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(54) **MILLING CUTTER AND METHOD FOR ITS REALIZATION**

(57) Circular milling cutter (1), in particular for wood-working, comprising:

- a cutter body (2), comprising at least a first surface (14) parallel to the Z axis around which the milling cutter itself is configured to rotate, and a second surface (14') substantially perpendicular to the Z axis,
- at least one seat (3) configured to house at least one cutting element (4),
- the cutting element (4), configured to remove a portion of the material to be worked, the cutting element comprising a groove (10),
- a block (16) configured to hold the cutting element (4) in position during the machining of the material, and characterized in that:

the block (16) comprises an abutment portion (25) configured to abut against the rear wall (27) of the seat (3) when the milling cutter (2) is in the open condition;
the block (16) comprises a shaped protrusion (34) configured to couple with the groove (10), in order to hold the cutting element (4) in position, the shaped protrusion (34) protruding with respect to the second support portion (32) by a dimension h;
the block (16) and the seat (3) defining a minimum distance (46) between them at the cutting element (4);
the abutment distance (29) can be comprised between the dimension (h) of the shaped protrusion (34) and the minimum distance (46).

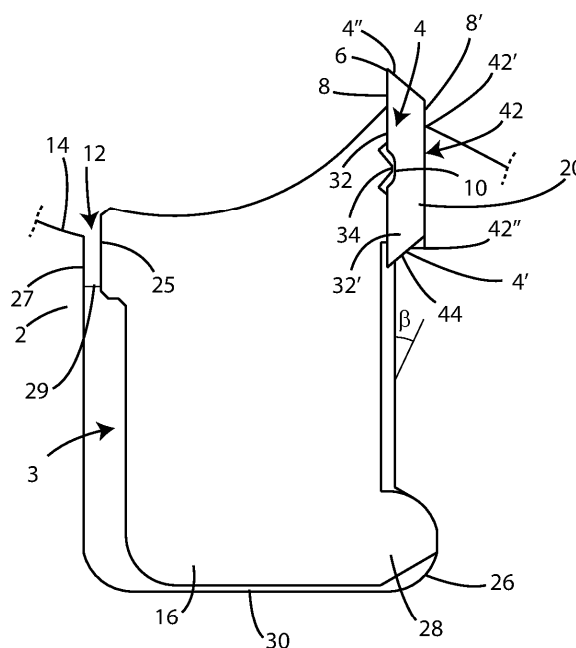


Fig. 6

Description

[0001] The present invention relates to a milling cutter with cutting inserts for woodworking or the like and refers, more particularly, to a cutting milling cutter. The present invention also relates to a method for the realization of said milling cutter.

[0002] The milling cutters described by the present invention are particularly suitable for the machining of window/door frames or the like that have complex profiles to be machined. Known milling cutters comprise cutter bodies adapted to be rotated and a series of cutting inserts mounted on the periphery of said bodies, with a substantially radial arrangement.

[0003] These cutters are generally used for machining profiles of wooden elements as in the case of machining window/door frames.

[0004] The profiles of window/door frames may in fact have a plurality of recessed and protruding elements due to the aesthetic appeal and functionality of the object itself. Known milling cutters comprise cutting inserts, also called knives, which can be shaped as needed and which are placed and fixed individually inside grooves peripherally made in the body of the milling cutter with desired angulations.

[0005] Since the knives, when working, are subject to an overturning moment in the opposite direction to the advancement due to the resistances they encounter in cutting the workpiece and to the centrifugal force resulting from the rotation of the milling cutter, each of said knives is locked on the body of the milling cutter so as to counteract these forces to ensure its precise and permanent positioning.

[0006] Usually, each knife is removably associated with the cutter bodies at a relative seat, by means of one or more locking elements or blocks and at least one screw, which locks it by pressure on a wall of said groove.

[0007] In consideration of the fact that the knives must be periodically replaced, it is important that the milling tools allow rapid and easy mounting and dismounting operations of the knives, even on board the machine, while still guaranteeing their precise and stable locking on the main body, also in consideration of the high cutting speeds and the relative centrifugal forces generated. In particular, in fact, during use the milling cutters are made to rotate at high speeds, and therefore the knives are subjected to a high centrifugal force, which depends on their mass.

[0008] The object of the present invention is, therefore, to propose a milling cutter that allows to overcome the drawbacks of the known solutions.

[0009] Another object of the present invention is to propose a milling cutter that allows to distribute the forces in an adequate manner.

[0010] Another object of the present invention is to propose a milling cutter that allows to use cutting elements of reduced dimensions.

[0011] Another object of the present invention is to

propose a milling cutter that allows to work the wood.

[0012] Another object of the present invention is to propose a milling cutter that is easily realizable and with low costs.

[0013] Another object of the present invention is to propose a milling cutter that allows to absorb the centrifugal forces linked to rotation at high speeds.

[0014] Another object of the present invention is to propose a milling cutter that allows to carry out precision machining.

[0015] Another object of the present invention is to propose a method for the realization of said milling cutter.

[0016] These and other objects, according to the present invention, are achieved by realizing a milling cutter for woodworking, according to the appended claim 1 and with a method for its realization according to claim 10; other technical detail characteristics of the milling cutter, according to the present invention, are reported in the dependent claims.

[0017] Further characteristics and advantages of the milling cutter for woodworking, which is the object of the present invention, will become more evident from the following description of the milling cutter in question and referring to the attached drawings, in which:

- figure 1 shows a perspective view from above of a milling cutter according to the invention,
- figure 2 shows it in a perspective view from below,
- figure 3 shows it in a side view,
- figure 4 shows it in section along the plane IV-IV,
- figure 5 shows it in a second embodiment
- figure 6 shows in side view a detail of the milling cutter in the closed condition;
- figure 7 shows it in the open condition.

[0018] Hereinafter, by Z axis is meant the axis around which the milling cutter is configured to rotate, perpendicular to the Z axis is defined a plane identified by means of the polar coordinates r and θ where r indicates the distance from the origin, and θ indicates the angle, in a traditional system of cylindrical coordinates. The positive direction of the Z axis is substantially that which departs from the base of the chuck to which the milling cutter is intended to be fixed, the positive direction of the angle θ is that of rotation of the milling cutter 1.

[0019] The present invention is particularly directed to a milling cutter 1, in particular for machining, by means of material removal, of a wooden element.

[0020] Advantageously, the present invention is directed to a rotating milling cutter 1, configured to be rotated at speeds up to about 16000rpm.

[0021] Suitably, the milling cutter 1 according to the invention may comprise a cutter body 2.

[0022] In an embodiment, the milling cutter 1 may be of the type described in European patent application EP4461489. In particular, in this case, one of the cutting tools defined in European patent application EP4461489 may substantially correspond to the cutting element 4.

[0023] In particular, the milling cutter 1 according to the invention may comprise at least one, and preferably a plurality of seats 3 configured to contain, at least partially, at least one cutting element 4. As mentioned, in an embodiment the milling cutter 1 according to the invention may comprise at least one cutting element 4. In particular, the cutting element 4, also called a knife, may have a longitudinal dimension of a few millimeters, preferably between 1 and 20mm, for example about 8 mm. Advantageously, the cutting element 4 may have a transverse dimension, i.e. a thickness 5, of about 1.5mm.

[0024] Suitably, therefore, the cutting element 4 may have, when in the configuration mounted in the seat 3, a first inclined portion 4' configured to be inside the seat 3, and a second inclined portion 4'' configured to be outside the seat 3. Suitably, the second portion 4'' may have a first cutting profile 6 configured to come into contact with the piece to be cut. Advantageously, the first inclined portion 4' and the second inclined portion 4'' may be connected by a third substantially flat portion 4'''. Advantageously, the cutting element 4 may comprise, on a first face 8, which is preferably configured not to come into contact with the body of the milling cutter 1 when the cutting element 4 is in the mounted configuration, a retention groove 10, configured to allow the retention and/or positioning of the cutting element 4, as will be clear later. Similarly, the cutting element 4 comprises a second face 8' which is configured to come into contact with the body of the milling cutter 1 when the cutting element 4 is in the mounted configuration.

[0025] Advantageously, the seat 3 in which the cutting element 4 is positioned may have an opening 12 positioned on a first surface 14 of the cutter body 2 which is substantially parallel to the Z axis. In an embodiment illustrated in figure 5, the opening 12 may also be parallel to the Z axis. In another embodiment shown in figs. 1 - 4, the opening 12 may also comprise a component on a plane perpendicular to the Z axis, for example on a second surface 14' of the cutter body which is positioned on a surface perpendicular to the Z axis. Advantageously, in the case of openings made on a first surface 14, these can be made with an end mill.

[0026] Suitably, the milling cutter 1 also comprises a block 16 configured and/or shaped to be inserted inside the seat 3, so as to keep the cutting element 4 in position during the operation of the milling cutter itself.

[0027] Suitably, therefore, the seat 3 and the block 16 may be reciprocally shaped so as to generate a form coupling that allows the block to exert a force F which generates a friction force F' that keeps the cutting element 4 in position. Suitably, therefore, the seat 3 may comprise an entry section 18, configured to allow the insertion of the cutting element 4 and/or the block 16. Suitably, the entry section 18 may comprise a first support portion 20 for the cutting element 4, configured to constrain the cutting element in abutment. Suitably, the first support portion 20 may be positioned at the upstream edge of the seat 3.

[0028] Suitably, internally - i.e. at lower radial coordinates - with respect to the first support portion 20, the seat 3 may comprise a bore portion 21, in which a first through opening 22 is defined, which connects the seat 3 with the first surface 14. Suitably, the first through opening 22 may not be threaded. In particular, the first through opening 22 may be configured to house, at least partially, a screw 24 which allows to hold the block 16 in position. Suitably, the bore portion 21 may not have a substantially radial direction, but may have a direction angled with respect to the radius, and more preferably may be angled by an angle β comprised between 10 and 50, and preferably about 30°.

[0029] Advantageously, the block 16 may comprise, in a rear position - i.e. at smaller angular coordinates and/or in a position opposite to the support portion 20 - a abutment portion 25 configured to abut against the rear wall 27 of the seat 3 when the milling cutter 2 is in the open condition. Suitably, the abutment portion 25 may protrude with respect to the rear wall of the block 16. Advantageously, the abutment portion 25 may protrude by a dimension such as to obtain a abutment distance 29 between the abutment portion 25 and the rear wall 27 of the seat 3.

[0030] In particular, the screw 24 is configured to move the block 16 between a first open position, shown in fig. 7, in which the block 16 does not hold the cutting element 4 in position, and a second closed position, shown in fig. 6, in which the block holds the cutting element 4 in position. Suitably, in the first open position, the abutment portion 25 may abut against the rear wall 27 of the seat 3. Advantageously, in the second closed position, the abutment distance 29 may be present between the abutment portion 25 and the rear wall 27.

[0031] Advantageously, in a more internal position with respect to the through opening 22, there may be a recessed portion 26 configured to house a corresponding protrusion 28 of the block 16. Suitably, the shaped portion 26 may be substantially in an undercut with respect to the bore portion 21. Suitably, the shaped portion 26 must therefore be made by means of an end mill, and cannot be made by means of a normal disk milling cutter. Suitably, the shaped portion may have a substantially semi-circular, or in any case curvilinear, section. Suitably, therefore, the shaped portion 26 may have an axis of symmetry substantially perpendicular to the first bore portion 21.

[0032] Advantageously, the shaped portion 26 may be substantially adjacent to a first bottom portion 30, which may preferably be substantially perpendicular to the bore portion 21.

[0033] Suitably, as mentioned, the milling cutter 1 may also comprise a block 16 configured to hold the cutting element 4 in position. Suitably, the block may provide a second support portion 32 configured to bear on the cutting element, preferably in a position substantially facing and/or corresponding to the first support portion 20. Suitably, on the second support portion 32, a shaped protrusion 34 may be defined, configured to couple with the groove 10, in order to maintain the cutting element in

position, and to facilitate its positioning. Suitably, the shaped protrusion 34 may be configured not to come into contact with the retention groove 10 when the block 16 and the cutting element 4 are in the mounted configuration and/or in the second closed position - i.e. there may be a certain clearance between the two elements.

[0034] Advantageously, the second support portion 32 may rest directly on the cutting element 4. Advantageously, in any case, the shaped protrusion 34 may protrude with respect to the second support portion 32 by a dimension h.

[0035] Suitably, more internally - i.e. in a position at lower radial coordinates, when the block is in the mounted configuration - with respect to the second support portion 32, the block may comprise a second bore portion 36, in which a second through opening 38 is defined, configured to allow the insertion of the screw 24. Suitably, the second through opening 38 may be threaded.

[0036] Suitably, more internally - i.e. in a position at lower radial coordinates, when the block is in the mounted configuration - with respect to the second bore portion 36, the block 16 may comprise the protrusion 28, which is configured to couple with the recessed portion 26 defined in the seat 3. Suitably, for this purpose, the protrusion 28 may have a substantially curvilinear section, and preferably defining a circumferential arc. Suitably, the radius of curvature of the protrusion 28 may be smaller than that of the recessed portion 26, in order to simplify the positioning of the block 16. Advantageously, the protrusion 28 may protrude with respect to the second bore portion 36.

[0037] Suitably, adjacent to the protrusion 28, the block 16 may comprise a second bottom portion 40. Suitably, the second bottom portion 40 may comprise a first semi-portion 40' adjacent to the protrusion 28 which may be angled with respect to the second bore portion 36 by an angle α less than 90° , and preferably by an angle α comprised between 10° and 50° , and more preferably may be about 30° , and a second semi-portion 40", adjacent to the first semi-portion 40', which is instead substantially perpendicular to the second bore portion 36. Suitably, α and β may be substantially equal.

[0038] Suitably, as is clear from figures 1, 2, 4, 6 and 7, the seat 3 of the cutter body 2 has a widening 42, which substantially corresponds to the support portion 20, at its outer end 42' - i.e. the one at larger radial coordinates - adapted to house the cutting element 4, and to provide an abutment to the cutting element itself. Suitably, the widening 42 may have a radial development, and preferably a development along the direction which is angled by the angle β with respect to the radial direction, which is smaller than the total development of the cutting element 4 in the direction β , but preferably comprised between:

- the sum of the development in the direction β of the second inclined portion 4" and of the third flat portion 4"', and

- the sum of the development in the direction β of the first 4' and second 4" inclined portion and of the third flat portion 4"', i.e. the overall radial development of the cutting element 4.

[0039] Substantially, therefore, when the cutting element 4 is in the mounted position, the first inclined portion 4' is at the inner end 42" of the widening 42. Suitably, the widening 42 may have, at its inner end 42", a step 44, which substantially defines the end of the widening 42. Suitably, the step 44 may have a thickness such that the minimum distance 46 between the step itself and the block 16, and in particular the inner end 32' of the second support portion 32, when the block is in the second open position, is less than the thickness of the cutting element 4.

[0040] Suitably, therefore, the abutment distance 29 may be comprised between the dimension h of the shaped protrusion 34 and the minimum distance 46. In this way it is possible to bring the block into its most retracted position, so as to easily remove the cutting element 4, without it being able to slide inside the milling cutter 2. Advantageously, moreover, when the block is in the second closed position, the step can be at a lower θ coordinate with respect to the inner end 32' of the support portion 32.

[0041] Suitably, the present invention also relates to a method for the realization of a milling cutter as described above. In particular, the method provides for the machining of a block of suitable material, preferably die-cast aluminum, by means of one or more milling cutters. Preferably, the recessed portion 26 can be made by using an end mill, more preferably by using a T-shaped bit.

Claims

1. Circular milling cutter (1), in particular for woodworking, comprising:

- a cutter body (2), comprising at least a first surface (14) parallel to the Z axis around which the milling cutter itself is configured to rotate, and a second surface (14') substantially perpendicular to the Z axis,
- at least one seat (3) configured to house at least one cutting element (4),
- the cutting element (4), configured to remove a portion of the material to be worked, the cutting element comprising a groove (10),
- a block (16) configured to hold the cutting element (4) in position during the machining of the material,

and characterized in that:

the block (16) comprises a abutment portion (25) configured to abut against the rear wall (27) of

the seat (3) when the milling cutter (2) is in the open condition;
 the block (16) comprises a shaped protrusion (34) configured to couple with the groove (10), in order to hold the cutting element (4) in position, the shaped protrusion (34) protruding with respect to the second support portion (32) by a dimension h;
 the block (16) and the seat (3) defining a minimum distance (46) between them at the cutting element (4);
 the abutment distance (29) can be comprised between the dimension (h) of the shaped protrusion (34) and the minimum distance (46).

2. Milling cutter according to the preceding claim **characterized in that** the cutting element (4) has a length of less than 2 cm.
3. Milling cutter according to one or more of the preceding claims **characterized in that** the seat (3) comprises a widening (42) at its outer end (42'), and that the minimum distance (46) is defined at a step (44) which internally limits the widening (42).
4. Milling cutter according to one or more of the preceding claims **characterized in that** the step is at a lower θ coordinate with respect to the inner end (32') of the support portion (32).
5. Milling cutter according to one or more of the preceding claims **characterized in that** the abutment portion (25) protrudes rearwardly with respect to the rear wall of the block (16).
6. Milling cutter according to one or more of the preceding claims **characterized in that** when the cutting element (4) comprises:
 - a first portion (4') configured to be inside the seat (3);
 - a second inclined portion (4'') configured to be outside the seat (3);
 - a third substantially flat portion (4''') connecting the first (4') and second (4'') inclined portion;

and that, when the cutting element (4) is in the mounted position, the first inclined portion (4') is at the inner end (42'') of the widening (42).

7. Milling cutter according to one or more of the preceding claims **characterized in that** the seat (3) has an opening 12 defined entirely on the first surface (14) of the cutter body (2).
8. Milling cutter according to one or more of the preceding claims **characterized in that** the cutting element has a retention groove (10) configured to cou-

ple with a corresponding shaped protrusion (34) defined on the block (16), in order to guarantee the positioning of the cutting element (4).

9. Milling cutter according to one or more of the preceding claims **characterized in that** the coupling between the shaped protrusion (34) and the retention groove (10) has a clearance.
10. Milling cutter according to one or more of the preceding claims **characterized in that** the recessed portion (26) has a substantially circular section.
11. Milling cutter according to one or more of the preceding claims **characterized in that** the protrusion (28) has a substantially circular section with a radius of curvature smaller than that of the recessed portion (26).
12. Milling cutter according to one or more of the preceding claims **characterized in that** the seat (3) has a bore portion (21) in which a first through opening (22) is defined, preferably not threaded, and the block (16) has a second bore portion (36) in which a second through opening (38) is defined, preferably threaded.
13. Milling cutter according to one or more of the preceding claims **characterized in that** the seat (3) has a first bottom portion (30) substantially perpendicular to the first bore portion (21), and the block (16) has a second bottom portion (40) angled by an angle α of less than 90° with respect to the second bore portion (36).
14. Method for the realization of a milling cutter according to one or more of the preceding claims **characterized in that** it provides a phase of material removal by means of an end mill, preferably by means of a T-profile bit.

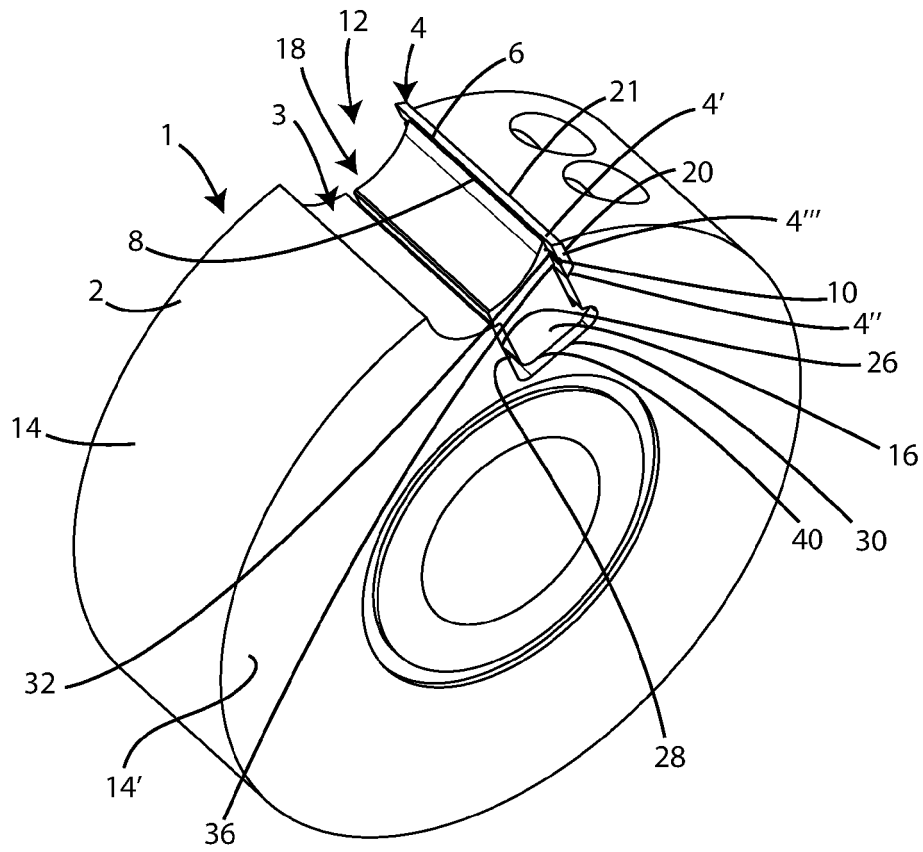


Fig. 1

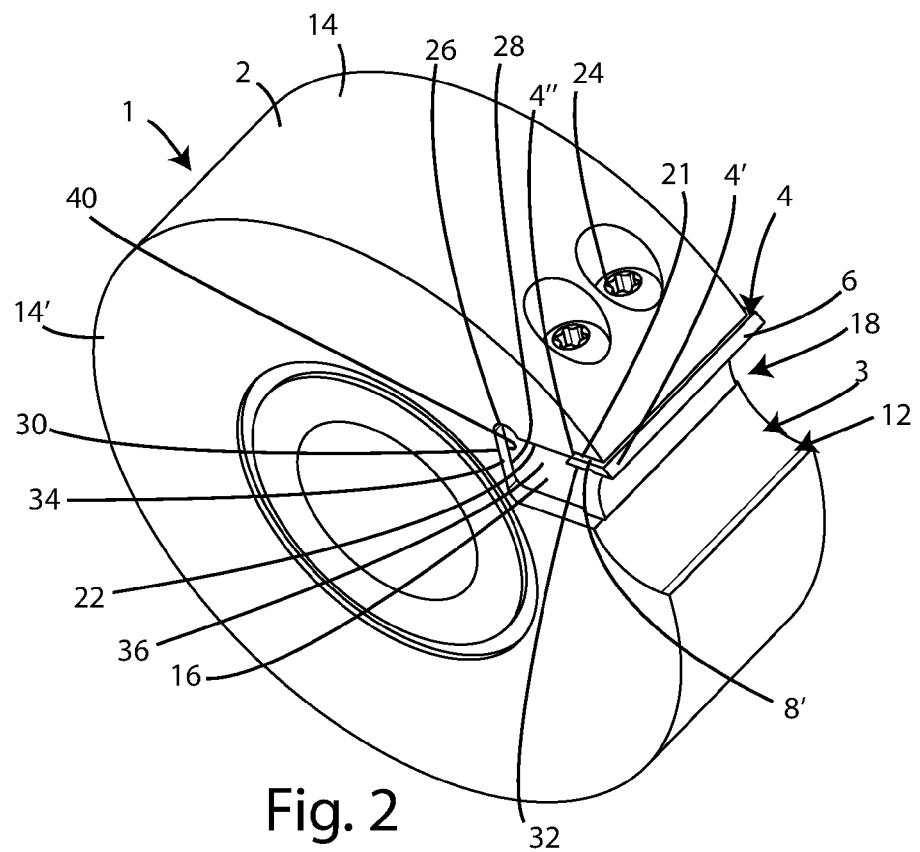


Fig. 2

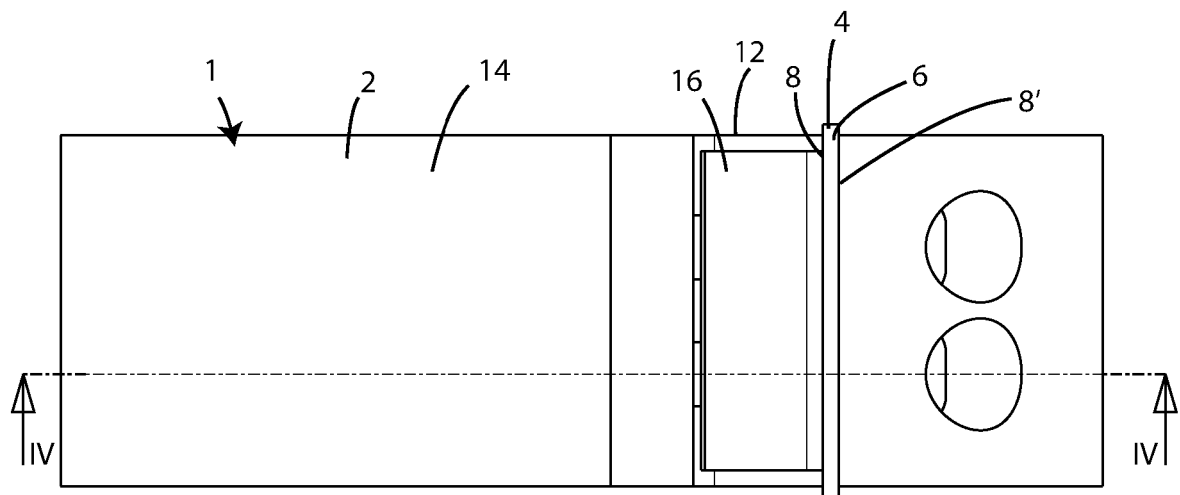


Fig. 3

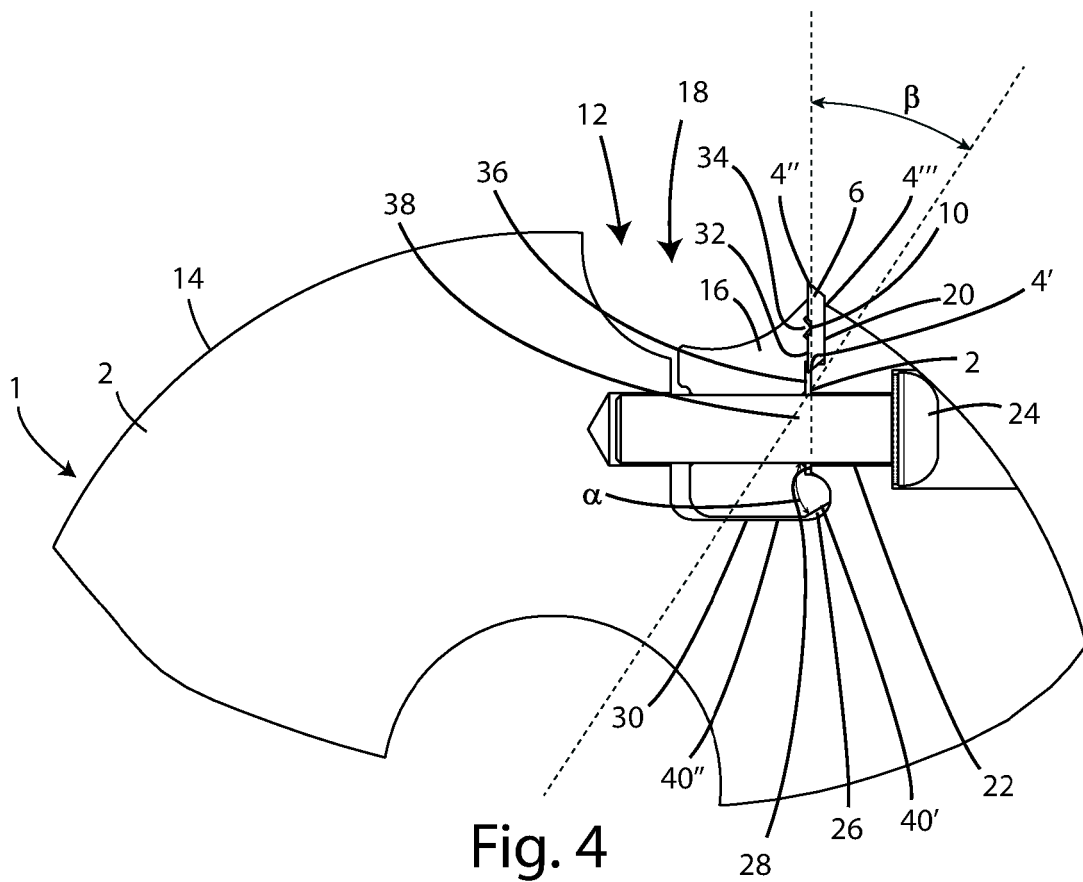


Fig. 4

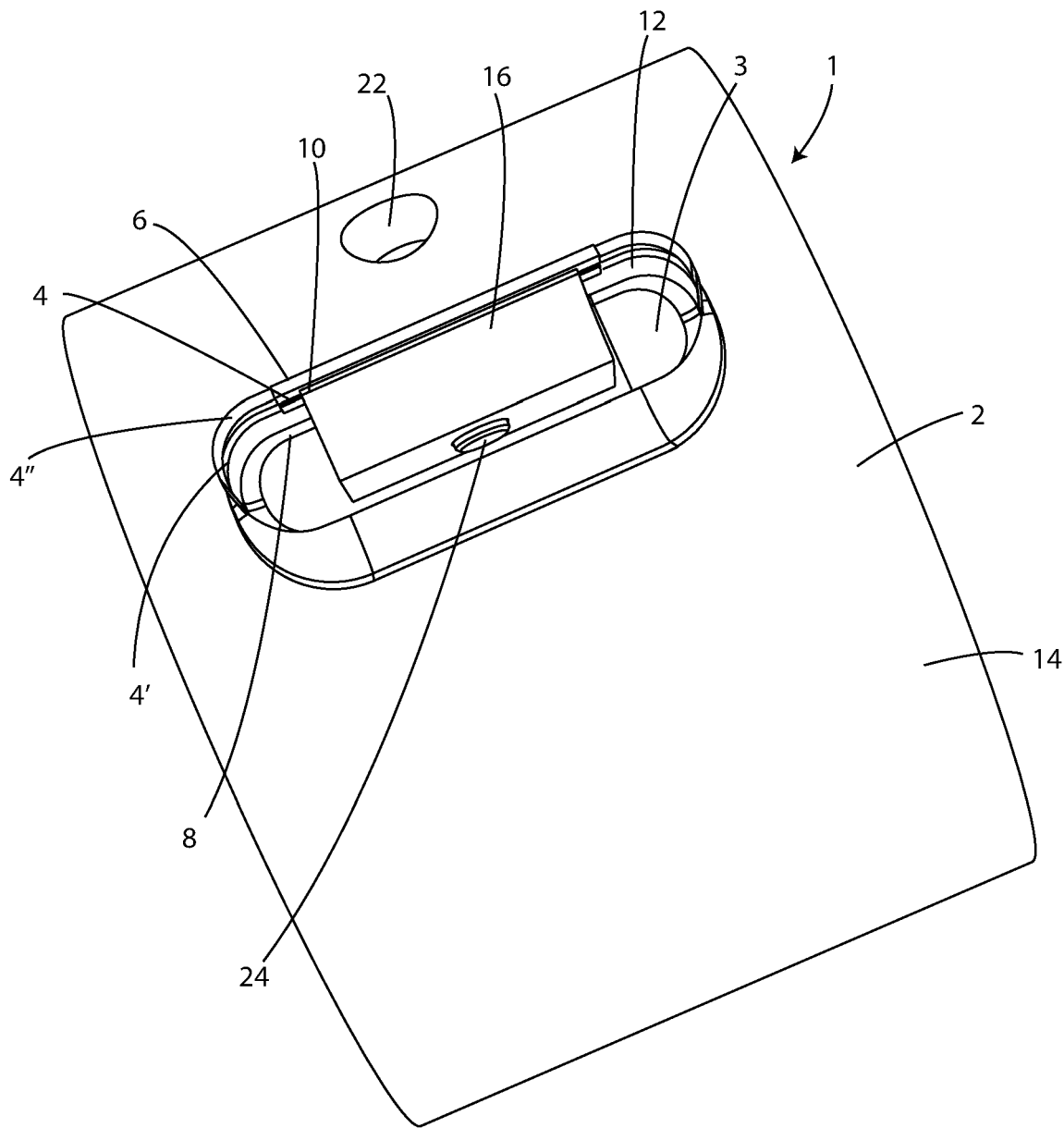


Fig. 5

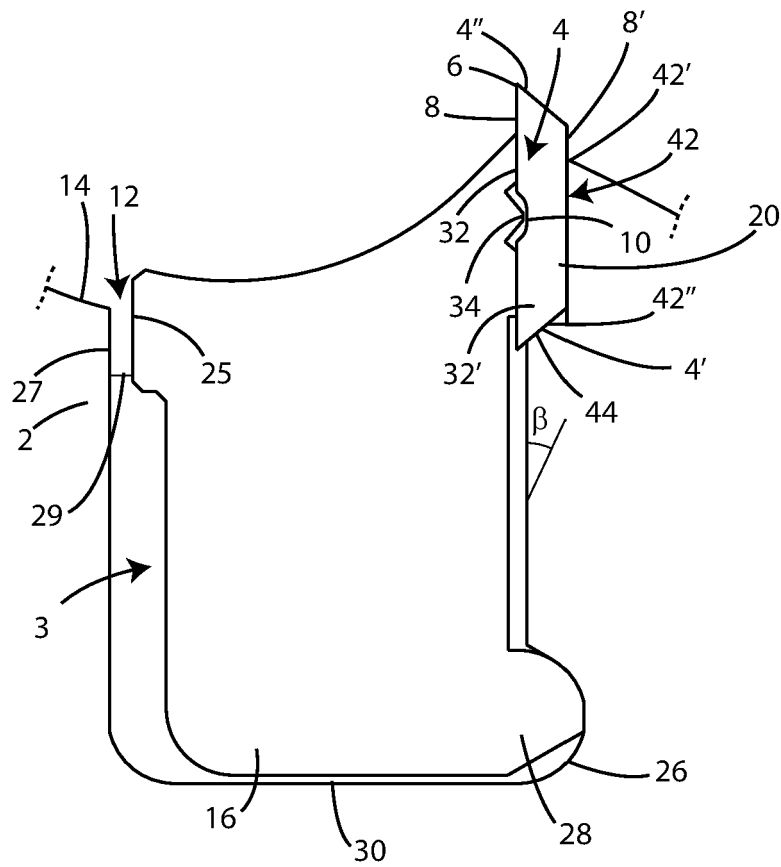


Fig. 6

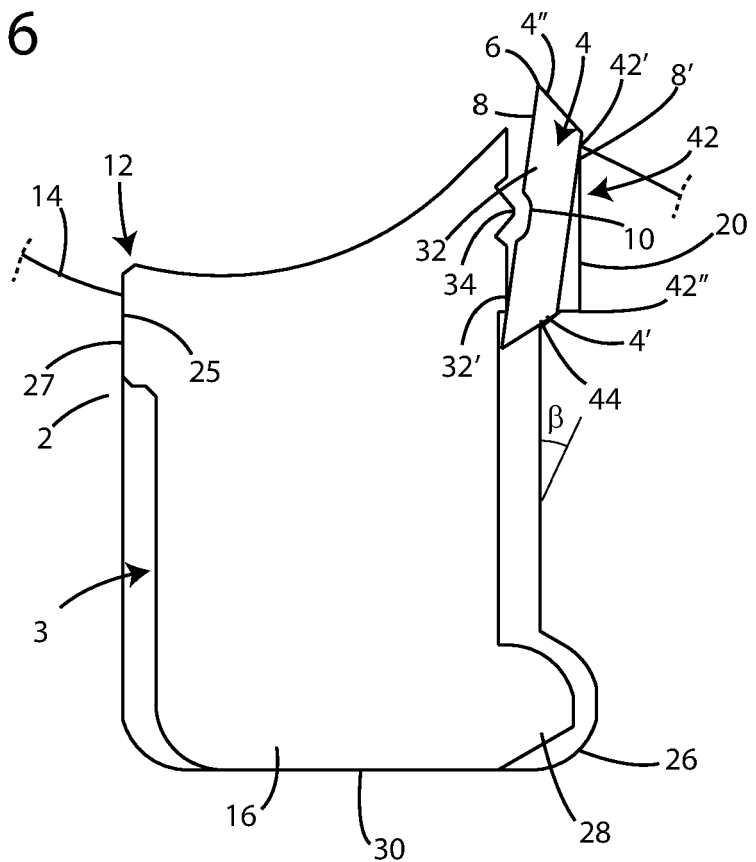


Fig. 7



EUROPEAN SEARCH REPORT

Application Number

EP 26 16 7577

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A	* figures 3-6 * * column 4, line 44 - column 5, line 37 *	13	B27G13/04
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		13 June 2026	Hamel, Pascal
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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