United States Patent [19]

Baab

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[54] **IRIS DIAPHRAGM WITH LINEAR APERTURE SCALE**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **95/64 R**

[51] **Int. Cl.** **G03b 9/06**

[58] **Field of Search** ..... 95/64 R

[56] **References Cited**

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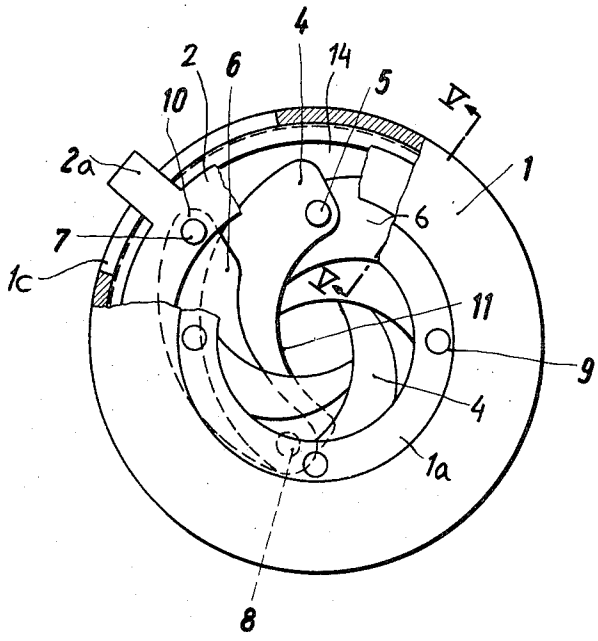
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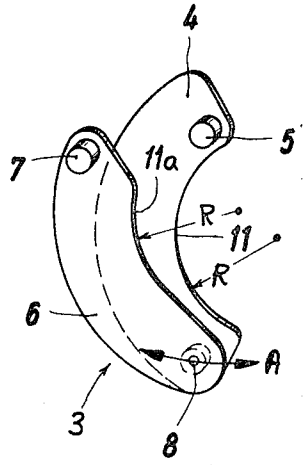
Primary Examiner—Joseph F. Peters, Jr.
Attorney—Karl F. Ross

[57] **ABSTRACT**

An iris diaphragm provided with a fixed mounting ring and a rotatable setting ring coplanar therewith has a multiplicity of angularly equispaced iris-leaf pairs each including a main leaf and an ancillary leaf articulated to each other at one end, the free opposite ends of the two leaves being respectively fulcrumed on the mounting ring and on the setting ring confronting the same side of the leaves. The generally crescent-shaped ancillary leaf has an arcuate inner edge with a radius of curvature substantially corresponding to the maximum radius of the diaphragm aperture; the main leaf may be of similar configuration of may have a generally elbow-shaped contour.

10 Claims, 6 Drawing Figures





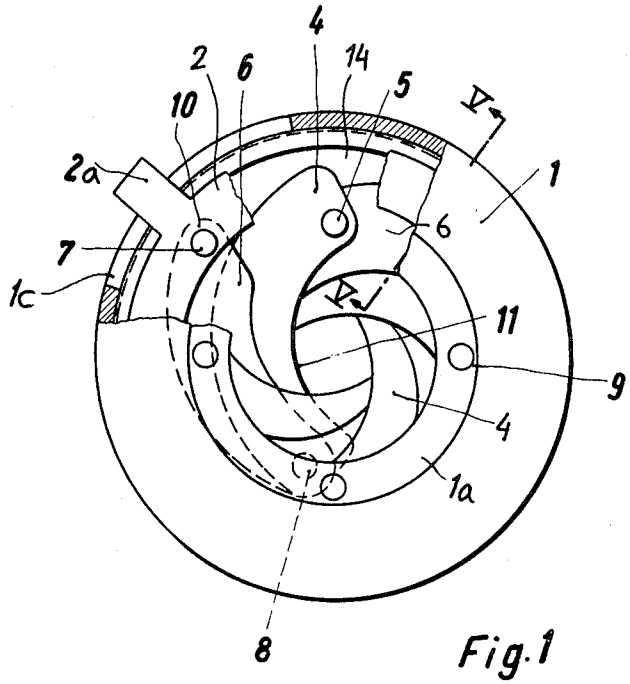


Fig. 1

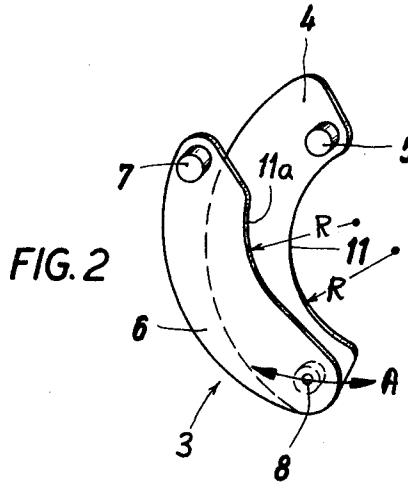


FIG. 2

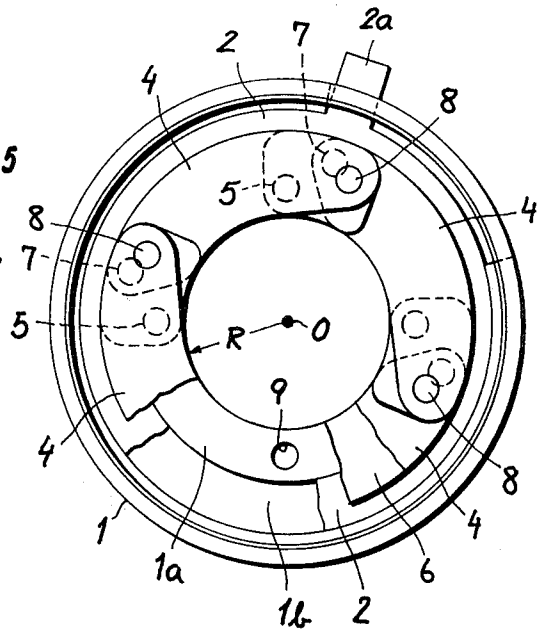


FIG. 6

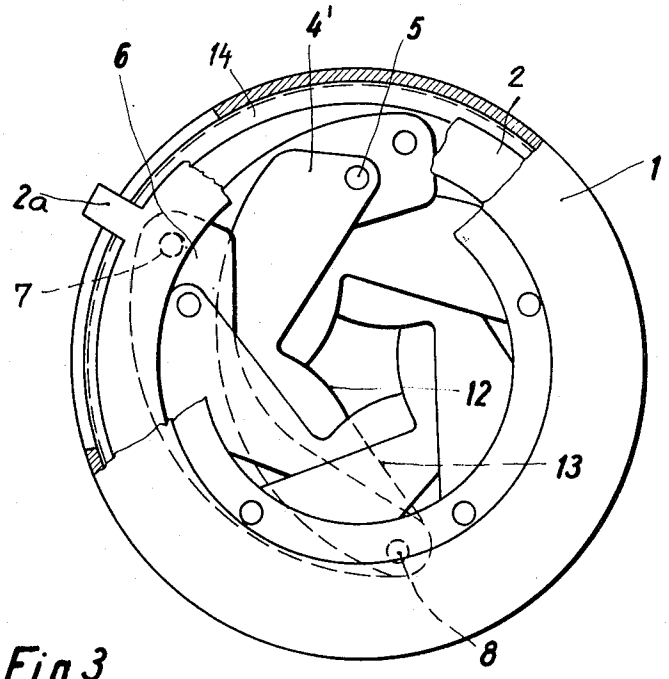


Fig. 3

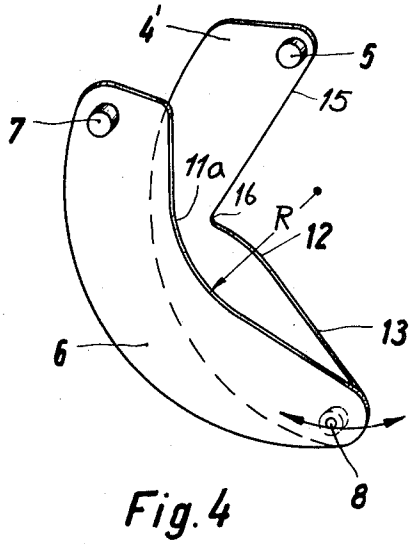


Fig. 4

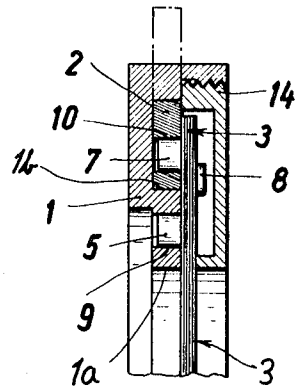


Fig. 5

IRIS DIAPHRAGM WITH LINEAR APERTURE SCALE

My present invention relates to an iris diaphragm of the type having two relatively rotatable rings, such as a movable setting ring and a stationary mounting ring, to which two sets of iris leaves are respectively pivoted, the leaves of one set being individually articulated to corresponding leaves of the other set so as to form therewith a number of iris-leaf pairs controlling diaphragm aperture or stop size.

Conventional diaphragms of this nature require considerable space for their pivots, particularly if the setting ring is to be rotatable through an arc greater than about 8° in order to cover a wide range of aperture stops. As a result, the outer diameter of the mounting ring must be relatively large with reference to the maximum diameter of the diaphragm aperture which in turn necessitates a larger dimensioning of the objective housing.

The principal object of my present invention is to provide an iris diaphragm of this type, e.g., for objectives of laboratory cameras or the like, which has a linear aperture scale over an extended range of stops while being of compact size, i.e., of relatively low ratio of outer to inner diameter in the position of maximum diaphragm aperture.

A more particular object is to provide a diaphragm of this character using only a small number of iris-leaf pairs (e.g. four or five) to accomplish these aims.

An iris diaphragm according to my present invention has its two relatively rotatable rings disposed on the same side of its iris-leaf assembly, the first ring (e.g. the fixed mounting ring) forming an inner annular land to which an end of one leaf of each pair (referred to hereinafter as an ancillary leaf) is pivoted; an end of the other leaf (referred to hereinafter as the main leaf) is pivoted to an outer annular land which is formed by the second ring, e.g., the rotatable setting ring, and is substantially coplanar with the inner land, the plane of the two lands being transverse to their common axis. The articulatedly interconnected opposite ends of the two leaves, projecting inwardly toward the axis in an angular position defining the minimum aperture stop, come to lie alongside the inner land in an alternate position defining the maximum aperture stop.

At least in the positions of the smaller aperture stops, in which the two pivots are relatively far apart, the aperture is bounded only by the inner edges of the main leaves. In some instances, in which the inner edges have an angled shape designed to extend the linearity of adjustment toward the zero-diameter end of the stop range, the inner edge of the ancillary leaf may intervene in the positions of maximum and near-maximum aperture. In either case it is advantageous to make the ancillary leaf generally crescent-shaped with an arcuate concave edge (i.e. the aforementioned inner edge) whose radius of curvature substantially equals the radius of the inner periphery of the smaller one of the two concentric rings, specifically the mounting ring in the preferred construction.

The above and other features of my invention will be described in detail hereinafter with reference to the accompanying drawing in which:

FIG. 1 is a face view of a diaphragm with four iris-leaf pairs embodying my invention, shown in an intermediate position of partial closure;

FIG. 2 is a perspective view of one of the leaf pairs of the diaphragm of FIG. 1;

FIG. 3 is a face view similar to FIG. 1 bit showing a diaphragm with five iris-leaf pairs embodying my invention;

FIG. 4 is a perspective view of one of the leaf pairs of the diaphragm of FIG. 3;

FIG. 5 is a fragmentary cross-sectional view taken on the line V—V of FIG. 1; and

FIG. 6 is a partial face view of the assembly of FIG. 1 as seen from the opposite side and in a wide-open position.

The iris diaphragm shown in FIGS. 1, 2 and 5 comprises an annular mounting 1 integral with a ring 1*a*, this mounting being recessed at 1*b* to form an annular seat for a setting ring 2 with a lug 2*a* projecting outwardly through a peripheral slot 1*c*. Lug 2*a* can be moved manually or automatically to rotate the setting ring 2 with reference to the mounting ring 1*a* about their common axis 0. The two rings 1*a* and 2 are each provided with four peripherally equispaced bores 9 and 10, respectively, accommodating pivot pins 5 and 7 of main leaves 4 and ancillary leaves 5 best illustrated in FIG. 2. The ends of these leaves remote from their pivots are interconnected by a rivet 8 so as to form an iris-leaf pair 3 swingable in the direction of arrow A when the setting ring 2 is displaced in either direction from its intermediate position illustrated in FIG. 1.

As best seen in FIG. 5, the two concentric rings 1*a* and 2 form a pair of coplanar lands on one side of the assembly of iris-leaf pairs 3, the heads of rivets 8 projecting from the opposite side into a space formed by an annular cover 14 removably threaded into the mounting 1.

In the embodiment of FIGS. 1, 2 and 6, in which the iris-leaf pairs 3 are fulcrumed at locations 90° apart, the main leaf 4 and the ancillary leaf 6 are both generally crescent-shaped with an arcuate inner edge 11 or 11*a* whose radius of curvature R equals the inner radius of ring 1*a*. In a position in which their pivots 5 and 7 are close together, with lug 2*a* swung clockwise from the position shown in FIG. 1, their interconnected ends lie alongside the land of ring 1*a*, as best seen in FIG. 6. This Figure also shows clearly that the several leaf pairs overlap one another in imbricated relationship, with the articulated end of each pair (carrying the rivet 8) overlaying the pivoted ends of an adjoining pair on the side remote from rings 1*a* and 2. The iris leaves, of course, are sufficiently flexible to allow their articulated ends to approach one another rather closely, despite the imbrication, when the lug 2*a* is swung to its opposite limiting position (counterclockwise in FIG. 1). It will be noted that the diaphragm aperture is defined by the arcuate edges 11 and has the approximate outline of a square with bulging sides.

The embodiment of FIGS. 3 and 4 is generally similar to the one just described, like reference numerals having been used for elements which have not been significantly modified; the cross-sectional view of FIG. 5 is also applicable to this embodiment and the imbricated relationship of the iris leaves is the same. In this case, however, there are five leaf pairs 4', 6, the main leaf 4' being generally elbow-shaped rather than crescent-shaped as in the previous case. The inner edge of leaf 4' has a substantially straight portion 15 angularly adjoining a convex portion 12 which extends generally per-

pendicularly thereto and merges tangentially into a substantially linear portion **13** including an obtuse angle with portion **15**. Because of the reduced width of the leaf **4'** at the corner **16** of its inner edge, the arcuate edge **11***a* of ancillary leaf **6** cuts across the angled edge in the region of that corner when the two leaves are aligned in the wide-open position of FIG. **6**.

The five peripherally equispaced leaf pairs of FIGS. **3** and **4**, fulcrumed at locations 72° apart, define a diaphragm aperture which in the intermediate position of setting ring **2** is bounded by the convex edge portions **12** of leaves **4'** and has a generally pentagonal outline. With increasing aperture, as the edge portion **12** swings past the edge **11***a* of ancillary leaf **6**, the latter takes over the function of limiting the ray path through the diaphragm.

The iris-leaf assembly according to my invention provides a substantially linear scale of aperture stops, i.e., the angle of rotation of setting ring **2** varies in proportion to the effective cross-sectional area of the diaphragm. This range of linearity encompasses six of the usual stop positions in the embodiment of FIGS. **1** and **2** but extends to a larger number of stops in the modification of FIGS. **3** and **4**. The outer diameter of the assembly, as illustrated, is less than twice its inner diameter **2R** in the second embodiment and only slightly greater, proportionally, than in the first one. No camming slots, curves or radial grooves are necessary; thus, my system affords very exact positive guidance for the iris leaves.

I claim:

1. An iris diaphragm comprising:

a first ring and a second ring respectively forming an inner annular land and an outer annular land substantially flush in a plane transverse to a common axis thereof, said rings being relatively rotatable about said axis; and

a plurality of iris-leaf pairs on one side of said plane each including a main leaf with an end pivoted to said inner land and an ancillary leaf with an end pivoted to said outer land, the opposite ends of said leaves being articulated to each other and projecting inwardly toward said axis in a first relative angular position of said rings by lying alongside said inner land in a second relative angular position of said leaves, thereby defining minimum and maximum aperture stops.

2. An iris diaphragm as defined in claim **1** wherein said first ring forms part of an annular diaphragm mounting having an annular peripheral recess, said second ring being seated in said recess.

3. An iris diaphragm as defined in claim **2** wherein said mounting is provided with a removable annular cover overlying said leaves on the side remote from said lands.

4. An iris diaphragm as defined in claim **1** wherein said ancillary leaf is generally crescent-shaped with an arcuate concave edge whose radius of curvature substantially equals the radius of the inner periphery of said first ring.

5. An iris diaphragm as defined in claim **4** wherein said main leaf is generally crescent-shaped with an arcuate concave edge of substantially the same radius of curvature as the concave edge of said ancillary leaf.

6. An iris diaphragm as defined in claim **5** wherein the number of said iris-leaf pairs is four, the pivots of corresponding leaves thereof being spaced 90° apart.

7. An iris diaphragm as defined in claim **4** wherein said main leaf is generally elbow-shaped with an angularly bent inner edge having a substantially straight portion, a convex portion generally perpendicular thereto and a substantially linear portion near the articulated end thereof, the latter portion including an obtuse angle with said substantially straight portion.

8. An iris diaphragm as defined in claim **7** wherein the concave edge of said ancillary leaf cuts across said angularly bent inner edge in said second relative angular position.

9. An iris diaphragm as defined in claim **7** wherein the number of said iris-leaf pairs is five, the pivots of corresponding leaves thereof being spaced 72° apart.

10. An iris diaphragm as defined in claim **1** wherein the articulated end of the leaves of each pair overlap the pivoted ends of the leaves of an adjoining pair in imbricated relationship in said second angular position.

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