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(54) **A MACHINE FOR ASSEMBLING WOODEN FLOORPLATES, WOODEN FENCES OR WOODEN PACKING MATERIAL AND METHOD**

(57) A machine for assembling wooden floorplates, wooden fences or wooden packing material is provided. The machine comprises a movable arm being coupled to at least a first group of devices, the at least first group of devices comprising
A) at least a first holding device for holding a wooden

component; and
B) at least a first joining device for joining said wooden component with at least one fastener;
wherein the at least first holding device and the at least first joining device are adapted to simultaneously hold and join the wooden component.

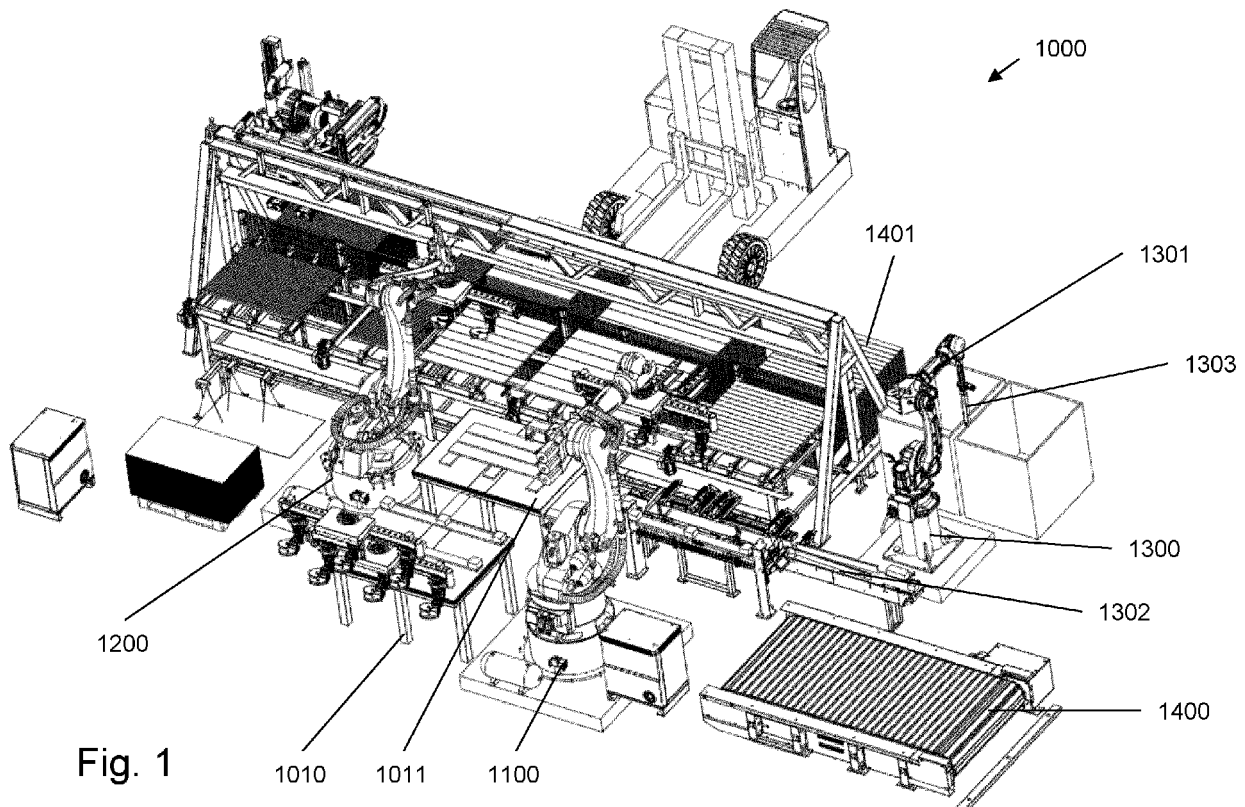


Fig. 1

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Description

Field of the Invention

[0001] The present invention generally relates to machinery for assembling wooden components into floorplates, wooden fences or wooden packing material, such as wooden pallets, boxes, crates and alike. The invention further relates to methods to assembling wooden components, into floorplates, wooden fences or wooden packing material, such as wooden pallets, boxes, crates and alike.

Background of the Invention

[0002] Nowadays, wooden pallets, are the most frequently used support to transport goods.

[0003] Machinery for assembling wooden components into wooden pallets are known in the art. Several different wooden components need to be assembled and attached one to the other in order to create a pallet, e.g. bock pallets or stringer pallets. These machinery are usually partially automated. Typically an operator places several wooden components in or onto a mould (also known as jig), after which a machine or robot, provided with a nail gun on its multiaxial arm, shoots the nails into the components, thereby coupling the various components on to each other in this mould.

[0004] As the wooden components may not always be exact in dimension, e.g. boards for the bottom deck board, stringer boards or top deck boards may not always be straight but may skew, the accuracy of the pallets made may not be within tolerances. The wooden components may shift in their position or may displace during the time lapse between laying them on the mould and nailing them. Also, the jig or mould has bigger tolerances so these skew boards may be fitted in.

[0005] The same applies for fully automated systems, like the one described in CN210336322. Here a robot with a multiaxial arm positions the wooden elements on a supporting table, a separate nailing apparatus is connecting the wooden elements by nailing them together. Also here the wooden components may shift in their position or may displace during the time lapse between laying them on the mould and nailing them. The wooden components may not always be exact in dimension, e.g. boards for the bottom deck board, stringer boards or top deck boards may not always be straight but may skew, the accuracy of the pallets made may not be within tolerances.

Summary of the Invention

[0006] It is an object of the present invention to provide a machine for assembling wooden components into floorplates, wooden fences or wooden packing material, such as wooden pallets, boxes, crates and alike, in which the tolerances of the wooden products provided are more

consistently met. It is further an object of the invention to provide an automated machine for assembling wooden components into floorplates, wooden fences or wooden packing material, such as wooden pallets, boxes, crates and alike, avoiding the use of moulds or jigs on or in which the wooden components need to be placed. It is further an object of the invention to provide a method to assemble wooden components into floorplates, wooden fences or wooden packing material, such as wooden pallets, boxes, crates and alike, which has a higher output. It is further an object of the invention to provide a method to assemble wooden components into wooden floorplates, wooden fences or wooden packing material, such as wooden pallets, boxes, crates and alike, in which method it is easy to change the dimension of the product made. Hence the method according to the invention provides more freedom to easily modify the type of wooden floorplates, wooden fences or wooden packing material, such as wooden pallets, boxes, crates and alike made. It is also an object of the present invention to provide a machine which may produce wooden products like floorplates, wooden fences or wooden packing material, such as wooden pallets, boxes, crates and alike, without the intervention of an operator, hence in full independency of an operator during some hours.

[0007] According to a first aspect of the invention, a machine for assembling wooden floorplates, wooden fences or wooden packing material, i.e. for assembling wooden components into wooden floorplates, wooden fences or wooden packing material is provided. The machine comprises at least a first movable arm, such as at least a first robot having a multiaxial arm, the first movable arm being coupled to at least a first group of devices, the at least first group of devices comprising

- A) at least a first holding device for holding a wooden component; and
- B) at least a first joining device for joining said wooden component with at least one fastener;

wherein the at least first holding device and the at least first joining device are adapted to simultaneously hold and join the wooden component.

[0008] According to some embodiments, the movable arm may be an arm of at least a first robot, preferably being a multiaxial arm of at least a first robot. The arm may be an arm of a robot. The at least first robot's arm may be a multiaxial arm, the at least a first group of devices being coupled to e.g. the extremity of this robot arm.

[0009] The movable arm, such as an arm of a robot, e.g. a multiaxial arm of a robot, may move in 3 dimensions, thereby moving a wooden component held by the holding device and bringing it in place where this wooden component needs to be coupled to another wooden component.

[0010] It is understood that the at least a first joining device joins this first wooden component with the at least one fastener to a second wooden component. The fas-

tener is preferably a metal fastener, such as a nail, spike, staple or screw. The joining device may be a nailing device, a stapling device or a screwing device.

[0011] The holding device and the joining device are in each other's proximity. The distance between the centre point of the holding device and the centre point of the joining device is not larger than 1000mm, such as not larger than 500mm, e.g. not larger than 400mm, e.g. about 80mm. The distance between the centre point of the holding device and the centre point of the joining device may be more than or equal to 10mm, e.g. more than or equal to 15mm.

[0012] The wooden components may be assembled into wooden pallets, wooden floorplates or wooden fences. As an example, the wooden component may be a wooden piece present in a pallet, e.g. a bottom deck board, a block, a stringer, a stringer board, a top deck board, or may be a combination of pieces present during the assembling of a pallet, such as a bottom deck board provided with one or a plurality (e.g. three) blocks (this combination is also referred to as "ski"), or one or more stringers or stringer boards provided with one or a plurality of top deck boards.

[0013] The joining with a fastener, such as a metal fastener, may preferably be nailing with one or more nails or spikes, or stapling with one or more staples. Nailing means that two components, both present in the wooden product to be provided, like the wooden pallet, are nailed one to the other. Stapling means that two components, both present in the wooden product to be provided, like a wooden pallet, are stapled one to the other. Hence a first wooden component is provided, e.g. on a support surface. The at least first group of devices is adapted to hold the second wooden component, held by the at least first holding device, and bring this second component in proximity, such as in contact with the first wooden component, after which the at least first joining device joins, e.g. nails or staples, the two components to each other, while the second component is still held by the at least first holding device.

[0014] The "at least first holding device and the at least first joining device being adapted to simultaneously hold and join, e.g. nail or staple, a wooden component" means that the joining device is able to insert a first fastener, like a nail or a spike or a staple or a screw in the component while the component is held by the holding device. Optionally the joining device may insert a second or further fastener, e.g. a nail or spike or staple or screw, in the component, while the holding device continues holding the component. Optionally the joining device may insert a second or further fastener, e.g. a nail or spike or staple or screw, in the component, while the holding device has released the component.

[0015] The holding device may also hold and carry wooden components and place it on a predefined position, without joining by means of a fastener, e.g. nailing or stapling or screwing, taking place.

[0016] The machine may be used to assemble block

pallets and/or stringer pallets, being an example of a packing material. The machine may be used to assemble other wooden packing materials, like wooden baskets, containers, crates, boxes and alike. The machine may be used to assemble wooden floorplates. The machine may be used to assemble wooden fences, like wooden garden fences and alike, which on their turn may e.g. be used to construct wooden stables or garden sheds.

[0017] The advantage of the machine according to the invention is that the use of moulds on or in which wooden components of the wooden product are placed prior to joining by means of a fastener, may be avoided. When components are first placed one on top of the other by e.g. a first robot arm holding a holding device, after which the two components are nailed or stapled or screwed together by means of a second robot arm holding a joining device to nail or staple or screw, and this without the use of a mould, the two components may move one relative to the other during transition between holding phase and nailing/stapling/screwing phase. This results in defective products, like pallets, or in products out of tolerances, like pallets out of tolerances. The simultaneous holding and joining according to the invention cause that the component being held by the holding device, is held in place during joining, like nailing or stapling or screwing. As such, no relative movement during holding and joining of the component can take place, resulting in a higher quality and accuracy of the wooden product, like wooden pallet, fence or floorplate being assembled.

[0018] As no moulds are needed, e.g. pallets of different dimensions may be assembled quite easily one after the other, as no changing of a mould is necessary to change between different dimensions.

[0019] According to some embodiments, the at least first holding device may comprise a gripper for gripping the wooden component.

[0020] The gripper is provided with at least two fingers, at least one of which is a movable finger. The fingers can be controlled and moved by pressurised fluid, e.g. pneumatically or hydraulically. The gripper may have one or more static fingers, which do not move but against which the wooden component is pressed by the at least one movable finger.

[0021] According to some embodiments, the at least first holding device may comprise a suction cup for sucking said wooden component.

[0022] According to some embodiments, the at least first holding device may comprise a vacuum lifting tool for lifting said wooden component.

[0023] Preferably the suction cup or vacuum lifting means applies its holding action at the surface of the wooden component, in which surface the joining device needs to insert its fastener. This has the advantage that various wooden components can be positioned one adjacent and in contact with the other along their side edges, via which side edges no fasteners are to be inserted. Using grippers may cause the finger or fingers of the gripper to prevent placing adjacent components against

each other sidewise, e.g. to make a closed top deck surface of a wooden pallet.

[0024] According to some embodiments, the at least a first group of devices further may comprise at least a second joining device.

[0025] According to some embodiments, the at least first holding device and said at least second joining device may be adapted to simultaneously hold said wooden component and join said wooden component with a fastener.

[0026] The first and second joining device, both being nailing devices, may be adapted to nail with identical nails or spikes, or may both nail with different nails or spikes. The nails and spikes may differ in length and/or gauge (or diameter). The nails may both be brad nails or finish nails, or one may be a brad nail the other a finish nail. The nails or spikes may differ in composition of the metal, e.g. the steel type of which they are made, etc.

[0027] The first and second joining device, both being stapling devices, may be adapted to staple with identical staples, or may both staple with different staples. The staples may differ in length, width and/or wire gauge (or diameter). The staples may differ in composition of the metal, e.g. the steel type of which they are made, etc.

[0028] Preferably the joining device or devices are nailing devices.

[0029] Optionally the group of devices may comprise a third and further joining device. Some or all further joining devices may be adapted to join a wooden component with a fastener while the holding device holds the wooden component.

[0030] It is understood that, in case the group of devices comprises more than one joining device, the joining devices may be adapted to join with a fastener simultaneously, or in sequence, or two or more joining devices may be adapted to join by means of a fastener simultaneously, while other joining devices from the group of devices join, by means of a fastener, earlier or later.

[0031] According to some embodiments, the at least first joining device may be a nailing gun. The nailing gun may be a pneumatic nailing gun.

[0032] Such pneumatic nailing gun may comprise a pressure vessel and a nail or spike cartridge. Using compressed air as driving fluid to shoot the nails or spikes, in combination with the use of a vacuum lifting means using air under pressure to lift the component, may simplify the general setup of the machine.

[0033] According to some embodiments, the at least first joining device may be a stapling gun, such as an electrical or pneumatic stapling gun.

[0034] Any other joining device from the group of devices may be an identical, similar or different joining device as compared to the first joining device.

[0035] According to some embodiments, the arm, e.g. the extremity of the arm, may be provided with a beam, the beam carrying the at least first group of devices.

[0036] According to some embodiments, the beam may carry N groups of devices, N being an integer larger

than 1.

[0037] The groups of devices may be identical, similar or different.

[0038] According to some embodiments, one, more than one or even all groups of devices may be movable in axial direction of the beam. The groups of devices may change position, e.g. automatically or manually, along the axis of the beam. As such, the intergroup distances between the groups of devices may be adjusted or set to a distance required for the wooden product to be provided. This enables the machine to hold and nail wooden components on distances between the wooden components which can be adjusted. This allows and gives freedom to provide a plurality of different wooden products.

[0039] The groups may all hold and join, e.g. nail or staple or screw, the component simultaneously. Preferably N is 2 or 3 but may be more. N being 2 or 3 is beneficial in the assembly of e.g. wooden pallets, as it allows the use of the machine to simultaneously hold a bottom deck board and join, e.g. nail or staple, the bottom deck board to 2 or 3 stringers or 2 or 3 blocks. In the latter case, a ski is provided in one movement of the movable arm, e.g. the robot arm. This also allows to nail or staple 2 or 3, but optionally more, stringer boards to a plurality of adjacent top deck boards, the top deck boards being joined, e.g. nailed or stapled, to the 2 or 3 but optionally more stringers one after the other. It also allows to join, e.g. nail or staple, this combined top deck board with stringer boards to 2 or 3 but optionally ore skis. The distance between the groups is thus preferably identical to the distance between the adjacent skis or stringer boards (centre to centre) in the pallet. As such, the machine may be used to provide block or stringer pallets with known composition.

[0040] Also for other wooden products, like wooden fences or wooden floorplates (or floor panels), or other wooden packaging material, the use of more than one group of devices one adjacent to the other may increase the production speed as different joining actions may be done simultaneously.

[0041] The machine may further comprise other pieces and tools. As an example, the machine may comprise at least one support surface, such as a table, to place the components to be joined upon. The machine may comprise a means to cause the components to be at the disposition of the holding device, e.g. an automatic provision of wooden components. The machine may comprise a means to take wooden blocks from a basket or container comprising a plurality of wooden blocks. The machine may comprise a means to take boards from a stack of boards, and e.g. sort them on a storage surface from which the holding device of the robot takes the beams to be joined. The machine may comprise at least a further robot or device to place one or more first components on a surface, before the arm with the at least one group of devices brings a second wooden component in contact with the first wooden component or components and joins this second component to the first component or compo-

nents. Alternatively, the holding device may place one or more first components on a surface, before it brings a second component in contact with the first component or components and joins this second component to the first component or components.

[0042] The movable arm, e.g. the arm of the robot, may comprise a carrying means to carry finished products, such as pallets, and stack them aside the machine. This carrying means may e.g. two forks or vacuum pads for lifting the assembled products, such as pallets.

[0043] A machine according to the invention may comprise at least a second movable arm, the second arm being coupled to at least one group of devices, the group of devices comprising

- A) at least a first holding device for holding a wooden component; and
- B) at least a first joining device for joining said wooden component with at least one fastener;

wherein the at least first holding device and the at least first joining device are adapted to simultaneously hold and join the wooden component.

[0044] the two and potentially more movable arms may be similar or identical. The one or more groups of devices on the second or further movable arm may be similar or identical to the groups of devices on the first movable arm.

[0045] Hence the machines according to the invention may comprise more than one robot, each robot having a multi-axial arm, this arm, optionally the extremity of this arm, being coupled to at least a first group of devices, the at least first group of devices comprising

- A) at least a first holding device for holding a wooden component; and
- B) at least a first joining device for joining said wooden component with at least one fastener;

wherein the at least first holding device and the at least first joining device are adapted to simultaneously hold and join the wooden component. As an example, a machine may comprise two robots each being provided with a one or a plurality of groups of devices. Each robot may comprise a beam on which a plurality of groups of devices are provided. These groups of devices may be movable along the axis of the beam to which it is provided. The robots may be identical or may differ one from the other, e.g. differ in the number of groups of devices provided on the multi-axial arms. For each of the robot arms, the arm may move according to 2, 3, 4, 5, 6 or more axes.

[0046] The movement and action of the arm, or of the robot when the movable arm is the arm of a robot, may be fully controlled by a control unit being part of the machine, controlling the arm of e.g. the robot and other automated pieces and tools, together forming the machine for assembling wooden components into products, such as a wooden pallet. The arm, e.g. the arm of the robot,

is adapted to execute one or more sequences of actions to be taken by the arm and optionally other pieces and tools of the machine, in order to assemble products, such as complete wooden pallets.

[0047] According to a second aspect of the invention, a method to assemble products, such as wooden pallets, from wooden components is provided.

[0048] The method to assemble wooden components into wooden floorplates, wooden fences or wooden packing material, comprises the steps of

- (a) providing a machine according to any one of the preceding claims;
- (b) providing a support surface;
- (c) providing a first wooden component on the support surface;
- (d) taking a second wooden component by the at least one holding device on the movable arm;
- (e) holding the second wooden component while bringing the second wooden component in contact with the first wooden component;
- (f) joining, with at least a first fastener, the second wooden component to the first wooden component while holding the second wooden component;
- (g) optionally joining, with at least one further fastener, the second wooden component additionally to the first wooden component, optionally after the holding device has interrupted the holding of the second wooden component; and
- (h) further assembling wooden components until a wooden floorplate, wooden fence or wooden packing material is assembled.

[0049] According to some embodiments, the movable arm may be an arm of a robot, preferably a multi-axial arm of a robot.

[0050] According to some embodiments, the step h) may comprise the repetition of steps c) to g) until a wooden floorplate, wooden fence or wooden packing material is assembled.

[0051] According to some embodiments, the machine is provided in which the at least a first group of devices further comprises at least a second joining device, and optionally the at least first holding device and the at least second joining device being adapted to simultaneously hold said wooden component and join said wooden component with a fastener. According to these embodiments, in step g), said joining said second wooden component additionally to the first wooden component is preformed after the holding device has interrupted the holding of the second wooden component.

[0052] According to some embodiments, the joining with at least one further fastener of step g) may be done after the holding device has interrupted the holding of the second wooden component.

[0053] Hence as an example, the joining, with a fastener, of step f) is performed by the at least one joining device of the group of devices while the holding device

is holding the second component, after which in step g) the holding device released the second component and the arm moves to position the joining device on a different position on the second component, the joining device thereafter joins with a fastener a second time the second component to the first component.

[0054] According to some embodiments, the method may provide wooden pallets, in one of the one or more sequences of steps c) to g), the first component may be a block, the second component being a bottom deck board.

[0055] According to some embodiments, the method may provide wooden pallets, in one of the one or more sequences of steps c) to g), the first component may be a bottom deck board provided with one or more blocks, the second component being a stringer board.

[0056] According to some embodiments, the method may provide wooden pallets, in one of the one or more sequences of steps c) to g), the first component may be a bottom deck board provided with one or more blocks, to which blocks a stringer has been provided, the second component being a top deck board.

[0057] According to some embodiments, the method may provide wooden pallets, in one of the one or more sequences of steps c) to g), the first component may be a stringer, the second component being a bottom deck board.

[0058] Preferably the joining action in steps f) and g) are nailing actions.

[0059] The method may provide wooden block pallets and/or wooden stringer pallets, being examples of wooden packing materials.

[0060] The machine may be used to assemble other wooden packing materials, like wooden baskets, wooden containers, wooden crates, wooden boxes and alike. The machine may be used to assemble wooden floorplates. The machine may be used to assemble wooden fences, like wooden garden fences and alike, which on their turn may be used to construct wooden stables or garden sheds.

[0061] Hence according to a third aspect of the present invention, a machine according to the first aspect of the invention is used to assemble wooden floorplates, wooden fences or wooden packing material, such as block pallets and/or stringer pallets.

[0062] It is understood that features of one aspect of the invention may be applied and combined with features of another aspect of the invention.

Brief Description of the Drawings

[0063]

Fig. 1 illustrates schematically a machine according to the invention.

Fig. 2, 3 and 4 illustrate schematically some details of the machine of figure 1.

[0064] The same reference signs refer to the same or a similar feature in the different figures.

Detailed Description of Embodiment(s)

[0065] A general overview of a machine according to the invention, in this embodiment a machine 1000 to provide wooden block pallets, is shown in general in figure 1. Details of the machine are shown in figures 2, 3 and 4.

[0066] The machine 1000 comprises two robots 1100 and 1200, each being provided with a movable arm 1001 with a beam 1005 on which three groups of devices 1002 are provided. Each group of device comprises a holding device 1003 comprising a vacuum pad lifting tool and a pneumatic nail gun 1004. The position of each of the group of devices may be set and adjusted along the axis of the beam 1005. This may be done automatically or manually. The machine 1000 further comprises a third robot 1300. This robot is provided with an arm 1301, on this arm a holding device 1303 to grip and hold blocks from a container and place them on an endless belt 1302.

[0067] It is understood that as an alternative, a machine may be provided comprising two or more robots, each being provided with a movable arm with a beam 1005 on which two, three or more groups of devices are provided.

[0068] As shown in figure 2, the blocks 10 provided on the endless belt 1302, are positioned in groups of 3 blocks in front of the robot 1100. By means of the vacuum pads of the holding device 1003 a bottom deck board is taken from a stack or row of bottom deck boards, and laid on the three blocks, after which the bottom deck board is nailed by the nailing gun 1004 of the joining device to the blocks while the holding device 1003 still holds the bottom deck board in place. After each block is nailed to the bottom deck boards once, the holding device 1003 interrupts its holding action, the robot arm is displaced over a little distance and a second nail is shot into the bottom deck board and each of the blocks. As such a ski is provided. The ski is turned, is lifted by the holding device and positioned on a first support surface 1010. The blocks are positioned upwards. This action is done three times providing three skis on the support surface 1010.

[0069] As shown in figures 3 and 4, while the first robot 1100 is providing and positioning the skis, the second robot 1200 is placing three stringer boards 11 on a second surface 1011, positions several top deck boards 12 on the three stringer boards 11 and nails the top deck boards 12 to the stringer boards 11. Also here, the top deck board is held by the holding device 1003, is positioned on the stringer boards, and nailed to the stringer boards by the nailing gun 1004 while the vacuum pads of the holding device hold the top deck boards in place. After each top deck board is nailed to the stringer boards once, the holding device 1003 interrupts its holding action, the robot arm is displaced over a little distance and a second nail is shot into the top deck board and each of the stringer boards. As such a top deck is provided on

support 1011.

[0070] The first robot 1100 now lifts the provided top board by means of the holding devices 1003, positions the top deck on the three skis and nails the top deck on the first block of the skis by means of the nail guns 1004, while the top deck is held in place by means of the holding devices 1003. The holding action is interrupted, the arm 1001 is repositioned and a second nail is shot to join the top deck to this first ski. This action is repeated 2 times for the other blocks of the skis. As such a block pallet is provided. The first robot 1100 now picks up the produced block pallet by means of its carrying device 1101. The finished block pallet is brought to the transport means 1400 by which the finished block pallet is carried away.

[0071] The joining devices are all the same for the groups of devices 1002 on one arm 1001. The joining devices on the robot 1100 are similar but not identical to the joining services on the robot 1200. The joining devices on the first robot 1100 nail larger nails as compared to the joining devices on the second robot 1200.

[0072] It is understood that the holding device, in this embodiment comprising vacuum pads, may be replaced by gripping fingers or alike. It is also understood that the machine 1000 can be used to produce other wooden products, like wooden packing materials, e.g. wooden baskets, containers, crates, boxes and alike, or wooden floorplates, or wooden fences, like wooden garden fences and alike.

[0073] The movement and action of the robots 1100, 1200 and 1300, as well as all other components of the machine 1000, is fully controlled by a control unit being part of a remote device.

[0074] The machine 1000 further comprises an automatic provision system 1401 to provide wooden components to the robots. Stacks of beams are provided to the automatic provision system, and the beams are offered to the robots such the robots can take the beams or wooden components one by one.

[0075] This machine 1000 is adapted for assembling wooden components into wooden pallets, in which the tolerances of the wooden pallets are more consistently met. It is an automated machine avoiding the use of moulds or jigs on or in which the wooden components need to be placed. The output of the machine is higher. The method to assemble wooden components into wooden pallets, to which the machine 1000 is adapted to, is easily changed in order to produce pallets with mutually different dimension. Hence the machine 1000 according to the invention provides more freedom to easily modify the type of wooden pallets made. The machine 1000 may produce wooden products like floorplates, wooden fences or wooden packing material, such as wooden pallets, boxes, crates and alike, without the intervention of an operator, hence in full independency of an operator during some hours.

[0076] Although the present invention has been illustrated by reference to specific embodiments, it will be apparent to those skilled in the art that the invention is

not limited to the details of the foregoing illustrative embodiments, and that the present invention may be embodied with various changes and modifications without departing from the scope thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein. In other words, it is contemplated to cover any and all modifications, variations or equivalents that fall within the scope of the basic underlying principles and whose essential attributes are claimed in this patent application. It will furthermore be understood by the reader of this patent application that the words "comprising" or "comprise" do not exclude other elements or steps, that the words "a" or "an" do not exclude a plurality, and that a single element may fulfil the functions of several means recited in the claims. Any reference signs in the claims shall not be construed as limiting the respective claims concerned. The terms "first", "second", "third", "a", "b", "c", and the like, when used in the description or in the claims are introduced to distinguish between similar elements or steps and are not necessarily describing a sequential or chronological order. Similarly, the terms "top", "bottom", "over", "under", and the like are introduced for descriptive purposes and not necessarily to denote relative positions. It is to be understood that the terms so used are interchangeable under appropriate circumstances and embodiments of the invention are capable of operating according to the present invention in other sequences, or in orientations different from the one(s) described or illustrated above.

Claims

1. A machine for assembling wooden floorplates, wooden fences or wooden packing material, said machine comprises at least a first movable arm, said first movable arm being coupled to at least a first group of devices, said at least first group of devices comprising

- A) at least a first holding device for holding a wooden component; and
- B) at least a first joining device for joining said wooden component with at least one fastener;

wherein said at least first holding device and said at least first joining device are adapted to simultaneously hold and join said wooden component.

2. A machine according to claim 1, wherein said movable arm is an arm of a robot, preferably a multiaxial arm of a robot.

3. A machine according to claim 1 or 2, wherein said at least first holding device comprises a vacuum lifting tool for lifting said wooden component.
4. A machine according to any one of the preceding claims, wherein said at least a first group of devices further comprises at least a second joining device. 5
5. A machine according to claim 4, wherein said at least first holding device and said at least second joining device are adapted to simultaneously hold said wooden component and join said wooden component with a fastener. 10
6. A machine according to any one of the preceding claims, wherein said at least first joining device is a nailing gun. 15
7. A machine according to any one of the preceding claims, wherein said arm is provided with a beam, said beam carrying said at least first group of devices. 20
8. A machine according to claim 7, wherein said beam carries N groups of devices, N being an integer larger than 1. 25
9. A machine according to any one of the claims 7 to 8, wherein said groups of devices are movable in axial direction of the beam. 30
10. A machine according to any one of the preceding claims, wherein said machine comprises at least a second movable arm, said second arm being coupled to at least one group of devices, said group of devices comprising 35
 - A) at least a first holding device for holding a wooden component; and
 - B) at least a first joining device for joining said wooden component with at least one fastener; 40

wherein said at least first holding device and said at least first joining device are adapted to simultaneously hold and join said wooden component. 45
11. A method to assemble wooden components into wooden floorplates, wooden fences or wooden packing material, said method comprises the steps of 50
 - (a) providing a machine according to any one of the preceding claims;
 - (b) providing a support surface;
 - (c) providing a first wooden component on said support surface; 55
 - (d) taking a second wooden component by the at least one holding device on the movable arm;
 - (e) holding the second wooden component while bringing the second wooden component in contact with said first wooden component;
 - (f) joining, with at least a first fastener, the second wooden component to the first wooden component while holding the second wooden component;
 - (g) optionally joining, with at least one further fastener, said second wooden component additionally to the first wooden component, optionally after the holding device has interrupted the holding of the second wooden component; and
 - (h) further assembling wooden components until a wooden floorplate, wooden fence or wooden packing material is assembled.
12. A method according to claim 11, said step h) comprises the repetition of steps c) to g) until a wooden floorplate, wooden fence or wooden packing material is assembled.
13. A method according to any one of the claims 11 to 12, a machine according to any one of the claims 5 to 6 being provided, wherein in step g), said joining said second wooden component additionally to the first wooden component is preformed after the holding device has interrupted the holding of the second wooden component.
14. A method according to any one of the claims 11 to 13, wherein the joining with at least one further fastener of step g) is done after the holding device has interrupted the holding of the second wooden component.
15. The use of a machine according to any one of the claims 1 to 10, to assemble wooden floorplates, wooden fences or wooden packing material, such as block pallets and/or stringer pallets.

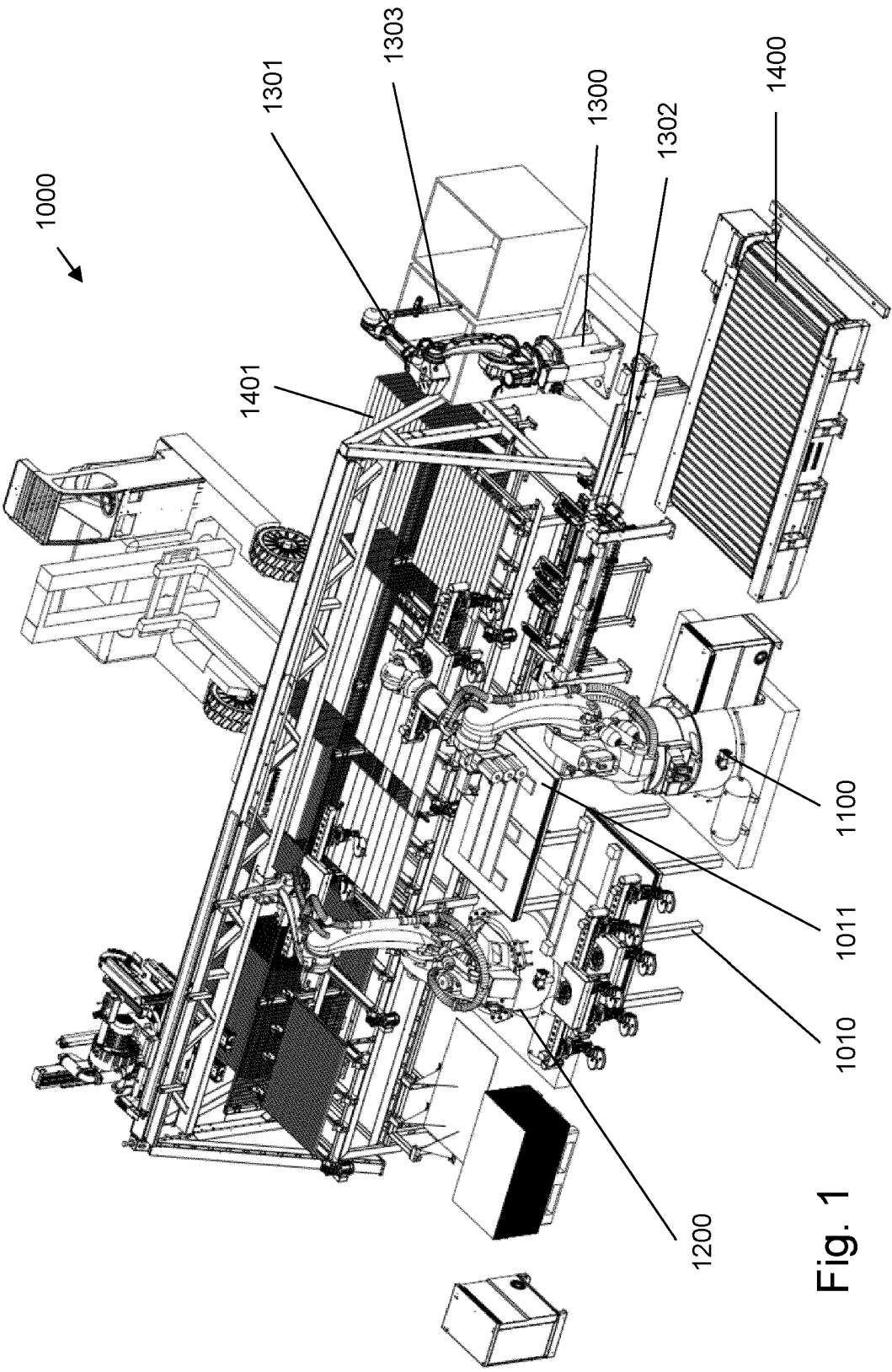


Fig. 1

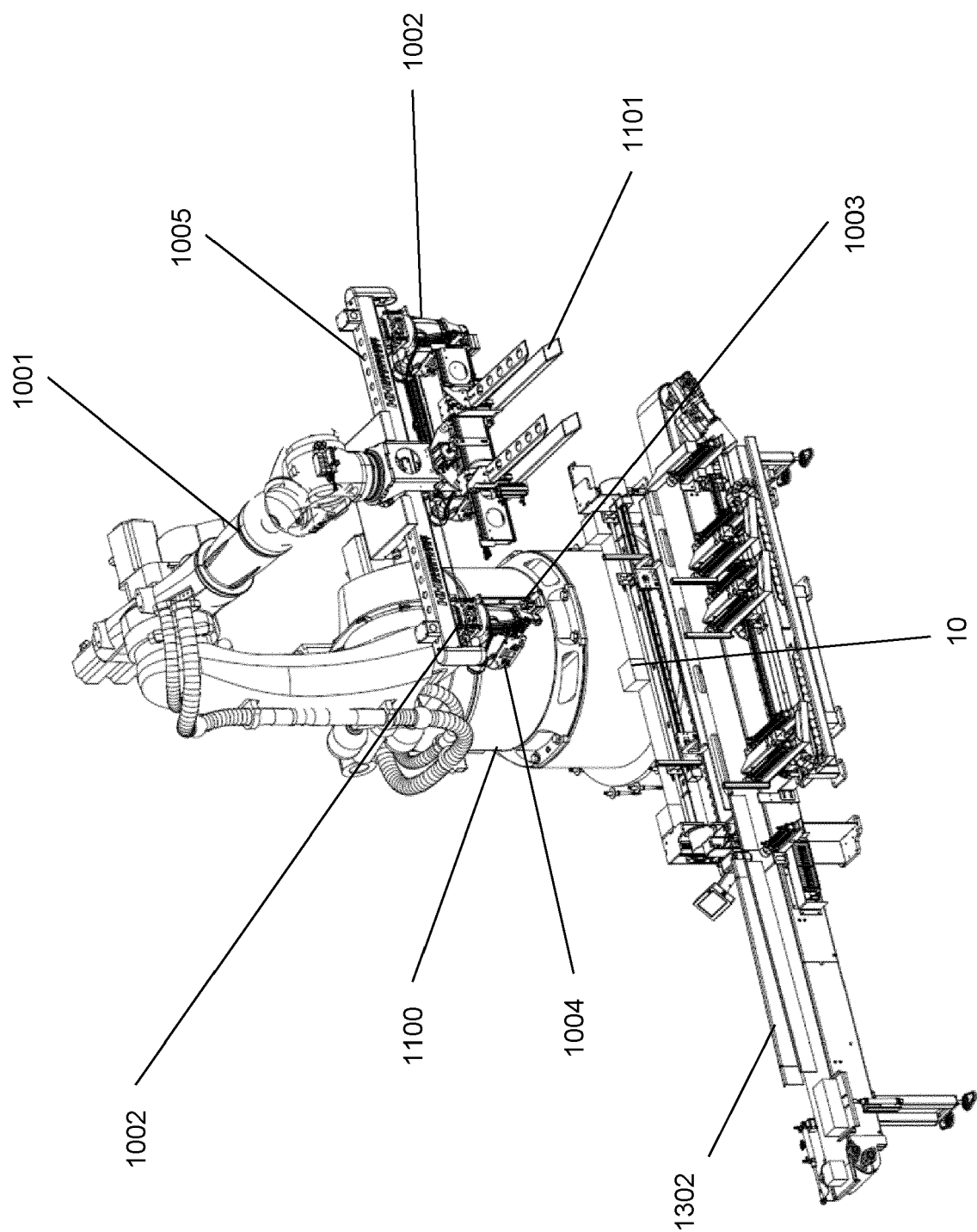


Fig. 2

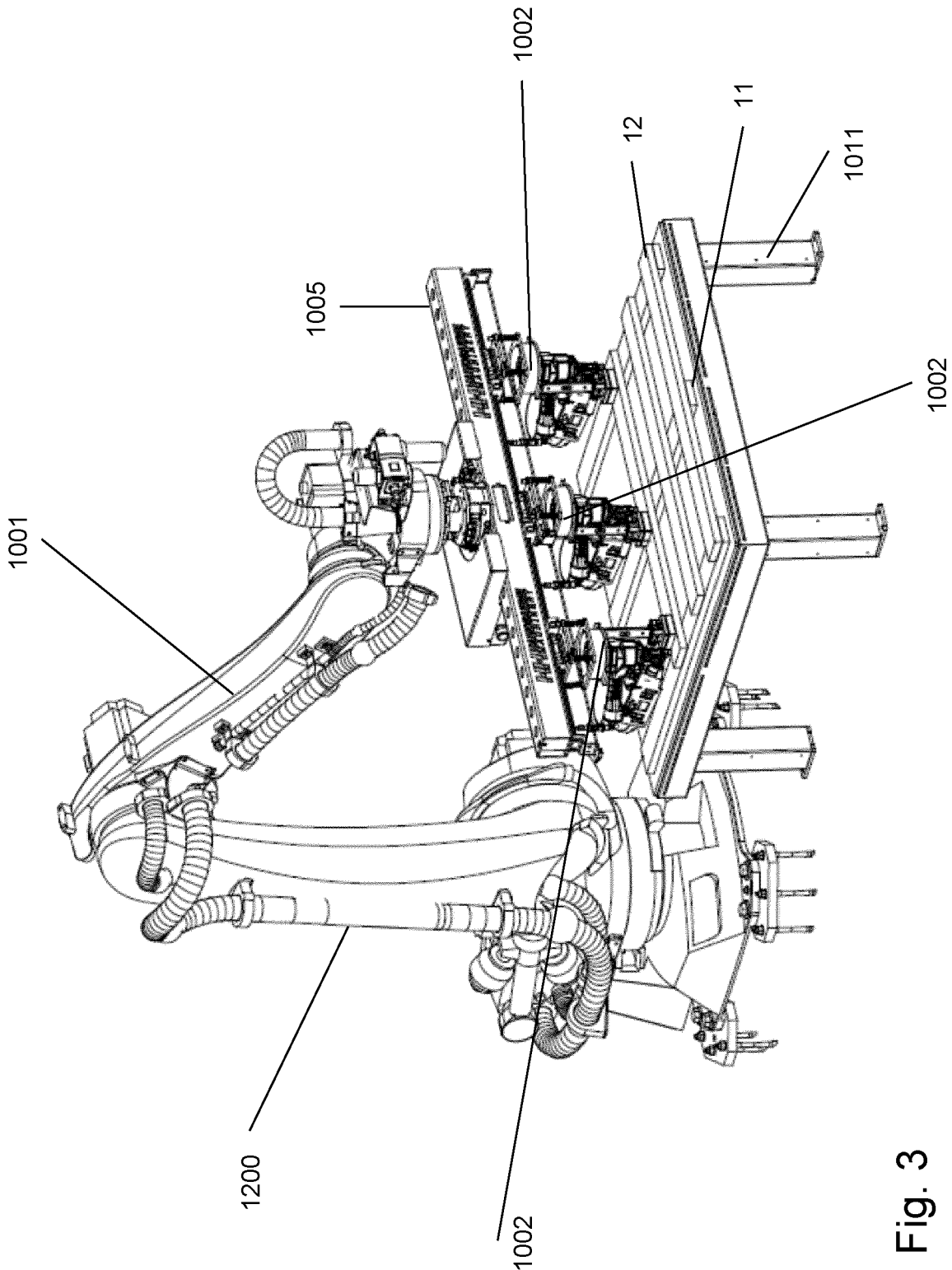


Fig. 3

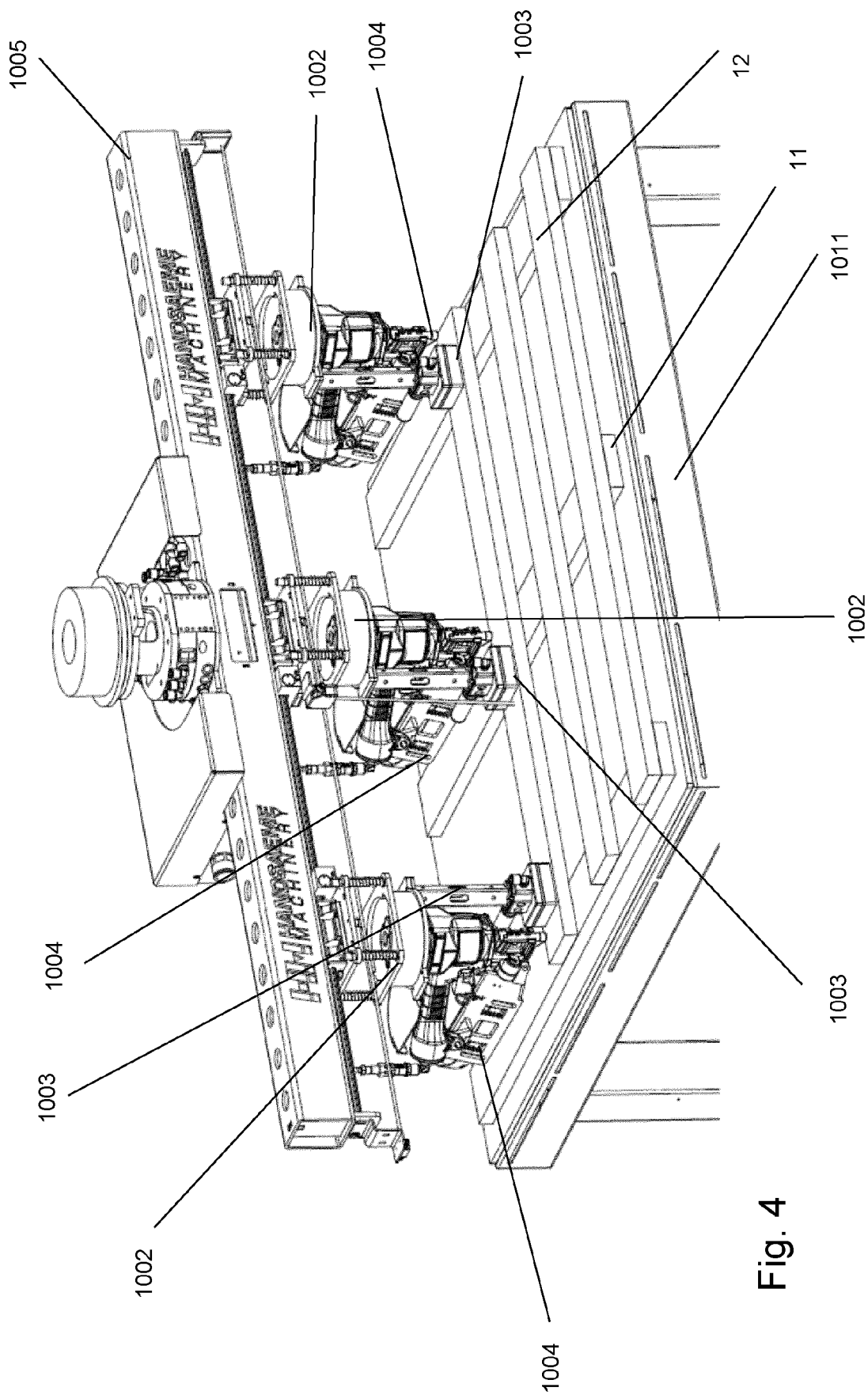


Fig. 4



EUROPEAN SEARCH REPORT

Application Number

EP 21 20 1911

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	US 2018/345525 A1 (WENNINGER CHET [US] ET AL) 6 December 2018 (2018-12-06) * abstract * * paragraphs [0086], [0087], [0088], [0092] - [0093], [0004]; figures * -----	1-15	INV. B27M3/04 B27M3/00 B27M3/34
			TECHNICAL FIELDS SEARCHED (IPC)
			B27M
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		24 March 2022	Hamel, Pascal
CATEGORY OF CITED DOCUMENTS			
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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24-03-2022

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
15	US 2018345525	A1	06-12-2018	NONE
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