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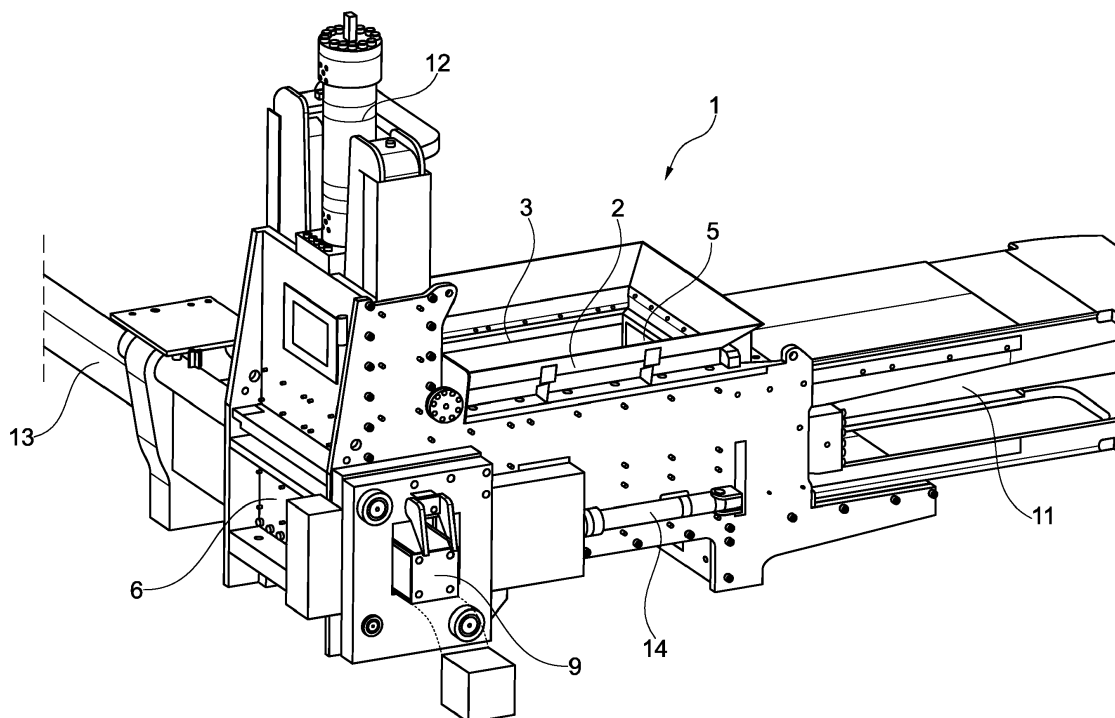
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**(54) Press for compacting materials**

(57) This application relates to a press (1) for compacting material (M) of metal scrap, metal waste or general waste. The press (1) comprises a compacting chamber (2) having at least one movable compaction surface (5, 7, 9) configured for compaction and a door arrangement (10) configured for selectively opening the compacting chamber (2) for removal of the compacted material (M); a hydraulic pressure actuation system (11, 12,

13) configured for acting upon said at least one movable compaction surfaces (5, 7, 9); and a door actuator (14) configured for acting upon said door arrangement (10) for opening and/or closing of the door arrangement (10). According to the invention, said door actuator (14) is an electric drive. A method for compacting material (M) is also disclosed.

**Fig. 1****EP 3 037 251 A1**

## Description

### FIELD OF THE INVENTION

**[0001]** The present invention relates to a press for compacting material of metal scrap, metal waste, general waste or other material, which does not necessarily have to consist of or even comprise metal, in which the material is formed into bales by means of compaction. The present invention further relates to a method of compacting material of metal scrap, metal waste or general waste or other material, which does not necessarily have to consist of or even comprise metal.

### BACKGROUND

**[0002]** Such presses are for example known from METSO Recycling, for example the METSO ET-APRESS®, in which the material can be formed into bales. A similar press is described, for example, in DE 102 58 660 A1 and in EP 1 056 589 B1. Further presses are known, for example cover presses where the compaction takes place predominantly along only two directions more or less in a plane whilst the material to be compacted is not significantly compacted along the third, perpendicular direction. Along one or more directions, the metal scrap or waste is compacted in a compacting chamber and, after the compaction has been completed, discharged from the compacting chamber by means of a discharging arrangement, usually comprising a door arrangement for selectively opening, and closing the compacting chamber.

**[0003]** Common for all known presses is the use of hydraulic cylinders for driving press covers and compaction surfaces, as well as any other moving part within these presses.

**[0004]** In principle, these presses have proven successful. However, there is still room for improvement to increase the efficiency of such presses.

**[0005]** In particular, hydraulic pumps used in the known presses are optimized for supplying hydraulic fluid at a high flow rate to the main hydraulic cylinders which are used for compacting the material. These main cylinders are massive and require very high flow rates for compacting the material and to minimize the cycle times. Hence, usually multiple, in particular double, pumps are used for providing the flow rate of the hydraulic fluid.

**[0006]** The very high flow rates of hydraulic fluid provided by the hydraulic pumps result in difficulties when auxiliary cylinders are to be actuated. It is particularly difficult to reliably control a relatively small auxiliary cylinder for actuating a door arrangement of the press, in particular the speed of actuation of these cylinders. Such auxiliary cylinders are typically used for opening or closing a door, e. g. of a discharging arrangement.

**[0007]** So far, this difficulty in controlling the actuation of auxiliary cylinders has resulted in deactivating at least one stage of the multiple pumps. However, this also

means that the multiple pumps cannot be used for providing hydraulic fluid to the main cylinders during that period so that the overall efficiency of the press is sub-optimal.

**[0008]** Further, common door arrangements are generally problematic when the door is obstructed by material which is to be compacted or has been compacted. In this case, actuating the auxiliary cylinder usually worsens the obstruction of the door which usually requires a shut off of the whole press.

### SUMMARY

**[0009]** An object of the invention is to increase the overall efficiency of presses of the generic type described in the introduction with optimally combined sequences of functions, both the coordinated operation of the different steps and the optimization of the kinematic sequence of the functional elements and the driving forces. In particular, an object of the present invention is to increase the overall efficiency of presses of the generic type described as the field of the invention with respect to an actuation of the movable parts of the press, in particular the compacting surface or surfaces of the press and a door arrangement.

**[0010]** According to a first aspect of the invention, these and other objects are achieved, in full or at least in part, by a press for compacting material of metal scrap, metal waste, general waste or other material, which does not necessarily have to consist of or even comprise metal, which press comprises a compacting chamber having at least one movable compaction surface configured for compaction of the material, and a door arrangement configured for selectively opening the compacting chamber for removal of the compacted material; a hydraulic pressure actuation system configured for acting upon said at least one movable compaction surface; and a door actuator configured for acting upon said door arrangement for opening and closing of the door arrangement. According to this first aspect, said door actuator is an electric drive.

**[0011]** By providing said door actuator as an electric drive, many advantages may be provided, e.g. the power consumption may be reduced, a simplified design of the pressure actuation system and the door actuator may be enabled, the time for reacting to any malfunctions of the overall system may be shortened, the kinematic sequence of the functional elements and the driving forces to be set up may be optimized to decrease a cycle time of the material compaction to increase the availability and efficiency of the press and/or to decrease the costs by reducing flow, pump and valve sizes. A more productive machine which can be used with lower operation costs is thereby provided.

**[0012]** In particular, by using an electric drive as the door actuator, it is possible that the hydraulic pump or multiple hydraulic pumps for the main hydraulic cylinders may continue to run at their optimized power providing

the high fluid flow rate required by the main hydraulic cylinders, while the door actuator is operated in a reliable and controlled way. Hence, separate circuits for controlling and actuating the door arrangement, on the one hand, and the compaction surface or compaction surfaces, on the other hand, are provided which facilitate the overall configuration and allows the operation of the press to be more efficient.

**[0013]** According to a preferred embodiment of the invention, the press comprises an obstruction sensor which is configured for sensing if opening and/or closing of the door arrangement is obstructed. Generally, an obstruction can generate a significant increase in the force required for opening or closing the door. The obstruction can also be a partial obstruction so that opening or closing of the door is partially possible and partially requires an unusually high amount of force. Such a sensor may be provided as part of the electric drive where it is detected whether the electric drive is successful in actuating the door arrangement or not. For example, the electric current and/or voltage consumed by the electric drive can be monitored for deriving information as to its operating state. If the electric drive and, hence, the door arrangement is obstructed, for example by residual of the compacted material, an operator can be alerted by generally known means such as a warning lamp, warning horn or other means, and the operation of the press can be paused.

**[0014]** In the press according to this preferred embodiment, any obstruction of the door arrangement can be quickly sensed and be reported to an operator. Thus, it can be avoided that the obstruction is aggravated by applying a high force to the door arrangement which could result in more difficulties when removing of the obstruction. Hence, the press can both more efficiently and more reliably and securely be operated.

**[0015]** Using an electric drive also generally allows for much easier and faster reacting to an obstruction of the door arrangement because the response of an electric drive is significantly faster and easier to obtain than a response from a hydraulic system. Even if a detecting time for detecting an obstruction of the door arrangement would not be shorter when the electric drive is used, at least the reaction time, i. e. the period required for shutting down a respective hydraulic valve, is longer for a hydraulic valve than the reaction time of an electric system. This results in the additional advantage of this preferred embodiment that an obstruction of the door arrangement can be detected and handled within a shorter period of time. Accordingly, an obstruction of the door can more easily be handled than when a hydraulic device is used.

**[0016]** According to an embodiment of the invention, said compacting chamber has at least two movable compaction surfaces.

**[0017]** According to a further embodiment of the invention, said compacting chamber has at least three movable compaction surfaces.

**[0018]** Providing multiple compaction surfaces enables a higher degree of compaction if compared to presses with fewer compaction surfaces. Multiple compaction surfaces can, be provided in an orthogonal relationship to each other. However, this is only optional and the compaction surfaces can also be arranged with respect to each other at other angles.

**[0019]** According to a second aspect of the invention, the above and other objects are also achieved, in full or at least in part, by a method for compacting material of metal scrap, metal waste, general waste or other material, which does not necessarily have to consist of or even comprise metal. According to this second aspect said method comprises the following steps:

a) charging material to be compacted into a compacting chamber in a press;

b) actuating a first movable compaction surface of said compacting chamber by a hydraulic first pressure actuator to move said first movable compaction surface to compact said material against a first opposite surface within said compacting chamber; and

c) actuating a door arrangement of said press by a door actuator to open said door arrangement, thereby enabling discharging of said material, wherein said door actuator is an electric drive.

**[0020]** In one embodiment of the method of compacting material, said method further comprises actuating a second movable compaction surface of said compacting chamber by a second pressure actuator to move said second movable compaction surface to compact said material against said first opposite surface or a second opposite surface within said compacting chamber.

**[0021]** In one embodiment of the method of compacting material, said method further comprises actuating a third movable compaction surface of said compacting chamber by a third pressure actuator to move said third movable compaction surface to compact said material to be compacted against said first opposite surface, said second opposite surface, or a third opposite surface within said compacting chamber.

**[0022]** Other objectives, features and advantages of the present invention will appear from the following detailed disclosure, from the attached claims, as well as from the drawings. It is noted that the invention relates to all possible combinations of the embodiments above.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0023]** The invention will be described in more detail with reference to the appended schematic drawings, which show an example of a presently preferred embodiment of the invention.

Fig. 1 is a perspective view of a press for compacting

material according to one embodiment of the present invention.

Fig. 2 is a part sectional view showing a first compaction step within the press for compacting material of Fig. 1.

Fig. 3 is a part sectional view showing a second compaction step within the press for compacting material of Fig. 1.

Fig. 4 is a part sectional view showing a third compaction step within the press for compacting material of Fig. 1.

Fig. 5 is a perspective view showing said compacted material being discharged out of the press for compacting material of Fig. 1.

## DEFINITIONS

**[0024]** Generally, all terms used in the claims are to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the [element, device, component, means, step, etc.]" are to be interpreted openly as referring to at least one instance of said element, device, component, means, step, etc., unless explicitly stated otherwise. The steps of any method disclosed herein do not have to be performed in the exact order disclosed, unless explicitly stated.

**[0025]** As used herein, the terms "comprising", "including" or "having" and variations of that term are not intended to exclude other additives, components, integers or steps.

**[0026]** As used herein, the term "movable compaction surface" means any surface of the press which can move towards the material for compaction thereof. Generally, "compaction" is to be understood as equivalent to "compression".

**[0027]** The surface movement may be a pivotable movement, such as a swivelling or pivotable movement of a press cover; or a linear movement of a compaction surface within a compacting chamber. Thus, the term "movable compaction surface" means any of these surfaces of a press cover and a movable wall surface within a compacting chamber.

**[0028]** As used herein, the term "opposite surface" means any surface towards which the movable compaction surface moves and against which the movable compaction surface compacts the material to be compacted.

**[0029]** As used herein, the term "door arrangement" means any arrangement which is suitable for opening and closing an opening of a compacting chamber for discharging of compacted material out of the compacting chamber. It may particularly be a door arrangement for opening and closing to enable discharging of the compacted material by pushing the compacted material out

through the door arrangement.

**[0030]** As used herein, the term "press for compacting material of metal scrap or waste" means a press which is objectively suitable for compacting material of metal scrap, metal waste, general waste or other material, which does not necessarily have to consist of or even comprise metal. The term "method for compacting material of metal scrap or waste" as used herein means a method where material of metal scrap, metal waste, general waste or other material, which does not necessarily have to consist of or even comprise metal, is compacted by the method.

## DETAILED DESCRIPTION

**[0031]** The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which a currently preferred embodiment of the invention is shown. The present invention may, however, be embodied in many different forms and should not be construed as limited to the embodiment set forth herein; rather, this embodiment is provided for thoroughness and completeness, and to fully convey the scope of the invention to the skilled addressee. Like reference characters refer to like elements throughout.

**[0032]** The Figures show the embodiment of a press 1 for compacting material. The press 1 has a compacting chamber 2 (seen in more detail in Figs. 2, 3 and 4) with an inlet opening 3 through which the material M to be compacted is charged into the compacting chamber 2. The compacting chamber 2 has a bottom surface 4 (as seen in Figs. 2, 3 and 4) onto which the material M to be compacted is placed when charged into the compacting chamber 2; a first movable compaction surface 5 with a first pressure actuator 11, which is provided as a hydraulic cylinder 11; a first opposite surface 6, which is provided as a wall surface in the compacting chamber 2 opposite to said first movable compaction surface 5 and towards which said first movable compaction surface 5 pushes and compacts the material M when compacting the material M; a second movable compaction surface 7 with a second pressure actuator 12, which is provided as a hydraulic cylinder 12; a second opposite surface 8, which is provided as a wall surface in the compacting chamber 2 opposite to said second movable compaction surface 7, which in this embodiment is the same as the bottom surface 4, and towards which said second movable compaction surface 7 pushes and compacts the material M when compacting; and a third movable compaction surface 9 with a third pressure actuator 13, which is provided as a hydraulic cylinder 13; a third opposite surface, which is provided as a wall surface in the compacting chamber 2 opposite to said third movable compaction surface 9, which in this embodiment is provided as a closed door arrangement 10 in the compacting chamber 2 and towards which said third movable compaction surface 9 pushes and compacts the material M when compacting.

**[0033]** Said door arrangement 10 has a door actuator

14, which is provided as an electric drive. Examples of an electric drive may be a ball screw drive with an electric motor and/or an integrated servo hydraulic driven cylinder. Said door arrangement 10 is arranged to be opened and closed by the door actuator 14.

**[0034]** A rack and pinion drive with an electric motor is preferred. It has proven to be particularly well suited so as to combine a transmission of the forces necessary to hold the door shut against compaction forces, with adequate speed in opening and closing the door and sufficient robustness upon obstruction of the door arrangement by scrap, in particular metal scrap.

**[0035]** In the rack and pinion drive, the rack is preferably mounted to the door and the pinion is on the shaft of the electric motor.

**[0036]** Preferably, the pinion is a helical gear wheel which means that the edges of its teeth are not parallel to the axis of rotation of the pinion, but inclined relative to this axis of rotation. More preferably, the angle of inclination is a value between 15° and 20°. Since the gear is curved, this inclination will result in the tooth shape being the segment of a helix.

**[0037]** It is also preferable, either as a measure separate from or in combination with the helical pinion, that the electric drive includes a gear between the electric motor and the pinion which is so arranged that the longitudinal axis of the electric motor and the axis of rotation of the pinion are at a substantially right angle to one another. This permits to orient the longitudinal axis of the motor for it to be substantially parallel to the rack.

**[0038]** When the material M has been compacted by all three movable compaction surfaces 5, 7 and 9, said door arrangement 10 is opened by said door actuator 14. Said third movable compaction surface 9 then pushes the compacted material M out of the compacting chamber 2 by actuation of the said third pressure actuator 13. Said third movable compaction surface 9 is thereafter arranged to withdraw back into the compacting chamber 2 and the door arrangement 10 is closed again by said door actuator 14.

**[0039]** During compaction by any of the three different movable compaction surfaces 5, 7, and 9, each surface moves from one first position to a second position, wherein the distances between the movable compaction surface 5, 7 and 9 and the corresponding opposite surfaces 6, 8 respectively are larger when the movable compaction surfaces 5, 7, and 9 are in the first position than when the movable compaction surfaces 5, 7 and 9 are in the second position. This also applies to a movable compaction surface when any of the movable compaction surfaces is arranged for a pivotable movement in correlation to the respective opposite surface thereof.

**[0040]** The second position is not necessarily fixed. The second position can be determined by a predefined position relative to the first position or to the respective opposite surface. Alternatively or additionally, the second position can be determined by a predefined resistance, force or pressure, against which the respective movable

surface presses. In this latter case, depending on the material M to be compacted, the second position can individually vary for one or more of the movable surfaces.

**[0041]** In the above-disclosed embodiment the pressure actuators 11, 12 and 13 are all hydraulic actuators, while the door actuator 14 is an electric drive, which is individually controlled separate from the hydraulic pressure actuation system. In other words, the means for actuating the compaction surfaces, on the one hand, which must apply huge forces to the material M and, at the required short cycle times, require very high fluid flow rates of hydraulic fluid, and the means for actuating the door arrangement, on the other hand, are de-coupled. This allows for selectively and independently actuating the compaction surfaces and the door arrangement, each at an optimal environment, in particular forces and speeds.

**[0042]** Cycles of material handling are performed during the method of compacting material. When starting a cycle, all three movable compaction surfaces are placed in a respective first position withdrawn from corresponding opposite surfaces. When said first movable compaction surface is in its first position, the compacting chamber 2 can be reached via the inlet opening 3. Thus, material to be compacted may be charged into the compacting chamber 2 via the inlet opening 3. The material M is placed on the bottom surface 4.

**[0043]** After a desired amount of material M has been charged into the press 1, the first movable compaction surface 5 of said compacting chamber 2 is actuated to move from its first position to its second position, and, when moving the first movable surface 5, the material M is moved and compacted against the first opposite surface 6 of the compacting chamber 2.

**[0044]** After the first movable compaction surface 5 has reached its second position, the second movable compaction surface 7 of said compacting chamber 3 is actuated to move from its first position to its second position, and when moving the second movable surface 7 the material M is moved and compacted against the second opposite surface 8 of the compacting chamber 2, which in the shown embodiment is the same as the bottom surface 4.

**[0045]** After the second movable compaction surface 7 has reached its second position, the third movable compaction surface 9 of said compacting chamber 2 is actuated to move from its first position to its second position, and, when moving the third movable surface 9, the material M is moved and compacted against the third opposite surface 10, which in this embodiment is the door arrangement 10.

**[0046]** After the third movable compaction surface 9 has reached its second position, the door arrangement 10 of the compacting chamber is actuated to be opened, and the second movable compaction surface 7 is actuated to withdraw from its second position back to its first position.

**[0047]** After the door arrangement 10 is completely

opened, said third movable compaction surface 9 is actuated to move from its second position to a third position thereof to move and, at least partially, discharge the compacted material out of the press 1.

**[0048]** After completion of discharging the compacted material M from the press 1, the third movable compaction surface 9 is actuated to withdraw from its third position and back to its first position, and the first pressure actuator 11 actuates the first movable compaction surface 5 to withdraw from its second position back to its first position. The first movable compaction surface 5 is withdrawn from its second to its first position either before or during the withdrawal of the third movable compaction surface 9 from its third back to its first position.

**[0049]** After the third movable compaction surface 9 has passed the door arrangement 10 during withdrawal into the press 1, the door actuator 14 is actuated to close the door arrangement 10.

**[0050]** Once all movable compaction surfaces 5, 7 and 9 are back in their respective first positions, a new cycle with charging of material to be compacted into the press 1 may start.

**[0051]** Although a specific order actuating the first, second and third movable compaction surfaces in connection with this embodiment has been described, this order can be changed, depending on the embodiment of the invention. For instance, if the cover is used as a compaction surface, the order of actuating the first, second and third movable compaction surfaces will be different.

**[0052]** The skilled person realises that a number of modifications of the embodiments described herein are possible without departing from the scope of the invention, which is defined in the appended claims. In particular, the relative position and orientation of surfaces and arrangements as well as the order of method steps can be modified for the above described embodiment and for other embodiments.

## Claims

1. A press (1) for compacting material (M) of metal scrap, metal waste or general waste comprising a compacting chamber (2) having at least one movable compaction surface (5, 7, 9) configured for compaction of the material (M), and a door arrangement (10) configured for selectively opening the compacting chamber (2) for removal of the compacted material (M); a hydraulic pressure actuation system (11, 12, 13) configured for acting upon said at least one movable compaction surface (5, 7, 9); and a door actuator (14) configured for acting upon said door arrangement (10) for opening and closing of the door arrangement (10),  
**characterised in that**  
said door actuator (14) is an electric drive.

2. The press (1) for compacting material (M) according to claim 1, wherein the electric drive comprises a rack and pinion drive and an electric motor.
3. The press (1) for compacting material (M) according to claim 2, wherein the rack is mounted to the door and the pinion is on the shaft of the electric motor.
4. The press (1) for compacting material (M) according to any of the preceding claims, further comprising an obstruction sensor configured for sensing if opening and/or closing of the door arrangement (10) is obstructed.
5. The press (1) for compacting material (M) according to any of the preceding claims, wherein said compacting chamber (2) has at least two movable compaction surfaces (5, 7, 9).
6. The press (1) for compacting material (M) according to any of the preceding claims, wherein said compacting chamber (2) has at least three movable compaction surfaces (5, 7, 9).
7. A method for compacting material (M) of metal scrap, metal waste or general waste,  
**characterised in that** said method comprises the following steps:
  - a) charging material (M) to be compacted into a compacting chamber (2) of a press (1);
  - b) actuating a first movable compaction surface (5) of said compacting chamber (2) by a hydraulic first pressure actuator (11) to move said first movable compaction surface (5) to compact said material (M) against a first opposite surface (6) within said compacting chamber (2),
  - c) actuating a door arrangement (10) of said press (1) by a door actuator (14) to open said door arrangement (10), thereby enabling discharging of said material (M), wherein said door actuator (14) is an electric drive.
8. The method for compacting material (M) according to claim 7, wherein the step of actuating the door arrangement comprises the transmission of forces from an electric motor to a rack and pinion drive.
9. The method for compacting material (M) according to claim 8, wherein the rack is mounted to the door and the pinion is on the shaft of the electric motor.
10. The method for compacting material (M) according to any of claims 7 to 9, further comprising a step of detecting whether an actuation of the door arrangement (10) is obstructed.
11. The method for compacting material (M) according

to any of claims 7 or claim 10, said method further comprising actuating a second movable compaction surface (7) of said compacting chamber (2) by a second pressure actuator (12) to move said second movable compaction surface (7) to compact said material (M) against said first opposite surface (6) or a second opposite surface (8) within said compacting chamber. 5

12. The method for compacting material (M) according to any of claims 7 to 11, said method further comprising actuating a third movable compaction surface (9) of said compacting chamber (2) by a third pressure actuator (13) to move said third movable compaction surface (9) to compact said material (M) against said first opposite surface (6), said second opposite surface (8) or a third opposite surface within said compacting chamber (2). 10 15

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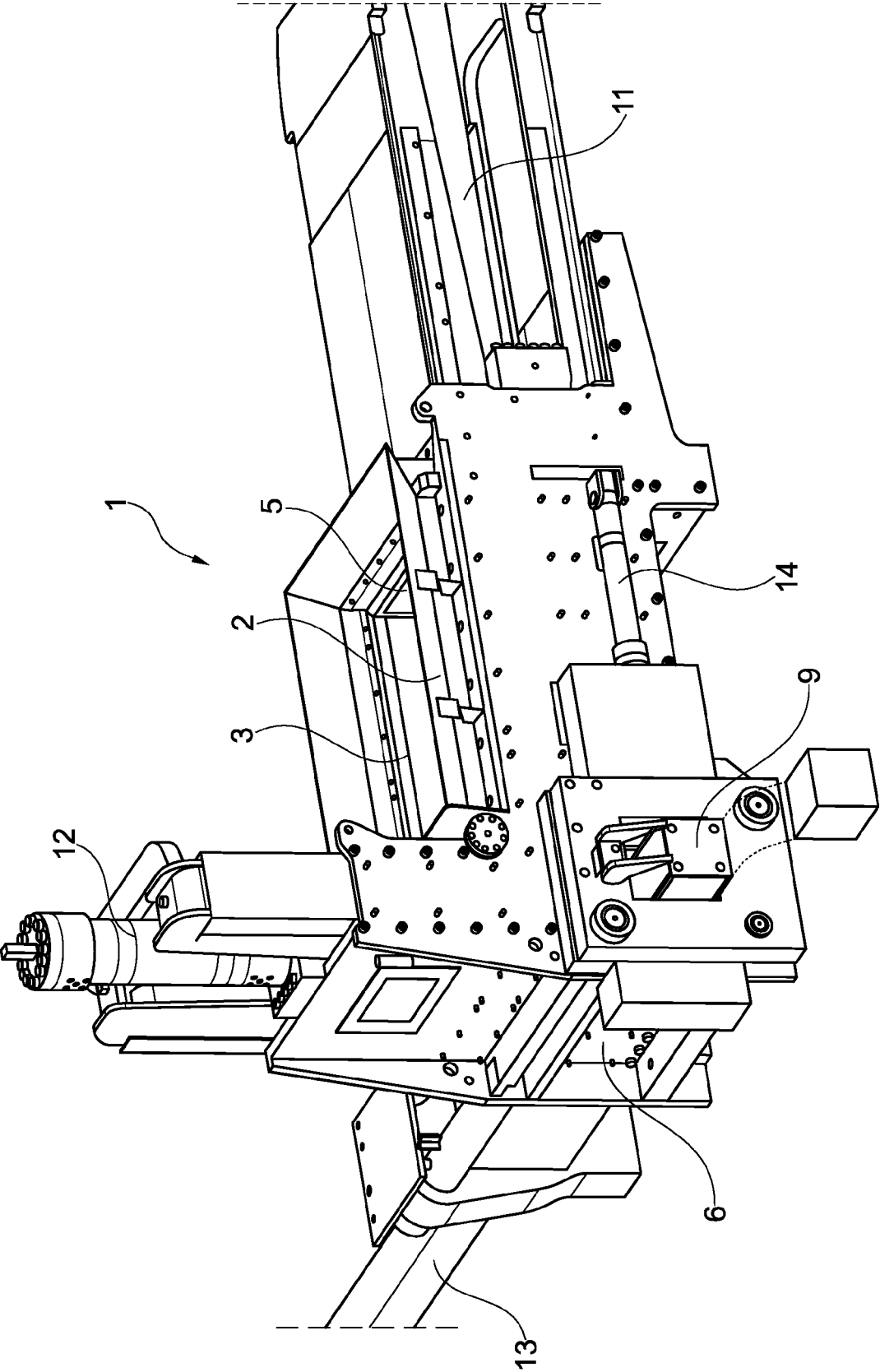


Fig. 1



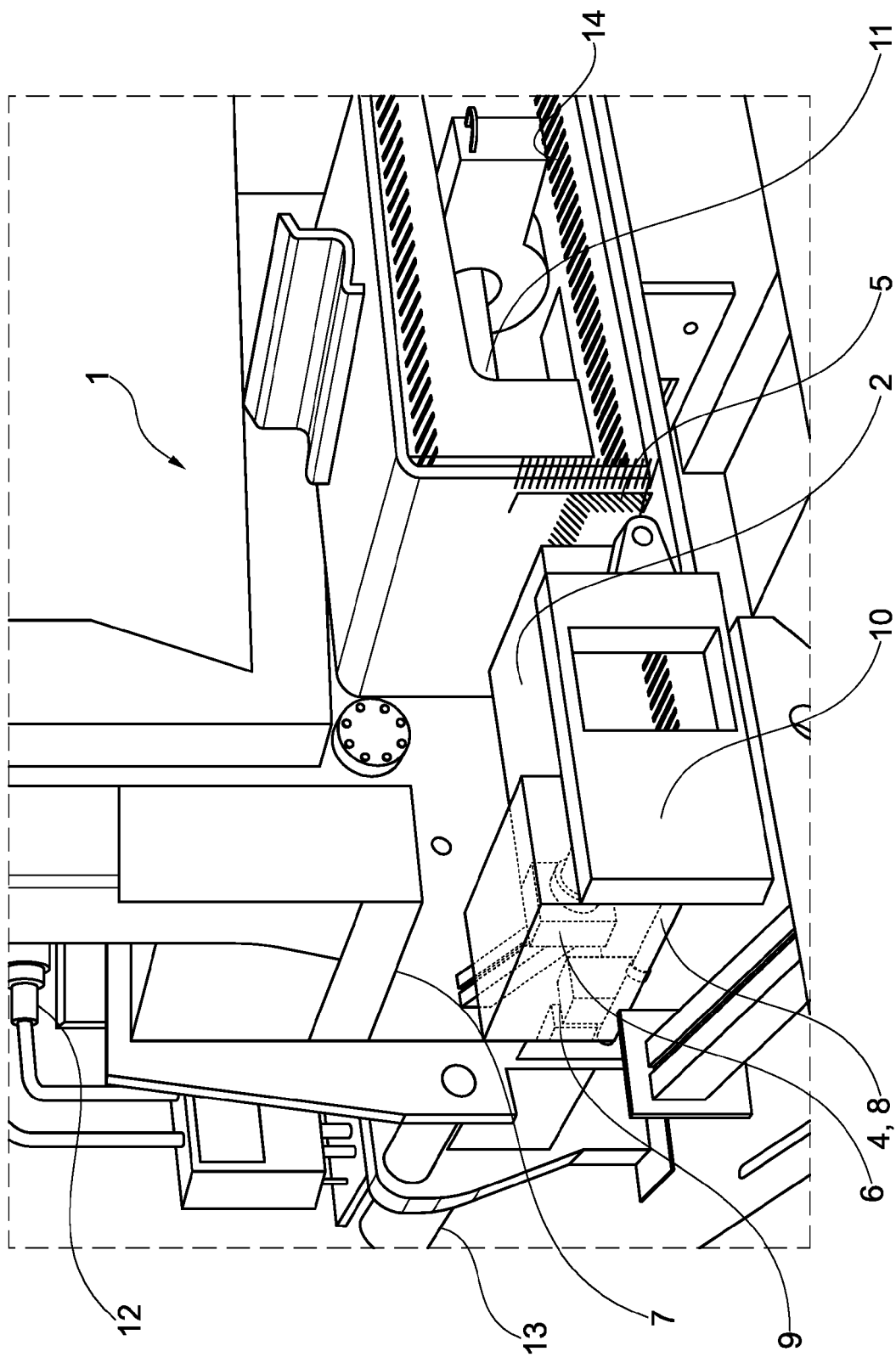


Fig. 2

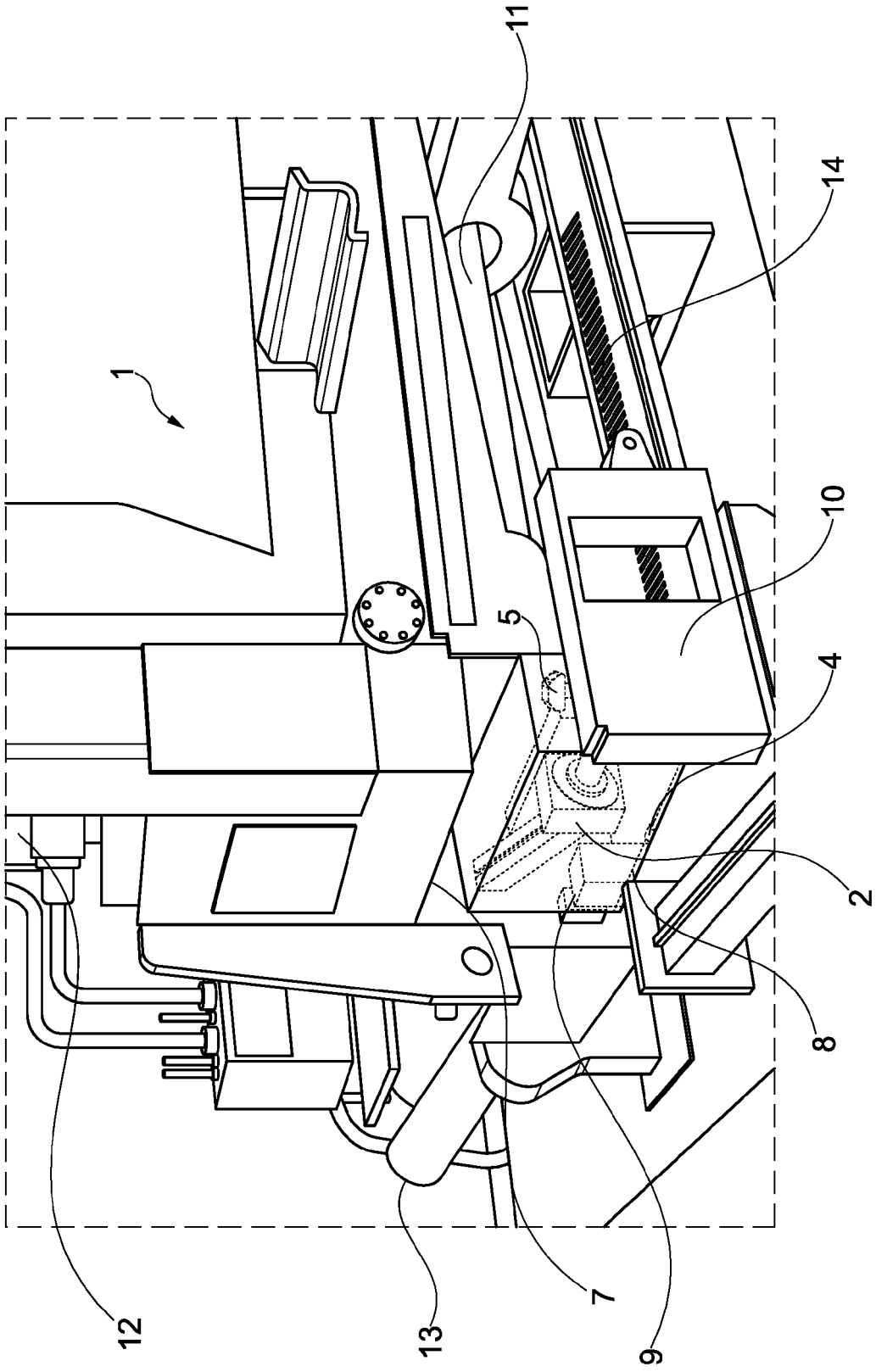


Fig. 3

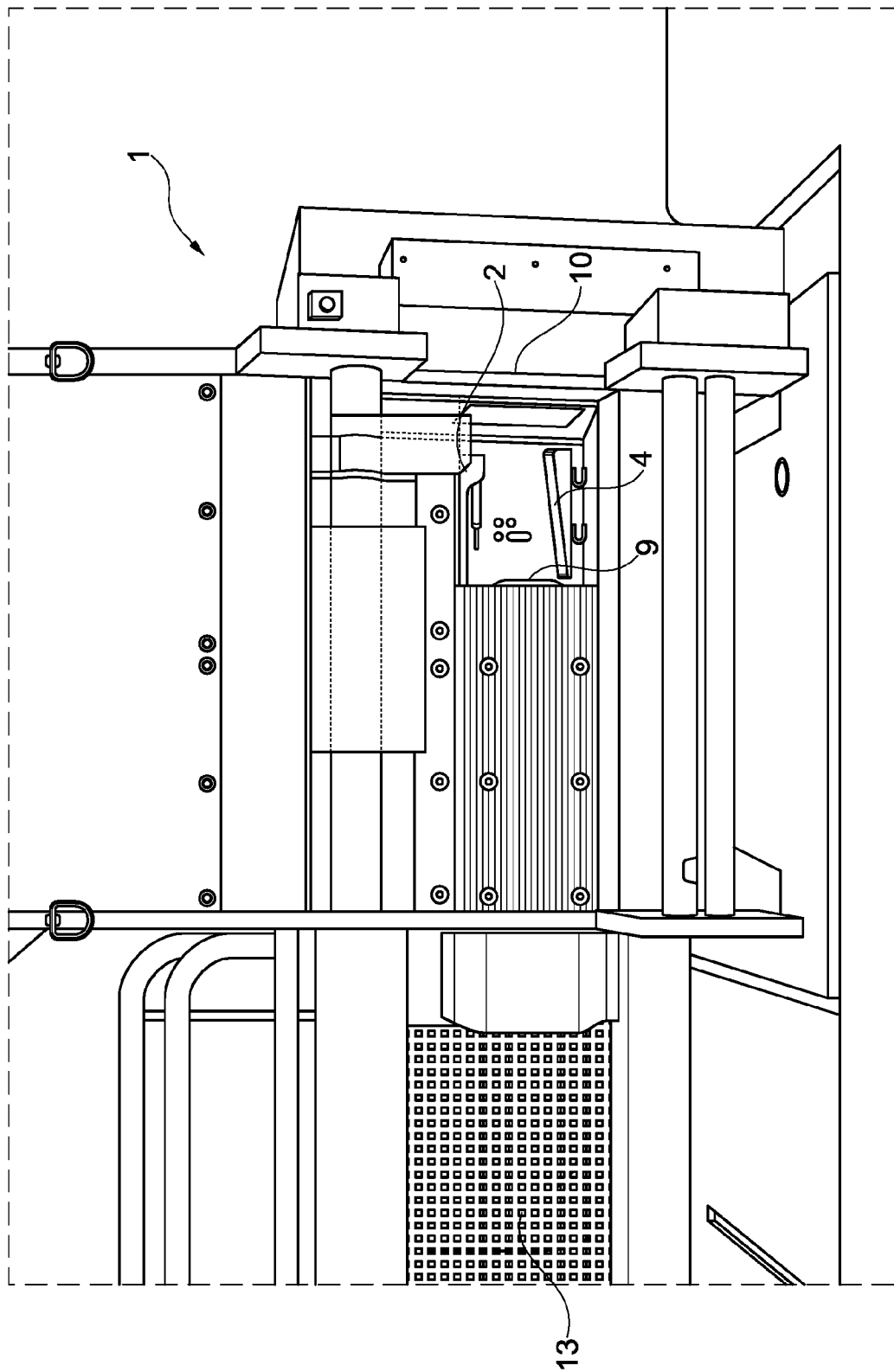


Fig. 4

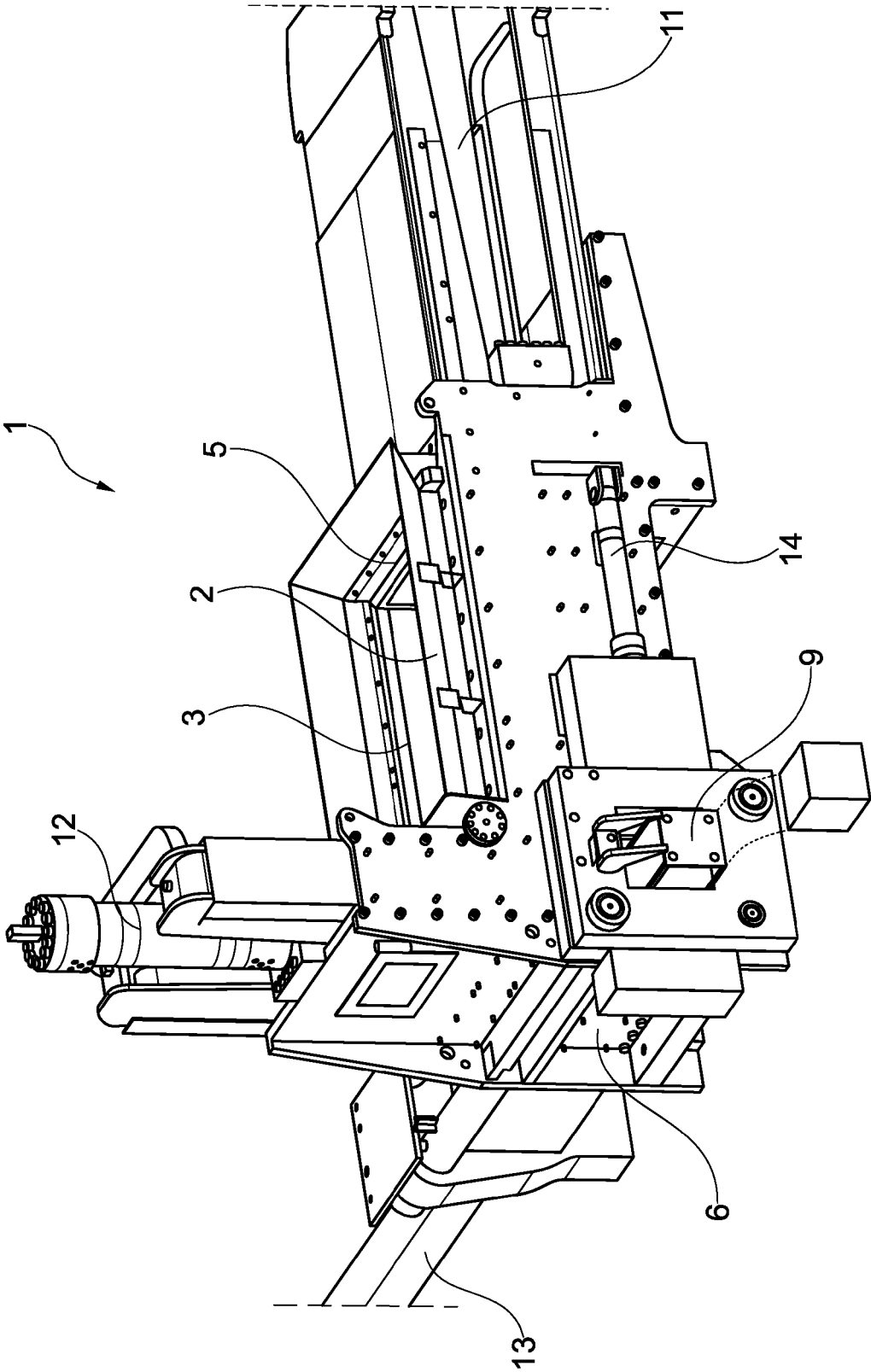


Fig. 5



## EUROPEAN SEARCH REPORT

Application Number  
EP 14 20 0238

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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                  |                                                        |                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                    | Relevant to claim                                      | CLASSIFICATION OF THE APPLICATION (IPC) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | EP 1 149 926 A2 (NTN TOYO BEARING CO LTD [JP]) 31 October 2001 (2001-10-31)                                                      | 1,5,7,11                                               | INV.                                    |
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| Y,D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | DE 102 58 660 A1 (METSO LINDEMANN GMBH [DE]) 15 July 2004 (2004-07-15)<br>* claims; figures *                                    | 6,12                                                   |                                         |
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| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DE 196 46 346 A1 (WOLF STAHLBAU KG [DE]) 11 September 1997 (1997-09-11)<br>* column 9, line 3 - line 9; claims; figures *        | 2,3,8,9                                                |                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                  |                                                        | TECHNICAL FIELDS SEARCHED (IPC)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                  |                                                        | B30B                                    |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                  |                                                        |                                         |
| Place of search<br><b>The Hague</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                  | Date of completion of the search<br><b>28 May 2015</b> | Examiner<br><b>Baradat, Jean-Luc</b>    |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                  |                                                        |                                         |

EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 14 20 0238

5 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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28-05-2015

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