

(19)



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(11)

EP 0 751 090 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.01.1997 Bulletin 1997/01

(51) Int Cl.⁶: **B66C 1/00**, B66D 3/20,
B66C 1/44, B66C 1/62

(21) Application number: **96660029.8**

(22) Date of filing: **18.06.1996**

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB IT LI NL PT SE

(30) Priority: **29.06.1995 FI 953236**

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(54) Transport apparatus

(57) Transport apparatus for moving an upright cylindrical object, such as a gas bottle, in an upright position from one location to another. The transport apparatus comprises a guide rail system (4) connected to the fixed structures of a building; a crab carriage (5) suspended so as to be movable on and guided by the guide rail system; a gripping and hoisting device (6) comprising a pair of gripping jaws (8) movable in a horizontal direction by means of a power means (7) and designed to grip an upright cylindrical object by a frictional hold from both sides of the object by pressing it between the gripping jaws; and a control unit (9) for controlling the transport apparatus.

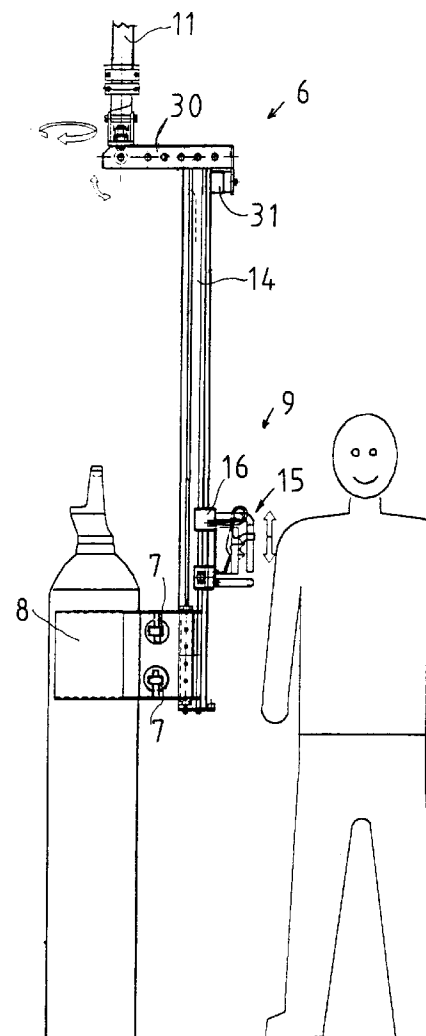


Fig 1

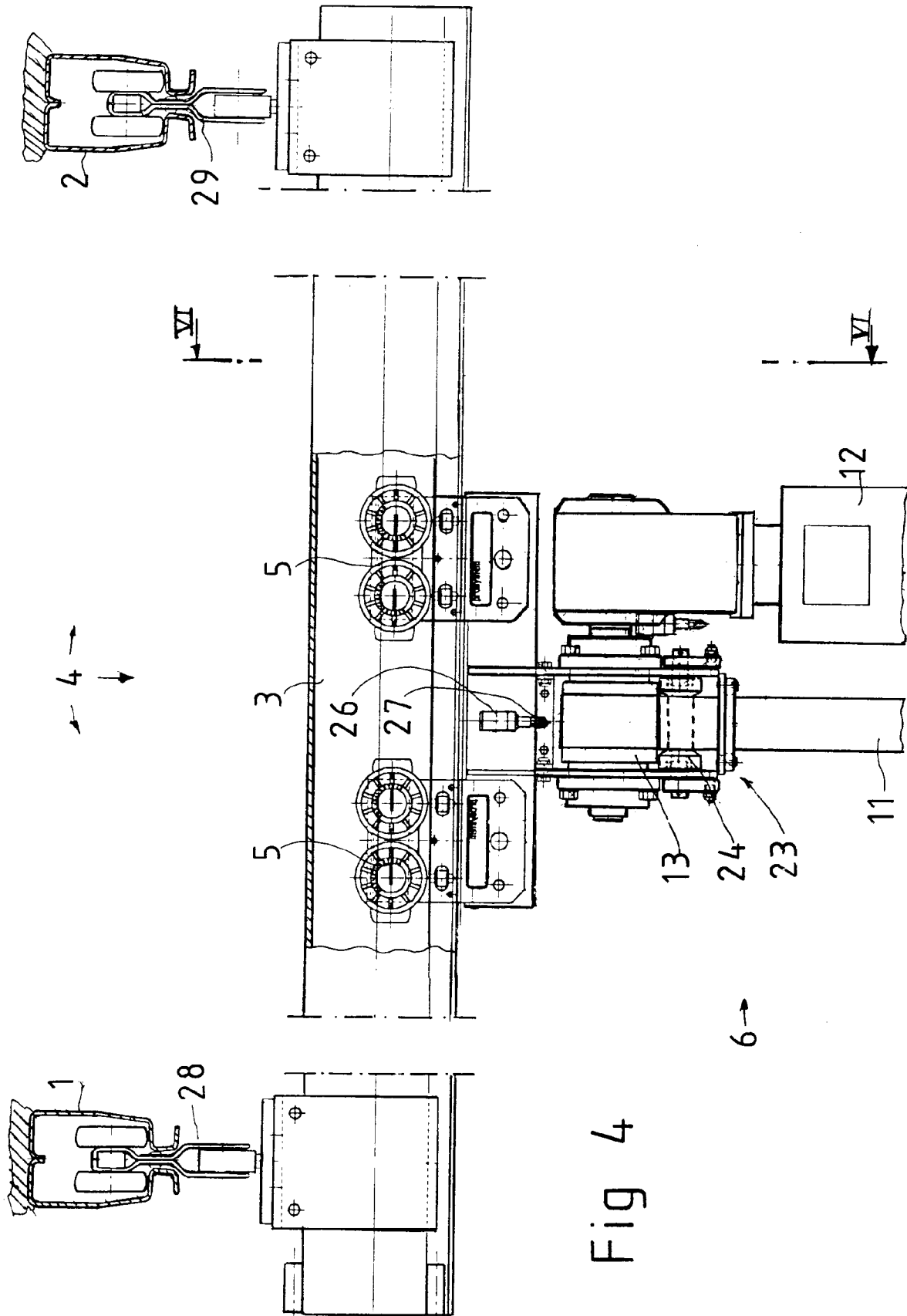


Fig 4

Description

The present invention relates to a transport apparatus as defined in the preamble of claim 1.

The object of the invention is to present a new type of transport apparatus for transporting a body in an upright position from one location to another. The weight of a typical gas bottle to be transported can be of the order of about 100-150 kg. So far, this type of objects, such as gas bottles, have been moved from one place to another by tilting the object and rolling it along the base, supported by its bottom edge. This is a difficult method and cannot be applied if the base has height differences or if the object has to be lifted onto an aerial conveyor, a transfer table or the like.

A special object of the invention is to produce an ergonomic transport apparatus which is easy to control, convenient to use and logical in respect of its control functions and which is applicable for transporting heavy upright cylindrical objects, such as gas bottles.

The transport apparatus of the invention is characterized by what is presented in claim 1.

According to the invention, the transport apparatus comprises a guide rail system consisting of guide sections mounted on the fixed structures of a building; a crab carriage suspended so as to be movable on and guided by the guide rail system; a gripping and hoisting device comprising a pair of gripping jaws movable in a horizontal direction with a power means and designed to grip an upright cylindrical object by a frictional hold from both sides of the object by pressing it between the gripping jaws, and a control unit for controlling the transport apparatus.

For instance a gas bottle always has an elongated cylindrical shape. However, bottles produced by different manufacturers may have different shapes in other respects, e.g. in respect of the shape of the neck. For this reason, it makes sense to grip the gas bottle by its cylindrical part between the gripping jaws, which hold it by the aid of friction, the transport apparatus being thus independent of the shape of the other parts of the gas bottle.

In an embodiment of the transport apparatus, the gripping and hoisting device comprises a hoist device comprising an elongated, flexible hoisting element, a reel for the coiling and decoiling of the hoisting element, and an elongated upright column frame connected at its upper end to the hoisting element for the raising and lowering of the column frame, the gripping jaws being connected to the lower end of said column frame. The hoisting element preferably consists of a textile belt. A hoist using a textile belt has many advantages over a chain hoist. A belt is somewhat elastic in the hoisting direction, whereas a chain is inelastic. Moreover, a belt is capable of twisting about its longitudinal axis. Because of its elasticity, a belt has the advantage that it does not produce a sudden jerk caused by rapid acceleration at the moment of starting, which would impose a strain on the

system, but instead the start takes place softly.

In an embodiment of the transport apparatus, the control unit comprises a manual control unit with a slide frame which is movable in the direction of and guided by the column frame, handles attached to the slide frame to provide a handgrip for the operator, and a number of operating switches disposed near the handle, allowing the operator to operate the operating switches with his/her fingers. The manual control unit movable with respect to the column frame can always be kept at an ergonomic constant height regardless of the level of height that the column frame with the load has been raised. The slide frame can be provided with a locking device, e.g. a friction brake or the like, which, when released, allows the slide frame to be adjusted and locked at a desired height on the column frame. In order that the operator need not support the manual control unit by hand during the adjustment, it is possible to provide a lightening device between the slide frame and the column frame.

In an embodiment of the transport apparatus, the crab carriage is freely movable on the guide rail system so that, by pushing/pulling/guiding the transport apparatus by the handles 17, it takes only a light effort to move a cylindrical object pressed between the gripping jaws 8 and raised off the base to a desired location within the operating range of the transport apparatus.

In an embodiment of the transport apparatus, the operating motor is an alternating-current motor; the control unit comprises a frequency converter for stepless control of the speed of the operating motor; and the operating switches include a potentiometer push button whose analog output signal is used for stepless control of the frequency converter. The potentiometer push button gives the operator a good feel of the lifting operation and a control system is formed between man and machine as the operator continuously receives clear feedback suited for human comprehension about the operation he/she is performing. When the potentiometer push button is only slightly pressed, the hoist works at a low speed. Correspondingly, when the push button is pressed vigorously, the hoist speed is higher. With the frequency converter, it is also possible to implement overload protection by employing an adjustable current limit. The current of the operating motor is monitored, and if it exceeds a preset limit for a given length of time, the current is switched off.

In an embodiment of the transport apparatus, the control unit comprises a first limit switch which detects the slackening of the hoisting element and, based on the slackening detected, stops the operating motor. The detection of the slackening can be implemented e.g. by using an arrangement where the first limit switch comprises a spring-loaded first follower pressing the hoisting element at a point below the reel and a switch element which is switched on in consequence of a preset displacement of the follower as the hoisting element becomes slack.

In an embodiment of the transport apparatus, the control unit comprises a second limit switch, designed to detect the amount of hoisting element coiled on the reel and to stop the operating motor based on that amount. The detection of the amount of hoisting element coiled on the reel can be implemented e.g. by using an arrangement where the second limit switch comprises a second switch element, which is switched on as it touches the hoisting element coiled on the reel when the coil reaches a preset size.

In the following, the invention is described in detail by the aid of embodiment examples by referring to the attached drawing, in which

Fig. 1 and 2 present diagrammatic side views of an embodiment of the transport apparatus of the invention, i.e. a column frame with a pair of gripping jaws and a manual control unit;

Fig. 3 presents section III-III of Fig. 2;

Fig. 4 presents a diagrammatic view of a part of an embodiment of the transport apparatus of the invention, i.e. a guide rail system and a crab carriage supported by it, with a hoisting machinery mounted on the guide rail system;

Fig. 5 presents section V-V of Fig. 2;

Fig. 6 presents section VI-VI of Fig. 4;

Fig. 7 presents a diagrammatic view of the limit switch arrangement in an example embodiment, and

Fig. 8 presents a diagram representing the electric control system of the transport apparatus.

Fig. 1 shows a transport apparatus for moving an upright gas bottle from one location to another while maintaining its upright position. As shown in Fig. 4, the transport apparatus comprises a guide rail system 4 consisting of guide sections 1, 2, 3, attached to the fixed structures of a building. The guide rail system in this case comprises two parallel first guide sections 1, 2 placed at a distance from each other and secured on the fixed structures of the building. Suspended on the first guide sections 1, 2 are crab carriages 28, 29. The crab carriages 28, 29 are connected to each other by a second guide section 3 transverse to the first guide sections 1, 2, said second guide section again carrying two further crab carriages 5, to which the gripping and hoisting device 6 is connected.

Further, as shown in Fig. 1, the transport apparatus comprises a gripping and hoisting device 6, which consists of a pair of gripping jaws 8 movable in a horizontal direction by means of a power means 7 and designed to apply a frictional grip on an upright cylindrical object from both sides of it by pressing the object between the gripping jaws 8. In addition, the transport apparatus comprises a control unit 9 for the control of the transport apparatus. The power means 7 may be e.g. a contraction/extension type cylinder, preferably a pneumatic cylinder, because an environment like the place of appli-

cation of the transport apparatus is usually provided with a pneumatic network. Moreover, a pneumatic cylinder is light in relation to the pressing power it provides. For practical reasons regarding space, the example application has two pneumatic cylinders to produce a high compressive force with a small structure that does not take up much space.

Fig. 4 shows further that the gripping and hoisting device 6 comprises a hoist 10 using an elongated flexible hoisting element 11. In this case, the hoisting element 11 is a textile belt, which is coiled on a reel 13 rotated by an operating motor 12. By rotating the reel 13, the belt is coiled onto the reel and decoiled from it.

Referring again to Fig. 1, the upper end of the elongated upright column frame 14 is joined to the belt 11 to enable the column frame to be raised and lowered. The gripping jaws 8 are joined to the lower end of the column frame 14. Disposed between the belt 11 and the column frame is a connecting arm 30, the belt 11 being attached to one end of this arm. The upper end of the column frame 14 is linked to the connecting arm 30 at a distance from the joint of the belt 11. The side of the column frame near its upper end leans against a rubber buffer 31 mounted on the connecting arm 30, so the connecting arm extends in a substantially transverse direction relative to the longitudinal direction of the column frame 14. When a load exerts a downward pull at the column frame 14, it can yield downwards as far as permitted by the elasticity of the rubber buffer. This arrangement together with the use of a textile belt 11 contributes towards achieving a gentle start, reducing the strain imposed on the guide rail system. The connecting arm 30 removes the column frame 14 aside from the vertical line of the belt 11 so that the centre of gravity of the load carried by the gripping jaws is aligned with the vertical line of the belt 11.

Figures 1, 2 and 5 show a manual control unit 15, by means of which the operator is able to control the functions of the transport apparatus. The manual control unit 15 comprises a slide frame 16 which is movable in the direction of and guided by the column frame 14. Attached to the slide frame 16 are handles 17 to provide a handgrip for the operator. Placed in the immediate vicinity of the handles 17 are a number of operating switches 18-21, which the operator of the transport apparatus can push with a finger. The operating switches may include e.g. switches for producing a lifting movement, a lowering movement, an emergency stop button, a button for operating the gripping jaws, a main switch, etc. The crab carriages 5 are freely movable on the guide rail system 4, so that, by pushing/guiding the transport apparatus by the handles 17, it is possible to move the cylindrical object pressed between the gripping jaws 8 and raised off the base to a desired location.

The operating motor 12 presented in Fig. 4 and 6 is an alternating-current motor. As can be seen from the simplified control scheme in Fig. 8, the control unit 9 comprises a frequency converter 22 for stepless control

of the speed of the operating motor 12. The operating switches 18 - 21 include potentiometer buttons 18, 19 which provide an analog output signal designed to steplessly adjust the frequency of the frequency converter to achieve a stepless lifting/lowering speed.

As shown in Fig. 4, 6 and 7, the control unit 9 comprises a first limit switch 23, a so-called lower limit, designed to detect the slackening of the hoisting element 8 and, based on the slackening detected, to stop the operating motor 12. The first limit switch 23 can be implemented by using an arrangement where a spring-loaded first follower roller 24 presses the belt 11 below the reel 13 and a switch element 25 is switched on when the follower roller 24 is displaced in consequence of the slackening belt 11 being displaced by a preset amount. Moreover, the control unit has a second limit switch 26, a so-called upper limit, designed to detect the amount of hoisting element coiled on the reel and, based on that amount, to stop the operating motor 12. The limit switch 26 can be implemented by using an arrangement where a second switch element 27 is switched on as it touches the belt 11 coiled on the reel 13 when the belt coil reaches a predetermined dimension. Thus, the upper limit can be easily adjusted by changing the position of the switch element 27 in relation to the circumference of the reel.

Fig. 5 presents a guide rail system designed to guide the slide frame 16 of the manual control unit 9 in relation to the column frame 14. The column frame 14 is a quadrilateral profiled beam with elongated guide rails 34, 35 of a round cross-section mounted on opposite sides 32, 33 of the profiled beam 14. The slide frame 16 has two wheels 36, 37 rotatably mounted directly opposite to each other, the wheels being provided with grooves to receive the guide rails. Fig. 5 also shows a locking device 38, which in this example is a friction brake which, when released, allows the manual control unit to be moved along the guide rails.

The invention is not restricted to the embodiment examples presented above, but instead many variations are possible within the scope of the inventive idea defined by the claims.

Claims

1. Transport apparatus for moving an upright cylindrical object, such as a gas bottle, in an upright position from one location to another, **characterized** in that the transport apparatus comprises
 - a guide rail system (4) consisting of guide sections (1, 2, 3) and connected to the fixed structures of a building,
 - a crab carriage (5) suspended so as to be movable on and guided by the guide rail system,
 - a gripping and hoisting device (6) comprising a pair of gripping jaws (8) movable in a horizontal direction by means of a power means (7) and

designed to grip an upright cylindrical object by a frictional hold from both sides of the object by pressing it between the gripping jaws, and

- a control unit (9) for controlling the transport apparatus.

2. Transport apparatus as defined in claim 1, **characterized** in that the gripping and hoisting device (6) comprises a hoist device (10) comprising an elongated, flexible hoisting element (11), a reel (13) operated by an operating motor (12) for the coiling and decoiling of the hoisting element, and an elongated upright column frame (14) connected at its upper end to the hoisting element for the raising and lowering of the column frame, the gripping jaws (8) being connected to the lower end of said column frame.
3. Transport apparatus as defined in claim 2, **characterized** in that the hoisting element (11) is a textile belt.
4. Transport apparatus as defined in any one of claims 1 - 3, **characterized** in that the control unit consists of a manual control unit (15) comprising a slide frame (16) which is movable in the direction of the column frame and guided by the same, handles attached to the slide frame (16) to provide a handgrip for the operator, and a number of operating switches (18-21) disposed near the handle so that the operator can operate them with his/her fingers.
5. Transport apparatus as defined in claim 4, **characterized** in that the crab carriage (5) is freely movable on the guide rail system so that, by pushing/guiding the transport apparatus by the handles (17), it is possible to move a cylindrical object pressed between the gripping jaws (8) and raised off the base to a desired location.
6. Transport apparatus as defined in any one of claims 1 - 5, **characterized** in that the operating motor (12) is an alternating-current motor; that the control unit (9) comprises a frequency converter (22) for stepless control of the speed of the operating motor; and that the operating switches (18-21) include a potentiometer push button (18, 19) whose analog output signal is used for stepless control of the frequency (18) of the frequency converter to achieve a stepless lifting/lowering speed.
7. Transport apparatus as defined in any one of claims 1 - 6, **characterized** in that the control unit (9) comprises a first limit switch (23) which detects the slackening of the hoisting element (8) and, based on the slackening detected, stops the operating motor.

8. Transport apparatus as defined in claim 7, **characterized** in that the first limit switch (23) comprises a spring-loaded first follower (24) pressing the hoisting element (11) at a point below the reel (13) and a switch element (25) which is switched on in consequence of a preset displacement of the follower as the hoisting element becomes slack. 5
9. Transport apparatus as defined in any one of claims 1 - 8, **characterized** in that the control unit (9) comprises a second limit switch (26), which detects the amount of hoisting element coiled on the reel (13) and, based on that amount, stops the operating motor. 10
10. Transport apparatus as defined in claim 9, **characterized** in that the second limit switch (26) comprises a second switch element (27), which is switched on as it touches the hoisting element (11) coiled on the reel when the coil reaches a preset size. 15 20

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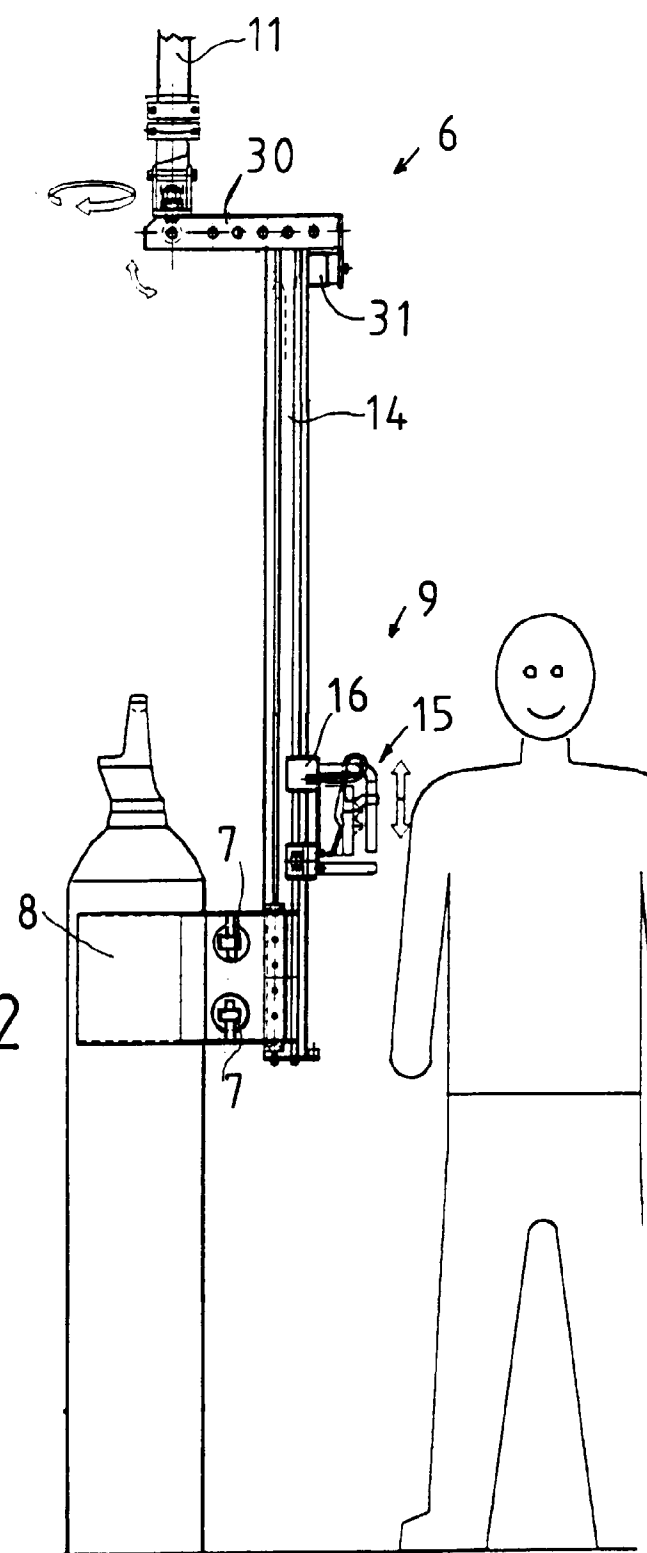
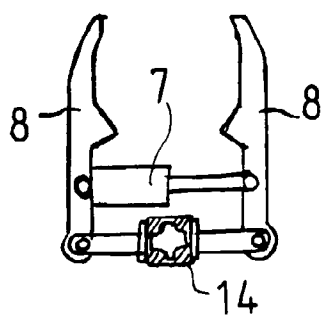
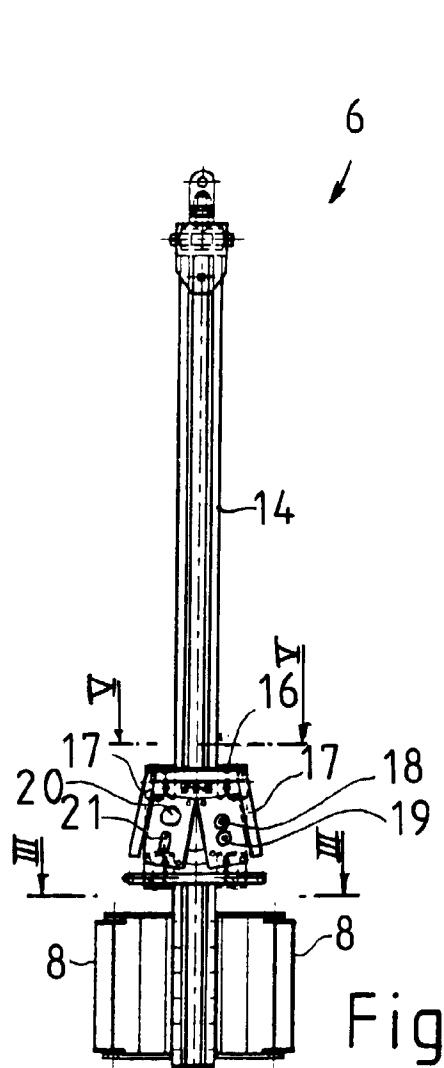
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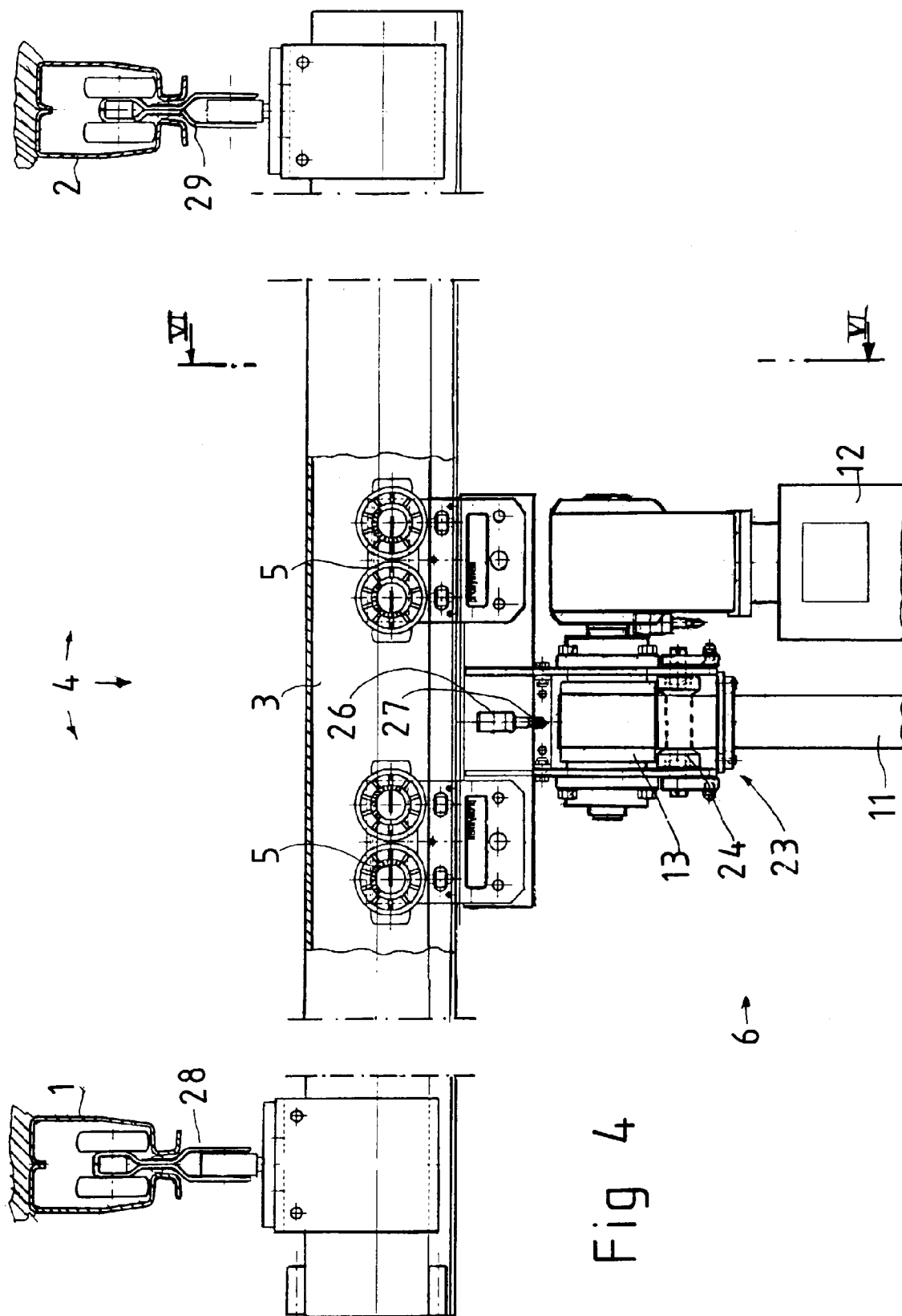


Fig 4

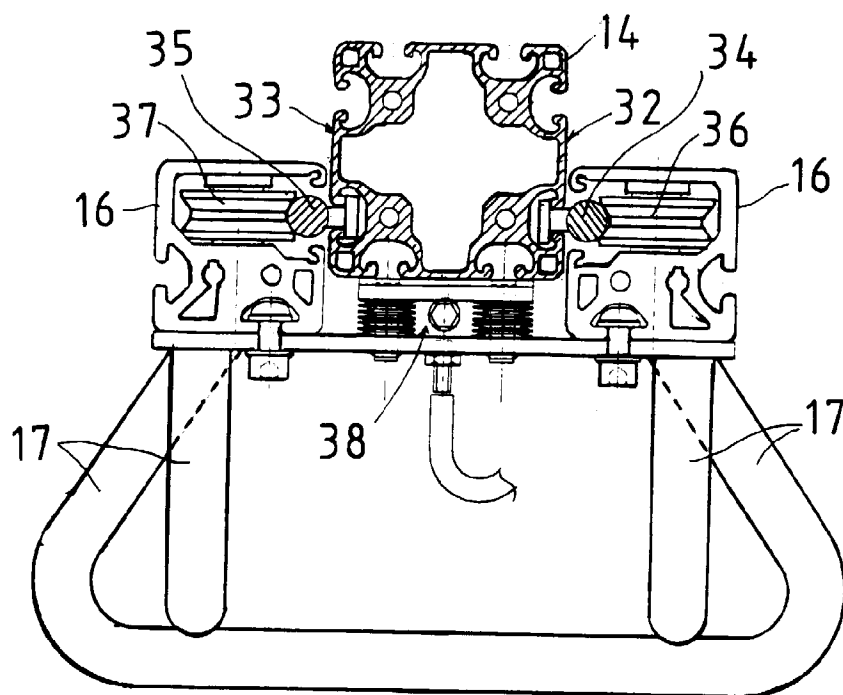


Fig 5

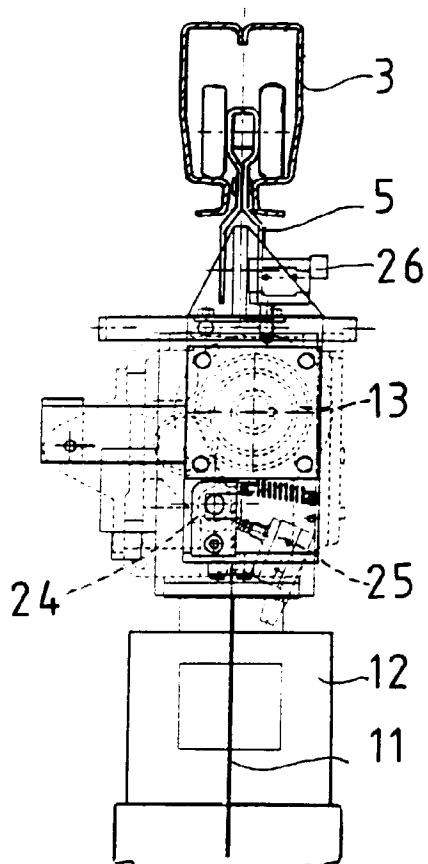


Fig 6

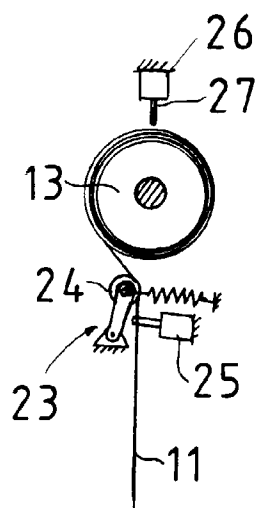


Fig 7

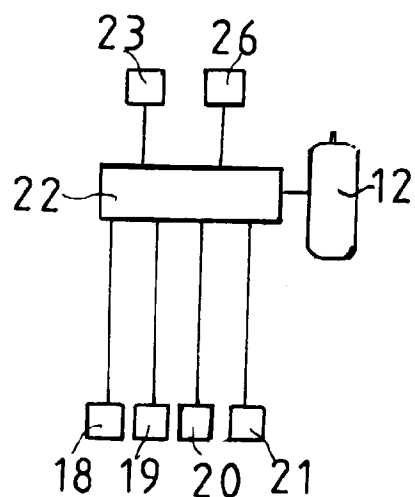


Fig 8



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EUROPEAN SEARCH REPORT

Application Number
EP 96 66 0029

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.6)
X	US-A-3 734 325 (STONE)	1,2	B66C1/00
Y	* column 6, line 14-62 *	3	B66D3/20
A	---	5	B66C1/44
	---		B66C1/62
Y	US-A-4 491 301 (PENDOLA) * column 2, line 42-51 *	3	

X	US-A-3 756 563 (STONE) * column 2, line 29 - column 5, line 38 *	1	

A	DE-A-23 32 028 (FA. R. STAHL) * the whole document *	6-10	

A	FR-A-2 177 850 (DEMAG)		

A	FR-A-1 207 913 (L'AIR LIQUIDE)		

A	US-A-4 708 574 (CONBOY)		

A	US-A-3 987 915 (CONNER)		

			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B66D B66C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11 October 1996	Examiner Van den Berghe, E
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			

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