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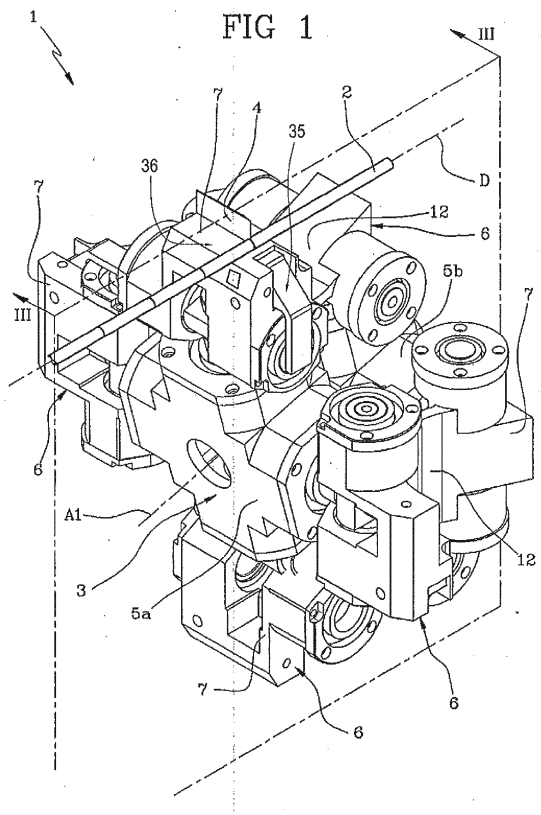
(54) A cutting head for at least one continuous rod in machines for making tobacco products

(57) A cutting head for at least one continuous rod in machines for making tobacco products comprises at least one supporting body (3) rotating about at least one axis of rotation (A1; A2); at least one blade (4) connected to the supporting body (3) for cutting the continuous rod (2) being fed along a feed axis (D); connected to the supporting body (3) there is a unit (6) for connecting the blade (4) and which comprises means (7, 8) for holding the position of the plane in which the blade (4) lies constantly at a right angle to the feed axis (D) of the continuous rod (2); the holding means (7, 8) also comprise means (19) for restoration of the active portion (4a) of the blade (4) and which allow a reserve portion (4b) of the blade (4) to be moved and fed outwards to replace the parts of the active portion (4a) of the blade (4) which have worn out as a result of cutting and sharpening operations.

FIG 1



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Description

[0001] This invention relates to a cutting head for at least one continuous rod in machines for making tobacco products.

[0002] More specifically, the cutting head according to this invention can be advantageously applied to a cigarette making machine, for cutting at least one continuous cigarette rod, or to a cigarette filter making machine, for cutting at least one continuous filter rod.

[0003] Still more specifically, the cutting head according to this invention can be advantageously applied to twin-line machines for making tobacco products, that is to say, machines characterized by the presence of two continuous rods which travel axially side by side and parallel to each other. Prior art cutting heads comprise a drum which is defined by two opposed, substantially circular side walls and a cylindrical wall of revolution which joins the two side walls to each other to form a closed body. The drum rotates about a respective axis of rotation and bears on the side of it two opposed blades which project from the selfsame wall of revolution.

[0004] More in detail, the blades are mounted on respective blade holders connected to the drum. The blade holder and the respective blade can rotate relative to the drum about a respective axis of rotation which is radial and perpendicular to the axis of rotation of the drum.

[0005] The cutting heads are coupled to a respective counterblade device to form a cutting unit. The counterblade devices usually comprise a rotating carousel having mounted on it a plurality of blade guide bushes which cyclically come into contact with the corresponding rod to hold it transversely and each of which is provided with a central slot through which the blade can pass in order to make the cut. In other words, each rod is held transversely by the bushes as the blade passes through so as to prevent the rods from swinging and shaking.

[0006] Since the continuous rods travel at a predetermined speed and cutting must be performed continuously and at right angles to the travelling direction, each blade which comes in proximity of the rods to be cut must move at a speed having a component which is concordant with the travelling speed of the rods, in such a way as to follow the rods.

[0007] In this regard, in prior art cutting heads, the drum is oriented in such a way that the axis of rotation of the drum makes a predetermined angle α with the travelling direction of the rods. The angle α thus determines the extent of the component of the speed which is parallel to the speed of the rods and is therefore strictly connected with the size of the cigarettes or filters to be cut. In this regard, it should be noted that each blade guide bush, during the movement imparted to it by the carousel, rotates at a speed such as to have a component which is equal to the travelling speed of the rods, so that the passage of the blade through the slot is perfectly coordinated.

[0008] Moreover, it should be noted that the continuous rods must be cut at right angles to their travelling direction. For this purpose, each blade is oriented, relative to the drum, in such a way as to be at right angles to the travelling direction of the rods at least when it is in the proximity of the rods.

[0009] Suitable means for adjusting the angular position of the blades are located inside the drum and operate on the blades in such a way as to keep them at right angles to the rod travelling direction - when they are at the rods - even after changeover to a different cigarette or filter size.

[0010] In other words, when the length of the individual cigarette sticks or filter plugs needs to be changed, it is necessary to change the angle α formed between the axis of rotation of the drum and the travelling direction of the continuous rods. This is done by modifying the inclination angle of the drum. The above mentioned adjustment means thus operate on the blade in such a way that when it reaches the continuous rods it is perpendicular to their travelling direction.

[0011] In the prior art cutting heads, the adjustment means comprise, for example, a cardan shaft operating between a drum mounting shaft and the blade holder.

[0012] Thus, each blade holder swings about its radial axis of rotation between two limit positions so that when it passes through the continuous rods it is substantially at right angles to their travelling direction.

[0013] This correction, however, does not take into account the fact that by virtue of the angle α at which the drum is inclined, the blade is exactly at a right angle to the rods only at one cutting position whereas around that position, it is slightly inclined as a result of the swinging about the radial axis about which the blade holder rotates and as a result of the rotation of the drum about an axis which is inclined at the angle α. Disadvantageously, therefore, when each blade passes through the respective blade guide bush, it is not exactly at a right angle to the travelling direction of the continuous rods since the blade is in a limited round of a swing. In other words, during the cutting of the continuous rods, the blade and the respective blade holder swing about their axis of rotation.

[0014] This has at least two major disadvantages. Firstly, the cigarette sticks or filter plugs thus obtained are not cut exactly at right angles.

[0015] Secondly, during its cutting action, the blade is not unlikely to come into contact, however lightly, with the blade guide bush. More specifically, this contact is most likely to occur when the blade enters and exits the slot of the blade guide bush. Besides damaging the blade and/or the bush, this contact causes the blade to shake. Shaking leads to further errors and imprecision in the cutting of the continuous rods.

[0016] Moreover, it should also be noted that in the prior art cutting heads, it is not possible to apply more than two blades. In effect, if this were done, the shaking caused by the adjustment means normally used would raise the risk of cutting imprecision and blade breakage to unacceptably high levels.

[0017] The above mentioned cutting heads are also equipped internally with feed devices which gradually feed the blade outwards to compensate for blade wear during use. These types of device are usually built into the cutting heads and are relatively complex and the space they occupy makes it difficult to mount two blades at 180° from each other. Further, precisely because they are located inside the cutting head, they are difficult to access for routine maintenance.

[0018] In this context, the basic technical purpose of this invention is to provide a cutting head for at least one continuous rod in machines for making tobacco products which overcomes the above mentioned disadvantages of the prior art.

[0019] More specifically, this invention has for an aim to provide a cutting head for at least one continuous rod in machines for making tobacco products which is capable of guaranteeing lasting precision in cutting at least one continuous rod.

[0020] Another aim of the invention is to overcome the problem of blade wear while avoiding frequent routine and extraordinary maintenance operations. The technical purpose indicated and the aims specified are substantially achieved by a cutting head for at least one continuous rod in machines for making tobacco products comprising the technical features set out in one or more of the accompanying claims.

[0021] The invention will now be described with reference to the accompanying drawings which illustrate a preferred, non-limiting embodiment of it and in which:

- Figure 1 is a perspective view of a cutting head for at least one continuous rod in machines for making tobacco products according to this invention;
- Figure 2 is another perspective view of the cutting head of Figure 1;
- Figure 3 is a side view of the cutting head of Figure 1 cut through the section plane III-III of Figure 1;
- Figure 4 is a partly exploded perspective view of a detail of the cutting head of Figure 1;
- Figure 5 is a view from the side and in cross section of a second embodiment of a cutting head according to the invention;
- Figure 6 is a view from the front and in cross section of the embodiment of Figure 5;
- Figure 7 is a schematic cross section of a third embodiment of the cutting head of Figure 1;
- Figure 8 is a partly exploded, schematic perspective view of a detail of the embodiment illustrated in Figure 7;
- Figure 9 is a scaled-up view, in cross section, of a detail from Figure 7;
- Figure 10 illustrates the detail of Figure 9 in a top view with some parts cut away;
- Figure 11 is a view from the front and in cross section of the cutting head of Figure 4;
- Figure 12 is a view from the side and in cross section of the cutting head of Figure 11;
- Figure 13 is a view from the side and in cross section of the cutting head of Figure 11.

[0022] With reference to the accompanying drawings, the numeral 1 denotes in its entirety a cutting head for at least one continuous rod in machines for making tobacco products.

[0023] The cutting head 1 is located downstream of a unit (not illustrated) for making at least one continuous rod 2.

[0024] More specifically, the cutting head 1 is located downstream of a unit for making a continuous cigarette rod 2 or a unit for making a continuous filter rod 2.

[0025] Preferably, the cutting head 1 described is located immediately downstream of a unit for making a pair of continuous rods 2 placed in parallel with each other and travelling in the same direction along a common feed axis "D". Thus, the cutting head 1 is preferably applied to a twin-line machine.

[0026] The cutting head 1 comprises a supporting body 3 which rotates about at least one respective axis of rotation A1; A2 and at least one blade 4 connected to the supporting body 3 in such a way as to rotate as one therewith about the axis of rotation A1; A2. Thus, as the blade 4 turns and reaches the continuous rods 2 to cut them, it is in substantially the same conditions with reference to the rods 2 themselves. Looking in more detail, the cutting head 1 comprises a plurality of blades 4 connected peripherally to the supporting body 3 and spaced at equal angular intervals from each other. Preferably, the cutting head 1 comprises four blades 4.

[0027] As illustrated, the supporting body 3 comprises two cross-shaped portions 5a, 5b, which are structurally separate from each other but reciprocally associated and each of which rotates about a respective axis of rotation A1, A2.

[0028] In detail, the first portion 5a is connected to a motor (not illustrated in the accompanying drawings) in such a way as to rotate about its axis of rotation A1 and more specifically about its centre of rotation R1.

[0029] The axis of rotation A1 of the first portion 5a makes with the feed axis "D" of the continuous rods 2 an angle α which is a function of the size of the cigarettes or filters to be cut.

[0030] In effect, the angle α determines a component of blade 4 speed, during rotation, which is concordant with the feed axis "D" of the rods 2 and with their travelling direction.

[0031] The second portion 5b which, as stated, is associated with the first portion 5a, rotates about its axis of rotation A2, and more specifically about its centre of rotation R2, driven by the first portion 5a, as will become clearer as this description continues.

[0032] In detail, the second portion 5b is constrained at its axis of rotation A2 by a supporting shaft 14 connected to the second portion 5b.

[0033] It should be noted that the portions 5a, 5b of the supporting body 3 are side by side and offset. In other

words, the axes of rotation A1, A2 of the portions 5a, 5b are always parallel to, but separate from, each other. It should also be noted that the centres of rotation R1, R2 of the portions 5a, 5b lie on a straight line parallel to the feed axis "D".

[0034] To change over to a different size of cigarettes or filters to be cut, the angle α must be changed by modifying the inclination of the first portion 5a. The inclination of the second portion 5b is thus modified accordingly in such a way that the axes of rotation A1, A2 remain parallel. Further, following this operation, the straight line joining the centres of rotation R1, R2 of the portions 5a, 5b remains parallel to the feed axis "D" of the continuous rods 2.

[0035] The blades 4 are coupled to the supporting body 3 through respective connecting units 6. More in detail, each blade 4 is connected to the portions 5a, 5b of the supporting body 3 in such a way that it can rotate relative to the selfsame portions 5a, 5b.

[0036] According to this invention, each connecting unit 6 comprises means 7, 8 for holding the position of the plane in which the respective blade 4 lies. In greater detail, the holding means 7, 8 keep the plane in which the blade 4 lies constantly at a right angle to the feed axis "D" of the continuous rods 2, during rotation of the blade 4 as one with the supporting body 3 about the axis of rotation A1; A2.

[0037] With reference in particular to the preferred embodiment illustrated, the holding means 7, 8 (which are defined and described in more detail below) are of the four-bar linkage type. More specifically, each connecting unit 6 cooperates with the portions 5a, 5b of the supporting body 3 to form a four-bar linkage. Thus, the angle formed in the space between the plane which the blade 4 lies in and the feed axis "D" of the continuous rods 2 remains constant during the rotation of the blade 4 about the axis of rotation A1; A2 of the supporting body 3.

[0038] More specifically, each connecting unit 6 comprises a respective blade holder 7 bearing a corresponding blade 4.

[0039] More in detail, each blade holder 7 is thus connected to the supporting body 3 at a peripheral edge of it 3a so that it can rotate relative to the supporting body 3 itself. In other words, each blade holder 7 is rotatably connected to the portions 5a, 5b of the supporting body 3.

[0040] In this regard, each connecting unit 6 comprises a pair of pins 8 associated with each blade holder 7. In particular, each pin 8 of the aforementioned pair connects the respective blade holder 7 respectively to the first portion 5a and to the second portion 5b of the supporting body 3.

[0041] As will become clearer as this description continues, the pins 8 allow the respective blade holders 7 they are associated with to rotate about their first axes of rotation B1, B2 and their second axes of rotation E1, E2. The first axes of rotation B1, B2 are perpendicular to the second axes of rotation E1, E2.

[0042] As illustrated, each pin 8 comprises a first tubular piece 9a, defining a first axis of rotation B1, B2 and rotatably inserted in the blade holder 7, and a second tubular piece 9b, defining a second axis of rotation E1, E2 and rotatably inserted in the first portion 5a or in the second portion 5b of the supporting body 3.

[0043] The first tubular piece 9a and the second 9b are coupled as one with, and at right angles to, each other.

[0044] In detail, the first tubular piece 9a is accommodated in respective coupling bushes 10 of the blade holder 7, whilst the second tubular piece 9b is accommodated in a radial hole 11 made in each portion 5a, 5b of the supporting body 3.

[0045] Thus, each connecting unit 6, through its blade holder 7, supports the respective blade 4 rotatably both about the aforementioned axes of rotation E1, E2, at right angles to the axes A1, A2, and about the aforementioned axes of rotation B1, B2, at right angles to the axes of rotation E1, E2.

[0046] In the embodiment illustrated, each pin 8 is substantially T-shaped. In alternative embodiments not illustrated, however, the pin 8 might have any other shape, such as, for example, the shape of an L or a cross, to define the first axes of rotation B1, B2 and the second axes of rotation E1, E2 perpendicular to each other.

[0047] Consequently, each blade holder 7 rotates relative to the portions 5a, 5b in such a way as to remain parallel to a straight line joining the centres of rotation R1, R2 of the portions 5a, 5b of the supporting body 3.

[0048] More in detail, with reference to Figure 3, where C1 denotes the intersection between the axes E1 and B1 and C2 denotes the intersection between the axes E2 and B2, the blade 4 is mounted on the blade holder 7 in such a way that its active portion 4a is at a right angle to the line joining the centres C1 and C2 and the line joining the centres C1 and C2 remains, in use, parallel at all times to the line joining the centres R1 and R2.

[0049] In other words, each blade holder 7 rotates about its second axes of rotation E1, E2 positioned radially along the portions 5a, 5b of the supporting body 3. The second axes of rotation E1, E2 are perpendicular to the first axes of rotation B1, B2, as well as to the axes of rotation A1, A2 of the portions 5a, 5b and pass through the centres of rotation R1, R2 of the portions 5a, 5b.

[0050] As may be inferred from this specification, the aforementioned holding means 7, 8 are defined by the blade holders 7 and the pins 8 combined with each other.

[0051] It follows, obviously, that the holding means 7, 8 are defined by the connecting units 6.

[0052] As already mentioned, the blade 4 connecting units 6 and the portions 5a, 5b of the supporting body 3 define a four-bar linkage.

[0053] In other words, the first portion 5a and the second portion 5b of the supporting body 3 define respective cranks of the four-bar linkage, while the blade holders 7 define respective links connected to the cranks.

[0054] With reference to Figure 3, it is evident that the axes of rotation A1, A2 of the four-bar linkage are not at right angles to the plane which the cranks lie in. The mo-

tion of the links is not, therefore, planar motion but extends in space.

[0055] With reference to the pins 8, the first tubular pieces 9a allow the blade holders 7 to rotate relative to the portions 5a, 5b about their first axes of rotation B1, B2, while the second tubular pieces 9b allow the blade holders 7 to rotate relative to the portions 5a, 5b about their second axes of rotation E1, E2.

[0056] The blade holders 7, on the other hand, comprise a housing wall 12 for the blade 4, which the blade 4 is rested on and fixed to.

[0057] The housing wall 12 is rigidly fixed to the coupling bushes 10.

[0058] The housing wall 12 comprises a surface 13 which the blade 4 adheres to. The surface 13 is at least partly curved and has a concavity facing in the direction opposite the supporting body 3. The surface 13 also has a plane portion 13a at right angles to the straight line joining the centres of rotation R1, R2 of the portions 5a, 5b.

[0059] In other words, the plane 13a of the surface 13 is positioned at right angles to the feed axis "D" of the continuous rods 2 and supports an active portion 4a of the blade 4.

[0060] Advantageously, the curved surface 13 houses a reserve portion of the blade 4 which is used to replace the parts of the active portion 4a of the blade 4 as the latter wears out and is continually sharpened. As shown in Figure 3, the reserve portion 4b of the blade 4 adheres to the curved surface 13 which houses it.

[0061] The cutting head 1 according to the invention is coupled to a counterblade device, not illustrated in the accompanying drawings, so as to form a cutting unit for machines used to make tobacco products.

[0062] The counterblade device comprises a rotary carousel which mounts a plurality of blade guides. As the blade guides rotate, they move towards the respective continuous rod until the rod is completely contained within the bush itself.

[0063] Each bush comprises a respective slot which allows the blade to pass through blade guide bush in such a way as to make a clean and precise cut without causing the rods to shake or vibrate.

[0064] As illustrated in Figures 11, 12 and 13, with reference to the blade 4 and the reserve portion of it 4b, the aforementioned connecting unit 6 and blade holder 7 comprise a kinematic mechanism 28 which advances the blade 4, and more specifically, its reserve portion 4b, along the surface 13 of the blade 4 housing wall 12.

[0065] It follows that the kinematic mechanism 28 defines means 19 for restoration of the active portion 4a of the blade 4.

[0066] The kinematic mechanism 28 comprises a first pin 29 housed in the second tubular piece 9b in such a way as to be able to slide therein along the axis E2 in both directions, indicated by the arrows F1 and F2. The first pin 29 has an active end 30 and is driven along the axis by a compressed air supply, schematically represented as a block 41.

[0067] More specifically, the active end 30 is frusto-conical in shape for reasons which will be explained below.

[0068] A second pin 31 is housed in a portion 32 of the first tubular piece 9a in such a way as to be able to slide therein along the axis B2 in both directions, indicated by the arrows F3 and F24. The second pin 31 has a first end 33 which faces the active end 30 of the first pin 29 and a second end 34 projecting outside the first tubular piece 9a. More specifically, two ends 33 and 34 of the second pin 31 are hemispherical in shape for reasons which will be explained below.

[0069] As illustrated in Figures 1, 2 and 4, a lever 35 is hinged in the upper portion 36 of the blade holder 7.

[0070] More specifically, the lever 35 is hinged to a flat portion 36a of the upper portion 36 about an axis of oscillation X, as illustrated in Figures 11 and 13.

[0071] A free end 37 of the lever 35 is in contact with the second end 34 of the second pin 31.

[0072] At its hinge point, the lever 35 is keyed to a lead screw 38 which extends inside the upper portion 36 along an axis D1 coinciding with the axis X and perpendicular to the first and second pins 29, 31. As illustrated in Figure 13, a shaft 39 whose axis is perpendicular to the axis D1 has at one end of it a toothed profile 39a designed to mesh with the lead screw 38.

[0073] As illustrated in Figure 12, the other end of the shaft 39 meshes, through an idle wheel 39b, with a feed roller 40 which is coaxial with the shaft 39, in such a way that the interposed idle wheel 39b allows the feed roller 40 to rotate in one direction only, as described in more detail below. With its outside surface, the roller 40 is in contact with the blade 4. It follows that every turn of the roller 40 causes the blade 4 to advance by a predetermined stretch as a function of the oscillation of the lever 35 about the axis of rotation X, as indicated by the arrow F5. Obviously, the predetermined stretch by which the blade 4 advances is a function of the radial dimensions of the toothed profile 39a and of the roller 40, so as to make the blade 4 move along the housing wall 12 to restore the active portion 4a of the blade 4 as it wears out and is continually sharpened.

[0074] In use, the compressed air supply 41 sends, at predetermined intervals and depending on the wear on the blade 4, a sequence of pneumatic pulses inside the second tubular piece 9b.

[0075] The pneumatic pulses move the first pin 29 along the axis E2 in the direction indicated by the arrow F1. Thanks to its frusto-conical shape, the active end 30 of the first pin 29 gradually engages the first end 33 of the second pin 31 and imparts to it a defined stroke.

[0076] As a result, the second pin 29 translates along the axis B2 in the direction indicated by the arrow F3 by a stretch which is defined by the stroke imparted by the first pin 31.

[0077] Since the second end 34 of the second pin 31 is in contact with the free end 37 of the lever 35, the

translation of the second pin 31 in the direction F3 causes the lever 35 to rotate anticlockwise (for someone observing Figure 11).

[0078] Rotation of the lever 35 corresponds to rotation of the lead screw 38, which is meshed with the toothed profile 39a, about the axis X, thereby causing the shaft 39 to rotate.

[0079] The shaft 39 rotates the idle wheel 39b which drives the feed roller 40 by a predetermined stretch of the blade 4 in order to restore the active portion 4a of the blade 4 as it wears out and is continually sharpened.

[0080] When the pneumatic pulse ceases, the first pin 29 translates along the axis E2 in the direction indicated by the arrow F2 to return to its rest configuration. The return translation of the pin 29 towards its rest configuration can be performed through the agency of an elastic or pneumatic biasing means.

[0081] Advantageously, the kinematic mechanism 28 is made using the connecting unit 6, keeping the structure of the cutting head 1 and without increasing the overall dimensions.

[0082] The active end 30 of the first pin 29 gradually disengages the first end 33 of the second pin 31 until it is completely free of the first pin 29. The lever 35, no longer opposed by the action of the second pin 31, rotates clockwise (for someone observing Figure 11) driving the second pin 29 along the axis B2 in the direction indicated by the arrow F4.

[0083] Rotation of the lever 35 corresponds to rotation of the lead screw 38, which is meshed with the toothed profile 39a, about the axis X, thereby causing the shaft 39 to rotate.

[0084] The shaft 39 rotates the idle wheel 39b, which in this case prevents the rotation of the feed roller 40 so that the blade 4 does not slide along the housing wall 12.

[0085] In this case, too, the reverse rotation of the lever 35 may be accomplished by an elastic or pneumatic biasing means.

[0086] Advantageously, since the kinematic mechanism 28 is housed in the connecting unit 6, it does not affect the dimensions of the cutting head 1 and it is easy to access for routine and extraordinary maintenance.

[0087] The invention achieves the above mentioned aims both as regards the orientation of the cutting head and thus of the counterblade unit, and as regards the restoration of the cutting blade itself. Indeed, as described above, the blade connecting means and the portions of the supporting body define a four-bar linkage.

[0088] Each blade holder 7, and hence each blade 4 rigidly fixed thereto, can rotate about the axes B1, B2 so as to counterbalance the inclination deriving from the angle α.

[0089] For the full 360° rotation, the blade holder 7 remains parallel to itself and to the line joining the centres R1 and R2, parallel to the feed axis D of the rods.

[0090] That way, during the rotation of the blades as one with the supporting body, the blades themselves lie at all times in one plane which never changes its orientation relative to the feed axis of the continuous rods. Obviously, that means the cutting edge applied to the continuous rods is exactly at right angles to the feed axis.

[0091] Moreover, since the blades do not oscillate, they can pass through the bushes of the counterblade device without any risk of coming into contact with the bushes themselves.

[0092] In other words, that prevents damage to the blades and/or the blade guide bushes and allows clean and precise cuts to be made.

[0093] Furthermore, cutting heads according to this invention may generally comprise N blades, where N is a whole number equal to 1 or greater than 1.

[0094] In the embodiment illustrated in Figures 5 and 6, the first tubular pieces 9a defining the transversal portion of the T-shaped pin 8 are rotatably inserted in holes 14 made at the ends of substantially radial arms 15 defining in twos relative to each portion 5a and 5b, a space 16 for receiving a blade holder 7.

[0095] Each piece 9b defining the longitudinal portion of the T-shaped pin 8 is in turn rotatably housed in a substantially radial hole 17 made in a respective bush designed to be coupled to the blade holder 7. It is clear that in this second embodiment, the connecting functions of the two pieces 9a and 9b making up the T-shaped pin 8 are the reverse of those of the first embodiment.

[0096] The third embodiment, illustrated in Figures 7 to 10 differs from the first embodiment in that the connecting unit 6 comprises a substantially box-shaped body 18 which forms the blade holder 7.

[0097] The box-shaped body 18 comprises internally the means 19 for restoration of the active portion 4a of the blade 4.

[0098] In particular, as described in more detail below, the restoration means 19 make it possible to move the blade 4, or more specifically, its reserve portion 4b, stepwise in order to replace the parts of the active portion 4a of the blade 4 as the latter wears out and is sharpened.

[0099] Similarly to the previous embodiments, in the third embodiment, too, and as illustrated in Figures 7 and 8, the first portion 5a and the second portion 5b of the supporting body 3 define respective cranks of the four-bar linkage, while the links connected to the cranks are defined by the box-shaped bodies 18. Thus, in this embodiment, too, the connecting units 6 define the holding means 7, 8.

[0100] In this embodiment, with reference in particular to Figure 8, each connecting unit 6 comprises a respective box-shaped body 18 having a corresponding blade 4 inside it.

[0101] More in detail, each box-shaped body 18 and, hence, each blade holder 7 is thus connected to the supporting body 3 at a peripheral edge of it 3a so that it can rotate relative to the supporting body 3 itself. In other words, each box-shaped body 18 is rotatably connected to the portions 5a, 5b of the supporting body 3.

[0102] In this embodiment, each connecting unit 6 comprises a pair of forks 8a associated with each box-

shaped body 18. In particular, each fork 8a of the aforementioned pair connects the respective box-shaped body 18 respectively to the first portion 5a and to the second portion 5b of the supporting body 3.

[0103] The forks 8a allow the respective box-shaped bodies 18 they are associated with to rotate about their first axes of rotation B1, B2 and their second axes of rotation E1, E2. The first axes of rotation B1, B2 are perpendicular to the second axes of rotation E1, E2.

[0104] As illustrated in Figure 8, each fork 8a is substantially T-shaped and comprises a first pair of bushings 10a which are positioned coaxially at opposite ends of the fork 8a and which define a first axis of rotation B1, B2. The bushes 10a form cavities for receiving first tubular pieces 9a which the box-shaped body 18 is equipped with. Further, each fork 8a comprises a respective second tubular piece 9b, defining the second axes of rotation E1, E2 and rotatably inserted in the first portion 5a or in the second portion 5b of the supporting body 3.

[0105] In detail, the first tubular piece 9a is accommodated in respective coupling bushes 10a of the fork 8a, whilst the second tubular piece 9b is accommodated in a radial hole 11 made in each portion 5a, 5b of the supporting body 3.

[0106] Thus, each connecting unit 6, through its box-shaped body 18, supports the respective blade 4 rotatably both about the aforementioned axes of rotation E1, E2, at right angles to the axes A1, A2, and about the aforementioned axes of rotation B1, B2, at right angles to the axes of rotation E1, E2.

[0107] Consequently, each box-shaped body 18 rotates relative to the portions 5a, 5b in such a way as to remain parallel to a straight line joining the centres of rotation R1, R2 of the portions 5a, 5b of the supporting body 3.

[0108] Further, as shown in Figure 10, at least a first tubular piece 9a comprises internally a duct 26 which in turn comprises an inlet 26a and an outlet 26b and whose function is described in more detail below.

[0109] The restoration means 19 (Figure 9) comprise a first roller 20 and a second roller 21 for feeding the blade 4. In particular, the first roller 20 is controlled by a gear motor 22. Thus, the aforementioned reserve portion 4b of the blade 4 is interposed between the first roller 20 and the second roller 21.

[0110] In detail, the first roller 20 has on an outer peripheral stretch of it a toothed profile 20a for meshing with a lead screw 23 associated with the gear motor 22.

[0111] In the preferred embodiment, the gear motor 22 is of a pneumatic type. In this embodiment, the gear motor 22 is connected to compressed air supply means 24 able to supply the gear motor 22 according to a sequence of pneumatic pulses at predetermined intervals and depending on the wear on the blade 4. Thus, a stepwise motion is imparted to the blade 4 which is gradually fed outwards to compensate for its wear during operation of the cutting head.

[0112] The compressed air supply means 24 are connected in known manner to the inlet 26a of the duct 26 of the first tubular piece 9a, whilst the outlet 26b of the duct 26 is connected to the gear motor 22 by means of a flexible element, labelled 27 in Figure 10.

[0113] Thus, the structure of the box-shaped body 18 can advantageously be used to convey the pneumatic pulses from the compressed air supply means 24, which are located outside the box-shaped body 18, to the gear motor 22, which is located inside the box-shaped body 18.

[0114] It should be noted that the gradual feeding of the blade 4 can be controlled by a control unit 25 according to preset time intervals which define the frequency of the above mentioned sequence of pneumatic pulses.

[0115] In an alternative embodiment, the state of wear of the blade 4 may be monitored by suitable sensors, not illustrated, which send a signal to the control unit 25 connected to the compressed air supply means 24. In this case, the unit 25 defines the above mentioned sequence of air pulses which the compressed air supply means send to the gear motor 22 to regulate blade 4 feed.

[0116] On receiving a pulse, the gear motor 22 drives the lead screw 23, which is meshed with the first roller 20, thereby allowing the blade 4, and hence the active portion 4a, to be fed.

[0117] More specifically, during blade 4 feed, the second roller 21 acts as an element opposing the first roller 20 and since the blade 4 is interposed between the first roller 20 and the second 21, it is driven outwards from the box-shaped body 18. This embodiment has numerous advantages. One of the most important is that the box-shaped body 18 is outside the cutting head 1 and is therefore easy to access for maintenance. It does not encumber the cutting head 1 and its restoration means 19, since they are enclosed within the box-shaped body 18, do not prevent the cutting head 1 from being equipped with two or more blades 4.

[0118] Moreover, this constructional simplicity means the cutting head 1 is relatively light in weight which is an advantage in terms of reduced inertia when it rotates.

[0119] Another important advantage is due to the very structure of the box-shaped body 18, which makes it easy to connect to the main compressed air supply of the machine to drive blade 4 feed.

[0120] Lastly, it should be noted that in all the embodiments described above, each of the restoration means 19 relating to one of the four blades 4 the cutting head 1 is equipped with can be activated independently of the others. In other words, during operation of the cutting head 1, it is possible to activate only the restoration means 19 of the blade 4 which is worn, while the restoration means of the blades 4 which are not worn can be left idle.

[0121] Thus, only the reserve portion or portions 4b of the worn blade or blades 4 is or are fed in order to replace the parts of the active blade 4 portion 4a as the blade wears out and needs sharpening.

Claims

1. A cutting head for at least one continuous rod in machines for making tobacco products comprising at least one supporting body (3) rotating about at least one axis of rotation (A1; A2) and comprising at least two portions (5a, 5b) which are associated with each other and rotate about respective axes of rotation (A1, A2) which are separate and parallel; at least one blade (4) connected to the supporting body (3) for rotating about the axis of rotation (A1; A2) for cutting the continuous rod (2) being fed along a feed axis (D); a unit (6) for connecting the blade (4) to the supporting body (3), comprising means (7, 8) for holding the position of the plane in which the blade (4) lies, the blade (4) being rotatably connected to the portions (5a, 5b) by means of the connecting unit (6); the plane in which the blade lies being constantly at a right angle to the feed axis (D) of the at least one continuous rod (2), during rotation of the blade (4) about the axis of rotation (A1; A2); the connecting unit (6) also comprising means (19) for restoration of the active portion (4a) of the blade (4), a substantially box-shaped body (18) forming a blade holder (7) and comprising internally the means (19) for restoration of the position of the blade (4), and a pair of forks (8a) associated with the box-shaped body (18), the respective fork (8a) connecting the box-shaped body (18) respectively to the first portion (5a) and to the second portion (5b) of the supporting body (3).

2. The cutting head according to claim 1, **characterized in that** the connecting unit (6) supports the blade (4) in such a way that it can rotate about at least one axis (E1; E2) at a right angle to at least one axis of rotation (A1; A2) of the supporting body (3).

3. The cutting head according to claim 1 or 2, **characterized in that** the connecting unit (6) supports the blade (4) in such a way that it can rotate about first axes of rotation (B1, B2) and second axes of rotation (E1, E2); the first axes of rotation (B1, B2) being at right angles to the second axes of rotation (E1, E2) and the second axes of rotation (E1, E2) being at right angles to the at least one axis of rotation (A1; A2) of the supporting body (3).

4. The cutting head according to claim 1, **characterized in that** the connecting unit (6) and the portions (5a, 5b) form a four-bar linkage in such a way that, in space, the angle formed between the plane in which the blade (4) lies and the feed axis (D) of the continuous rod (2) is constant during the rotation of the blade (4) about the axis of rotation (A1; A2).

5. The cutting head according to claim 4, **characterized in that** the connecting unit (6) comprises at least one blade holder (7) to which the blade (4) is fixed; the blade holder (7) being rotatably connected to the portions (5a, 5b).

6. The cutting head according to claim 5, **characterized in that** the connecting unit (6) comprises two respective pins (8) each positioned between the portions (5a, 5b) and the blade holder (7) for allowing the blade holder (7) to rotate about the first axes of rotation (B1, B2) and the second axes of rotation (E1, E2), the first axes of rotation (B1, B2) and the second axes of rotation (E1, E2) being at right angles to each other.

7. The cutting head according to claim 6, **characterized in that** each pin (8) comprises at least a first tubular piece (9a; 9b), inserted in the blade holder (7), and a second tubular piece (9b; 9a), coupled at a right angle to the first and inserted in one of the portions (5a, 5b).

8. The cutting head according to claim 7, **characterized in that** the pin (8) is substantially T-shaped, comprising a longitudinal tubular piece (9b) and a transversal tubular piece (9a), coupled, at its intermediate zone to one end of the longitudinal piece (9b).

9. The cutting head according to claim 8, **characterized in that** the transversal tubular piece (9a) is inserted in the blade holder (7) and the longitudinal tubular piece (9b) is inserted in one of the two portions (5a, 5b).

10. The cutting head according to claim 8, **characterized in that** the transversal tubular piece (9a) is inserted in a respective portion (5a, 5b) and the tubular piece (9b) is inserted in the blade holder (7).

11. The cutting head according to any of the claims from 1 to 10, **characterized in that** the blade holder (7) comprises a housing wall (12) for the blade (4), comprising a surface (13) which is at least partly curved, designed to house a reserve portion of the blade (4).

12. The cutting head according to any of the claims from 1 to 11, **characterized in that** it comprises a plurality of blades (4), preferably four blades (4), each connected to the supporting body (3) by means of a respective connecting unit (6).

13. The cutting head according to any of the claims from 1 to 12, **characterized in that** the means (19) for restoration of the active portion (4a) of the blade (4) comprise a kinematic mechanism (28) which advances the blade (4) along the surface (13) of the blade (4) housing wall (12).

14. The cutting head according to claim 13, **character-**

ized in that the kinematic mechanism (28) comprises a first pin (29) housed in the second tubular piece (9b), a second pin (31) housed in a portion (32) of the first tubular piece (9a), a lever (35) in contact with the second pin (31) and rotating about an axis of oscillation (X); the lever (35) driving gearing (38, 39, 40) for advancing the blade (4) by a predetermined stretch for restoration of the active portion (4a) of the blade (4).

15. The cutting head according to claim 13 or 14, **characterized in that** the kinematic mechanism (28) is driven by a compressed air supply (41) which sends a sequence of pneumatic pulses at predetermined intervals and depending on the wear on the blade (4).

16. The cutting head according to claim 1, **characterized in that** the respective, substantially T-shaped fork (8a), comprises a first pair of bushings (10a) which are positioned coaxially at opposite ends of the fork (8a) and which define a first axis (B1, B2) of rotation.

17. The cutting head according to claim 16, **characterized in that** the bushings (10a) form cavities for receiving first tubular pieces (9a) of the box-shaped body (18).

18. The cutting head according to claim 17, **characterized in that** at least a first tubular piece (9a) comprises internally a duct (26), the duct (26) comprising an inlet (26a) and an outlet (26b).

19. The cutting head according to claim 16, **characterized in that** the respective fork (8a) comprises a second tubular piece (9b); the second piece (9b) defining a second axis (E1, E2) of rotation, and being rotatably inserted in the first portion (5a) or in the second portion (5b) of the supporting body (3).

20. The cutting head according to claim 1, **characterized in that** the restoration means (19) comprise a first feed roller (20) and a second feed roller (21), the first roller (20) being controlled by a gear motor (22); the blade (4) comprising a reserve portion (4b) interposed between the first roller (20) and the second roller (21).

21. The cutting head according to claim 20, **characterized in that** the gear motor (22) is of the pneumatic type; there being compressed air supply means (24) able to supply the gear motor (22) according to a sequence of pneumatic pulses at predetermined intervals and depending on the wear on the blade (4).

22. The cutting head according to claim 21, **characterized in that** the compressed air supply means (24) are connected to the inlet (26a) of the duct (26) of the first tubular piece (9a) and also being **characterized in that** the outlet (26b) of the duct (26) is connected to the gear motor (22) by means of a flexible element (27).

23. The cutting head according to any of the foregoing claims from 1 to 22, **characterized in that** each of the means (19) for restoration of the active portion (4a) of the blade (4) can be activated for at least one of the blades (4) independently of each of the other means (19) for restoration of the active portion (4a) of the other blades (4) constituting the cutting head (1).

24. A machine for making tobacco products comprising at least one cutting head for continuous rods according to any of the claims from 1 to 23.

FIG 1

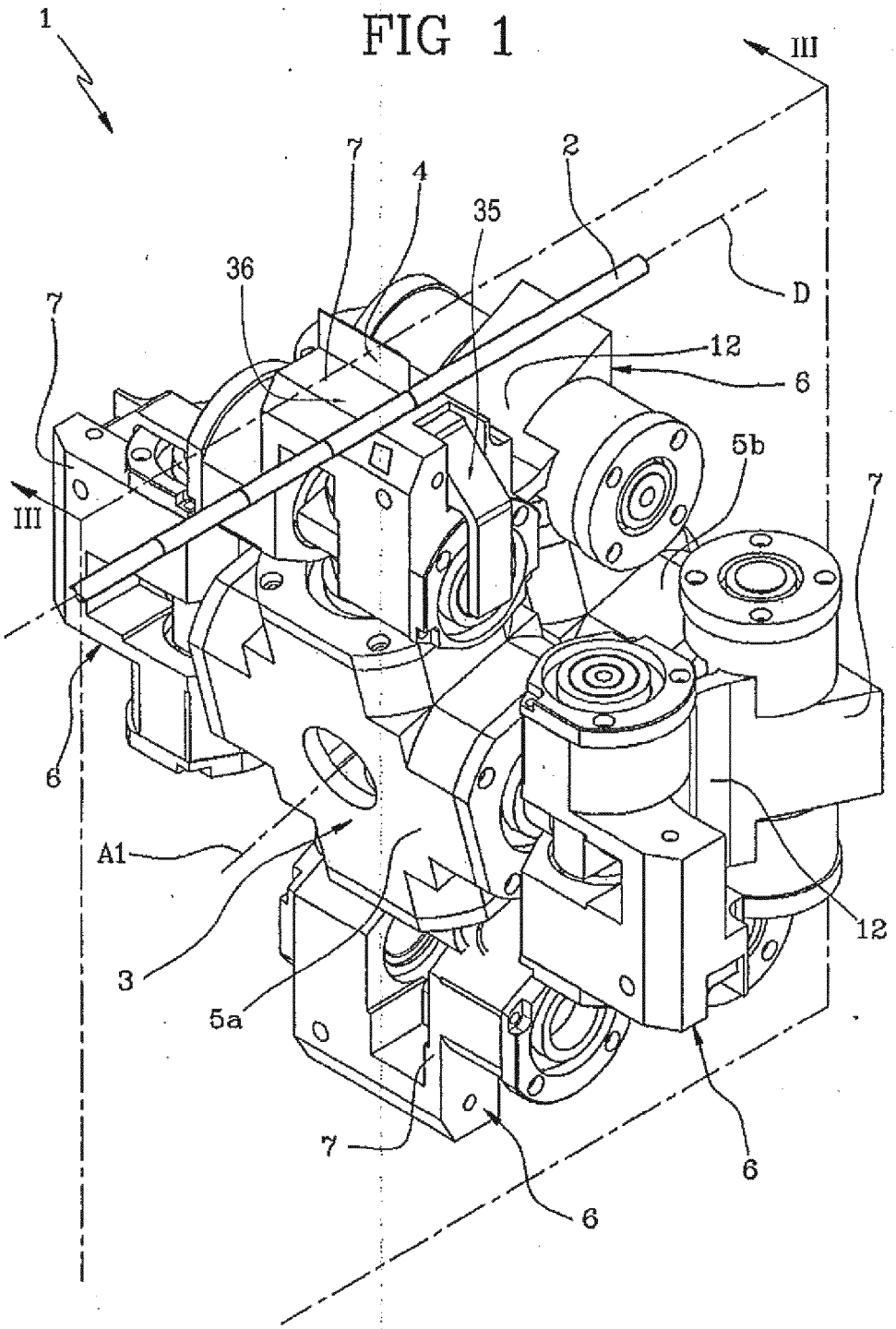


FIG 2

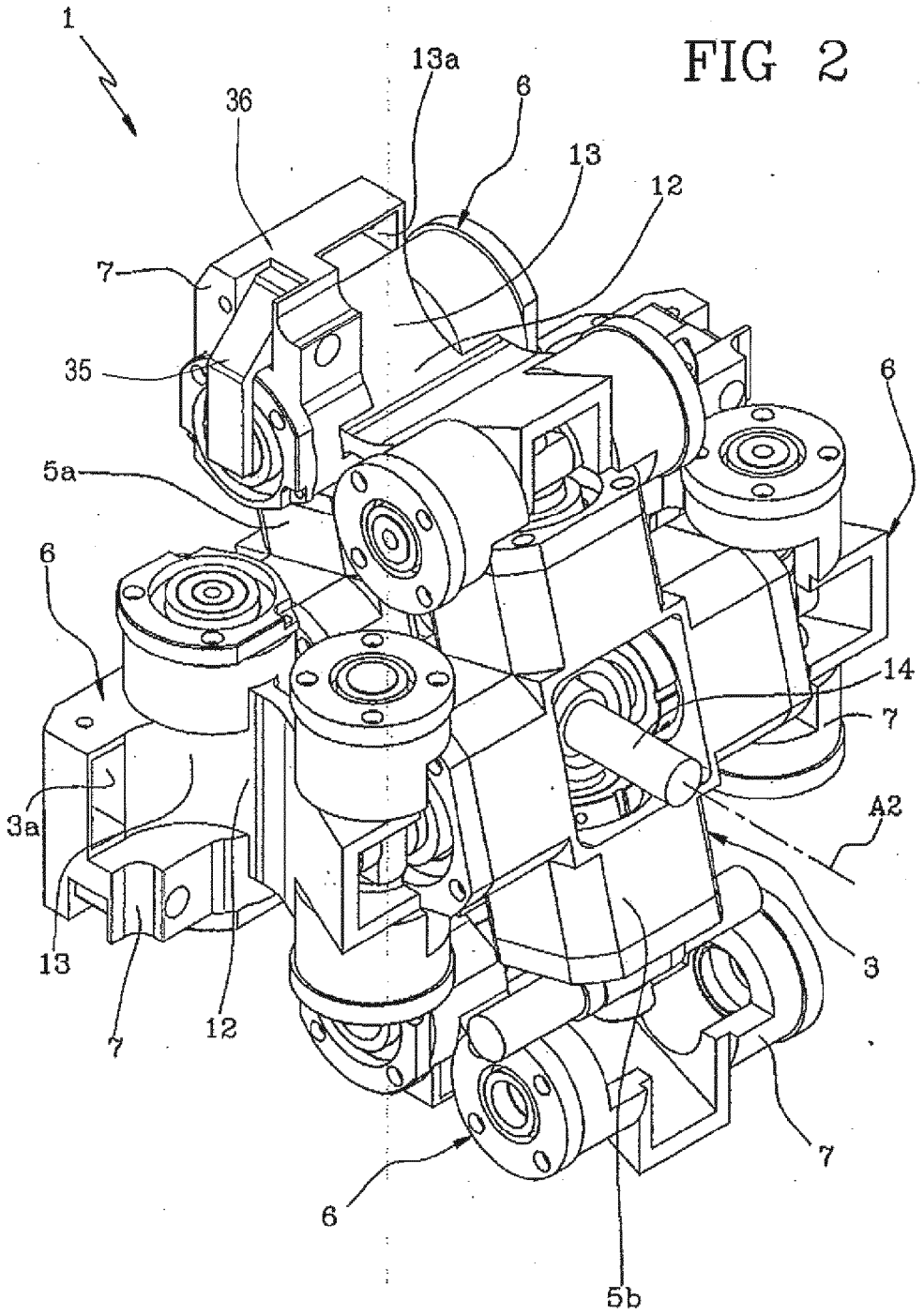
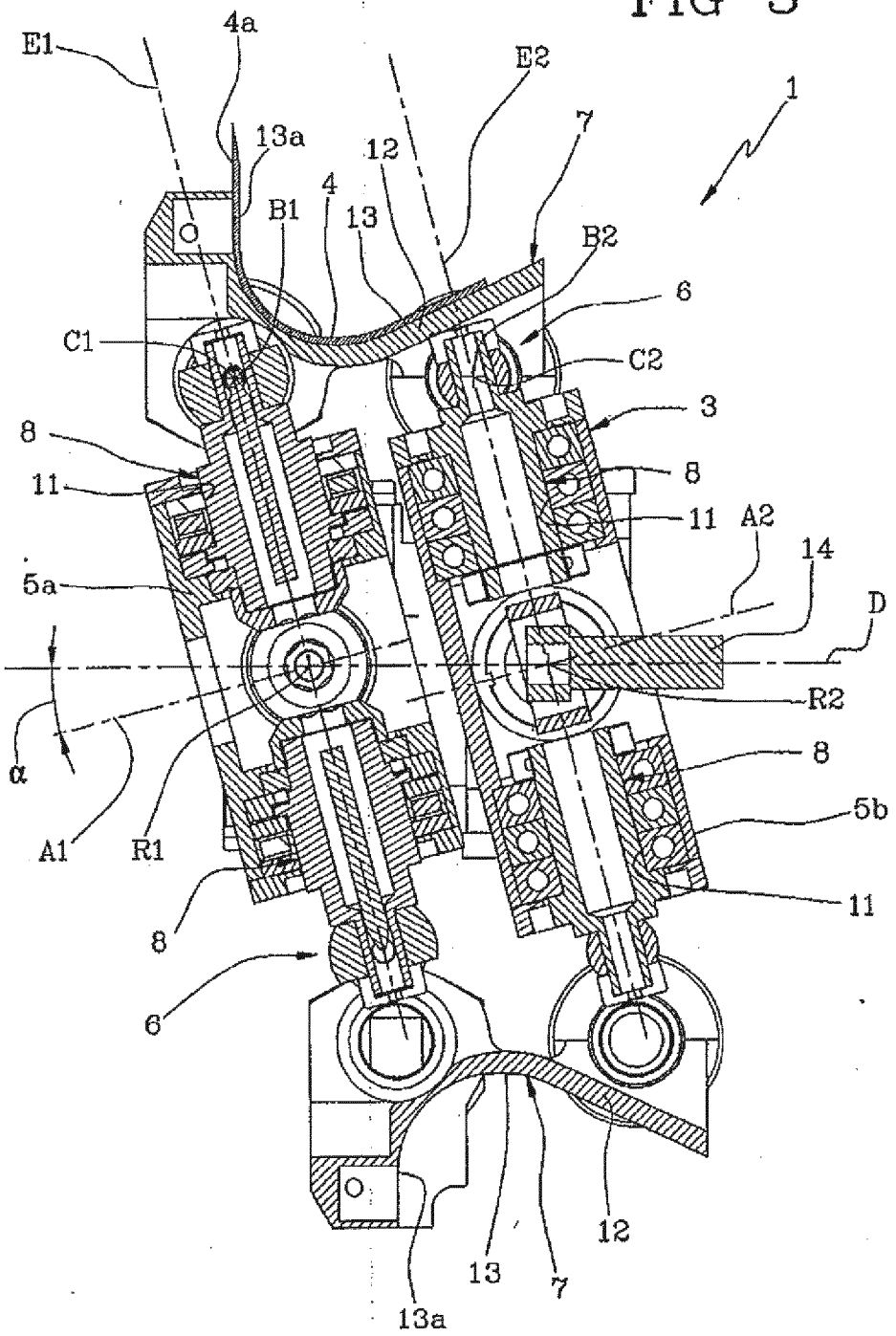


FIG 3


E1
4a
E2
1
13a
12
7
4
B1
13
B2
6
C1
C2
3
8
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11
A2
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R1
11
8
6
12
13
7
13a

FIG 4

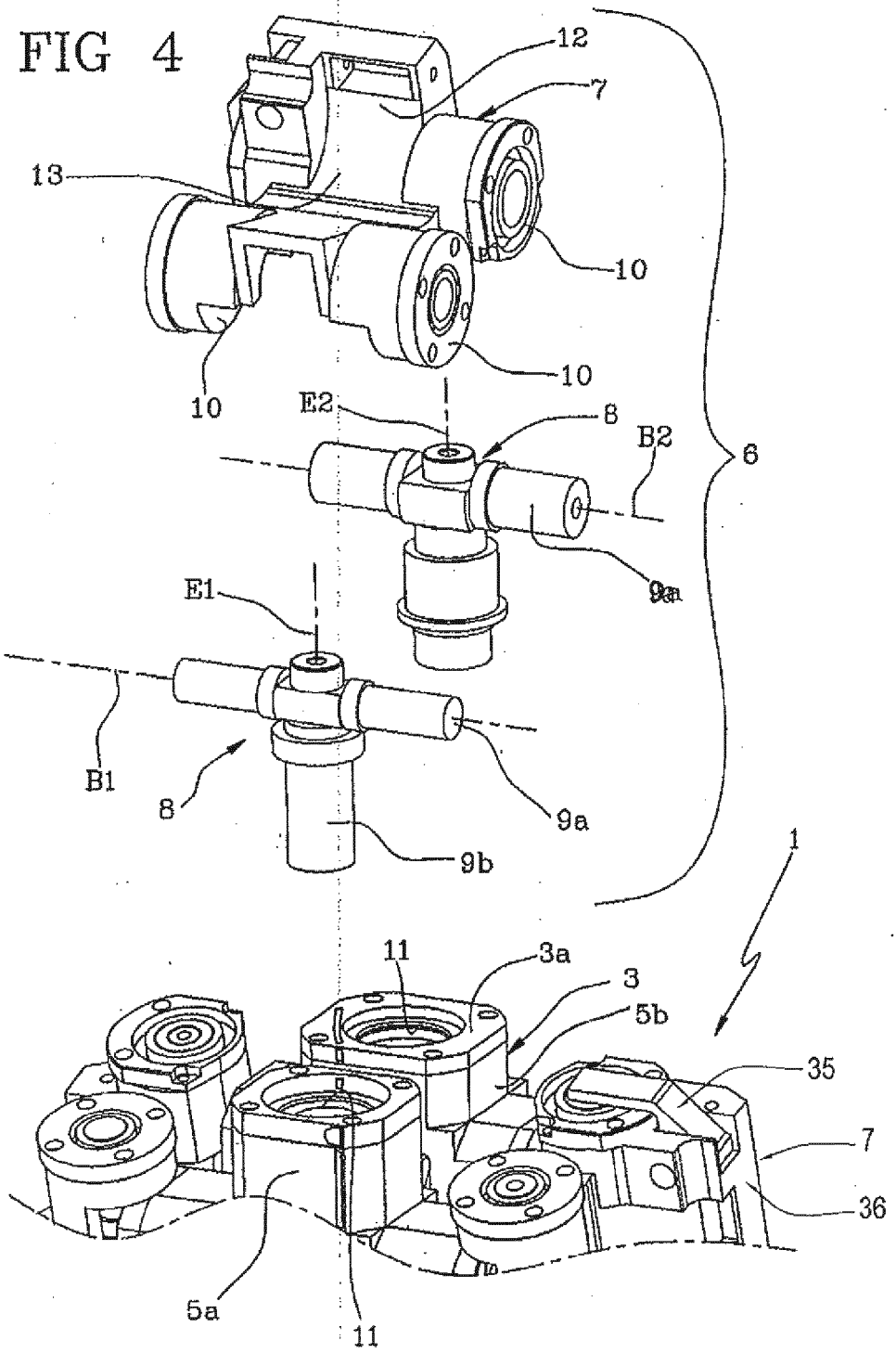
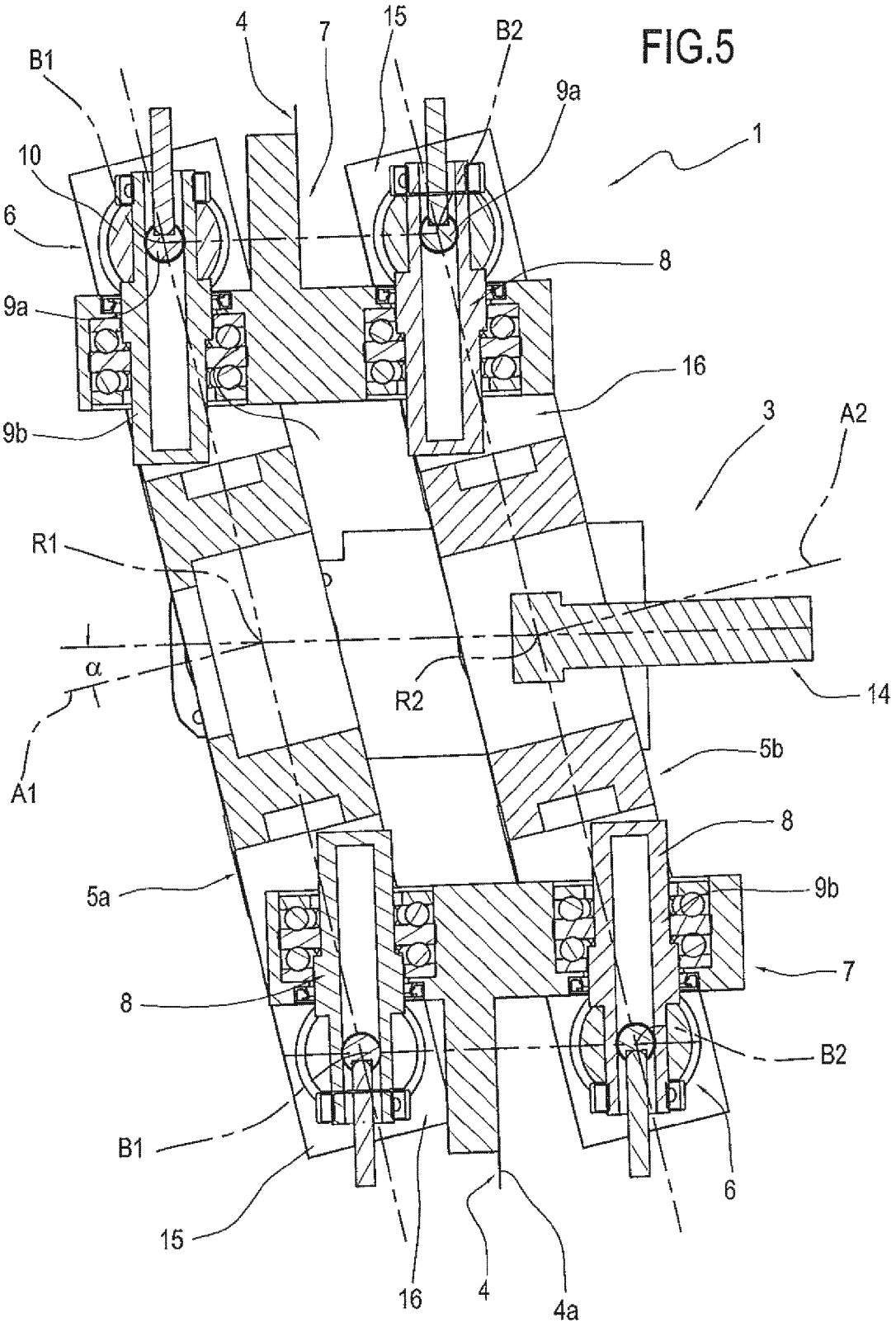


FIG.5


4
7
15
B2
B1
9a
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10
6
8
9a
16
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3
A2
R1
α
R2
14
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5b
8
5a
9b
7
8
B2
B1
6
15
16
4
4a

FIG.6

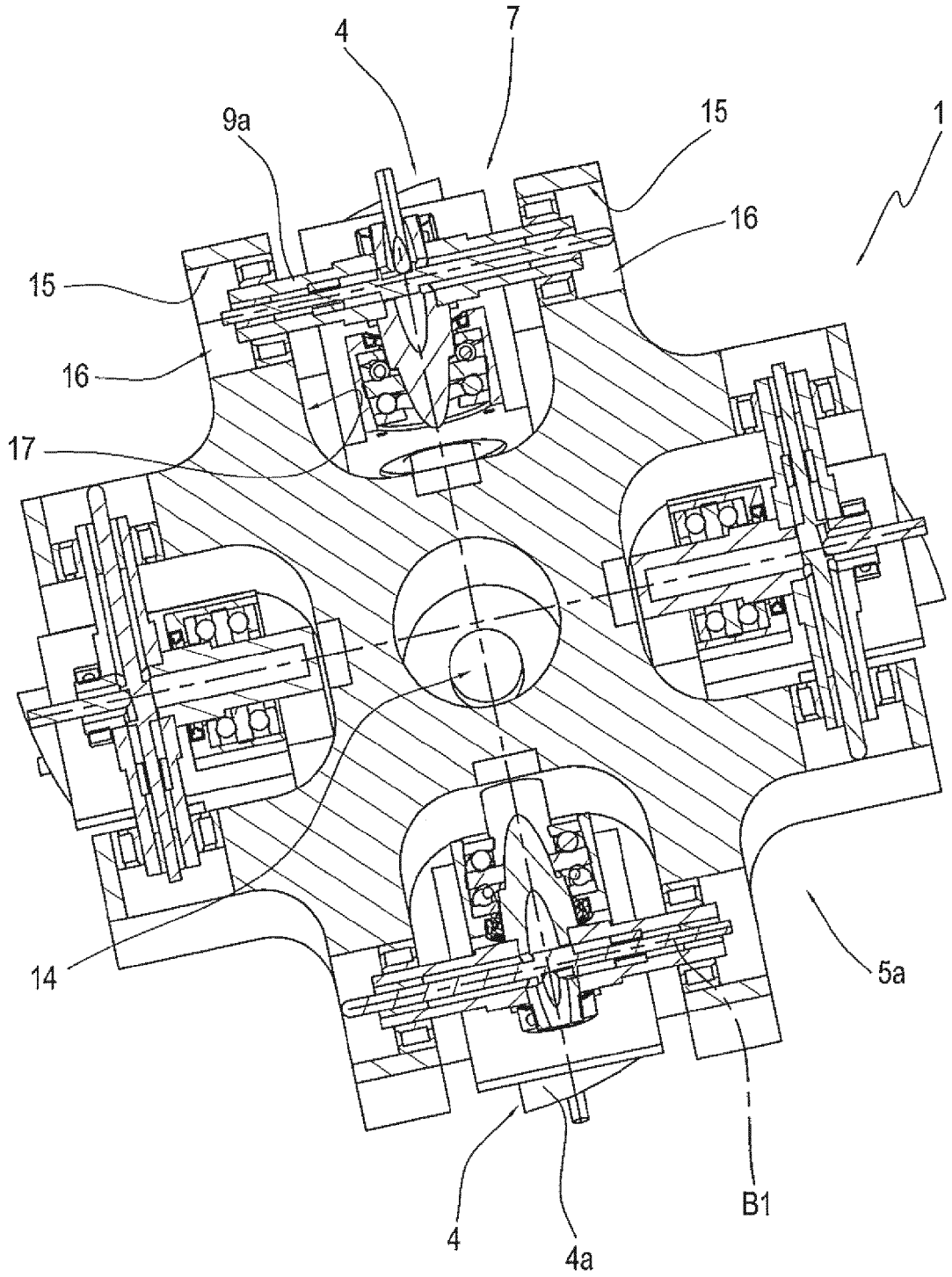


FIG.7

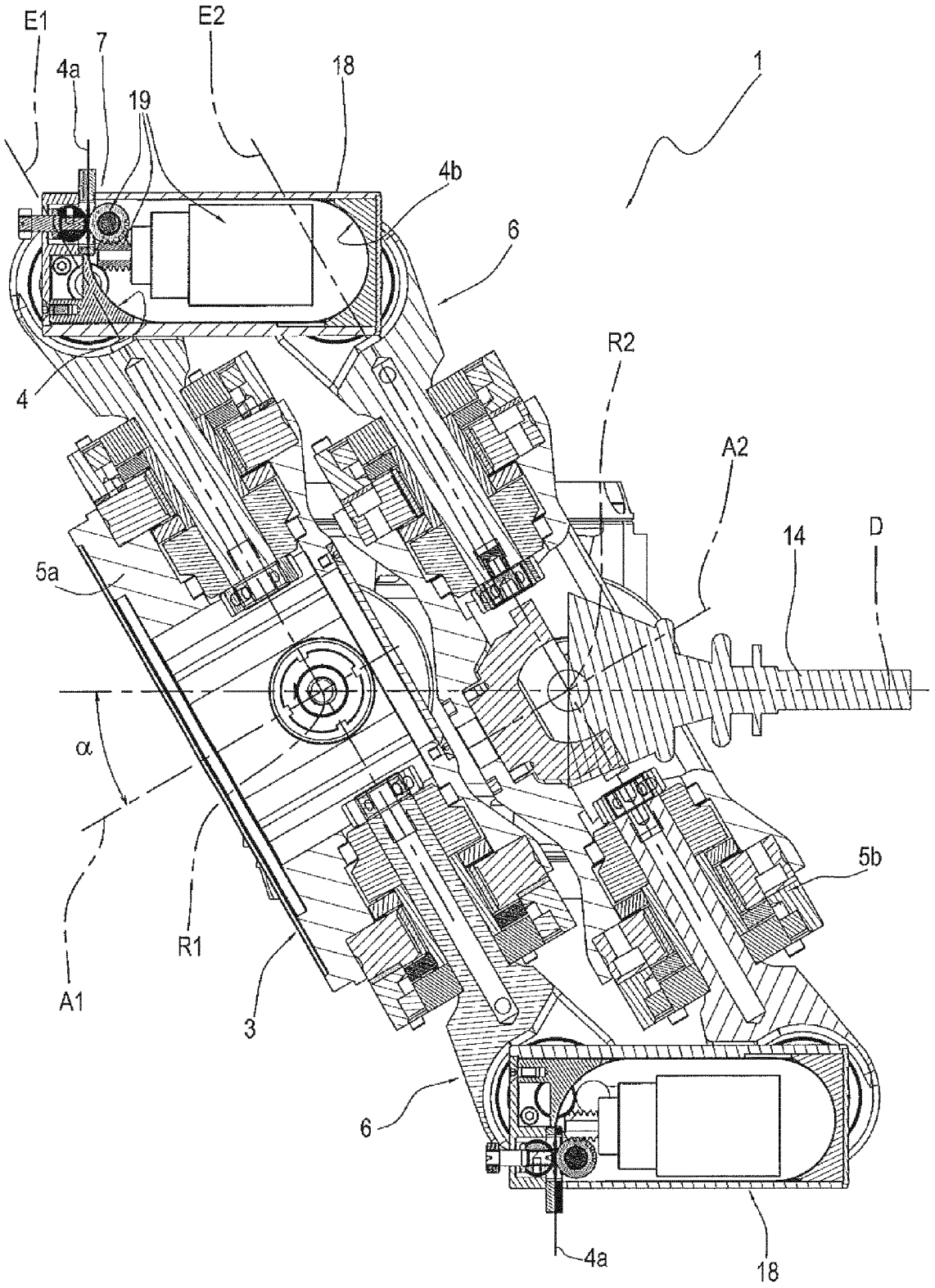


FIG.8

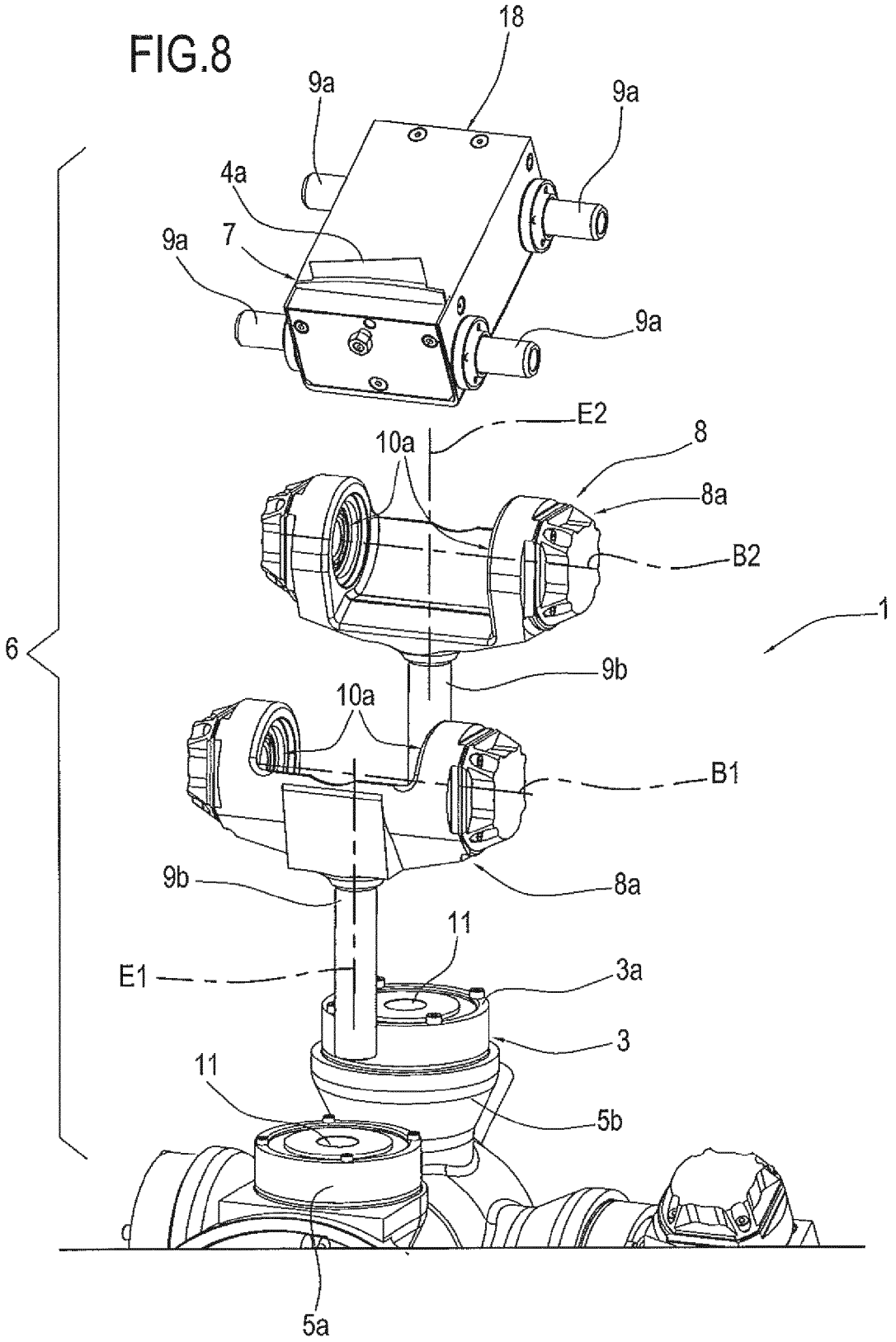


FIG.9

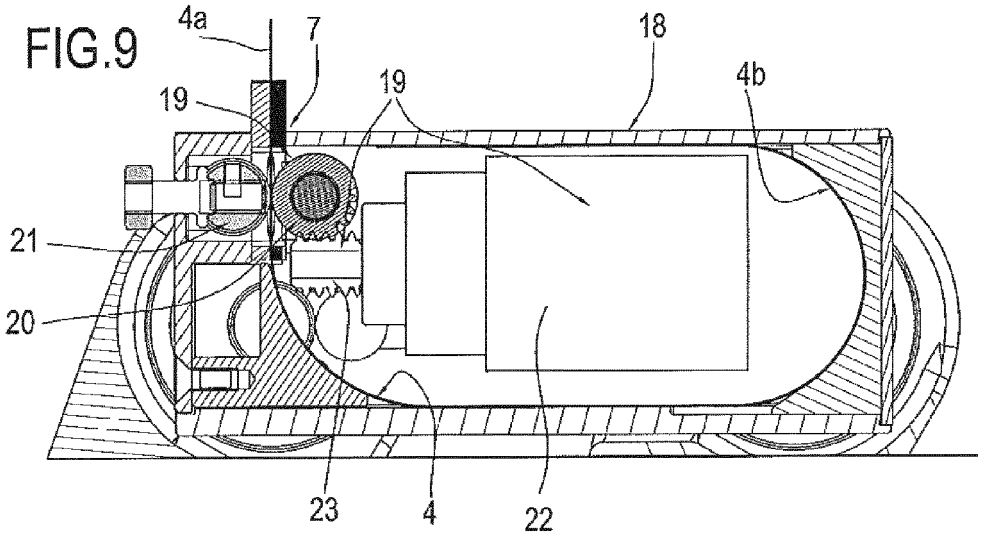


FIG.10

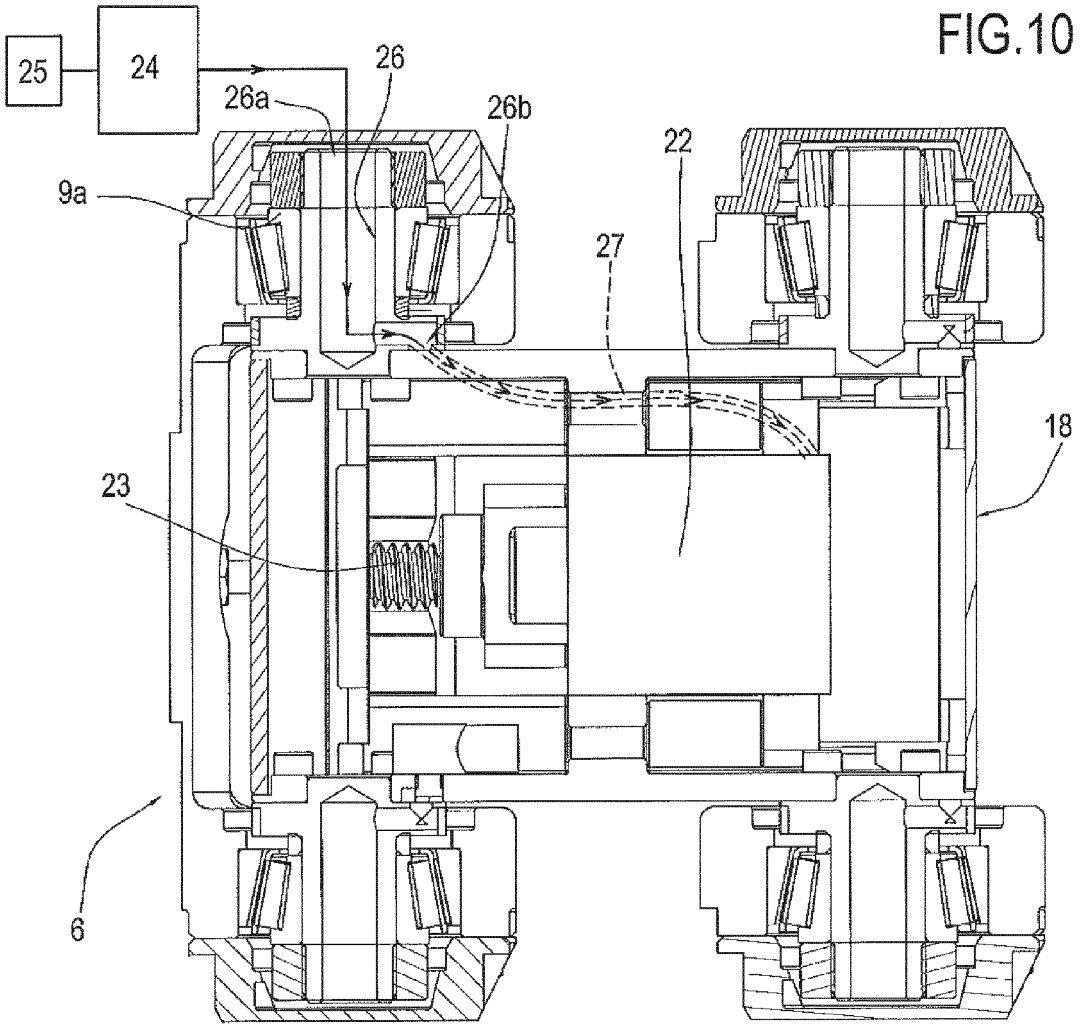
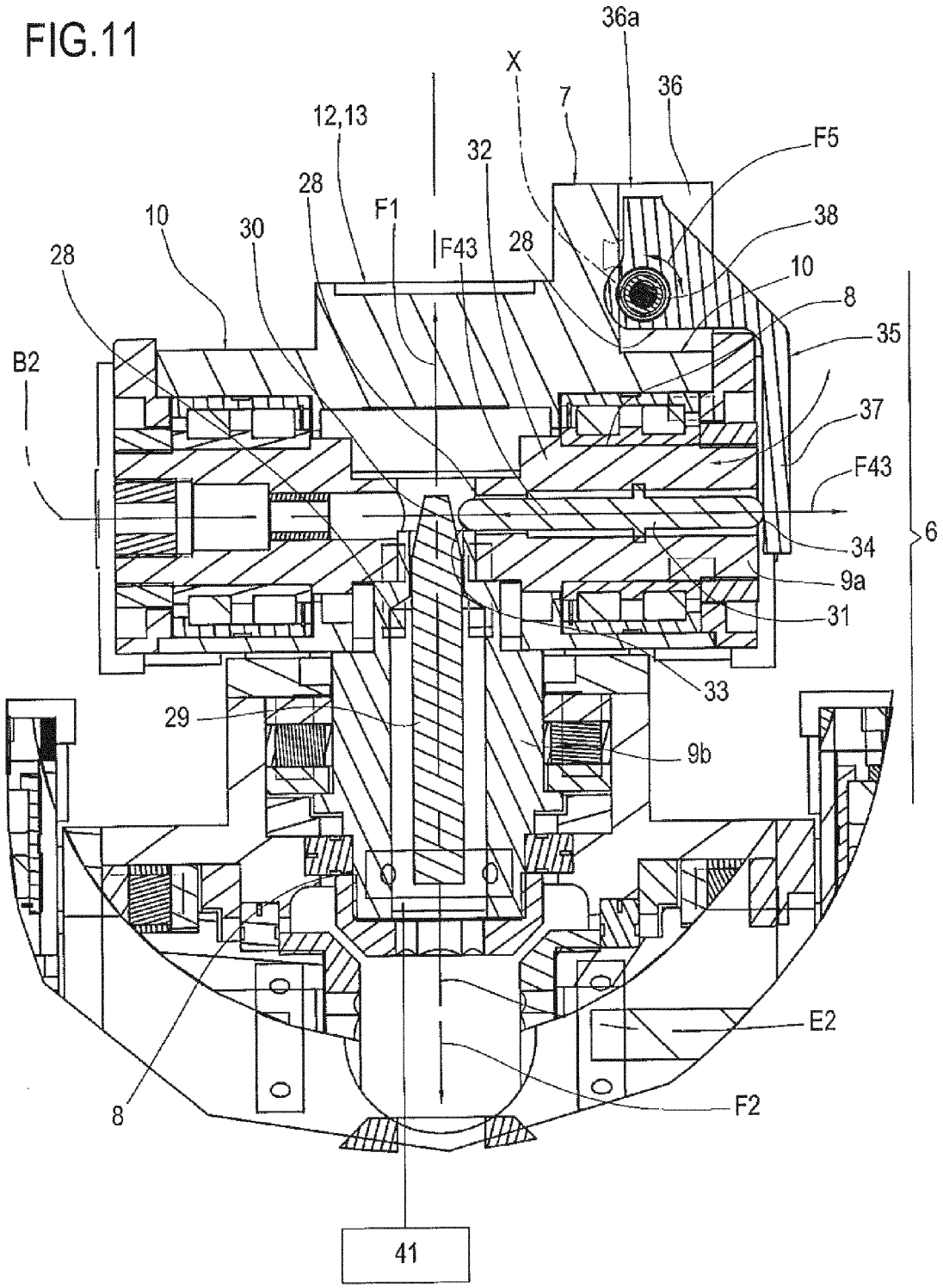


FIG.11


36a
X
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36
12,13
F5
32
28
F1
38
10
30
F43
28
28
10
8
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B2
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F43
6
34
9a
31
33
29
9b
E2
8
F2
41

FIG.12

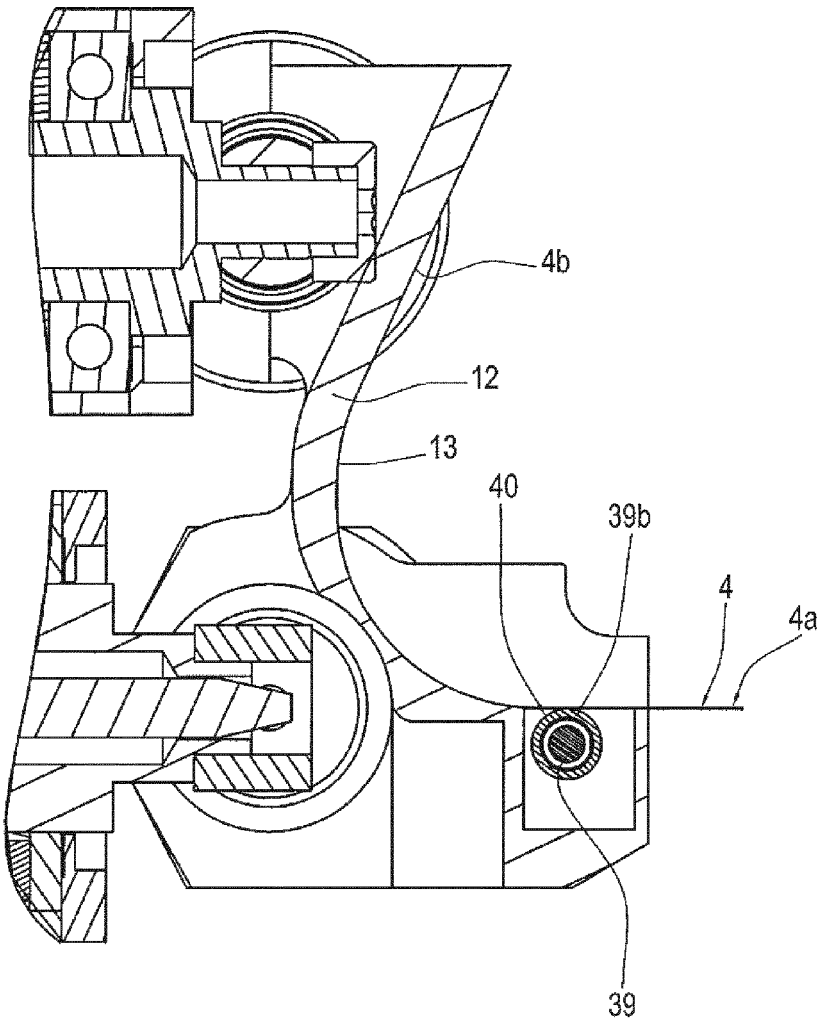
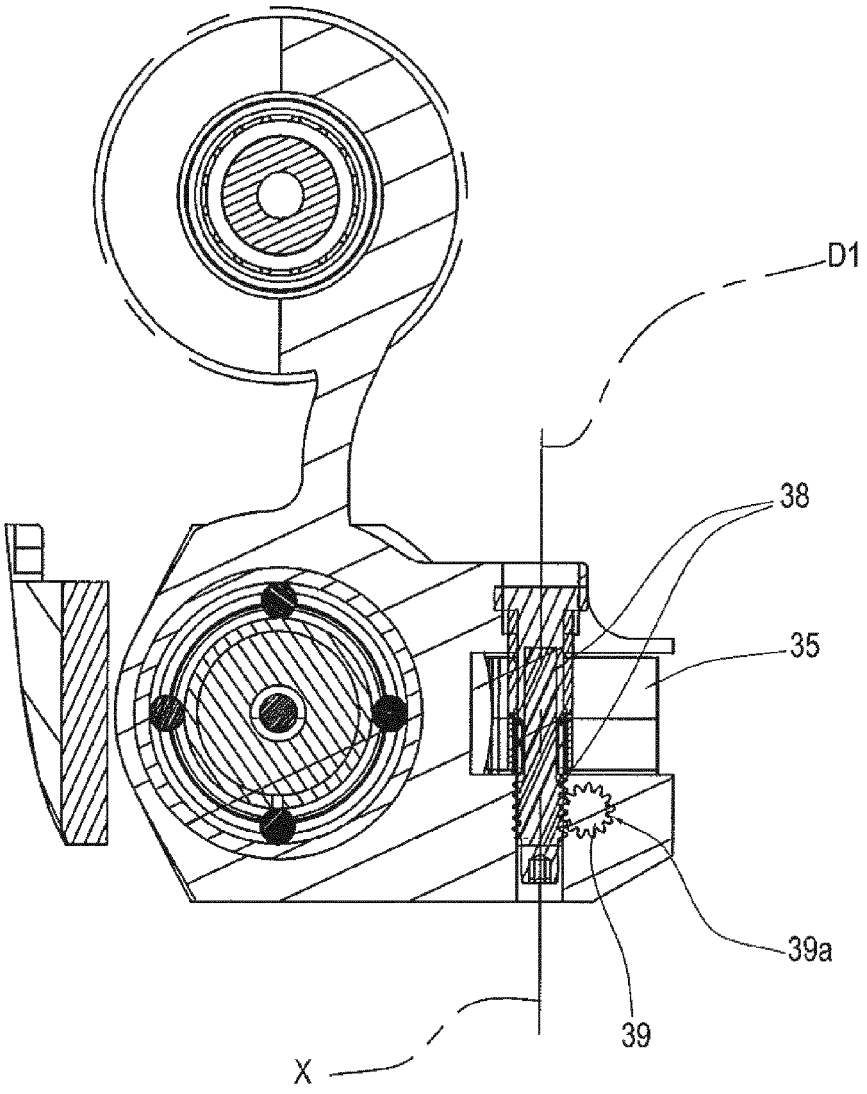


FIG.13



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EUROPEAN SEARCH REPORT

Application Number
EP 12 16 5292

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 982 298 A (KURT KOERBER) 3 February 1965 (1965-02-03) * page 1, line 33 - line 42 * * page 4, line 20 - line 66; figures *	1-24	INV. A24C5/28
A	GB 452 180 A (CLARA QUESTER; KARL QUESTER) 18 August 1936 (1936-08-18) * page 1, line 11 - line 20; figures * * page 2, line 10 - line 106 *	1-24	
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A	DE 932 300 C (TABAK & IND MASCH [DE]) 29 August 1955 (1955-08-29) * the whole document *	1-24	
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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
Munich	6 September 2012	Marzano Monterosso

CATEGORY OF CITED DOCUMENTS

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