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[21] Appl. No **810,639**

[22] Filed **Mar. 26, 1969**

[45] Patented **July 20, 1971**

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[32] Priority **Apr. 4, 1968**

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[31] **P 17 72 142.5**

[50] Field of Search..... 350/41, 42,
44, 187, 255, 310, 40, 46, 47; 95/12.5, 45, 46;
267/65; 188/87, 94; 74/27; 355/62, 63

[56] **References Cited**

UNITED STATES PATENTS			
552,006	12/1895	Runkel	188/94 UX
756,881	4/1904	Nehring.....	95/45
2,572,919	10/1951	French et al.....	95/12.5 UX
2,851,924	9/1958	Beusker.....	350/255
2,906,185	9/1959	Naumann et al.....	95/45 X
2,506,947	5/1950	Walker.....	350/187
2,540,017	1/1951	Thompson.....	355/63 X

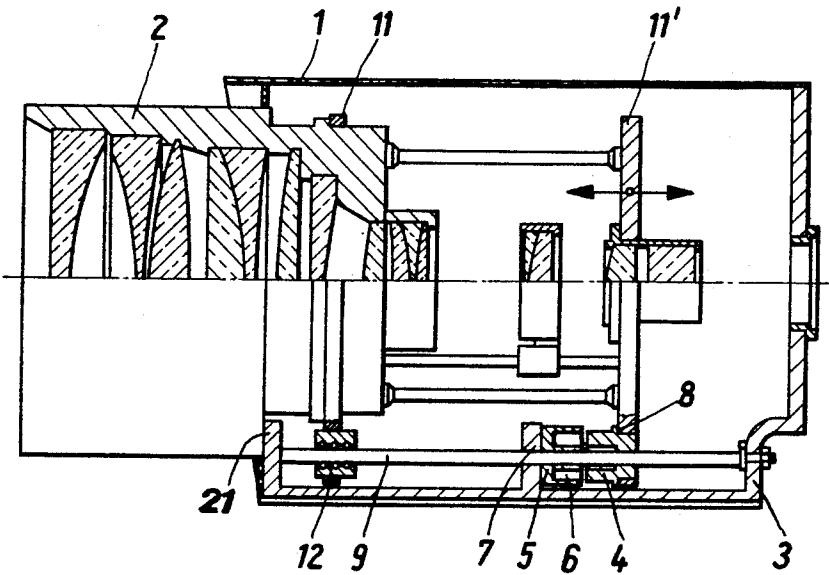
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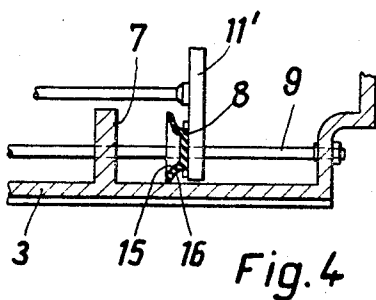
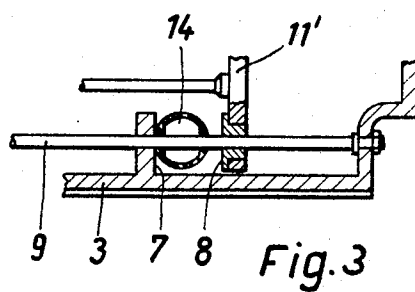
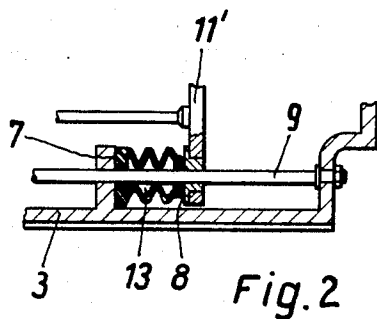
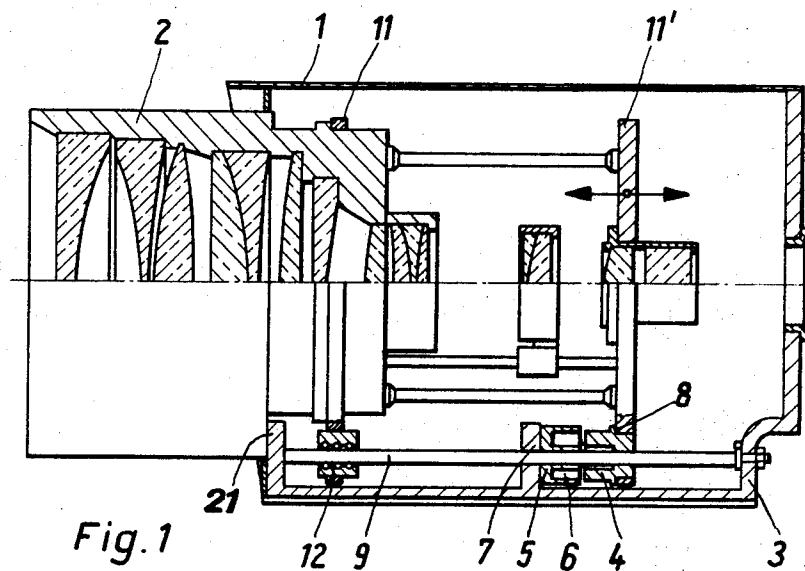
[54] **SHOCK ABSORBER FOR ADJUSTABLE OPTICAL COMPONENTS**
1 Claim, 4 Drawing Figs.

[52] U.S. Cl..... **350/255,**
350/187

[51] Int. Cl..... **G02b 7/04**

ABSTRACT: A hydraulic or pneumatic bumper is interposed between a slidable lens assembly and a support therefor to cushion the impact in a terminal position of the displacement stroke.





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SHOCK ABSORBER FOR ADJUSTABLE OPTICAL COMPONENTS

Our present invention relates to an optical system wherein an objective or a part thereof is displaceably mounted on a support that is to be movable between two limiting positions.

The displacement (particularly in axial direction) of one or more lenses of an optical system is used to vary the effective focal lens of a zoom-type objective and/or to select the range. In small cameras, this adjustment of an objective component generally does not give rise to objectionable impact objectionable impact so that a padding of cork, rubber or other elastic material will sufficiently damp the shock as the mobile parts strike a fixed stop. In the case of larger equipment, however, e.g. as used in television cameras, this is no longer true inasmuch as the mobile masses are heavy enough to generate appreciable shocks which could damage the sensitive optical elements.

It is, therefore, the general object of our invention to provide means in such optical system for effective cushioning the impact of two relatively movable parts in order to prevent possible dislocations.

The use of conventional dashpot assemblies in a shock absorber of this nature is not practical since optical components frequently must be adjusted quite rapidly in either direction. It is, therefore, a more particular object of our invention to provide means effective only in a terminal phase of displacement to retard the advance of the mobile unit toward its limiting position.

These objects are realized, pursuant to our present invention, by the interposition of a shock absorber including a fluid cushion between a part of the movable lens assembly and a part of its support, the fluid cushion becoming effective only in a terminal phase of the displacement stroke.

Although, in principle, the working fluid of the shock absorber could be either a hydraulic liquid or a gas, the use of gases—especially air—is particularly advantageous in order not to encumber the system.

More specifically, the cushion-forming air may be trapped in a chamber communicating with the outer atmosphere through a vent or other restricted passage through which the air, on contraction, may slowly escape and which in turn allows the air to re-enter upon reversal of motion. Thus, according to an advantageous embodiment, the chamber may be formed by an open-ended cylinder and a piston on two relatively movable parts, the piston being normally withdrawn from the cylinder but fitting into its open end with small clearance as the two parts approach close to each other. The chamber could also be formed by a flexible, preferably resilient envelope which may be traversed by a guide rail in an incompletely fluidtight manner so that its interior can limitly communicate with the outer atmosphere.

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

FIG. 1 illustrates, partly in side elevation and partly in axial section, a camera objective provided with shock absorber means embodying the invention; and

FIGS. 2—4 are sectional detail views illustrating several modifications of the system of FIG. 1.

In FIG. 1 we have illustrated a camera housing 1 whose bottom forms a well 3 spanned by several parallel guide rails 9 (only one shown) on which a lens carrier 2 is slidably supported. Carrier 2 has extensions 11, 11', the first one forming a seat for ball bearings 12 engaging the rails 9 whereas the second one supports pistons 4 individually straddling these

rails, each piston confronting an open-ended cylinder 5 on a stationary rib 7 traversed by the rails 9. A boss 6 inside cylinder 5 defines therewith a ring channel adapted to receive an annular face of the corresponding piston 4 with small peripheral clearance whereby the air in that space is compressed as the part 22 approaches the rib 7. A flange 8 on piston 4 limits the penetration of a small residual air pocket therein which facilitates the subsequent separation of the piston 4 from the cylinder 5.

In the operation of the system of FIG. 1, which may be part of a television camera, the lens carrier 2 can be axially displaced along the rails 9 and can be locked, by conventional clamps or the like not shown, in a selected position. If, upon release of these clamps, the camera should be tilted forwardly, the carrier 2 will tend to slide toward the left, yet the impact of the approach of extensions 11, 11' to their respective stops 21, 7 will be cushioned by the interengagement of pistons 4 and cylinders 5. Naturally, a similar shock absorber may be effective in the other limiting position of the lens carrier 2; for this purpose, one or more duplicates of piston 4 and cylinder 5 could be mounted, for example, on extension 11 and rib 7, respectively, in confronting relationship.

FIG. 2 shows generally the same system wherein, however, the piston-and-cylinder assembly of FIG. 1 has been replaced by a bellows 13 on rib 7. The bellows 13 is traversed by the rail 9 with enough clearance to allow its interior to communicate, to a restricted extent, with the outside air. After the lower end of carrier extension 11' has compressed the bellows 13, the carrier can freely move in the opposite direction (i.e. to the right) whereupon the bellows gradually re-expands preparatorily to a further reversal of motion.

In FIG. 3 the bellows 13 has been replaced by a spherical envelope or ball 14 which, again, may have some communication with the surrounding atmosphere at the points of traverse of rail 9. Naturally, there may be an individual bellows 13 or ball 14 mounted on each rail 9.

In FIG. 4, finally, a resilient cup 15 similar to conventional suction cups has been mounted on the carrier extension 11' to confront a flat surface of rib 7; this cup is not traversed by a rail 9 but may be disposed between two parallel rails. In order to allow for the escape of air from the interior of the cup in its contacting position, and for the reentry of air upon reversal of the motion of carrier 2 (FIG. 1), a small vent hole 15 is formed in its wall.

We claim:

1. In an optical system including a lens support with a rail parallel to an optical axis and lens means having a part slidably guided by said rail for displacement between two limiting positions, the combination therewith of shock absorber means including a cylinder member with an open end and a piston member coaxial therewith confronting said open end, one of said members being mounted on said guided part with its axis parallel to the direction of displacement, the other of said members being mounted on a part of said support and being spaced from the other of said members during a major portion of a displacement stroke between said limiting positions, said piston member entering the open end of said cylinder member upon said lens approaching one of said limiting positions and being receivable in said open end with small clearance for cushioning the terminal movement of the lens by compressing the air trapped in said cylinder member, said piston member and said cylinder member being axially traversed by said rail, said cylinder member having a central boss hugging said rail and defining with the cylinder wall a ring channel, said piston member having an annular face spaced from said rail and receivable in said ring channel.