(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 568 957 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **93107167.4**

(51) Int. Cl.[5] : **A47C 20/04**

(22) Date of filing : **03.05.93**

(30) Priority : **04.05.92 CH 1418/92**

(43) Date of publication of application :
10.11.93 Bulletin 93/45

(84) Designated Contracting States :
DE ES FR GB IT

(71) Applicant : **VG S.A.**
Via Campione, 57
CH-6816 Bissone (CH)

(72) Inventor : **Zapponi, Brunello**
Viale Nuvoli 58/9
I-10098 Rivoli (IT)

(74) Representative : **Jorio, Paolo et al**
Studio Torta, Via Viotti, 9
I-10121 Torino (IT)

(54) Actuator assembly, particularly for articulated hospital beds.

(57) An actuator assembly (1, 61), particularly for operating the movable portions (6, 7) of hospital beds (3) ; the actuator assembly (1, 61) presenting at least one actuating unit (16) for operating a respective movable portion (6, 7) of the bed (3) ; and the actuating unit (16) presenting an elongated casing (17) having a transverse front end recess (25) and defining, internally, a guide (39) for the piston (40) of a linear actuator (37) housed inside the casing (17) and designed to engage the operating lever (14) of the movable portion (6, 7) of the bed when the front recess (25) is engaged by a fixed cross bar (10, 11) about which the movable portion (6, 7) of the bed pivots ; the front recess (25) constituting the point at which the actuating unit (16) is connected to the bed (3).

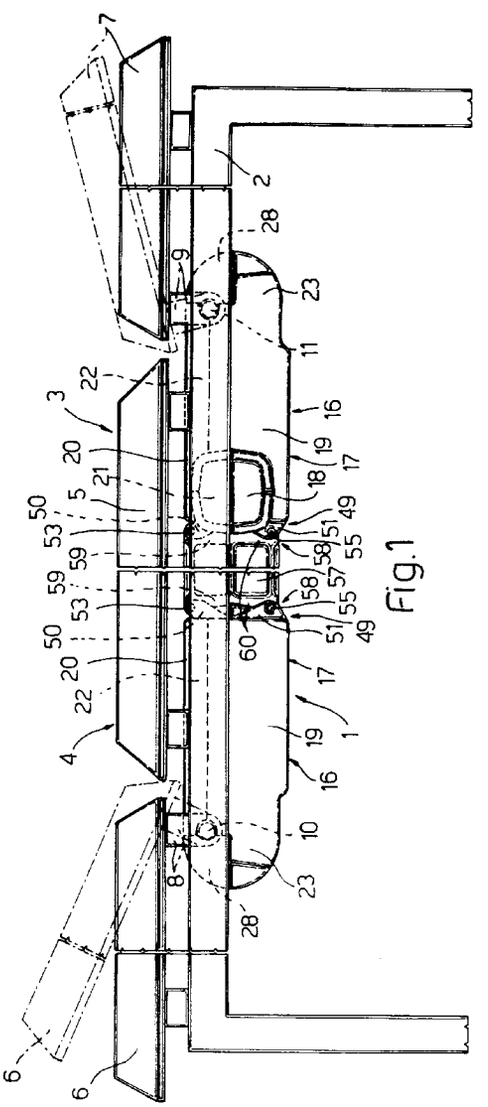

Fig.1

EP 0 568 957 A1

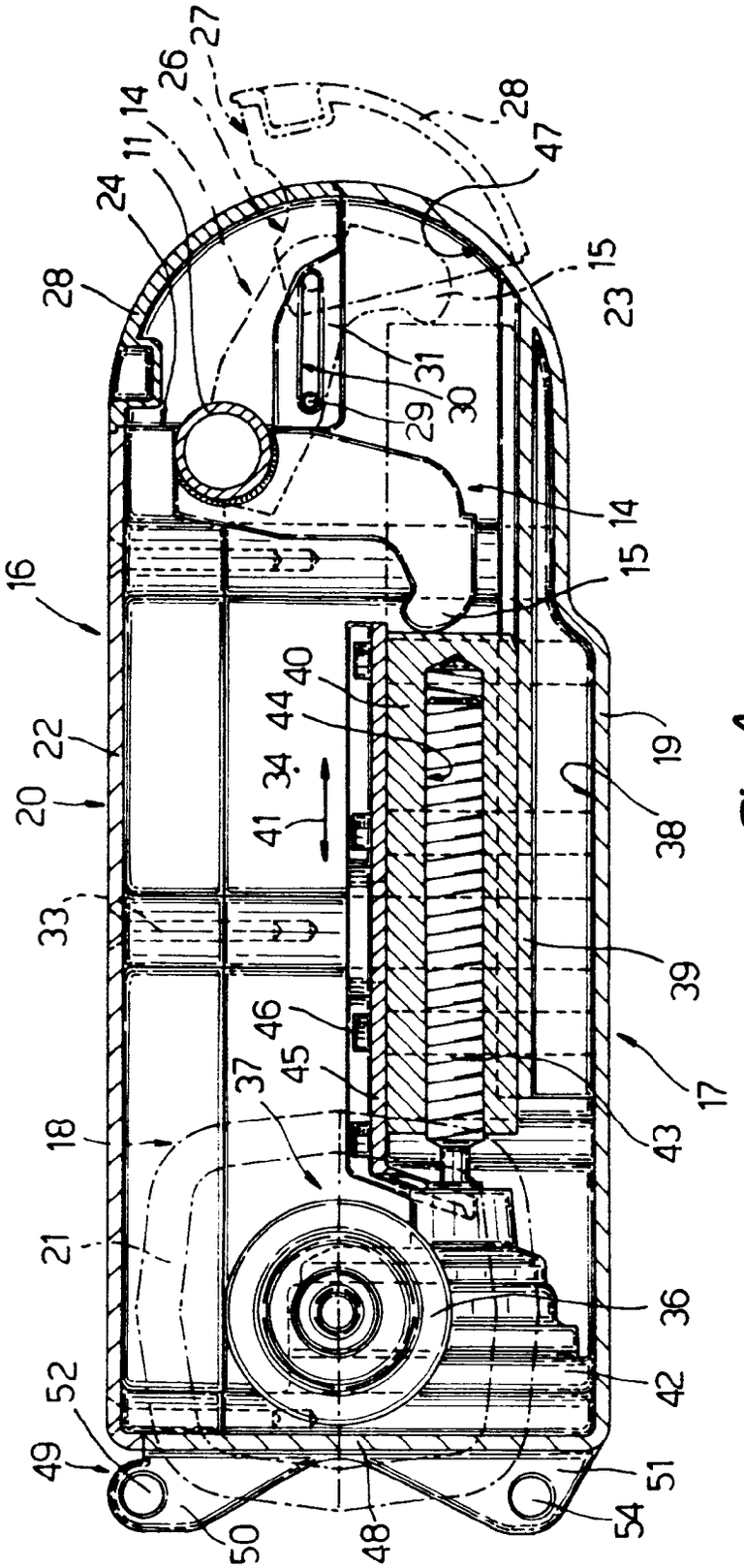
27
26
14
11
24
28
47
28
15
23
31
29
30
14
15
16
40
44
22
34
19
20
41
38
33
39
46
45
37
17
18
43
21
36
52
42
49
51
50
48
54

Fig.4

The present invention relates to an actuator assembly, particularly for articulated hospital beds.

Hospital beds in particular are known to comprise a fixed frame, and a supporting surface normally divided into a fixed portion connected to the frame, and one or more movable portions, each located at a respective end of the supporting surface and designed to rotate, about a respective axis perpendicular to the longitudinal axis of the bed, into a tilted position in relation to the fixed portion of the supporting surface.

Each movable portion normally presents a number of brackets extending downwards from the end of the movable portion facing the fixed portion, and supporting a bar extending perpendicular to the longitudinal axis of the bed and connected in rotary manner to the bed frame. The cross bar defines the rotation axis of the respective movable portion, and is normally fitted integral with a radial lever cooperating with an actuator assembly for rotating the movable portion about said axis of rotation.

The actuator assemblies currently employed on articulated beds of the aforementioned type are normally as described and illustrated in International Patent Application PCT/DE89/00290, which relates to an actuator assembly fittable to beds with two movable end sections, and comprising an elongated casing housing two opposed linear actuators. Each actuator comprises a motor housed centrally inside the casing; and a piston connected to the motor and moving back and forth, along a longitudinal guide formed inside the casing, to and from a respective end portion of the casing. The casing comprises a bottom cup-shaped body, and a top cover by which the two end portions of the casing are left exposed and accessible from outside. At each end portion of the casing, the bottom body presents two openings extending downwards from the top edges of the respective lateral walls of the bottom body, and housing a respective cross bar of a respective movable section of the bed. The casing also comprises two end covers for closing the end portions of the casing at the top.

In actual use, the known actuator assembly described above is fitted to the bed by removing the end covers; positioning the casing underneath the bed, between the two cross bars of the two movable sections, and substantially parallel to the longitudinal axis of the bed; raising the casing so as to insert the operating levers of the two cross bars inside the end portions of the casing, connect the levers to the respective pistons, and engage each cross bar inside a respective pair of said openings; and replacing the two end covers so that the casing is suspended on the cross bars.

The known actuator assembly described above clearly presents several drawbacks in terms of both design and operation.

Firstly, the casing is suspended on the cross bars by means of the end covers, which, especially when made of plastic material, are subject to breakage, thus resulting in detachment of the actuator assembly from the bed.

Secondly, due to the manner in which the casing is fitted to the bed, the above known actuator assembly allows of absolutely no variation in the distance between the two cross bars, which must fit accurately inside respective pairs of openings formed on the bottom body of the casing. In other words, therefore, a specific casing is required for each type of bed.

Finally, no part of the known actuator assembly described above is usable in the case of beds with only one movable end section.

It is an object of the present invention to provide an actuator assembly for articulated beds, designed to overcome the aforementioned drawbacks.

According to the present invention, there is provided an actuator assembly, particularly for articulated hospital beds wherein each movable section comprises a portion of the supporting surface of the bed; a cross bar connected to and defining the axis of rotation of said supporting surface portion; and externally-operated lever means for rotating said supporting surface portion about said axis of rotation; the actuator assembly being connectable to said lever means, and being characterized by the fact that, for each said movable section, it comprises an independent actuating unit in turn comprising an elongated casing, a linear actuator housed inside the casing, and a piston moved axially by the linear actuator along a guide formed in the casing; the casing presenting a transverse front end recess; the piston, in use, engaging said respective lever means when the front recess is engaged by said respective fixed cross bar; and the front recess constituting the point at which the actuating unit is connected to the bed.

According to a preferred embodiment, the actuator assembly described above comprises two said actuating units fittable to respective movable sections of the bed; and means for mutually connecting the two actuating units; the actuating units being identical and opposed to each other; said connecting means comprising hinge means for mutually connecting the two actuating units in rotary manner about at least one axis perpendicular to the longitudinal axis of the actuator assembly, and lock means for locking the two actuating units in a substantially mutually aligned position; and the front recesses of the two actuating units presenting, when the actuating units are aligned, a center distance substantially equal to that of said cross bars.

Said connecting means preferably comprise a central body interposed between the two actuating units and connected to each by a said hinge means and a said lock means; said central body preferably being selectable from a number of central bodies differing in size in a direction parallel to the longitudinal axis of the actuating units.

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 schematic side view of a preferred embodiment of the actuator assembly according to the present invention and as fitted to a bed with movable end portions;

Fig.2 shows a schematic plan view of the Fig.1 actuator assembly;

Fig.3 shows a larger-scale plan view, with parts removed for clarity, of a detail in Fig.2;

Fig.4 shows a section along line IV-IV in Fig.3;

Fig.5 shows a section along line V-V in Fig.3;

Fig.6 shows a schematic side view of a variation of the Fig.2 actuator assembly in an intermediate assembly position.

Number 1 in Fig.1 indicates an actuator assembly fitted in removable manner to the fixed frame 2 of a bed 3, the supporting surface 4 of which comprises a fixed central section 5, a top or head section 6, and a bottom or foot section 7. Sections 6 and 7 present respective pairs of brackets 8 and 9 for connecting them to respective cross bars 10 and 11 located close to the opposite ends of central section 5 of supporting surface 4, and connected to frame 2 so as to rotate, in relation to frame 2, about respective axes 12 and 13.

As shown more clearly in Fig.4, each bar 10, 11 presents a substantially L-shaped lever 14 extending substantially radially outwards from respective bar 10, 11, and comprising a square end arm 15 cooperating with actuator assembly 1 for determining the angular position of respective bar 10, 11 about respective axis 12, 13 and in relation to frame 2.

As shown in Fig.1, actuator assembly 1 comprises two identical opposed actuating units 16 mutually connected in removable and mutually separable manner, connected in removable manner to frame 2, and located between bars 10 and 11 beneath central section 5 of bed 3.

As shown in Fig.s 3, 4 and 5, each actuating unit 16 comprises an outer casing 17 substantially in the form of a rectangular parallelepipedon with its longitudinal axis perpendicular to bars 10 and 11, and having, close to one end, a lateral projection 18 extending substantially parallel to bars 10 and 11.

As shown more clearly in Fig.6, casing 17 comprises a bottom cup-shaped body 19 closed at the top by a cover 20 defined by a first cup-shaped portion 21 extending over the top half of projection 18, and by a second cup-shaped portion 22 extending over the portion of casing 17 adjacent to projection 18. At the opposite end of casing 17 to that presenting projection 18, bottom body 19 presents a sunken end portion 23 projecting beyond the corresponding end of portion 22 of cover 20, and defines, together with portion 22, a transverse front frame 24 defined at the top by the top wall of portion 22 of cover 20, and laterally by the lateral walls of portion 22 and bottom body 19. The lateral walls of frame 24 present two aligned recesses, which combine to define a front transverse recess 25 having a semicylindrical section and formed half on cover 20 and half on bottom body 19. Recess 25 presents a substantially rectangular, circular-ended section, and is deeper than the radius of respective bar 10, 11, so as to house, in use, over half of the circumference of respective bar 11, 12, and act as the connecting point of casing 17 to bar 10, 11. The remainder of the circumference of each bar 10, 11 engages a recess 26 defined by two aligned recesses formed in the lateral walls of a front frame 27 of a cup-shaped cover 28 movable, in relation to the bottom body, between a closed position (continuous line in Fig.4) wherein cover 28 is positioned over sunken portion 23 with front frame 27 contacting front frame 24, and an open position (dotted line in Fig.4) wherein cover 28 is turned down in front of the free end of portion 23 to enable access to recess 25 from the outside. To enable the above movement, cover 28 presents two coaxial inner lateral pins 29 (only one shown), each mounted so as to rotate and slide transversely inside a respective guide slot 30 (only one shown) formed in a respective upper lateral longitudinal appendix 31 (only one shown) of sunken portion 23.

Portions 21 and 22 of cover 20 are connected to bottom body 19 of casing 17 by respective screws 32, 33, so as to define, with body 19, a substantially L-shaped chamber 34, a first portion 35 of which extends inside lateral projection 18, and, as shown more clearly in Fig.3, houses the reversible motor 36 of a linear actuator 37. The intermediate portion of a second portion 38 of chamber 34, extending along the longer longitudinal axis of casing 17 and substantially perpendicular to respective bar 10, 11, houses a U-shaped guide 39 of a piston 40 constituting the output member of actuator 37 and having a substantially square section. Piston 40 is moved by motor 36 to and from sunken portion 23 of bottom body 19 in direction 41 perpendicular to respective bar 10, 11.

To enable the above reciprocating motion of piston 40, motor 36 is connected to a reduction gear 42 housed inside an initial portion of portion 38 of chamber 34 and having an output consisting of a screw 43, which engages an internally-threaded axial hole 44 in piston 40, and is connected to piston 40 by a screw-nut screw coupling. To prevent piston 40 from rotating with screw 43, said intermediate portion of chamber 34 houses an intermediate longitudinal transverse plate 45 connected by screws 46 to bottom body 19, contacting the flat lateral surface of piston 40 opposite that contacting guide 39, and supporting electronic components (not shown) for controlling actuator 37.

Chamber 34 presents an end portion 47 extend-

ing inside sunken portion 23 of bottom body 19, accessible from the outside by opening cover 28, and housing respective lever 14, the free end of arm 15 of which is positioned, in use, contacting the free end of respective piston 40.

As shown in Fig.s 2 and 4, at the opposite end to cover 28, casing 17 is closed by an end wall 48 perpendicular to direction 41 and fitted on its outer surface with a comb type connecting device 49 defined by a number of pairs of superimposed tabs 50 and 51. Top tabs 50 present respective coaxial through holes 52 designed to receive a common hinge pin 53 (Fig.2); and bottom tabs 51 present respective coaxial through holes 54 parallel to holes 52 and recess 25, and designed to receive a common lock pin 55 (Fig.2) parallel to pin 53. Each pair of superimposed tabs 50 and 51 defines, together with each adjacent pair of tabs 50 and 51, a groove 56 extending along the outer surface of wall 48, perpendicular to pins 53 and 55, and substantially equal in width to the thickness of tabs 50 and 51.

As shown in Fig.2, the two actuating units 16 of assembly 1 are connected to each other by a central bracket 57, which may be made integral with frame 2 by means of known connecting elements (not shown), and is selected from a number of central brackets 57 similar to one another but differing in width parallel to the longitudinal axis of respective actuating units 16. The width of central bracket 57 is so selected as to achieve a given length of actuator assembly 1, and such that the center distance of the two opposite front recesses 25 of assembly 1 is substantially equal to the center distance of bars 10 and 11.

At the opposite ends facing walls 48 of respective actuating units 16, central bracket 57 presents two comb type connecting devices 58, each similar to device 49 and comprising at least two pairs of superimposed tabs 59 and 60 (Fig.1), each of which engages a respective groove 56 and is engaged by respective pins 53 and 55 for connecting actuating units 16 integral with each other.

The Fig.6 variation shows an actuator assembly 61 substantially identical to assembly 1, except that central bracket 57 is dispensed with, and comb type connecting devices 47 of actuating units 16 are connected directly by a top pin 53 and a bottom pin 55.

In actual use, assembly 1 is placed beneath bed 3, in the space between bars 10 and 11; covers 28 are opened; and at least one of pins 55 is withdrawn to enable actuating units 16 to be set to the angular position shown in Fig.6 relative to assembly 61. The angle formed by actuating units 16 is such as to enable levers 14 to be inserted inside end portion 47 of chamber 34, and recesses 25 to be positioned facing respective bars 10 and 11. Units 16 are then aligned, and pin 55 (or both pins 55) assembled so as to insert bars 10 and 11 inside respective recesses 25 and so firmly connect assembly 1 to bed 3.

The same also applies even in the event of a variation in the center distance of bars 10 and 11, in which case, a central bracket 57 of appropriate width need simply be selected and the same actuating units 16 employed, which, being identical, may be mass produced at low cost.

Obviously, in the case of beds 3 with a standard center distance of bars 10 and 11, actuator assembly 61 without central bracket 57 may be employed.

Finally, in the case of beds with only one movable section, e.g. head section 6, this may be operated using only one of actuating units 16.

Claims

1. An actuator assembly, particularly for articulated hospital beds (3) wherein each movable section comprises a portion (6, 7) of the supporting surface (4) of the bed (3); a cross bar (10, 11) connected to and defining the axis of rotation (12, 13) of said supporting surface portion (6, 7); and externally-operated lever means (14) for rotating said supporting surface portion (6, 7) about said axis of rotation (12, 13); the actuator assembly (1, 61) being connectable to said lever means (14), and being characterized by the fact that, for each said movable section, it comprises an independent actuating unit (16) in turn comprising an elongated casing (17), a linear actuator (37) housed inside the casing (17), and a piston (40) moved axially by the linear actuator (37) along a guide (39) formed in the casing (17); the casing (17) presenting a transverse front end recess (25); the piston (40), in use, engaging said respective lever means (14) when the front recess (25) is engaged by said respective fixed cross bar (10, 11); and the front recess (25) constituting the point at which the actuating unit (16) is connected to the bed (3).

2. An actuator assembly as claimed in Claim 1, characterized by the fact that it comprises two said actuating units (16) fittable to respective movable sections of said bed (3); and means (57) for mutually connecting said two actuating units (16); the actuating units (16) being identical and opposed to each other; said connecting means (57) comprising hinge means (53) for mutually connecting the two actuating units (16) in rotary manner about at least one axis perpendicular to the longitudinal axis of the actuator assembly (1), and lock means (55) for locking the two actuating units (16) in a substantially mutually aligned position; and the front recesses (25) of the two actuating units (16) presenting, when the actuating units (16) are aligned with each other, a center distance substantially equal to that of said cross

bars (10, 11).

3. An actuator assembly as claimed in Claim 2, characterized by the fact that said connecting means (57) comprise a central body (57) interposed between said two actuating units (16) and connected to each actuating unit (16) by a said hinge means (53) and a said lock means (55).

4. An actuator assembly as claimed in Claim 3, characterized by the fact that said central body (57) is selectable from a number of central bodies differing in size in a direction parallel to the longitudinal axis of said actuating units (16).

5. An actuator assembly as claimed in any one of the foregoing Claims, characterized by the fact that said casing (17) comprises a cup-shaped bottom body (19) and a cover (20) closing said bottom body (19); the bottom body (19) presenting, at one longitudinal end, a sunken end portion (23) projecting beyond the cover (20); said front recess (25) being formed along an edge (24) of said sunken portion (23); and said edge (24) extending perpendicular to the longitudinal axis of the casing (17).

6. An actuator assembly as claimed in Claim 5, characterized by the fact that each said bar (10, 11) is a cylindrical bar (10, 11); the section of said front recess (25) being deeper than the radius of the respective bar (10, 11).

7. An actuator assembly as claimed in Claim 5 or 6, characterized by the fact that said casing (17) comprises a further cover (28) fitted to the bottom body (19) and movable, in relation to the bottom body (19), between an open and closed position wherein it opens and closes said sunken portion (23), which defines a housing for said respective lever means (14).

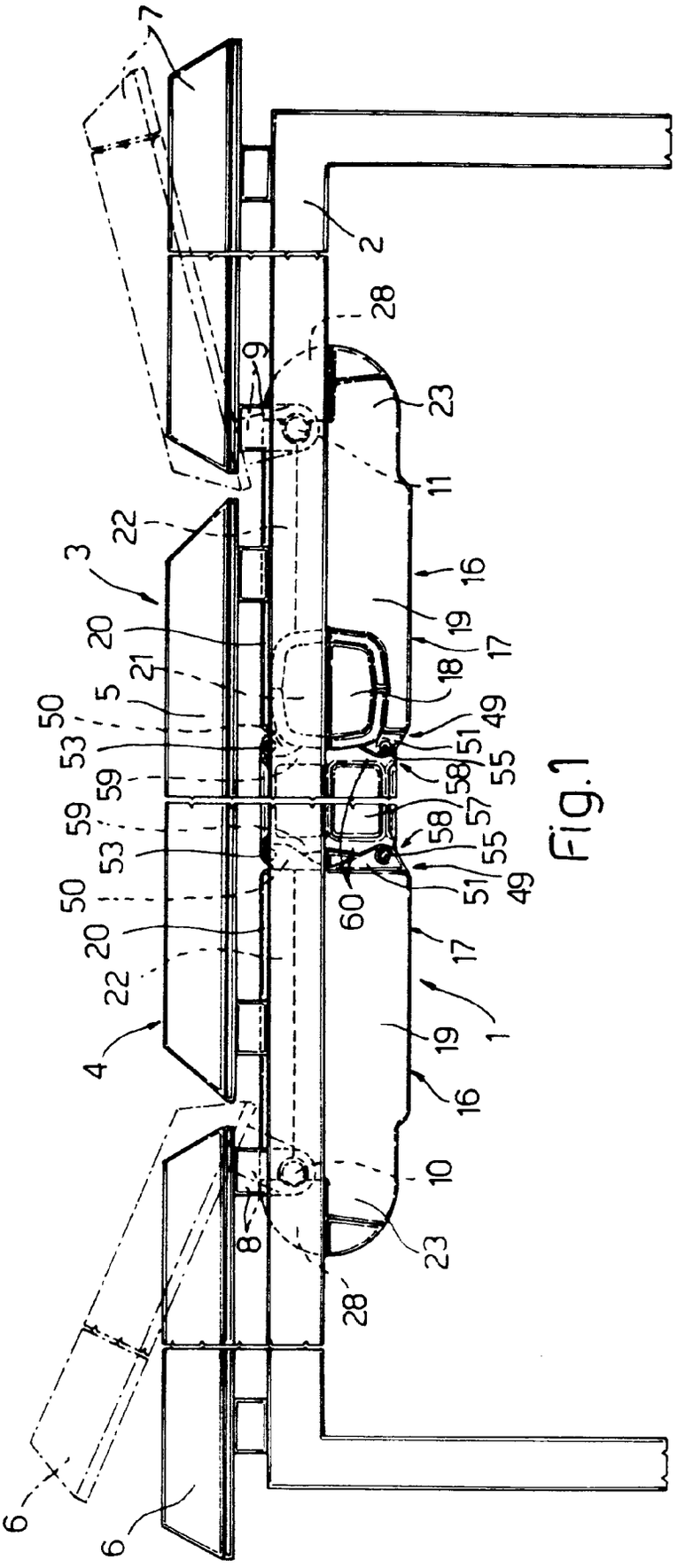
7
2
28
9
23
11
22
3
16
20
19
21
18
17
5
50
49
53
51
59
58
55
59
57
58
53
55
50
51
49
60
20
17
22
19
4
1
16
10
8
23
28
6
6

Fig.1

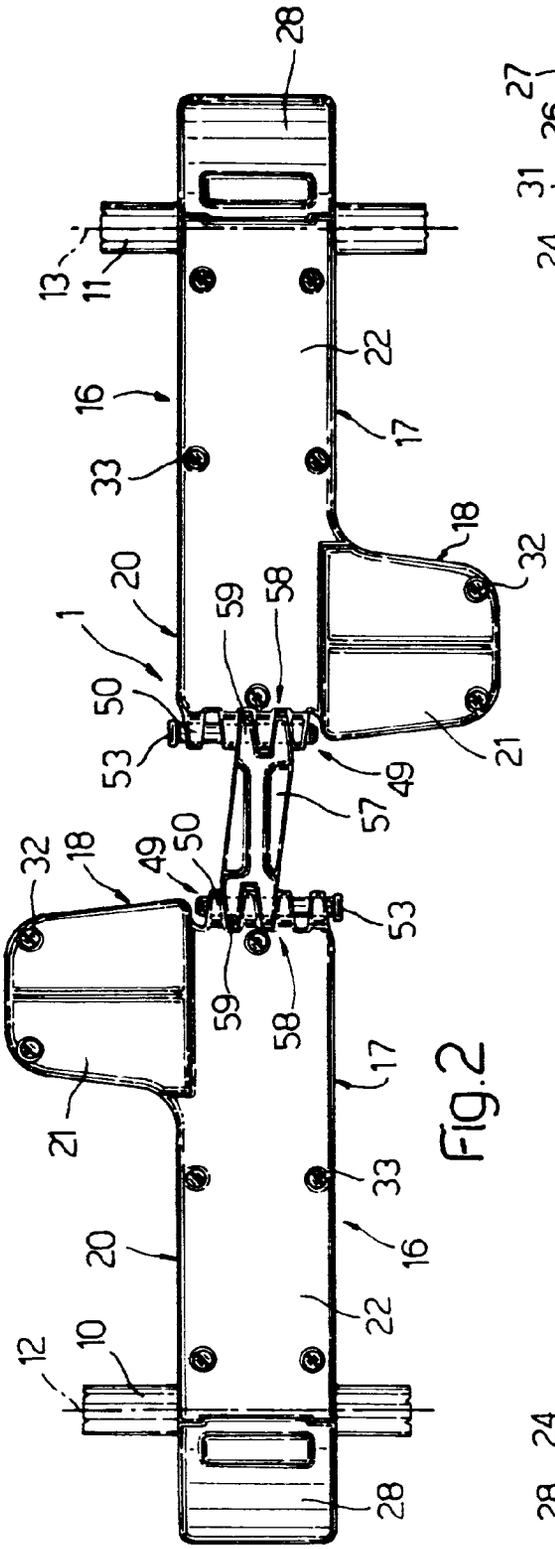

Fig.2

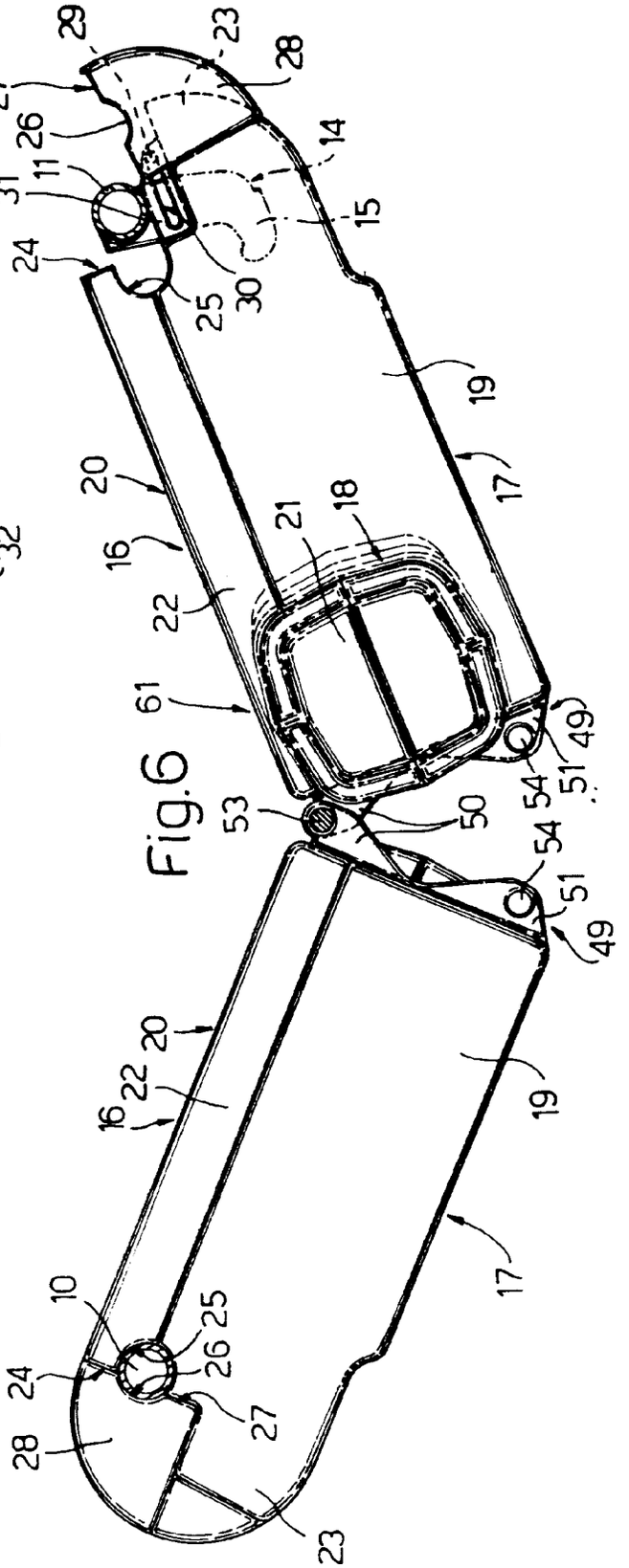

Fig.6

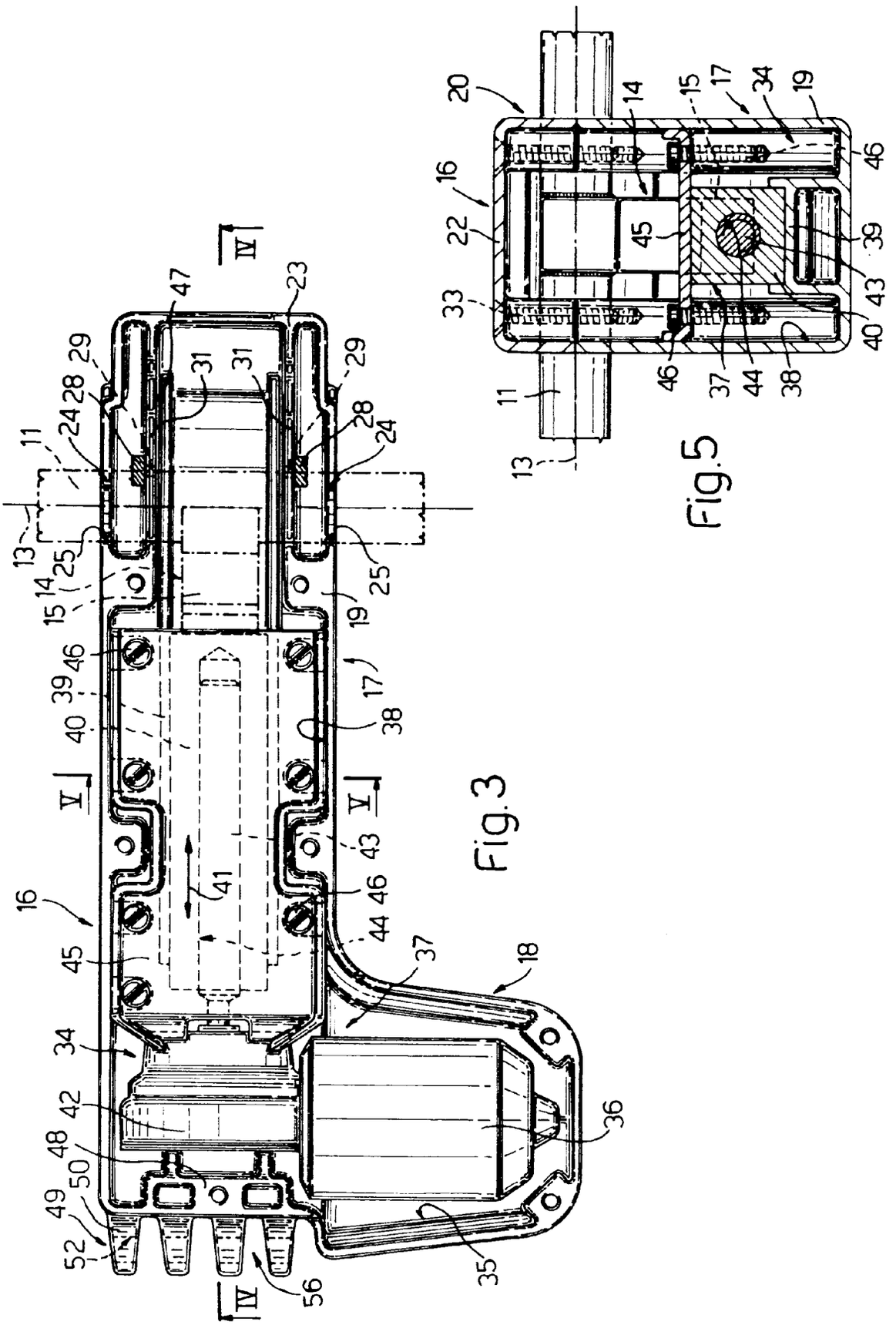
IV
IV
V
V
VI
VI
11
13
14
15
16
17
18
19
20
22
23
24
25
28
29
31
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
52
56

Fig.3

Fig.5

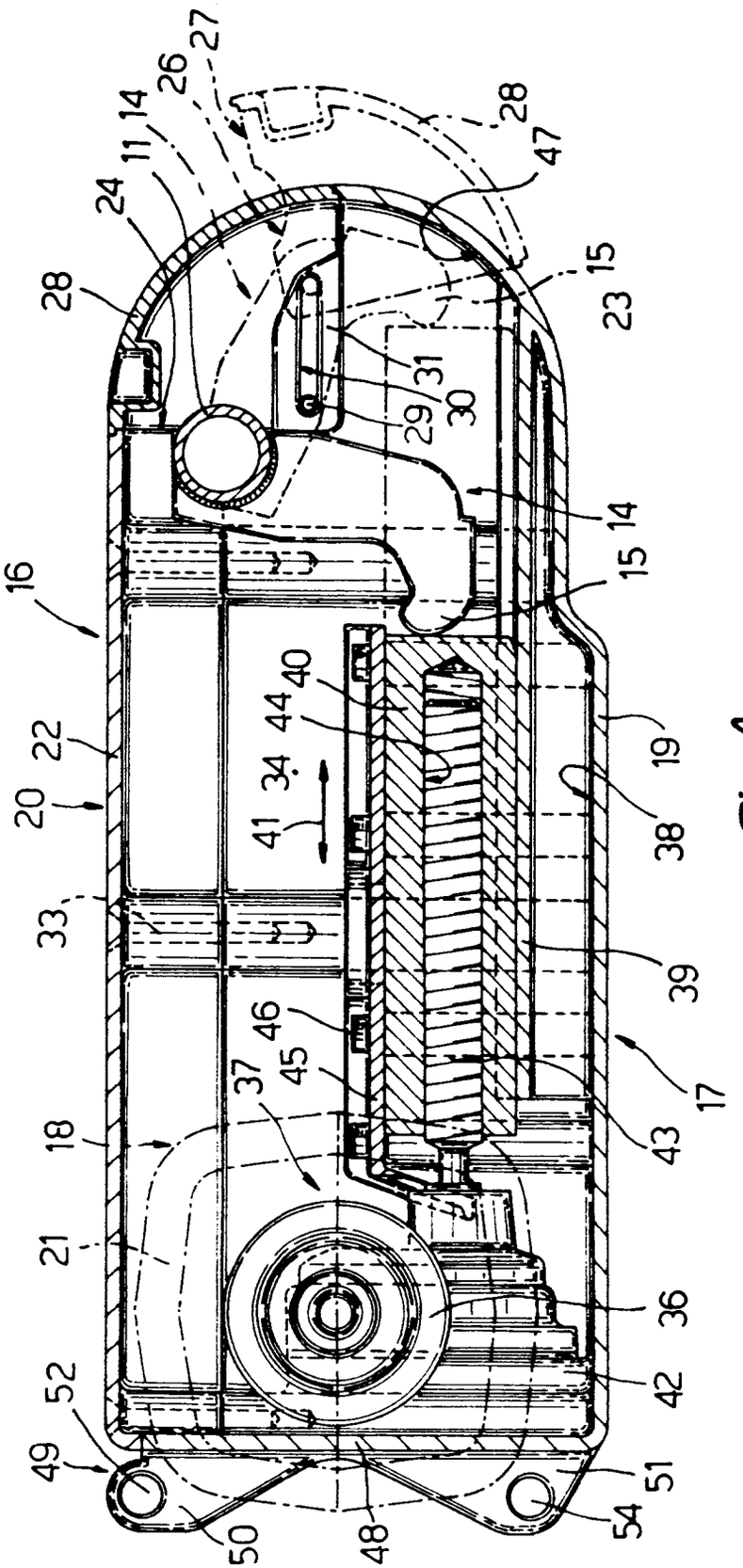
27
26
14
11
24
28
47
28
15
23
31
30
29
14
15
16
40
44
22
34
19
20
41
38
33
39
46
45
37
17
18
43
21
36
52
42
49
51
50
48
54

Fig.4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 10 7167

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)
A	DE-U-8 800 360 (NIKO) * page 8, line 4 - page 12; figures *	1,2	A47C20/04
P,X	DE-U-9 210 801 (DEWERT) * page 5, line 23 - page 9, line 13; figures *	1	
A	US-A-5 063 623 (BATHRICK)		
D,A	WO-A-8 910 715 (DEWERT)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

A47C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 AUGUST 1993	VANDEVONDELE J.

CATEGORY OF CITED DOCUMENTS

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

EPO FORM 1503 03.82 (P0401)