

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

11.10.2000 Bulletin 2000/41

(51) Int Cl.7:

B66F 9/065, B66F 9/075

(21) Application number:

00830230.9

(22) Date of filing:

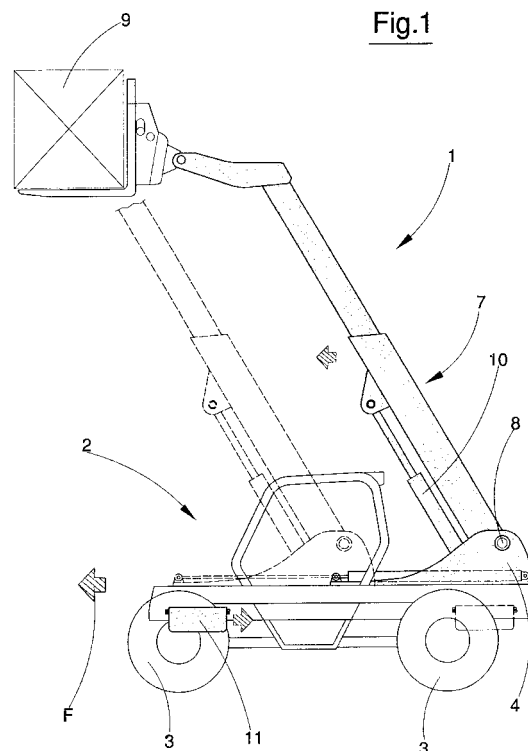
28.03.2000

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| <div>(84) Designated Contracting States:</div> <div>AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE</div> <div>Designated Extension States:</div> <div>AL LT LV MK RO SI</div> | <div>(72) Inventor: Magni, Riccardo</div> <div>41100 Modena (IT)</div>                                                                  |
| <div>(30) Priority: 02.04.1999 IT MO990064</div>                                                                                                                                        | <div>(74) Representative: Gotra, Stefano</div> <div>BUGNION S.p.A.</div> <div>No. 25, Via Emilia Est</div> <div>41100 Modena (IT)</div> |
| <div>(71) Applicant: MANITOU</div> <div>COSTRUZIONI INDUSTRIALI S.r.l.</div> <div>41013 Castelfranco Emilia (Modena) (IT)</div>                                                         |                                                                                                                                         |

(54)

A high lift truck

(57) The high lift truck for raising loads to considerable heights comprises a vehicle having a chassis (2) which is mobile on wheels or tracks. A load-bearing arm (7) has a lower end constrained to a slide (4) which is slidable on the chassis (2) in a horizontal direction. A counterweight (11) is constrained to the chassis (2) and can translate on command in a parallel direction to the sliding direction of the slide (4), in both senses, between two extreme endrun positions. The translations of the counterweight (11) and the slide (4) are correlated so that when the counterweight (11) slides in one direction, the slide (4) moves in the opposite direction. The counterweight (11) is predisposed to balance the tilting moment exerted on the chassis (2) by a load (9) borne by the arm (7) and raised to a considerable height.



## Description

**[0001]** The invention relates in particular to a lift truck comprising a vehicle having a mobile chassis on wheels or tracks, to which a sliding platform is constrained, which platform can move on command forwards and backwards into two extreme endrun positions. A bottom end of a load arm is constrained to the sliding platform and moves forwards and backwards horizontally solidly with the platform. The arm is extensible, for example telescopically, in order to lift a load to considerable heights.

**[0002]** Lift trucks of this type are already known, commonly called "high lift" trucks and especially useful for transporting loads to high floors inside buildings. In these cases the movement of the load comprises, apart from a vertical lift of the arm to bring the load to the desired height, also a horizontal transfer in order to enter the building and deposit the load on a desired floor of the building. The horizontal transfer is carried out by sliding the platform.

**[0003]** An example of a high lift truck of the type described above is disclosed in US 4,147,263, in which the sliding platform and the arm (solidly constrained to the platform) can selectively assume at least a first position, retreated with respect to the longitudinal axis of the vehicle, at which normally the arm can be extended to lift a load to a considerable height, and a second position, advanced, at which the load can be transferred by the arm to an inside of a building.

**[0004]** There is, however, in high lift trucks, the problem of preventing the truck from tilting forward by effect of the moment impressed by a load raised high, especially when the arm and platform are in the advanced position.

**[0005]** The main aim of the present invention is to realise a lift truck in which the above-described prior art drawback is overcome.

**[0006]** An advantage of the invention is that it provides a lift truck which functions simply, with immediacy, and which is reliable.

**[0007]** A further advantage of the invention is to make available a lift truck which is simply constructed and economical.

**[0008]** These aims and advantages are obtained by the invention, as it is characterised in the appended claims.

**[0009]** Further characteristics and advantages of the present invention will better emerge from the detailed description that follows of a preferred but non-exclusive embodiment of the invention, illustrated purely by way of a nonlimiting example in the accompanying figures of the drawings, in which:

figure 1 is a lateral view in vertical elevation of an embodiment of the lift truck of the invention;  
figure 2 is a schematic drawing of a lateral view from behind of a detail of the lift truck of figure 1;  
figure 3 is a lateral view of the detail of figure 2;

figure 4 is the detail of figure 3, in a different operative configuration;

figure 5 is a schematic drawing of a lateral view from behind of the lift truck of figure 1;

figure 6 is a lateral view of a detail of figure 5;

figure 7 is a detail of figure 6 in a different operative configuration.

**[0010]** With reference to the figures of the drawings, 1 denotes in its entirety a lift truck for raising loads to considerable heights.

**[0011]** The truck 1 comprises a vehicle with a chassis 2, mobile in an advancement direction F which is parallel to the longitudinal axis of the vehicle. In the illustrated embodiment the chassis 2 is mobile on wheels 3, but alternatively the vehicle could be tracked.

**[0012]** The truck 1 further comprises a slide 4, constrained to the chassis 2 and able to translate on command in a horizontal direction in both senses, up to two endrun positions. The translation direction of the slide 4 is parallel to the longitudinal axis of the vehicle. The slide 4 can assume a retreated endrun position (illustrated in figures 3 and 7 and in figure 1 with an unbroken line) in which it is situated at the posterior part of the vehicle, and an advanced endrun position (illustrated in figures 4 and 6 and with a broken line in figure 1) in which it is situated at the front part of the vehicle. In the illustrated embodiment the slide 4 runs on wheels along two straight parallel guides 5 arranged on opposite sides of the slide 4. The slide 4 is commanded to translate in both senses by a hydraulic cylinder 6 hinged by a bottom side thereof to the slide 4 and by a stem side thereof to a front part of the chassis 2 (with reference to the longitudinal axis of the vehicle).

**[0013]** The truck 1 is provided with a load-bearing arm 7 having a lower end constrained to the slide 4 by a rotating pivot 8. The upper end of the arm 7 is provided with means of known type for supporting a load 9. The arm 7 is horizontally mobile solidly with the slide 4 and is extensible telescopically in order to raise the load 9 to considerable heights. The extending and retracting of the arm 7 are commanded by a hydraulic cylinder 10 located parallel to the arm 7. The cylinder 10 is hinged at its bottom to the slide 4 and at the stem side to the arm 7.

**[0014]** The truck 1 comprises a counterweight 11, constrained to the chassis 2 and able to translate on command in a parallel direction to the slide translation direction. In the illustrated embodiment, the counterweight 11 is predisposed below the slide 4 and is slidable on wheels along two straight parallel guides 12 situated on opposite sides of the counterweight 11. The counterweight can slide in both senses between two endrun positions.

**[0015]** The translations of the counterweight 11 and the slide 4 are correlated so that when the counterweight 11 translates in one sense, the slide 4 translates in the other sense, and vice versa.

**[0016]** Preferably the maximum run of the counterweight 11 is greater than that of the slide 4. In the illustrated embodiment the maximum run of the counterweight 11 is about double that of the slide 4.

**[0017]** The counterweight 11 and the slide 4 are mechanically inter-connected in order that the movement of the counterweight 11 can be subjected to the movement of the slide 4. In order to achieve this, a drive transmission mechanism is provided on the truck 1, which mechanism transmits drive from the slide 4 to the counterweight 11 so that a movement of the slide 4 in one direction corresponds to a movement of the counterweight 11 in the opposite direction. In the illustrated embodiment, the transmission mechanism is an overgear, which means that for any determined translation of the slide 4 in one direction there will be a counterweight 11 translation of greater entity in the opposite direction.

**[0018]** The transmission mechanism comprises two flexible organs 13 and 14, each of which is constituted, in the illustrated embodiment, by a cable. The flexible organs 13 and 14 are connected to the counterweight 11 and the slide 4 in such a way that when the slide 4 moves in one direction, the counterweight 11 is drawn by one of the cables and when the slide moves in the opposite direction, the counterweight 11 is drawn by the other cable. The two flexible organs 13 and 14 are set side-by-side, are parallel to each other and lie on two different vertical planes and on opposite sides of the median line of the slide 4 and counterweight 11, as can clearly be seen in figures 2 and 5.

**[0019]** In the illustrated embodiment, a first flexible organ 14 (figures 5, 6 and 7) exhibits one end fixed to a front side (with reference to the longitudinal axis of the vehicle) of the counterweight 11 and the opposite end fixed to a front part of the chassis 2. A second flexible organ 13 (figures 2, 3 and 4) exhibits one end fixed to a back side of the counterweight 11 and the opposite end fixed to a back part of the chassis 2. Each flexible organ is connected to the slide 4 by means of a respective pulley 15 and 16 which is mobile solidly with the slide 4. The pulleys 15 and 16, on which the flexible organs 13 and 14 are coupled, are freely rotatable about respective rotation axes which are solidly mounted on the slide 4. The first and second flexible organs are also wound respectively on two pulleys 17 and 18, which pulleys 17 and 18 are freely rotatable about two rotation axes and are solidly mounted on, respectively, a back and a front part of the chassis 2.

**[0020]** During operation, when the slide 4 and the arm 7 mounted thereon are in retreated position (the continuous line in figure 1, figure 3 and figure 7), the counterweight 11 is in an advanced position. In this configuration the arm 7 can be extended to lift the load to considerable heights. When the slide 4 is moved forward (figures 3 and 4) the second flexible organ 13 is drawn by traction of the second pulley 15, mobile solidly with the slide 4, and draws the counterweight 11 backwards. When the slide 4 has reached the front endrun limit, the

counterweight 11 will have reached the back endrun limit (figure 4). In this configuration, in which the load 9 borne by the arm 7 is raised to a considerable height and can be deposited inside a building (broken line in figure 1), the counterweight 11 balances the moment tending to cause the vehicle to tilt forward. Once the load 9 has been released, the slide 4 is brought back (figures 6 and 7). During the backwards movement the first flexible organ 14 is drawn back by traction of the first pulley 16, mobile solidly with the slide 4, and causes the counterweight 11 to advance, returning thus to the initial position.

## 15 Claims

### 1. A high lift truck, comprising:

a vehicle provided with a chassis (2) which is mobile on wheels or tracks;  
a slide (4) constrained to the chassis (2) and which can translate on command in a horizontal direction in both senses between two extreme endrun positions; a load-bearing arm (7) having a lower end which is constrained to the slide (4), the arm being mobile horizontally solidly with the slide (4), the arm (7) being extensible in order to raise a load (9) to a considerable height,

characterised in that it comprises a counterweight (11) constrained to the chassis (2), which counterweight (11) can translate on command in a parallel direction to a translation direction of the slide (4), in both senses, between two extreme endrun positions; translations of the counterweight (11) and the slide (4) being correlated, so that when the counterweight (11) translates in one sense the slide (4) translates in an opposite sense; the counterweight (11) being predisposed to balance a tilting moment exerted on the chassis (2) by a load (9) borne on the arm (7) and raised to a considerable height.

### 2. The high lift truck of claim 1, characterised in that it comprises a mechanism (13, 14, 15, 16, 17, 18) for transmission of drive, for transmitting drive between the slide (4) and the counterweight (11) so that when the slide (4) moves in one sense the counterweight (11) moves in an opposite sense.

### 3. The high lift truck of claim 2, characterised in that the mechanism for transmission of the drive is a multiplier, so that to a determined movement of the slide (4) there corresponds a movement of a greater entity by the counterweight (11).

### 4. The high lift truck of claim 3, characterised in that the mechanism for transmission comprises two

flexible organs (13, 14), connected to the counterweight (11) and the slide (4) in such a way that, by effect of a translation of the slide (4) in one sense, the counterweight (11) is pulled by one of the two flexible organs (13), and that, by effect of a translation of the slide (4) in another sense, the counterweight (11) is pulled by another of the two flexible organs (14)

5. The high lift truck of claim 4, characterised in that each of the two flexible organs (13, 14) exhibits one end thereof which is fixed to the counterweight (11) and an opposite end thereof which is fixed to the chassis (2), each of the two flexible organs (13, 14) also being wound about a respective pulley (15, 16) which is freely rotatable about an axis thereof which axis is fixed to the slide (4).
6. The high lift truck of claim 5, characterised in that each of the two flexible organs (13, 14) is wound about a respective pulley of two pulleys (17, 18), each of which two pulleys (17, 18) is freely rotatable about a rotation axis which is solidly constrained to the chassis (2).
7. The high lift truck of any one of the preceding claims, characterised in that a maximum run of the counterweight (11) is greater than a maximum run of the slide (4).
8. The high lift truck of claim 7, characterised in that the maximum run of the counterweight (11) is about twice the maximum run of the slide (4).

Fig.1

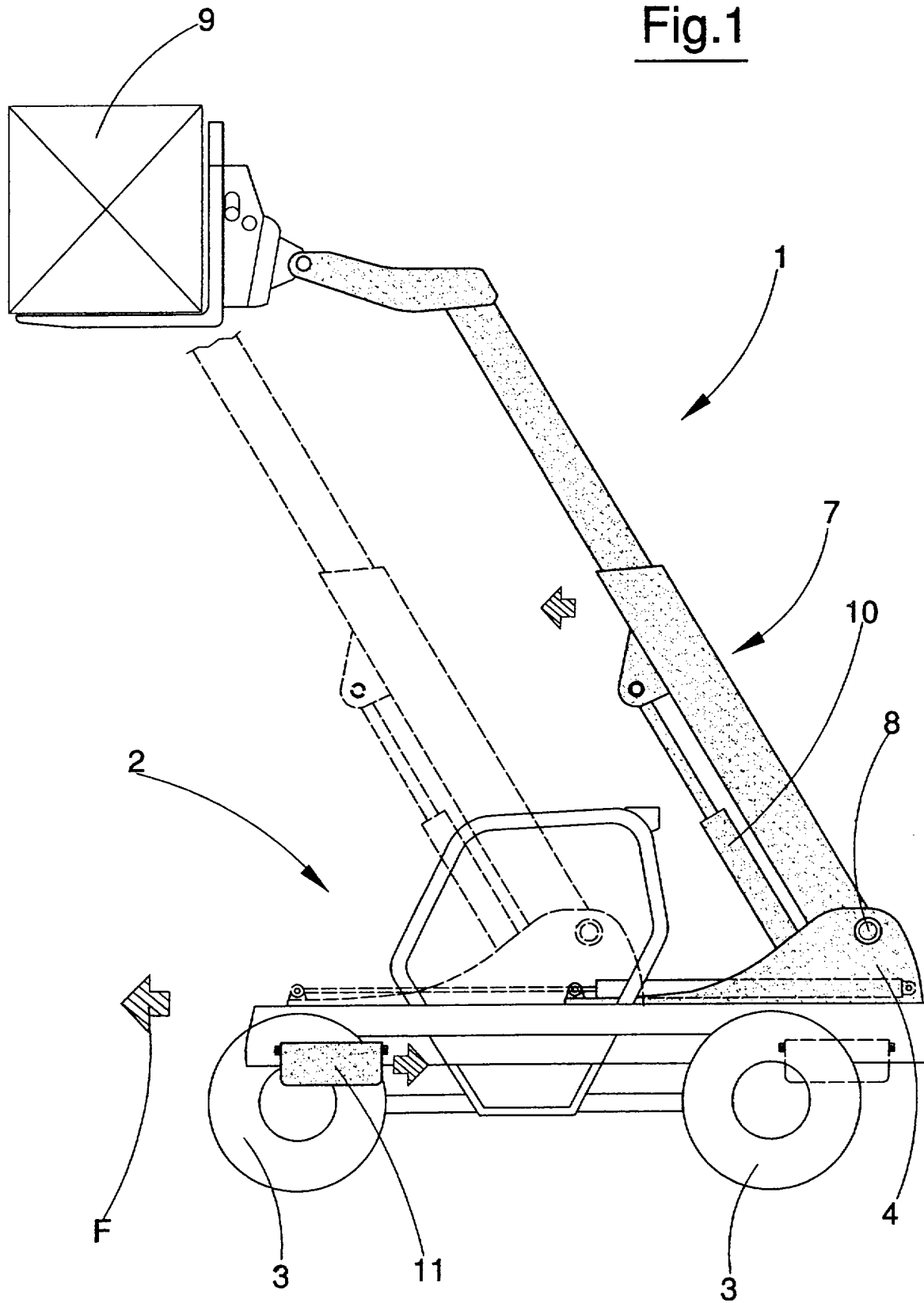


Fig. 5

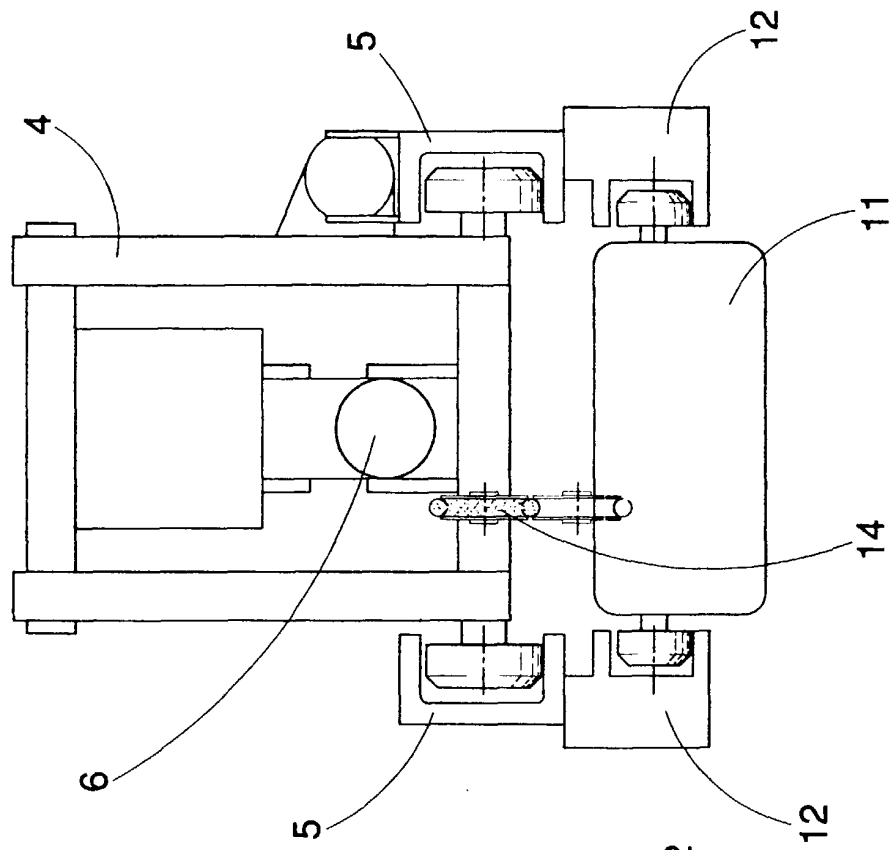


Fig. 2

