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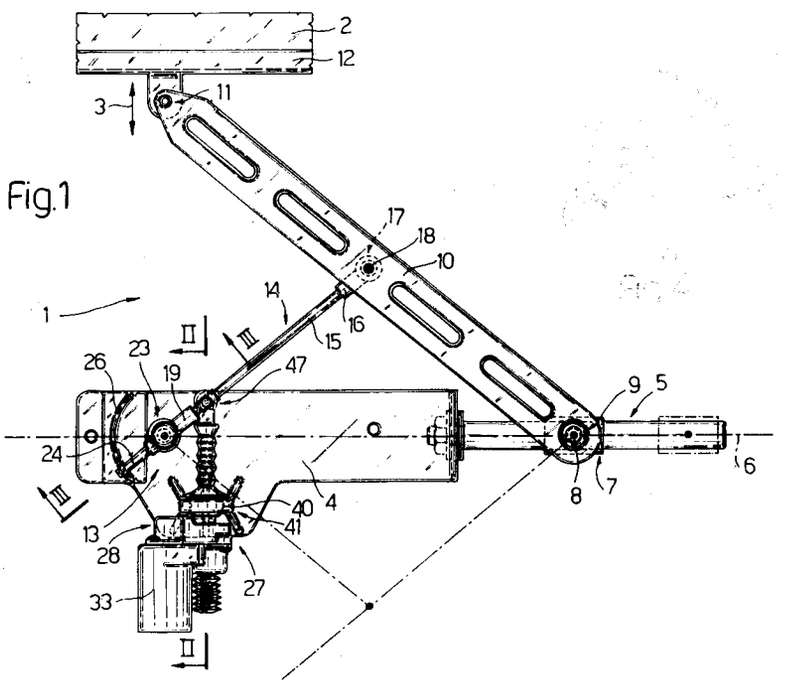
(54) Window regulator, particularly for motor vehicles.

(57) A window regulator (1)(52) wherein a slide (7), mounted on a guide (5) extending along an axis (6), is connected, by means of a first hinge (9), to a first end of a drive arm (10), the other end of which is connected, by means of a second hinge (11), to a window (2) sliding in a direction (3) perpendicular to the axis (6) of the guide (5). The drive arm (10) is rotated in relation to the slide (7) by an actuating arm (14) having a first point (23) hinged to the guide (5) on the axis (6) of the same, and a second point (17) hinged to the center line of the drive arm (10); the distance between the first and second points (23, 17) of the actuating arm (14) being equal to half the distance between the first and second hinges (9, 11).

Fig.1



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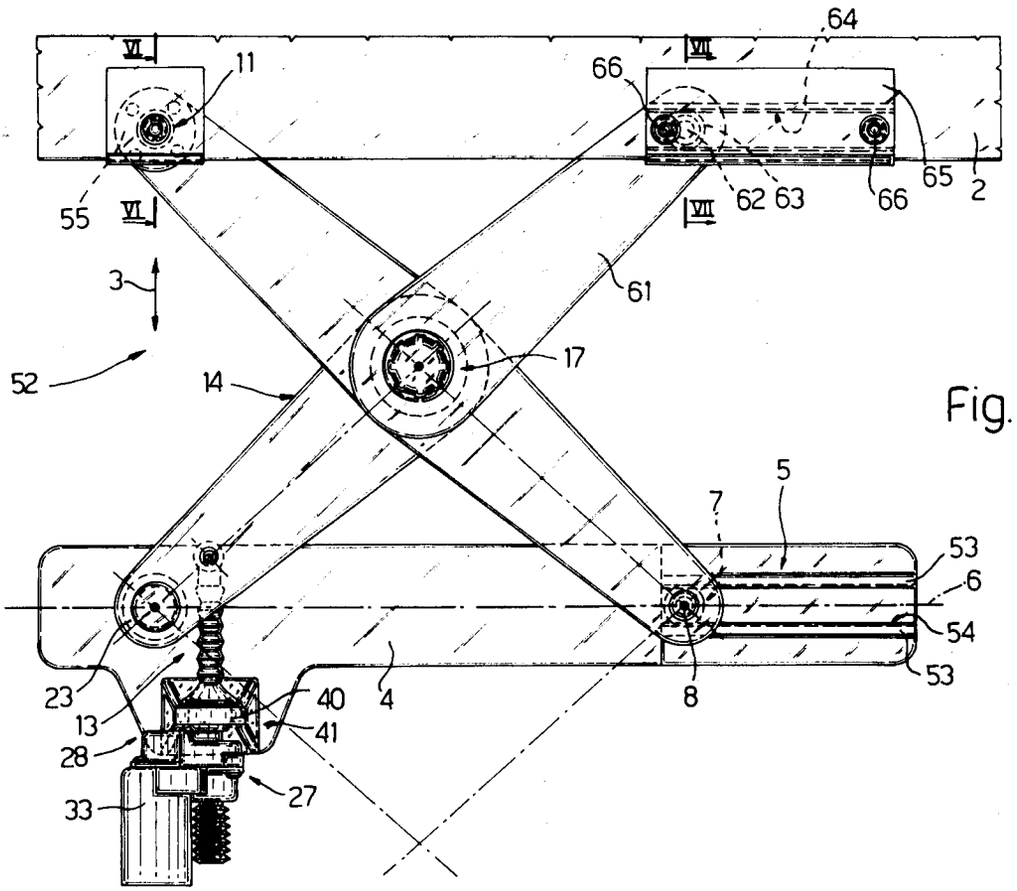
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Fig. 5

The present invention relates to a window regulator, particularly for motor vehicles.

In particular, the present invention relates to a window regulator suitable for fitment inside a motor vehicle door for enabling troublefree, noisefree vertical control of a sliding window on the door.

According to the present invention, there is provided a window regulator, characterised by the fact that it comprises a guide extending along an axis; a slide mounted on said guide so as to slide along said axis; a drive arm; first hinge means connecting said drive arm to said slide; second hinge means connecting said drive arm to a sliding window; and actuating means comprising an actuating arm having a first point connected for rotation to said guide, and a second point connected for rotation to the center line of said drive arm; the distance between said first and second points of said actuating arm being equal to half the distance between said first and second hinge means.

A number of non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Fig.1 shows a side view of a first preferred embodiment of the window regulator according to the present invention;

Fig.2 shows a section along line II-II in Fig.1;

Fig.3 shows a section along line III-III in Fig.1;

Fig.4 shows a variation of a detail in Fig.1;

Fig.5 shows a side view of a second preferred embodiment of the window regulator according to the present invention;

Fig.6 shows a section along line VI-VI in Fig.5;

Fig.7 shows a section along line VII-VII in Fig.5;

Fig.8 shows a variation of a detail in Fig.5.

Number 1 in Fig.1 indicates a window regulator suitable for fitment inside the door (not shown) of a vehicle (not shown), particularly a motor vehicle, for regulating the position of a window 2 sliding in the direction shown by arrow 3 and defined by guides (not shown) fitted to the opposite side edges (not shown) of window 2.

Regulator 1 comprises an elongated plate 4 fitted at one end in removable manner with a guide 5 consisting of a pin having an axis 6. Regulator 1 also comprises a slide 7 consisting of a sleeve mounted in sliding manner on guide 5 so as to slide along axis 6, and having a radial hinge pin 8 for a substantially spherical hinge 9 connecting slide 7 to a first end of a drive arm 10, the second fork-shaped end of which is connected by a substantially spherical hinge 11 to a bracket 12 integral with the bottom end of window 2.

An actuating device 13 provides for rotating drive arm 10 about hinges 9 and 11 and simultaneously moving slide 7 along guide 5 for sliding window 2 in the direction of arrow 3.

Device 13 comprises an actuating arm 14 defined, as shown in Fig.1, by a rod 15, one end of which is fitted with a sleeve 16 connected by a spherical joint 17 to a pin 18 integral with an intermediate portion of drive arm 10 and located halfway between hinges 9 and 11. As shown particularly in Fig.3, the end of rod 15 opposite that fitted with sleeve 16 presents a tubular body 19 facing and parallel to plate 4, and having, on the side facing plate 4, a spherical seat 20 for the spherical head 21 of a pin 22 perpendicular to and integral with plate 4 and defining, together with seat 20, a spherical joint 23 connecting arm 14 to plate 4 and separated from joint 17 by the same distance between the axis of pin 18 and hinges 9 and 11.

As shown more clearly in Fig.3, on the opposite side to that connected to rod 15, tubular body 19 is fitted with an appendix 24 coaxial with rod 15 and engaged in sliding manner through an opening 25 formed parallel to plate 4 through a curved bracket 26 integral with plate 4 and coaxial with pin 22.

In the embodiment shown in Fig.s 1 to 3, device 13 also comprises an electromechanical linear actuator 27. As shown particularly in Fig.2, actuator 27 comprises a housing 28 having two opposite walls 29 and 30 between which a substantially cylindrical nut screw 32 is mounted for rotation via the interposition of bearings 31. Nut screw 32 is rotated about its axis inside housing 28 by an electric motor 33, and is fitted through with a rigid screw 34 connected to nut screw 32 by a recirculating ball coupling 35. Screw 34 comes out of housing 28 through a sleeve 36 extending outwards from wall 29 and engaged inside a diametrical through hole in a spherical head 37. Head 37 is engaged for rotation inside a spherical seat 38 in a cylindrical body 39 supported on a bracket 40 integral with plate 4, and defining, together with head 37, a spherical joint 41 connecting actuator 27 to plate 4.

As shown in Fig.s 2 and 3, the free end of screw 34 is fitted with a ring 42 engaged in rotary manner by a pin 43 defining, with ring 42, a hinge 44 having its axis parallel to that of pin 18. On the end opposite that engaging ring 42, pin 43 presents a rotary snap-on fork 45 connected to an intermediate portion of rod 15 and defining, with the same, a second hinge 46 in turn defining, with hinge 44, a further spherical joint 47.

In the Fig.4 variation, actuating device 13 is replaced by an actuating device 48 comprising, in place of linear actuator 27, a sector gear 49 connected integral with rod 15 and having its axis through the center of joint 23. In addition to sector gear 49, actuating device 48 also comprises a pinion 50 meshing with sector gear 49 and fitted on

to a shaft 51 supported on plate 4 and rotated by any type of activating device (not shown), e.g. a hand-operated crank (not shown) fitted to shaft 51.

In actual use, by virtue of said distance between joints 17 and 23 being equal to that between pin 18 and each of hinges 9 and 11, rotation of actuating arm 14 in either direction about an axis through the center of joint 23 and substantially parallel to the axis of pin 18 results in axial displacement of slide 7 along guide 5, and amplified straightline displacement of hinge 11 and, consequently, window 2 in the direction of arrow 3 and along a straightline trajectory through joint 23. Moreover (Fig.1), by virtue of joint 23 being located substantially along axis 6, hinge 11 is displaced along a straightline trajectory substantially perpendicular to axis 6.

The embodiment shown in Fig.s 5 to 7 relates to a window regulator 52 substantially similar to regulator 1 and the corresponding parts of which are indicated using the same numbering system.

Guide 5 of regulator 52 is formed on an end portion of plate 4, and consists of two ribs 53 parallel to axis 6 and defining a slot 54 having a concave inner profile and engaged in sliding manner by slide 7 consisting, in this case, of a roller having a convex outer profile and mounted for rotation on pin 8.

As shown in Fig.6, hinge 11 is a spherical hinge defined by a plate 55 fitted to the end of drive arm 10 and having a central spherical seat 56 engaged by a spherical head 57 integral with a lateral surface of bracket 12, the opposite lateral surface of which is fitted with a pin 58 having a head 59 fitted through a hole 60 in window 2.

The above solution for connecting arm 10 to window 2 may obviously also be applied to regulator 1.

As shown in Fig.5, actuating arm 14 of regulator 52 extends beyond joint 17 in the form of a second arm 61 of the same length as and coaxial and integral with arm 14. On the end opposite that connected to arm 14, arm 61 is fitted with a pin 62 in turn fitted in idle manner with a roller 63 having a convex outer profile. Roller 63 constitutes a slide traveling along a guide 64 having a concave inner profile, substantially parallel to axis 6, and formed on a lateral surface of a plate 65, from the opposite surface of which, contacting window 2, there extend two pins 66 similar to pin 58 and fitted through respective holes 67 in window 2.

In actual use, displacement of window 2 in the direction of arrow 3 results in displacement of roller 63 along guide 64. Roller 63 acts as a movable support for the bottom edge of window 2, and prevents window 2 from rotating uncontrollably about the axis of pin 58 in the absence of guides (not shown) for guiding the lateral edges (not shown) of window 2.

As shown in Fig.s 5 and 8, actuating arm 14 of regulator 52 may also be operated by actuating device 13 (Fig.5) or by actuating device 48 (Fig.8).

Claims

1. A window regulator (1)(52), characterised by the fact that it comprises a guide (5) extending along an axis (6); a slide (7) mounted on said guide (5) so as to slide along said axis (6); a drive arm (10); first hinge means (9) connecting said drive arm (10) to said slide (7); second hinge means (11) connecting said drive arm (10) to a sliding window (2); and actuating means (13)(48) comprising an actuating arm (14) having a first point (23) connected for rotation to said guide (5), and a second point (17) connected for rotation to the center line of said drive arm (10); the distance between said first and second points (23, 17) of said actuating arm (14) being equal to half the distance between said first and second hinge means (9, 11).

2. A window regulator as claimed in Claim 1, characterised by the fact that said axis (6) extends in a direction perpendicular to the displacement direction (3) of said second hinge means (11).

3. A window regulator as claimed in Claim 1 or 2, characterised by the fact that said first point (23) is located on said axis (6).

4. A window regulator as claimed in any one of the foregoing Claims, characterised by the fact that it comprises a further guide (64) substantially parallel to said axis (6) and connected integral with said window (2); and a further slide (63) traveling along said further guide (64); said further slide (63) being connected to a third point (62) on said actuating arm (14); and said second point (17) being located between and equally distant from said first and third points (23, 62).

5. A window regulator as claimed in any one of the foregoing Claims, characterised by the fact that said actuating means (13) comprise a linear actuator (27) located between said guide (5) and a portion of said actuating arm (14) extending between said first and second points (23, 17).

6. A window regulator as claimed in Claim 5, characterised by the fact that said linear actuator (27) is connected to said guide (5) and

said actuating arm (14) by respective spherical joints (41, 47).

7. A window regulator as claimed in Claim 5 or 6, characterised by the fact that said linear actuator (27) is an electromechanical actuator.

8. A window regulator as claimed in Claim 7, characterised by the fact that said linear actuator (27) comprises a motor (33), a nut screw (32) connected to said motor (33) so as to rotate about its axis, and a screw (34) connected to said nut screw (32) by a recirculating ball coupling (35); said screw (34) being connected to said portion of said actuating arm (14) by said spherical joint (47), and being moved axially in relation to said nut screw (32) by said motor (33) so as to turn said actuating arm (14) about a further axis substantially perpendicular to the axis (6) of said guide (5) and intersecting said first point (23).

9. A window regulator as claimed in any one of the foregoing Claims from 1 to 4, characterised by the fact that said actuating means (48) comprise a sector gear (49) and a pinion (50) meshing with said sector gear (49); said sector gear (49) being supported on said guide (5) and rotating with said actuating arm (14) about a further axis perpendicular to the axis (6) of said guide (5) and intersecting said first point (23).

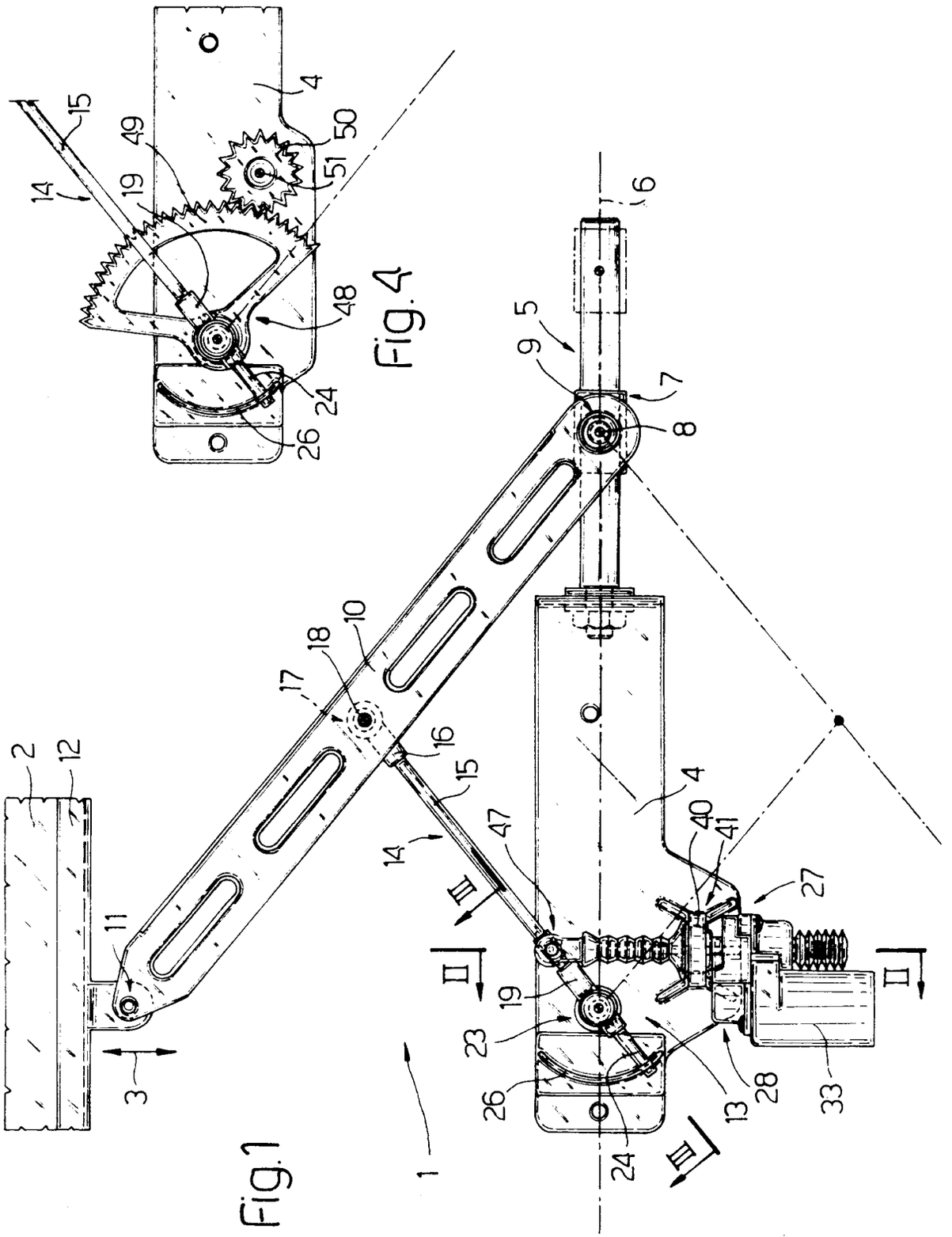
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Fig.1

Fig.4

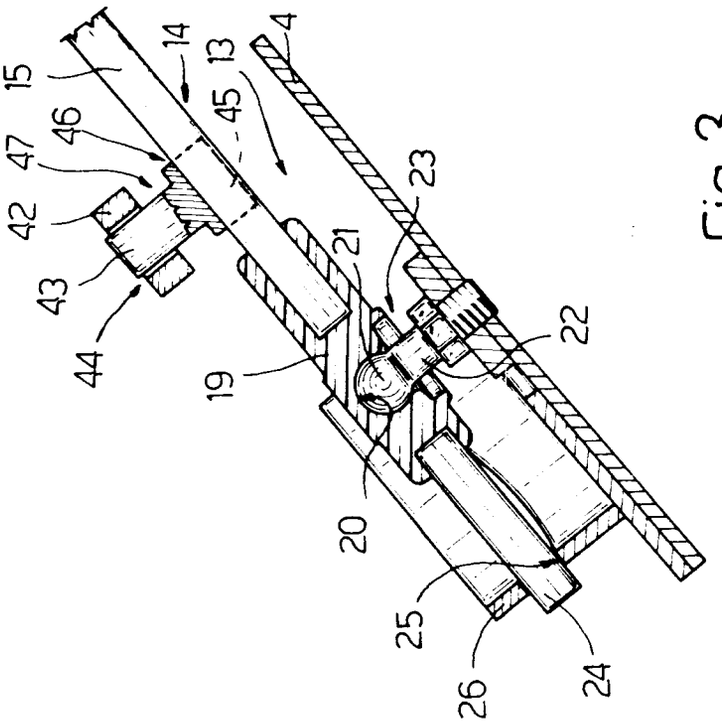
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Fig.3

Fig.2

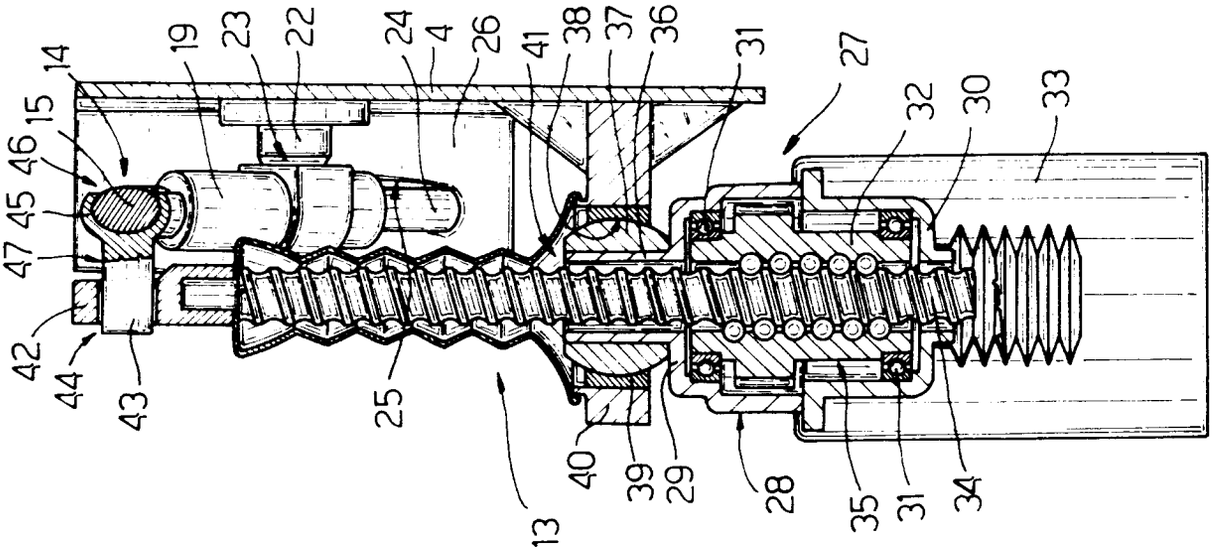
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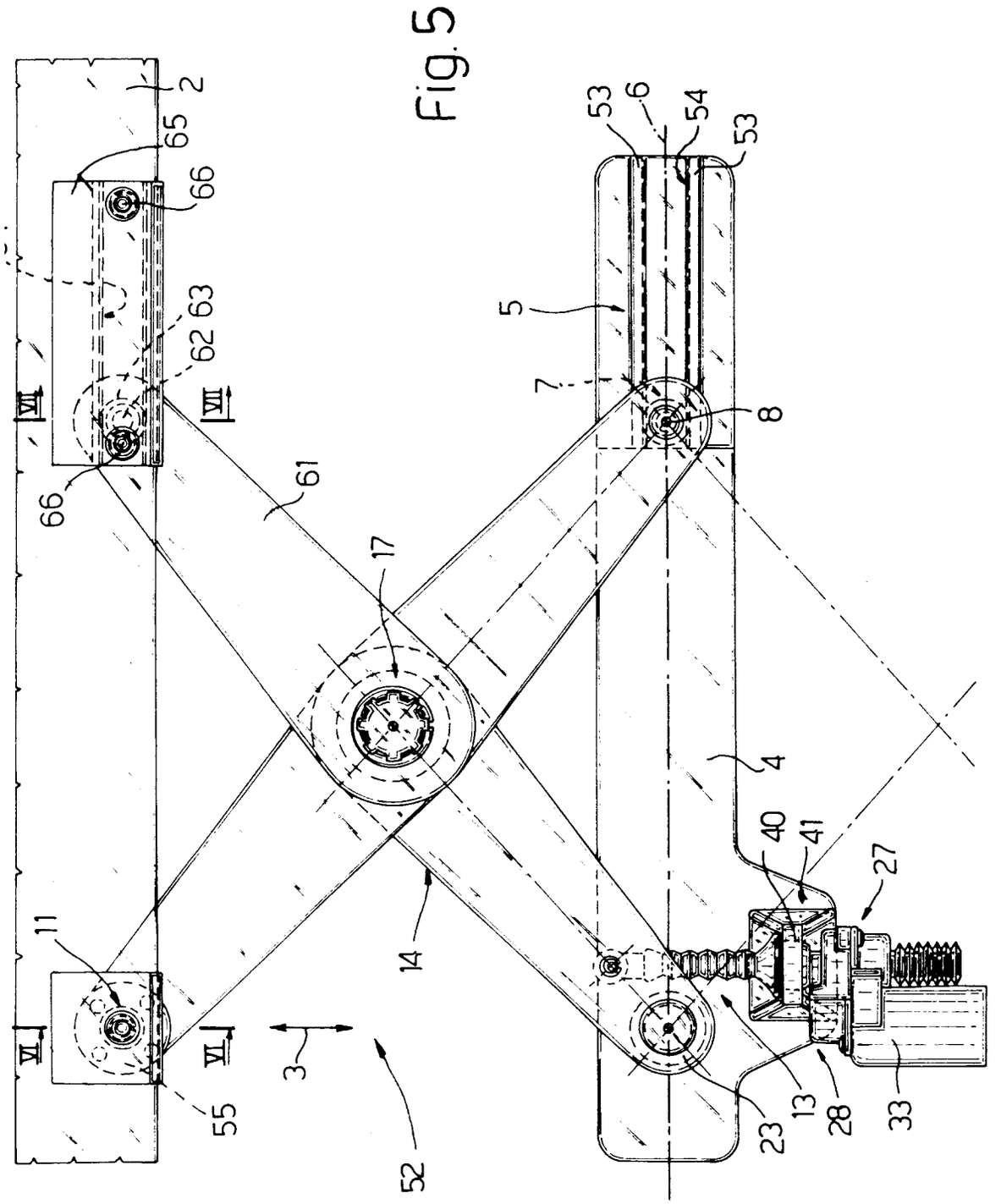
Fig.5



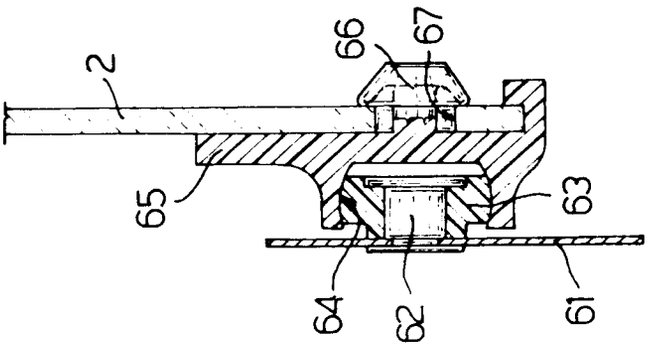


Fig. 7

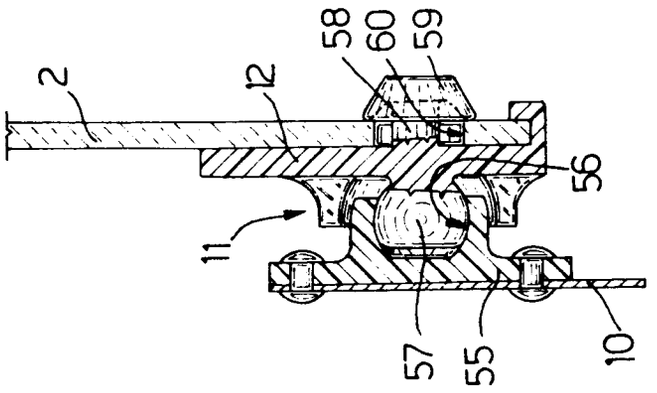


Fig. 6

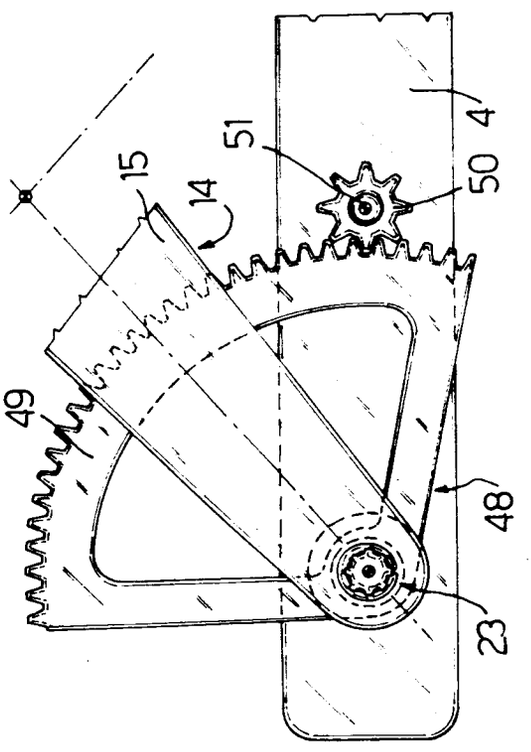


Fig. 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 11 1132

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.5)
X	US-A-2 768 532 (RUSSELL)	1-5,7	E 05 F 11/40 E 05 F 15/16
Y	US-A-2 768 532 (* column 3, line 12 - line 56 *)	6,9	
A	US-A-2 768 532 (* column 3, line 61 - column 4, line 4; figures 2,3,4 *)	8	
Y	US-A-2 547 851 (A. BRUNDAGE)	6	
A	US-A-2 547 851 (* column 2, line 33 - line 35 *)	8	
A	FR-A-2 359 954 (RIV - SKF OFFICINE DI VILLAR PEROSA) * page 3, line 27 - page 4, line 10 * * * page 4, line 28 - page 5, line 31; figures 1,2,4 * *	8	
Y	US-A-2 781 191 (J. PICKLES) * column 1, line 42 - line 55 * * * column 2, line 2 - line 9; figure 1 * *	9	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

E 05 F

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	16 October 91	GUILLAUME G.E.P.

CATEGORY OF CITED DOCUMENTS

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