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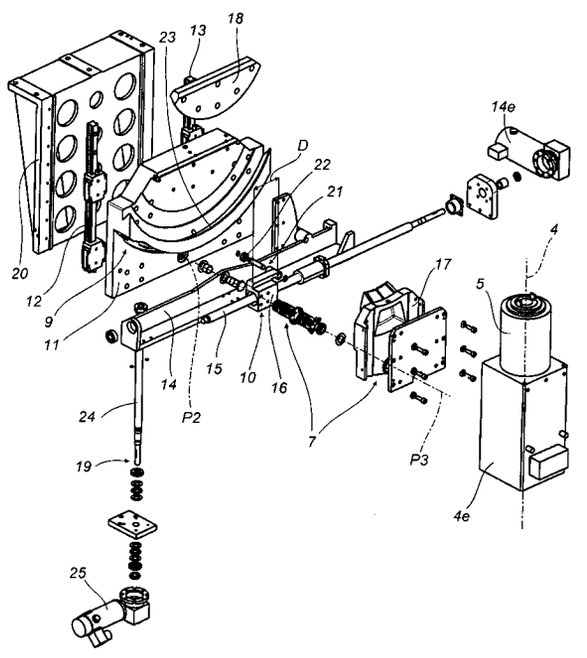
(54) A machine for working wooden panels or similar workpieces

(57) A machine for working wooden panels (1) or similar workpieces comprises: a horizontal work table (3) on which the panel (1) rests; a power-driven machining axis (4) comprising a spindle (5) that projects from the work table (3) and mounts a tool (6) for machining the panel (1); first means (7) for adjusting the angle of the machining axis (4) relative to a vertical position, that is, perpendicular to the horizontal work table (3); second means (8) for adjusting the position of the machining axis (4) in height, that is to say, the distance between the tool (6) and the horizontal work table (3). The power-driven machining axis (4) is linked to a first supporting block (9) by guide means (17, 18) for rotating the power-driven axis (4) about a first pivot point (P1) through the first adjustment means (7), and the first supporting block (9) defining a part of the second adjustment means (8) can be moved vertically in both directions along a vertical axis (Z) comprising the first pivot point (P1) about which the machining axis (4) rotates.

FIG. 2



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Description

[0001] The present invention relates to a machine for working wooden panels or similar workpieces.

[0002] The machine forming the subject-matter of this specification is called a lower vertical router or, in the jargon of the trade, "spindle moulder".

[0003] This type of machine is used for various types of machining operations on panels made of wood or similar materials (for example, for moulding or cutting tenons on crosspieces or uprights which will be used to make door or window frames) and has average productivity.

[0004] The machine basically comprises a horizontal work table on which the wooden panels rest and a machining axis protruding from the horizontal work table, both supported by a base.

[0005] The machining axis comprises a motor-powered spindle, which supports and drives one or more tools for machining the panels.

[0006] The spindle is powered by a drive unit mounted parallel with the spindle itself and connected to it by belt and pulley assemblies.

[0007] In addition to this, the spindle may be adjusted in height (Z-axis) and inclined with respect to the horizontal work table in order to perform moulding operations on panels at different angles and on panels of different thickness.

[0008] To adjust the power-driven axis (and hence the tool) in this way, the machine comprises a rigid plate which mounts a slide which in turn mounts the spindle and drive motor unit.

[0009] The slide is crescent shaped and is equipped with an arc-shaped toothed sector that meshes with a power-driven worm screw that is mounted parallel with the horizontal work table and enables the power-driven axis (that is, the spindle and drive motor unit) to be angled by up to about 45° towards the outside of the machine and up to about 10° towards the inside of the machine with respect to its reference position, that is to say, perpendicular to the horizontal work table.

[0010] In addition to this, as mentioned above, the power-driven axis may be adjusted in height along the Z-axis with respect to the work table by means of an actuating element (for example a lead nut and worm screw mechanism) acting on a second slide connected directly to the spindle and parallel with the spindle itself.

[0011] This particular structure of the power-driven axis and of the mechanisms for adjusting its height and angle is not free of disadvantages, however.

[0012] A unit parallel with the spindle for driving the spindle itself and a twin drive unit for adjusting the height and angle of the spindle occupy a considerable amount of space under the work table and, at operating level, limit the extent to which the power-driven axis can be angled. Each time the tool has to be adjusted in height (at the same angle) the guards and covers around the tool must be repositioned, thereby increasing downtime.

[0013] The object of the present invention is to overcome the above mentioned disadvantages by providing a machine for working wooden panels or similar workpieces where the structure for supporting the machining axis is extremely practical and precise and allows the machining axis itself to be adjusted quickly and easily and within a very wide angle.

[0014] According to the invention, this object is achieved by a machine for working wooden panels or similar workpieces and comprising: a horizontal work table on which the panel rests; a power-driven machining axis comprising a spindle that projects from the work table and mounts a tool for machining the panel; first means for adjusting the angle of the machining axis relative to a vertical position, that is, perpendicular to the horizontal work table; second means for adjusting the position of the machining axis in height, that is to say, the distance between the tool and the horizontal work table; the power-driven machining axis is linked to a first supporting block by guide means for rotating the power-driven axis about a first fixed pivot point through the first adjustment means, and the first supporting block defining a part of the second adjustment means can be moved vertically in both directions along a vertical axis comprising the first pivot point about which the machining axis rotates.

[0015] The technical characteristics of the invention, with reference to the above objects, are clearly described in the claims below and its advantages are apparent from the detailed description which follows, with reference to the accompanying drawings which illustrate a preferred embodiment of the invention provided merely by way of example without restricting the scope of the inventive concept, and in which:

- Figure 1 is a schematic top plan view illustrating a machine according to the present invention for working wooden panels or similar workpieces;
- Figure 2 is an exploded perspective view, with some parts cut away in order to better illustrate others, of a machining axis fitted with means for adjusting the height and angle of the machining itself and forming part of the machine of Figure 1;
- Figures 3, 4, 5, 6 illustrate the machining axis of Figure 2 in different operating configurations, all these figures being front views from side B indicated in Figure 1 and with some parts cut away to better illustrate others;
- Figure 7 is a geometric diagram showing the links and movements of the machining axis illustrated in the figures listed above.

[0016] With reference to the accompanying drawings, and in particular with reference to Figure 1, the machine according to the invention is used for machining wooden panels 1 or similar workpieces (indicated by the broken line in Figure 1 since they do not strictly form part of the invention).

[0017] The machine, labelled 2 in its entirety, is called a lower vertical router or, in the jargon of the trade, "spindle moulder".

[0018] This type of machine is used for various types of machining operations on panels (for example, moulding or cutting tenons on crosspieces or uprights which will be used to make door or window frames).

[0019] The machine 2 essentially comprises the following parts:

- a horizontal work table 3 on which the panel 1 rests;
- a power-driven machining axis 4 comprising a spindle 5 that projects from the work table 3 and mounts at least one tool 6 for machining the panel 1;
- first means 7 for adjusting the angle of the machining axis 4 relative to a vertical position, that is, perpendicular to the horizontal work table 3; and
- second means 8 for adjusting the position of the machining axis 4 in height, that is to say, the distance between the tool 6 and the horizontal work table 3.

[0020] As illustrated also in Figure 2, the power-driven machining axis 4 is linked to a first supporting block 9 by guide means 17 and 18 for rotating the power-driven axis 4 about a first fixed pivot point P1 (see also Figure 7) through the first adjustment means 7.

[0021] In addition to this, the first supporting block 9 defining a part of the second adjustment means 8 can be moved vertically in both directions along a vertical axis Z comprising the first pivot point P1 about which the machining axis 4 rotates.

[0022] The machining axis 4 is linked to the first block 9 by a part of the first adjustment means 7 which are linked, at a second pivot point P2 on the vertical axis Z, to a lower end of the first block 9.

[0023] More specifically, again with reference to Figure 2, the machining axis 4 is slidably linked to the above mentioned part of the first adjustment means 7 through first kinematic coupling elements 10 defining a third, mobile pivot point P3 between the machining axis 4 itself and the above mentioned part of the first adjustment means 7.

[0024] The first kinematic coupling elements 10 are linked to the machining axis 4 in such a way as to enable the machining axis 4 to move in both directions along the part of the first adjustment means 7, thereby causing the machining axis 4 to rotate about the first pivot point P1 (see arrows F, Figures 3 to 7).

[0025] Looking in more detail, the above mentioned part of the first adjustment means 7 comprises a second block 14 for supporting a worm screw 15 driven by suitable means 14e.

[0026] The second supporting block 14 is pivoted centrally at the lower end of the first block 9 to form the second pivot point P2. The worm screw 15 is engaged with a third block 16 equipped with a lead nut, forming the aforementioned first kinematic coupling means 10: this coupling enables the third block 16, that is, the machining axis 4, and the worm screw 15 to slide relative to each other, which, combined with the free rocking motion of the second block 14, enables the machining axis 4 to be positioned at different angles (see arrows F14 in Figures 3 and 7).

[0027] In order to achieve the maximum angling flexibility, the third block 16 is linked to the lower portion of the machining axis 4 at a third pivot point P3 and by means of a supporting guide 17 that is in turn linked to the upper portion of the first block 9 so as to allow the power-driven machining axis 4 to rotate about the first pivot point P1: the guide 17 defines a part of the aforementioned guide means.

[0028] With reference again to Figures 2 to 6, the supporting guide 17 is slidably coupled with the first block 9 by a dovetailed plate 18 attached to the first block 9, with the guide 17 slidably linked between them: the plate 18 constitutes the other part of the guide means.

[0029] The plate 18 has an arc-shaped sliding profile designed to enable the machining axis 4 to rotate about the first pivot point P1 by the same maximum angle, labelled α and α' in the drawings in both directions with respect to the vertical reference axis Z. This angle may, by way of a non-restricting example, be 45° in either direction relative to the axis Z.

[0030] The above mentioned second adjustment means 8 comprise the first block 9 consisting of a slide 11 that is slidably coupled, on the surface opposite that to which the machining axis 4 is linked, with at least one pair of guides 12 and 13 for moving the slide 11 vertically (see arrows F2, Figures 6 and 7) so as to adjust the height of the machining axis 4.

[0031] The two fixed vertical guides 12 and 13 in which the slide 11 runs are mounted on a frame 20 inside the machine 2.

[0032] As clearly shown in Figures 2, 3 and 5, the slide 11 is driven by second power-driven kinematic elements 19 which are positioned vertically under the slide 11 and which move the slide 11 vertically in both directions.

[0033] Looking in more detail, the second kinematic elements 19 may comprise a lead nut and screw mechanism 24 acting directly on the slide 11 and equipped with a drive motor 25 enabling the machining axis 4 to be adjusted in height as described above.

[0034] The special geometric structure of the pivot points P2 and P3 is stabilised and guided by guiding and stabilising means 21 acting between the machining axis 4 and the first supporting block 9 in order to keep the machining axis 4 in a stable position at least when it is at a coincident position between the second and the third pivot points P2 and P3 which may also be the position where the machining axis 4 coincides with the vertical reference axis Z: in practice, the position where it is perpendicular to the work table 3, as shown in Figure 4.

[0035] As shown in Figure 2, the guiding and stabilising means 21 may comprise a roller 22 associated to the third block 16 pivoted to the machining axis 4 at P3.

[0036] The roller 22 is located at a distance D that does not coincide with the second and third pivot points P2 and P3 and is slidably coupled with an arc-shaped guide 23 made in the first block 9: this geometry thus creates a rigid system between the second block 14, the third block 16 and the machining axis 4 at the aforementioned coincident positions of the pivot points P2 and P3.

[0037] In the embodiment being described, the power-driven machining axis 4 preferably, but without restricting the scope of the invention, is an electro-spindle 4e on which the tool spindle 5 is mounted.

[0038] In practice, the machining axis 4 may be adjusted by angling the machining axis 4 itself by activating the worm screw 15 that drives the lead nut of the third block 16, thus moving the axis 4 in the desired direction thanks not only to the rocking motion of the second block 14 but also to the sliding of the guide 17 on the plate 18 (as may be clearly inferred from Figures 3 and 5 showing two angular end positions of the machining axis 4). Once positioned at the required angle, the machining axis 4 can be positioned in height relative to the work table 3 by actuating the slide 11 which enables the entire assembly, comprising the axis 4, guide 17 and the second block 14, to vary its position in height while keeping the first pivot point P1 on the vertical axis Z.

[0039] The machine structured as described above achieves the aforementioned objects thanks to an extremely compact geometric and kinematic system that occupies a minimum of space and, compared to prior art arrangements, increases the adjustment range, for example in terms of the angle of the machining axis.

[0040] The double pivoting of the machining axis 4 at points P1 and P3 and the pivoting of the rocking block 14 axis at point P2 enables the machining axis 4 to perform a wide angular movement in both directions but without increasing the overall dimensions of the structure.

[0041] Similarly, the adjustment in height also occurs along the vertical axis Z, thus making it easier to keep the machining axis 4 in a well defined position that eliminates the need to reposition the guards and guides around it.

[0042] Thanks to the two pivot points lying on the axis Z and the third pivot point P3 located below the first pivot point of the axis, the latter can be angled to a large extent while greatly limiting the motion of the rocking block within the machine.

[0043] This offers the following advantages:

- a reduction in the overall dimensions of the machine without negatively affecting machine performance;
- possibility of angling the machining axis to a large extent in both directions with respect to the vertical axis, thus greatly enhancing the machine's capability and operating flexibility;
- significant reduction in the machine's changeover or down time necessary for fitting the accessory parts around the machining axis.

[0044] The invention described has evident industrial applications and may be subject to modifications and variations without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent elements.

Claims

1. A machine for working wooden panels (1) or similar workpieces, the machine (2) being of the type comprising at least:

   - a horizontal work table (3) on which the panel (1) rests;
   - a power-driven machining axis (4) comprising a spindle (5) that projects from the work table (3) and mounts at least one tool (6) for machining the panel (1);
   - first means (7) for adjusting the angle of the machining axis (4) relative to a vertical position, that is, perpendicular to the horizontal work table (3);
   - second means (8) for adjusting the position of the machining axis (4) in height, that is to say, the distance between the tool (6) and the horizontal work table (3); the machine (2) being

   characterised in that:

   - the power-driven machining axis (4) is linked to a first supporting block (9) by guide means (17, 18) for rotating said axis (4) about a first pivot point (P1) through the first adjustment means (7); and
   - the first supporting block (9) defining a part of the second adjustment means (8) can be moved vertically in both directions along a vertical axis (Z) comprising the first pivot point (P1) about which the machining axis (4) rotates.

2. The machine according to claim 1, **characterised in that** the machining axis (4) is linked to the first block (9) by a part of the first adjustment means (7) which are in turn linked, at a second pivot point (P2) located on the vertical axis (Z), to a lower end of the first block (9).

3. The machine according to claim 2, **characterised in that** the machining axis (4) is slidably linked to said part of the first adjustment means (7) through first kinematic coupling elements (10) defining a third, mobile pivot point (P3) between the machining axis (4) itself and said part of the first adjustment means (7); the first kinematic coupling elements (10) being linked to the machining axis (4) in such a way as to enable the machining axis (4) itself to

move in both directions along said part of the first adjustment means (7), thereby causing the machining axis (4) to rotate about the first pivot point (P1).

4. The machine according to claim 1, **characterised in that** the first block (9) comprises a slide (11) that is slidably coupled, on the surface opposite that to which the machining axis (4) is linked, with at least one pair of guides (12, 13) for moving the slide (11) vertically and constituting the second means (8) for adjusting the position of the machining axis (4) in height.

5. The machine according to claims 1 to 3, **characterised in that** said part of the first adjustment means (7) comprises a second block (14) for supporting a power-driven worm screw (15),the second block (14) being pivoted centrally at the lower end of the first block (9) to form the second pivot point (P2); the worm screw (15) being engaged with a third block (16) equipped with a lead nut, forming the first kinematic coupling means (10) so as to enable the third block (16), that is, the machining axis (4), and the worm screw (15) to slide relative to each other, which, in combination with the free rocking of the second block (14), also enables the machining axis (4) to be angled.

6. The machine according to claim 5, **characterised in that** the third block (16) is linked, at a third pivot point (P3), to the lower portion of the machining axis (4) equipped with a supporting guide (17) constituting a part of respective guide means; said guide (17) being in turn linked to the upper portion of the first block (9) so as to allow the power-driven machining axis (4) to rotate about the first pivot point (P1).

7. The machine according to claim 6, **characterised in that** the supporting guide (17) is slidably coupled with the first block (9) by a dovetailed plate (18), constituting the other part of the guide means and attached to the first block (9), with the guide (17) slidably linked between them; the plate (18) having an arc-shaped sliding profile designed to enable the machining axis (4) to rotate about the first pivot point (P1) by the same maximum angle (α, α') in both directions with respect to the vertical reference axis (Z).

8. The machine according to claim 4, **characterised in that** the slide (11) is driven by second power-driven kinematic elements (19) which are positioned vertically under the slide (11) and which move the slide (11) vertically in both directions.

9. The machine according to claims 4 and 8, **characterised in that** the slide (11) runs in the pair of fixed vertical guides (12, 13) which are in turn mounted on a frame (20) in the machine (2).

10. The machine according to claims 5 and 6, **characterised in that** it comprises guiding and stabilising means (21) acting between the machining axis (4) and the first supporting block (9) in order to keep the machining axis (4) stable at least at a position where the machining axis (4) coincides with the vertical reference axis (Z).

11. The machine according to claim 10, **characterised in that** the guiding and stabilising means (21) comprise a roller (22) associated to the third block (16) pivoted to the machining axis (4) at point (P3); the roller (22) being located at a fixed distance (D) from the third pivot point (P3) and being slidably coupled with an arc-shaped guide (23) made in the first block (9).

12. The machine according to claim 1, **characterised in that** the power-driven machining axis (4) consists of an electro-spindle.

13. The machine according to claim 8, **characterised in that** the second kinematic elements (19) comprise a worm screw and lead nut mechanism (24) acting directly on the slide (11) and equipped with a drive motor (25) enabling the machining axis (4) to be adjusted in height.

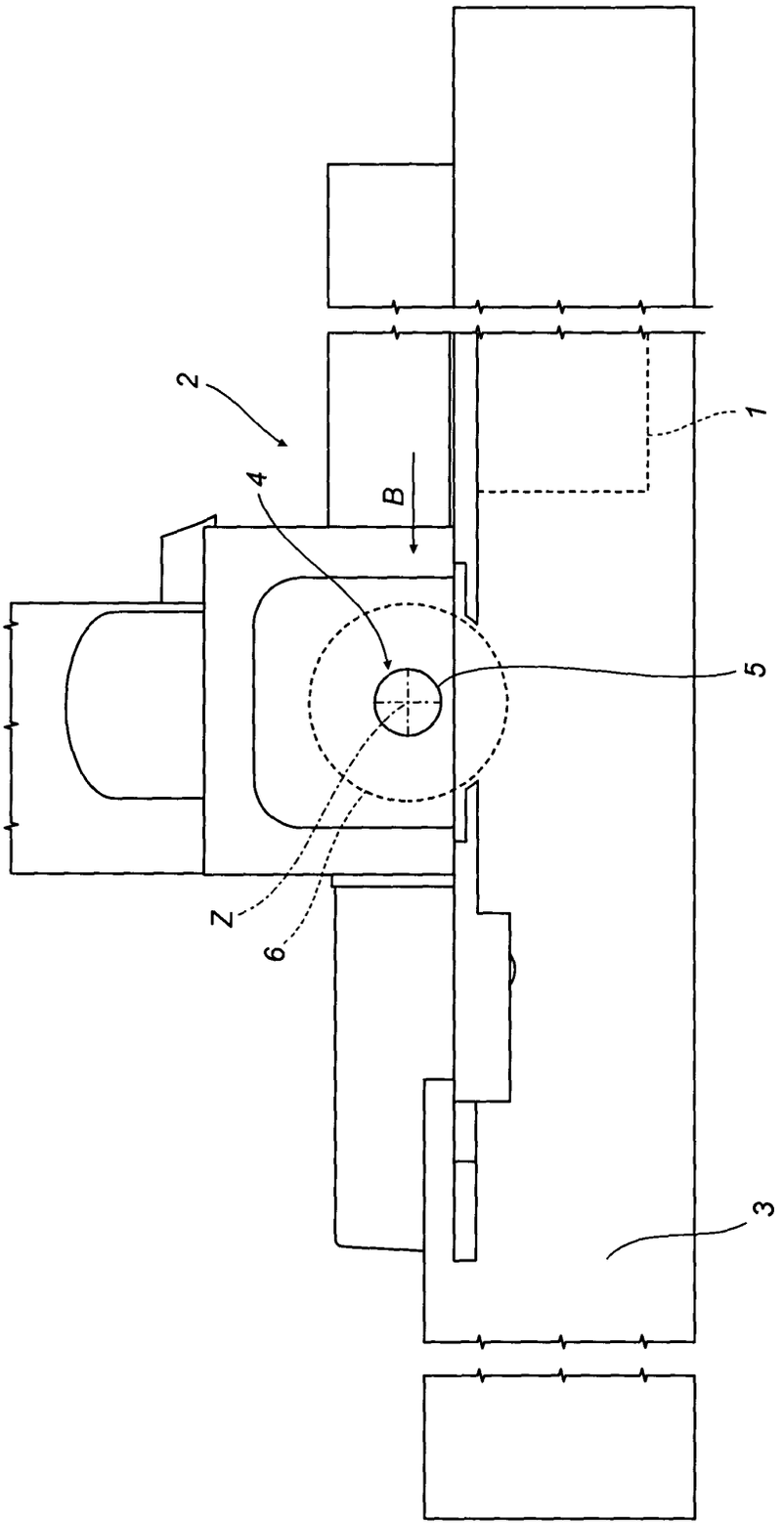

FIG. 1

FIG. 2

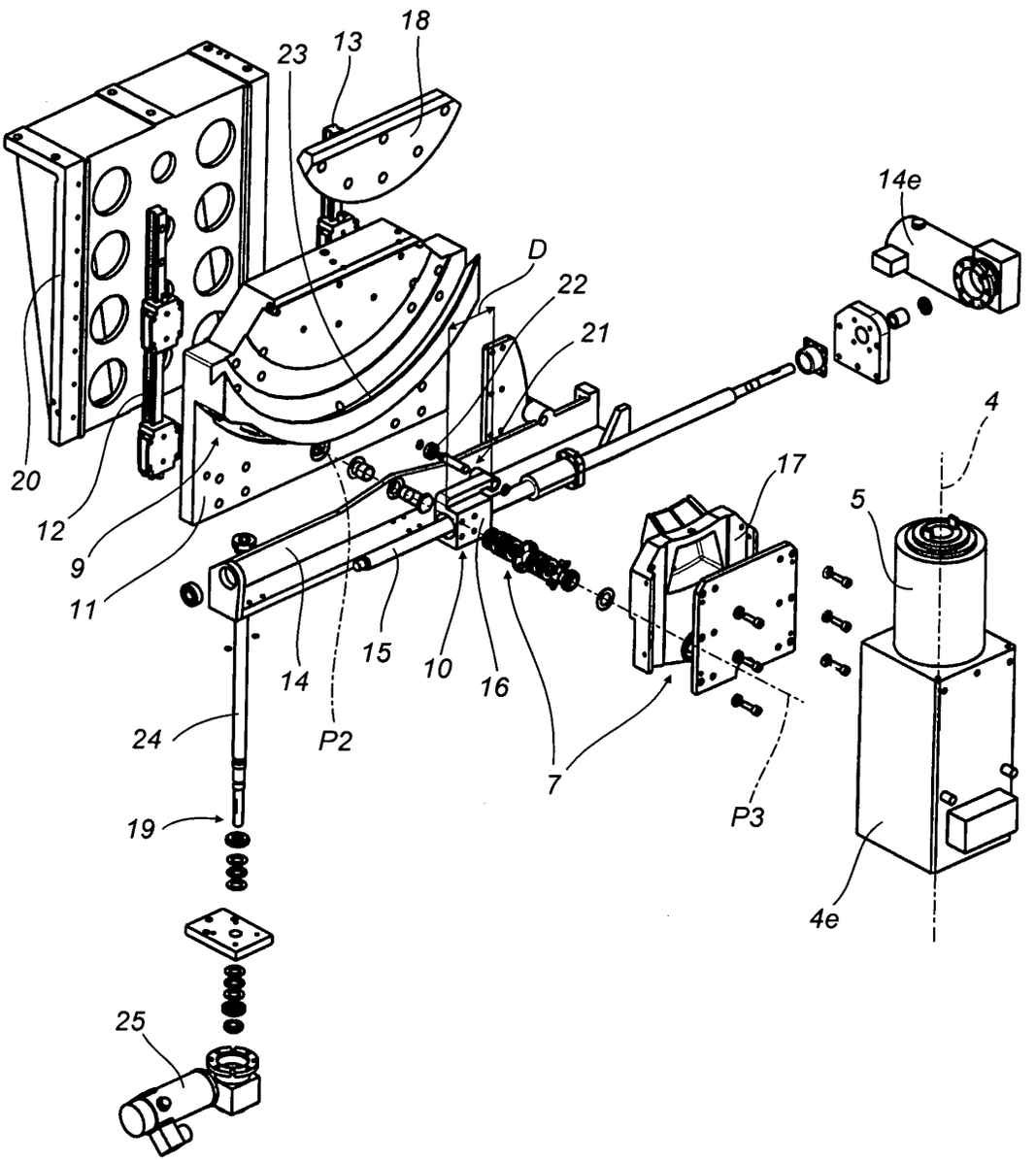

FIG. 4

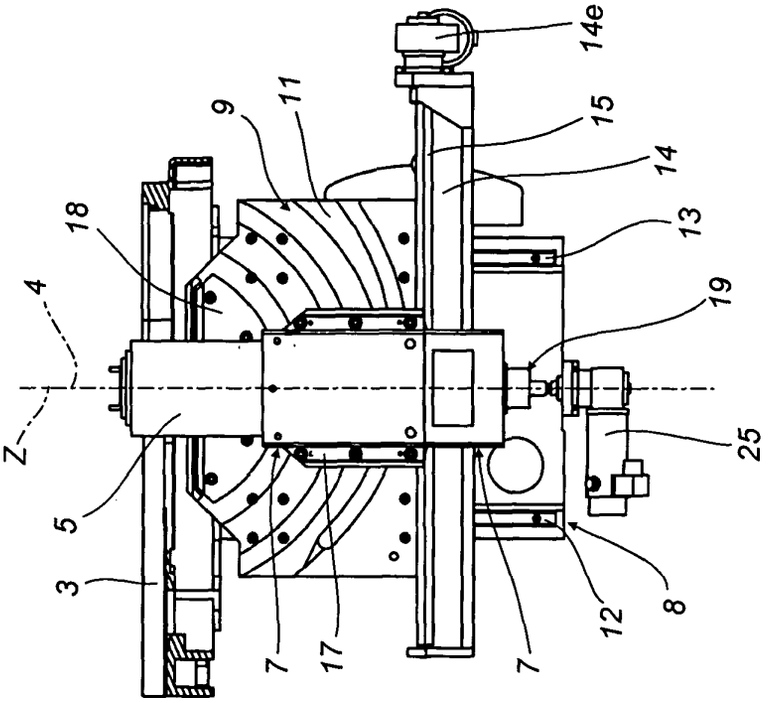
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FIG. 3

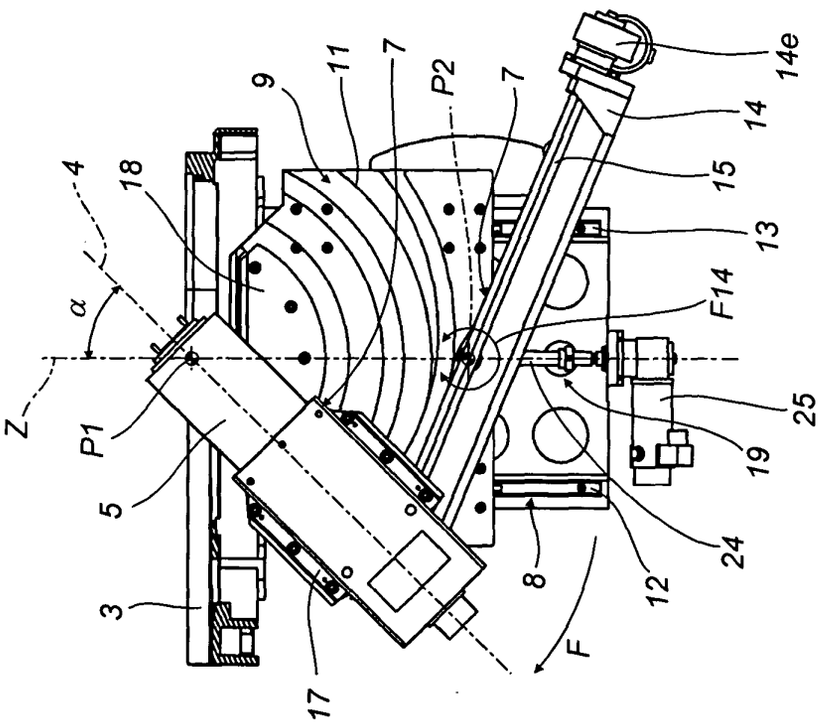
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FIG.6

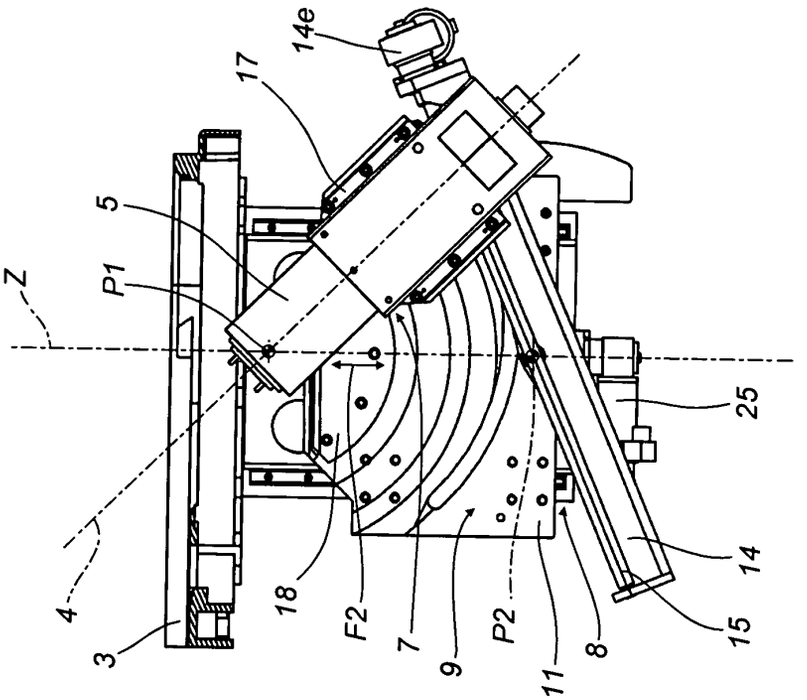
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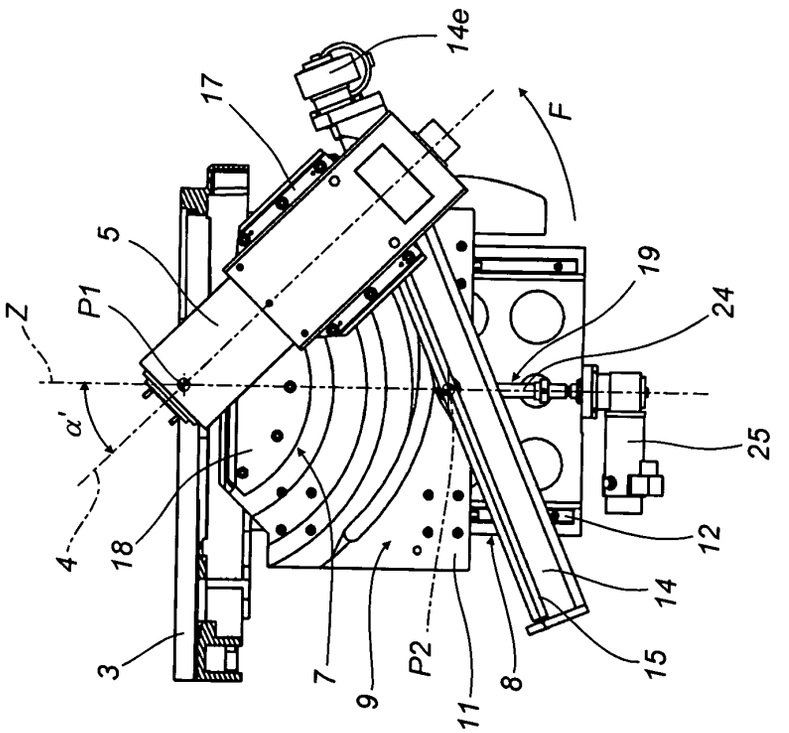
FIG.5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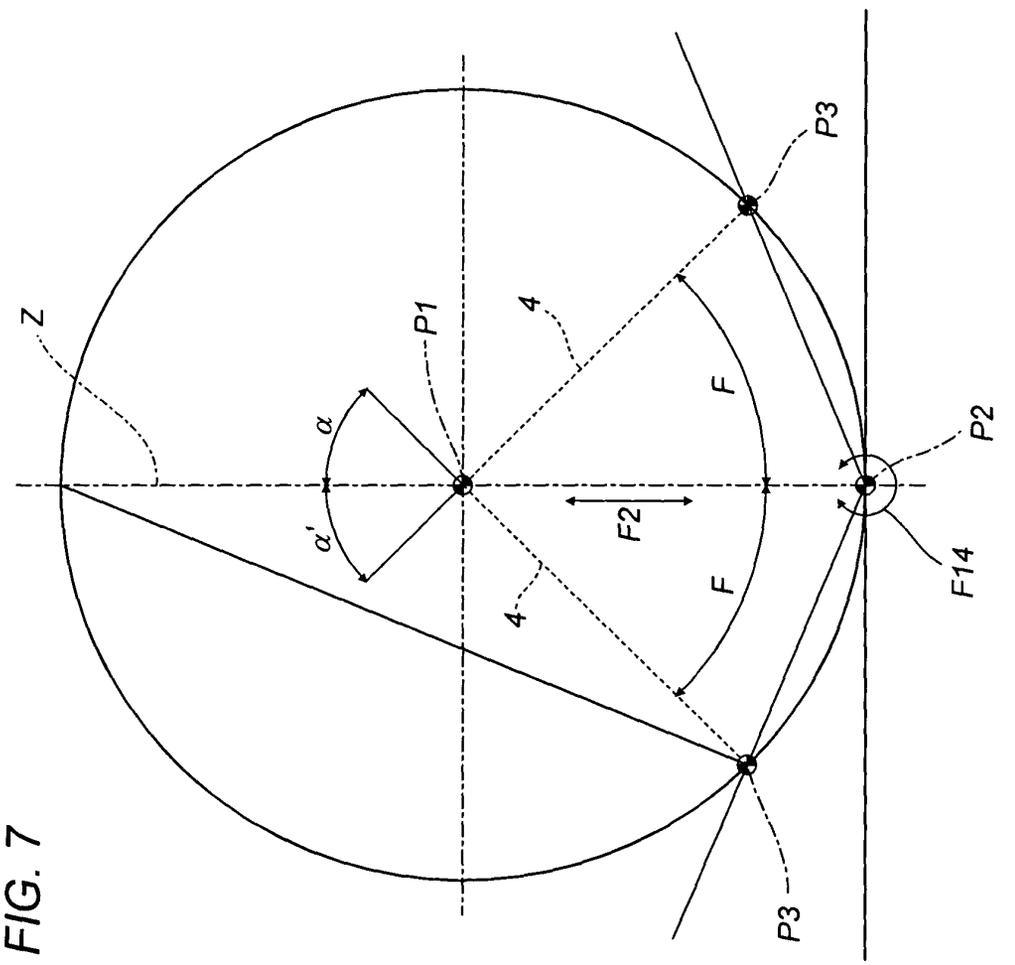

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 05 42 5331

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B27C
B23Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 August 2005	Meritano, L

CATEGORY OF CITED DOCUMENTS

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26-08-2005

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