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(54) Fork-lift truck and load handling method

(57) A self-propelled fork-lift truck (10), particularly for handling palletized loads (C). The fork-lift truck (10) has a substantially vertical gantry (22) fixed to a frame (16) and having a hydraulic actuator (32) controlling the

vertical movement of a loading fork (13); and a device (33, 35, 48, 50) for moving the gantry (22) in a substantially horizontal direction (Y) to and from the front edge (E) of the frame (16).

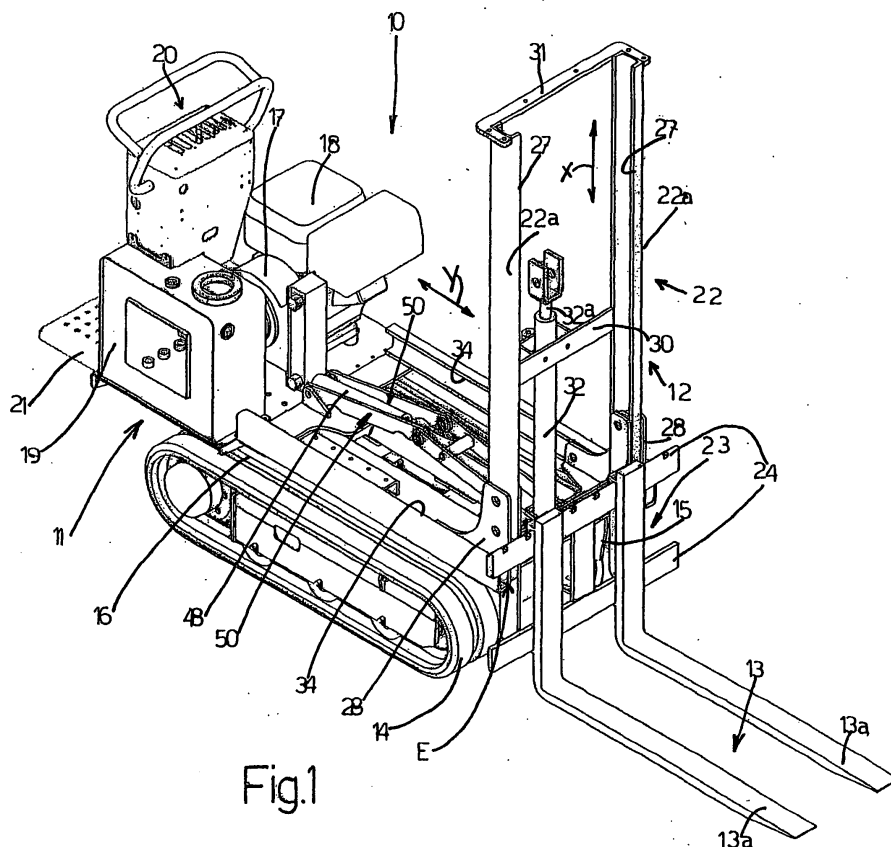


Fig.1

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Description

[0001] The present invention relates to a self-propelled fork-lift truck, particularly for moving palletized loads; to a kit for constructing such a fork-lift truck; and to a load handling method, in particular for handling palletized loads.

[0002] The self-propelled fork-lift truck is of the type commonly known as a "minidumper", and may be used for loading, transporting, and unloading palletized loads comprising pallets of cement, bricks, etc.

[0003] The fork-lift truck claimed may be used for moving palletized loads on both housing and highway construction sites.

[0004] As is known, a self-propelled fork-lift truck normally comprises:

- a tractor with rear drive and control levers worked by an operator at the rear of the tractor; and
- a pallet fork with two teeth, which slide vertically on a gantry with slideways. More specifically, the fork is supported on a slide which slides on a gantry with vertical slideways, and the gantry is integral with the tractor, to which is associated a hydraulic actuator for lifting and lowering the slide to normally transport and unload the pallet in a plane, e.g. onto a vehicle loading bed, above the ground on which the truck travels.

[0005] In conventional solutions, after lowering the fork to the bottom limit position, the operator moves the truck forward to insert the fork beneath the pallet; the slide is then raised vertically along the gantry to lift the pallet resting on the fork; and, on reaching the unloading station, the slide is lowered, and the fork withdrawn by reversing the truck.

[0006] The above method of handling palletized materials has various drawbacks, mainly due to the loads - at times of considerable size and weight - being carried around the site on a fork projecting with respect to the truck.

[0007] To begin with, this seriously impairs the manoeuvrability of the truck, which is often called upon to operate in confined spaces.

[0008] The reduction in manoeuvrability is caused by the considerable increase in the length of the truck-pallet assembly, due, as stated, to the pallet resting on a projecting fork.

[0009] Moreover, transporting projecting loads greatly reduces the stability of the truck-pallet assembly; and transporting a projecting pallet constitutes a serious safety hazard, should the pallet, for any reason (collision, collapse of the pallet, etc.), fall off the fork, thus causing damage or injury to equipment or persons in the immediate vicinity.

[0010] Moreover, though advantageous in many respects, fork-lift trucks of the type described have the further drawback that, when loading, for example, loose

sacks onto a vehicle loading bed, the material must first be loaded manually onto the fork-lift truck, and then unloaded onto the vehicle bed. Very often, even unloading is performed manually.

[0011] Loading the loose material manually onto the fork-lift truck, and then unloading the same material manually onto the vehicle bed obviously involves a considerable amount of time which seriously increases building material handling costs.

[0012] A main object of the present invention is therefore to eliminate the aforementioned drawbacks by providing an innovative self-propelled (minidumper-type) fork-lift truck.

[0013] A further object of the present invention is a kit for a tractor of a self-propelled (in particular, minidumper-type) fork-lift truck particularly suitable for moving palletized loads.

[0014] Yet a further object of the present invention is an innovative load handling method, in particular for handling palletized loads.

[0015] According to the present invention, the slide-mounted fork can slide vertically inside slideways on a gantry to raise the load; and what is more - and this represents the innovative feature of the present invention - the gantry itself can slide horizontally to position the load over the tractor, so that the load is no longer transported on a projecting fork.

[0016] More specifically, the slide and the gantry to which the slide is fitted are operated by two hydraulic actuators as controlled by the operator using the rear drive and control levers.

[0017] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings (not to scale), in which:

Figure 1 shows a first three-dimensional front view of a minidumper in accordance with the present invention, and which shows the fork in the lowered position, and the gantry in the forward position, at the front edge of the tractor;

Figure 2 shows a second three-dimensional front view of the minidumper according to the present invention, and which shows the fork in the lowered position, and the gantry in the furthestmost withdrawn position from the front edge of the tractor;

Figure 3 shows a third three-dimensional front view of the minidumper according to the present invention, and which shows the fork in the raised position, and the gantry in the Figure 2 withdrawn position;

Figure 4 shows a fourth three-dimensional rear view of the minidumper according to the present invention;

Figure 5 shows an exploded view of the minidumper according to the present invention;

Figures 6-11 show the various steps in one possible cycle to load, lift, and unload a pallet of sacks of cement onto a vehicle loading bed.

[0018] Number 10 in the accompanying drawings indicates a minidumper in accordance with the present invention.

[0019] Minidumper 10 comprises a tractor 11, and a device 12 for lifting and handling a load C (Figures 6-11)

[0020] Device 12 advantageously comprises a fork 13 for lifting a palletized load (Figures 6-11), but which may be replaced by any other load-supporting member (not shown), e.g. a platform member.

[0021] Tractor 11 comprises two tracks 14, 15, on which is mounted a frame 16 supporting a drive assembly 17 having a fuel tank 18, a hydraulic oil tank 19, and a control panel 20, in turn comprising a number of levers by which to drive minidumper 10 and operate the various devices - described in detail later on - relating to fork 13.

[0022] Tractor 11 is fitted at the rear, in the usual way, with a platform 21, which rotates about two hinges 21a (Figure 4), and on which the operator (not shown) stands to drive minidumper 10 and/or operate the various devices from panel 20.

[0023] Frame 16 has a front edge E, which, as will be seen, can be considered the "zero point" for a series of load-handling operations described in detail later on.

[0024] Device 12 for lifting and handling load C comprises a gantry 22, on which runs a slide 23 fitted with fork 13 (or a platform member not shown).

[0025] As shown particularly in the Figure 5 exploded view, fork 13 comprises two teeth 13a supported by slide 23, which in turn comprises two horizontal guides 24 by which to adjust the horizontal position of teeth 13a, and two lateral plates 25 fitted with normally four rolling bearings 26 (two per side) (Figure 5).

[0026] Gantry 22 comprises two parallel, substantially vertical posts 22a having, on the inner side, respective slideways 27, along which rolling bearings 26 of slide 23 run in use.

[0027] Gantry 22 also comprises two lateral plates 28 fixed by known means to the two lateral posts 22a; and three reinforcing cross members 29, 30, 31. Cross members 29, 30 also provide for supporting, by known means, a hydraulic actuator 32, which, by means of systems similar to those described in the Applicant's Italian Utility Model BO2002U000239 acts on slide 23 to move it vertically in direction X.

[0028] That is, hydraulic actuator 32, which comprises a rod 32a, provides for moving fork 13 from a bottom loading position shown in Figures 1, 4-7, to a position in which rod 32a of hydraulic actuator 32 is fully extended, as shown in Figures 3 and 10.

[0029] As shown in the Figure 5 exploded view, each lateral plate 28 has a pair of rolling bearings 33; each pair of rolling bearings 33 runs inside a respective slideway 34; and slideways 34 are two in number, extend horizontally and parallel to each other, and form part of a frame 35 for supporting gantry 22.

[0030] As shown in Figure 5, frame 35 also comprises a front cross member 36 perpendicular to slideways 34 and having a vertical plate 37; and a rear cross member

38 parallel to front cross member 36 and also having a vertical plate 39.

[0031] Front plate 37 has two locating teeth 40 (only one shown in Figure 5), each for engaging a respective locating seat 41 (only one shown in Figure 5) formed on front edge E of frame 16.

[0032] The rear plate 39 in turn has a through hole 42.

[0033] To assemble frame 35, through hole 42 is aligned with a through hole 43 formed in a cross member 44 of frame 16; and, after positioning frame 35 on frame 16 by means of teeth 40 and respective seats 41, a threaded rod 45 is simply inserted through the two aligned through holes 42, 43, and two washers 46, 47 (Figure 5) are tightened at the two ends to fix frame 35 as required to frame 16.

[0034] Gantry 22 is moved as required in a substantially horizontal direction Y by means of a second hydraulic actuator 48, one end 48a of which is hinged by conventional means to frame 35 at two vertical lugs 49 formed on rear cross member 38.

[0035] The rod 48b of actuator 48 pushes two lateral connecting rod/crank mechanisms 50.

[0036] More specifically, a first end 50a of each mechanism 50 is hinged by known means to a respective lug 49, and a second end 50b of each mechanism 50 is hinged by known means, not shown in Figure 5, to cross member 29 of gantry 22.

[0037] That is, rod 48b of hydraulic actuator 48 acts on connecting rods 51 of mechanisms 50 to move gantry 22 as required in a substantially horizontal direction Y.

[0038] Given the possibility of also moving gantry 22 (in direction Y) within the body of frame 16 of tractor 11, load C (possibly palletized), when being transported, for example, from a loading station to an unloading station (see below), is located within the body of frame 16, and weighs on the supporting structure of tractor 11, with all the obvious advantages this entails as regards the size and stability of load C, the centre of gravity of which is located within frame 16.

[0039] In every respect, device 12 for lifting and handling load C may actually be considered a kit for troublefree assembly to tractor 11, which may also serve, when need be, for supporting alternative equipment typical of this type of application (mini-excavator, mixer, etc.).

[0040] In other words, device 12 can be said to form a kit 12 for a tractor 11 of a self-propelled fork-lift truck 10, particularly for handling palletized loads.

[0041] Kit 12 comprises:

- a gantry 22, on which a slide 23 runs in a substantially vertical direction X, slide 23 having a fork 13 for supporting load C;
- a first hydraulic actuator 32 for moving slide 23 in direction X;
- a substantially horizontal frame 35 comprising slideways 34, for gantry 22, extending in a horizontal direction Y;

- a second hydraulic actuator 48 and two lateral mechanisms 50 for moving gantry 22 in direction Y; and
- devices 40, 41, 42, 43, 45, 46, 47 for locating and fastening frame 35 to frame 16 of tractor 11; which locating and fastening devices 40, 41, 42, 43, 45, 46, 47 are designed for easy assembly and removal of kit 12 to and from tractor 11, which may be used for supporting alternative equipment typical of this type of application (mini-excavator, mixer, etc.).

[0042] Operation of minidumper 10 according to the present invention is easily deducible from Figures 1-5.

[0043] By way of example, however, of one possible cycle performable by minidumper 10, accompanying Figures 6-11 show one possible method of handling a palletized load C.

[0044] Figure 6 shows a loading station S1, at which to load a palletized load C; and fork 13 in the position just prior to commencing the loading step.

[0045] Gantry 22 is located at edge E of frame 16, i. e. in the fully outwardly extended position; slide 23 is lowered completely to ground level; and the two lateral mechanisms 50 are fully extended by hydraulic actuator 48.

[0046] In Figure 7, fork 13 is inserted beneath palletized load C, which, by means of slide 23, can be raised as required in direction X from a first position P1 (Figure 7) to a second position P2 (Figure 8) at a higher level than frame 16, all of which is achieved by means of hydraulic actuator 32.

[0047] At this point, gantry 22 can be backed up by second hydraulic actuator 48 in direction Y from position P2 (Figure 8) to a third position P3 (Figure 9), which is the furthest withdrawn position of gantry 22 with respect to edge E.

[0048] At the operator's discretion, the withdrawal movement in direction Y can be made either at station S1 or as minidumper 10 moves over to the unloading station S2 (Figures 10 and 11).

[0049] When minidumper 10 reaches unloading station S2, palletized load C is raised by slide 23, again controlled by hydraulic actuator 32, from the third position P3 (Figure 9) to a fourth position P4 (Figure 10).

[0050] At this point, as shown in Figure 11, load C is moved in direction Y from the fourth position P4 to a fifth position P5 at front edge E of frame 16, and is then lowered (in direction X) from the fifth position P5 to a sixth position P6 (shown by the dash line in Figure 11) in which the palletized load C is unloaded onto the bed PN of a vehicle CM standing at unloading station S2.

[0051] Once the pallet supporting load C is deposited onto bed PN of vehicle CM, minidumper 10 is backed up to withdraw fork 13 from the pallet.

[0052] As will be clear to anyone skilled in the art, without departing from the scope of the present invention, minidumper 10 according to the invention may be used to implement methods of handling palletized loads C

other than the one described above, though still within the technical possibilities afforded by gantry 22 being movable in a substantially horizontal direction Y.

[0053] More specifically, in a further cycle embodiment (not shown), the lowered load C may be moved horizontally from the furthestmost position from edge E (Figure 9) to edge E.

[0054] Load C can then be raised and lowered (in direction X) to deposit it onto bed PN of vehicle CM.

[0055] Though tractor 11 may be wheel-mounted (not shown), tracks 14, 15 represent the best solution, by distributing stress evenly over the ground, and improving balance to safeguard against forward tipping of minidumper 10 when fork 13, supporting palletized load C, is located at the front end (as in Figures 8 and 11, for example).

[0056] As stated, one of the main advantages of minidumper 10 lies, in the case of non-palletized loads, in eliminating the two operations comprising manual loading of the material onto a conventional minidumper, and subsequent unloading of the same material onto a vehicle loading bed.

[0057] Using minidumper 10 according to the present invention, the non-palletized load loaded directly onto it is raised to a higher position than bed PN of vehicle CM, and then unloaded onto the bed.

Claims

1. A self-propelled fork-lift truck (10), particularly for handling palletized loads (C); the fork-lift truck (10) comprising:

- a tractor (11) having a frame (16) and rear drive and control means (20) operated by an operator; and
- a substantially vertical gantry (22), said gantry (22) being fixed to said frame (16) and having actuating means (32) for moving a slide (23), having supporting means (13) for supporting the load (C), in a substantially vertical direction (X) to lift and lower said load (C) in said substantially vertical direction (X);

the fork-lift truck (10) being **characterized by** comprising means (33, 35, 48, 50) for moving said gantry (22) in a substantially horizontal direction (Y) to and from the front edge (E) of said frame (16) .

2. A self-propelled fork-lift truck (10) as claimed in Claim 1, wherein said means (33, 35, 48, 50) for moving said gantry (22) in the substantially horizontal direction (Y) comprise a hydraulic actuator (48) and two connecting rod/crank type lateral mechanisms (50).

3. A self-propelled fork-lift truck (10) as claimed in any

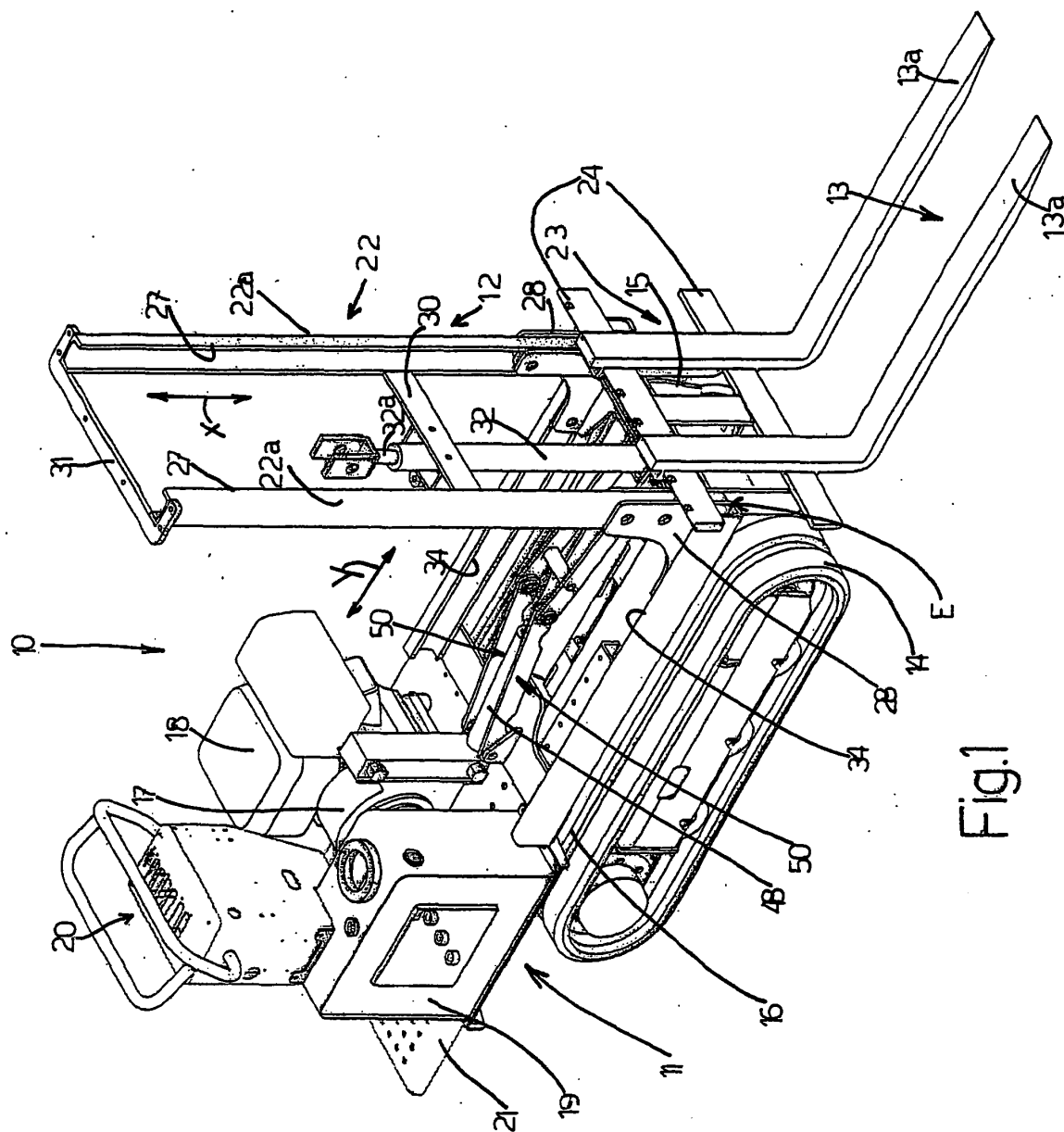
one of the foregoing Claims, wherein said supporting means (13) for supporting the load (C) comprise a fork (13) for supporting palletized loads (C).

4. A self-propelled fork-lift truck (10) as claimed in Claim 1 or 2, wherein said supporting means (13) for supporting the load (C) comprise a platform member for supporting non-palletized loads. 5
5. A kit (12) for a tractor (11) of a self-propelled fork-lift truck (10), particularly for handling palletized loads (C); said kit (12) being **characterized by** comprising: 10
 - a gantry (22) having guide means (27) for guiding a slide (23) in a substantially vertical direction (X), said slide (23) having supporting means (13) for supporting a load (C): 15
 - actuating means (32) for moving said slide (23) in said substantially vertical direction (X); 20
 - a frame (35) comprising guide means (33, 34) for guiding said gantry (22) in a substantially horizontal direction (Y);
 - actuating means (48, 50) for moving said gantry (22) in said substantially horizontal direction (Y), said gantry (22) running in said guide means (34) on said frame (35); and 25
 - locating and fastening means (40, 41, 42, 43, 45, 46, 47) for locating and fastening said frame (35) to a frame (16) of said tractor (11). 30
6. A kit (12) as claimed in Claim 5, wherein said means (48, 50) for moving said gantry (22) in the substantially horizontal direction (Y) comprise a hydraulic actuator (48) and two connecting rod/crank type lateral mechanisms (50). 35
7. A kit (12) as claimed in Claim 5 or 6, wherein said supporting means (13) for supporting the load (C) comprise a fork (13) for supporting palletized loads (C). 40
8. A kit (12) as claimed in Claim 5 or 6, wherein said supporting means (13) for supporting the load (C) comprise a platform member for supporting non-palletized loads. 45
9. A method of handling loads (C), in particular palletized loads; the method comprising the steps of: 50
 - lifting the load (C), at a loading station (S1) and at the front edge (E) of a frame (16) of a tractor (11) of a fork-lift truck (10), in a substantially vertical direction (X) from a first position (P1) to a second position (P2) higher than a frame (16) of the fork-lift truck (10); 55
 - backing up said load (C) in a substantially hor-

- izontal direction (Y) from said second position (P2) to a third position (P3) withdrawn with respect to said front edge (E) of the frame (16);
- moving said load (C) from said loading station (S1) to an unloading station (S2) by moving the tractor (11);
- raising said load (C) in said substantially vertical direction (X) from said third position (P3) to a fourth position (P4);
- moving said load (C) from said fourth position (P4) to a fifth position (P5) at the front edge (E) of the frame (16) by moving the load (C) in said substantially horizontal direction (Y); and
- lowering said load (C) in said substantially vertical direction (X) from said fifth position (P5) to an unloading sixth position (P6).

10. A method of handling loads; the method comprising the steps of:

- lifting the load, at a loading station and at the front edge of a frame of a tractor of a fork-lift truck, in a substantially vertical direction from a first position to a second position higher than a frame of the fork-lift truck;
- backing up said load in a substantially horizontal direction from said second position to a third position withdrawn with respect to said front edge of the frame;
- moving said load from said loading station to an unloading station by moving the tractor;
- moving said load from said third position to a fourth position at the front edge of the frame by moving the load in said substantially horizontal direction;
- raising said load in said substantially vertical direction from said fourth position to a fifth position; and
- lowering said load in said substantially vertical direction from said fifth position to an unloading sixth position.



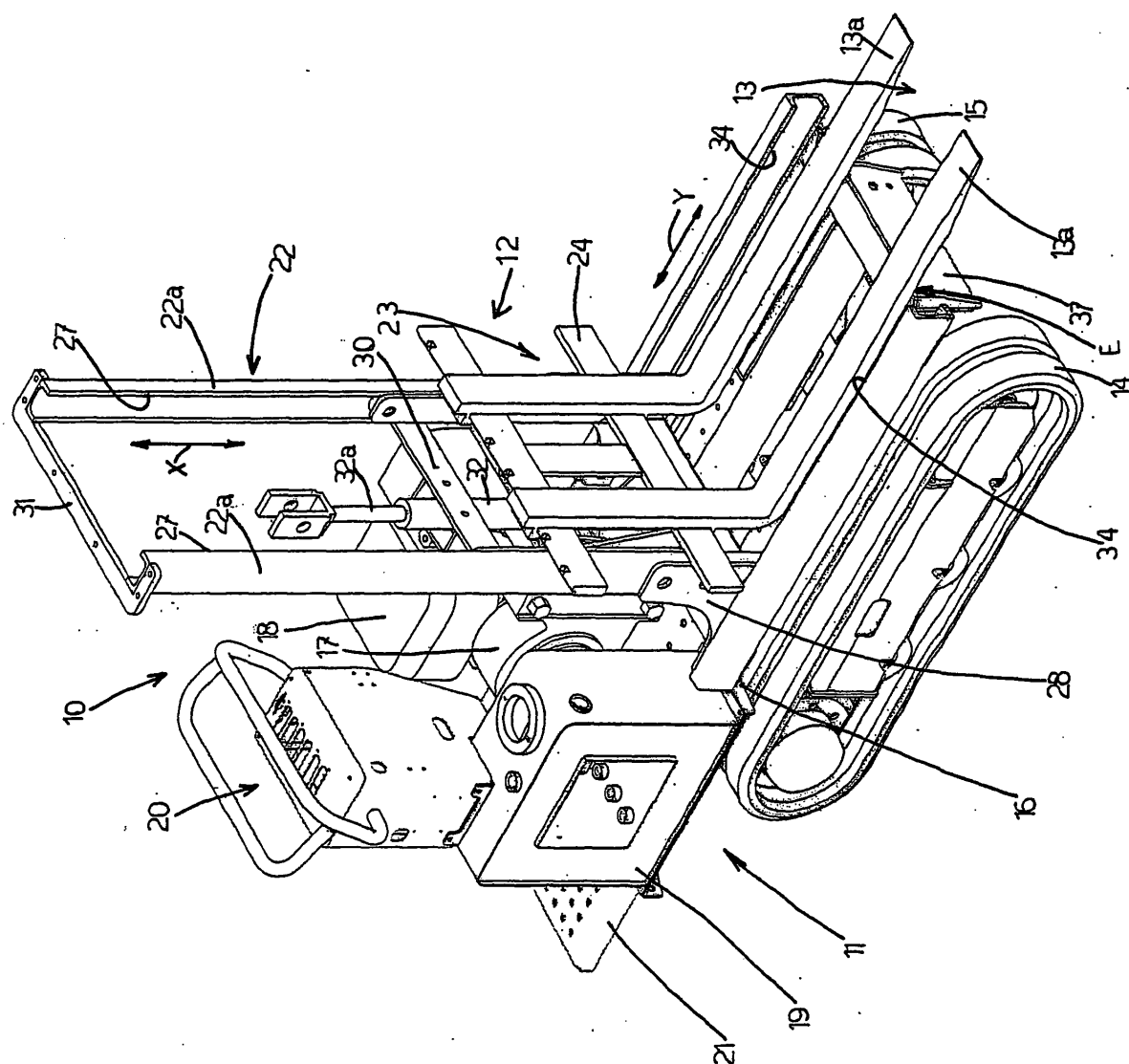


Fig.2

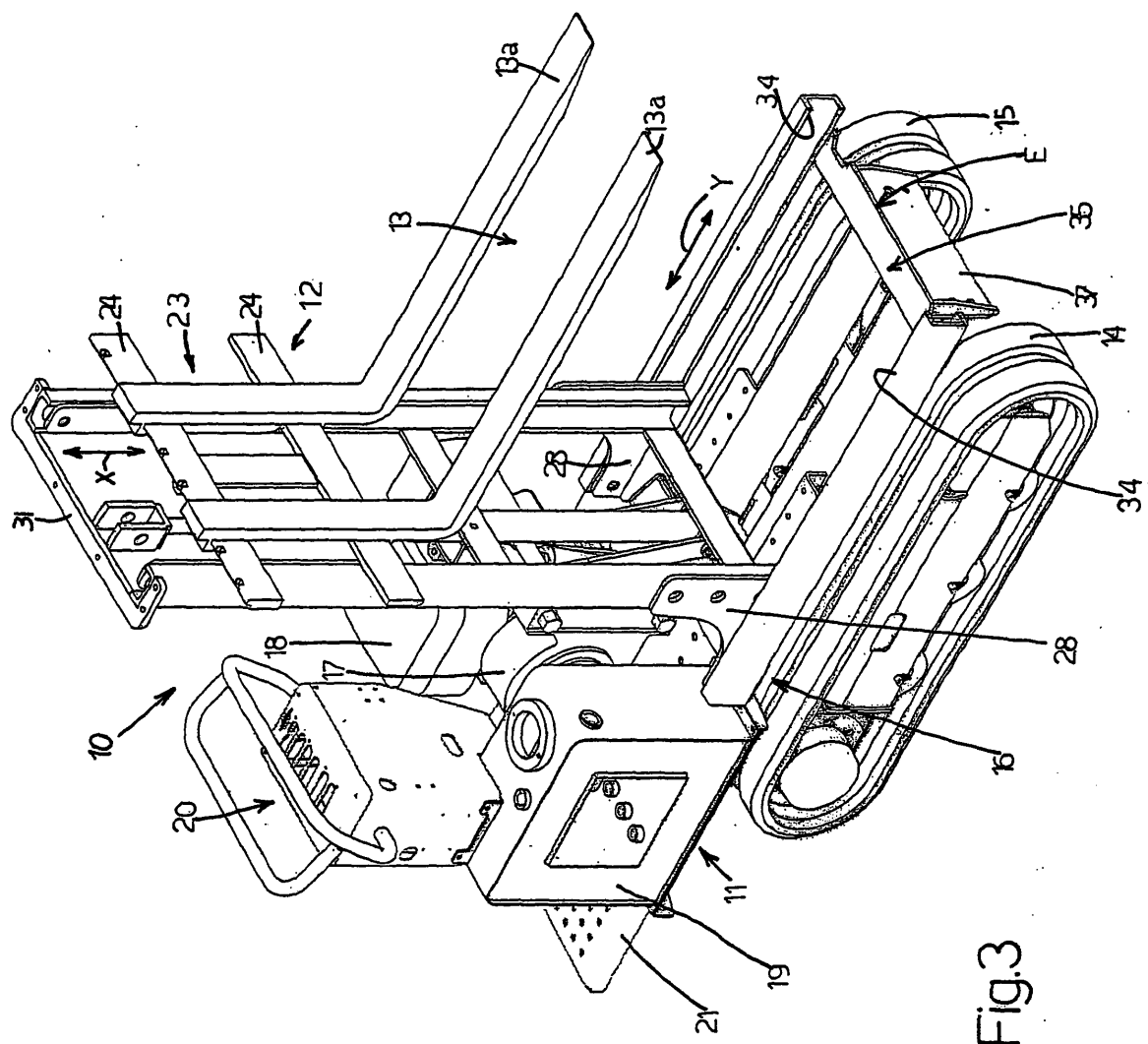


Fig. 3

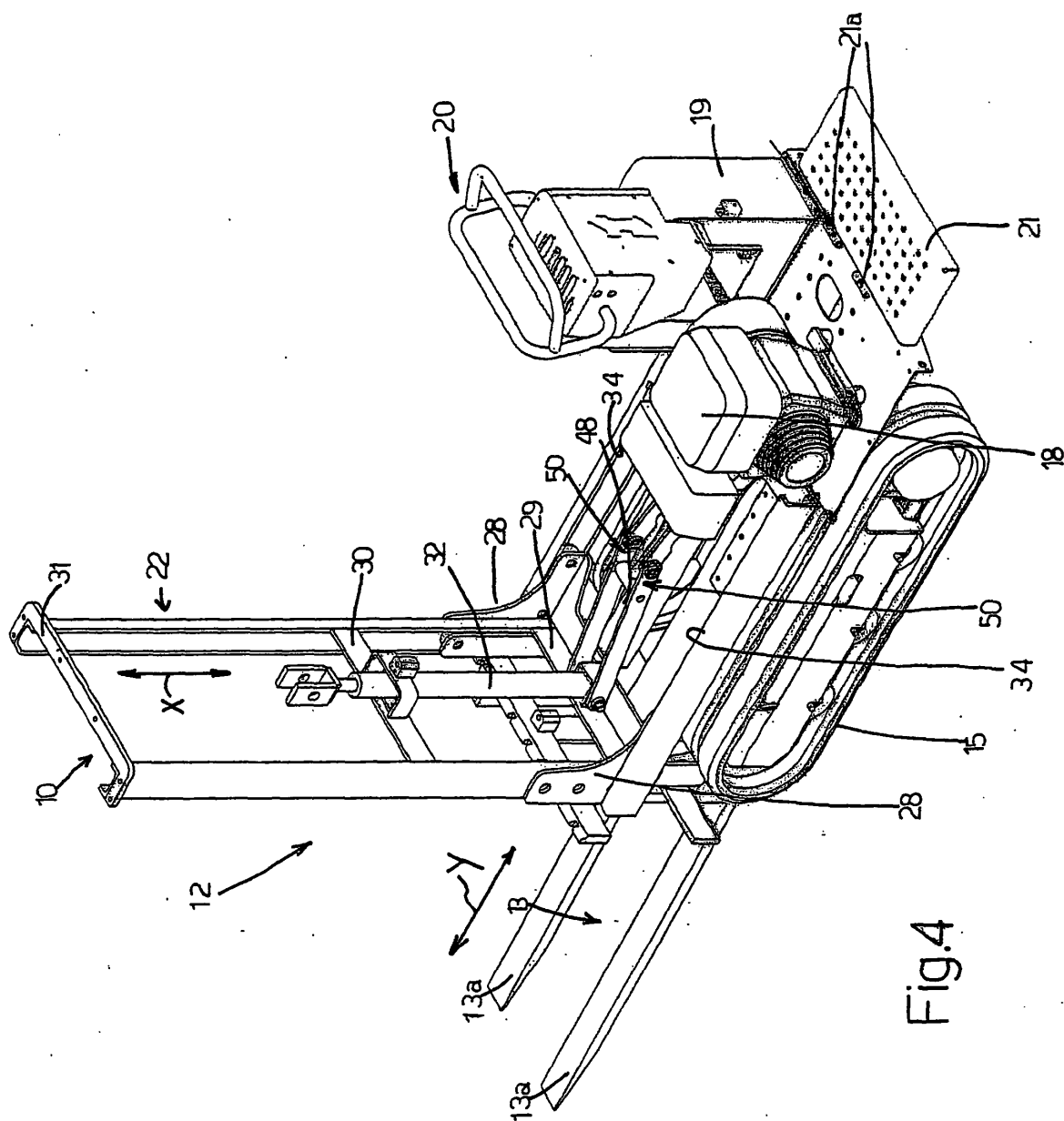


Fig. 4

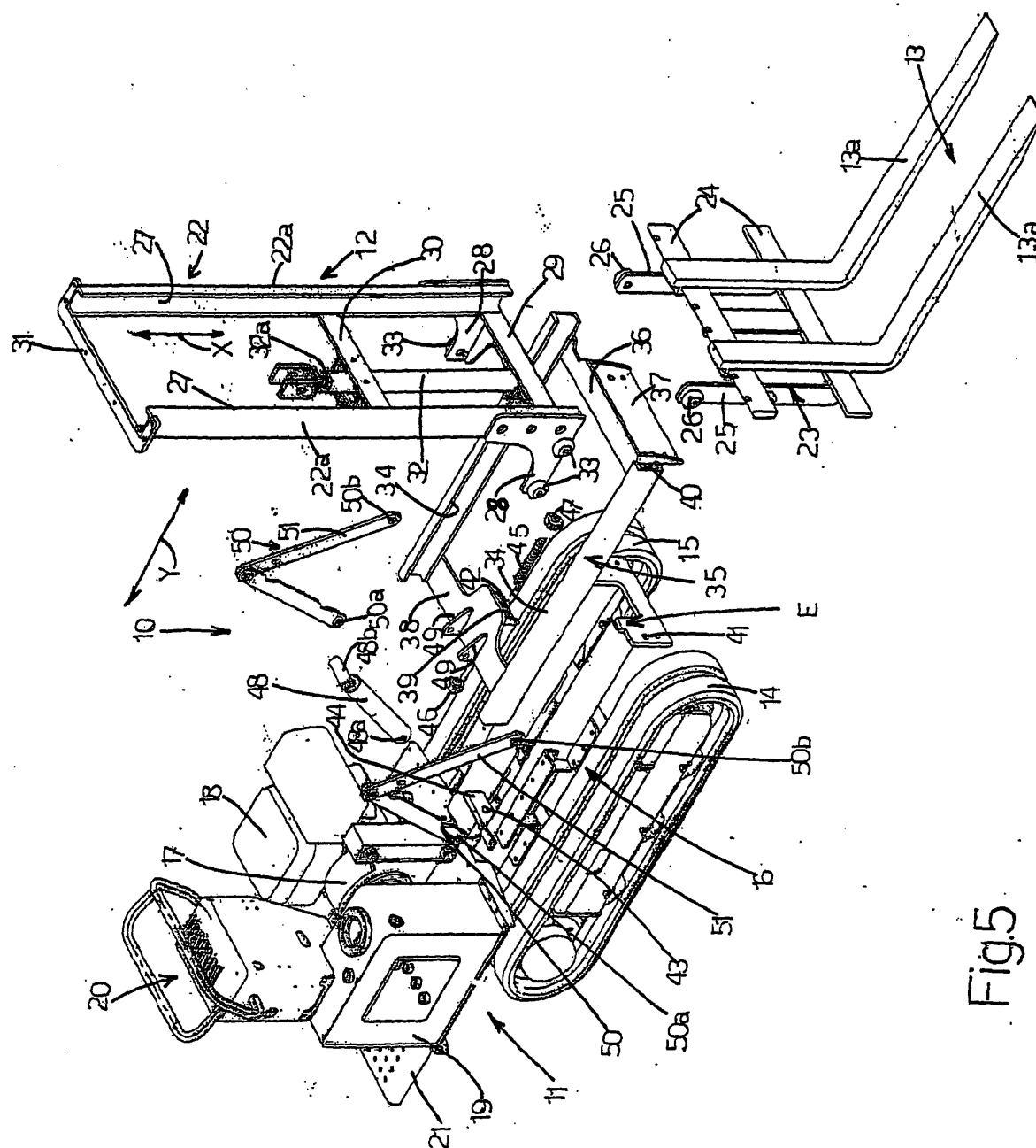
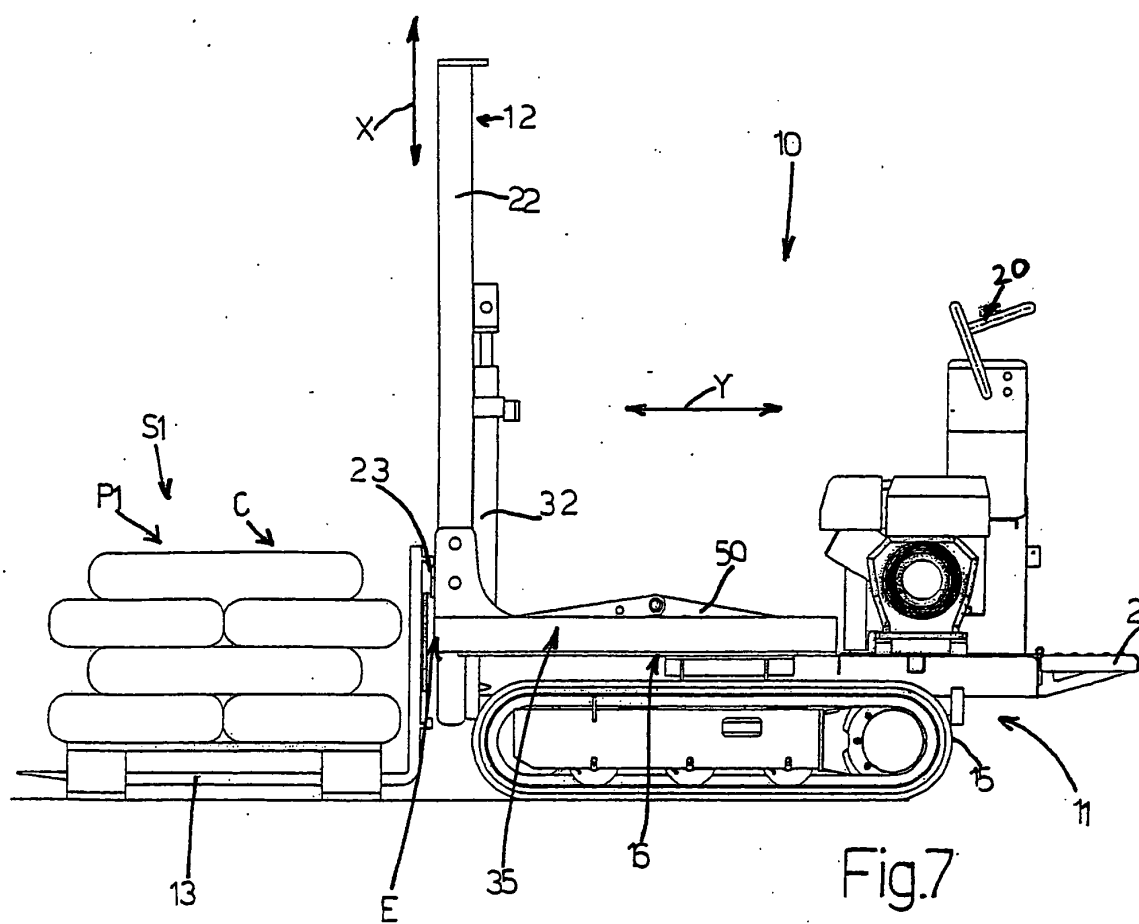
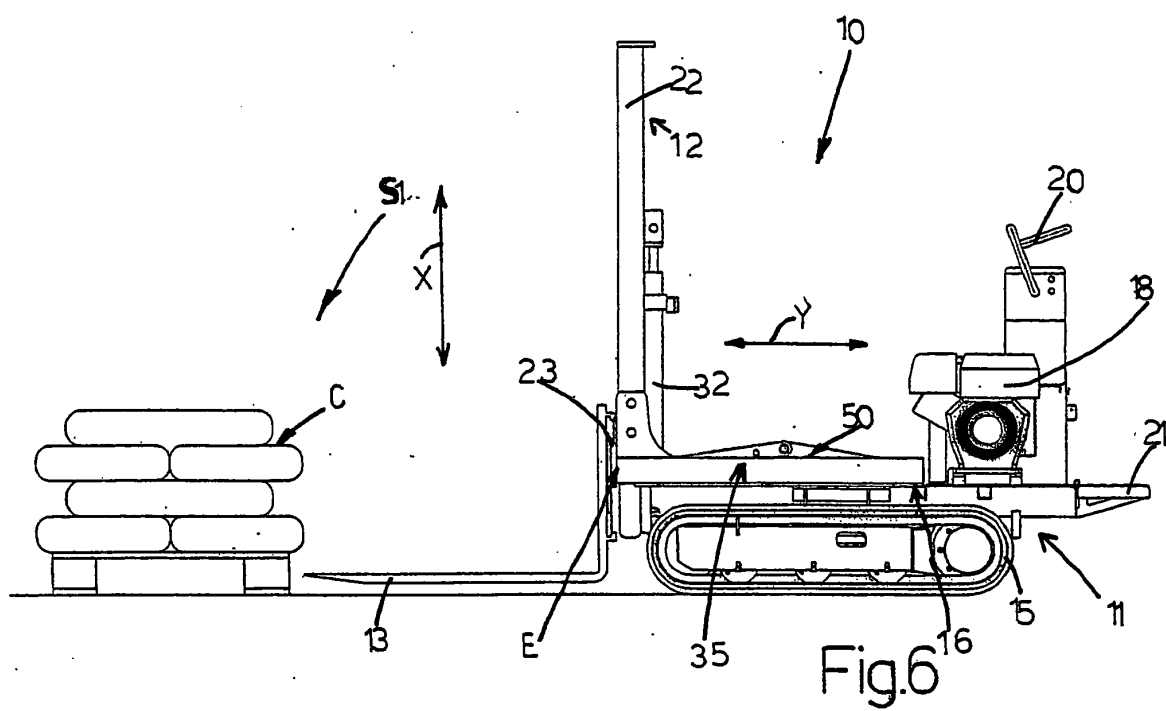


Fig.5



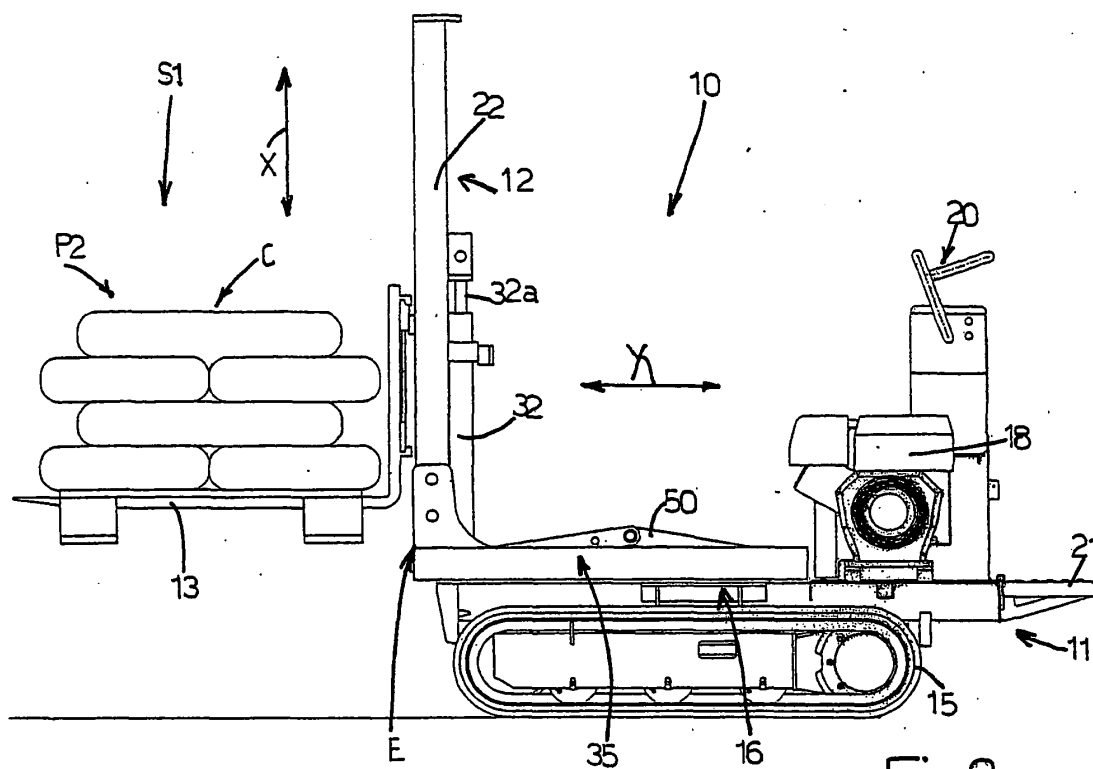


Fig.8

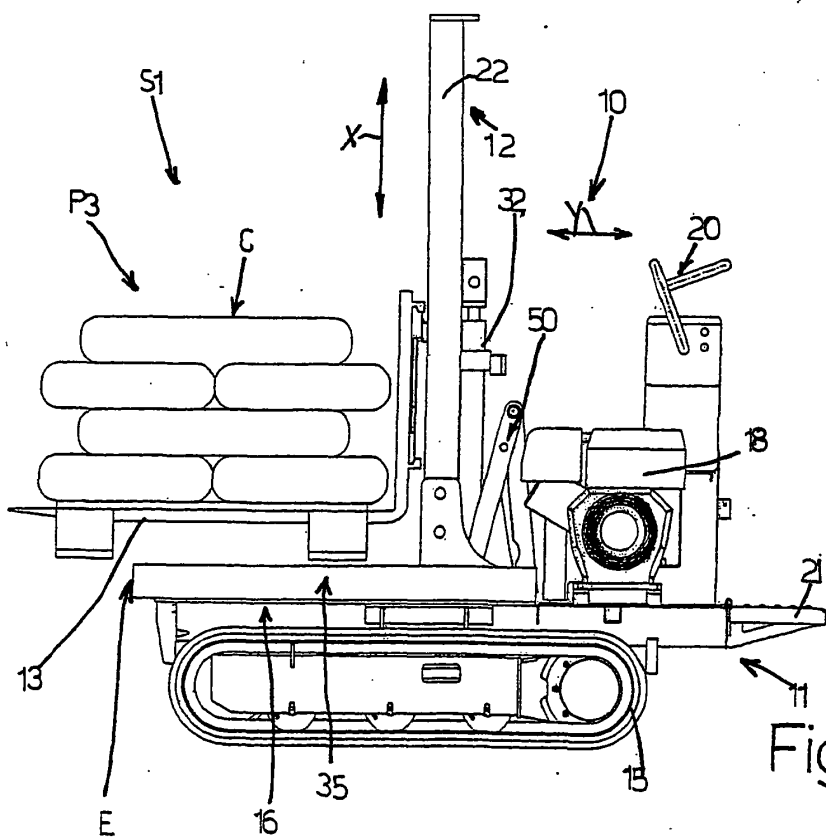


Fig.9

