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(54) **Milling apparatus**

(57) An apparatus for milling an object (2) comprises a cutting unit (55), a further cutting unit (56) and driving

means (25) for moving said cutting unit (55) and said further cutting unit (56) with respect to one another along a movement direction (A2).

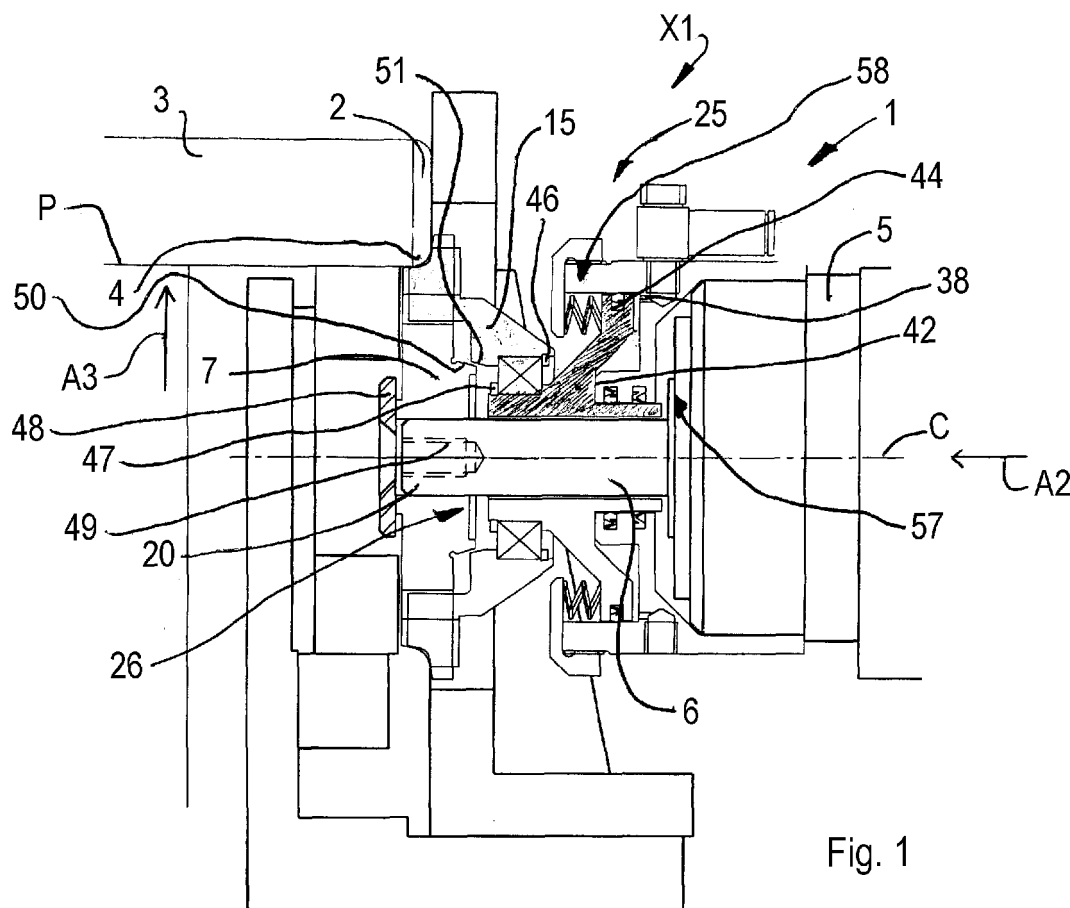


Fig. 1

Description

[0001] The invention relates to an apparatus for milling, in particular for rounding a rim of a panel.

[0002] A laminar edge-finishing element can be applied to one or more sides of panels made of wood or composite wood-based material or the like. The edge element is milled so as to round or chamfer the rims of the edge element and thus eliminate possible sharp rims.

[0003] An apparatus is known for rounding a rim of a panel comprising a milling unit that has a miller arranged for removing from the edge element the excess of material, and a rotation device, arranged for rotating the miller. The apparatus further comprises a feeler pin roller, which is coaxial with the miller, by means of which the miller is guided to follow the profile of the panel.

[0004] The miller comprises cutting elements, which have a specific cutting profile and which cut the edge element on the basis of the cutting profile thereof, i.e. the cutting elements cut from the edge element, and therefore also from the panel, parts of the rim of the edge element so that the profile of the rim corresponds to the cutting profile.

[0005] A drawback of such an apparatus is that if it is necessary to obtain a rim having a profile that is different from the cutting profile of the miller mounted on the milling unit, it is necessary to disconnect the miller from the rotation device and replace the miller with a further miller having the desired cutting profile. This operation significantly increases the panel-machining time. Alternatively, it is possible to reduce the time required to replace the miller by replacing the whole milling unit, comprising both the rotation device and the miller and replacing the milling unit with a further milling unit provided with a further rotation device that is the same as the previous rotation device and with a further miller having the desired cutting profile. In this case a user is forced to purchase two milling units, each of which comprising a rotation device and a miller having the desired cutting profile. Further, in order to enable the user to proceed with the replacement operation of the milling unit, it is necessary to misalign the feeler pin roller, consequently extending the replacement operation.

[0006] A further apparatus is known for rounding a rim of a panel comprising a miller, which has cutting elements units, each unit is positioned at a specific radius of the miller and has a specific cutting profile. In such an apparatus it is thus possible to change the cutting profile without replacing the miller.

[0007] A drawback of this apparatus is that each unit requires a corresponding feeler pin roller. In this manner the apparatus has to comprise a plurality of feeler pin rollers, each of which is used for a specific unit. The apparatus may comprise an automatic change device that changes the feeler pin roller whenever the unit is changed, so as to drive the feeler pin roller that corresponds to the unit operating at that moment. The apparatus, due to the complexity thereof, thus has high pur-

chasing and maintenance costs.

[0008] An object of the invention is to improve apparatuses for rounding a rim of a panel.

[0009] A further object of the invention is to make an apparatus for milling in which it is possible to vary the cutting profile of the miller and which is constructionally simpler and therefore less costly with respect to known apparatuses. According to the invention an apparatus is provided for milling an object comprising a cutting unit and a further cutting unit characterised in that said apparatus further comprises driving means for moving said cutting unit and said further cutting unit with respect to one another along a movement direction.

[0010] Owing to the invention, it is possible to obtain an apparatus for rounding a rim of a panel in which it is possible to vary the cutting profile in a simple manner. The driving means moves alternatively one of the two cutting units towards the rim, the two cutting units may thus interact on the rim alternatively and without an operator needing to remove manually one of the two cutting units. It is further possible to obtain an apparatus in which it is not necessary to replace a feeler pin roller each time that the cutting profile is changed. In fact, the two cutting units can be arranged at the same distance from the rotation axis, inasmuch as the driving means mutually move the cutting unit and the further cutting unit along a movement direction that substantially coincides with the rotation axis. Consequently, the distances of the cutting unit and of the further cutting unit from the rotation axis are equivalent and the feeler pin roller can thus be used for both cutting units.

[0011] The invention can be better understood and implemented with reference to the attached drawings that illustrate an embodiment thereof by way of non-limiting example, in which:

Figure 1 is a front view of an apparatus during an operating configuration;

Figure 2 is a view of the apparatus like that in Figure 1, during a further operating configuration;

Figure 3 is a partially exploded perspective view of a part of the apparatus;

Figure 4 is a plan and schematic view of a panel and of the apparatus.

[0012] Figures 1 and 2 show an apparatus 1 for milling an edge element 2 that has been applied to a panel 3.

[0013] The edge element 2 has a height and a length that is greater than the thickness and respectively of the length of the panel 3. It is thus necessary to trim the edge element 2, i.e. separate from the edge element 2, and thus from the panel 3, those edge element parts that protrude from the profile of the section of the panel 3. Further, during trimming the rims of the edge element 2 are rounded so that the panel 3 does not have sharp rims.

[0014] Figure 4 shows the panel 3, which is moved by moving means that is not shown, along a movement direction A1 substantially arranged according to a preva-

lent dimension of the edge element 2. At the edge element 2 there is positioned an apparatus 1, which is arranged on the side opposite the panel 3 with respect to the edge element 2. As shown in Figure 1, the moving means defines a supporting plane P on which the panel 3 is moved. The apparatus 1 is arranged for interacting with a portion 4 of the edge element 2 arranged at a rim of the edge element 2, which is arranged near the supporting plane P and extends along the movement direction A1. The apparatus 1 comprises a rotation device 5, comprising a motor, for example an electric motor. The rotation device 5 is arranged for rotating a shaft 6 around a rotation axis C, which is substantially perpendicular to the movement direction A1. The apparatus 1 further comprises a cutting unit 55, comprising a supporting body 7, shown in Figure 3. The supporting body 7 has a central body 10 having a substantially disc shape in the centre of which there is provided a hole 8, shaped so that the supporting body 7 can be inserted onto the shaft 6. The supporting body 7 is fixed to an end zone 20 of the shaft 6 by connecting means, which is not shown, so that the rotation device 5 can rotate the supporting body 7 around the rotation axis C. The connecting means may comprise keys, a first part of which is received inside cavities 9, obtained on the supporting body 7 at the hole 8. The keys further comprise a second part that is on the other hand received inside further cavities that are not shown, obtained on the shaft 6. The keys are maintained in position by a washer 48, fixed to the shaft 6 through a screw that is received in a threaded hole 49, obtained in the end zone 20. From a lateral external surface 18, which surrounds the central body 10, a plurality of projecting elements 11 project radially that are arranged at equivalent angular distances. The cutting unit 55 further comprises a plurality of cutting elements 12. Each cutting element 12 is fixed to the respective projecting element 11, in particular part of a first face 13 of the cutting element 12 adheres to a face of the projecting element 11, through fixing means which is not shown. The cutting elements 12 have a cutting profile 14 and during rotation of the supporting body 7, cut the portion 4 according to the cutting profile 14. In particular the supporting body 7 rotates around the rotation axis C according to a rotation direction R1, so that during rotation, the portion 4 interacts exclusively with the cutting elements 12. Each projecting element 11, in fact, being arranged successively according to the rotation direction R1 to the respective cutting element 12, does not come into contact with the portion 4. The apparatus 1 further comprises a further cutting unit 56, comprising a further supporting body 15. The further supporting body 15 has a further central body 16 having a substantially ring shape, in the centre of which there is provided a further hole 17 of greater dimensions than the hole 8. In this manner also the further supporting body 15 can be inserted on the shaft 6, so as to be positioned between the supporting body 7 and the rotation device 5 along the direction A2. From a peripheral zone 54 of the further central body 16, that faces the supporting body

7, there projects a plurality of further projecting elements 19. In particular, between the further projecting elements 19 and the further central body 16 there are arranged connecting elements 21 that project from the peripheral zone 54 to the supporting body 7 according to the direction A2. The further projecting elements 19 are thus arranged in a position upstream of the further central body 16 according to the direction A2 and project radially from the connecting elements 21. Moreover, the further projecting elements 19 are arranged at a distance from the rotation axis C that is greater than the lateral external surface 18, so that as the further supporting body 15 is arranged near the supporting body 7, the further projecting elements 19 do not interfere with the central body 10 and are arranged so as to face the lateral external surface 18. In particular, the further projecting elements 19 are arranged on the further supporting body 15 at equivalent angular distances and are alongside the projecting elements 11.

[0015] The further cutting unit 56 further comprises a further plurality of further cutting elements 22. Each further cutting element 22 is fixed to the respective further projecting element 19, in particular, part of a further first face 23 of the further cutting element 22 adheres to a further face of the further projecting element 19, through further fixing means which is not shown. The further cutting elements 22 are functionally configured like cutting elements 12 and have a further cutting profile 24, which may be different from the cutting profile 14.

[0016] The supporting body 7 and the further supporting body 15 are shaped so that the distance between an edge 42 of the cutting element 12 and the rotation axis C is substantially equivalent to the distance between a further edge 43 of the further cutting element 22 and the rotation axis C.

[0017] The apparatus 1 further comprises a driving device 25, arranged for mutually moving the cutting unit 55 and the further cutting unit 56 along the direction A2. In particular the driving device 25 moves the further supporting body 15 away from and towards the edge element 2. In particular the driving device 25 comprises first driving means 57, arranged for moving said further cutting unit 56 towards said edge element 2, and second driving means 58 arranged for moving said further cutting unit 56 away from said edge element 2.

[0018] The driving device 25 comprises a body 39, comprising a cylindrical body 26 that is inserted onto the shaft 6 and positioned between the supporting body 7 and the rotation device 5 along the direction A2. The cylindrical body 26 is not fixed to the shaft 6 and thus does not rotate together with the shaft 6. A first end zone 27 of the cylindrical body 26 is inserted into the further hole 17 and between the further supporting body 15 and the first end zone 27 are arranged rolling means, in this case a bearing 28, so that the cylindrical body 26 rotatably supports the further supporting body 15. The bearing 28 is maintained in position in the further hole 17 along the direction A2 through a first axial positioning element 46

that locks a first part of the bearing 28 on the further supporting body 15 and a second axial positioning element 47 that locks a second part of the bearing 28 on the body 39.

[0019] The body 39 further comprises an oblique movable wall 30 that projects from a central zone 29 of the cylindrical body 26 to the rotation device 5. The movable wall 30 is oblique to the rotation axis C and is shaped so as to define a hollow cone shape inserted into the shaft 6. The movable wall 30 has an end 31 in contact with a frame 32, that is fixed to the rotation device 5 and surrounds the movable wall 30. The first driving means 57 comprises a chamber 33, which is defined by the frame 32 and by the movable wall 30. The chamber 33 is defined by an internal cylindrical wall 35, which is comprised in the frame 32 and inserted onto the shaft 6, and an external cylindrical wall 34, which is comprised in the frame 32, inserted onto the shaft 6 and has a greater radius than that of the internal cylindrical wall 35. Between the shaft 6 and the internal cylindrical wall 35 there is arranged a second end zone 36 of the cylindrical body 26. In the internal cylindrical wall 35 there are hollows in which gaskets 45 are inserted that, by acting on the end zone 36, ensure the seal of the chamber 33. At the end 31 there is a further hollow, into which there is inserted a further gasket 44, which, by acting on the external cylindrical wall 34, further ensures the seal of the chamber 33. The chamber 33 is further defined by a bottom wall 37, comprised in the frame 32 and arranged near the rotation device 5, and by the movable wall 30 which is arranged upstream of the bottom wall 37 according to the direction A2. The first driving means 57 further comprises a device, which when it is driven feeds a pressurised fluid to the chamber 33 through a conduit 38 obtained in the frame 32 and that leads onto the bottom wall 37. When the device is driven, the fluid then enters the chamber 33, and exerts a pressure on the movable wall 30. In this way the body 39 is moved according to a direction opposite the direction A2.

[0020] The second driving means 58 comprises elastic means 40, for example a spring, arranged according to the direction A2. The elastic means 40 is fixed to an abutting wall 41, fixed to the external cylindrical wall 34 and acts on the end 31 according to the direction A2.

[0021] The apparatus 1 further comprises a moving device, which is not shown, for example a pneumatic actuator, arranged for moving the rotation device 5 along the direction A2. The moving device thus moves along the direction A2 both the cutting unit 55 and the further cutting unit 56.

[0022] During operation the apparatus 1 can thus assume a first operating configuration X1, shown in Figure 1, in which the second driving means 58 is driven. In the first operating configuration X1, when the rotation device 5 rotates the shaft 6, the cutting elements 12 interact with the portion 4, thus rounding the rim of the edge element 2 according to the cutting profile 14. The further cutting elements 22 are in fact more retracted than the portion

4 of the cutting elements 12 along the direction A2, so as not to interact with the portion 4. The position of the further supporting body 15, to which the further cutting elements 22 are associated, is in fact determined by the body 39 that is maintained in a retracted position by elastic means 40. In particular, the elastic means 40 maintains a part 42 of the movable wall 30 abutting on a further part of the internal cylindrical wall 35.

[0023] If a user wishes to replace the cutting profile 14 with the further cutting profile 24, the apparatus 1 is arranged in the second operating configuration X2 owing to the first driving means 57. Initially the moving device moves the rotation device 5 according to the direction A2, so as to move away the supporting body 7, and thus the cutting elements 12, from the edge element 2.

[0024] The first driving means 57 is thus driven and the device then feeds the pressurised fluid into the chamber 33, which pressurised fluid then, by acting on the movable wall 30, moves the movable wall 30, and consequently the body 39, to the supporting body 7 along the direction A2. In this manner the further supporting body 15, by moving together with the body 39, is moved along the direction A2 toward the portion 4, so that the further cutting elements 22 jut out with respect to the cutting elements 12 and are in contact with the edge element 2.

[0025] During advancing, the further supporting body 15 is guided to the correct position through centring means 59. The centring means 59 comprises a conical centring surface 50, obtained in a zone of the supporting body 7 that faces the further supporting body 15. The conical centring surface 50 interacts with a complementary conical surface 51 obtained on an edge of the further hole 17. In particular, when the apparatus 1 assumes the second operating configuration X2, the complementary conical surface 51 interacts in a shapingly coupled manner with the conical centring surface 50 enabling the further supporting body 15 to be positioned correctly. In this manner, in the second operating configuration X2, the further cutting elements 22 interact with the portion 4. In particular, when the rotation device 5 rotates the shaft 6, the supporting body 7 is rotated, without the cutting elements 12 interacting with the portion 4. The supporting body 7 rotates and comes into contact with the further supporting body 15, that is in this manner rotated in turn. In particular, a second face 52 of a cutting element 12, opposite the first face 13, comes into contact with a further face 53 of the further projecting element 19, as the further projecting element 19 being positioned in succession on the cutting element 12 according to the rotation direction R1. In this manner the further projecting elements 19, rotating according to the rotation direction R1, round the rim of the edge element 2 according to the further cutting profile 24, different from the cutting profile 14.

[0026] If a user wishes to return to using the cutting profile 14, the second driving means 58 returns the apparatus to the first operating configuration X1. Initially, the first driving means 57 is disconnected, in particular

the fluid exits the chamber 33 so that the pressure acting on the movable wall 30 decreases. The elastic means 40 then moves the body 39 according to the direction A2, the further cutting unit 56 then moves away from the edge element 2, so that the cutting elements 12 are nearer the portion 4 than the further cutting elements 22. Subsequently the moving device moves the rotation device 5 according to a direction opposite the direction A2, so as to move the supporting body 7, and thus the cutting elements 12, towards the edge element 2. The apparatus has assumed the first operating configuration X1, when the cutting elements 12 again come into contact with the portion 4.

[0027] The apparatus 1 further comprises positioning means, which is not shown, arranged for maintaining the apparatus 1 at the correct distance from the portion 4 along a further direction A3 substantially perpendicular to the supporting plane P, so that the edge 42 and the further edge 43 are at a distance from the rotation axis C that is substantially equivalent to the distance between the supporting plane P and the rotation axis C. The positioning means may comprise a roller suitable for engaging with a surface of the panel 3 on which the edge element 2 is not applied.

[0028] The roller interacts with the surface of the panel 3 in transit and is induced to rotate on the surface of the panel 3. In this manner the roller is able to follow the transverse profile of the panel 3. Moreover, it is the roller that ensures the correct positioning of the apparatus 1 both when the apparatus assumes the first operating configuration X1 and when the apparatus 1 assumes the second operating configuration X2.

Claims

1. Apparatus for milling an object (2), comprising a cutting unit (55) and a further cutting unit (56), **characterised in that** said apparatus further comprises driving means (25) for moving said cutting unit (55) and said further cutting unit (56) with respect to one another along a movement direction (A2).
2. Apparatus according to claim 1, comprising a rotation device (5) arranged for driving both said cutting unit (55) and said further cutting unit (56).
3. Apparatus according to claim 2, or 3, wherein said driving means (25) causes a movement of said further cutting unit (56) with respect to said cutting unit (55) between a first operating configuration (X1), in which said cutting unit (55) interacts with said object (2), and a second operating configuration (X2), in which said further cutting unit (56) interacts with said object (2).
4. Apparatus according to claim 3, wherein said movement is chosen in such a way that in said first operating configuration (X1), said further cutting unit (56) does not interact with said object (2) and, in said second operating configuration (X2), said cutting unit (55) does not interact with said object (2).
5. Apparatus according to claim 2, or according to claim 3 as appended to claim 2, or 4 as appended to claim 2, comprising a moving device for moving said cutting unit (55) and said further cutting unit (56) together with said rotation device (5) along said movement direction (A2).
6. Apparatus according to any preceding claim, wherein said driving means (25) comprises first driving means (57) for moving said further cutting unit (56) towards said object (2).
7. Apparatus according to claim 6, wherein said driving means (25) comprises second driving means (58) for moving said further cutting unit (56) away from said object (2).
8. Apparatus according to any preceding claim, wherein said driving means (25) comprises a body (39) connected to said further cutting unit (56), said body (39) being movable along said movement direction (A2).
9. Apparatus according to claim 8, as appended to claim 6, or 7, wherein said first driving means (57) comprises chamber means (33), said body (39) comprising movable wall means (30) of said chamber means (33) and said chamber means (33) being arranged for receiving a pressurised fluid so as to move said movable wall means (30) along said movement direction (A2).
10. Apparatus according to claim 9, wherein said first driving means (57) comprises a device for feeding said fluid into said chamber means (33).
11. Apparatus according to claim 9, or 10, as claim 8 is appended to claim 7, wherein said second driving means (58) comprises elastic means (40), said elastic means (40) acting on a side of said movable wall means (30) opposite said chamber means (33).
12. Apparatus according to claim 2, or according to any one of claims 3 to 11 as appended to claim 2, comprising a shaft (6) that extends along said movement direction (A2) and is rotated around the axis (C) by said rotation device (5).
13. Apparatus according to claim 12, wherein said cutting unit (55) comprises a supporting body (7) fixed to said shaft (6).
14. Apparatus according to claim 13, wherein said sup-

porting body (7) comprises projecting elements (11) that project radially from said shaft (6) and to which are associated cutting elements (12), arranged for cutting said object according to a cutting profile (14).

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15. Apparatus according to any one of claims 12 to 14, as appended to any one of claims 8 to 11, wherein said body (39) is mounted on said shaft (6) so as to be able to rotate with respect to said shaft (6).

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16. Apparatus according to claim 15, wherein said further cutting unit (56) comprises a further supporting body (15), said further supporting body (15) being rotatably supported by said body (39).

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17. Apparatus according to claim 16, wherein said further supporting body (15) comprises further projecting elements (19) that project radially from said shaft (6) and to which are associated further cutting elements (22) arranged for cutting said object (2) according to a further cutting profile (24).

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18. Apparatus according to claim 17, as claim 15 is appended to claim 14, wherein said further projecting elements (19) project towards said cutting unit (55) so as to be able to be inserted between two of said successive projecting elements (11).

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19. Apparatus according to any preceding claim, and comprising centring means (59) for guiding said driving means (25).

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20. Apparatus according to claim 19, wherein said centring means (59) comprises a conical surface (50), made in said cutting unit (55) and a further conical surface (51) obtained in said further cutting unit (56), said conical surface (50) being arranged for interacting in a shapingly coupled manner with said further conical surface (51).

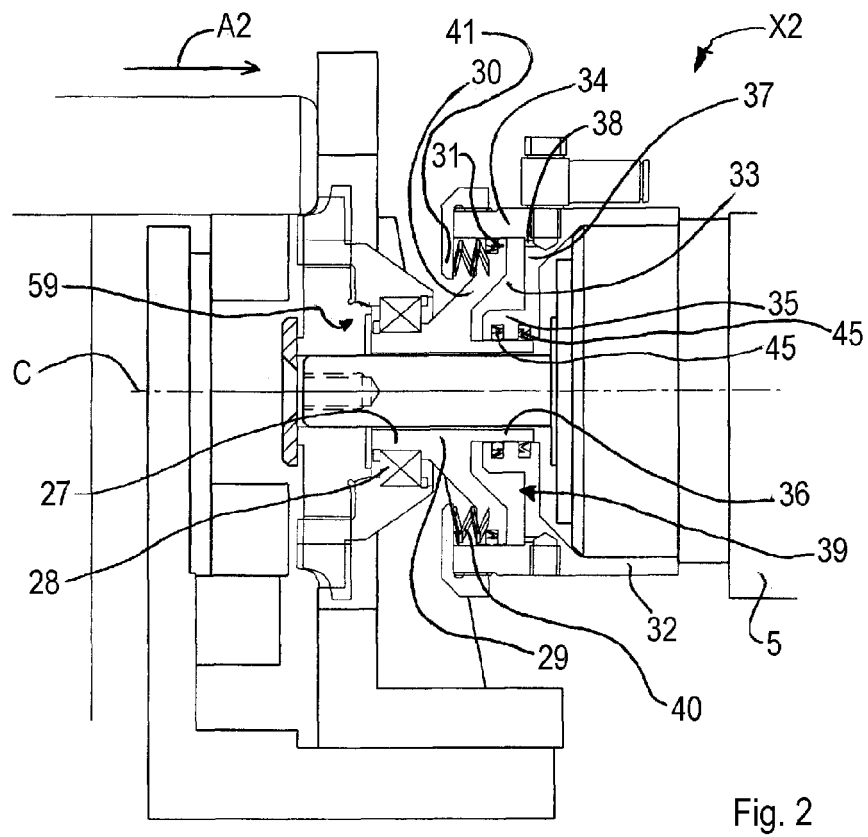
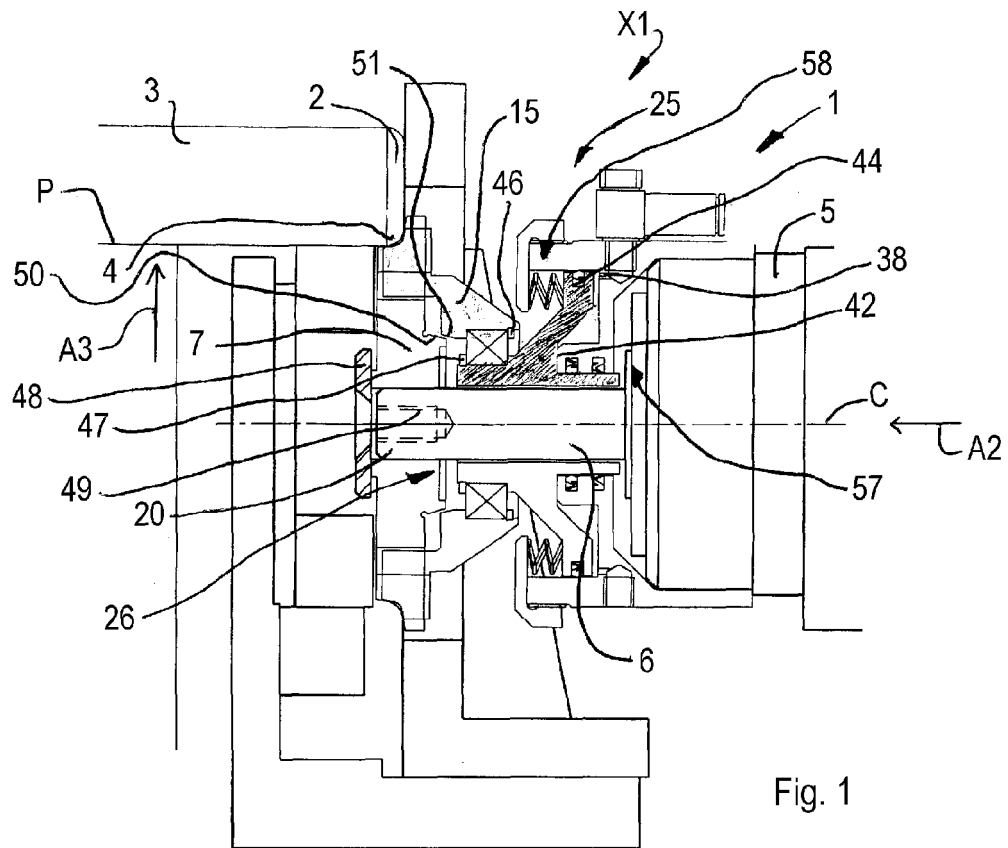
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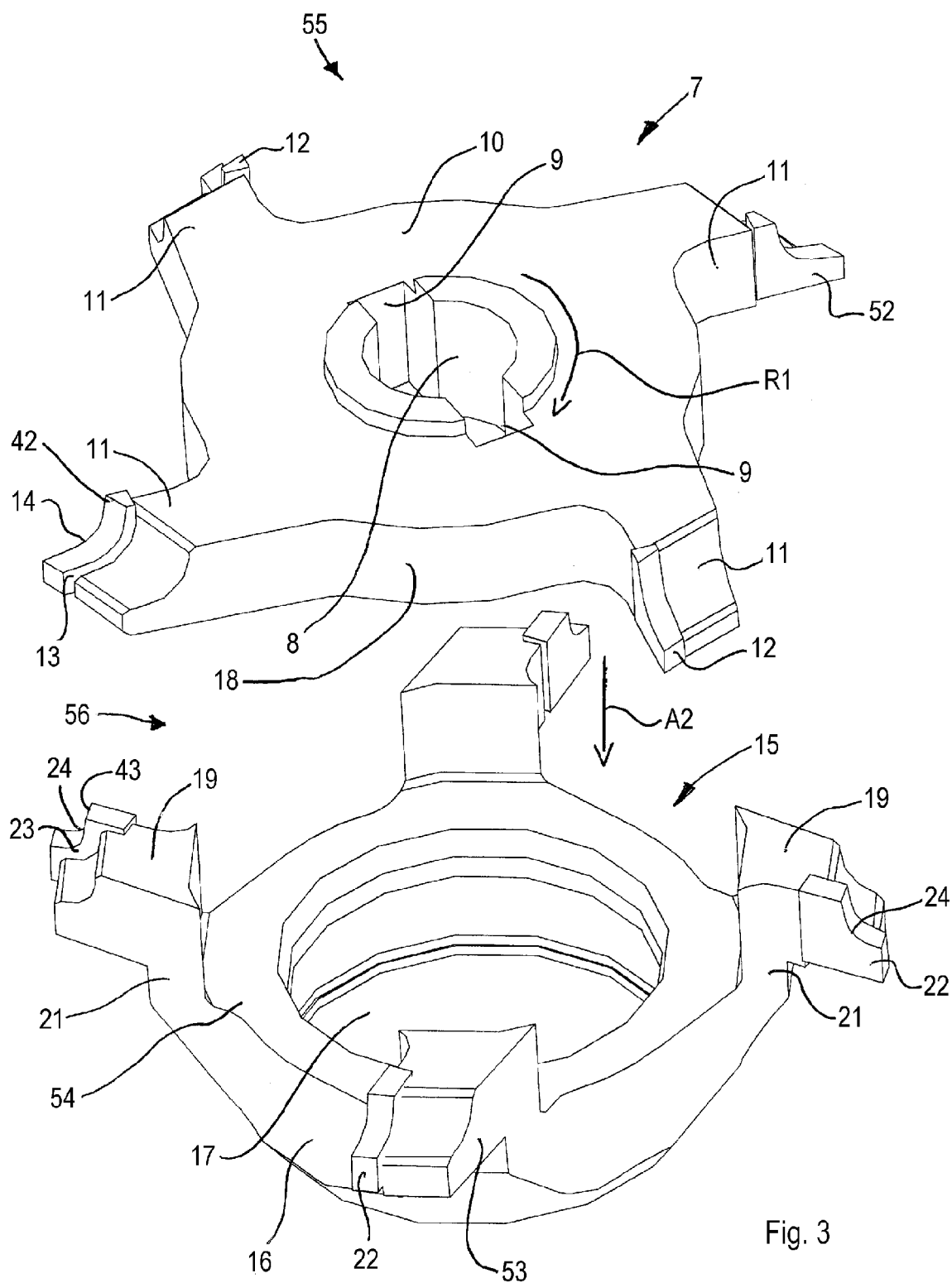
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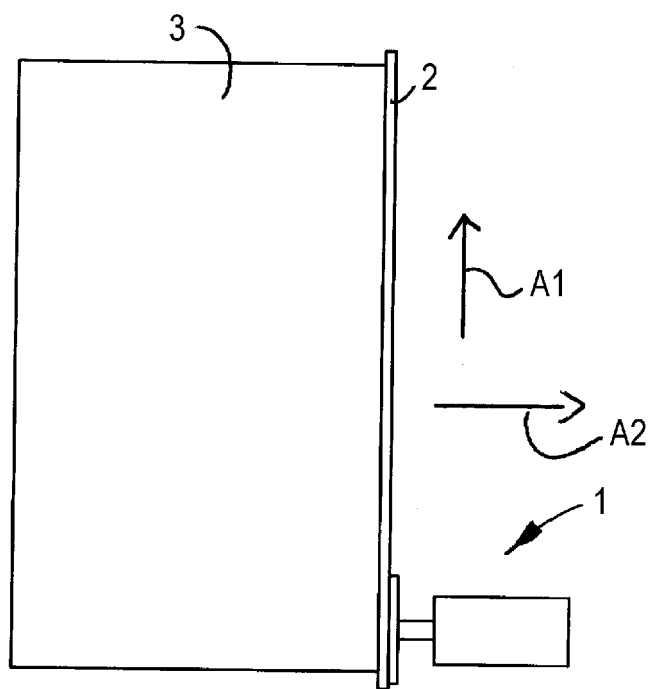


Fig. 4



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 08 15 9542

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			B27D B23C B29C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 25 September 2008	Examiner Meritano, Luciano
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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