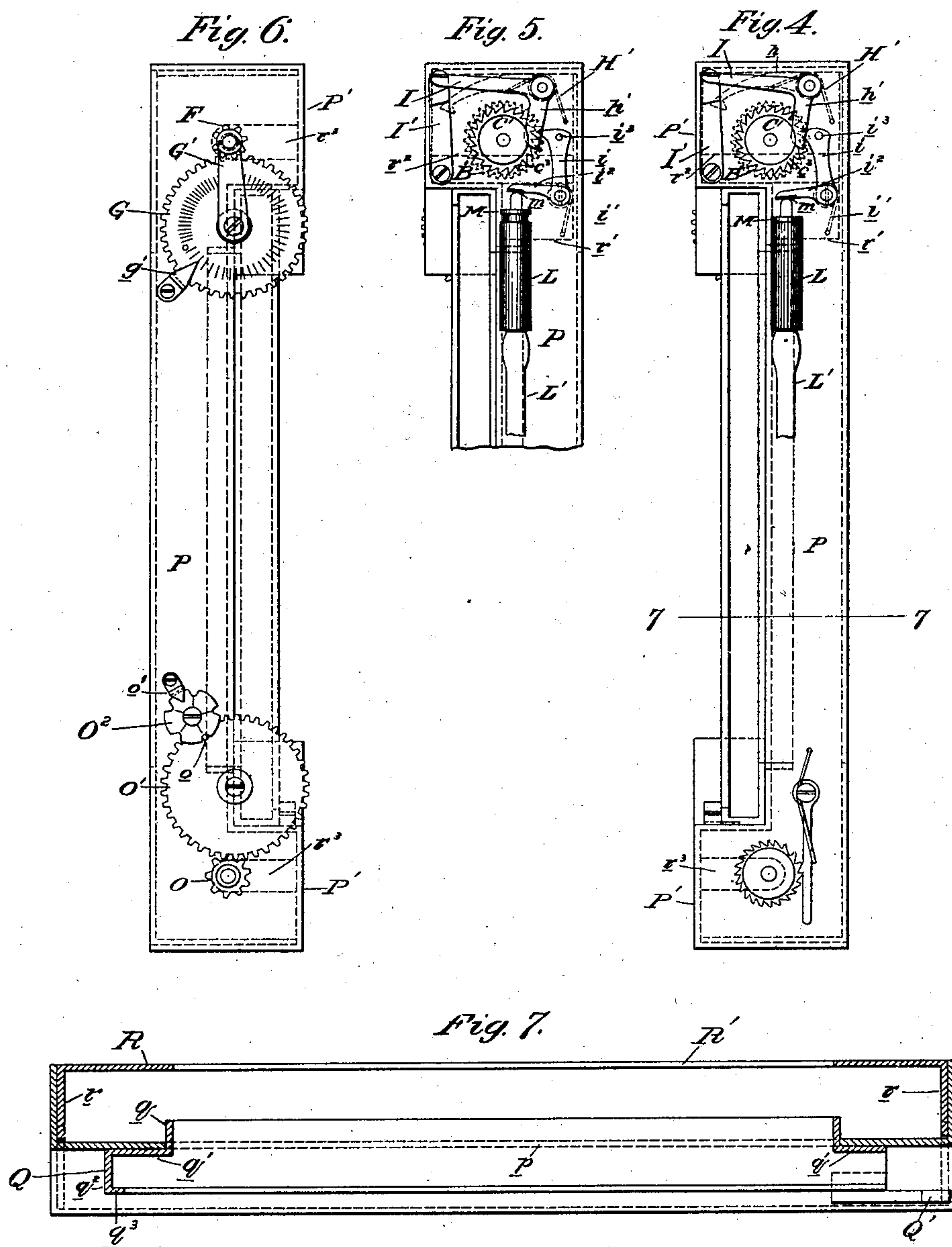
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4 SHEETS—SHEET 3.



Witnesses:  
 L. F. Browning  
 W. A. Stahlman

Inventor:  
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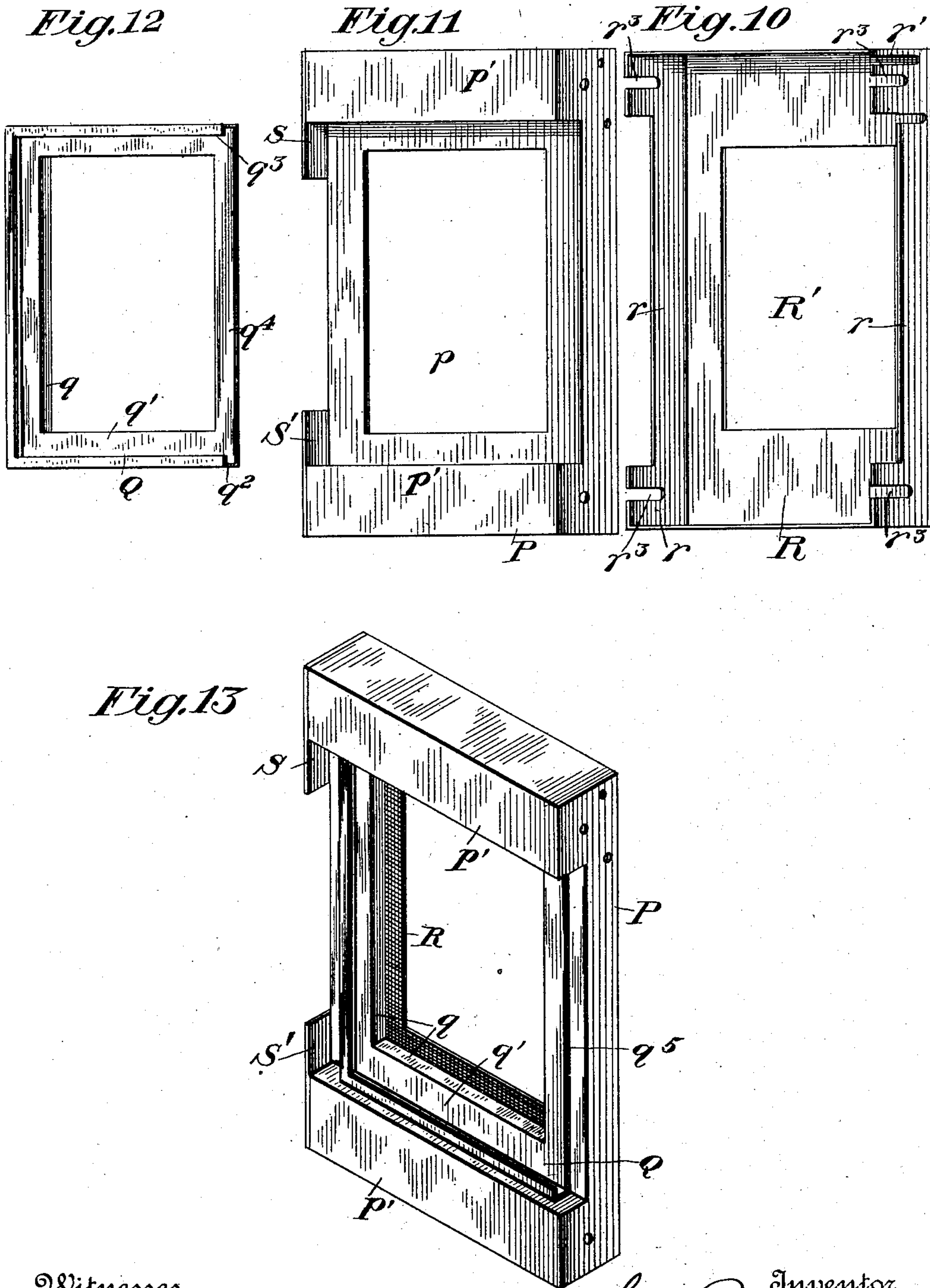


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APPLICATION FILED APR. 25, 1902.

NO MODEL.

4 SHEETS—SHEET 4.



Witnesses  
W. A. Stahlke.  
L. J. Browning.

Inventor  
Louis Borsum  
By his Attorneys  
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# UNITED STATES PATENT OFFICE.

LOUIS BORSUM, OF PLAINFIELD, NEW JERSEY.

## PHOTOGRAPHIC FOCAL-PLANE SHUTTER.

SPECIFICATION forming part of Letters Patent No. 720,659, dated February 17, 1903.

Application filed April 25, 1902. Serial No. 104,668. (No model.)

*To all whom it may concern:*

Be it known that I, LOUIS BORSUM, a citizen of the United States, residing in Plainfield, county of Union, State of New Jersey, have  
5 invented certain new and useful Improvements in Photographic Focal-Plane Shutters, of which the following is a specification.

The primary feature of this invention comprises a novel means by which the slit or  
10 opening in the shutter may be adjusted by manipulating an appropriate device located outside of the shutter-frame, and incidentally associated with such means is a scale or index by which the operator may determine the  
15 width of the shutter-slit. In connection with such a scale or indicator there is employed a similar indicator operated by the winding of the spring-drum or lower shutter-roll, that indicates the number of turnings of the spring-  
20 drum, and consequently the speed of the shutter. By means of the two indexes, one giving the dimensions of the slit and the other approximate speed of the shutter, the operator is informed of all conditions requisite for  
25 any special exposure.

The invention further contemplates certain improvements in the shutter-frame or inclosing casing. Generally these improvements contemplate that the frame will be made of  
30 two telescopic sections stuck up or otherwise suitably formed from sheet metal, aluminium being preferably employed on account of its lightness and the ease with which it may be worked. These sections when combined may  
35 have chambers at the top and bottom of appropriate dimensions for containing the rolls, and intermediate them is the opening for the exposure formed in a countersunk or depressed part lying between the two end cham-  
40 bers, and the top and lower walls of which are formed by parts of the walls of the end chambers between which the plate-holder is fitted to slide.

Heretofore ways of adjusting a focal-plane  
45 shutter-slit from the exterior of the box or shutter frame have been proposed; but none of them, as far as is known, are constructed in accordance with this invention, the details of which are hereinafter described.

50 In the accompanying drawings, Figure 1 is an elevation looking at the side of the shutter-frame, having a countersunk portion to

receive a suitable plate-holder; Fig. 2, an elevation of the opposite side, with the telescoping section of the frame on that side removed 55 and showing the upper shutter-roll partly in section; Fig. 3, a detail view of the upper shutter-roll and associated parts, partly in longitudinal section; Fig. 4, an end elevation of the right-hand side of Fig. 1, showing the 60 parts in position for the shutter to be tripped; Fig. 5, a view of the upper part of Fig. 4, showing the parts in position immediately after the shutter has been tripped; Fig. 6, an end elevation on the left-hand side of Fig. 1; 65 Fig. 7, a horizontal section on the line 7 7 of Figs. 1 and 4, showing, however, only the two telescoping members of the shutter frame or casing; Fig. 8, a detail view showing a modification in the construction of the clutch con- 70 tained within the upper shutter-roll. Fig. 9 is a detail view showing the way in which the slit-adjusting tapes are applied to the end bars of the two shutter-sections. Figs. 10 and 11 show in perspective the two parts of the 75 telescoping casing, and Fig. 12 is a like view of the slide-piece for receiving the plate-holder, and Fig. 13 is a perspective view showing these three parts assembled.

This invention while not confined to is par- 80 ticularly applicable to cameras wherein the image is focused by the aid of mirrors or reflectors upon a surface observable by the operator—as, for instance, in what is known as a “reflex” camera, wherein the image formed 85 by the lenses is received by a mirror placed at an angle of forty-five degrees in front of the shutter and is reflected upwardly upon a piece of ground glass.

The mere details of construction shown and 90 hereinafter described are not essential elements of the invention in its broader aspect, since, obviously, they may be varied by those skilled in the art. Experience has, however, demonstrated that the construction disclosed 95 is a practical and efficient one.

A is the ordinary spring-drum or lower roll, mounted in suitable bearings in the frame.

B is the upper roll, the shaft C of which is under certain conditions capable of rotation 100 independently of the roll. Within the roll B, which is shown as a hollow cylinder, is secured one member, b, of a clutch. The other member, c, of the clutch is attached to the



shaft C, which is capable of endwise movement to the left, as viewed in Figs. 2 and 3, to separate the two members of the clutch, which are normally urged into engagement 5 by a coiled spring  $c'$ , contained within the hollow roll. The shaft has suitable bearings in the frame and extends loosely through the member  $b$  of the clutch secured within the roll. To one end of the roll there is secured 10 a toothed or ratchet wheel  $B'$ , and outside of the wheel is a grooved pulley D, fitted on the squared part  $c^2$  of the shaft. Outside of the casing or frame the shaft has fixed to it a ratchet-wheel  $c^3$ , and on the end of the shaft 15 is a thumb-piece or button  $C'$ . On the shaft, at the other end of the roll, is another pulley E, fitted upon a squared portion  $c^4$  of the shaft. Obviously when the shaft is drawn outwardly to the left, as seen in Fig. 3, the 20 two members of the clutch are separated, and the shaft is then capable of rotation independently of the roll, and the pulleys D E of course rotate with it. When the shaft is released, the spring  $c'$  returns it and again 25 brings into engagement the two members of the clutch.

X and Y, respectively, indicate the upper and lower curtains or shutter-sections, and  $x$   $y$  are their end bars or slats. Cords or 30 tapes  $z$ , preferably the latter, are attached at their ends to the pulleys D and E, respectively, and the opposite end of each is threaded, Figs. 2 and 9, through a slot in the end of the slat  $y$  and is then attached to the slat 35  $x$  by threading it through a slot therein and stitching it. If there is a proper tension on the spring-drum A, obviously if the shaft C is shifted endwise to separate the members of the clutch it, with the pulleys D and E, 40 may be revolved to effect a variation of the shutter-slit. To indicate to the operator the slit adjustment that has been made, the following plan may be adopted: On the shaft outside the frame is loosely applied a spur- 45 pinion F, having a hub constituting a clutch member  $f$ . On the end of the shaft is fixed an opposing clutch member  $f'$ . When the shaft is moved endwise to adjust the slit, these two clutch members pass into engagement and the 50 pinion F is rotated. It gears with a toothed wheel G, the face of which contains a scale to be read in connection with a pointer  $g'$ , mounted on the side of the frame. The gear F may be held in position by a forked plate 55  $G'$ , embracing the hub  $f$  and attached to the spindle of the wheel G. A rock-shaft H, mounted in a bearing in the frame adjacent the end of the roll to which the toothed wheel  $B'$  is applied, carries a pawl  $h$  on its inner 60 end that by a spring  $H'$  is normally held out of engagement with said wheel. To the outer end of the shaft is applied an arm I, adapted to engage a spring-latch  $I'$  on the side of the casing. The tripping-latch is shown as a bell- 65 crank lever, to which is applied a spring  $i'$ , and one arm,  $i$ , of which is the tripping-pawl and the other,  $i^2$ , is acted upon by the piston of

the pneumatic cylinder L or otherwise. An arm  $h'$ , extending from the rock-shaft H, lies 70 between the ratchet-wheel  $c^3$  and a pin or projection  $i^3$  on the tripping-pawl  $i$ . Normally the spring  $i'$  urges the pawl  $i$  into engagement with the ratchet  $c^3$ . In the position of the parts shown in Fig. 4 the arm  $h'$  lies 75 across the outer face of the ratchet-wheel  $c^3$  and prevents endwise movement of the shaft C when the curtain is being wound upon the upper roll. This is not of great importance when the spring  $c'$  is employed. To adjust the shutter-slit, the arm I is pulled down until 80 caught by the latch  $I'$ , when the pawl  $h$  will engage the toothed wheel  $B'$  and lock the roll. At the same time the arm  $h'$  moves the tripping-pawl  $i$  out of engagement with the ratchet-wheel  $c^3$  on the roll-shaft C. If now 85 the shaft C be moved endwise to the left, the adjustment of the slit hereinbefore described may be made by rotating the shaft and with it the pulleys D E, the roll B being held positively against rotation. When the shaft C 90 is returned to normal position by pressure or reaction of spring  $c'$ , the spring-latch I may be pressed out of engagement with the arm I and all the parts will return to the normal position, (shown in Fig. 4,) in which the shutter 95 may be fully wound on the roll B by rotation of the thumb-piece  $C'$ . To trip the shutter, it is only necessary to throw up the arm  $i^2$ . The specific details of this part of the structure of course are quite immaterial, as they 100 may be varied in any appropriate manner to suit any desired conditions or operations. The shutter may be conveniently tripped by means of the pneumatic cylinder L, to which is applied a tube  $L'$ , having a bulb  $L^2$ , and 105 the plunger M of which works against the arm  $i^2$  of the tripping pawl or latch.

On the same side of the casing as the shutter-slit index G a pinion O is applied to the end of the shaft or spindle  $A'$  of the spring- 110 roll. It meshes with a gear-wheel  $O'$ , mounted on the side of the casing and carrying a pin  $o$ , that once in each revolution advances a wheel  $O^2$  one step or tooth. Suitable marks on the face of the wheel  $O^2$  read in relation 115 to a pointer  $o'$  will indicate the number of turns given to a spring-roll, and consequently the approximate speed of the shutter.

If the tapes  $z$  are of the same thickness as the curtain and the winding-roll B and pul- 120 leys D E of equal diameter, the slit-opening, when of a certain width, will not be varied by the winding or unwinding of the curtain; but if the tapes are of greater or less thickness than the curtain obviously the width of 125 such slit-opening will change in passing in front of the plate. The general arrangement shown, in which tapes are employed that are wound upon themselves in the same way that the curtain is, presents, therefore, the oppor- 130 tunity of controlling to a measurable extent variation of slit-opening in transit across the plate merely by using tapes of a proper thickness as compared with the curtain. For in-



stance, in this way the width of the slit may be decreased as it passes the plate, thereby affording a longer exposure for the foreground—*i. e.*, for the lower part of the plate.

5 The construction of casing or frame inclosing the shutter constitutes a feature of this invention, and the special form in which it is shown is as follows: A rectangular open-  
10 faced box or casing-section P is formed at the top and bottom with rearwardly-extending projections P', forming enlarged or, as shown, substantially rectangular chambers, within  
15 which respectively the upper and lower rolls are mounted to rotate, their respective shafts being provided with bearings in the sides. Between the part P' P' this member of the  
20 casing is of considerably less thickness. The depressed or countersunk face of this section is cut away to form a rectangular opening *p* of appropriate dimensions relatively to the  
25 shutter and plate to be used. Within this opening is seated an open or skeleton rectangular frame Q, having a preferably continuous inwardly-projecting flange *q*, that passes  
30 into the opening to serve as a light-guard to prevent vagrant or reflected rays of light from reaching the plate around the edges of the shutter. On the outer side the flat  
35 portion *q'* of this skeleton frame lies flat against the depressed face surrounding the opening *p* of the casing-section P. Around three sides of the flat part *q'* of the skeleton  
40 frame there is a raised curb or flange *q*<sup>2</sup>, opposite parts of which fit close against the walls of the parts P' P'. The outer edges *q*<sup>3</sup> of this  
45 curb are turned inwardly to form guides or ways for the reception of a plate-holder (not shown) of any appropriate construction. The plate-holder may slide entirely below the  
50 flange or overturned edges *q*<sup>3</sup>, or its edges may be provided with grooves within which the flanges *q*<sup>3</sup> fit. The plate-holder may be slid in from the open side *q*<sup>4</sup>, which in this instance  
55 is the same side of the frame at which the tripping devices hereinbefore described are located. A spring-latch Q', Fig. 1, will serve to retain the plate-holder in place. The raised  
60 edge or shoulder *q*<sup>5</sup>, formed by the flat part *q'* of the skeleton frame at the open side, may abut against a rib or shoulder that may be formed on the plate-holder, thus forming a joint that will insure exclusion of light. The other  
65 member R of the frame or casing fits into the open face of the member P, and its side walls *r* may be of such depth as to conform to the side walls of the member P. At the corner where the ratchet-wheel B' is located the side wall of the part R is slotted or cut away, as indicated by the dotted lines *r'*, Figs. 4 and  
5, and as clearly shown in Fig. 10, so as not to interfere with the rock-shaft H, its pawl, &c.; but, as shown by the dotted line *r*<sup>2</sup> in Fig. 5 and as is obvious from Figs. 10 and 11, the wall of the member R at this point passes  
between the pulley D and the wall of the member or box P, so as to hold the pulley in position. At the other three corners of the

member R its side walls are formed with slots *r*<sup>3</sup>, which straddle the two ends of the shaft A' and the end of the shaft C at which the pulley E is located. The rolls and pulleys are therefore held in proper position. The back of the member R is of course formed with a rectangular opening R' to afford the proper exposure. The two members P and R of the shutter frame or casing, as well as the member Q, may each be struck up or formed from a single piece of sheet metal, and the whole structure is compact, light, and of small dimensions. Where the adjustment described is to be made from the outside of the camera-box, the shaft C may of course be sufficiently prolonged and the button C' placed outside of the box, or so that when in normal position the button will lie in a recess or countersink in the wall of the box. The thumb-button of the spring-roll may also have, as is usual, endwise movement and may normally lie seated in a countersink in a wall in the camera-box, and of course the indicating devices, both as to width of the shutter-slit and the tension of the spring-roll, may all be located on the outer face of the camera-box.

In Fig. 8 is shown a modified style of clutch to be contained within the upper or winding roll. The central part of the shaft is squared, as at *s*, and slides within a correspondingly-shaped opening in a diaphragm *s'* in the roll. When the shaft is withdrawn endwise to separate the clutch members, the squared part *s* passes out of engagement with the rectangular opening in the partition.

S S' are plates applied to the ends of the parts P' P' to afford bearings for the indicator-wheels, &c. They need not, of course, be used when the part P is made of metal of sufficient thickness and strength to afford proper support for such parts.

I claim as my invention—

1. In a focal-plane shutter, the combination of the shutter-sections, the spring-roll, the winding-roll and its shaft, a clutch by which the winding-roll and its shaft may be locked to rotate together or independent rotation of the shaft permitted, pulleys mounted upon the shaft to always rotate with it, and a flexible connection extending from each pulley to the lower shutter-section and thence to the upper shutter-section to which it is attached for the purpose set forth.

2. In a focal-plane shutter, the combination of the shutter-sections, the spring-roll, the winding-roll and its shaft, a clutch by which the winding-roll and its shaft may be locked to rotate together or independent rotation of the shaft permitted, pulleys mounted upon the shaft to always rotate with it, and a flexible connection extending from each pulley to the lower shutter-section and thence to the upper shutter-section to which it is attached, whereby the shutter-slit may be adjusted, and indicating devices for indicating to the operator the adjustment of the shutter-slit.



3. In a focal-plane shutter, the combination of the shutter-sections, the spring-roll and indicator operating on the winding of the roll to advise the operator of the tension thereof, the winding-roll, means for adjusting the width of the shutter-slit, and indicating devices showing the adjustment.

4. In a focal-plane shutter, the combination of the shutter-sections, the winding-roll, its endwise-movable shaft, pulleys on the shaft at each end of the roll through which the shaft slides, but which rotate with it, a clutch member attached to the roll within it and a second clutch member movable within the roll and attached to the endwise-movable shaft, and flexible connections extending from each pulley through the lower shutter-section and thence to the upper shutter-section to which they are attached.

5. In a focal-plane shutter, the combination of the shutter-sections, the spring-roll, the winding-roll, a toothed wheel fast with the winding-roll, the winding-roll shaft movable endwise within the roll, a clutch having one member rotating with the roll and another member rotating with the shaft, a toothed wheel fast upon the roll-shaft, pulleys on each side of the winding-roll through which the shaft slips endwise, but which rotate with it, flexible connections extending from the pulleys to the lower shutter-section and thence to the upper shutter-section to which they are attached, a tripping-pawl normally engaging the wheel on the roll-shaft, a detent normally disengaged from the toothed wheel on the winding-roll, and means whereby when the roll-shaft is moved endwise for the adjustment of the shutter-slit the tripping-pawl is moved out of engagement with the wheel on the roll-shaft, and the detent engaged with the wheel on the winding-roll.

6. In a focal-plane shutter, means for adjusting the shutter-slit comprising a hollow winding-roll, its shaft, a normally closed clutch locking the shaft and roll to rotate together, means for opening the clutch to permit rotation of the shaft independently of the roll and pulleys mounted upon the shaft and always rotating with it.

7. In a focal-plane shutter, means for adjusting the shutter-slit comprising a hollow winding-roll, its shaft, a normally closed clutch locking the shaft and roll to rotate together, means for opening the clutch to permit rotation of the shaft independently of the roll, pulleys mounted upon the shaft and always rotating with it and means for locking the roll when the shaft and pulleys are independently rotated.

8. In a focal-plane shutter, means for ad-

justing the shutter-slit comprising the winding-roll, its shaft normally rotating with the roll, but capable of independent rotation when moved endwise relatively to the roll, pulleys mounted upon the shaft and always rotating with it, an index for indicating the adjustment of the shutter-slit and a clutch by which the scale is operated each time that the shaft is moved endwise to adjust the slit.

9. In a focal-plane shutter the combination with the two rolls, the endwise-movable shaft of one of the rolls, a clutch interposed directly between the shaft and its roll and comprising two members one carried by the rolls and the other by the shaft whereby the roll and shaft may be locked to rotate together or the shaft permitted to rotate independently of the roll, pulleys, at the ends of the roll, mounted on the shaft to always rotate with it, and flexible connections extending as described from the pulleys to the ends of the shutter-sections.

10. In a focal-plane shutter, the combination of the two rolls, pulleys located at the end of one of the rolls, means whereby said roll and the pulleys are locked to rotate together or the pulleys permitted to rotate independently of the rolls, means for so independently rotating them and flat tape connections extending from the rolls to the ends of the shutter-sections as described.

11. In a focal-plane shutter, a frame comprising two telescoping sections each made of sheet metal and one of which is formed with projections from one side thereof at the top and bottom forming chambers to receive the shutter-rolls, the space between the adjacent walls of these two enlargements being adapted to receive a plate-holder.

12. In a focal-plane shutter, a frame comprising two telescoping sections, one P, with the enlarged chambers P', P', for the reception of the shutter-rolls, and the other R, fitting within it as described, a skeleton frame fitting within the exposure-opening of the first-named frame-section, having a light-guard flange extending into the opening, and formed outside of the opening as a slide or way for the reception of a plate-holder.

13. A focal-plane shutter-frame comprising opposite telescoping sheet-metal sections within which the curtains and rolls are contained.

In testimony whereof I have hereunto subscribed my name.

LOUIS BORSUM.

Witnesses:

KATHARINE MACMAHON,  
LILLIE F. BROWNING.