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(72) Inventor: **Rolla, Edoardo**
I-16136, GENOVA (IT)

(74) Representative: **Porsia, Attilio et al**
Via Caffaro 3/2
16124 Genova (IT)

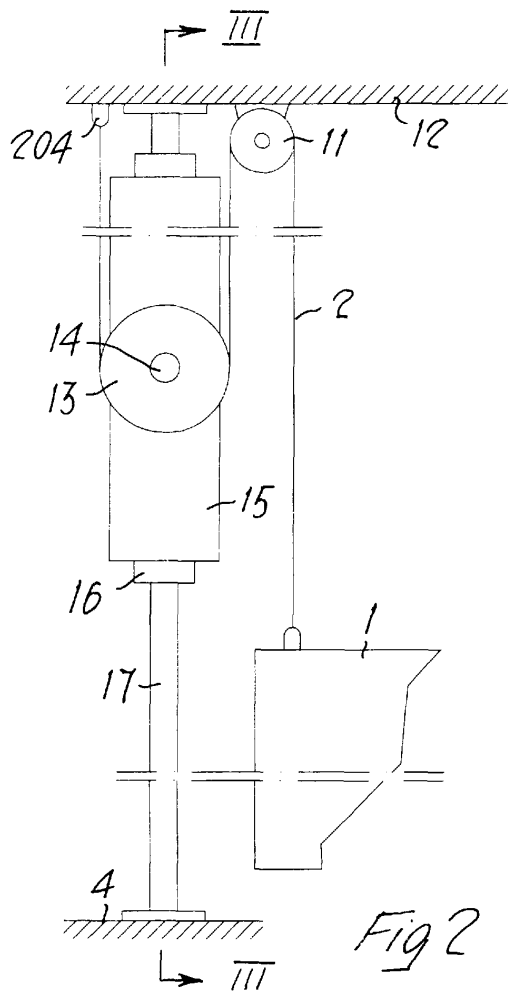
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(71) Applicant: **Filippo Rolla S.r.l.**
16125 Genova (IT)

(54) **Hydraulic lift**

(57) Hydraulic lift, comprising: a fixed tubular riser (17) which is mounted, at its ends, by means of suitable connections between the floor (4) of the lift cabin travel shaft and the ceiling (12) of said shaft and communicates at its ends with unions (18, 19) for supplying and discharging a hydraulic fluid; at least one fixed cylindrical piston (121) which is positioned halfway along the height concentrically with said tubular riser (17); at least one fixed diaphragm (221) which is situated at the height of said cylindrical piston (121) and which divides said tubular riser (17) into two chambers (26; 126) which are not interconnected; a cylinder (16) coaxial with said tubular riser (17) and defining a cylindrical cavity (20; 120) sealingly housing said fixed cylindrical piston (121); said cylinder (16) having a length equal to about half the length of said tubular riser (17) and said cylinder (16) being able to slide relative to said fixed piston (121) from one end to the other of said tubular riser (17); communication apertures (23; 24) on the two sides of said fixed piston (121) able to connect said two chambers (26, 126) of the tubular riser to said cylindrical cavity (20; 120) of the said movable cylinder (16); means for supplying alternately the pressurised fluid into said two chambers (26; 126) of the tubular riser (17) so as to cause said movable cylinder (16) to slide upwards or downwards; at least one first pair of idle pulleys (11) which are each fixed to an anchoring point situated on the ceiling (12) of the travel shaft of the lift cabin (1); at least one second pair of idle pulleys (13) mounted on said movable cylinder and fixed in diametrically opposite positions relative thereto; at least one pair of cables (2) for suspending a cabin (1), which are secured at one end to the ceiling (12) and driven around said second pair of idle pulleys (13) and from the latter pass around said first pair of idle pulleys (11) and are then secured to the structure of the cabin (1), and means

(15) for counterbalancing the weight of the cabin, which are fixed to said movable cylinder.



Description

[0001] The present invention relates to hydraulic lifts. As is known, in order to facilitate installation inside narrow shafts, hydraulically operated lifts have been developed where the cabin is raised and lowered by means of the reciprocating displacement of a piston sliding inside a single-acting cylinder, the end of which is mounted on the floor of the pit inside the lift travel shaft. A side elevation and partially sectioned view of an example of a known hydraulic lift is shown schematically in Fig. 1 of the accompanying drawings. With reference to this figure, 8 denotes a tubular cylinder which extends from the bottom floor 4 of the lift pit to about halfway along the overall height of the travel which is to be performed by the lift cabin 1. A piston 7, which extends externally through a fluid-tight opening 9 at the top end of the cylinder 8, is mounted slidably inside the cylinder 8. A pulley 3, which is rotatably supported by the shaft 5, is keyed onto the free end of the piston 7. 2 denotes two or more cables which are secured at one end to an anchoring point 104 on the base of the bottom floor 4 of the lift pit and pass around the pulley 5 downwards as far as the anchoring point on the structure of a cabin 1 which is guided, in a manner known per se, so as to slide between special lateral guides (not shown).

[0002] 10 denotes a tubular union which is connected to a hydraulic circuit associated with a pump (not shown). By operating the pump it is possible to allow alternately the entry of a hydraulic fluid into the cylinder 8 via the union 10, thereby causing raising of the piston 7 carrying the pulley 5 which, via the cable 2, will cause raising of the cabin 1 along the lift travel shaft. Allowing the hydraulic fluid to flow out freely through the union 10 results in the downwards movement of the cabin by means of gravity.

[0003] The known hydraulic lifts of the type described above schematically with reference to Figure 1 of the drawings have various drawbacks, in particular from the point of view of the power which is dissipated during their operation. These hydraulic lifts, in fact, since they are normally not equipped with counterweights, result in a considerable amount of wasted energy since they always have to move the weight of the cabin with or without passengers.

[0004] The object of the present invention is therefore to provide a hydraulic lift which is able to overcome the drawbacks of the known hydraulic lifts and which allows optimization of the amount of energy which is used in order to raise and lower the cabin, resulting in a considerable saving in energy which can be calculated as being equivalent to about two thirds of that of the hoisting systems of conventional hydraulic lifts.

[0005] This object is achieved by the present invention with a hydraulic lift according to Claim 1.

[0006] Further characteristic features and advantages of the present invention will emerge more clearly from the following description, provided by way of a non-lim-

iting example with reference to the other accompanying drawings in which:

- Fig. 2 is a schematic side elevation view of a hydraulic lift with counterweight according to the present invention;
- Fig. 3 shows a cross-sectional view along the line III-III of Fig. 2 of the present hydraulic lift with counterweight;
- Fig. 4 shows a schematic side elevation view of a constructional variation of the present hydraulic lift; and
- Fig. 5 shows a cross-sectional view along the line V-V of Fig. 3 of a further constructional variant of the present hydraulic lift.

[0007] With reference firstly to Figure 3 in the drawings, the hydraulic lift according to the invention comprises a tubular riser 17 consisting of two fixed tubular stems which are fixed at their ends between the bottom part or floor 4 of the travel shaft of the lift cabin and the top part or ceiling 12 of this shaft. The stems of the riser 17 are connected at their ends to unions 18 and 19 for supplying and/or discharging, respectively, a hydraulic fluid, which are associated with a hydraulic circuit comprising a motor-driven pump (not shown). 121 denotes a fixed cylindrical piston which is positioned at the central end of the stems of the riser 17 and is concentric with said stems of the tubular riser. Said piston 121 also comprises a fixed diaphragm 221 which divides the internal compartment of said tubular riser 17 into two chambers 26 and 126 which are not interconnected. 16 denotes a movable cylinder which is positioned coaxially around these stems of the fixed riser 17 so as to create a cylindrical cavity 20 and 120 which is formed between these stems of the fixed riser 17 and this movable cylinder 16 and inside which said fixed cylindrical piston 121 is sealingly positioned for example by means of a double set of O-rings 22. The chambers 26 and 126 communicate, upstream and downstream of the piston 121, respectively, via radial apertures 24 and 23, with the cylindrical cavities 120 and 20 of the cylinder 16. Seals 25 ensure fluid-tightness between the ends of the cylinder 16 and the riser 17. The counterweight 15 is mounted on the cylinder 16, and the idle pulleys 13 are keyed onto the cylinder/counterweight assembly by means of the spindles 14. The movable cylinder 16 has a length equal to about half the height of the fixed riser 17 for the purposes which will be described below.

[0008] With reference now to Fig. 2 of the accompanying drawings, 1 denotes the cabin of the lift. The ends of the cables 2 (only one of which is visible in the figures) are fixed to the structure of the cabin 1. Each of these cables 2 is driven, upstream of the cabin, around a first pair of idle pulleys 11 which are fixed to the top part 12 of the lift housing structure. From this first pair of pulleys 11 the cables 2 pass around a second series of idle pulleys 13, the spindles 14 of which are fixed laterally to the

cylinder/counterweight assembly 15, 16 and, from these pulleys 13, the cables 2 lead to the anchoring means 204 on the ceiling 12 of the structure. The counterweight 15 must have a weight such as to counterbalance the weight of the lift cabin 1 plus part of carrying capacity.

[0009] In Figures 2 and 3 the present hydraulic lift is shown in the position where the cabin 1 is completely lowered. In order to raise this cabin 1 up to the desired height it is required to pump hydraulic fluid from the union 18 which is situated at the base of the fixed riser 17 so that this fluid rises up along the longitudinal cavity 26 and reaches the diaphragm 221 of the fixed piston 121 and then flows through the apertures 24 into the cylindrical cavity 120. The increase in the fluid volume inside said cylindrical cavity 120 results in lowering of the movable cylinder 16 with the counterweight 15 and the idle pulleys 13. This lowering with simultaneous rotation of the idle pulleys 13, which are integral with the movable cylinder 16, causes raising of the cabin 1 up to the desired height. In order to lower the cabin 1 again it is sufficient to perform a reverse operation, identical to that described above, with pumping of hydraulic fluid from the union 19 which is positioned at the top of the fixed riser 17 and consequent filling of the top part of the cylindrical cavity 20. During these lowering and raising movements of the cabin 1 of the present lift, advantageously the weight of the latter is counterbalanced by the counterweight 15 which is integral with the movable cylinder 16. In this way the power needed to raise and lower the cabin of the present lift is up to one third less than the power needed to raise and lower the cabin of a conventional hydraulic lift.

[0010] Fig. 5 shows a constructional variant of the present hydraulic lift in which identical parts have the same numbers as that used in the above description. The central piston, which is positioned at half the height and concentric with the stems 171 and 172 of the tubular riser 17, is formed in this variant by two pistons 121 and 122 each equipped with a diaphragm 221 and 222. A chamber 300 is therefore formed between these diaphragms 221 and 222, resulting in a reduction in the working stroke of the cylinder 16; in fact, the greater the distance between the attachment point fixed to the top part 12 and the attachment point fixed to the bottom part 4, the greater will be the size of this chamber 300 between the diaphragms 221 and 222 of the two pistons 121 and 122 and the smaller will be the extension of the cylindrical cavities 20 and 120. In this way it is possible to adjust the working stroke of the cylinder so as to ensure mechanical stoppage of the cylinder at the end surfaces, without having to provide a cylinder/piston assembly especially for each use, but by constructing it in modular fixed sizes. The pressure of the hydraulic fluid inside the chamber 300 must always be less than or equal to the pressure inside the cavities 20 and 120 and therefore two non-return valves 30 and 31 are positioned on the diaphragms 221 and 222. These non-return valves 30 and 31 allow the hydraulic fluid which is present inside the chamber 300 to pass into the cavities 20 and 120

should the pressure of the fluid inside the chamber 300 be greater than the pressure inside the cavities 20 and 120. Two cylindrical sleeves 250 and 251 are also formed in the vicinity of the ends of the cylinder 16. A series of radial apertures 230, 231 and 232 connecting the chamber 126 to the cylindrical cavity 20 are formed on the stem 172 in the vicinity of the piston 121, while a series of radial apertures 240, 241, 242 connecting the chamber 26 to the cylindrical cavity 120 are formed in the vicinity of the piston 122. During operation of the lift, in the same way as described with reference to the embodiment in Figs. 2 and 3, when for example the bottom end of the cylinder 16, which is assumed to be moving upwards, approaches the piston 122, the sleeve 251 will gradually obstruct the radial apertures 240, 241 and 242, damping the contact between this cylinder 16 and the piston 112. In entirely the same way, contact between the top end of the cylinder 16 and the piston 221 will be cushioned by gradual closing of the radial apertures 230, 231 and 232.

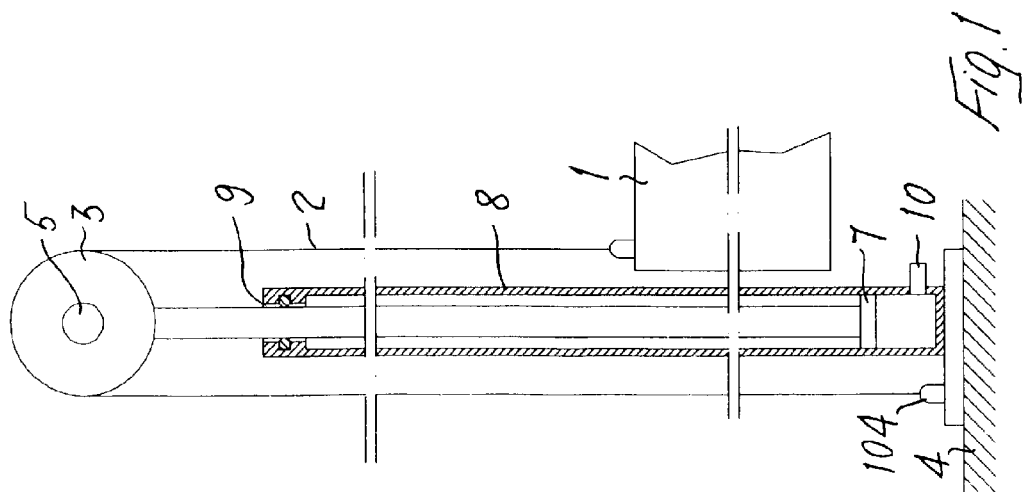
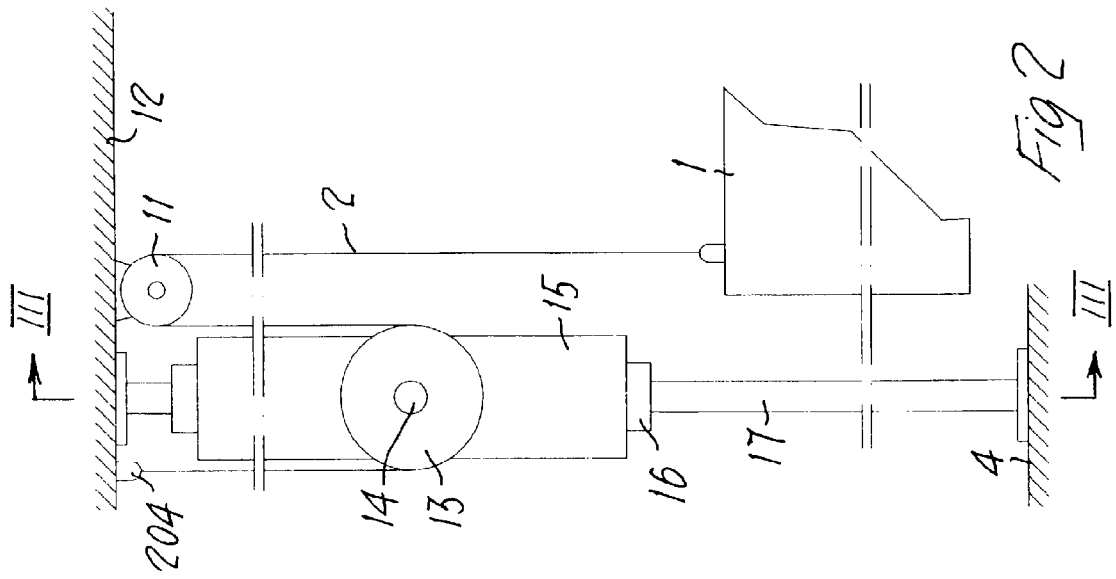
[0011] Fig. 4 shows a further constructional variant of the present hydraulic lift in which the cables 2 fixed to the cabin 1, once they have passed around the pulleys 11, are fixed directly to the cylinder 16 by means of the corresponding attachment points 32. This variant of the present lift may be used in the case where the distance between the attachment points on the top part 12 and the bottom part 4 is greater than twice the working stroke of the lift. With this variant it is also possible to reduce the weight of the counterweight by about half.

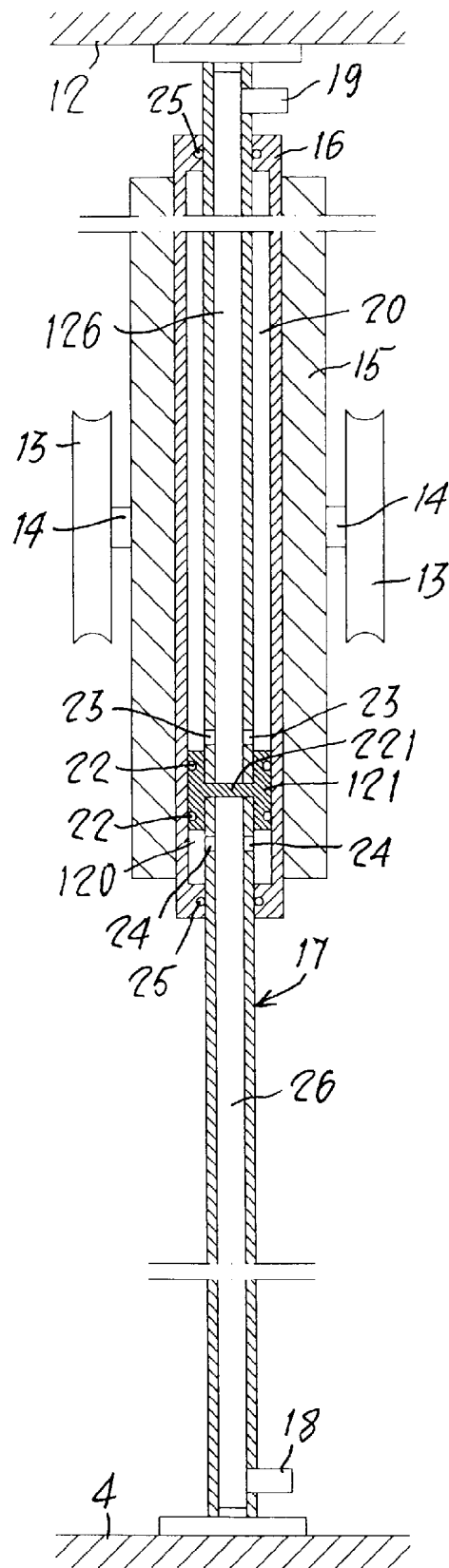
Claims

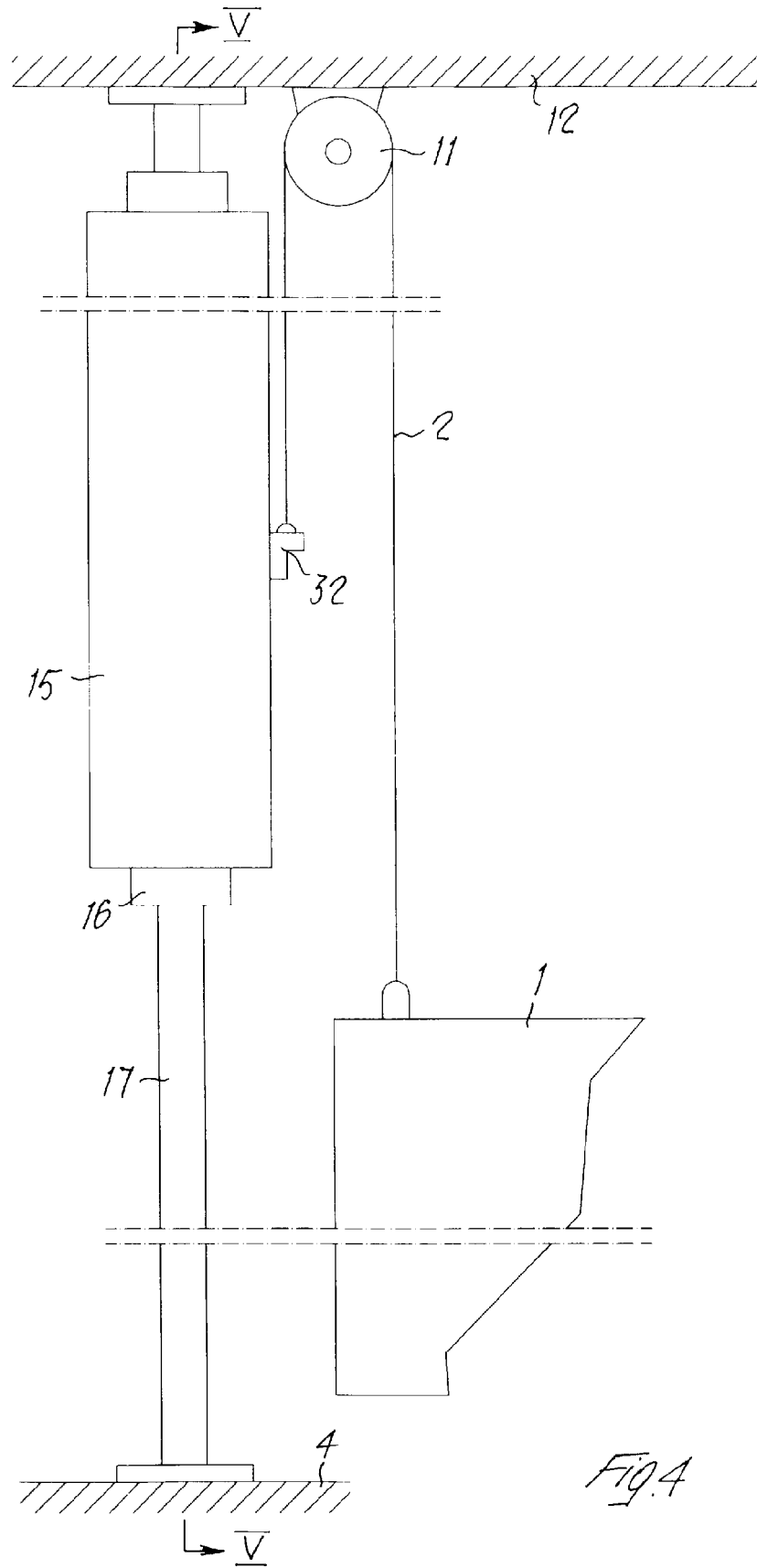
1. Hydraulic lift, **characterized in that** it comprises a fixed tubular riser (17) which is mounted, at its ends, by means of suitable connections, between the floor (4) of the lift cabin travel shaft and the ceiling (12) of said shaft and communicates at its ends with unions (18, 19) for supplying and discharging a hydraulic fluid; at least one fixed cylindrical piston (121) which is positioned halfway along the height concentrically with said tubular riser (17); at least one fixed diaphragm (221) which is situated at the height of said cylindrical piston (121) and which divides said tubular riser (17) into two chambers (26; 126) which are not interconnected; a cylinder (16) coaxial with said tubular riser (17) and defining a cylindrical cavity (20; 120) sealingly housing said fixed cylindrical piston (121); said cylinder (16) having a length equal to about half the length of said tubular riser (17) and said cylinder (16) being able to slide relative to said fixed piston (121) from one end to the other of said tubular riser (17); communication apertures (23; 24) on the two sides of said fixed piston (121) able to connect said two chambers (26, 126) of the tubular riser to said cylindrical cavity (20; 120) of the said movable cylinder (16); means for supplying alter-

nately the pressurised fluid into said two chambers (26; 126) of the tubular riser (17) so as to cause said movable cylinder (16) to slide upwards or downwards; at least one first pair of idle pulleys (11) which are each fixed to an anchoring point situated on the ceiling (12) of the travel shaft of the lift cabin (1); at least one second pair of idle pulleys (13) mounted on said movable cylinder and fixed in diametrically opposite positions relative thereto; at least one pair of cables (2) for suspending a cabin (1), which are secured at one end to the ceiling (12) and driven around said second pair of idle pulleys (13) and from the latter pass around said first pair of idle pulleys (11) and are then secured to the structure of the cabin (1), and means (15) for counterbalancing the weight of the cabin, which are fixed to said movable cylinder.

2. Hydraulic lift according to Claim 1, **characterized in that** said fixed piston (121) comprises a peripheral cylindrical sleeve which divides said cylindrical cavity into two chambers (20, 120).
3. Hydraulic lift according to Claim 1, **characterized in that** said fixed piston (121) divides said cavity of the fixed tubular riser (17) into two chambers (26; 126).
4. Hydraulic lift according to Claim 1, **characterized in that** said cylindrical sleeve of the fixed piston (121) comprises seals (22).
5. Hydraulic lift according to Claim 1, **characterized in that** said movable cylinder (16) comprises seals (25) at its ends.
6. Hydraulic lift according to Claim 1, **characterized in that** said hydraulic piston is formed by two pistons (121, 122) each equipped with an associated diaphragm (221, 222), an internal chamber (300) being formed between said pistons (121, 122) and at least one non-return valve (30, 31) being positioned in each of said diaphragms so as to connect said internal chamber (300) to said chambers (26, 126) formed in the tubular riser (17).
7. Hydraulic lift according to Claim 6, **characterized in that** it comprises in the vicinity of each of said pistons (121, 122) a series of radial apertures (230, 231, 232, 240, 241, 242) for connecting said chambers (126, 26) to said cylindrical cavities (20, 120), sleeves (250, 251) being positioned in the vicinity of the ends of the movable cylinder (16) so as to gradually close said radial apertures (230, 231, 232, 240, 241, 242).







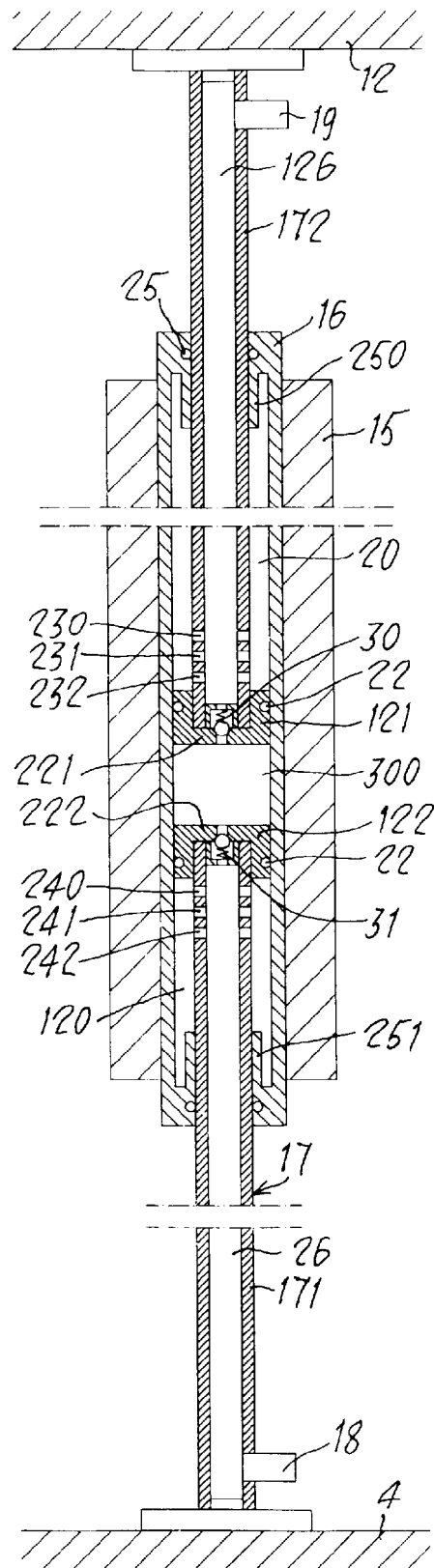


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 09 17 9422

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 22 February 2010	Examiner Nelis, Yves
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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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 17 9422

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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