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(54) **Milling machine for machining wood beams**

(57) A milling machine for machining on wood beams, which comprises a guided movement line (11) for a beam (12) to be machined and a milling station (13) which comprises two milling assemblies (18, 19) which are controlled by electronic means (20) and are each adapted to mill mutually opposite faces (12a, 12b, 12c, 12d) of the same portion of beam (12). The milling assemblies (18, 19) each comprise a single cutter (23, 30) which is associated with respective means (21) for translational motion along two respective perpendicular directions which lie on a plane which is arranged transversely

with respect to the direction of the movement line (11). The electronic means (20) coordinating the translational motion means (21) in order to allow simultaneously the cutters (23, 30), arranged at the beginning of the milling sequence on corresponding contiguous faces (12a, 12b, 12c, 12d) of the beam (12), a first stroke for milling along a respective face (12b, 12c), a second idle stroke along a face (12c, 12d) which is contiguous to the previously milled one, and a third stroke for milling along the face (12d, 12a) which is parallel to the previously milled one; the cutters (23, 30) are moved around the beam (12) along a same direction of motion.

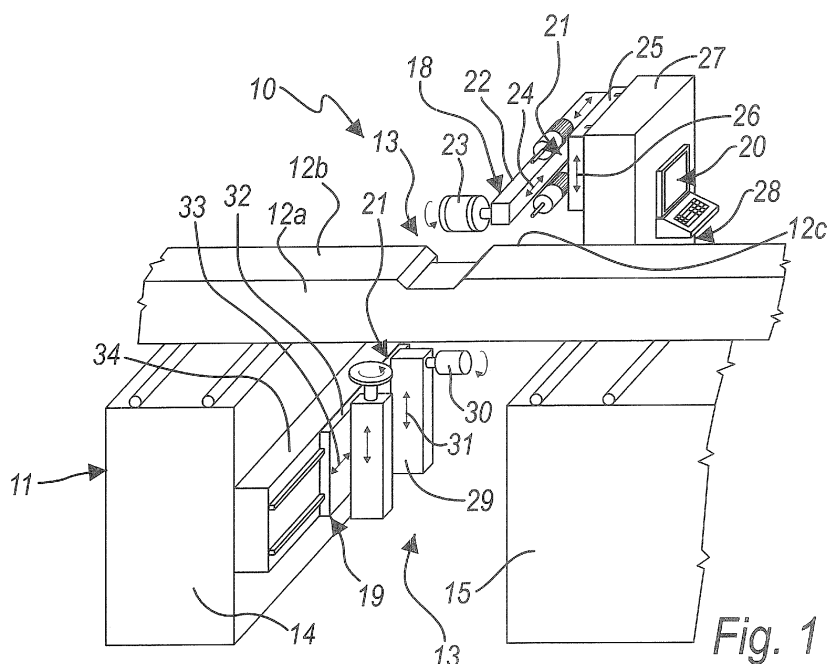


Fig. 1

Description

[0001] The present invention relates to a milling machine for machining wood beams.

[0002] In particular, the invention can be used conveniently with wood beams used in the building sector to provide work such as abutment seats for walls, supports for structural elements, et cetera.

[0003] Several different types of machining are performed on wood beams intended to constitute structural elements of a building.

[0004] Among these, one of the most typical is constituted by machining on an intermediate beam portion which consists of two first symmetrical millings on two parallel faces of the beam, so as to provide first locators, and two second symmetrical millings provided on the two remaining faces substantially in the same axial position as the first millings, which constitute second locators; these second millings are deeper than the preceding ones (Figure 5a included in the accompanying drawings shows this machining).

[0005] Currently, a machine is known for providing this kind of machining which is constituted by a line for moving the beam and by a station on which the beam is held and in which there are two distinct milling assemblies, a first assembly which works in a horizontal direction and a second assembly which works in a vertical direction.

[0006] Each assembly in practice is constituted by a C-shaped structure, which is directed toward the beam to be cut; two cutters are provided on the ends of the cantilever arms of the C-shape and therefore work in parallel (the distance between the arms that support the cutters can be adjusted as a function of the dimensions of the beam and of the milling depth).

[0007] The first assembly is made to perform a translational motion, transversely to the axis of the beam, from an inactive position which is spaced from said beam to a position for working thereon; the distance between the cutters is such as to allow simultaneous milling of the two horizontal faces.

[0008] Once milling has been performed, the first assembly is made to perform a translational motion back into the inactive position.

[0009] At this point, the second assembly is made to perform a vertical translational motion from an inactive position below the beam to a position for working on the beam; in this case also, the distance between the cutters is such as to allow simultaneous milling of the two vertical faces.

[0010] Once milling has been performed, the second assembly is again made to perform a translational motion into the inactive position and the beam is ready for any other machining operations on the region that has just been milled by way of other machining assemblies or heads.

[0011] The use of the four cutters leads to a series of space occupation problems which are not negligible.

[0012] It is in fact evident that the need to work sepa-

ately with two milling assemblies which surround the beam inevitably leads to the provision of very wide maneuvering spaces for said assemblies in order to prevent them from interfering with each other.

[0013] These wide spaces therefore lead to very large space occupations of the machining station.

[0014] Further, the distances of the translational motion of the assemblies are thus very large, accordingly leading to long machining times.

[0015] Moreover, the same machining times are slowed by the fact that each assembly performs two idle strokes for each milling operation (one for approaching the beam and one for moving away).

[0016] The aim of the present invention is to solve the problems noted in known types of milling machines for machining on wood beams.

[0017] Within this aim, an object of the present invention is to provide a milling machine for machining on wood beams which has a reduced space occupation with respect to known machines.

[0018] Another object of the present invention is to provide a milling machine for machining on wood beams which works faster than known machines.

[0019] Another object of the present invention is to provide a milling machine for machining on wood beams which has a smaller number of components than known machines.

[0020] Another object of the present invention is to provide a milling machine for machining on wood beams which is flexible in use.

[0021] This aim and these and other objects, which will become better apparent hereinafter, are achieved by a milling machine for machining on wood beams which comprises a guided movement line for a beam to be machined and a milling station which comprises two milling assemblies which are controlled by electronic means and are each adapted to mill mutually opposite faces of the same portion of beam, characterized in that said milling assemblies each comprise a single cutter which is associated with respective means for translational motion along two respective perpendicular directions which lie on a plane which is arranged transversely with respect to the direction of said movement line, said electronic means coordinating said translational motion means in order to allow simultaneously said cutters, arranged at the beginning of the milling sequence on corresponding contiguous faces of the beam, a first stroke for milling along a respective face, a second idle stroke along a face which is contiguous to the previously milled one, and a third stroke for milling along the face which is parallel to the previously milled one, said cutters being moved around the beam along a same direction of motion.

[0022] Further characteristics and advantages of the invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a perspective view of a machine according to the invention, related to the milling station;

Figure 2 is a front view of the movement line with the milling station, which compose a machine according to the invention;

Figure 3 is a transverse view of the milling station of a machine according to the invention, shown in the direction of advancement of the beam being machined;

Figure 4 is a transverse view of the milling station of a machine according to the invention, shown in the opposite direction with respect to the advancement direction of the beam being machined;

Figures 5a, 5b, 5c and 5d are a diagram of four positions assumed by the cutters during machining, illustrating the various steps of the milling of the beam; Figures 6a, 6b and 6c are three perspective views of portions of beams on which kinds of machining which can be performed with a machine according to the invention are shown schematically.

[0023] It is noted that anything found to be already known during the patenting process is understood not to be claimed and to be the subject of a disclaimer.

[0024] With reference to the figures, a milling machine for machining on wood beams, according to the invention, is generally designated by the reference numeral 10.

[0025] The milling machine 10 comprises a guided movement line 11 for a beam 12 to be machined and a milling station 13 (the beam is not shown in Figure 2).

[0026] The guided movement line 11 is of the type with rollers and substantially comprises two aligned portions 14 and 15, which are spaced by the milling station 13.

[0027] The guided movement line 11 is provided with a side 16 for supporting the beam 12 and with shuttles 17 for moving the beam along the line 11, respectively two shuttles on the first portion 14 and two on the second portion 15.

[0028] The milling station 13 comprises two separate milling assemblies: a first assembly 18, which is adjacent to the second portion 15 of the movement line 11 at the leading end, and a second assembly 19, which is adjacent to the first portion 14 of said line at the trailing end; each of the milling assemblies 18 and 19 allows mainly to mill mutually opposite faces of the same portion of beam; said assemblies also allow to mill leading and trailing portions of the beams and to perform other types of machining, as explained in greater detail hereinafter.

[0029] The milling assemblies 18 and 19 are controlled by electronic means 20 (such as typical numeric control systems), which allow an automated movement thereof which is coordinated with the movement of the beam along the movement line 11.

[0030] According to the inventive concept of the invention, the two milling assemblies 18 and 19 each comprise a single cutter, which is associated with respective means 21 for translational motion, described hereinafter, along two respective perpendicular directions which lie

on a plane which is transverse to the direction of the movement line 11.

[0031] In particular, the first milling assembly 18 (shown in Figures 1 and 3) comprises a first arm 22, which is substantially parallel to the sliding plane formed by the movement line 11 and lies transversely to the direction of the movement line 11; in practice, the first arm 22 is perpendicular to the movement line 11 and therefore perpendicular to the beam 12.

[0032] At the end of the first arm 22 there is a first cutter 23, whose axis of rotation is substantially horizontal (parallel to the direction of the line 11).

[0033] The translational motion means 21 associated with the first cutter 23 comprise first controlled sliding means 24 (shown schematically, for the sake of simplicity, by means of a double arrow) for the first arm 22 on a first carriage 25 in a direction which coincides substantially with the extension of the first arm 22.

[0034] The first arm 22 lies at right angles to the movement line 11 and parallel to the plane formed by said line (in practice a horizontal translational motion): the first controlled sliding means 24 therefore allow a movement in said direction for the arm and accordingly determine a milling direction of the first cutter 23.

[0035] The first controlled sliding means 24 are constituted for example by straight guides and actuators of the electromechanical type, such as for example ballscrew systems associated with precision guides or advancement systems of the rack-and-pinion type or other systems.

[0036] The first carriage 25 in turn is associated with first means 26 (also shown schematically, for the sake of simplicity, by means of a double arrow) for rectilinear motion along a first guide 27 which is rigidly coupled to the frame 28 of the machine in a direction which is substantially perpendicular to the sliding plane formed by the movement line 11 (in practice a vertical translational motion).

[0037] In this case also, the first rectilinear motion means 26 are constituted for example by straight guides and actuators of the electromechanical type, such as for example ballscrew systems associated with precision guides or advancement systems of the rack-and-pinion type or other systems.

[0038] The second milling assembly 19 (shown in Figures 1 and 4) comprises a second arm 29, which is substantially perpendicular to the first arm 22 and perpendicular to the sliding plane formed by the movement line 11 (in practice, a vertical arm).

[0039] At the end of the second arm 29 there is a second cutter 30, which has a substantially horizontal axis.

[0040] The translational motion means 21 comprise second controlled sliding means 31 (also shown schematically, for the sake of simplicity, by means of a double arrow) for the second arm 29 on a second carriage 32 in a direction which is parallel to the direction of translational motion of the first carriage (in practice a vertical translational motion).

[0041] In this case also, the second controlled sliding means 31 are constituted for example by straight guides and actuators of the electromechanical type, such as for example ballscrew systems which are associated with precision guides or advancement systems of the rack-and-pinion type or other systems.

[0042] The second carriage 32 in turn is associated with second means 33 (also shown schematically, for the sake of simplicity, by means of a double arrow) for rectilinear motion along a second guide 34, which is rigidly coupled to the frame of the machine along a direction which is parallel to the sliding direction of the first arm 22 (in practice, a horizontal translational motion which is perpendicular to the line 11 and to the beam 12).

[0043] In this case also, the second rectilinear motion means 33 are constituted for example by straight guides and actuators of the electromechanical type, such as for example ballscrew systems associated with precision guides or advancement systems of the rack-and-pinion type or other systems.

[0044] The electronic means 20 allow to coordinate the translational motion means 21 in order to allow the cutters 23 and 30, arranged at the beginning of the milling sequence on corresponding contiguous faces of the beam 12, to perform simultaneously a first milling stroke along a respective face, a second idle stroke along a face which is contiguous to the previously milled one, and a third milling stroke along the face which is parallel to the previously milled one (the cutters 23 and 30 are moved around the beam 12 along a same direction of motion).

[0045] With reference to the example being described, the first cutter 23 is arranged laterally to a first lateral face 12a of the beam 12; the projection of the first cutter 23 intersects the lateral (vertical) face 12a by an extent which is substantially equal to the milling depth to be provided on the upper (horizontal) face 12b of the beam.

[0046] The second cutter 30 is arranged above the upper face 12b of the beam 12; the projection of the second cutter 30 intersects the upper face 12b by an extent which is substantially equal to the milling depth to be provided on the second (vertical) lateral face 12c of the beam.

[0047] As can be seen from the broken lines of Figure 3, the projection of the first arm 22 onto the upper face 12b, before milling begins, is superimposed on the upper face 12b; likewise, the projection of the second arm 29 onto the second lateral face 12c, before milling begins, is superimposed on the second lateral face 12c; in practice, the arms 22 and 29 are moved in a cantilever fashion on the beam 12 with respect to their carriages. This situation is shown by Figure 5a and by the broken lines of Figures 3 and 4.

[0048] With this configuration, it is possible to provide the machining of Figure 6a. Milling of the beam occurs in the following manner.

[0049] The second arm 29 is drawn downward, toward the carriage 32, moving the second cutter 30 so that it interferes with the beam 12 at the second lateral face 12c, providing a first vertical milling pass; the second

cutter is moved to a position such that its projection is completely external to the second lateral face 12c of the beam 12.

[0050] Simultaneously, the first arm 22 is subjected to a horizontal translational movement in the direction of the first carriage 25, moving the first cutter 23 so that it interferes with the beam 12 at the upper face 12b, providing a first horizontal milling pass; the first cutter 23 is subjected to a translational motion to such a position that its projection is completely external to the upper face 12b of the beam 12.

[0051] Figures 5a and 5b illustrate the initial and final positions of these first milling passes (these positions are also shown in Figures 3 and 4: the initial ones are shown in broken lines).

[0052] At this point, the second arm 29 is subjected to a horizontal translational motion on the lower face 12d, causing the second cutter 30 to perform an idle stroke, without milling, until the projection of the cutter 30 intersects the lower face 12d by an extent which is substantially equal to the milling depth to be provided on the first lateral face 12a of the beam; this arrangement is shown in Figure 5c; in this step, the second carriage in practice passes from one side of the beam 12 to the other.

[0053] At the same time, the first arm 22 is subjected to a vertical translational motion on the second lateral face 12c, causing an idle stroke of the first cutter 23, without milling, until the projection of the first cutter 23 intersects the second lateral face 12c by an extent which is substantially equal to the milling depth to be provided on the lower face 12d of the beam; this arrangement is shown in Figure 5c; in this step, the first carriage in practice passes from a position above the beam 12 to a position below it.

[0054] At this point, the second arm 29 is subjected to an upward translational motion away from the second carriage 32, moving the second cutter 30 so that it interferes with the beam 12 at the first lateral face 12a, providing a second vertical milling pass; the second cutter is subjected to a translational motion to such a position that its projection is completely external to the first lateral face 12a of the beam 12 (this position is shown in Figure 5d).

[0055] At the same time, the first arm 22 is subjected to a horizontal translational motion away from the first carriage 25, moving the first cutter 23 so that it interferes with the beam 12 at the lower face 12d, providing a second horizontal milling pass; the first cutter 23 is subjected to a translational motion to such a position that its projection is completely external to the lower face 12d of the beam 12 (this position is shown in Figure 5d).

[0056] In practice, as summarized in Figure 5a, the first and second cutters 23 and 30 provide respective horseshoe-shaped paths which surround the beam 12 and are rotated by 90° with respect to each other and in which the parallel portions of each path are matched by steps for milling the beam; the initial points of the cutters are defined on a same side of the beam.

[0057] As mentioned, the movement of the cutters along said horseshoe-shaped paths is coordinated and substantially simultaneous.

[0058] In this embodiment, the horseshoe-shaped path of the second cutter 30 is open upward.

[0059] Advantageously, two drills 35 are arranged on the first carriage 25 and their action is substantially parallel to the translational motion of the first arm 22 on the first carriage 24.

[0060] The drills 35 can perform a translational motion on the first carriage 24 parallel to the first arm 22, in practice allowing to provide holes which are perpendicular to the longitudinal axis of the beam 12, as shown in Figure 6b.

[0061] Conveniently, a third cutter 36 is arranged on the second carriage 32 and has an axis of rotation which is parallel to the direction of translational motion of the second arm 29; such cutter can perform a translational motion on the second carriage 32, parallel to the second arm 29, so as to be able to provide horizontal milling passes on the side of the beam or, as shown in Figure 6c, on the head.

[0062] In practice it has been found that the invention thus described achieves the intended aim and objects.

[0063] The present invention in fact provides a machine which has just two cutters for providing the machinings around the beam.

[0064] The particular arrangement of the two cutters and the fact that they work in practice simultaneously causes the overall space occupation of the milling station to be much smaller than in known machines in which it was necessary to move a large milling assembly after a machining step in order to make room for the second milling assembly.

[0065] The particular structure of the milling assemblies allows to keep the cutters very close to the beam, allowing very short translational motion times thereof, to the full benefit of production times.

[0066] Advantageously, the particular structure of the milling assemblies allows to use drills and additional cutters to provide other typical work on the beam.

[0067] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0068] In practice, the materials employed, so long as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

[0069] The disclosures in Italian Patent Application No. PD2006A000426 from which this application claims priority are incorporated herein by reference.

[0070] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the

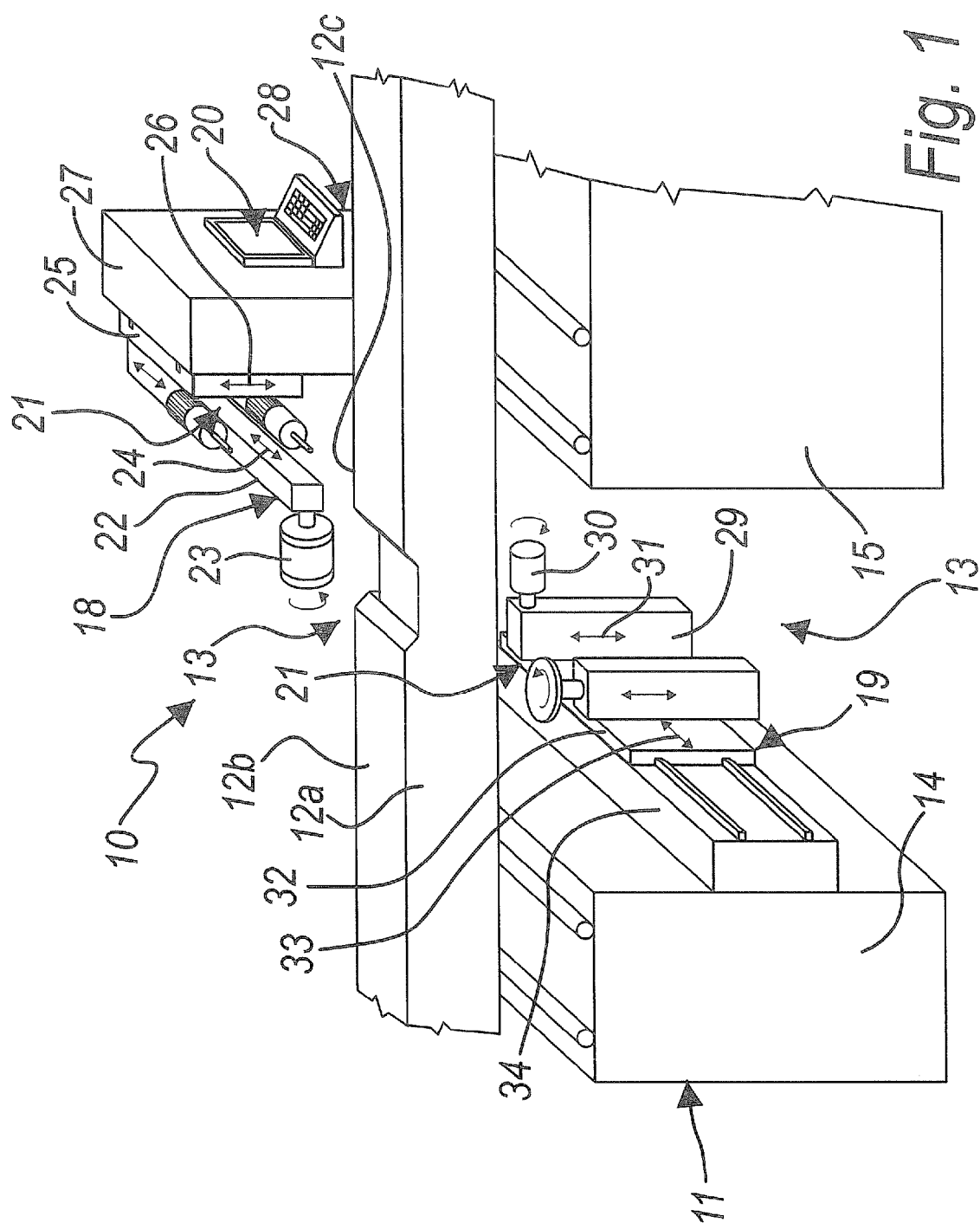
interpretation of each element identified by way of example by such reference signs.

5 Claims

1. A milling machine for machining on wood beams, which comprises a guided movement line (11) for a beam (12) to be machined and a milling station (13) which comprises two milling assemblies (18, 19) which are controlled by electronic means (20) and are each adapted to mill mutually opposite faces (12a, 12b, 12c, 12d) of the same portion of beam (12), **characterized in that** said milling assemblies (18, 19) each comprise a single cutter (23, 30) which is associated with respective means (21) for translational motion along two respective perpendicular directions which lie on a plane which is arranged transversely with respect to the direction of said movement line (11), said electronic means (20) coordinating said translational motion means (21) in order to allow simultaneously said cutters (23, 30), arranged at the beginning of the milling sequence on corresponding contiguous faces (12a, 12b, 12c, 12d) of the beam (12), a first stroke for milling along a respective face (12b, 12c), a second idle stroke along a face (12c, 12d) which is contiguous to the previously milled one, and a third stroke for milling along the face (12d, 12a) which is parallel to the previously milled one, said cutters (23, 30) being moved around the beam (12) along a same direction of motion.
2. The milling machine for machining on wood beams according to claim 1, **characterized in that** a first one (18) of said milling assemblies (18, 19) comprises a single first arm (22) which is substantially parallel to the sliding plane formed by said movement line (11) and lies transversely to the direction of said movement line (11), a first one (23) of said cutters (22, 23) being provided at the end of said first arm (22), said means (21) for translational motion comprising first means (24) for the controlled sliding of said first arm (22) on a first carriage (25) along a direction which coincides substantially with the extension of said first arm (22), said first carriage (25) being in turn associated with first means (26) for rectilinear movement along a first guide (27) which is rigidly coupled to the frame (28) of the machine along a direction which is substantially perpendicular to the sliding plane formed by said movement line (11), the second (19) of said milling assemblies (18, 19) comprising a single second arm (29), which is substantially perpendicular to said first arm (22) and perpendicular to the sliding plane formed by said movement line (11), at the end of said second arm (29) there being a second one (30) of said cutters (23, 30), said means (21) for translational motion comprising sec-

ond means (31) for the controlled sliding of said second arm (29) on a second carriage (32) along a direction which is parallel to the direction of translational motion of said first carriage (25), said second carriage (32) being in turn associated with second means (33) for rectilinear movement along a second guide (34) which is rigidly coupled to the frame (28) of the machine along a direction which is parallel to the sliding direction of said first arm (22).

3. The machine according to claim 1, **characterized in that** said cutters (23, 30) provide respective horse-shoe-shaped paths which wrap around the beam (12) and are rotated through 90° with respect to each other, the parallel portions of each of said paths corresponding to steps for milling the beam, the starting points of said cutters (23, 30) being formed on a same side of the beam, the movement of said cutters (23, 30) on said horseshoe-shaped paths being coordinated and substantially simultaneous.
4. The machine according to claim 1, **characterized in that** said first cutter (23) and said second cutter (30) have a rotation axis which is substantially parallel to the direction of said movement line (11).
5. The machine according to claim 2, **characterized in that** on said first carriage (25) there is at least one drill (35) whose action is substantially parallel to the translational motion of said first arm (22) on said first carriage (24), said drill (35) being able to perform a translational motion on said first carriage (24) parallel to said first arm (22).
6. The machine according to claim 2, **characterized in that** a third cutter (36) is arranged on said second carriage (32) and has an axis of rotation which is parallel to the direction of translational motion of said second arm (29), said third cutter (36) being able to perform a translational motion on said second carriage (32) parallel to said second arm (29).
7. The machine according to claim 2, **characterized in that** said guided movement line (11) comprises substantially two aligned portions (14, 15), which are spaced by said milling station (13), said guided movement line (11) providing a side (16) for supporting the beam (12) and shuttles (17) for moving the beam along said line (11), said first milling assembly (18) being adjacent to the leading end of said second portion (15) of the movement line (11), said second assembly (19) being adjacent to the trailing end of the first portion (14) of said line (11).
8. The machine according to claim 1, **characterized in that** said means for translational motion comprise actuators of the electromechanical type.



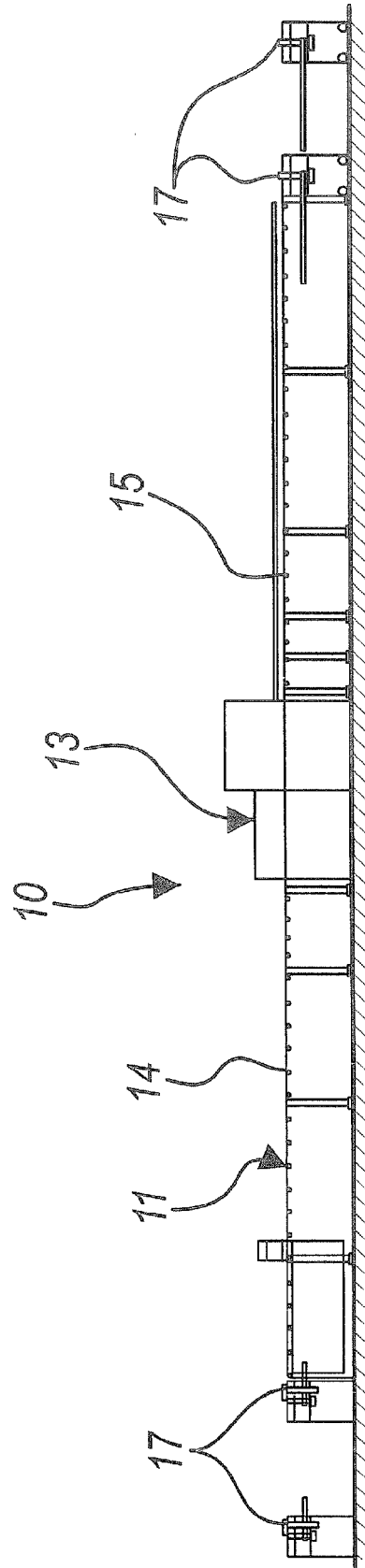
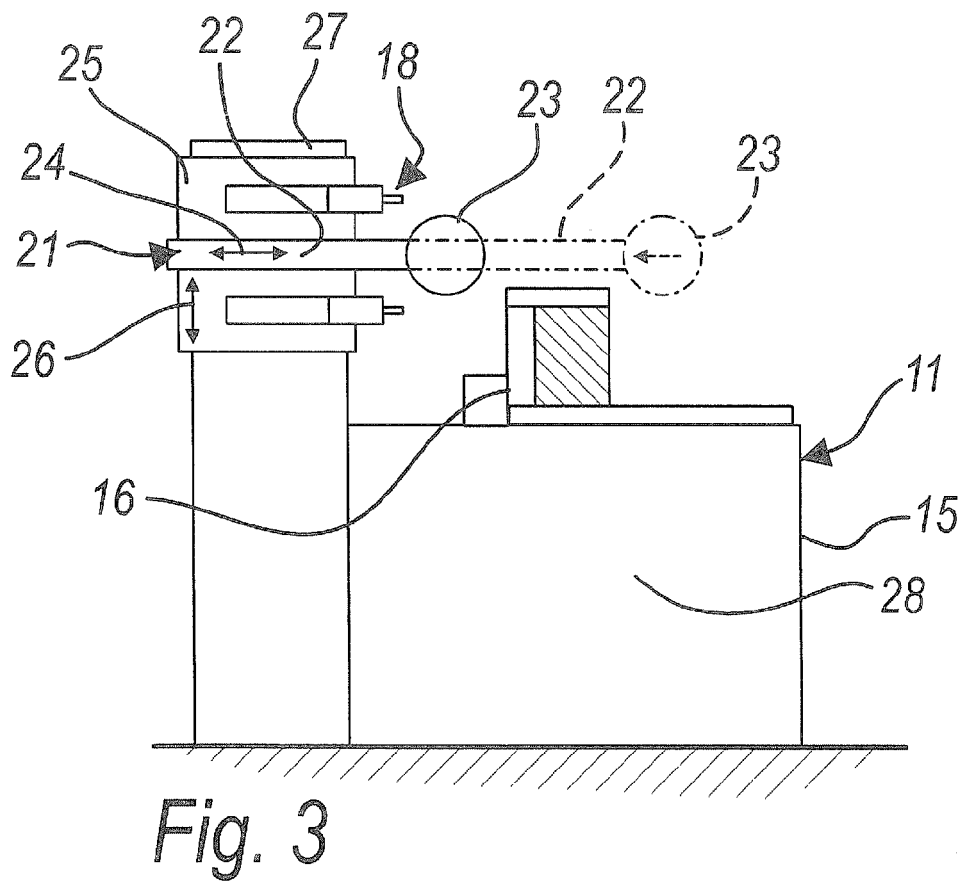
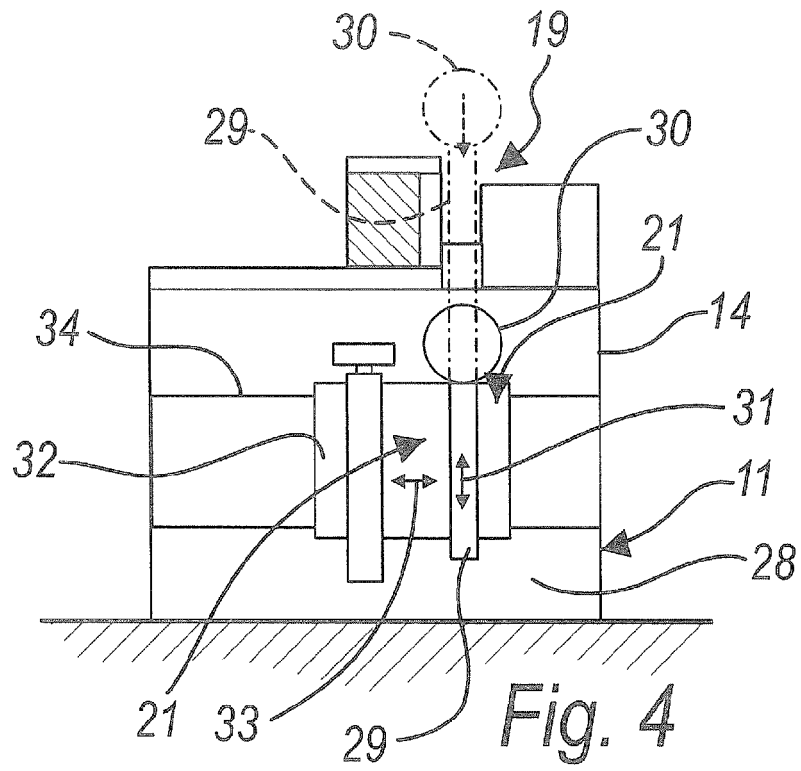


Fig. 2



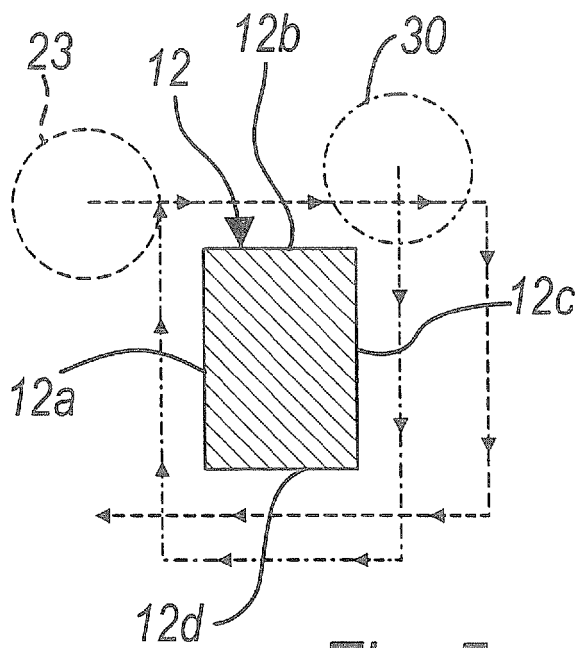


Fig. 5a

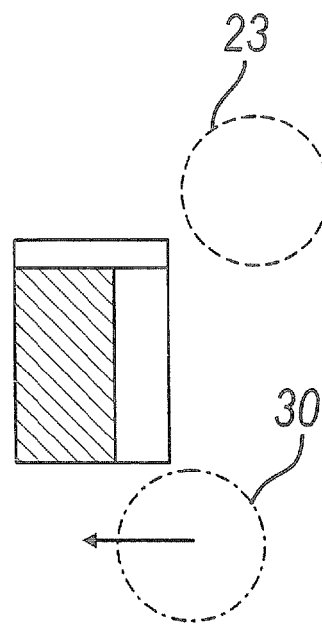


Fig. 5b

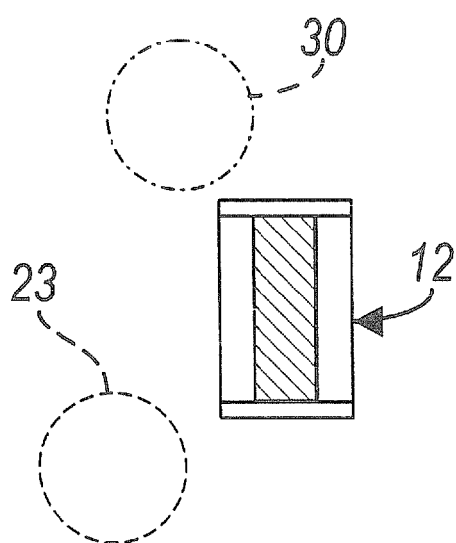


Fig. 5d

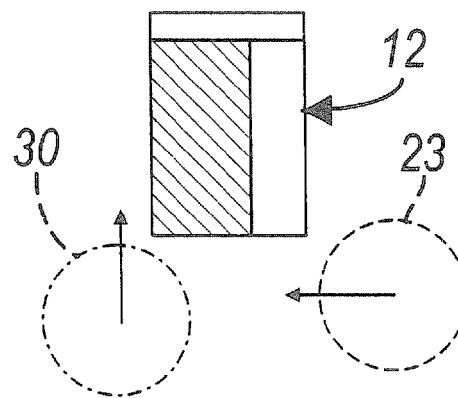


Fig. 5c

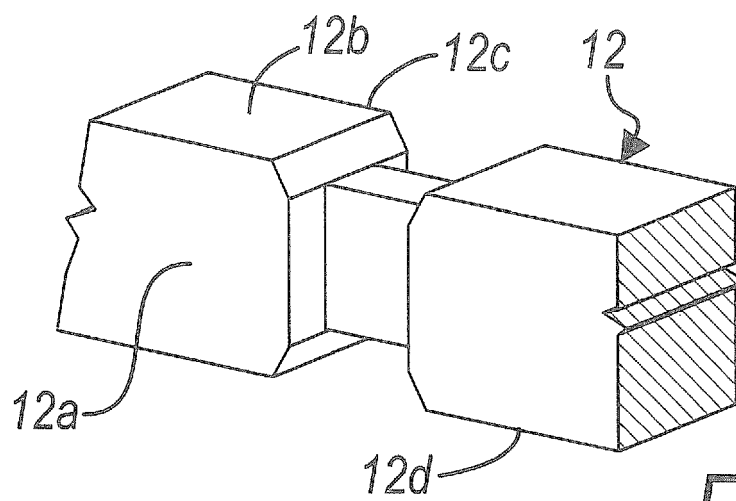


Fig. 6a

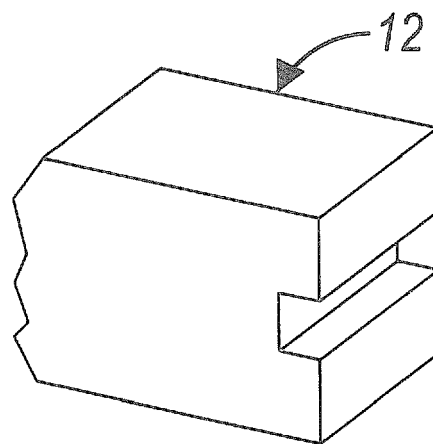


Fig. 6b

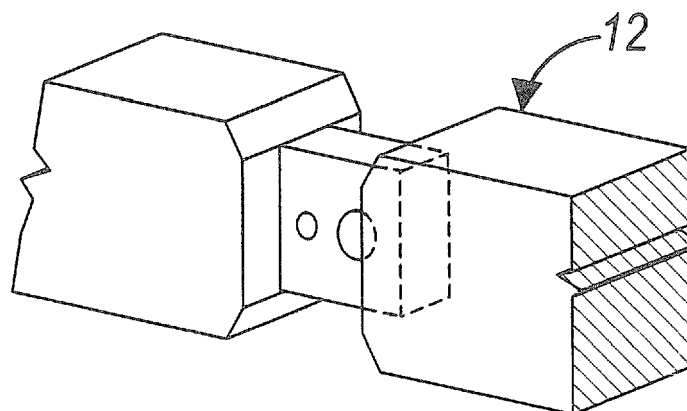


Fig. 6c



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 11 8666

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	* abstract * * paragraph [0005] * * paragraph [0007] - paragraph [0008] * * paragraph [0013] - paragraph [0015] * * paragraph [0018] - paragraph [0019] * * paragraph [0024] * * paragraph [0026] - paragraph [0028] * * paragraph [0033] - paragraph [0034] * * figures *	6,7	
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A	* abstract * * column 1, lines 3-18 * * column 2, lines 12-33 * * column 3, lines 40-61 * * figures *	1	
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A	* abstract * * column 2, lines 45-52 * * figures *	1	

The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 26 February 2008	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			

4

EPO FORM 1503 03/82 (P04/C01)

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

EP 07 11 8666

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26-02-2008

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REFERENCES CITED IN THE DESCRIPTION

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