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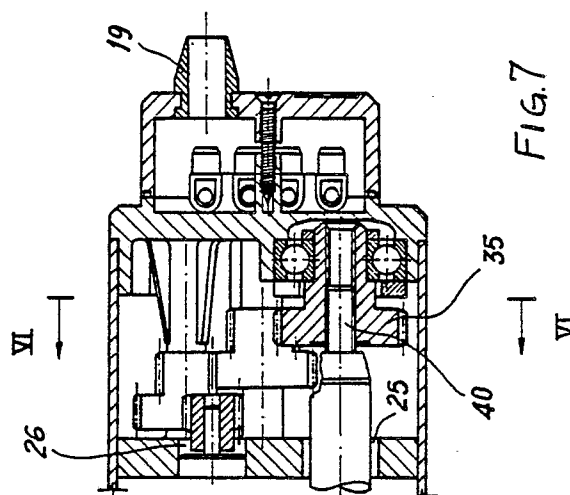
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54 **Geared linear actuator particularly suitable for opening windows.**

57 The invention refers to a geared linear actuator, particularly well-suited for operating windows, repositioning dish-type radio antennae and optical units, for operating valves, repositioning solar panels and so on. According to this invention, the actuator has an elongated prism-shaped housing (10) in which a hollow rod (22) slides, passing through one of the ends (18) of the housing and secured to the window to be operated.

Said hollow rod (22) is internally threaded and is screws to an externally threaded coaxial rod (40), the rotation of which is controlled by an electric motor (20).



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### Geared linear actuator particularly suitable for opening windows

The subject-matter of this invention consists of a geared linear actuator, particularly well-suited for opening/closing windows.

It is well-known that the windows of industrial buildings require remote controlled devices, not only since they are often in inaccessible places, for example at considerable heights, but also and above all because automatic control of the degree of opening is needed in relation to the external environmental conditions or to specific indoor emergency situations.

These actuators must also be capable of operating windows of various shapes and types, entailing a wide range of actuators of different shapes, sizes, travel and type of constraint.

The purpose of this invention is to create a highly reliable actuator, with great flexibility of use. This would mean lower costs, as one single type of actuator could be used for windows with very different sizes and characteristics.

The actuator according to the invention has an elongated prism-shaped housing containing a remote-controlled electric motor capable of interlocking with any type of automatic or manual control.

By means of a series of reduction gears, the motor in question controls the rotation of a threaded bar positioned on an axis parallel to the longest side of the prism-shaped housing of the actuator. To this threaded bar an internally threaded hollow rod is screwed which cannot rotate freely but can move freely axially.

One end of the internally threaded hollow rod, called conventionally the outer end, passes through one of the ends of the prism-shaped housing and is equipped with an eye-bolt, to be secured to the window to be moved, in one direction or another.

There are of course many different ways of connecting the hollow rod to the window.

For connecting the prism-shaped housing to the window frame, said housing has on two parallel sides a pair of dovetail-shaped grooves. One or two correspondingly shaped anchor bolts can be fixed into these grooves.

In this way it is possible to secure the housing of the actuator in any position, with any inclination, in a fixed or mobile position, as described in detail below.

Stop screws are also fitted inside the actuator housing.

The invention is described in greater detail below, with the help of drawings illustrating an example of its embodiment.

Figure 1 is an external side view of the actuator according to the invention.

Figure 2 is a view from above of the same actuator.

Figure 3 is a cross-section on plane III-III of figure 2, in which for the sake of simplicity the reduction gears are not shown.

Figure 4 is a cross-section of figure 1, on IV-IV.

Figure 5 is an external view of the end of the actuator opposite to the output side of the internally threaded hollow rod.

Figure 6 is a cross-section on VI-VI of figure 7 below.

Figure 7 is an enlargement of the cross-section already illustrated in figure 3, showing the series of reduction gears.

With specific reference to the above figures, 10 is the elongated prism-shaped housing of the actuator. This housing has two sides 11 and 12 on which there are lengthwise dovetailed grooves 13 and 14. The housing also has a top side 15 and a bottom side 16. Naturally the actuator housing can be positioned in any direction, and therefore the terms "side", "top" and "bottom" refer only to the positioning of the drawings.

Lastly, the housing 10 of the actuator has two ends 17 and 18. The first, 17, conventionally called the "rear" end, has a sleeve for the power cable of the electric motor 20. The other end, 18, conventionally called the "front" end, also has a hole fitted with a bushing 21 through which the internally threaded hollow rod 22 passes.

In the form of embodiment shown in the drawings, the internally threaded hollow rod 21 terminates with a transverse hole 23 to connect the rod to the mobile window to be operated.

The motor 20 is supported by a diaphragm 24, equipped with a hole 25 through which the hollow rod 22 passes and a second hole 26 for the shaft of the electric motor 20.

Between the diaphragm 24 and the inside surface of the rear end 17 of the housing 10, are the gears of a reduction unit, formed, in the case illustrated in the drawings, by the gear wheels 30, 31, 32, 33, 34 and 35, arranged in series so as to achieve a triple reduction. The last gear wheel, 35, is shrunk onto a threaded rod, 49.

By preventing rotation of the internally threaded hollow rod 22, which is screwed onto the threaded rod 49, said hollow rod 22 moves in and out of the housing 10 when the electric motor 20 is made to rotate in one direction or the other. To prevent rotation of the hollow rod 22, it is sufficient, for example, as in the case illustrated, to secure the transverse hole 23 to any part of the window to

be moved.

A pair of limit switches, one of which is indicated as 41 in figure 3, allows rotation of the motor 20 to be halted automatically, and thus axial movement of the hollow rod 22 in one direction or the other.

To mount the housing 10 of the linear actuator according to the invention, an anchor bolt 50, equipped with a complementary dovetail groove may be inserted into one of the two grooves 13 or 14. The anchor bolt may then be secured to the window frame.

As an alternative, as shown in figure 6, the anchor bolt 50 may in turn be secured to a bracket 51, at any relative angle, by means of a screw 52.

The anchor bolt 50 may also be secured to the support 51 in a manner allowing free rotation, so that the unit formed by the housing 10 and the rod 22 behave towards the mobile window like the swaying elements of a jointed frame with a certain degree of freedom.

If necessary, the bracket 51 may even be a U-shaped support, as shown by the dashed lines in figure 6.

Finally, it should also be noted that the electric motor 20 may be either of the d.c. powered type or of the a.c. powered type. In the former case, it will be fed with a low voltage from stand-by batteries.

## Claims

1) Geared linear actuator, particularly well-suited for operating windows, characterized in that it has an elongated prism-shaped housing (10) in which a hollow rod (22) slides, and which passes through one of the ends (18) of said housing and is connected to the window to be operated; in which said hollow rod is internally threaded and screwed onto an externally threaded coaxial bar (40), the rotation of which is in turn controlled by a suitable motor, preferably electric (20).

2) Linear actuator according to the foregoing claim, characterized in that between said threaded bar (40) and said motor (20) for operating it, there is a reduction gear (30, 31, 32, 33, 34, 35).

3) Linear actuator according to the foregoing claims, characterized in that on at least one side of the housing a groove (13, 14) is provided, preferably a dovetail groove, capable of receiving a fixing block (50) having a complementary cross-section and which may be secured in any position along said groove.

4) Linear actuator according to claim 3, characterized in that said fixing block is firmly fastened or jointed to a supporting bracket (51).

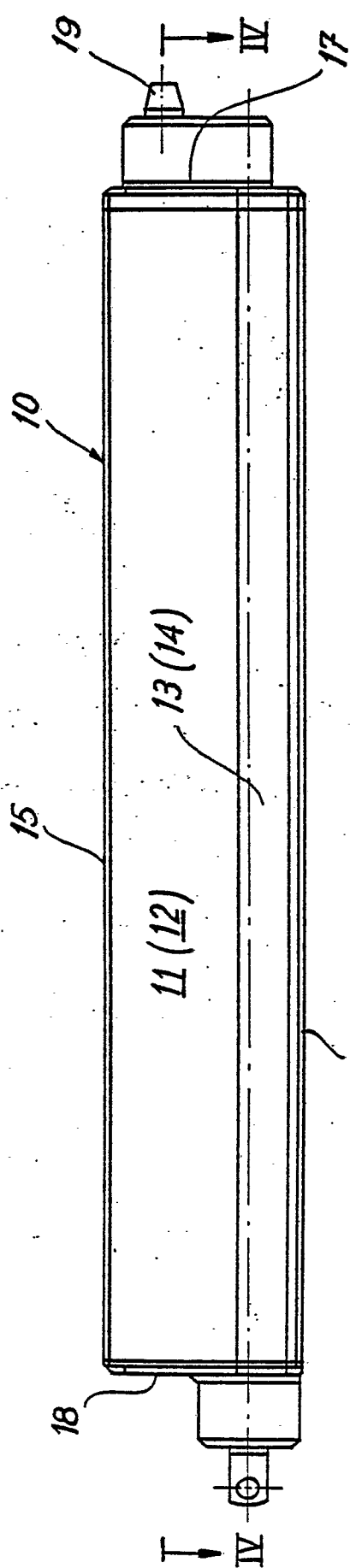


FIG. 1

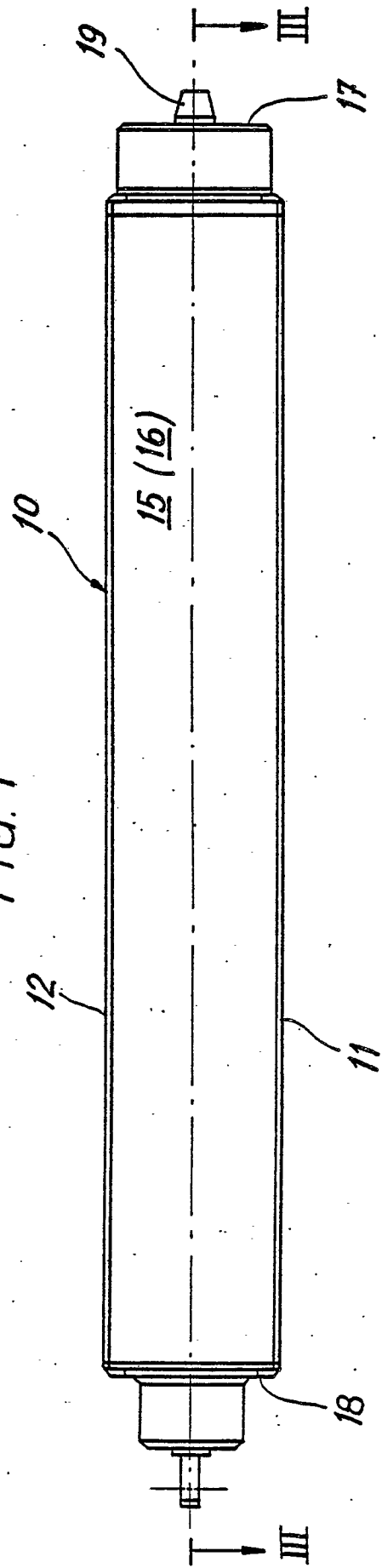
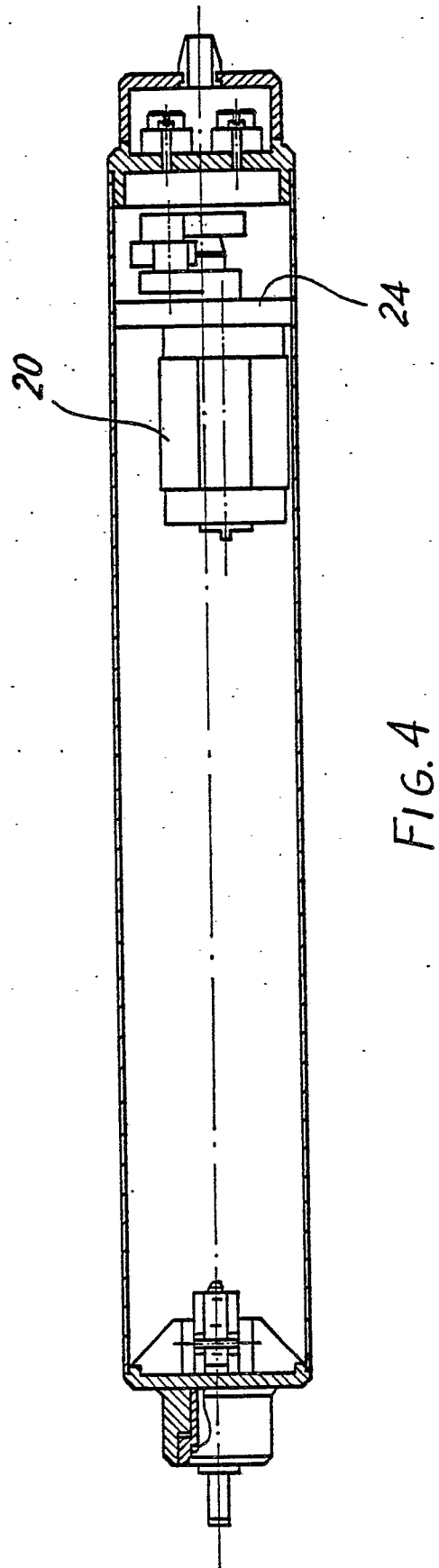
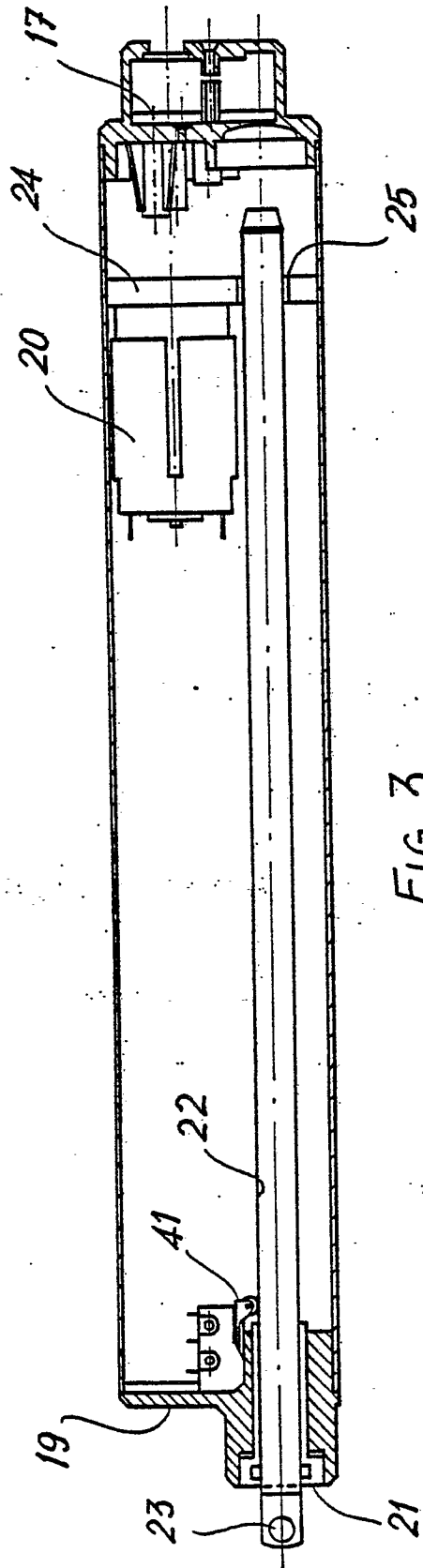


FIG. 2



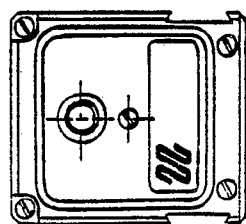


FIG. 5

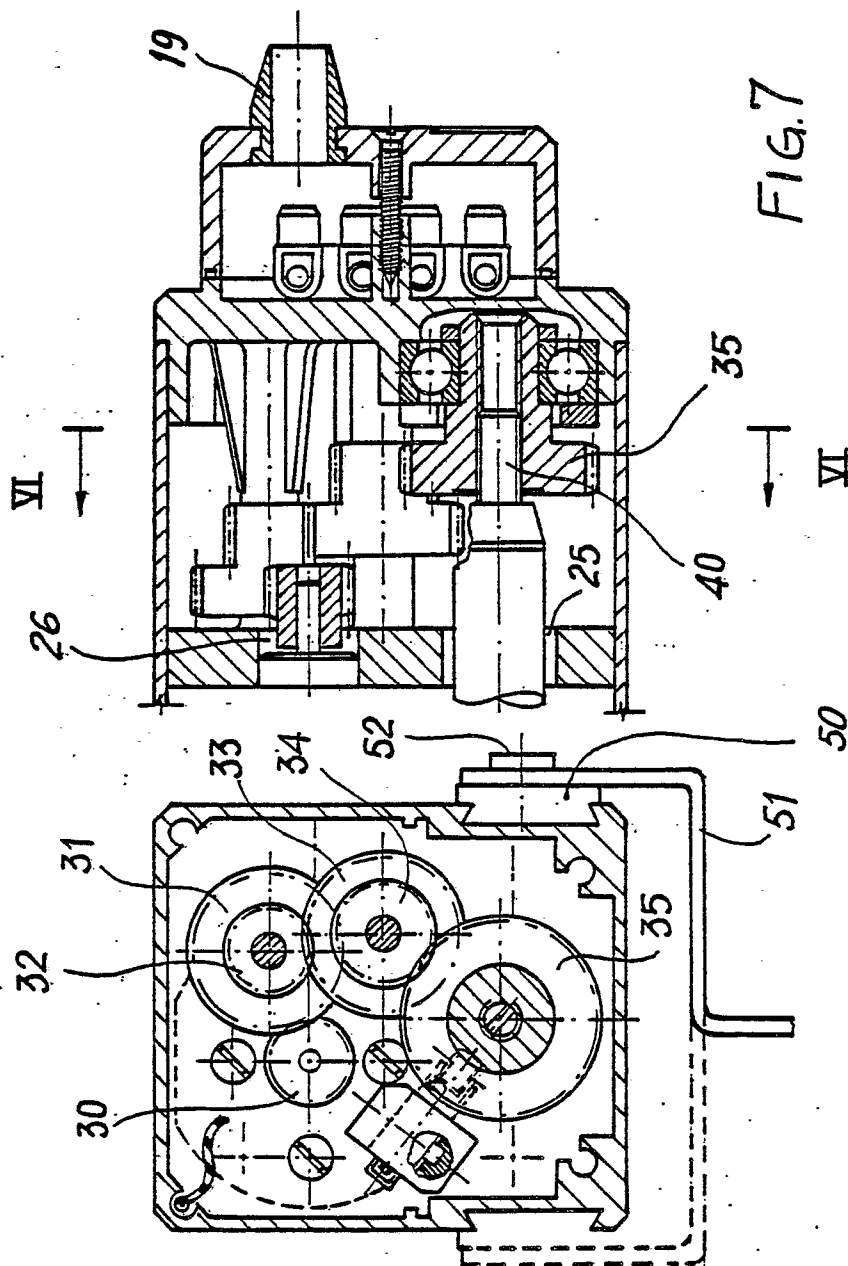


FIG. 7

FIG. 6



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE-U-8 703 448 (LICENTIA PATENT-VERWALTUNGS-GmbH) * Whole document *	1,2	E 05 F 15/10
Y	---	3,4	
Y	WO-A-8 001 341 (A. WACHE) * Figure 3; page 3, lines 18-28 * -----	3,4	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			E 05 F F 16 H H 02 K A 01 G
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16-03-1989	Examiner KISING A.J.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	