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(71) Applicant: **Freeman & Pardoe Limited**
Alcester
Warwickshire B49 6ES (GB)

(72) Inventor: **Clingan, Andrew Kevin**
Stratford Upon Avon, Warwickshire CV37 4 (GB)

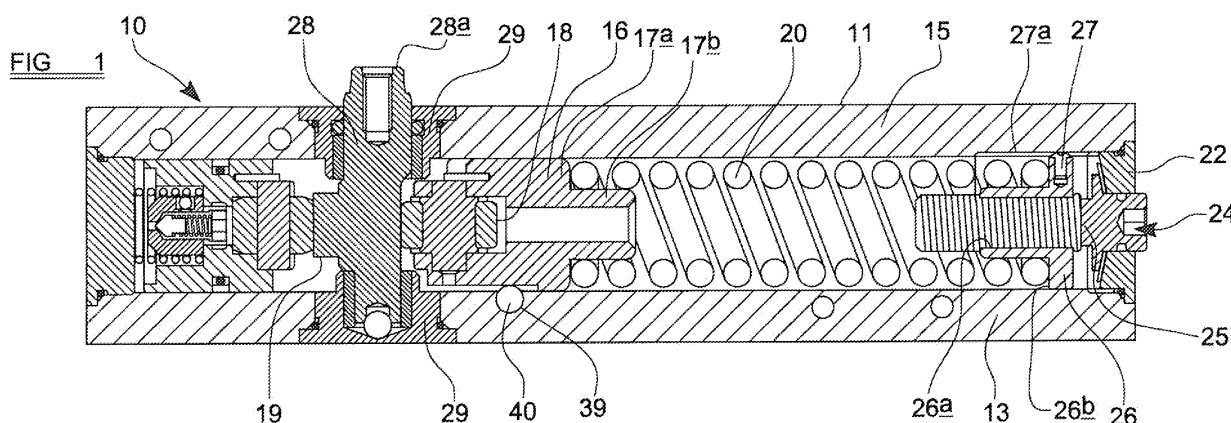
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(74) Representative: **Ashton, Timothy**
Forrester & Boehmert
Pettenkoferstrasse 20-22
80336 München (DE)

(54) **Apparatus for controlling angular movement of a door**

(57) An apparatus for controlling angular movement of a door is described. The apparatus includes a housing (11); a piston (16), having a longitudinal axis, slidable in a passage in the housing; a cam member (19) which is connected to, supported on or integral with a rotatable axle which extends transversely through the housing;

and a spring member (20) positioned in the passage in the housing (11) for biasing an end of the piston (16) into engagement with a surface of the cam member (19). The apparatus also includes a holding member (40) which extends through a wall of the housing and engages a part of the piston (16), the holding member (40) inhibiting rotation of the piston (16) about its longitudinal axis.



Description

[0001] This invention relates to an apparatus for controlling angular movement of a door.

[0002] Such apparatuses are well known in the art and are commonly known as "door closers". There are two main types of door closer in use today - these are known in the art as "rack and pinion" and "cam-action" door closers.

[0003] As a result of the UK Disabled Discrimination Act 1995, the force required to open a door (the force being measured at an edge of the door remote from its hinged connection to the door frame) during the first 30° of angular movement should not exceed 30N. Furthermore, the force required to open a door during the second 30° (i.e. 30° to 60°) of angular movement should not exceed 22.5N. These criteria have been introduced to ensure that disabled persons can easily open a door which is fitted with such an apparatus as above described.

[0004] Unfortunately, some configurations of "rack and pinion" door closer could not meet these criteria as the initial force required to open the door is too great. Thus, the "cam action" door closer was developed as this type of door closer was able to function within the force criteria set as a result of the UK Disabled Discrimination Act 1995.

[0005] A "cam action" door closer typically comprises a piston slidably mounted in a cylinder in a housing, which housing is connectable, conventionally, to an upper part of a door. The piston is biased towards one end of the housing, into engagement with a cam member, by a spring. The cam member is connected to, supported on or integral with an axle which extends transversely through the housing. The axle is rotatable about an axis which is perpendicular to a longitudinal axis of the piston. One end of the axle, which end protrudes through an aperture in the housing, is pivotally connected to an arm. The other end of the arm is slidably supported in a track which is connected to a frame supporting the door. The cam member, which is engaged by a cam follower supported on the piston, is configured such that, in combination with the piston and spring, it provides a substantially uniform resistance force to the opening of the door, which meets the criteria referred to above. The door closer also comprises a hydraulic damper mechanism to provide smooth closing of the door. It should be appreciated that in an alternative configuration, the housing could be connected to a frame supporting the door, with the track supporting the arm being connected to the door itself.

[0006] The force of the spring acting on the piston can be increased or decreased by a device which compresses or decompresses the spring. The compressing/decompressing device is conventionally supported in an end cap which is threadably engaged with one end of the housing.

[0007] One problem with cam-action door closers is that during use, the piston and the spring may rotate about their longitudinal axes in the cylinder in the housing.

Rotation of the piston/spring in this way may result in an adjustment of the compressing/decompressing device, which may result in a change in the effective length of the spring. In addition, rotation of the piston in use can have the effect of causing misalignment of the cam follower and the cam member, which can result in undesirable point loading leading to excessive wear to these components.

[0008] It is therefore an object of the present invention to address the above problem.

[0009] Therefore, according to a first aspect of the invention there is provided an apparatus for controlling angular movement of a door, the apparatus including:-

a housing;
a piston, having a longitudinal axis, slidable in a passage in the housing;
a cam member which is connected to, supported on or integral with a rotatable axle which extends transversely through the housing; and
a spring member positioned in the passage in the housing for biasing an end of the piston into engagement with a surface of the cam member,

wherein the apparatus includes a holding member which extends through a wall of the housing and engages a part of the piston, the holding member inhibiting rotation of the piston about its longitudinal axis.

[0010] Further features of the first aspect of the invention are set out in claims 2 to 5 appended hereto.

[0011] According to a second aspect of the invention there is provided a method of modifying an apparatus for controlling angular movement of a door, the apparatus including:-

a housing;
a piston, having a longitudinal axis, slidable in a passage in the housing;
a cam member which is connected to, supported on or integral with a rotatable axle which extends transversely through the housing; and
a spring member positioned in the passage in the housing for biasing an end of the piston into engagement with a surface of the cam member,
the method including:-

creating an aperture in a wall of the housing, which aperture extends through a wall of the housing and communicating with the passage in the housing; and
passing a holding member through the aperture into engagement with a part of the piston.

[0012] Further features of the second aspect of the invention are set out in claims 7 to 10 appended hereto.

[0013] Examples of the invention will now be described by way of example only with reference to the accompanying drawings, of which:-

Figure 1 is a cross-sectional view of an apparatus in accordance with the present invention;

Figure 2 is a further cross-sectional view of an apparatus in accordance with the present invention;

Figure 3 is a yet further cross-sectional view of an apparatus in accordance with the present invention; and

Figure 4 is an end view of the apparatus corresponding to figure 1.

[0014] Referring to the figures there is shown an apparatus 10 for controlling angular movement of a door. The apparatus 10 includes a housing 11 which is rectangular in cross-section and has four side walls, 12, 13, 14, 15. The side walls are positioned such that walls 12 and 14 face each other and walls 13 and 15 face each other. The housing is filled with a hydraulic fluid, e.g. a suitable oil.

[0015] Interior surfaces of the walls 12, 13, 14, 15 define a cylinder, which extends lengthwise of the housing 11, and supports a piston 16. The piston 16 is slidable in the cylinder in the housing 11 and is biased towards one end of the housing 11 by a spring member 20. The spring member 20 in this example is a helical spring, but it must be appreciated that many other types of spring could be used without departing from the scope of the present invention.

[0016] An end of the spring member 20 remote from the piston 16 is supported by a spring compressing/decompressing device 24, which can be manually adjusted to reduce/increase the effective length of the spring member 20. The device 24 includes a part 26 which is moveable lengthwise of the housing 11. The part 26 has a threaded bore 26a to receive a screw part 25, and a flange part 26b which engages an end of the spring 20. The part 26 is inhibited from rotation about its longitudinal axis by an holding part 27 which is received in a recess 27a in an interior surface of the side wall 15. One end of the screw part 25 is supported for rotation in an aperture in an end cap 22, which end cap 22 is threadedly engaged with an end of the housing 11 remote from the piston 16. Rotation of the screw part 25 in one direction, e.g. using an Allen key inserted into a recess in the screw part 25, compresses the spring member 20, thus rendering a door to which the apparatus 10 is connected harder to open. Rotation of the screw part 25 in an opposite direction decompresses the spring 20, thus rendering the door easier to open.

[0017] An end of the spring member 20 remote from the device 24 engages and receives parts of the piston 16. More specifically, a stepped part 17a of the piston 16 engages an end of the spring member 20 and a projecting part 17b of that end of the piston 16 is received in the end of the spring member 20.

[0018] An end of the piston 16 remote from the part 17

supports a cam follower 18, which rotatable, in normal use, about an axis substantially perpendicular to the longitudinal axis of the housing 11. The spring member 20 biases the cam follower 18 into engagement with a surface of a cam member 19.

[0019] In this example the cam member 19 is heart shaped in plan view (see figures 2 and 3) and is integral with a rotatable axle 28 which extends transversely through the housing 11 - the axis of rotation of the axle 28 is substantially parallel with the axis of rotation of the cam follower 18. It should be noted that the cam member 19 could, alternatively, be connected to or supported on a separate axle. The use of a heart shaped cam member 19 means that the force required to open a door to which the apparatus 10 is connected reduces as the door is progressively opened. This aids the apparatus 10 in compliance with the regulations brought into effect as a result of the UK Disabled Discrimination Act 1995.

[0020] One end 28a of the axle 28 extends through an aperture in the side wall 15 and is supported for rotation by a suitable bearing 29. An opposite end of the axle 28 is supported by a respective bearing 29 in a recess in the side wall 13.

[0021] An end of the housing 11 remote from the end cap 22 supports a hydraulic damper mechanism 50, which includes a piston 51 slidable in that end of the cylinder in the housing 11. A part of the piston 51 supports a cam follower 54 which is rotatable, in normal use, about an axis substantially perpendicular to the axle 28. A spring member 52 is positioned between the piston 51 and an end cap 53, the spring 52 serving to bias the cam follower 54 into engagement with a surface of a cam member 19. The end cap 53 is threadedly engaged with the end of the housing 11. The piston 51 is therefore movable by the cam member 19 when the apparatus 10 is operated. The damper mechanism 50 is configured such that movement of hydraulic fluid from a cavity defined by the piston 51 and the end cap 53 to the remainder of the housing 11 is controlled. This ensures that a door to which the apparatus 10 is connected does not close too quickly.

[0022] The damper mechanism 50 also includes an overload valve, generally indicated at 55, which acts to control axial movement of the piston 51 if, for example, a door to which the apparatus 10 is connected is forcibly closed by a person.

[0023] The apparatus 10 also includes a holding member in the form of a cylindrical member or pin 40 (see figures 1 and 3) which extends through an aperture 39 in the side wall 13 of the housing 11. The pin 40 engages a flattened surface of the piston 16 which inhibits rotation of the piston 16 about its longitudinal axis. The aperture 39 in the side wall 13 is closed by a closing member in the form of a ball bearing 41, although it should be appreciated that an appropriate member could be used so long as it completely closes the aperture 39.

[0024] The apparatus 10 operates as follows. In use, the end 28a of the axle is connected to one end of an

arm (not shown). The other end of the arm is slidably supported in a track. The apparatus 10 may be installed such that the housing 11 is connected to a door and the track is connected to a frame supporting the door or a surface adjacent the door. Alternatively, the housing 11 may be connected to a frame supporting the door or a surface adjacent the door, with the track being connected to the door.

[0025] When a person pushes on the door, so as to open the door, the arm pivots causing the axle 28 to rotate. Rotation of the axle 28 effects rotation of the heart shaped cam member 19 which forces the piston 16 towards the end cap 22, against the force of the spring 20. When the door is fully opened the cam has been rotated substantially 180° about its axis.

[0026] The provision of the holding member 40 is highly advantageous as it inhibits rotation of the piston 16 as the piston 16 is moved reciprocally by the cam member 19 in the cylinder in the housing 11. The holding member 40 ensures that the cam follower 18 and cam member 19 are maintained in alignment during use, thus minimising wear to those components.

[0027] When used in this specification and claims, the terms "comprises" and "comprising" and variations thereof mean that the specified features, steps or integers are included. The terms are not to be interpreted to exclude the presence of other features, steps or components.

[0028] The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. An apparatus for controlling angular movement of a door, the apparatus including:-

a housing;
a piston, having a longitudinal axis, slidable in a passage in the housing;
a cam member which is connected to, supported on or integral with a rotatable axle which extends transversely through the housing; and
a spring member positioned in the passage in the housing for biasing an end of the piston into engagement with a surface of the cam member,

wherein the apparatus includes a holding member which extends through a wall of the housing and engages a part of the piston, the holding member inhibiting rotation of the piston about its longitudinal axis.

2. An apparatus according to claim 1 wherein the holding member is substantially cylindrical.

3. An apparatus according to claim 1 or claim 2 wherein the holding member engages a flattened surface of the piston.

4. An apparatus according to any preceding claim wherein the cam member is substantially heart shaped in plan view.

5. An apparatus according to any preceding claim wherein the holding member extends through an aperture in the wall of the housing, the aperture being closed by a closing member.

6. A method of modifying an apparatus for controlling angular movement of a door, the apparatus including:-

a housing;
a piston, having a longitudinal axis, slidable in a passage in the housing;
a cam member which is connected to, supported on or integral with a rotatable axle which extends transversely through the housing; and
a spring member positioned in the passage in the housing for biasing an end of the piston into engagement with a surface of the cam member, the method including:-

creating an aperture in a wall of the housing, which aperture extends through a wall of the housing and communicating with the passage in the housing; and
passing a holding member through the aperture into engagement with a part of the piston.

7. A method according to claim 6 wherein the holding member is substantially cylindrical.

8. A method according to claim 6 or claim 7 wherein the holding member engages a flattened surface of the piston.

9. A method according to claim 6, claim 7 or claim 8 wherein the cam member is substantially heart shaped in plan view.

10. A method according to any one of claims 6 to 9 wherein the holding member extends through an aperture in the wall of the housing, the aperture being closed by a closing member.

11. An apparatus substantially as hereinbefore described with reference to and/or as shown in the accompanying drawings.

12. A method substantially as hereinbefore described with reference to and/or as shown in the accompanying drawings.

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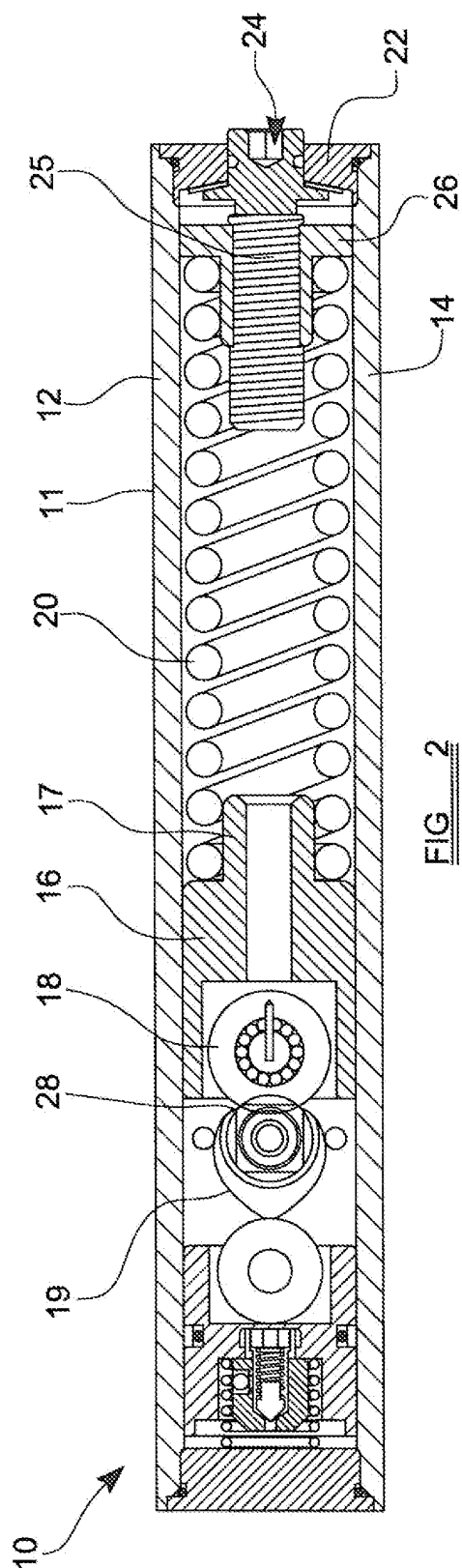
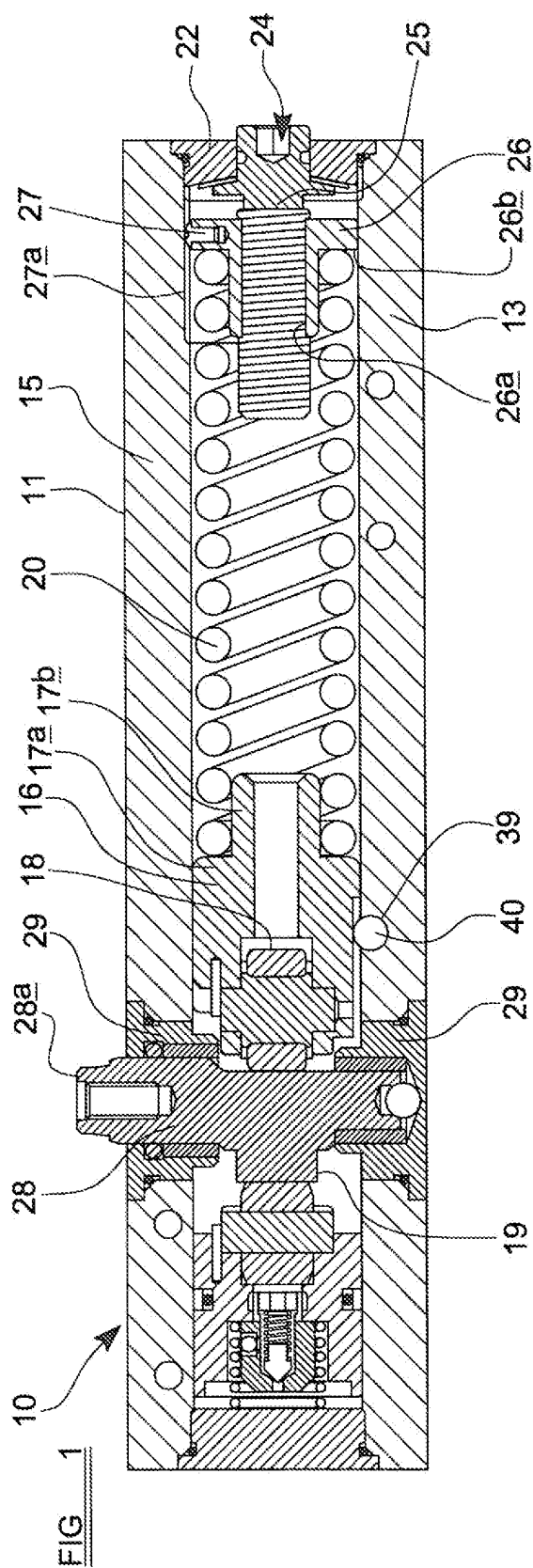


FIG 3

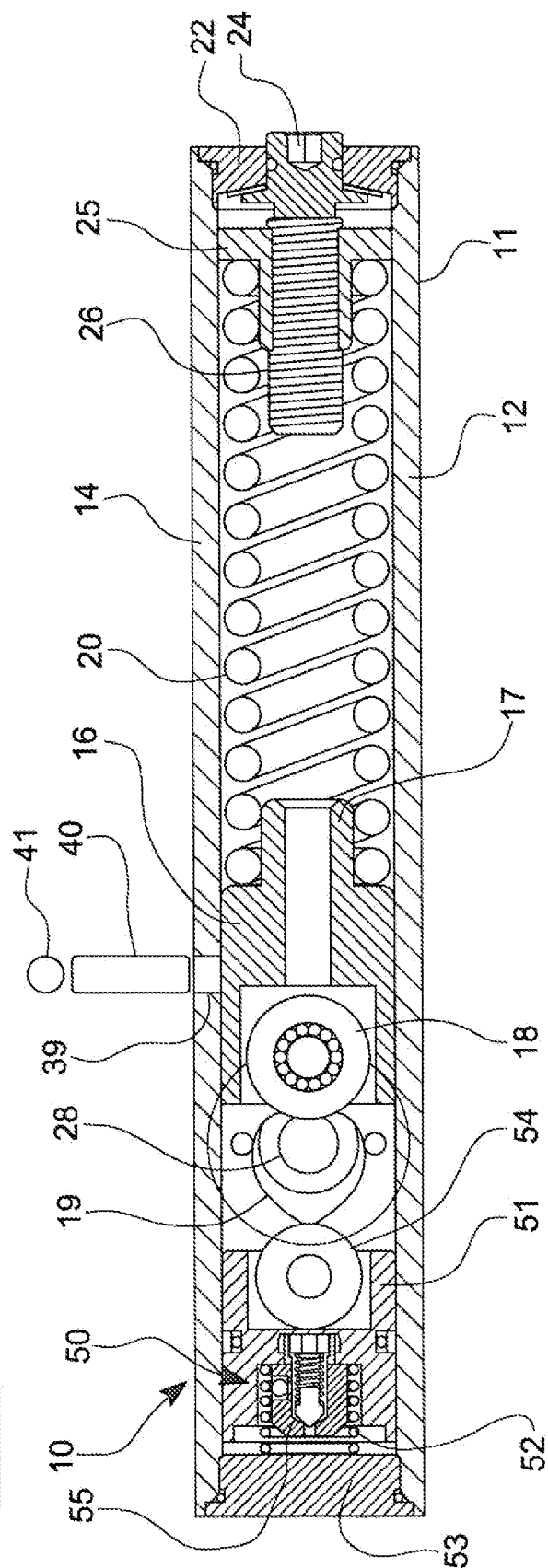


FIG 4

