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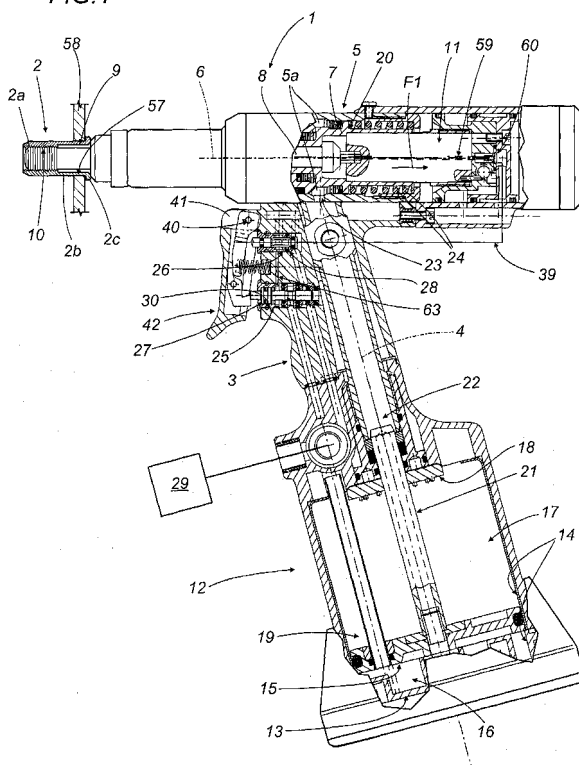
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(54) **A rivet gun for threaded rivets**

(57) A rivet gun (1) for threaded rivets or inserts (2) comprises a grip handle (3), a hydraulic cylinder (20) supported by the handle (3), a unit (9) for holding and retaining an insert (2) connected to the hydraulic cylinder (20), a pneumatic cylinder (19) for activating the hydraulic cylinder (20) for traction of the threaded rivets or inserts (2), and a pneumatic motor (11) for driving the

rotation of the holding and retaining unit (9), a first and second control valve (27, 28) respectively for the pneumatic cylinder (19) and the pneumatic motor (11). The gun (1) also comprises a control trigger (42), pivoting on a pin (40) and rotating according to an inward or traction and a return movement, during its traction movement successively activating the first and second valves (27, 28), by means of a rocker arm (46) and a lever (49).

FIG. 1



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Description

[0001] The present invention relates to a rivet gun for threaded rivets.

[0002] In the sector of apparatuses for the application of rivets and threaded rivets or inserts, use is known of pneumatic - hydraulic rivet guns with a handle, to which a single-action hydraulic cylinder and a pneumatic cylinder which activates the hydraulic cylinder are structurally and dynamically attached.

[0003] The rod of the hydraulic cylinder is attached to a holding unit for a threaded rivet or insert.

[0004] For application of a threaded rivet, the holding unit comprises a rod or tie rod with a threaded end, onto which the rivet can be screwed.

[0005] After the rivet has been screwed onto the holding unit, the rivet previously inserted in a hole passing through the parts to be fixed to one another or a wall on which the threaded insert is to be applied, the rivet locking operation occurs as described below.

[0006] The handle of the gun is fitted with a rocker arm trigger, which can be used to perform two separate operations one after another.

[0007] More specifically, when the operator squeezes its first arm, the trigger performs a first oscillation starting from a central balanced position, opening a first valve, which, by means of the pneumatic cylinder, moves the hydraulic cylinder piston opposing the action of a return spring.

[0008] This movement translates into traction of the rod and the holding unit with consequent deformation of the rivet, which is in this way applied to the part which requires a threaded insert or to the parts to be joined to one another.

[0009] At the end of the squeezing action on the first arm, when the trigger is released, the rocker arm returns to the central balanced position, whilst the above-mentioned return spring restores the initial hydraulic cylinder configuration.

[0010] At this point, the operator squeezes the second arm of the rocker arm, and the trigger, performing a second oscillation opposite to the previous one, opens a second valve which activates a pneumatic motor that causes the holding unit threaded rod to rotate in the direction opposite to that in which the rivet was screwed onto it. In this way, the threaded rod is disengaged from the rivet previously clinched.

[0011] It has been established that the number of rivets which can be applied in a unit of time using guns of this type has precise and insuperable limits due to the operating methods described, which are relatively complex.

[0012] The aim of the present invention is to provide a gun for threaded rivets which can overcome the disadvantage described with reference to prior art, and therefore exceed the operating speed of guns of the type described with simplified operation.

[0013] The technical features of the present invention,

in accordance with the above-mentioned aims, are set out in the claims herein and the advantages more clearly illustrated in the detailed description which follows, with reference to the accompanying drawings, which illustrate a preferred embodiment without limiting the scope of application, and in which:

- Figure 1 is a side view partially in cross-section of a rivet gun made in accordance with the present invention;
- Figures 2 to 4 are enlarged cross-sections of a detail from Figure 1 in three different successive operating configurations;
- Figures 5 and 6 are side views partially in cross-section of another detail from Figure 1 in two successive operating configurations.

[0014] With reference to Figure 1, the numeral 1 denotes as a whole a rivet gun for threaded rivets or inserts 2 which have internal threading 2a, a portion 2b which can be deformed by traction and a contact collar 2c. The rivet gun 1 comprises an elongated grip 3, whose longitudinal axis is labelled 4.

[0015] At one end of the grip 3 there is an integral substantially cylindrical body 5, whose longitudinal axis, labelled 6, is substantially transversal to the axis 4 of the grip 3.

[0016] As is known, the inside of the body 5 forms a cylindrical chamber 5a in which there slides along the axis 6 a piston 7 attached to a rod 8 whose free end projecting from the body 5 is attached to a rivet 2 holding unit 9 comprising a threaded portion 10 designed to connect to the threading 2a on the rivet 2.

[0017] Again as is known, the rod 8 and the holding unit 9 move not only along the axis 6 but also rotate about the axis 6, driven by a pneumatic motor 11 located in the body 5 and kinematically connected to the rod 8.

[0018] The free end of the grip 3, labelled 12 as a whole, is substantially cylindrical, closed by a base wall 13. Inside it there is a cylindrical compartment 14, separated by a piston 15 into a first chamber 16, located between the piston 15 and the base wall 13, and a second chamber 17, located between the piston 15 and an end wall, labelled 18, which is substantially parallel with the wall 13.

[0019] In particular, the cylindrical compartment 14 and the piston 15 together form a pneumatic cylinder 19 which drives the piston 7 which, together with the cylindrical chamber 5a, forms a hydraulic cylinder 20.

[0020] As is known, the hydraulic cylinder 20 is activated following the piston 15 stroke along the axis 4 away from the wall 13 and towards the wall 18. A rod 21 integral with the piston 15 consequently slides inside a cylindrical chamber 22 coaxial with the cylindrical compartment 14, made inside the grip 3 and holding pressurised oil which, following the rod 22 stroke, is pushed through a hole 23 into the cylindrical chamber 5a, pushing the piston 7 along the axis 6 and away from the hold-

ing unit 9, against the opposing action of a helical spring 24.

[0021] On the grip 3, at its end close to the cylindrical body 5 and on the side facing the holding unit 9, there are first control means 25 for the pneumatic cylinder 19 and second control means 26 for the pneumatic motor means 11. The first and second control means 25 and 26 consist of a first and, respectively, a second valve 27 and 28 which open and close to allow the passage of a control fluid from a supply fluid source, schematically illustrated with a block 29.

[0022] As illustrated in Figures 1, 2, 3 and 4, both of the valves 27 and 28 are inserted in respective seats 30 and 31 on the grip 3 with axes labelled A and B substantially parallel with the axis 6 and, together with the axis 6, forming a plane radial to the cylindrical body 5, the second valve 28 being inserted between the first valve 27 and the hydraulic cylinder 20.

[0023] The two valves 27 and 28 respectively comprise containment bodies 32 and 33 with respective collars 34 and 35 for axial locking of the bodies 32 and 33 in contact with a flat surface 36 on the grip 3, and respective control stems 37 and 38, coaxial to the axes A and B.

[0024] More particularly, the stem 37 is mobile between a first position in which it projects by a predetermined section beyond the collar 34 at which, as is known, it closes the connecting pipes, not illustrated, between the source 29 and the chamber 16 of the pneumatic cylinder 19, and a second, retracted position, in which, as is known, it opens the above-mentioned connecting pipes.

[0025] Similarly, the stem 38 is mobile between a first position, in which it projects by a predetermined section beyond the collar 35 at which, as is known, it closes the connecting pipe, schematically illustrated with a line 39 in Figure 1, between the source 29 and the pneumatic motor 11, and a second, retracted position, in which, as is known, it opens the connecting pipe 39.

[0026] On a pin 40 transversal to the axes 4 and 6 and mounted on a wall 41 projecting from the grip 3, a control trigger 42 is pivoted, mobile about the pin 40, according to an inward or traction and a return movement, towards and away from the flat surface 36, during which it can successively activate the first and second control valves 27 and 28.

[0027] The trigger 42 is box-shaped, having a cavity 43 facing the flat surface 36, housing first and second means 44 and 45 for successive activation of the first and second valves 27 and 28.

[0028] More precisely, the first means 44 consist of a rocker arm 46 mounted on a pin 47 parallel with the pin 40 and connecting the two opposite side walls 48 of the trigger 42, whilst the second means 45 consist of a lever 49 pivoting on the pin 40.

[0029] The rocker arm 46 comprises a first, L-shaped arm 50 whose free end 51 activates the stem 37 of the first valve 27, and a second arm 52 which activates the

lever 49 and is inserted between the base 53 of the trigger 42 cavity 43 and the free end 54 of the lever 49.

[0030] The lever 49 is inserted with its free end 54 between the second arm 52 and a counteractive spring 55 inserted in a seat 56 between the seats 30 and 31 and activates the stem 38 of the second valve 28.

[0031] In practice, as is known and illustrated in Figures 1, 5 and 6, the operator inserts a rivet 2 in a hole 57 made in a wall 58 on which the rivet 2 is to be applied, then inserts the threaded portion 10 of the rod 8 holding unit 9 in the rivet 2. When the threaded portion 10 meets the threaded portion 2a of the insert 2, under the thrust exerted by the operator towards the wall 58, there is an axial movement of the rod 8 relative to the cylindrical body 5 in direction F1 towards the motor 11 with consequent opening, by a stem 59 integral with the rod 8, of a valve 60 which activates the motor 11, which simultaneously screws the portion 10 onto the threaded portion 2a of the insert 2. During this operation the gun 1 moves from the position illustrated in Figure 5 to the position illustrated in Figure 1, where the motor 11 stops at the moment when, as is known, the front end of the cylindrical body 5 makes contact with the collar 2c of the insert 2.

[0032] At this point, as illustrated in Figures 2 to 4, the operator starts activating the trigger 42 which is performing the operation described above in the home position, illustrated in Figure 2, for detachment from a first wall 61 forming the surface 36 of the handle 3 and in which the first and second valves 27 and 28, still closed, have the respective stems 37 and 38 projecting from the bodies 32 and 33.

[0033] When pulled, the trigger 42 rotates about the pin 40 and during a first part of its angular travel, illustrated in Figure 3, brings the free end 51 of the rocker arm into contact with the end of the stem 37 of the valve 27, in contact with a handle 3 second contact wall 62 formed by the valve 27 locking collar 34, the stem 37 consequently sliding along its axis A and opening the valve 27. After this, the source 29 is connected to the first chamber 16 and the piston 15 slides along the cylindrical compartment 14, causing the rod 21 to slide in the cylindrical chamber 22, resulting in the passage of the oil through the hole 23 into the chamber 5a and movement of the piston 7 in the direction F1 which pulls the rod 8, deforming the portion 2b of the insert 2 as illustrated in Figure 6.

[0034] During this first part of the trigger 42 angular travel, the rocker arm 46 remains stationary about the pin 47 in a first, stable configuration in which its second arm 52 is inserted between the base 53 of the trigger 42 and the lever 49 subject to the action of the spring 55. Obviously, during this first stage the elastic reaction of the spring 55 is stronger than the opposing reaction of the valve 27 stem 37.

[0035] As traction on the trigger 42 continues, the trigger performs a second part of its angular travel, reaching a final position in which it is in contact with the handle 3

first contact wall 61. As a result, as illustrated in Figure 3, the rocker arm 46 subject to the reaction of the second contact wall 62 rotates about the pin 47, clockwise as seen in Figures 2 to 4, overcoming the resistance of the spring 55 and moving its second arm 52 away from the base 53 of the trigger 42. After this, the rocker arm 46 moves to a second configuration, illustrated in Figure 4, in which it frees the valve 27 stem 37 from its first arm 50, simultaneously pushing the lever 49 with the end of its second arm 52.

[0036] Therefore, the lever 49 rotates anti-clockwise about the pin 40 towards a position in which it makes contact with the end of the valve 28 stem 38, opening the valve and so, as is known, opening the pipe 39 connecting the source 29 to the pneumatic motor 11 which rotates the holding unit 9 in such a way as to unscrew the threaded portion 10 of the rod 8 from the threading 2a on the insert 2.

[0037] It should be noticed that, in the second configuration, illustrated in Figure 4, when the first arm 50 of the rocker arm 46 disengages from valve 27 stem 37 and the second valve 28 is opened by the lever 49, by means of a pipe 63 for pneumatic communication with the first valve 27, the valve 28 supplies the control fluid to the first valve 27 to restore it to the closed condition in which the stem 37 returns to the condition illustrated in Figures 4 and 2.

[0038] At the same time, restoring the valve 27 to the closed condition causes, in the known way, the passage of the pressurised fluid into the second chamber 17 of the compartment 14, causing the piston 15 to descend to the condition illustrated in Figure 1 after which the oil passes through the hole 23 from the chamber 5a to the chamber 22, allowing the spring 24 to return the piston 7 to its initial condition, illustrated in Figure 1.

[0039] When the operator releases the trigger 42, the action of the spring 55 returns the trigger to the home position illustrated in Figure 2.

[0040] The invention described can be subject to modifications and variations without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent elements.

Claims

1. A rivet gun for threaded rivets or inserts (2) comprising a grip handle (3), a hydraulic cylinder (20) supported by the handle (3), means (9) for holding and retaining an insert (2) connected to the hydraulic cylinder (20), a pneumatic cylinder (19) for activating the hydraulic cylinder (20) for traction of the rivets inserted (2), pneumatic motor means (11) for driving the rotation of the holding and retaining means (9), first control means (25) for the pneumatic cylinder (19) and second control means (26) for the pneumatic motor means (11), the rivet gun being

characterised in that it comprises a control trigger (42), mobile according to an inward or traction and a return movement, the trigger (42), during its traction movement, successively activating the first and second control means (25, 26).

2. The rivet gun according to claim 1, **characterised in that** the control trigger (42) comprises first and second activating means (44, 45) for successively activating the first and, respectively, the second control means (25, 26).

3. The rivet gun according to claim 2, **characterised in that** the first activating means (44) comprise a rocker arm (46) pivoting on a first pin (47) integral with the trigger (42) and comprising a first arm (50) for activating the first control means (25) and a second arm (52) for activating the second activating means (26).

4. The rivet gun according to claim 3, **characterised in that** the second activating means (26) comprise a lever (49) mobile between a position in which it is detached from the second control means (26) and a position in which the second control means (26) are activated by the action of the second arm (52) of the rocker arm (46) and against the action of the counteractive elastic means (55).

5. The rivet gun according to claim 4, **characterised in that** the trigger (42) pivots with one end at a second pin (40) integral with the handle (3) and its inward or traction movement, opposed by elastic means (55), extends between a home position in which it is detached from a handle (3) first contact wall (61) and a position in which it makes contact with the handle (3) first contact wall (61) following its rotation about the second pin (40), the lever (49) pivoting on the second pin (40) and the rocker arm (46) having an L-shaped first arm (50) facing the first control means (26).

6. The gun according to any of the foregoing claims from 1 to 5, **characterised in that** first and second control means (25, 26) comprise a first and, respectively a second opening and closing valve (27, 28) for a control fluid from a source (29) of rivet gun (1) supply fluid.

7. The rivet gun according to claims 5 and 6, **characterised in that** in the trigger (42) home position and during a first part of its angular travel corresponding to activation of the first valve (27) by the free end of its first arm (50), the rocker arm (46) remains stationary about the first pin (47) in a first, stable configuration, in which its second arm (52) is between the base (43) of the trigger (42) and the lever (49) subject to the action of the elastic means (55); the

first, stable configuration being maintained until the first valve (27) is opened and the free end of the first arm (50) simultaneously makes contact with a handle (3) second contact wall (62).

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8. The rivet gun according to claim 7, **characterised in that**, during a second part of its angular travel, the trigger (42) reaches its final position in which it makes contact with the handle (3) first contact wall (61), the rocker arm (46), subject to the action of the trigger (42) and the reaction of the second contact wall (62), rotating about its pivot pin (47) and moving its second arm (52) away from the base (53) of the trigger (42) and moving towards a second configuration in which it frees the first valve (27) from its first arm (50) and has the end of its second arm (52) push the lever (49) towards a second valve (28) open position, overcoming the resistance of the elastic means (55).
9. The rivet gun according to claim 8, **characterised in that** it comprises means (63) for pneumatic communication between the first and second valves (27, 28); the communicating means (63) being designed, in the second configuration, to supply the control fluid to the first valve (27) as a result of the second valve (28) opening, so as to restore the first valve (27) to the closed condition.
10. The gun according to any of the foregoing claims from 1 to 9, **characterised in that** the control trigger (42) is box-shaped and houses the first and second activating means (44, 45) which are respectively mounted on the first and second rotation pins (47, 40) connecting two side walls of the trigger (42).

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FIG.1

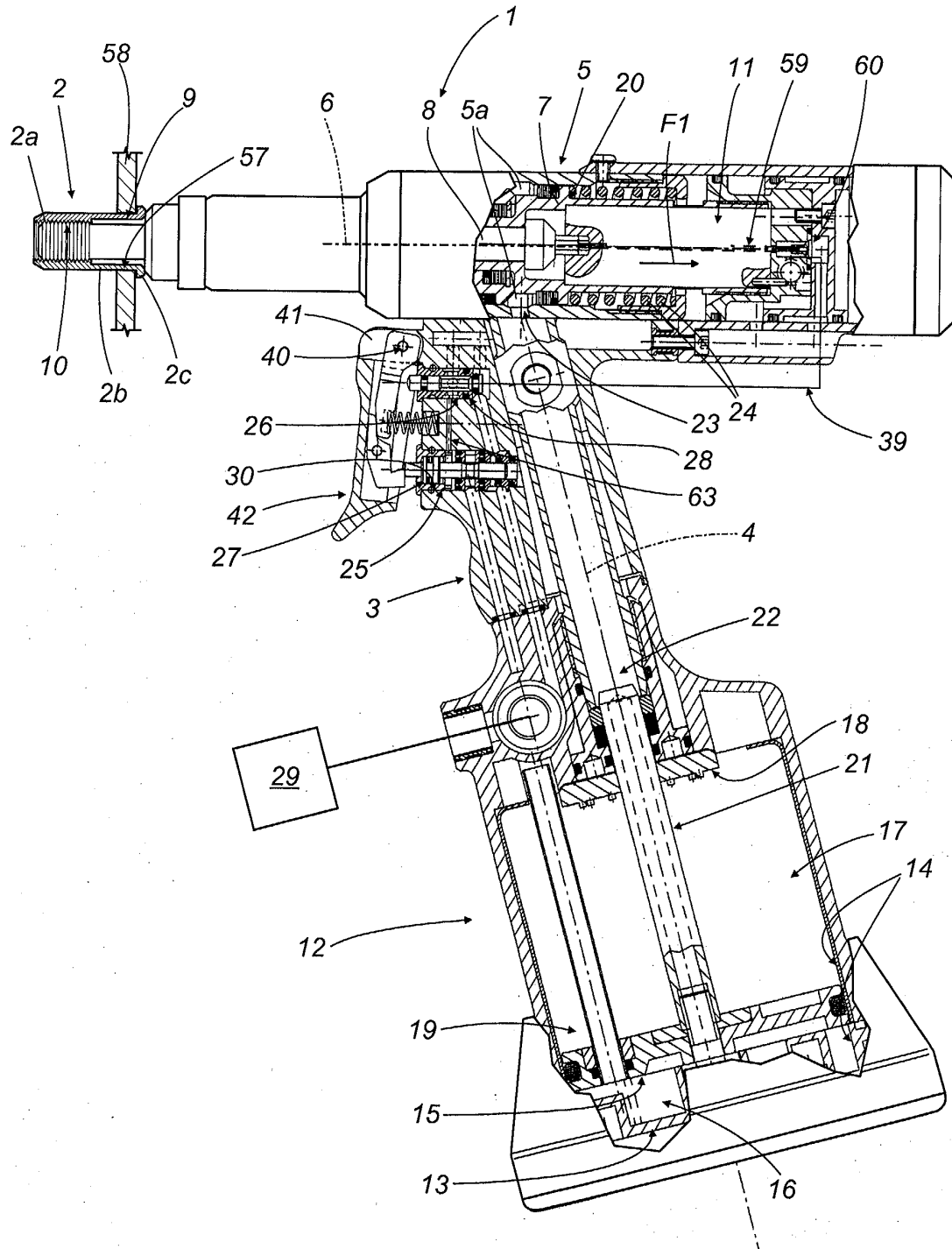


FIG.2

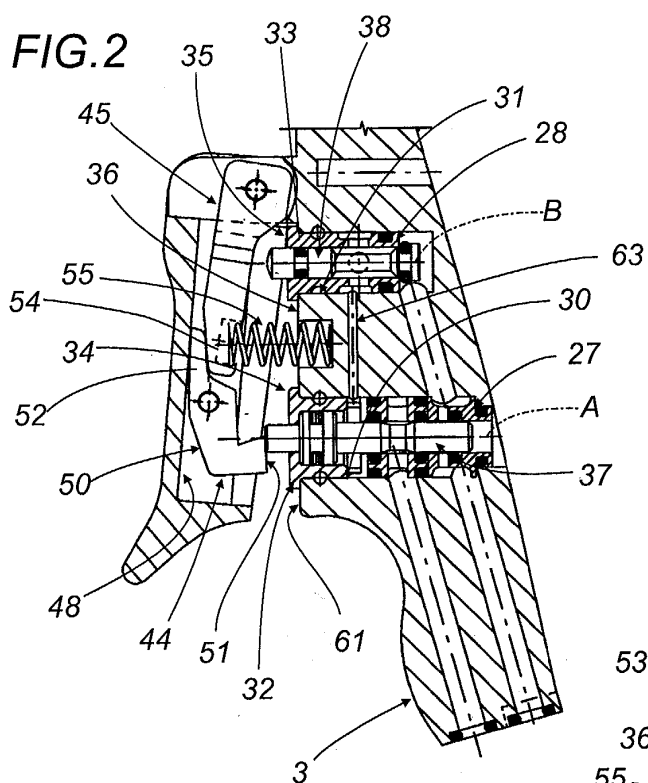


FIG.3

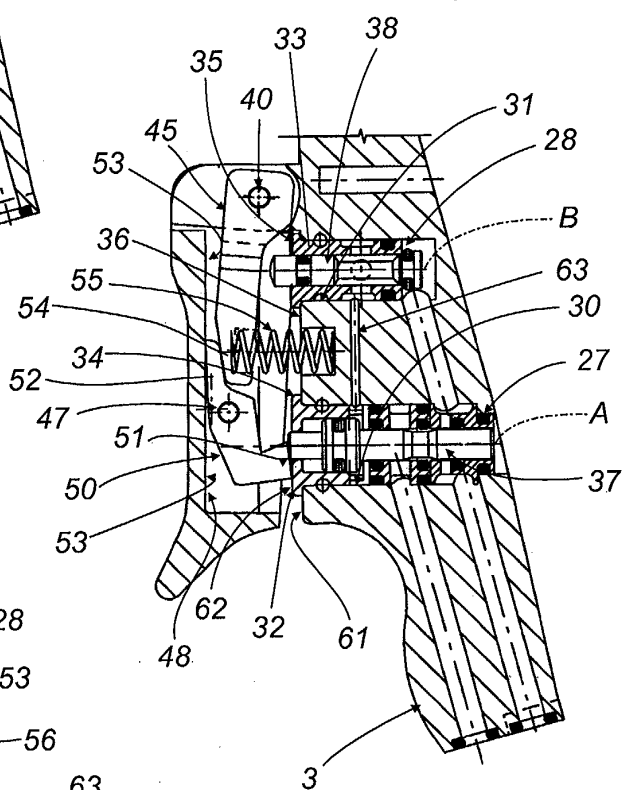
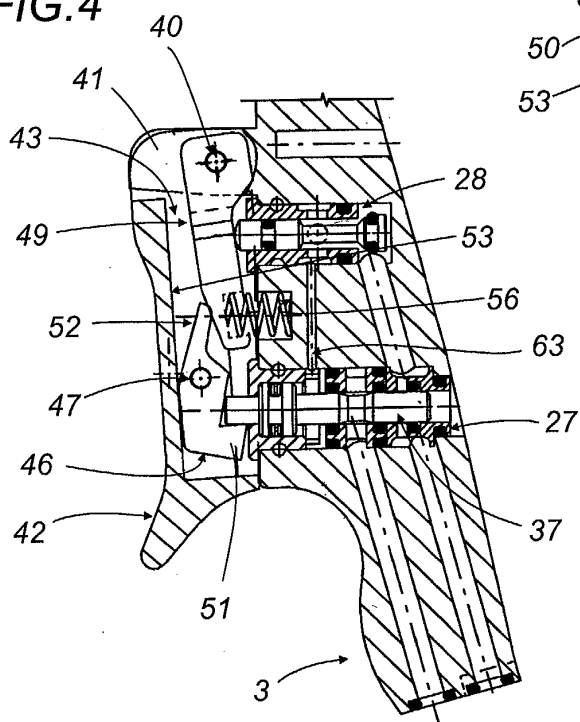


FIG.4



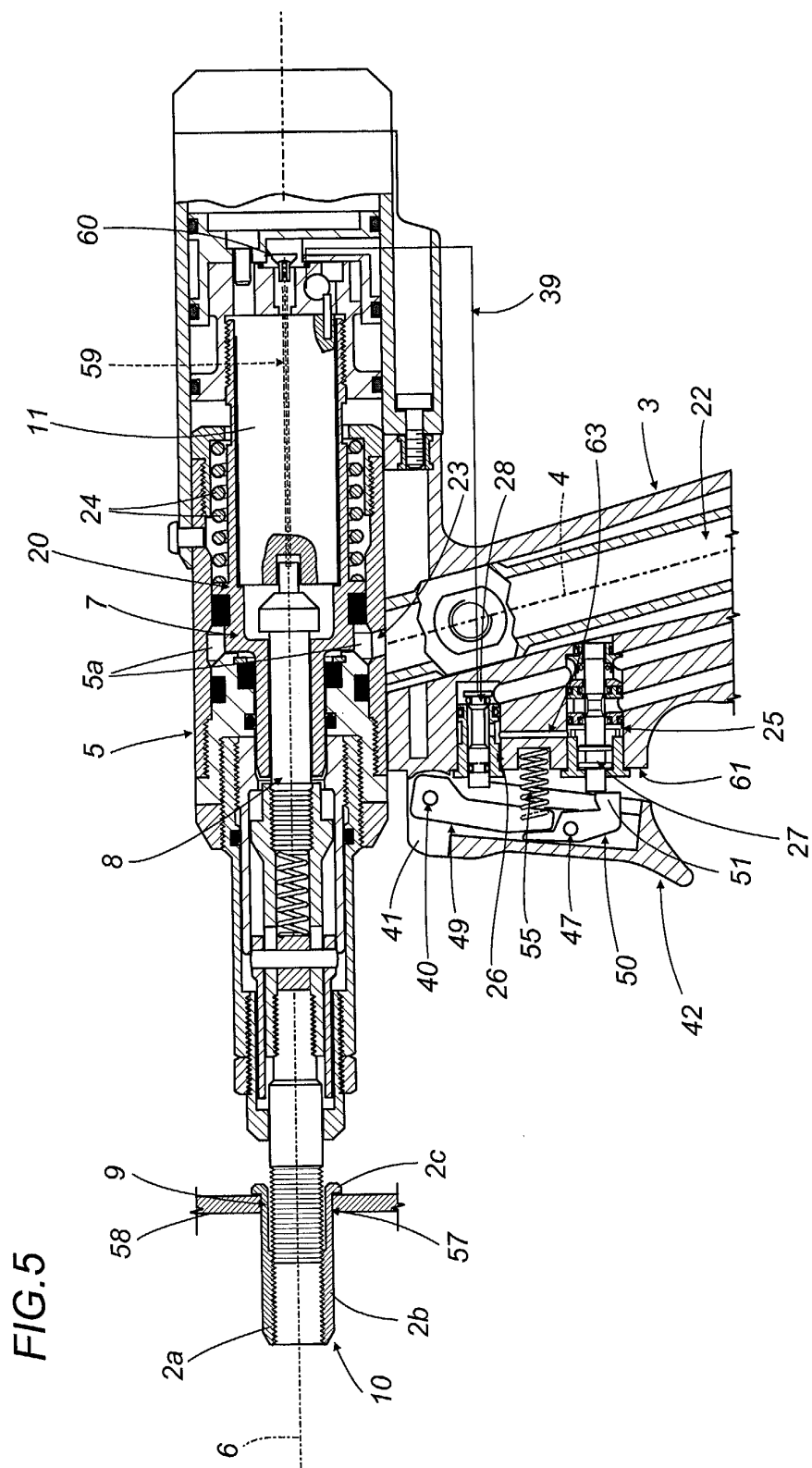


FIG.6

