



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
20.01.2016 Bulletin 2016/03

(51) Int Cl.:
B26D 7/26 (2006.01)

(21) Application number: **15176335.6**

(22) Date of filing: **10.07.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA

(72) Inventors:
• **FERRARI, Michele**
40064 OZZANO (IT)
• **LANZARINI, Luca**
40056 CREPELLANO (IT)
• **NEGRINI, Stefano**
40012 CALDERARA DI RENO (IT)

(30) Priority: **16.07.2014 IT BO20140409**

(74) Representative: **Maccagnan, Matteo et al**
Studio Torta S.p.A.
Via Viotti, 9
10121 Torino (IT)

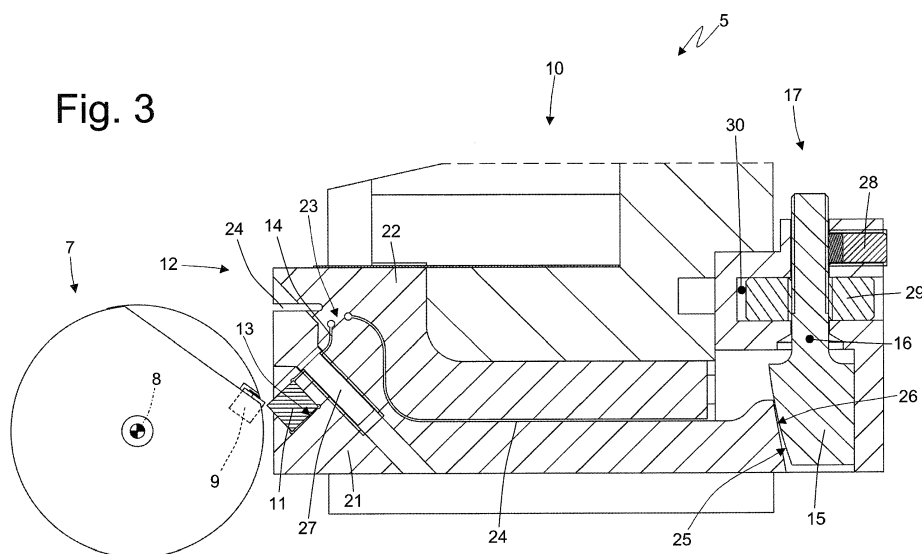
(71) Applicant: **G. D Societa per Azioni**
40133 Bologna (IT)

(54) **CUTTING UNIT FOR CUTTING A STRIP OF PACKING MATERIAL WITH REVERSIBLE ADJUSTING DEVICE FOR ADJUSTING THE BLADE POSITION**

(57) Cutting unit (5) for cutting a strip (3) of packing material; the cutting unit (5) has: a blade (11; 9); a supporting body (12) having a seat (13) for housing the blade (11; 9); and at least one adjusting member (15), which is inserted in a slide channel (16) formed in the supporting body (12) so as to slide axially along the slide channel (16) itself, and is coupled mechanically to the blade (11; 9) to adjust the position of the blade (11; 9); the supporting body (12) is divided into a movable portion (21) in which

the seat (13) housing the blade (11; 9) is formed and in a fixed portion (22) adjacent to the movable portion (21); the movable portion (21) of the supporting body (12) is movable elastically with respect to the fixed portion (22) by elastic deformation; and the adjusting member (15) generates a variable thrust between the movable portion (21) of the supporting body (12) and the fixed portion (22) that moves the movable portion (21) away from the fixed portion (22).

Fig. 3



Description

TECHICAL FIELD

[0001] The present invention relates to a cutting unit for cutting a strip of packing material.

PRIOR ART

[0002] In many packing machines strip packing material is used which is unwound from a reel and is then cut into lengths by a cutting unit.

[0003] Generally, the cutting unit comprises a cutting drum which is mounted rotatable and supports at its corresponding lateral surface (at least) one first blade, and a contrast element (which may be fixed or rotating as well) coupled to the cutting drum and supporting (at least) a second blade which cooperates with the first blade to cyclically perform the transverse cut of the strip of packing material.

[0004] Both blades are subject to wear and therefore it is necessary to periodically replace them (which usually takes place simultaneously for both blades, i.e. generally both blades that cooperate together are changed at the same time). Once the new blades have been mounted it is necessary to adjust the mutual position of the blades themselves so as to obtain an optimal mechanical coupling that allows performing a precise cut without burrs of the strip of packing material, without, at the same time, subjecting the mechanical members to excessive stress (which produces accelerated wear or even breakage of the blades). To be able to adjust the mutual position of the blades, at least one of the two blades is coupled to a set of adjusting screws which are arranged at a certain distance from each other along the whole extension of the blade; each adjusting screw has a tip that touches (directly or indirectly, or with the interposition of a mechanical return element) the blade to be adjusted and can be screwed to push from the inside the blade to be adjusted towards the other blade. In other words, the more an adjusting screw is screwed, the more the tip of the adjusting screw pushes from the inside on the blade to be adjusted towards the other blade, i.e. moves the blade to be adjusted close to the other blade.

[0005] During the replacement of the blades, the operator mounts one blade in a fixed and definitive position onto the corresponding support, while mounting the other blade (to be adjusted) onto the corresponding support in a relatively slack position in order to make an adjustment of the blade position. Before mounting the blade to be adjusted onto the corresponding support the operator unscrews all the adjusting screws, while after mounting the blade to be adjusted onto the corresponding support the operator proceeds to progressively tighten the adjusting screws so as to adjust the position of the blade to be adjusted with respect to the other blade until obtaining an optimal mechanical coupling between the two blades.

[0006] However, it was noted that the adjusting of the

mutual position of the two blades to obtain an optimal mechanical coupling between the two blades themselves is a complex operation (i.e. requiring particularly expert staff) and time consuming (for an experienced operator it will take at least one hour to complete the operation). Consequently, the adjustment of the mutual position of the two blades for obtaining an optimal mechanical coupling turns out to be a particularly expensive operation both for the need to have an experienced operator to intervene (direct cost associated with hourly cost of the expert operator), and for the prolonged machine downtime that this operation entails (indirect cost related to the lack of production of the packaging machine during downtime).

[0007] The patent application EP0318174A2 (in the embodiment illustrated in Figures 11 and 12) describes a cutting unit 224 for cutting a strip 16 of paper in a printing machine; the cutting unit 224 comprises: a blade 164; a supporting body 226 having a seat for housing the blade 164; and an adjusting member 246 (in particular a screw), which is inserted (screwed) inside a slide channel 250 formed on the supporting body 226 so as to be able to slide axially along the slide channel 250 itself and is coupled mechanically to the blade 164 housed inside the seat to adjust the position of the blade 164 according to its own axial position along the slide channel 250. The supporting body 226 is divided into a movable portion 226b in which the seat housing the blade 164 is formed and in a fixed portion 226a adjacent to the movable portion 226b. The movable portion 226b of the supporting body 226 is suited to move elastically with respect to the fixed portion 226a of the supporting body 226 by virtue of elastic deformation of a central portion 226c of the supporting body 226. The adjusting member 246 generates a variable thrust between the movable portion 226b of the supporting body 226 and the fixed portion 226a moving the movable portion 226b towards the fixed portion 226a starting from a neutral state without elastic deformations of the supporting body 226 and consequently determining an elastic deformation of the supporting body 226. In addition, by remaining still along the slide channel 250, the adjusting member 246 allows the movable portion 226b of the supporting body 226 to move closer to the fixed portion 226a (but not to move away from the fixed portion 226a) so as to exploit the elasticity of the supporting body 226 for self-adjusting in use the position of the blade 164 and thus maintaining on the blade 164 a constant contact force with the contrast drum 12 during cutting. Consequently, the function of the adjusting member 246 is to adjust the elastic pre-load of the supporting body 226 to vary (adjust) the contact force that is generated in use between the blade 164 and the contrast drum 12 during cutting. The adjusting member 246 is capable of varying (adjusting) the contact force that is generated in use between the blade 164 and the contrast drum 12 during cutting, but it is not able to detect an exact and definite location of the blade 164 during cutting, since when cutting, the supporting body 226 is

free to deform elastically under the thrust exerted on the blade 164 by the contrast drum 12.

[0008] The patent application GB2200863A describes a cutting unit provided with a drum 3 supporting the knives 8 and with a further drum 6 acting as an anvil; the radial position of the knives 8 is individually adjustable by means of adjusting means 11.

DESCRIPTION OF THE INVENTION

[0009] The object of the present invention is to provide a cutting unit for cutting a strip of packing material, so that the cutting unit thus is free from the drawbacks described above, i.e. it allows to perform the mutual adjusting position of the two blades for obtaining an optimal mechanical coupling in a simple and fast way, and which, at the same time, is easy and inexpensive to produce.

[0010] According to the present invention, a cutting unit, as claimed in the attached claims is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The present invention will now be described with reference to the accompanying drawings, which illustrate some examples of non-limiting embodiments, wherein:

- Figure 1 is a schematic view of a station for feeding the packing material provided with a cutting unit obtained according to the present invention;
- Figure 2 is a schematic view and partly in cross section of the cutting unit of Figure 1;
- Figure 3 is a schematic view and partly in cross section of a different embodiment of the cutting unit of Figure 1;
- Figure 4 is a schematic view and partly in cross section of a further embodiment of the cutting unit of Figure 1;
- Figure 5 is a view in enlarged scale of a detail of Figure 4;
- Figure 6 is a schematic view of a further embodiment of the cutting unit of Figure 1;
- Figures 7 and 8 are two different perspective views of a cutting drum of the cutting unit of Figure 6;
- Figures 9 and 10 are two different front views of the cutting drum of Figures 7 and 8; and
- Figures 11, 12 and 13 are three views in cross section of the cutting drum of Figures 7 and 8 respectively along the section lines XI-XI, XII-XII and XIII-XIII.

PREFERRED EMBODIMENTS OF THE INVENTION

[0012] In Figure 1 number 1 indicates as a whole a station for feeding the packing material to a subsequent packing station 2 (illustrated schematically).

[0013] In the feed station 1, a strip 3 of packing material is unwound from a reel 4, and then is conveyed through

a cutting unit 5 to be cyclically transversely cut so as to separate from the strip 3 of packing material, itself a succession of lengths 6 of packing material which are fed to the packing station 2.

[0014] The cutting unit 5 illustrated schematically in Figure 1 comprises a cutting drum 7 which is mounted rotatable about an axis of rotation 8 and supports at its lateral surface (at least) one blade 9 (of parallelepiped shape as shown in Figure 2); furthermore, the cutting unit 5 illustrated schematically in Figure 1 comprises a fixed contrast element 10 (i.e. arranged in a fixed position and therefore without of movement) that is coupled to the cutting drum 7 and supports a blade 11 (of parallelepiped shape as shown in Figure 2) which cooperates with the blade 9 to cyclically perform the transverse cut of the strip 3 of packing material.

[0015] As shown in Figure 2, the fixed contrast element 10 comprises a supporting body 12 having a seat 13 which is suited to house the blade 11; in the embodiment illustrated in Figure 2, the seat 13 is formed inside the supporting body 12, reproduces in negative the shape of the blade 11 and has an opening towards the outside through which an edge of the blade 11 protrudes from the supporting body 12 to cooperate cyclically with the blade 9 carried by the cutting drum 7. To allow to insert and remove the blade 11 in/from the seat 13, at the seat 13, the supporting body 12 comprises at least one cut 14, which terminates at the seat 13 and generates a localized weakening of the supporting body 12 to allow an elastic deformation of the seat 13. Said elastic deformation of the seat 13 allows to temporarily widen the seat 13 in order to allow an axial movement of the blade 11 and also allows to tighten the seat 13 around the blade 11 so as to lock the blade 11 in a fixed position inside the seat 13 itself. At least one lock screw (known and not illustrated) is provided, which is screwed inside a corresponding threaded hole formed in the supporting body 12 in proximity to the seat 13 and allows tightening the seat 13 around the blade 11; generally multiple lock screws arranged at a certain distance from each other along the axial extent of the blade 11 are provided. In other words, by unscrewing the lock screw it is possible to allow a widening of the seat 13 in order to allow an axial movement of the blade 11, while tightening the lock screw the seat 13 is tightened around the blade 11 to lock the blade 11 in a fixed position inside the seat 13. By way of example, the cut 14 may be obtained by means of spark erosion.

[0016] The fixed contrast element 10 comprises at least one adjusting member 15, which is inserted in a slide channel 16 formed in the supporting body 12 so as to slide axially along the slide channel 16 itself. The axial position of the adjusting member 15 along the slide channel 16 (i.e. the axial movement of the adjusting member 15 along the slide channel 16) is controlled by an actuating device 17 that is normally operated manually.

[0017] In the embodiment illustrated in Figure 2, the adjusting member 15 has a central threaded hole 18 and

the actuating device 17 comprises an actuating screw 19, which is screwed inside the threaded hole 18 of the adjusting member 15 and is arranged in an axially fixed position on the supporting body 12 so that rotation of the actuating screw 19 produces a corresponding axial sliding of the adjusting member 15 along the slide channel 16. According to a preferred embodiment, the actuating screw 19 is also housed inside the slide channel 16 and a head of the actuating screw 19 is locked axially between a shoulder of the slide channel 16 and a retaining member 20 on the side opposite the shoulder; in this embodiment, the slide channel 16 is entirely without threads. The retaining member 20 has centrally a through hole, through which the head of the actuating screw 19 is reachable from the outside so that a user can rotate the actuating screw 19 by means of a screwdriver in order to translate the adjusting member 15 axially along the slide channel 16.

[0018] According to a preferred embodiment, the actuating device 17 comprises a locking screw (not shown), which is suited to push radially on the adjusting member 15 to prevent the sliding of the adjusting member 15 along the slide channel 16. Said locking screw is opened, when necessary, to axially translate the adjusting member 15 along the slide channel 16 and is closed once having reached the desired axial position of the adjusting member 15 along the slide channel 16 so as to "freeze" the desired axial position thereof.

[0019] According to a different embodiment not illustrated, the adjusting member 15 centrally does not have a threaded hole, the actuating screw 19 is screwed inside the slide channel 16 (which, for this purpose, is at least partially threaded) and has one end resting on the adjusting member 15 so that rotation of the actuating screw 19 produces a corresponding axial sliding of the adjusting member 15 along the slide channel 16 (i.e. the end of the actuating screw 19 pushes on a side of the adjusting member 15). In this embodiment, the actuating device 17 comprises a return spring, which is arranged in the slide channel 16 on the opposite side to the actuating screw 19 and which pushes the adjusting member 15 towards the actuating screw 19; thanks to the thrust exerted by the return spring, the adjusting member 15 is always in contact with the end of the actuating screw 19.

[0020] The adjusting member 15 is mechanically coupled to the blade 11 housed inside the seat 13 for adjusting the position of the blade 11 according to its own axial position along the slide channel 16; in other words, by moving axially the adjusting member 15 along the slide channel 16 the position of the blade 11 is modified accordingly, i.e. the position of the seat 13 carrying the blade 11 is modified accordingly. The supporting body 12 is divided into a movable portion 21 in which the seat 13 housing the blade 11 is formed and a fixed portion 22 adjacent to the movable portion 21. The movable portion 21 of the supporting body 12 is suited for moving elastically with respect to the fixed portion 22 by virtue of an elastic deformation of a border area 23 of the supporting

body 12 arranged between the movable portion 21 and the fixed portion 22. The adjusting member 15 generates a variable thrust (depending on the axial position of the adjusting member 15 along the slide channel 16) between the movable portion 21 of the supporting body 12 and the fixed portion 22 of the supporting body 12 that moves the movable portion 21 away from the fixed portion 22 starting from a neutral state with no elastic deformation of the supporting body 12 and consequently determining an elastic deformation of the supporting body 12.

[0021] In other words, the supporting body 12 is locally weakened so as to create a border area 23 dividing the supporting body 12 in a movable portion 21 (in which the seat 13 housing the blade 1 is formed) and in a fixed portion 22 and is suited to deform elastically for producing a relative displacement between the movable portion 21 and the fixed portion 22. The adjusting member 15 is interposed between the movable portion 21 of the supporting body 12 and the fixed portion 22 of the supporting body 12 to generate a variable thrust (depending on the axial position of the adjusting member 15 along the slide channel 16) moving the movable portion 21 away from the fixed portion 22 starting from a neutral state with no elastic deformation of the supporting body 12 and consequently determining an elastic deformation of the supporting body 12. By axially moving the adjusting member 15 along the slide channel 16 in one direction the thrust is increased and thus the movable portion 21 of the supporting body 12 is further moved away from the fixed portion 22 of the supporting body 12, while by moving axially the adjusting member 15 along the slide channel 16 in the opposite direction the thrust is decreased, and thus the movable portion 21 of supporting body 12 moves close to the fixed portion 22 of the supporting body 12 by elastic return.

[0022] It is important to note that starting from a neutral state without elastic deformations of the supporting body 12, the movement of the adjusting member 15 along the slide channel 16 is suited for moving the movable portion 21 away from the fixed portion 22 creating, consequently, an elastic deformation of the supporting body 12, but the movement of the adjusting member 15 along the slide channel 16 is not able to move (beyond the neutral condition without elastic deformations of the supporting body 12) the movable portion 21 close to the fixed portion 22.

[0023] Also, it is important to observe that by remaining still along the slide channel 16, the adjusting member 15 keeps the movable portion 21 of the supporting body 12 at a given and constant distance from the fixed portion 22 of the supporting body 12 thus preventing the movable portion 21 from moving close to the fixed portion 22; therefore in use the fixed portion 22 of the supporting body 12 (carrying the blade 11) remains in a fixed position, as the contact between the two blades 9 and 11 presses the blade 11, i.e. compresses the blade 11 tending to move the movable portion 21 close to the fixed portion 22 and instead does not apply any type of traction to the blade 11 (i.e. does not tend in any way to further

move the movable portion 21 away from the fixed portion 22). This characteristic is important to ensure that only an axial sliding of the adjusting member 15 along the slide channel 16 can adjust the position of the blade 11 (i.e. the fixed portion 22 of the supporting body 12 carrying the blade 11); in this way, the adjusting member 15 is usable to adjust the position of the blade 11 until reaching the optimal position of the blade 11 itself.

[0024] In the embodiment illustrated in Figure 2, the supporting body 12 comprises a pair of cuts 24 separating the movable portion 21 from the fixed portion 22 and delimiting the border area 23; the two cuts 24 are arranged at a certain distance (nonzero) from each other and the border area 23 of the supporting body 12 is bounded by the two cuts 24 (i.e. is comprised between the two cuts 24). According to a different embodiment, the supporting body 12 may comprise a single cut 24 separating the movable portion 21 from the fixed portion 22, or may comprise more than two cuts 24 which separate the movable portion 21 from the fixed portion 22. According to further embodiments, the elastic deformation of the border area 23 of the supporting body 12 might not be obtained by means of cuts 24, but by using other weakening means of the supporting body 12.

[0025] In the embodiment illustrated in Figure 2, the adjusting member 15 has an inclined surface 25, through which the adjusting member 15 varies the position of the blade 11 according to its own axial position along the slide channel 16. In other words, the adjusting member 15 is wedge-shaped and has on one side the inclined surface 25 through which the adjusting member 15 pushes on the movable portion 21 of the supporting body 12, i.e. the thrust of the adjusting member 15 on the movable portion 21 of the supporting body 12 takes place through the inclined surface 25. The inclined surface 25 of the adjusting member 15 pushes on the movable portion 21 of the supporting body 12 along a direction of thrust which is perpendicular to the axial sliding direction of the adjusting member 15 along the slide channel 16. Preferably, the movable portion 21 of the supporting body 12 has an inclined plane 26 which is arranged in contact with the inclined surface 25 of the adjusting member 15; obviously the two inclined surfaces 25 and 26 have identical or at least similar inclinations so as to slide easily one with respect to the other. Essentially, the inclined surface 25 of the adjusting member 15 which pushes (indirectly) on the blade 11 housed inside the seat 13; i.e. the inclined surface 25 of the adjusting member 15 is not in direct contact with the blade 11 housed inside the seat 13, but pushes on the movable portion 21 of the supporting body 12 which carries the seat 13 housing the blade 11 (accordingly, the inclined surface 25 of the adjusting member 15 indirectly pushes on the blade 11 housed inside the seat 13).

[0026] In the embodiment illustrated in Figure 2, the inclined surface 25 of the adjusting member 15 indirectly pushes on the blade 11 housed inside the seat 13, i.e. the inclined surface 25 of the adjusting member 15 is not

in direct contact with the blade 11. According to an alternative embodiment not illustrated, the inclined surface 25 of the adjusting member 15 pushes directly on the blade 11 housed inside the seat 13, i.e. the inclined surface 25 of the adjusting member 15 is in direct contact with the blade 11.

[0027] In Figure 2 only one adjusting member 15 coupled to a corresponding actuating screw 19 is illustrated; in fact, more adjusting members 15 arranged mutually parallel and side by side at a certain distance from each other are normally provided, which are coupled to corresponding adjusting screws 19 and push on corresponding portions of the blade 11. In other words, being the blade 11 relatively axially extended not only one single adjusting member 15 is used pushing on a single area of the blade 11, but more adjusting members 15, mutually parallel and spaced apart from each other, pushing on corresponding different areas of the blade 11 are used.

[0028] In the embodiment illustrated in Figure 2, only the blade 11 is coupled to the adjusting members 15; alternatively only the blade 9 may be coupled to the adjusting members 15, or both blades 9 and 11 may be coupled to corresponding adjusting members 15.

[0029] In Figures 3 a different embodiment of the cutting unit 5 described above is illustrated.

[0030] In Figure 3 a lock screw 27 is illustrated, which is screwed inside a corresponding threaded hole formed on the supporting body 12 (in particular in the movable portion 21 of the supporting body 12) in the vicinity of the seat 13 and it allows the tightening of the seat 13 around the blade 11. Furthermore, in Figure 3 is illustrated a locking screw 28, which is suited for pushing radially on the adjusting member 15 to prevent the sliding of the adjusting member 15 along the slide channel 16. In particular, the locking screw 28 is screwed inside a threaded hole that is arranged perpendicularly to the slide channel 16 and ends inside the slide channel 16 itself; in this way, the tip of the locking screw 28 can press against the slide channel 15 to prevent the sliding of the adjusting member 15 along the slide channel 16.

[0031] The cutting unit 5 illustrated in Figure 3 differs from the cutting unit 5 illustrated in Figure 2 due to the conformation of the main elements and due to the conformation of the actuating device 17.

[0032] The actuating device 17 illustrated in Figure 3 does not comprise the actuating screw 19 which is replaced by a threaded actuating ring nut 29, which is screwed about a threaded portion of the adjusting member 15 and is arranged in an axially fixed position in the supporting body 12 (in particular in the fixed portion 22 of the supporting body 12) so that the rotation of the actuating ring nut 29 determines the corresponding axial sliding of the adjusting member 15 along the slide channel 16. In particular, the actuating ring nut 29 is inserted inside a housing 30 which is formed on the supporting body 12 and has axially a size (substantially) equal to the size of the actuating ring nut 29.

[0033] In Figures 4 and 5 a different embodiment of

the cutting unit 5 described above is illustrated.

[0034] The cutting unit 5 illustrated in Figures 4 and 5 differs from the cutting unit 5 illustrated in Figure 3 due to the conformation of the main elements and in that it is the blade 9 (and not the blade 11) which is coupled to the adjusting members 15. In other words, in the embodiment illustrated in Figures 4 and 5 the adjusting members 15 are coupled to the blade 9 carried by the rotatable cutting drum 7, instead of being coupled to the blade 11 carried by the fixed support 10 (as in the cutting unit 5 illustrated in Figure 3).

[0035] In Figures 6-13 a further embodiment of the cutting unit 5 described above is illustrated. The embodiment illustrated in Figures 6-13 differs from the cutting unit 5 illustrated in Figures 4 and 5 for the conformation of the main elements and for the fact that also the fixed support 10 is mounted to rotate about a corresponding axis of rotation parallel to the axis of rotation 8.

[0036] In the embodiment illustrated in Figures 6-13, the cutting drum 7 comprises a pair of twin blades 9 which are arranged in mirror image one with respect to the other and are coupled to corresponding adjusting members 15.

[0037] Furthermore, in the embodiment illustrated in Figures 6-13, each blade 9 is tightened on the inside of the corresponding seat 9 by a lock body 31 which is independent and separate from the supporting body 12 and is connected to the supporting body 12 by a plurality of lock screws 27.

[0038] In the embodiments illustrated in the attached figures, the cutting units 5 comprise both a coupling by means of the inclined surface 25 between the adjusting member 15 and the blade 9 or 11, and an elastic deformability of the supporting body 12. According to other embodiments not illustrated, a cutting unit 5 could comprise only the inclined surface 25 between the adjusting member 15 and the blade 9 or 11 (i.e. without an elastic deformability from the supporting body 12), or only an elastic deformability of the supporting body 12 (i.e. without the presence of the inclined surface 25 between the adjusting member 15 and the blade 9 or 11).

[0039] The cutting units 5 described above have numerous advantages.

[0040] First, the cutting units 5 described above allow to adjust in both directions the position of the blade 9 or 11, that is, by axially moving an adjusting member 15 in a direction (turning the corresponding actuating screw 19 or the corresponding actuating ring nut 29) the blade 9 or 11 is moved close to the other blade 11 or 9 (as occurs even in the known cutting units) and by moving axially the adjusting member 15 in the opposite direction (turning the corresponding actuating screw 19 or the corresponding actuating ring nut 29) the blade 9 or 11 is moved away from the other blade 11 or 9 (this condition does not occur in the known cutting unit) thanks to the elasticity in the system that makes bidirectional the movement of the seat 13 housing the blade 9 or 11.

[0041] In other words, in the known cutting units a blade may be pushed towards the other blade by acting on the

corresponding actuating device, but it is never possible to move a blade away from the other blade if not by dismounting and then remounting the blade and starting to adjust the position from the beginning (i.e. by resetting and starting over); in fact, in the known cutting units the actuating device is monodirectional, i.e. is only able to push a blade towards the other blade and is not able to move a blade away from the other blade. Consequently, if during the adjustment of the position of the blades the two blades are accidentally moved too close it is no longer possible to move the two blades slightly away from each other acting on the corresponding actuating device but it is necessary to disassemble and replace at least one blade, and then re start the adjustment of the position from the beginning (i.e. by resetting and starting over).

[0042] Instead, in the cutting units 5 described above there is elasticity acting between the movable portion 21 and the fixed portion 22 of the supporting body 12 and which pushes the movable portion 21 (in which the seat 13 housing the blade 9 or 11 is formed); consequently, the actuating device 17 turns out to be bidirectional (reversible), i.e. it is able to both move a blade 9 or 11 towards the other blade 11 or 9, and to move the blade 9 or 11 away from the other blade 11 or 9. Such feature greatly simplifies and quickens the adjustment of the mutual position of the two blades 9 and 11 since by allowing to correct any positioning errors by virtue of bidirectionality (reversibility) it allows to act on the position of the blade 9 or 11 with much more freedom and rapidity.

[0043] Furthermore, the cutting units 5 described above allow a very fine adjustment of the position of the blade 9 or 11 thanks to the use of an inclined surface 25, through which the adjusting member 15 varies the position of the blade 9 or 11 as a function of its axial position along the slide channel 16. The inclined surface 25 acts as a "reduction gear" of the stroke of the adjusting member 15 since an axial movement of the adjusting member 15 along the slide channel 16 is transformed by the inclined surface 25 in a significantly smaller movement of the movable portion 21 of the supporting body 12 with respect to the fixed portion 22. The "gear ratio" of the inclined surface 25 is equal to the tangent of the inclination angle of the inclined surface 25; in the embodiment illustrated in the attached figures, the inclination angle of the inclined surface 25 is between 10 and 15°, and therefore the "gear ratio" of the inclined surface 25 is approximately 3.7-5.7 (i.e. to obtain a displacement of 1 mm of the movable portion 21 of the supporting body 12 with respect to the fixed portion 22 it is necessary that the adjusting member 15 axially translates along the slide channel 16 by approximately 3.7-5.7 mm). Thanks to this "speed reduction" effect of the stroke of the adjusting member 15 obtained by way of the inclined surface 25, it is possible to adjust in a much finer way (sensitive) the position of the blade 9 or 11 to the advantage of simplicity (and therefore effectiveness and efficiency) of the adjustment of the mutual position of the two blades 9 and 11.

[0044] Finally, the cutting units 5 described above are

also easy and inexpensive to produce, since they have an overall structure similar to the known cutting unit 5 with respect to which they differ in relatively few details of simple implementation. For example, the subdivision of the supporting body 12 in a movable portion 21 and in a fixed portion 22 is achievable with extreme simplicity by performing in supporting body 12 one or two cuts 24 (for example achievable by means of spark erosion or milling in an easy and inexpensive way).

Claims

1. A cutting unit (5) for cutting a strip (3) of packing material; the cutting unit (5) comprising:

at least one blade (11; 9);
a supporting body (12) having a seat (13) for housing the blade (11; 9); and

at least one adjusting member (15), which is inserted in a slide channel (16) formed in the supporting body (12) so as to slide axially along the slide channel (16), and is coupled mechanically to the blade (11; 9) housed inside the seat (13) to adjust the position of the blade (11; 9) according to its own axial position along the slide channel (16);

wherein the supporting body (12) is divided into a movable portion (21) in which the seat (13) housing the blade (11; 9) is formed and a fixed portion (22) adjacent to the movable portion (21); and

wherein the movable portion (21) of the supporting body (12) is movable elastically with respect to the fixed portion (22) by elastic deformation of the supporting body (12) itself;

the cutting unit (5) being **characterized in that:**

by sliding axially along the slide channel (16), the adjusting member (15) generates a variable thrust between the movable portion (21) of the supporting body (12) and the fixed portion (22) of the supporting body (12) that moves the movable portion (21) away from the fixed portion (22) starting from a neutral state without elastic deformations of the supporting body (12) and consequently determining an elastic deformation of the supporting body (12); and

by remaining still along the slide channel (16), the adjusting member (15) maintains the movable portion (21) of the supporting body (12) at a given and constant distance from the fixed portion (22) of the supporting body (12) thus preventing the movable portion (21) to move close to the fixed portion (22).

2. The cutting unit (5) according to Claim 1, wherein the movable portion (21) of the supporting body (12) is movable elastically with respect to the fixed portion (22) by virtue of elastic deformation of a border area (23) of the supporting body (12) arranged between the movable portion (21) and the fixed portion (22).
3. The cutting unit (5) according to Claim 2, wherein the supporting body (12) comprises at least one cut (24) separating the movable portion (21) from the fixed portion (22).
4. The cutting unit (5) according to Claim 3, wherein the border area (23) of the supporting body (12) is bounded by the cut (24).
5. The cutting unit (5) according to Claim 3 or 4, wherein the supporting body (12) comprises two cuts (24) separating the movable portion (21) from the fixed portion (22), and are located at a nonzero distance one from the other.
6. The cutting unit (5) according to Claim 5, wherein the border area (23) of the supporting body (12) is bounded by the two cuts (24).
7. The cutting unit (5) according to one of Claims 1 to 6, wherein the adjusting member (15) has a first inclined surface (25) by which the adjusting member (15) adjusts the position of the blade (11; 9) according to its own axial position along the slide channel (16).
8. The cutting unit (5) according to Claim 7, wherein the first inclined surface (25) of the adjusting member (15) pushes on the movable portion (21) of the supporting body (12) in a thrust direction perpendicular to the axial slide direction of the adjusting member (15) along the slide channel (16).
9. The cutting unit (5) according to Claim 8, wherein the movable portion (21) of the supporting body (12) has a second inclined surface (26) which is arranged in contact with the first inclined surface (25) the adjusting member (15).
10. The cutting unit (5) according to one of Claims 1 to 9 and comprising a lock screw (28), which pushes radially on the adjusting member (15) to prevent the sliding of the adjusting member (15) along the slide channel (16).
11. The cutting unit (5) according to one of Claims 1 to 10 and comprising a threaded actuating ring nut (29) screwed about a threaded portion of the adjusting member (15) and arranged in an axially fixed position inside the supporting body (12), so that rotation of the actuating ring nut (29) produces a corresponding

axial sliding of the adjusting member (15) along the slide channel (16).

12. The cutting unit (5) according to Claim 11, wherein the actuating ring nut (29) is inserted inside a housing (30) formed in the supporting body (12) and of the same size axially as the actuating ring nut (29). 5

13. The cutting unit (5) according to one of Claims 1 to 10 and comprising an actuating screw (19) screwed inside a threaded hole (18) of the adjusting member (15) and arranged in an axially fixed position inside the supporting body (12) so that the rotation of the actuating screw (19) produces a corresponding axial sliding of the adjusting member (15) along the slide channel (16). 10 15

14. The cutting unit (5) according to Claim 13, wherein:
 - the actuating screw (19) is arranged along the slide channel (16); and 20
 - the head of the actuating screw (19) is locked axially between a shoulder of the slide channel (16) and a retaining member (20) on the opposite side of the shoulder. 25

15. The cutting unit (5) according to one of Claims 1 to 10 and comprising:
 - an actuating screw (19) screwed inside the slide channel (16), 30
 - and one end of which rests on the adjusting member (15) so that the rotation of the actuating screw (19) produces a corresponding axial sliding of the adjusting member (15) along the slide channel (16); and 35
 - a return spring, which is arranged in the slide channel (16) on the opposite side to the actuating screw (19) and which pushes the adjusting member (15) towards the actuating screw (19). 40

45

50

55

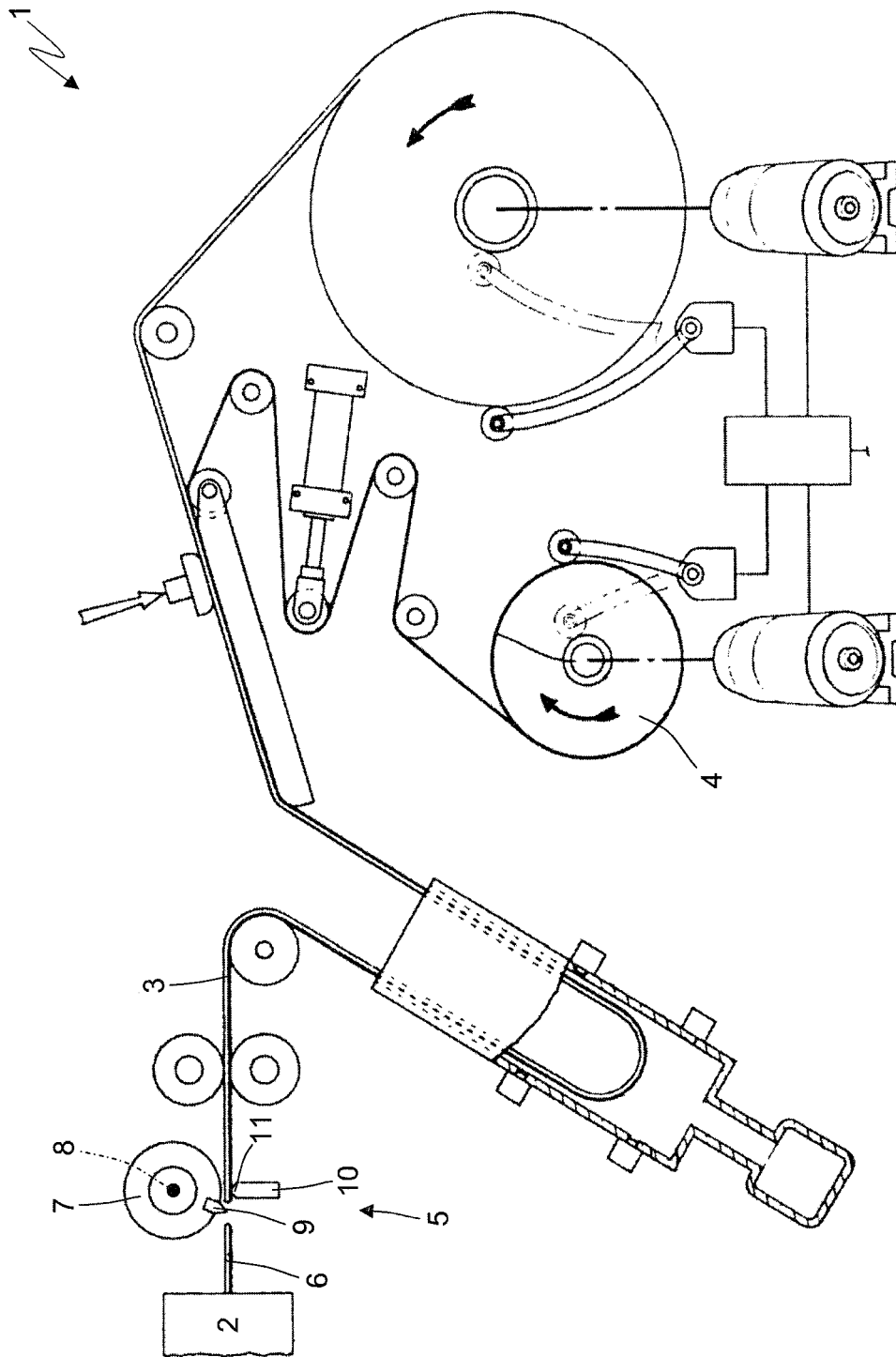


Fig. 1

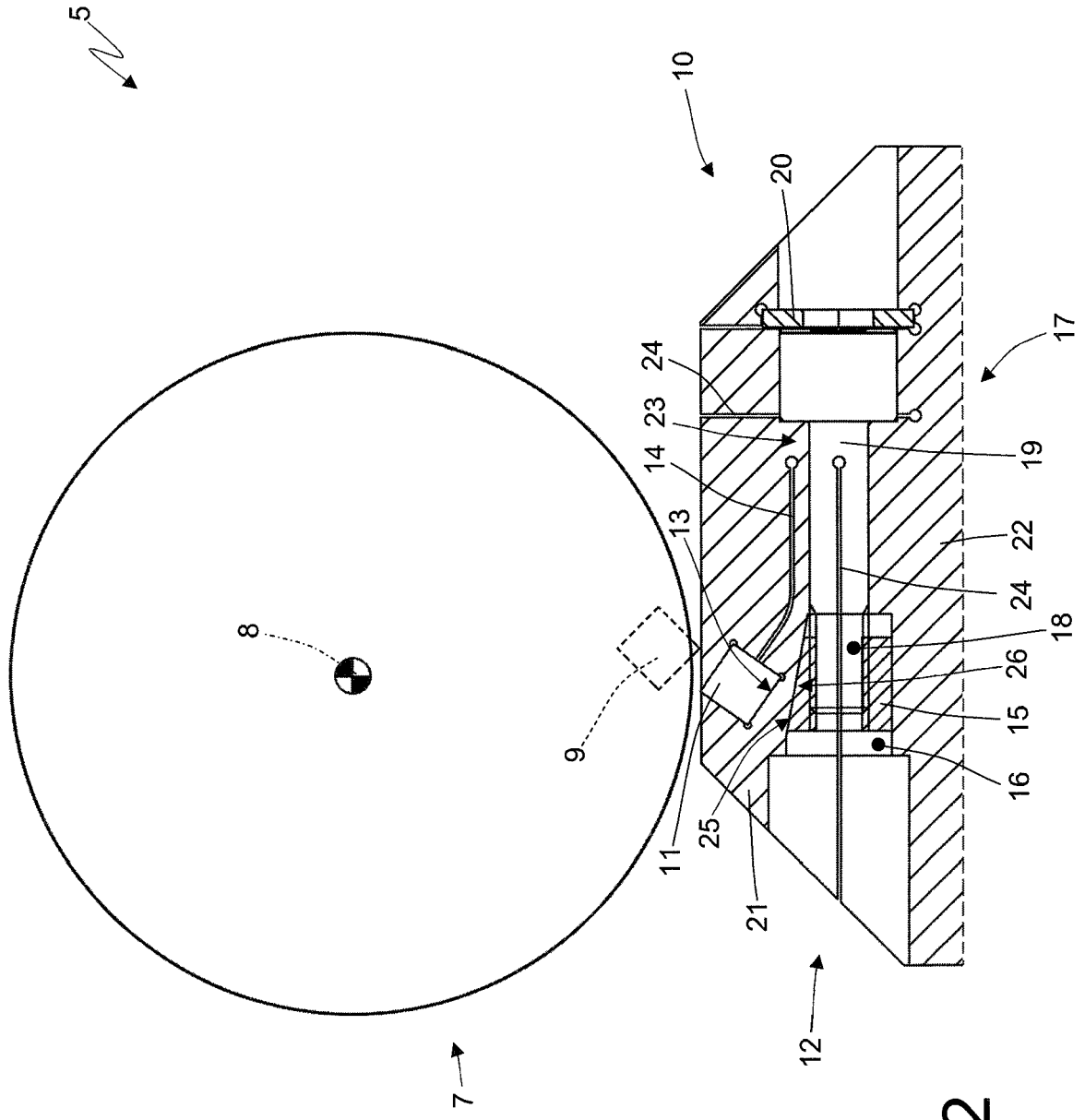
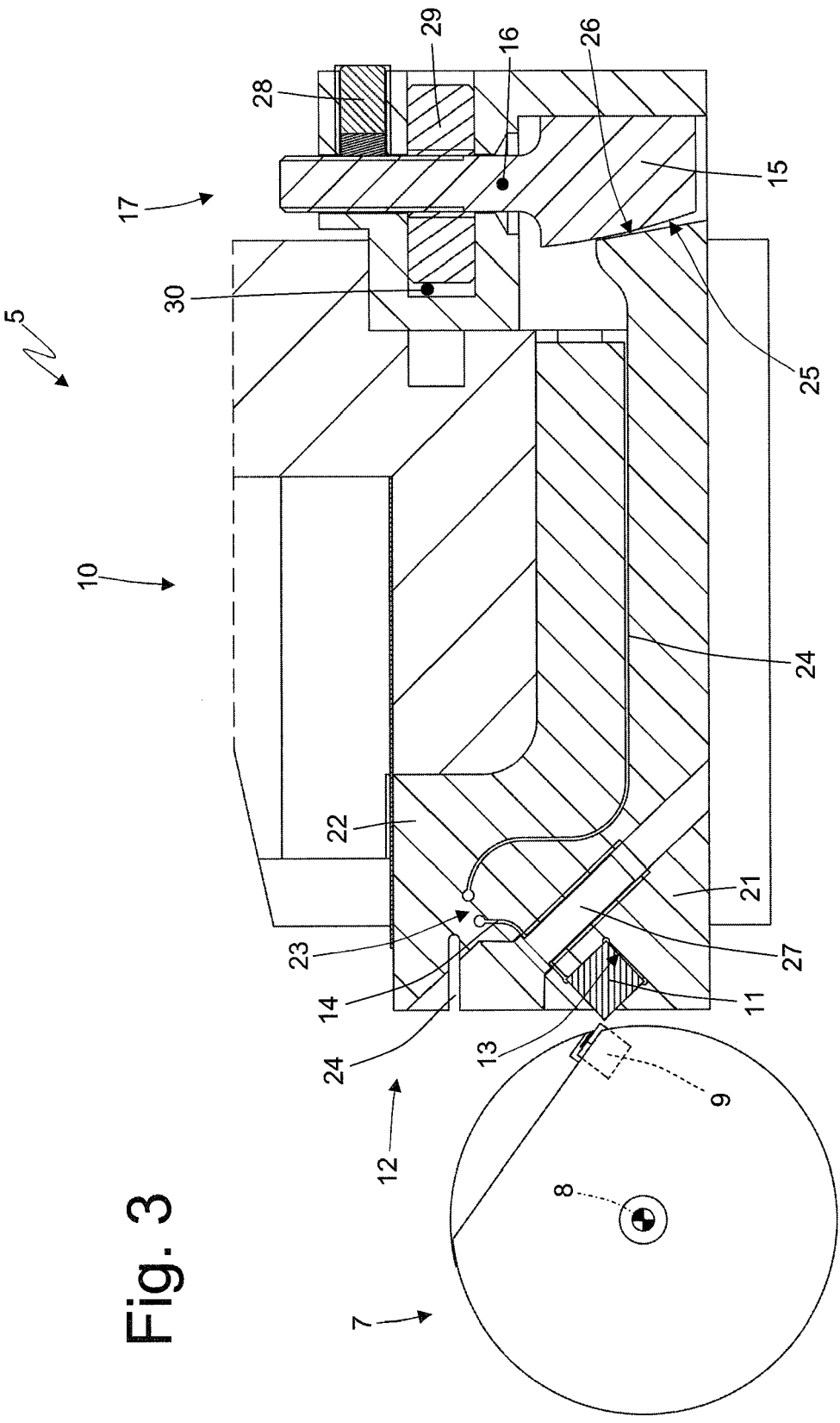


Fig. 2

Fig. 3



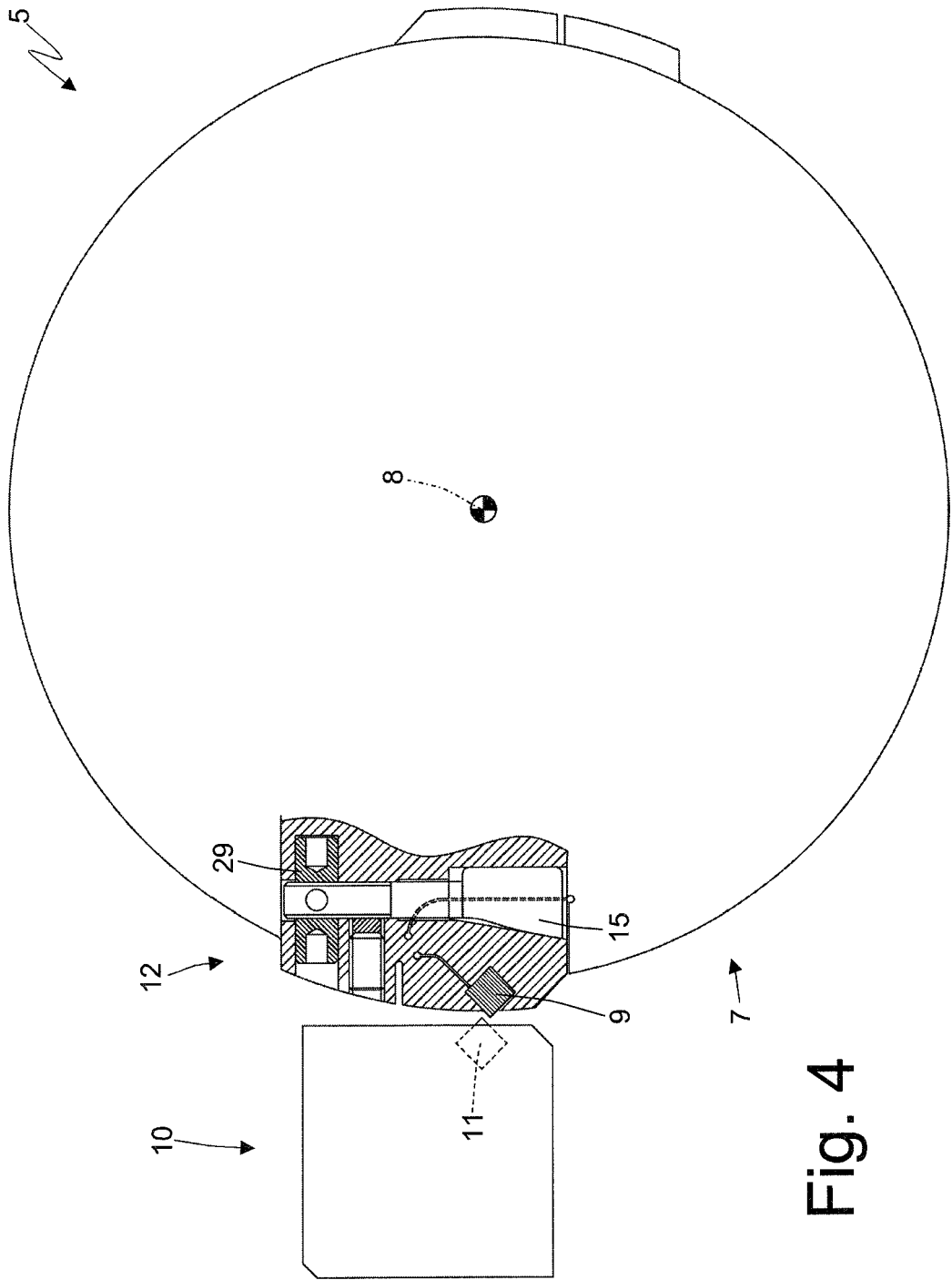
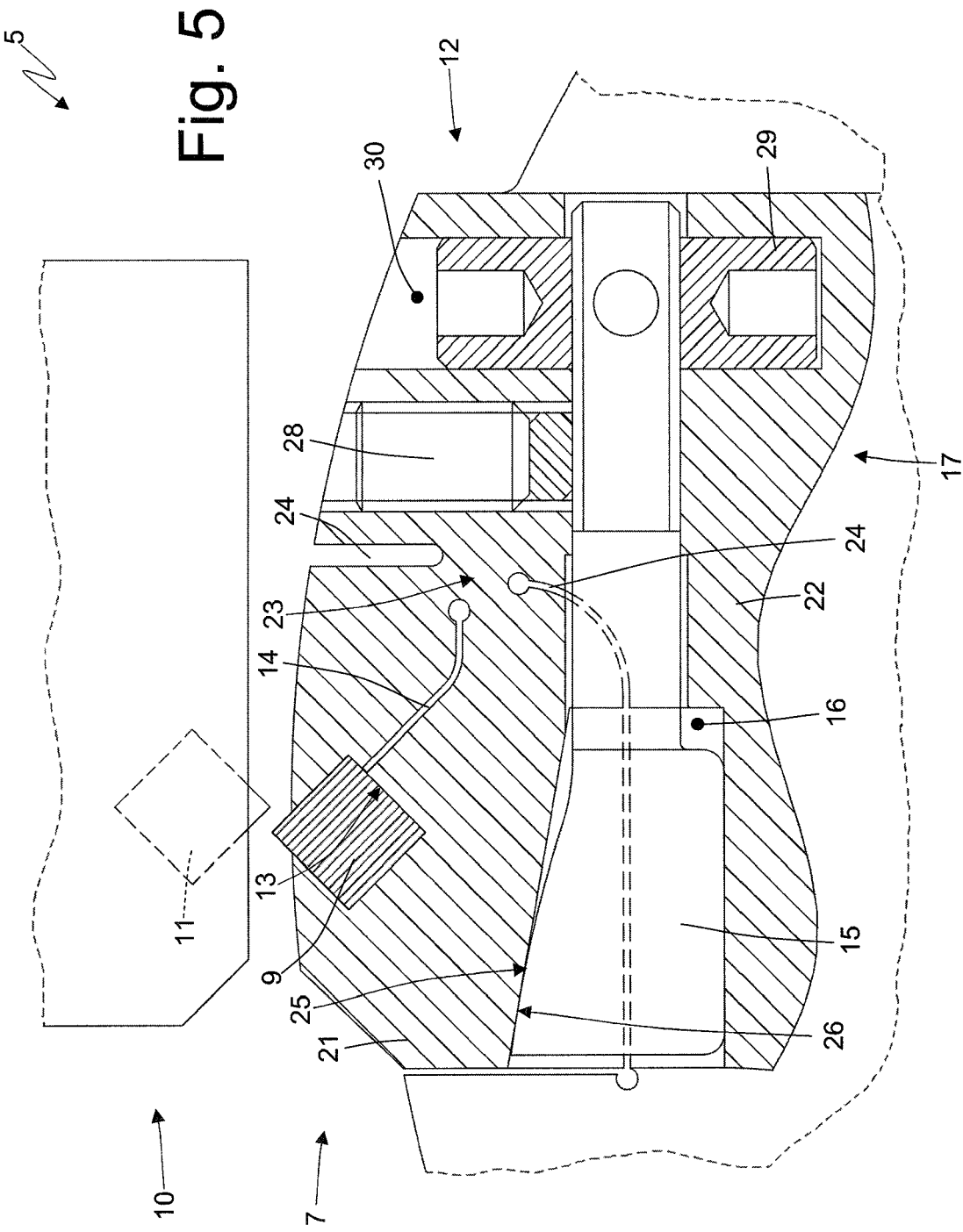


Fig. 4



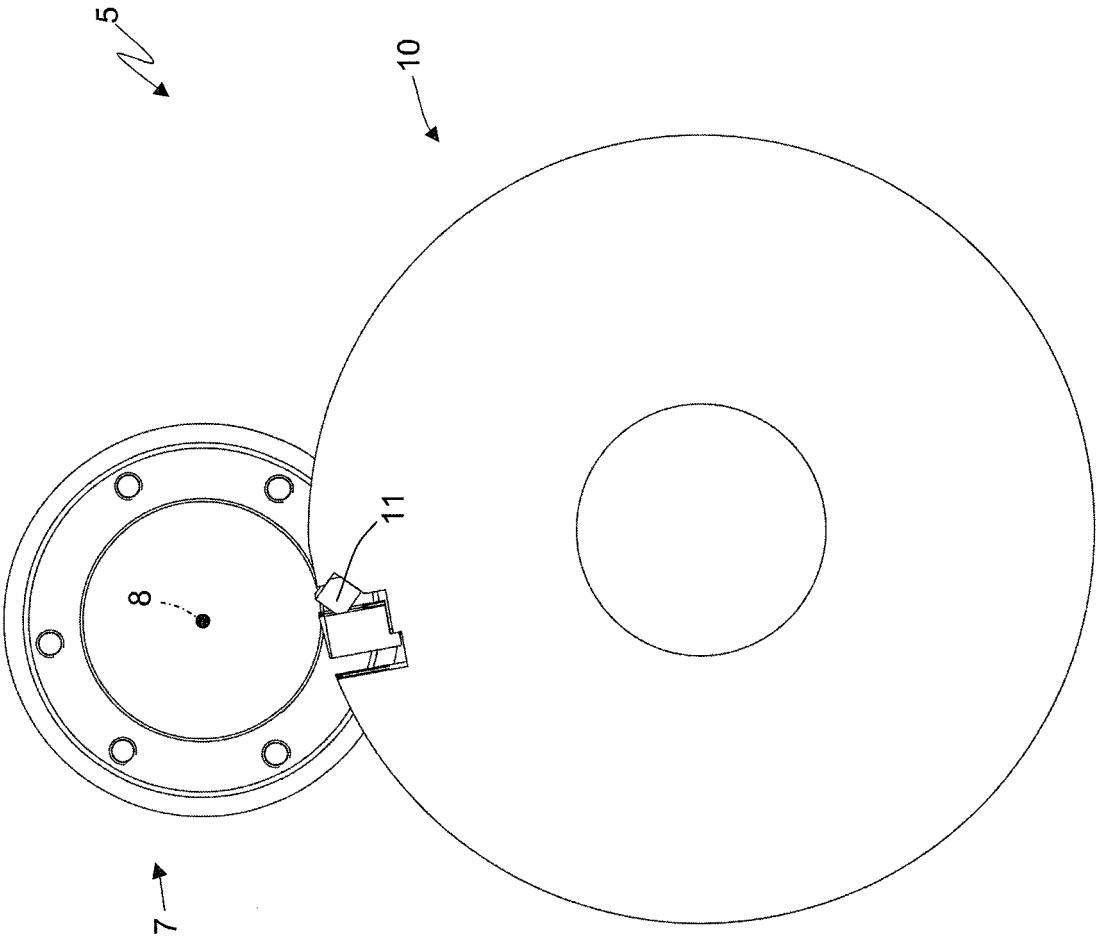


Fig. 6

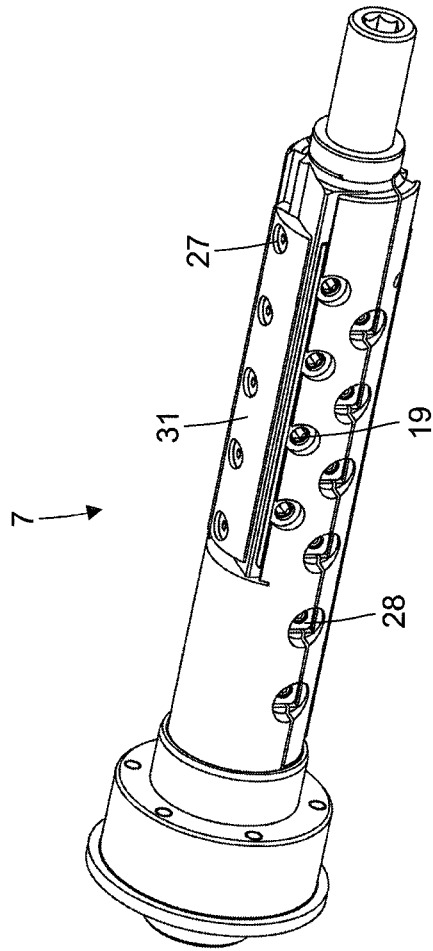
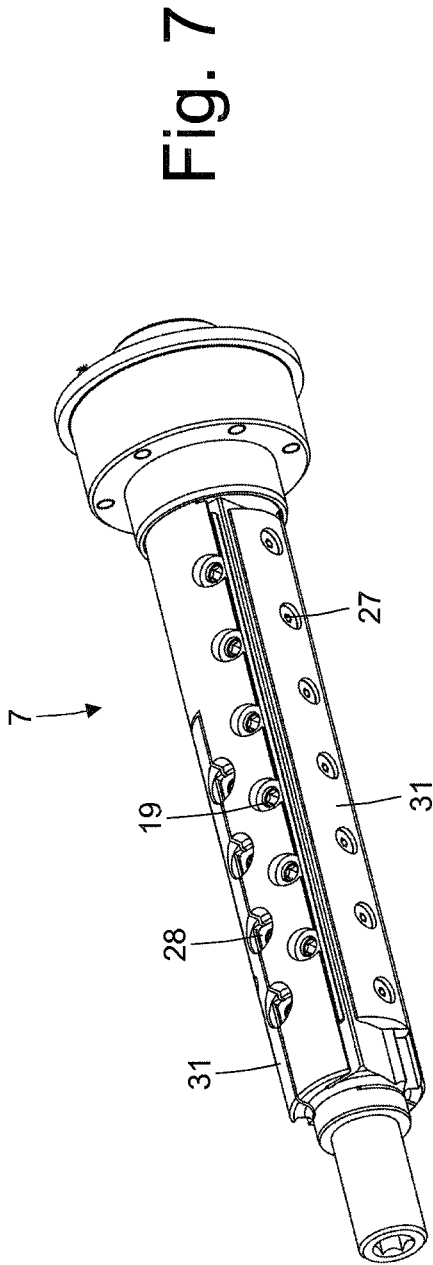


Fig. 8

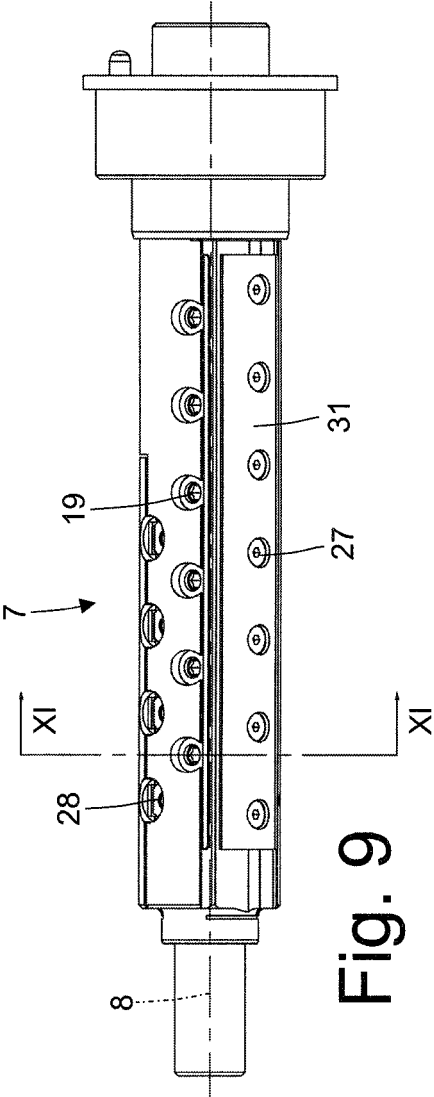


Fig. 9

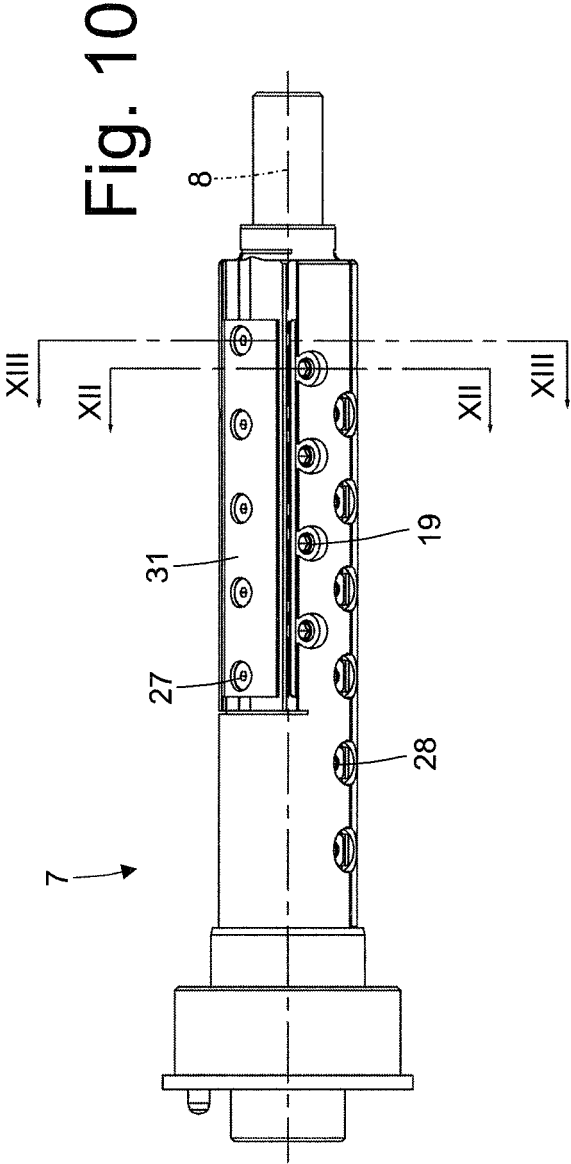


Fig. 10

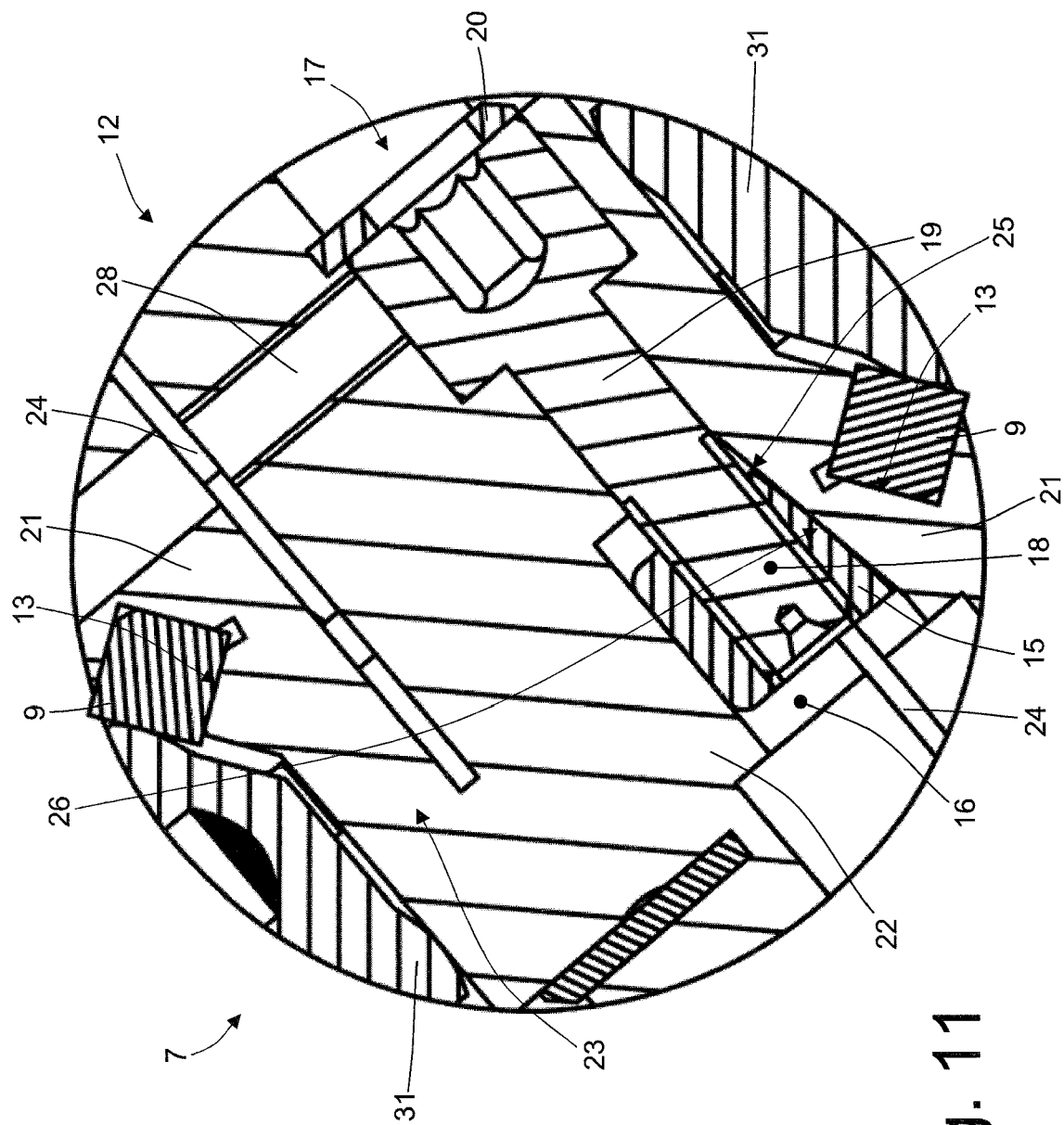


Fig. 11

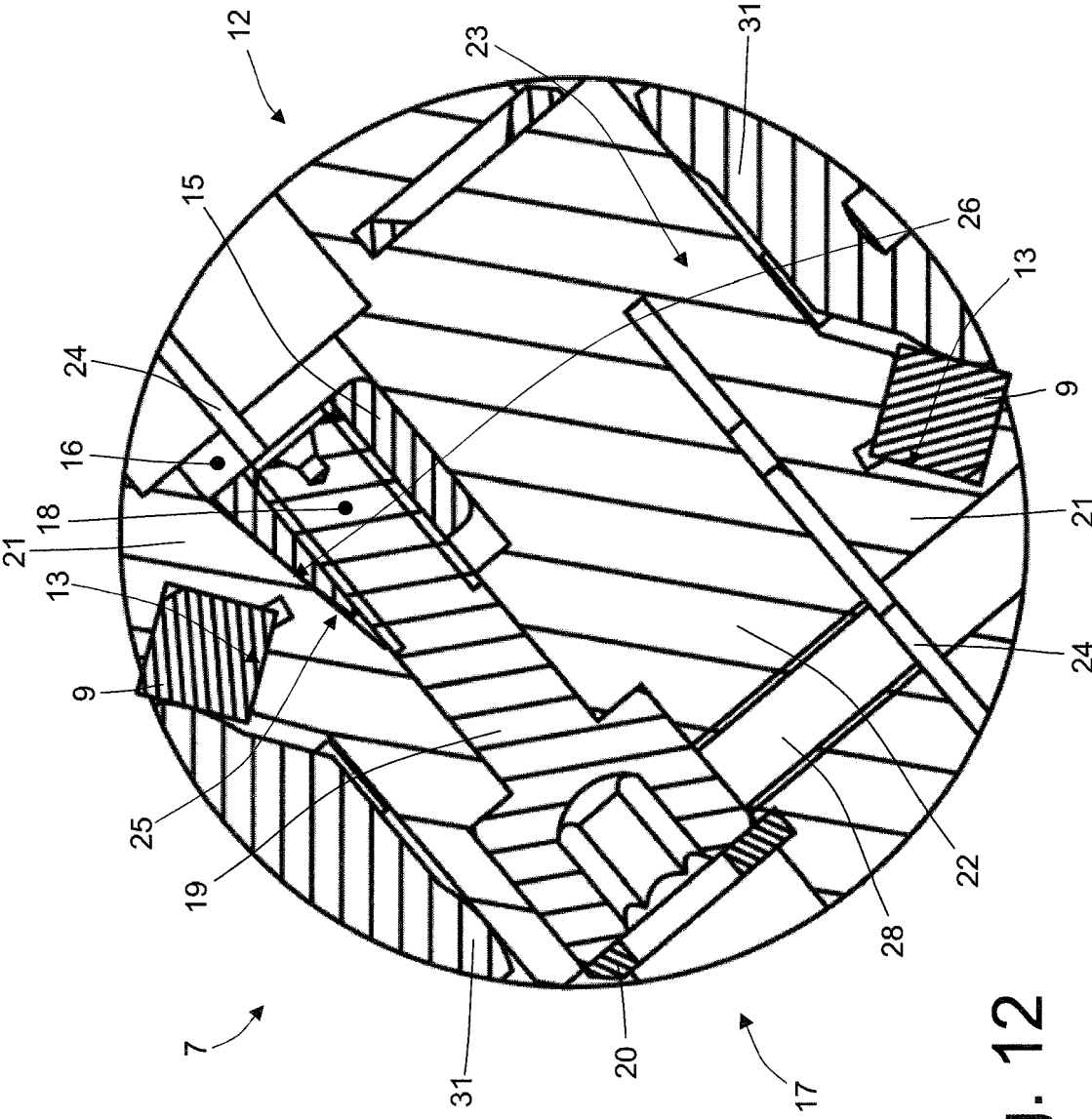


Fig. 12

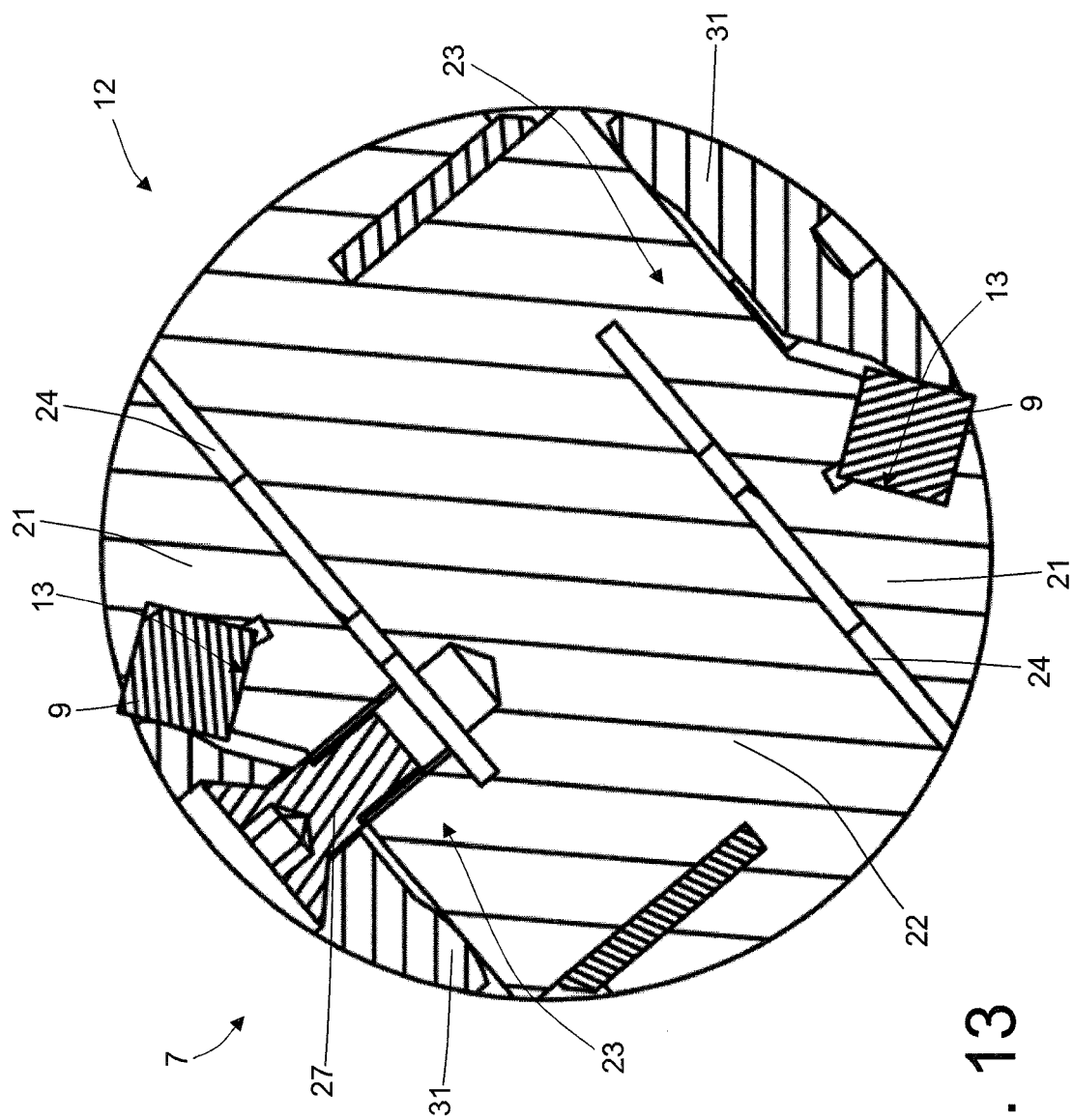


Fig. 13



EUROPEAN SEARCH REPORT

 Application Number
 EP 15 17 6335

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	WO 2011/012333 A1 (SIDEL SPA [IT]; CARMICHAEL JAMES [IT]) 3 February 2011 (2011-02-03) * page 6, line 11 - page 8, line 5; figures 2,3 *	1-15	INV. B26D7/26
X	EP 2 703 135 A1 (PASABAN S A [ES]) 5 March 2014 (2014-03-05) * figures 11,12,15,16 *	1-15	
Y	EP 0 318 174 A2 (SCHEFFER INC [US]) 31 May 1989 (1989-05-31) * figure 12 *	1-15	
A	GB 2 200 863 A (KOERBER AG) 17 August 1988 (1988-08-17) * the whole document *	1-15	
A	EP 0 198 221 A1 (SASIB SPA [IT]) 22 October 1986 (1986-10-22) * the whole document *	1-15	
A	EP 2 386 388 A1 (HUNKELER AG [CH]) 16 November 2011 (2011-11-16) * figure 3 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) B26D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 November 2015	Examiner Wimmer, Martin
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	

EPO FORM 1503 03.82 (P04C01)

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

EP 15 17 6335

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-11-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011012333 A1	03-02-2011	CN 102574601 A	11-07-2012
		EP 2459454 A1	06-06-2012
		US 2012216663 A1	30-08-2012
		WO 2011012333 A1	03-02-2011
		WO 2011012926 A1	03-02-2011
EP 2703135 A1	05-03-2014	CA 2833998 A1	01-11-2012
		EP 2703135 A1	05-03-2014
		RU 2013147453 A	10-06-2015
		US 2014076118 A1	20-03-2014
		WO 2012146791 A1	01-11-2012
EP 0318174 A2	31-05-1989	EP 0318174 A2	31-05-1989
		JP H01159194 A	22-06-1989
		US 4962683 A	16-10-1990
GB 2200863 A	17-08-1988	DE 3703463 A1	18-08-1988
		GB 2200863 A	17-08-1988
		IT 1216731 B	08-03-1990
		JP S63212496 A	05-09-1988
		US 4860623 A	29-08-1989
EP 0198221 A1	22-10-1986	DE 3663323 D1	22-06-1989
		EP 0198221 A1	22-10-1986
		IT 1186850 B	16-12-1987
		US 4699033 A	13-10-1987
EP 2386388 A1	16-11-2011	EP 2386388 A1	16-11-2011
		US 2011277608 A1	17-11-2011

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 0318174 A2 [0007]
- GB 2200863 A [0008]