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(54) Title: ASSEMBLY FOR ACTUATING A SYRINGE

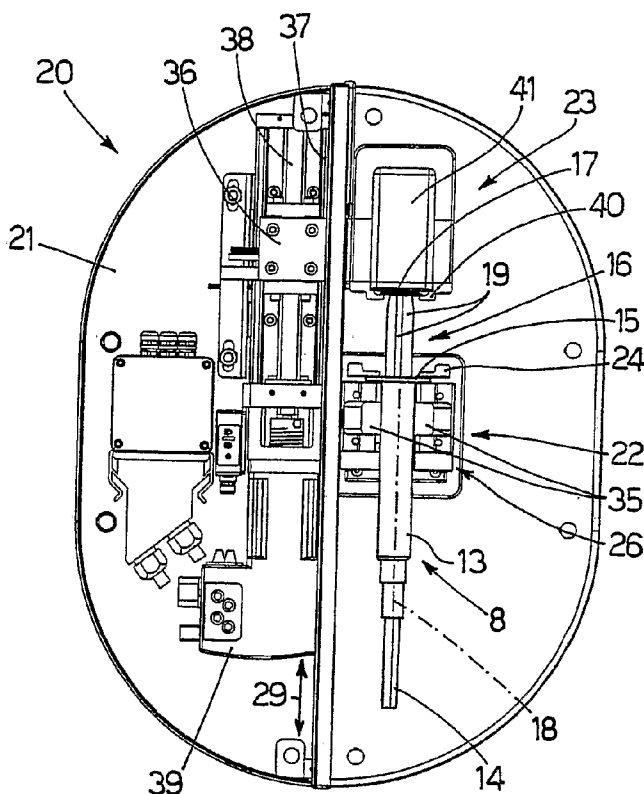


Fig.2

(57) Abstract: In an assembly for actuating a syringe (8), two gripping devices (22, 23) are designed to receive and withhold a containment cylinder (13) and, respectively, a piston (16) of the syringe (8), and are defined by respective pairs of jaws (24, 26, 40, 41) for gripping a flange (15) of the containment cylinder (13) and, respectively, of an end head (17) of the piston (16), the jaws (24, 26, 40, 41) of at least one gripping device (22, 23) being mobile with respect to one another between a gripping position and a release position under the thrust of a corresponding actuation device (28, 43).

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## ASSEMBLY FOR ACTUATING A SYRINGE

TECHNICAL FIELD

The present invention relates to an assembly for actuating a  
5 syringe.

In particular, the present invention relates to an assembly  
for actuating a syringe in a machine for the preparation of  
toxic pharmaceutical products, such as, for example,  
10 cytostatic drugs for chemotherapy, to which the following  
description will make explicit reference, without this  
implying any loss of generality.

BACKGROUND ART

15 In the sector of the preparation of cytostatic drugs, it is  
known to provide an assembly for actuating a syringe  
comprising a containment cylinder provided with at least one  
flange projecting outwards from the containment cylinder  
itself and a piston slidably engaged in the containment  
20 cylinder and provided with an end head set in a position  
transverse to the piston itself.

Generally, the assembly comprises two devices, one for  
gripping the containment cylinder and the other for gripping  
25 the piston; and an actuation device for displacing the two  
gripping devices with respect to one another in a direction  
parallel to a longitudinal axis of the syringe.

The gripping devices are shaped so as to define respective  
30 seats having a fixed height approximating by excess a  
thickness of the flange of the containment cylinder and,  
respectively, of the head of the piston.

From what has been set forth above, it follows that known  
35 assemblies for actuating syringes of the type described above

present some drawbacks principally deriving from the fact that the conformation of the gripping devices entails an extremely precise insertion of the flange of the containment cylinder and of the head of the piston in the corresponding seats, is incapable of guaranteeing a correct blocking of the flange of the containment cylinder and of the head of the piston in the seats themselves, and is moreover unable to receive and withhold syringes having flanges of the containment cylinder and heads of the piston with thicknesses larger than a threshold value.

Furthermore, since the structure of the gripping devices can lead to some play between the seats and the elements of the syringe, the displacement of the gripping devices with respect to one another in the aforesaid direction can be different from the displacement of the piston along the containment cylinder, thus jeopardizing the correct dosage of the pharmaceutical products.

#### 20 DISCLOSURE OF THE INVENTION

It is an object of the present invention to provide an assembly for actuating a syringe that will be free from the drawbacks described above and that will be simple and economically advantageous to produce.

25 According to the present invention there is provided an assembly for actuating a syringe according to what is claimed in the annexed claims.

#### 30 BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described with reference to the annexed drawings, which illustrate a non-limiting example of embodiment thereof, and in which:

35 Figure 1 is a schematic front view, with parts removed for reasons of clarity, of a machine for the preparation of

pharmaceutical products provided with a preferred embodiment of the assembly of the present invention;

Figure 2 is a schematic side view of the assembly of Figure 1;

Figure 3 is a schematic perspective view, with parts removed  
5 for reasons of clarity, of the assembly of Figure 2;

Figure 4 is a schematic side view, with parts removed for reasons of clarity, of a first detail of Figures 2 and 3; and

Figure 5 is a schematic side view, with parts removed for reasons of clarity, of a second detail of Figures 2 and 3.

10

#### BEST MODE FOR CARRYING OUT THE INVENTION

With reference to Figure 1, designated as a whole by 1 is a machine for the preparation of pharmaceutical products, in the case in point toxic pharmaceutical products, such as, for  
15 example, cytostatic drugs for chemotherapy.

The machine 1 comprises a containment box frame 2, which has a substantially parallelepipedal shape, and is divided internally by a substantially horizontal intermediate wall 3  
20 into a top chamber 4 and a bottom chamber 5.

The top chamber 4 houses inside it a magazine 6 for a plurality of containers 7 and syringes 8, a dosage station 9 for the preparation of pharmaceutical products, and a gripping  
25 and conveying device 10 for moving the containers 7 and the syringes 8 within the chamber 4 itself.

The bottom chamber 5 houses inside it an electronic control unit 11 for operation of the machine 1, and a device 12 for  
30 collecting the processing waste coming from the machine 1 itself.

According to what is illustrated in Figure 2, each syringe 8 comprises a containment cylinder 13, which is closed at one  
35 end by a needle (not illustrated) provided with a protective

cap 14, has, at a free end thereof, an annular flange 15 projecting radially outwards from the outer surface of the cylinder 13, and is slidably engaged by a piston 16, which is provided with a substantially plane end head 17 orthogonal to a longitudinal axis 18 of the syringe 8, and has a plurality of reinforcement ribbings 19 distributed about the axis 18 parallel to the axis 18 itself.

With reference to Figures 1 and 2, the dosage station 9 comprises, in the case in point, three actuation assemblies 20, each of which is designed to receive, withhold, and actuate a corresponding syringe 8, and comprises a substantially vertical supporting plate 21, and two gripping devices 22, 23, mounted on the plate 21 itself to receive and withhold the cylinder 13 and, respectively, the piston 16 of the syringe 8 itself.

According to what is illustrated in Figures 2 and 3, the device 22 comprises a fixed jaw 24, which projects from the plate 21 in a horizontal direction 25 substantially orthogonal to the plate 21 itself, and has the shape of a fork; and a mobile jaw 26, which projects from the plate 21 in the direction 25, and comprises a slide 27, slidably coupled to the plate 21 for effecting, with respect to the plate 21 and under the thrust of an actuation device 28, rectilinear displacements in a vertical direction 29 orthogonal to the direction 25.

The device 28 comprises a spring 30 set between the plate 21 and the slide 27 for displacing, and normally keeping, the slide 27 and hence the jaw 26 in a gripping position (Figure 4) of the flange 15 of the cylinder 13 of a syringe 8; and a cam 31, which is slidably coupled to a guide (not illustrated) mounted on the plate 21 parallel to the direction 25, cooperates, in the case in point, with a tappet roller 32

carried by the slide 27, and is moreover coupled, via an external-screw/internal-screw coupling, to a screw 33, which is set in rotation by an electric motor 34 to impart upon the cam 31 rectilinear displacements in the direction 25 and  
5 displace the slide 27, and hence the jaw 26, in the direction 29 from the gripping position into a release position (not illustrated) of the flange 15.

The slide 27 supports two gripping arms 35, which are  
10 substantially parallel to one another and to the direction 25, are slidably coupled to the slide 27, are normally kept in a gripping position of the cylinder 13 of a syringe 8 by a spring (not illustrated) engaged to the arms 35 themselves, and are mobile with respect to one another against the action  
15 of the aforesaid spring (not illustrated) to receive and withhold cylinders 13 of different diameters.

The device 23 comprises a slide 36, which is slidably coupled to a guide 37 fixed to the plate 21 parallel to the direction  
20 29, and is moreover coupled, via an external-screw/internal-screw coupling to a screw 38, which is set in rotation by an electric motor 39 to impart upon the slide 36 rectilinear displacements along the guide 37 in the direction 29 and displace the device 23 away from and towards the device 22.

25  
The slide 36 comprises a fixed jaw, defined by a guide 40 made on the slide 36 parallel to the direction 25, is provided with a seat (not illustrated) made through the slide 36 parallel to the direction 29 for receiving a ribbing 19 of the piston 16, and supports a mobile jaw 41, comprising a slide 42 slidably  
30 coupled to the slide 36 for effecting, with respect to the slide 36 and under the thrust of an actuation device 43, rectilinear displacements in the direction 29.

35 The device 43 comprises a spring 44 set between the slides 36

and 42 for displacing, and normally keeping the slide 42, and hence the jaw 41, in a gripping position (Figure 5) of the head 17 of the piston 16 of a syringe 8, and a cam 45, which is slidably coupled to a guide (not illustrated), mounted on the slide 36 parallel to the direction 25, co-operates, in the case in point, with a tappet roller 46 carried by the slide 42, and is moreover coupled, via an external-screw/internal-screw coupling, to a screw 47, which is set in rotation by an electric motor 48 to impart upon the cam 45 rectilinear displacements in the direction 25 and displace the slide 42, and hence the jaw 41, in the direction 29 from the gripping position into a release position (not illustrated) of the head 17.

Actuation of a syringe 8 will now be described starting from an instant in which:

the gripping devices 22, 23 of the corresponding assembly 20 are set so as to receive the syringe 8 closed, i.e., with the piston 16 set substantially within the cylinder 13;

the jaws 24, 26 of the device 22 are set in their gripping position; and

the guide 40 and the jaw 41 of the device 23 are set in their gripping position.

At this point, the electric motors 34, 48 are actuated for displacing the cams 31 and, respectively, 45 in the direction 25. Consequently, the jaw 26 of the device 22 and the jaw 41 of the device 23 are displaced in the direction 29 against the action of the springs 30 and, respectively, 44 from their gripping positions into their release positions for enabling insertion of the flange 15 between the jaws 24, 26 and of the head 17 between the guide 40 and the jaw 41.

Next, the electric motors 34, 48 are actuated for displacing the cams 31 and, respectively, 45 in the direction 25 in a

sense opposite to the previous one. Consequently, the jaw 26 of the device 22 and the jaw 41 of the device 23 are displaced by the springs 30 and, respectively, 44 in the direction 29 from their release positions into their gripping positions (Figures 4 and 5).

Finally, the motor 39 is actuated for displacing the device 23 with respect to the device 22 in the direction 29 and enabling the syringe 8 to carry out drawing-in and/or dosage of the pharmaceutical products from and/or into the corresponding containers 7.

In connection with what is set forth above, it should be pointed out that the devices 22, 23 are provided with respective sensors 49 for measurement of the displacement of the jaws 26 and, respectively, 41 in the direction 29, namely, into the corresponding gripping positions.

The assembly 20 presents some advantages principally deriving from the fact that:

the displacement of the jaws 26 and 41 into their release positions enables easy insertion and extraction of the syringe 8 into, and respectively from, the gripping devices 22, 23, and moreover enables the devices 22, 23 to receive and withhold syringes 8 having flanges 15 and heads 17 of different thicknesses;

the displacement of the jaws 26 and 41 into their gripping positions guarantees a correct blocking of the cylinder 13 and of the piston 16 within the devices 22, 23 and hence a perfect coincidence between the displacement of the devices 22, 23 in the direction 29 and the displacement of the piston 16 along the cylinder 13 in the direction 29 itself;

the displacement of the arms 35 enables gripping of syringes 8 of different diameters; and

the displacement of the jaws 26 and 41 into their release



positions enables easy extraction of the syringe 8 open from the gripping devices 22, 23, i.e., with the piston 16 set substantially on the outside of the cylinder 13.

CLAIMS

1.- An assembly for actuating a syringe (8), the syringe (8) comprising a containment cylinder (13) provided with at least one gripping element (15) projecting outwards from the containment cylinder (13) itself, and a piston (16) slidably engaged in the containment cylinder (13) and provided with an end head (17); said assembly comprising two devices (22, 23) for gripping the containment cylinder (13) and, respectively, the piston (16); and an actuation device (39) for displacing the two gripping devices (22, 23) with respect to one another in a direction (29) substantially parallel to a longitudinal axis (18) of the syringe (8); each gripping device (22, 23) comprising two corresponding jaws (24, 26, 40, 41) for gripping the gripping element (15) and, respectively, the end head (17); and being characterized in that the jaws (24, 26, 40, 41) of at least one first said gripping device (22, 23) are mobile with respect to one another between a gripping position and a release position of the gripping element (15) or of the end head (17); actuator means (28, 43) being provided for displacing the jaws (24, 26, 40, 41) of the first gripping device (22, 23) between said gripping and release positions.

2.- The assembly according to Claim 1, in which the jaws (24, 26, 40, 41) of the first gripping device (22, 23) are mobile with respect to one another in said direction (29).

3.- The assembly according to Claim 1 or 2, in which said actuator means (28, 43) comprise first actuator means (31, 34, 45, 48) for displacing the jaws (24, 26, 40, 41) of the first gripping device (22, 23) from their gripping position into their release position and second actuator means (30, 44) for displacing the jaws (24, 26, 40, 41) of the first gripping device (22, 23) from their release position into their

gripping position.

4.- The assembly according to Claim 3, in which the second actuator means (30, 44) are elastic actuator means for displacing, and normally keeping, the jaws (24, 26, 40, 41) of the first gripping device (22, 23) in their gripping position.

5.- The assembly according to Claim 3 or 4, in which the first actuator means (31, 34, 45, 48) comprise cam actuator means.

6.- The assembly according to Claim 5, in which the first actuator means (31, 34, 45, 48) comprise an electric motor (34, 48); a cam (31, 45), coupled to an output shaft (33, 47) of the electric motor (34, 48) via an external-screw/internal-screw coupling; and a tappet (32, 46), carried by one of the jaws (24, 26, 40, 41).

7.- The assembly according to any one of the preceding claims, in which the jaws (24, 26, 40, 41) of each gripping device (22, 23) are mobile with respect to one another between a corresponding said gripping position and a corresponding said release position under the thrust of corresponding said actuator means (28, 43).

8.- The assembly according to any one of the preceding claims, in which the jaws (24, 26) of the gripping device (22) of the containment cylinder (13) and at least one jaw (40) of the gripping device (23) of the piston (16) are shaped so as to define, each of them, a respective guide for enabling insertion of the syringe (8) in the gripping devices (22, 23).

9.- The assembly according to any one of the preceding claims, in which one of the jaws (24, 26) of the device (22) for gripping the containment cylinder (13) comprises two arms (35) that are mobile with respect to one another according to the

dimensions of the containment cylinder (13) itself.

10.- The assembly according to Claim 9 and moreover comprising  
an elastic device for normally keeping the two arms (35) in a  
5 gripping position of the containment cylinder (13).

11.- The assembly according to any one of the preceding  
claims, in which the piston (16) comprises a plurality of  
reinforcement ribbings (19) distributed about said axis (18);  
10 at least one jaw (40) of the device (23) for gripping the  
piston (16) comprising a seat designed to receive and house  
one of the reinforcement ribbings (19) following upon a  
displacement for insertion of the syringe (8) in the gripping  
devices (22, 23).

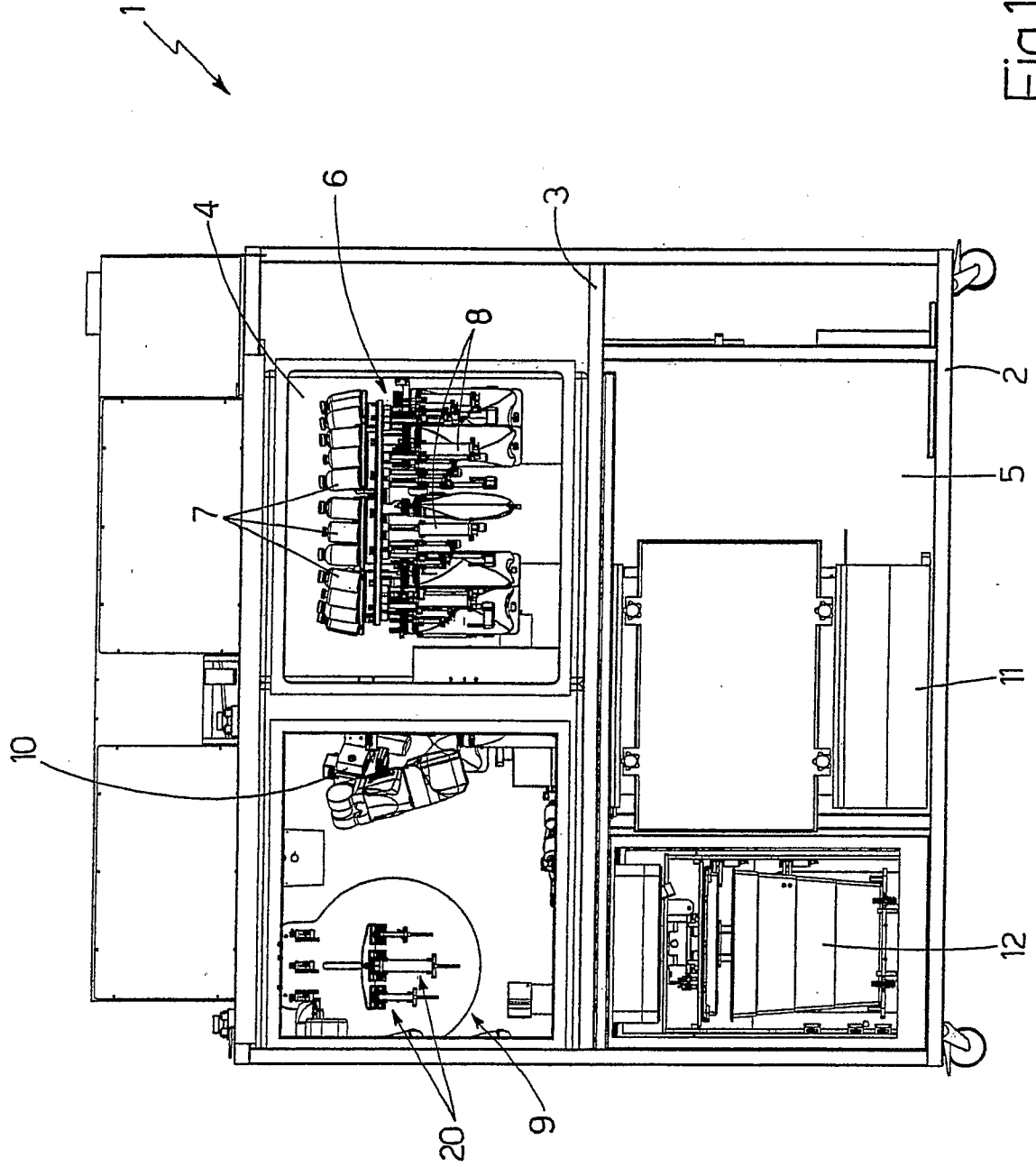


Fig.1

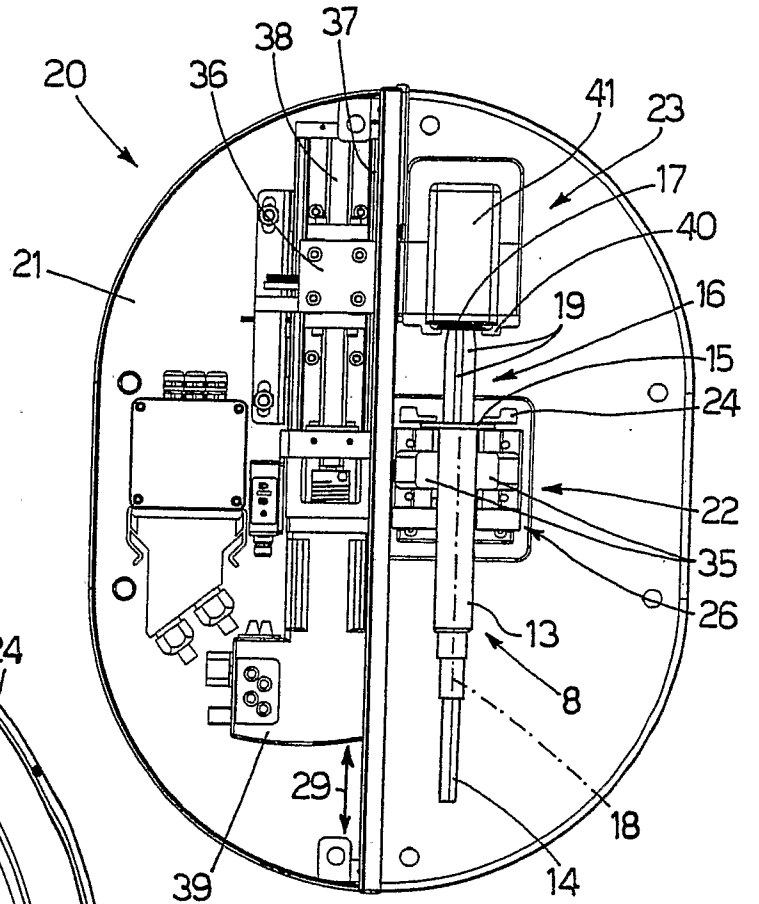


Fig.2

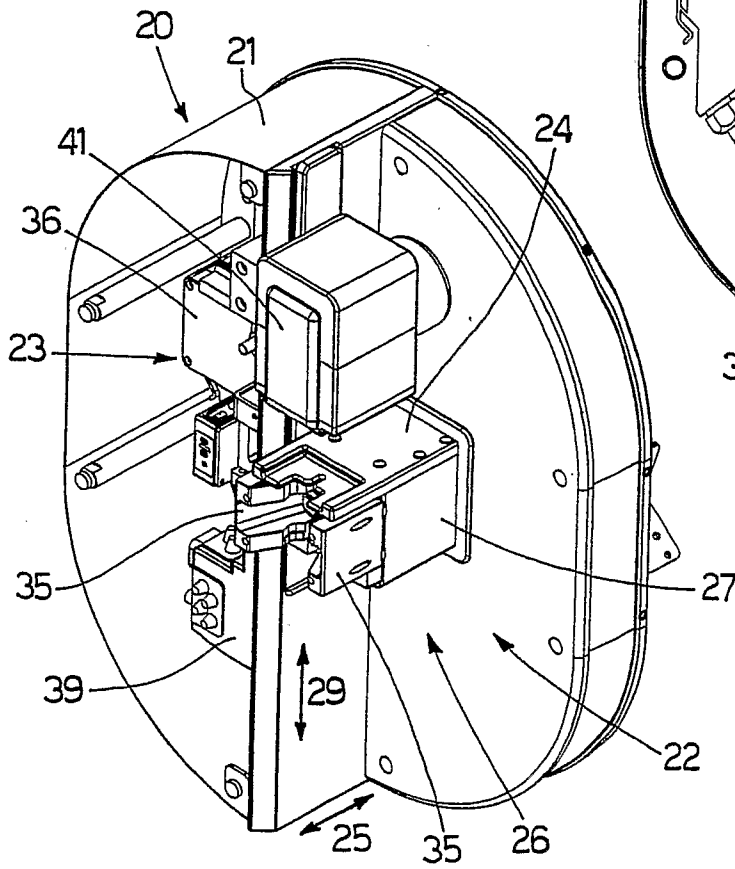
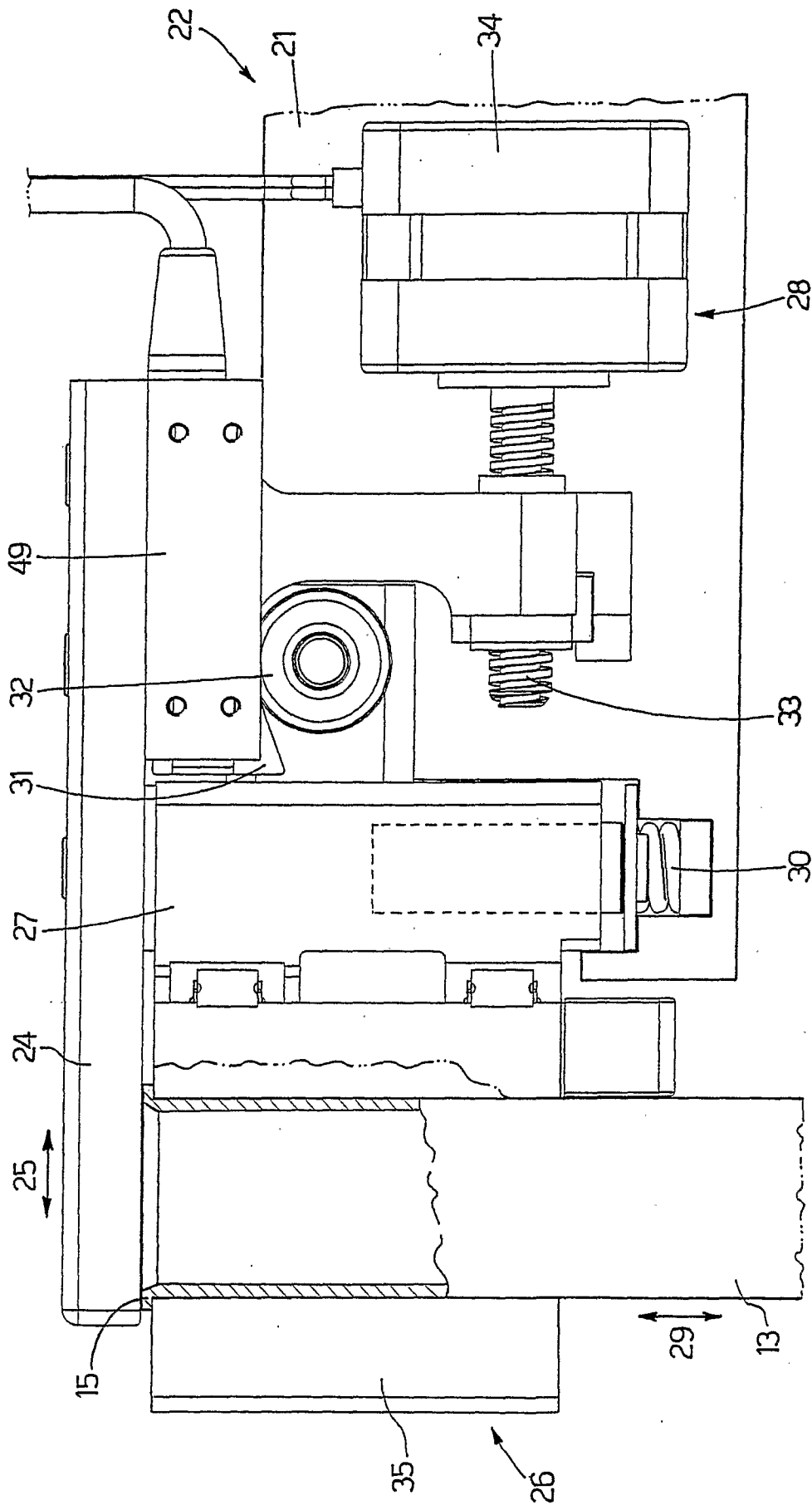


Fig.3



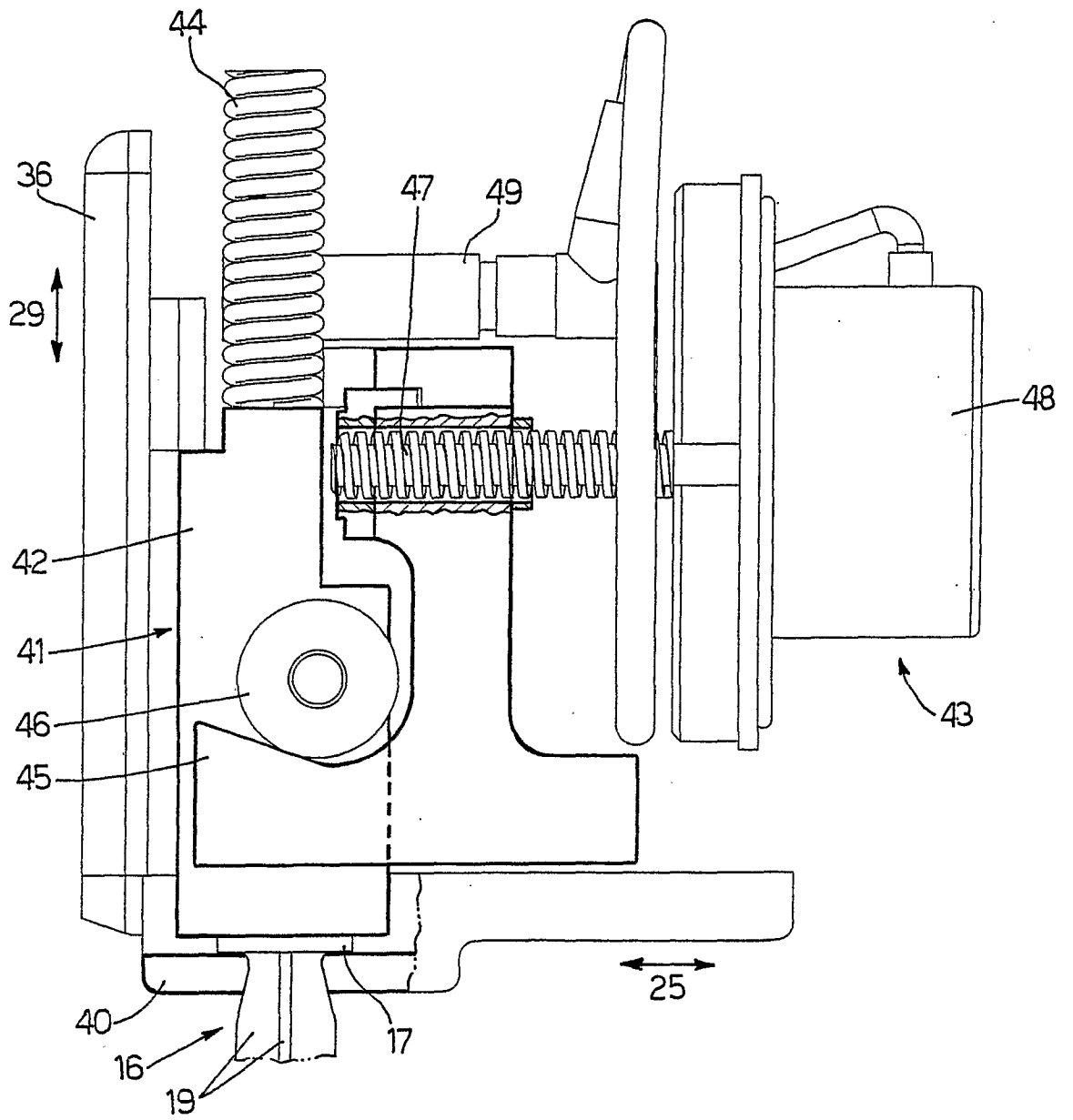


Fig.5



# INTERNATIONAL SEARCH REPORT

International application No  
PCT/IT2007/000790

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. B65B3/00                      A61J1/20				
According to International Patent Classification (IPC) or to both national classification and IPC				
<b>B. FIELDS SEARCHED</b>				
Minimum documentation searched (classification system followed by classification symbols) B65B A61J				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	US 3 935 883 A (STACH PAUL E ET AL) 3 February 1976 (1976-02-03)	1,2,8-11		
Y	column 3; figures 1-3 column 4, lines 39-48	7		
Y	----- WO 2007/053709 A (MEDI PHYSICS INC [US]; HELLE KEVIN [US]; PANCY JAMES [US]; SHANKS CHAR) 10 May 2007 (2007-05-10)	7		
A	figure 4	1-6,8-11		
A	----- EP 1 779 830 A (INGENIUM UNIVERSAL APS [DK]) 2 May 2007 (2007-05-02) paragraphs [0084], [0085]; figure 25	1-11		
A	----- US 5 431 201 A (TORCHIA MARK G [CA] ET AL) 11 July 1995 (1995-07-11) columns 5,6; figure 2	1-11		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"><input type="checkbox"/> Further documents are listed in the continuation of Box C.</td> <td style="width: 50%; border: none;"><input checked="" type="checkbox"/> See patent family annex.</td> </tr> </table>			<input type="checkbox"/> Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> See patent family annex.
<input type="checkbox"/> Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> See patent family annex.			
* Special categories of cited documents :				
*A* document defining the general state of the art which is not considered to be of particular relevance	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention			
*E* earlier document but published on or after the international filing date	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone			
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*O* document referring to an oral disclosure, use, exhibition or other means	*&* document member of the same patent family			
*P* document published prior to the international filing date but later than the priority date claimed				
Date of the actual completion of the international search  <p style="text-align: center;">18 July 2008</p>	Date of mailing of the international search report  <p style="text-align: center;">28/07/2008</p>			
Name and mailing address of the ISA/ European Patent Office, P.B. 5018 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer  <p style="text-align: center;">Bielsa, David</p>			

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/IT2007/000790
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Patent document cited in search report	A	Publication date	Patent family member(s)	Publication date
US 3935883	A	03-02-1976	NONE	
WO 2007053709	A	10-05-2007	NONE	
EP 1779830	A	02-05-2007	NONE	
US 5431201	A	11-07-1995	AT 182465 T	15-08-1999
			AU 7528494 A	19-06-1995
			CA 2180146 A1	08-06-1995
			WO 9515142 A1	08-06-1995
			DE 69419774 D1	02-09-1999
			DE 69419774 T2	02-03-2000
			EP 0731684 A1	18-09-1996
			ES 2138089 T3	01-01-2000