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(54) **PORTABLE EQUIPMENT WITH SAFETY DEVICE**

(57) The invention relates to portable equipment (1) suitable for operating on a fastening element, for example a tear-off rivet or a threaded insert or a lockbolt, comprising gripping members (2) suitable for engaging said fastening element, and actuation members suitable for actuating the gripping members (2).

The portable equipment (1) comprises a pneumatic group (3) operatively connected to the actuation members to command the action thereof, comprising a tank (4) containing a pressurized gas.

The tank (4) comprises an annular body (5) that is open at a bottom section (6) and has an axis (X-X), and a bottom cover (7) that closes the annular body (5), delimiting a pressurized chamber (50) therewith.

The tank (4) comprises a ring recess (8), obtained in the bottom section (6), in which it houses an elastic ring (9) that locks the bottom cover (7), and a safety device (13) that prevents the elastic ring (9) from being removed from the ring recess (8).

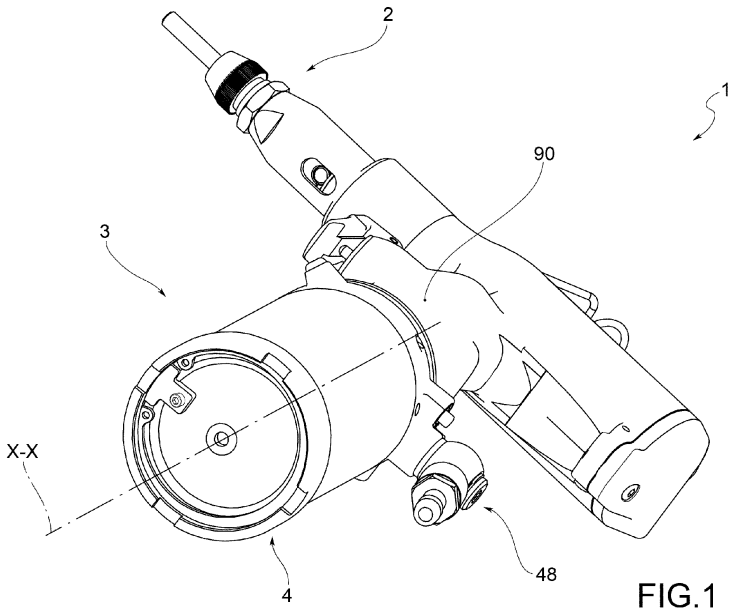

FIG.1

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Description

[0001] The present invention relates to portable equipment suitable for operating on a fastening element.

[0002] In particular, the present invention relates to the technical field of equipment suitable for carrying out fastening operations on fastening elements such as tear-off rivets, threaded inserts, or lockbolts, i.e., those fastening elements which are suitable for joining two distinct components, typically two sheet metal elements. The equipment in question is suitable for carrying out specific deformation operations, including plastic and/or permanent ones, of the fastening element or of a portion thereof, to obtain the fastening of the two distinct components.

[0003] In the prior art, this equipment is also known as guns and/or inserting and/or riveting machines, also depending on the type of fastening element on which they operate. In the present discussion, reference is made to said equipment with the generic definition of "portable equipment."

[0004] Depending on the type of fastening element, insert, or rivet or lockbolt, the equipment must perform specific operations and actions on the fastening element to complete the fastening. Said actions provide for axial movements in one direction, in both directions, with or without intermediate stops, and sometimes also involve rotational actions with respect to the axis along which the axial movements are performed.

[0005] For the aforesaid reason, the portable equipment belonging to the prior art comprises specific assemblies of components designed to engage fastening elements to command them in motion. In particular, the portable equipment comprises gripping members suitable for engaging a fastening member, and comprises specific actuation members that actuate the gripping members. Preferably, said actuation members are of the hydraulic type, and the hydraulic actuation of said actuation members is performed by means of a pneumatic group specially operatively connected to said hydraulic actuation members.

[0006] Typically, in fact, the portable equipment has a pressurized pneumatic cylinder, also known as an air tank or sometimes as a "barrel."

[0007] A typical problem of the portable equipment of the prior art is related to safety aspects of said pneumatic tank.

[0008] Specifically, during maintenance operations or under conditions of malfunction of the portable equipment, such as those caused by a blockage of a valve or drain line, the bottom cover that hermetically seals the pressure vessel must be disassembled, for example manually, by an operator.

[0009] Since, in certain situations, the tank contains pressurized gas, it is necessary to ensure that the removal of the bottom cover is done under the safest conditions.

[0010] In addition, it is also important to avoid improper or accidental disassembly of the bottom cover, for example due to impact, or also at the same time any accidental event causing unwanted and uncommanded actuation of the portable equipment.

[0011] Therefore, there is a strong need in the industry for portable equipment provided with a pneumatic tank that is easy to make, in which improper or accidental disassembly of the bottom cover is prevented, and for which the disassembly operations of the bottom cover may be performed safely.

[0012] The object of the present invention is to meet the needs of the industry and to solve the problems of the prior art mentioned above.

[0013] This object is achieved by the equipment claimed in claim 1. The claims dependent on these request protection for further features and entail further technical benefits.

[0014] In addition, further features and advantages of the invention will become clear from the description provided below of its preferred embodiments, given as non-limiting examples in reference to the attached figures, wherein:

- Fig. 1 is a perspective view of the portable equipment in accordance with the present invention, according to a preferred embodiment;
- Fig. 2 is a perspective view of the pneumatic group of the portable equipment in accordance with the present invention, according to a first preferred embodiment;
- Fig. 3a is a perspective view of the pneumatic group in Fig. 2, without the safety device;
- Fig. 3b is a perspective view of the safety device in Fig. 2;
- Fig. 4 is a perspective view of the pneumatic group of the portable equipment in accordance with the present invention, according to a second preferred embodiment;
- Fig. 5a is a perspective view of the pneumatic group in Fig. 4, without the safety device;
- Fig. 5b is a perspective view of the safety device in Fig. 4;

[0015] With reference to the attached figures, number 1 indicates portable equipment suitable for operating on a fastening element. The portable equipment 1 is suitable for operating on a fastening device such as a tear-off rivet or a threaded insert or a lockbolt.

[0016] According to the present invention, the portable equipment 1 comprises gripping members 2, suitable for engaging and operating on the fastening element, and comprises actuation members suitable for actuating said gripping members 2.

[0017] The features, type and operation of the gripping members 2 and actuation members are in no way limiting with respect to the present invention. In addition, the type of fastening element does not limit the present invention.

[0018] Preferably, the actuation members comprise a trigger that may be pulled by a user.

[0019] According to a preferred embodiment, the portable equipment 1 comprises a grippable equipment body 90 that houses the gripping members 2 and the actuation members and permits the connection to the pneumatic group 3, as described below.

[0020] According to a preferred embodiment, the equipment body 90 comprises a pipe extending orthogonally to a handle portion of said equipment body. Preferably, the gripping members are placed at the end of said pipe, for example in a removable and interchangeable manner as needed.

[0021] According to the present invention, the portable equipment 1 comprises a pneumatic group 3 operatively connected with the actuation members to pneumatically command the action thereof on the gripping members 2.

[0022] Said pneumatic group 3 comprises a tank 4 containing a pressurized gas.

[0023] Preferably, the tank 4 is fluidically connected to a gas source, such as an air compressing machine.

[0024] The type of gas used for the pneumatic command of the actuation members is in no way limiting to the objects of the present invention. Preferably, reference is made in this discussion to compressed air of the type available in manufacturing environments or more generally to compressed air supplied by an air compressing machine.

[0025] Specifically, said tank 4 comprises an annular body 5 that extends along an axis X-X.

[0026] The tank 4 is open at one of its bottom sections 6.

[0027] The tank 4 also comprises a bottom cover 7 which hermetically seals the annular body 5, the cover being located at the bottom section 6.

[0028] The coupling of the bottom cover 7 with the annular body 5 delimits a pressurized chamber 50 containing the gas.

[0029] Preferably, an inner face of the bottom cover 7 axially delimits the pressurized chamber 50.

[0030] According to a preferred embodiment, the pneumatic group 3 comprises a pneumatic piston housed in the tank 4. Said pneumatic piston slides in the annular body 5 and operates in said pressurized chamber 50, moved by the pressurized gas therein.

[0031] Preferably, the pneumatic piston is single-acting or double-acting.

[0032] Preferably, moreover, the portable equipment 1 comprises gas filling members 48 that may be fluidically connected to a hose from an external tank or air compressing machine to feed gas into the pressurized chamber 50.

[0033] According to the present invention, the tank 4 also comprises a ring recess 8 which is radially internally obtained in said bottom section 6 and positioned externally to the pressurized chamber 50.

[0034] For this object, preferably the bottom section 6 protrudes radially externally from the annular body 5, as it has larger dimensions in the radial direction.

[0035] In other words, along the axis X-X, the tank 4 comprises the ring recess 8, the bottom cover 7 and the pressurized chamber 50.

[0036] In still other words, the bottom section 6 protrudes axially from the bottom cover 7, beyond which the ring recess 8 is located.

[0037] Preferably, the ring recess 8 is a continuous annular groove accessible in a substantially radial direction from a region proximal to the axis X-X.

[0038] According to the present invention, the tank 4 comprises an elastic ring 9 housed in a non-deformed configuration in the ring recess 8 to lock the bottom cover 7.

[0039] Specifically, said elastic ring 9 extends over a circumferential section encompassing two angular ends 10, 11 separated angularly.

[0040] In other words, the elastic ring 9 is an at least partially elastically deformable and circumferentially interrupted component.

[0041] According to a preferred embodiment, the elastic ring 9 is an elastic stop ring, for example made of steel or made of a polymeric material.

[0042] In a preferred embodiment, the elastic ring 9 is a Seeger ring, also known as a "circlip."

[0043] In other words, the elastic ring 9 is removable from the ring recess 8 by bringing the two angular ends 10, 11 together angularly, thus reducing the outer diameter of said ring 9 and allowing it to exit the ring recess 8.

[0044] For this purpose, preferably, the elastic ring 9 comprises specific engagement openings, and said operations for removing the elastic ring 9 are conveniently carried out with a dedicated tool or implement, such as "Seeger pliers."

[0045] According to the present invention, the angular ends 10, 11 define a safety seat 12 therebetween. In other words, the safety seat 12 has a predefined angular width defined by the angular ends 10, 11.

[0046] Preferably, moreover, the safety seat 12 is open radially toward the axis X-X, i.e., it is accessible in a substantially radial direction from a region proximal to the axis X-X.

[0047] According to the present invention, the tank 4 comprises a safety device 13 fixed in the safety seat 12 so as to prevent the elastic ring 9 from being removed from the ring recess 8 by means of elastic deformation.

[0048] Preferably, the safety device 9 is appropriately placed between the angular ends 10, 11 in such a way as to prevent its movement, i.e., to make the removal operations of the elastic ring 9 inoperable.

[0049] Preferably, the safety device 9 is an elastically non-deformable component.

[0050] According to a preferred embodiment, the safety device 13 is at least partially housed in the ring recess 8.

[0051] According to a preferred embodiment, the safety device 13 may be inserted into the ring recess 8 from a region proximal to the axis X-X in a substantially radial direction.

[0052] In other words, the safety device 13 circumfer-

entially at least partially occupies the ring recess 8 for an angular extension equal to or less than the angular extension of the safety seat 12.

[0053] According to a preferred embodiment, the elastic ring 9 is housed in the ring recess 8 in such a way as to prevent its improper or accidental removal in the axial direction.

[0054] Preferably, in fact, the ring recess 8 comprises a pair of mutually facing and axially separated annular surfaces, the axial distance of which defines the width, i.e., the height, of the ring recess 8. Preferably, moreover, the safety device 13 is positioned axially in contact with at least one of said annular surfaces.

[0055] According to a preferred embodiment, the safety device 13 consists of a T-shaped planar body and comprises an engagement portion 20 at least partially housed in the ring recess 8.

[0056] Preferably, said engagement portion 20 forms the head of the T-shaped safety device 13.

[0057] In other words, the lateral edges 28, 29 of the engagement portion 20 are positioned circumferentially proximal to the two angular ends 10, 11.

[0058] In still other words, preferably said engagement portion 20 is specially shaped to physically prevent the mutual approach of the angular ends 10, 11 of the elastic ring 9 in the circumferential direction.

[0059] According to a preferred embodiment, the engagement portion 20 has an axial dimension, also called the thickness, such that it engages, with interference, with the annular surfaces of the ring recess 8.

[0060] According to a preferred embodiment, the bottom cover 7 comprises a vent duct 30 suitable for placing the pressurized chamber 50 in fluid connection with the external environment.

[0061] In a preferred embodiment, the vent duct 30 is open on the outer face 75 of the bottom cover 7.

[0062] According to a preferred embodiment, moreover, the safety device 13 hermetically closes said vent duct 30.

[0063] In other words, in a preferred embodiment, the safety device 13 mounted to the bottom cover 7 prevents the pressurized gas from flowing through the vent duct 30 to the outside environment.

[0064] Specifically, the safety device 13 comprises a sealing portion 21 that closes the vent duct 30, which sealing portion is, for example, provided with special sealing gaskets. Preferably, said sealing portion 21 extends in a radial direction, for example starting directly from the engagement portion 20.

[0065] Preferably, by removing the safety device 13, the vent duct 30 is in fluid connection with the external environment, i.e., the gas leaves the pressurized chamber 50.

[0066] In a preferred embodiment, the gas is discharged through the vent duct 30 at the same time as the disassembly operations of the safety device 13.

[0067] Preferably, the gas is completely discharged through the vent duct 30 before the safety device 13 is removed.

[0068] According to a preferred embodiment, the safety device 13 comprises a connecting portion 22 configured for coupling to the bottom cover 7, and for example provided with connecting holes.

[0069] Preferably, moreover, said connecting portion 22 extends in a radial direction, for example starting directly from the sealing portion 21.

[0070] Preferably, the sealing portion 21 and the connecting portion 22 form the "stem" of the T-shaped safety device 13.

[0071] In a preferred embodiment, the safety device 13 is removably attached to the bottom cover 7, for example by form- or force-coupling or by snap-on or mechanical connection.

[0072] According to a preferred embodiment, the safety device 13 is attached to the bottom cover 7 by means of a threaded coupling comprising a screw 70 and a nut screw 60.

[0073] According to a first embodiment, the vent duct 30 and the nut screw 60 are two distinct openings in the bottom cover 7, for example aligned in radial direction and open on the outer face 75.

[0074] According to a second preferred embodiment, the nut screw 60 extends passing along the bottom cover 7, i.e., it is suitable for putting the pressurized chamber 50 into fluid connection with the external environment. Preferably, moreover, the screw 70 secures the safety device 13 and seals the nut screw 60.

[0075] In other words, the nut screw 60 and the vent duct 30 are a single opening that allows pressurized gas to escape at the same time as the disassembly operations of the safety device 13.

[0076] Preferably, by unscrewing the screw 70 from the nut screw 60, the gas flows around the threads of the screw 70 and the nut screw 60.

[0077] According to a preferred embodiment, the bottom cover 7 comprises at least one lightening groove 80, e.g., a plurality of lightening grooves 80 positioned on the outer face 75, and the safety device 13 has a varying thickness according to said at least one lightening groove 80.

[0078] Innovatively, the portable equipment fully fulfills the intended object by overcoming the typical problems of the prior art.

[0079] Advantageously, the portable equipment allows for the completely safe disassembly of its pressurized components.

[0080] Advantageously, the portable equipment is easy to make, allowing easy and intuitive assembly and disassembly operations.

[0081] Advantageously, the portable equipment prevents improper or accidental disassembly of its pressurized components.

[0082] Advantageously, the portable equipment is foolproof, minimizing the risk of accidents.

[0083] Advantageously, in fact, the safety device is a multifunctional component which prevents accidental

disassembly of the elastic ring with the tank under pressure and makes it possible to simplify the disassembly operations thereof.

[0084] Advantageously, the emptying of the pressurized chamber takes place simultaneously with the removal of the safety device, i.e., before the removal of the bottom cover.

[0085] Advantageously, the presence of a separate hole from the connecting nut screw further minimizes risk during disassembly operations. Advantageously, in fact, the risk of overpressure on the screw threads is remedied.

[0086] Advantageously, the safety device is designed to achieve a simplified attachment that ensures maximum tightness. Advantageously, in fact, the sealing portion is comprised in the radial direction between the engagement portion and the connecting portion.

[0087] It is clear that a person skilled in the art may make changes to the invention described above in order to meet contingent needs, which changes all fall within the scope of protection as defined in the following claims.

Claims

1. Portable equipment (1) suitable for operating on a fastening element, for example a tear-off rivet or a threaded insert or a lockbolt, comprising:

   - gripping members (2) suitable for engaging said fastening element;
   - actuation members suitable for actuating the gripping members (2);
   - a pneumatic group (3) operatively connected to the actuation members to pneumatically command the action thereof on the gripping members (2), said pneumatic group (3) comprising a tank (4) containing a pressurized gas, wherein the tank (4) comprises:

     i) an annular body (5) that extends along an axis (X-X) and that is open at a bottom section (6);
     ii) a bottom cover (7) positioned at the bottom section (6) to hermetically close the annular body (5), delimiting a pressurized chamber (50) therewith;
     iii) a ring recess (8) radially internally obtained in said bottom section (6);
     iv) an elastic ring (9) housed in a non-deformed configuration in the ring recess (8) to lock the bottom cover (7), wherein the elastic ring (9) extends over a circumferential section, comprising two angularly separated angular ends (10, 11) defining a safety seat (12) therebetween;
     v) a safety device (13) fixed in the safety seat (12) so as to prevent the elastic ring (9) from being removed from the ring recess (8) by means of elastic deformation.

2. Portable equipment (1) according to claim 1, wherein the safety device (13) is removably fastened to the bottom cover (7).

3. Portable equipment (1) according to any one of the preceding claims, wherein the safety device (13) is at least partially housed in the ring recess (8).

4. Portable equipment (1) according to claim 3, wherein the safety device (13) consists of a T-shaped planar body, comprising an engagement portion (20) at least partially housed in the ring recess (8) between the two angular ends (10, 11).

5. Portable equipment (1) according to any one of the preceding claims, wherein the bottom cover (7) comprises a vent duct (30) suitable for putting the pressurized chamber (50) into fluid connection with the external environment, wherein the safety device (13) hermetically closes said vent duct (30).

6. Portable equipment (1) according to claim 5, wherein the safety device (13) comprises a sealing portion (21) that closes the vent duct (30), wherein said sealing portion (21) extends in radial direction from the engagement portion (20).

7. Portable equipment (1) according to any one of the preceding claims, wherein the safety device (13) is fastened to the bottom cover (7) by means of a threaded coupling which comprises a screw (70) and a nut screw (60) .

8. Portable equipment (1) according to claim 7, wherein the nut screw (60) extends passing through the bottom cover (7), wherein the screw (70) sealingly closes the nut screw (60).

9. Portable equipment (1) according to claims 6 to 8, wherein the safety device (13) comprises a connecting portion (22) which extends in radial direction from the sealing portion (21).

10. Portable equipment (1) according to claims 4 to 9, wherein the bottom cover (7) comprises at least one lightening groove (80), wherein the safety device (13) has a varying thickness according to said at least one lightening groove (80).

11. Portable equipment (1) according to any one of the preceding claims, wherein the pneumatic group (3) comprises a single effect or double effect piston housed in the tank (4) in the pressurized chamber (50).

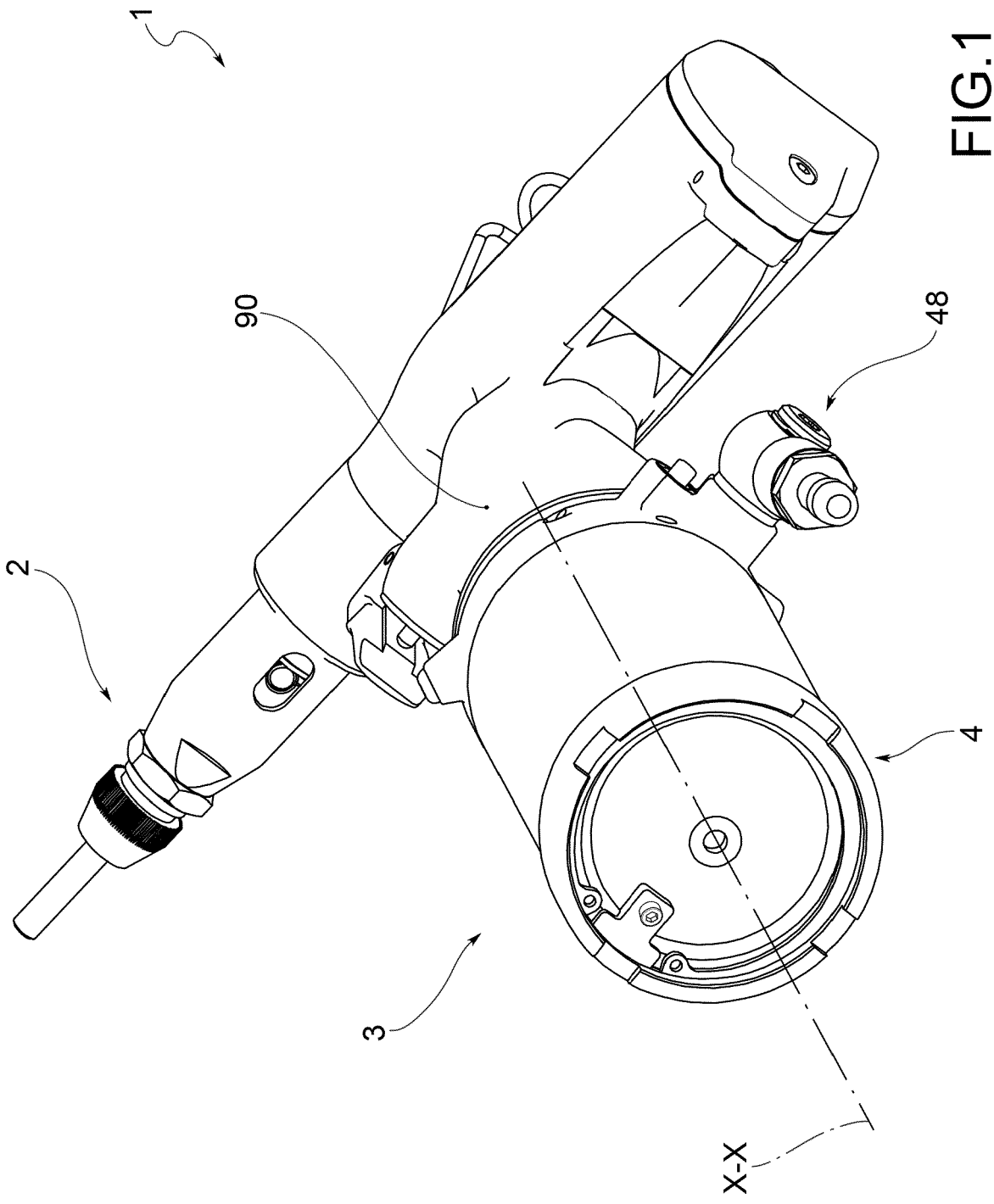

FIG.1

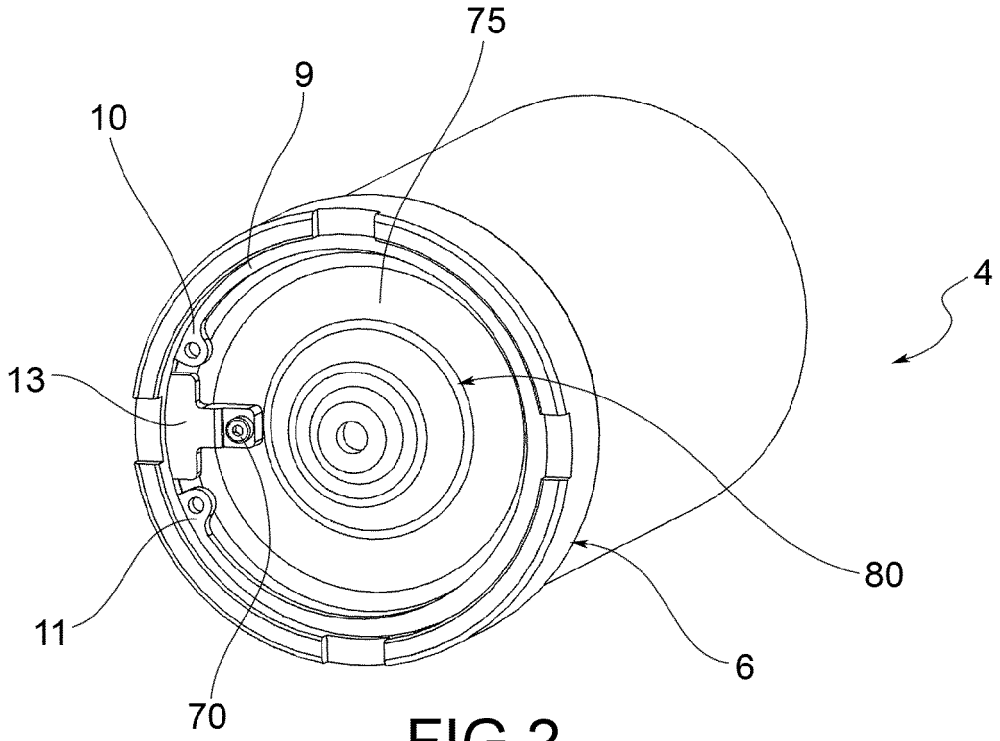

FIG.2

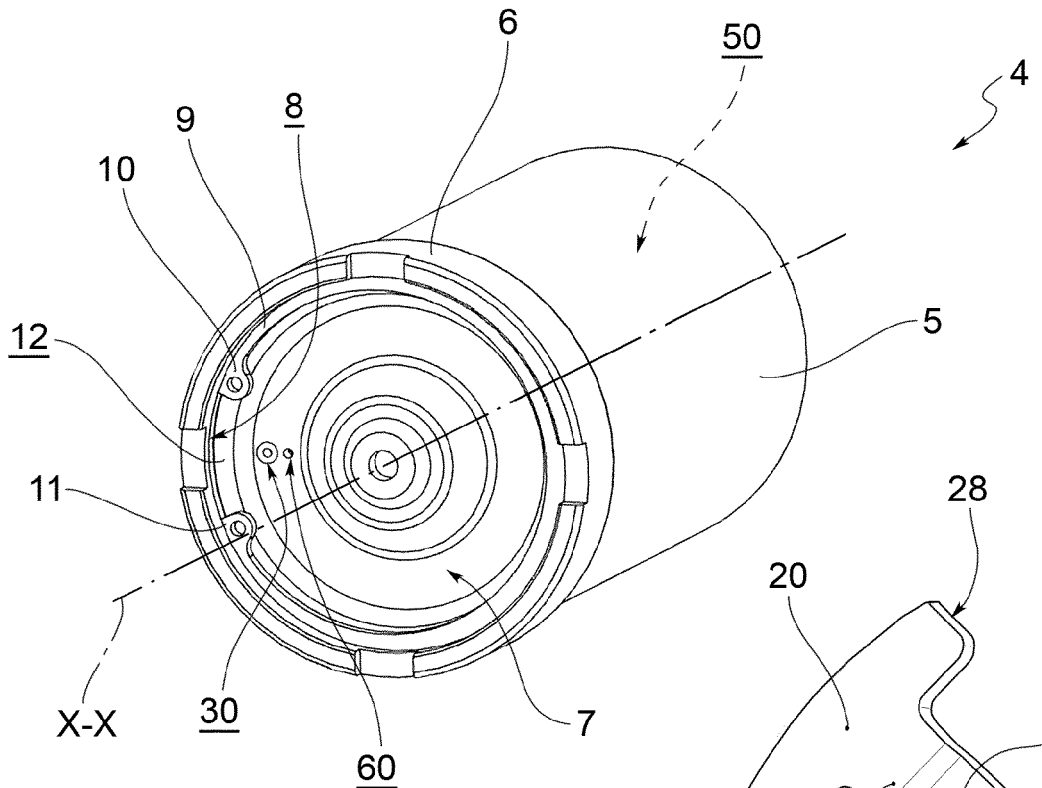

FIG.3a

FIG.3b

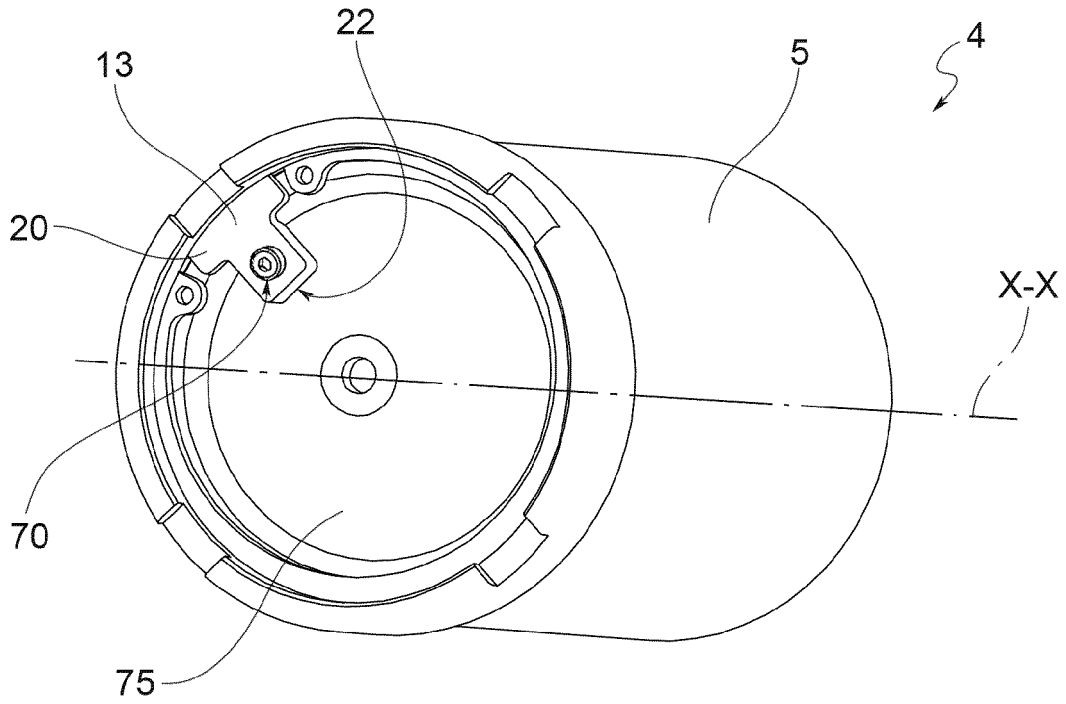

FIG.4

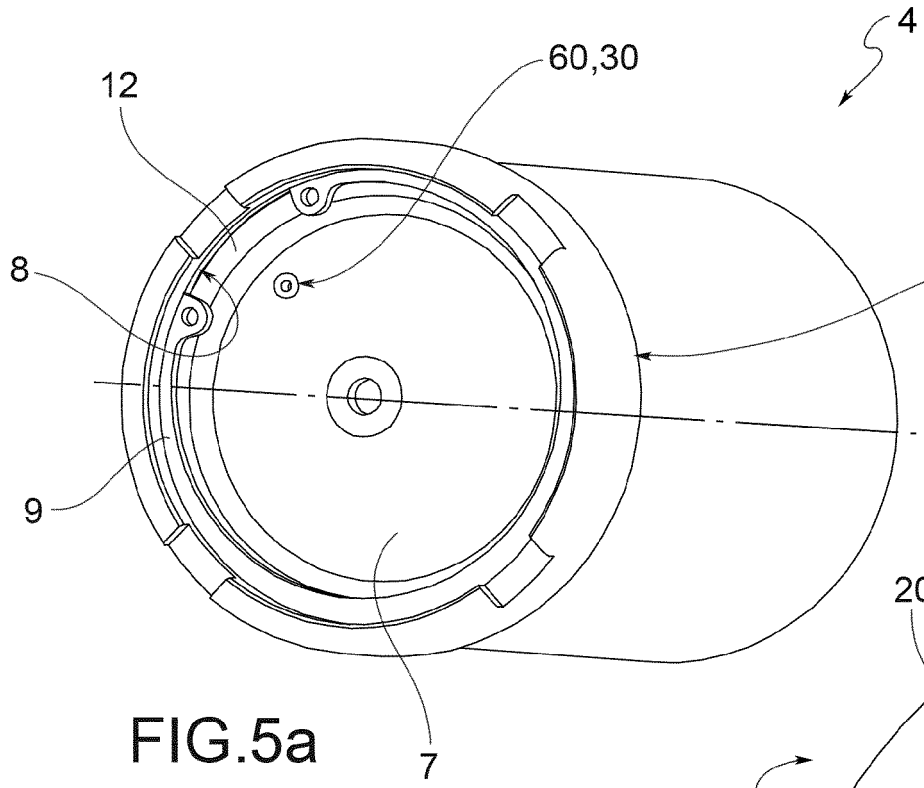

FIG.5a

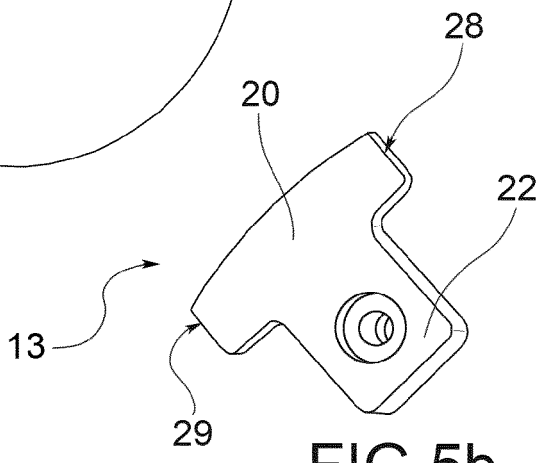

FIG.5b

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EUROPEAN SEARCH REPORT

Application Number
EP 22 19 5137

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 February 2023	Charvet, Pierre

CATEGORY OF CITED DOCUMENTS

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