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(54) **Angular machine for machining wooden or similar workpieces**

(57) An angular machine for machining a workpiece (2) made of wood or similar materials comprises a mutually opposite first abutting element (21) and second abutting element (22) for abutting on respective end portions (9; 10) of said workpiece (2) and gripper means (51) for grasping said workpiece (2), which is movable towards and away from said first abutting element (21) and said second abutting element (22) and rotatable around a first axis (R2) having a working position contained in a plane (H) substantially equidistant from opposite abutting surfaces (24; 25) of said first abutting element (21) and of said second abutting element (22).

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Description

[0001] The invention relates to an angular machine for machining workpieces made of wood or similar materials.

[0002] In particular, the invention refers to an angular machine for making uprights and crosspieces of casings, for example glazed casings such as windows.

[0003] Angular machines are known for making uprights and crosspieces of casings comprising a plurality of workstations.

[0004] Such workstations are arranged, suitably spaced, along a first side and a second side of the aforesaid angular machines.

[0005] In particular, the first side and the second side extend in a manner that is substantially parallel respectively to a first axis and to a second axis that are horizontal and mutually perpendicular.

[0006] Along the first side there is provided a cutting station and a tenoning station, the tenoning station being positioned downstream of the cutting station.

[0007] The cutting station comprises a first horizontal axis tool for facing opposite end portions of the workpiece to be machined.

[0008] In this manner, the cutting station makes opposite end surfaces of the workpiece to be machined substantially flat. The tenoning station comprises a second tool, generally a spindle moulder, for making tenons on the aforesaid end surfaces.

[0009] Such angular machines further comprise a carriage extending substantially parallel to the second axis and which is movable along the first side of the angular machine parallel to the first axis.

[0010] The carriage is provided at an end thereof, positioned near the first side, with a wall extending parallel to the first axis.

[0011] This wall supports a first abutting element and a second abutting element.

[0012] The first abutting element and the second abutting element comprise respectively a mutually facing first abutting surface and second abutting surface, arranged for abutting on a first side surface of the workpiece.

[0013] Between the first abutting surface and the second abutting surface there is further defined an opening in which is inserted a respective end portion of the workpiece to be machined.

[0014] The carriage further comprises a locking element, positioned between the first abutting element and the second abutting element, substantially parallel to the first axis.

[0015] The locking element is moved by a pneumatic cylinder fixed to the aforesaid wall.

[0016] The locking element is arranged for abutting on a second side surface of the workpiece, opposite the aforesaid first side surface, so as to lock the workpiece to be machined respectively against the first or the second abutting surface.

[0017] In this manner, the locking element locks the workpiece parallel to the first axis.

[0018] Known angular machines further comprise a gripper slidably supported by the carriage and arranged for grasping and moving the workpiece to be machined.

[0019] In particular, this gripper is movable parallel to the second axis, towards and away from the aforesaid opening, and is rotatable by 180° around a rotation axis thereof that is substantially parallel to a third axis, that is substantially vertical and perpendicular to the first axis and to the second axis.

[0020] This enables the workpiece to be suitably rotated for machining the aforesaid opposite end portions one at a time. In particular, the aforesaid rotation axis is contained in a plane positioned at a certain distance from a further plane that is substantially equidistant from the aforesaid abutting surfaces.

[0021] This means that the opening defined between the first abutting surface and the second abutting surface has to be sufficiently wide to be able to receive the aforesaid end portions, following a rotation by 180° of the gripper.

[0022] Along the second side there are positioned one after the other, compared with an advancing direction of the workpiece, a profiling station, a first milling station and a second milling station.

[0023] The profiling station comprises profiling tools, having respective rotation axes parallel to the third axis, for profiling and milling the first side surface of the workpiece, in particular for making a groove into which a glass pane of the casing is subsequently inserted.

[0024] The first milling station comprises first milling tools, having respective rotation axes parallel to the first axis, for cutting from the aforesaid first side surface a portion of the workpiece extending parallel to the second axis, this portion being called a "list" by those skilled in the art.

[0025] This list is subsequently used for locking the glass previously inserted into the casing.

[0026] The second milling station comprises a second milling tool, having a rotation axis parallel to the third axis, to make a hollow in the aforesaid second side surface of the workpiece, arranged, in use, to receive a hardware to be inserted into the casing.

[0027] A drawback of such machines is that they are particularly bulky.

[0028] In fact, the aforesaid wall of the carriage has to be sufficiently wide to be able to support the first abutting element and the second abutting element, suitably distanced from one another, so that the first abutting element and the second abutting element define the aforesaid opening, having dimensions such as to be able to receive the opposite end portions of the workpiece, following the 180° rotation of the gripper.

[0029] Further, in such machines the second side is very wide, inasmuch as the profiling station, the first milling station and the second milling station have to be positioned along the second side.

[0030] A further drawback of the aforesaid angular machines is that they are particularly expensive.

[0031] This is due to the costs to be borne for making the aforesaid workstations.

[0032] A still further drawback is that the aforesaid machines have a significant weight.

[0033] This is due to the considerable mass determined by the dimensions of the machines.

[0034] An object of the invention is to improve the angular machines for machining workpieces made of wood or similar materials.

[0035] A further object is to provide compact angular machines.

[0036] A still further object is to make angular machines of moderate cost.

[0037] Still another further object is to obtain angular machines that are lighter than known angular machines.

[0038] In a first aspect of the invention there is provided an angular machine for machining a workpiece made of wood or similar materials comprising a mutually opposite first abutting element and second abutting element for abutting on respective end portions of said workpiece and gripper means for grasping said workpiece, which is movable towards and away from said first abutting element and said second abutting element and rotatable around a first axis, characterised in that said first axis has a working position contained in a plane substantially equidistant from opposite abutting surfaces of said first abutting element and of said second abutting element.

[0039] In a second aspect of the invention there is provided an angular machine for machining a workpiece made of wood or similar materials, comprising first milling means for cutting an external longitudinal portion of said workpiece and second milling means for making hollow means in a side of said workpiece, characterised in that there is provided moving means for rotating said first milling means and said second milling means around a rotation axis.

[0040] Owing to the first and second aspect of the invention, it is possible to obtain a particularly compact, light and low-cost angular machine.

[0041] In fact, on the one hand, owing to the first aspect of the invention, it is possible to minimise a distance between said first abutting element and said second abutting element for the same maximum width of said workpiece to be machined.

[0042] In this manner, supporting means of said angular machine arranged for supporting said first abutting element and said second abutting element have overall dimensions, and consequently a weight, that are moderate.

[0043] On the other hand, owing to the second aspect of the invention, it is possible to provide a sole milling station as opposed to the two milling stations provided in known angular machines.

[0044] In fact, it is possible to suitably rotate said milling station between a first working position and a second working position, in which said milling station is arranged for respectively cutting said portion and for making said hollow means.

[0045] This makes said angular machine more compact and cheaper than known machines.

[0046] In a third aspect of the invention, there is provided an angular machine for machining a workpiece made of wood or similar materials, comprising locking means for locking end portions of said workpiece against abutting means, actuator means for moving said locking means towards and away from said abutting means, and flexible driving means for connecting said actuator means to said locking means.

[0047] The invention can be better understood and carried into effect with reference to the attached drawings in which an embodiment of the invention is shown by way of non-limiting example, in which:

Figure 1 is a perspective view of an angular machine;
Figure 2 is a perspective view of gripper means included in the angular machine in Figure 1, in a first operating configuration;
Figure 3 is a perspective view of the gripper means in Figure 2 in a second operating configuration;
Figure 4 is a schematic top view of the gripper means in Figure 3;
Figure 5 is a perspective view of locking means included in the angular machine in Figure 1;
Figure 6 is a side view of milling means included in the angular machine in Figure 1 in a first working position;
Figure 7 is an enlarged detail of Figure 6;
Figures 8 and 9 are perspective views of the milling means in Figure 6;
Figure 10 is a side view of the milling means in Figure 6 in a second working position;
Figure 11 is an enlarged detail of Figure 10;
Figures 12 and 13 are perspective views of the milling means in Figure 10;
Figure 14 is a perspective view of a further embodiment of the angular machine in Figure 1;
Figure 15 is a side view of milling means included in the angular machine in Figure 14 in the first working position;
Figure 16 is an enlarged detail of Figure 15;
Figures 17 and 18 are perspective views of the milling means in Figure 15;
Figures 19 and 20 are perspective views of the milling means in the second working position.

[0048] With reference to Figure 1, there is shown an angular machine 1 for machining workpieces 2 made of wood or similar materials arranged for forming uprights and crosspieces of casings 3 (Figure 12), for example glazed casings such as windows.

[0049] The angular machine 1 is then disclosed with reference to a tern 14 of Cartesian axes comprising a first axis X, a second axis Y and a third axis Z, the first axis X and the second axis Y being substantially horizontal and the third axis Z being substantially vertical.

[0050] The angular machine 1 comprises a first side 4

and a second side 5 extending substantially parallel respectively to the second axis Y and to the first axis X.

[0051] In other words, the first side 4 and the second side 5 are positioned substantially at right angles.

[0052] The angular machine 1 comprises a cutting station 6 and a tenoning station 7 positioned along the first side 4.

[0053] The tenoning station 7 is positioned downstream of the cutting station 6 compared with a first advancing direction A1, substantially parallel to the second axis Y of the workpiece 2 along the first side 4.

[0054] The cutting station 6 comprises a blade 8, rotating around a first rotation axis, not shown, substantially parallel to the first axis X, for facing a first end portion 9 and a second end portion 10, which are mutually opposite, of the workpiece 2 (Figures 2 and 3).

[0055] In other words, the blade 8 makes substantially flat a first end surface 11 and a second end surface 12 respectively of the first end portion 9 and of the second end portion 10.

[0056] The tenoning station 7 comprises a spindle moulder 13 arranged for making tenons in the first end surface 11 and in the second end surface 12.

[0057] The angular machine 1 further comprises a carriage 15, shown in detail in Figures 2 and 3, extending substantially parallel to the first axis X and movable substantially parallel to the second axis Y.

[0058] The carriage 15 is slidable along a first guide 17, extending parallel to the first side 4, between a first position and a second position, which are not shown, in which the carriage 15 is positioned respectively substantially at a first end, which is not shown, and at a second end 16 of the first guide 17, the second end 16 being opposite the first end.

[0059] The carriage 15 is provided at one end 18 thereof, positioned near the first side 4, with a first wall 19 extending substantially parallel to a first plane YZ defined by the second axis Y and by the third axis Z (Figures 2 to 5).

[0060] The first wall 19 supports a first abutting element 21, a second abutting element 22 and a third abutting element 23.

[0061] The first abutting element 21 and the second abutting element 22 respectively comprise a mutually facing first abutting surface 24 and second abutting surface 25, which are substantially parallel to a second plane XZ defined by the first axis X and by the third axis Z, whilst the third abutting element 23 comprises a third abutting surface 28 substantially parallel to a third plane XY defined by the first axis X and by the second axis Y.

[0062] The first abutting surface 24 and the second abutting surface 25 are arranged for abutting, in use, on a first side surface 26 of the workpiece 2 extending substantially parallel to the second plane XZ, whilst the third abutting surface 28 is arranged for abutting on a second side surface 29 of the workpiece 2 extending substantially parallel to the third plane XY.

[0063] Between the first abutting surface 24 and the second abutting surface 25 there is defined an opening 27 in which, in use, the first end portion 9 and the second end portion 10 are inserted.

[0064] The carriage 15 further comprises a first locking element 30, shown in Figures 2 and 4, supported by a first support 43 positioned and movable along a second guide 31 fixed to the first wall 19, between the first abutting element 21 and the second abutting element 22, substantially parallel to the second axis Y (Figure 5).

[0065] In particular, the first locking element 30 is arranged for abutting on a third side surface 32 of the workpiece 2 opposite the first side surface 26 so as to lock the workpiece 2 respectively against the first abutting surface 24 or against the second abutting surface 25.

[0066] In this manner, the first locking element 30 locks the workpiece 2 parallel to the second axis Y.

[0067] The first locking element 30 is moved by a first actuator 35, indicated by a broken line, fixed to a second wall 36 of the angular machine 1 extending substantially parallel to the second plane XZ.

[0068] The first actuator 35 and the first locking element 30 are connected by looped cable means 37 on a first wheel 38 and a second wheel 39 that are free to rotate around respective rotation axes substantially parallel respectively to the first axis X and to the second axis Y and are fixed respectively to the first wall 19 and to the second wall 36. Between the first wheel 38 and the second wheel 39 a third wheel 40 and a fourth wheel 41 are interposed that are fixed on an edge portion 42 defined between the first wall 19 and the second wall 36, that are free to rotate around respective rotation axes, substantially parallel to the third axis Z, the fourth wheel 41 being positioned below the third wheel 40.

[0069] In other words, the looped cable means 37 comprises a first part 44 positioned substantially at the first wall 19 and fixed to the first support 43, and a second part 45 positioned substantially at the second wall 36 and fixed to the first actuator 35.

[0070] The carriage 15 further comprises a second locking element 33, for example a presser, positioned substantially above, and movable towards and away from, the third abutting surface 28.

[0071] The second locking element 33 is movable along a third guide 46 extending substantially parallel to the third axis Z and fixed to an upright 47 supported by the first abutting element 21.

[0072] In particular, the second locking element 33 is arranged for abutting a fourth side surface 34 of the workpiece 2 opposite the second side surface 29 so as to lock the workpiece 2 against the third abutting surface 28.

[0073] In this manner, the second locking element 33 locks the workpiece 2 parallel to the third axis Z.

[0074] The second locking element 33 is moved by, and is connected to, a second actuator 48 fixed to a crosspiece 49 of a supporting element 50, having substantially the shape of an overturned L and mounted on the second abutting element 22.

[0075] The angular machine 1 further comprises a grip-

per 51 slidably supported by the carriage 15 and arranged for grasping and moving one or more workpieces 2 to be machined.

[0076] The gripper 51 is movable substantially parallel to the first axis X, towards and away from the opening 27, and is rotatable, automatically or manually by an operator, by 180° around a second rotation axis R2, between a first operating configuration P1 (Figure 2) and a second operating configuration P2 (Figures 3 and 4), in which an abutting surface 100 of the gripper 51, arranged for abutting the first side surface 26, is substantially coplanar respectively with the first abutting surface 24 and with the second abutting surface 25.

[0077] The second rotation axis R2 has a working position contained in a plane H, shown by a dash-dot line in Figures 3 and 4, substantially equidistant from the first abutting surface 24 and from the second abutting surface 25.

[0078] In particular, the second rotation axis R2 extends substantially parallel to the third axis Z and is substantially parallel to a fourth axis B substantially parallel to the third axis Z and substantially equidistant from the first abutting surface 24 and from the second abutting surface 25.

[0079] The gripper 51 thus enables the workpiece/s to be machined to be rotated by 180° to enable the cutting station 6 to machine, one at a time, respectively the first end portion 9 and the second end portion 10 of the workpiece/s 2.

[0080] The angular machine 1 further comprises a profiling station 52 and a milling station 53, the milling station 53 being positioned downstream of the profiling station 52 with respect to a second advancing direction A2, substantially parallel to the first axis X, of the workpiece 2 along the second side 5.

[0081] The profiling station 52 comprises profiling tools 55, 56, that are adjustable parallel to the second axis Y and to the third axis Z and having a respective fourth and fifth rotation axis R4, R5 substantially parallel to the third axis Z, for profiling and milling the first side surface 26 of the workpiece 2, in particular for making a groove 57 (Figures 6 and 7) in which a glass pane, which is not shown, of the casing 3 is subsequently inserted.

[0082] The milling station 53 is disclosed with particular reference to Figure 1 and to Figures 6 to 13.

[0083] The milling station 53 is supported by a supporting plate 158, or carriage.

[0084] The supporting plate 158 is connected by a connecting element 160 to a stem 112 of a third actuator 64, the third actuator 64 being rotatably supported by a base 102 of the angular machine 1.

[0085] The third actuator 64 is arranged for rotating the supporting plate 158, and with the supporting plate 158, the milling station 53, around a sixth rotation axis R6 substantially parallel to the first axis X between a first working position W1, shown in Figures 6 to 9, and a second working position W2, shown in Figures 10 to 13.

[0086] In order to do so, roller means 300 is provided that is mounted on and projects from the supporting plate 158, the roller means 300 acting as sliding block means for the supporting plate 158.

[0087] The roller means 300 is free to rotate around a rotation axis substantially parallel to the first axis X and is arranged to engage a curvilinear guide 65 that is substantially C-shaped that is fixed to a base 102 wall 101. In particular, the curvilinear guide 65 has a curvature radius R that is substantially constant, the centre of which coincides with the sixth rotation axis R6.

[0088] The aforesaid roller means 300 comprises a first roller 121, a second roller 122 and a third roller 123.

[0089] The first roller 121 is arranged for contacting, and sliding along, a first contact surface 130 of the curvilinear guide 65, whilst the second roller 122 and the third roller 123 are arranged for contacting a second contact surface 131 opposite, and less extensive than, the first contact surface 130, of the curvilinear guide 65.

[0090] In other words, the second roller 122 and the third roller 123 are positioned on the opposite side of the curvilinear guide 65 with respect to the first roller 121.

[0091] In use, in order to move the milling station 53 from the first working position W1 to the second working position W2, the stem 112 is driven in the direction indicated by the first arrow F1.

[0092] In this manner, the supporting plate 158 guided by the roller means 300 along the curvilinear guide 65 rotates around the sixth rotation axis R6 in the direction indicated by the second arrow F2.

[0093] On the other hand, in order to move the milling station 53 from the second working position W2 to the first working position W1, the stem 112 is driven in the direction indicated by the third arrow F3.

[0094] In this manner, the supporting plate 158 guided by the roller means 300 along the curvilinear guide 65 rotates around the sixth rotation axis R6 in the direction indicated by the fourth arrow F4.

[0095] The milling station 53 comprises a second support 58 that is adjustable substantially parallel to the second axis Y and to the third axis Z.

[0096] In other words, the second support 58 is movable substantially parallel to the second axis Y and to the third axis Z.

[0097] To the second support 58 there is fixed a spindle holder 66 rotatingly supporting a spindle 59 rotating around a seventh rotation axis R7 substantially parallel to the second axis Y when the milling station 53 is in the first working position W1 and is substantially parallel to the third axis Z when the milling station 53 is in the second working position W2. On the spindle 59 a first milling cutter 60 and a second milling cutter 61 are mounted coaxially and at a certain distance from one another.

[0098] In other words, the first milling cutter 60 and the second milling cutter 61 have the seventh rotation axis R7 in common.

[0099] The first milling cutter 60 is arranged, when the milling station 53 is in the first working position W1, for cutting from the first side surface 26 a portion 62, or list,

of the workpiece 2 extending substantially parallel to the first axis X.

[0100] This list 62 is subsequently used for locking the aforesaid glass pane previously inserted into the casing 3.

[0101] The second milling cutter 61 is arranged vice versa, when the milling station 53 is in the second working position W2, for making in the third side surface 32 of the workpiece 2 a hollow 63, arranged, in use, for receiving hardware, not shown, to be inserted into the casing 3.

[0102] With the spindle holder 66 there is further associated a further spindle holder 70 rotatingly supporting a further spindle 67 rotating around an eighth rotation axis R8 substantially parallel to the seventh rotation axis R7.

[0103] The further spindle 67 is positioned upstream of the spindle 59, with respect to the second advancing direction A2, and is connected to, and driven by, the spindle 59 through second belt means 68.

[0104] On the further spindle 67 there is mounted a third milling cutter 69 arranged, when the milling station 53 is in the first working position W1, for rounding or angling the list 62 just before the list 62 is separated from the workpiece 2.

[0105] Further, the second support 58 rotatingly supports a dividing blade 76 positioned downstream of the spindle 59 with respect to the second advancing direction A2 and arranged, when the milling station 53 is in the first working position W1, for maintaining the list 62 separated from the workpiece 2 after the list 62 has been separated from the workpiece 2.

[0106] In an embodiment of the invention, shown in Figures 14 to 20, there is provided a further supporting plate 258 that is fixed to a pin 104, that is rotatable around the, and extends along the, sixth rotation axis R6.

[0107] In particular, the second pin 104 is rotatingly supported by a supporting element 103 fixed to the wall 101.

[0108] In this embodiment, on the further supporting plate 258 there is mounted further roller means 105 that is free to rotate around a further rotation axis that is substantially parallel to the first axis X.

[0109] The further roller means 105 comprises a roller 125 arranged for engaging and for sliding inside a slot 106, having a substantially elliptical shape and extending substantially parallel to the second axis Y.

[0110] In particular, the slot 106 is part of cam means 107 having, for example, a substantially triangular shape.

[0111] The cam means 107 is slidable by means of sliding block elements 187, 108, along a linear guide 109 extending substantially parallel to the third axis Z.

[0112] Further, the cam means 107 comprises a protrusion 111 to which there is fixed a further stem 212 of a further third actuator 164, the further third actuator 164 being fixed to the base 102 and being arranged for moving the cam means 107 substantially parallel to the third axis Z along the linear guide 109.

[0113] In this embodiment, to move the milling station 53 from the first working position W1 to the second working position W2, the further stem 212 is operated in the direction indicated by the fifth arrow F5.

[0114] In this manner, the cam means 107 is moved downwards and rotates the roller 105, and with the roller 105 the further supporting plate 258, around the sixth rotation axis R6 in the direction indicated by the second arrow F2.

[0115] It should be noted that during this movement the roller 105 slides inside the slot 106 in the direction indicated by the sixth arrow F6.

[0116] On the other hand, in order to move the milling station 53 from the second working position W2 to the first working position W1, the further stem 212 is operated in the direction indicated by the seventh arrow F7.

[0117] In this manner, the cam means 107 is moved upwards and rotates the roller 105, and with the roller 105 the further supporting plate 258, around the sixth rotating axis R6 in the direction indicated by the fourth arrow F4.

[0118] It should be noted that during this movement the roller 105 slides inside the slot 106 in the direction indicated by the eighth arrow F8.

[0119] The angular machine 1 further comprises a working plane 71 extending substantially parallel to the first axis X and arranged for supporting the workpiece 2 along the second side 5 and movement means 72 arranged for moving the workpiece 2 along the second advancing direction A2 (Figure 1).

[0120] The movement means 72 comprises a plurality of motor-driven rollers 73 arranged, in use, for contacting the second side surface 29 or the fourth side surface 34.

[0121] The angular machine 1 further comprises a third support 74 that is movable parallel to the second axis Y towards or away from the working plane 71, and arranged for supporting a partially or completely, mounted casing 3 (Figure 1) when the milling station 53 is in the second working position W2. The third support 74 is substantially coplanar with the working plane 71 and comprises a plurality of rollers that are free to rotate around respective rotation axes substantially parallel to the second axis Y.

[0122] The operation of the angular machine 1 is disclosed below.

[0123] Initially, the carriage 15 is in the first position and the gripper 51 is positioned in the first operating configuration P1.

[0124] Subsequently, a workpiece 2 is loaded on the gripper 51 in such a way that the first side surface 26 abuts on the abutting surface 100 of the gripper 51 and the first abutting surface 24 of the first abutting element 21.

[0125] It should be noted that it is possible to load also more than one workpiece 2 at a time onto the gripper 51.

[0126] Subsequently, the gripper 51 locks the workpiece 2 and moves the workpiece 2 towards the opening 27 so that the workpiece protrudes from the opening by a desired length.

[0127] Still subsequently, the first locking element 30

and the second locking element 33 are driven that lock the workpiece 2 parallel to the second axis Y and to the third axis Z.

[0128] Subsequently, the carriage 15 is driven along the first advancing direction A1 so that the blade 8 of the cutting station 6 faces the first end portion 9 of the workpiece 2 to make the first end surface 11.

[0129] Subsequently, the carriage 15 is positioned in the second position and the gripper 51 is moved towards the opening 27 so that the first end surface 11 protrudes by a desired length from the opening 27, in particular by a length that it is desired to tenon.

[0130] Still subsequently, the carriage 15 is moved towards the first position and the spindle moulder 13 of the tenoning station 7 tenons the first end surface 11.

[0131] In this manner, there is obtained a first end surface 11 substantially parallel to the first plane YX in which straight tenons were made.

[0132] If it is desired to obtain a first end surface 11 tilted in relation to the first plane XY and consequently tilted tenons, it is sufficient to suitably combine the movement of the carriage 15 parallel to the second axis Y with the movement of the gripper 51 parallel to the first axis X during the movement of the workpiece 2 between the first position and the second position.

[0133] When the carriage 15, after the first end portion 9 has been machined, is in the first position, the second locking element 33 lifts up from the fourth side surface 34 and the first locking element 30 is moved away from the third side surface 32.

[0134] Still subsequently, the gripper 51 is moved away from the opening 27, the gripper 51 being maintained clamped, and the gripper 51 is positioned manually or automatically in the second operating configuration P2, so that it is now possible to machine the second end portion 10.

[0135] The machining of the second end portion 10 is not disclosed below as it is substantially similar to the machining performed on the first end portion 9.

[0136] Once machining the second end portion 10 has finished the gripper 51 is released and the faced and tenoned workpiece 2 is removed.

[0137] Subsequently, the workpiece 2 is positioned on the working plane 71, and the motor-driven rollers 73 are driven that move the workpiece 2 along the second advancing direction A2.

[0138] In this manner, the workpiece 2 is profiled in the profiling station 52 and is subsequently machined in the milling station 53.

[0139] In particular, when the milling station 53 is in the first working position W1 the list 62 is separated from the workpiece 2, whilst when the milling station 53 is in the second machining position W2 the hollow 63 is made.

[0140] It should be noted how the angular machine 1 is particularly compact, light and low-cost.

[0141] In fact, on the one hand, it is possible to minimise a distance between the first abutting element 21 and the second abutting element 22 for the same maximum width of the workpiece 2 to be machined.

[0142] In this manner, the first wall 19 of the carriage 15, arranged for supporting the first abutting element 21 and the second abutting element 22 have moderate overall dimensions and consequently a moderate weight.

[0143] On the other hand, it is possible to provide only one milling station 53 opposite the two milling stations provided in known angular machines.

Claims

1. Angular machine for machining a workpiece (2) made of wood or similar materials comprising a first abutting element (21) and second abutting element (22), which are mutually opposite, for abutting on respective end portions (9; 10) of said workpiece (2) and gripper means (51) for grasping said workpiece (2), which is movable towards and away from said first abutting element (21) and said second abutting element (22) and rotatable around a first axis (R2), **characterised in that** said first axis (R2) has a working position contained in a plane (H) substantially equidistant from opposite abutting surfaces (24; 25) of said first abutting element (21) and of said second abutting element (22).

2. Machine according to claim 1, wherein said first axis (R2) is a substantially vertical axis.

3. Machine according to any preceding claim, and comprising first milling means (60) for cutting an external longitudinal portion (62) of said workpiece (2), second milling means (61) for making hollow means (63) in a side (32) of said workpiece (2), and moving means (64, 65, 300; 105, 106, 107, 109, 164) for rotating said first milling means (60) and said second milling means (61) around a second axis (R6;R6').

4. Machine according to claim 3, wherein said first milling means and said second milling means comprise respectively a first milling cutter (60) and a second milling cutter (61) that are rotatable around a third common rotation axis (R7).

5. Machine according to claim 3, or 4, wherein said first milling means (60) and said second milling means (61) are supported by supporting plate means (158, 258) that is rotatable around said second axis (R6).

6. Machine according to claim 5, wherein said moving means (64, 65, 300; 105, 106, 107, 109, 164) comprises roller means (105; 300) mounted on said supporting plate means (158; 258).

7. Machine according to claim 6, wherein said roller means (105; 300) is free to rotate around an axis substantially parallel to said second axis (R6).

8. Machine according to claim 6, or 7, wherein said moving means (64, 65, 300; 105, 106, 107, 109, 164) comprises guide means (65; 106) for engaging with said roller means (105; 300) and along which said roller means (105; 300) is slidable.

9. Machine according to claim 8, wherein said guide means (65; 106) comprises slot means (106).

10. Machine according to claim 9, wherein said slot means (106) is part of cam means (107).

11. Machine according to claim 10, wherein said moving means (64, 65, 300; 105, 106, 107, 109, 164) comprises further guide means (65; 106) along which said cam means (107) is slidable.

12. Machine according to claim 11, wherein said further guide means comprises linear guide means (109).

13. Machine according to claim 12, wherein said linear guide means (109) extends substantially perpendicularly to said second axis (R6).

14. Machine according to any one of claims 11 to 13, wherein said moving means (64, 65, 300; 105, 106, 107, 109, 164) comprises an actuator (164) connected to said cam means (107) for moving said cam means (107) along said further guide means (109).

15. Machine according to any one of claims 10 to 14, wherein said supporting plate means (258) is connected to pin means (104) extending along and rotatable around said second axis (R6), so that a movement of said cam means (107) along said further guide means (109) causes through said pin means (104) a rotation of said supporting plate means (258) around said second axis (R6).

16. Machine according to claim 8, wherein said guide means (65; 106) comprises curvilinear guide means (65).

17. Machine according to claim 16, wherein said curvilinear guide means (65) is substantially C-shaped.

18. Machine according to claim 16, or 17, wherein said curvilinear guide means (65) has a curvature radius (R) the centre of which coincides with said second axis (R6).

19. Machine according to any one of claims 16 to 18, wherein said moving means (64, 65, 300; 105, 106, 107, 109, 164) comprises a further actuator (64) connected to said supporting plate means (158) for moving said supporting plate means (158) along said curvilinear guide means (65).

20. Machine according to any one of claims 3 to 19, wherein said second axis (R6) is substantially horizontal.

21. Machine according to any preceding claim, and comprising locking means (30) for locking said end portions (9; 10) against said opposite abutting surfaces (24;25), actuator means (35) for moving said locking means (30) towards and away from said opposite abutting surfaces (24, 25) and flexible driving means (37) for connecting said actuator means (35) to said locking means (30).

22. Machine according to claim 21, wherein said flexible driving means (37) comprises a first part (44), and a second part (45) positioned respectively substantially at a first supporting wall (19) and at a second supporting wall (36) arranged respectively for supporting said locking means (30) and said actuator means (35).

23. Machine according to claim 22, wherein said first wall (19) and said second wall (36) are contained in respective substantially perpendicular planes (YZ; XZ).

24. Machine according to any one of claims 21 to 23, wherein said flexible driving means comprises a looped cable (37) on wheel means (38, 39, 40, 41).

25. Machine according to claim 24, wherein said wheel means (38, 39, 40, 41) comprises a first wheel (38), a second wheel (39), a third wheel (40) and a fourth wheel (41), said first wheel (38) being mounted on said first wall (19) and being free to rotate around a rotation axis that is substantially perpendicular to said first wall (19), said second wheel (39) being mounted on said second wall (36) and being free to rotate around a further rotation axis that is substantially perpendicular to said second wall (36), said third wheel (40) and said fourth wheel (41) being fixed to an edge portion (42) defined between said first wall (19) and said second wall (36) and being free to rotate around a still further rotation axis that is substantially perpendicular to said rotation axis and to said further rotation axis.

26. Angular machine for machining a workpiece (2) made of wood or similar materials, comprising first milling means (60) for cutting an external longitudinal portion (62) of said workpiece (2) and second milling means (61) for making hollow means (63) in a side (32) of said workpiece (2), **characterised in that** there is provided moving means (64) for rotating said first milling means (60) and said second milling means (61) around a rotation axis (R6).

27. Machine according to claim 12, wherein said first

milling means and said second milling means comprise respectively a first milling cutter (60) and a second milling cutter (61) that are rotatable around a further common rotation axis (R7).

28. Machine according to claim 26, or 27, wherein said first milling means (60) and said second milling means (61) are supported by supporting plate means (158; 258) that are rotatable around said second axis (R6).

29. Machine according to claim 28, wherein said moving means (64, 65, 300; 105, 106, 107, 109, 164) comprises roller means (105; 300) mounted on said supporting plate means (158; 258).

30. Machine according to claim 29, wherein said roller means (105; 300) is free to rotate around an axis substantially parallel to said second axis (R6).

31. Machine according to claim 29, or 30, wherein said moving means (64, 65, 300; 105, 106, 107, 109, 164) comprises guide means (65; 106) for engaging with said roller means (105, 300) and along which said roller means (105, 300) is slidable.

32. Machine according to claim 31, wherein said guide means (65; 106) comprises slot means (106).

33. Machine according to claim 32, wherein said slot means (106) is part of cam means (107).

34. Machine according to claim 33, wherein said moving means (64, 65, 300; 105, 106, 107, 109, 164) comprises further guide means (109) along which said cam means (107) is slidable.

35. Machine according to claim 34, wherein said further guide means (109) comprises linear guide means (109).

36. Machine according to claim 35, wherein said linear guide means (109) extends substantially perpendicularly to said second axis (R6).

37. Machine according to any one of claims 34 to 36, wherein said moving means (64, 65, 300; 105, 106, 107, 109, 164) comprises an actuator (164) connected to said cam means (107) for moving said cam means (107) along said further guide means (109).

38. Machine according to any one of claims 33 to 37, wherein said supporting plate means (258) is connected to pin means (104) extending along, and rotatable around, said second axis (R6), so that a movement of said cam means (107) along said further guide means (109) causes through said pin means (104) a rotation of said supporting plate means (258) around said second axis (R6).

39. Machine according to claim 31, wherein said guide means (65; 106) comprises curvilinear guide means (65).

40. Machine according to claim 39, wherein said curvilinear guide means (65) is substantially C-shaped.

41. Machine according to claims 39 or 40, wherein said curvilinear guide means (65) has a curvature radius (R) the centre of which coincides with said second axis (R6).

42. Machine according to any one of claims 39 to 41, wherein said moving means (64, 65, 300; 105, 106, 107, 109, 164) comprises a further actuator (64) connected to said supporting plate means (158) for moving said supporting plate means (158) along said curvilinear guide means (65).

43. Machine according to any one of claims 26 to 42, wherein said second axis (R6) is substantially horizontal.

44. Machine according to any one of claims 26 to 43, and comprising locking means (30) for locking end portions (9; 10) of said workpiece (2) against abutting means (24; 25), actuator means (35) for moving said locking means (30) towards and away from said abutting means (24; 25), and flexible driving means (37) for connecting said actuator means (35) to said locking means (30).

45. Machine according to claim 44, wherein said flexible driving means (37) comprises a first part (44), and a second part (45) positioned respectively substantially at a first supporting wall (19) and at a second supporting wall (36) arranged respectively for supporting said locking means (30) and said actuator means (35).

46. Machine according to claim 45, wherein said first wall (19) and said second wall (36) extend along respective substantially perpendicular planes (YZ, XZ).

47. Machine according to any one of claims 44 to 46, wherein said flexible operating means (37) comprises a looped cable (37) on wheel means (38, 39, 40, 41).

48. Machine according to claim 47, wherein said wheel means (38, 39, 40, 41) comprises a first wheel (38), a second wheel (39), a third wheel (40) and a fourth wheel (41), said first wheel (38) being mounted on said first wall (19) and being free to rotate around a first axis that is substantially perpendicular to said first wall (19), said second wheel (39) being mounted

on said second wall (36) and being free to rotate around a second axis that is substantially perpendicular to said second wall (36), said third wheel (40) and said fourth wheel (41) being fixed to an edge portion (42) defined between said first wall (19) and said second wall (36) and being free to rotate around a third axis substantially perpendicular to said first axis and to said second axis.

49. Angular machine for machining a workpiece (2) made of wood or similar materials, comprising locking means (30) for locking end portions (9; 10) of said workpiece (2) against abutting means (24; 25), actuator means (35) for moving said locking means (30) towards and away from said abutting means (24; 25), and flexible driving means (37) for connecting said actuator means (35) to said locking means (30).

50. Machine according to claim 49, wherein said flexible driving means (37) comprises a first part (44) and a second part (45) positioned respectively substantially at a first supporting wall (19) and at a second supporting wall (36) arranged respectively for supporting said locking means (30) and said actuator means (35).

51. Machine according to claim 50, wherein said first wall (19) and said second wall (36) extend along respective substantially perpendicular planes (YZ; XZ).

52. Machine according to claim 50, or 51, wherein said flexible driving means comprises a looped cable (37) on wheel means (38, 39, 40, 41).

53. Machine according to claim 52, wherein said wheel means (38, 39, 40, 41) comprises a first wheel (38), a second wheel (39), a third wheel (40) and a fourth wheel (41), said first wheel (38) being mounted on said first wall (19) and being free to rotate around a first rotation axis that is substantially perpendicular to said first wall (19), said second wheel (39) being mounted on said second wall (36) and being free to rotate around a second rotation axis that is substantially perpendicular to said second wall (36), said third wheel (40) and said fourth wheel (41) being fixed to an edge portion (42) defined between said first wall (19) and said second wall (36) and being free to rotate around a third rotation axis that is substantially perpendicular to said first axis and to said second axis.

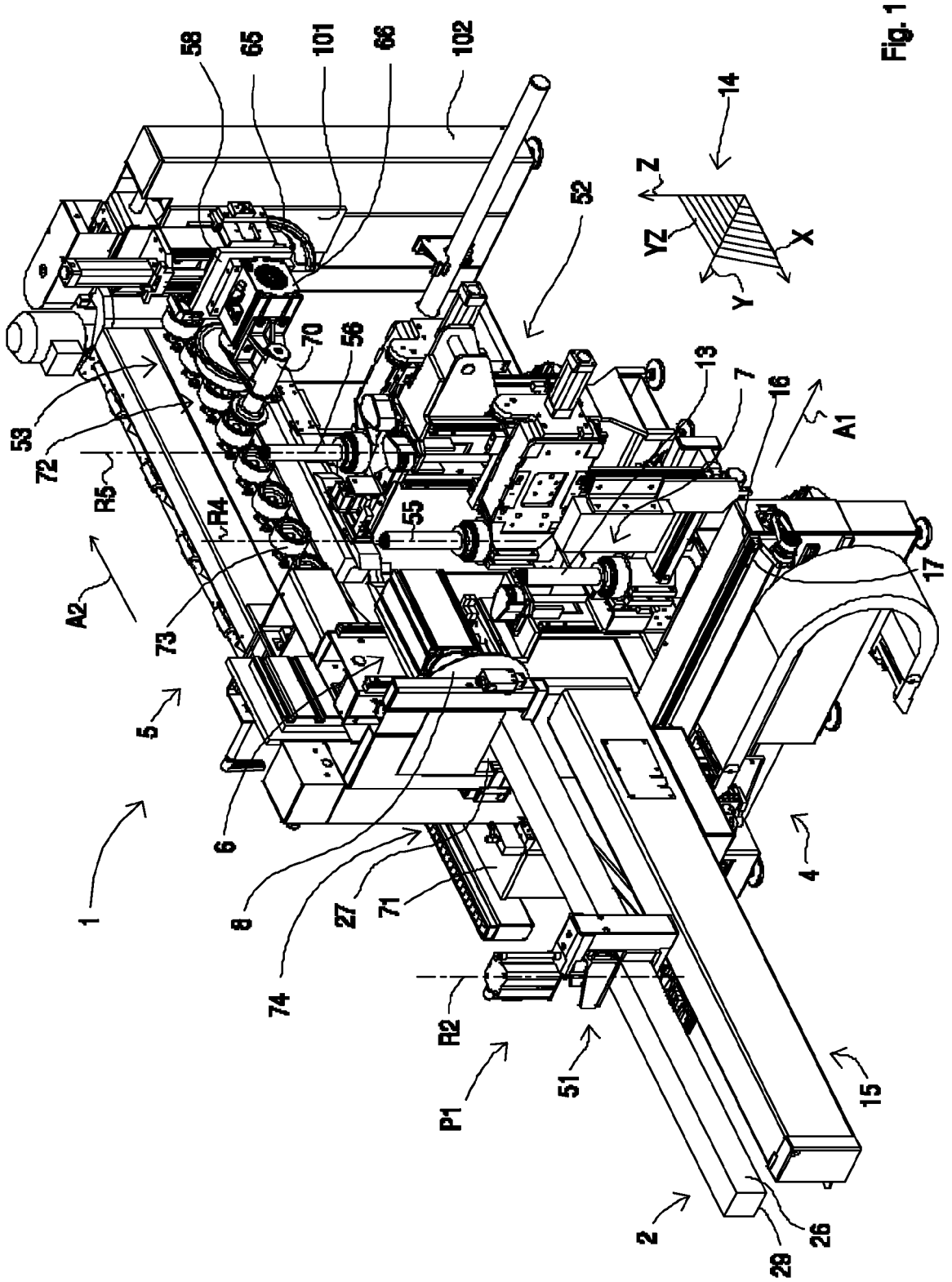

58
65
101
66
102
14
Z
YZ
X
Y
52
70
56
53
72
R5
R4
55
13
7
16
A1
17
A2
73
5
6
8
27
71
74
R2
P1
51
4
15
1
2
26
29

Fig. 1

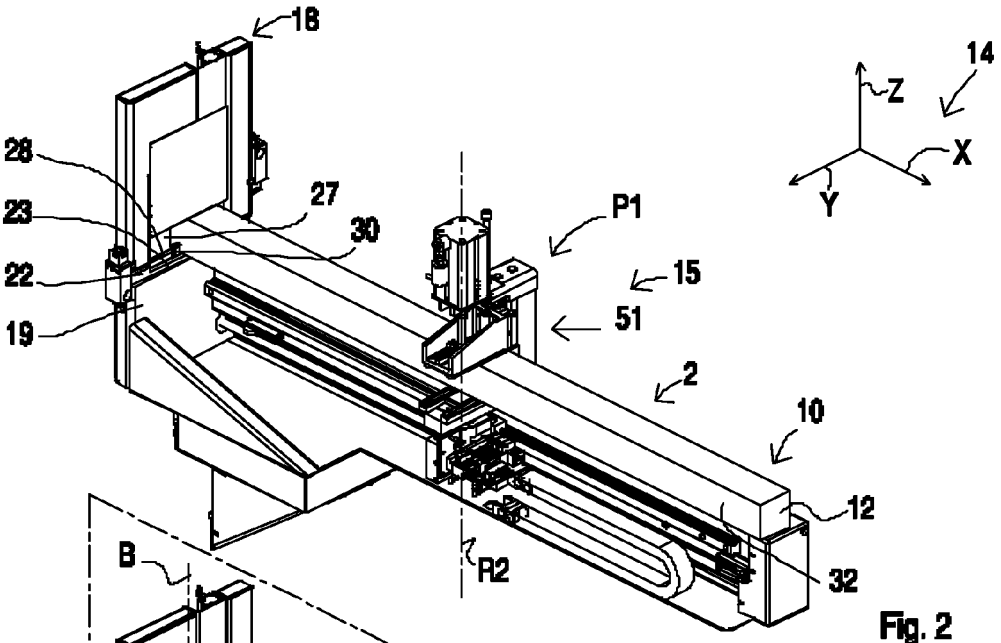


Fig. 2

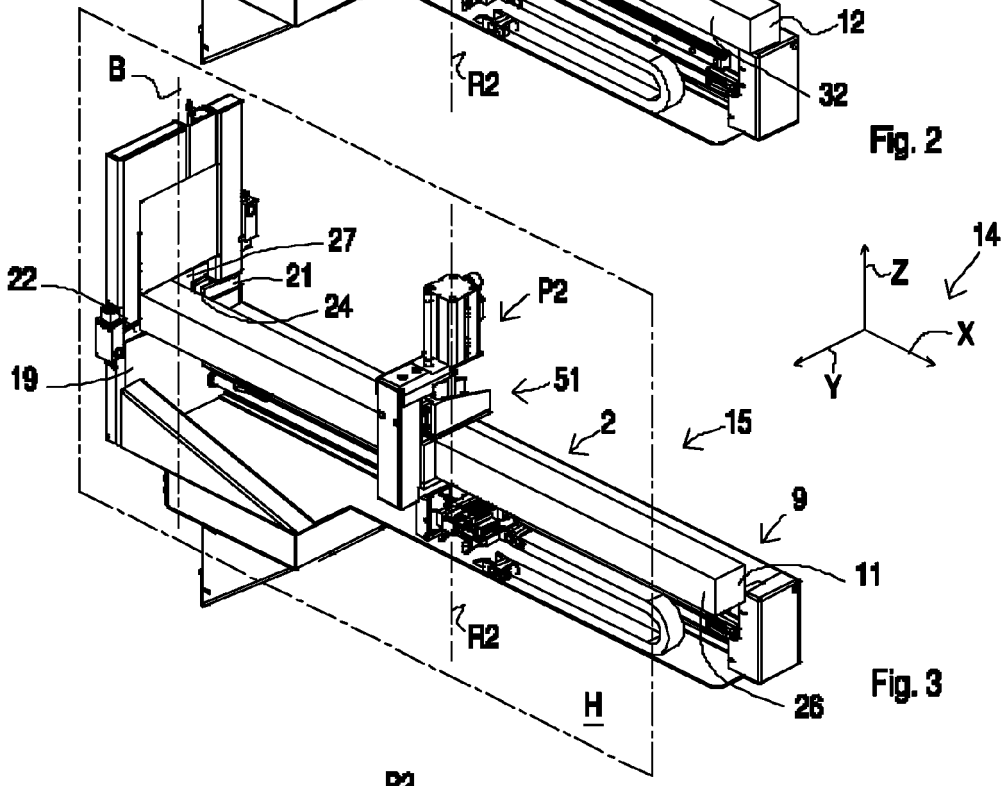


Fig. 3

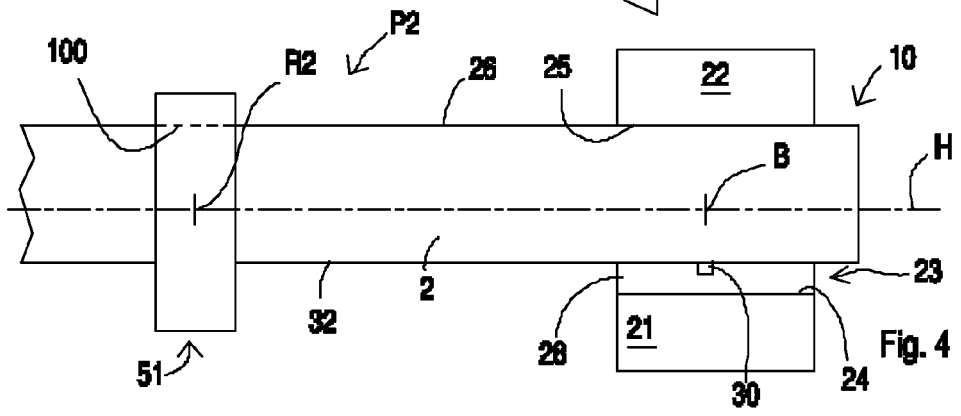


Fig. 4

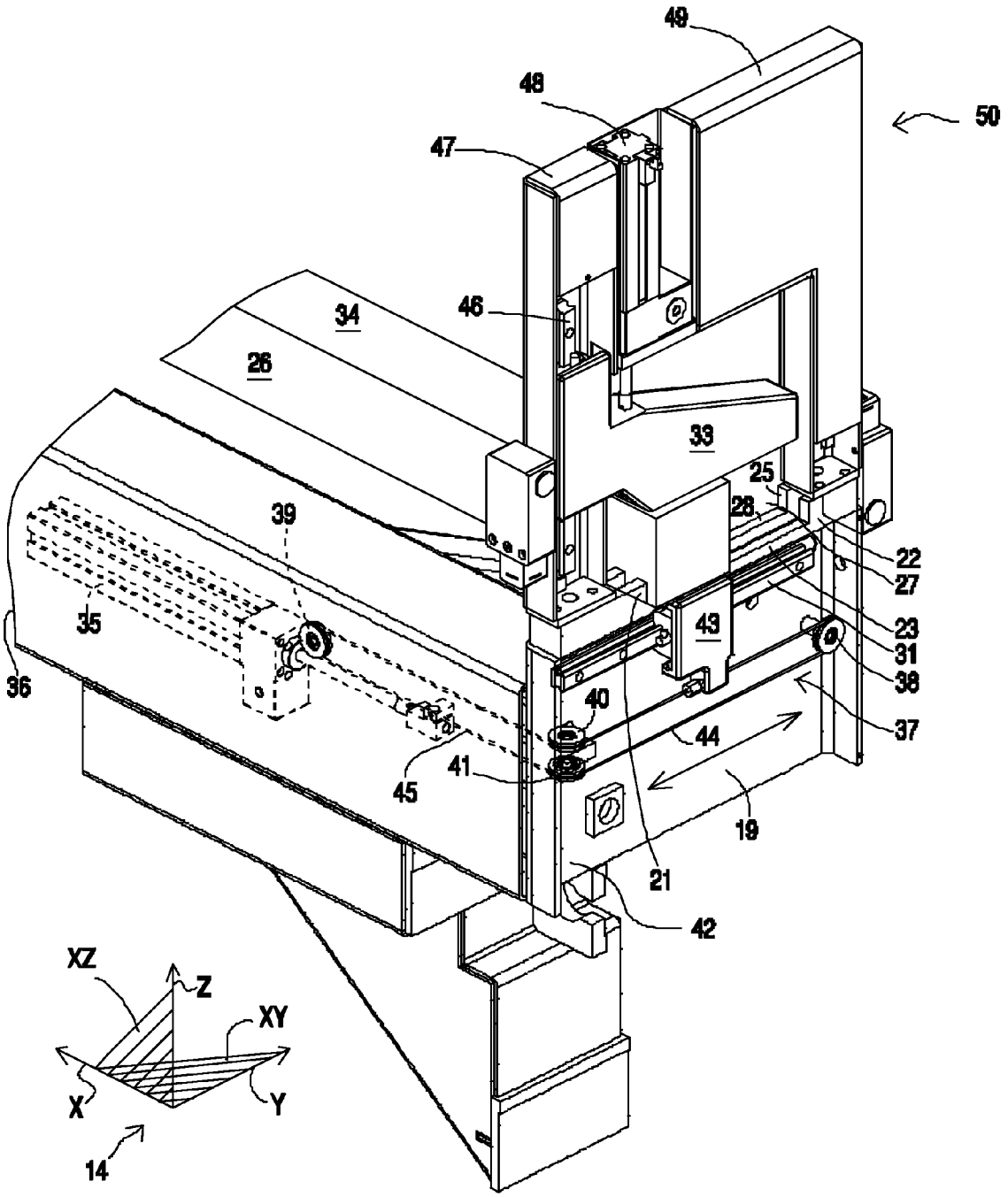

49
48
47
50
46
34
26
33
25
28
22
27
39
35
23
31
36
43
38
40
37
44
41
45
19
21
42
XZ
Z
XY
X
Y
14

Fig. 5

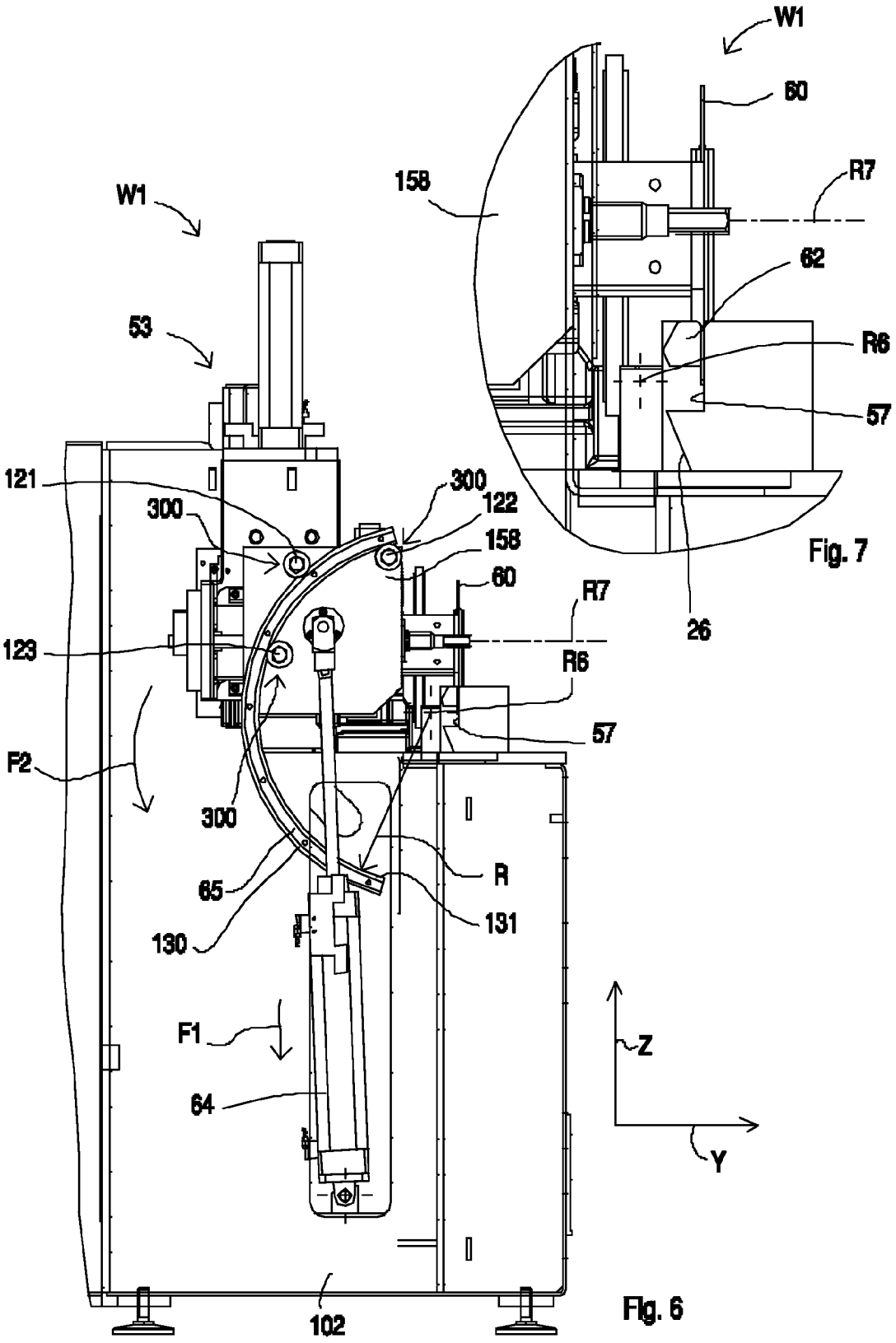
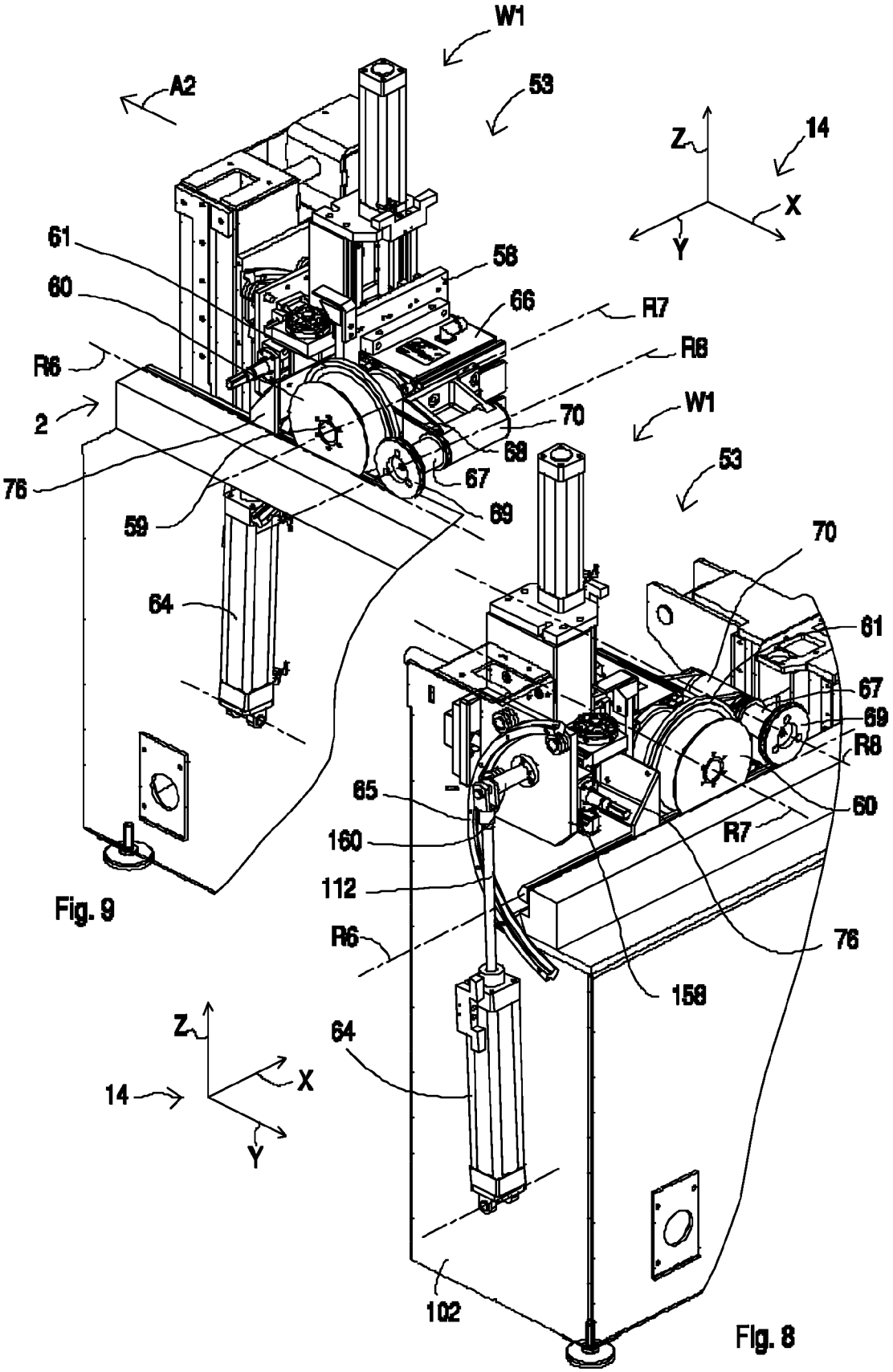

W1
53
121
300
300
122
158
60
R7
123
R6
57
F2
300
65
R
130
131
F1
64
102
Z
Y
W1
60
158
R7
62
R6
57
26

Fig. 7

Fig. 6


W1
A2
53
Z
14
X
Y
61
60
58
66
R7
R6
R8
2
70
W1
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53
76
67
59
69
70
64
61
67
69
R8
65
60
160
R7
112
R6
76
158
Z
64
14
X
Y
102

Fig. 9

Fig. 8

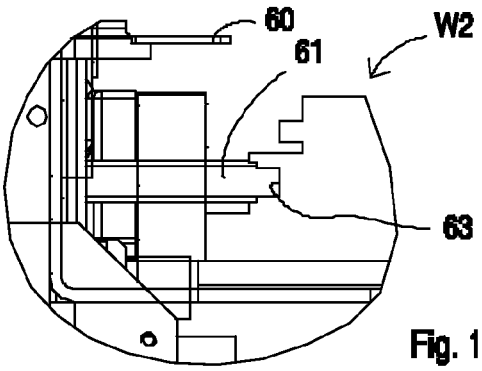


Fig. 11

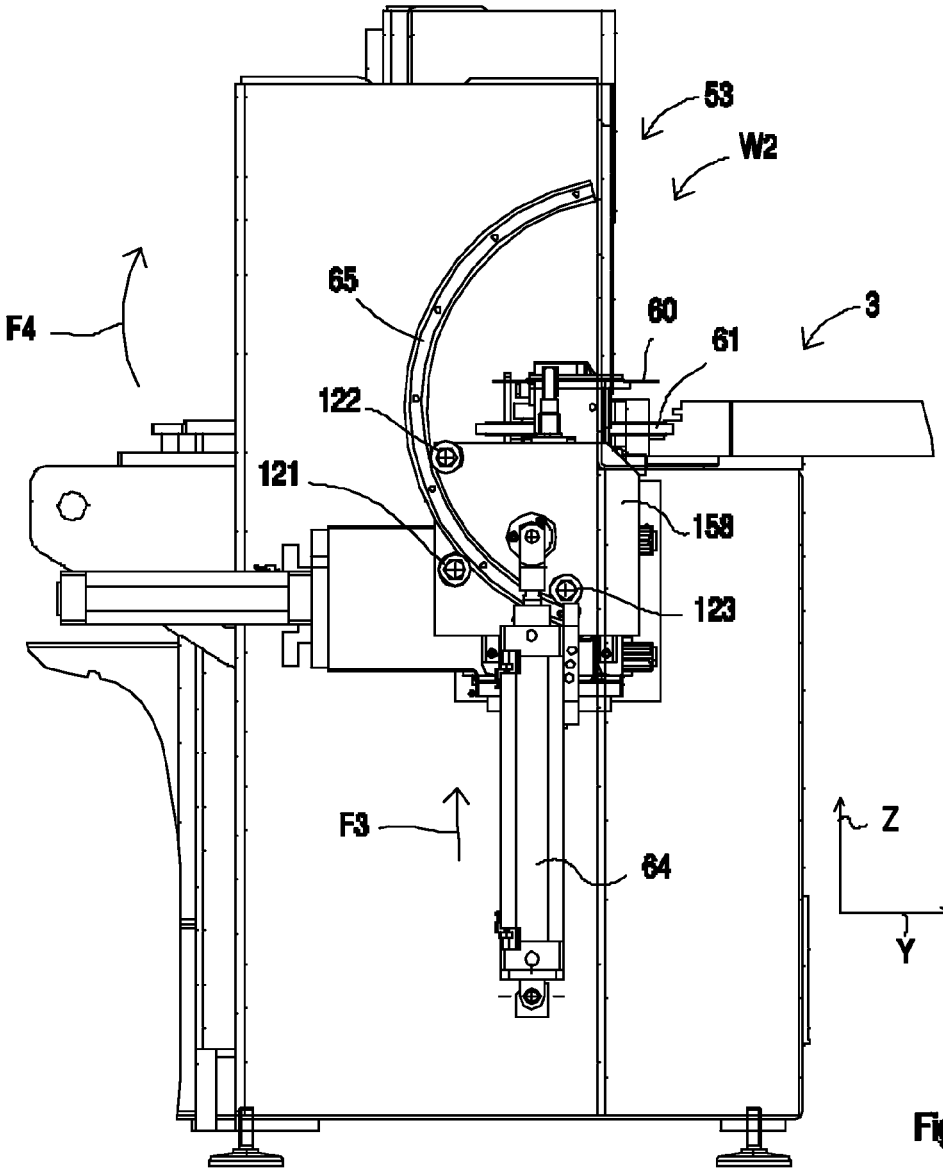


Fig. 10

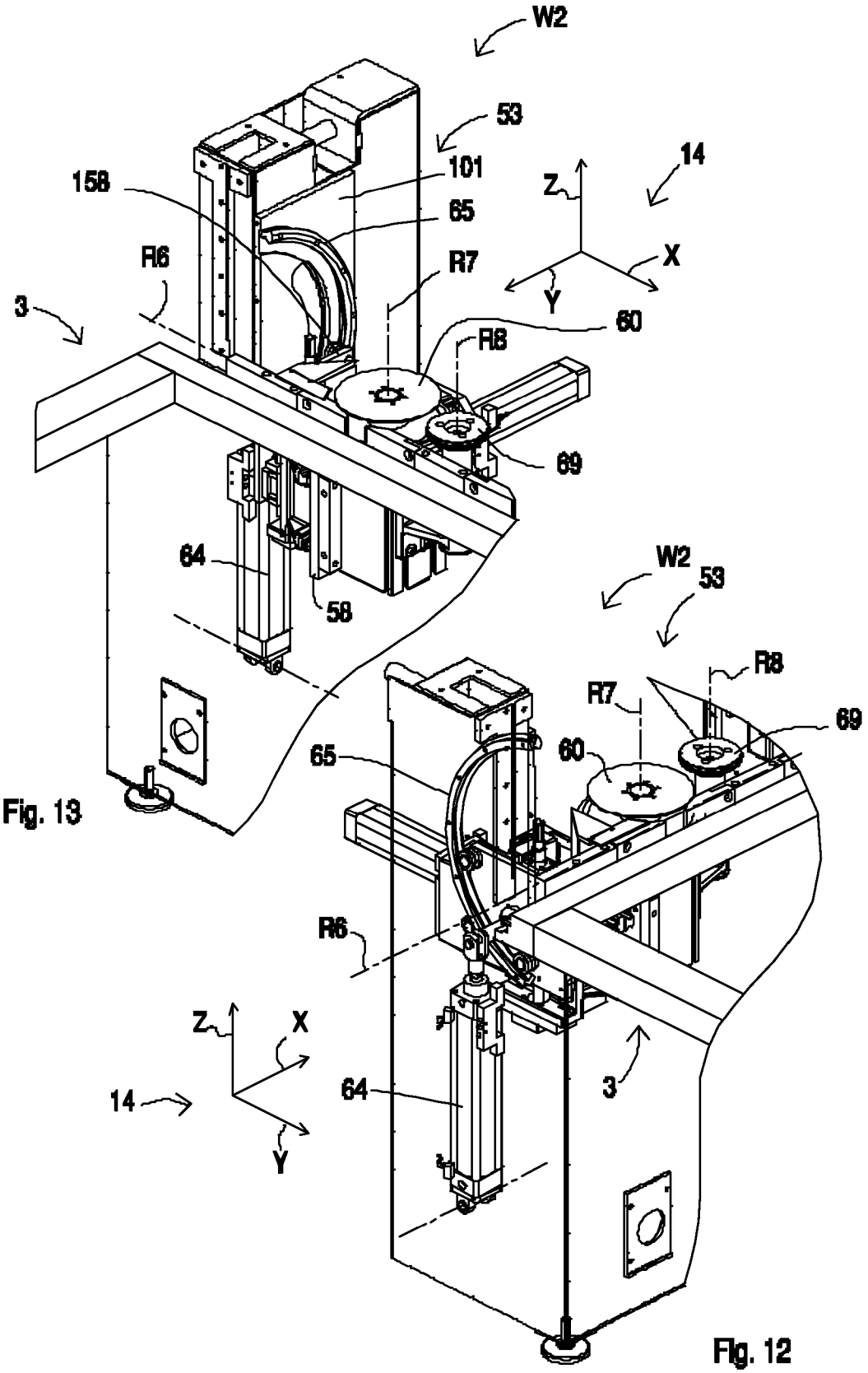

W2
53
101
158
65
14
Z
X
Y
R6
R7
3
60
R8
69
64
58
W2
53
R8
R7
69
65
60
R6
Z
X
14
64
Y
3

Fig. 13

Fig. 12

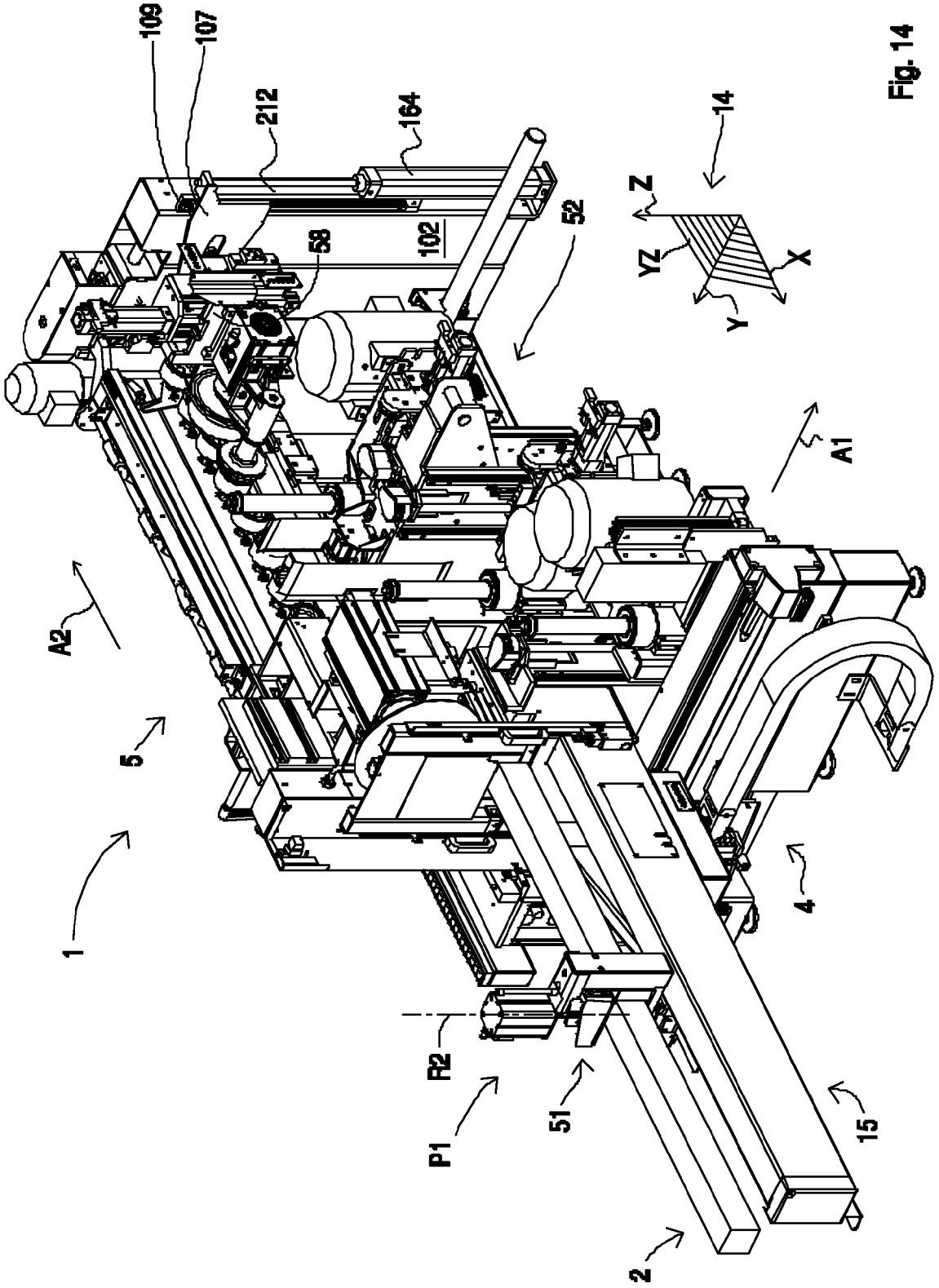


Fig. 14

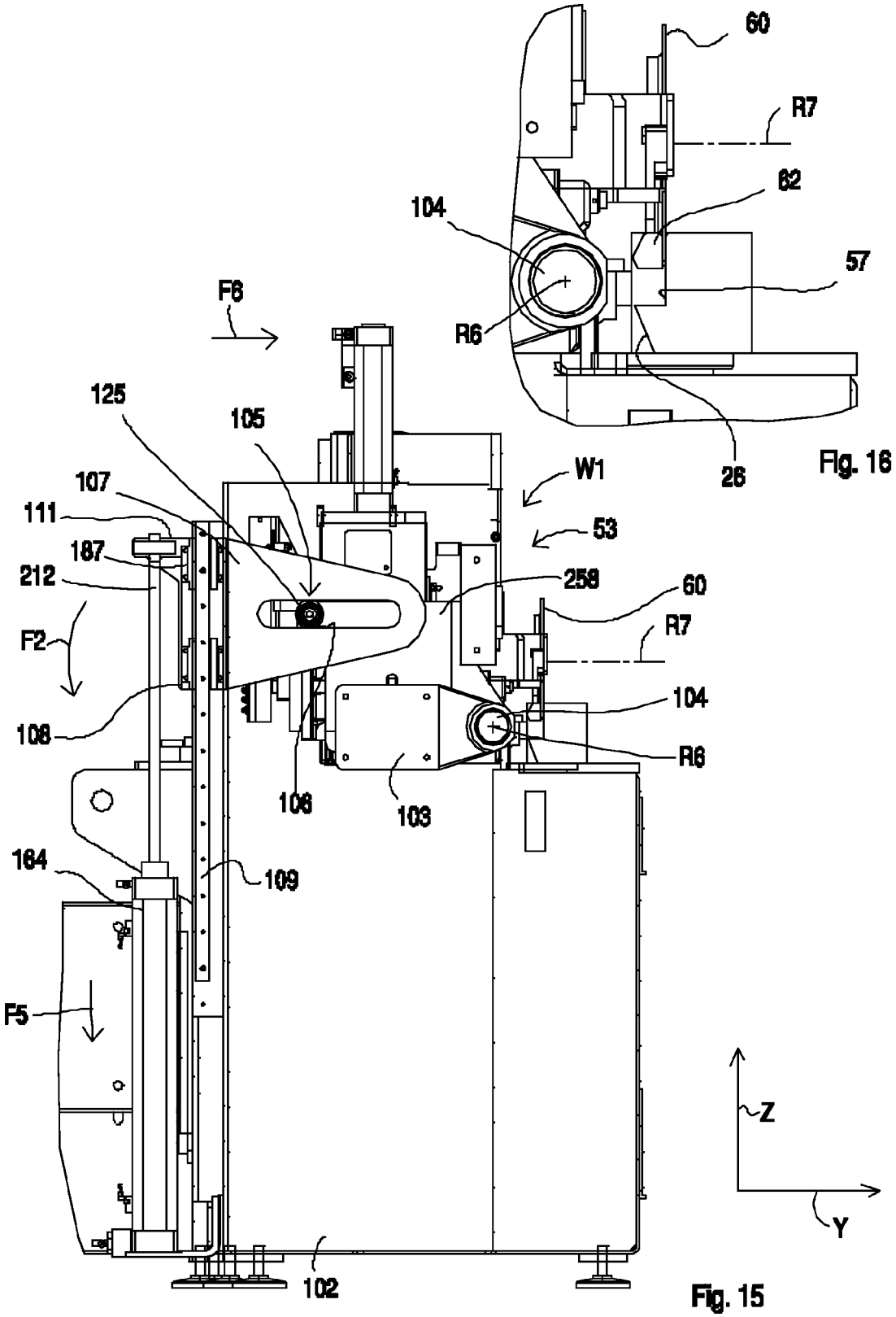

60
R7
62
104
57
F6
R6
125
105
26
W1
107
111
53
187
212
259
60
F2
R7
104
108
R6
106
103
164
109
F5
Z
Y
102

Fig. 16

Fig. 15

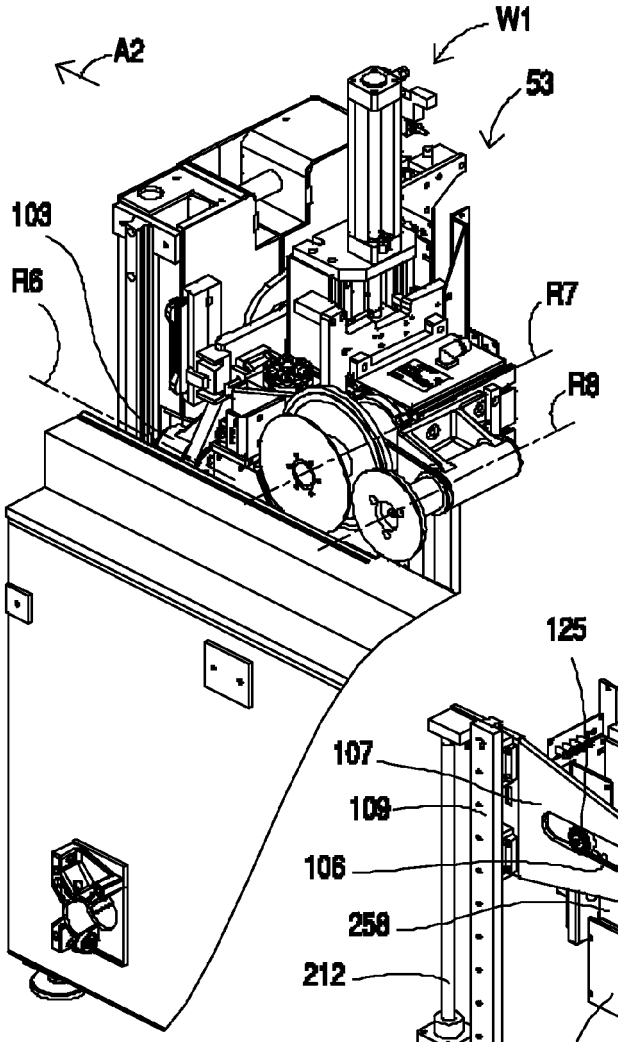
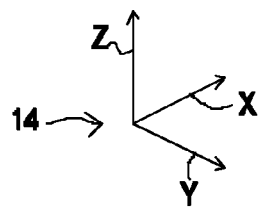

A2
W1
53
103
R6
R7
R8

Fig. 18


Z
14
X
Y

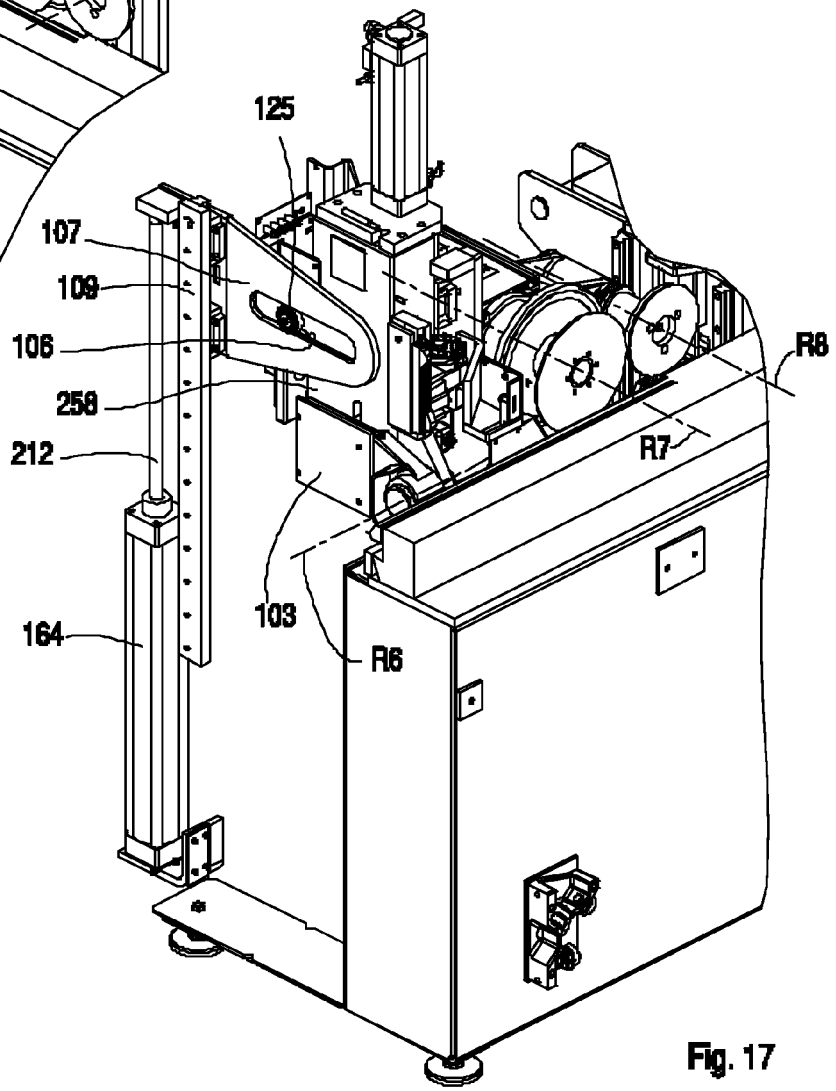

125
107
109
106
258
212
164
103
R6
R7
R8

Fig. 17

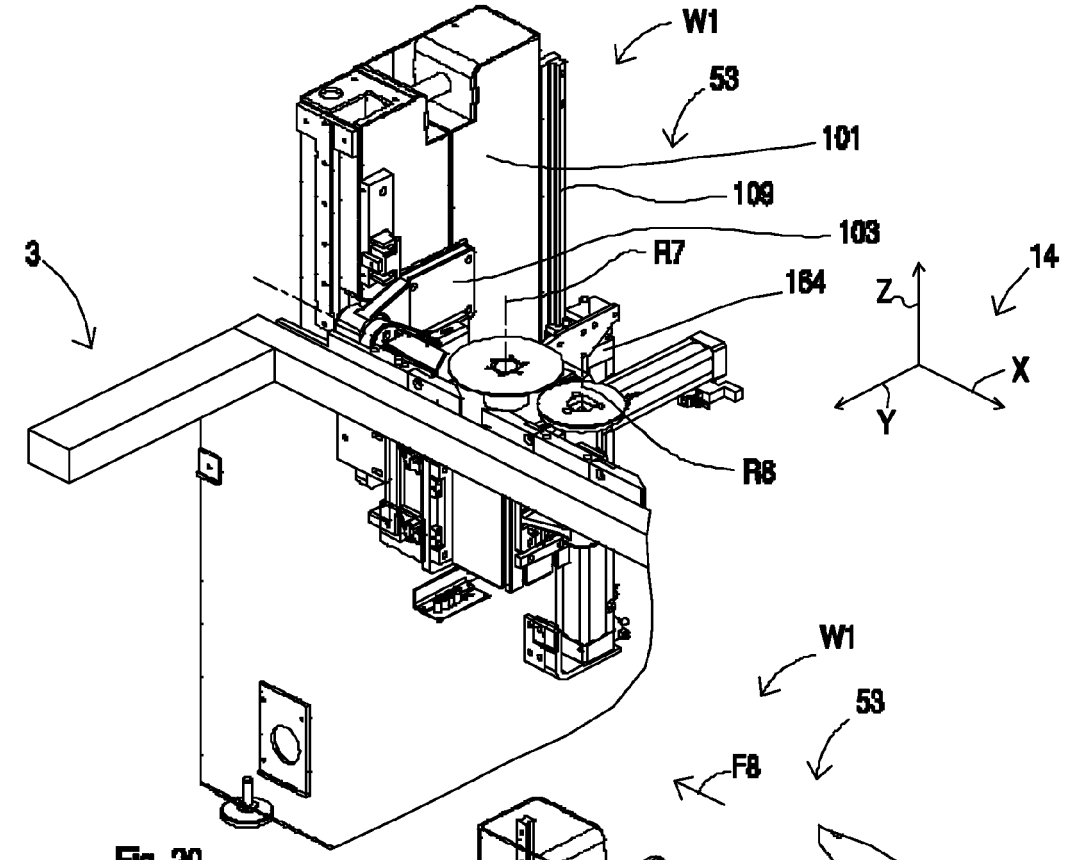

W1
53
101
109
103
R7
164
3
14
Z
X
Y
R8

Fig. 20

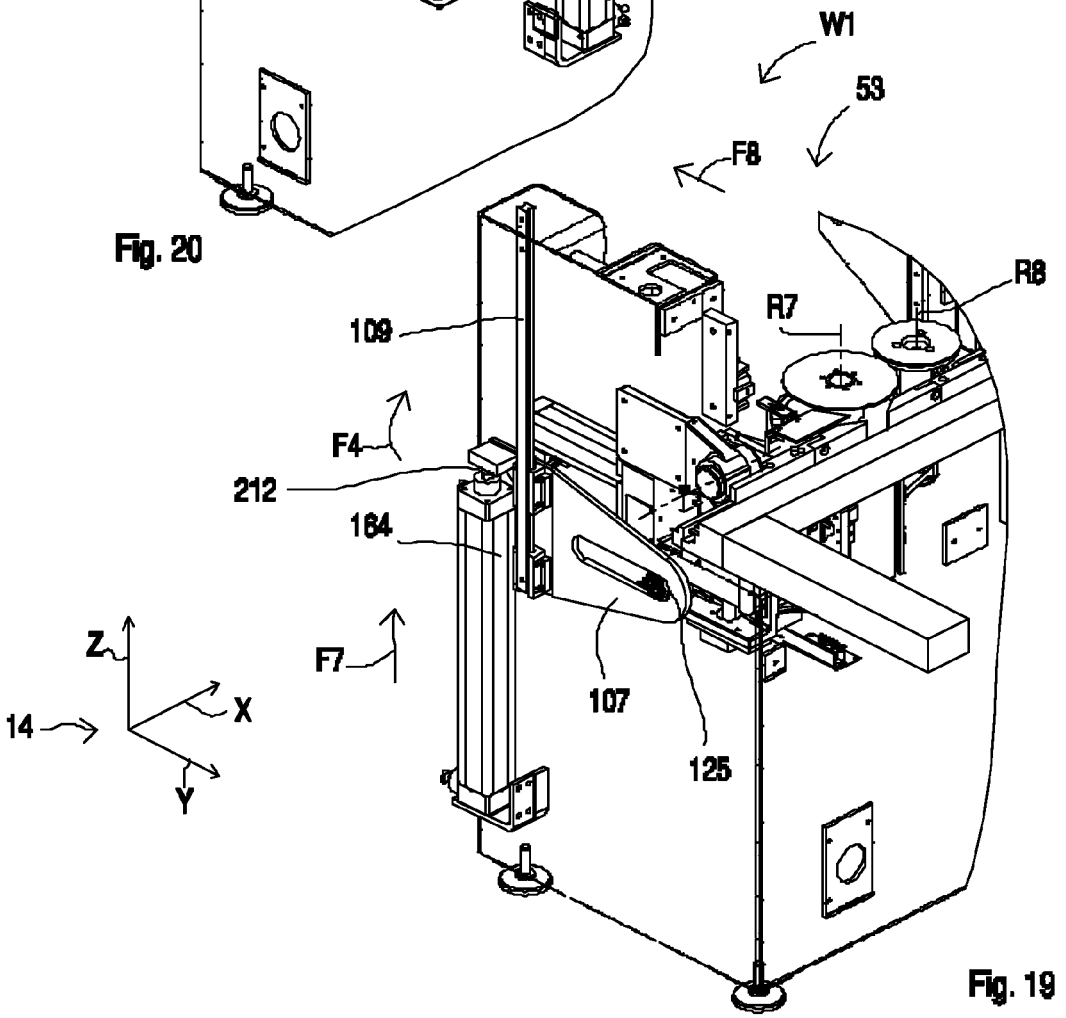

W1
53
F8
R8
R7
109
F4
212
164
F7
107
125
Z
14
X
Y

Fig. 19