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H. C. DECKEL ET AL

PROCESS FOR TAKING PHOTOGRAPHS

Filed Jan. 8, 1941

Serial No.
373,640

3 Sheets-Sheet 1

Fig. 1

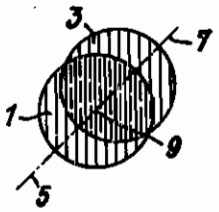


Fig. 2

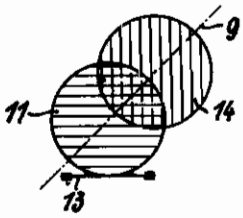


Fig. 3

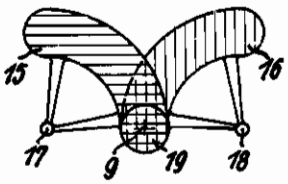


Fig. 5

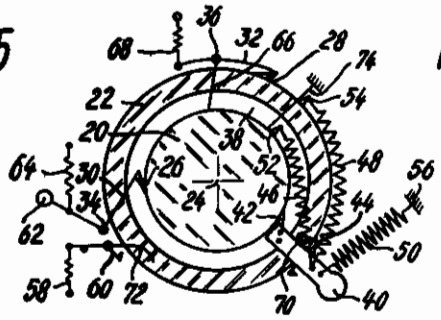


Fig. 4

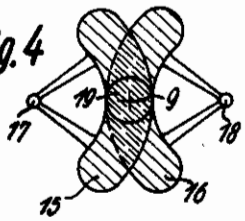


Fig. 6

Fig. 7

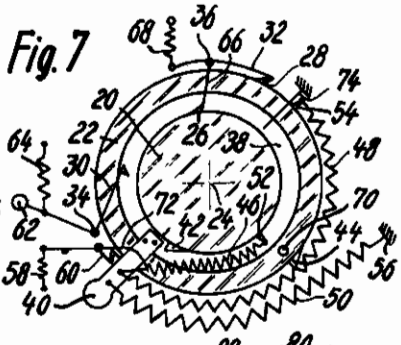


Fig. 8

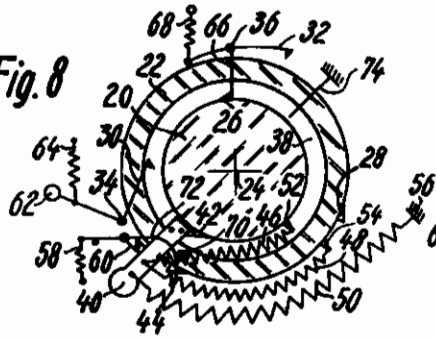
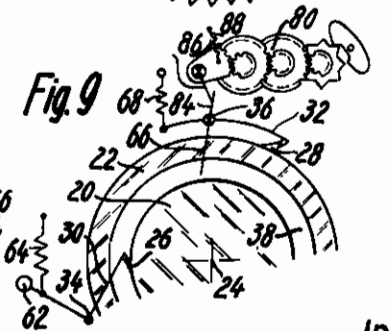


Fig. 9



Inventors
Hans C. Deckel
Eduard Maurer
& Franz Xaver Stömmer

Cushman, Darby & Cushman
their Attorneys.

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Fig. 10

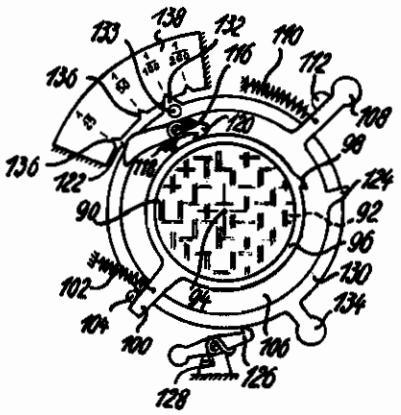


Fig. 11

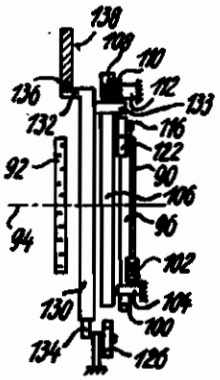


Fig. 12

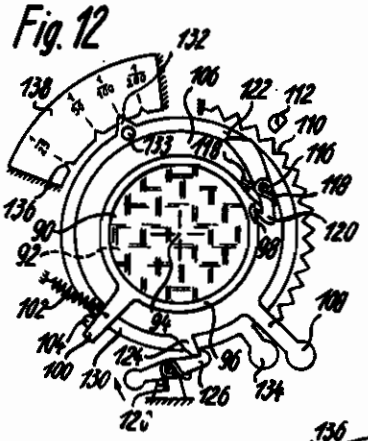


Fig. 13

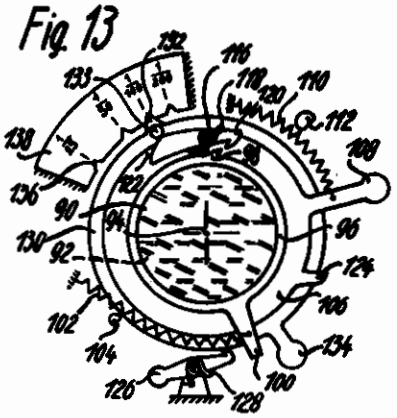
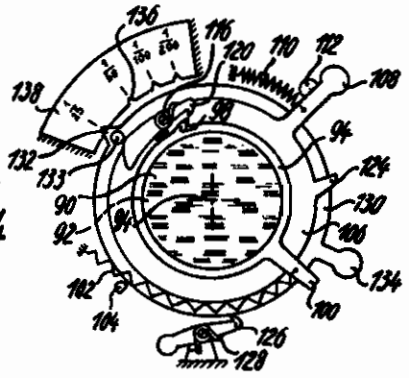


Fig. 14



Inventors
Hans C. Deckel
Edward Maurer
By Franz Xaver Stömmer
Cumpston & Shepard
their Attorneys.

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Fig. 15

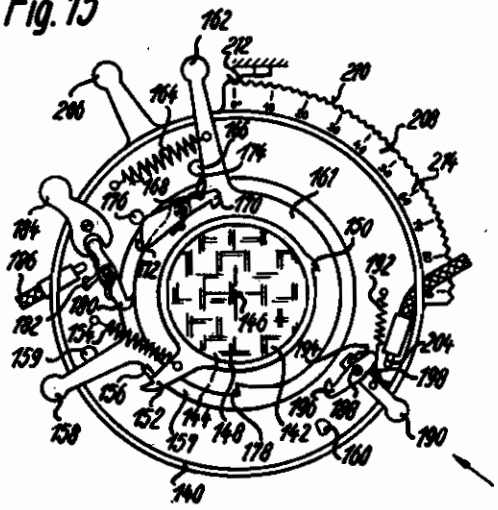


Fig. 16

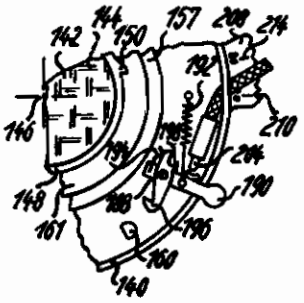


Fig. 17

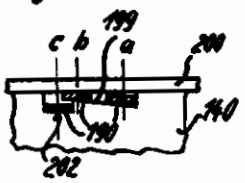
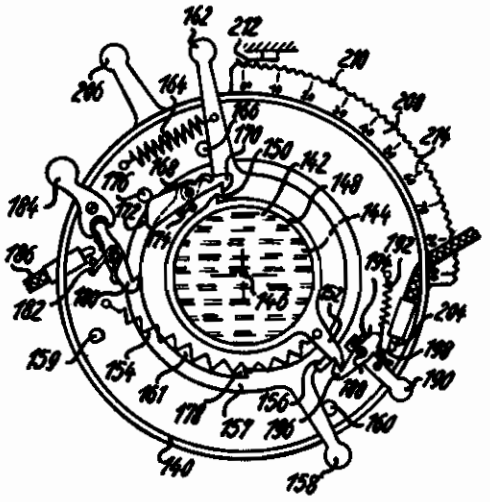


Fig. 18



Inventors
Hans C. Deckel
Eduard Maurer
Franz Xaver Stömmer

By Cumpston & Shepard
Their Attorneys.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR TAKING PHOTOGRAPHS

Hans C. Deckel, Munchen-Solln., Eduard Maurer, Munchen, and Franz Xaver Stömmer, Munchen, Germany; vested in the Alien Property Custodian

Application filed January 8, 1941

The present invention relates to a process for taking photographs.

With the photographic shutters used with the processes known to the art the passage of light is controlled e. g. by swinging shutter-leaves, sliding curtains and the like; all these means, however, require complicated actuating devices as well as comparatively large dimensions of the shutter.

One object of the process according to the invention consists in two polarizing filters relatively moved in relation to one another being used to control the passage of light when taking photographs. E.g. the actuation of a shutter is facilitated thereby in the simplest manner, and its dimensions may be kept extraordinarily small.

Another object of the invention consists in the amount of the relative rotatory displacement of the polarizing filters in relation to one another being changeable at will.

A further object is that in the case of one stationary and one movable polarizing filter being used to control the passage of light, both filters may be rotated jointly into any desired position, and that the filter which is stationary during the exposure, can be fixed in the position named.

Finally further objects of the invention consist in one or both of the polarizing filters serving to control the passage of light being able to be formed square or as circular discs, rings or ring-sectors.

The form of filter most convenient for every individual case depends on the arrangement of same. Thus with a photographic camera one filter may e. g. be arranged stationary in the space in front of the sensitive layer and have a square form, whilst the second movable filter is arranged near the camera lens and has the form of a circular disc.

To these and other ends the invention resides in certain improvements and combinations of parts all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 to 4 are diagrammatic illustrations of differently formed polarizing-filters which in accordance with the present invention may be moved in different ways in relation to one another to obtain the controlling effect of a photographic shutter.

Fig. 5 is a view showing a shutter constructed in accordance with the characteristics of the present invention, the individual parts of it being in position of rest;

Fig. 6 is a view similar to that of Fig. 5 with the individual parts in a position corresponding to the shutter under tension.

Fig. 7 is likewise a view similar to that of Fig. 5 with the individual parts in a position corresponding to the shutter when opened.

Fig. 8 is a view similar to that of Fig. 5 with the individual parts in the closed position subsequent to the opening of the shutter;

Fig. 9 is a partial view similar to that of Fig. 5, constructed in accordance with the present invention with an exposure regulating mechanism arranged additionally.

Fig. 10 is a view illustrating a shutter constructed in accordance with the characteristics of the present invention and with which the amount of the relative movement of the polarizing-filters in relation to one another is changeable at will and in which furthermore the parts are in position of rest.

Fig. 11 is an end elevation with parts of such a shutter being shown in vertical section.

Fig. 12 is a view similar to that of Fig. 10 with the individual parts in a position corresponding to the shutter under tension.

Fig. 13 is a view similar to that of Fig. 10 with the individual parts in a position corresponding to the position of the shutter when running down.

Fig. 14 is a view similar to that of Fig. 13, but with an exposure value adjusted differently.

Fig. 15 is a view representing a shutter constructed in accordance with the characteristics of the present invention and with which the shutter as a whole is rotatably adjustable about the optical axis of the photographic camera, and in which furthermore the parts are in position of rest.

Fig. 16 is a partial view similar to that of Fig. 15, in which individual parts occupy a different position.

Fig. 17 is a partial view in direction of the arrow inserted in Fig. 15 with the individual parts on a large scale; and

Fig. 18 is a view similar to that of Fig. 15 with the individual parts in a position corresponding to the position of the shutter when open.

It is a physical phenomenon known in itself that the path of rays of light may be controlled by means of two polarizing-filters changeable in their reciprocal angular adjustment; this control is possible due to the fact that the electromagnetic waves of the light which are polarized after having passed through the first filter, that is to

say which can no longer swing but in one definite plane, cannot pass through a second filter unless its individual structural parts are parallel or approximately parallel to the structural parts of the first filter. If, however, the structural parts of the two filters lie at a corresponding angle e. g. at right angle to one another, any passage of the light polarized in the first filter through the second filter is impossible. According to the present invention this possibility of control resulting from the wave-like nature of the light was the base for the construction of a photographic shutter.

In Figures 1 to 4 several arrangements of polarizing filters acting as shutters are shown the individual filters of which may be moved in different ways to admit or to impede the passage of rays of light respectively.

With the arrangement according to Fig. 1, two polarizing filters 1 and 3 are arranged in such a manner in a photographic camera not shown that their axes of rotation 5 and 7 coincide with the optical axis 9 of the apparatus. With this arrangement a control of light in the sense of the invention may be achieved e. g. by making the one filter (3) stationary, while the other filter (1) is rotatably adjusted forward and backward in relation to the former (3) in its plane about the axis 5 by 90°; instead of this the filter 1 might also be rotatably adjusted in the same direction twice by 90° in relation to the other filter and only subsequently returned to its original position. This return-movement may e. g. again be executed in two rotations by 90° each in relation to the stationary filter (this resulting at the same time in a new working step of the shutter) or filter 3 which is immovable during the preceding step is rotatably adjusted by 180° jointly with filter 1, the shutter thus remaining closed during the return-movement (closed winding up). Naturally, the return-movement may be effected forwards or backwards; hence results as a special case a shutter in which the movable filter (1) performs a continuous rotation by 90° each.

Instead of one movable and one stationary polarizing filter also both filters 1 and 3 can be movable and be rotated simultaneously against one another about the axes 5 and 7 to control the passage of light, the possibilities of movement being the same as indicated above, and the only difference consisting in the angles of rotation being half as large.

A further possibility of performing the movements of the filters to control the passage of light is given with the arrangement according to Fig. 1, by e. g. filter 1 being rotatably adjusted by 90° in relation to the stationary filter 3 and thereupon filter 3 hurrying after filter 1 which is now at rest, by the same degree of angle. For the return-movement the same possibilities indicated above exist also in this case.

Finally it would also be possible to rotatably adjust both the filters alternately by 90° each in relation to each other (thus in directions remaining constant).

In Fig. 2 an arrangement of filters is shown with which a filter 11 can swing about an axis 13 lying outside the optical axis 9 and at right angle to the latter. The second filter 14 is supported stationary in the photographic camera. With this arrangement the passage of light is controlled by filter 11 being swung out of the path of rays to allow the light to pass through; to interrupt the passage of light filter 11 is thereupon swung back again to its original position shown in Fig. 2. Naturally also filter 14 might be supported swingable by a second axis lying parallel to axis 13, the opening and closing of the passage of light being effected by swinging the two filters 11 and 14 jointly. Besides it would also be possible to swing one or both the filters about axes cutting the optical axis 9; in this case one filter or both of them might be swung by 90° each to control the passage of light.

In Fig. 3 and 4 an arrangement of filters is shown in blocking and free passage position with which two movable filters 15 and 16 swing about axes 17 and 18 lying outside the optical axis 9 of the camera lens 19. The arrangement might also be made in such a way that but one of the two filters is constructed swingable whilst the other filter lies stationary in front of the camera lens 19; the area of the stationary filter may then be limited to the aperture of the camera lens.

With polarizing filters having their axes of rotation outside the optic axis of the camera the same relative movements are possible to control the passage of light in itself as enumerated in connection with the example of execution according to Fig. 1, the only difference consisting in the filters illustrated e. g. in Fig. 1 are always executing merely pure rotations as self-motions, whilst with the arrangements according to Fig. 2–4 a swinging of the filters takes place. These swinging self-motions of the filter or filters respectively render it possible that the free passage of light may also be effected in such a way that one filter or both (contrary to the rotating filters which cover each other in every position) are partially or entirely removed from the path of rays. When releasing the passage of light by removal of one filter or of both of them, the distance of the axes of rotation of the filters from the optical axis may be chosen at will, thus also infinitely large; in the latter case the swinging motions of the filter or filters would become parallel displacements.

The polarizing filters shown in fig. 1 to 4 may be arranged singly or jointly immediately at the camera lens or/and between the lens and the light sensitive surface.

In fig. 5 to 9 an example of execution of a photographic shutter according to the invention is shown where the axes of the two polarizing filters drawn for reasons of greater clearness with different diameters coincide with the optical axis of the photographic camera.

The shutter consists of two disc-like polarizing filters 20 and 22 which are supported rotatably about their joint middle axis 24 at a corresponding distance and covering one another in a photographic camera not shown. The filters carry stops 26 and 28 which are engaged when the shutter is in the position of rest (fig. 5) by pawls 30 and 32 supported rotatably at the places 34 and 36; by these pawls the filters 20 and 22 are safeguarded against displacement in their position of rest in which no light can reach the emulsion-carrier due to the reciprocal angle-position of the structures of their material. Furthermore a master member 38 having the same axis as the two filters and carrying a setting lever 40 is supported rotatably. Said setting lever adjoins in the position shown in fig. 5 with its one side formed accordingly two stops 42 and 44 provided at the circumference of filters 20 and 22 respectively. The ends of two tension springs 46 and 48 as well as of a retracting spring 50 are also fastened to the setting lever 40. The springs 46 and 48 are anchored with their other ends in the filters 20 and 22 at 52 and 54, whilst the second

end of the retracting spring is held at 56 at a place of the photographic camera not shown.

When setting the shutter the lever 40 and simultaneously with it the member 38 is under the expansion of springs 46, 48 and 50 adjusted by rotation by an angle of 90° in a clockwise direction into the position shown in fig. 6 and it is held there in position by a pawl 60 activated by a spring; during this motion of tension the filters 20 and 22 are held by the pawls 30 and 32 in their original position impeding the passage of light. When the release lever 62 arranged at the pawl-lever 30 is pressed down against the action of its spring 64, the pawl 30 is lifted thereby out from the notch 26; thus filter 20 is released and the force of the tensioned spring 48 displaces same rotatably towards the right, until stop 42 comes again to adjoin the setting lever 40 (fig. 7). Corresponding to the path of tension of lever 40 the angle of displacement by rotation of the filter amounts to 90° in doing so. By this rotatory displacement of the one filter against the other one which is still held in its position by pawl 32, the passage of light to the emulsion carrier is released so that the shutter is open in the position shown in fig. 7. Shortly before filter 20 completes its "opening movement", the stop 26 provided on its reaches an arm 66 of pawl 32 and imparts both of them a short rotation to the left against the action of a spring 68; thus stop 28 is released and now the second filter moved by the force of spring 48 hurries after the first filter, until stop 44 comes to adjoin lever 40 which likewise corresponds to an angle of rotation of 90°. Thus both the springs 46 and 48 are released, and the reciprocal position of the filters being the same now as in fig. 5, the shutter is closed again (fig. 8).

So as to bring the entire set back again to the position of rest shown in fig. 5 automatically and without opening the shutter, the filter disc 22 carries a stop 70. When ending the closing movement, this stop encounters an arm 72 of pawl 60 and displaces both against the force of spring 58 in such a way that pawl 60 is lifted out from its notch at the setting lever 40. Thus the force of the retracting spring 50 comes into effect and turns the setting lever 40 or the master member 38 respectively and with same over the stops 42 and 44 also the two polarizing filters jointly towards the left, until the notches 26 and 28 have passed under the evading pawls 30 and 32, and are back again in the position shown in fig. 5. Any rotation of the filters towards the left beyond these positions of rest is prevented by stop 74.

In fig. 9 the shutter described above is shown with an exposure regulating mechanism of known kind arranged additionally for executing exposures of different durations. This exposure regulating mechanism (80) is supported in a suitable manner in the shutter casing and is impelled by a lever 82 protruding into the path of an arm 84; this arm forms part of the multiple-arm-lever 32, 68 supported in the point of rotation 36. This device is acting in the following manner:

After actuating the release lever 62 the filter 20 is displaced by rotation by force of spring in a clockwise direction in the manner already described. The stop 26 moved with it by this action encounters shortly before ending this rotatory movement the arm 66 and attempts to rotate the latter and the levers connected with it about point 36. This rotatory displacement, however, is delayed by the exposure regulating mechanism 80, so that the release of the stop 28 by pawl 32 and thus the beginning of the closing movement of the second filter begins only after a certain time. The amount of this delay determining the duration of exposure may be determined at will in known manner by corresponding adjustment of the exposure regulating mechanism. The return of the exposure regulating mechanism to the position of rest determined by a stop 86 is effected by a tension spring 88.

It may still be mentioned that it is, of course, possible without difficulty to intercalate between the release lever 62 and the pawl 30 a retarding device of known construction.

Building in an exposure regulating mechanism in a shutter naturally involves the shutter being made more complicated and more expensive. So as to avoid these drawbacks a shutter may be used as shown in fig. 10 to 14 of the drawings. With the shutter shown in these figures exposures may be effected which had so far only been possible by producing different speeds of running down, without interfering with the speed of running down of its moved parts, that is to say without using adjustable exposure regulating mechanisms or the like. This effect is produced by taking advantage of the well known physical fact, that the amount of the light allowed to pass through is dependent on the mutual position of two polarizing filters at the time.

According to fig. 10 two disc-shaped polarizing filters 90 and 92 are arranged at a corresponding axial distance and covering one another in a photographic camera not shown, their common middle axis 94 coinciding with the optical axis of the photographic camera. Furthermore the arrangement of the two filters is such that filter 90 may be rotated about axis 94, whilst the filter 92 is supported not rotatably in the photographic camera. For the purpose of its displacement by rotation the filter 90 is held in a ring-shaped mounting 96 which shows at its circumference two adjoined pieces 98 and 100. Adjoined piece 100 is engaged by a tension spring 102 and tends to rotate mounting 98 and consequently filter 90 in a clockwise direction, until adjoined piece 180 comes to adjoin a stop 104 (fig. 10). In a position shown in fig. 11 a rotatably master member 106 is arranged which is provided with a handle 108 and has the same axis as the two filters. This handle is engaged by a tension spring 110 which is stronger than spring 102 and tries to displace by rotation the master member 106 in an anti-clockwise direction until the handle 108 comes to lie against a stop 112. At the one side of the member 106 a two-arm pawl is supported rotatably at 116. As shown in fig. 10, this pawl lays itself under action of a spring 118 with a hook-shaped end 120 against the circumference of the mounting 96. The other arm of the pawl shows an oblique surface 122. Finally another adjoined piece 124 is at the circumference of member 106 behind which piece, when the shutter is tensioned, the hook-shaped end of a release pawl 128 subject to the action of a spring 126 falls.

As shown in fig. 11 another rotating ring 130 is arranged between the two filters 90, 92 and having the same axis as they, this rotating ring carrying a projection 132 and near it a stop 133. Projection 132 engages on turning the ring (by means of a handle 134) notches 136 provided at a scale 138 at the individual graduation lines of same. The graduation lines of this scale designate exposure corresponding to the usual durations of exposure (e. g. 1/25, 1/50, 1/100 of a second etc.) obtained by the known shutters. In

the graduation of the scale not only the function according to which the passage of light is taking place dependent on the relative motion of the filters, but also other factors influencing the action of the shutter (e. g. lack of uniformity in the movements of the filter 90 etc.) are considered.

The action of the shutter described is as follows:

In position of rest of the shutter (Fig. 10) the position of filter 96 is determined by the lengthening piece 100 adjoining stop 104. In this position the particles of structure of filter 90 are at right angles to the particles of structure of the stationary filter 92 so that the passage of light through the shutter is blocked. When the shutter is put in tension member 106 is moved by means of handle 106 against the force of spring 110 away from stop 112 in a clockwise direction, until stop 124 comes to lie behind the hook of release pawl 126, the master member thus being held firmly in its new position (fig. 12). On reaching the position of tension the hook-shaped end 120 of the two-arm pawl moved together with member 106 catches besides under the action of spring 118 behind the adjoined piece 98 of filter-mounting 96. The position of filter 90 in relation to filter 92 has not been altered during the action of tension, so that the shutter has preserved its closed position. When the release pawl 126 is now moved in the direction of the arrow against the force of spring 128, the adjoined piece 124 is released and member 108 is displaced rotatably in an anticlockwise direction by the shutter spring 110. During this rotatory displacement the rotatably supported filter 90 is carried along over pawl 120 and adjoined piece 88 under tensioning of spring 102 (the latter being weaker than spring 110). This rotatory displacement of filter 90 together with member 108 lasts, until the oblique surface 122 of the pawl supported at 116 buts against stop 133 protruding into its path and glides along it. During this action the pawl is displaced by rotation against the force of its spring 118, and thus stop 88 of the filter-mounting 96 is released (fig. 13). Whilst master member 108 continues now its path until handle 108 adjoins stop 112, filter 88 is retracted to its original position shown in fig. 10 and 12 in a clockwise direction by the spring 102 coming now into action.

As becomes apparent from the above, the position of stop 133 in every case is determining the amount of the rotatory displacement of filter 90. As on the other hand with polarizing filters the amount of light allowed to pass through depends according to a wellknown physical law in every case on the amount of the reciprocal relative movement of two filters, it is possible by adjustment of stop 133 by means of the handle 134 to alter at will the amount of light reaching the carrier of emulsion when the shutter is running down, though the speed of running down of the shutter always remains the same. With the example of execution described the notches 138 of scale 136 are arranged in such a manner that during the rotary displacement of filter 90 adjusted thereby the same amount of light is allowed to pass through as with the usual durations of exposure of the known sector-shutters; these durations of exposure are therefore indicated at the respective notches, although the process of opening of the new shutter differs on principle from that of the known shutters.

In fig. 10, 12 and 13 the shutter or the stop 133 of same respectively is adjusted e. g. to an amount of light corresponding to that at an exposure with $\frac{1}{100}$ sec. Due to this position of the stop, filter 90 is only carried along by master member 106 to such an extent (when the shutter runs down) that its particles of structure are lying at the end of the opening movement at an acute angle to the particles of structure of the stationary filter 92 (see fig. 13).

Contrary to it fig. 14 shows the adjustment of stop 133 to the largest amount of light which in the present case is to correspond e. g. to that at a period of exposure of $\frac{1}{25}$ sec. As may be seen from the figure, in this instance filter 90 is separated from member 108 only at the end of the rotatory adjustment of the latter; with this operation the rotatory displacement of the filter is so large that in relation to the structural particles of filter 92 its own structural parts come to lie in parallel position in which, as is known, the highest degree of penetrability is reached.

In the manner described all values of exposure obtained heretofore by adjustment of the period of exposure may be attained with a shutter according to the present invention without any alteration of the speed of the shutter-parts moved being necessary. The device forming the object of the invention may therefore be constructed in a simple manner without any means altering the speed (such e. g. adjustable exposure regulating mechanisms) with but one speed of running down.

With an additional arrangement of the means generally known in the construction of shutters for carrying out B- and T-exposures and consequently not shown in detail it is possible without difficulty with a shutter according to the invention to execute also such exposures.

Finally it may be mentioned that a reduction of the path of rotation of master member 108 and of the movement of the filter by half might be achieved by the filter 92 which with the example of execution described is not rotatable, being likewise arranged rotatable and being controlled by suitable means in such a way that it moves by the same amount as filter 90, but in opposite direction when said filter is rotatably adjusted.

The quality of a photograph may under certain conditions strongly be interfered with by the light of reflection occurring on smooth surfaces. In fig. 15 to 18 a shutter bearing the features of the present invention is shown which besides the control of the passage of light may also be used for subduing or eliminating to the greatest possible extent the disturbing light of reflection mentioned.

As is well known, due to the physical fact that reflected light is polarized for its greater part, that is that it only continues to swing in one definite plane, it is possible to subdue reflected light in general by means of a polarizing filter; therefore, all that is necessary is to rotatably displace a polarizing filter intercalated in the path of this light, until its structural particles lie vertical to the direction of swinging of the light whereby the latter is practically extinguished.

When using a shutter with which polarizing filters are serving to control the light, in the usual photographic cameras with a finder or in cameras with a special finder chamber it is possible to subdue and eliminate reflected light in a simple manner. All that is necessary in such cases to support the shutter on a rotating disc at the photographic camera, in order to be able

to displace it by rotation as a whole; it has to be rotatably adjusted in every case by the same amount as a polarizing filter intercalated before the finder or the finder-lens respectively has to be rotatably displaced in order that its structural particles get into the position vertical to the swinging plane of the reflected light and thus extinguish same. By the shutters being roatably displaced at the same time its one filter which is not moved during the process of exposure, gets likewise into the angular position extinguishing the reflected light so that on opening the shutter when a photograph is taken, this light cannot reach the emulsion-carrier. During the process of adjustment described previously the shutter is not opened.

The uniformity of the displacements by rotation of the observation filter and the shutter may be obtained e. g. by reading and new adjustment of the respective amount of displacement by rotation at corresponding scales, or also by the filter arranged in front of the finder being coupled with the shutter (e. g. over gear-wheels) so that same is in every case moved along with it by the same amount at the movements of adjustment of the filter.

In consideration of the particularly simple circumstances described above, showing an example of execution of a shutter for the kinds of photographic cameras mentioned above has been dispensed with; as an example a shutter has been chosen that is suitable for being used with photographic cameras with ground glass plate adjustment or with reflex cameras with joint photographic and finder lens, and with which consequently special means have to be provided for so as to be able to open the shutter during the adjustment of the camera. Such a shutter is described hereafter under reference to the drawing.

According to fig. 15 two disc-shaped polarizing filters 142 and 144 are arranged at corresponding axial distance and covering each other in a shutter-casing 140, their joint middle axis 146 coinciding with the optical axis of the photographic camera. Furthermore the arrangement of both filters is such that filter 142 may be rotated in relation to the casing 140 about the axis 146, whilst filter 144 is arranged non-rotatable in casing 140. For the purpose of its rotatory displacement filter 142 is held in a ring-shaped mounting 148 having two adjoined pieces 150 and 152 at its circumference. Adjoined piece 152 is engaged by a tension spring 154 tending to rotatingly displace mounting 148 and thus filter 142 in a clockwise direction until stop 152 comes to but against a stop 156 forming part of a rotating ring 157 having the same axis as the two filters; this ring carries a handle 158 and by means of same it may be rotatingly displaced between two stops 159 and 160.

Furthermore a master member 161 having the same axis as the two filters 142 and 144 is rotatably supported in casing 140 and carrying a handle 162. This handle is engaged by a tension spring 164 of greater force than that of spring 154 and tends to displace rotatingly member 161 in an anticlockwise direction, until handle 162 adjoins a stop 166 provided in casing 140. At the one side of member 161 a two-arm pawl is rotatably supported at 168. This pawl is formed as a hook 170 at its one end and shows an oblique surface 172 at its other end. Besides a spring 174 tries to rotatingly displace the pawl in a clockwise direction, which is impeded in the positions shown in fig. 15 and 18 by a stop pin 176 arranged in casing 140. At the circumference of member 161 an adjoined piece 178 is provided behind which the hook-shaped end of a release pawl 180 places itself, when the shutter is under tension, this pawl 180 being subject to the action of a spring 182. The release pawl may be actuated either immediately by means of a hand lever 184 or over a wire release 186 from any desired place of the photographic camera not represented in detail.

In casing 140 a hand lever 190 is rotatably supported by an axle 188 which is subject to the action of a tension spring 192. A plate spring 194 fastened at the end of lever 190 influences a pawl 196 likewise rotatably supported by axle 188 in such a manner that it lays itself with its stop 198 against the one side of lever 190. The hook-shaped end of pawl 196 protrudes in certain positions into the path of the lengthening piece 152 of filter mounting 148.

The hand lever 190 penetrates through the shutter casing 140 in a hook-shaped recess 199 limited on one side of the cover plate 200 of the shutter (fig. 17). To move pawl 196 from its position of rest shown in Fig. 16 into the acting position shown in Fig. 15 or 18 handle 190 is rotatingly displaced about axle 188 from its end position "*a*" shown in Fig. 17 against the action of spring 192, until it drops into a notch 202 by its own tension and is held there firmly (position "c"). During this process pawl 196 is carried along by plate spring 194. For the return movement of lever 190 from this position said lever must be pushed out by hand from notch 202; only then spring 192 can enter into action.

Apart from the immediate operation by hand as described the rotary displacement of lever 198 from its position "*a*" may also be effected by a flexible cable thrust device 204 from any desired place of the photographic camera. The end of this flexible cable thrust device when actuated presses against a correspondingly formed spot of lever 190 and moves same again towards notch 202. The path of the end of the flexible cable thrust device is so limited, however, that lever 190 cannot drop into notch 202, but only gets as far as position "*b*" in which pawl 196 is already in position of action in relation to the adjoined piece 152. From Fig. 17 it may be seen without difficulty that lever 190 is not blocked in position "*b*" so that it returns to its final position "*a*" under the pull of spring 192 without any special movement of disengagement, when the action of the flexible cable thrust device 204 has ceased.

The cases of immediate actuation of lever 190 by hand or by using the thrust device 284 will be explained in detail later on.

The individual parts of the shutter described above are arranged in casing 140, and according to the invention this casing is rotatably supported about the axis 146 at a photographic camera not represented in detail. To displace casing 140 (and with it the shutter as a whole) by rotation a handle 206 is provided. Furthermore casing 140 carries on a part of its circumference comprising about 90° an arch-shaped plate 208 the border of which is provided with teeth 210. These teeth are engaged by a stationary supported spring 212 securing the shutter casing in its angular position at the time against unintended rotatory displacements. On plate 208 an angle-graduation 214 (suitably agreeing with the individual teeth 210) is provided so as to be able to fix the individual amounts of rotatory displacement also numerically.

Before describing the process of eliminating reflected light by the means according to the present invention, we will first explain the action of the means serving for execute the exposure proper.

In position of rest of the shutter (Fig. 15) the position of filter 142 is determined by the lengthening piece 152 adjoining stop 156. In this position the structural particles of filter 142 are at right angle to the structural particles of filter 144 supported incapable of being rotatingly displaced in casing 140 so that the passage of light through the shutter is blocked. When the shutter is put in tension, member 161 is moved against the force of spring 164 away from stop 166 in a clockwise direction, until adjoined piece 178 comes to lie behind the hook of the release pawl 160 and the master member is thus firmly held in its new position. Besides, on reaching the position of tension, the hook-shaped end 170 of the two-arm pawl supported by member 161 drops under action of spring 174 behind the adjoined piece 150 of filter mounting 148. The position of filter 142 in relation to filter 144 has not been altered during the process of tension, so that the shutter preserved its closed position.

When the release pawl 180 is now moved against the force of spring 182 either by means of hand lever 184 or over the wire release 186 in a clockwise direction, stop 176 is released and member 161 is rotatingly displaced by spring 164 in an anticlockwise direction. By this rotatory displacement the rotatably supported filter 142 is carried along over pawl 178 and adjoined piece 150. whilst spring 154 is tensioned (it being weaker than spring 164). This rotatory displacement of filter 142 toegther with member 161 lasts, until the oblique surface 172 of the pawl supported at 168 buts against stop 176 protruding into its path and glides along it. In doing so, the pawl is displaced rotatingly against the force of its spring 174 and stop 158 of filter mounting 148 is released thereby. At this moment the position of filter 142 is such that its structural particles lie parallel to those of filter 144, so that the passage of light to the emulsion carrier is released. Whilst now master member 181 comes to rest by lever 162 butting against stop 166, filter 142 is brought back to its original position shown in Fig. 15 by its spring 154 and thus the passage of light through the shutter is blocked again. Whilst the exposure is executed, hand lever 198 is in the position shown in Fig. 16 in which pawl 196 lies outside the path of lengthening piece 152, so that it cannot enter into action.

It may still be mentioned that means for regulating the speed of shutter (exposure regulating mechanism) has for reason of simplicity been omitted in the example of execution shown.

If now, before carrying out an exposure, a reflected light emanating from a shining surface of the object of which a photograph is to be taken, is to be eliminated, this may be done e. g. with a photographic camera with ground glass plate adjustment in the following manner:

After insertion of the ground glass plate into the photographic camera the lever 190 is first rotatingly displaced to its notch-position "c" shown in Fig. 15 and particularly in Fig. 17. Then ring 157 is moved by means of handle 158 from its position shown in Fig. 15 into the position shown in Fig. 18 as far as stop 160. By this operation also filter 142 is carried along over stop 156 and lengthening piece 152 against the force of spring 154. Shortly before the movement of ring 157 ends, lengthening piece 152 drops behind the pawl 196 protruding now into its path, so that filter 142 is held fast in its new position. In this position, however, its structural particles lie parallel to those of filter 144 fastened in casing 140, so that the sight through the shutter is unobstructed (Fig. 18). This opening of the shutter by means of handle 158 may be carried out independently from the master member 161 being in position of rest or of tension.

Whilst looking through the ground glass plate inserted into the photographic camera, the shutter as a whole should be rotated by means of the handle 206 about axis 146, until the structural particles of filter 144 lie vertical to the swinging direction of the polarized reflected light, this being practically extinguished thereby. The adjusted angular position is secured by spring 212 engaging teeth 210. Then the adjustment is finished, lever 190 is again displaced rotatingly into its position "a," pawl 196 being removed from the path of the lengthening piece 152 over stop 196. Filter 142 now moves under action of spring 154 and carries long ring 157 back into the position shown in Fig. 15, the passage of light through the shutter being blocked again. After exchanging the ground glass plate with the exposure material the exposure may now be executed in the manner previously described with the adjusted angular position of the shutter.

Fixing filter 142 in the open position shown in Fig. 18 may also be effected by operating the flexible cable thrust device 204. During this operation, however, the lever 190 is, as described previously, displaced rotatingly only as far as position "b," so that when the pressure brought to bear on it ceases, it returns again to its original position "a" under action of spring 192 and removes pawl 196 from the path of lengthening piece 152. Thus filter 142 is in this case held in open position only during the operation of the flexible cable thrust device 204.

The movement of pawl 196 over the device 204 is particularly suitable for photographic cameras with a joint photographic and finder lens because with these apparatuses a certain error-avoiding constraint in the sequence of the various actions is rendered possible thereby. This sequence is e. g. as follows:

If, in taking a photograph, disturbing reflected light is to be eliminated filter 142 must be rotatingly displaced into the open position by means of handle 156. In this position the filter is held fast readily by pawl 196, because with the last named kind of photographic cameras it is convenient to arrange the flexible cable thrust device 204 in such a way that it continuously tries under spring pressure to hold lever 190 in position "b" and thus pawl 196 in acting position. Now the open shutter can be rotatingly displaced by means of handle 206 into the corresponding angular position in order to eliminate the reflected light. Before or after this adjusting movement the shutter must be put in tension in the usual manner by means of handle 162.

After finishing the adjustment a release member provided at the photographic camera is actuated. This results first of all in the device 204 being pulled back from its acting position into the position of rest, and consequently in lever 190 being brought back by spring 192 from its

position "b" into the original position; in doing so, filter 142 is released by pawl 196 for the shutting movement. By further actuating the release member the swingable mirror (arranged in reflex cameras with but one lens) after closing the shutter, is removed from the path of light of the camera lens and lastly pawl 180 is actuated over wire release 166, and thus the process of exposure is brought into effect.

From using the flexible cable thrust device 188 and 204 to operate members 160 and 198 respectively results finally with photographic cameras of any construction the advantage that the operation places may be arranged at will at the photographic camera, and (due to the flexibility of the thrust devices) preserve their original position when the shutter is rotatingly displaced.

For reasons of operation it may be advantageous with a shutter according to the invention to make the opening and closing movements of the polarizing filters corresponding to a chosen variation with regard to time for execute an exposure. This may be achieved without difficulty by using means known in the art (e. g. by intercalating controlling curves).

HANS C. DECKEL.
EDUARD MAURER.
FRANZ XAVER STÖMMER.