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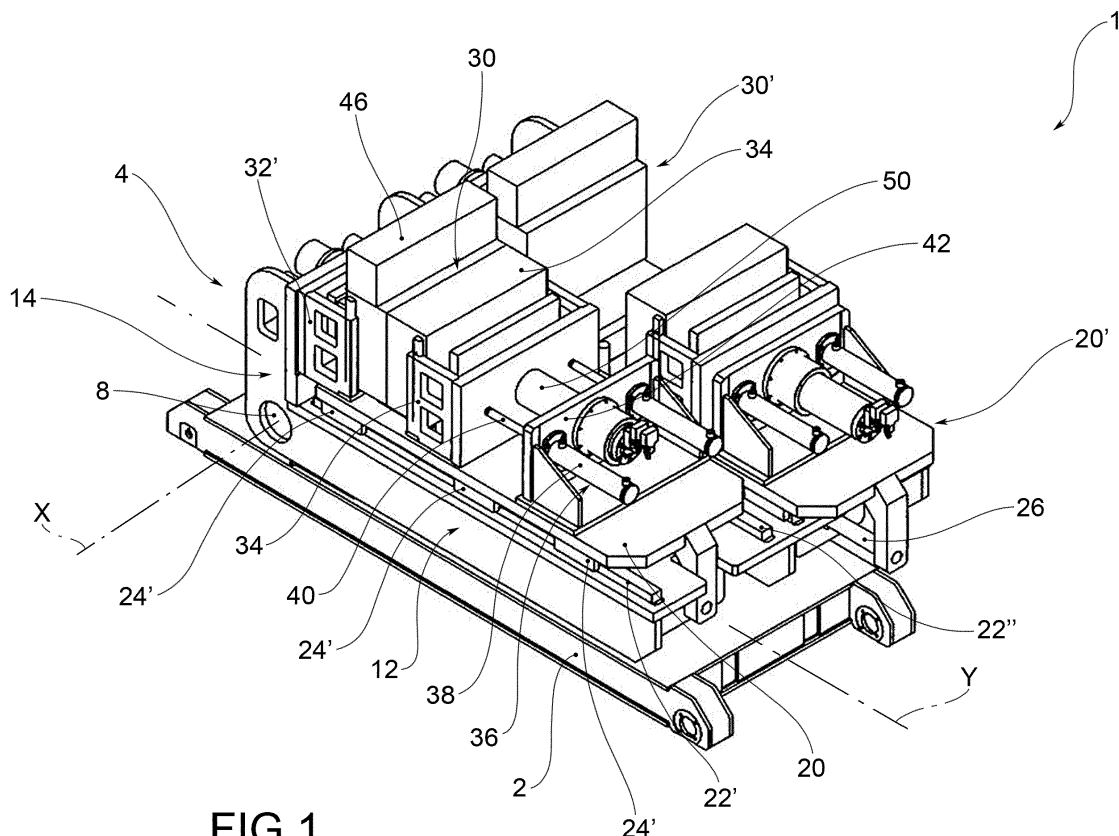
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(54) **DIE-CASTING MACHINE FOR ALUMINIUM CASTINGS AND GRAVITY CASTING METHOD**

(57) A die-casting machine (1) for a casting plant for the production of castings in aluminum or its alloys comprises a cradle (6), a fixed die-holder (32), a carriage (20) and a movable die-holder (34), facing the fixed die-holder (32). The method for realising a casting by gravity casting provides for making the casting of the molten material in

a well (46) of the of the die group (30), translating the carriage (20), gripping the casting carried by the movable die-holder (34) and translating the movable die-holder (34) further moving it away from the fixed die-holder (32), thus completely freeing the casting.

**FIG.1****EP 3 248 711 A1**

Description

[0001] The present invention relates to the field of plants for the production of aluminium castings using gravity casting; in particular, the object of the present invention is a die-casting machine for such plants.

[0002] As is known, such plants generally comprise a loading robot carrying a cup, which collects the molten aluminium intended to realise the casting.

[0003] The robot moves the cup close to a die-casting machine carrying one or more dies. The molten aluminium is poured by the robot into a well of the die mounted on the die-casting machine and then let to flow into the die, through the rotation that the machine imparts thereto.

[0004] The need to rotate the die has a great impact on the size of the machine and on the operating range, generating footprint and design drawbacks.

[0005] The object of the present invention is to implement a die-casting machine for a gravity die-casting plant that overcomes the above drawbacks.

[0006] Such an object is achieved by a die-casting machine according to claim 1. The dependent claims describe embodiment variations.

[0007] The features and the advantages of the die-casting machine according to the present invention will appear more clearly from the following description, made by way of an indicative and non-limiting example with reference to the following figures, in which:

- figure 1 shows a die-casting machine according to an embodiment of the present invention (two dies and two die sidewalls);
- figure 2 shows a side view of the machine in figure 1, in a horizontal configuration;
- figure 3 shows the machine in figure 2 in a vertical configuration;
- figure 4 shows a die-casting machine according to a further embodiment of the present invention (a single die and four sidewalls);
- figure 5 shows a side view of the machine in figure 4, in a horizontal configuration.

[0008] A gravity casting plant for the production of aluminium castings comprises a loading robot provided with a casting cup adapted to collect molten aluminium, at least one die-casting machine adapted to receive the aluminium from the cup moved by the robot and to realize the casting by gravity casting, and a gripping robot for gripping and moving away the the casting just realised.

[0009] According to a preferred embodiment (figure 1), the plant comprises the die-casting machine 1. According to this embodiment, machine 1 is of the type with two dies, wherein each die has two sidewalls, that is, consists of two parts in mutual movement, the coupling of which creates in the impression of the casting to be made.

[0010] In particular, machine 1 comprises a fixed base 2, intended to rest on a ground plane T.

[0011] Machine 1 further comprises a movable part 4

supported by base 2 and rotatable with respect to said base 2.

[0012] In particular, the movable part 4 comprises a cradle 6 hinged to base 2 through a hinge 8, which defines a transversal rotation axis X.

[0013] Machine 1 further comprises a cradle movement group 10, such as hydraulically or electrically actuated, for example consisting of a cylinder 11 - piston 13 assembly, operating between base 2 and cradle 6 of the movable part 4 to realise a rotation of cradle 6 around the rotation axis X.

[0014] Preferably, the cradle movement group 10 is suitable for imparting a rotation to the cradle of between 0° and 90°, extremes included.

[0015] Preferably, cradle 6, which for example has an "L" configuration, has a base 12 and a shoulder 14, connected to base 12. Preferably, in the connecting region between base 12 and shoulder 14 is arranged hinge 8.

[0016] For example, the movement group 10 engages base 2, to which cylinder 11 is connected, and base 12, to which piston 13 is connected.

[0017] The movable part 4 further comprises at least one carriage 20, supported by base 12, translatable on command along a longitudinal translation axis Y, perpendicular to the transversal rotation axis X.

[0018] In particular, carriage 20, for example in the shape of a plate, is slidably engaged with base 12 through a guide system comprising, for example, a pair of rails 22', 22" fixed to base 12, and corresponding slides 24' fixed to the carriage and slidably engaged with the respective rails 22', 22".

[0019] The movable part 4 further comprises a carriage movement group, for example hydraulically or electrically actuated, preferably of the cylinder - piston 26 type, connected mechanically to carriage 20 and actuatable to move said carriage 20 in translation with forward and backward movement.

[0020] Preferably, the carriage movement group is supported by base 12 of cradle 6 and arranged on a lower surface of base 12, opposite the upper surface on which carriage 20 rests.

[0021] In addition, the movable part 4 comprises a die group 30 comprising a fixed die-holder 32, intended to support a fixed die 32', a movable die-holder 34, intended to support a movable die 34', and a die movement group 36 for moving the movable die-holder 34.

[0022] The fixed die-holder 32 is fixed to cradle 6, and in particular to shoulder 14 of said cradle 6; the movable die-holder 34 is translatably supported by carriage 20 and arranged longitudinally facing the fixed die-holder 32.

[0023] The coupling of the movable die 32' with the fixed die 34' creates a compartment which is the imprint of the casting in production.

[0024] Preferably, the fixed die-holder 32 is arranged longitudinally close to the rotation axis X while the movable die-holder 34 is arranged opposite the rotation axis X with respect to the fixed die-holder 32, longitudinally facing the latter.

[0025] The die movement group 36 is supported by carriage 20 and operatively connected to the movable die-holder 34 to move it in translation along the translation axis Y.

[0026] Preferably, the die movement group 36, for example hydraulically or electrically actuated, comprises a cylinder 38 - piston 40 assembly, wherein cylinder 38 is fixed to an auxiliary plate 42 supported by carriage 20 and fixed to this, and piston 40 is engaged with the movable die-holder 34.

[0027] Preferably, the die movement group 36 further comprises a guide column 50 slidably engaged with the auxiliary plate 42 and with the movable die-holder 34 to effectively guide it in translation, keeping perpendicularity and parallelism in an optimal manner.

[0028] Preferably, the die movement group 36 comprises a pair of cylinder - piston assemblies, the respective cylinders 38 whereof are fixed to the auxiliary plate 42, transversely spaced and parallel, between which the guide column 50 is arranged.

[0029] Preferably, the die movement group and in particular the cylinder-piston assembly are arranged opposite the fixed die-holder 32 with respect to the movable die-holder 34.

[0030] According to a preferred embodiment, the die group 30 further comprises a well 46, for example attached to the fixed die 32.

[0031] In the embodiment shown in figures 1 to 3, the die-casting machine is of the type with two dies and two sidewalls per die, i.e. it is provided with two carriages 20, 20' transversely side by side (and relative carriage movement group and die group 30'), wherein each die group is provided with the fixed die-holder and the movable die-holder.

[0032] In a further embodiment (figures 4 and 5), the die-casting machine is of the type with one die only, i.e. provided with a single translating carriage, and four sidewalls, i.e. provided with a die group able to support a fixed die, a movable die longitudinally facing the fixed die and two sidewalls, transversely translatable, which participate in the formation of the imprint.

[0033] In the normal operation of the plant, the die-casting machine is in an initial configuration, corresponding to the horizontal configuration (figure 2) or to the vertical configuration (figure 3). In such initial configuration, the die group 30 is closed, i.e. such as to form the imprint for the casting; in other words, the fixed die 32', supported by the fixed die-holder 32, is coupled to the movable die 34', supported by the movable die-holder 34, and optionally to the sidewalls.

[0034] The loading robot carries the casting cup where the molten aluminium is close to well 46 and pours the molten aluminium in such a well.

[0035] According to an embodiment of the operating method of the machine, after pouring the molten metal into the well, the cradle movement group provides for the rotation of the cradle from the initial configuration (horizontal or vertical) to a final configuration (vertical or hor-

izontal, respectively).

[0036] According to a further embodiment of the operating method, as the molten metal is poured from the cup to the well, the cradle is rotated from the initial configuration to the final configuration.

[0037] After the pouring and after a predetermined time, the die-casting machine if in the vertical configuration is brought to the horizontal configuration and it is opened.

[0038] In order to carry out such opening, the carriage movement group operates on carriage 20, thus moving the movable die 34', carried by carriage 20, away from the fixed die 32', through translation along the longitudinal translation axis Y.

[0039] In this configuration, the casting is supported by the movable die 34' and separated from the fixed die 32'. the gripping robot grips the casting.

[0040] Thereafter, the die movement group acts on the movable die-holder 34, moving it away from the fixed die-holder 32, thus completely freeing the casting.

[0041] The casting, supported by the gripping robot, is moved away, while the die-casting machine is prepared for another casting.

[0042] In particular, the carriage movement group operates on carriage 20, performing a translation that brings it close to the fixed die-holder 32; thereafter, the die movement group operates on the movable die-holder 34 through a translation that couples the movable die 34' to the fixed die 32', thus forming the imprint, possibly together with the sidewalls.

[0043] According to the requirements, the cradle movement group operates on cradle 6, imposing a rotation about the rotation axis X which brings the cradle from the horizontal configuration to the vertical configuration.

[0044] According to a possible embodiment, the opening and moving away of the carriage take place while the machine is in the vertical configuration.

[0045] Innovatively, the die-casting machine according to the present invention overcomes the drawbacks mentioned with reference to the prior art.

[0046] In fact, advantageously, the longitudinal dimensions are particularly small.

[0047] In particular, the position of the imprint defined by the coupling of the movable die with the fixed die and possibly with the sidewalls is close to the shoulder of the cradle, so that when the machine is in the vertical configuration for filling with the cup, the imprint or the well are at a particularly low height H, easily reached by the loading robot.

[0048] This is due, in particular, to the fact that the die group comprises a fixed die-holder connected to the cradle. The fixed die-holder does not need, of course, a movement group, whereby the longitudinal distance between the fixed die and the rotation axis X is particularly small.

[0049] Moreover, also the dimensions of the cylinder-piston assembly of the die movement group are particularly small since placed on board of the translatable car-

riage, along with the movable die-holder of the die group.

[0050] This reduces the stroke of the cylinder-piston assembly, because the total displacement necessary to the movable die is partly carried out by the translatable carriage.

[0051] It is clear that a man skilled in the art may make changes to the machine described above in order to meet incidental needs, all falling within the scope of protection defined in the following claims.

Claims

1. Die-casting machine (1) for a casting plant for the production of castings in aluminium or its alloys, comprising:

- a cradle (6) rotatable on command with respect to a transverse rotation axis (X);
- a fixed die-holder (32) suitable to support a fixed die (32'), placed on board the cradle (6), fixed to the cradle (6) and disposed in proximity of the rotation axis (X);
- a carriage (20) disposed on board the cradle (6), on the side opposite the rotation axis (X) with respect to the fixed die-holder (32), translatable on command along a longitudinal translation axis (Y), orthogonal the rotation axis (X);
- a movable die-holder (34) suitable to support a movable die (34'), placed on board the carriage (20) and facing the fixed die-holder (32);
- a die movement group (36) for moving the movable die-holder old mobile (34), arranged on board the carriage (20).

2. Die-casting machine according to claim 2, comprising a cradle movement group (10), for example hydraulically or electrically actuated, in order to achieve the rotation of the cradle (6) around the rotation axis (X).

3. Die-casting machine according to claim 1 or 2, comprising a fixed base (2), intended to rest on a ground plane (T).

4. Die-casting machine according to claim 2 and 3, wherein the cradle movement group comprises a cylinder (12) - piston (14) assembly, operating between the base (2) and the cradle (6).

5. Die-casting machine according to any of the preceding claims, wherein the cradle (6) has an "L" configuration, having a base (12) and a shoulder (14), and wherein the fixed die-holder (32) is supported by the shoulder (14) of the cradle (6).

6. Die-casting machine according to any of the preceding claims, comprising a system of guides compris-

ing a pair of rails (22', 22'') fixed to a base (12) of the cradle (6) and corresponding slides (24') fixed to the carriage (20) and slidably engaged with the respective rails (22', 22'').

7. Die-casting machine according to any of the preceding claims, comprising a carriage movement group, for example hydraulically or electrically actuated, on board the cradle (6), connected mechanically to the carriage (20) and actuatable to move said carriage (20) in translation with forward and backward movement.

8. Die-casting machine according to any of the preceding claims, wherein the die movement group (36) is hydraulically or electrically actuated.

9. Die-casting machine according to any of the preceding claims, wherein which the die movement group (36) comprises a cylinder (38) - piston (40) assembly, wherein the cylinder (38) is fixed to an auxiliary plate (42) supported by the carriage (20) and fixed to this, and the piston (40) is engaged with the movable die-holder (34).

10. Die-casting machine according to any of the preceding claims, further comprising a guide column (50) for effectively guiding the movable die-holder (34) in translation.

11. Plant for casting aluminium or its alloys, comprising a loading robot provided with a casting cup for the collection of molten metal, at least one die-casting machine realised according to any of the preceding claims, and a gripping robot for gripping and the removing the casting just made.

12. Method for the realising a casting by gravity casting, comprising the steps of:

- providing a die-casting machine in an initial configuration wherein a die group (30), comprising a fixed die-holder (32) and a movable die-holder (34), is closed and realises an imprint for the casting;
- casting the molten material in a well (46) of the die group (30) and, simultaneously or subsequently, rotating a cradle (6) of the machine (1), which brings the die group (30), in a final configuration;
- translating, through a carriage movement group, a carriage (20) of the machine (1), supported by the cradle (6) and that supports the movable die-holder (34), to open the die group (30);
- gripping the casting carried by the movable die-holder (34);
- translating, through a die movement group, the

movable die-holder (34) further moving it away from the fixed die-holder (32), thus completely freeing the casting.

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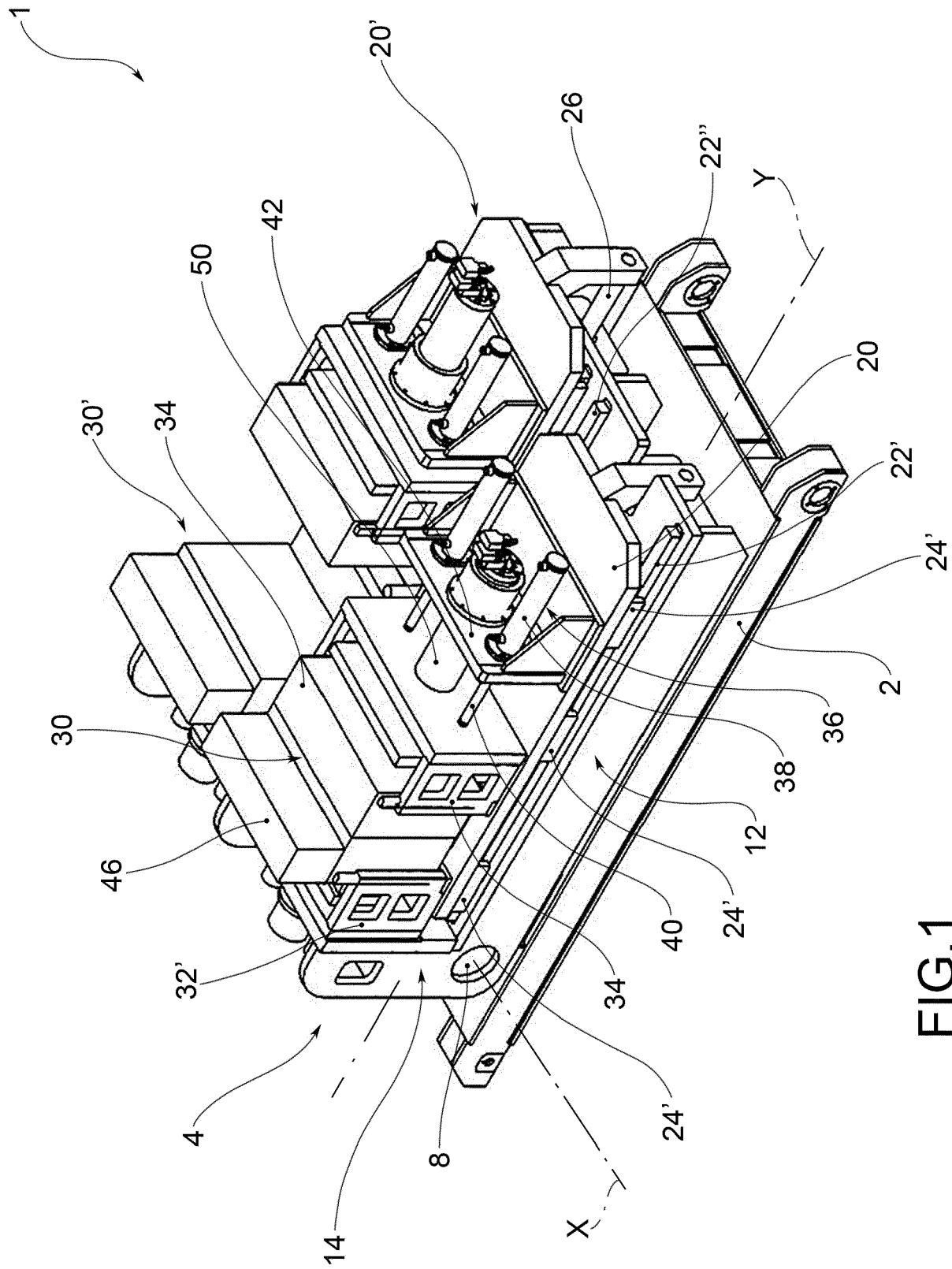
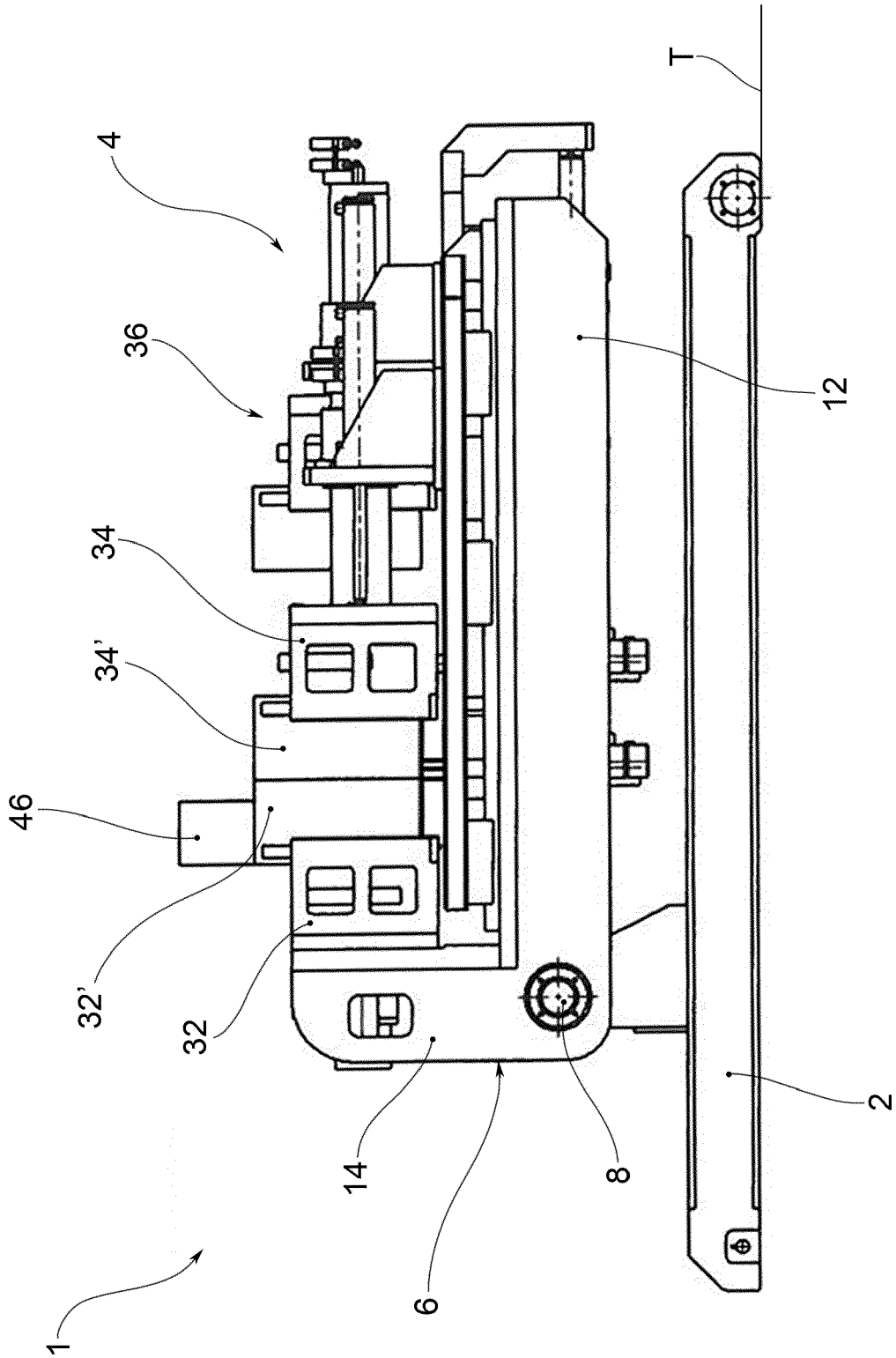
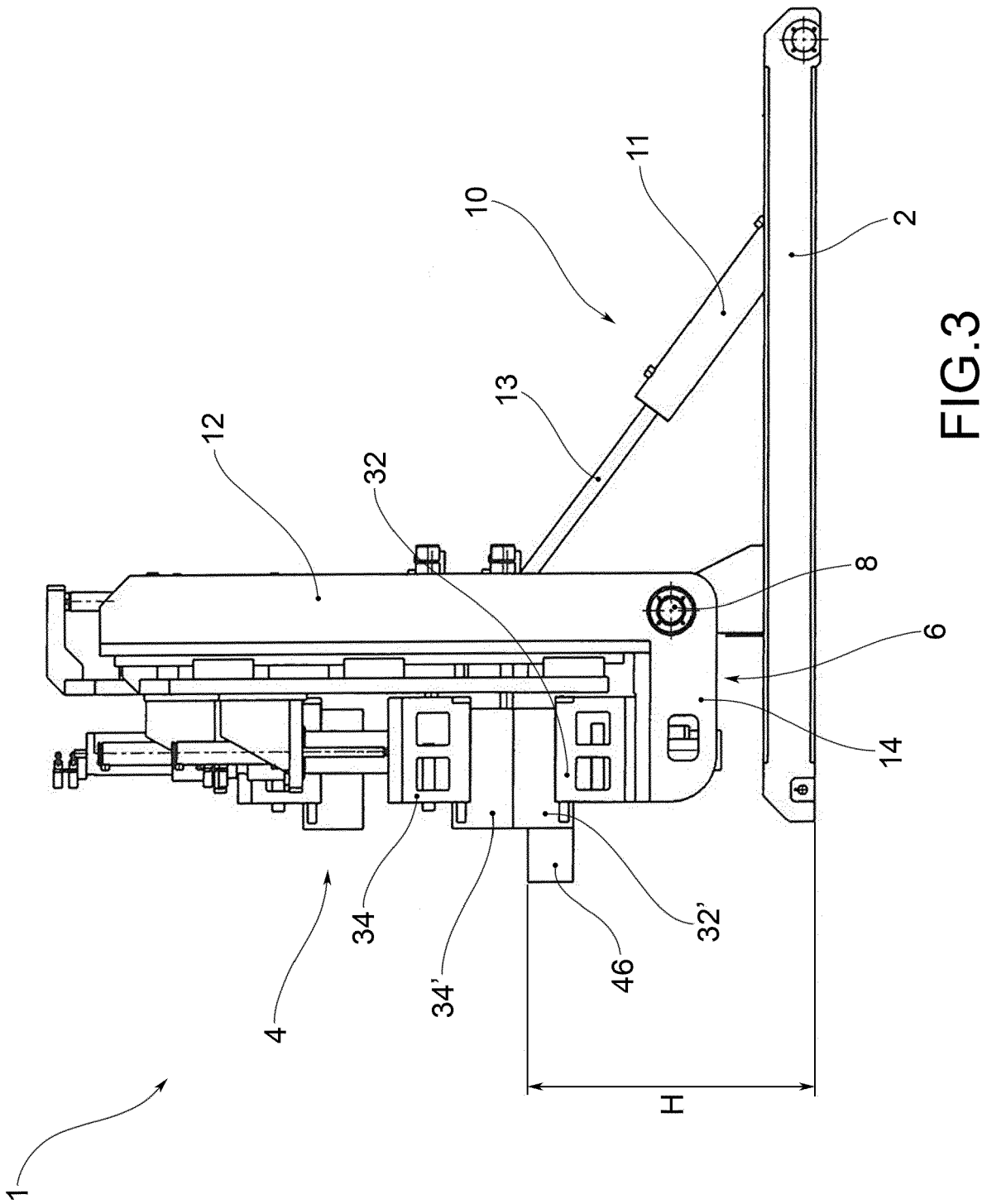


FIG.1





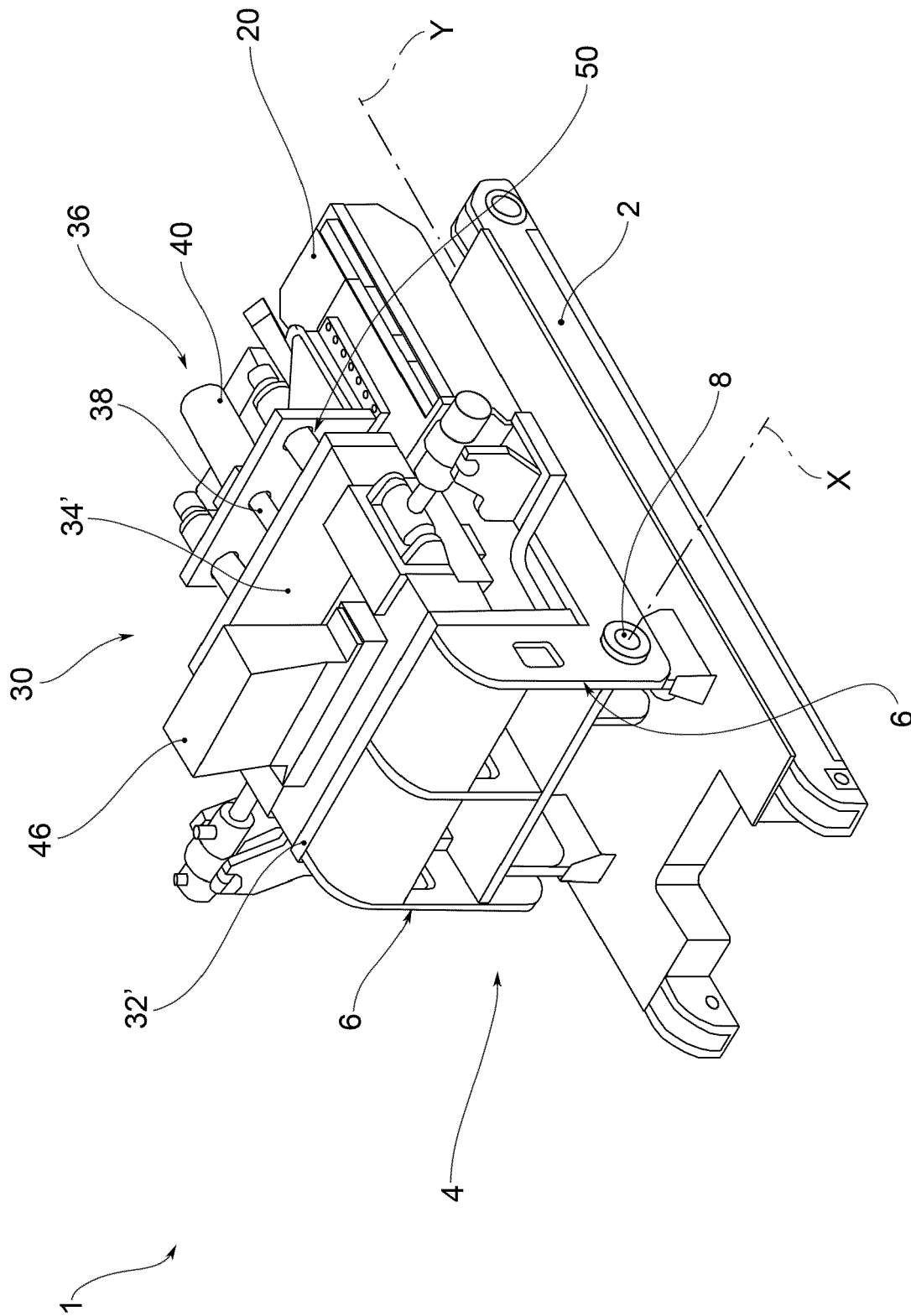


FIG. 4

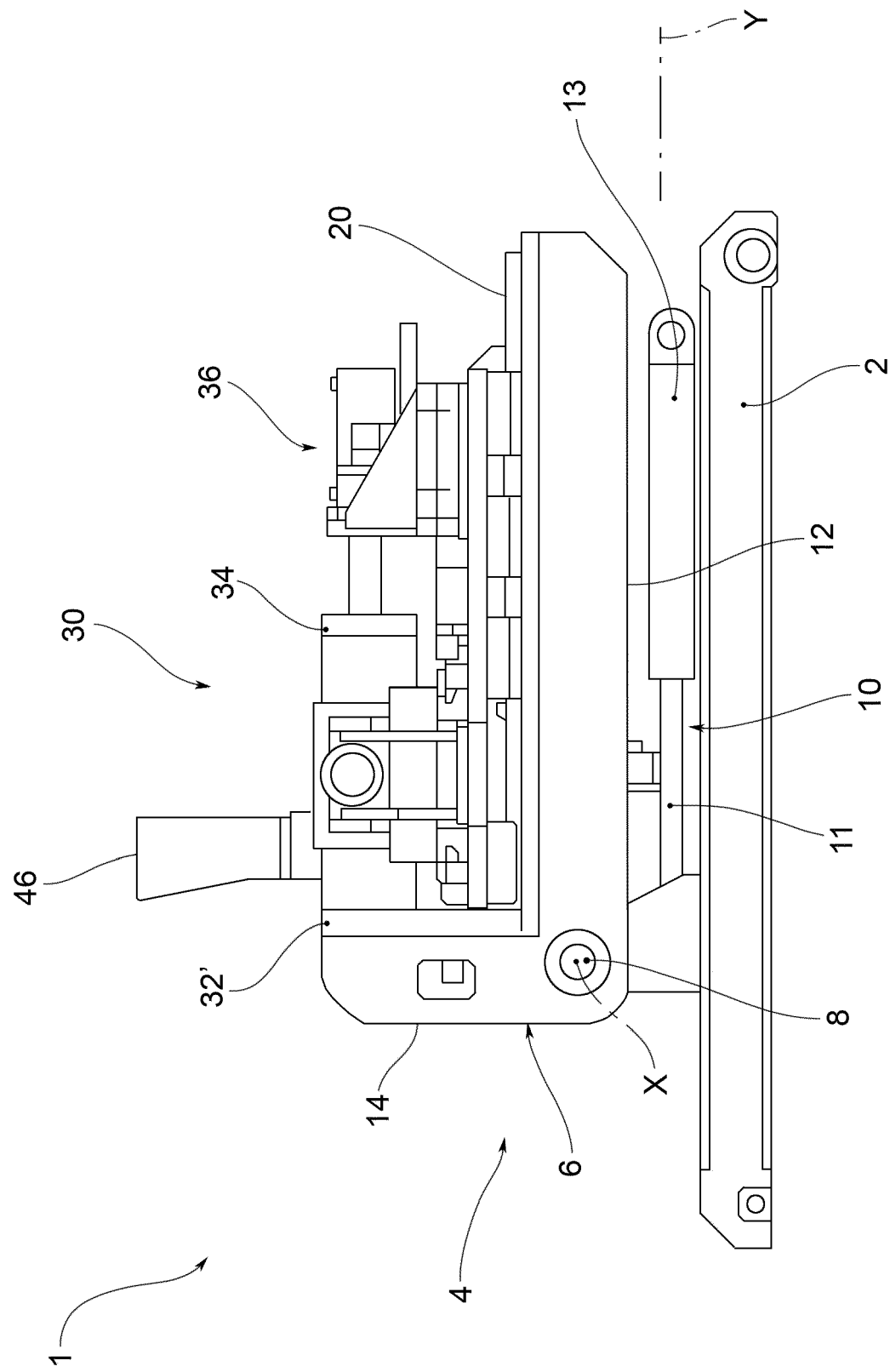


FIG.5



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Application Number
EP 17 17 2289

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