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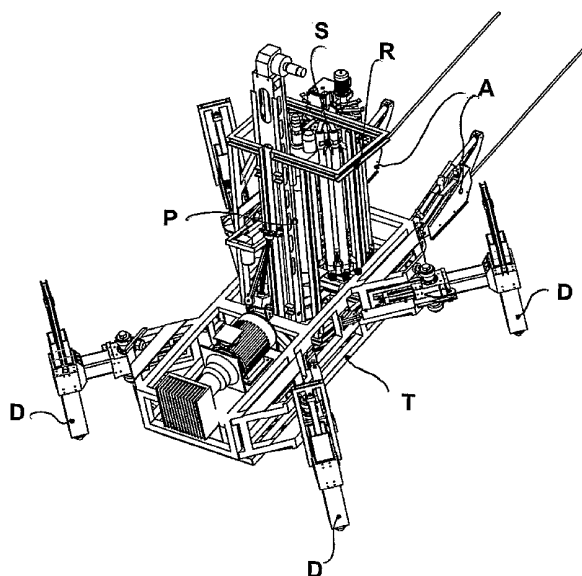
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(54) Title: MOBILE BASKET FOR CONSOLIDATION WORK ON WALLS



(57) Abstract: Mobile basket for consolidation work on walls provided a main frame (T) provided in the front part with hoisting and for translation of the new basket up and down the wall; legs (D) fitted at the side of said main frame (T) a secondary frame or cage (R), designed to support the magazine (S) of the rods; mast or drill (P) and a mechanical hand (M); a mast or drill (P), applied to the secondary frame or cage (R) parallel to its longer side so that it is generally square to the main frame (T); a rod magazine (S); a mechanical hand (M), positioned between the mast or drill (P) and the magazine (S), designed to take a rod from the magazine (S) each time and transfer it to the mast or drill (P).

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TITLE

MOBILE SLOPE WORKING MACHINE FOR CONSOLIDATION WORK

DESCRIPTION

5 This patent concerns mobile baskets for work on rocky walls, such as drilling, scaling, laying of netting, cables and structures for consolidation. In particular it concerns a new basket, with autonomous movement independent of supporting structures, provided with devices designed to improve its stability and adherence to the wall, improve its dependability, work capacity and safety.

10 It is known that stretches of road or railways and installations below rocky walls can be endangered by the instability of the wall above. To prevent fragments and portions of rocky wall falling onto stretches of road or railway or on the installations below, the rocky wall is consolidated with netting and cables laid on the wall itself in order to contain it. Said netting and cables are fixed at intervals according to requirements over the surface of the wall by means of active and/or passive tie rods driven into the wall.

15 To correctly lay the netting and cables and to position the tie rods in the rocky wall, two methods are currently used.

One consists in the laying of ground supporting structures, such as tubular scaffolding, for the personnel and machinery.

20 The other makes use of mobile suspended baskets which move vertically up and down the wall to be consolidated.

Said baskets consist mainly of a parallelepiped metal structure, suspended at the top of the wall to be consolidated by means of supporting cables; the basket is vertically translated up and down the rocky wall by means of cables operated by one or more hoisting elements.

25 The metal structure of the basket is designed to accommodate the personnel assigned to consolidation of the wall in addition to the machinery and tools, including

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the material necessary for laying and fixing the netting and cables to the rocky wall and performance of the drilling operations.

5 The known suspended baskets are provided, on the side facing the rocky wall, with sliding blocks or guides designed both to facilitate translation of the basket up and down the rocky wall and to improve the stability of the basket on the rocky wall during the various consolidation operations. They are also provided with a series of extendible pistons used both to facilitate movement and to stabilise the basket.

10 The above baskets have a number of drawbacks that complicate operations for perfect execution of consolidation work and oblige the operators to perform several vertical translations up and down the wall and to adopt intricate and complicated stratagems which at times put their own safety at risk.

In addition to these drawbacks, the current baskets expose the operators to harmful effects deriving from the work carried out, dust and noise, and to the risks inherent in the wall itself, collapse and landslides of portions at risk.

15 The main problem that the known baskets have to overcome is continuous variation in configuration due to the irregularity of the rocky wall to be consolidated at the various points along the path of the basket.

20 Another drawback of the known baskets is the difficulty of reaching, even only occasionally and/or temporarily, areas immediately adjacent to the vertical path of the basket without translating the lifting unit installed at the top of the rocky wall. During consolidation of the wall situations may occur that cannot be predicted in advance and consequently it is not possible to programme with absolute certainty the vertical bands covered by the path of the basket unless each path is amply overlapped with the adjacent ones.

25 A further drawback of the known baskets consists in the difficulty of the basket, during its vertical translation, of overcoming sudden changes in gradient such as parts jutting out, recesses or projections, ledges or niches.

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To remedy all the above drawbacks, a new mobile basket has been designed and produced for consolidation work on rocky walls.

5 One of the main aims of the new mobile basket is to perform the operations on the rocky wall without the direct intervention of persons, or without the need for persons on board the basket.

Another main aim is to remove the possibility of harmful effects, dust and noise, and the risks inherent in the consolidation work for the site personnel.

10 Another of the main aims of the new mobile basket is to facilitate overcoming of projections, ledges, recesses or other sudden variations in gradient of the rocky wall.

Another of the main aims of the new mobile basket is to be able to translate laterally in order to reach areas of the rocky wall to be consolidated immediately adjacent to the vertical band covered by the path of the basket without having to translate the lifting unit installed at the top of the rocky wall.

15 Another of the aims of the new mobile basket is to maintain a substantially vertical configuration even on stretches of the rocky wall that are not vertical or in any case are very different from the vertical.

Another aim of the new mobile basket is to permit the consolidation or application of anchorings at an angle with respect to the square of the rocky wall.

20 A further aim of the new mobile basket is to permit several consolidations and/or applications of anchorings along the same up-down path without having to go back up each time to load the tools and/or anchorings.

25 These and other aims, direct and complementary, are achieved by the new mobile basket for consolidation work on rocky walls comprising a main frame, provided with spacers and lateral translation devices, and a secondary frame or cage with drilling unit generally perpendicular and slantable with respect to the main frame.

The spacers and lateral translation devices, subsequently called legs, permit

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positioning and adjustment of the position of the new mobile basket in relation to the local configuration of the rocky wall.

The angle of the secondary frame or cage with the drilling unit on the main frame is adjusted by a worm screw jack.

5 The cage supports the drilling unit comprising the mast or drill, a magazine of drilling rods parallel to the mast and a mechanical hand which takes the rod from the magazine and positions it on the mast or drill for application at the pre-selected point on the rocky wall.

10 The mechanical hand consists of a slide, sliding square to the rods stored in the magazine, and is provided with three fingers, two of which are side by side and fixed and the third of which can be rotated between the first two in order to retain each rod between said two fixed fingers and the third rotating finger.

15 The new mobile basket is suspended from cables, fixed on the upper part of the wall, wound and blocked by hoisting devices present on the upper front part of the main frame.

The characteristics of the new mobile basket for consolidation work on rocky walls will be better illustrated by the following description with reference to the drawing attached as a non-restrictive example.

20 Figure 1 shows an axonometric view of the new mobile basket comprising a main frame (T), provided with side legs (D), on which a secondary frame or cage (R) is hinged generally perpendicular and slantable with respect to the main frame (T).

Said cage (R) houses both the rod magazine (S) and the mast or drill (P), and a mechanical hand (M) designed to transfer each rod from the magazine (S) to the mast or drill (P).

25 In the front part of the main frame (T) hoisting and/or grip devices (A) are present for connection and anchoring of the new basket to cables fixed at the top of the rocky wall and for translation of the new basket up and down the wall.

Figure 2 illustrates in detail only the main frame (T) consisting of metal profiles assembled to form a grid structure which is generally a rectangular parallelepiped. The main frame (T) is provided, preferably on the longer sides and generally near the corners, with four housings with generally triangular shape (T1) in which the side legs (D) are hinged.

5 Each leg (D) comprises a support (D1) hinged to the frame-structure (T) and which can be rotated on the horizontal plane by means of a hydraulic, mechanical or pneumatic actuator (D1a).

Coaxially, or beside said support (D1), there is a second telescopic element (D2) provided at the end, facing in the opposite direction to the main frame (T), with a vertical guide (D3). The sliding movement of said second telescopic element (D2) is provided by a hydraulic, mechanical or pneumatic actuator.

10 A thrust element (D4) is housed and runs in said vertical guide (D3) and its sliding is controlled by an appropriate hydraulic, mechanical or pneumatic actuator.

15 The lower end of said thrust element (D4) is specially shaped or in any case designed to rest on the rocky wall.

Each leg (D) constructed as above has three degrees of freedom: rotation, extension-retraction, raising-lowering.

On the front part of the main frame (T), or on one of the two shorter sides of the parallelepiped structure of the main frame (T), at least two hoisting and/or grip devices (A) are applied and/or fixed designed to connect the new basket to the cables for descent and ascent of said new basket running on said cables up and down the rocky wall.

20 The cage (R) is hinged in the generally central part of the main frame (T).

25 Said cage (R) consists of a series of metal profiles constituting a frame which is substantially parallelepiped and developed in a generally square direction to the main frame (T).

Said cage (R) is hinged on the main frame (T) so that it rotates on a horizontal axis perpendicular to the two longer sides of the main frame (T).

The angle, roughly between $+10^\circ$ and -5° , of said cage (R) is obtained and adjusted by a hydraulic, pneumatic or mechanical mechanism, preferably a worm screw jack (R1), as can be seen in figures 3a and 3b.

Said cage (R) is designed to support the rod magazine (S), the mast or drill (P) and a mechanical hand (M) designed to transfer each drilling rod from the magazine (S) to the mast or drill (P).

The mast or drill (P) consists preferably of a rotation head, driven by a hydraulic motor, to which a drill bit is connected designed to drill the rocky wall.

Said mast or drill (P) is applied to the cage (R) parallel to its longer side so that it is generally square to the main frame (T).

The rod magazine (S) is also applied to the cage (R) parallel to its longer side so that it is generally square to the main frame (T) and parallel to the mast or drill (P).

The drilling rod magazine (S), shown schematically in figure 4, consists mainly of a shaft (S1) having, near its ends, two hubs (S2) for connection with various supports (S3) for housing the rods.

Each hub (S2) consists substantially of two discs (S2a) parallel and interconnected by a tubular section (S2b).

The hub constructed as above is housed on the shaft (S1) so that said shaft (S1) crosses said tubular section (S2b) of the hub (S2).

The various supports (S3) for housing the rods are applied radially on each hub (S2).

Each support (S3), shown schematically in figure 5, consists of a connection element (S3a) to which two elastic plates (S3b) are joined, parallel and protruding beyond the connection element (S3a) and each provided at the end with a raised element facing the plate (S3b) opposite.

Each support (S3) is applied and joined to the hub (S2) so that the plates (S3b) are radial with respect to the hub (S2) and so that said plates are parallel to the shaft (S1) of the magazine (S).

5 The set of the two series of supports (S3) of the two hubs (S2) house and retain a series of drilling rods, arranged parallel to the shaft (S1) of the magazine (S).

Substantially each connection element (S3a) and its two plates (S3b) constitute a generally U-shaped housing with width such as to contain a rod. The ends of the two plates (S3b) provided with raised element ensure retention of each rod arranged parallel to the shaft (S1) of the magazine (S).

10 On each hub (S2) covering elements (S4) are also applied, radial and aligned with the supports (S3), designed to cover-protect the ends of the rods housed and retained in the magazine (S).

15 A corner portion of both the hubs (S2), roughly 60°, is without supports (S3) and covering elements (S4) thus permitting access of the mechanical hand (M), in sequence, to the rods housed in the magazine (S).

The magazine (S) constructed as above is rotated by a mechanism, preferably a gearmotor.

The mechanical hand (M) is positioned between the mast or drill (P) and the magazine (S).

20 The mechanical hand (M), shown schematically in figures 6, 7a, 7b, consists of a slide (M1), sliding square to the magazine (S) and to the mast or drill (P), and is provided with three fingers (M2a, M2b, M2c).

25 Two (M2b, M2c) of said fingers are side by side, parallel and fixed to the structure of the slide (M1) while the third finger (M2a), intermediate with respect to said two (M2b, M2c), can be rotated on a perpendicular plane to the two fixed fingers (M2b, M2c).

The end of each of the fingers (M2a, M2b, M2c) has a concave seat designed to

adhere to and press on the surface of the rod.

An actuator (M3) translates the slide (M1) and the entire mechanical hand (M) along appropriate guides (R2) present and fixed to the cage (R), thus translating said mechanical hand (M) from the magazine (S) to the mast or drill (P) and vice versa
5 and so that the three fingers (M2a, M2b, M2c), when positioned close to each other, are substantially aligned in a direction parallel to the shaft (S1) of the magazine (S) and to the drilling axis of the mast or drill (P).

A further actuator (M4) rotates the third finger (M2a) with respect to the other two fixed fingers (M2b, M2c).

10 The mechanical hand (M) has the function of taking a rod from the magazine (S) each time and transferring it to the mast or drill (P).

Substantially the mechanical hand (M) performs a series of co-ordinated movements to carry out said rod transfer.

15 The magazine (S) is rotated so as to present the corner portion without rods facing the mechanical hand (M) and the mast or drill (P).

The third finger (M2a) of the mechanical hand (M) is opened, or moved away, by the other two (M2b, M2c).

20 The mechanical hand (M) is translated towards the magazine (S) until the two fixed fingers (M2b, M2c) go beyond the circumference defined by the various rods of the magazine (S).

The magazine (S) is rotated until the first rod available of the series is located between the two fixed fingers (M2b, M2c) and the mobile finger (M2a).

Subsequently the mechanical hand (M) is translated until the two fixed fingers (M2b, M2c) come into contact with the rod and then the actuator (M4) is operated to rotate
25 the third finger (M2a) in order to grip said rod between the three fingers (M2a, M2b, M2c).

Lastly, the mechanical hand (M) is translated towards the mast or drill (P) so that the

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rod is extracted from the supports (S3) of the magazine (S) and transferred to the mast or drill (P).

5 All the mechanisms such as actuators, motors and pistons of the new basket are controlled by a control unit which supervises and combines the various movements and rotations. Said control unit is controlled by appropriate software developed to synchronise the movement of the extendible mechanisms with that of the retrieval elements.

The new mobile basket for consolidation work on rocky walls constructed as above has considerable advantages.

10 Thanks to said legs (D) the new mobile basket can be translated laterally with respect to the vertical band of its vertical path, thus reaching lateral adjacent areas. The new mobile basket can be slanted and rotated with respect to the surface of the rocky wall, by appropriately slanting and extending the thrust elements (D4) and/or appropriately slanting the cage (R), to facilitate the various consolidation operations on the rocky wall.

15 The new mobile basket can easily overcome any change in gradient, projections, ledges, recesses or other sudden variations in gradient of the rocky wall by appropriately slanting and extending the thrust elements (D4) of its legs (D).

20 The new basket does not expose the site personnel to the harmful effects of the work processes and the danger inherent in remaining at length in a high risk area. It works by optimising personnel efficiency and extends possible use to groups of persons currently not employed, such as female personnel and the disabled.

25 By replacing the drilling unit with specifically designed elements, work can be carried out on the wall such as: sandblasting, gonite and beton, pressure cleaning with water and solvents, painting, demolition and scaling etc.

These are the schematic procedures sufficient for a person skilled in the art to produce the invention; during concrete application there may consequently be

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variations without affecting the substance of the innovative concept.

With reference to the preceding description and the attached drawing the following claims are therefore made.

CLAIMS

1. Mobile basket for consolidation work on walls characterised in that it comprises:
- a main frame (T) provided in the front part with hoisting and/or grip devices (A) for connection to cables fixed at the top of the rocky wall and for translation of the new basket up and down the wall;
 - legs (D) fitted at the side of said main frame (T) and comprising a support (D1) hinged to the frame-structure (T) and which can be rotated on the horizontal plane by means of an actuator (D1a), a second telescopic element (D2) sliding coaxially or beside said support (D1) and a thrust element (D4) sliding square to the second telescopic element (D2) at its end opposite the main frame (T);
 - a secondary frame or cage (R), designed to support the magazine (S) of the rods, mast or drill (P) and a mechanical hand (M), developed in a generally square direction to the main frame (T), hinged on the main frame (T) so that it rotates on a horizontal axis;
 - a mast or drill (P), applied to the secondary frame or cage (R) parallel to its longer side so that it is generally square to the main frame (T), consisting preferably of an electric motor to which a drill bit is connected for drilling the rocky wall;
 - a rod magazine (S), rotating with shaft generally parallel to the secondary frame or cage (R) thus resulting generally square to the main frame (T) and parallel to the mast or drill (P), designed to contain several rods;
 - a mechanical hand (M), positioned between the mast or drill (P) and the magazine (S), designed to take a rod from the magazine (S) each time and transfer it to the mast or drill (P).
2. Mobile basket for consolidation work on walls, as in claim 1, characterised in that the magazine (S) consists of a shaft (S1) having, near its ends, two hubs (S2) for connection with various supports (S3) housing the rods, and where each hub (S2) consists substantially of two discs (S2a) parallel and interconnected by a tubular

- section (S2b), and where the various supports (S3) housing the rods are applied radially on each hub (S2).
3. Mobile basket for consolidation work on walls, as in claims 1, 2, characterised in that a corner portion of both hubs (S2), roughly 60°, is without supports (S3) and covering elements (S4) thus permitting the mechanical hand (M) to access, in sequence, the rods housed in the magazine (S).
- 5
4. Mobile basket for consolidation work on walls, as in claims 1, 2, 3, characterised in that the mechanical hand (M) consists of a slide (M1), sliding square to the magazine (S) and to the mast or drill (P), provided with three fingers (M2a, M2b, M2c), and where two (M2b, M2c) of said fingers are side by side, parallel and fixed on the structure of the slide (M1) while the third finger (M2a), intermediate with respect to the other two (M2b, M2c), can be rotated on a plane perpendicular to the two fixed fingers (M2b, M2c).
- 10
5. Mobile basket for consolidation work on walls, as in claims 1, 2, 3, 4, characterised in that the end of each of said fingers (M2a, M2b, M2c) of the mechanical hand (M) is provided with a concave seat designed to adhere to and press on the surface of the rod.
- 15
6. Mobile basket for consolidation work on walls, as in the previous claims, characterised in that it has hydraulic, pneumatic, mechanical and electrical actuators for movement of the various parts of each leg (D).
- 20
7. Mobile basket for consolidation work on walls, as in the previous claims, characterised in that it has hydraulic, pneumatic, mechanical and electrical actuators for rotation of the magazine (S).
8. Mobile basket for consolidation work on walls, as in the previous claims, characterised in that it has hydraulic, pneumatic, mechanical and electrical actuators for translation of the mechanical hand (M) and for opening/closing of the third mobile finger (M2a).
- 25

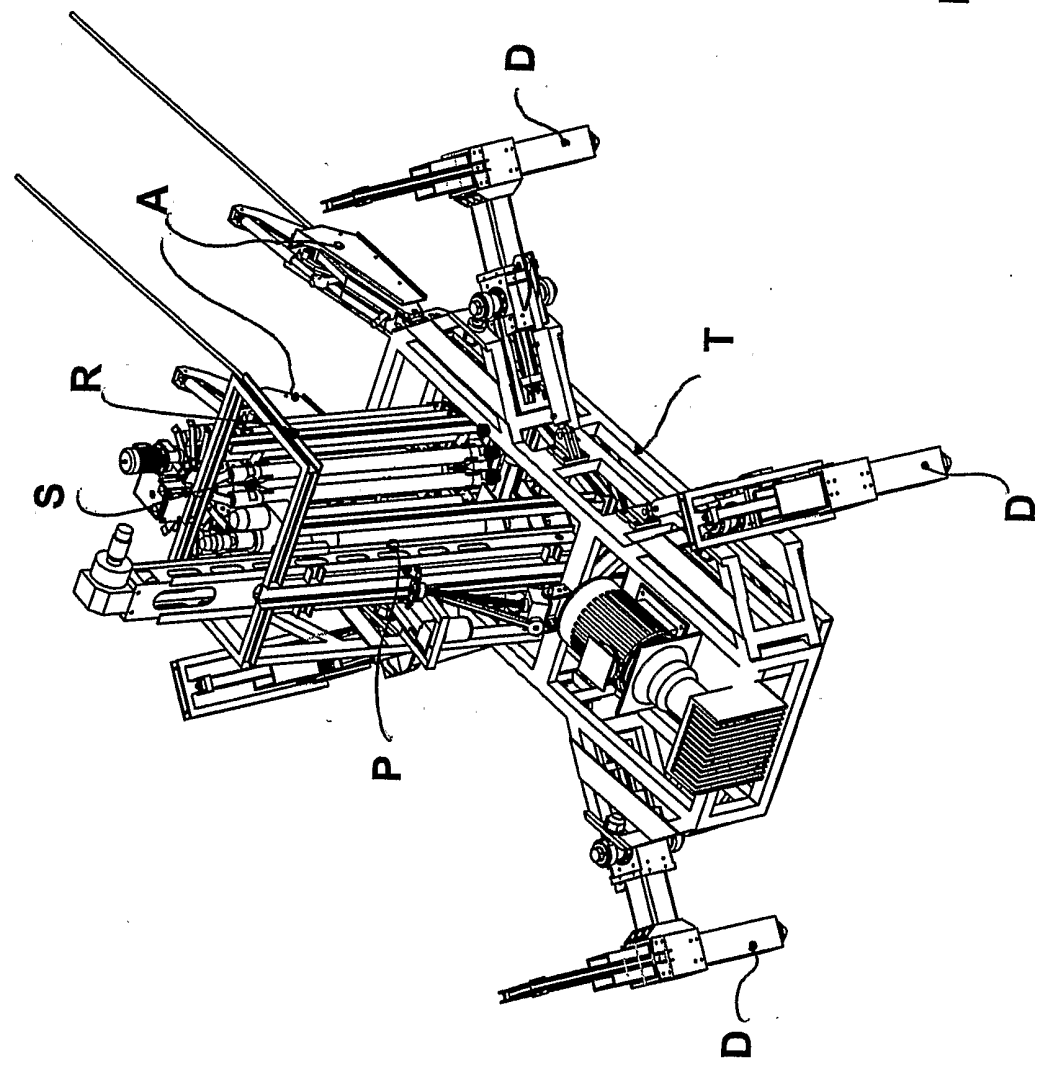


Fig. 1

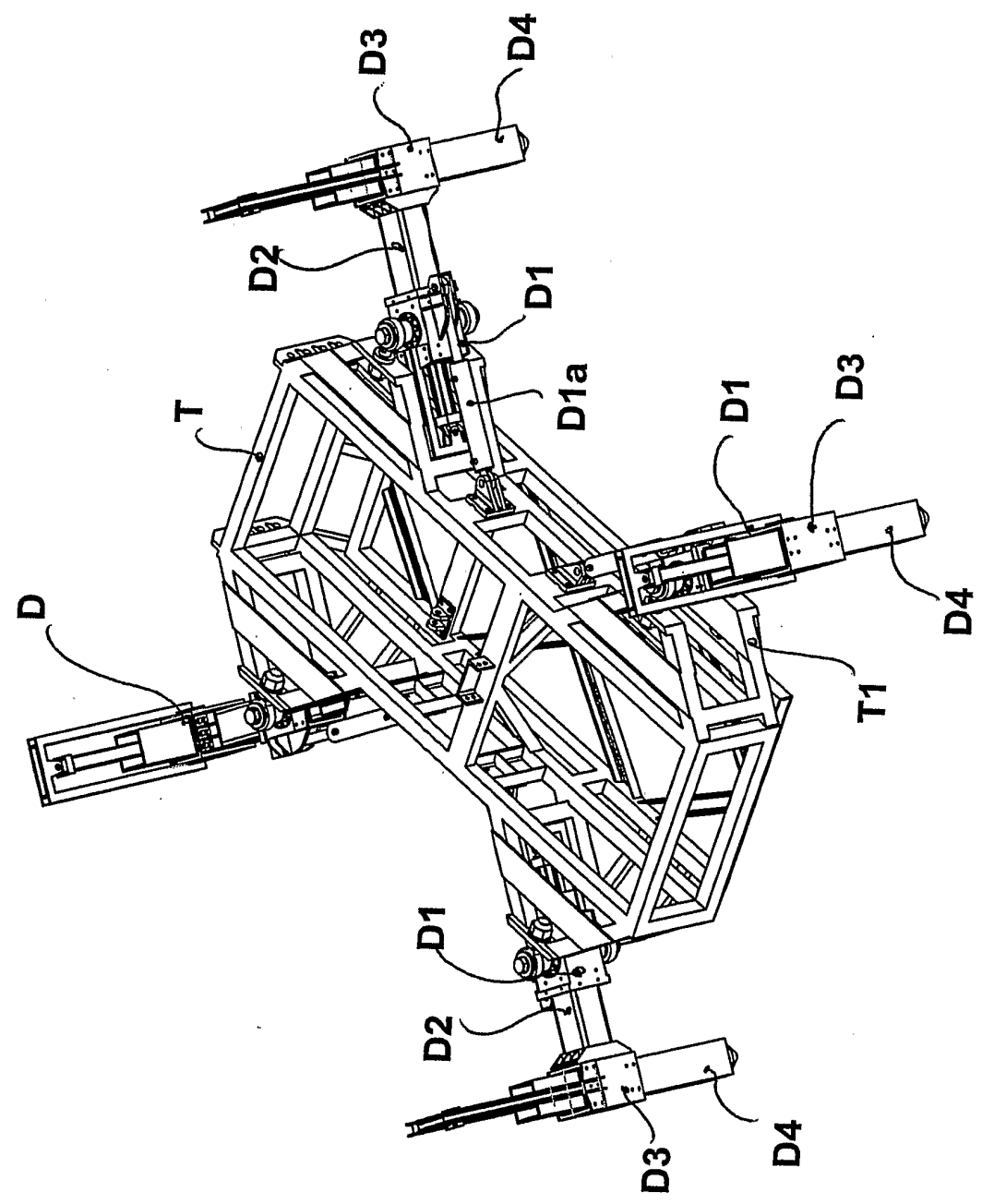


Fig. 2

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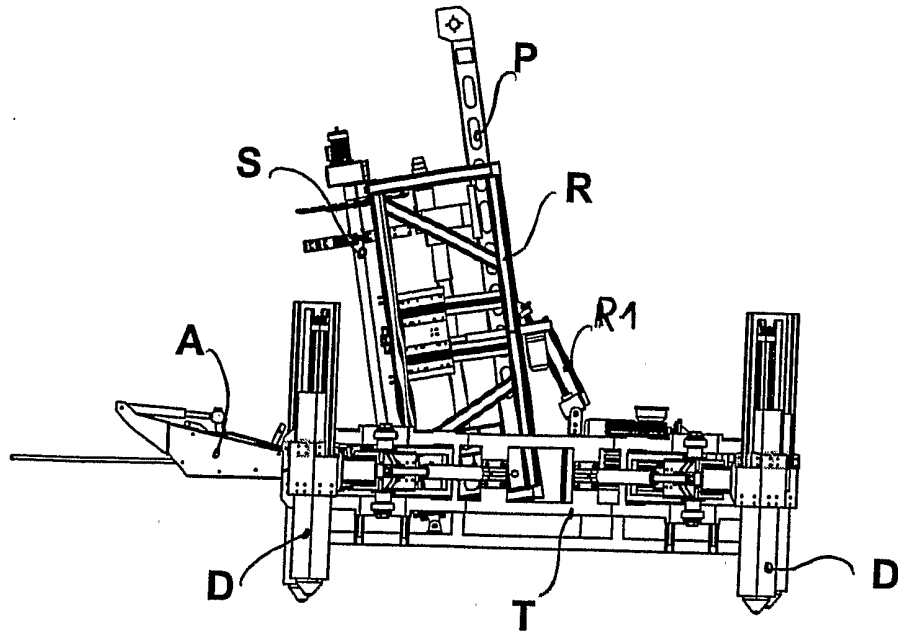


Fig. 3a

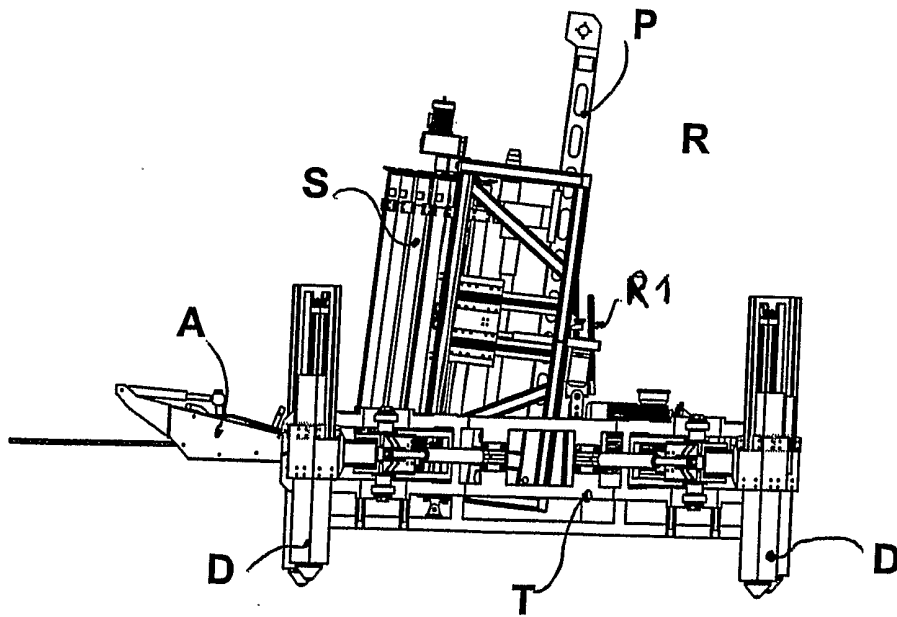


Fig. 3b

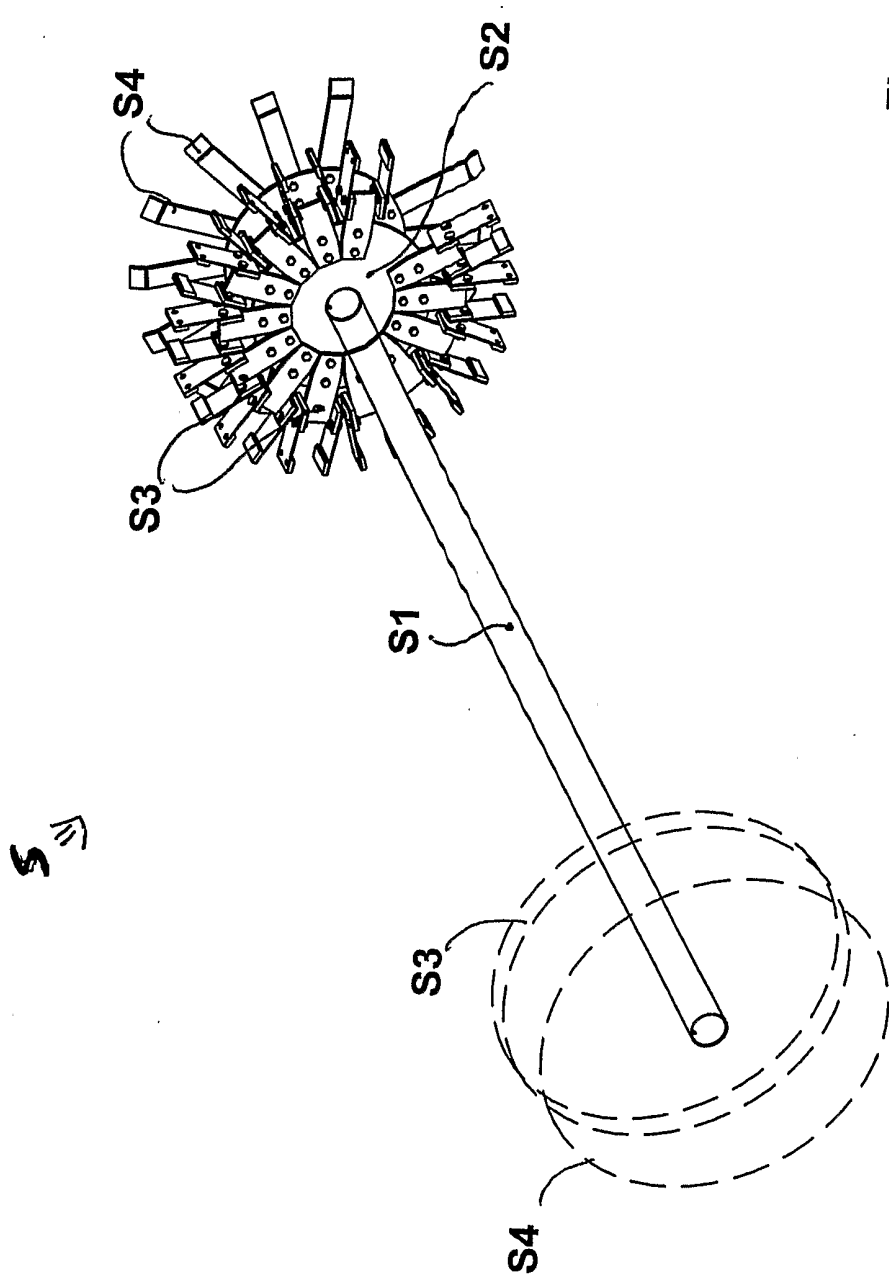
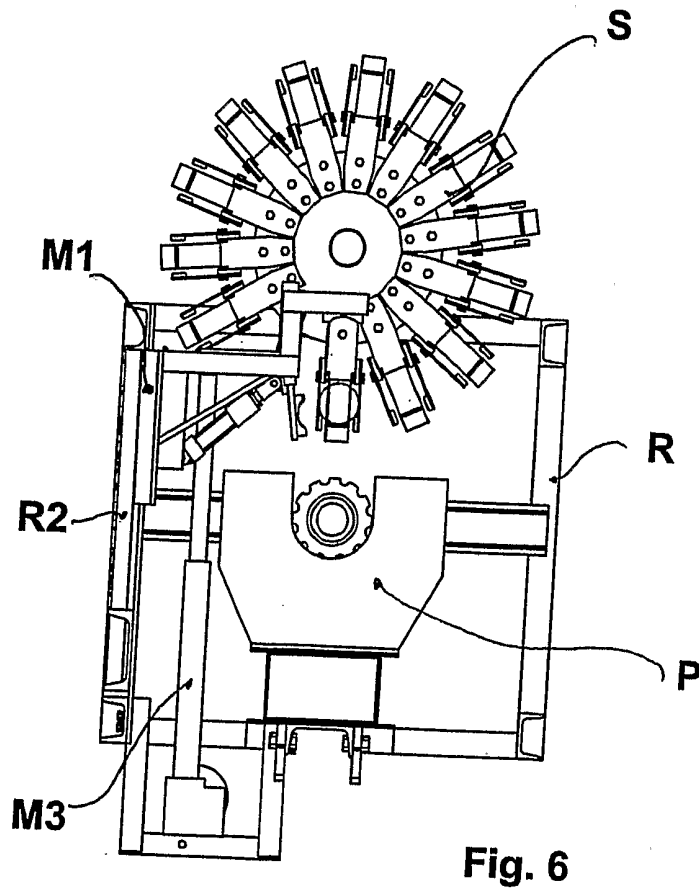
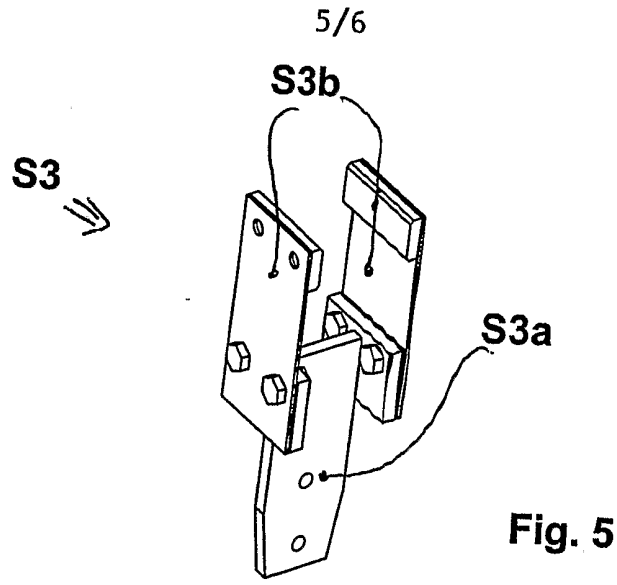


Fig. 4

S



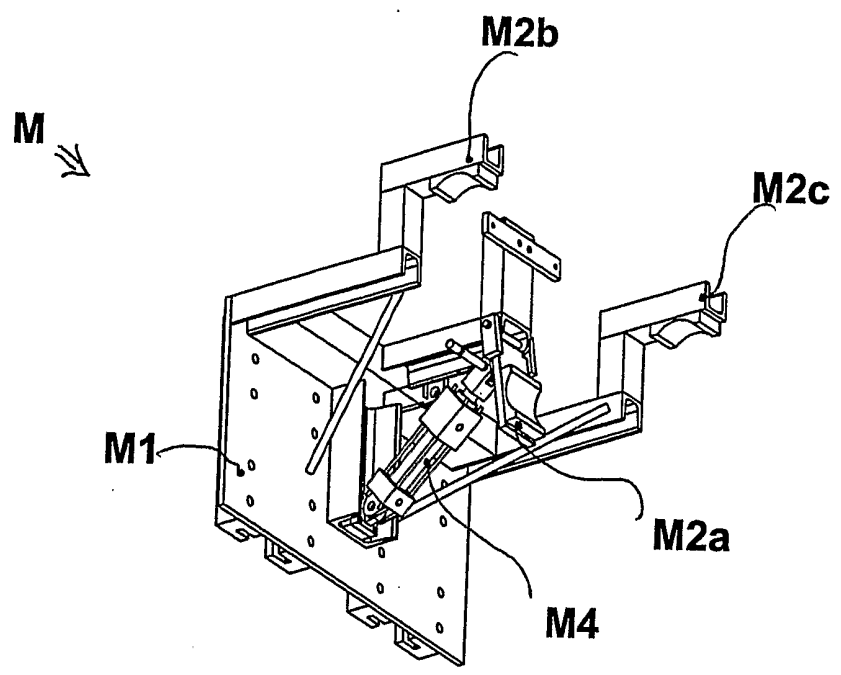


Fig. 7a

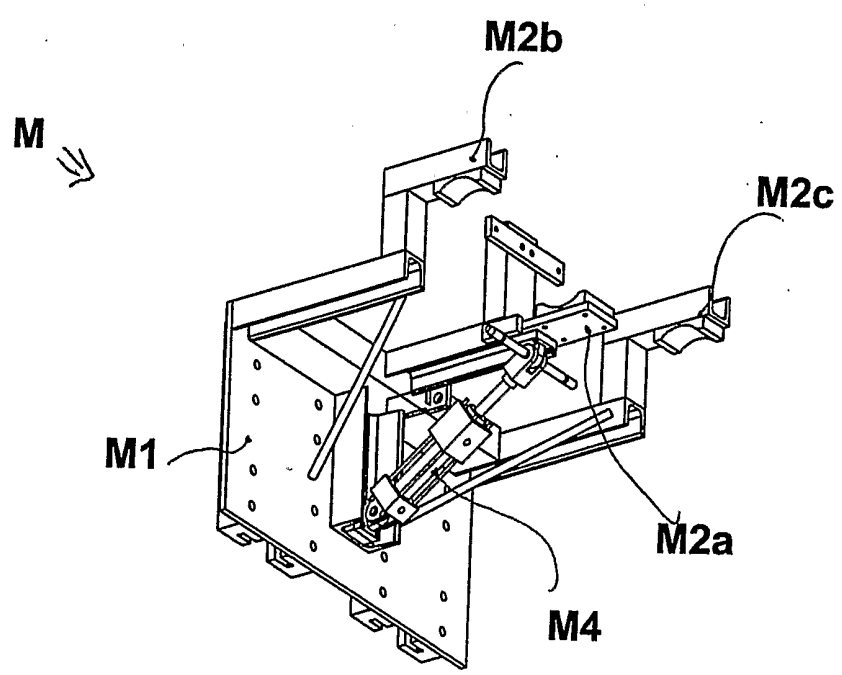


Fig. 7b

INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 E21B7/02 B66F11/00 E02D17/20

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)
 IPC 7 E04G B66F A47L E21B E02D

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 practical, search terms used)
 EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 884 447 A (OKAMOTO, TOSHIHITO) 16 December 1998 (1998-12-16) figures 1-9,11-28	1,6
A	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 24, 11 May 2001 (2001-05-11) & JP 2001 200633 A (CHIYODA SEISAKUSHO:KK; TANAKA KOGYO KK), 27 July 2001 (2001-07-27) abstract; figures	1
A	PATENT ABSTRACTS OF JAPAN vol. 018, no. 056 (M-1551), 28 January 1994 (1994-01-28) & JP 05 278649 A (TOSHIHITO OKAMOTO), 26 October 1993 (1993-10-26) abstract; figures	1
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& document member of the same patent family

Date of the actual completion of the international search 21 March 2005	Date of mailing of the international search report 04/04/2005
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Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Masset, M
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US 4 476 940 A (REICHERT ET AL) 16 October 1984 (1984-10-16) the whole document</p> <p style="text-align: center;">-----</p>	1

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Information on patent family members

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