



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.06.2022 Bulletin 2022/24

(51) International Patent Classification (IPC):
B27C 3/06 (2006.01) **B27C 9/04** (2006.01)
B27M 1/08 (2006.01)

(21) Application number: **21212695.7**

(52) Cooperative Patent Classification (CPC):
B27M 1/08; B27C 3/06; B27C 9/04

(22) Date of filing: **07.12.2021**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(30) Priority: **10.12.2020 IT 202000030278**

(54) **MACHINE TOOL**

(57) The present invention relates to a machine tool (1) for drilling and/or milling workpieces (P1, P2) comprising: first means of transport (2) for transporting, in use, a first plurality of consecutive workpieces (P1), along a first advancing direction (D1); second means of transport (3) for transporting, in use, a second plurality of consecutive workpieces (P2), along a second advancing direction (D2) substantially parallel to said first advancing direction (D1); at least one support (8) substantially parallel to said first advancing direction (D1) and said second advancing direction (D2) and arranged between said first means of transport (2) and said second means of transport (3); first drilling and/or milling means (9) connected to said at least one support (8) in a movable manner along a first axis (X) parallel to said first advancing direction (D1) and said second advancing direction (D2); said first drilling and/or milling means (9) being mounted on a first side of said at least one support (8), substantially facing said first transport means (2); and second drilling and/or milling means (10) connected to said at least one support (8) in a movable manner along a second axis parallel to said first axis (X); said second drilling and/or milling means (10) being mounted on a second side of said at least one support (8), substantially facing said second means of transport (3), in such a way as to allow, in use, the simultaneous drilling and/or milling of said first plurality of workpieces (P1) by said first drilling and/or milling means (9) and of said second plurality of workpieces (P2) by said second drilling and/or milling means (10) while said first plurality of workpieces (P1) advances along said first advancing direction (D1) and said second plurality of workpieces (P2) advances along said second advancing direction (D2).

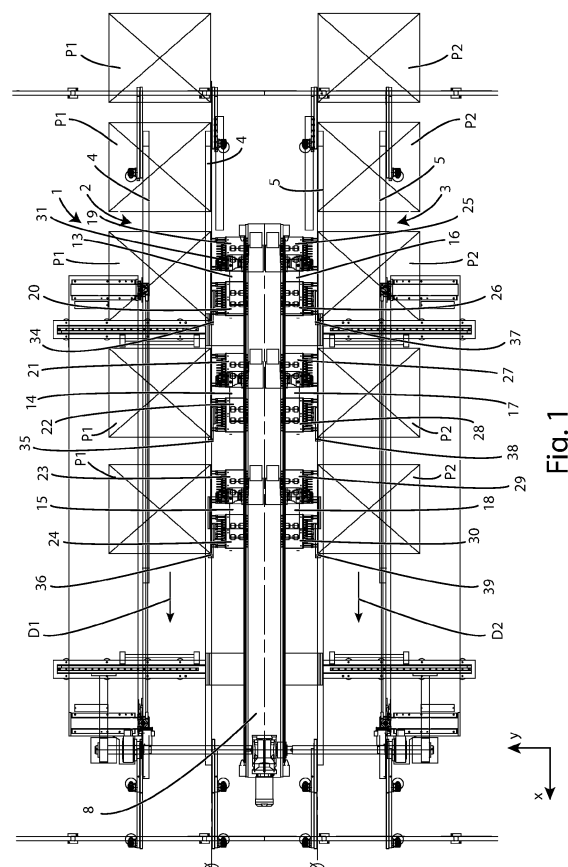


Fig. 1

Description

[0001] The present invention relates to a machine tool.

[0002] In particular, the invention refers to a machine tool for drilling and/or milling workpieces, in particular panels or elements of fixtures or similar, flow type, namely during the advancement of the workpieces themselves along the direction of the machining line.

[0003] Various machine tools for performing drilling or milling operations on moving panels along an advancement direction are known.

[0004] The latter, however, show various drawbacks and disadvantages, mainly connected to the low machining precision, essentially due to the fact that the workpiece is not stationary during machining.

[0005] A further limit of traditional machines of this type concerns the related encumbrances, which in most cases are considerable.

[0006] In the light of the above, it is therefore a scope of the present invention to provide a machine tool that is capable of performing high-precision operations on moving workpieces.

[0007] Another scope of the invention is to provide a machine tool that has a high productivity level.

[0008] A further scope of the present invention is to provide a machine tool that has a limited overall size.

[0009] It is therefore specific object of the present invention a machine tool for drilling and/or milling workpieces comprising: first means of transport for transporting, in use, a first plurality of consecutive workpieces, along a first advancing direction; second means of transport for transporting, in use, a second plurality of consecutive workpieces, along a second advancing direction substantially parallel to said first advancing direction; at least one support substantially parallel to said first advancing direction and said second advancing direction and arranged between said first means of transport and said second means of transport; first drilling and/or milling means connected to said at least one support in a movable manner along a first axis parallel to said first advancing direction and said second advancing direction; said first drilling and/or milling means being mounted on a first side of said at least one support, substantially facing said first transport means; and second drilling and/or milling means connected to said at least one support in a movable manner along a second axis parallel to said first axis; said second drilling and/or milling means being mounted on a second side of said at least one support, substantially facing said second means of transport, in such a way as to allow, in use, the simultaneous drilling and/or milling of said first plurality of workpieces by said first drilling and/or milling means and of said second plurality of workpieces by said second drilling and/or milling means while said first plurality of workpieces advances along said first advancing direction and said second plurality of workpieces advances along said second advancing direction.

[0010] Further according to the invention, said first drill-

ing and/or milling means may be movable in both mutually opposite directions of said first axis; and in that said second drilling and/or milling means are movable in both mutually opposite directions of said second axis.

[0011] Advantageously according to the invention, said first drilling and/or milling means may comprise at least a first drilling and/or milling unit and at least a first stop element configured to come into contact, in use, with at least a first workpiece of said first plurality of workpieces and feed said at least a first workpiece along said first advancing direction at the same speed as said at least a first drilling and/or milling unit; and said second drilling and/or milling means may comprise at least a second drilling and/or milling unit and at least a second stop element configured to come into contact, in use, with at least a second workpiece of said second plurality of workpieces and feed said at least a second workpiece along said second advancing direction at the same speed as said at least a second drilling and/or milling unit.

[0012] Still according to the invention, said at least a first contact element may be movable along a third axis, substantially perpendicular to said first axis, between an operative position, wherein said at least a first contact element is substantially at the same height as said first plurality of pieces, and an inactive position, wherein said at least a first contact element is at a different height from the height of said first plurality of workpieces; and said at least a second contact element may be movable along a fourth axis, substantially perpendicular to said second axis, between an operative position, wherein said at least a second contact element is substantially at the same height as said second plurality of pieces, and an inactive position, wherein said at least a second contact element is at a different height from the height of said second plurality of workpieces.

[0013] Preferably according to the invention, said at least a first drilling and/or milling unit may be movable along a fifth axis substantially perpendicular to said first axis and said third axis, and in that said at least a second drilling and/or milling unit is movable along a sixth axis substantially perpendicular to said second axis and said fourth axis.

[0014] Conveniently according to the invention, said first drilling and/or milling means may comprise at least a first drilling and/or milling device, comprising at least one drilling and/or milling unit, and at least a second drilling and/or milling device, comprising at least one drilling and/or milling unit.

[0015] Further according to the invention, said first drilling and/or milling means may comprise at least a first carriage movably connected, along said first axis, to said at least one support; on said at least a first carriage being mounted at least a first drilling and/or milling device comprising at least one drilling and/or milling unit.

[0016] Preferably according to the invention, said first drilling and/or milling means may comprise at least a second carriage movably connected to said at least one support along said first axis and independently of said at

least a first carriage; on said at least a second carriage being mounted at least a second drilling and/or milling device comprising at least one drilling and/or milling unit.

[0017] Further according to the invention, said first drilling and/or milling means may comprise at least two carriages connected to said at least one support in a movable manner along said first axis and independently of each other; on each of said at least two carriages being mounted at least two drilling and/or milling devices relatively movable along said first axis and each comprising at least one drilling and/or milling unit.

[0018] Preferably according to the invention, said second drilling and/or milling means may comprise at least a third drilling and/or milling device, comprising at least one drilling and/or milling unit, and at least a fourth drilling and/or milling device, comprising at least one drilling and/or milling unit.

[0019] Advantageously according to the invention, said second drilling and/or milling means may comprise at least a third carriage movably connected, along said first axis, to said at least one support; on said at least a third carriage being mounted at least a third drilling and/or milling device comprising at least one drilling and/or milling unit.

[0020] Further according to the invention, according to the invention, said second drilling and/or milling means may comprise at least a fourth carriage movably connected to said at least one support along said first axis and independently of said at least a third carriage; on said at least a fourth carriage being mounted at least a fourth drilling and/or milling device comprising at least one drilling and/or milling unit.

[0021] Conveniently according to the invention, said second drilling and/or milling means may comprise at least two carriages connected to said at least one support in a movable manner along said first axis and independently of each other; on each of said at least two carriages being mounted at least two drilling and/or milling devices relatively movable along said first axis and each comprising at least one drilling and/or milling unit.

[0022] Still according to the invention, said at least a first drilling and/or milling device, and/or said at least a second drilling and/or milling device, and/or said at least a third drilling and/or milling device, and/or said at least a fourth drilling and/or milling device may comprise a plurality of drilling and/or milling units.

[0023] Preferably according to the invention, the drilling and/or milling units of said plurality of drilling and/or milling units may be mutually parallel.

[0024] It is also object of the present invention a system comprising: a machine tool according to any one of the preceding claims; and at least one cutting station for cutting workpieces, located upstream of said machine tool.

[0025] Conveniently according to the invention, said system may comprise a separating station, located between said at least one cutting station and said machine tool, for separating the workpieces cut by said at least one cutting station into said first plurality of workpieces

and said second plurality of workpieces.

[0026] The present invention will be now described, for illustrative but not limitative purposes, according to its preferred embodiments, with particular reference to the figures of the enclosed drawings, wherein:

figure 1 is a top plan view of a machine tool according to an embodiment of the present invention;

figure 2 is a front view of the machine tool shown in figure 1;

figure 3 is a side view of the machine tool illustrated in figures 1 and 2, in a first operating configuration; figure 4 is a side view of the machine tool illustrated in figures 1 and 2, in a second operating configuration; and

figure 5 shows an operating scheme of the machine tool of figures 1-4.

[0027] In the various figures, similar parts will be indicated with the same numerical references.

[0028] With reference to the attached figures, 1 indicates as a whole a machine tool according to an embodiment of the present invention.

[0029] This machine tool 1 comprises a first transport system 2 for feeding a first plurality of consecutive panels P1, according to a first advancing direction D1, and a second transport system 3 for feeding a second plurality of consecutive panels P2, along a second advancing direction D2, parallel to the first advancing direction D1, in which said first plurality of panels P1 and second plurality of panels P2 respectively correspond to a first machining line and to a second machining line parallel to each other.

[0030] Specifically, the second transport system 3 is arranged parallel to the first transport system 2 with a predetermined distance from the latter.

[0031] Each of said first 2 and second 3 transport systems comprises a respective pair of lower conveyors 4, 5 with chains or belts and, above these, a pair of rows of idle rollers 6, 7, or motorized belts, provided with a thrust system acting in such a way as to push, during the operation of the drilling machine 1, the rows of idle rollers 6, 7 on the panels P1, P2 transported by the lower conveyors 4, 5.

[0032] The aforementioned idle rollers 6, 7 are preferably rubber-coated in order to avoid slipping phenomena when panels P1, P2 advance.

[0033] Both the lower conveyors 4, 5 and the overlying rows of idle rollers 6, 7 are parallel to the aforementioned first D1 and second D2 advancing directions.

[0034] Between the first transport system 2 and the second transport system 3 there is an oblong support 8 oriented, parallel to the first D1 and to the second D2 advancing direction as well.

[0035] On the two opposite sides of the oblong support 8, respectively facing the first 2 and the second 3 transport system, a first operating system 9 and a second operating system 10, for respectively working in use the first plurality of panels P1 and the second plurality of panels P2.

els P2, in which a first X-axis is parallel to said advancing direction D1, D2, are mounted in a movable way along the first X-axis.

[0036] On each of said two sides of the oblong support 8 there are respective longitudinal guides 11, 12 directed parallel to the first D1 and to the second D2 advancing direction.

[0037] The first operating system 9 comprises three carriages 13, 14, 15 movables, according to said first X-axis, on the longitudinal guides 11 provided on a first side of the oblong support 8.

[0038] Similarly, the second operating system 10 comprises three carriages 16, 17, 18 movables, according to said first X-axis, on the longitudinal guides 12 provided on a second side of the oblong support 8, opposite the aforementioned first side.

[0039] The aforementioned carriages 13, 14, 15, 16, 17, 18 are moved by means of a respective first moving system.

[0040] Each carriage 13, 14, 15, 16, 17, 18 carries a respective pair of drilling heads 19, 20; 21, 22; 23, 24; 25, 26; 27, 28; 29, 30, each equipped with a plurality of drilling tips 31 and movable with respect to the relative carriage and also with respect to one another, along said first X-axis by means of a guide system and a movement system associated with each carriage.

[0041] Between each carriage 13, 14, 15, 16, 17, 18 and the relative pair of drilling heads 19, 20; 21, 22; 23, 24; 25, 26; 27, 28; 29, 30 it is provided a respective vertical movement system 32, 33 for moving, vertically along a second Z-axis orthogonal to the first X-axis, such pair of drilling heads 19, 20; 21, 22; 23, 24; 25, 26; 27, 28; 29, 30 between a raised position, in which the drilling tips 31 are arranged at a higher level than the panels P1, P2, and a lowered position, in which the drilling tips 31 face the thickness of the panels P1, P2.

[0042] Furthermore, each pair of drilling heads 19, 20; 21, 22; 23, 24; 25, 26; 27, 28; 29, 30 is associated with a respective stop member 34, 35, 36, 37, 38, 39 arranged downstream of said pair and it is vertically and integrally movable with the relative pair of drilling heads 19, 20; 21, 22; 23, 24; 25, 26; 27, 28; 29, 30 by means of the aforementioned vertical movement system 32, 33, so that when the pair of drilling heads 19, 20; 21, 22; 23, 24; 25, 26; 27, 28; 29, 30 is in the lowered position, the stop member 34, 35, 36, 37, 38, 39 abuts the panel P1, P2 to be machined.

[0043] Each stop member 34, 35, 36, 37, 38, 39 is also movable with respect to the relative pair of drilling heads 19, 20; 21, 22; 23, 24; 25, 26; 27, 28; 29, 30 also along said first X-axis.

[0044] Furthermore, each drilling head 19, 20; 21, 22; 23, 24; 25, 26; 27, 28; 29, 30 is equipped with a respective movement system to move, individually, the related drilling tips 31 parallel to a third Y-axis, orthogonal to said first X-axis and second Z-axis, to make the holes in the panel P1, P2 provided in the machining program set in the machine tool 1.

[0045] According to a further embodiment of the invention (not shown), each of the first operating system 9 and the second operating system 10 can comprise even a single carriage, on which a single drilling head is mounted, or a plurality of carriages, each supporting a single drilling head.

[0046] On the basis of further variants of the present invention (not shown), in addition to, or in replacement of the drilling tips 31 indicated above, tools for carrying out milling operations can be provided.

[0047] The operation of the machine tool 1 described above provides that the first 9 and the second 10 operating systems perform the drilling operations in the first P1 and in the second P2 plurality of panels during the advancement of the same panels P1, P2 along the first D1 and in the second D2 advancing direction.

[0048] Specifically, in order to have a high degree of precision in drilling operations, the aforementioned movement systems along the first X-axis and the second Z-axis are operated in such a way that each stop member 34, 35, 36, 37, 38, 39 stops with a respective advancing panel P1, P2; in this way it is certain that the pair of drilling heads 19, 20; 21, 22; 23, 24; 25, 26; 27, 28; 29, 30 associated with each stop member 34, 35, 36, 37, 38, 39, in the lowered position, moves at the same speed as the respective panel P1, P2 along the first X-axis, thus excluding the possibility that relative movements may occur along said first X-axis between the drilling heads 19, 20; 21, 22; 23, 24; 25, 26; 27, 28; 29, 30 and the panels P1, P2 pushed by the stop members 34, 35, 36, 37, 38, 39.

[0049] The drilling operations of the panels P1, P2 by the drilling tips 31 are carried out exactly in the interval of time in which the stop members 34, 35, 36, 37, 38, 39 are engaged, or rather in abutment, with the panels P1, P2.

[0050] At the end of the drilling operations of each triad of panels P1, P2, the lifting of the stop members 34, 35, 36, 37, 38, 39 are arranged up to the relative raised position and the subsequent retraction of the carriages 13, 14, 15, 16, 17, 18 along the first X-axis from the forward-position shown in figure 4 to the initial position shown in figure 3.

[0051] At this point, the first 9 and the second 10 operating systems wait for the arrival of the next triad of panels P1, P2 to be machined, which, once reached in correspondence with the drilling heads 19, 20; 21, 22; 23, 24; 25, 26; 27, 28; 29, 30 are engaged by the same stop members 34, 35, 36, 37, 38, 39 in the lowered position, from here the operating cycle develops according to the same methods described above.

[0052] Upstream of the machine tool 1, a cutting station (not shown) can be provided for cutting panels into smaller pieces.

[0053] A separation station (not shown) can also be provided between the aforementioned cutting station and the machine tool 1, to separate the panels cut by the cutting station into two rows of panels, which will then respectively be picked up by the first 2 and the second

3 transport system of the machine tool 1 itself, to be subjected to the foreseen drilling operations.

[0054] As can be seen from the foregoing description, the machine tool, according to the present invention, allows being achieved a high degree of precision in the performed machining.

[0055] By using the aforementioned machine tool it is, therefore, possible to obtain machined workpieces substantially free of imperfections in terms of shape, size and position of the related machined parts.

[0056] The same machine tool also has a high productivity index thanks to the possibility of simultaneously machining two different rows of pieces during their advancement along the respective production line, without this negatively affecting the machining accuracy.

[0057] The present invention has been described for illustrative but not limitative purposes, according to its preferred embodiments, but it is to be understood that modifications and/or changes can be introduced by those skilled in the art without departing from the relevant scope as defined in the enclosed claims.

Claims

1. Machine tool (1) for drilling and/or milling workpieces (P1, P2) comprising:

first means of transport (2) for transporting, in use, a first plurality of consecutive workpieces (P1), along a first advancing direction (D1);
second means of transport (3) for transporting, in use, a second plurality of consecutive workpieces (P2), along a second advancing direction (D2) substantially parallel to said first advancing direction (D1);

at least one support (8) substantially parallel to said first advancing direction (D1) and said second advancing direction (D2) and arranged between said first means of transport (2) and said second means of transport (3);

first drilling and/or milling means (9) connected to said at least one support (8) in a movable manner along a first axis (X) parallel to said first advancing direction (D1) and said second advancing direction (D2); said first drilling and/or milling means (9) being mounted on a first side of said at least one support (8), substantially facing said first transport means (2); and

second drilling and/or milling means (10) connected to said at least one support (8) in a movable manner along a second axis parallel to said first axis (X); said second drilling and/or milling means (10) being mounted on a second side of said at least one support (8), substantially facing said second means of transport (3), in such a way as to allow, in use, the simultaneous drilling and/or milling of said first plurality of workpieces

(P1) by said first drilling and/or milling means (9) and of said second plurality of workpieces (P2) by said second drilling and/or milling means (10) while said first plurality of workpieces (P1) advances along said first advancing direction (D1) and said second plurality of workpieces (P2) advances along said second advancing direction (D2).

2. Machine tool (1) according to claim 1, **characterized in that** said first drilling and/or milling means (9) are movable in both mutually opposite directions of said first axis (X); and **in that** said second drilling and/or milling means (10) are movable in both mutually opposite directions of said second axis.

3. Machine tool (1) according to claim 1 or 2, **characterized**

in that said first drilling and/or milling means (9) comprise at least a first drilling and/or milling unit (31) and at least a first stop element (34, 35, 36) configured to come into contact, in use, with at least a first workpiece of said first plurality of workpieces (P1) and feed said at least a first workpiece along said first advancing direction (D1) at the same speed as said at least a first drilling and/or milling unit (31); and

in that said second drilling and/or milling means (10) comprise at least a second drilling and/or milling unit (31) and at least a second stop element (37, 38, 39) configured to come into contact, in use, with at least a second workpiece of said second plurality of workpieces (P2) and feed said at least a second workpiece along said second advancing direction (D2) at the same speed as said at least a second drilling and/or milling unit (31).

4. Machine tool (1) according to claim 3, **characterized**

in that said at least a first contact element (34, 35, 36) is movable along a third axis (Z), substantially perpendicular to said first axis (X), between an operative position, wherein said at least a first contact element (34, 35, 36) is substantially at the same height as said first plurality of pieces (P1), and an inactive position, wherein said at least a first contact element (34, 35, 36) is at a different height from the height of said first plurality of workpieces (P1); and

in that said at least a second contact element (37, 38, 39) is movable along a fourth axis, substantially perpendicular to said second axis, between an operative position, wherein said at least a second contact element (37, 38, 39) is substantially at the same height as said second plurality of pieces (P2), and an inactive position,

wherein said at least a second contact element (37, 38, 39) is at a different height from the height of said second plurality of workpieces (P2).

5. Machine tool (1) according to claim 4, **characterized in that** said at least a first drilling and/or milling unit (31) is movable along a fifth axis (Y) substantially perpendicular to said first axis (X) and said third axis (Z), and **in that** said at least a second drilling and/or milling unit (31) is movable along a sixth axis substantially perpendicular to said second axis and said fourth axis.
6. Machine tool (1) according to any one of claims 3 to 5, **characterized in that** said first drilling and/or milling means (9) comprise at least a first drilling and/or milling device (19), comprising at least one drilling and/or milling unit (31), and at least a second drilling and/or milling device (20), comprising at least one drilling and/or milling unit (31).
7. Machine tool (1) according to any one of claims 1 to 6, **characterized in that** said first drilling and/or milling means (9) comprise at least a first carriage (13) movably connected, along said first axis (X), to said at least one support (8); on said at least a first carriage (13) being mounted at least a first drilling and/or milling device (19) comprising at least one drilling and/or milling unit (31).
8. Machine tool (1) according to claim 7, **characterized in that** said first drilling and/or milling means (9) comprise at least a second carriage (14) movably connected to said at least one support (8) along said first axis (X) and independently of said at least a first carriage (13); on said at least a second carriage (14) being mounted at least a second drilling and/or milling device (21) comprising at least one drilling and/or milling unit (31).
9. Machine tool (1) according to claim 7 or 8, **characterized in that** said first drilling and/or milling means (9) comprise at least two carriages (13, 14, 15) connected to said at least one support (8) in a movable manner along said first axis (X) and independently of each other; on each of said at least two carriages (13, 14, 15) being mounted at least two drilling and/or milling devices (19, 20; 21, 22; 23, 24) relatively movable along said first axis (X) and each comprising at least one drilling and/or milling unit (31).
10. Machine tool (1) according to any one of claims 3 to 9, **characterized in that** said second drilling and/or milling means (10) comprise at least a third drilling and/or milling device (25), comprising at least one drilling and/or milling unit (31), and at least a fourth drilling and/or milling device (26), comprising at least one drilling and/or milling unit (31).

11. Machine tool (1) according to any one of claims 3 to 10, **characterized in that** said second drilling and/or milling means (10) comprise at least a third carriage (16) movably connected, along said first axis (X), to said at least one support (8); on said at least a third carriage (16) being mounted at least a third drilling and/or milling device (25) comprising at least one drilling and/or milling unit (31).
12. Machine tool (1) according to claim 11, **characterized in that** said second drilling and/or milling means (10) comprise at least a fourth carriage (17) movably connected to said at least one support (8) along said first axis (X) and independently of said at least a third carriage (16); on said at least a fourth carriage (17) being mounted at least a fourth drilling and/or milling device (27) comprising at least one drilling and/or milling unit (31).
13. Machine tool (1) according to claim 11 or 12, **characterized in that** said second drilling and/or milling means (10) comprise at least two carriages (16, 17, 18) connected to said at least one support (8) in a movable manner along said first axis (X) and independently of each other; on each of said at least two carriages (16, 17, 18) being mounted at least two drilling and/or milling devices (25, 26; 27, 28; 29, 30) relatively movable along said first axis (X) and each comprising at least one drilling and/or milling unit (31).
14. Machine tool (1) according to claim 6 or 10, **characterized in that** said at least a first drilling and/or milling device (19), and/or said at least a second drilling and/or milling device (20), and/or said at least a third drilling and/or milling device (25), and/or said at least a fourth drilling and/or milling device (26) comprise a plurality of drilling and/or milling units (31).
15. Machine tool (1) according to claim 14, **characterized in that** the drilling and/or milling units (31) of said plurality of drilling and/or milling units (31) are mutually parallel.
16. System comprising:
a machine tool (1) according to any one of the preceding claims; and
at least one cutting station for cutting workpieces, located upstream of said machine tool (1).
17. System according to claim 16, **characterized in that** it comprises a separating station, located between said at least one cutting station and said machine tool (1), for separating the workpieces cut by said at least one cutting station into said first plurality of workpieces (P1) and said second plurality of workpieces (P2).

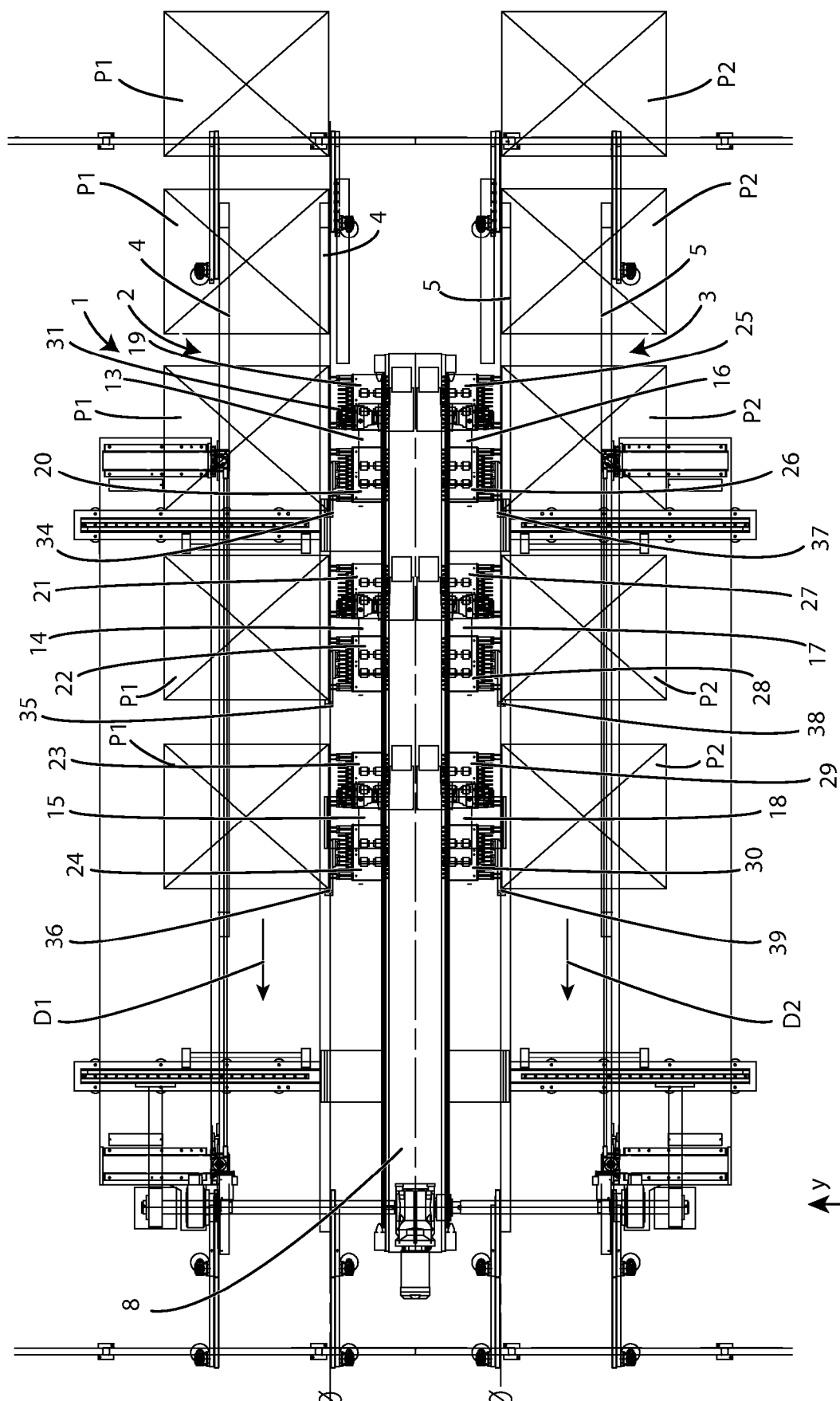


Fig. 1

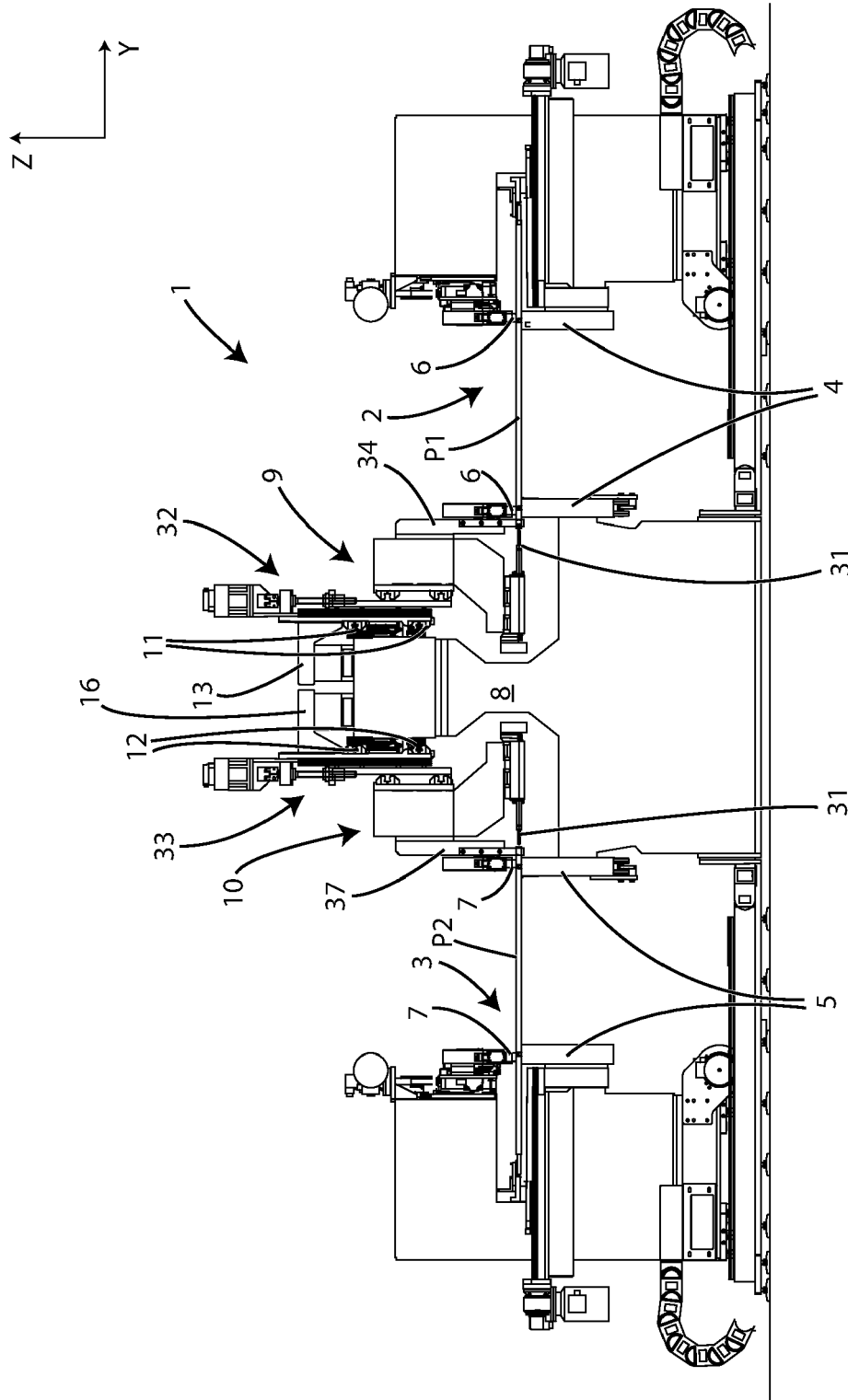


Fig. 2

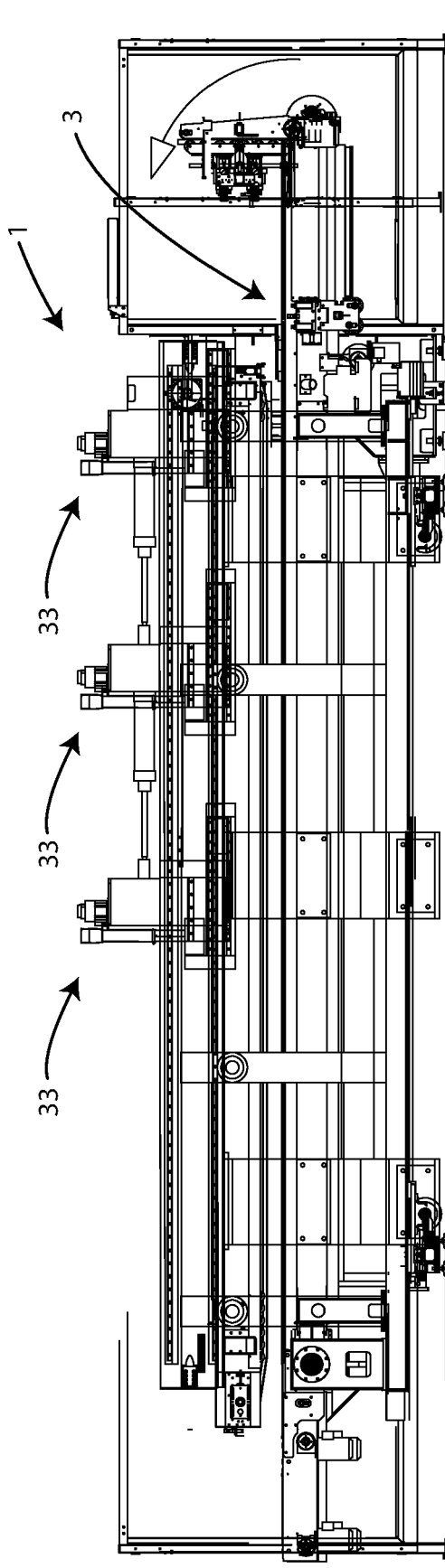


Fig. 3

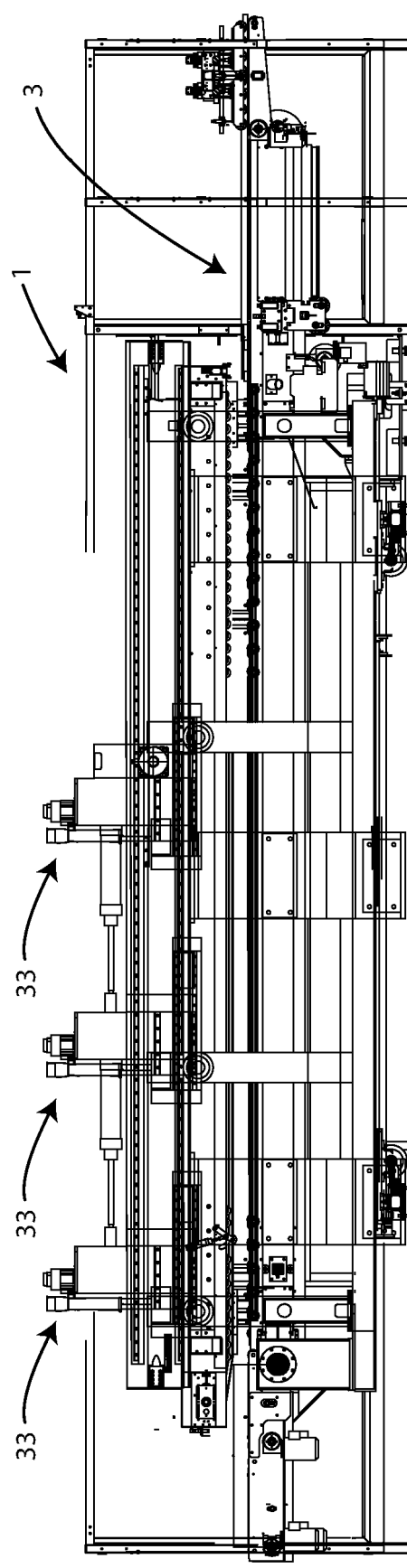


Fig. 4

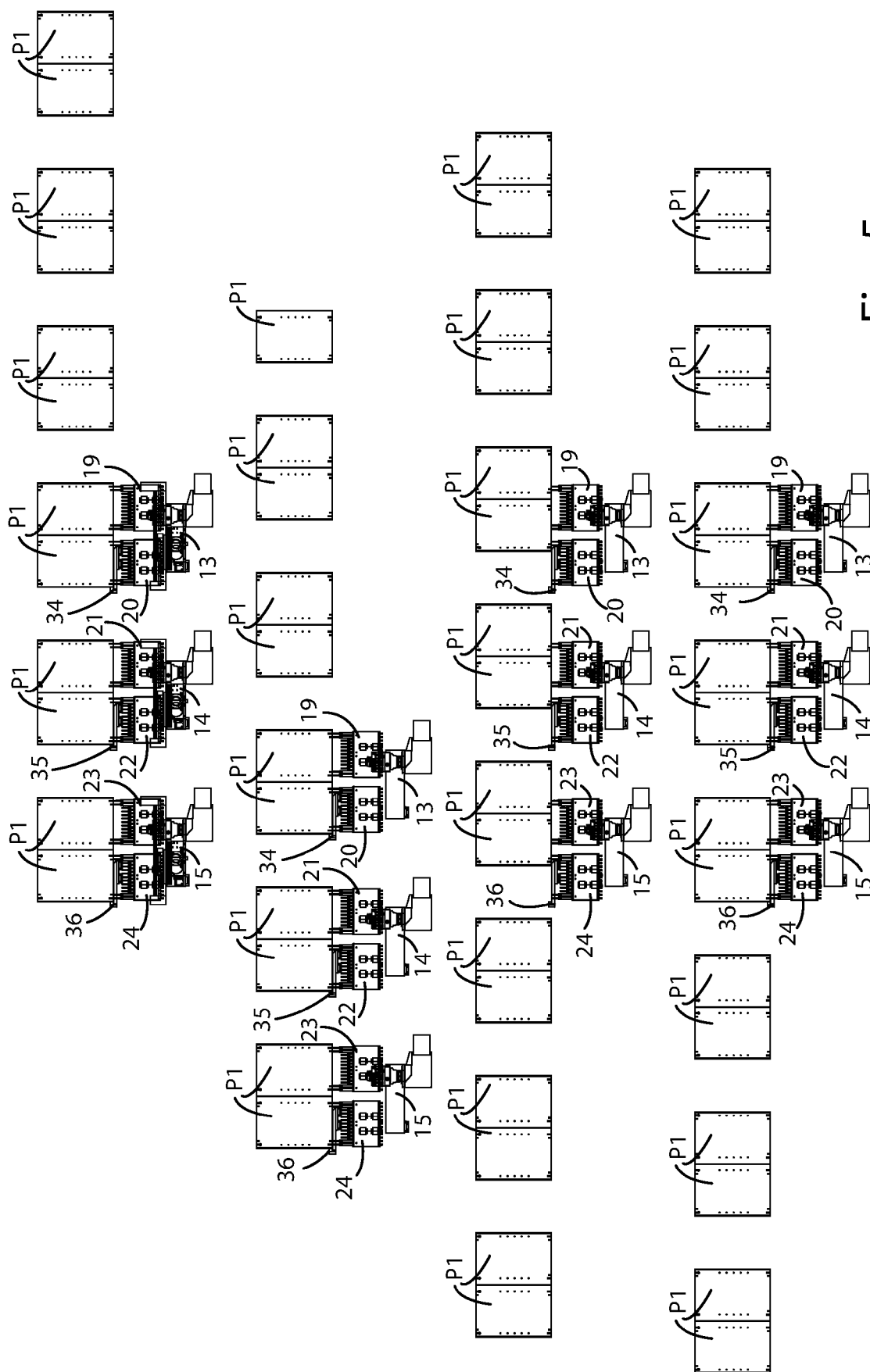


Fig. 5



EUROPEAN SEARCH REPORT

Application Number

EP 21 21 2695

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 159 023 A2 (BIESSE SPA [IT]) 3 March 2010 (2010-03-03)	1-9, 14-17	INV. B27C3/06
A	* abstract * * paragraphs [0019], [0021], [0022], [0024] - [0026] * * figures *	10-13	B27C9/04 B27M1/08
X	----- CN 107 738 321 A (JINGHUA POWERFUL WOODWORKING MACHINERY CO LTD) 27 February 2018 (2018-02-27)	1-9, 14-17	
A	* abstract * * figures *	10-13	
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A	* abstract * * figures *	10-13	
			TECHNICAL FIELDS SEARCHED (IPC)
			B27C B27M
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 April 2022	Examiner Hamel, Pascal
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
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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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