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- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))
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(54) Title: VEHICLE LIFT

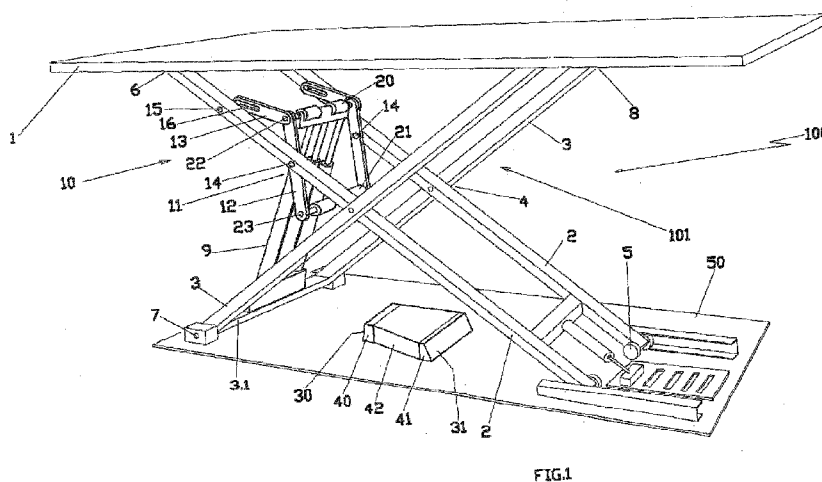


FIG.1

(57) Abstract: The invention concerns a vehicle lift, of the type that comprises, under the support plane (1) of the vehicle, a lifting/lowering mechanism (101), consisting of at least two pairs of levers articulated to one another in an intermediate section, which constitute the two forks, moved by at least one fluid-dynamic actuator (9). Such a lift (100) foresees that the fluid-dynamic actuator (9) acts on an articulated system (10), which supports at least one first roller (20) and at least one second roller (21), arranged on the respective axes. Said two rollers (20, 21), in the initial step of lifting/opening the fork, are kinematically coupled with two corresponding inclined surfaces (30,31).



**Title: Vehicle lift**

## DESCRIPTION

of the invention having the TITLE "Vehicle lift" to Fiorese Marta and Fiorese Sara.

The present finding concerns a vehicle lift, according to the general part of claim 1.

5 As well known, among the various types of lifts, used in body shops and in garages to allow the worker to work on the lower part of a vehicle, so-called fork or similar type systems are commonly used.

Such a lifting group comprises, at the two sides of the support plane of the vehicle, a fork-type lifting/lowering mechanism, consisting of two pairs of levers articulated to  
10 one another at an intermediate section thereof and where the lever of each of the two pairs, the one arranged most externally, has the lower end hinged on the base plate, resting on the ground and the upper end sliding beneath the support plane for supporting the vehicle, with longitudinal direction, while, contrarily, the other two levers, those arranged most externally, have the lower end sliding on the  
15 aforementioned base plate and the upper end sliding beneath the aforementioned upper support plane for lifting the vehicle.

The two pairs of levers that constitute the two forks are moved by at least one fluid-dynamic actuator, having one end articulated on the cross member that connects the two lower ends of the two outermost levers and the other end articulated, through an  
20 intermediate bracket, to the two upper arms of the two innermost levers.

Usually, these lifts, due to the particular structure of the frame (fork plus support plane) and of the lifting mechanisms used, when they are completely closed, have a bulk in height that is acceptable for the majority of vehicles whereas, on the other hand, due to such bulk, they cannot be used for all cars, in particular sports and racing

cars, in which the space between the bottom of the vehicle and the ground is very small.

In so-called "low profile" lifts, i.e. in lifts that have a limited bulk in height when they are completely "packed up", the difficulties mainly occur in the first lifting step, 5 when the fluid-dynamic actuator has to develop the force (initial pickup) necessary to lift the load.

The value of such a force, as the lifting proceeds, decreases thanks to the increasing inclination of the cylinders so that, in practice, a great force (thrust) of the cylinders is only necessary in the first section of the upward stroke of the lift. In fact, substantial 10 bulks in height and/or in width are in any case necessary in order to be able to install cylinders with sufficient dimensions in order to obtain the force necessary for lifting in the first part of the upward stroke, obviously using up material and energy.

Another limitation concerning fork-type lifts or similar consists of the fact that the structure must be limited in terms of the extension in width, in order to be able to be 15 contained within the inner width of the wheels of the vehicle; moreover, the thrust mechanisms must not project from the upper plane since, frequently, sports and racing cars are lifted with the bottom, that rests directly on the plane of the lift.

The purpose of the present finding is to make a fork-type lift of the type described above, which does not have the drawbacks displayed by similar known products. 20 Specifically, the purpose of the finding is to make a fork-type lift that, as well as having a minimum bulk in height that is smaller than that of lifts found on the market, also associated the properties of requiring, at the start of lifting, a thrust force of the jacks of substantially lower value than the thrust force required by common lifts.

A further purpose is to make a fork-type lift or similar, which has a simplified and 25 light structure, with the elements that constitute the lifting mechanism, in particular

the levers, the pins and the components of the oil-hydraulic circuit, of reduced dimensions; at the same time it must be suitably strong, so that the mechanical safety system, applied to the structure, allows workers to work beneath the lifted vehicle in optimal conditions.

5 Such purposes are achieved by inserting, between the fluid-dynamic actuator and the lifting mechanism consisting of the fork levers, an articulated system consisting of two connecting rods and a rocker arm, where the two mutually opposite side walls of the rocker arm, hinged between the two innermost levers, support at least one first roller, hinged with rotary coupling on a first pin, which joins the upper end of the  
10 fluid-dynamic actuator with the rocker arm, said first roller working in kinematic coupling with a first surface that is variable from a horizontal position to an inclined position with respect to the ground and at least one second roller, hinged with rotary coupling on a second pin, positioned on the opposite side on said rocker arm. Such a second roller works in kinematic coupling with a second surface, variable from a  
15 horizontal position to an inclined position with respect to the ground.

Operatively, when the lift is completely closed and packed, the fluid-dynamic actuator and the articulated system are aligned with each other on the same horizontal axis so that, being able to use oil-hydraulic cylinders of reduced dimensions, it is possible to reduce to the minimum the bulk in height of the lift, i.e. the distance  
20 between the base plate, resting on the floor, and the upper lifting plane, where the vehicle rests.

Thereafter, through the effect of the kinematic coupling described above, the fork mechanism moves, carrying out a greater vertical stroke than the trajectory travelled by the rollers on the respective inclined surfaces, with the practical result of requiring  
25 a lower thrust force, the so-called "pickup", of the fluid-dynamic actuator, in the first

lifting step, such as to be almost equal to the value of the force required by the aforementioned actuator when the lift is almost completely lifted.

Further advantages and characteristics of the finding will become clearer from the description of a possible embodiment thereof, given only as a non-limiting example,

5 with the help of the attached tables of drawings, where:

- fig. 1 represents a perspective view of the lift according to the finding, in open condition;
- figs. 2, 3 and 4 represent section views of the lift according to fig.1, in completely closed condition; fig. 2 is a plan view sectioned according to the  
10 line II-II of fig. 4, whereas figs. 3 and 4 are elevated views, respectively sectioned according to the lines III-III and IV-IV of fig. 2;
- fig. 5 represents a perspective view of the articulated system, in completely closed condition of the lift, with the position of the rollers on the respective inclined surfaces;
- 15 - figs. 6 and 7 represent the operation of the articulated rocker arm/pair of connecting rods group and the position of the rollers with respect to the respective surfaces, during the initial lifting steps;
- figs. 8 and 9 represent the operation of the articulated rocker arm/pair of connecting rods group and the position of the rollers with respect to the  
20 respective surfaces, during the steps after the initial lifting ones.
- fig.10 represents a detailed view of a variant of fig.1.

In figs.1-3 it is possible to see a vehicle lift according to the finding, indicated with reference numeral 100, where the lifting/lowering movement of the upper support plane 1 is obtained by a moving group 101, which comprises, at each of the two  
25 longitudinal sides of said support plane 1, two pairs of levers 2 and 3, articulated to

each other at an intermediate section 4; the two parallel levers 2, arranged most internally, are equipped at the lower end with wheels 5 able to slide at the ground level, along a trajectory concordant with the longitudinal axis of the plane 1 and the upper end hinged with a first pin 6 below the plane 1, whereas the two levers 3, arranged most externally, have the lower end hinged with the second pin 7 to the base 50, resting on the ground and the upper end equipped with wheels 8, able to slide below the plane 1.

The entire lifting mechanism is actuated by a fluid-dynamic actuator, wholly indicated with reference numeral 9, which has the lower end articulated on a cross member 3.1, which connects the two outermost levers 3, whereas the upper end acts on an articulated system, wholly indicated with reference numeral 10, to give a synchronous movement to the two lateral scissors.

The articulated system 10, which connects to the two innermost levers 2, consists of a rocker arm, wholly indicated with reference numeral 11 and two connecting rods 13, where each of the two side walls 12 of the rocker arm 11 is hinged on a corresponding intermediate axis 14, whereas the connecting rods 13 are held by two projecting pins 15, on which the corresponding slits 16 slide, which are formed on said corresponding connecting rods 13.

Moreover, the rocker arm 11 supports, at the two opposite ends, at least two rollers 20 and 21, which, in the first lifting step (opening of the fork) of the lift, move in kinematic contact with at least two corresponding inclined surfaces 30 and 31, formed on two opposite portions 40 and 41 of a single block 42, or made on two opposite portions 40 and 41 of two or more separate blocks 43 and 44.

In particular, as can be seen in fig.3, the portions of the two surfaces 30 and 31, which are in kinematic contact with the corresponding rollers 20 and 21, are inclined a

mutually convergent manner (in the illustrated example, upwards) and have the same or different inclination to each other and a shape suitable for optimising the thrust of the fluid-dynamic actuator 9.

Constructively, as can be seen in particular in fig. 5, the opposite rollers 20 and 21 are hinged on the pins 22 and 23 and the front pin 22 has a dual function: that of articulating the rocker arm 11/connecting rod 13 pair and that of fastening the upper part of the fluid-dynamic actuator 9, which transmits the force to the articulated system 10.

Operatively, as can be seen in the sequence of fig. 6 and thereafter, with the constructive solution according to the finding, in the initial lifting step, it is foreseen for the two opposite rollers 20 and 21, supported by the rocker arm 11, which angularly rotates on the intermediate axis 14 when, through the effect of the thrust of the fluid-dynamic actuator 9, said rocker arm gradually lifts in combination with the opening of the fork, which move, in the first fraction of stroke, both in contact with the respective inclined surfaces 30 and 31 (fig. 7); thereafter, only the second roller 21 (fig. 8) remains in contact and, thereafter again, the roller 21 also completely moves away from the corresponding surface 31 (fig. 9) and the lift continues the upward stroke.

In practice, laboratory tests and practical garage tests have confirmed that, through the effect of the balancing of the opposing forces that act at the contact point of the rollers 20 and 21 on the corresponding blocks 42 or 43 and 44, the thrust force, or "pickup", required of the actuator 9 in the initial upward step is substantially less than the initial thrust force required of the actuator mounted on normal lifts.

In a second embodiment, as can be seen in the details "A-B" of fig.6, when the lift is totally closed (horizontal axis) the roller 21 is slightly distanced (K) from the

corresponding surface 31 so that, in the initial lifting step, only the front roller 20 rests on the relative surface 30 and, only thereafter, the aforementioned second roller 21 also goes back to rest; thereafter, in the upward step, the roller 21 also moves away from the respective surface 31.

5 The finding also foresees, as can be seen in fig. 5 and in the detail of fig. 6, that the front pin 22, hinged to the two side walls 12 of the rocker arm 11, is engaged inside two grooves 24, which allows the aforementioned pin 22, in the initial operating step, to travel a short stroke inside the grooves 24, during the contact of the roller 20 with the inclined surface 30.

10 Constructively, the fluid-dynamic actuator 9 is made up of a plurality of jacks 9.1, screwed to a single supply block 9.2, which acts as hinging means of the entire group 9 to the cross member 3.1.

In practice, a further embodiment operating according to the ways described above, foresees that the two inclined surfaces 30 and 31 are applied below the plane 1.

15 Similarly, another embodiment, again operating according to the ways described above foresees that the two inclined surfaces 30 and 31 are applied on the levers 2 and 3 of the fork mechanism.

Again in practice, the articulated system 10 and the inclined surfaces 30 and 31, can be applied, as well as to vehicle lifts with single and double fork, also to lifts with  
20 lifting/lowering mechanism consisting of at least two pairs of articulated levers, for any use and with a support device consisting of a single platform, two platforms, multiple platforms or with different forms of load supports.

Moreover, the rollers 20 and 21 can be replaced with sliding blocks which move in contact with the corresponding shaped surfaces 30 and 31.

The present finding can undergo modifications and variants and its technical details can be replaced with other technically equivalent elements; moreover, the materials and sizes can be various, according to requirements, provided that it is encompassed by the inventive concept defined by the following claims.

## CLAIMS

1. VEHICLE LIFT, of the type that comprises, under the support plane (1) of the vehicle, a lifting/lowering mechanism (101), consisting of at least two pairs of levers (2, 3), articulated to one another in an intermediate section, which constitute the two  
5 forks, moved by at least one fluid-dynamic actuator (9) which acts on a rocker arm (11) of an articulated system (10), where said rocker arm (11) supports at least one first roller (20) and at least one second roller (21), arranged on respective external axes with respect to the intermediate rotation axis (14) of the aforementioned rocker arm (11), said articulated system (10) consisting of a rocker arm (11), which two side  
10 walls (12) are hinged to the two innermost levers (2), each one on a corresponding intermediate axis (14), said vehicle lift being characterised in that, in the initial lifting step, the two opposite rollers (20, 21) are supported by the rocker arm (11), which, being able to rotate angularly on the intermediate axis (14), through the effect of the thrust of the fluid-dynamic actuator (9), gradually lifts in combination with the  
15 opening of the fork, whereas said rollers (20, 21) move in contact with respective inclined surfaces (30, 31); thereafter, the first roller (20) moves away from the inclined surface (30) while only the second roller (21) remains in contact and, afterwards again, the roller (21) also moves away from the inclined surface (31).

2. VEHICLE LIFT, according to claim 1, characterised in that, at the start of the  
20 lifting step, only the first roller (20) is in contact with the respective inclined surface (30); only afterwards, in the first lifting step, the second roller (21) also comes into contact with the respective inclined surface (31); thereafter in the lifting step, the first roller (20) moves away from the respective inclined surface (30), while the second roller (21) still remains in contact with the respective inclined surface (31) until,

again afterwards in the lifting step, the aforementioned second roller (21) also moves away from the respective inclined surface (31).

3. VEHICLE LIFT, according to claim 1, characterised in that, in the first lifting step, the first roller (20) moves remaining in contact with the corresponding inclined surface (30), while the second roller (21) stays distanced from the corresponding inclined surface (31); thereafter in the lifting step, the second roller (21) makes contact with the corresponding inclined surface (31) and, thereafter again, while the first roller (20) moves away from the inclined surface (30), the second roller (21) also moves away from the corresponding inclined surface (31); thereafter, both of the rollers (20, 21) continue the lifting step remaining distanced from the corresponding inclined surfaces (30, 31).

4. VEHICLE LIFT, according to claim 1, characterised in that, at and during the initial lifting fraction, both of the rollers (20,21) move simultaneously, remaining always in contact on the relative inclined surfaces (30, 31); thereafter, in the lifting, said rollers (20, 21) move, going away from the respective inclined surfaces (30, 31).

5. VEHICLE LIFT, according to the first and one or more of the other previous claims, characterised in that the pin (22) of the first roller (20) is hinged inside two corresponding grooves (24) formed on the rocker arm (11), this allows the aforementioned pin (22), in the initial lifting step, to travel a short stroke inside said grooves (24), during the contact of the first roller (20) with the relative inclined surface (30).

6. VEHICLE LIFT, according to one or more of the previous claims, characterised in that the inclined surfaces (30, 31) are arranged opposite, convergent and with mutually identical inclination with respect to the horizontal plane of the base (50).

7. VEHICLE LIFT, according to one or more of the previous claims, characterised in that the inclined surfaces (30, 31) are arranged opposite, convergent and with mutually different inclinations with respect to the horizontal plane of the base (50).

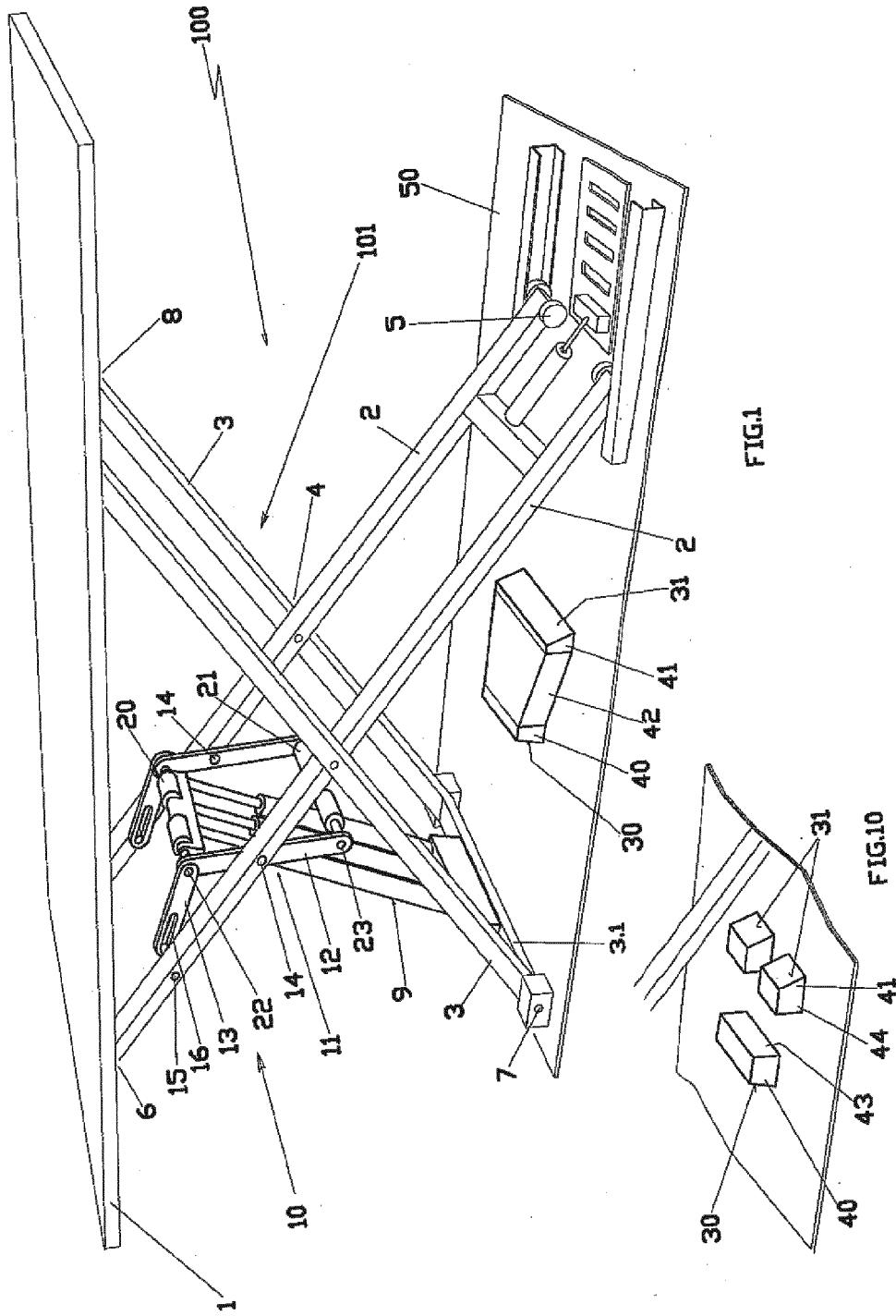
8. VEHICLE LIFT, according to one or more of the previous claims, characterised in that the inclined surfaces (30, 31), where the respective rollers (20, 21) move, extend 5 rectilinearly or shaped according to a profile that goes from horizontal to inclined with respect to the horizontal plane and said shape, suitable for optimising the thrust of the fluid-dynamic actuator (9), is the same in both of the surfaces (30, 31).

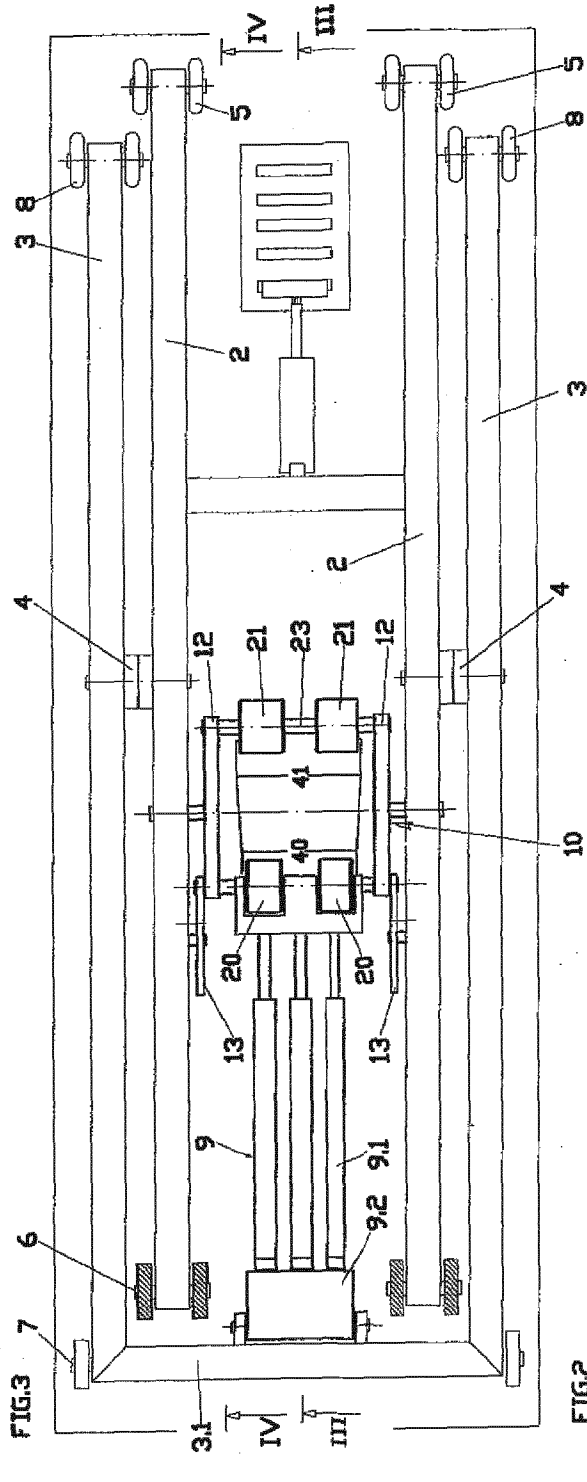
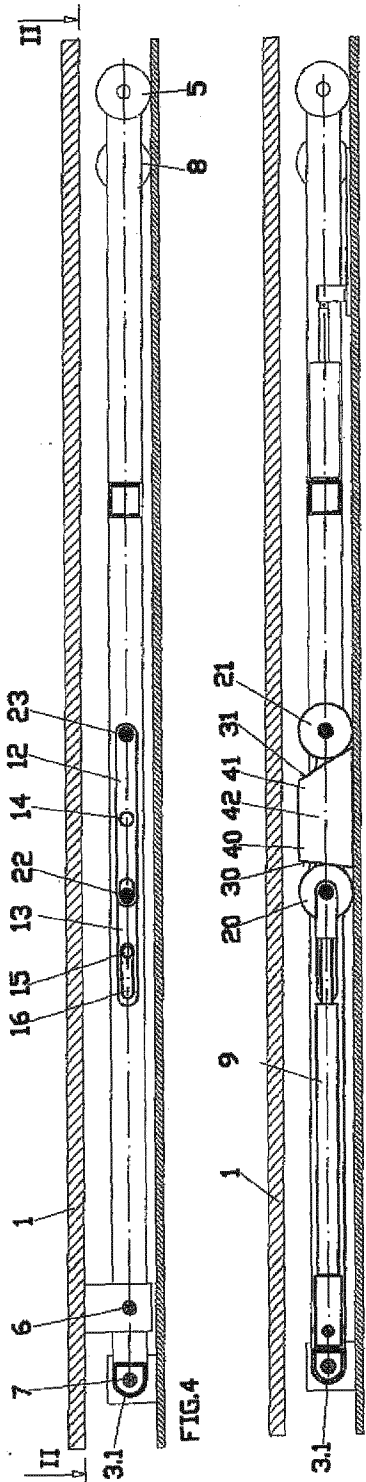
9. VEHICLE LIFT, according to one or more of the previous claims, characterised in 10 that the inclined surfaces (30, 31), where the respective rollers (20, 21) move, extend rectilinearly or shaped according to a profile that goes from horizontal to inclined with respect to the horizontal plane and said shape, suitable for optimising the thrust of the fluid-dynamic actuator (9), is mutually different in the two aforementioned surfaces (30, 31).

15 10. VEHICLE LIFT, according to one or more of the previous claims, characterised in that the inclined surfaces (30,31) are made on two opposite portions (40, 41) of a single block (42).

11. VEHICLE LIFT, according to one or more of the previous claims, characterised in that the inclined surfaces (30,31) are made on two opposite portions (40, 41) of two 20 or more separate and opposite blocks (43, 44).

12. VEHICLE LIFT, according to one or more of the previous claims, characterised in that the elements that make contact with the surfaces (30, 31) consist of sliding blocks.







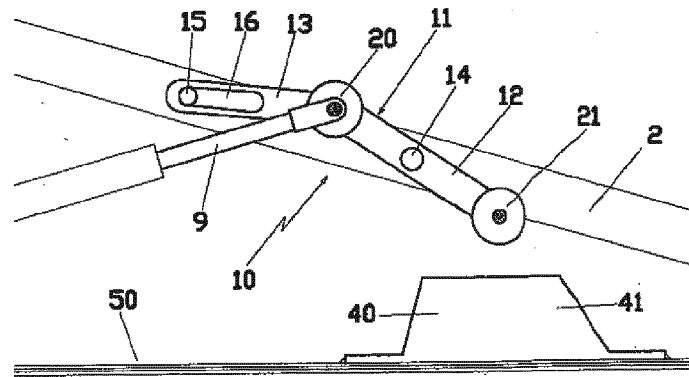


FIG. 9

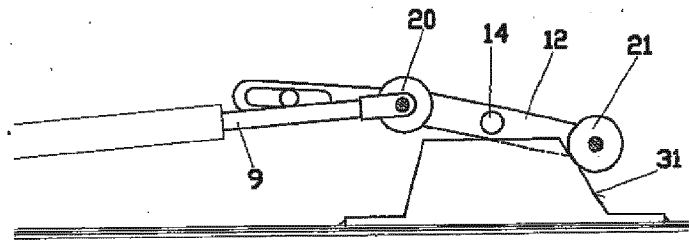


FIG. 8

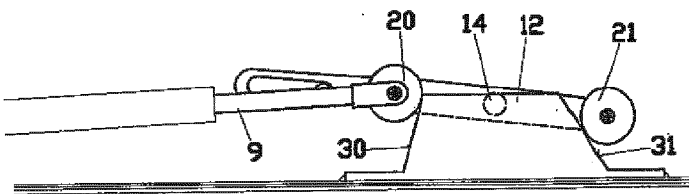


FIG. 7

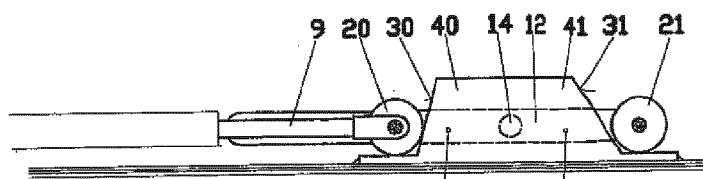
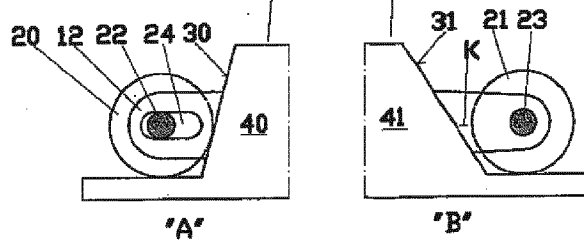


FIG. 6



'A'

'B'

**INTERNATIONAL SEARCH REPORT**

International application No  
PCT/EP2015/061154

**A. CLASSIFICATION OF SUBJECT MATTER**  
 INV. B66F7/06 B66F7/08  
 ADD.  
 According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**  
 Minimum documentation searched (classification system followed by classification symbols)  
 B66F

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 practicable, search terms used)  
 EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

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| Date of the actual completion of the international search<br><br>23 June 2015 | Date of mailing of the international search report<br><br>30/06/2015 |
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| Name and mailing address of the ISA/<br>European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Authorized officer<br><br>Rupcic, Zoran |
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2015/061154

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