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(54) **Chain-drive actuator**

(57) A chain-drive actuator (10) that is useful particularly but not exclusively for closing and opening horizontally-hinged doors and windows, and comprises, within a box-like containment body (11), motor means (13) connected to a reduction unit (14) that is in turn coupled in output to an actuation unit (15) that comprises a chain (16) with an outer end preset to pass through a corresponding opening formed in the box-like body. The actuator comprises guiding means (19) for the chain (16) that comprise at least one guiding slot (21), which is formed at the bottom of the box-like body and in which an inner end (23) of the at least one chain is slidingly guided so as to form a movable stroke limiter during traction and retraction.

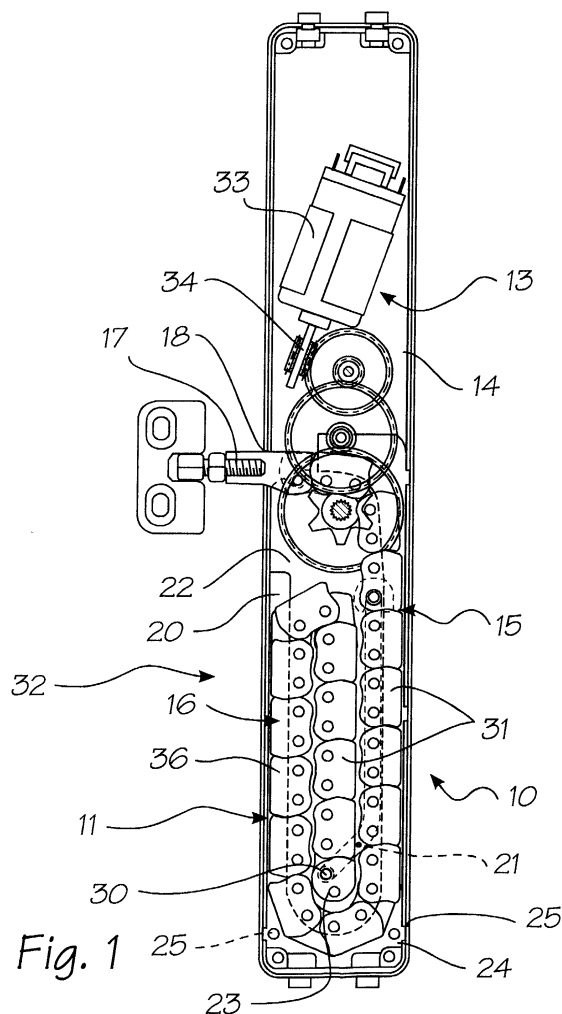


Fig. 1

Description

[0001] The present invention relates to a chain-drive actuator that is useful particularly but not exclusively for the closing and opening movement of horizontally-hinged windows and doors.

[0002] As is known, chain actuators that allow effective movement of leaves, particularly of the horizontally-hinged type, have long been used in various fields of application and in particular in the field of doors and windows.

[0003] Various constructive types of chain-drive actuator are currently commercially available.

[0004] However, despite the variety of technical solutions adopted, such types substantially comprise a box-like body that accommodates motor means, usually constituted by an electric motor, which are connected to a reduction unit, which is in turn coupled in output to an actuation unit, substantially constituted by at least one chain.

[0005] In commercially available actuators, the chain normally occupies all of the space inside the box-like containment body, sliding along its entire length and movement path within corresponding guides, which cause the actuator to become constructively very complicated and bulky.

[0006] Moreover, the shape assumed by the longitudinal extension of the chain inside the box-like body is substantially defined by the contour and dimensions of said body.

[0007] The chain is normally arranged so that its portions are substantially parallel to the walls of the box-like body.

[0008] The aim of the present invention is to provide a chain-drive actuator that solves the drawbacks noted in commercially available actuators and ensures high constructive simplicity, without thereby detracting from functional qualities and performance in application, and reduced dimensions.

[0009] Within this aim, an object of the present invention is to provide a chain-drive actuator that is functionally flexible and can be manufactured in various sizes and with various traction capabilities depending on the requirements of the application.

[0010] Another object of the present invention is to provide a chain-drive actuator that is constituted by a reduced number of components without thereby affecting the overall robustness of the assembly.

[0011] Another object of the present invention is to provide a chain-drive actuator that can be easily associated with doors and windows even if they are already installed.

[0012] Another object of the present invention is to provide a chain-drive actuator that can be manufactured with known technologies and systems.

[0013] This aim and these and other objects that will become better apparent hereinafter are achieved by a chain-drive actuator of the type that comprises, within a

box-like containment body, motor means connected to a reduction unit that is in turn coupled in output to an actuation unit that comprises a chain with an outer end preset to pass through a corresponding opening formed in said box-like body, said actuator being characterized in that it comprises guiding means for said chain comprising at least one guiding slot, which is formed at the bottom of said box-like body and in which an inner end of said at least one chain is slidingly guided so as to form a movable stroke limiter during traction and retraction.

[0014] Further characteristics and advantages of the present invention will become better apparent from the following detailed description of an embodiment thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figures 1 to 3 are sectional orthographic projection views of a chain-drive actuator according to the invention in three different steps of operation;

Figure 4 is a partially sectional orthographic projection view of a detail of the actuator of Figure 1.

[0015] With particular reference to Figures 1 to 4, a chain-drive actuator according to the invention is generally designated by the reference numeral 10.

[0016] The actuator 10 comprises, inside a box-like body 11 that in this case has an elongated shape and is constituted by two mutually reversibly connected half-shells 12, motor means, generally designated by the reference numeral 13, which are connected to a reduction unit 14, which in turn is coupled in output to an actuation unit 15, which comprises in this case a chain 16 formed by links.

[0017] The chain 16 has an outer end 17 that is preset to pass through a corresponding opening 18 formed in the box-like body 11.

[0018] The actuator 10 also comprises guiding means, generally designated by the reference numeral 19, for the chain 16, which comprise a peripheral guide 20, which abuts against corresponding internal walls of the box-like body 11 and is suitable for the external guiding and containment of the chain 16, and a guiding slot 21, which is formed at the bottom 22 of the box-like body 11 and in which a corresponding inner end 23 of the chain 16 is slidingly guided so as to form a movable stroke limiter during traction and retraction.

[0019] In particular, the peripheral guide 20 is constituted by a plate-like element 24 which is longitudinally U-shaped, abuts against the box-like body 11, and has an L-shaped end portion that is directed toward the opening 18 of the box-like body 11, so as to guide the chain 16 toward the opening by redirecting it.

[0020] In practice, the inner longitudinal edge of the plate-like element 24 guides the chain 16 because it is arranged within the dimensions of the chain 16, between the upper and lower link plates 35a and 35b of each link 36.

[0021] The plate-like element 24 has tabs 25 for po-

sitioning and engagement with respect to the box-like body 11.

[0022] The slot 21 comprises a first portion 26, which is substantially parallel to the longitudinal walls of the box-like body 11 and whose start end 27 forms an outgoing stroke limiter for the chain 16, and continues with a second portion 28, which is inclined with respect to the first portion 26 and ends with an end 29 that is arranged in a substantially central region with respect to the transverse dimension of the body 11 and is proximate to the corresponding end thereof.

[0023] In particular, the inner end 23 of the chain 16 is associated with a pin 30 that is slidingly inserted in the slot 21.

[0024] The guiding means 19 cooperate to arrange the chain 16 so that its portions 31 are substantially parallel to the longitudinal walls of the box-like body 11, wound spirally during traction and retraction.

[0025] In particular, in this embodiment the chain 16 is contained within a delimited portion 32 of the body 11.

[0026] The motor means 13 are constituted, in this case, by an electric motor 33, whose axis 34 is arranged substantially obliquely with respect to the longitudinal direction of the body 11.

[0027] The reduction unit 14, in this case, is of the gear type.

[0028] In practice, the operation of the actuator 10 is as follows.

[0029] Assuming that one begins in a step in which the chain 16 is completely wound inside the box-like body 11, the action of the motor 33, by means of the reduction unit 14, produces during extraction the sliding of the chain 16, which is contained in its path internally by the very arrangement of its links and externally by the element 24, whose L-shaped redirection proximate to the opening 18 allows to direct the chain 16 toward the outlet.

[0030] The chain 16 can be extracted to its full length until the pin 30 reaches the end 27, which determines the outgoing stroke limit for the chain 16.

[0031] During retraction, again under the action of the motor 33 with the mediation of the reduction unit 14, the chain 16 is redirected initially in the correct retraction path substantially by the element 24, which guides it along the first turn of the spiral.

[0032] At the same time, the pin 30 slides toward the end 29, where it is retained, causing the chain 16 to spontaneously coil up on itself, thus forming the core and the hinge-like coupling about which the remaining part of the chain 16 winds conditionally.

[0033] In practice it has been observed that the present invention has achieved the intended aim and objects.

[0034] In particular, it should be noted that the actuator according to the invention allows an optimum level of functionality and robustness while ensuring an overall structure that is constituted by a reduced number of components, thereby providing considerable cost re-

ductions in production and manufacturing.

[0035] It is also noted that this constructive simplification in no way impairs flexibility of application, which can be the most disparate according to different requirements of application.

[0036] It is also noted that the actuator according to the invention is easy to apply by the operator even optionally on-site.

[0037] The present invention is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

[0038] The technical details can be replaced with other technically equivalent elements.

[0039] The materials may be any according to requirements.

[0040] The disclosures in Italian Patent Application No. PD2001A000136 from which this application claims priority are incorporated herein by reference.

[0041] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A chain-drive actuator of the type comprising, within a box-like containment body, motor means connected to a reduction unit that is in turn coupled in output to an actuation unit, said actuation unit comprising a chain with an outer end preset to pass through a corresponding opening formed in said box-like body, said actuator being **characterized in that** it comprises guiding means for said chain that comprise at least one guiding slot, which is formed at the bottom of said box-like body and in which an inner end of said at least one chain is slidingly guided so as to form a movable stroke limiter during traction and retraction.
2. The actuator according to claim 1, **characterized in that** said guiding means for said chain comprise a peripheral guide, which abuts against corresponding internal walls of the box-like body and is suitable to contain and guide externally said chain.
3. The actuator according to claim 2, **characterized in that** said peripheral guide is constituted by a plate-like element that is longitudinally U-shaped and abuts against said box-like body, with an L-shaped end portion that is directed toward the output proximate to said opening of said box-like body, so as to guide said at least one chain by redirecting it.

4. The actuator according to claims 2 and 3, **characterized in that** the inner longitudinal edge of said plate-like element is arranged within the dimensions of said chain, between the upper and lower link plates of each link. 5

5. The actuator according to one or more of the preceding claims, **characterized in that** said plate-like element has tabs for positioning and engagement with said box-like body. 10

6. The actuator according to claim 1, **characterized in that** said slot comprises a first portion, which is substantially parallel to the longitudinal walls of said box-like body and whose start end forms an outgoing stroke limit for said at least one chain, said first portion continuing with a second portion, which is inclined with respect to said first portion and ends with an end that is located in a central region with respect to the transverse dimension of said body and is proximate to a corresponding end thereof. 15
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7. The actuator according to one or more of the preceding claims, **characterized in that** the inner end of said at least one chain is associated with a pin that is slidingly inserted in said slot. 25

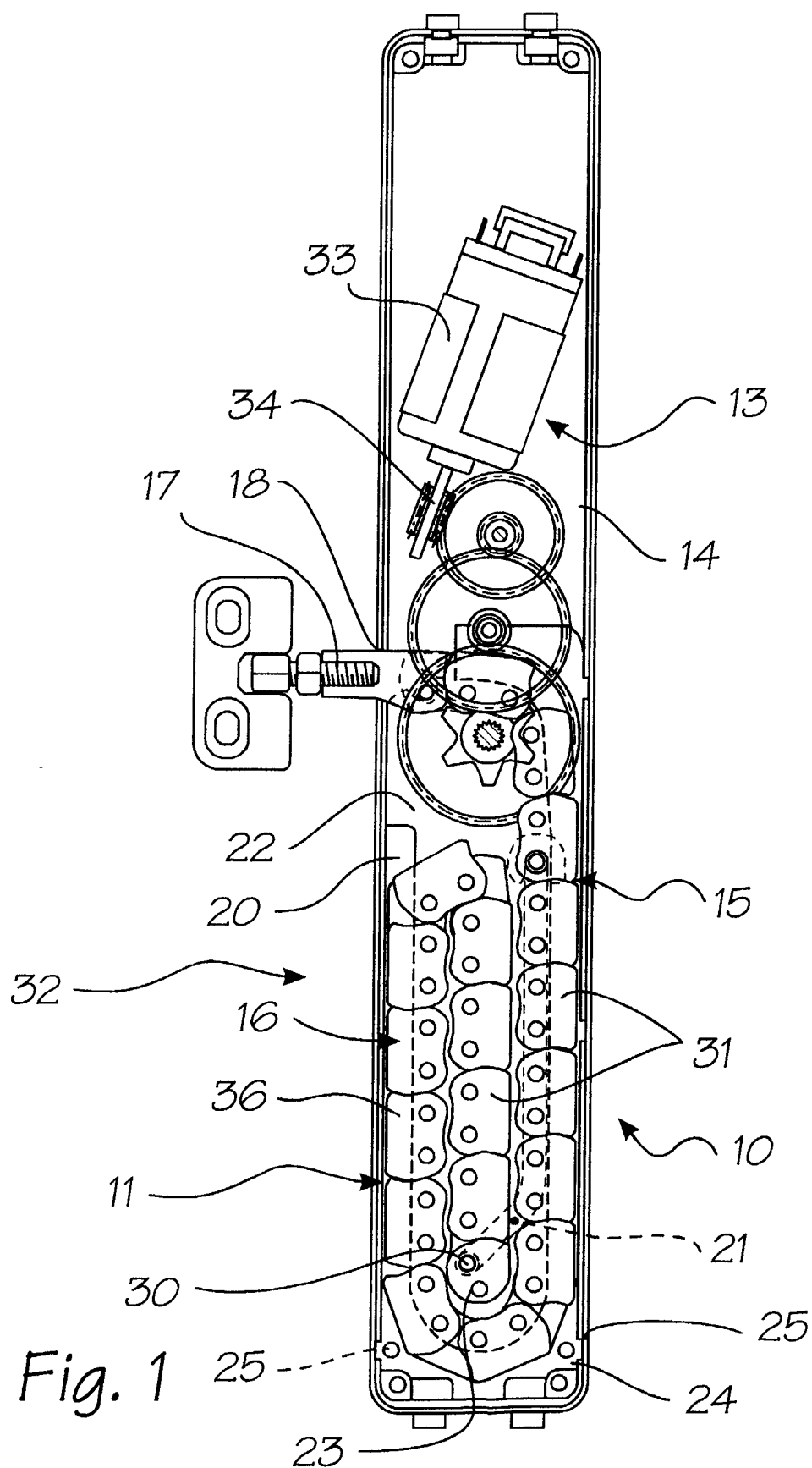
8. The actuator according to one or more of the preceding claims, **characterized in that** said guiding means cooperate to arrange said at least one chain so that its various portions are substantially parallel to the longitudinal walls of said box-like body, winding spirally during traction and retraction. 30

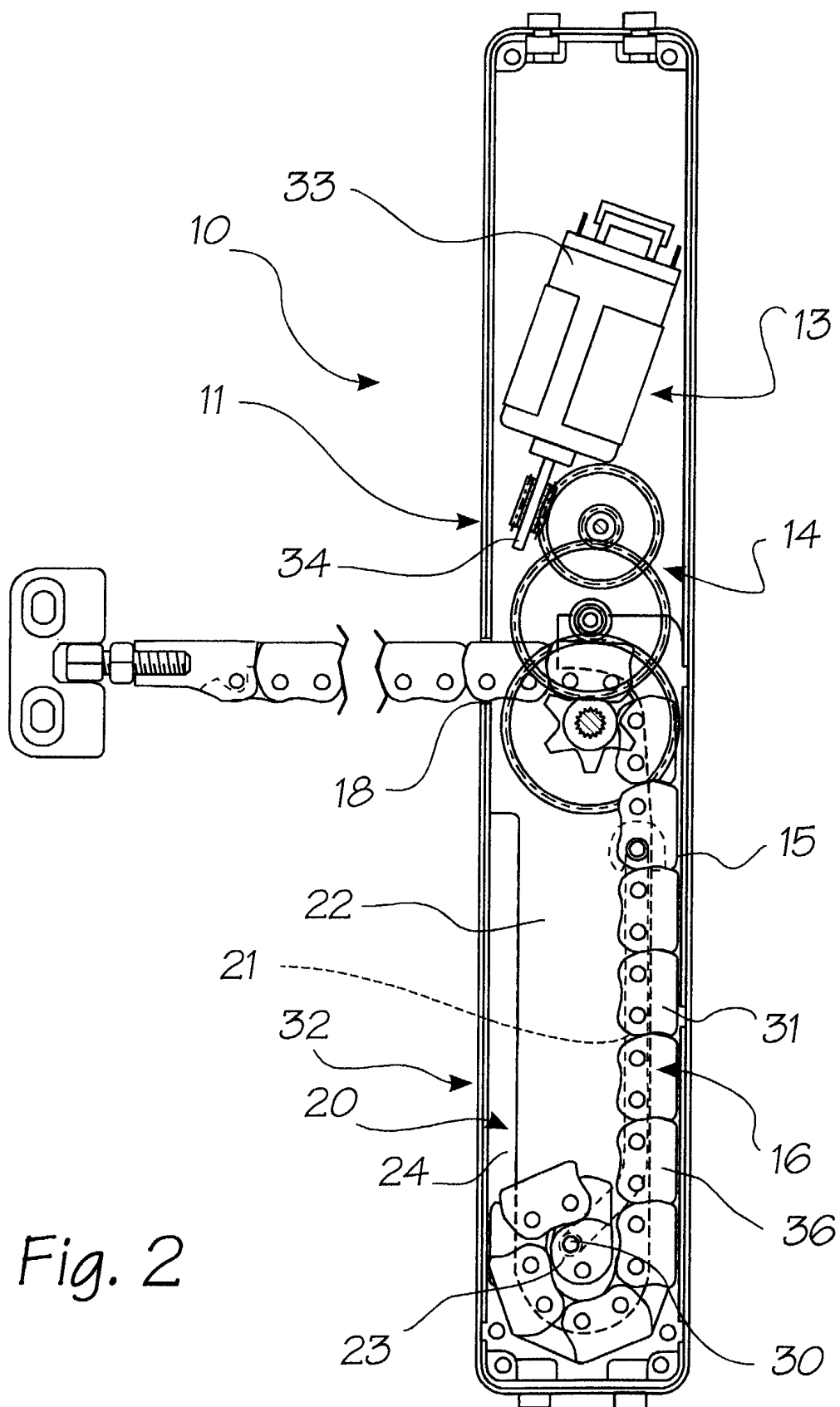
9. The actuator according to one or more of the preceding claims, **characterized in that** said at least one chain occupies a delimited portion of said box-like body, the opposite portion being occupied by said motor means and said reduction unit. 35
40

10. The actuator according to one or more of the preceding claims, **characterized in that** said motor means are constituted by an electric motor that is mounted so that its axis is oblique with respect to the longitudinal direction of said body. 45

11. The actuator according to one or more of the preceding claims, **characterized in that** said reduction unit is of the gear type. 50

12. The actuator according to one or more of the preceding claims, **characterized in that** said elongated box-like body is constituted by two half-shells that are mutually reversibly connected. 55





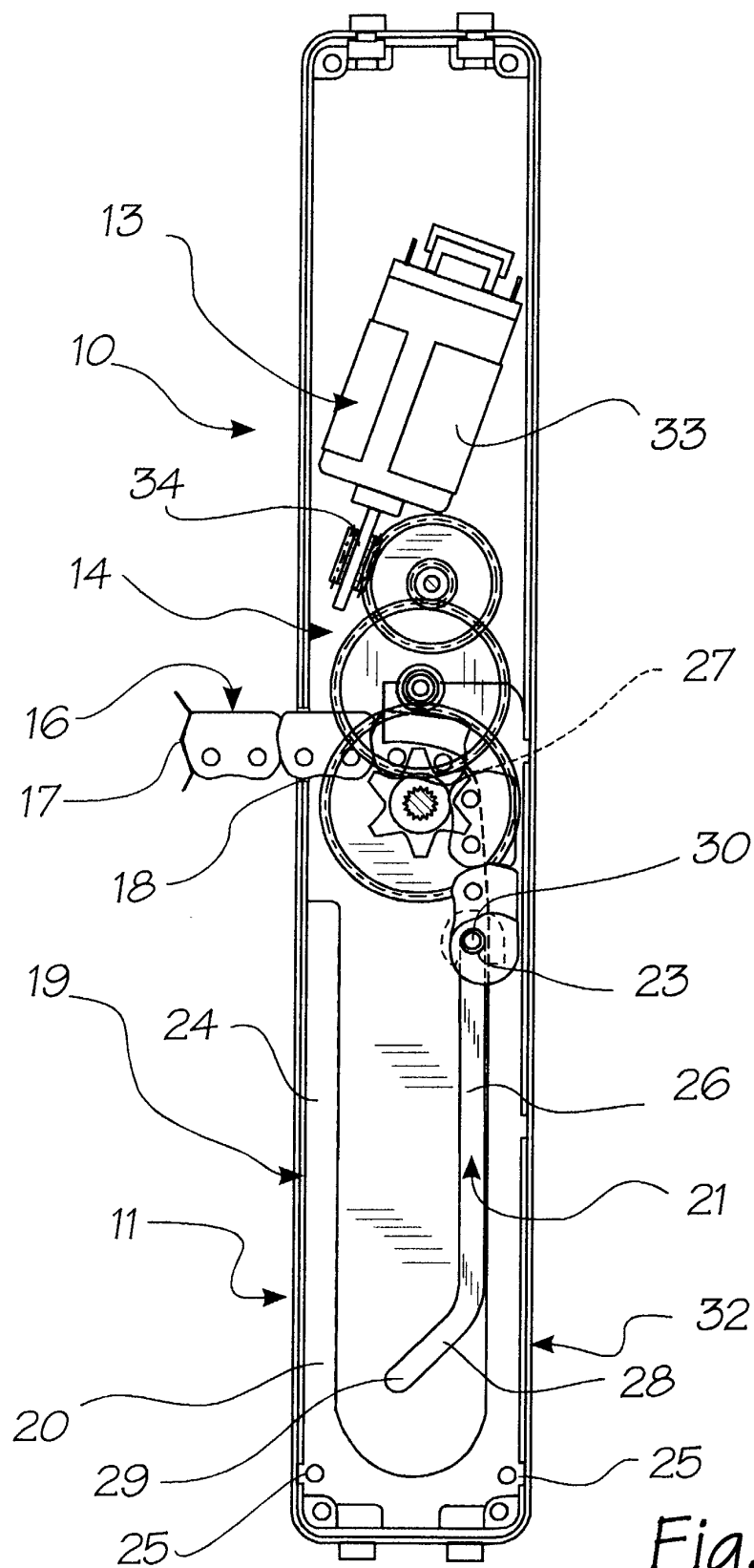


Fig. 3

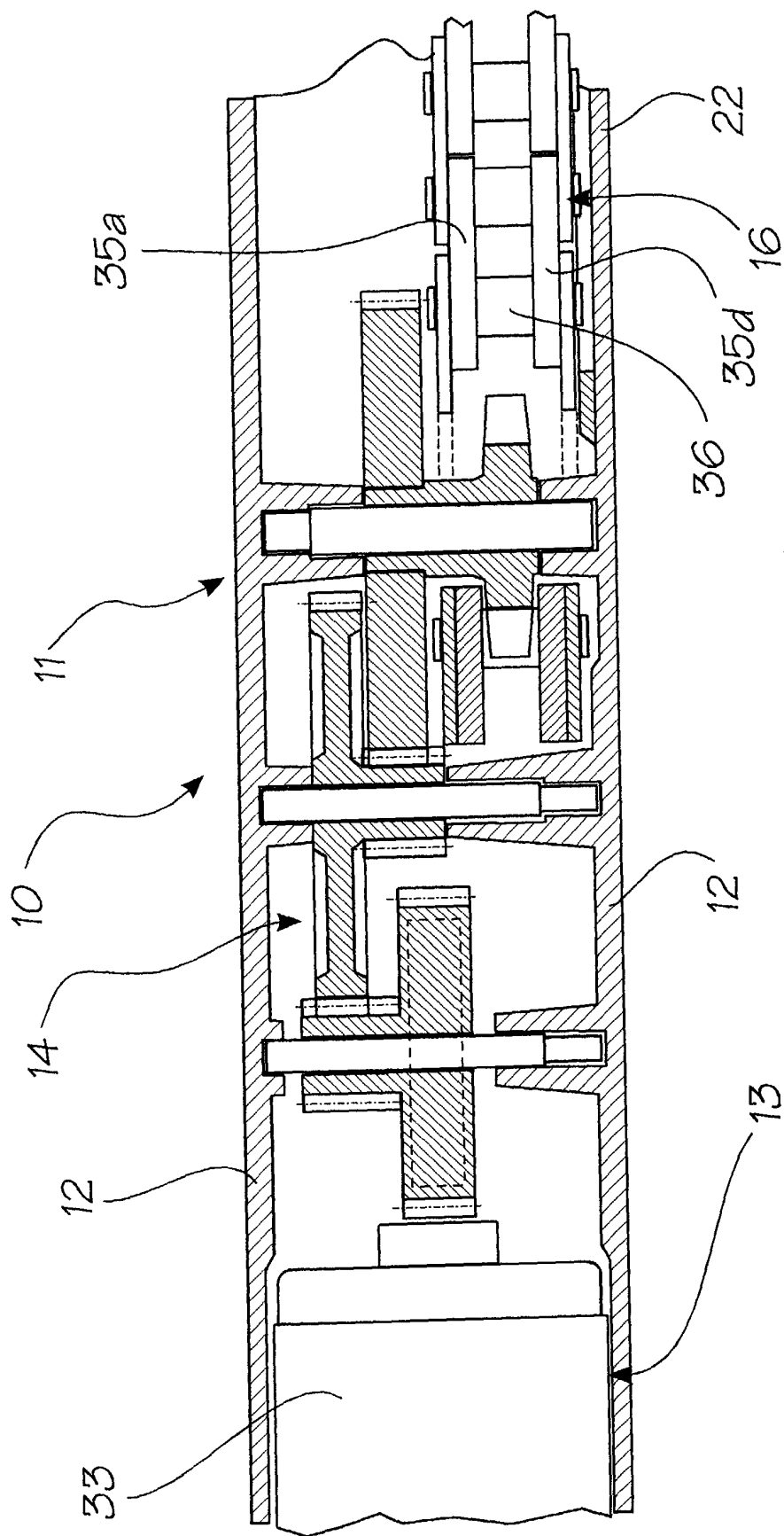


Fig. 4