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(54) A multi-use mobile elevator excavator.

(57) The invention relates to a mobile elevator-excavator, which widens the field of operation of elevator-loaders having arms, permitting of their use also as excavators. A platform (3) is mounted on a frame (1) mounted oil wheels (2), which platform (3) rotates about a vertical axis and on which platform (3) are housed not only a cabin but also a first, telescopically extensible manoeuvring arm (4). The said first manoeuvring arm (4) is hinged, at ins inferior end, to the said platform (3) about a horizontal axis and has hinged by means of a pivot (6) to the end of its final segment (42) a second, telescopically extensible arm (5). A rapid on-off device (7) is constrained to one end of a second segment (52), which permits of solid attachment of various types of tools, such as fork groups, shovels as well as an excavator arm (14) equipped with a bucket or shovel (15).

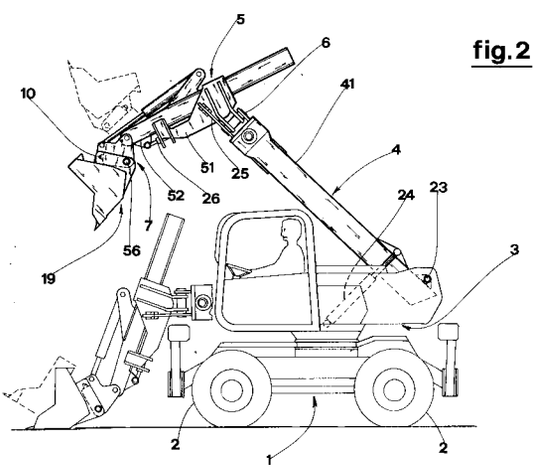

fig.2

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Object of the present invention is a multi-use mobile elevator-excavator.

The said invention proposes to perform differing tasks and functions which are at present performed by separate machines, thus uniting the said tasks in a single machine. In particular, apart from the typical task of an elevator, which must permit lifting, moving and stacking of heavy loads at height and necessitating long reach, the said machine having at the same time a contained mass so as to be able to be manoeuvrable inside superiorly and laterally closed stacking areas, the present machine can be used also as a loading shovel and excavator.

The prior art teaches machines which have attempted to unite the three above-mentioned functions. Some of the said machines envisage the possibility of mounting a loading shovel or an excavator to the end of a telescopic arm of the type used for lifting trucks. The resulting realisations are however not highly functional and are characterised by numerous limitations. For example, in those prior art realisations in which the excavator is applied to the top of the telescopic arm, thanks to the structure of the connection used grave operational limitations are manifested with reference to the lateral operational capacity as well as the ability to work at a certain distance below ground level.

The need to overcome the above-mentioned operational limits and lacks has led, in some cases, to the proposing of complicated solutions, especially for the excavator group; in other cases, the difficulty of obtaining a satisfying result by means of the use of only the telescopic arm of the elevator has led to the decision to add a second arm to the machine, articulated for use as an excavator. All of the preceding has brought about greater constructional and functional complexity for the whole vehicle.

The present invention, as characterised in the claims, proposes to obviate the drawbacks and lacks of the prior art by providing a multi-use elevator-excavator equipped with a single arm which arm is structured and articulated in order to perform all the movements necessary for the various tasks (elevator, loader, excavator) with specific tools which can be mounted and dismounted to and from the end of the said arm by means of a rapid on-off attachment.

Further characteristics of the present invention will better emerge from the description that follows of a preferred but non-exclusive embodiment illustrated purely as an example in the accompanying figures, in which:

- Figure 1 shows a schematic vertical-elevation lateral view relative to a first configuration;
- Figure 2 shows a vertical-elevation schematic lateral view relative to a second configuration;
- Figure 3 shows a vertical-elevation lateral view relative to a third configuration;
- Figure 4 shows a particular of the end of the telescopic arm denoted by 4;
- Figure 5 shows a schematic section according to line IV-IV of figure 4;
- Figure 6 shows, in enlarged scale, a particular of figure 5 in a different operational configuration;
- Figure 7 shows, in enlarged scale, a detail of the rapid on-off attachment system;
- Figure 8 shows, in enlarged scale, a schematic secion made according to line VII-VII of figure 7.

In the figures, 1 denotes a frame mounted on wheels 2 above which a platform 3 is rotatably constrained about a vertical axis. On the platform 3 a cabin 22 is laterally housed, by the side of which cabin 22 a first, telescopically extensible manoeuvring arm 4 operates. The said manoeuvring arm 4 is pivoted at is lower end and by means of a horizontal-axis pivot 23 to sustaining means solid with the platform 3 and is activated to rotate in the two directions about the said horizontal-axis pivot 23 by means of a hydraulic jack 24. The manoeuvring arm 4 is rotatably mobile about the pivot 23 in a median plane of the platform 3 and is composed of a first segment 41, internally to which a further segment 42 is slidabiy coaxially housed. A hydraulic cylinder, not represented in the figures, produces the axial sliding motion of the segment 42 with respect to the first segment 41. At the externally projecting end of the segment 42 the first segment 51 of a further telescopically extensible arm 5 is pivoted by means of a pivot 6 having its axis perpendicular to the individual direction of the manoeuvring arm 4 axis. By means of a lever mechanism 25 operating between the end of the segment 42 and the segment 51 both the rotation movement of the said arm 5 about the pivot 6 and the location of the said arm 5 in a predetermined position with respect to the said segment 42 and thus with respect to the manoeuvring arm 4 is commanded. The pivot 6 has its axis perpendicular to the direction set by the pivot 23 axis.

The arm 5 exhibits a second segment 52 which is axially slidably coupled to the said first segment 51, the said second segment 52 being slidable in both directions with respect to the first segment 51 by operation of a hydraulic cylinder 26.

The longitudinal axis of the arm 5 forms together with the pivot 6 axis a breadth angle which makes possible a horizontal positioning of the arm 5 when the manoeuvring arm 4 is in a completely raised position with regard to the platform 3 and when the said platform 3 is completely horizontal.

The segment 42 call be secured rigidly to the first segment 41 in a plurality of positions by

means of a pair of opposite mobile pistons 43 equipped with shaped heads 44 able to couple with corresponding hollow seatings 46 arranged laterally on the said segment 42. In particular, each piston 43 is part of a single-action hydraulic cylinder 45 which is solidly constrained on the first segment 41 and located with its axis perpendicular to the axis of the said first segment 41. The end or shaped head 44 of the piston 43 is turned towards the inside of the first segment 41 and exhibits a rounded form constituted by a portion of spherical surface which has the same radius as the spherical surface of the hollow seatings 46 arranged laterally on the segment 42. Along the segment 42 three couples of hollow seatings 46 are arranged, all aligned on the same plane which also contains the piston 43 axis. In the retracted position the pistons 43 do not interfere with the segment 42 which segment 42 can be freely commanded to slide in both senses with respect to the first segment 41. The insertion of the shaped heads 44 of the pistons 43 into the hollow seatings 46 produces a both axially and torsionally rigid connection between the segment 42 and the first segment 41 in predetermined positions.

At the end of the second segment 52 a rapid on-off attachment organ 7 is located which is predisposed to permit of mounting tools such as fork groups 18, shovels 19 or excavator arms 14.

The attachment organ 7 comprises a body 8 which is hinged to the end of the second segment 52 by means of a pivot 56 having its axis perpendicular to the arm 5 axis and to the direction specified by the pivot 6 axis. The body 8 is activated and commanded to rotate about the pivot 56 by a hydraulic cylinder 9 operating between said body 8 and the second segment 52. Two identical fixed centring cones 10 are arranged superiorly on the body 8, with parallel axes contained in a single plane parallel to the pivot 56 axis. Also inferiorly two mobile centring cones 11 are arranged, which are coaligned and located symmetrically with respect to a vertical median plane of the body 8 perpendicular to the pivot 56 axis. The two mobile centring cones 11 exhibit their common axis parallel to the pivot 56 axis and are guided and commanded to slide axially and symmetrically with respect to the median plane of symmetry perpendicular to the common axis. Each mobile centring cone 11 is fixed to a mobile piston 12 coaxially internally to a small hydraulic cylinder 13. Two hydraulic cylinders 13 are symmetrically opposed and communicating to form a single chamber. The backward stroke of the mobile centring cones 11 is realised by means of the springs 27 operating on the mobile pistons 12.

The fixed centring cones 10 and mobile centring cones 11 are envisaged to couple in corresponding hollow conical seatings 20 and 21 predisposed on corresponding attachment organs 17 with which the said tools are equipped, said tools being the excavator arm 14, the fork group 18 and the shovel 19. In particular, the arrangement of the fixed centring cones 10 and the mobile centring cones 11 of the attachment organ 7 and of the corresponding hollow conical seatings 20 and 21 is realised in such a way that a perfect alignment of the mobile centring cones 11 axis and the corresponding hollow seating 21 axis is not reached until the two fixed centring cones 10 are perfectly coupled with the corresponding hollow conical seatings 20.

The situation described, visible in figure 8, permits of realising a solid play-free coupling between the rapid on-off device 7 and the single attachment organs 17.

By means of the rapid on-off device 7 a fork group 18, a shovel 19 and an excavator arm 14, all of known and usual type, can be fixed solidly to the end of the arm 5 by a very fast manoeuvre: the said excavator arm 14 may have pivoted to its end a bucket, or shovel 15, activated hydraulically by means of a hydraulic cylinder 16.

The possibility of coupling the excavator arm 14 to the end of the arm 5 permits of endowing the machine with a considerable operative capacity deriving from the particular arrangement and combination and articulation relative to the various arms. It permits, on the one hand, of operating the bucket at a greater depth with respect to ground level, having a longer reach, and on the other hand of operating extremely well in restricted spaces. It is possible, thanks to the several positioning possibilities permitted by the articulation about the pivot 6, to work with the excavator arm 14 on any level parallel to the longitudinal median plane of the vehicle containing the rotation axis of the platform 3 with respect to the frame 1 .

It is further possible to maintain, even with the tool mounted, the same minimum dimensions configuration as that attainable without any tool attached.

Claims

1. A multi-use mobile elevator-excavator, characterised by the fact that it comprises:
   - a frame (1) mounted on wheels (2);
   - a platform (3) rotatably fixed on the said frame (1) about a vertical axis;
   - a first manoeuvring arm (4) , telescopically extensible, which at its lower end is hinged rotatably about a horizontal axis to support means solid to the said platform (3); further comprising means to connect rigidly at least the said

first manoeuvring arm (4) final segment (42) with a first segment (41) movably in a plurality of pre-established positions;

- a second arm 5, telescopically extensible, which is connected by a first segment (51) to an upper projecting end of the said final segment (42) of the said first manoeuvring arm (4) by means of a connection with a pivot (6) which permits of limited relative rotation in the two directions about an axis which is perpendicular to the axis of the said first manoeuvring arm (4) as well as to the hinging axis of the said first manoeuvring arm (4) with the said platform (3); the said second arm (5) being equipped, at the end of its own second segment (52), with a rapid on-off device (7) predisposed to permit of a solid mounting of a tool (fork, shovel, excavator arm).

2. An elevator-excavator as in claim 1, characterised by the fact that the second arm (5) longitudinal axis forms with the pivot (6) axis, by means of which pivot (6) axis it is connected to the said final segment (42), a breadth angle such as to enable the attainment of a horizontal position of the said second arm (5) when the said first manoeuvring arm (4) is in a completely raised position with respect to the platform (3), which platform (3) is situated horizontally.

3. An elevator-excavator as in claim 1, characterised by the fact that the said means to connect rigidly the said final segment (42) to the said first segment (41) comprise: at least one mobile piston (43) equipped with an end or shaped head (44) and destined to couple exactly with a corresponding hollow seating (46) predisposed laterally on the said final segment (42); said mobile piston (43) being part of a single-action hydraulic cylinder (45) solidly arranged on the said first segment (41) with a perpendicular axis to the axis (of the said first segment (41) and the first manoeuvring arm (4).

4. An elevator-excavator as in claim 3, characterised by the fact that the said end or shaped head (44) of the said mobile piston (43) has a rounded shape, being constituted by a portion of spherical surface which has the same radius as the spherical surface of the hollow seating (46).

5. An elevator-excavator as in claim 4, characterised by the fact that the two said mobile pistons (43) operate symmetrically at the two diametrically opposite sides of the said first segment (41).

6. An elevator-excavator as in claim 1, characterised by the fact that the said rapid on-off device (7) comprises:

- a body (8) hinged to the end of the said second segment (52) of the said second arm (5) (on a pivot (56) having an axis perpendicular to the axis of the said second arm (5) and to the direction specified by the pivot (6) axis, by means of which pivot (6) the said end of the second segment (52) is hinged to the said first manoeuvring arm (4); the said body (8) being commanded to rotate about the pivot (56) by means of a hydraulic cylinder (9) operating between the said body (8) and the said second segment (52);
- two fixed centring cones (10), solid to the said body (8), arranged with parallel or nearly parallel axes and positioned perpendicularly to the direction specified by the axis of the said pivot (56);
- two mobile centring cones (11), axially coaligned and located symmetrically with respect to a vertical median plane of the body (8) which plane is perpendicular to the pivot (56) axis; the said two mobile centring cones (11) having their axes parallel to the pivot (56) axis and being commanded to slide axially symmetrically with respect to the said median plane perpendicular to the common axis; each of the said mobile centring cones (11) being fixed to a mobile piston (12) which mobile piston (12) is coupled axially internally to one of a plurality of hydraulic cylinders (13); the said hydraulic cylinders (13) being symmetrically opposite and communicating among themselves; the said fixed centring cones (10) and the mobile centring cones (11) being destined to couple with corresponding hollow conical seatings (20) and (21) on a corresponding attachment organ (17) of the said tools.

7. An elevator-excavator as in claim 6, characterised by the fact that the reciprocal location of the fixed centring cones (10) and mobile centring cones (11) and the hollow conical seatings (20) and (21) is such that, once the coupling of the fixed centring cones (10) with the relative hollow conical seatings (20) is made, the said mobile centring cones (11) are

not exactly aligned with the respective hollow seatings (21).

8. An elevator-excavator as in claim 7, characterised by the fact that the said attachment organ (17) is fixed to a first end of an excavator arm (14) which excavator arm (14) has hinged to its other end a bucket or shovel (15) activated hydraulically by means of a hydraulic cylinder (16) arranged on the excavator arm (14) itself.

9. An elevator-excavator as in claim 7, characterised by the fact that the said attachment organ (17) is arranged solidly on a fork lifting group (18).

10. An elevator-excavator as in claim 7, characterised by the fact that the said attachment organ (17) is arranged solidly on a shovel (19).

fig.1

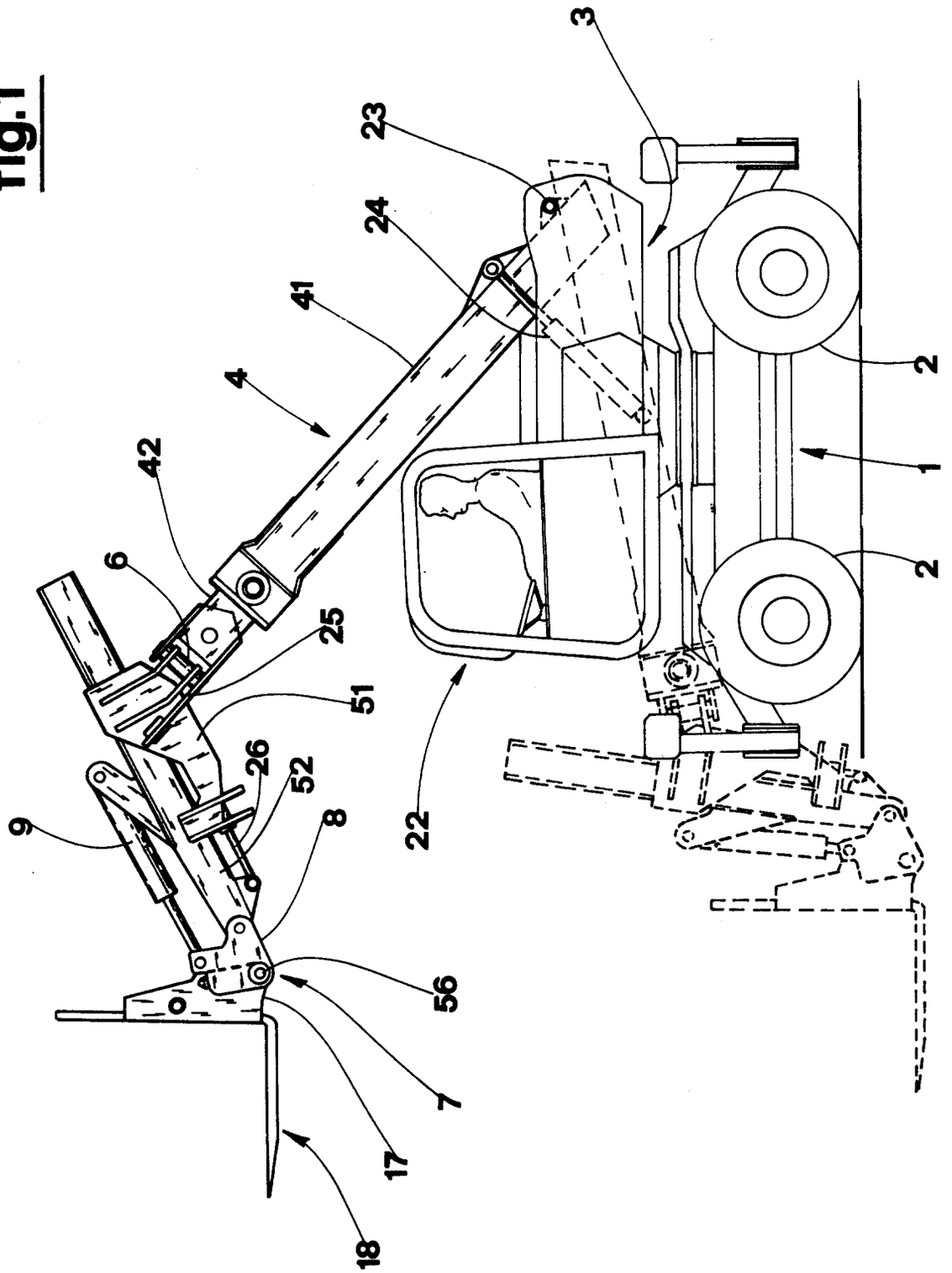


fig.2

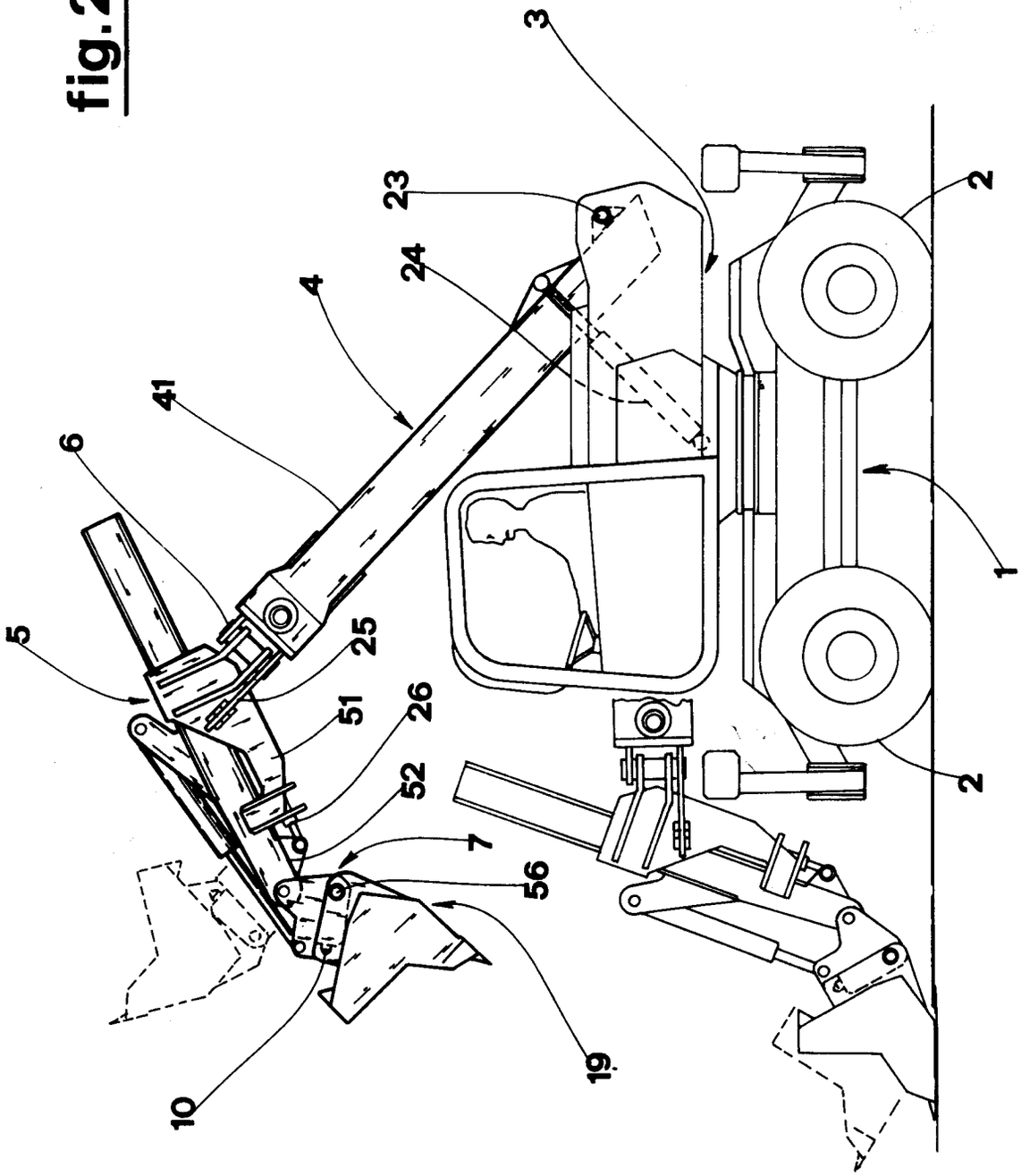
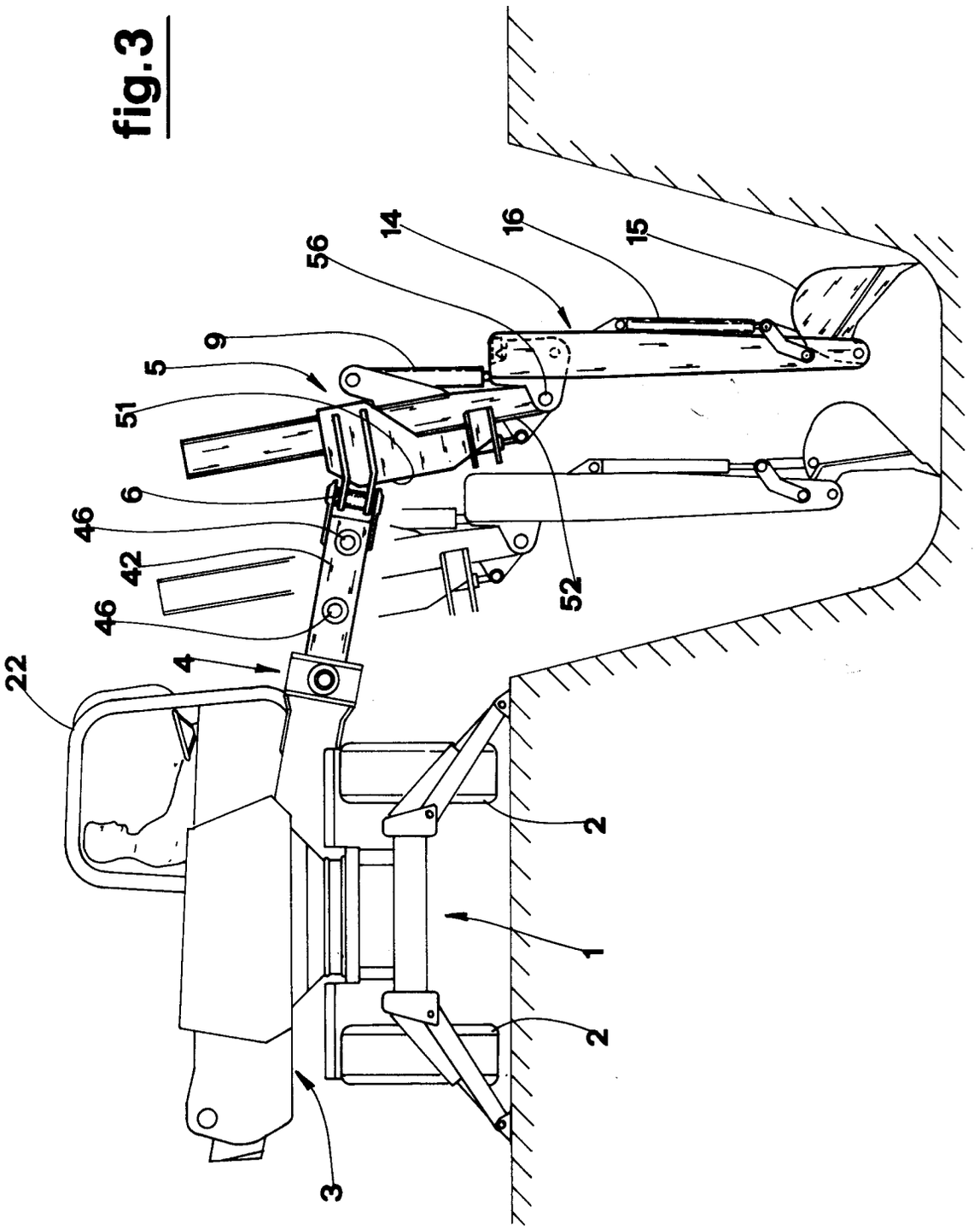


fig.3



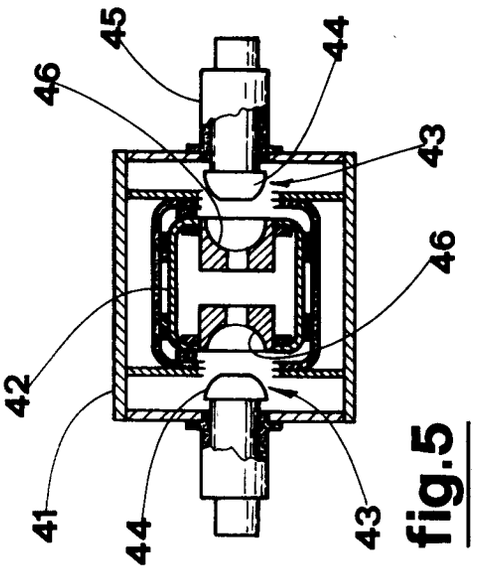


fig.5

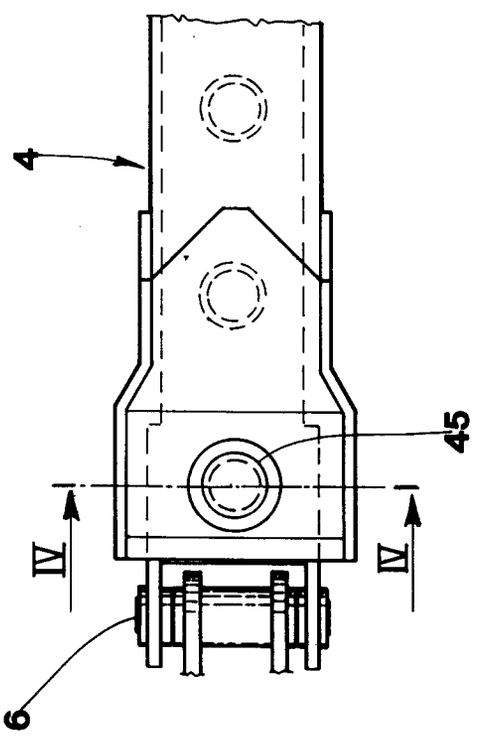


fig.4

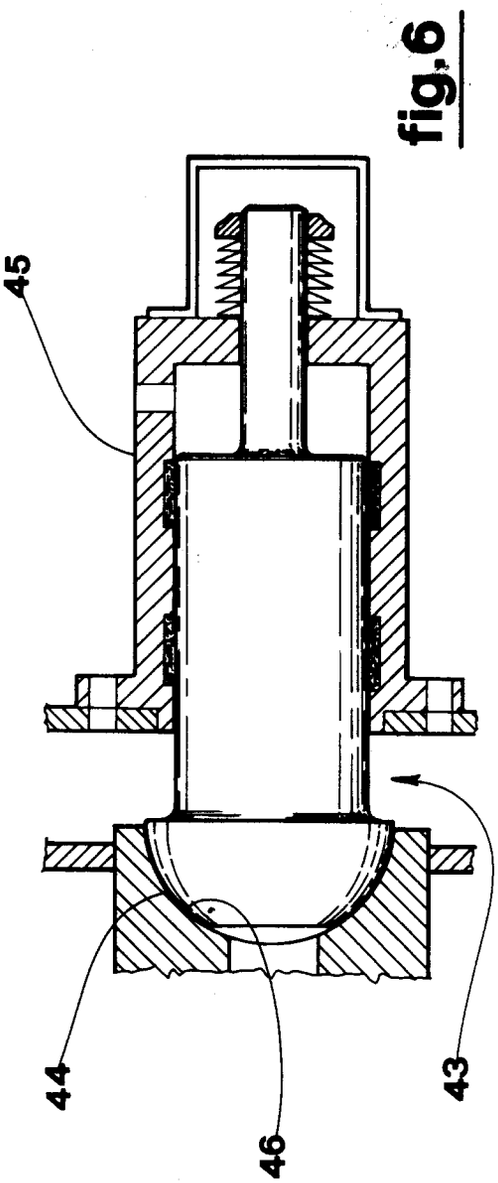


fig.6

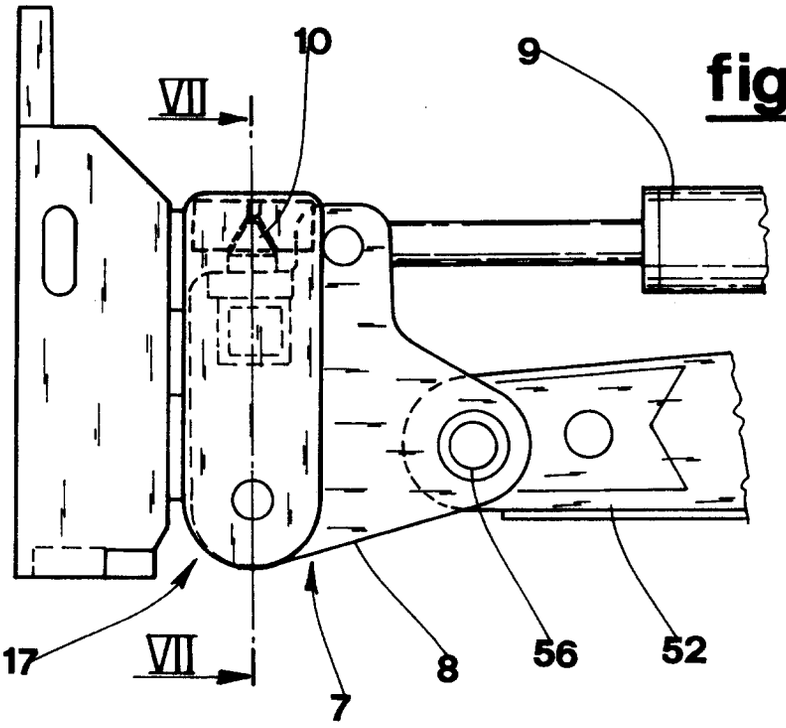


fig.7

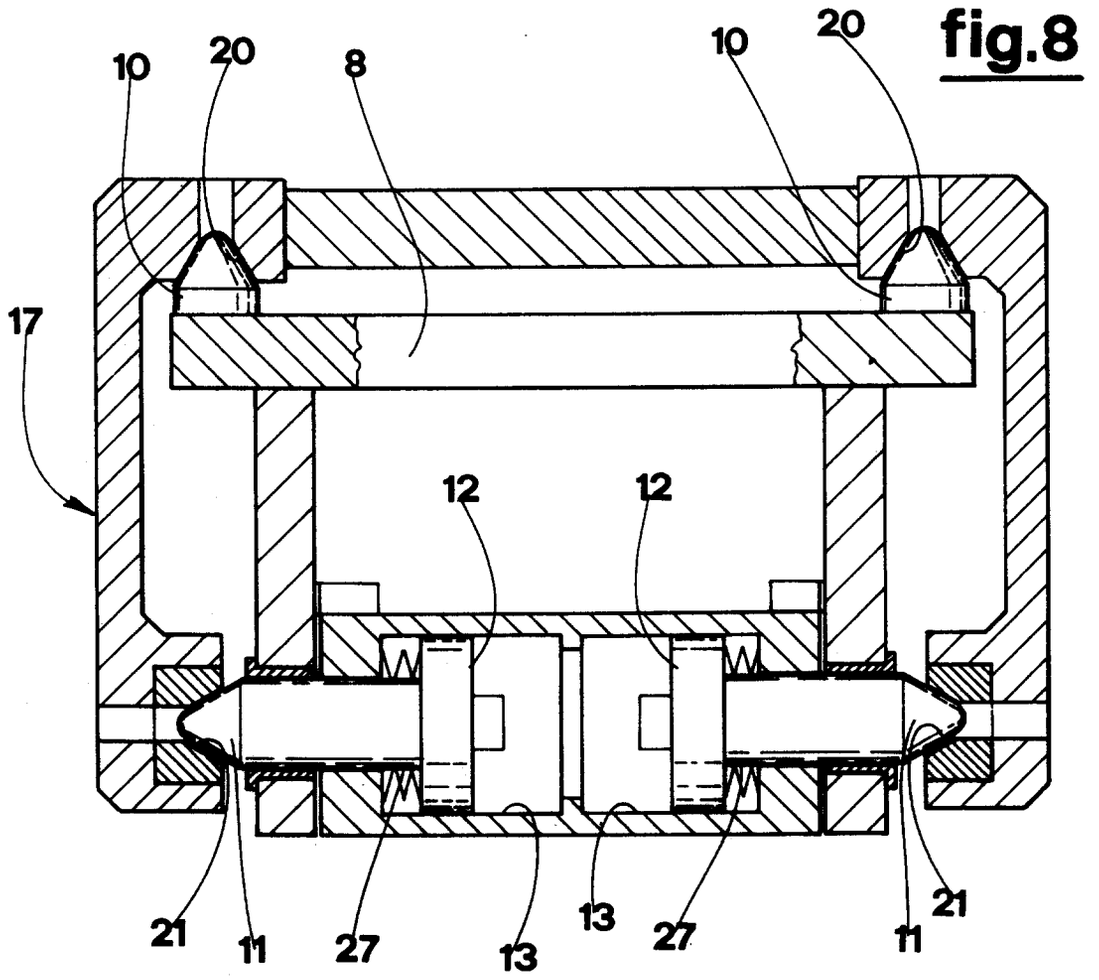


fig.8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 83 0203

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	CA-A-1 077 893 (CANADIAN MINE SERVICES LTD) * page 27, line 13 - page 29, line 17; figures 13,14 *	1,2	E 02 F 3/38 E 02 F 3/39 E 02 F 3/30
Y A	DE-A-2 362 338 (HARNISCHFEGER CORP.) * page 7, paragraph 2 - page 8, last paragraph; figures *	1,2 3-5	
A	US-A-3 129 831 (E.V. MROZEK) * column 1, line 70 - column 3, line 56; figures *	1,2	
A	EP-A-0 036 455 (LINER LIMITED) * abstract; figures *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

E 02 F
B 66 F
B 66 C

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
THE HAGUE	16-12-1992	ESTRELA Y CALPE J

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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European Patent Office

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid,

namely claims:

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions,
namely:

See sheet -B-

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid,

namely claims:

☒ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims,

namely claims: 1-5

LACK OF UNITY OF INVENTION A POSTERIORI

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims 1-5 : Mobile elevator-excavator with 2 telescopic arms and a pivot

2. Claims 6-10: Quick-coupling device for implement (Rapid on-off device)