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(54) **Driving system for a lift plant, particularly for the up and down movement of the lift cabin**

(57) The invention relates to a driving system (1) for a lift plant, particularly for the up and down movement of an arch (9) of a cabin (2) of the plant along a vertical travel of prefixed length; the system of the invention comprises an elongated and smooth fixed member (3), extending vertically for a length substantially corresponding to the length of the travel of the arch of the cabin (2) or of the counterweight (50), and at least one wheel (4) rotatably supported on board the arch (9) of the cabin and maintained constantly rollingly engaged along one side (L1) of the fixed member (3); the wheel (4) being controlled and driven to rotate by motor means (5); the fixed member (3) is a wing of a metal section bar and constitutes a guide for the cabin (2); an opposite wheel (20) is preferably provided, positioned at the same height as the other and engaged with the smooth and fixed member (3) at an opposite side (L2) thereof.

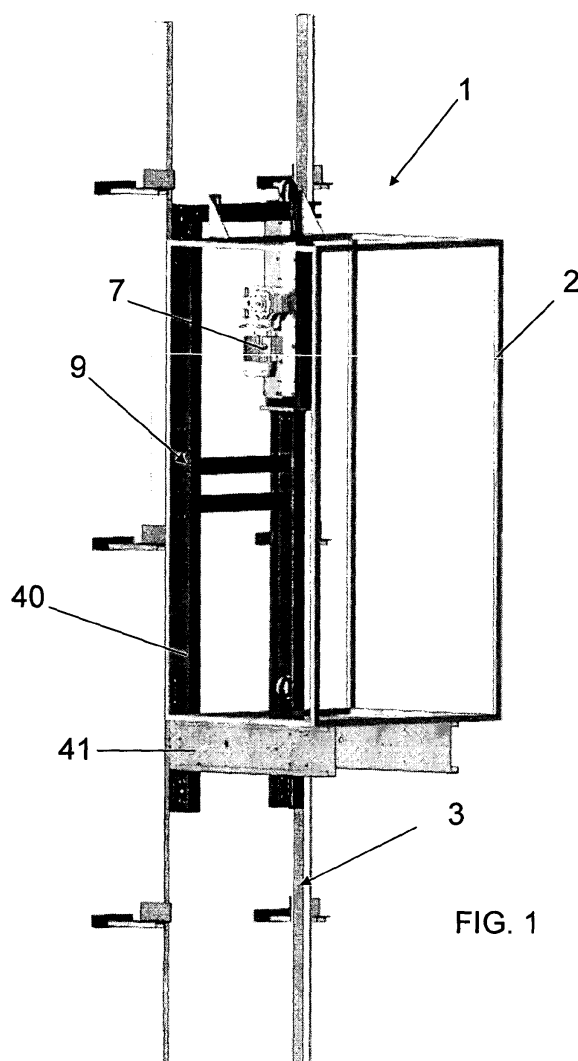


FIG. 1

Description

Field of application

[0001] The present invention relates to a driving system for a lift plant, particularly for the up and down movement of an arch of the lift plant integral with a cabin.

[0002] More particularly, but not exclusively, the invention relates to a driving system designed to drive a lift cabin along a vertical travel of prefixed length and the following description is given with specific reference to this field of application with the sole purpose of simplifying disclosure thereof.

Prior art

[0003] As is well known in this specific technical field, there are various technical solutions for building lift plants for both civil and industrial applications.

[0004] The lift cabin is typically guided during the movement along steel guides extending vertically and attached to at least one side of the travel shaft. The hoisting system can be provided by means of several cables, for example several cables which connect the cabin to a counterweight and several cables which connect the cabin to the motor means.

[0005] The mass of the counterweight is normally calculated so as to reduce to a minimum the stress of movement, for example it can be equal to half of the nominal capacity of the cabin. When the cabin is up, the mass of the counterweight is down, and vice versa.

[0006] The vertical movement of the cabin is controlled by motor means via pulleys whereon the cables are wound. The control is assigned to an electromechanical device.

[0007] It is often necessary to provide at the top of the lift plant machine rooms or in any case a space for holding the motor means, the pulleys and the electromechanical device.

[0008] There are however also driving systems of a different type, for example actuated by hydraulic piston systems which do not even require machine rooms, i.e. they do not require a specific space which allows the motor and the relative mechanical means to be positioned.

[0009] These systems provide an integration or assembly of the driving system in such a way that it can occupy a reduced space, for example by positioning it in the travel shaft of the cabin or at the bottom of a pit.

[0010] Albeit advantageous in various respects, these systems also have certain limitations due to the presence of the tank containing the oil or the hydraulic fluid. In some cases the motor is even immersed in the actual tank to gain space, although costly dielectric fluids have to be used and fluids based on water avoided.

[0011] If the tank is positioned in a pit, possibly under the piston, a frame has to be provided for support of the piston with an increase in costs and times of assembly.

[0012] Finally rack driving systems also exist, suitable for very high travels, for example for plants to be installed in skyscrapers.

[0013] All the systems of a known type have common disadvantages arising from the fact that they are not particularly suitable for installations in existing homes or in any case require burdensome masonry work on ready-built buildings.

[0014] The technical problem underlying the present invention is that of devising a driving system for a lift plant, particularly for the up and down movement of an arch associated with the cabin of the plant, which has such structural and functional features as to overcome the disadvantages mentioned above.

[0015] More particularly the system according to the invention should have such features of compactness and simplicity as to allow the driving system to travel together with the arch of the plant.

[0016] Another object of the invention is that of making available a driving system which allows movement of the arch associated with the cabin of the lift in a particularly regular and silent manner, also avoiding sudden movements during the phase of departure and arrival.

[0017] A further object of the invention is that of making available a driving system of simple and reliable structure which even allows operation safety to be guaranteed in the case of an electrical or mechanical fault.

Summary of the invention

[0018] The idea for solving the problem underlying the present invention is that of providing an elongated fixed member extending vertically for a length substantially corresponding to the length of the travel of the arch associated with the cabin and a driving system integral with the arch of the cabin or with the counterweight and sliding along this fixed member.

[0019] On the basis of this idea and in order to solve the technical problem the invention relates to a driving system of the type previously mentioned and characterised in that it comprises an elongated fixed member, extending vertically for a length substantially corresponding to the length of the travel of the arch of the cabin or of the counterweight, and at least one wheel rotatably supported on board the arch associated with the cabin and maintained in constant rolling engagement along one side of said smooth and fixed member; said wheel being controlled and driven to rotate by motor means.

[0020] Advantageously, said fixed member is smooth and is a wing of a metal section bar which constitutes a guide of the arch.

[0021] An opposite wheel is also provided, engaged with said fixed member, at an opposite side thereof.

[0022] Said opposite wheel is advantageously at the same height as the other.

[0023] It should also be noted that the opposite wheel is also subjected in turn to the action of said motor means with formation of at least one pair of drive wheels simul-

taneously rollingly engaged on opposite sides of the fixed member.

[0024] Further features and the advantages of the system according to the invention will be made clearer by the description of one of its embodiments given by way of a non-limiting example with reference to the accompanying drawings and by the dependent claims.

Brief description of the drawings

[0025]

- Figure 1 shows a perspective and schematic view for a lift plant built in accordance with the present invention;
- Figure 1A shows a schematic front view of the lift plant of Figure 1;
- Figure 1B shows a schematic plan view of a driving system incorporated in the lift plant of Figure 1;
- Figure 2 shows a vertical elevation and front schematic view of the system of Figure 1;
- Figure 3 shows a vertical elevation and side schematic view of the system of Figure 1 along the arrow III of Figure 2;
- Figure 4 shows a vertical elevation and side schematic view of the system of Figure 1 along the arrow IV of Figure 2;
- Figure 5 shows a vertical elevation schematic view of the system of Figure 1 along the arrow V;
- Figure 6 shows a sectioned schematic view of the system of Figure 1 in the view of Figure 5 along the section line VI-VI of Figure 1A;
- Figure 6A shows a front schematic view of a protective casing of the system according to the invention;
- Figure 7 shows a cross-sectioned schematic view of the system of Figure 1 taken along the section line VII-VII of Figure 3;
- Figure 8 shows a cross-sectioned schematic view of the system of Figure 1 taken along the section line VIII-VIII of Figure 3;
- Figure 9 shows a perspective and schematic view of a lift plant built in accordance with the present invention in one of its embodiments;
- Figure 10 shows another perspective and schematic view of the variant of Figure 10;

- Figure 11 shows a schematic side view of the variant of Figure 9.

Detailed description

[0026] Referring to these drawings, and particularly to the examples of Figures 1 and 9, 1 denotes overall and schematically a driving system for a lift plant, particularly for the up and down movement of a so-called arch 9 associated with the cabin 2 of the plant along a prefixed travel.

[0027] The cabin 2 is integral with the arch 9, that is to say with a support frame which comprises a first portion 40 extending vertically and a second portion 41 perpendicular to the previous one and which supports the floor of the cabin 2. The first portion 40 of the arch 9 is mobilely guided between two guides of the lift plant.

[0028] The guides of the arch 9 are made of metal, for example steel, extending vertically and fixed to at least one side of the travel shaft. The driving system comprises also a counterweight 50 which is connected to the arch 9 by means of cables 48 wound on a pulley 49 situated centrally at the top of the guides.

[0029] The counterweight 50 is mobilely guided between guides wholly similar to those used to border the sliding of the arch 9. The drawings are only an indication and the position of the counterweight and of the relative guides can also be different from that illustrated.

[0030] The counterweight 50 facilitates with its mass the movement of the lift.

[0031] When the cabin 2 is up, the mass of the counterweight is down and vice versa. A more detailed description will be given of the counterweight 50 with reference to Figure 9 onwards.

[0032] The system 1 comprises an elongated fixed member 3 extending vertically for a length substantially equal to the length of said travel.

[0033] The fixed member 3 is preferably in a single part and non-extending, that is to say made in one piece in its entirety, and can coincide with one of the guides of the arch 2 of the lift plant, or it can be provided in addition to the conventional guides, for example as shown in Figure 9 in which it can be seen that the member 3 is extending parallel to the guides and also acts as one of the guides of the counterweight 50.

[0034] The fixed member 3 has a T section and is preferably built by means of a metal section bar. There is nothing against, however, the section of the member 3 being I or L shaped.

[0035] The system 1 comprises moreover at least one wheel 4 rotatably supported on the arch 9 and subjected to the action of motor means 5 which comprise an electric motor 7 and a kinematic mechanism 12 for transmission of the motion. The wheel 4 is rollingly engaged along one side L1 of said fixed member 3.

[0036] More particularly, the system 1 comprises an electric motor 7 having a drive shaft 8 extending vertically and substantially parallel to the fixed member 3. The drive

shaft 8 transmits the motion to a reducer unit contained in a box 10 with a helical wheel and a worm screw.

[0037] Via the reducer unit of the kinematic mechanism 12 the motion from the drive shaft 8 is transferred to a transmission shaft 18 supported in the system 1 in orthogonal extension in relation to the fixed member 3. A support plate 32 supports the motor means 5 and the reducer unit associated therewith in a prefixed distanced relationship with the arch 9, and therefore also in relation to the fixed member 3, in such a way that the reducer does not rotate in relation thereto.

[0038] The transmission shaft 18 is inserted in the reducer unit 10 and, in a manner in itself conventional, in a hollow shaft 14 which is the slow component of the reducer. One end of the transmission shaft 18 extends outside of the reducer unit of the box 10 in the direction of the fixed member 3. More particularly, as shown in Figure 7, the transmission shaft 18 is inserted between two opposite bearings and supports the reducer unit and the same electric motor 7.

[0039] Integral with the free end of the transmission shaft 18 is a primary, motor or driving toothed wheel 15, which meshes with a corresponding secondary, drawn or driven toothed wheel 16. The secondary driven toothed wheel 16 is at the end of a respective shaft 19. The primary and secondary toothed wheels 15 and 16 are supported by respective opposite bearings.

[0040] The primary and secondary toothed wheels 15 and 16 are designed to transmit motion to respective series of gears; more particularly the toothed wheel 15 is in toothed coupling with a series 22 of five gears positioned above it and with a similar series 24 of five gears positioned below it.

[0041] In a totally symmetrical manner, the driven wheel 16 meshes with a series 21 of five gears positioned above it and with a similar series 23 of five gears positioned below it, as shown clearly in Figure 6.

[0042] The series of gears 22 and 24 are held in a main box 33 which is integral with the arch 9. The two mobile boxes 34 and 35 hold the other two series of gears 21 and 23.

[0043] In substance, in the system 1 there are therefore four trains of gears meshing, each train comprising a first drive gear and subsequent gears each of which is driven and at the same time driver of the subsequent gear in the train.

[0044] The covers 36, 37, 38, 39 and 39b contain the shaft support bearings and close respectively the boxes 33, 34 and 35, as shown in Figure 6A. The first gears of each train are connected to the kinematic mechanism 12 comprising the reducer unit of the box 10 and the electric motor 7; more particularly, the toothed wheel 26 and the toothed wheel 27, meshing one with the other, are each keyed on a respective drive shaft 13, 17. The reducer unit of the box 10 and the transmission shaft 18 actuate the primary toothed wheel 15 which moves the secondary wheel 16 and, with it, the respective trains of gears.

[0045] The gears are positioned parallel to the sides

L1, L2 of the fixed T-shaped member 3 and are coupled with a respective idle wheel in an alternated manner.

[0046] Advantageously, according to the invention, the wheel 4 is rotatably supported on board the arch 9; this wheel 4 is coupled with the first 26 of said series 21 of five gears positioned above the motor toothed wheel 16, that is to say with the first gear 26 of the first train of gears 22.

[0047] The wheel 4 and the corresponding gear 27 are supported by a transmission shaft.

[0048] From the previous description it can be seen clearly how the wheel 4 is subjected to the motor means 5 by the kinematic mechanism 12 of the reducer unit and of the series 22 of gears.

[0049] As already mentioned, the wheel 4 is rollingly engaged along one side L1 of the fixed member 3. More particularly, the wheel 4 is maintained in close contact with the side L1 in close adherence without play.

[0050] In order to facilitate the contact and the rolling without sliding of the wheel 4 along the side L1 of the fixed member 3 a covering 30 is provided for the wheel 4 with a material having prefixed elastic yielding and surface of prefixed roughness. Advantageously screws 31 are provided, accessible laterally to the box 33 and to the covers 38 and 39 in order to regulate the adherence of the wheel 4 with covering 30 to the fixed member 3.

[0051] Similarly a second wheel 20 is provided, rotatably supported on board the arch 9 and rollingly engaged along an opposite side L2 of the same fixed member 3. The second wheel 20 is coaxially coupled with the first gear 26 of the series 21 of gears positioned above the driven toothed wheel 16, that is to say the first gear 26 of the second train 21 positioned parallel to the first train 22.

[0052] The wheel 20 and the corresponding gear 27 are supported by a transmission shaft 17.

[0053] The second wheel 20 is in turn maintained in close contact with the side L2 of the fixed member 3 in close adherence without play. Also for this second wheel 20 a covering 30 is provided with a material having prefixed elastic yielding and surface of prefixed roughness.

[0054] Advantageously, the wheels 4 and 20 are maintained rollingly engaged on opposite sides L1, L2 of the fixed member 3, which acts substantially as a vertical track for the moving of the entire arch 9 and with it of the cabin 2 integral therewith and of the same motor means 5 all integral with the arch 9 of the lift.

[0055] In a preferred embodiment, the third and the fifth gear of the series of gears 21, 22, 23 and 24 are coaxially associated with wheels 28 and 29 totally similar structurally to the wheels 4 and 20. The connections between wheels 28, 29 and respective gears takes place in the same way as for the wheels 4 and 20.

[0056] The wheels 28 on one side (L1) and the wheels 29 on the other side (L2) of the fixed member 3 are also rollingly engaged in a totally similar manner to what occurs for the wheels 4 and 20.

[0057] It should be noted that the wheel 4 and the sec-

ond and opposite wheel 20 are at the same height one in relation to the other. This is the case also for the wheels 28 and for the other opposing wheels 29.

[0058] The second wheel 20 is directly subjected to the action of the motor means 5, being coupled to the driven toothed wheel 16; nevertheless the wheels 4 and 20 can be considered a pair of drive wheels simultaneously rollingly engaged with the fixed member 3.

[0059] The pairs of drive wheels 4, 20 or 28, 29 total six. There is obviously nothing against their number being higher or lower according to needs and to the weight of the arch of the cabin which has to be driven up and down.

[0060] The functioning of the system according to the invention is particularly simple in that the system according to the invention travels together with the cabin of the lift.

[0061] Means of electrical interconnection with flexible sheath which can be bunched are obviously provided for the motor means 5. These means have not been described in that wholly conventional and within the reach of any person skilled in the art who has to supply electrically an electric motor moving along a predefined path having an initial position and a final position.

[0062] The programming of the movement is also assigned in a manner in itself conventional to an electronic controller typically used for moving lift plants.

[0063] All the wheels 4, 20, 28, 29 associated with the trains of gears 22, 21, 23 and 24 are in close adherence without play with respective sides L1 and L2 of the fixed member 3 and co-operate with this fixed member 3, establishing a rolling engagement in a vertical direction which allows up and down driving of the cabin 2. The motor means 5 are piloted strictly for the time necessary for transferring motion to the toothed wheels 15, 16 and to the relative gears connected to them so as to move the wheels.

[0064] Referring now in particular to Figure 9 onwards, a description is given of an alternative embodiment of the driving system 1 according to the present invention. In this embodiment the details and co-operating parts having the same structure and functioning of the previous embodiment will be illustrated with the same reference numerals.

[0065] In the embodiment of Figure 9 the driving system 1 is sliding along a fixed member 3 which corresponds to one of the guides of the counterweight 50. The system 1 is made integral with the counterweight 50 and drives in its sliding motion also the counterweight 50, consequently actuating also the arch and the cabin 2 connected to the counterweight 50 by the cable or cables 49.

[0066] The fixed member 3 can also be wholly independent from the guides of the counterweight, even if the fact that it can coincide with one of the guides may be advantageous.

[0067] In this embodiment, the action of the system 1 on the counterweight 50 makes the movement of the cabin 2 particularly regular and gentle due in fact to the in-

termediation of the drives represented by the pulleys 48 and cables 49.

[0068] The drive wheels 4, 20, 28 and 29, adherent and in close contact with the respective sliding surfaces L1, L2 of the fixed member 3, drive the counterweight 50 in an up and down movement actuated by the motor means 5 controlled by the electronic controller of the lift plant.

[0069] The main advantage of the driving system according to the invention lies in its uncommon compactness and simplicity such as to allow the driving system to travel together with the cabin of the plant.

[0070] A particular aspect of the invention lies in the fact that the chosen fixed member is specifically a metal section bar, and more particularly the wing of a metal section bar, said wing constituting, within the lift plant, a guide for the cabin.

[0071] A further advantage lies in its safe operation in the case of an electrical or mechanical fault, in that from the inside of the cabin it is possible to move the same cabin for example by handle manoeuvre means which can be provided in order to be active for example directly on one of the toothed wheels 15 or 16 to manoeuvre the system 1 manually in the case of a fault until a safety level or floor is reached.

[0072] A further advantage comes from the fact that the system of the present invention is suitable for being used in buildings with any number of floors.

Claims

1. Driving system (1) for a lift plant, particularly for the up and down movement of an arch (9) of the lift plant integral with a cabin (2) and along a vertical travel of prefixed length, **characterised in that** it comprises an elongated fixed member (3), extending vertically for a length substantially corresponding to the length of the travel of the cabin (2), and at least one wheel (4) rotatably supported on board the arch (9) of the cabin or of the counterweight (50) and maintained constantly rollingly engaged along one side (L1) of said fixed member (3); said wheel (4) being controlled and driven to rotate by motor means (5).
2. Driving system according to claim 1, **characterised in that** it comprises, for each one of said at least one wheel (4), an opposite wheel (20) engaged with said fixed member (3), at an opposite side (L2) thereof.
3. Driving system according to claim 1, **characterised in that** the fixed member (3) is smooth and is a metal section bar.
4. Driving system according to claim 1, **characterised in that** the fixed member (3) is a wing of a metal section bar and constitutes a guide for the arch (9) of the cabin (2) or of the counterweight (50).

5. Driving system according to claim 2, **characterised in that** said opposite wheel (20) is at the same height as the other (4).
6. Driving system according to claim 2, **characterised in that** said opposite wheel (6) is subjected in turn to the action of said motor means (5), with formation of at least one pair of drive wheels (4, 20) simultaneously rollingly engaged with the fixed member (3). 5 10
7. Driving system according to claim 1, **characterised in that** the pairs of drive wheels are six.
8. Driving system according to claim 1, **characterised in that** said motor means (5) are kinematically connected to four trains (21, 22, 23, 24) of gears meshing one with the other, each train comprising a first drive gear (15, 16) and subsequent gears, which are driven and at the same time driving the subsequent gear, the gears of each train being coupled with a respective wheel and idle in an alternated manner. 15 20
9. Driving system according to claim 1, **characterised in that** the first gears (15, 16) of each train are connected to a wheel mechanism actuated by said motor means (5). 25
10. Driving system according to claim 4, **characterised in that** said fixed member (3) extends parallel to one of the guides of said arch (9) or of said counterweight (50). 30

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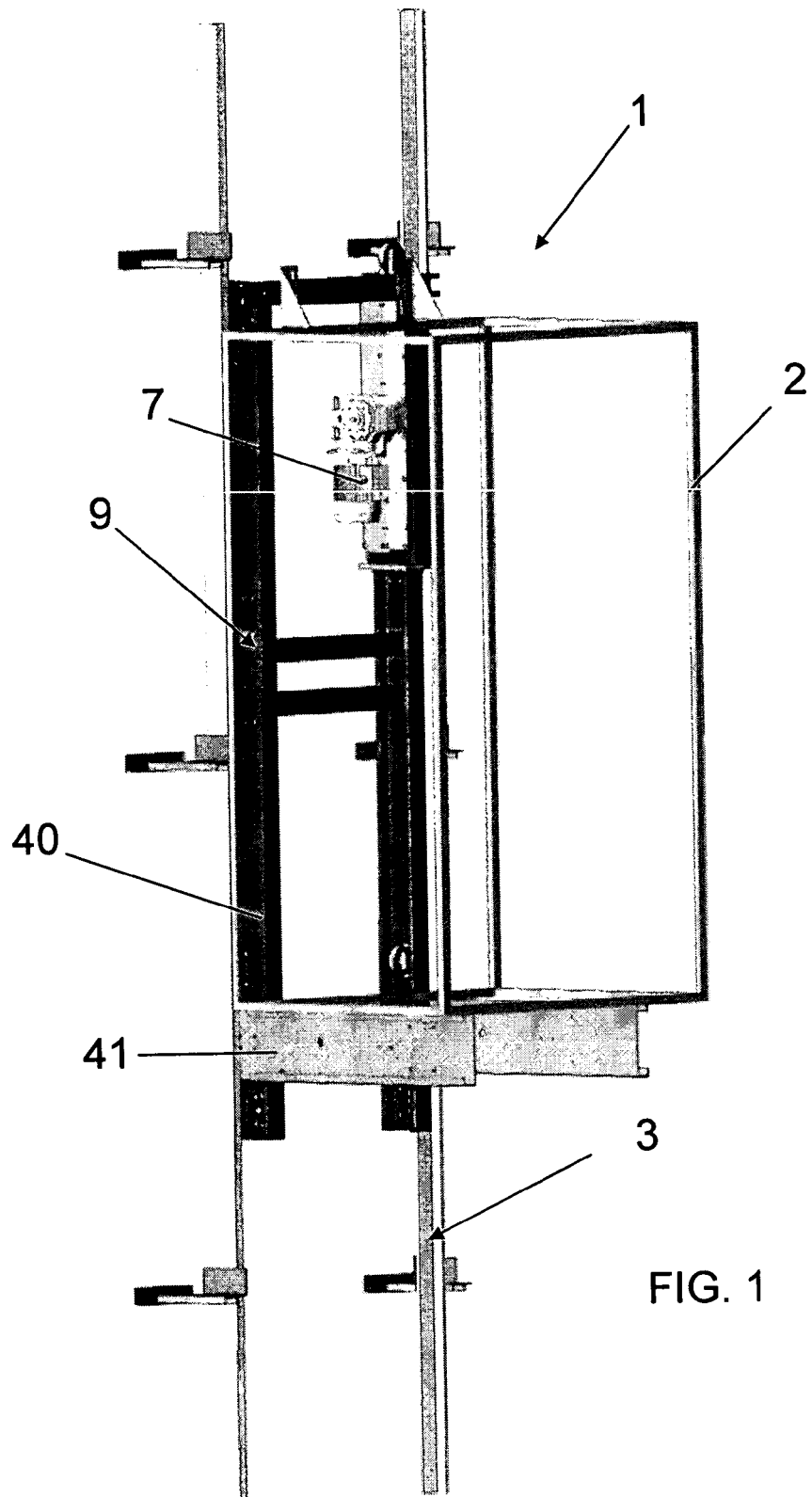


FIG. 1

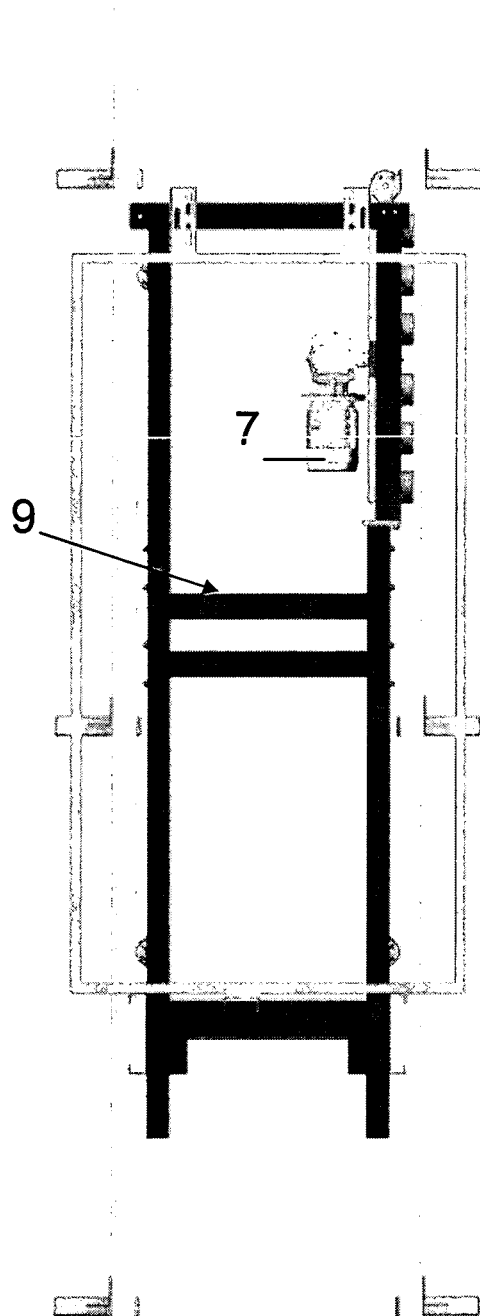
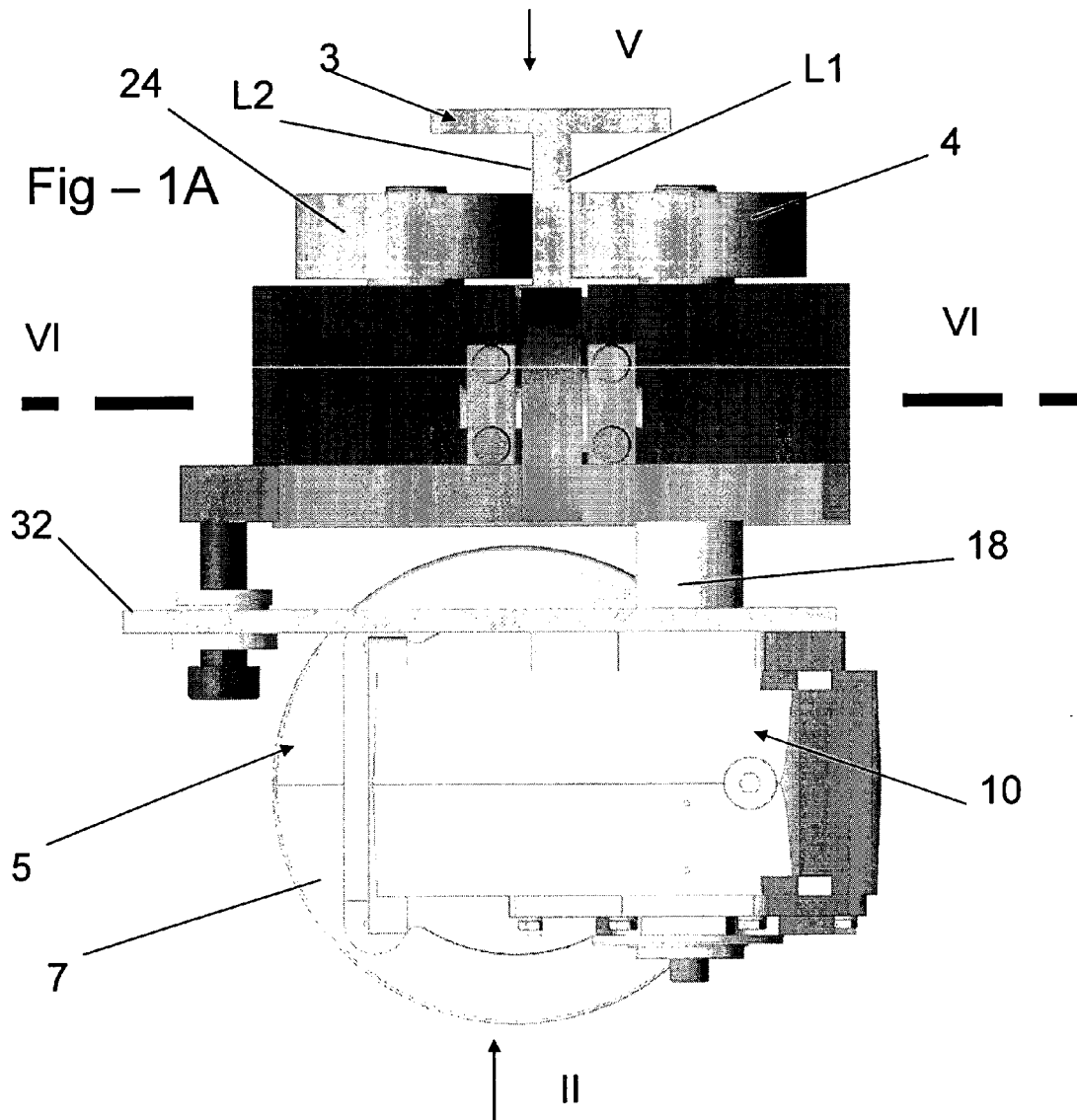
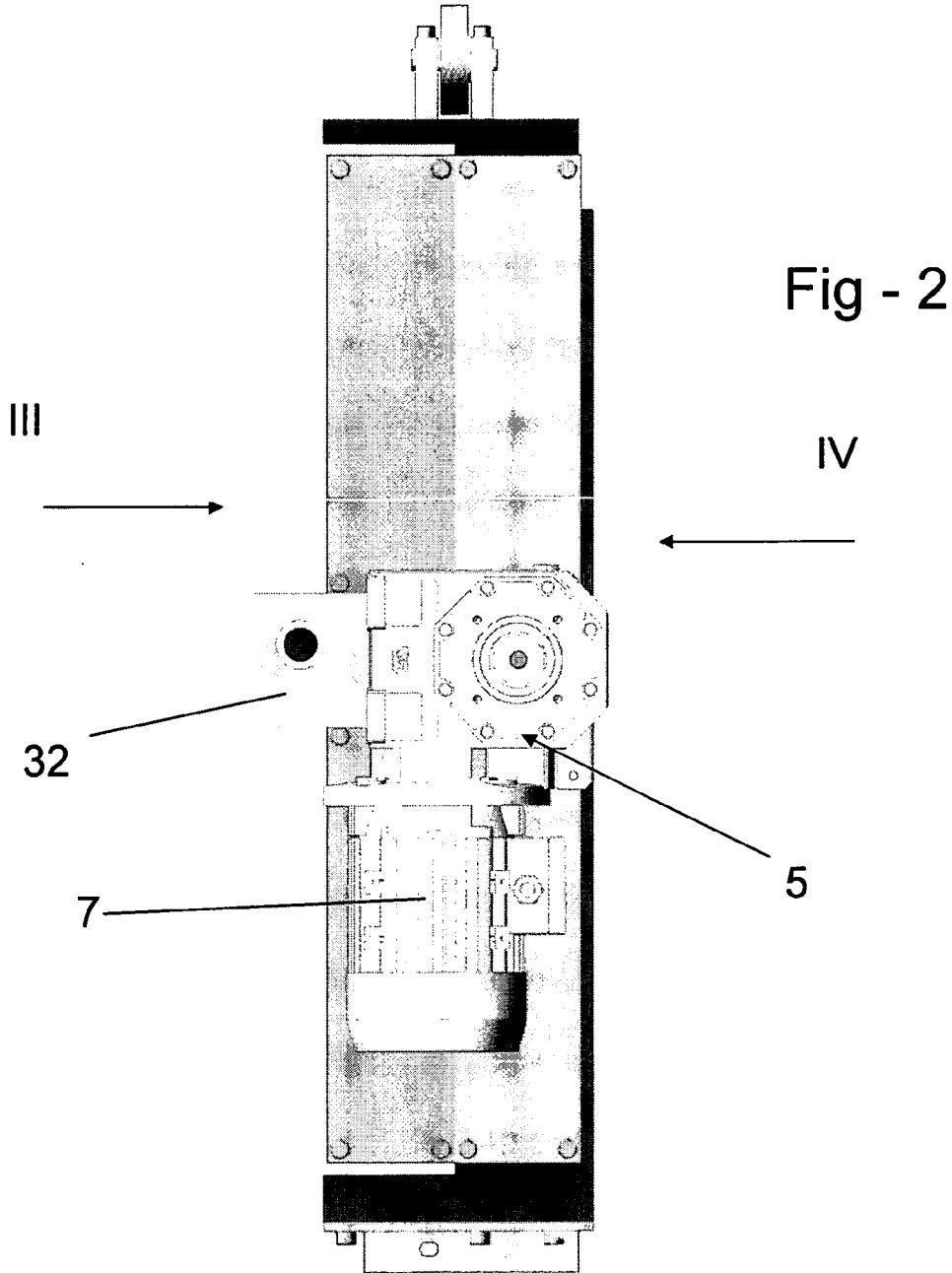
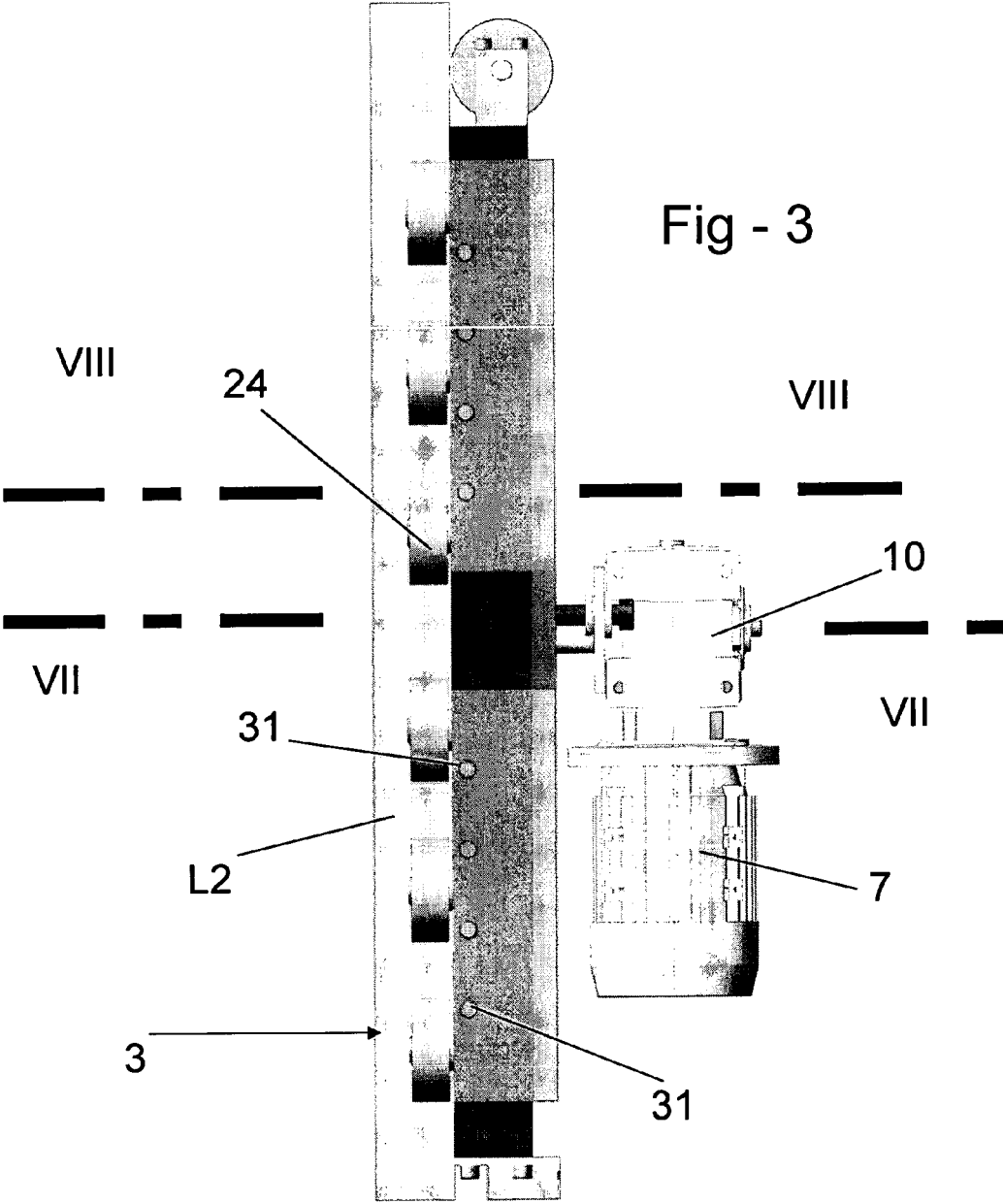
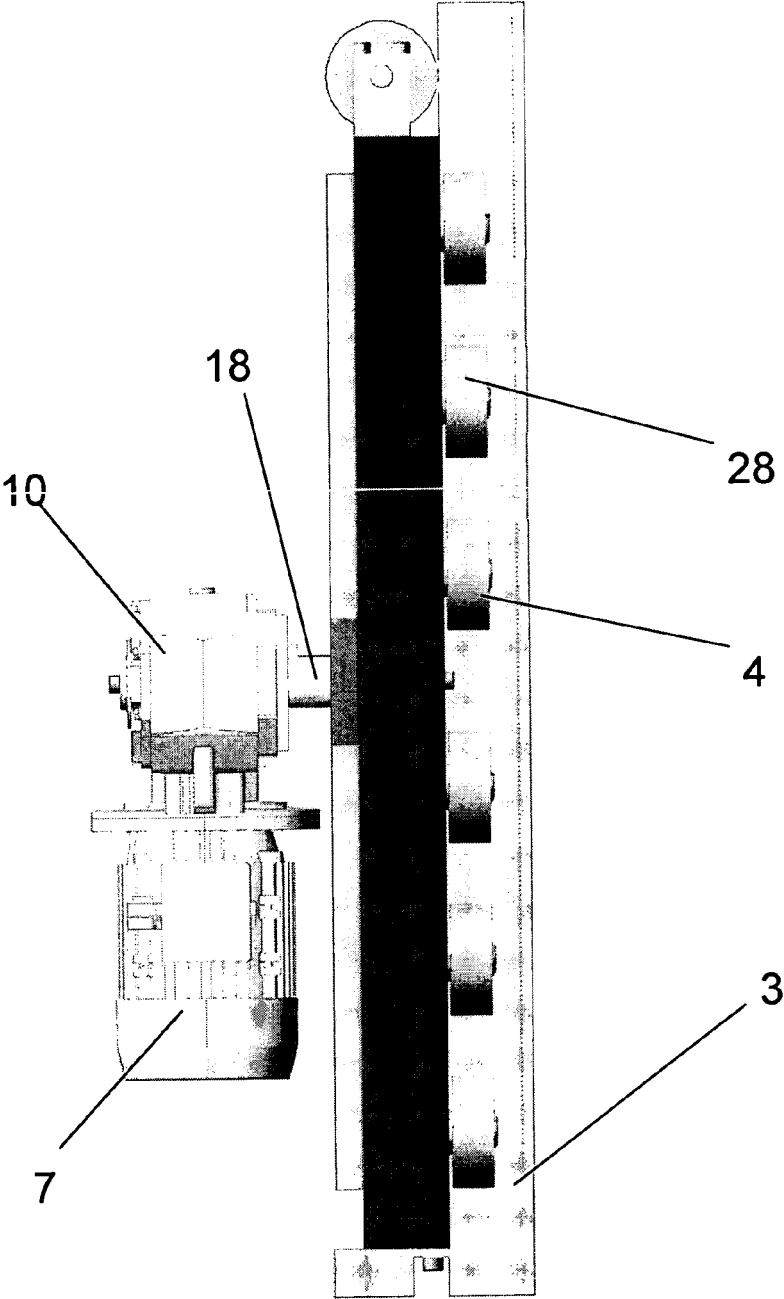


FIG 1A









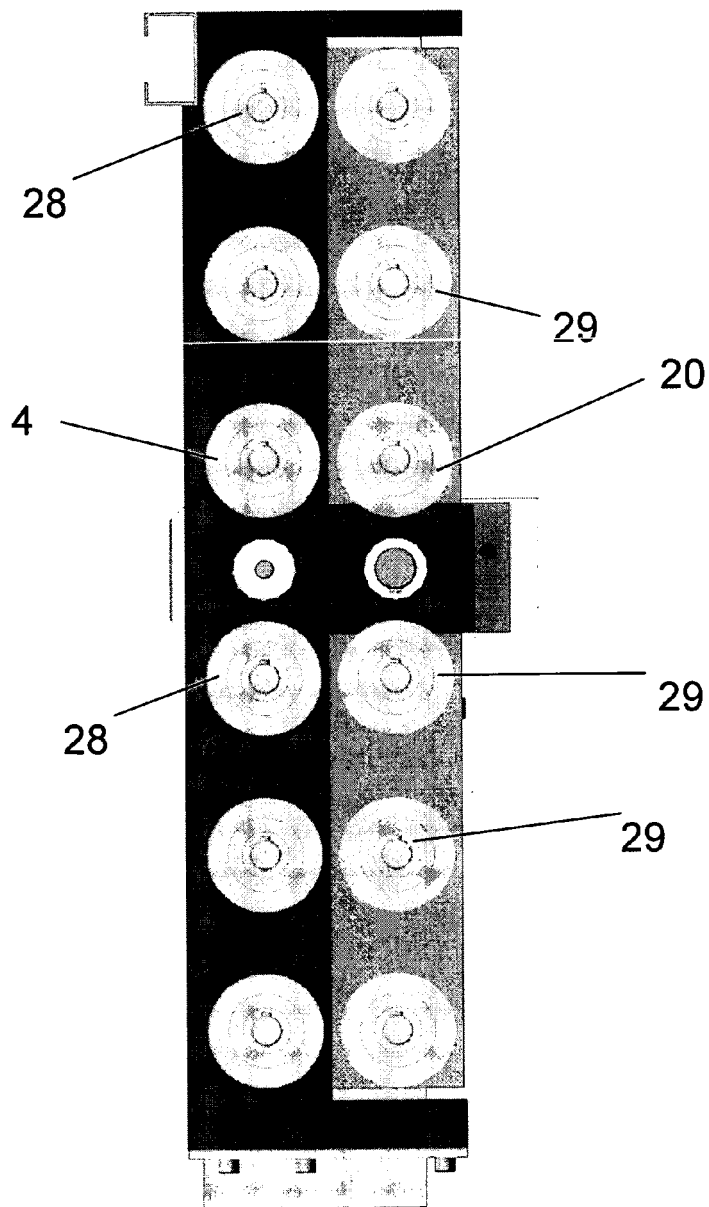


Fig - 5

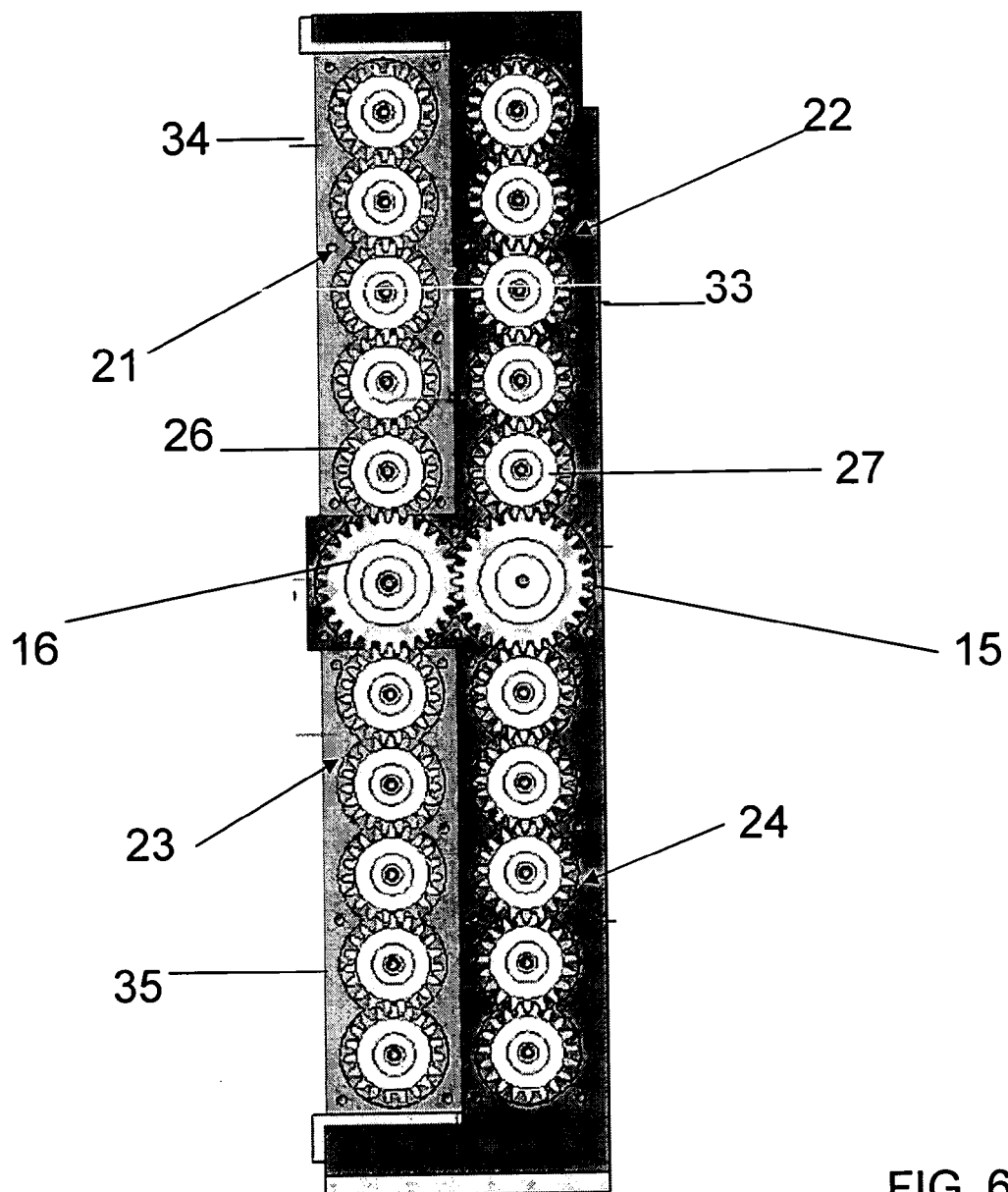


FIG. 6

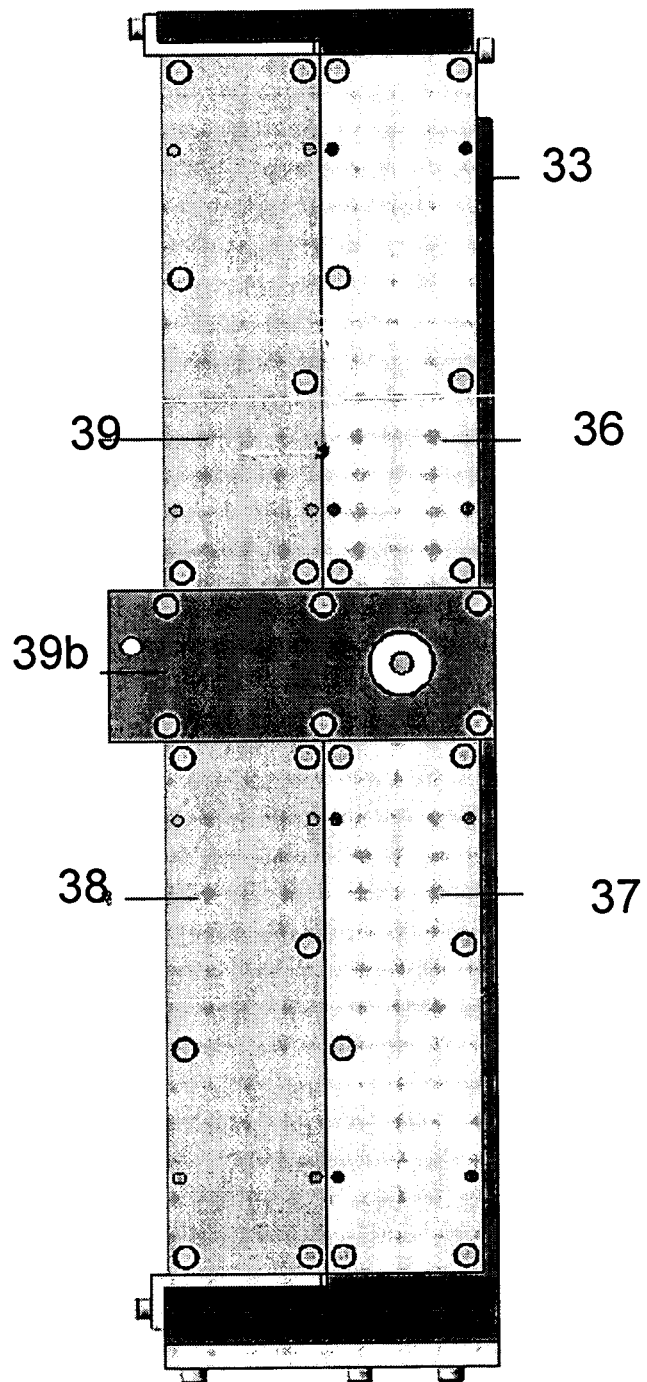
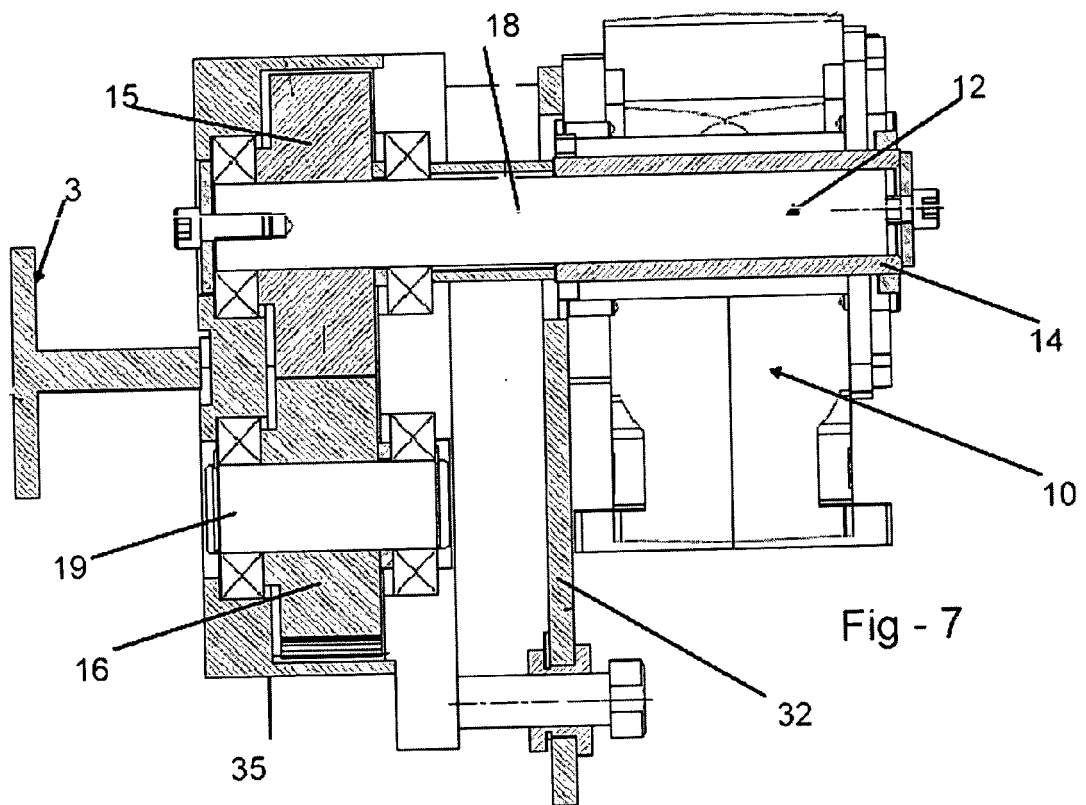


FIG. 6A



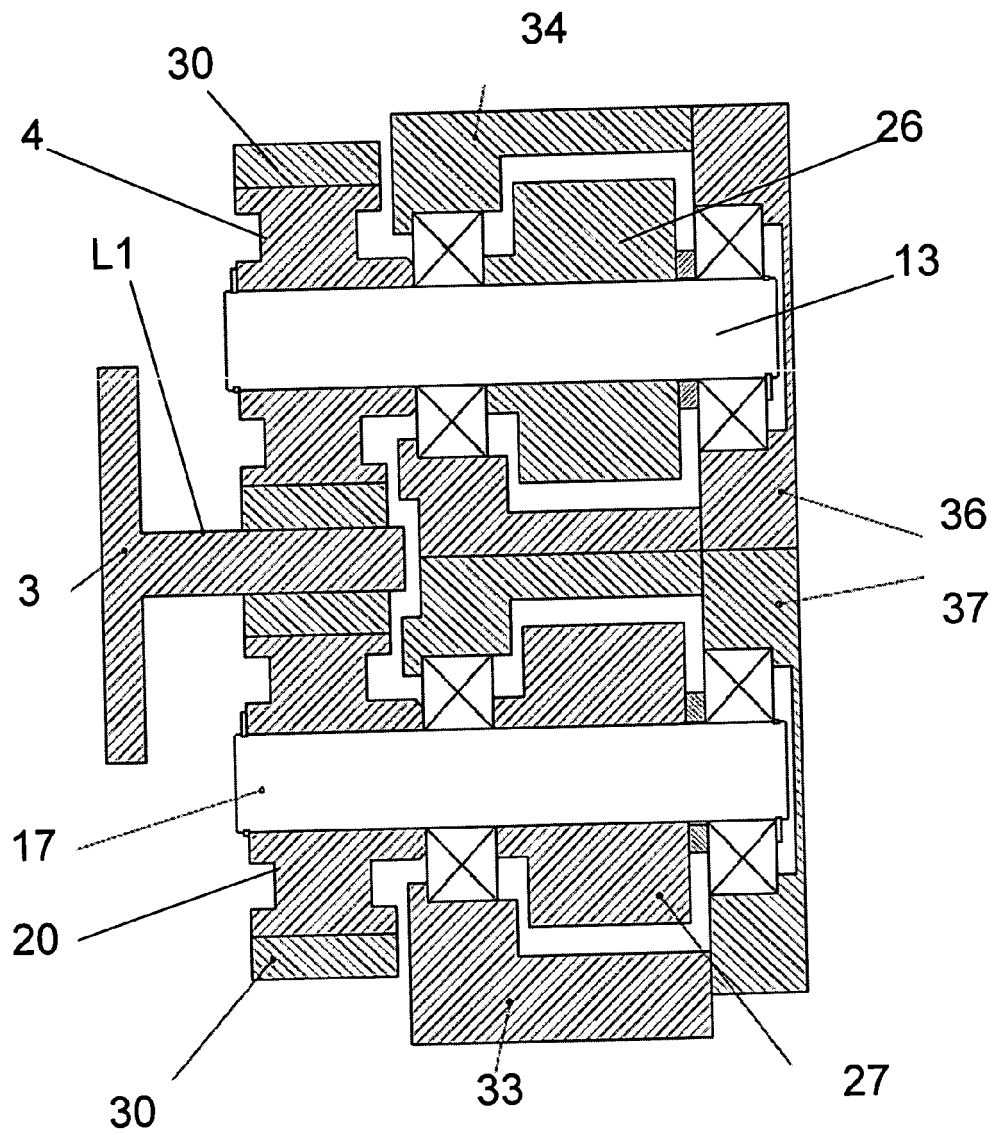


Fig - 8

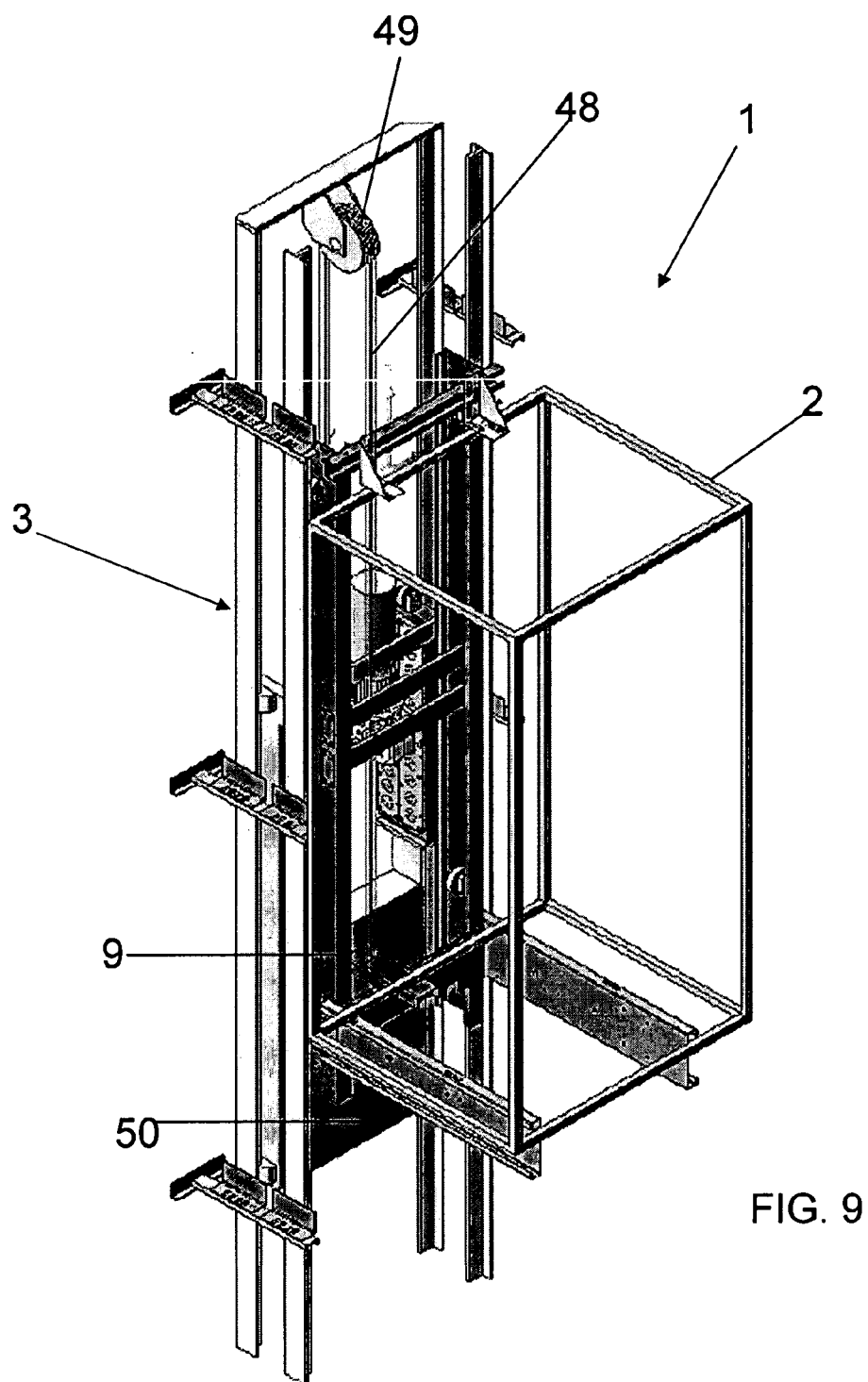
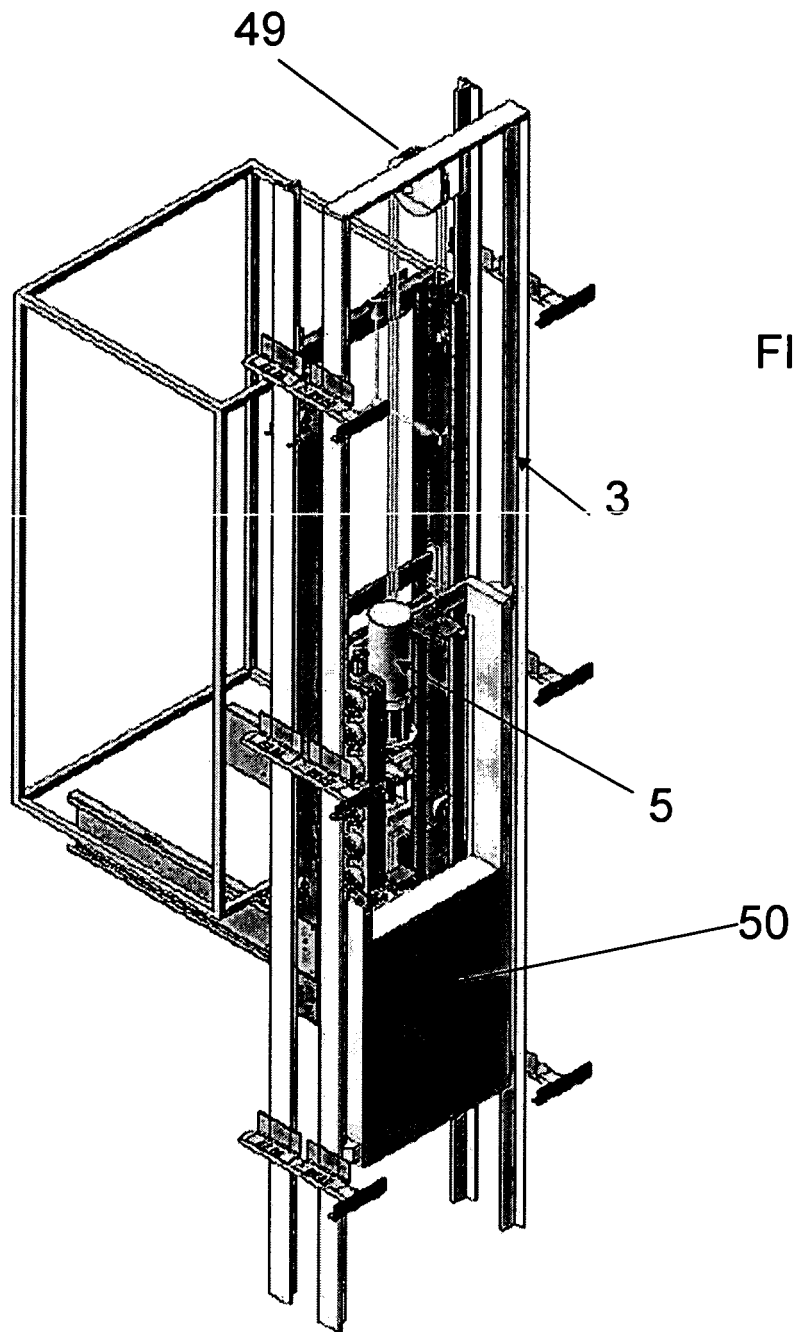
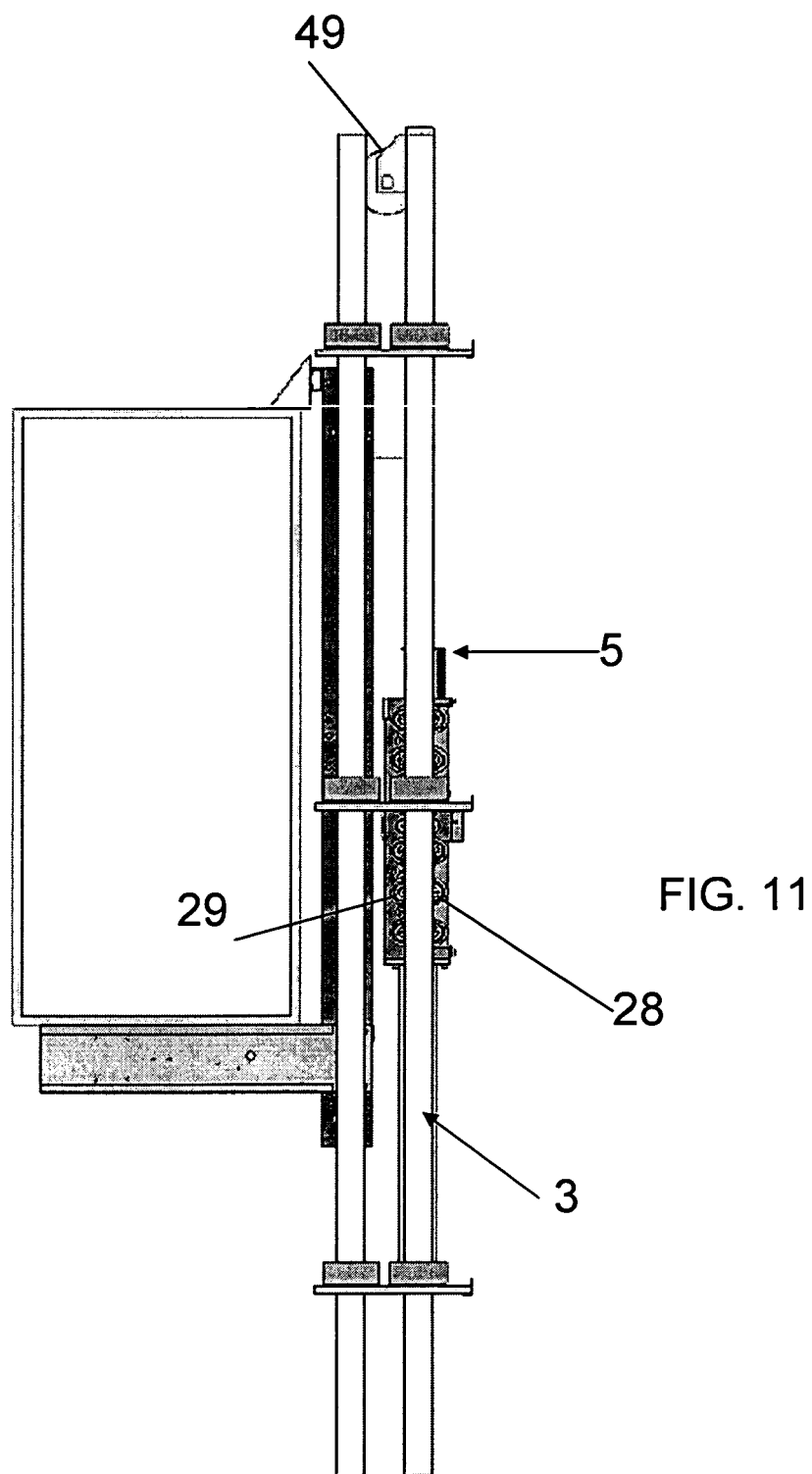


FIG. 9







EUROPEAN SEARCH REPORT

Application Number
EP 10 42 5136

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 566 784 A (RENNETAUD JEAN-MARIE [US]) 22 October 1996 (1996-10-22)	1-7,10	INV. B66B9/02
Y	* the whole document *	8,9	

X	FR 933 675 A (MENSUA MANZORRO) 28 April 1948 (1948-04-28) * claims 1,2; figures 1-3 *	1-3,5,6, 10	

Y	JP 3 243600 A (FUJIKURA LTD) 30 October 1991 (1991-10-30) * abstract *	8,9	

			TECHNICAL FIELDS SEARCHED (IPC)
			B66B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 September 2010	Examiner Janssens, Gerd
CATEGORY OF CITED DOCUMENTS		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	
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			

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EPO FORM 1503 03.82 (P04C01)

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

EP 10 42 5136

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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21-09-2010

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FR 933675	A	28-04-1948	NONE	
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