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(54) **Chain-drive actuator**

Kettenantrieb

Commande à transmission par chaîne

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**EP-A- 0 864 720** **GB-A- 2 159 600**  
**US-A- 3 090 613**

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## 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]** GB-A-2 159 600 teaches a chain actuator providing a looped chain when retracted

**[0009]** 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.

**[0010]** The problem met by the present invention is how, during retraction of the chain, to constrain the chain of the actuator to obligatory form elongated loop formations in compact side by side relationship.

**[0011]** 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.

**[0012]** 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.

**[0013]** 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.

**[0014]** Another object of the present invention is to pro-

vide a chain-drive actuator that can be manufactured with known technologies and systems.

**[0015]** This aim and these and other objects that will become better apparent hereinafter are achieved by a chain-drive actuator according to claim 1.

**[0016]** 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.

**[0017]** With particular reference to Figures 1 to 4, a chain-drive actuator according to the invention is generally designated by the reference numeral 10.

**[0018]** 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.

**[0019]** 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.

**[0020]** 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.

**[0021]** 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.

**[0022]** In practice, the inner longitudinal edge 24a 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.

**[0023]** The plate-like element 24 has tabs 25 for positioning and engagement with respect to the box-like body 11.

**[0024]** 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 out-

going 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.

**[0025]** In particular, the inner end 23 of the chain 16 is associated with a pin 30 that is slidingly inserted in the slot 21.

**[0026]** 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.

**[0027]** In particular, in this embodiment the chain 16 is contained within a delimited portion 32 of the body 11.

**[0028]** 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.

**[0029]** The reduction unit 14, in this case, is of the gear type.

**[0030]** In practice, the operation of the actuator 10 is as follows.

**[0031]** 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.

**[0032]** 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.

**[0033]** 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.

**[0034]** 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.

**[0035]** In practice it has been observed that the present invention has achieved the intended aim and objects.

**[0036]** 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 reductions in production and manufacturing.

**[0037]** 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.

**[0038]** It is also noted that the actuator according to the invention is easy to apply by the operator even op-

tionally on-site.

**[0039]** The present invention is susceptible of numerous modifications and variations, all of which are within the scope of the claims.

**[0040]** The materials may be any according to requirements.

**[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 (10) of the type comprising a box-like containment body (11) including laterally spaced apart opposite longitudinally extending side-wall means defining a longitudinal extension of said box-like containment body (11) and transverse wall means (22) defining a transverse extension of said box-like containment body (11), provided within said box-like containment body (11) being motor means (13) connected to a reduction unit (14) coupled in output to an actuation unit (15), said actuation unit (15) comprising at least one movable chain (16) formed of an array of mutually articulated chain links (36), said chain (16) having an outer end (17) arranged to pass towards the outside through a corresponding output opening (18) formed in said box-like containment body (11), said chain drive actuator (10) further comprising at least one longitudinally extending guiding slot (21), which is formed at the bottom (22) of said box-like containment body (11), said slot (21) comprising a first portion, which is substantially parallel to the longitudinal walls of said box-like body and whose first terminal end (27) or 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 a second terminal end (29) that is located in a central region with respect to the transverse dimensions of said body and is proximate to a corresponding end thereof, said chain (36) having an inner end (23) provided with a stroke limiter formation (30) slidingly guided within said slot (21) from a chain extraction end of stroke position when said stroke limiter formation (30) reaches said first terminal end (27) up to a chain retraction end of stroke position of said chain (36) when said stroke limiter formation (30) reaches said second terminal end (29) and vice versa, said chain-drive actuator (10) further comprising additional guiding means (19) for said chain (16) to obligatory form during extraction and retraction spiral windings with chain portions (31) substantially parallel to the longitudinal walls of said box-like body

- (11), said additional guiding means (19) comprising a peripheral guide (20) constituted of a longitudinal U-shaped plate-like element (24) having an inner longitudinal edge arranged within the dimensions of said chain (16), between the upper and lower link plate (35a, 35b) of each link (36), the longitudinally extending legs of the U-shape of said plate-like element (24) having said inner edge provided with opposite edge portions (24a) thereof longitudinally extending and arranged opposite to each other and at a selected transverse distance constituting a space width sufficient to contain in compact mutually facing relationship three substantially parallel longitudinally extending portions (31) of said spirally wound chain (16).
2. A chain drive actuator according to claim 1, **characterised in that** said plate-like element (24) that is longitudinally U-shaped abuts against the internal walls of said box-like containment body (11), with an L-shaped end portion that is directed towards said output opening (18) so as to guide said at least one chain (16) by redirecting it.
  3. A chain drive actuator according to one or more of claims 1-3, **characterised in that**, said plate-like element (24) has tabs (25) for positioning and engagement of said box-like containment body (11).
  4. A chain drive actuator according to one or more of the preceding claims, **characterised in that**, the inner end (23) of said at least one chain (16) is associated with a pin (30) that is slidingly inserted in said slot (21).
  5. A chain drive actuator according to one or more of the preceding claims, **characterised in that** said guiding means (19) cooperate to arrange said at least one chain (16) so that its various portions (31) are substantially parallel to the longitudinal walls of said box-like containment body (11), winding serpentine-like during traction and retraction.
  6. A chain drive actuator according to one or more of the preceding claims, **characterised in that**, said at least one chain (16) occupies a longitudinally delimited portion (32) of said box-like containment body (11), the opposite longitudinal portion being occupied by said motor means (13) and said reduction unit (14).
  7. A chain drive actuator according to one or more of the preceding claims, **characterised in that**, said motor means (13) are constituted by an electric motor that is mounted so that its axis (34) is oblique with respect to the longitudinal direction of said box-like containment body (11).
  8. A chain drive actuator according to one or more of the preceding claims, **characterised in that**, said reduction unit (14) is of the gear type.
  9. A chain drive actuator according to one or more of the preceding claims, **characterised in that**, said elongated box-like containment body (11) is constituted by two half-shells (32) that are mutually reversibly connected.

#### Patentansprüche

1. Kettenantriebsaktor (10) des Typs, der einen kastenähnlichen Aufnahmekörper (11) mit seitlich beabstandeten, gegenüberliegenden, longitudinal verlaufenden Seitenwandmitteln, die eine longitudinale Ausdehnung des kastenähnlichen Aufnahmekörpers (11) definieren, und Querwandmitteln (22), die eine Querausdehnung des kastenähnlichen Aufnahmekörpers (11) definieren, umfasst, wobei in dem kastenähnlichen Aufnahmekörper (11) Motormittel (13) vorgesehen sind, die mit einer Untersetzungseinheit (14) verbunden sind, deren Ausgang mit einer Betätigungseinheit (15) gekoppelt ist, wobei die Betätigungseinheit (15) wenigstens eine bewegliche Kette (16), die aus einer Aneinanderreihung von aneinander angelenkten Kettengliedern (36) gebildet ist, umfasst, wobei die Kette (16) ein äußeres Ende (17), das so angeordnet ist, dass es durch eine entsprechende Ausgangsöffnung (18), die in dem kastenähnlichen Aufnahmekörper (11) ausgebildet ist, nach außen verläuft, wobei der Kettenantriebsaktor (10) ferner wenigstens einen longitudinal verlaufenden Führungsschlitz (21) umfasst, der im Boden (22) des kastenähnlichen Aufnahmekörpers (11) ausgebildet ist, wobei der Schlitz (21) einen ersten Abschnitt aufweist, der zu den longitudinalen Wänden des kastenähnlichen Körpers im Wesentlichen parallel ist und wovon ein erstes Abschlussende (27) oder Startende eine Ausgangshubgrenze für die wenigstens eine Kette bildet, wobei der erste Abschnitt durch einen zweiten Abschnitt fortgesetzt wird, der in Bezug auf den ersten Abschnitt geneigt ist und in einem zweiten Abschlussende (29) endet, das sich in einem mittleren Bereich in Bezug auf die Querabmessungen des Körpers befindet und sich in der Nähe eines entsprechenden Endes hiervon befindet, wobei die Kette (36) ein inneres Ende (23) besitzt, das mit einer Hubbegrenzerformation (30) versehen ist, die in dem Schlitz (21) von einem Kettenextraktionsende einer Hubposition, wenn die Hubbegrenzerformation (30) das erste Abschlussende (27) erreicht, bis zu einem Kettenretraktionsende der Hubposition der Kette (36), wenn die Hubbegrenzerformation (30) das zweite Abschlussende (29) erreicht, und umgekehrt gleitend geführt wird, wobei der Kettenantriebsaktor (10) ferner zusätzliche Führungs-

mittel (19) für die Kette (16) enthält, um während der Extraktion und der Retraktion zwangsläufig spiralförmige Windungen mit Kettenabschnitten (31), die zu den longitudinalen Wänden des kastenähnlichen Körpers (11) im Wesentlichen parallel sind, zu bilden, wobei die zusätzlichen Führungsmittel (19) eine Umfangsführung (20) enthalten, die aus einem longitudinalen U-förmigen plattenähnlichen Element (24) mit einer inneren longitudinalen Kante, die innerhalb der Abmessungen der Kette (16) zwischen der oberen und der unteren Verbindungsplatte (35a, 35b) jeder Verbindung (36) angeordnet ist, gebildet ist, wobei die longitudinal verlaufenden Schenkel der U-Form des plattenähnlichen Elements (24) eine Innenkante besitzen, die mit gegenüberliegenden Kantenabschnitten (24a) versehen ist, die longitudinal verlaufen und einander gegenüber angeordnet sind und einen ausgewählten Querabstand besitzen, der eine Zwischenraumbreite bildet, die ausreicht, um drei im Wesentlichen parallele, longitudinal verlaufende Abschnitte (31) der spiralförmig gewundenen Kette (16) in einer kompakten, einander zugewandten Beziehung aufzunehmen.

2. Kettenantriebsaktor nach Anspruch 1, **dadurch gekennzeichnet, dass** das plattenähnliche Element (24), das longitudinal U-förmig ist, an den Innenwänden des kastenähnlichen Aufnahmekörpers (11) anliegt, wobei ein L-förmiger Endabschnitt zu der Ausgangsöffnung (18) gerichtet ist, um die wenigstens eine Kette (16) zu führen, indem er sie umlenkt.
3. Kettenantriebsaktor nach einem oder mehreren der Ansprüche 1-3, **dadurch gekennzeichnet, dass** das plattenartige Element (24) Ansätze (25) besitzt, um den kastenähnlichen Aufnahmekörper (11) zu positionieren und mit ihm in Eingriff zu gelangen.
4. Kettenantriebsaktor nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** dem inneren Ende (23) der wenigstens einen Kette (16) ein Stift (30) zugeordnet ist, der in den Schlitz (21) gleitend eingesetzt ist.
5. Kettenantriebsaktor nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Führungsmittel (19) zusammenwirken, um die wenigstens eine Kette (16) in der Weise anzuordnen, dass ihre verschiedenen Abschnitte (31) im Wesentlichen zu den longitudinalen Wänden des kastenähnlichen Aufnahmekörpers (11) parallel sind und sich während der Traktion und der Retraktion serpentinartig winden.
6. Kettenantriebsaktor nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die wenigstens eine Kette (16) einen longitudinal begrenzten Abschnitt (32) des kasten-

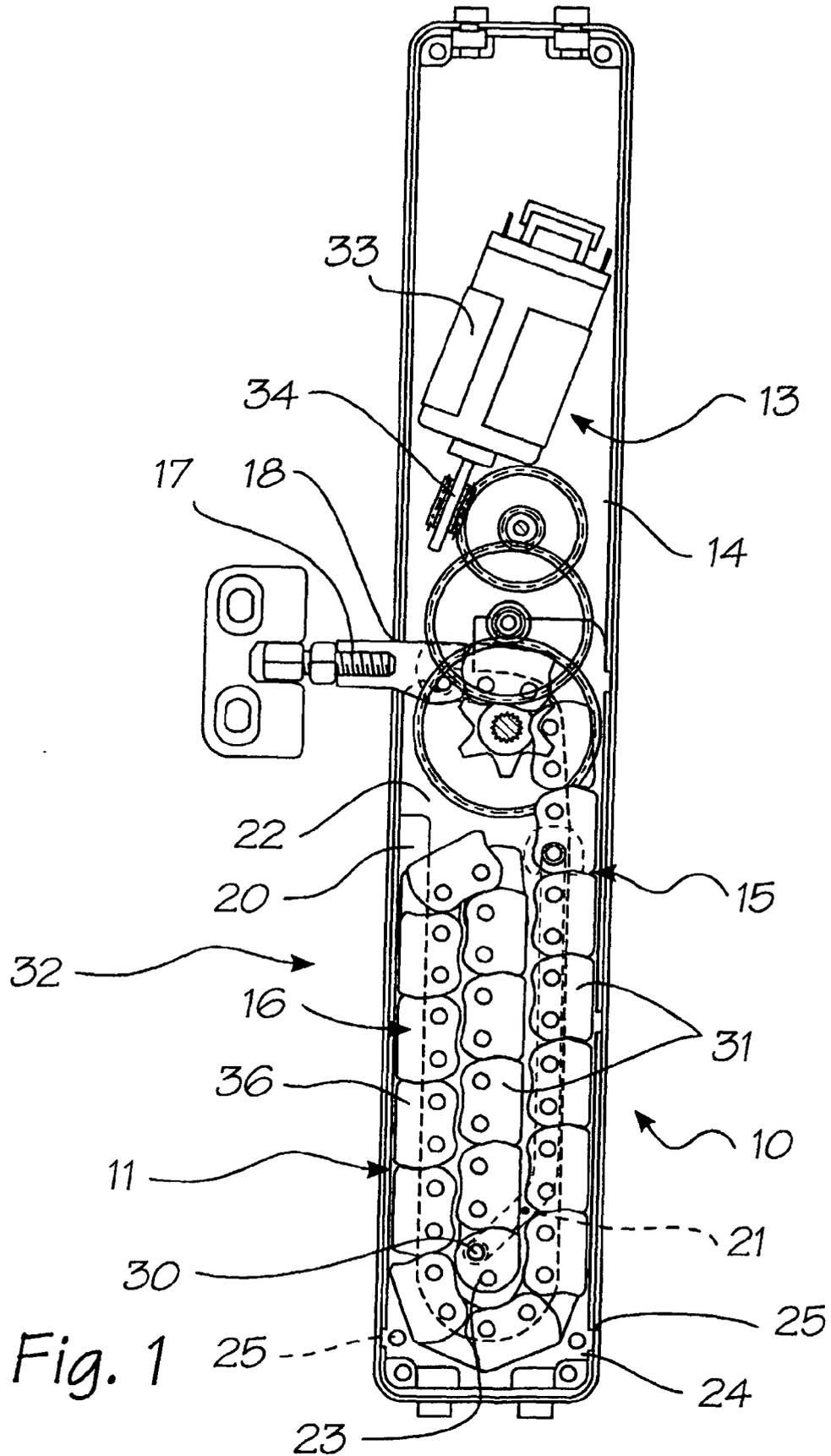
ähnlichen Aufnahmekörpers (11) belegt, wobei der gegenüberliegende longitudinale Abschnitt durch die Motormittel (13) und die Untersetzungseinheit (14) belegt ist.

7. Kettenantriebsaktor nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Motormittel (13) durch einen Elektromotor gebildet sind, der so montiert ist, dass seine Achse (34) in Bezug auf die Längsrichtung des kastenähnlichen Aufnahmekörpers (11) schräg ist.
8. Kettenantriebsaktor nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Untersetzungseinheit (14) vom Zahnradtyp ist.
9. Kettenantriebsaktor nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der lang gestreckte kastenähnliche Aufnahmekörper (11) durch zwei Halbschalen (32) gebildet ist, die gegenseitig umkehrbar miteinander verbunden sind.

## Revendications

1. Actionneur à transmission par chaîne (10) du type comprenant un corps de confinement en forme de boîte (11) comprenant des moyens de paroi latérale s'étendant longitudinalement, opposés espacés latéralement, définissant une extension longitudinale dudit corps de confinement en forme de boîte (11) et des moyens de paroi transversale (22) définissant une extension transversale dudit corps de confinement en forme de boîte (11), avec à l'intérieur dudit corps de confinement en forme de boîte (11), un moyen moteur (13) raccordé à une unité de réduction (14) couplée en sortie à une unité d'actionnement (15), ladite unité d'actionnement (15) comprenant au moins une chaîne mobile (16) formée avec une rangée de maillons de chaîne (36) mutuellement articulés, ladite chaîne (16) ayant une extrémité externe (17) agencée pour passer vers l'extérieur par une ouverture de sortie (18) correspondante formée dans ledit corps de confinement en forme de boîte (11), ledit actionneur à transmission par chaîne (10) comprenant en outre au moins une fente de guidage (21) s'étendant longitudinalement, qui est formée au fond (22) dudit corps de confinement en forme de boîte (11), ladite fente (21) comprenant une première partie, qui est sensiblement parallèle aux parois longitudinales dudit corps en forme de boîte, et dont une première extrémité terminale (27) ou extrémité de départ forme une limite de course sortante pour ladite au moins une chaîne, ladite première partie se prolongeant par une seconde partie, qui est inclinée par rapport à ladite première partie et se termine

- par une seconde extrémité terminale (29) qui est positionnée dans une région centrale par rapport aux dimensions transversales dudit corps et est à proximité de son extrémité correspondante, ladite chaîne (36) ayant une extrémité interne (23) prévue avec une formation de limiteur de course (30) guidée de manière coulissante à l'intérieur de ladite fente (21) à partir d'une position de fin de course d'extraction de chaîne lorsque ladite formation de limiteur de course (30) atteint ladite première extrémité terminale (27) jusqu'à une position de fin de course de rétraction de chaîne de ladite chaîne (36) lorsque ladite formation de limiteur de course (30) atteint ladite seconde extrémité terminale (29) et vice versa, ledit actionneur à transmission par chaîne (10) comprenant en outre des moyens de guidage supplémentaires (19) pour ladite chaîne (16) afin de former obligatoirement pendant l'extraction et la rétraction des enroulements en spirale avec les parties de chaîne (31) sensiblement parallèlement aux parois longitudinales dudit corps en forme de boîte (11), lesdits moyens de guidage supplémentaires (19) comprenant un guide périphérique (20) constitué par un élément longitudinal (24) en forme de plaque en forme de U ayant un bord longitudinal interne agencé dans les limites des dimensions de ladite chaîne (16) entre les plaques de liaison supérieure et inférieure (35a, 35b) de chaque maillon (36), les branches s'étendant longitudinalement de la forme de U dudit élément en forme de plaque (24) ayant ledit bord interne prévu avec des parties de bord opposées (24a) s'étendant longitudinalement et agencées à l'opposé l'une de l'autre et à une distance transversale sélectionnée constituant une largeur d'espace suffisante pour contenir selon une relation mutuellement en regard compacte, trois parties (31) s'étendant longitudinalement sensiblement parallèles de ladite chaîne (16) enroulée en spirale.
2. Actionneur à transmission par chaîne selon la revendication 1, **caractérisé en ce que** ledit élément en forme de plaque (24) qui est longitudinalement en forme de U vient en butée contre les parois internes dudit corps de confinement en forme de boîte (11), avec une partie d'extrémité en forme de L qui est dirigée vers ladite ouverture de sortie (18) afin de guider ladite au moins une chaîne (16) en la redirigeant.
  3. Actionneur à transmission par chaîne selon une ou plusieurs des revendications 1 à 3, **caractérisé en ce que** ledit élément en forme de plaque (24) a des pattes (25) pour le positionnement et la mise en prise dudit corps de confinement en forme de boîte (11).
  4. Actionneur à transmission par chaîne selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** l'extrémité interne (23) de ladite au moins une chaîne (16) est associée avec une broche (30) qui est insérée de manière coulissante dans ladite fente (21).
  5. Actionneur à transmission par chaîne selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** lesdits moyens de guidage (19) coopèrent pour agencer ladite au moins une chaîne (16) de sorte que ses différentes parties sont sensiblement parallèles aux parois longitudinales dudit corps de confinement en forme de boîte (11), s'enroulant en serpentif pendant la traction et la rétraction.
  6. Actionneur à transmission par chaîne selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** ladite au moins une chaîne (16) occupe une partie délimitée longitudinalement (32) dudit corps de confinement en forme de boîte (11) ; la partie longitudinale opposée étant occupée par ledit moyen moteur (13) et ladite unité de réduction (14).
  7. Actionneur à transmission par chaîne selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit moyen moteur (13) est constitué par un moteur électrique qui est monté de sorte que son axe (34) est oblique par rapport à la direction longitudinale dudit corps de confinement en forme de boîte (11).
  8. Actionneur à transmission par chaîne selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** ladite unité de réduction (14) est du type à engrenages.
  9. Actionneur à transmission par chaîne selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit corps de confinement allongé en forme de boîte (11) est constitué par deux demi-coques (32) qui sont raccordées de manière mutuellement inversable.



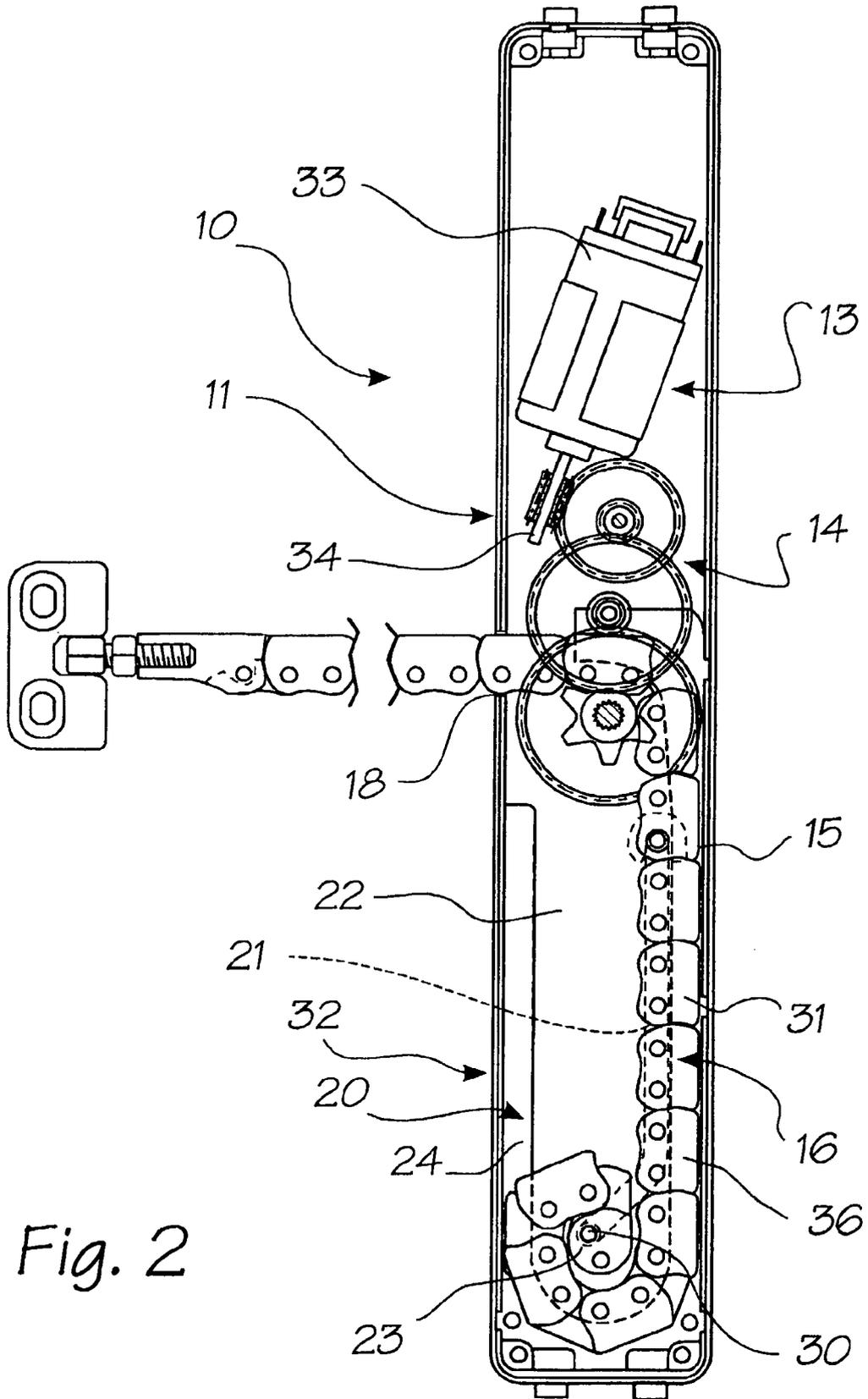


Fig. 2

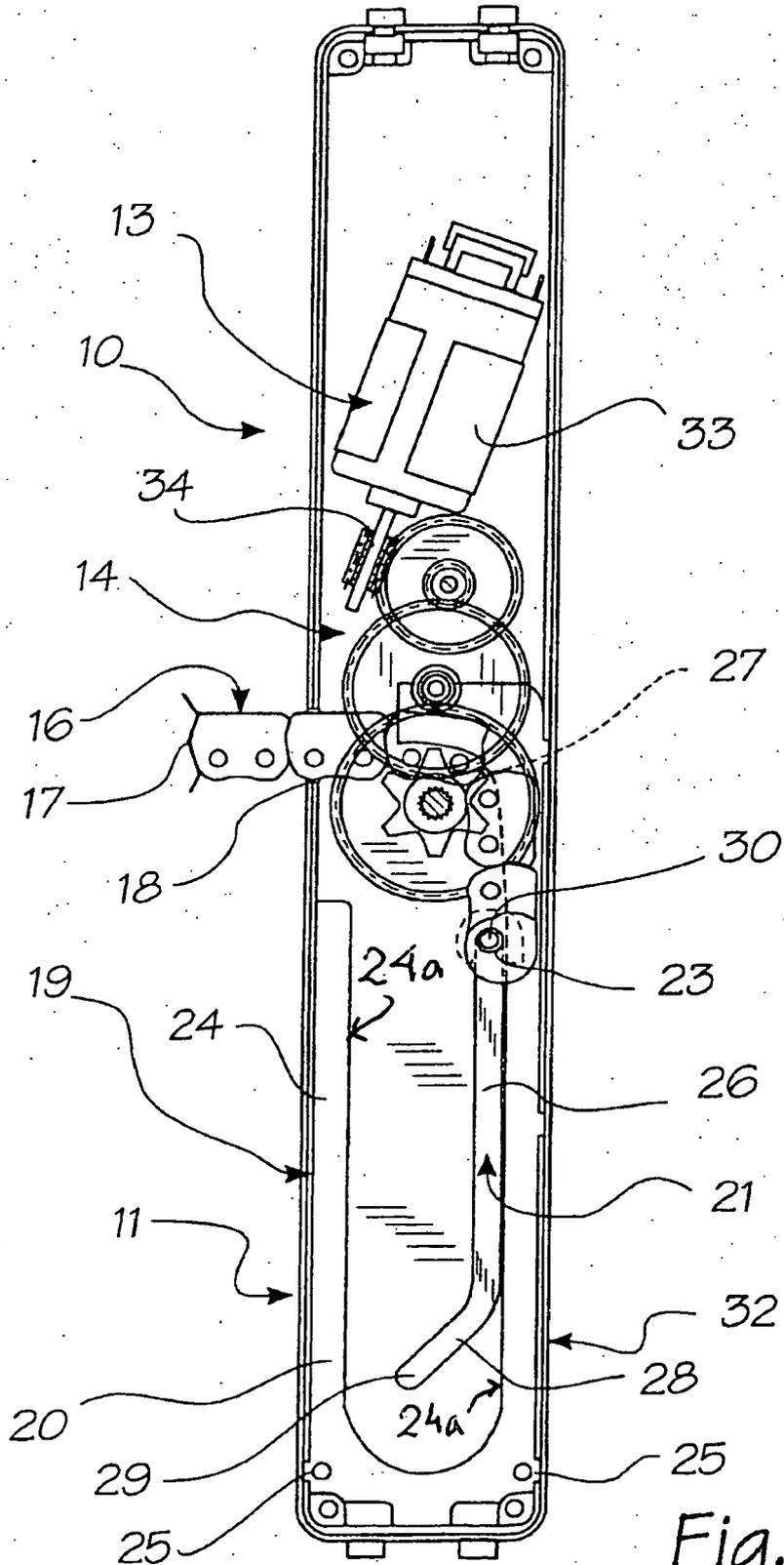


Fig. 3

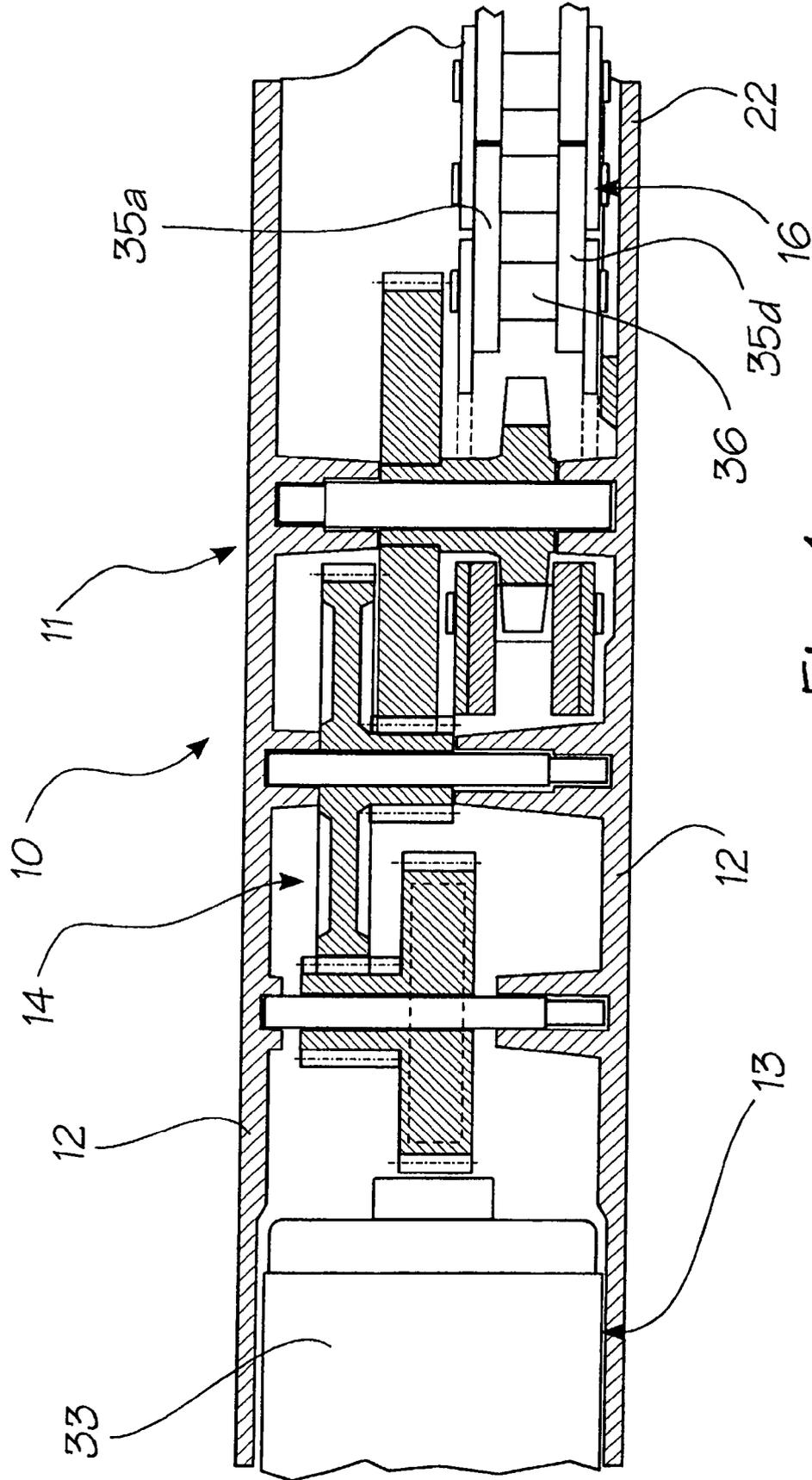


Fig. 4

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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