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(54) **WORKING GROUP WITH ADJUSTABLE COPIER**

(57) The present invention relates to a working unit for machining at least one piece (P), said machining group comprising: a rotary tool (41) rotating around a first rotation axis and configured to perform at least one machining on at least one piece (P); a copier (1, 20, 40) arranged in correspondence with said rotary tool (41) and capable of resting on at least one face of said at least one piece (P) to guide said rotary tool (41) with respect to said at least one piece (P). Said copier (1, 20, 40) comprises: a first support (2, 21, 42); a second support (5; 26, 30, 34; 48) axially movable with respect to said first support (2, 21, 42) along a predetermined direction; and an annular element (14, 31, 47) rotatable with respect to said first support (2, 21, 42) around a second rotation axis (A, B, C) parallel to said predetermined direction, wherein said annular element (14, 31, 47) is radially elastically deformable with respect to said second axis of rotation (A, B, C) and comprises a first end portion (14b, 31b, 47a) axially engaged, according to said second axis of rotation (A, B, C), to said first support (2, 21, 42) and a second end portion (14a, 31a, 47b) axially engaged, according to said second axis of rotation (A, B, C), to said second support (5; 26, 30, 34; 48), so that an axial displacement of said second support (5; 26, 30, 34; 48) towards said first support (2, 21, 42) is followed by a reduction of the axial dimensions of said annular element (14, 31, 47) and a radial expansion of said annular element (14, 31, 47), and in such a way that an axial displacement of said second support (5; 26, 30, 34; 48) in the opposite direction with respect to said first support (2, 21, 42) follows an expansion of the axial size of said annular element (14, 31, 47) and a reduction of the radial size of said annular element (14, 31, 47).

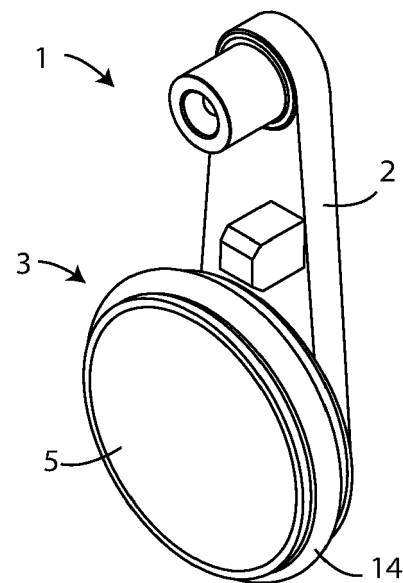


Fig. 1

Description

[0001] The present invention relates to a working group with adjustable copier.

[0002] Specifically, this working group comprises a tool, such as for example a milling cutter, and a copying device, capable of rolling on the surface of the workpiece to be machined, in such a way as to allow the tool itself to operate on the workpiece following the profile of the latter.

[0003] In the following, the description will be directed to a working unit including a milling cutter as a tool for machining panels, but it is clear that the same should not be considered limited to this specific use and this type of tool, as it can also be extended to other types of tools and the machining of workpieces of different shapes.

[0004] Currently, wooden panels intended for various applications are generally made with two panels between which particleboard is pressed.

[0005] These panels are generally edge-banded with a tape, typically made of plastic, which is applied to the relative panel by gluing and subsequently finished using suitable tools (called "rounders", in the jargon of the sector) to round off the edges of the tape.

[0006] To perform this corner rounding operation, special cutters are used.

[0007] However, it is essential that the cutters do not damage the upper and lower surfaces of the panel, which jointly represent the so-called noble part of the panel itself.

[0008] For this purpose, it is, therefore, necessary that the cutters are positioned correctly with respect to the corner to be rounded.

[0009] As is known, the external surfaces of the panels inevitably have surface inaccuracies, and for this reason, they cannot be considered perfectly flat.

[0010] In light of the above, in order to achieve the correct positioning of the cutter with respect to the edge of the panel to be milled, the so-called "copiers" devices (or even just "copiers") are provided, each of which comprises a concentric or eccentric disc with respect to the axis of rotation of the cutter, which is made to roll on the surface of the panel in such a way that the cutter operates on the panel following, by means of the copier, any surface imperfections of the panel itself.

[0011] Working units are currently known, such as rounders, which comprise a milling cutter and a copier equipped with adjustable contact elements (i.e., contact elements whose relative position can be voluntarily changed) with respect to the milling cutter to compensate for the inevitable progressive wear of the cutter itself.

[0012] These working units also include a plurality of intermediate members or elements between the support of the copier and the aforesaid contact elements, to achieve the desired movement of the latter.

[0013] The aforesaid known type of working units, therefore, generally have a rather complex and articulated structure.

[0014] In light of the above, it is, therefore, an object of the present invention to provide a working unit with an adjustable copier, which allows machining to be carried out with a high degree of precision, effectively compensating for the effects of progressive wear of the tool to which it is associated and the plays of the kinematic chain between the tool and the copier.

[0015] Another object of the invention is to provide a working unit with an adjustable copier, which allows compensating for possible differences due to the construction tolerances of the tool associated with the copier with respect to the relative nominal measurements.

[0016] A further object of the invention is to provide a working unit with an adjustable copier, which has a simple and essential structure.

[0017] Another object of the present invention is to provide a working unit with an adjustable copier, which allows machine downtime to be reduced to a minimum.

[0018] A further object of the present invention is to provide a working unit with an adjustable copier that has particularly low manufacturing costs.

[0019] It is therefore specific object of the present invention a working unit for machining at least one piece, said machining group comprising: a rotary tool rotating around a first rotation axis and configured to perform at least one machining on at least one piece; a copier arranged in correspondence with said rotary tool and capable of resting on at least one face of said at least one piece to guide said rotary tool with respect to said at least one piece; said copier comprising: a first support; a second support axially movable with respect to said first support along a predetermined direction; and an annular element rotatable with respect to said first support around a second rotation axis parallel to said predetermined direction, wherein said annular element is radially elastically deformable with respect to said second rotation axis. And comprises a first end portion axially engaged, according to said second axis of rotation, to said first support and a second end portion axially engaged, according to said second axis of rotation, to said second support, so that an axial displacement of said second support towards said first support is followed by a reduction of the axial dimensions of said annular element and a radial expansion of said annular element, and in such a way that an axial displacement of said second support in the opposite direction with respect to said first support follows an expansion of the axial size of said annular element and a reduction of the radial size of said annular element.

[0020] Preferably according to the invention, said annular element comprises a concavity facing towards said second axis of rotation.

[0021] Advantageously according to the invention, said annular element may have a substantially omega-shaped profile.

[0022] Further according to the invention, said first axis of rotation may substantially coincide with said second axis of rotation.

[0023] Conveniently according to the invention, said

second support may comprise at least a portion or rotatable element, which is rotatable around said second axis of rotation integral with said annular element.

[0024] Still according to the invention, said second support may comprise a translatable element axially engaged, according to said second axis of rotation, to said at least one portion or rotating element and rotatably released from said at least one portion or rotatable element.

[0025] Preferably according to the invention, said copier comprises an adjustment member, configured to adjust the position of said movable element along an axis parallel to said second axis of rotation with respect to said at least one portion or rotatable element.

[0026] Conveniently according to the invention, a variable volume chamber communicating with said second support is formed in said copier and may be connectable to a fluidic system to introduce, in use, at least one fluid into said chamber, thus determining an axial displacement of said second support along an axis parallel to said second rotation axis with respect to said first support.

[0027] Further according to the invention, said chamber may be formed between said first support and said second support.

[0028] Still according to the invention, said copier comprises a rotatable element adjacent to said second support and rotatable around said second axis of rotation in an integral manner with said annular element, and said chamber is formed between said second support and said rotatable element.

[0029] Advantageously according to the invention, said copier may comprise at least one mechanical actuation member movable with respect to said second support and acting on said second support so as to cause a displacement of said second support by applying a force on said at least one mechanical actuation member.

[0030] Conveniently according to the invention, said annular element may have, in correspondence with its external surface, a plurality of notches to accentuate the elastic behavior of said annular element.

[0031] 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 first isometric view of an adjustable copier of a machining unit, according to a first embodiment of the present invention;

figure 2 is a second isometric view of the adjustable copier shown in figure 1;

figure 3 is a sectional view of the adjustable follower illustrated in figures 1 and 2;

figure 4 is a first isometric view of an adjustable copier of a machining unit, in accordance with a second embodiment of the present invention;

figure 5 is a second isometric view of the adjustable copier shown in figure 4;

figure 6 is a sectional view of the adjustable follower shown in figures 4 and 5;

figure 7 is an isometric view of an adjustable copier of a machining unit, according to a third embodiment of the present invention;

figure 8 is a sectional view of the adjustable follower shown in figure 7;

figure 9 is a front view of a machining unit incorporating the adjustable follower shown in figures 7 and 8 and a milling cutter, during the execution of a milling operation on a panel; and

figure 10 shows a milling unit incorporating the machining unit represented in figure 9.

[0032] With particular reference to figures 1-3, 1 indicates an adjustable copier, which can be associated with a milling cutter (not shown) or with another rotary tool (not shown) to jointly form a machining unit.

[0033] The adjustable copier 1 comprises a support 2 and a revolving member 3 supported by said support 2 and configured so as to be able to rotate with respect to the latter around a rotation axis A, which preferably matches the axis of rotation of said cutter or said another rotary tool.

[0034] The aforementioned support 2 can be, for example, a part of the frame of the aforementioned machining unit.

[0035] At an end portion of the support 2 a hole 4 is formed, directed along the rotation axis A.

[0036] The rotating member 3 comprises, in turn, a piston 5 rotating around the rotation axis A and movable in translation along the same axis A in both opposite directions D1, D2 (see figure 3).

[0037] In particular, the piston 5 of the revolving member 3 has, in section, a "T" shape and comprises a shank 6, i.e. a stem, having a substantially cylindrical shape, which is inserted into the hole 4 of the support 2.

[0038] In the outer lateral surface of the stem 6 of the piston 5 a peripheral circumferential groove 7 is formed, which defines a bottom end portion 8 of the stem 6 itself.

[0039] The aforesaid bottom end portion 8 of the stem 6, in turn, defines, jointly with the internal walls of the hole 4 of the support 2, an internal chamber 9 with variable volume.

[0040] In the stem 6 of the piston 5 there is also formed an abduction duct 10, which flows into the bottom 11 of the stem 6 itself and also into the external lateral surface of the latter in correspondence with the peripheral circumferential groove 7.

[0041] The abduction duct 10 is connected to a compressed air system, or a system with another type of fluid, not shown in the attached figures.

[0042] A first annular gasket 12a and a second annular gasket 12b are provided between the internal surfaces of the support 2, which identify the hole 4 and the stem 6 of the piston 5 to prevent the leakage of air, or of another fluid, between the stem 6 and the aforementioned internal surfaces of the support 2.

[0043] The piston 5 also comprises a flat portion 13 substantially having the shape of a disc and extending

orthogonally to the stem 6 from the end of the latter opposite the bottom 11.

[0044] The rotating member 3 also comprises an elastic ring 14, i.e. a ring with an elastic behavior, coaxial to the aforementioned milling cutter or other rotating tool and having a first annular end portion 14a, integrally connected to the outer circular edge of the flat portion 13 of the piston 5.

[0045] A second annular end portion 14b of the elastic ring 14, opposite to said first annular end portion 14a, is, instead, rigidly connected to the external circular wall 15a of a radial ball bearing 15, whose internal circular wall 15b (with respect to which rotates the external circular wall 15a) is rigidly connected to the support 2 by means of an intermediate annular element 16 arranged between the support 2 and the flat portion 13 of the piston 5 along a direction parallel to said rotation axis A.

[0046] In more detail, the aforesaid radial ball bearing 15 is arranged coaxially with the piston 5 and the elastic ring 14, so that the rotating member 3 can rotate, together with the outer circular wall 15a of the radial ball bearing 15, around the rotation axis A with respect to the support 2, the intermediate annular element 16, and the inner circular wall 15b of the deep groove ball bearing 15.

[0047] The aforementioned elastic ring 14 also comprises an enlarged annular portion 14c located between the first annular end portion 14a and the second annular end portion 14b, and projecting radially outwards with respect to the latter two.

[0048] Preferably, the elastic ring 14 has an omega or trapezoidal profile with respect to a sectional plane passing through the rotation axis A.

[0049] Alternatively, according to a variant embodiment not shown in the enclosed figures, the aforementioned enlarged annular portion can be provided at one of the two annular ends of the elastic ring 14.

[0050] During the operation of the adjustable copier 1, the rotating member 3 is made to roll over the panel to be worked keeping the enlarged annular portion 14c of the elastic ring 14 in contact with the panel itself, in such a way that the rotating tool (not shown in figures 1-3) connected to the adjustable copier 1 operates on the panel following the profile of the latter.

[0051] If, for any operational requirement, for example, to compensate for tool wear, increasing the radial size of the rotating member 3 is necessary, it will be sufficient to introduce compressed air or another fluid into the abduction duct 10 via the aforementioned compressed air system, in such a way as to obtain as effects the increase of the volume of air in the internal chamber 9, and the consequent displacement of the rotating member 3 in the direction D2.

[0052] This displacement of the revolving member 3 in the direction D2 will, in fact, cause a reciprocal approach, in the axial direction, between the first annular end portion 14a, and the second annular end portion 14b of the elastic ring 14, and a consequent expansion, in the radial direction, of the relative enlarged annular portion 14c.

[0053] If restoring the initial shape of the elastic ring 14002C to reduce the radial size of the rotating member 3, is subsequently necessary, it will be sufficient to disable the aforementioned compressed air system and let the air escape from the internal chamber 9, in such a way that the elastic ring 14 can relax and autonomously reacquire its original shape due to its elastic behavior.

[0054] Figures 4-6, on the other hand, show a second adjustable copier 20 in accordance with the present invention, which can be associated with a milling cutter (not shown) or with another rotary tool (not shown) to jointly form a second working unit.

[0055] The second adjustable copier 20 comprises a support 21 and a revolving member 22 supported by this support 21 and configured to be able to rotate with respect to the latter around a rotation axis B.

[0056] Said support 21 can be, for example, a part of the frame of the aforementioned second working unit.

[0057] In the support 21 there is a hole 23 directed according to the rotation axis B.

[0058] In particular, this hole 23 is completely open at one end thereof and, at the end opposite to this, it communicates with the outside through a passage 24 obtained in an external wall 25 of the support 21, and connected to a compressed air system or another fluid type system (not shown).

[0059] In the hole 23 there is a piston 26, capable of translating along the rotation axis B in both opposite directions D3, D4 (see figure 6).

[0060] An internal chamber 27 is therefore formed between the bottom of the piston 26 and the external wall 25 of the support 21 with a variable volume according to the quantity of air present in it.

[0061] An O-ring 28 is provided between the piston 26 and the side walls defining the hole 23 to prevent air leakage between said side walls and the piston 26.

[0062] Preferably, the aforementioned O-ring 28 is housed in an outer circumferential groove 29 formed in the outer lateral surface of the piston 26.

[0063] The aforementioned rotating member 22 comprises, in turn, a disk 30 arranged coaxially with the piston 26, in such a way that the latter faces a face of the disk 30 itself.

[0064] The revolving member 22 also includes an elastic ring 31, i.e., a ring with elastic behavior, coaxial to the aforementioned milling cutter or another rotary tool.

[0065] This elastic ring 31 has a first annular end portion 31a, integrally connected to the outer circular edge of the disk 30, and a second annular end portion 31b solidly connected, by means of an intermediate ring 32, to the outer circular wall 33a of a radial ball bearing 33 having an internal circular wall 33b integral with the support 21.

[0066] In particular, this radial ball bearing 33 is arranged coaxially with the elastic ring 31.

[0067] The aforementioned elastic ring 31 also comprises an enlarged annular portion 31c located between the first annular end portion 31a and the second annular

end portion 31b and protruding radially outwards with respect to the latter two.

[0068] Preferably, the elastic ring 31 has an omega or trapezoidal profile with respect to a sectional plane passing through the rotation axis B.

[0069] Alternatively, in accordance with a constructive variant not shown in the attached figures, the aforementioned enlarged annular portion can be provided at one of the two annular ends of the elastic ring.

[0070] Furthermore, an axial washer 34 is provided between the piston 26 and the disk 30 and it is arranged coaxially with the elastic ring 31 and with the radial ball bearing 33 so that the rotating member 22 can rotate freely around the rotation axis B with respect to the piston 26, which instead is not enabled to rotate but only to translate according to the rotation axis B.

[0071] In the aforementioned external wall 25 of the support 21 a threaded-through hole is obtained, in which an adjustment set screw 35 is screwed, which is suitable for allowing, precisely, by means of screwing or unscrewing manoeuvres, the adjustment of the position of the piston 26 along the rotation axis B for the correct positioning of the axial washer 34.

[0072] The aforesaid adjustment set screw 35 also acts as a mechanical stop for the piston 26 in order to prevent the rollers of the axial washer 34 from coming out of their respective annular seats.

[0073] During the operation of the second adjustable copier 20, the relative rotating member 22 is made to roll on the panel to be worked keeping the enlarged annular portion 31c of the elastic ring 31 in contact with the panel itself, in such a way that the rotary tool (not shown in figures 4-6) connected to the second adjustable copier 20 operates on the panel following the profile of the latter.

[0074] In the event that, for any operational requirement, reducing the radial size of the rotating member 22 is necessary, it will be sufficient to introduce compressed air or another fluid into the internal chamber 27 through the passage 24, by means of the aforesaid compressed air system, in to obtain the effects of the increase in the volume of air in the internal chamber 27 and the consequent displacement of the piston 26 and of the disc 30 in the direction D3.

[0075] This displacement of the disc 30 in the direction D3 will, in fact, cause a moving away, in the axial direction, of the first annular end portion 31a from the second annular end portion 31b of the elastic ring 31 and a consequent reduction, in the radial direction, of the radial dimensions of the relative enlarged annular portion 31c.

[0076] If restoring the initial shape of the elastic ring 31 to increase the radial size of the revolving member 22 is subsequently necessary, it will be sufficient to deactivate the aforementioned compressed air system and let the air escape from the internal chamber 27, in such a way that the elastic ring 31 can relax and autonomously reacquire its original contracted shape thanks to its elastic nature.

[0077] Figures 7-10, on the other hand, show a third

adjustable copier 40 in accordance with the present invention connected to a milling cutter 41 to jointly form a third working unit 41'.

[0078] In particular, said third adjustable copier 40 can be directly connected to the cutter 41 or to another tool, or arranged in correspondence with said cutter or other tool by means of a support connected to other parts of the machine, such as, for example, the relative frame or the basement; the latter consideration also applies to the adjustable copier 1 and for the second adjustable copier 20 described above.

[0079] In particular, the cutter 41 has an annular cutting edge 42' for milling the edge E of a panel P.

[0080] The third adjustable copier 40 comprises a support 42 and a rotating member 43 supported by this support 42 and configured in such a way as to be able to rotate with respect to the latter around an axis of rotation C.

[0081] The support 42 can be, for example, a part of the frame of the aforementioned third processing unit 41'.

[0082] The same support 42 comprises a protruding portion 44 configured as a sort of pin and directed according to said rotation axis C.

[0083] An angular ball bearing 45 is mounted on the protruding portion 44 of the support 42, namely a double row angular ball bearing, provided with an internal circular wall 45a integral with said protruding portion 44, and an external circular wall 45b rigidly connected to the rotating member 43.

[0084] The angular contact ball bearing 45 is arranged in such a way that its axis matches the aforementioned rotation axis C.

[0085] Specifically, the rotating member 43 includes a first connecting ring 46, fixed to the outer circular wall 45b of the angular ball bearing 45, and an elastic ring 47 coaxial to the cutter 41.

[0086] In particular, this elastic ring 47 has a first annular end portion 47a connected to the first connecting ring 46 and a second annular end portion 47b connected to a second ring 48, which is also part of the rotating member 43.

[0087] In more detail, the first connecting ring 46, the elastic ring 47, and the second ring 48 are all coaxial with the angular contact ball bearing 45.

[0088] The aforementioned elastic ring 47 also comprises an enlarged annular portion 47c located between the first annular end portion 47a and the second annular end portion 47b and protruding radially outwards with respect to the latter two.

[0089] Preferably, the elastic ring 47 has an omega or trapezoidal profile with respect to a sectional plane passing through the rotation axis C.

[0090] The elastic ring 47 can have a plurality of notches 47' on its outer annular surface to accentuate the elastic behavior and therefore reduce the tensions due to the axial movement of the second ring 48.

[0091] The aforementioned plurality of notches can also advantageously be provided in the elastic ring 14 of

the adjustable copier 1 and in the elastic ring 31 of the second adjustable copier 20.

[0092] Alternatively, in accordance with a constructive variant not shown in the attached figures, the aforementioned enlarged annular portion can be provided at one of the two annular ends of the elastic ring.

[0093] The third adjustable copier 40 also includes a sort of cap 49 having a substantially circular shape and also forming part of the aforementioned revolving member 43.

[0094] Specifically, this cap 49 is fixed by means of screws 49' to the first connection ring 46 to abut with an annular surface of the second ring 48 covering the side of the third adjustable copier 40 opposite to the support 42.

[0095] Therefore, in this way, the first connecting ring 46, the elastic ring 47, the second ring 48, and the cap 49 turn out to be rotatable, in a mutually integral manner, around the aforesaid rotation axis C with respect to the support 42.

[0096] In particular, the first connecting ring 46 and the cap 49 are configured in such a way that a gap is formed between them, to allow the second ring 48 arranged therein to have a linear translation along the rotation axis C.

[0097] Therefore, by suitably modulating the tightening degree of the aforementioned screws 49', it is possible to push, axially, the second ring 48 against the elastic ring 47 in such a way as to make the latter two mutually integral.

[0098] In the cap 49 there is also formed a plurality of through threaded holes 50 directed parallel to the rotation axis C and opened towards the second ring 48, in which respective adjustment set screws 50' are screwed to modify the axial position of said second ring 48 manually by screwing and/or unscrewing operations, thus achieving the adjustment of the deformation of the elastic ring 47, or its expansion in the radial direction; in this way, it will, therefore, be possible to obtain a radial expansion of the elastic ring 47 by means of compression exerted axially on it.

[0099] Between the second ring 48 and the cap 49, there is also provided a chamber 51 placed in fluid communication with a compressed air system or a system with another type of fluid (not shown) through a first channel 52a and a second channel 52b communicating with each other and obtained, respectively, in the cap 49 and in the support 42.

[0100] To prevent air or other fluid leaks from the aforementioned chamber 51, a first sealing ring 53 (in particular, a radial sealing ring for rotational uses) is provided between the cap 49 and the protruding portion 44 of the support 42, a second sealing ring 54 between the cap 49 and the second ring 48, and a third sealing ring 55 between the second ring 48 and the first connecting ring 46.

[0101] In particular, the second sealing ring 54 and the third sealing ring 55 are rings made of elastomeric material, i.e., O-rings.

[0102] By activating the aforesaid compressed air system (not shown) it is possible to introduce air into the chamber 51 in such a way as to obtain, as effects, an axial displacement of the second ring 48 towards the first connecting ring 46 and, consequently, a radial expansion of the elastic ring 47 for axial compression of the latter.

[0103] It follows, therefore, that in the third adjustable copier 40 in question two distinct methods are envisaged for obtaining radial expansion of the elastic ring 47, in particular a first method, which can be performed manually by screwing the adjustment set screws 50' and a second method, feasible by introducing compressed air into the chamber 51, as described above.

[0104] During the operation of the third adjustable copier 40, the relative rotating member 43 is made to roll on one face of the panel P to be worked keeping the enlarged annular portion 47c of the elastic ring 47 in contact with this face, so that the cutting edge 42' of the cutter 41 operates on the edge E of the panel P following the profile of the latter.

[0105] In case of, due to any operating requirement, it is necessary to increase the radial size of the rotating member 43, it will be sufficient to implement one of the two operating methods described above to achieve the radial expansion of the elastic ring 47 by means of.

[0106] If it is subsequently necessary to restore the initial shape of the elastic ring 47 to reduce the radial size of the rotating member 43, it will be sufficient to let the air out of the chamber 51 or to unscrew the adjustment dowels 50' located in the threaded through holes 50, in such a way that the elastic ring 47 can relax and autonomously reacquire its original shape thanks to its own elastic nature.

[0107] As can be easily deduced from the preceding description, the adjustable copier according to the present invention, although having a simple overall structure, allows machining to be carried out with a high degree of precision, effectively compensating for the possible irregularities of the rotary tool with which it is associated with respect to the relative original shape and the play of the kinematic chain between the tool and the copier.

[0108] 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. Working unit for machining at least one piece (P), said machining group comprising:

- a rotary tool (41) rotating around a first rotation axis and configured to perform at least one machining on at least one piece (P);

- a copier (1, 20, 40) arranged in correspondence with said rotary tool (41) and capable of resting on at least one face of said at least one piece (P) to guide said rotary tool (41) with respect to said at least one piece (P); said copier (1, 20, 40) comprising:
- a first support (2, 21, 42);
 - a second support (5; 26, 30, 34; 48) axially movable with respect to said first support (2, 21, 42) along a predetermined direction; and
 - an annular element (14, 31, 47) rotatable with respect to said first support (2, 21, 42) around a second rotation axis (A, B, C) parallel to said predetermined direction, wherein said annular element (14, 31, 47) is radially elastically deformable with respect to said second axis of rotation (A, B, C) and comprises a first end portion (14b, 31b, 47a) axially engaged, according to said second axis of rotation (A, B, C), to said first support (2, 21, 42) and a second end portion (14a, 31a, 47b) axially engaged, according to said second axis of rotation (A, B, C), to said second support (5; 26, 30, 34; 48), so that an axial displacement of said second support (5; 26, 30, 34; 48) towards said first support (2, 21, 42) is followed by a reduction of the axial dimensions of said annular element (14, 31, 47) and a radial expansion of said annular element (14, 31, 47), and in such a way that an axial displacement of said second support (5; 26, 30, 34; 48) in the opposite direction with respect to said first support (2, 21, 42) follows an expansion of the axial size of said annular element (14, 31, 47) and a reduction of the radial size of said annular element (14, 31, 47).
2. Working unit according to claim 1, **characterized in that** said annular element (14, 31, 47) comprises a concavity facing towards said second axis of rotation (A, B, C).
 3. Working unit according to claim 2, **characterized in that** said annular element (14, 31, 47) has a substantially omega-shaped profile.
 4. Working unit according to any one of the preceding claims, **characterized in that** said first axis of rotation substantially coincides with said second axis of rotation (A, B, C).
 5. Working unit according to any one of the preceding claims, **characterized in that** said second support (5; 26, 30, 34; 48) comprises at least a portion or rotatable element (13, 30, 48), which is rotatable around said second axis of rotation (A, B, C) integral with said annular element (14, 31, 47).
 6. Working unit according to claim 5, **characterized in that** said second support comprises a translatable element (26) axially engaged, according to said second axis of rotation (A, B, C), to said at least one portion or rotating element (30) and rotatably released from said at least one portion or rotatable element (30).
 7. Working unit according to claim 6, **characterized in that** said copier (20) comprises an adjustment member (35), configured to adjust the position of said movable element (26) along an axis parallel to said second axis of rotation (B) with respect to said at least one portion or rotatable element (30).
 8. Working unit according to any one of the preceding claims, **characterized in that** a variable volume chamber (9, 27, 51) communicating with said second support (5; 26) is formed in said copier (1, 20, 40) 30, 34; 48) and is connectable to a fluidic system to introduce, in use, at least one fluid into said chamber (9, 27, 51), thus determining an axial displacement of said second support (5; 26, 30, 34; 48) along an axis parallel to said second rotation axis (A, B, C) with respect to said first support (2, 21, 42).
 9. Working unit according to claim 8, **characterized in that** said chamber (9, 27) is formed between said first support (2, 21) and said second support (5; 26, 30, 34).
 10. Working unit according to claim 8, **characterized in that** said copier (40) comprises a rotatable element (49) adjacent to said second support (48) and rotatable around said second axis of rotation in an integral manner with said annular element (14, 31, 47), and **in that** said chamber (51) is formed between said second support (48) and said rotatable element (49).
 11. Working unit according to claim 1, **characterized in that** said copier (40) comprises at least one mechanical actuation member (50') movable with respect to said second support (48) and acting on said second support (48) so as to cause a displacement of said second support (48) by applying a force on said at least one mechanical actuation member (50').
 12. Working unit according to any one of the preceding claims, **characterized in that** said annular element (14, 31, 47) has, in correspondence with its external surface, a plurality of notches (47') to accentuate the elastic behavior of said annular element (14, 31, 47).

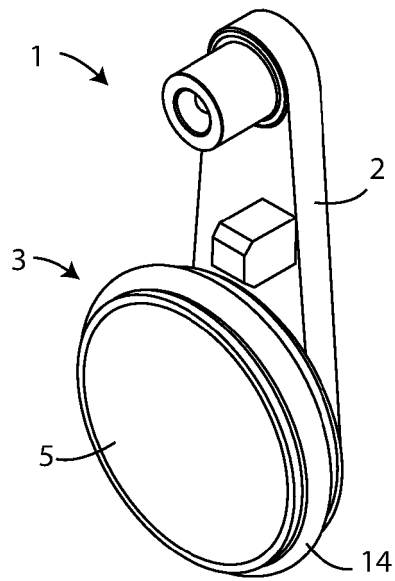


Fig. 1

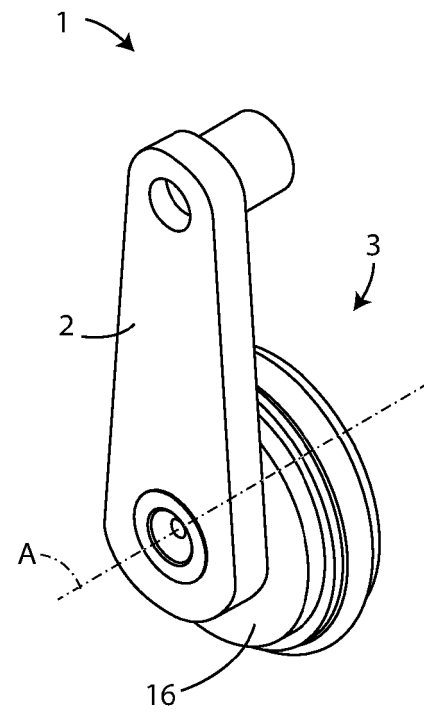


Fig. 2

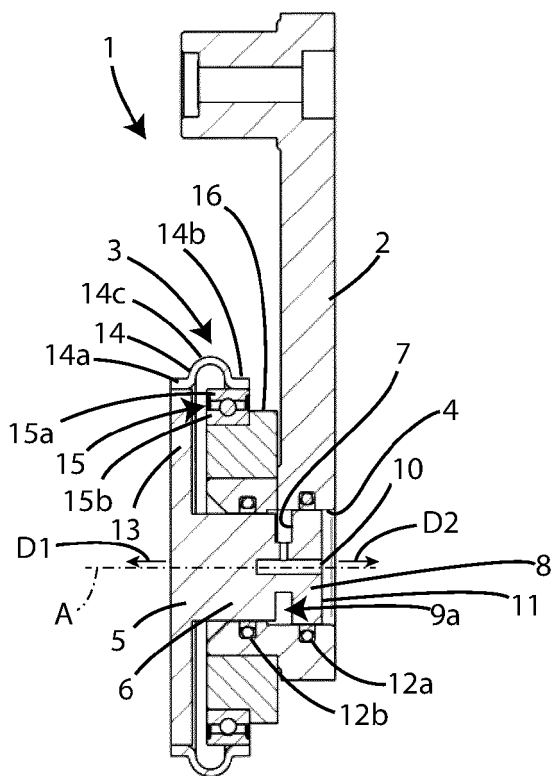


Fig. 3

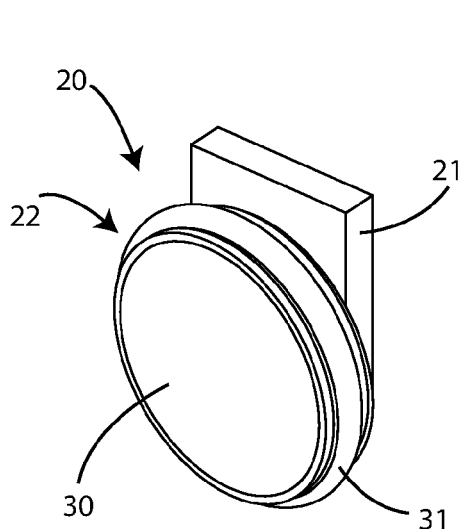


Fig. 4

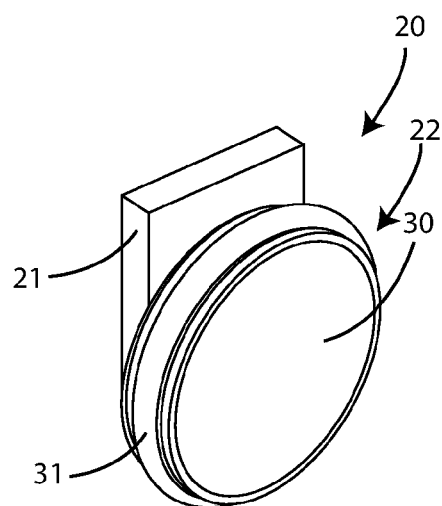


Fig. 5

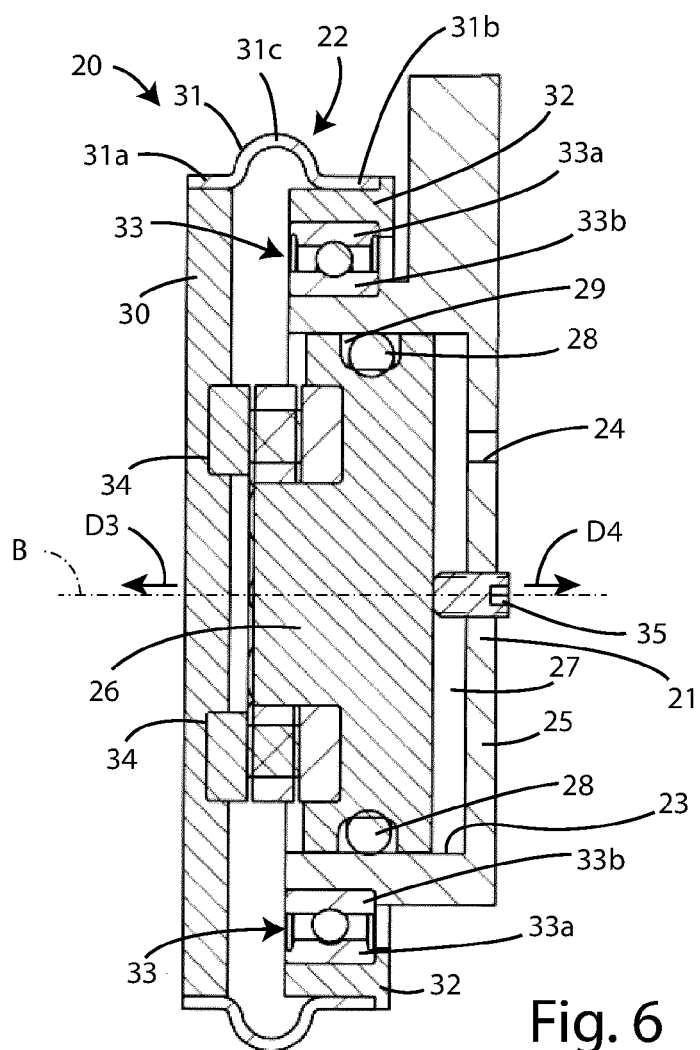


Fig. 6

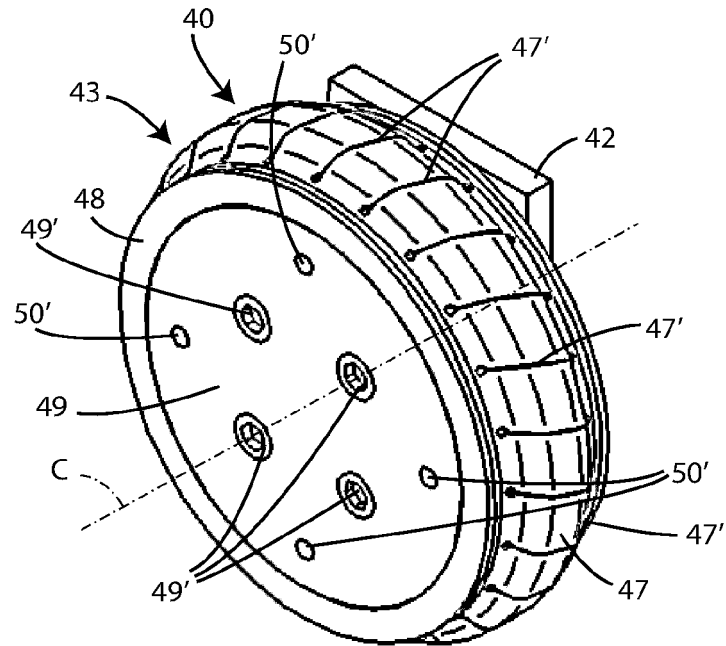


Fig. 7

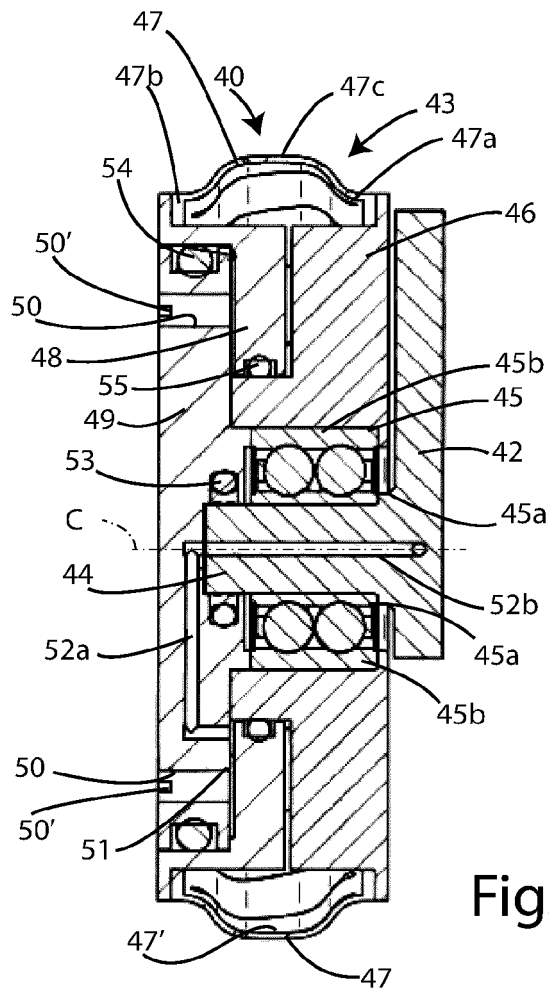


Fig. 8

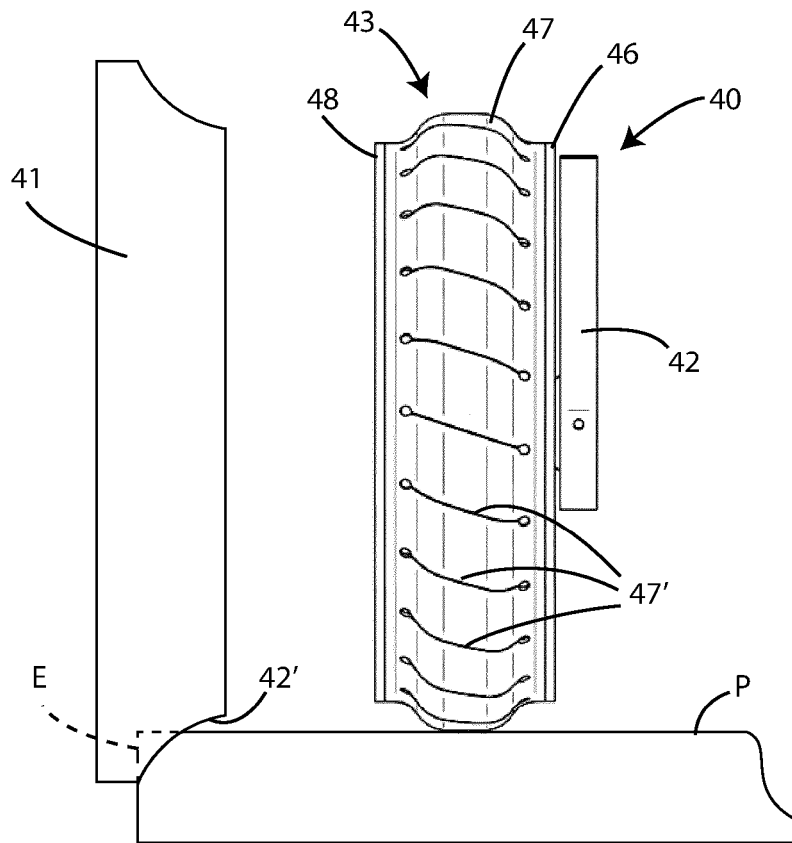


Fig. 9

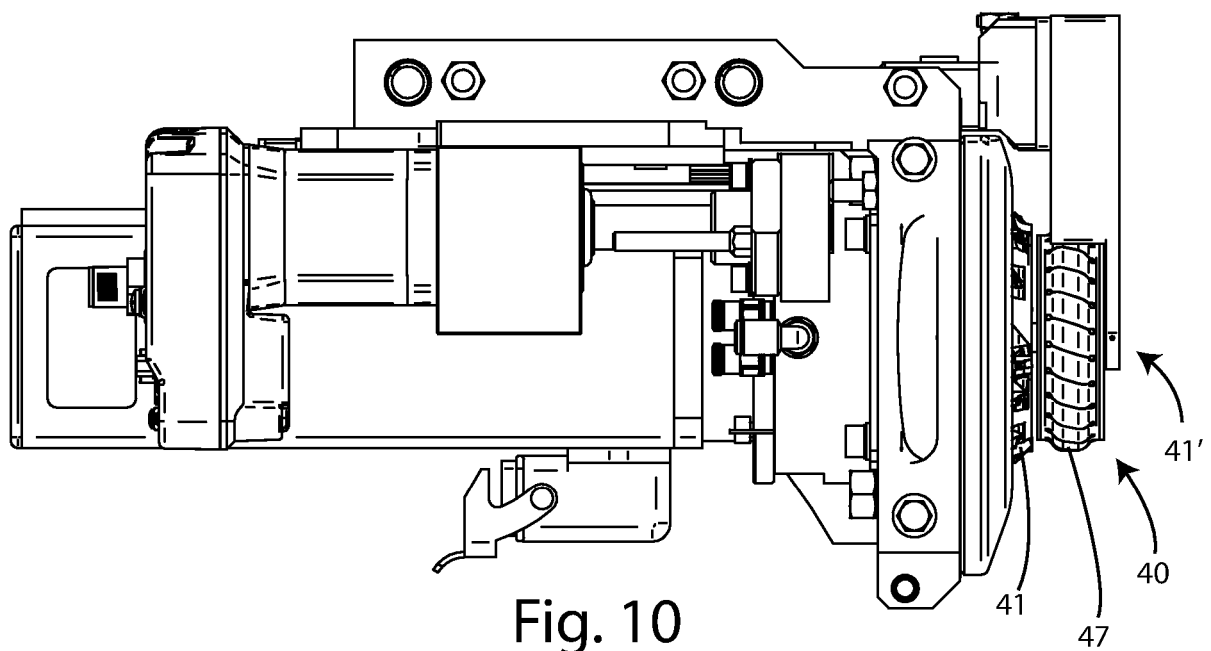


Fig. 10



EUROPEAN SEARCH REPORT

Application Number

EP 23 15 8724

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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 A	DE 10 2017 207673 A1 (SCM GROUP SPA [IT]) 9 November 2017 (2017-11-09) * abstract * * paragraphs [0031], [0032], [0035], [0037], [0015], [0044], [0034], [0024] * * claim 1 * * figures * -----	1-6, 11, 12 7-10	INV. B27C5/00
			TECHNICAL FIELDS SEARCHED (IPC)
			B27C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 31 May 2023	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			

