United States Patent [19]

Massey

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[54] CAM FOLLOWER ASSEMBLIES

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[51] **Int. Cl.** **F16h 21/44**

[58] **Field of Search** 74/89, 569, 568, 74/567, 99

[56] **References Cited**

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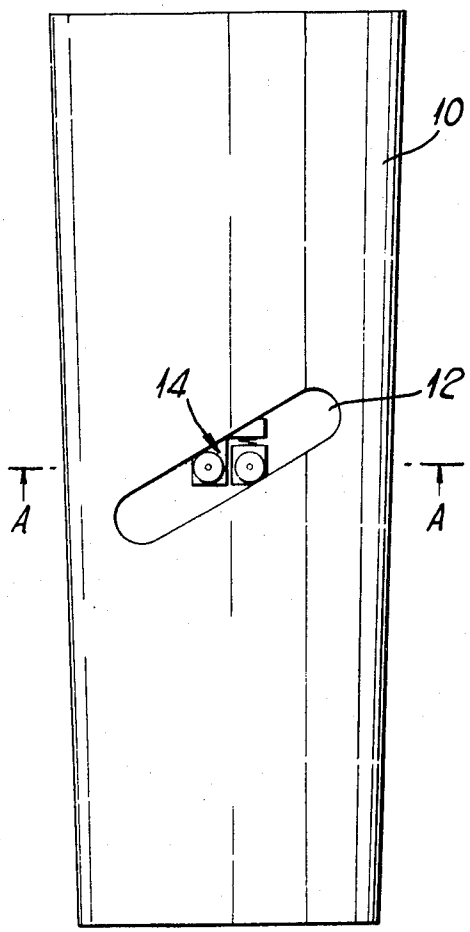
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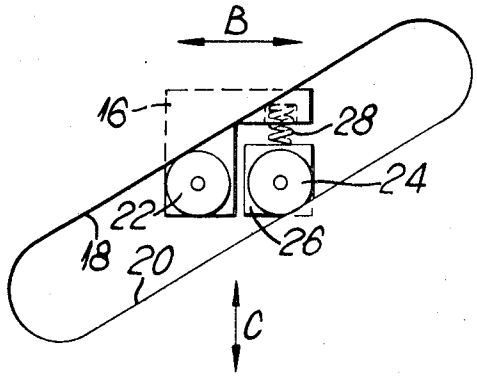
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Attorney—Holcombe, Wetherill & Brisebois

[57] **ABSTRACT**

A cam follower assembly comprises two followers biased apart, in a direction transverse to the movement controlled by the cam, against two cam faces. By attaching the element moved to one follower, movement in either direction is controlled by one cam face, and accurate control can be achieved with a small assembly.

5 Claims, 3 Drawing Figures





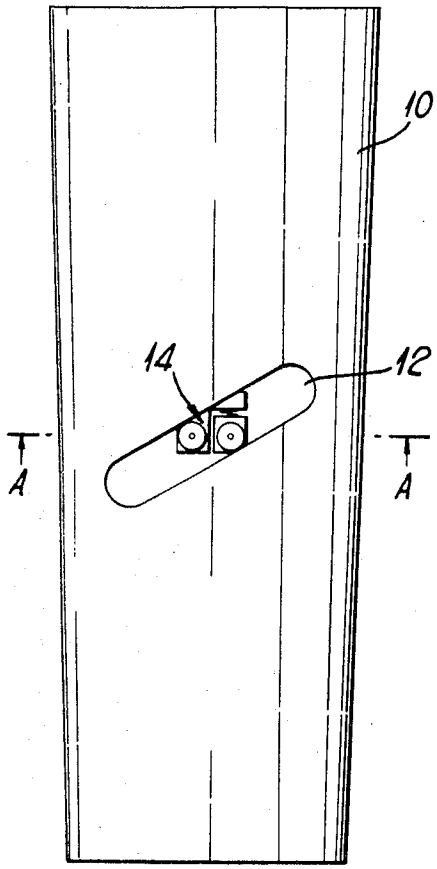
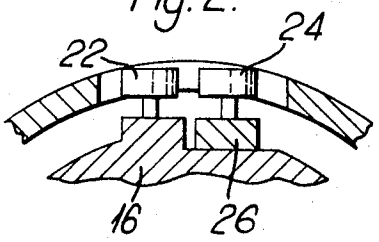


Fig. 1.

Fig. 2.



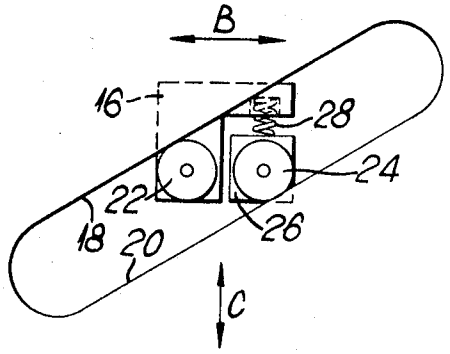


Fig. 3.

CAM FOLLOWER ASSEMBLIES

This invention relates to cam followers. It is particularly useful in cam systems for zoom lenses and a specific embodiment described below illustrates such an application, but the invention is not limited to such a use.

In any cam system, relative displacement in the direction between a cam and a cam follower assembly causes relative movement in a second direction.

One object of this invention is to provide a cam follower assembly which allows movement in either sense in the second direction to be controlled by the same cam profile.

Another object is to provide a cam follower assembly whose dimension in the second direction is small.

Accordingly, the present invention provides a cam follower assembly for co-operating with a cam having a control face and a back-up face, the assembly comprising a base member, a control cam follower mounted on the base member for co-operation with the cam control face, and a back-up cam follower connected to the base member by resilient means for biasing into engagement with the cam back-up face, the control and back-up cam followers being disposed to the direction of movement of the assembly controlled by the control face.

Preferably, the cam followers are disposed so that the line joining their centres is perpendicular to said direction.

Each cam follower may suitably be a roller journalled for rotation along its respective cam face.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIG. 1 illustrates a zoom lens assembly incorporating a cam follower according to this invention;

FIG. 2 is a partial section taken on the line A—A of FIG. 1; and

FIG. 3 shows the cam follower with the developed cam profile superimposed.

Referring now to the drawings, a zoom lens assembly includes a tubular sleeve **10** having cut in it a cam slot **12.** A cam follower assembly **14** mounted inside the sleeve has a base member **16** to which is attached a lens element (not shown) which is moved axially of the sleeve **10** to adjust the focal length (zoom) or focus of the lens assembly. Thus a cam slot **12** and follower assembly **14** co-operate to allow adjustment of zoom or focus to be made by rotating the sleeve **10.** The axial movement of the follower assembly **14** is controlled by a control face **18** of the cam slot **12** and a back-up face **20** of the slot **12** assists in this control and in preventing backlash, as will be explained.

Turning now to the follower assembly **14,** a first roller **22** constitutes a control cam follower and is journalled on the base member **16** for rotation along the control face **18.** A second roller **24** is journalled on a support **26** for rotation along the back-up face **20.** The support **26** is slidingly mounted on the base member **16** and is biased in a direction parallel to the lens axis by a coil spring **28.** The rollers **22, 24** are disposed equidistantly on either side of the lens axis with their axes equally spaced from and parallel to a line perpendicular to the lens axis.

Thus, as best seen in FIG. **3,** as the sleeve **10** is rotated in the direction B, the follower assembly **14** (and hence the lens element) move in the direction C in a manner which is controlled entirely by the control face **18.** The spring **28** both urges the rollers **22, 24** into contact with the faces **18, 20** thus minimising backlash in the follower assembly, and also takes up any irregularity in the profile of the back up face **20.**

The follower assembly according to the invention thus allows movement in the direction C to be controlled by a single cam face, and the back-up face need not be cut with the accuracy required for the control face.

Further, the disposition of the rollers allows the use of a cam slot of small axial dimension, thus reducing the rotating mass, and either a follower assembly of small axial dimensions or the employment of larger diameter rollers for a given size of cam slot with a consequent reduction in wear. Also, since the roller axes are parallel, the distance of the rollers radially from the lens axis is not critical and the cam form will be reproduced accurately provided only that the rollers are maintained in contact with the cam faces.

I claim:

1. A cam follower assembly for co-operating with a cam having a control face and a back-up face, the assembly comprising a base member, a control cam follower mounted on the base member for co-operation with the cam control face, and a back-up cam follower connected to the base member by resilient means for biasing said back-up cam follower into engagement with the cam back-up face, the control and back-up cam followers being disposed so that the line joining their centers is transverse to the direction of movement of the assembly controlled by the control face.

2. An assembly as claimed in claim **1,** in which the cam followers are disposed so that the line joining their centres is perpendicular to said direction.

3. An assembly as claimed in claim **1,** in which each cam follower is a roller journalled for rotation along its respective cam face.

4. An assembly as claimed in claim **1,** in which the resilient means is a coil spring.

5. In an assembly including a first member defining first and second cam faces and adapted for movement in one direction, and a second member carrying cam follower means cooperating with said cam faces to cause movement of said second member in a second direction in response to movement of said first member in said first direction, the improvement wherein said cam follower means comprises a base member, a first cam follower mounted on the base member for cooperation with said first cam face, a second cam follower, and resilient means connecting said second cam follower to said base member, said cam followers being disposed with the line joining their centres oblique to said second direction.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,754,473 Dated August 28, 1973

Inventor(s) RICHARD ANTHONY MASSEY

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

[30] Foreign Application Priority Data

January 27, 1971 Great Britain . . . 3303/71

Signed and sealed this 19th day of March 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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