

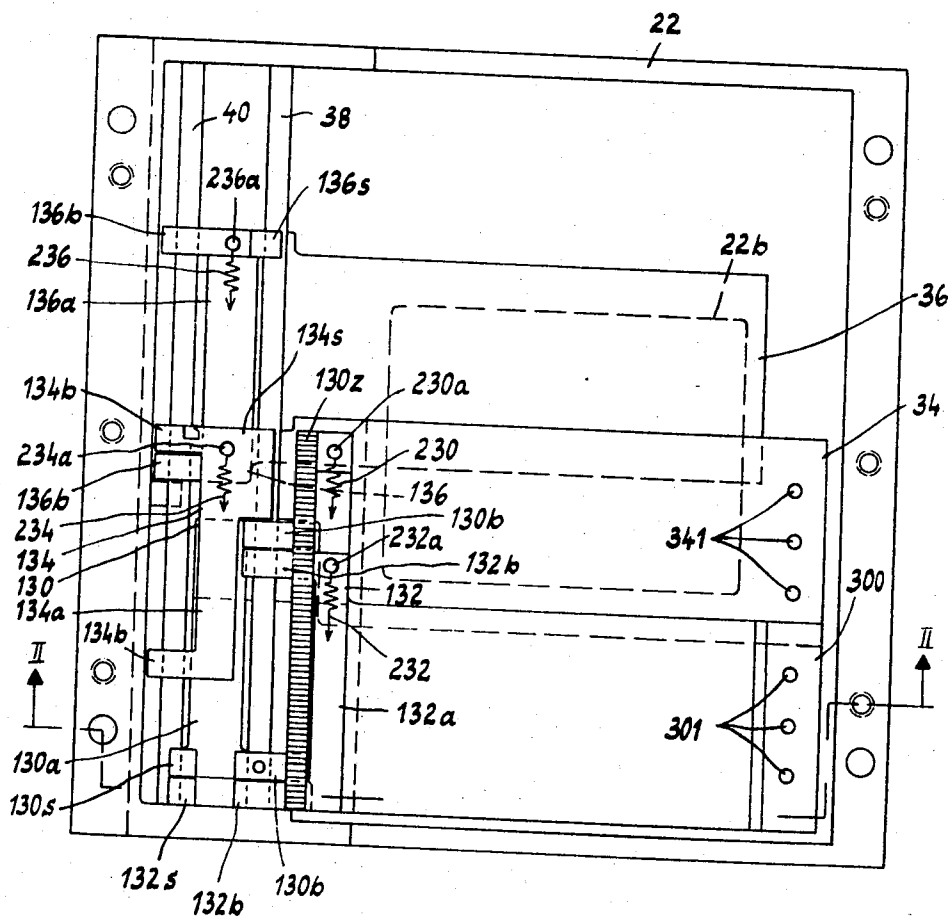
[72] Inventor Otto Wienchol,
Pullach im Isartal, Germany
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[73] Assignee Compur-Werk Gesellschaft mit
beschränkter Haftung & Co.,
Munich, Germany,
a firm of Germany
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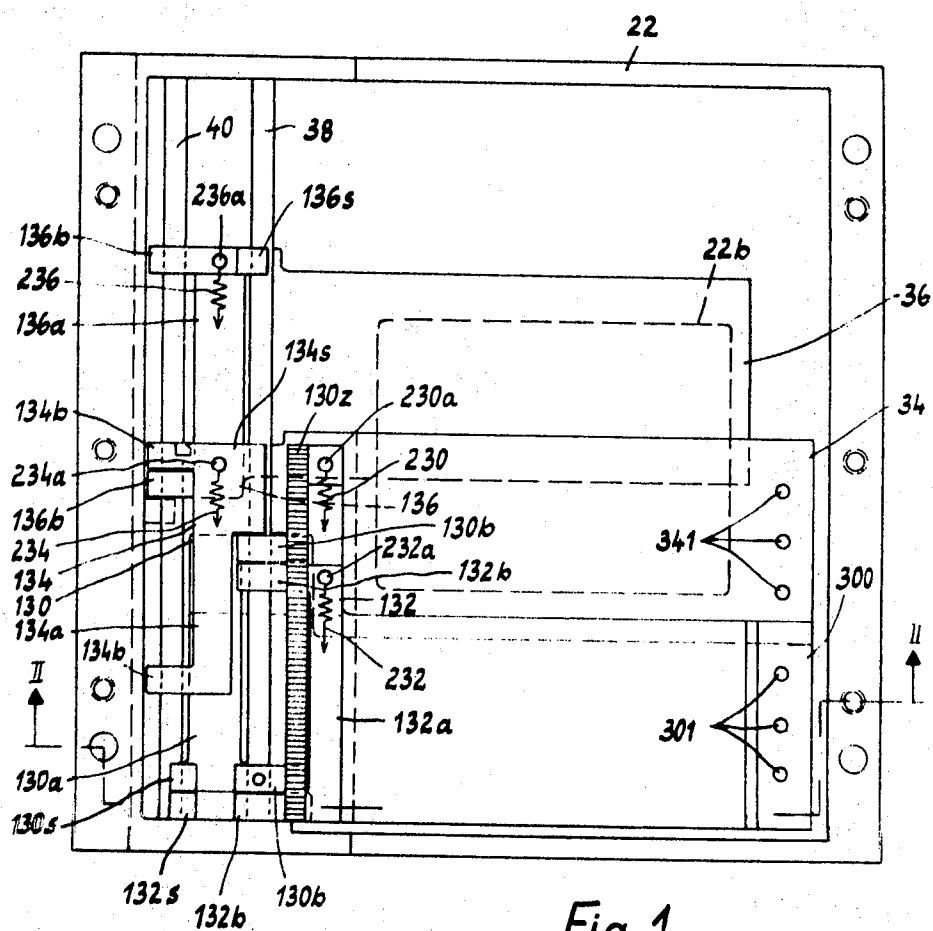
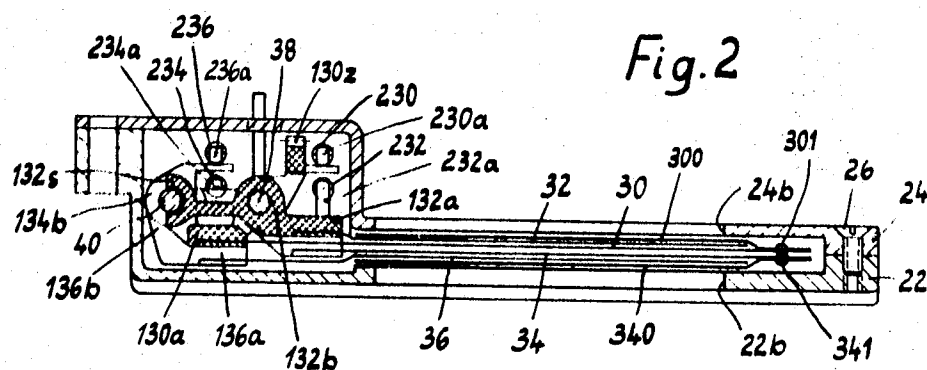
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UNITED STATES PATENTS
2,664,800 1/1954 Mayo..... 95/55
2,950,665 8/1960 Meixner..... 95/55
Primary Examiner—John M. Horan
Assistant Examiner—D. J. Clement
Attorney—Charles Shepard, Stonebraker and Shepard

[54] **PHOTOGRAPHIC SHUTTER**
4 Claims, 2 Drawing Figs.

[52] U.S. Cl..... 95/55
[51] Int. Cl..... G03b 9/36
[50] Field of Search..... 95/55

ABSTRACT: A photographic shutter of the focal plane type has two movable blades or slides constituting an opening group, and two blades or slides, constituting a closing group. In each group, one is the main blade and the other is a supplementary blade. Each main blade has associated therewith a masking blade which partially engages over the associated supplementary blade, to increase the lightproofness of the overlap joint between the two blades of the group. The masking blade is parallel to and slightly spaced from the main blade with which it is associated, to form a thin pocket between the main blade and its associated masking blade, which pocket receives a portion of the supplementary blade of the same group of blades.





PHOTOGRAPHIC SHUTTER

CROSS REFERENCE TO RELATED APPLICATION

The present invention is closely related to, and may be regarded as an improvement on, the construction disclosed in the co-pending application of Franz Singer, Ser. No. 680,814, filed November 6, 1967. The disclosure of said application 680,814 (hereafter sometimes referred to as the "prior application") is hereby incorporated herein by reference, and the disclosure of the present application will proceed on the assumption that the reader is already familiar with the disclosure of the prior application so that it will not be necessary to describe in great detail that part of the present construction and operation which are already disclosed in the prior application. Many of the parts of the present construction are substantially identical with the corresponding parts of the construction disclosed in the prior application, and such parts in the present application have been given the same reference numerals used for the corresponding parts in the prior application, thus facilitating quick understanding of the present construction by those who are already familiar with the prior application, and enabling the description in the present application to be relatively brief.

BACKGROUND OF THE INVENTION

The present invention relates to focal plane shutters, as distinguished from objective shutters or between-the-lens shutters. Focal plane shutters are located just in front of, and as near as possible to, the focal plane or film plane of the camera. The shutter normally blocks off passage of light to the focal plane. When a photographic exposure is to be made, the shutter parts are moved to provide an opening through which light may reach the sensitized film in the focal plane.

In some focal plane shutters, sometimes called curtain shutters, the light obstructing material is flexible, and is unwound from one roller and wound up on another roller. In another type of focal plane shutter, to which the present invention relates, there are blades (which may also be called slides) which move across the exposure area, one blade having a trailing edge which may be called the opening edge, and another blade having an advancing edge which may be called the closing edge and which follows along after the opening edge, leaving a space between them which may be called the exposure slot.

Although it is possible to use a single blade for opening and another single blade for closing the exposure area, a more compact construction is possible if one uses a plurality of blades (which may be called the opening group of blades) for performing the opening movement, and a separate plurality of blades (which may be called the closing group of blades) for closing the exposure aperture at the termination of the exposure. Examples of such shutters having a group of opening blades and a separate group of closing blades, are the shutters disclosed in U.S. Pat. Nos. 2,921,510 and 2,950,665, and also the shutter disclosed in the above-mentioned prior application 680,814.

Some of these known constructions have the drawback that the blades or slides are not sufficiently protected against entry of stray light between the blades, particularly between the main blade of each group and its supplementary blade or slide, where they overlap within the exposure area. Thus undesirable fogging or premature exposure of the film may occur. An object of the present invention is to avoid this, and to provide a simple, economical, and especially a compact construction affording safe protection against entry of light at the overlap of the blades, even if the stray light comes laterally, from directions at a great angle to the optical axis.

According to one feature of the present invention, at least one of the blades or slides has associated therewith a masking blade or slide which at least partially engages over the other blade of the same group, in light proofing fashion, and preferably in such a way as to form a labyrinth type of joint. According to a further feature of the invention, the masking blade is firmly connected to and is carried by the blade with which it is associated.

BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawing, which forms a material part of the present disclosure and is incorporated herein by reference, and which illustrates a preferred embodiment of the invention:

FIG. 1 is a front elevation of a focal plane shutter unit according to a preferred embodiment of the invention, removed from the camera and with the front cover plate of the unit removed, showing the blades in the rest or rundown position assumed at the completion of the exposure; and

FIG. 2 is a horizontal section through the unit, taken approximately on the line II-II of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The shutter unit comprises a housing having two approximately rectangular portions of similar outline, a rear portion 22 and a front portion 24 connected to each other by a few screws 26. The two parts of the housing have openings or picture windows 22b and 24b, respectively, which are aligned with each other and which define the exposure aperture or picture area through which light may pass rearwardly to impinge upon the sensitized photographic film located immediately behind the shutter unit. The usual lens (not shown) of the camera has an optical axis which extends centrally through the exposure area or picture window defined by the openings 22b and 24b. The exposure aperture is under the control of flat blades or slides which are vertically movable and alternately open and close the exposure aperture.

In the preferred construction there are four approximately rectangular blades or slides 30, 32, 34, and 36 made of opaque thin sheet material, preferably sheet steel. At one end (the left end when viewed as in FIGS. 1 and 2) each blade is secured, as for example by screws, to its own individual guide element or carrier 130, 132, 134, and 136, respectively, the blades and their carriers being movable vertically in a hollow space between the rear section 22 and the front section 24 of the housing. Within the housing to the left of the exposure area are two round guide rods 38 and 40 which serve as tracks or rails on which the guide elements or carriers 130, 132, 134, and 136 may move vertically.

The blades 30 and 32 collectively constitute the opening group of blades, of which the blade 30 is the main opening blade and the blade 32 is the trailing or supplementary opening blade. The horizontally extending upper edge of the blade 30 constitutes the opening edge of the exposure slot, during the exposure operation. The blades 34 and 36 collectively constitute the closing group of blades, of which the blade 34 is the main closing blade and 36 is the trailing or supplementary closing blade. The horizontally extending lower edge of the blade 34 is the closing edge of the exposure slot.

The guide element or carrier of each individual slide has a web to which the slide itself is fastened. Laterally projecting portions or flanges at the top and bottom of each guide element are slidably engaged with the guide rods 38 and 40. Preferably the carriers and 130 and 132 for the respective opening blades 30 and 32 have webs 130a and 132a to which the respective blades are attached, and have flanges 130b and 132b which completely encircle the guide rod 38 and have holes through which the guide rod extends slidably but snugly, and also have flanges 130c and 132c, respectively, with open sided notches for engaging the other guide rod 40 sufficiently to prevent these respective carriers from swinging on the guide rod 38, but not completely encircling the guide rod 40. Similarly, the other two carriers 134 and 136 for the closing blades 34 and 36, respectively, have webs 134a and 136a, respectively, to which the respective blades are attached, and have flanges 134b and 136b which completely encircle the guide rod 40 and have holes through which the guide rod extends snugly but slidably, and also have flanges 134c and 136c, respectively, with open sided notches which engage the other guide rod 38 sufficiently to prevent the carriers 134 and 136 from swinging on the guide rod 40, but these carriers do not completely encircle the guide rod 38. Thus the opening

blades 30 and 32 are mounted mainly on the guide rod 38, but the guide rod 40 prevents them from swinging out of their intended planes of movement, and the closing blades 34 and 36 are mounted mainly on the guide rod 40, but the guide rod 38 prevents them from swinging out of their intended planes of movement.

As a consequence of this provision for axial displacement and rotary guidance, the blades are accurately guided for movement in planes parallel to and relatively close to each other. Only a very short length of guidance on the rods 38 and 40 is necessary, as a result of which the guiding accuracy is very high and the constructional size is reduced. Also, the guidance and the retention against rotary movement takes place under low-friction conditions, since the carriers 130, 132, 134, and 136, or at least the parts thereof which engage the rods 38 and 40, are preferably molded from low friction plastic material, such as "Delrin" or "Teflon," both of which are well known per se, and which have a very low coefficient of sliding friction when sliding on the rods 38 and 40 which are of metal. Moreover, the plastic material may preferably be impregnated or coated with a friction-reducing compound such as molybdenum disulphide.

In the rest or rundown position illustrated in FIG. 1 (at the conclusion of an exposure and before the shutter is tensioned or cocked ready for the next exposure) the opening blades 30 and 32 both lie below the bottom edge of the exposure aperture 22b, and the exposure aperture is covered and closed by the two closing blades, the lower part of the exposure aperture being covered by the main closing blade 34 and the upper part by the supplementary or trailing closing blade 36, the two blades overlapping each other across the middle of the exposure area or picture window. However, when the shutter blades are in the tensioned or cocked position, ready for making an exposure, then both of the closing blades 34 and 36 lie above the top edge of the picture window 22b, and the window is covered by the two opening blades 30 and 32, the blade 30 closing the upper part and the blade 32 closing the lower part of the picture area, with the blades overlapping each other to some extent across the center of the picture. This tensioned or cocked position of the blades is not illustrated in the drawings of the present application, but will be readily understood by those skilled in the art, and is illustrated in FIG. 5 of the drawings of said prior application, although the blades in the prior application do not have the additional features which form the subject matter of the present invention.

The arrangement of the pairs of blades or slides 30, 32 and 34, 36 close to the plane of the film, calls for a very careful sealing of light because, in contrast to an objective shutter, stray light might otherwise reach the film not only in the direction of the optical axis but from all sides or margins as well. In order to prevent an undesirable stray light fogging of the film in this manner, especially light from the sides, the present invention provides special masking blades or slides, 300 and 340 respectively, in association with the respective main blades 30 and 34. Each masking blade is connected by rivets 301 and 341, respectively, with the associated main blade at the side of the picture window or exposure area opposite to the side where the guide rods 38 and 40 are located. As best seen in FIG. 2, the masking or auxiliary blade 300, lying flat against and riveted to the blade 30 at their right hand ends, is bent so that the main part of the length of the blade 300 lies parallel to and slightly spaced from the blade 30, forming a thin pocket between the blades 30 and 300. The effective light-blocking part of the length of the supplementary opening blade 32, throughout substantially its entire height, lies within this pocket between the blades 30 and 300, when the shutter is in the run down position shown in FIG. 1, and when the shutter is in the tensioned or cocked position, the overlapping part of the height of the blade 32 (that is, the upper edge portion thereof) lies within the lower portion of the pocket between the blades 30 and 300.

Similarly, the right hand end of the masking blade 340 lies against the right hand end of the main closing blade 34 and is

fastened thereto as by means of the rivets 341, but the main area of the blade 340 is slightly spaced from and parallel to the blade 34, to provide a pocket between them. When the shutter is in the cocked or tensioned position, with both blades 34 and 36 above the top edge of the picture window or exposure aperture 22b, then the blade 36 lies, throughout substantially its entire height, within the pocket between the blades 34 and 340. However, at the conclusion of an exposure, when the parts are in the rest position shown in FIG. 1, only the lower edge portion or overlapping portion of the height of the blade 36 lies within the pocket formed between the blades 34 and 340.

The masking blades or auxiliary blades 300 and 340 thus provide what may be called a labyrinth-type overlapping arrangement with their respective trailing or supplementary blades 32 and 36, effectively preventing stray light from passing between the respective blades where they are overlapped, even if such stray light comes from the side or obliquely, rather than coming in the general direction of the optical axis. Since the masking blades 300 and 340 are very thin, these masking blades even with their rivets represent only a very trivial and entirely acceptable increase in the weight and size of the shutter assembly.

It is in the provision of these masking blades 300 and 340, that the construction of the present application differs from the construction of said prior application, Ser. No. 680,814. The blades are powered, and operated and controlled in their tensioning or cocking movements and in their exposure-making movements, in the same way as the blades of said prior application, the masking blades 300 and 340 moving, of course, with their respective main blades 30 and 34, since they are rigidly connected thereto. Since the movements are fully described in said prior application, it is not necessary to describe them in detail here, and it is sufficient to say that each of the four blades 30, 32, 34, and 36 has its own individual power spring indicated respectively at 230, 232, 234, and 236, the lower end of each spring being connected to a suitable anchor point (not shown) and the upper end being connected respectively at 230a, 232a, 234a, 236a to the respective carriers 130, 132, 134, and 136 of the respective blades 30, 32, 34, and 36. As mentioned in said prior application, the driving springs 230 and 234 are preferably of identical length and power, while the driving springs 232 and 236 for the trailing slides are also of the same length and power compared to each other, but preferably somewhat weaker than the main springs 230 and 234.

During the tensioning or cocking movement, the slides are moved upwardly from the rest or run down positions shown shown FIG. 1, as for example by means of a pinion which engages the gear teeth of a rack bar 130z which is mounted on the carrier 130 and extends parallel to the guide rods 38 and 40. Preferably the pinion is coupled to the film advancing mechanism of the camera, so that when the film is advanced the pinion will be rotated to raise the carrier 130 to its cocked or tensioned position, and this upward movement of the carrier 130 also raises the carriers 132, 134, and 136 of the other blades, because of cooperating parts on one carrier overlying parts on another, as will be readily understood by those familiar with said prior application. The parts are latched to hold them in their uppermost tensioned or cocked position. Then when the shutter trigger or release is operated, the blades start their downward movements under the power of their individual springs, making the exposure in a way well understood in the art and explained in said prior application.

It is to be understood that the disclosure is given by way of illustrative example only, rather than by way of limitation, and that without departing from the invention, the details may be varied within the scope of the appended claims.

I claim:

1. A photographic shutter of the focal plane type comprising means forming an exposure aperture, guide rods located laterally beyond one side edge of said exposure aperture, a plurality of shutter blades mounted for movement

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along said guide rods and movable relative to said aperture to admit light therethrough and to close said aperture to passage of light, each of said shutter blades having a length sufficient to extend from said one side edge of the aperture across the width of the aperture and having a far end projecting beyond the opposite side of the aperture, one of said blades slightly overlapping another of said blades in the area of said exposure aperture when such blades are in closed position, a first one of said blades having associated therewith a masking blade which at least partially overlaps a second blade on the opposite side thereof from the side on which the first blade lies, to increase the light-proofness of the joint between the first and second blades, characterized by the fact that said first one of said blades is made of a thin piece of sheet material and said masking blade is made of a separate thin piece of sheet material connected rigidly to the first blade at said far end thereof remote from said guide rods and beyond said opposite side of the aperture, said masking blade extending thence, from the far end of the first blade, in a general direction toward said guide rods and parallel to and slightly spaced from said first blade on which it is mounted, to form between them a thin pocket for receiving an edge of said second blade.

2. A photographic shutter as defined in claim 1, in which said blades include a main opening blade and a supplementary opening blade, and a main closing blade and a supplementary

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closing blade, and in which there is one masking blade mounted on and moving with said main opening blade and forming therewith a thin pocket for receiving an edge of said supplementary opening blade to increase the lightproofness of the overlap joint between the main opening blade and the supplementary opening blade when they are in light obstructing position across said exposure aperture, and in which there is also a second masking blade mounted on and moving with said main closing blade and forming therewith a thin pocket for receiving an edge of said supplementary closing blade to increase the lightproofness of the overlap joint between the main closing blade and the supplementary closing blade when they are in light obstructing position across the exposure aperture.

3. A construction as defined in claim 2, in which each masking blade is riveted at one end to one end of the respective main blade on which it is mounted, and extends therefrom in a direction toward the opposite end of the respective main blade on which it is mounted, spaced from and substantially parallel to such blade.

4. A construction as defined in claim 3, in which each main blade is made of one piece of thin sheet steel and each masking blade riveted thereto is made of a separate piece of thin sheet steel and is free of any sharp bends or folds.

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