

April 22, 1952

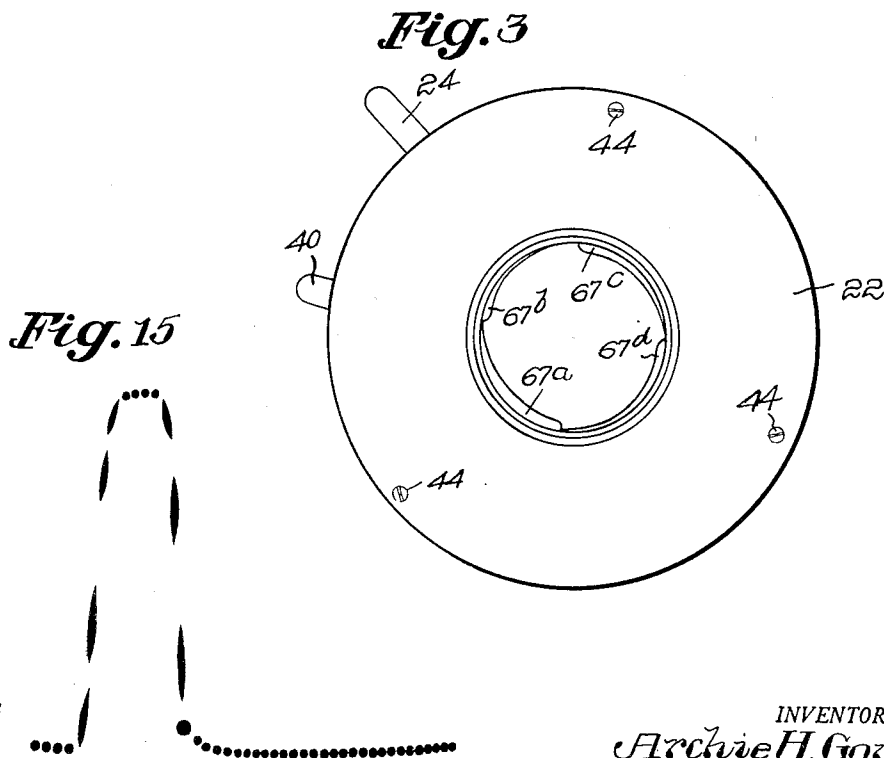
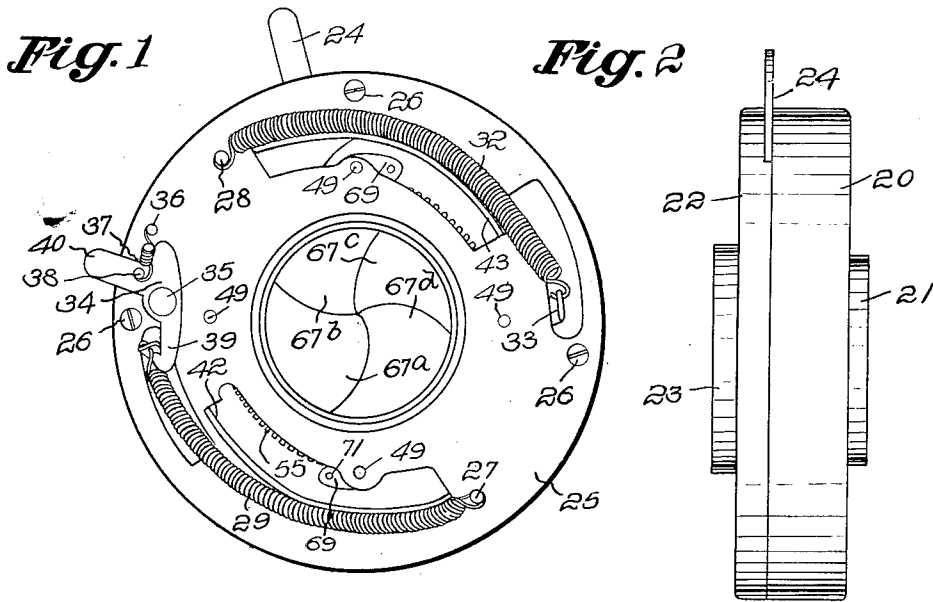
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2,593,873

SHUTTER LEAF DRIVING MEANS FOR BETWEEN-THE-LENS SHUTTERS

Filed May 17, 1949

5 Sheets-Sheet 1



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5 Sheets-Sheet 2

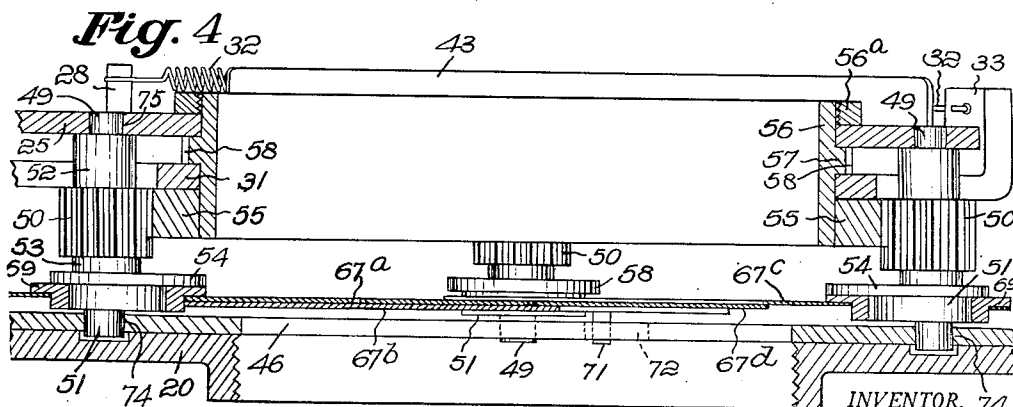
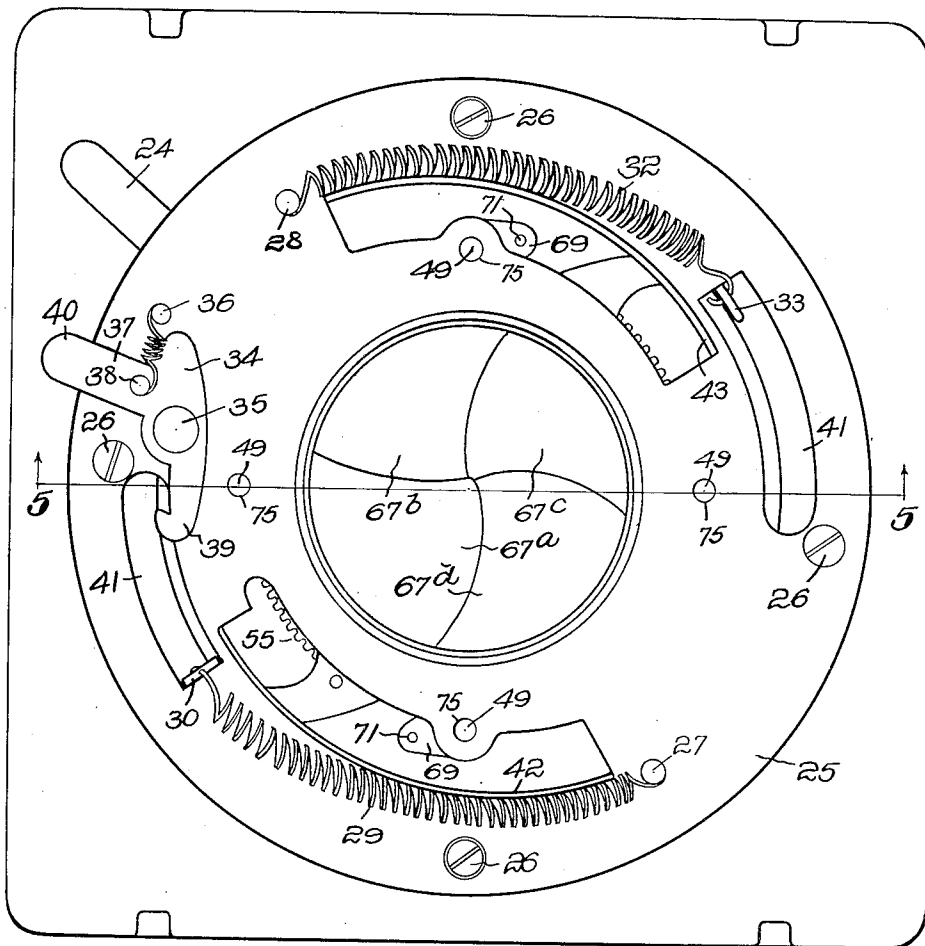


Fig.5

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Fig. 6

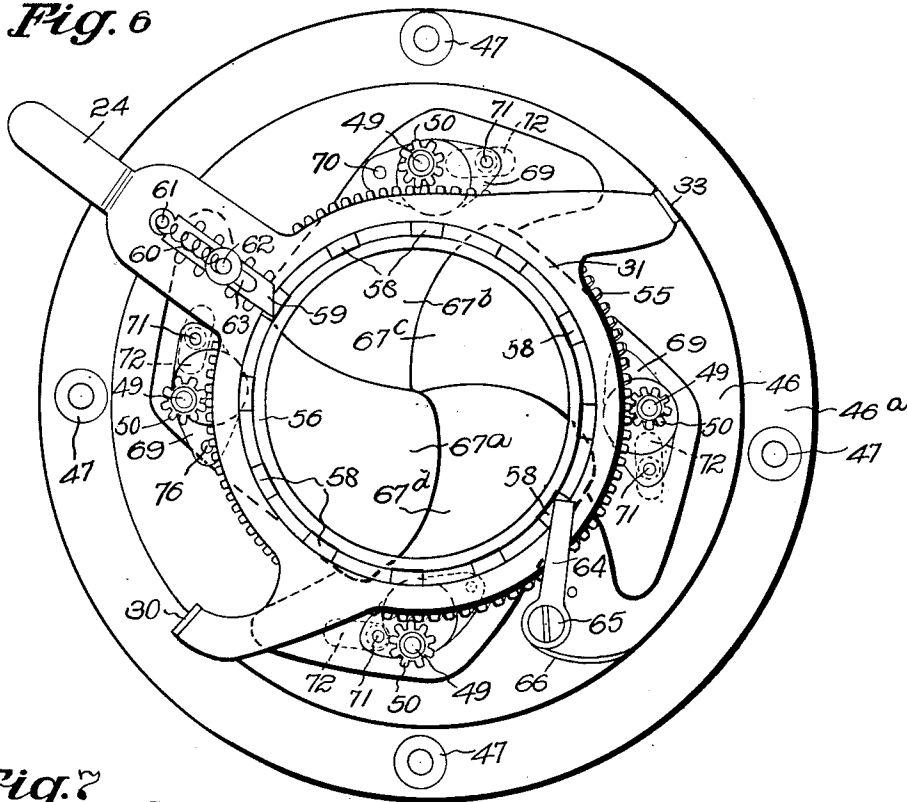


Fig. 7

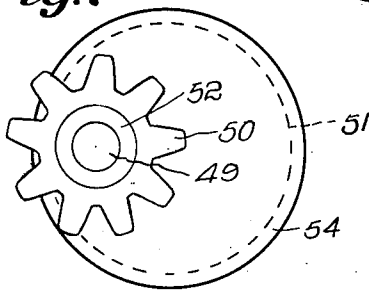


Fig. 9

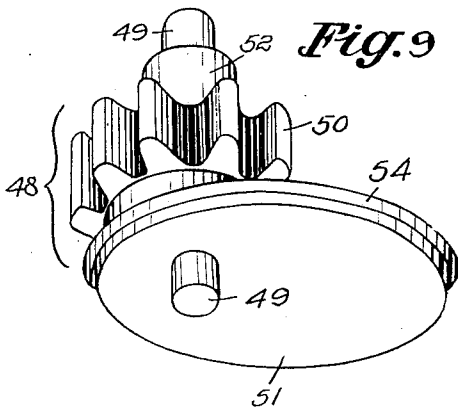
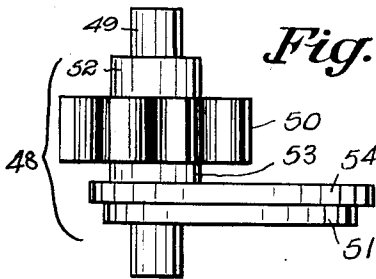


Fig. 8



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Fig. 10

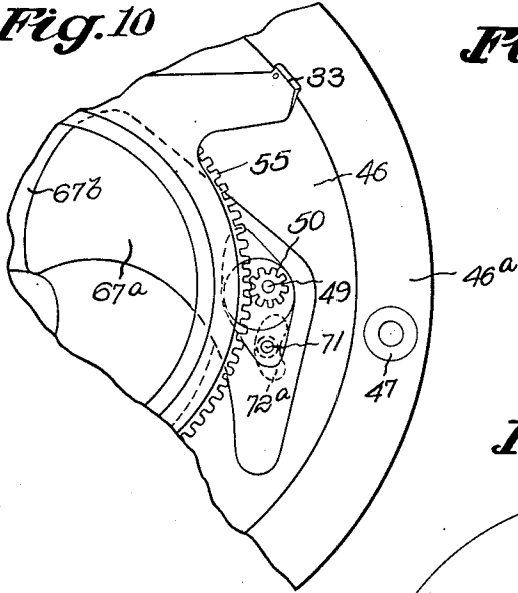


Fig. 11

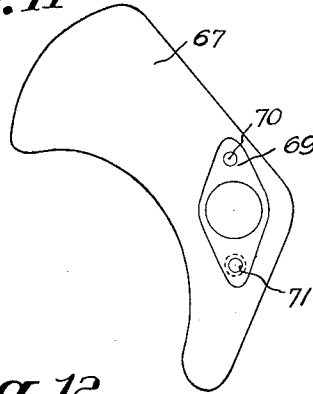


Fig. 12

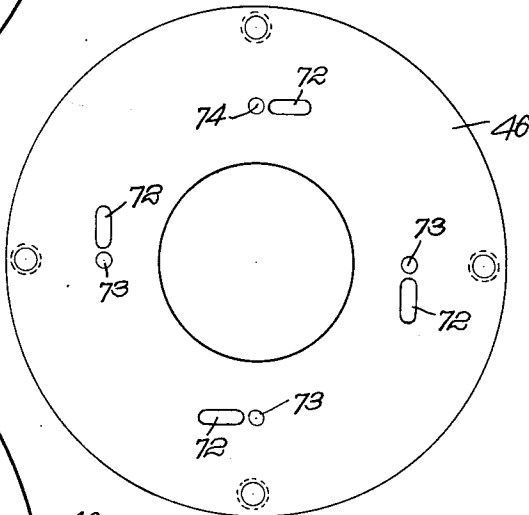
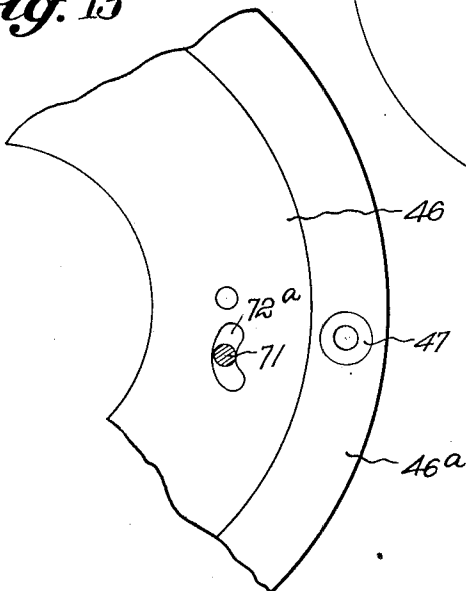


Fig. 13



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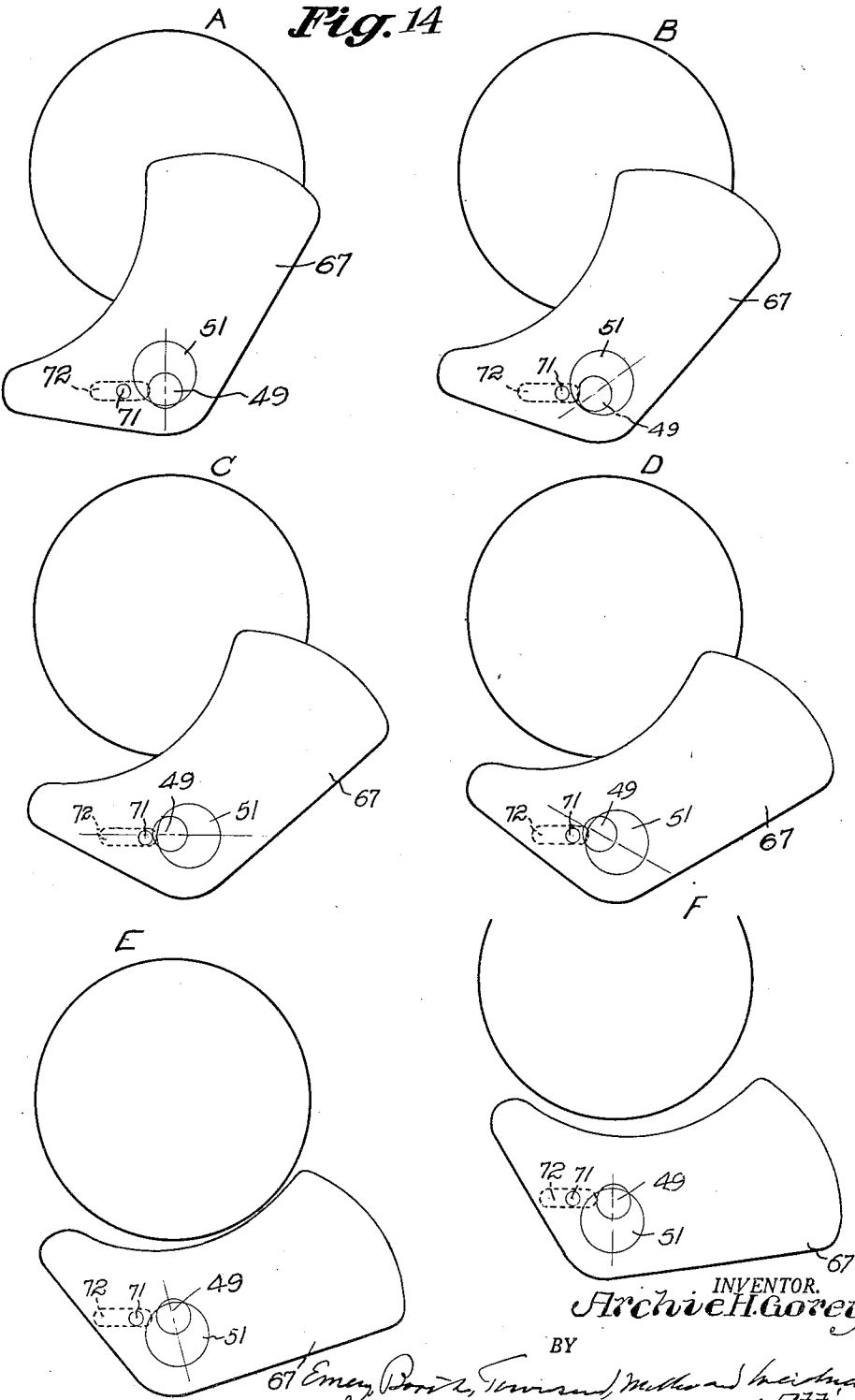
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SHUTTER LEAF DRIVING MEANS FOR BETWEEN-THE-LENS SHUTTERS

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UNITED STATES PATENT OFFICE

2,593,873

SHUTTER LEAF DRIVING MEANS FOR
BETWEEN-THE-LENS SHUTTERSArchie H. Gorey, Rochester, N. Y., assignor to
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Application May 17, 1949, Serial No. 93,712

12 Claims. (Cl. 95—63)

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This invention relates to shutter mechanism for photographic cameras, and particularly to shutter-leaf driving means for between-the-lens shutters.

In order that the principle of the invention may be readily understood, I have disclosed a single embodiment thereof in the accompanying drawings, wherein

Fig. 1 is a front view of the shutter having the front cover plate removed, more clearly to show some of the operating mechanism, the shutter being shown in the set condition;

Fig. 2 is a right-hand side view of Fig. 1;

Fig. 3 is a view similar to Fig. 1, but showing the front cover plate in position, the shutter trigger having been released and the shutter being in the open condition;

Fig. 4 is a view similar to Fig. 1 but on a larger scale, the shutter being shown in the closed condition after having been released and allowed to run down;

Fig. 5 is a section through Fig. 4 on the line 5—5 thereof, showing clearly the construction of the shutter-leaf driving mechanism;

Fig. 6 is a view similar to Fig. 4 but with the shutter leaf mounting plate removed to show the shutter-leaf driving mechanism;

Fig. 7 is a top plan view of one of the shutter-leaf driving eccentrics;

Fig. 8 is a side view of the construction shown in Fig. 7;

Fig. 9 is an isometric view of the shutter-leaf driving eccentric and gear pinion assembly;

Fig. 10 is a view similar to Fig. 6, but with a fragmentary section only being shown and representing the employment of a curved guide path for the shutter-leaf guide pin;

Fig. 11 is a detail, on an enlarged scale, of one of the shutter leaves, showing the bearing support plate and the position of the shutter-leaf guide pin;

Fig. 12 is a plan view of the lower shutter-leaf mounting plate or shutter pinion support plate, showing the shutter driving eccentric shaft bearing holes with relation to the shutter leaf pin guide openings, a straight guide opening being herein shown;

Fig. 13 is a view similar to Fig. 10, but having certain of the parts removed to show the construction of the curved guide path for the shutter guide pin;

Fig. 14 comprises a series of plan views showing the several positions of one of the shutter leaves during 180° of rotation of the shutter drive eccentric, during which the shutter leaf

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moves from a closed condition to the full open condition; and

Fig. 15 is a reproduction of an oscillogram or oscillograph of the shutter opening and closing, disclosing the high operating efficiency of the shutter of my invention.

The need of a high-efficiency high-speed shutter is well known and numerous attempts have been made to construct a shutter having movable blades or leaves to open and close the exposure aperture, and a number of different types of driving mechanisms have been evolved, but in so far as I know I am the first to provide a shutter of the between-the-lens type having a simple leaf drive mechanism that will insure high shutter speeds, and at the same time maintain a high efficiency with respect to the light admitted through the shutter opening. The shutter herein disclosed is capable of shutter speeds as high as 1/800 of a second with constantly highly efficient repeat performances.

In this application I am showing only the shutter-leaf operating mechanism and simple means for holding the shutter in the cocked or set condition and for releasing the shutter for making an exposure. The more complete shutter control mechanism for controlling the speeds and for flash synchronization will be the subject-matter of another application to be filed by me.

The objects of this invention are to provide a high-speed shutter having a minimum of moving parts and of simple construction; to provide a shutter having a high light-admitting efficiency; and to provide a shutter having extremely high shutter speeds that can be operated with a minimum of jar or vibration to the camera on which it is mounted. Other and important objects will be apparent from the detailed description.

Referring first to Figs. 1, 2 and 3, the shutter case or housing is represented at 20, it having a cylindrical flange 21 into which the back element of the lens is fitted. Also fitted to the case or housing 20 is a cover 22 having a cylindrical flange 23 into which the front element of the lens is fitted.

A shutter setting or reset lever is represented at 24 and the upper shutter pinion support plate at 25. The said upper shutter pinion support plate 25 is held to the case or housing 20 by means of screws 26, 26. Attached to the said upper shutter pinion support plate 25 are pins 27 and 28. To the pin 27 is attached a spring 29, the other end whereof is attached to an upstanding or upturned end 30, Fig. 4, of a shutter set-

ting lever ring 31, most clearly shown in Figs. 5 and 6, and of which the shutter setting or reset lever 24 is an integral radial extension, as shown in Fig. 6. To the pin 28 is attached a spring 32, the other end whereof is connected to an upstanding end 33, Fig. 4, of the said shutter lever setting ring 31. Also attached to the upper shutter pinion support plate 25 is a shutter release bell crank 34, being attached by means of a shoulder stud 35. Attached to the said upper shutter pinion support plate 25 is a pin 36, and connected therewith is a spring 37 that is hooked to a pin 38 of said bell crank 34. The lower end, viewing Figs. 1 and 4, of said bell crank 34 is provided with a hook-like formation 39 that engages the said upstanding end 30 of the shutter setting lever ring when the shutter is in the cocked or set condition. The bell crank 34 is provided with an outwardly extending member or arm 40 for releasing the shutter. In the said plate 25, there are provided openings 41, 41 through which the said upstanding ends 30 and 33 protrude, as best shown in Fig. 4.

The said plate 25 is formed with flanges having a generally circular shape to support the springs 29 and 32, the said flanges being indicated as 42 and 43 respectively, in Fig. 4. The mechanism shown generally in Fig. 1 is covered and thereby protected by the cover 22, which is held to the shutter case or housing 20 by means of screws 44, 44, Fig. 3.

Reference will next be made to Figs. 4 to 9.

In Figs. 4 and 5, the shutter is shown as attached to the usual lensboard, indicated at 45 in Fig. 4. In Fig. 1, the shutter is shown in a cocked or set condition, but in Fig. 4 the shutter is shown in a released condition (that is, in a closed condition following exposure).

The shutter case or housing 20, which is of a cup-shaped formation, is best shown in Fig. 2, and to the bottom of such cup-shaped structure, as shown in Fig. 5, is attached the lower shutter-leaf mounting or lower shutter pinion support plate, indicated at 46. Also attached to the shutter case or housing 20, by means of suitable spacer bushings 47, 47, Fig. 6, is the said upper shutter pinion support plate 25 held thereto by the said screws 26, 26, Fig. 4. A reinforcing ring 46a is shown in Figs. 6, 10 and 13.

Carried between the lower and upper shutter pinion support plates 46 and 25 are a series of shutter operating eccentric assemblies, best shown in Figs. 7, 8 and 9, and indicated in entirety at 48. Each of the said assemblies 48 is made up of a shaft 49 having a gear or pinion 50 and an eccentric 51, the said gear or pinion being provided above and below with spacers 52 and 53. The said eccentric 51 is provided with a flange 54 to retain the shutter leaves, shortly to be referred to. This construction is also shown in Fig. 5. In Fig. 14 a shutter leaf or blade is shown as received on an eccentric 51.

Meshing with the series of shutter gears or pinions 50, 50 is a single shutter pinion-drive gear 55, best shown in Fig. 5 as attached to a cylindrical member 56 that is also provided with a flange or notched ratchet ring 57 having a series of teeth or ratchet openings, indicated at 58 in Fig. 6. The said cylindrical member 56 is fitted into a suitable opening in the upper shutter pinion support plate 25, as shown in Fig. 5, and is held thereto by a cylindrical nut 56a that is threaded to the cylindrical member 56 and is locked in any suitable manner to provide a free and easy movement of the said cylindrical mem-

ber 56 in the upper shutter pinion support plate 25.

The shutter setting lever ring 31 is fitted over or about the cylindrical member 56 between the flange or notched ring 57 and the drive gear 55, as shown in Fig. 5. The said shutter setting lever ring 31 is free to rotate on the cylindrical member 56 and is caused to be rotated in a contraclockwise direction, viewing Figs. 4 and 6, by said springs 29 and 32. Said shutter setting lever ring 31 can be rotated manually in a clockwise direction by means of the shutter reset lever 24, which forms a radially extending part thereof. Motion in both a clockwise and a contraclockwise direction of said ring 31 is limited by the openings 41 in the upper shutter pinion support plate 25 which openings 41 therefore together act as a stop for limiting the movement of the said drive gear 55 under impetus of said springs 29 and 32, after the drive gear 55 is released, so that each pinion and its disk makes just one revolution before the said drive gear 55 is stopped.

The shutter setting lever ring 31 is provided with a radially sliding dog 59, Fig. 6, that engages the teeth or ratchet openings 58 of the ratchet ring 57. The said dog 59 is caused to move radially inward to engage the teeth or ratchet openings 58 by means of a spring 60, one end of which is connected to a pin 61, that in turn is attached to the said dog 59, the other end of the spring 60 being attached to a shoulder rivet 62 on said ring 31 which passes through an opening 63 in the dog 59. The said dog 59 causes the cylindrical member 56 to be rotated in a contraclockwise direction, viewing Fig. 6, by the action of the springs 29 and 32.

When the shutter reset lever 24 is moved in a clockwise direction, the cylindrical member 56 is prevented from turning in a clockwise direction by a pawl 64, shown most clearly in Fig. 6. The said pawl 64 is attached to the lower shutter-leaf mounting or support plate 46 by means of a shoulder screw 65 and is caused to rotate in a contraclockwise direction by a spring 66.

When the shutter setting lever 24, which, as stated, is a radial extension of the shutter setting lever ring 31, is rotated in a clockwise direction, the dog 59 will not engage the teeth or openings 58 of the ratchet 57 because of the cam-shaped face of the dog 59. When, however, the said setting lever 24, radially extending from said ring 31, is moved in a contraclockwise direction, because of the action of springs 29 and 32, the cylindrical member 56 and the shutter pinion drive gear 55 will also be moved in a contraclockwise direction a distance sufficiently far to cause each of the series of gears or pinions 50 to make one complete rotation in a clockwise direction. When said shutter setting lever 24 of the said ring 31 is manually rotated in a clockwise direction, the cylindrical member 56, the drive gear 55 and the series of gears or pinions 50 of the assemblies 48 will be prevented from rotating by the pawl 64, as previously stated. When said shutter setting lever 24 has reached the limit of its clockwise movement, the upturned end 30 of the shutter setting lever ring 31, of which said setting lever 24 forms a part, will be engaged by the hook-like formation 39 of lever 34, and will be prevented from being rotated in a contraclockwise direction until the outwardly extending member 40 of the bell crank 34 is again operated.

Fitted between the upper and lower shutter pinion support plates 25 and 46, as previously

stated, are the shutter-leaf operating eccentric assemblies 48, most clearly shown in Figs. 7, 8 and 9. There is one of these assemblies for each shutter leaf or blade, and in the disclosed embodiment of the invention four leaves or blades are provided. In Fig. 11, the construction of one of the series of shutter leaves or blades is indicated at 67. A bearing plate 69 is attached to such shutter leaf or blade 67 by means of a rivet 70 and a shoulder pin 71. The said bearing plate 69 fits over one of the eccentrics 51, as most clearly shown in Fig. 5, and the shoulder pin 71 rides in an opening, slot or groove 72 in the lower shutter pinion support plate 46, which is also provided with bearing holes 74, 74, in which rotate the shafts 49 of the series of eccentric assemblies 48. The upper shutter pinion support plate 25 is also provided with bearing holes 75, most clearly shown in Figs. 4 and 5, for the shafts 49 of the eccentric assemblies 48.

The shutter leaf or blade assembly construction is most clearly shown in Fig. 6, wherein the series of pinions 50 of the eccentric assemblies 48 are engaged by the said shutter pinion drive gear 55. When the shutter is in a set or cocked condition, as shown in Fig. 1, all of the shutter leaves or blades, which are respectively indicated in Figs. 1, 3, 4 and 6 at 67a, 67b, 67c, 67d, are in a closed condition. When the member or arm 40 of the shutter release bell crank 34 is moved in a downward or counterclockwise direction, viewing Figs. 1 and 4, the hook-like formation 39 is withdrawn from upstanding end 30 and the shutter setting lever ring 31 will be caused to rotate in a counterclockwise direction because of the springs 29 and 32 and the dog 59. When the shutter setting or reset lever 24 has reached approximately a position half-way in its total travel, the shutter leaves or blades 67a, 67b, 67c and 67d will be in fully open condition, as shown in Fig. 3. The shutter setting lever ring 31 continues to rotate.

The series of pinions 50 and eccentrics 51 will cause the shutter leaves 67a, 67b, 67c and 67d to continue to rotate until the shutter leaves or blades are again closed, as shown in Figs. 4 and 6. As each eccentric 51 turns in its bearing member 69 of its shutter leaf or blade, the shutter leaves or blades will be caused to assume successive positions, most clearly shown in Fig. 14, wherein one of the eccentrics 51 is shown in its several positions during 180° of its rotation. As each eccentric 51 rotates, its shutter leaf is guided by the corresponding shoulder pin 71, thus imparting the motion to each shutter leaf, as clearly shown in Fig. 14, where one shutter leaf or blade is shown in its successive positions. The several consecutive or successive steps of this operation are indicated by the letters A, B, C, D, E and F, in said Fig. 14, wherein A represents the position of a shutter leaf or blade at the start of the exposure cycle, and F at the completion of the full open cycle. It will be apparent that as each eccentric 51 continues to rotate, the corresponding shutter leaf or blade will be caused to close in a manner substantially the same as the opening cycle.

This particular construction provides means for operating shutter leaves at a much higher speed than heretofore possible and in a manner to obtain very high shutter efficiency, thus providing a high light-transmitting efficiency relative to a given exposure time, and such efficiency is very clearly illustrated by the representation in Fig. 15 of a record made on a cathode ray oscilloscope.

The action of the shutter leaves or blades (herein four in number) can be modified by changing the shape of the opening, slot or groove in the lower shutter pinion support plate or shutter-leaf mounting plate 46, as shown in Fig. 13, wherein the opening is a sector of a circle, and is indicated at 72a. This sector shape of opening gives a slightly higher shutter-opening efficiency, but it does not have quite as good a mechanical efficiency due to the steep angle of attack. Other modifications of the shape of the opening 72 in which the pin 71 travels can be used to obtain different characteristics of the shutter leaf or blade movement, and are all within the scope of my invention.

From the foregoing description it will be apparent that I have provided a new structure for operating shutter leaves or blades at high speed and at high efficiency. In tests on a model of the shutter as herein disclosed, I have readily attained shutter speeds of $\frac{1}{800}$ of a second with efficiencies of 65%.

The oscillogram or oscillograph in Fig. 15 shows the characteristics of a shutter opening operating at $\frac{1}{700}$ of a second, at an efficiency of 65%. Each dot in the oscillogram or oscillograph record represents $\frac{1}{2000}$ of a second.

The construction herein disclosed is of a type that makes most efficient use of the power applied to operate the shutter leaves or blades and at the same time transmits to the shutter leaves or blades the least amount of shock, thus preventing shock waves in the shutter leaves or blades themselves which, when they do occur, normally impair the shutter operation.

The pins 71 are guided to and fro in the openings, slots or grooves 72, whether the latter be straight or of curved formation. In the latter case the movement of the leaves or blades 67 is slightly modified for the following reason.

In addition to each of the eccentrics there must be a guide pin or like formation (that is, a pin on the leaf and a slot or groove on some stationary part) that modifies the action of the shutter blade. If I provided only an eccentric to move the blade or leaf, the leaf or blade would have no specific or definite motion. It would merely wobble or move around in any direction. There must, therefore, be a guide pin or equivalent formation, to modify the motion imparted to the blade by the eccentric. If the groove is straight, there would be a certain motion of the blade, and if the groove is curved, there would be a different motion depending on the shape of the curve. The curve need not be a part of a circle. It might even be an inclined straight line. An inclined line would cause the shutter to open or close, depending on which way the incline extends, thus causing a difference in the time in which the blade opens with respect to the time at which it closes.

The drive gear 55 and cylindrical member 56 turn in one direction only, and are mechanically prevented from turning in the opposite direction. The pinions 50, the eccentrics 51 and the shafts 49 therefor turn only in one direction.

Within the scope of my invention, the pins 71, instead of being formed upon or carried by the shutter leaves, might be formed upon or carried by the lower support ring 46 or equivalent part, and the straight or curved openings, slots or grooves 72 or 72a might be formed in the leaves themselves.

Having thus described one illustrative embodiment of the invention, it is to be understood that

although specific terms are employed, they are used in a generic and descriptive sense, and not for purposes of limitation, the scope of the invention being set forth in the following claims.

I claim:

1. A between-the-lens shutter for photographic cameras, comprising in combination, a case or housing adapted to be mounted upon the lens board or the like of a camera and having a suitable exposure opening, a series of shutter leaves or blades cooperatively positioned so as together, in one position to close and in another position to uncover said exposure opening, each of said shutter leaves or blades having within its perimeter a substantially circular formation, a corresponding series of disks directly and respectively mounted in and filling each of said substantially circular formations, each of said disks being eccentrically provided substantially within the perimeter thereof with a pivot upon which it turns to open and close said leaves or blades, means to turn each of said pivots in one direction through a complete revolution in a cycle of opening and closing the shutter leaves or blades, thereby to cause the leaves or blades to uncover said exposure opening and then to close the same; and cooperating guiding formations upon said shutter leaves or blades and upon a relatively stationary part of the shutter to establish the exact path of the opening and closing movements of said shutter leaves or blades.

2. A between-the-lens shutter in accordance with claim 1, wherein each leaf or blade is provided upon one face with a bearing plate having a substantially circular opening therein to receive the corresponding eccentrically mounted disk.

3. A between-the-lens shutter in accordance with claim 1, wherein each leaf or blade is provided upon one face with a bearing plate having a substantially circular opening therein to receive the corresponding eccentrically mounted disk, and wherein to constitute the cooperating guiding formations, each such bearing plate is provided with a guide pin, and a relatively stationary member of the shutter is provided with a slot-like formation that receives said guide pin.

4. A between-the-lens shutter in accordance with claim 1, wherein for the purpose of turning the eccentric disks, each of said disks has a pinion fast on its pivot.

5. A between-the-lens shutter in accordance with claim 1, wherein there is provided for imparting opening and closing movement to each of the leaves or blades a separate eccentric assembly consisting of such eccentric disk, a pinion and a shaft carrying said pinion, such shaft constituting the said pivot for the said disk.

6. A between-the-lens shutter in accordance with claim 1, wherein there is provided for imparting opening and closing movement to each of the leaves or blades, a separate eccentric assembly consisting of such eccentric disk, a pinion and a shaft carrying said pinion, such shaft constituting the said pivot for the said disk, and wherein at least one fixed support plate is provided in which all the said shafts are mounted.

7. A between-the-lens shutter in accordance

with claim 1, wherein each of the eccentric disks is provided with a surrounding flange for the purpose of retaining the corresponding shutter leaf or blade.

8. A between-the-lens shutter in accordance with claim 1, wherein the cooperating guiding formations are a guiding pin extending from the leaf or blade and a slot-like formation upon a relatively fixed part of the shutter and receiving said guide pin.

9. A between-the-lens shutter in accordance with claim 1, wherein the cooperating guiding formations are a pin extending from the leaf or blade and a straight slot upon a relatively fixed part of the shutter, and receiving said pin.

10. A between-the-lens shutter in accordance with claim 1, wherein there are provided cooperating means to hold the shutter in set position and cooperating means for releasing the shutter for making an exposure.

11. A between-the-lens shutter for photographic cameras comprising a casing having an exposure opening therein, a plurality of shutter leaves mounted in said casing and cooperating to close said exposure opening in one position and to uncover said exposure opening in another position, each of said shutter leaves having a circular formation, a plurality of circular disks, one of which is mounted in each of said circular formations to rotate therein, each of said disks fitting closely in its circular formation, a shaft secured to each disk eccentrically thereof, guide means in a relatively stationary part of the shutter, a second formation on each shutter leaf cooperating with said guide means to control the exact paths of the opening and closing movements of said shutter leaves, and means operable to rotate said shafts through a complete revolution per picture-taking cycle thereby to cause the shutter leaves to uncover said exposure opening and then to close the same in a cycle.

12. A between-the-lens shutter for photographic cameras, in accordance with claim 11, wherein there is a pinion on each of said shafts, and a drive gear in said casing, with which all of such pinions mesh, and wherein as the means to rotate said shafts through just a complete revolution per picture-taking cycle, springs are provided to rotate said drive gear and there is included stationary means to limit the motion of said drive gear, whereby each pinion and its disk makes just one revolution before the movement of said drive gear is stopped.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,307,751	Pirwitz	Jan. 24, 1919
1,828,215	Barenzy	Oct. 20, 1931
1,861,257	Barenzy	May 31, 1932
1,881,904	Owens	Oct. 11, 1932
2,269,400	Steiner	Jan. 6, 1942