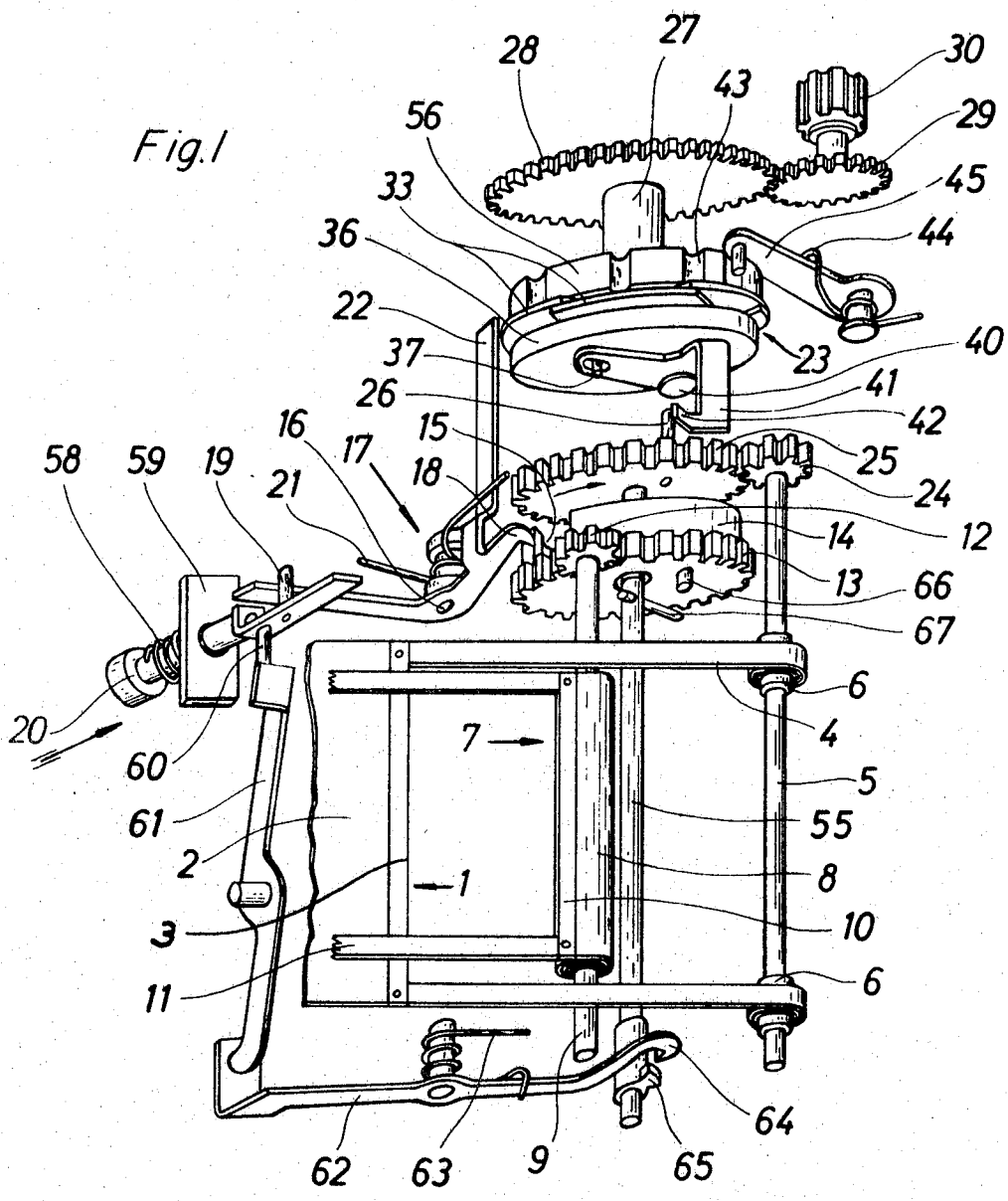
June 2, 1970 H. KNAPP 3,515,049

ROLLER BLIND SHUTTER

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Fig. 1



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ROLLER BLIND SHUTTER

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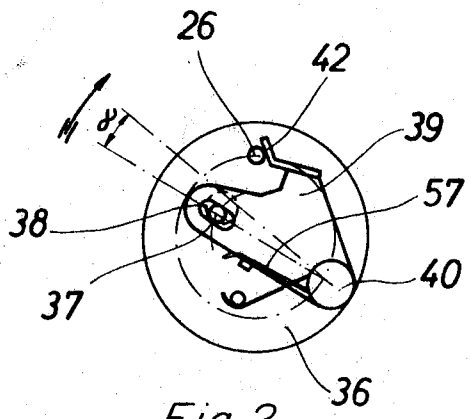


Fig. 2

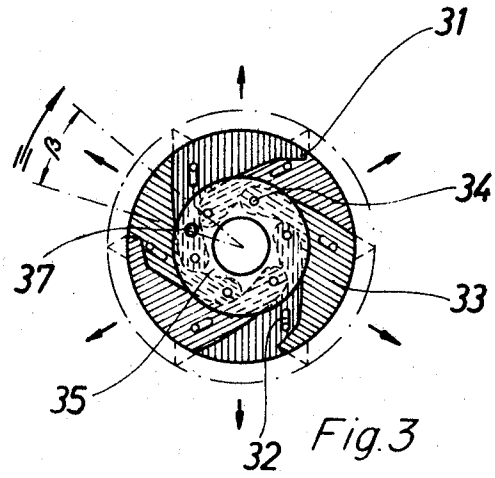
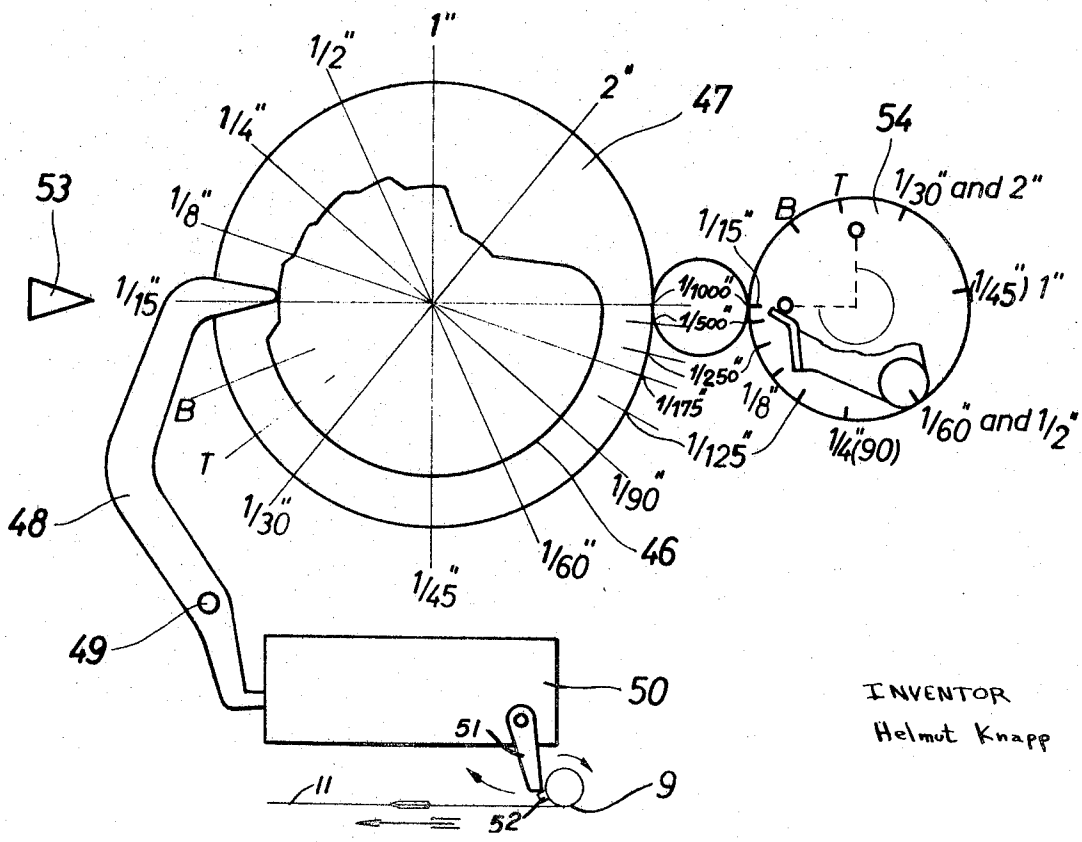


Fig. 3

Fig. 4



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ROLLER BLIND SHUTTER

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ABSTRACT OF THE DISCLOSURE

Roller blind shutters or focal plane shutters, and more particularly a roller blind shutter which has a first curtain or shade which unwinds after being released by means such as a push-button, and a second curtain or shade which winds off after being released by adjustable delay means. The delay of the second curtain or shade alters or varies the width of the slit or aperture which sweeps over the focal field and determines the exposure time.

Heretofore, it has been difficult to adjust the delay of the second shade and thus of the exposure time in roller blind shutters. First of all, the knob for the adjustment had to be pulled out, adjusted for the correct exposure time and then put back into place. Secondly, this adjustment knob rotated together with the unwinding curtain or shade so that the running time of the shade and thus the preset shutter time would be altered in an uncontrollable manner by any inadvertent contact with this knob.

It is an object of the present invention to construct a roller blind shutter or focal plane shutter which overcomes the aforementioned disadvantages of conventional shutters by having a device composed of shiftable laminae blades or leaves which can be rotated about its axis as a whole. The circumference defined by the outer edges of these laminae is changed by the action of a cam which rotates simultaneously with the unwinding of the first curtain or shade, and a pawl, arranged in the area of this circumference and which normally prevents the second curtain or shade from winding off, is unlatched.

The shiftable laminae device may have, according to the invention, a disc rotatably arranged in the housing, which disc has pins spaced in equal radial and equidistant increments. The pins engage elongated apertures or holes of the laminae which are pivotally mounted with one each linkage on a laminae ring which is arranged coaxially with the disc. The position and the shape of the elongated holes in the laminae and the location of their linkage points is preferably selected in such a manner that the movement of the laminae is in a radial direction in at least one of the end positions of their movement when disc and laminae ring are rotated relative to one another.

The shape of the laminae is selected so that the circumference defined by the outer edges of the laminae is substantially circular in at least one end position of the area of their movement. Thus, when the shiftable laminae device is operated by the cam of the first curtain or shade, enlargement of its outer diameter is accomplished in a practically uniform manner, whereby the pawl is unlatched independent of the rotation of the shiftable laminae device.

In a preferred embodiment of the invention, a control lever is arranged on the disc of the shiftable laminae device near the circumference thereof, which is swingably pivoted on a shaft parallel to the shaft of the disc. The first end of this lever, which is parallel to the plane of the disc, has at this end an elongate hole or aperture which is engaged by a pin which is fixed on the laminae ring. The other end of the lever which is bent perpendicularly to the plane of the disc, has an unlatching nose on its end, which is positioned in the path of the cam which rotates

simultaneously with the unwinding of the first curtain or shade. A spring returns the laminae of the shiftable laminae device to the starting point after they had been actuated by the cam.

A shaft can be arranged coaxially to the shiftable laminae device which shaft rotates simultaneously with the unwinding of the first curtain or shade. The aforementioned cam may be eccentrically fastened on this shaft so that it runs on the unlatching nose of the control lever during the rotation of the shaft, and swingably shifts this lever.

According to the invention, a cylindrical body may be provided which is either directly coupled or connected by a reduction gear with the winding drum of the second curtain or shade. This body may have a cut-out on a short area of its circumference, into which a nose of the pawl engages when the shutter is operated and which nose blocks the action of the second curtain or shade, until the pawl is unlocked by the cam actuating the shiftable laminae device. A spring preferably urges the pawl in the direction against the cylindrical body and against the circumference of the laminae of the shiftable laminae device, respectively, whereby the push-button which after being pressed also sets the first curtain or shade in motion, releases the pawl in the direction of the spring force thereof. Thus, this pawl can follow the movement which is imparted upon it by the laminae, freely in the opposite direction in every position of the push-button.

In further development of the invention, a cam disc is coupled with the operation gear of the shiftable laminae device for adjusting of long exposure times, for example, ranging from two seconds to 1/30 second, which cam disc has a cam follower lever riding on it which adjusts the delay of a blocking gear which releases the second shade after said gear had run its course.

The invention is disclosed in more detail in the following description and is illustrated in the drawings in a preferred embodiment by way of example. In the drawings:

FIG. 1 is an illustration of the essential parts of the roller blind shutter, shown in perspective;

FIG. 2 is a plan view of the shiftable laminae device and of the control lever;

FIG. 3 is a plan view of the laminae of the open-end shiftable laminae device; and

FIG. 4 is a schematic illustration of the cam disc for the time delay device for long exposure time periods.

As shown in FIG. 1, the shutter according to the invention, has a first curtain or shade generally designated by the numeral **1**, the curtain **2** of which is wound on a winding drum (not shown in the drawing) when the shutter is released. On the upper and lower sides of right border **3** of curtain **2**, which determines the left side of the shutter aperture or slot, there are tapes **4**, the ends of which are wound on two winding drums **6** which are fastened on a common shaft **5**. The second curtain or shade, designated by the general numeral **7**, has a curtain **8**, one end of which is windable on a shaft **9**, while the other end, the border **10** of which forms the right side of the shutter aperture or slot, has tapes **11** on the upper and lower sides of border **10**, which are wound on drums (not shown in the drawing) when the shutter is operated.

Shaft **9** has a gear **12** which is in mesh with a larger gear **13**, on which a cylindrical part **14** is fastened. A relatively short portion of the circumference of cylindrical part **14** has a cut-out **15**. A lever **17** which is pivotally located at **16** has a nose **18** on the free end of a first arm thereof. Nose **18** is located above cut-out **15** of cylindrical part **14** at the time when the second curtain or shade is in the cocked condition. The second arm of lever **17** abuts against a pin **19** of the trigger push-

button **20**, which normally is kept by a spring **58** in its rest position and which is pushed for actuation the shutter. A spring **21** urges lever **17** in the direction of cylindrical part **14** so that nose **18** latches in cut-out **15** of cylindrical part **14**, when the second arm of lever **17** is released by pushing of trigger push-button **20**. Lever **17** has a further arm **22** which is arranged on the first arm approximately in the area of nose **18** at a right angle of the arm which extends in the direction of the shiftable laminae device **23** which is described later.

A gear **24** is fastened on shaft **5** of first curtain or shade **1**, which gear is in mesh with a gear **25**, which is fastened on a shaft **55**. A pin **26** protrudes laterally over the face of gear **25**. A ratchet tooth **65** is fastened on shaft **55** (or optionally on shaft **5**, respectively) into which a pawl **64** of a pawl lever **62** engages. Lever **62** is shifted by way of a transfer lever **61** which is actuated by a pin **60** of trigger push-button **20** against the force of its return stroke spring **63** whereby shaft **55** is released, after gear **13** at first had been arrested by lever **17** in the above-described manner.

A pin **67** protrudes radially over shaft **55** in close proximity of gear **13**. Pin **67** can engage an abutment **66** of gear **13**. On the other hand, pin **67** is arranged for preventing the unwinding of second curtain or shade **7** as long as first shade **1** has not yet been unwound. Otherwise pin **67** serves for cocking of the shutter. This process is started by way of gearing (not shown in the drawing) on gear **24**.

A shiftable laminae device, generally designated by the numeral **23**, is arranger coaxial with gear **13**. This device essentially consists of a disc **56** which is fixedly connected with a gear **28** by way of a shaft **27**. Gear **28** is in mesh with a gear **29** connected with the exposure time adjusting knob **30**. Thus, by turning time adjusting knob **30**, the angular position of disc **56** may be changed.

Pins **31** protrude over the face of disc **56**, arranged in equal radial distances from the center of disc **56** and equidistant from one another. A lamina **33** is shiftably supported on each one of these pins by way of an elongated aperture or hole **32**.

Six pins **31** and six laminae **33** are preferably provided, whereby the assembly is made in such manner that three laminae are arranged directly on disc **56** on alternate pins and the other three laminae are arranged on the first three laminae for covering the spaces between them. The laminae are fastened on a laminae ring **35** which is coaxial with shaft **27** of disc **56**, in the proximity of their inner end by way of a pivotal point **34**. Thus, the laminae may be spread outwardly from their inner starting position by a rotation of laminae ring **35** relative to disc **56**, whereby the diameter of the circumference is defined by the outer edges of the laminae. To this extent the position and the shape of the elongated holes of the laminae and the position of their pivotal points is selected in such manner that the laminae move approximately in a radial direction in the proximity of their outer border position. The outer edges of the laminae are shaped in such manner that the circumference defined by the sum total of them, forms substantially a circle. The laminae are covered on the off-side of disc **56** by a plate **36**, which is fixed on disc **56**. A pin **37** is firmly attached on laminae ring **35** extends through a cut-out of plate **36**. Pin **37** engages an elongated hole **38** of a control lever **39**, which is swingably located on a pivotal point **40** which is firmly arranged on disc **56** and on plate **36**, respectively, so that laminae ring **35** is rotated by an angle β when control lever **39** is swung by an angle α, such as may be seen in FIGS. 2 and 3. Control lever **39** has a further arm **41** arranged at a right angle of the plane of plate **36**, said arm **41** having a protruding nose **42** on the free end thereof, which nose is arranged in the path of the movement of cam **26**.

Disc **56** has indentations **43** on the periphery thereof, the angular positions of which correspond to pre-determined exposure times of shutter. A ratchet lever **45**, loaded by a spring **44**, may engage these indentations so that a discernible latching occurs ot these standardized exposure times.

The above-described shutter operates in the following manner:

When the shutter is cocked, the first curtain or shade **1** and the second curtain or shade **7** are in the position to the right of the drawing FIG. 1. The shiftable laminae device **23** is rotated into an angular position relative to cam **26** corresponding to a certain exposure time, by turning time adjusting knob **30**. When release push-button **20** is acutated, the following sequence of actions takes place. First, the second curtain or shade **7** is locked by nose **18** of lever **17**; then pawl lever **62** is swung against the force of spring **63** over pin **60** and over transfer lever **61**; eventually pawl **64** is lifted off ratchet tooth **65** and thereby first curtain or shade **1** is released. When first shade **1** has travelled through a certain distance and cam **26** thus has rotated through a certain angle (pin **67** releases thereby abutment **66**), the latter hits the release nose of the control lever, which pivotally moves and rotates laminae ring **35**, whereby laminae **33** swing outwardly; thereby arm **22** of lever **17** is lifted, and thus the nose **18** thereof is withdrawn from cut-out **15** of cylindrical part **14**. Second shade **7** is thus released and travels a distance corresponding to the exposure time after the first shade which had already been released earlier. The particular advantage of this arrangement is that the setting of the exposure time can be made continuously by knob **30**, that is, without pulling it out and pushing it back, and that knob **30** does not move, so that the movement of the shades or curtains cannot be changed by accidental contact with the knob.

For the setting of long exposures, that is, essentially delays between approximately $\frac{1}{15}$ of a second and several seconds, the cam **46** is provided, being firmly attached to gear **47** which is in mesh with gear **29**. Gear **47** has twice as many teeth as gear **28** so that shiftable laminae device **23** makes two revolutions while cam **46** makes one revolution. The circumference of cam **46** is contacted by cam follower lever **48** which is pivotally arranged on a pin **49**, which is fixedly attached to the housing. Lever **48** sets the time delay of a time-delay device **50** by the free end of the former. Time-delay device **50** has a pawl **51** which engages a ratchet tooth **52** of shaft **9** and which releases the latter after the set time has elapsed (see FIG. 4). Cam **46** has a constant radius over approximately half the circumference thereof. The dimension of the radius is such that time-delay device **50** is put out of action, that is, pawl **51** maintains ratchet tooth **52** in released position.

A dial plate indicating the adjustable exposure times, may be fastened either on gear **47** or on cam **46**. When such exposure time is set with respect to a stationary mark **53**, such dial mark will represent the set exposure time. A similar dial plate **54** may also be attached to gear **28**.

Thus, when an extended exposure time, such as one second, is set by adjusting knob **30**, the first curtain or shade **1** will travel as it is the case with the short exposure times after release push-button **20** has been actuated, whereas second curtain or shade **7** is kept immobile by pawl **51** of time-delay device **50** until said shade is released by releasing ratchet tooth **52** and travels its distance. When an exposure time setting is made at the mark "B," lever **17** holds second shade **7** back as long as release push-button **20** is held in its pushed position.

While the invention has been described and illustrated with respect to a certain preferred example which gives satisfactory results, it will be understood by those skilled in the art after understanding the principle of the invention, that various other changes and modifications may be made without departing from the spirit and scope of the invention and it is intended therefore in the appended claims to cover all such changes and modifications.

I claim:

1. A roller-blind shutter of a camera having a housing,

said shutter comprising a first shaft (5) rotatably mounted in said camera housing, said shaft having a positive drive connection with both a release pin (26) arranged eccentrically to the axis of rotation of said shaft and a ratchet tooth (65) arrested by a pawl (64) arranged for releasing of said ratchet tooth upon actuation of the camera shutter release button (20), at least one winding drum (6) fastened on said first shaft (5), a flexible element (4) wound on said winding drum (6), the free end of said element being fastened on a first curtain (2) covering a film in the wound state of said flexible element (4), said first curtain adapted for moving in front of said film after said ratchet tooth (65) being released thereby unwinding said flexible element from said winding drum, turning said first shaft (5), a second shaft (9) rotatably mounted in said camera housing, said second shaft extending parallel to said first shaft (5), said second shaft (9) having a positive drive connection with a blocking drum having a cylindrical surface (14) coaxial to the axis of the rotation thereof, a short portion of said surface having a recess (15) engaged by the nose (18) of a blocking lever (17) pivotally mounted in said camera housing, a second curtain (8) wound around said second shaft (9), at least one flexible element (11) fixed on the free end of said second curtain, said flexible element adapted for unwinding said second curtain from said second shaft and for moving of said second curtain in front of said film, a release means (23) for releasing the running of said second curtain (8), said release means blocked by said blocking lever (17), said release means including a disc (56) mounted in said camera housing for a pivotal movement about a central axis coaxial with said axis of rotation of said release pin (26) and operatively connected with an exposure time adjusting knob (30) for adjusting of the angular position of said disc (56) relative to said release pin (26), a plurality of blades (33) arranged on said disc (56), said blades equally spaced from one another and from said axis of said disc, the radial outer edge of each one of said blades shaped for forming of an outer envelope curve in cooperation with all of said blades, said envelope curve having substantially the shape of a circle having said axis of said disc as the center, said blades mounted on said disc for at least an approximately radial movement, a blade actuating means (41, 37, 35, 34) having a nose (42) protruding into the path of movement of said release pin (26), said actuating means connected with each one of said blades for moving said blades in unison changing the diameter of said curve of said outer envelope of said blades after

said nose (42) being actuated by said release pin (26), and arm (22) fixed on said blocking lever (17), said arm arranged close to said envelope of said blades, said arm (22) moving said blocking lever (17) after said diameter of said envelope had been changed, withdrawing said nose (18) out of said recess (15) and releasing said second shaft (9) for providing of the movement of said second curtain (8) in the same direction as said first curtain, the border edges (3, 10) at the free ends of both curtains forming the shutter slot, the width of which being determined by the angular position of said disc (56) relative to said release pin (26).

2. A roller-blind shutter according to claim 1, and a first pinion (24) secured to said first shaft (5), said pinion engaging a first gear (42) secured, to a third shaft (55) carrying said ratchet tooth (65), said release pin (26) protruding parallel to and eccentrically offset of the axis of said third shaft from one side of said first gear (42), and a second pinion (12) secured on said second shaft (9), said second pinion engaging a second gear (13) arranged coaxially and freely rotatable with respect to said third shaft (55), said blocking drum having the outer cylindrical surface thereof coaxial to said third shaft, said drum secured to one side of said second gear (13).

3. A roller-blind shutter according to claim 2, and an abutment (66) protruding over the other side of said second gear (13), said abutment engaged by a pin (67) extending radially from said third shaft (55).

4. A roller-blind shutter according to claim 1, and a plurality of pins protruding over one side of said disc (56), said pins equally spaced from one another and from the axis of said disc, each one of said pins engaging a slot (32) formed in each one of said blades (33), said blades hinged on a blade-actuating ring (35) arranged coaxially to and rotatable relative to said disc (56), and a further pin (37) protruding over said ring (35) engaging an elongated aperture (38) of a control lever (39) hinged eccentrically on said disc and said nose (42) formed on said control lever.

5. A roller-blind shutter according to claim 1, said disc (56) having indentations on the radial outer surface thereof and a spring-loaded ratchet engaging said indentations.

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JOHN M. HORAN, Primary Examiner