ABSTRACT

“ENDLESS SCREW RECIPROCATING ACTUATOR FOR NON LINEAR PATHS AND WINDOW LIFTER USING THE SAME”

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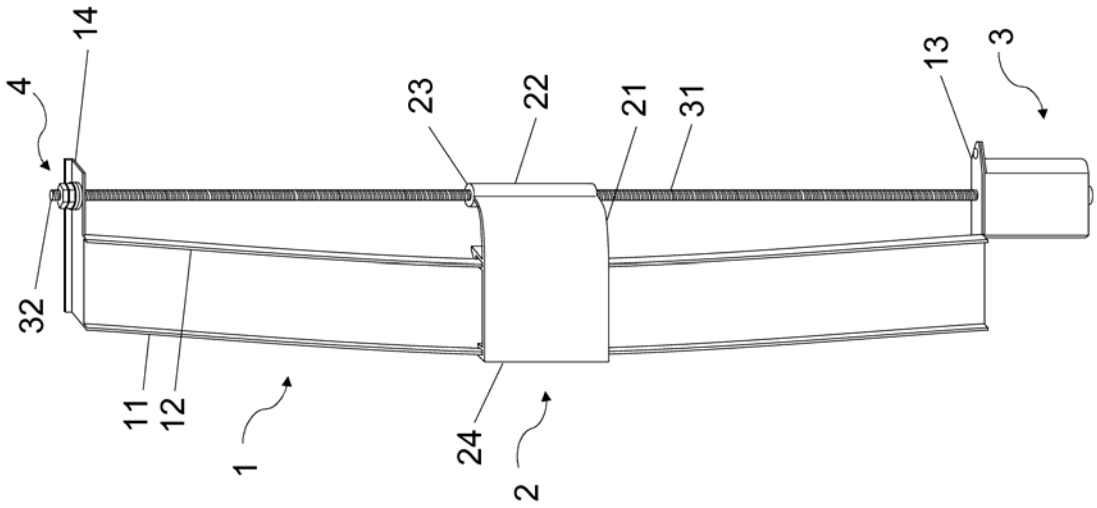
Actuator for non linear paths, provided with an endless screw (31), driven by an electric motor (3). Said endless screw, by being screwed in a threaded cavity (23) of a cylindrical element (22), linked to a slider (24) by a flexible plate (21), drives said slider (24) and a movable element linked to it, like a glass of a door of a car, along a path which is determined by the curved profile of said rail (11, 12).

While driving said slider (24), said flexible plate (21) is forced to flex itself, so as to compensate differences and variations in position and orientation between said endless screw (31) and said rail (11, 12).

A thrust bearing group (4), at the end (32) of said endless screw (31), holds the force said endless screw is loaded with while driving said slider (24) towards the end 14 of a base plate 1.



“ENDLESS SCREW RECIPROCATING ACTUATOR FOR NON LINEAR PATHS

AND WINDOW LIFTER USING THE SAME”

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DESCRIPTION

FIELD OF THE INVENTION

The present invention relates to endless screw actuators, and to window lifters using the same, for moving a movable element, like a glass of a door of a car, along non rectilinear paths.

BACKGROUND OF THE INVENTION

The present invention has the purpose to realize electrical actuators, and particularly window lifters, with a minimal parts count and economical to manufacture.

Current art in window lifters, after years of technical evolutions, is substantially aligned on actuators based on cables driven by a motor drive, and which are typically made of 25-30 parts.

Such actuators, notwithstanding many benefits in terms of reliability and costs with respect to previous generations, substantially completed their evolution, making it difficult to meet an increasing request for more economical devices.

Hence, the demand for a new generation of actuators, which can bring significant cost improvements, is very strong.

SUMMARY OF THE INVENTION

The present invention, as will be better understood from the following descriptions, allows to realize, with a parts count significantly lower with respect to current art, actuators for non linear paths and window lifters for the automotive industry, which meet the increasing request for more economical devices.

A preferred embodiment of the present invention is a device composed of:

a base plate, provided with a rail, whereon a movable group can slide;

a movable group, composed of a slider, shaped so as to be slidably coupled to said rail, and provided with fastening elements for securing a movable element, like a glass of a door of a car; a cylindrical element, provided with a threaded cavity, in which an endless screw can be screwed and unscrewed; a flexible plate which flexibly links said slider to said cylindrical element;

an electrical motor, secured to one end of said base plate and provided with a long threaded shaft, which performs the function of an endless screw, and which is screwed in the threaded cavity of said cylindrical element of said movable group;

a thrust bearing group, secured to an end of said base plate, at the opposite side with respect to said electric motor.

Said endless screw, by being screwed or unscrewed in the threaded cavity of said cylindrical element of said movable group, drives in both directions said cylindrical element, said slider, connected to it by said flexible plate, and said movable element fastened to it, like a glass of a door of a car.

The movement of said slider follows the path determined by the profile of said rail, which can be curved, according to requirements.

While said slider is driven along said rail, said flexible plate, which links said cylindrical element to said slider, is forced to flex itself so as to compensate differences and variations in position and orientation between said cylindrical element, aligned to said endless screw, and said slider, aligned to the segment of rail whereon it is.

Said thrust bearing group, secured to the end of said endless screw, holds the force said endless screw is loaded with, while driving said slider and said movable element.

BRIEF DESCRIPTION OF THE DRAWINGS

A detailed description of the invention is hereinafter described, with specific reference being made to the drawings, in which:

FIG. 1 is an isometric view of a preferred embodiment of an actuator, according to the present invention.

FIG. 2 is a fragmentary isometric view of the actuator shown in FIG. 1, in the surroundings of said movable group.

FIG. 3 is an isometric view of said movable group, in the embodiment shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

The foregoing detailed description is given by way of illustration and example only of some significant embodiments of the present invention and is not intended to limit the scope of the claims in any manner, the spirit and scope of the present invention being limited solely by the appended claims.

FIG. 1, and details shown in FIG. 2 and 3, illustrate **a preferred embodiment** of the present invention, wherein an actuator is composed of:

a base plate 1, provided with a rail 11, 12, whereon a movable group 2 can slide;

a movable group 2, composed of: a slider 24, shaped so as to be slidably coupled to said rail 11, 12, and provided with fastening elements, not shown in said figures, for securing a movable element, like a glass of a door of a car; a cylindrical element 22, provided with a threaded cavity 23, in which an endless screw 31 can be screwed and unscrewed; a flexible plate 21, which flexibly links said slider 24 to said cylindrical element 22;

an electrical motor 3, secured to one end 13 of said base plate 1, and provided with a long threaded shaft 31, which performs the function of an endless screw, and which is screwed in the threaded cavity 23 of said cylindrical element 22;

a thrust bearing group 4, composed of: a thrust bearing bush 41, placed at the end 14 of said base plate 1, in which is inserted the end 32 of said endless screw 31; a threaded nut 42, screwed at the end 32 of said endless screw 31, provided with a flange 43 abutting said bearing bush 41, and with a cylindrical prolongation for centring in said bush 41; a threaded nut 44, screwed at the end 32 of said endless screw 31, and tightened to said threaded nut 42.

Said endless screw 31, by being screwed or unscrewed in the threaded cavity 23 of said cylindrical element 22, drives in both directions said cylindrical element 22, said slider 24 connected to it by said

flexible plate 21, and said movable element fastened to it, like a glass of a door of a car.

The movement of said slider 24 follows the path determined by the profile of said rail 11, 12, which can be curved, according to requirements.

Said flexible plate 21, which links said slider 24 with said cylindrical element 22, is shaped and dimensioned so as:

to flex itself, so as to compensate, while driving said slider 24, differenced and variations of position and orientation between said cylindrical element 22, aligned to said endless screw 31, and said slider 24, aligned to the segment of rail 11, 12 whereon it is;

to balance the torque exerted on said cylindrical element 22 by screwing or unscrewing said endless screw 31 in said threaded cavity 23, so preventing the rotation of said cylindrical element 22;

to exhibit high rigidity, in the driving direction of said cursor 24, so as to be able to transfer the force needed to move said movable element, like a glass of a door of a car, without undergoing significant deformations.

Said thrust bearing group 4, secured to the end 32 of said endless screw 31, holds the force said endless screw 31 is loaded with while driving said slider 24 towards the end 14 of said base plate 1.

The fastening elements which secure a movable element, like a glass of a door of a car, to said slider 24, will not be described herein, since many current systems can be used, and their use has no influence on the innovations disclosed by this invention.

Even the fastening elements which secure said base plate 1 to the frame which holds it, like a door of a car, will not be described herein, since many current systems can be used used, and their use has no influence on the innovations disclosed by this invention.

The embodiment of the present invention illustrated in FIG. 1, wherein said endless screw 31 is a prolongation of said electrical motor 3, is a configuration which minimizes parts count and manufacturing costs. However, the space available to house said actuator and its conformation, may require alternative embodiments, in order to adapt the shape of said actuator to specific requirements.

In particular, it may be necessary to reduce the total length of said actuator, by placing said electrical motor in an alternative position to that illustrated in FIG. 1.

An alternative embodiment of the present invention is an actuator, analogous to the actuator illustrated in FIG. 1, in which: said electrical motor 3 is placed on a side of said endless screw 31, its shaft being parallel to said endless screw 31; said endless screw 31 is provided with thrust bearings 4 at both ends; said electrical motor 3 is geared to said endless screw 31 by means of a cylindrical toothed wheel on the shaft of said electrical motor 3, and a cylindrical toothed wheel on said endless screw 31.

An alternative embodiment of the present invention is an actuator, analogous to the actuator illustrated in FIG. 1, in which: said electrical motor 3 is placed on a side of said endless screw 31, its shaft being not parallel to said endless screw 31; said endless screw 31 is provided with thrust bearings 4 at both ends; said electrical motor 3 is geared to said endless screw 31 by means of a conical toothed wheel on the shaft of said electrical motor 3, and a conical toothed wheel on said endless screw 31.

While only some preferred embodiments of the present invention have been shown and described, it will be understood that various modifications and changes could be made thereunto, in order to adapt the invention to the requirements of specific applications.

The present description should not be intended to give a comprehensive list of all the possible variations of the present invention. It should be noted, however, that variations of dimensions or profiles of the embodiments shown and described may cause even significant variations of the device, without departing the spirit and scope of the invention disclosed.

CLAIMS

1. A reciprocating actuator of a movable element, composed of:

at least one rail, profiled along an assigned path;

a slider, slidingly coupled to said at least one rail, and provided with fastening elements for securing said movable element to it;

at least one element provided with a threaded cavity, linked to said slider by at least one flexible plate;

an endless screw, placed on a side of said at least one rail and rotationnally coupled to it, which is screwed in said at least one element provided with a threaded cavity;

the rotation in both ways of said endless screw drives in both directions said at least one element provided with a threaded cavity, and consequently said slider linked to it; said at least one flexible plate, while driving said slider along said at least one rail, is forced to flex itself so as to compensate the differences and variations of position and orientation, between said at least one element provided with a threaded cavity, which is aligned to said endless screw, and said slider, which is aligned to the segment of said at least one rail whereon it is

2. A reciprocating actuator of a movable element, according to claim 1, wherein: an end of said endless screw is axially connected to the shaft of an electrical motor, and the other end is provided with a thrust bearing, which holds the force, said endless screw is loaded with, while driving said slider.

3. A reciprocating actuator of a movable element, according to claim 1, wherein: an electrical motor is placed on a side of said endless screw, its shaft being parallel to it; said endless screw is provided with thrust bearings at both ends, which hold the force, said endless screw is loaded with, while driving said slider; said electrical motor is geared to said endless screw by means of two cylindrical toothed wheels placed on the shaft of said electrical motor, and on said endless screw.

3. A reciprocating actuator of a movable element, according to claim 1, wherein: an electrical motor is placed on a side of said endless screw, its shaft being not parallel to said endless screw; said endless

screw is provided with thrust bearings at both ends, which hold the force, said endless screw is loaded with, while driving said slider; said electrical motor is geared to said endless screw by means of two conical toothed wheels placed on the shaft of said electrical motor, and on said endless screw.

5. A reciprocating actuator of a movable element, according to claims 2 or 3 or 4, wherein a rigid base plate integrates: said at least one rail; seats for assembling said endless screw and said thrust bearing(s); seats for assembling said electrical motor; fastening elements for securing said base plate to a support whereon it has to be assembled.

6. A reciprocating actuator of a movable element, according to claims 1 or 2 or 3 or 4 or 5, wherein: said movable element, driven by said slider, is a glass of a door of a car.

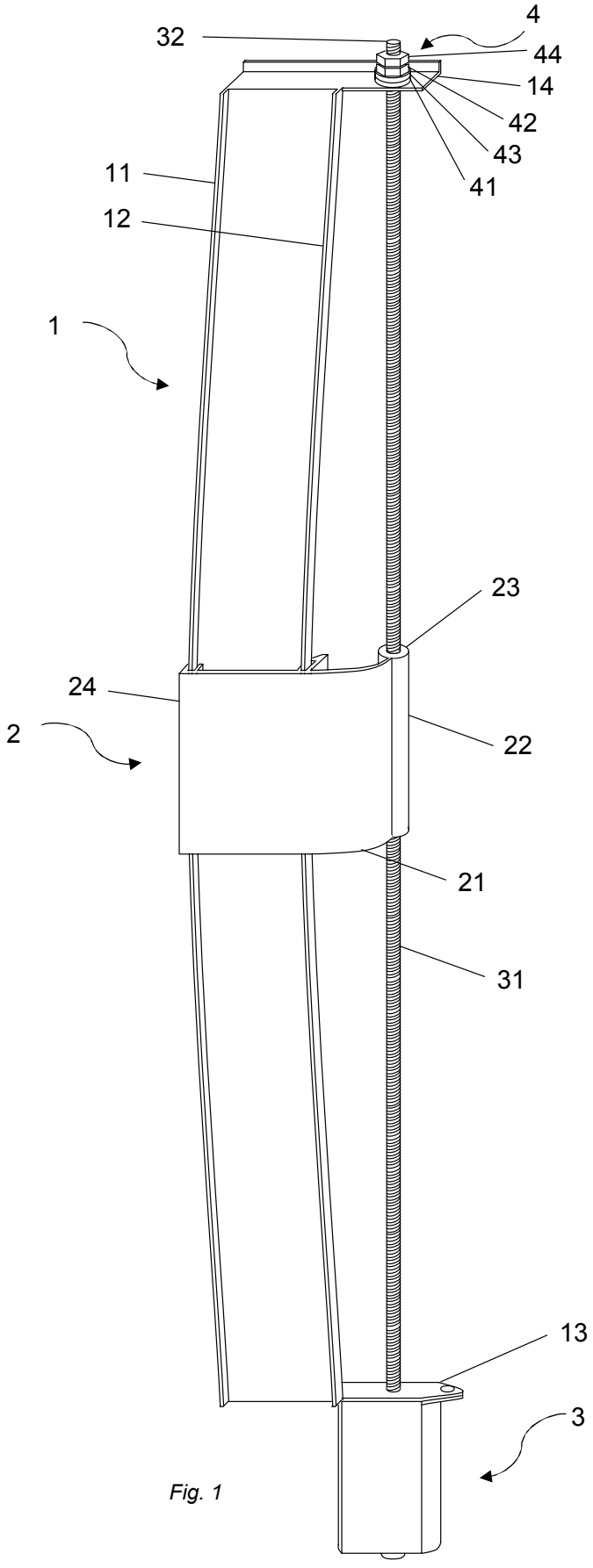

Fig. 1

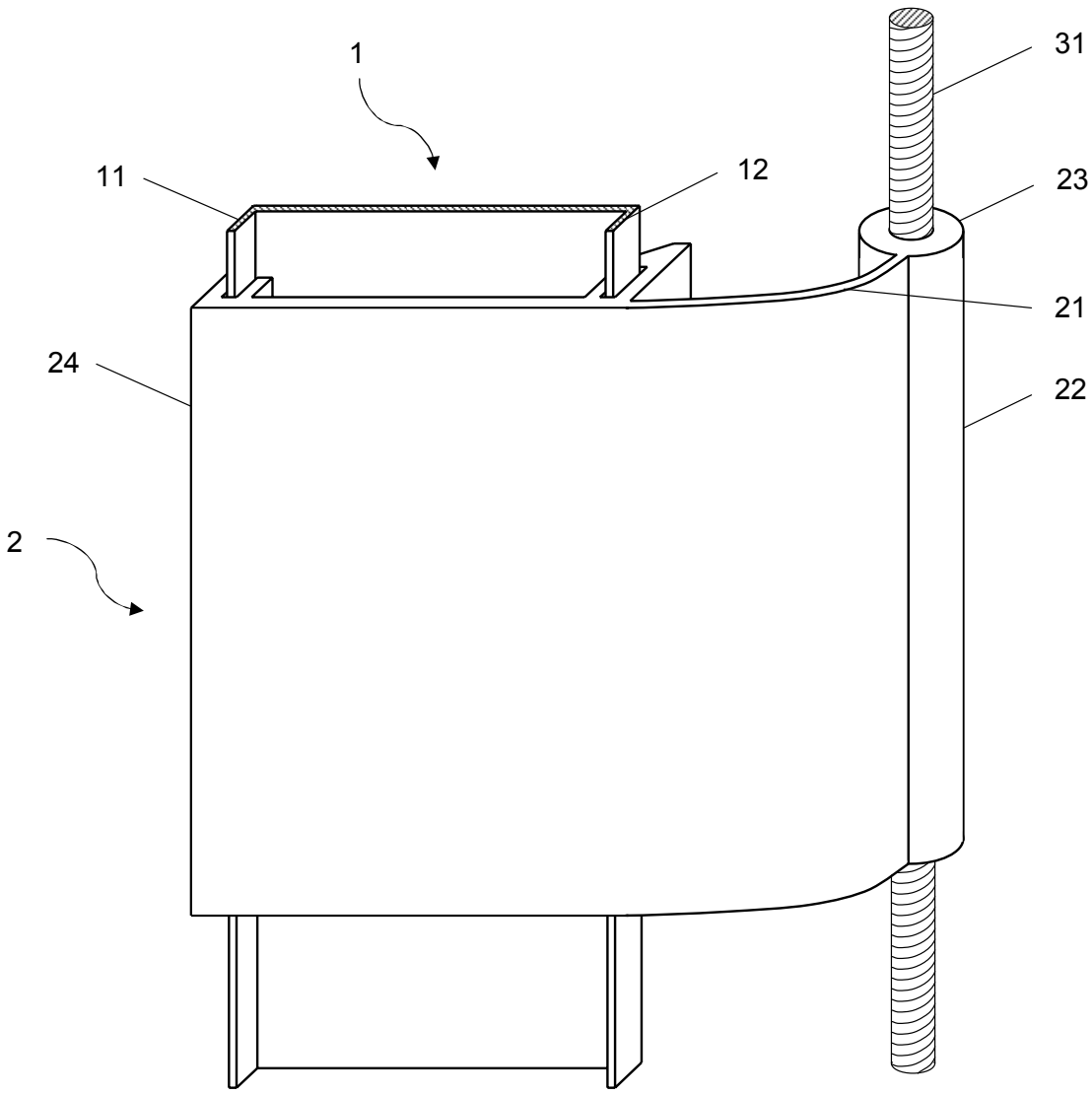

Fig. 2

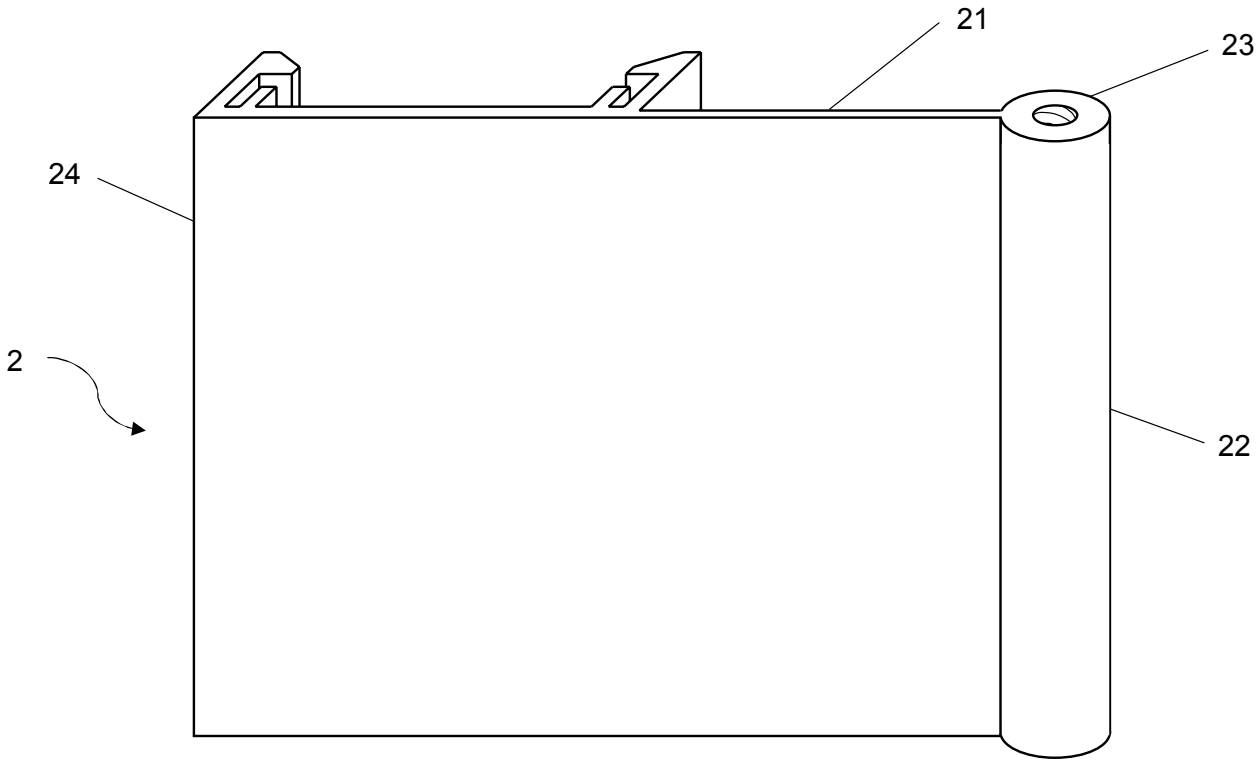

Fig. 3