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(54) SPLITTING MACHINE PROVIDED WITH A MOVABLE CARRIAGE

(57) The present invention relates to a splitting machine which comprises a transport element which comprises a carriage adapted to move along the conveyor belt from a first locking position of the material to be cut/split to a second position at said cutting station/split, and vice versa, wherein said carriage is provided with a plurality of arms capable of sliding vertically, each independently of the other arms, from a first rest position wherein the arm is not in contact with the block to be cut/split to a second gripping position on the block to be cut.

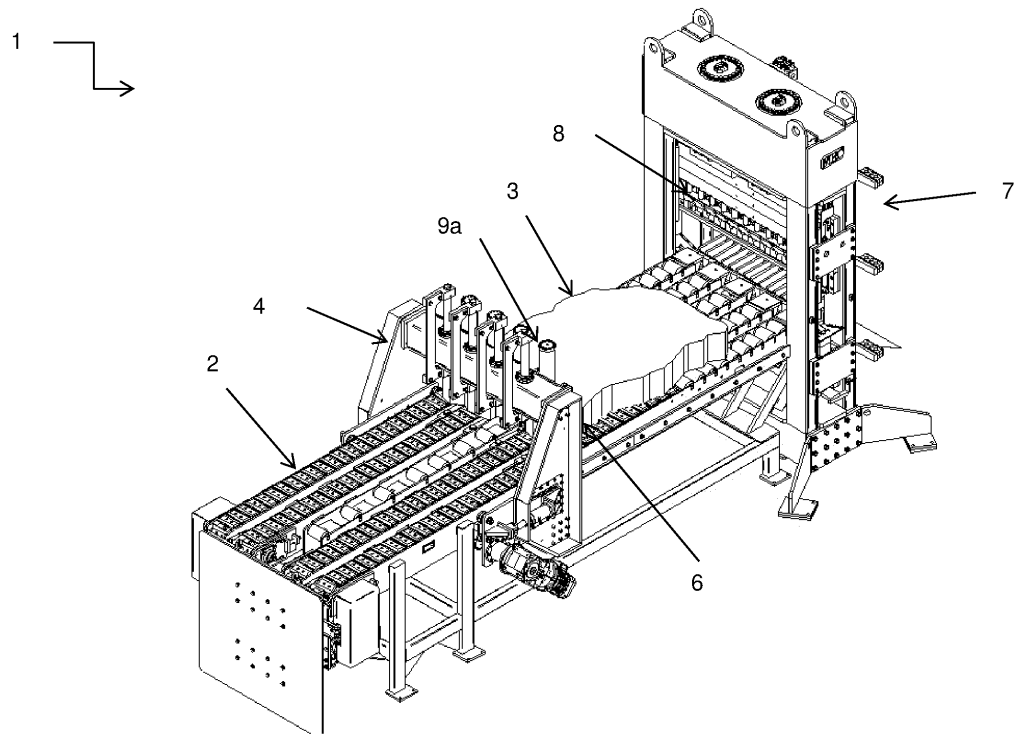

Fig. 6

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Description

Field of the invention

[0001] The present invention relates to an automatic or manual splitting machine for splitting irregularly shaped and variable sized materials. In particular, the present invention refers to a splitting machine capable of blocking a marble, porphyry, granite and similar materials block, having irregular shape and variable dimensions and thus transporting it blocked to a splitting station. The present invention also refers to a method for splitting a material block using the splitting machine.

State of the art.

[0002] Automatic splitting machines for splitting stone, marble, granite and similar stone material blocks, or concrete shapes made with special molds in cement factories, are known for the purpose of creating surface coating elements.

[0003] Typically such splitting machines comprise at least a conveyor belt longitudinally extending onto which the stone blocks to be split are placed.

[0004] However, at present, the splitting machines available on the market have the disadvantage that, once positioned onto the conveyor belt, some stones, especially those of uneven thickness, tend to appear at the splitting station in an unstable position, thus causing a splitting operation lacking the required precision.

[0005] Therefore, the Applicant of the present patent application has found the need to create a splitting machine allowing to overcome the above mentioned drawbacks, so that the material to be cut/split, once loaded onto the conveyor belt, can be blocked and transported until reaching the cutting/splitting station.

Summary of the invention

[0006] According to a first aspect, the present invention refers to a splitting machine such as the one indicated in claim 1.

[0007] The present invention stems from the general consideration according to which the technical problem highlighted above can be effectively and reliably solved by means of an automatic or manual splitting machine for cutting/splitting natural stone and/or concrete material blocks, wherein said machine comprises a motorized or not motorized conveyor belt, adapted to receive said material blocks to be cut/split positioned thereon and to transport them towards at least one cutting/splitting station of said blocks provided with at least one cutting/splitting device,
characterized in that said machine further comprises a carriage provided with a plurality of arms able to, independently one each other, vertically slide from a first rest position wherein the arm is not in contact with the block to be cut to a second gripping position on the block to be cut, wherein said carriage is adapted to move along the conveyor belt from a first locking position wherein the material block to be cut is blocked to a second position at said cutting/splitting station, and vice versa.

[0008] In this way, each of the arms contributes to block onto the conveyor belt the material block to be subjected to the cutting action; in fact, thanks to the fact that each of the arms acts independently from the other arms, each arm vertically moves from the rest position to that one gripping the material block to be cut by a specific distance determined by the thickness of the material block at that arm.

[0009] The result is that each arm will lock itself in a gripping position in contact with the surface of the material block to be cut at a different height than the other arms, following the profile given by the different thickness of the block to be cut.

[0010] The material block to be cut is thus securely blocked by the plurality of arms, regardless of its shape, profile, thickness.

[0011] According to a preferred embodiment, said conveyor belt consists of an area of motorized transport elements (rollers, belts, chains, etc.) and subsequently of an area of non-motorized elements, consisting of a series of arms arranged adjacent one to the other and transversely with respect to the conveying direction of the conveyor belt.

[0012] In this way, the motorized area ensures the advancement of the stone on the front of the carriage so that the plurality of arms can subsequently block and advance the stone towards the cutting/splitting area.

[0013] According to a preferred embodiment, said carriage is provided with a first plurality of said arms arranged above the conveyor belt.

[0014] In this way each arm of the first plurality of said arms is able to vertically descend from the rest position to that one gripping onto the upper surface of the material block to be cut.

[0015] According to a preferred embodiment, said carriage is provided with a second plurality of said arms arranged below the conveyor belt.

[0016] In this way each arm of the second plurality of said arms is able to vertically rise from the rest position to that one gripping the lower surface of the material block to be cut.

[0017] According to a preferred embodiment, said carriage is provided with both said first and said second plurality of said arms arranged, respectively, above and below the conveyor belt.

[0018] In this way each arm of the first plurality of said arms is able to vertically descend from the rest position to that one gripping onto the upper surface of the material block to be cut/split, and each arm of the second plurality of said arms is able to vertically rise from the rest position to the gripping position onto the lower surface of the material block to be cut/split, the movement of each arm not being constrained by the movement of any of the other arms. The material block to be cut/split is thus further

blocked, both from above and below.

[0019] According to a preferred embodiment, said arms of said first and/or second plurality of arms are arranged substantially parallel and opposed to each other, along the conveying direction of the conveyor belt.

[0020] According to a preferred embodiment, the gripping position of each arm on the block to be cut is determined on the basis of the achievement of a predetermined pressure contact threshold value between that arm and the block to be cut/split.

[0021] In this way, each arm of said first and/or second plurality of arms descends/rises towards the material block to be cut/split until it comes into contact with the block itself and settles against it only when the pressure between the arm and the block to be cut/split is greater than a predetermined pressure value. The material block to be cut/split is then blocked by said plurality of arms, regardless of the shape and thickness (for example, not uniform) of the block itself.

[0022] According to a preferred embodiment, said arms are operated by means of pneumatic, hydraulic or electric cylinders/pistons.

[0023] According to a preferred embodiment, said carriage is able to move from the first position, wherein the material block to be cut is blocked by said arms, to the cutting/splitting station, keeping the material block blocked by means of said arms to be cut/split all the way between the blocking station and the cutting station.

[0024] According to a preferred embodiment, the positioning of said cutting device is adjustable according to the depth of the cut/split required.

[0025] According to a second aspect, the present invention refers to a method for cutting a material block such as that on indicated in claim 6.

[0026] The present invention in fact arises from the general consideration according to which the technical problem highlighted above can be solved in an effective and reliable way by a method for cutting a material block using the splitting machine described above with reference to the first aspect of the present invention.

[0027] In particular, the cutting/splitting method of the present invention comprises the steps of:

a) positioning a material block to be cut onto a conveyor belt of a splitting machine;

b) blocking said material block onto the conveyor belt, at a blocking station, by means of a plurality of arms positioned onto a carriage movable along the conveyor belt, wherein said arms are able to, independently one each other, vertically slide from a first rest position wherein the arm is not in contact with the block to be cut to a second gripping position on the block to be cut;

c) moving said carriage, and consequently with it the material block to be cut/split blocked by said plurality of arms positioned onto the carriage, from said blocking station to a cutting/splitting station;

d) subjecting the material block to be cut/split to a cutting/splitting action by at least one cutting/splitting device;

e) freeing the material block from the grip of said plurality of arms;

f) removing the block of cut/split material from the conveyor belt;

g) moving the carriage back from said cutting/splitting station to said locking station.

[0028] In this way, each of the arms contributes to block onto the conveyor belt the material block to be subjected to the cutting/splitting action and to transport the material block to the cutting/splitting station.

[0029] In fact, thanks to the fact that each of the arms acts independently from the other arms, each arm vertically moves from the rest position to the gripping position of the material block to be cut/split by a specific distance determined by the thickness of the material block at that arm. The result is that each arm will lock itself in a gripping position in contact with the surface of the material block to be cut at a different height than the other arms, following the profile given by the different thickness of the block.

[0030] Furthermore, once the material block to be cut/split has been blocked, this material block will be brought to the cutting/splitting station by moving along the conveyor belt the carriage onto which the arms keeping blocked the material block to be cut are positioned.

[0031] Once it has been cut/split, the material block will be freed from the arm gripping and the carriage will be brought back to the locking position to repeat the operations to block a new material block to be cut/split and take it to the cutting/splitting station.

[0032] The cut pieces are then continued along the conveyor belt or removed from the conveyor belt itself and collected in suitable collection stations for the cut pieces.

[0033] According to a preferred embodiment, the step a) of positioning the material block to be cut/split onto the conveyor belt of the splitting machine is performed by means of a device adapted to grasp the material block to be cut/split, such as for example a pincer or jaw device able to firmly hold the material block until it is placed onto the conveyor belt.

[0034] According to a preferred embodiment, the step d) of cutting/splitting the material block can be repeated several times before carrying out the step e) of releasing the grip of the material block. To this end, once step d) has been carried out a first time, obtaining a first piece cut from the material block, the carriage is made to move further along the conveyor belt until this remaining portion of the material block to be cut/split is located at the cutting/splitting device to be subjected to a new cutting/split-

ting action, while maintaining the grip of the arms onto the remaining portion of the material block still to be cut/split.

[0035] Once the cutting/splitting operation is performed for the second time, a second piece is cut/split according to the requests. This operation can be repeated several times according to the required cutting pieces. At the end of the series of cutting/splitting operations, the remaining block material is freed from the arms grip and the carriage is brought back along the conveyor belt to the blocking station.

[0036] Further characteristics and advantages of the present invention will become clearer from examination of the following detailed description of a preferred but not exclusive embodiment, illustrated only by way of non-limitative example, with the support of the accompanying drawings, wherein:

- Figure 1 is an overall view of an embodiment of a splitting machine according to the present invention free of the cutting/splitting station;
- Figure 2 is another view of the splitting machine shown in Fig. 1;
- Figure 3 is a detail of Fig. 1, wherein a carriage equipped with adaptable arms is shown;
- Figure 4 is a detail of Fig. 2, wherein the carriage of Fig. 3 is shown;
- Figure 5 shows the splitting machine of Fig. 1 where the cutting/splitting station is also visible;
- Figure 6 shows the splitting machine of Fig. 5 wherein a stone block to be cut/split is visible positioned onto the conveyor belt;
- Figure 7 shows the splitting machine of Fig. 2 wherein the cutting/splitting station is also visible;
- Figure 8 shows the splitting machine of Fig. 7 wherein a stone block to be cut/split is visible positioned onto the conveyor belt;
- Figure 9 shows a front view of the carriage of the splitting machine of the previous figures, wherein the arms are in a position such as to keep the stone block to be cut/split firmly locked;
- Figure 10 shows a front view of the carriage of the splitting machine of Fig. 9, wherein the arms are in a position such as to leave free the stone block to be cut/split.

Detailed description of the invention.

[0037] With reference to Figs. 1-10 an embodiment of a splitting machine 1 according to the present invention is shown below.

[0038] Figs. 1 and 2 show an overall view, on one side and on the opposite side, of an automatic splitting machine 1 for cutting/splitting material blocks 3 in natural stone and/or concrete, where it is visible the motorized conveyor belt 2 onto which a stone block 3 to be cut/split is positioned (shown in Figs. 6 and 8).

[0039] The conveyor belt 2 consists of an area of motorized transport elements (rollers, belts, chains, etc.) and subsequently an area of non-motorized elements consisting of a series of rollers arranged adjacent to each other and transversely with respect to the conveying direction of the conveyor belt.

[0040] At the outgoing end of the conveyor belt 2 there is a cutting station 7 (shown in Figures 5-8) of said material blocks 3 equipped with at least one cutting/splitting device 8. The positioning of the cutting device 8 is adjustable according to the required cutting depth.

[0041] The conveyor 1 further comprises a carriage 4 (shown in detail in Figures 3 and 4, seen from the front and from the rear, with respect to the transport direction of the conveyor belt 2), adapted to move along the conveyor belt 2 sliding along the side guides arranged onto the edges of the conveyor belt 2. The carriage 4 is provided with at least a first plurality of arms 5a arranged above the conveyor belt 2 and a second plurality of arms 5b arranged below the conveyor belt 2. These arms 5a, 5b are arranged substantially parallel to each other, along the conveying direction of the conveyor belt 2 and are able to vertically slide, each independently of the other arms 5a, 5b, from a first rest position wherein the arm is not in contact with the material block 3 to be cut/split to a second gripping position onto the material block 3 to be cut/split. Each arm 5a, 5b is driven by a corresponding pneumatic, hydraulic or electric cylinder 9a, 9b.

[0042] Each of the arms 5a arranged above the conveyor belt 2 is able to vertically descend from the rest position to the gripping position onto the upper surface of the material block 3 to be cut/split. Vice versa, each arm 5b of the second plurality of said arms arranged under the conveyor belt 2 is able to vertically rise from the rest position to that one gripping the lower surface of the material block 3 to be cut/split, the movement of each arm 5a, 5b being not constrained by the movement of any of the other arms 5a, 5b. The material block to be cut/split is thus further blocked, both from above and below.

[0043] The result is that each arm 5a, 5b will lock itself in the gripping position in contact with the surface of the material block 3 to be cut/split at a different height than the other arms 5a, 5b, following the profile given by the different thickness of the material block 3.

[0044] The gripping position of each arm 5a, 5b on the material block 3 to be cut/split is determined on the basis of the achievement of a predetermined threshold value of contact pressure between the arm 5a, 5b and the material block 3 to be cut/split.

[0045] The carriage 4 is moved from the first block station 6 (Fig. 6), where the material block 3 to be cut/split is blocked by the arms 5a, 5b, to the cutting/splitting station 7, keeping blocked the material block 3 to be cut/split all the way between the blocking station 6 and the cutting/splitting station 7 by means of the arms 5a, 5b (Fig. 9).

[0046] The material block 3 is then subjected to the cutting/splitting operation.

[0047] Once the cutting/splitting operation has been performed, the user can decide whether to perform a new cutting/splitting operation of the stone block 3 remaining after the first cutting/splitting operation. In this case, the carriage 4 is moved further along the conveyor belt 2 until this remaining portion of the material block 3 to be cut/split is in correspondence with the cutting/splitting device 8 to be subjected to a new cutting/splitting action, while maintaining the grip of the arms 5a, 5b onto the remaining portion of the material block 3 still to be cut/split (Fig. 9).

[0048] The cutting/splitting operation of the material block 3 can be repeated several times, based on the needs and dimensions of the material block 3 to be cut/split.

[0049] Once all the required cutting/splitting operations have been performed, the remaining material block 3 (uncut/unsplit) is freed from the grip of the arms 5a, 5b (Fig. 10) and the carriage 4 is brought back to the locking position 6 to repeat the operations to block a new material block 3 to be cut/split and take it to the cutting/splitting station 7 (Fig. 9).

[0050] The cut/split pieces 3 are then continued along the conveyor belt 2 or removed from it and collected in suitable collection stations for the cut/split pieces. Naturally, those skilled in the art will be aware of many modifications and variations of the preferred embodiment described above, while still remaining within the scope of the invention.

[0051] Therefore, the present invention is not limited to the preferred embodiment described, illustrated only by way of non limiting example, but is defined by the following claims.

Claims

1. Automatic or manual splitting machine (1) for cutting/splitting natural stone and/or concrete material blocks (3), wherein said machine (1) comprises a powered or not powered conveyor belt (2), adapted to receive said blocks (3) to be cut/split positioned thereon and to transport them towards at least one cutting/split station (7) of said blocks (3) provided with at least one cutting/splitting device (8), **characterized in that** said machine (1) further comprises a carriage (4) provided with a plurality of arms (5) able to, independently one each other, vertically slide from a first rest position wherein the arm (5) is not in contact with the block (3) to be cut/split to a second gripping position onto the block (3), wherein said carriage (4) is adapted to move along the conveyor belt (2) from a first locking position (6) wherein the block (3) is blocked to a second position at said cutting/splitting station (7), and vice versa.

2. Splitting machine (1) according to claim 1, wherein said carriage (4) is provided with at least a first plurality of said arms (5a) arranged above the conveyor belt (2) and/or with at least a second plurality of said arms (5b) arranged below the conveyor belt (2).

3. Splitting machine (1) according to claim 2, wherein said arms of said first (5a) and/or second (5b) plurality of arms are arranged substantially parallel one each other, along the conveyor belt (2) transport direction.

4. Splitting machine (1) according to any one of the preceding claims, wherein the gripping position of each arm (5a, 5b) on the block (3) to be cut/split is determined on the basis of the achievement of a predetermined threshold value of contact pressure between the arm (5a, 5b) and the block (3).

5. Splitting machine (1) according to any one of the preceding claims, wherein each of said arms (5a, 5b) is driven by a corresponding pneumatic, hydraulic or electric piston (9a, 9b).

6. Method for cutting/splitting a material block (3) by using the splitting machine (1) according to any one of claims 1-5, wherein the method comprises the steps of:

   a) positioning a material block (3) to be cut/split onto a conveyor belt (2) of the splitting machine (1);
   b) blocking said material block (3) onto the conveyor belt (2), in correspondence with a locking station (6), by means of a plurality of arms (5a, 5b) positioned onto a carriage (4) movable along the conveyor belt (2), wherein said arms (5a, 5b) are able to, independently one each other, vertically slide from a first rest position wherein the arm (5a, 5b) is not in contact with the block (3) to a second gripping position onto the block (3);
   c) moving said carriage (4), and with it consequently the material block (3) to be cut/split blocked by said plurality of arms (5a, 5b) positioned on the carriage (2), from said locking station (6) to a cutting/splitting station (7);
   d) subjecting the material block (3) to at least one cutting/splitting action by at least one cutting/splitting device (8);
   e) freeing the material block (3) from the grip of said plurality of arms (5a, 5b);
   f) removing the material block (3) from the con-

veyor belt (2); and
g) moving the carriage (4) back from said cutting/splitting station (7) to said locking station (6).

7. Method according to claim 6, wherein the step d) of cutting/splitting the material block (3) can be repeated several times before executing the step e) wherein the grip onto the material block (3) is released, by positioning each time the material block (3) still to be cut/split at the cutting/splitting station (7).

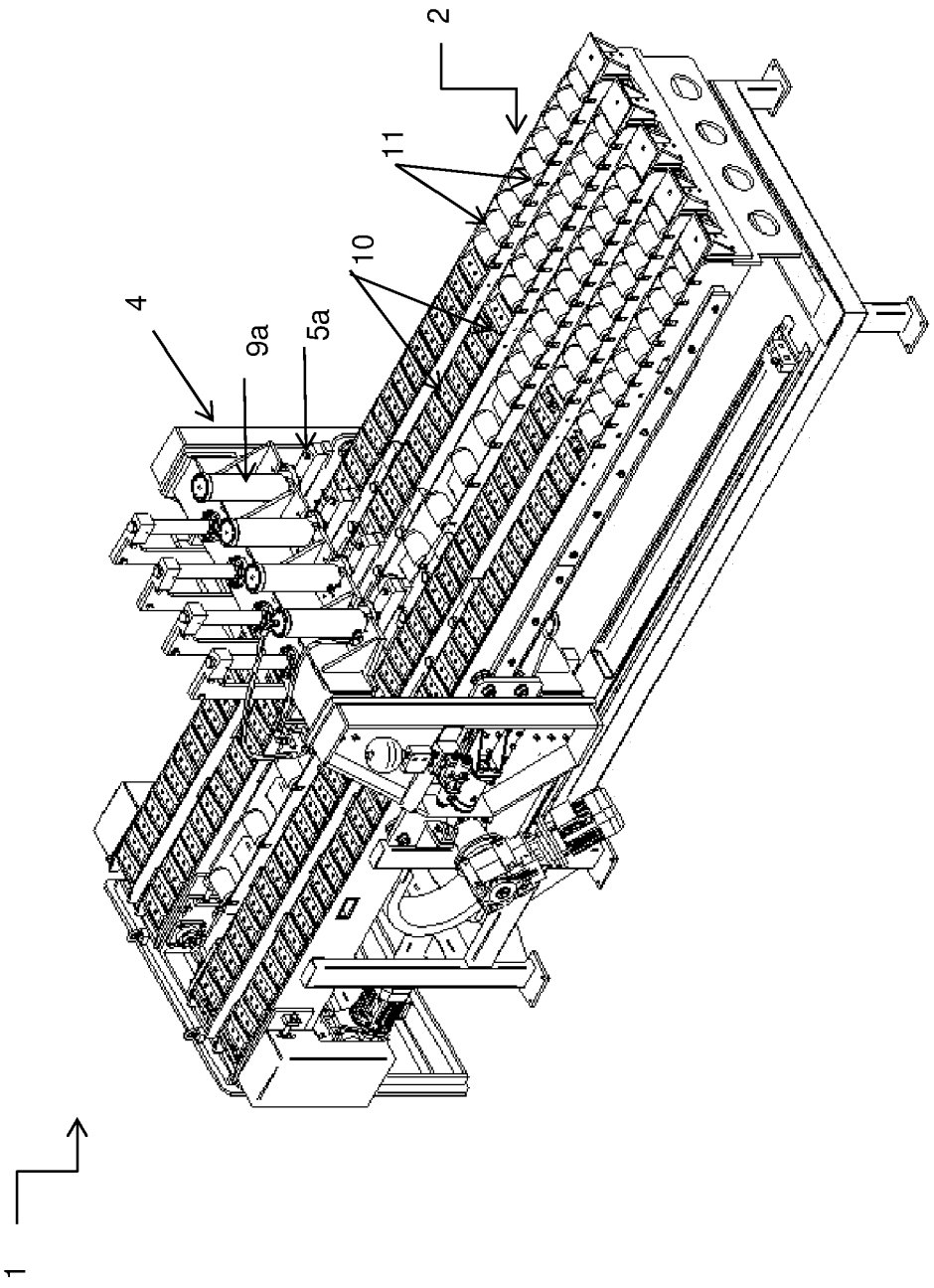

Fig. 1

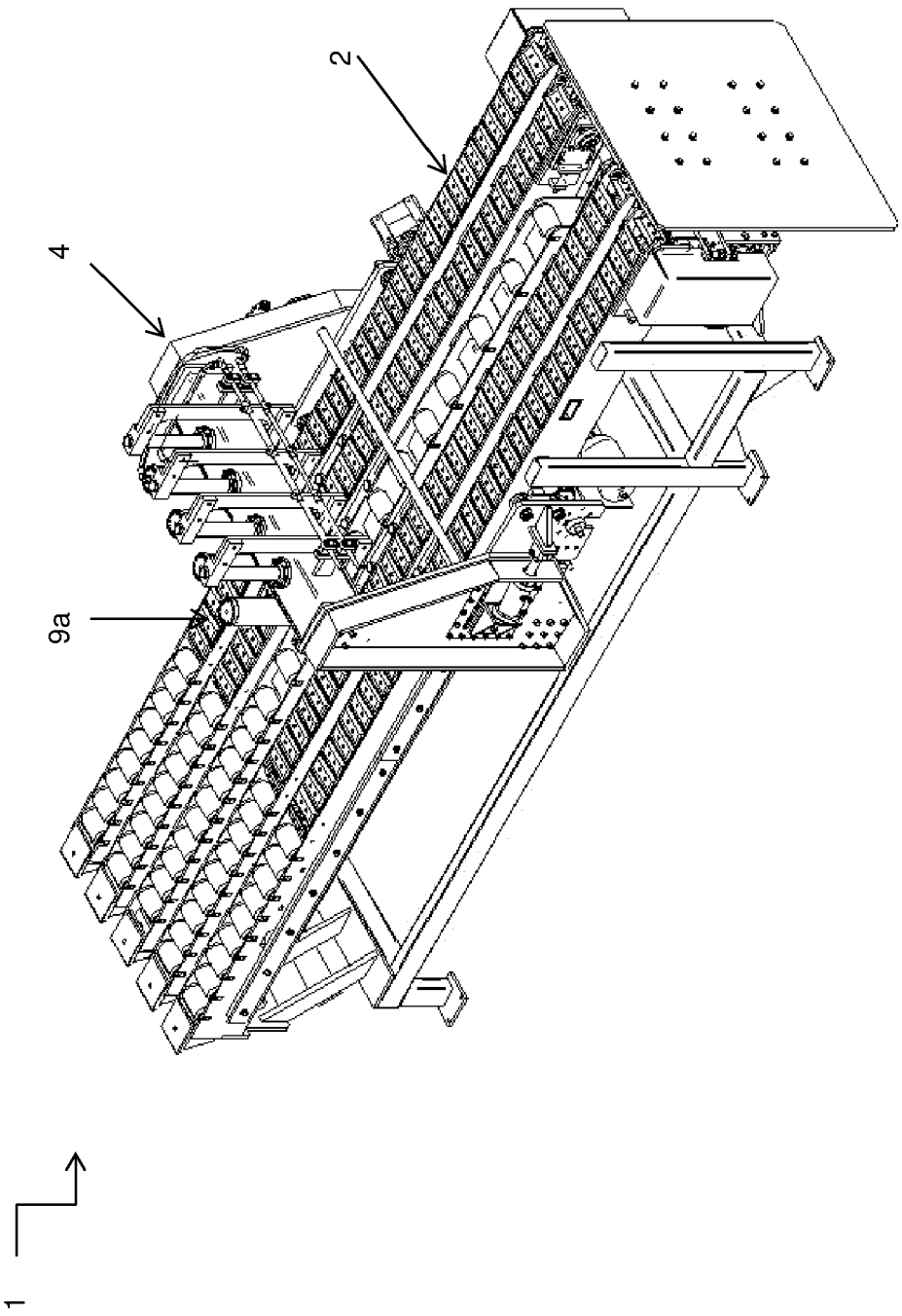

Fig. 2

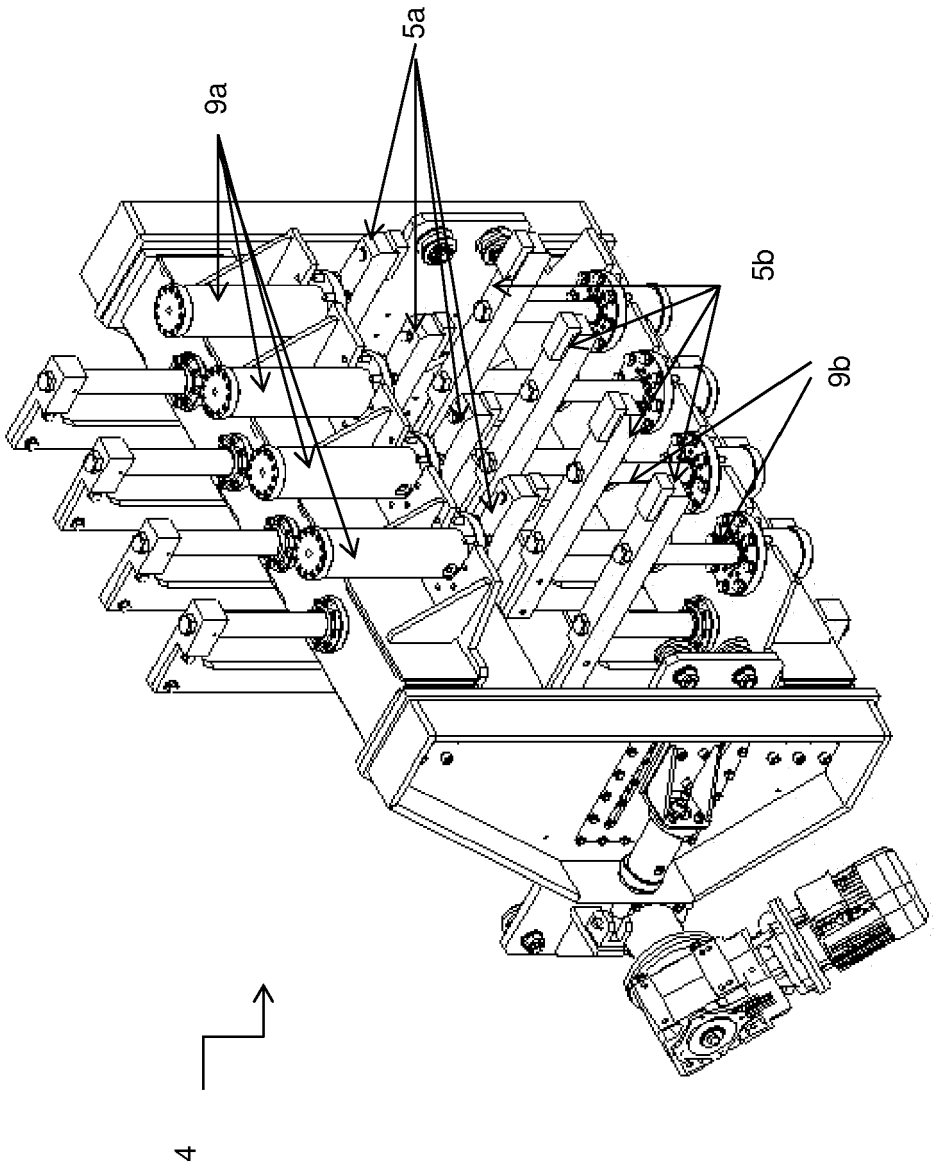

Fig. 3

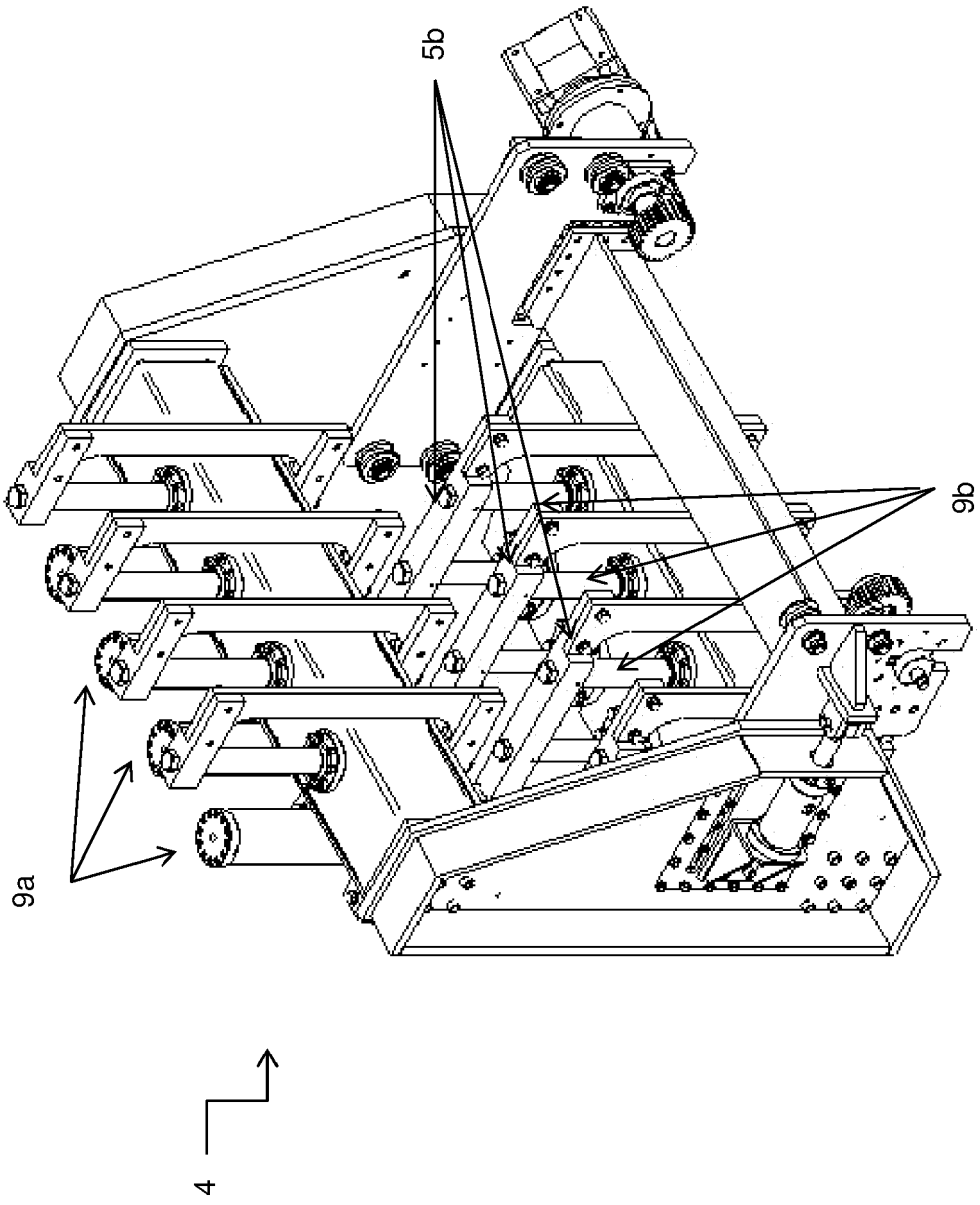

Fig. 4

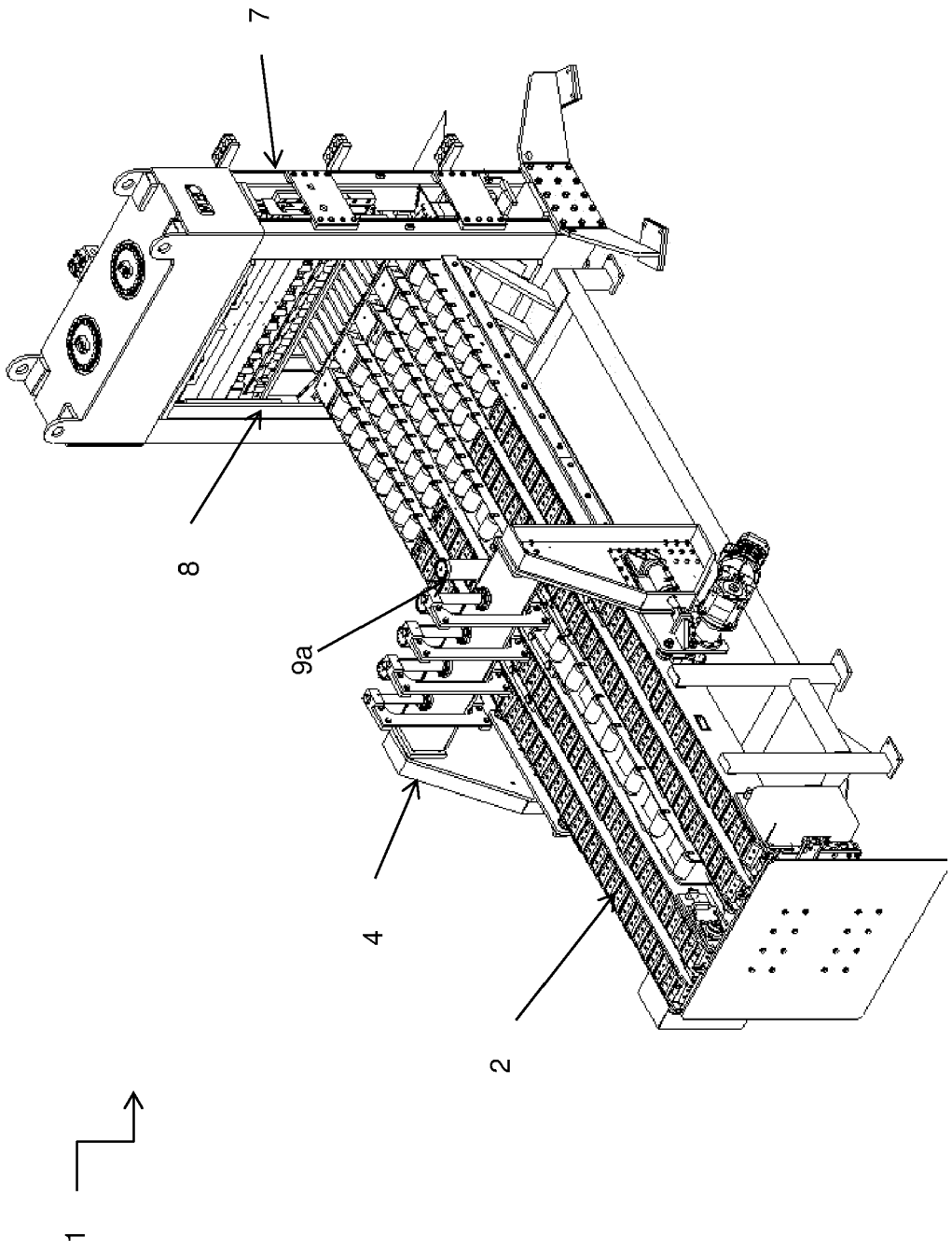

Fig. 5

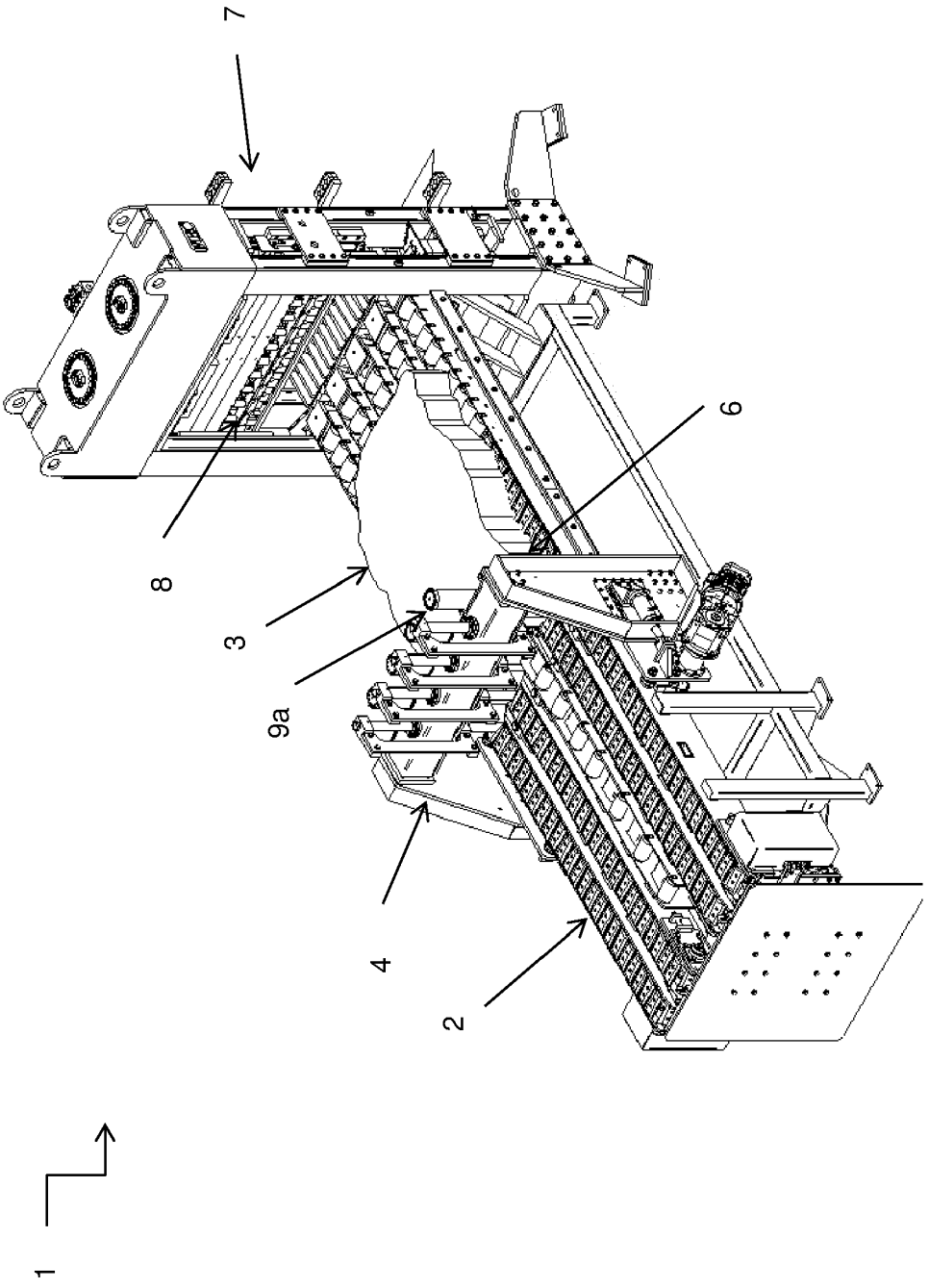

Fig. 6

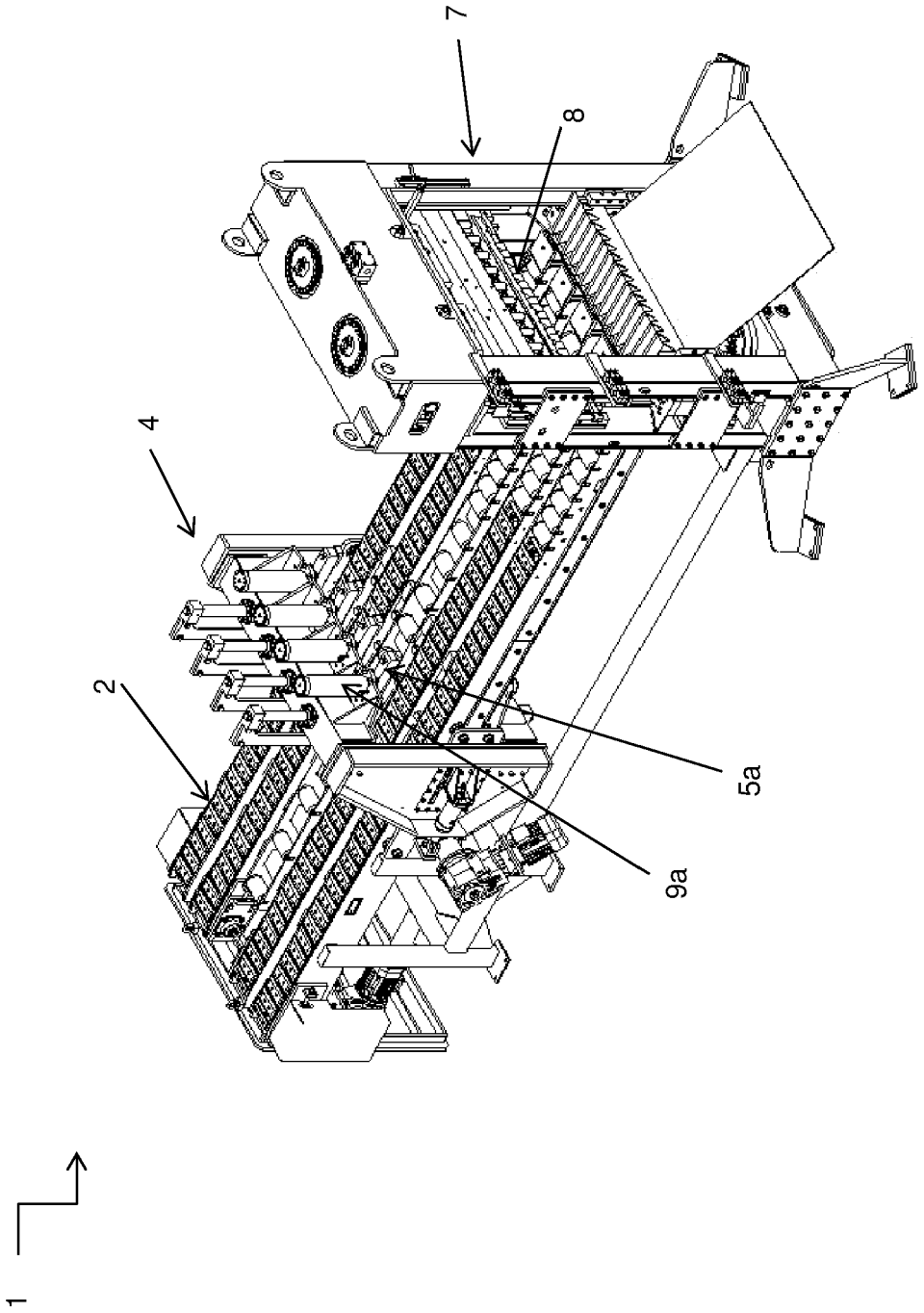

Fig. 7

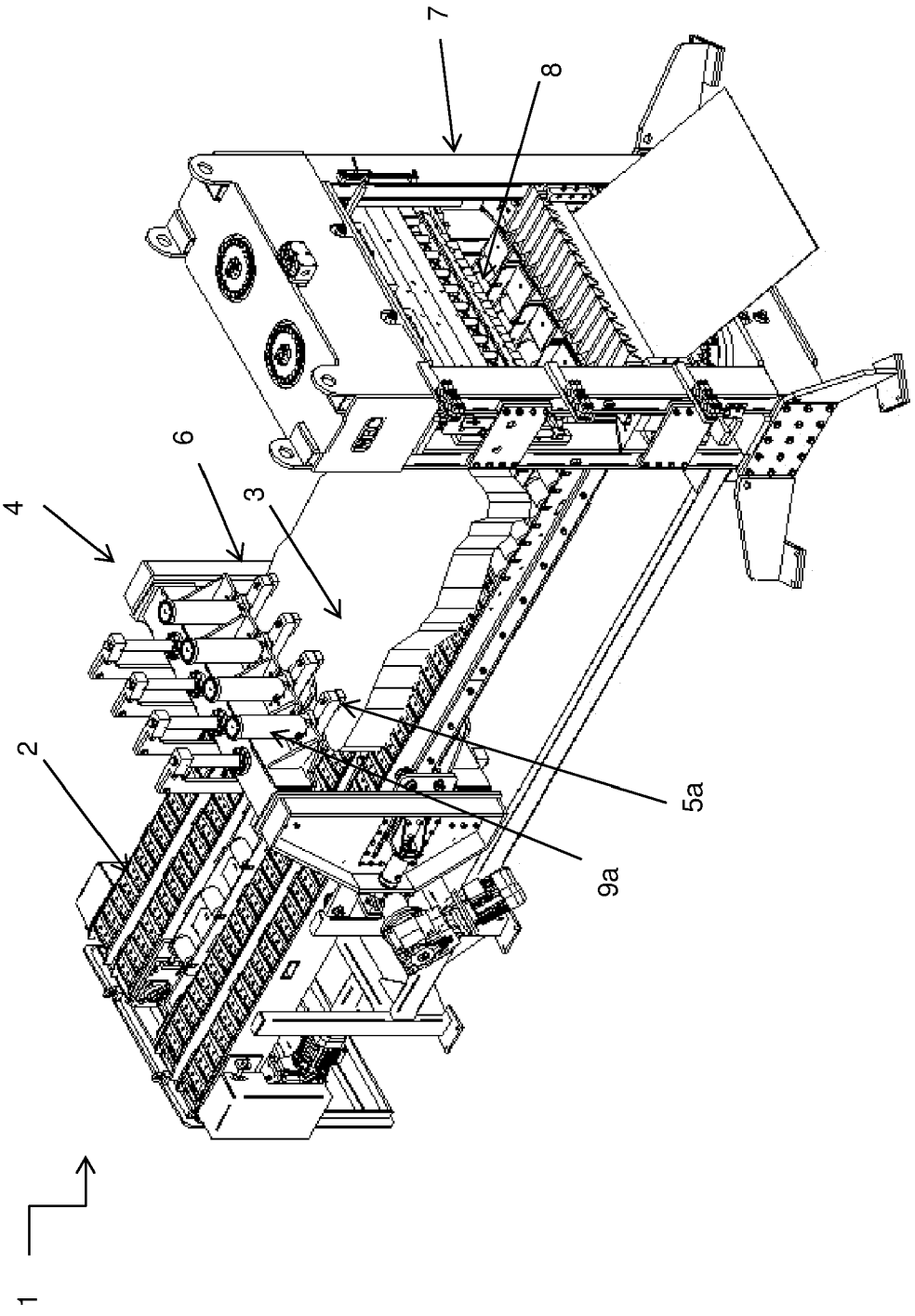

Fig. 8

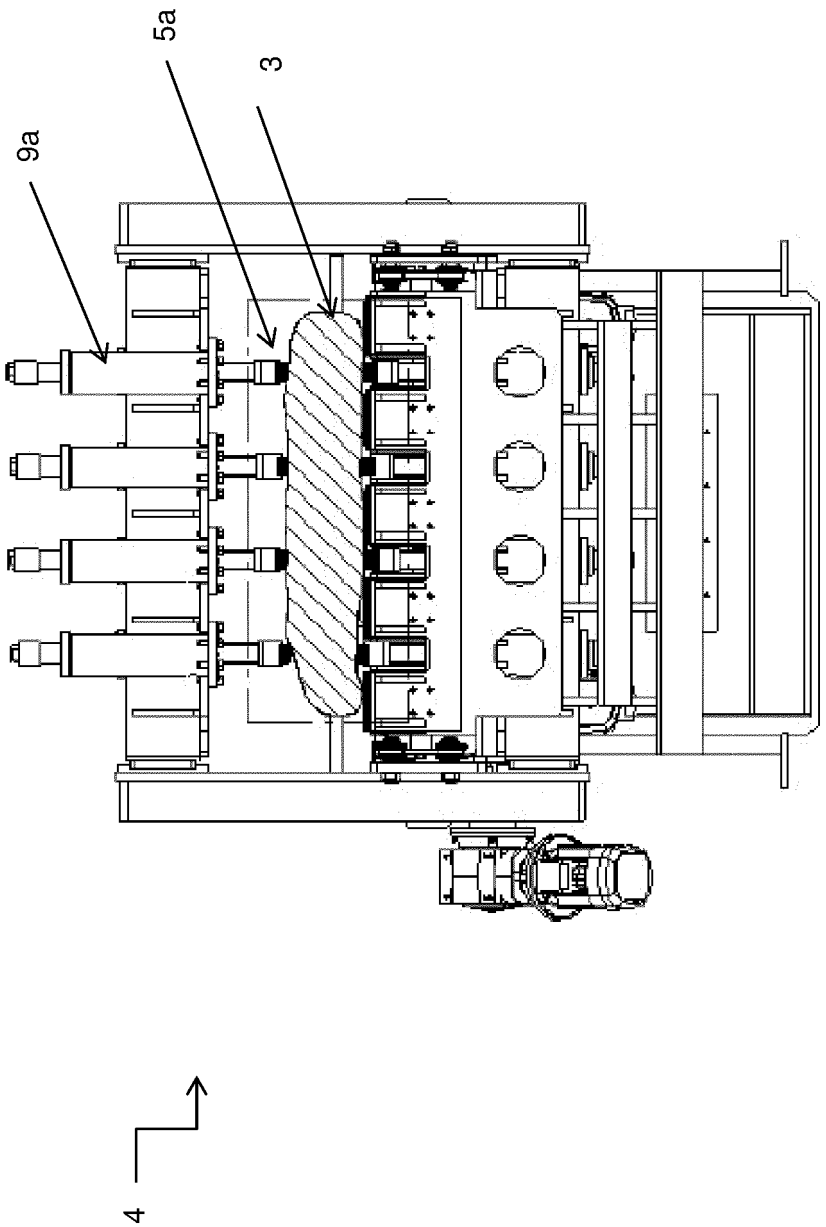

Fig. 9

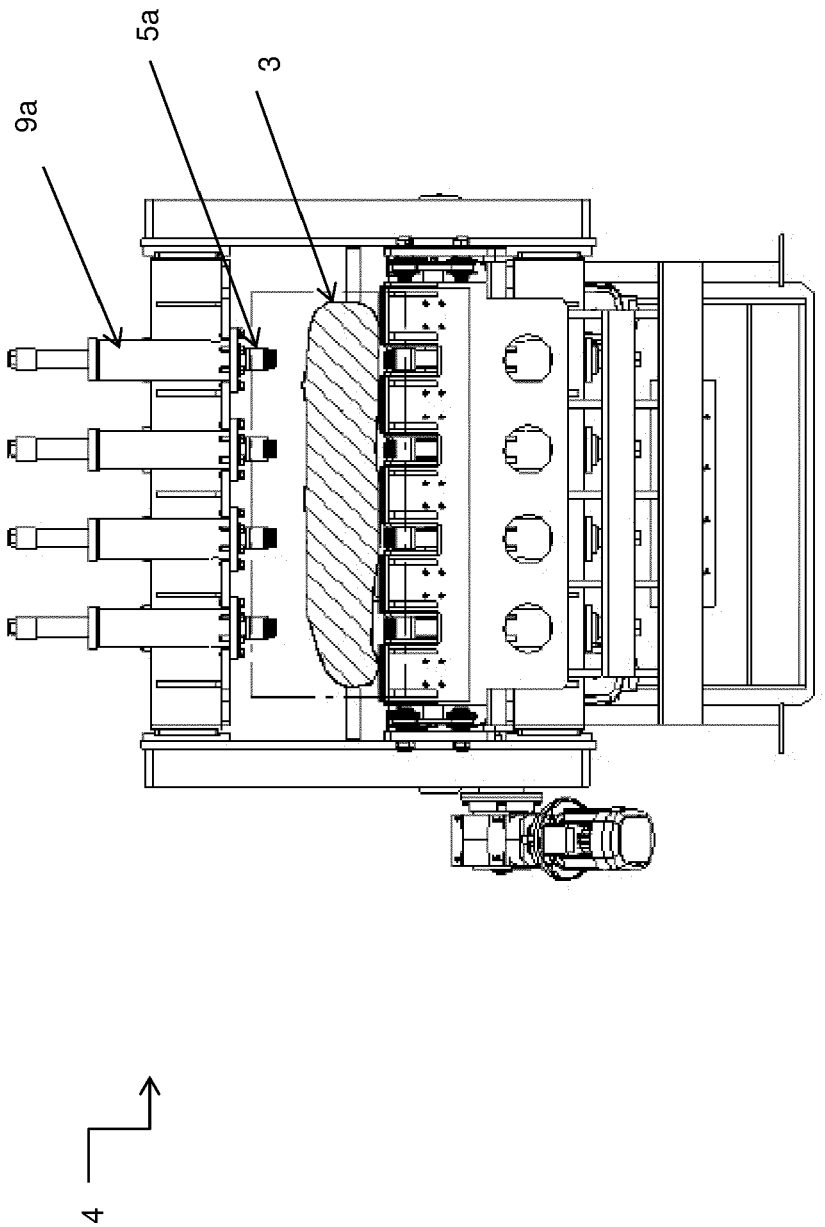

Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 20 02 0028

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 2 543 795 A (POUNDFIELD PRODUCTS LTD [GB]) 3 May 2017 (2017-05-03) * page 1, lines 6-10 * * page 18, line 30 - page 19, line 4 * * page 21, lines 8-11 * * page 24, line 26 - page 26, line 28 * * figures 4-17 *	1-7	INV. B28D1/26 B28D7/00 B28D1/22
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A	AU 28490 77 A (DOTTAVI R) 8 March 1979 (1979-03-08) * page 2, lines 1-4 * * page 5, lines 8-14 * * figures 1,3,5 *	1-7	
A	EP 3 069 838 A1 (BIESSE SPA [IT]) 21 September 2016 (2016-09-21) * paragraphs [0001], [0025], [0028], [0038] * * figures 1,2 *	1-7	TECHNICAL FIELDS SEARCHED (IPC) B28D B28B
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 May 2020	Chariot, David

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82