(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 705 455 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
27.09.2006 Bulletin 2006/39

(51) Int Cl.:
F42B 33/10 *(2006.01)* ***F42B 35/02*** *(2006.01)*

(21) Application number: **06111343.7**

(22) Date of filing: **17.03.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **23.03.2005 IT MO20050070**
13.05.2005 IT MO20050117

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(54) Apparatus for preparing ammunitions

(57) An apparatus for preparing an ammunition (2) is provided with supporting means (16, 52) for receiving a tool device (56; 58) suitable for performing machining operations by removing material from a cartridge case (3) of said ammunition (2), and with fastening means (33, 34) for receiving a detecting device (35) suitable for detecting a possible radial runout between said cartridge case (3) and a projectile (4) of said ammunition (2).

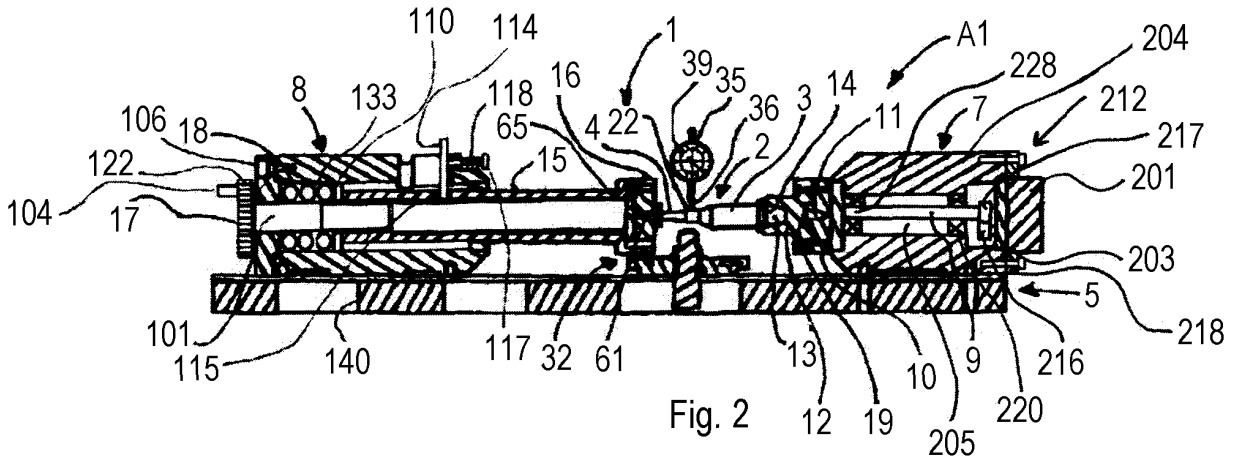

Fig. 2

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Description

[0001] The invention relates to an apparatus for preparing precision ammunitions for firearms, particularly for shooting or hunting arms.

[0002] An ammunition for firearm comprises a cartridge case with which, in a portion thereof called case mouth, a projectile, also called ball, is associated, arranged for being thrown against a desired target.

[0003] The cartridge case comprises a cylindrical wall, generally of metal, inside which a propellant charge is packed, and a bottom wall called bottom.

[0004] The bottom comprises in a central region thereof a hole arranged for receiving a primer.

[0005] A circular groove is further present near the bottom, said circular groove acting as a support for an extractor of an automatic or semi-automatic firearm.

[0006] When an ammunition is fired, the propellant charge contained within the cartridge case is primed by the primer that produces the deflagration thereof, following which an amount of kinetic energy is made available to the ball sufficient for overcoming the friction forces restraining said ball to the case mouth, passing through the so-called "barrel" of the firearm and following a desired path for reaching the desired target.

[0007] Between the lovers of precision shooting, both sharpshooters and sportsmen, there is the common practice of performing machining operations on the cartridge cases in order to increase the shooting precision.

[0008] In particular, operations of turning the case mouth are commonly performed on the new cartridge cases, with the purpose of making uniform the thickness of the case mouth that could vary from point to point due to machining errors occurred during the manufacturing of the cartridge case.

[0009] Furthermore, the lovers of precision shooting often reuse cartridge cases already used in order to increase the shooting precision and save money. In fact, after a first shot, the cartridge case, as a consequence of the strong pressures exerted on the cylindrical walls by the deflagration of the propellant charge therein contained, distorts, by adapting itself to a firing chamber of the firearm used. When reused, that assures an improved efficiency to the cartridge case, the shooting precision of the used firearm being remarkably increased.

[0010] The deflagration of the propellant charge, that distorts the cartridge case, modifies as well some dimensions thereof, which must be recovered in order to use again the cartridge case. In particular, the portion of the cartridge case that is more subjected to deformations is the case mouth, which, due to the remarkable pressures produced by the deflagration, undergoes an extension along the longitudinal axis of the cartridge case.

[0011] Apparatuses are known arranged for performing machining operations with material removal from the ammunitions, in particular from the cartridge cases, in order to restore the dimensions thereof, enabling so a subsequent reuse of said cartridge cases.

[0012] In particular, US 6484616 discloses a device for preparing ammunitions by using new or used cartridge cases.

[0013] The device according to US 6484616 is provided with a plurality of interchangeable tools that enable the cartridge case to be shortened to a predetermined length, said machining being called "trimming" by the persons skilled in the art, an internal or external flaring of the case mouth to be achieved and the thickness of said case mouth to be made uniform by means of turning machining.

[0014] However, the ammunitions made according to US 6484616 can show a non-perfect coaxiality between the ball and the respective cartridge case.

[0015] Such defect results particularly disadvantageous for the lover of precision shooting, because ammunitions that do not show coaxiality between the cartridge case and the ball result particularly unsatisfactory for the shooting precision.

[0016] In fact, in the case of poor coaxiality, the ball, forced to leave the cartridge due to the deflagration, passes through the barrel of the firearm with a path that does not coincide with the axis of the barrel.

[0017] That produces a non-perfect control of the shooting, with consequent unsuccessful achievement of the desired target.

[0018] An object of the invention is to improve the apparatuses for preparing ammunitions for firearms, particularly for preparing precision ammunitions for shooting or hunting firearms.

[0019] A further object is to provide apparatuses that enable ammunitions to be prepared being provided with good dimensional precision, such that the errors occurring when said ammunitions are fired against a target are minimised.

[0020] A still further object is to obtain ammunition having a satisfactory coaxiality between the cartridge case and the respective ball, thus increasing the shooting precision.

[0021] According to the invention, an apparatus is provided for preparing an ammunition, said apparatus being provided with supporting means for receiving a tool device suitable for performing machining operations by removing material from a cartridge case of said ammunition, said apparatus being characterised in that it comprises fastening means for receiving a detecting device suitable for detecting a possible radial runout between said cartridge case and a projectile of said ammunition.

[0022] Owing to the invention an apparatus can be realized with which ammunitions can be prepared that enable the shooting precision and control to be improved.

[0023] In fact, the apparatus according to the invention, besides allowing machining operations on the cartridge case arranged for restoring the dimensional features thereof, enables a possible radial runout between the projectile and the respective cartridge case to be detected. In other words, with a single apparatus, not only the cartridge case can be machined, but also the coaxiality

between cartridge case and projectile can be verified. That enables shoots to be obtained that are particularly effective and suitable for precision shooting.

[0024] In a version, an alignment device is provided that can be received by the supporting means in order to enable, whenever necessary, the coaxiality between the cartridge case and the projectile to be restored. That enables the path of the projectile to be better controlled.

[0025] In a further version, motor means is provided arranged for rotating the ammunition with respect to said tool device comprising speed reducing means. That enables the ammunition to be rotated without the cartridge case being overheated, which cartridge case, distorting itself, could compromises the precision of said machining operations.

[0026] In a still further version, there are provided holding means, that is suitable for being associated with at least one portion of the ammunition, and threaded driving means, arranged for moving said holding means. That enables said holding means to be moved axially towards, or away from, said ammunition, according to the length of the latter.

[0027] The invention can be better understood and implemented with reference to the enclosed drawings, that show some exemplifying and non limitative embodiments thereof, in which:

Figure 1 è a perspective view of an apparatus for preparing an ammunition in a first operating configuration;
Figure 2 is a schematic longitudinal cross-section of the apparatus of Figure 1;
Figure 3 is a plan view of a nut element of an alignment device contained in the apparatus of Figure 1;
Figure 4 is a side view of a pin of the device of Figure 3;
Figure 4a is a side view of an alternative version of the pin of Figure 4;
Figure 5 is a top view of the pin of Figure 4;
Figure 6 is a side view of a supporting element contained in the apparatus of Figure 1;
Figure 7 is a schematic longitudinal cross-section of the apparatus of Figure 1 in a second operating configuration;
Figure 8 is a front view of a shell holder contained in the apparatus of Figure 6;
Figure 9 is a sketched cross-section taken along the plane IX-IX of the shell holder of Figure 8;
Figure 10 is a schematic cross-section taken along the plane X-X of the shell holder of Figure 8;
Figure 11 is a side view of a support of the shell holder of Figure 8;
Figure 12 is a schematic longitudinal cross-section of the apparatus of Figure 1 in a third operating configuration;
Figure 13 is a schematic longitudinal enlarged cross-section of a moving device of the apparatus of Figure 1;
Figure 14 is an enlarged, partially cross-sectioned detail of a motor device of the apparatus of Figure 1;
Figure 15 is an enlarged detail of an alternative version of the motor device of Figure 14;
Figure 16 is a side view of a cleaning device included in the apparatus of Figure 1;
Figure 17 is a perspective view of an enlarged and interrupted detail of a base element included in the apparatus of Figure 1;
Figure 18 is a cross section of the base element of Figure 17;
Figure 19 is a cross section of an abutting element suitable for being associated with the base element of Figure 17;
Figure 20 is a top view of the abutting element of Figure 19. In the Figures 1 and 2, an apparatus 1 is shown arranged for preparing an ammunition 2 for a firearm, in a first configuration A1 wherein a possible radial runout can be detected between a cartridge case 3 and a respective ball 4 or projectile of the ammunition 2. In the first configuration A1, the detected radial runout can also be corrected, when necessary.

[0028] The apparatus 1 is provided with a base element 5, for example of stainless steel, having substantially parallelepiped shape and comprising fastening means provided with a fastening hole or cavity 33 and a key element 34.

[0029] The cavity 33 and the key element 34 enable a comparator 35, provided with a tracer 36, to be mounted on the base element 5, and consequently on the apparatus 1, said comparator 35 being arranged for detecting possible radial runouts between the cartridge case 3 and the ball 4.

[0030] In particular, the cavity 33, internally threaded, is obtained in an upper surface 37 of the base element 5 and may receive, via threaded coupling, a supporting element, not shown, arranged for supporting the comparator 35. The supporting element may comprises, for example, a compass leverage element, provided with a first arm having a threaded end engaging the cavity 33, and a second arm hinged on the first arm. The comparator 35 is mounted on the second arm.

[0031] In an alternative version, the comparator 35 may be mounted on the base element 5 by means of a magnetic block, not shown, that co-operates with the key element 34. The key element 34 is attached to a side surface 38 of the base element 5 and is made of magnetic material, for example iron, so that the key element 34 engages the magnetic block supporting the comparator 35 owing to attractive magnetic forces.

[0032] The magnetic block is not described herein in more detail, being an element of known type, that is commonly sold together with the comparators.

[0033] A slit 6 is further obtained on the upper surface 37 of the base element 5, said slit 6 extending through the full length of the base element 5 and being substan-

tially "U"-shaped.

[0034] A first unit 7 and a second unit 8, mutually opposed, are fixed to the slit 6, for example via threaded coupling.

[0035] The first unit 7 has substantially cylindrical shape and is provided with an internally hollow shell 204, developing around a first, substantially longitudinal axis Z1 (Figure 14).

[0036] The shell 204 is closed at its own end region 211 by a first annular cover 218 provided with a circular passage.

[0037] The first annular cover 218 is removably fixed to the shell 204 for example through a plurality of screws 219.

[0038] The shell 204 is further provided with an internal surface 207 that defines a cylindrical chamber 205 comprising a first chamber 208, a second chamber 209 and a third chamber 210, that are mutually adjacent and having progressively increasing diameters.

[0039] The cylindrical chamber 205 is arranged for receiving within it a portion of a motor device 212.

[0040] The motor device 212, which provides for rotating around the first axis Z1 the ammunition 2, comprises a motor 201, a speed reducer 203 and a driven shaft 9.

[0041] The motor 201, that for example may be of electric type, extends along the first axis Z1, and projects outside the shell 204 from the end region 211 through the circular passage of the first annular cover 218.

[0042] The motor 201 is provided with a flange 202, placed into the third chamber 210, with which the speed reducer 203 is associated, for example through threaded coupling, said speed reducer 203 projecting from the flange 202 into the third chamber 210.

[0043] The motor 201 further comprises a motor shaft 213 extending along the first axis Z1.

[0044] A first gear wheel 214, for example a spur gear wheel of known type, is keyed onto an end of the motor shaft 213, facing the speed reducer 203.

[0045] The first gear wheel 214 engages an input pinion 215 placed inside a box-shaped element 224 with which the speed reducer 203 is provided.

[0046] In particular, the input pinion 215 is keyed on a first shaft 226 extending along a second axis Z2 which is substantially parallel to the first axis Z1.

[0047] Thus, the input pinion 215 takes up a substantially eccentric position with respect to the first axis Z1.

[0048] The box-shaped element 224 comprises therein a gearing, not shown, arranged for obtaining a desired transmission ratio.

[0049] In particular, said gearing ends with an output pinion 216, keyed on a shaft 225 developing along a third axis Z3 substantially parallel to the first axis Z1.

[0050] Thus, also the output pinion 216 takes up a substantially eccentric position with respect to the first axis Z1.

[0051] The output pinion 216 projects from the box-shaped element 224 and is arranged for engaging a second gear wheel 217, inside the second chamber 209.

[0052] The second gear wheel 217 is keyed on a first portion 222 of the driven shaft 9, so as to rotate the latter.

[0053] The driven shaft extending along the first axis Z1 is placed inside the first chamber 208 where it is supported by a plurality of bearings 220.

[0054] In an alternative version, shown in Figure 15, the driven shaft 9 is supported by a single conical bearing 227 substantially placed at a second portion 223 of the driven shaft 9, opposed to the first portion 222.

[0055] It is pointed out that the first gear wheel 214, the input pinion 215, the output pinion 216, the second gear wheel 217 and the gearing housed inside the box-shaped element 224, achieve a transmission with substantially parallel axes.

[0056] The speed reducer 203 enables the driven shaft 9 to be driven with a rotation speed lower than the rotation speed of the driving shaft 213, so that the cartridge case 3 is not overheated during the following machining processes, as it will be better described later.

[0057] Thus, undesired deformations of the cartridge case 3 are prevented, that could compromise the success of said machining processes.

[0058] In an alternative version, not shown, the first gear wheel and the second gear wheel are keyed on the drive shaft and on the driven shaft respectively, the drive shaft and the driven shaft having mutually parallel axes. The first gear wheel and the second gear wheel are mutually coupled through flexible transmission means, such as a toothed belt.

[0059] A first support 10 is associated to an end zone 228 of the driven shaft 9 opposed to the first portion 222 and adjacent to the second portion 223, said first support 10 being provided, at one central region thereof, with a protrusion 19 provided with a countersunk hole 11.

[0060] A second support 12, shown in detail in Figure 6, is removably mounted on the first support 10, for example by means of a plurality of screws. The first support 10 is interposed between the driven shaft 9 and the second support 12.

[0061] The second support 12 comprises a first element 229, of substantially cylindrical shape, provided, at one central region 231 thereof, with a hollow 250 arranged for being shapingly coupled with the protrusion 19 of the first support 10 so as to enable the second support 12 to be positioned in accurate manner with respect to the first support 10.

[0062] The first element 229 is provided, substantially at the central portion 231 thereof, with a substantially cylindrical relief 232, whereon a pair of bearings 233 is mounted.

[0063] The second support 12 further comprises a second element 230 provided with a cylindrical recess 243 arranged for engaging the pair of bearings 233.

[0064] Thus, the second element 230 can rotates with respect to the first element 229.

[0065] The second element 230 is provided with a frustum conical seat 13 arranged for receiving, in use, an end 14 of the cartridge case 3. Owing to its own shape,

the frustum conical seat 13 can receive cartridge cases having calibre different from each other. Alternatively, the second support 12 can be changed according to the calibre of the desired ammunition to be prepared.

[0066] The second unit 8 has substantially cylindrical shape and is received into a cylindrical shell 112 closed at a first end 108 thereof by a second annular cover 106. The second annular cover 106 is attached to the cylindrical shell 112 for example by means of screws.

[0067] The second unit 8 further comprises a second end 107, opposed to the first end 108, from which second end 107 a tube 15 protrudes, to which a rotating element 16 is associated, said rotating element 16 being rotatable with respect to the tube 15, owing to a bearing, not shown.

[0068] The tube 15, internally threaded, develops around the substantially horizontal first axis Z1 (Figure 13). The rotating element 16 is provided, at a first portion 121 thereof facing the first unit 7 with a further countersunk hole 61 arranged for receiving, in use, a further end 65 of the ball 4 opposed to the end 14 of the cartridge case 3.

[0069] The second unit 8 further comprises a moving device 103, shown in detail in Figure 13, arranged for axially moving the tube 15.

[0070] In particular, the moving device 103 enables the tube 15 to be moved towards, or away from, the first unit 7, according to the length of the ammunition 2 to be supported for machining.

[0071] Furthermore, by moving the tube 15 towards the first unit 7 the ammunition 2 can be held in order to enable the machining process to be performed; vice versa by moving the tube 15 away from the unit 7 the ammunition 2 just machined can be removed and a further ammunition to be machined can be loaded.

[0072] The moving device 103 comprises a knob 17 placed near the second annular cover 106.

[0073] The knob 17 may be provided externally with a knurling 122 and/or a cylindrical element 104, having the function of crank, protruding from a first face 130 of said knob.

[0074] In particular, the knob 17 can be rotated by manually operating on the cylindrical element 104 or the knurling 122 with which it is provided.

[0075] The knob 17 is further provided with a stem 101, externally threaded, projecting from a second face 131 of the knob 17 opposed to the first face 130 and extending along the first axis Z1. In particular, the stem 101 is arranged for coupling with the tube 15 through threaded connection.

[0076] The stem 101 is further sliding inside a bushing 109, received into a circular passage 123 obtained into the second annular cover 106.

[0077] An abutting ring 110 is positioned into contact with a bottom region 111 of the tube 15 and partially enclose the stem 101. A spring 18, enveloping the stem 101, is interposed between the second annular cover 106 and the abutting ring 110.

[0078] In particular, the spring 18 is contained into an annular hollow 133 defined by the second annular cover 106, the abutting ring 110, an internal surface of the cylindrical shell 112 and the stem 101.

[0079] A substantially L-shaped opening 113 is further obtained in the cylindrical shell 112, said opening 113 having a longitudinal section 124 arranged along the first axis Z1 and a transversal section extending transversally to the first axis Z1. The transversal section has an end portion 119 that is far from the longitudinal section 124 and a further end portion 120 at which the longitudinal section 124 leads away. The opening 113 is arranged for receiving a first pin 114 perpendicularly positioned with respect to the first axis Z1. The first pin 114 is made integral with the tube 15 since it engages a seat 115 obtained in a portion of surface of the tube 15 facing the opening 113.

[0080] The second end 107 is provided with a further opening 116 extending along the first axis Z1, communicating with the opening 113 and arranged for engaging the second pin 117 via a threaded connection.

[0081] The second pin 117 is arranged for interacting with the first pin 114, and is partially enveloped by a further spring 118, which is interposed between the second end 107 and the second pin 117, said spring 118 being arranged for preventing the second pin 117 from being accidentally screwed/unscrewed to/from the further opening 116.

[0082] In particular, the second pin 117 is arranged for contacting the first pin 114 and acts as an axial adjustment element for the latter and therefore for the tube 15.

[0083] In fact, the second pin 117 can be screwed to, or unscrewed from, the further opening 116 by maintaining said second pin 117 in contact with the first pin 114, and thus an axial position of the first pin 114 can be modified along the first axis Z1.

[0084] The cylindrical shell 112 is fixed to the base 5 via screws, not shown, suitable for being positioned, operatively substantially in vertical manner, inside through slots 140, obtained in the base element 5.

[0085] In order to modify the position of the second unit 8 along the slit 6 of the base element 5 it is necessary to raise the apparatus 1 from a working plane, not shown, whereon said apparatus 1 is positioned, to unscrew the screws and move them inside the slots 140, to screw the screws and reposition the apparatus 1 onto the working plane.

[0086] By doing so, the second unit 8 can be moved towards, or away from, the first unit 7, according to the calibre of the ammunition 2. Thus, the tube 15 can be preliminary positioned, although in a non-accurate manner, with respect to the first unit 7.

[0087] In a version of the invention, shown in the Figures 17 to 20, the apparatus 1 comprises side blocking means arranged for blocking the second unit 8 along the base element 5 in a desired axial position.

[0088] In such version, the base element 5 comprises a first groove 302 communicating with a second groove 303, the first groove 302 and the second groove 303 be-

ing obtained on the upper surface 37 of the base element 5.

[0089] The first groove 302 and the second groove 303 extend along the longitudinal development of the base element 5 and have substantially the shape of "U" in the cross section, the second groove 303 being less deep and large than the first groove (Figures 17 and 18).

[0090] The base element 5 is further provided with a pair of threaded through holes 300 which are obtained into the side surface 38 and which extending along a transversal direction with reference to the longitudinal development of the base element 5. In other words, the threaded through holes 300 extend substantially perpendicularly in respect to the side surface 38 and make the latter in communication with the first groove 302.

[0091] With reference to the Figures 19 and 20, an abutting element 304 is shown, suitable for being shapingly coupled with the first groove 302 and having substantially parallelepiped shape.

[0092] The abutting element 304, that can slide into the first groove 302, is provided with a pair of unthreaded through holes 311, and is arranged for being associated, for example by means of threaded coupling, with the cylindrical shell 112 of the second unit 8.

[0093] The abutting element 304 is further provided with a sloped surface 310, facing, in use, the threaded through holes 300 and arranged for interacting with blocking screws, that are not shown, arranged for engaging the threaded through holes 300.

[0094] When the position of the second unit 8 is desired to be modified along the first groove 302, it is sufficient to unscrew the blocking screws so as to move the blocking screws away from the sloped surface 310 and to slide the second unit 8 along the first groove 302 by means of the abutting element 304 associated with the cylindrical shell 112.

[0095] When the second unit 8 is positioned at a desired distance from the first unit 7, the blocking screws are tightened into the threaded through holes until an end portion of the blocking screws contacts the sloped surface 310.

[0096] In such version, since the blocking screws are positioned sideways with respect to the base element 5, the axial position of the second unit 8 with respect to the first unit 7 can be simply and quickly adjusted, without the need for raising/lowering the apparatus 1.

[0097] Furthermore, the slope of the sloped surface 310 enables the force exerted by the blocking screws on said sloped surface 310 to be decomposed into a first component oriented substantially vertically downward and a second component oriented substantially horizontally.

[0098] Owing to the first component that pushes the abutting element 304 against a bottom surface of the first groove 302, the cylindrical shell 112 can be more effectively tightened, and then the second unit 8, on the base element 5.

[0099] Also in such version the tube 15 can be preliminarily positioned with respect to the first unit 7, even though in non-accurate manner.

[0100] When the apparatus 1 is in a rest position, before starting any operation on the ammunition 2, the first pin 114 is positioned in the end portion 119 of the opening 113. There is no ammunition between the first unit 7 and the second unit 8.

[0101] When an operation on the ammunition 2 is requested to be achieved, the end 14 of said ammunition is placed in the second support 12 and the first pin 114 is moved into the further end portion 120 of the opening 113.

[0102] Now it is possible to rotate the knob 17, for example by manually operating the cylindrical element 104, and successively the stem 101 associated thereto.

[0103] In particular, by rotating the knob 17, the stem 101 interacts, via the threaded connection, with the tube 15. The force exerted by the spring 18, that tends to move the abutting ring 110 away from the second annular cover 106, prevents the tube 15 from rotating integral with the stem 101. Thus, by rotating according to a first direction the knob 17, the tube 15 is unscrewed from the stem 101 and consequently the rotating element 16 moves towards the first unit 7. Instead, by rotating the knob 17 in a second direction opposed to said first direction, the tube 15 screws onto the stem 101 and the rotating element 16 moves away from the first unit 7.

[0104] The first pin 114, that is integral with the seat 115, is axially moved together with the tube 15 and moves at the interior of the longitudinal section 124 of the opening 113.

[0105] It is moreover possible, by manually operating the second pin 117 that is held into contact with the first pin 114, to further axially move said first pin 114 and the tube 15 associated thereto.

[0106] Thus, by either operating the knob 17 or the second pin 117, a really accurate axial adjustment can be achieved of the rotating element 16, towards, or away from, the first unit 7. In fact, by proceeding as described above, the rotating element 16 is moved towards the first unit 7 until a position is reached such that the ammunition 2 can be properly held between the rotating element 16 and the second support 12. It is now possible to stop the rotation of the knob 17 and/or of the second pin 117.

[0107] It is noticed that when the tube 15 is moved along the first axis Z1, the knob 17 is not axially moving, due to the abutting action performed by the spring 18 on the second annular cover 106 and on the abutting ring 110. Once the desired operations have been performed on the ammunition 2, the first pin 114 is manually operated so as to be positioned again in the end portion 119 so as to be blocked in the transversal section of the opening 113. Now it is possible to disengage the ammunition 2 from the apparatus 1.

[0108] It is noticed that, when the first pin 114 is positioned in said transversal section, the first pin 114 drags together itself the tube 15 and the knob 17, that, having no abutting element, can move away from the second

annular cover 106.

[0109] In the first configuration A1, between the first unit 7 and the second unit 8 an alignment device 32 is interposed, that can slide at the interior of the slit 6 (or at the interior of the second groove 303) and comprises a nut 20 and a pin 21 arranged for interacting with a case mouth 22 of the cartridge case 3.

[0110] The nut 20, shown in detail in Figure 3, is substantially disk shaped, and is provided, in a central region thereof, with an internally threaded hole 23 arranged for coupling with the pin 21. The nut 20 further comprises a side knurled wall 24 provided with a plurality of radial holes 25 wherein tools can be inserted, not shown, so as to more comfortably rotate the nut 20, as will be described below.

[0111] The pin 21, shown in the Figures 4 and 5, comprises a first section 26, a second section 29 and a central section 28.

[0112] The first section 26 has substantially circular cross section and is provided, at one end thereof, with a substantially "V" shaped resting surface 27 arranged for interacting with the case mouth 22 of the cartridge case 3.

[0113] The second section 29, opposed to the first section 26, has substantially cross section of a rounded rectangle, being delimited by two guiding surfaces 62, mutually parallel, suitable for being shapingly coupled with the slit 6 of the base element 5. The guiding surfaces 62 prevent the pin 21 from rotating with respect to the base element 5. In the second section a threaded region 30 and a smooth region 31 can be recognised.

[0114] The central section 28 externally threaded, having substantially circular cross section, is interposed between the first section 26 and the second section 29.

[0115] The pin 21 is suitable for being removably coupled with the threaded hole 23 that is obtained into the nut 20 by means of the threading present in the central section 28 and in the threaded region 30 of the second section 29.

[0116] In an alternative version, shown in the Figure 4a, the alignment device 32 comprises a further pin 234 functionally analogous to the pin 21 and arranged for being used as an alternative to the latter.

[0117] The further pin 234 comprises a further first section 235, a further second section 236 and a further central section 237. The further first section 235 is provided, at one end thereof, with a head 238 supporting a pair of rollers 239.

[0118] The rollers 239, mutually aligned, co-operate for defining resting surfaces 240 arranged for interacting with the case mouth 22 of the cartridge case 3.

[0119] The further second section 236, that is opposed to the further first section 235, has substantially section of rounded rectangle being delimited by two further guiding surfaces 241, mutually parallel, suitable for being shapingly coupled with the slit 6 of the base element 5. The further guiding surfaces 241 prevent the further pin 234 from rotating with respect to the slit 6 of the base element 5. In addition, in the further second section 236 a further threaded region 242 can be recognised.

[0120] Between the further first section 235 and the further second section 236, the further central section 237, externally threaded, is interposed, having substantially circular shape. The further pin 234 results suitable for being removably coupled with the threaded hole 23 obtained in the nut 20 by means of the threading present in the further central section 237 and in the further threaded region 242 of the further second section 236.

[0121] The apparatus 1 in the first configuration A1 operated as described in the following.

[0122] A user inserts the end 14 of the ammunition 2, of which possible radial runouts are desired to be detected, into the frustum conical seat 13 of the second element 230 of the second support 12.

[0123] The further end 65 of the ball 4 is positioned into the further countersunk hole 61 of the second unit 8, whose distance from the first unit 7 is adjusted as a function of the length of the ammunition 2 by operating on the moving device 103 as described above.

[0124] Subsequently, the tracer 36 of the comparator 35 is laid over the case mouth 22 of the cartridge case 3.

[0125] At this point, the ammunition 2 is rotated by a full revolution by manually rotating the second element 230 with respect to the first element 231, so that the comparator 35 can detect when the cartridge case 3 is not placed in coaxial position with respect to the ball 4 and the possible radial runout is displayed on a graduated scale with which the comparator 35 is provided.

[0126] When the comparator 35 detected a radial runout, the ammunition 2 is rotated such that the region wherein the largest deviation from the coaxiality has been detected is directed toward the alignment device 32 place near the case mouth 22.

[0127] At this point, with the tracer 36 still laid on the case mouth 22, the nut 20 of the alignment device 32 is rotated until the radial runout descends below a desired limit, for example comprised between one and two hundredths of millimetre. In some case, the radial runout can also be reduced virtually to zero.

[0128] The nut 20 can be rotated by manually operating on the side knurled wall 24 or by means of a suitable tool inserted into one of the radial holes 25.

[0129] Thus, the pin 21 or the further pin 234, that are screwed to the nut 20, are forced to move upwardly or downwardly according to the rotating direction imposed to the nut 20.

[0130] In fact, as the first section 29 of the pin 21 or the further second section 236 of the further pin 234 are shapingly coupled with the slit 6, when the nut 20 is rotated, the pin 21 or the further pin 234, that are screwed to the nut 20, can not rotate, instead are forced to move upwardly or downwardly according to the direction with which the nut 20 is rotated.

[0131] In particular, as the nut is operated such that the pin 21 or the further pin 234 is raised, the resting surface 27 or the resting surfaces 240 are enabled to interact with the case mouth 22.

[0132] As the ammunition 2 is restraint at its ends, the pressure exerted by the resting surface 27 or by the resting surfaces 240 on the case mouth 22 enables the coaxiality between the cartridge case 3 and the ball 4 to be restored.

[0133] In Figure 7 a schematic cross section of the apparatus 1 is shown in a second operating configuration A2, wherein the apparatus 1 enables an external turning machining with shaving removal to be performed on the case mouth 22 of the cartridge case 3.

[0134] The turning machining is carried out on the new cartridge cases, in order to prepare said cartridge cases for being fired for the first time. In fact, during the manufacturing of the new cartridge cases some machining errors can occur, owing to which the case mouth 22 has a non-uniform thickness. This means that zones of relatively reduced thickness and zones of higher thickness can be identified on the case mouth 22 of a new cartridge case 3. If the cartridge case 3 were used without undergoing an external turning machining, during deflagration the zones of relatively reduced thickness will deform before and in greater extent than the zones of higher thickness. Thus, a trajectory not coinciding with the symmetry axis of the barrel of the firearm will be impressed to the ball 4, said trajectory not enabling the ball 4 to reach the desired target.

[0135] In order to achieve the external turning machining of the case mouth 22 is used the same apparatus 1 opportunely modified used for detecting and restoring the coaxiality between cartridge case 3 and ball 4.

[0136] In particular, the alignment device 32 and the caliper or the magnetic coupling arranged for supporting the camparator 35 are disassembled.

[0137] Then, the second support 12, coupled to the first support 10 through a plurality of screws, is disassembled from the first support 10, and a further support 40, shown in schematic manner in Figure 11, is mounted in place of the second support 12.

[0138] The further support 40 comprises a base 43 of substantially cylindrical shape, provided with a plurality of further holes 41 arranged for being penetrated by a plurality of screws enabling the further support 40 to be associated in removable manner to the first support 10.

[0139] The base 43 is then provided, at a central region thereof, with a further hollow 42 arranged for being shapingly coupled with the protrusion 19 of the first support 10, so as to enable the further support 40 to be positioned in accurate manner with respect to the first support 10.

[0140] In addition, the further support 40 comprises a further externally threaded cylindrical element 44 arranged for being coupled in removable manner with a shell holder 45, schematically shown in the Figures 8 to 10.

[0141] The further support 40 is also provided with a substantially cylindrical shank 46, acting as centring means, arranged for being shapingly coupled with a base 47 of the cartridge case 3.

[0142] The substantially cylindrical shell holder 45 is provided with an internally threaded cylindrical opening 49, arranged for engaging by threaded coupling with the further cylindrical element 44 of the further support 40.

[0143] The shell holder 45 further comprises a through hole 50 arranged for being passed through by the shank 46 of the further support 40.

[0144] In addition a groove 51 is provided, arranged for holding the cartridge case 3 during machining. As shown in Figure 7, in plant view the groove 51 is "U" shaped, being provided with two mutually parallel rectilinear portions 63 and a circular portion 64 interposed between the rectilinear portions 63.

[0145] The end 14 of the cartridge case 3 is provided with an edge that is inserted into the groove 51 so as to be positioned between the rectilinear portions 63. Successively, the edge of the cartridge case 3 is brought to seat against the circular portion 64 and the shank 46 is inserted into the base 47 so as to centre the cartridge case 3 with respect to the shell holder 45.

[0146] In addition, a supporting member is positioned, by means of a plurality of screws, on the rotating element 16 of the second unit 8, said supporting member comprising a sleeve 52 of substantially cylindrical shape, that, being fixed to the tube 15, stops the rotation of the rotating element 16.

[0147] The sleeve 52 is provided with an internally threaded through recess 53 arranged for receiving a first tool post 54 for turning.

[0148] The first tool post 54 is provided with a peg 55 arranged for precisely inserting into the case mouth 22 of the cartridge case 3 in order to support it and prevent, during machining, the case mouth 22 from being inward deformed in undesired manner. In addition, on the first tool post 54 a first tool 56, for example of carbide, is mounted, arranged for performing the turning machining.

[0149] When the case mouth 22 is desired to-be externally turned, a cartridge case 3 is inserted into the groove 51 of the shell holder 45.

[0150] The cartridge case 3, once arrived near the shank 46, stops at the ideal position for being machined.

[0151] By operating the knob 17 and/or the second pin 117 of the second unit 8, the moving device 103 is actuated so as the tube 15, together with the first tool post 54, is moved near the first unit 7, until the peg 55 is fully inserted into the cartridge case 3.

[0152] At this point, by means of the motor device 212, the driven shaft 9 is actuated, which driven shaft, rotating, enables the external turning of the case mouth 22 to be performed by the first tool 56.

[0153] With reference to the Figure 12, the apparatus 1 is shown in a third operating configuration A3 wherein the machining operation of trimming and flaring of the case mouth 22 can be performed.

[0154] In fact, after usage, the cartridge case 3 may have suffered some deformations along its longitudinal axis, altering the length thereof and damaging an edge 60 of the case mouth 22.

[0155] In particular, trimming, i.e. shortening of the

case mouth 22 of the cartridge case 3, allows to prevent the edge 60 of the case mouth 22 from interfering with a region of the barrel where a rifling is present, arranged for imparting a rotation to the ball 4 when the ball 4 is fired, so as to improve the trajectory thereof. The flaring, that is performed both internally and externally to the edge 60, allows instead to prevent possible burrs of the edge 60 from damaging the ball 4 when inserted into the cartridge case 3.

[0156] In the third operating configuration A3, the apparatus 1 comprises the same components already described with reference to the second operating configuration A2, except for the used tools.

[0157] In particular, in the third operating configuration A3, a second tool post 57 is mounted on the sleeve 52 by means of a threaded coupling, said second tool post 57 being provided with a second tool 58, for example made of carbide, arranged for performing the machining operations of trimming and internal and external flaring.

[0158] The second tool 58 is provided with a further peg 59 arranged for engaging the case mouth 22 and acting as a support for the cartridge case 3 during the machining operations.

[0159] When the case mouth 22 is desired to be trimmed and internally and externally flared, a cartridge case 3 is inserted into the groove 51 of the shell holder 45, with modalities similar to those described before with reference to the external turning of the case mouth 22.

[0160] The second tool post is then moved near the second cartridge case 3 by acting on the moving device 103 and successively the driven shaft 9 is rotated, by means of the motor device 212, that enables the required machining operations of the case mouth 22 to be performed by the second tools means 57.

[0161] With reference to Figure 16 a cleaning device 244 is shown arranged for removing residuals of propellant charge in case still present inside the cartridge case 3 after a deflagration occurred.

[0162] The cleaning device 244 comprises a third support 245, suitable for being associated in removable manner with the first support 10 via a plurality of screws, and provided with a threaded opening 248 at a central area 246 thereof.

[0163] The cleaning device 244 further comprises cleaning brush means 247 provided at an end thereof with a threaded shank 249 arranged for engaging the threaded opening 248.

[0164] The cleaning brush means 247 comprises a rod 250 from which a plurality of bristles 251, or similar, substantially radially projects.

[0165] When the cartridge case 3 is desired to be internally cleaned, the third support 245 is fixed to the first support 10, then the cartridge case 3 is manually moved towards the cleaning device 244 until the rod 250 is introduced into the cartridge case 3.

[0166] Successively, the driven shaft 9 is rotated, by means of the motor device 212, which driven shaft 9 rotates the rod 250 that, by means of the bristles 251, removes from the cartridge case 3, manually retained, the residuals of propellant charge in case present therein.

[0167] In a version of the invention, not shown, the apparatus 1 comprises protection means, arranged for protecting the user while said machining operations are performed.

[0168] Such protection means comprises barrier means suitable for being positioned near a portion of the apparatus 1 comprised between the first unit 7 and the second unit 8 wherein the machining operations on the cartridge case 3 are performed.

[0169] The barrier means comprises a transparent shell, being substantially "U"-shaped, and suitable for being associated with the base element 5, for example by means of a plurality of hinges.

[0170] Thus, the transparent shell is movable between a lowered position, wherein the machining operations are performed and consequently the driven shaft 9 is rotated, and a raised position wherein an already machined cartridge case 3 can be removed and a cartridge case 3 to be machined can be positioned, in which raised position the driven shaft 9 is not rotated. The protection means further comprises safety switch means, suitable for being associated with the side surface 38 of the base element 5, interacting with the transparent shell in order to stop the rotation of the driven shaft 9 when the transparent shell lies in the raised position.

[0171] By using a single apparatus 1, whereon the proper tools are mounted, all the operations can be therefore performed that enable an ammunition 2 to be prepared for precision shooting. In particular, the apparatus 1 can be used preliminarily for removing, by means of the cleaning device, possible remains of propellant charge present in an already used cartridge case 3.

[0172] Successively the apparatus 1 can be configured in the second operating configuration A2 in order to perform the external turning machining on the case mouth of a new cartridge case 3 still devoid of the respective ball 4.

[0173] Still successively, the apparatus 1 is arranged in the third operating configuration A3 in order to perform the trimming operation and the internal and external flaring of the case mouth of the cartridge case 3, still devoid of the respective ball 4.

[0174] Once preceded by a proper propellant charge, the ball 4 is then inserted into the cartridge case 3, so as to complete the ammunition 2.

[0175] The apparatus 1 is then arranged into the first operating configuration A1 in order to detect possible radial runouts between the ball 4 and the cartridge case 3 and, whenever necessary, to correct them. At this point the ammunition 2 is ready to be fired.

[0176] The radial runouts are checked, and whenever necessary corrected, each time a new ball 4 is mounted on the cartridge case 3.

[0177] After the same cartridge case 3 has been reused for a certain number of shots, for example two or three shots, it is advisable to control the length of the

cartridge case 3 and, whenever necessary, newly perform the machining operation of trimming and internal and external flaring.

Claims

1. Apparatus for preparing an ammunition (2), provided with supporting means (16, 52) for receiving a tool device (56; 58) suitable for performing machining operations by removing material from a cartridge case (3) of said ammunition (2), **characterised in that** said apparatus comprises fastening means (33, 34) for receiving a detecting device (35) suitable for detecting a possible radial runout between said cartridge case (3) and a projectile (4) of said ammunition (2).

2. Apparatus according to claim 1, wherein said fastening means (33, 34) comprises a fastening hole (33) obtained in a base (5) of said apparatus (1) for removably receiving a first arm of a supporting element suitable for supporting said detecting device (35), said supporting element comprising a second arm suitable for being associated with said detecting device (35) and hinged with said first arm.

3. Apparatus according to claim 1, wherein said fastening means (33, 34) comprises magnetic fastening means (34) suitable for removably coupling with a magnetic support for supporting said detecting device (35).

4. Apparatus according to claim 3, wherein said magnetic fastening means comprises a magnetic element (34) suitable for being fastened to a base (5) of said apparatus (1), said base (5) being made of non-magnetic material.

5. Apparatus according to any preceding claim, and further comprising an alignment device (32) arranged for aligning said cartridge case (3) and said projectile (4), so as to correct said radial runout.

6. Apparatus according to claim 5, wherein said alignment device (32) comprises pin means (21; 234) with which resting means (26; 235) is associated, said resting means (26; 235) being arranged for supporting a case mouth (22) of said cartridge case (3), said pin means (21; 234) being movable in a substantially parallel direction to an axis thereof towards, or away from, said case mouth (22).

7. Apparatus according to claim 6, wherein said resting means (26; 235) is provided with a resting surface (27) suitable for restingly receiving said case mouth (22) and substantially V-shaped.

8. Apparatus according to claim 6, wherein said resting means (26; 234) comprises a pair of rollers (239) defining respective resting surfaces (240) suitable for restingly receiving said case mouth (22).

9. Apparatus according to any preceding claim, and further comprising motor means (212) for rotating said ammunition (2) with respect to said tool device (56; 58), said motor means (212) being provided with speed reducing means (203).

10. Apparatus according to any preceding claim, and further comprising holding means (16, 12; 55, 45; 59, 45) suitable for being associated with at least one portion (3; 4) of said ammunition (2).

11. Apparatus according to claim 10, wherein said holding means (16, 12; 55, 45; 59, 45) comprises first holding means (12; 45) for holding a first end (14; 47) of said at least one portion (3; 4) and second holding means (16; 55; 59) for holding a second end (65; 22) of said at least one portion (3; 4).

12. Apparatus according to claim 11, as claim 10 is appended to claim 9, wherein said first holding means (12; 45) is rotatable by said motor means (212).

13. Apparatus according to claim 12, wherein said first holding means (12; 45) is connected with shaft means (9) rotatable by said motor means (212), said shaft means (9) being supported by conical bearing means (227).

14. Apparatus according to any one of claims 11 to 13, and further comprising threaded driving means (15, 101, 116, 117) associated with said second holding means (16; 55; 59) so as to move said second holding means (16; 55; 59) towards, and away from, said first holding means (12; 45).

15. Apparatus according to any one of claims 11 to 14, and further comprising a disengaging device (113, 114) slidingly drivable in order to move said second holding means (16; 55; 59) away from said first holding means (12; 45) so as to disengage said ammunition (2).

16. Apparatus according to any one of claims 11 to 15, wherein said first holding means (12; 45) and said second holding means (16; 55; 59) comprise respectively first housing means (12) provided with a first seat (13) for receiving said first end (14) and second housing means (16) provided with a second seat (61) for receiving said second end (65), while said possible radial runout is controlled, at least one of said first housing means (12) and said second housing means (61) being rotatingly supported in order to rotate said ammunition (2).

17. Apparatus according to claim 16, wherein said first seat (13) and said second seat (61) are substantially frustum conical.

18. Apparatus according to claim 16, or 17, wherein said second housing means (16) is included in said supporting means (16, 52).

19. Apparatus according to any preceding claim, wherein said supporting means (16, 52) is provided with a recess (53) wherein said tool device (56; 58) cab be fixed.

20. Apparatus according to claim 19, as appended to claim 14, wherein said recess (53) is obtained in a supporting member (52) which can be fixed to said threaded driving means (15, 101, 116, 117) through said second housing means (16), so as to prevent said second housing means (16) from rotating with respect to said threaded driving means (15, 101, 116, 117).

21. Apparatus according to any one of claims 11 to 18, or according to claim 19 or 20, as claim 19 is appended to any one of claims 11 to 18, wherein said first holding means (12; 45) comprises a holding element (45) suitable for supporting said first end (14) while said machining operations are performed, said holding element (45) being provided with groove means (51) suitable for holding an edge of said first end (14).

22. Apparatus according to any preceding claim, wherein said supporting means (16, 52) supports first tool means (56) arranged for performing an external turning machining on said cartridge case (3).

23. Apparatus according to any one of claims 1 to 21, wherein said supporting means (16, 52) supports second tool means (58) arranged for performing machining operations of trimming and flaring on said cartridge case (3).

24. Apparatus according to any preceding claim, and further comprising a cleaning device (244) arranged for removing residuals of propellant charge from said cartridge case (3).

25. Apparatus according to claim 2, or claim 4, or according to any one of claims 5 to 24 as appended to claim 2 or 4, and further comprising side blocking means arranged for blocking said supporting means (16, 52) along said base (5) in a desired axial position.

26. Apparatus according to claim 25, wherein said side blocking means comprises a blocking element acting on a sloped surface (311) of abutting means (304) suitable for being associated with said supporting means (16, 52).

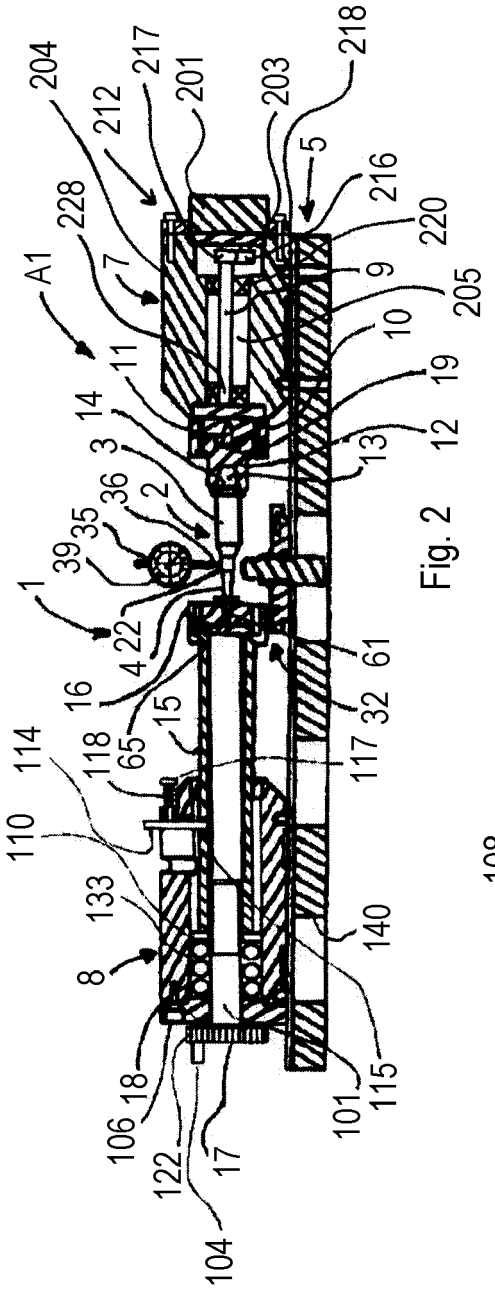
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Fig. 2

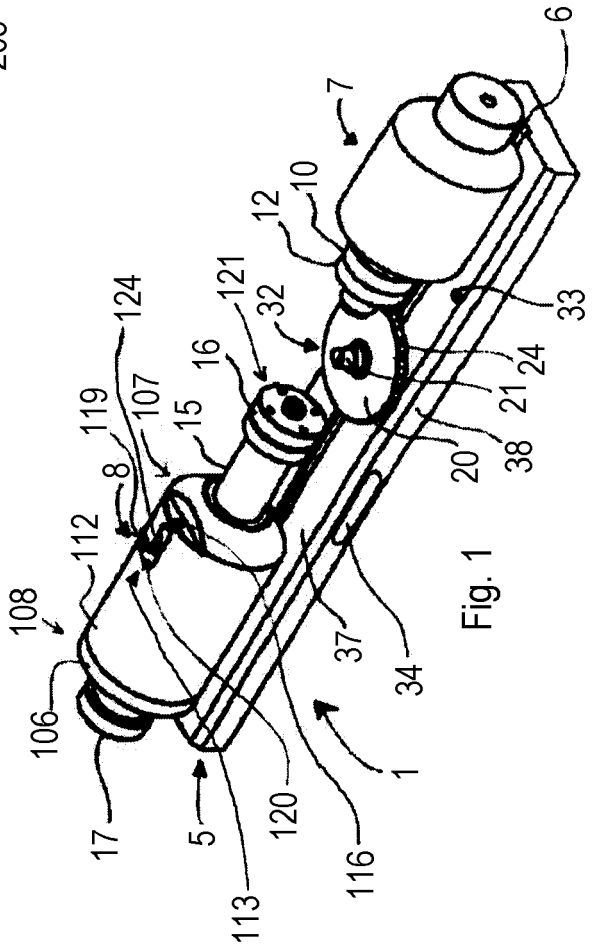
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Fig. 1

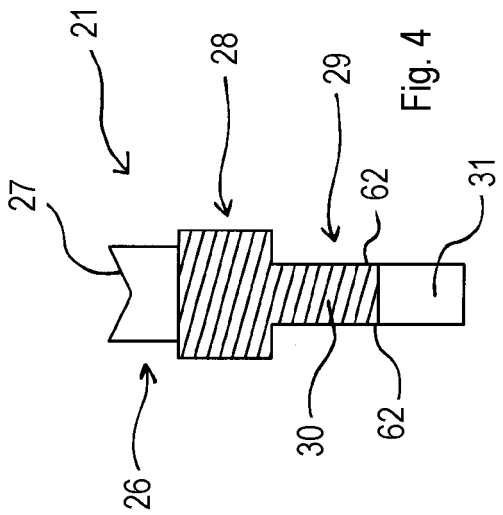

Fig. 4

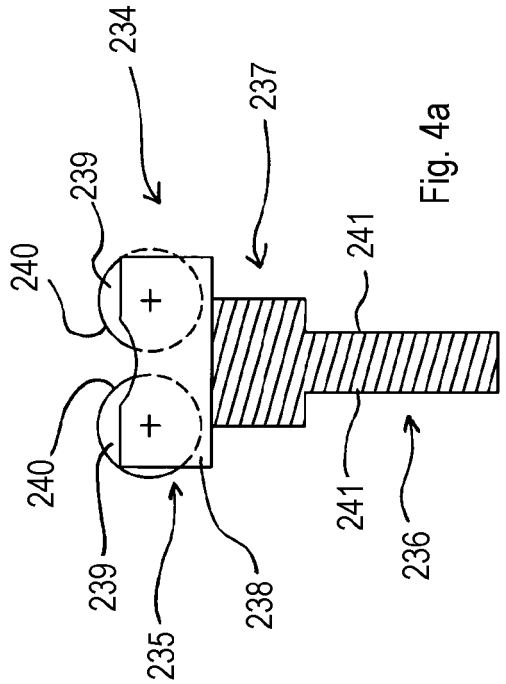

Fig. 4a

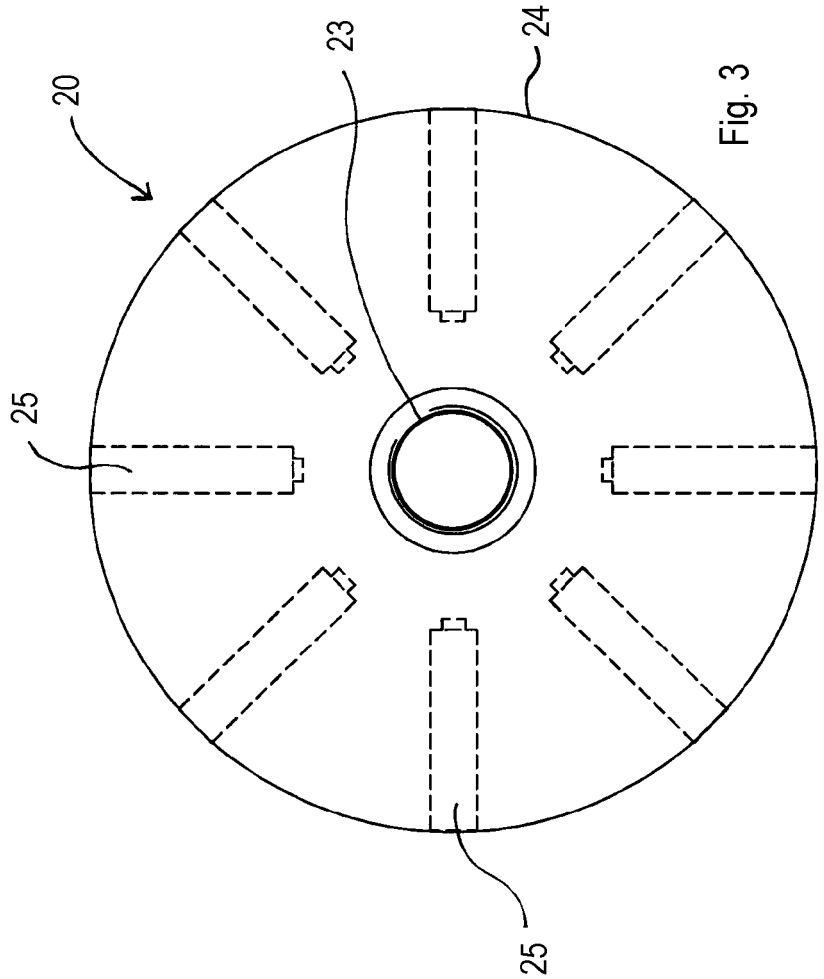

Fig. 3

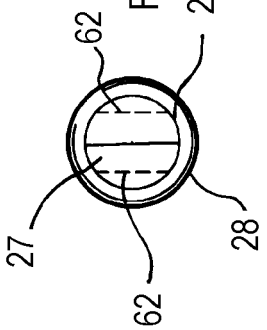

Fig. 5

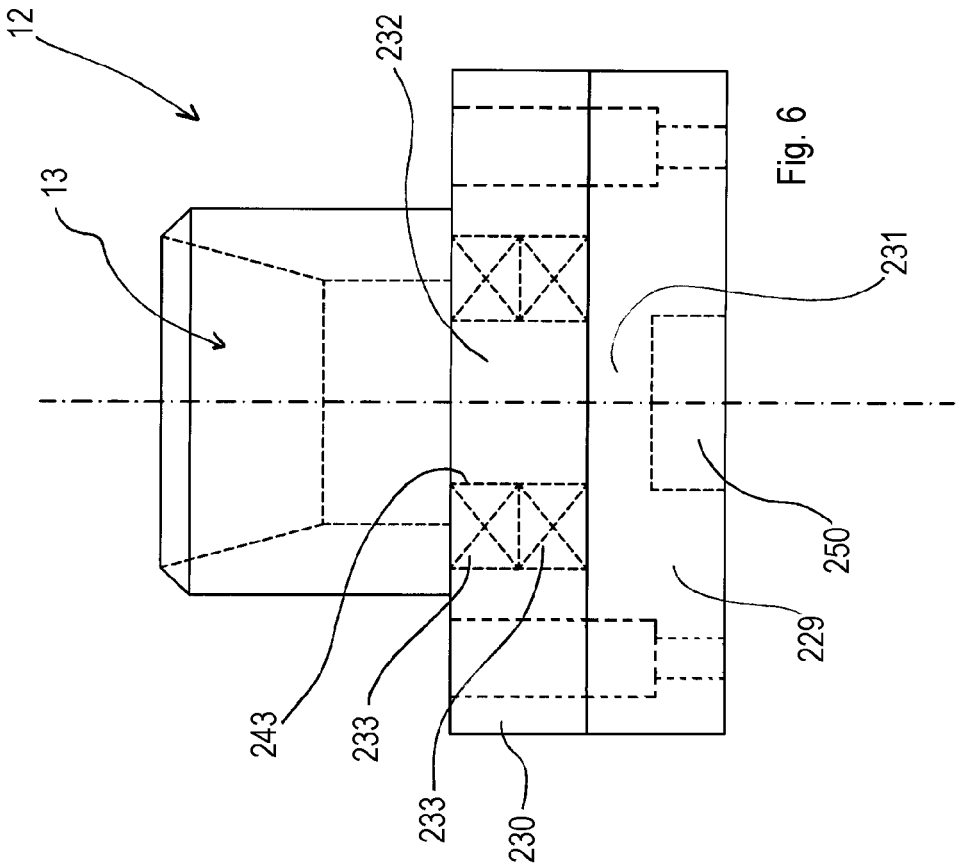
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Fig. 6

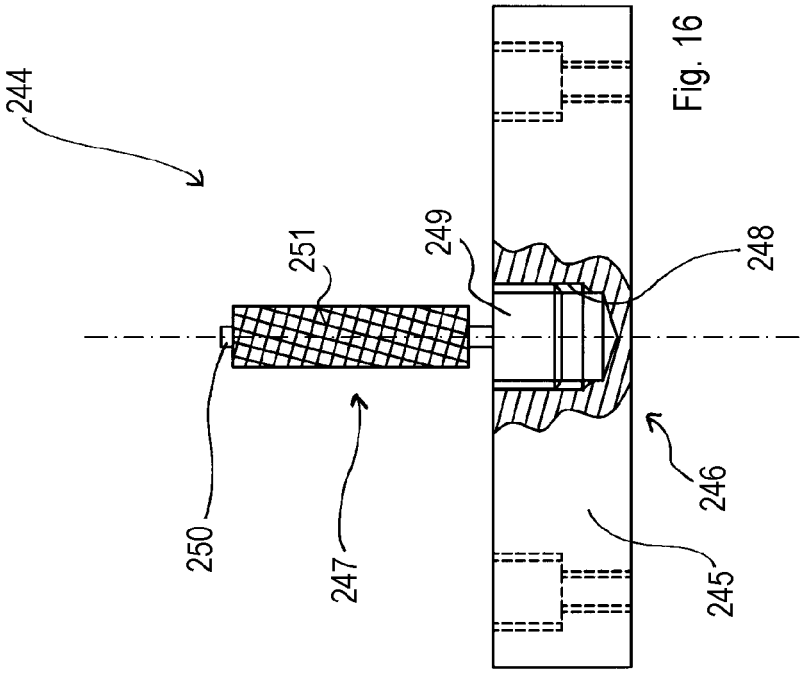
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Fig. 16

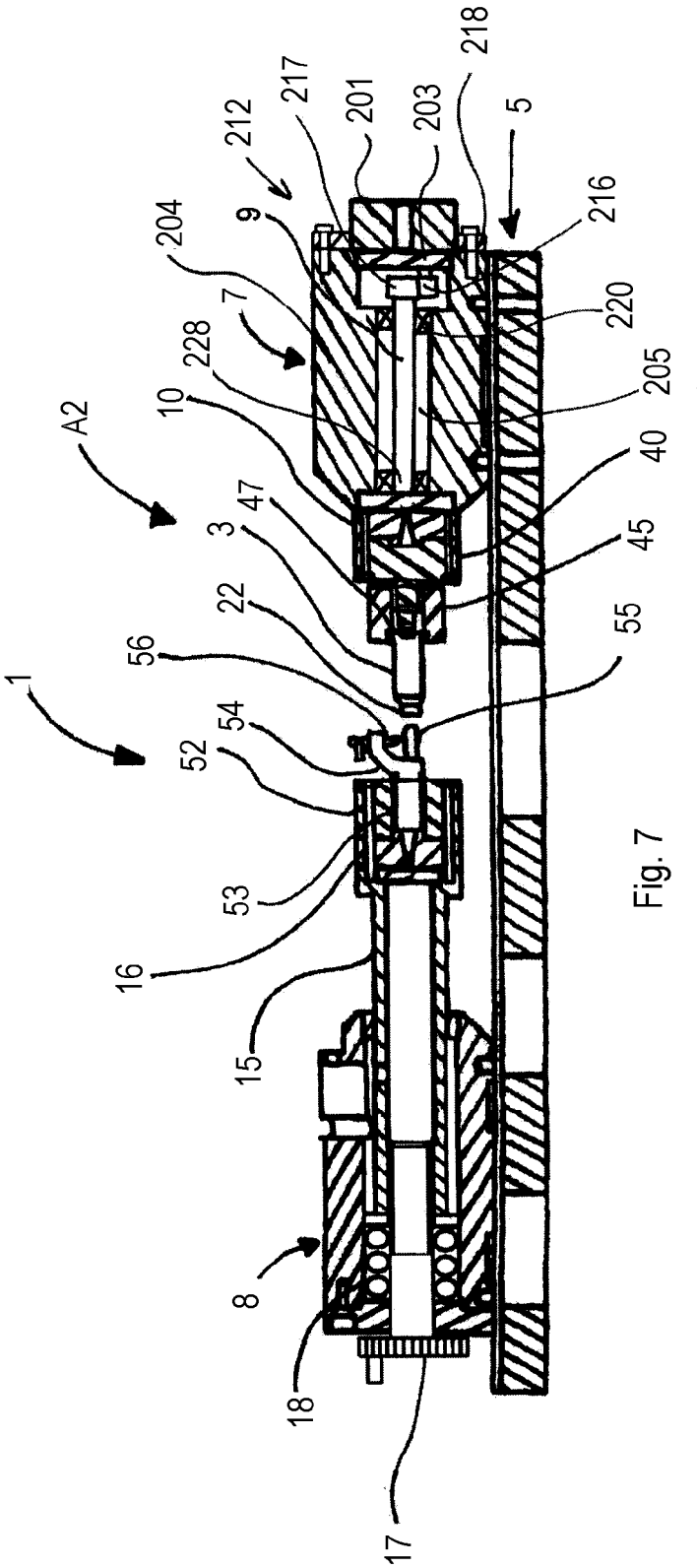
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Fig. 7

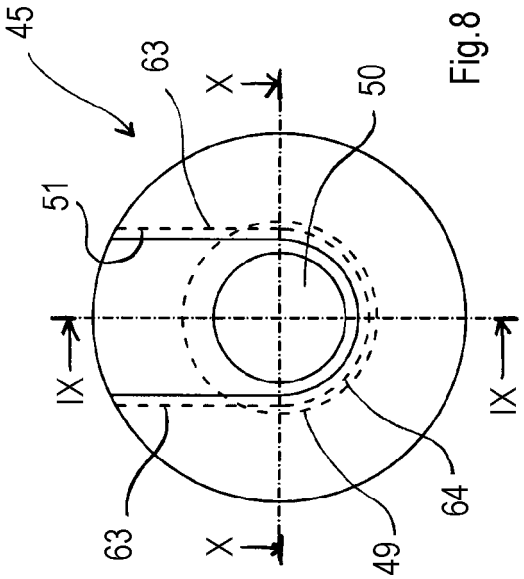

Fig.8

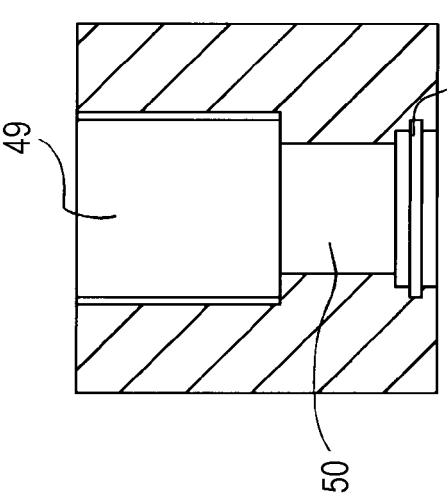

Fig. 10

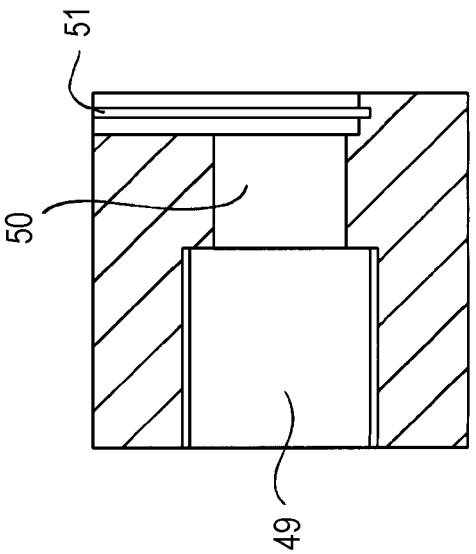

Fig. 9

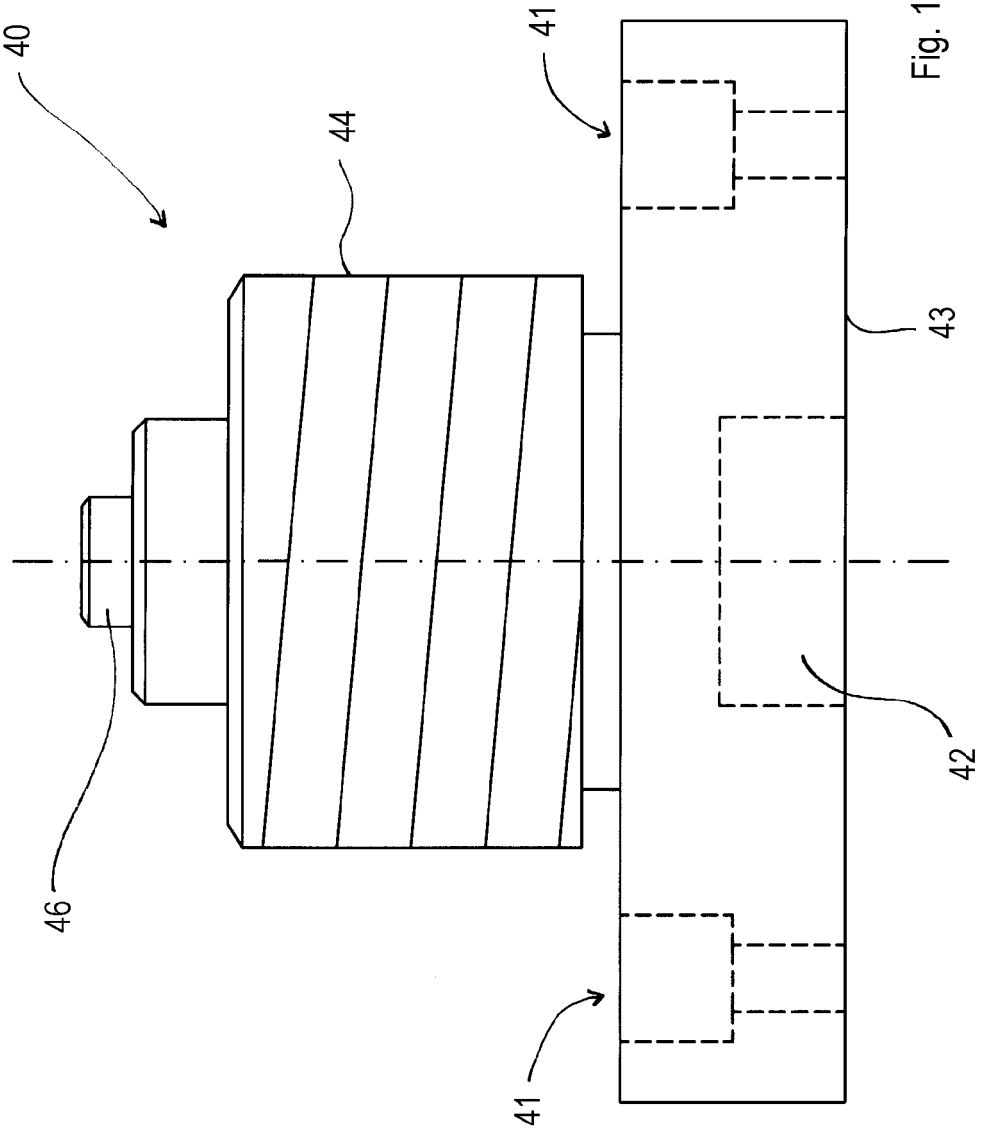

Fig. 11

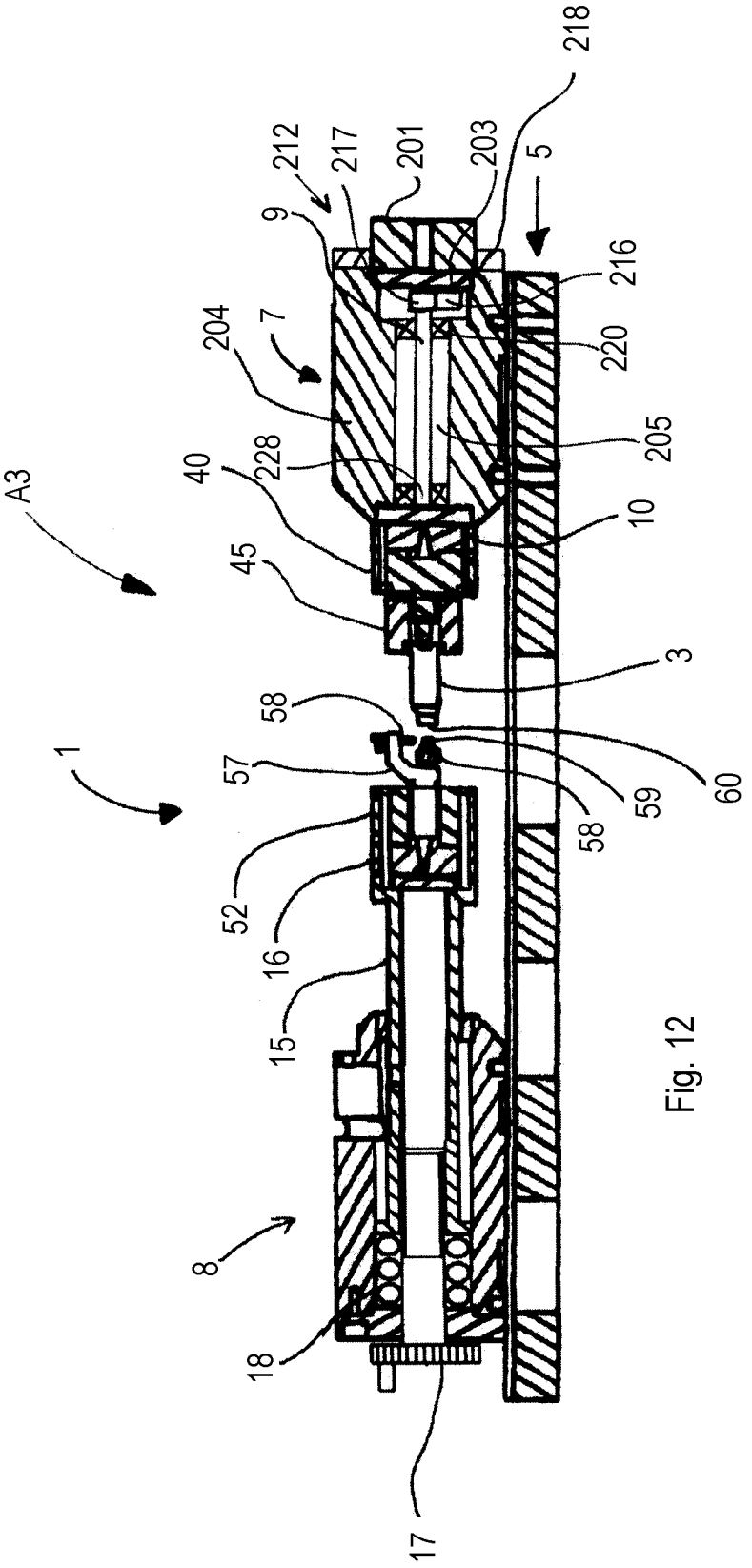
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Fig. 12

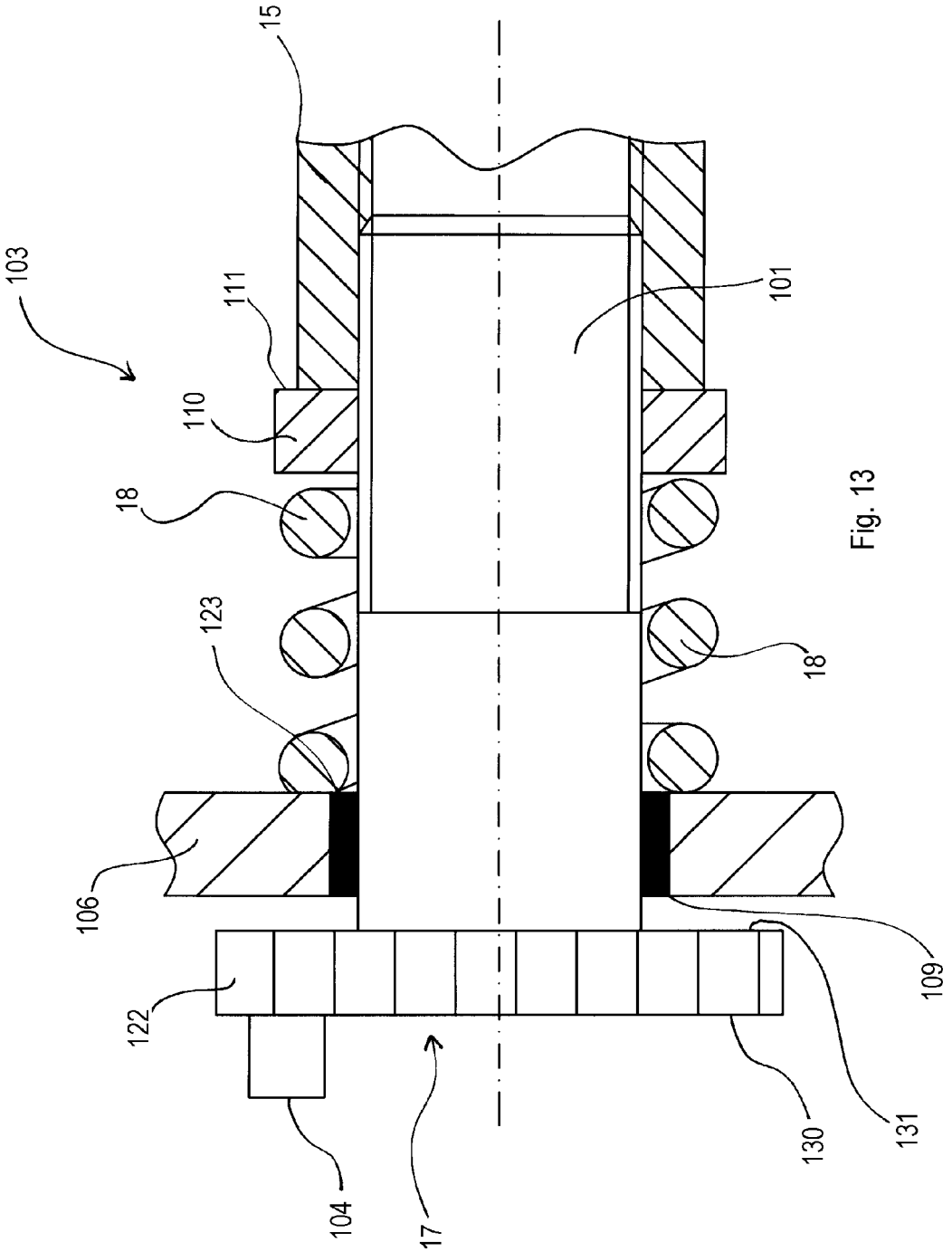

Fig. 13

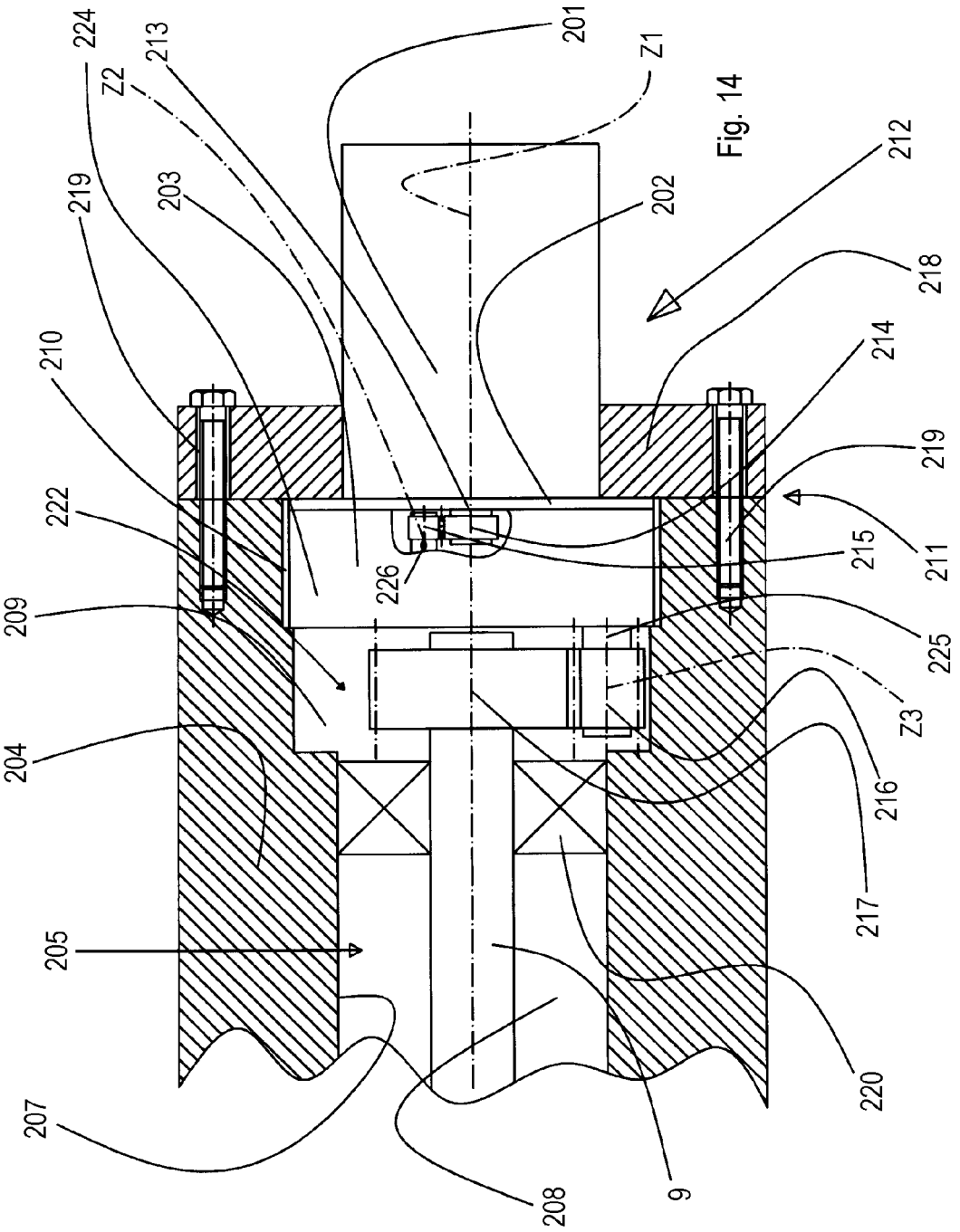
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Fig. 14

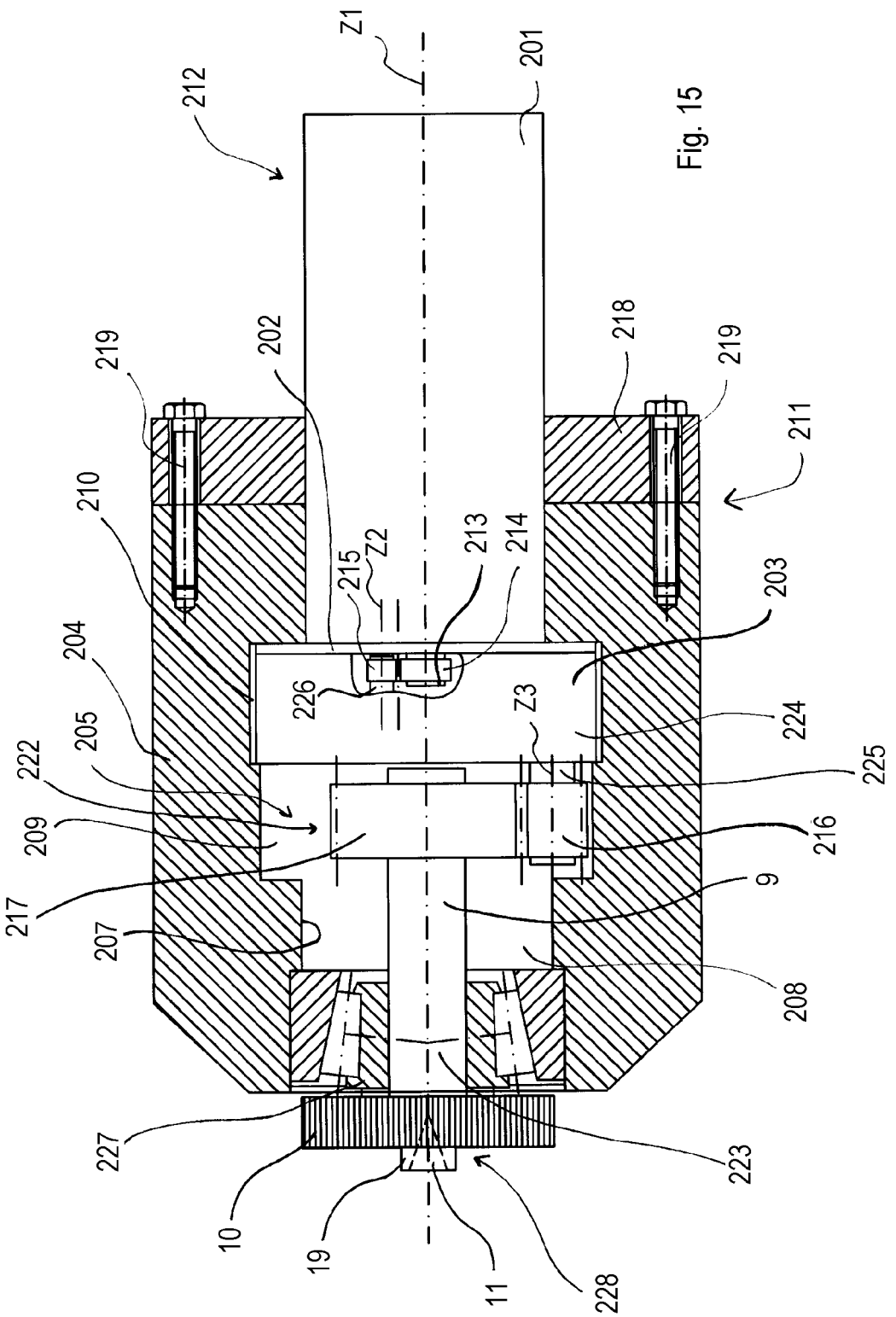
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Fig. 15

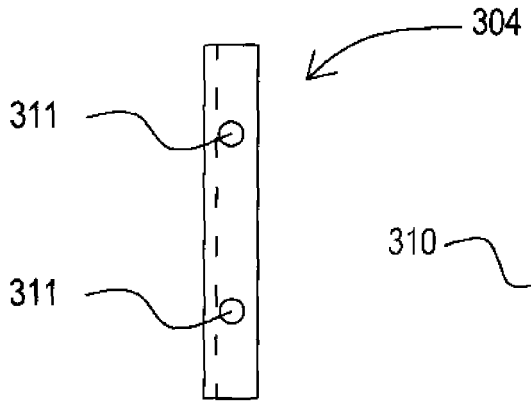

Fig. 20

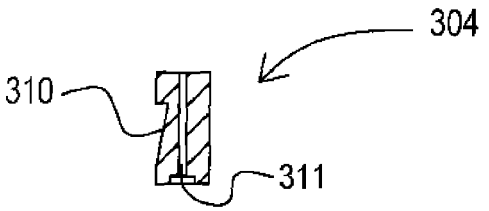

Fig. 19

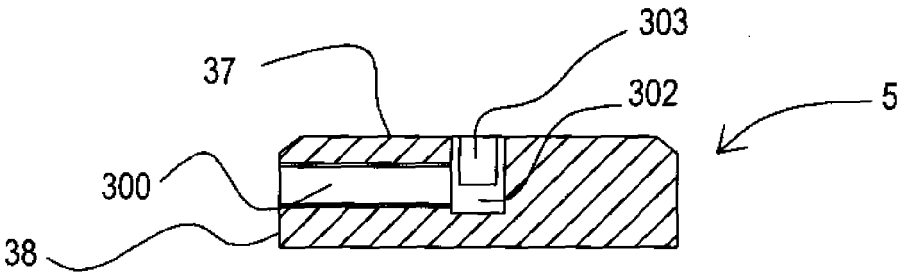

Fig. 18

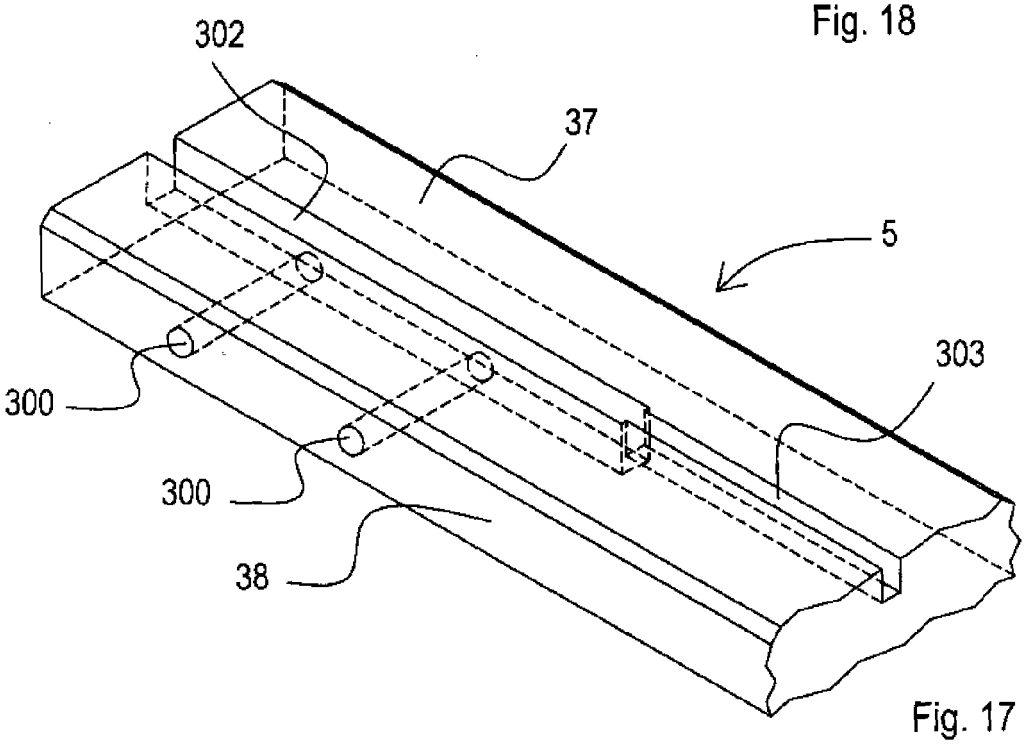

Fig. 17

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 11 1343

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	US 5 788 429 A (GRACEY ET AL) 4 August 1998 (1998-08-04) * column 2, line 55 - column 4, line 67 * * figures *	1-19,25, 26	INV. F42B33/10 F42B35/02
A		22-24	

Y	US 2002/178598 A1 (BERGER HEINZ) 5 December 2002 (2002-12-05) * paragraphs [0016] - [0024] * * figures *	1-19,25, 26	
A		22-24	

A	LAYHER / ONLINE-SHOP FÜR MASCHINEN UND ZUBEHÖR: "Ersatz-Magnetfuss - Universal Messtativ - Kühlmittelschlauch mit Magnetfuss" INTERNET ARTICLE, [Online] 1 February 2005 (2005-02-01), XP002389297 Retrieved from the Internet: URL:http://www.top-maschinen.de/messwerkzeuge-pruefmittel/magnete-magnetstative/index.htm> [retrieved on 2006-07-07] * figures *	1-4	TECHNICAL FIELDS SEARCHED (IPC) F42B G01B

A	CH 688 388 A (KARL SUTTERLIN MECHANISCHE WERKSTOTTE) 29 August 1997 (1997-08-29) * the whole document *	1-8	

A	US 4 653 157 A (ALEXANDER ET AL) 31 March 1987 (1987-03-31) * the whole document *		

A	US 4 679 330 A (WILLIAMS ET AL) 14 July 1987 (1987-07-14) * the whole document *		

D,A	US 6 484 616 B1 (GIRAUD DOUGLAS) 26 November 2002 (2002-11-26) * the whole document *		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 July 2006	Gex-Collet, A-L

CATEGORY OF CITED DOCUMENTS

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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10-07-2006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5788429 A	04-08-1998	NONE	
US 2002178598 A1	05-12-2002	CA 2388679 A1	01-12-2002
CH 688388 A	29-08-1997	NONE	
US 4653157 A	31-03-1987	NONE	
US 4679330 A	14-07-1987	JP 2077772 C	09-08-1996
		JP 7097002 B	18-10-1995
		JP 62140001 A	23-06-1987
US 6484616 B1	26-11-2002	NONE	

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

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Patent documents cited in the description

- US 6484616 B **[0012] [0013] [0014]**