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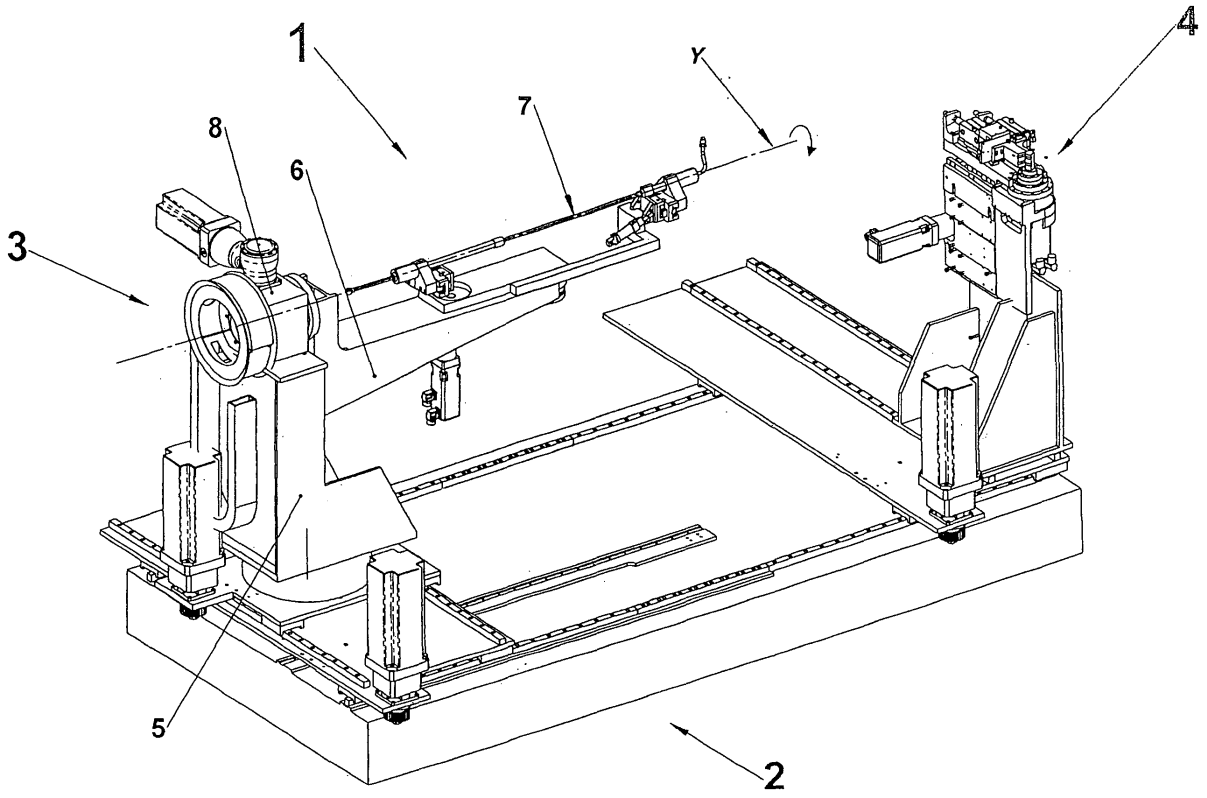
(54) **Tube bending machine**

(57) The invention belongs in the field of machines for bending tubes and refers in particular to a machine (1) comprising a supporting base (2), a positioning device (3) for the tube (7) to be bent and a bending device (4) for said tube (7) characterised by having devices capable of rotating through up to 360° in order to bend said tube (7) in various bending planes, including starting alternatively from either end of said tube or, as necessary, at an intermediate part.

Fig. 1



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Description

OBJECT OF THE INVENTION

[0001] The present invention relates to a machine for bending tubes of any length (short, medium or long) without having to withdraw the tube to be bent, in order to effect curves with a different radius and/or in different bending planes.

[0002] The machine which is the subject of the present invention is also suitable for bending tubes designated as hybrid, that is to say tubes formed from lengths of metal and lengths of rubber or other non-metallic material.

THE STATE OF THE ART

[0003] Tube-bending machines are known which bend tubes by setting about the bending starting from one end of the tube to be bent and keeping the other end of said tube in the positioning device. Tubes bent with said known machines have the disadvantage of oscillating and/or undergoing deformation subsequently to bending because they are left lacking adequate support, in a so-called overhanging position, that is to say restrained at a single point and subjected to the force of gravity.

[0004] In relation to the bending of tubes generally designated hybrid, that is to say tubes formed from lengths of metal and lengths of rubber or other non-metallic material, the known tube-bending machines have great difficulty in bending said hybrid tubes, because said machines set about bending the tube starting from just one end of said tube, and the bending devices can easily touch the non-metallic parts of the tube, with the risk of damaging it.

[0005] Among tube-bending machines, an orbital machine for bending long tubes is also known, described in document US 7.093.475. Said machine includes a bending head mounted on a U-shaped arm which rotates around the horizontal axis of the tube to be bent. The machine described in said document has the disadvantage of being able to manipulate tubes of small size because the weight of the head mounted on the above-mentioned U-shaped arm must be small for structural reasons relating to the shape of said arm. Furthermore, the length of the tubes to be bent is anyway limited by the breadth of the U which constitutes the above-mentioned arm, the overall dimensions of the bent tube being limited by the breadth of the U formed by the above-mentioned arm.

[0006] The machine described in document US 7.093.475 is capable of bending tubes only in one plane of curvature, having therefore a limited productive capacity.

DESCRIPTION OF THE INVENTION

[0007] An object of the present invention is to create a machine for bending metal or hybrid tubes, that is to say tubes formed from lengths of metal and lengths of rubber or other non-metallic material, of any size and length, with characteristics which are such as to be able to overcome the disadvantages mentioned with reference to the known art.

[0008] These and other objects are achieved by means of a tube-bending machine characterised by comprising a positioning arm equipped with means for rotating through up to 360° around the central axis of the tube to be bent and one or more locking devices suitable for rotating through up to 360° around one or more fulcrums.

[0009] This and other characteristics will become clearer from the following description of some embodiments illustrated, purely by way of non-limiting example in the attached drawings in which:

Figure 1 shows a perspective view of the whole of a tube-bending machine which is the subject of the present invention with a positioning device suitable for rotating through up to 360°;

Figure 2 shows the machine of fig. 1 highlighting the locking device and the means suitable for rotating said device up to 360° around fulcrum (F);

Figure 3 shows the machine of fig. 1 highlighting the two locking devices and the means suitable for rotating said devices up to 360° around fulcrums (F) and (G);

Figure 4 shows the machine of fig. i with a second bending device.

[0010] With reference to Figure 1, no. (1) indicates a machine for bending tubes, consisting of a supporting base (2) which supports a positioning device (3) for the tube to be bent (7) of wholly metallic or hybrid type, that is to say formed from lengths of metal and lengths of rubber or other non-metallic material, by one or more devices (4) for bending the tube (7) to be bent. Said positioning device (3) consists of a turret (5) and a positioning arm (6).

[0011] Said machine also includes means known to persons skilled in the art for the purpose of making the positioning device (3), by means of the translation of turret (5) and/or device (4), take up mutual positions for the purpose of allowing said device (4) to be moved, according to methods known to persons skilled in the art, for the purpose of bending said tube (7) on the basis of the preset work programme.

[0012] Said Figure 1 also shows the positioning device (3) provided with means (8) for rotating the positioning arm (6) through up to 360° around the central axis (Y) of the tube (7) to be bent, so as to be able advantageously to bend said tube (7), particularly of hybrid type, in various bending planes having in common said central axis (Y), having among other things the possibility of locking the tube in the intermediate area and being able to start indifferently from either of its ends, thus overcoming the disadvantages of the known machines.

[0013] Figure 2 shows the machine of fig. 1, highlighting the positioning arm (6) equipped with a locking device (9) for the tube (7) to be bent. Said locking device (9) is provided with means (10) for rotating through up to 360° around a fulcrum (F) so as to rotate said tube (7) for the purpose of being able to bend either end of said tube (7) alternatively by means of device (4) on the basis of a preset work programme.

[0014] Figure 3 shows the machine of figure 1, demonstrating another embodiment according to which the positioning arm (6), equipped with two locking devices (12) and (13) for the tube (7) to be bent, is provided with means (10) and (11) for rotating through up to 360° around fulcrum (F) and fulcrum (G) so as to rotate said tube (7) for the purpose of being able to bend either end of said tube (7) alternatively and/or an intermediate part of said tube by means of device (4) on the basis of a preset work programme.

[0015] Figure 4 shows the machine of fig. 1, equipped with a further bending device (14) capable of moving and being moved by known movement means. Equipping machine 1 with further possibilities of bending enables a considerable increase in the possibilities of bending said tube (7).

[0016] Machine 1 can be susceptible of numerous variations particularly as regards the positioning of the elements without thereby departing from the protective compass of the claims set out below.

Claims

1. a tube-bending machine (1), comprising:

- a supporting base (2);
- a positioning device (3) for the tube (7) to be bent,
- at least one device (4) for bending the tube (7) to be bent,
- means for making the positioning device (3) and the device (4) for bending said tube (7) take up mutual positions for bending said tube (7) **characterised in that** said positioning device (3) comprises a turret (5) and a positioning arm (6) equipped with means (8) suitable for rotating said positioning arm (6) through 360° around the central axis (Y) of the tube (7) to be bent, in order to position said tube (7) for the purpose of being bent by means of said device (4) in various bending planes;

2. a tube-bending machine (1) according to claim 1 **characterised in that** said positioning arm (6) is equipped with at least one locking device (9) for the tube (7) to be bent equipped with means (10) suitable for rotating said locking device (9) through up to 360° around a fulcrum (F) in order to rotate said tube (7) for the purpose of bending either end of the tube (7) alternatively by means of device (4);

3. a tube-bending machine (1) according to claim 1 **characterised in that** said positioning arm (6) is equipped with two locking devices (12) and (13) for the tube (7) to be bent and means (10) and (11) suitable for rotating said devices through up to 360° respectively around a fulcrum (F) and a fulcrum (G) in order to rotate said tube (7) for the purpose of bending either end of tube (7) alternatively by means of device (4);

4. a tube-bending machine (1) according to one of the preceding claims **characterised in that** it comprises at least one second bending device (14).

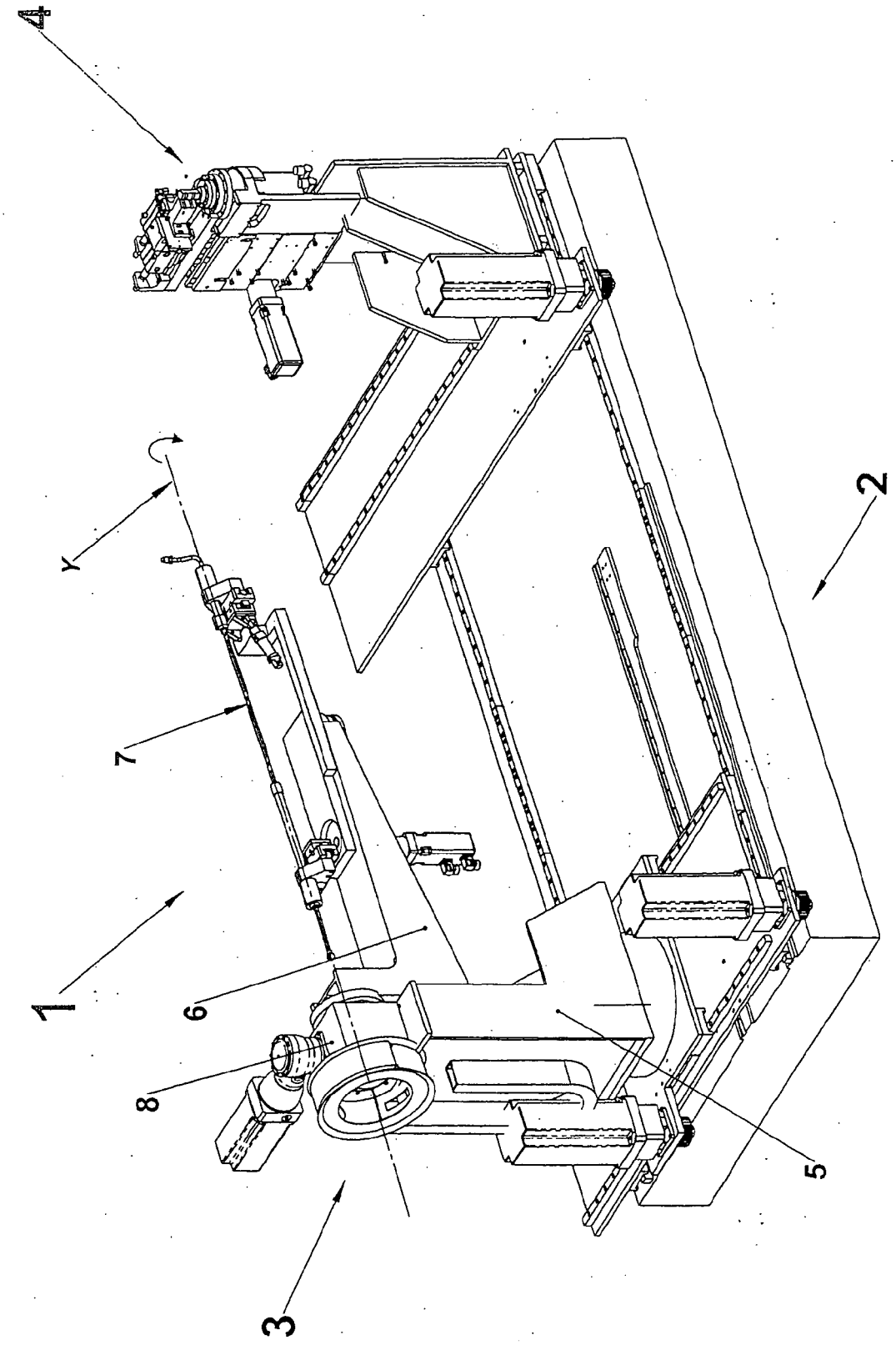

Fig.1

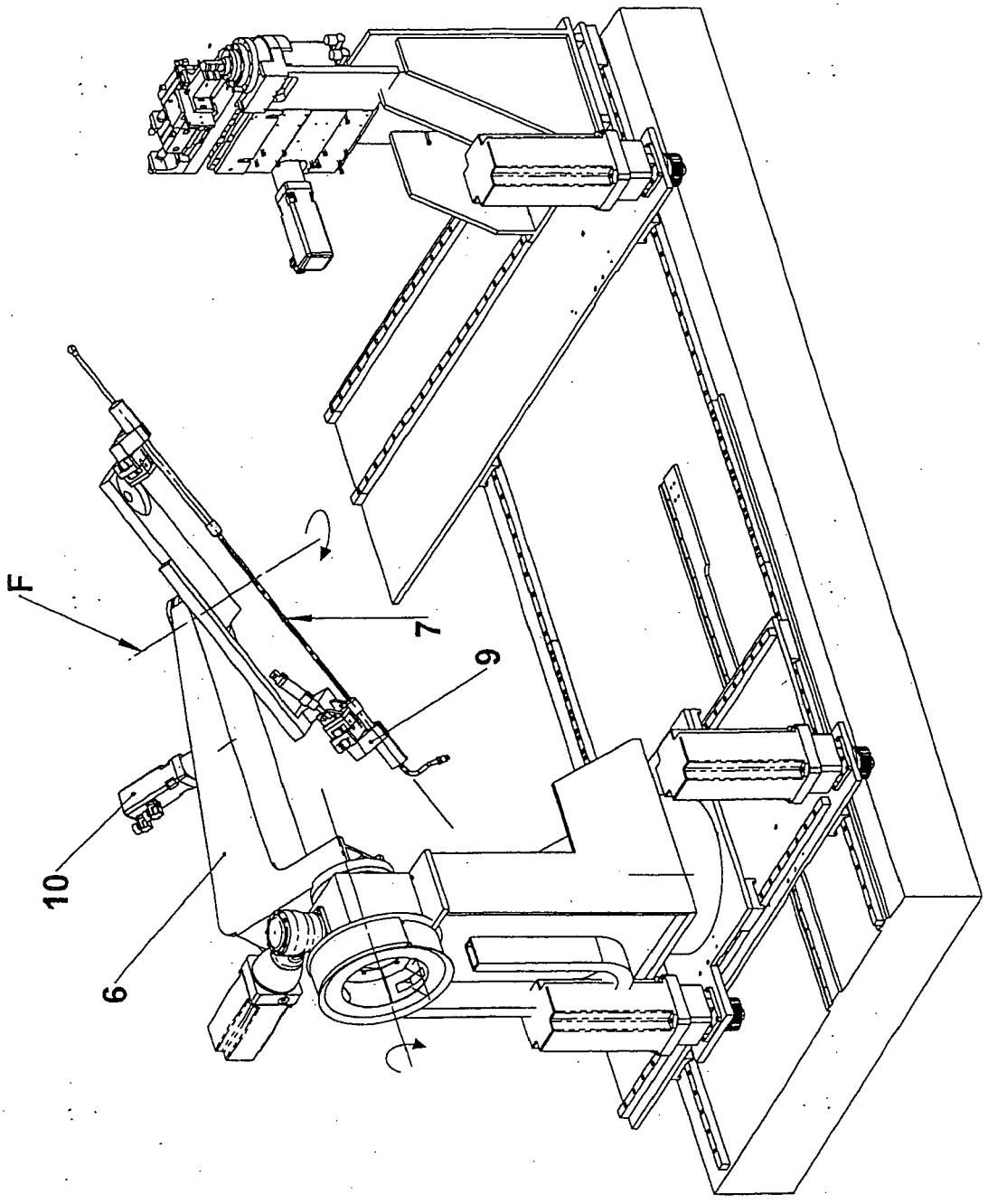

Fig.2

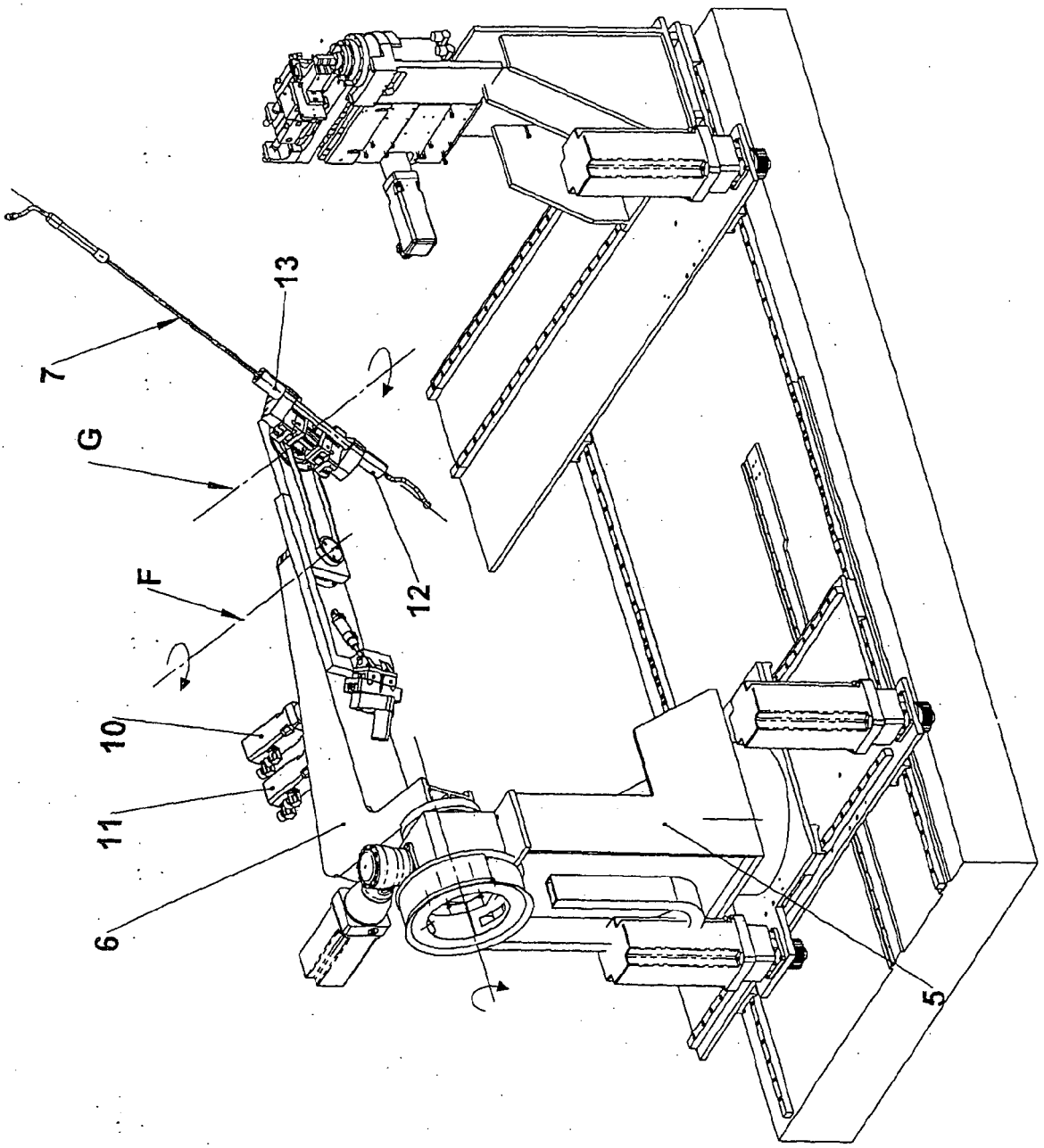

Fig.3

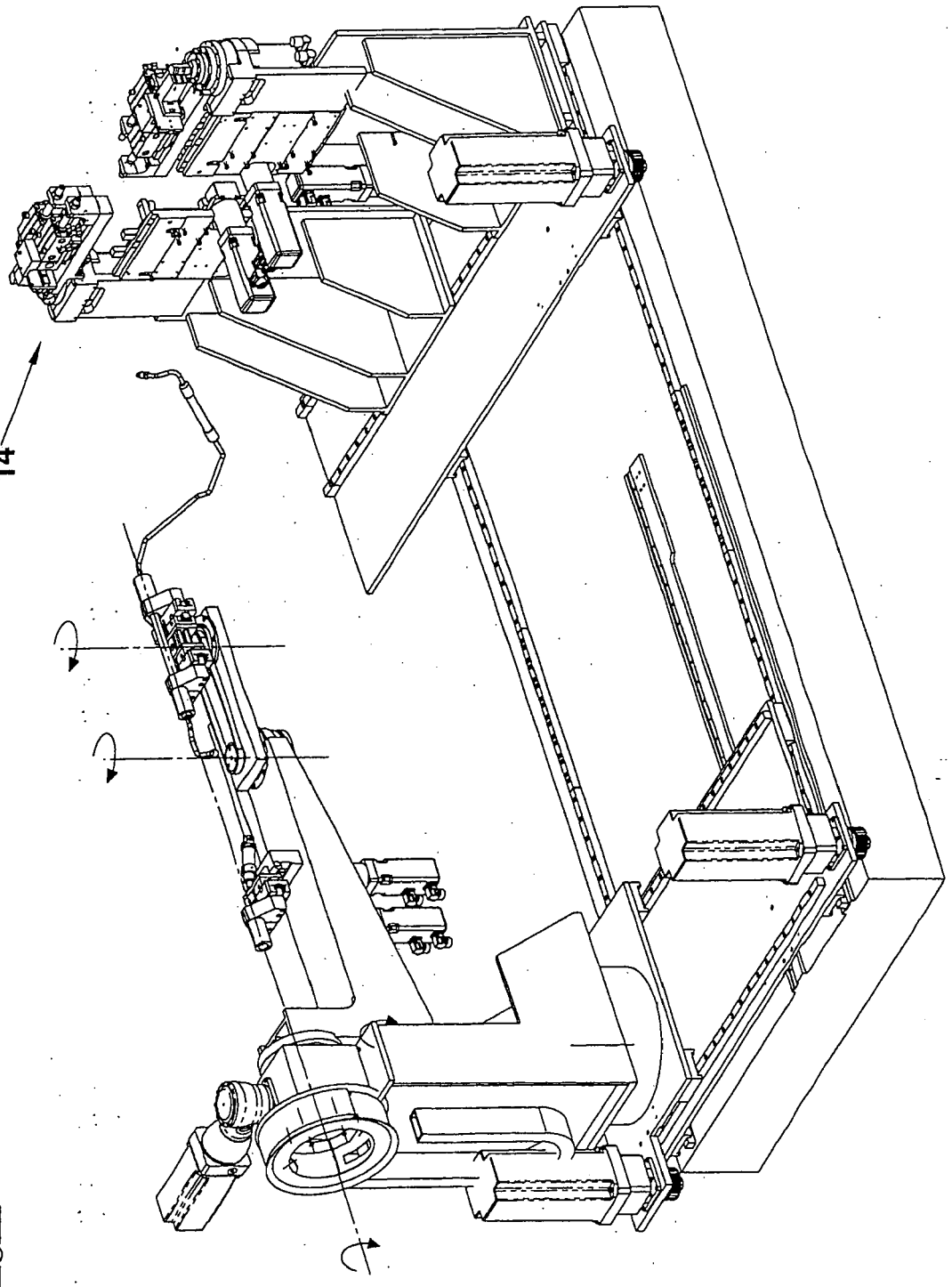

Fig.4

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EUROPEAN SEARCH REPORT

Application Number
EP 08 01 1762

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC) B21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 November 2008	Vinci, Vincenzo

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
O : non-written disclosure
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 01 1762

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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