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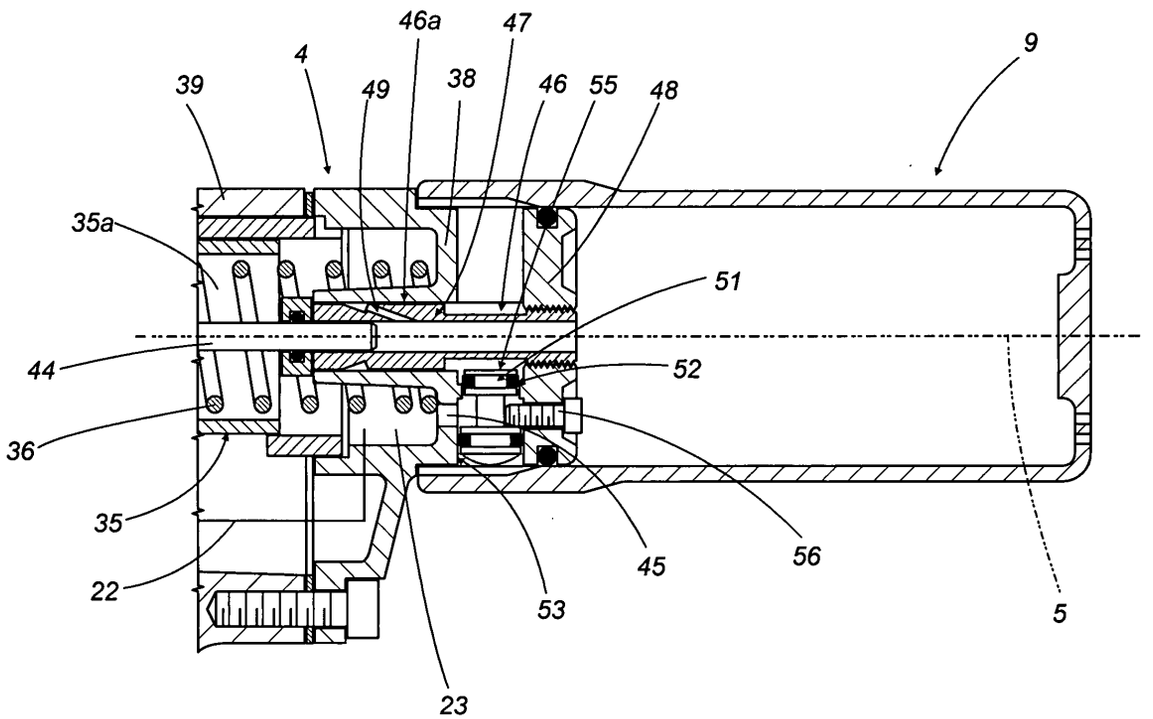
(54) A riveting gun

(57) A riveting gun comprises a substantially cylindrical body (4) equipped at one end with a head (6) for gripping the rivet (8) mandrels (7) a discharge channel (44) coaxial with the body (4) and extending between an inlet at the gripping head (6) and an opposite outlet, leading into a container (9), pneumatic means (19,20,21,22) designed to produce a stream of fluid that discharges rivet (8) mandrels (7) into the container (9), the riveting gun being characterised in that the pneumatic means (19,20,21,22) comprise shutoff means (50) for interrupting the stream of fluid.

FIG.3



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Description

[0001] The present invention relates to a riveting gun.

[0002] Prior art riveting guns of this type, designed to apply break mandrel rivets of any kind, comprise a handgrip or handle and a substantially cylindrical body attached to the handgrip transversally to the latter and equipped at one end with a rivet gripping and breaking off head.

[0003] The handgrip houses a pneumatic cylinder and piston assembly which drives the piston of a hydraulic cylinder housed in the body and coaxial with the latter.

[0004] The piston of the hydraulic cylinder has attached to it a tubular rod, coaxial with the body, one end of which is associated with the rivet gripping head.

[0005] The rivets are applied as follows.

[0006] The rivet, held by the riveting gun gripping head, is positioned inside the hole made in the parts to be joined. The user then pulls the trigger on the handgrip. This opens a first shutoff valve which puts a compressed air source into communication with a chamber of the pneumatic cylinder, which causes the related piston to perform its forward stroke.

[0007] This piston is equipped with a rod which, during the forward stroke, runs through an oil filled chamber inside the handgrip and communicating with the thrust chamber of the piston of the hydraulic cylinder.

[0008] As it moves away from the rivet gripping head against the opposing action of a return spring, the piston applies, through the cylinder rod and gripping head, a pulling force that upsets a portion of the rivet on the parts to be joined and at the same time breaks off the rivet mandrel or stem.

[0009] It has been found, however, that the hydraulic mechanism that drives riveting guns of this type has the inevitable disadvantage connected with oil leaks. Leaking obviously gets worse as the gun gets older.

[0010] This means that the oil must be renewed or at least topped up at regular intervals.

[0011] The attempts to overcome this disadvantage by more precise machining of the critical parts responsible for leakages and by adding oil seals have considerably increased production costs without fully solving the problem.

[0012] Also known to prior art are riveting guns fitted with containers for collecting riveting debris, this debris, as is well known, consisting of the spent rivet mandrels or stems.

[0013] More specifically, the mandrel of each rivet, after being broken off, is ejected through a discharge channel coaxial with the riveting gun head and extending between an inlet at the gripping head and outlet leading into the container, which is fixed to the body on the side opposite the gripping head. The mandrel is driven along the discharge channel by a stream of compressed air.

[0014] If the container is removed from the gun body, to empty it when it is full, for example, a safety device prevents mandrels from being ejected until the container is put back in place again.

[0015] The safety device may consist of a hand-operated valve to shut off the compressed air system or even mechanical gate valve means to close the discharge channel.

[0016] Neither of these types of device, however, provide a sufficient guarantee of safety.

[0017] Indeed, the former rely on a manual operation and the latter, on account of the high pressure in the pneumatic system and since they do not interrupt the circulation of air in the system, may cause the mandrel to backfire through the inlet of the discharge channel.

[0018] The aim of the present invention is to overcome the above mentioned disadvantages.

[0019] Accordingly, the present invention provides a riveting gun comprising a handgrip and a substantially cylindrical body attached to the handgrip transversally to the latter and equipped at one end with a head for gripping the rivet mandrels, first actuating means associated with the handgrip, second actuating means associated with the body and controlled by the first actuating means, designed to apply to the gripping head a pulling force in the direction of the axis of the cylindrical body, the riveting gun being characterised in that the second actuating means comprise respective cam means.

[0020] The invention will now be described with reference to the accompanying drawings which illustrate preferred embodiments of it and in which:

- Figures 1 and 2 are longitudinal sections of a riveting gun according to the present invention in two working positions;
- Figures 3 and 4 show a part of the riveting gun of Figure 1 in two different operating conditions.

[0021] With reference to Figures 1 and 2, the numeral 1 denotes in its entirety a riveting gun, in particular a pneumatic one, comprising an elongated handgrip 2 whose longitudinal axis is labelled 3.

[0022] One end of the handgrip 2 is attached to a substantially cylindrical body 4, whose longitudinal axis, labelled 5, is substantially transversal to the axis 3 of the handgrip 2.

[0023] A first end of the body 4 is equipped with a head 6 for gripping the mandrels 7 of the rivets 8, and the second end is equipped with a cylindrical container 9 coaxial with the body 4 and designed to collect the spent mandrels 7 discharged from the riveting gun 1 after upsetting of the rivets 8.

[0024] The free end of the handgrip 2, labelled 10 in its entirety, is substantially cylindrical in shape, is closed by a bottom wall 11 and defines within it a cylindrical cavity 12, which is divided by a piston 13 into a first chamber 14, between the piston 13 and the bottom wall 11, and a second chamber 15 between the piston 13 and an end wall, labelled 16, that is substantially parallel

to the bottom wall 11.

[0025] More specifically, the cylindrical cavity 12 and the piston 13 together constitute first actuating means associated with the handgrip 2.

[0026] At the end of the handgrip 2 close to the casing 4, there is pivotally mounted a trigger 17. The latter, acting, in conjunction with a rod 18 parallel to the axis 3 and sliding in a direction parallel to the axis 3, actuates a distribution valve (of the type described in Italian utility model No 208.712) and illustrated schematically as a block 19. The valve 19 is connected through a pipe 20 to a compressed air source 21.

[0027] When the trigger 17 is pulled, the valve 19 connects the source 21 in known manner directly with the first chamber 14 so as to drive the piston 13 from the rest position illustrated in Figure 1 to the working position illustrated in Figure 2. Alternatively, the valve 19 can also connect the source 21 in known manner directly with the second chamber 15 so as to drive the piston 13 from the working position illustrated in Figure 2 to the rest position illustrated in Figure 1.

[0028] Also in known manner and for the reasons described below, the valve 19 uninterruptedly supplies a chamber 23 inside the body 4 through a conduit, that is schematically illustrated by a continuous line, labelled 22, in Figures 1 and 2, and that extends partly inside the handgrip 2 and partly inside the body 4.

[0029] As shown in Figures 1 and 2, the piston 13 is attached to a rod 24 that is coaxial with the axis 3 of the handgrip 2 and slides in a guide sleeve 25 made in the handgrip 2 itself. Fitted on the end of the rod 24 facing the body 4 there is a wedge 26, one face 27 of which is parallel to the axis 3 and another face 28, opposite the face 27, being at a defined angle to the axis 3 and constituting the active pushing section of a cam element 29 comprising a cam follower push roller 30 and a contact and guide roller 31. Specifically, the cam follower 30, which cooperates with the angled face 28 of the wedge 26, is rotatably mounted on a shaft 32, whose axis is transversal to the axis 5 and which is in turn mounted on a carriage 33 housed in the body 4 and running in the direction of the axis 5. More specifically, the wedge 26, the roller 30 and the carriage 33 together constitute second actuating means connected to the first actuating means by the rod 24.

[0030] As shown in Figures 1 and 2, the carriage 33 is connected by a tubular rod 34 to the gripping head 6, whilst on the side of the carriage 33 opposite the gripping head 6, there is a cup-like element 35 that defines a seat 35a accommodating an end portion of an opposing helical spring 36 fitted between the end wall 37 of the seat 35a and a wall 38 transversal to the axis 5, parallel to the end wall 37 and attached to the outer casing 39 defining the body 4.

[0031] Looking in more detail, with reference also to Figures 3 and 4, the seat 35a defined by the aforementioned cup-like element 35 and the face 38 form the chamber 23 into which the conduit 22 leads.

[0032] The gripping head 6 comprises a rivet nozzle 40 screwed to the front end 41 of the casing 39 of the body 4 and two jaws 42 housed in a respective chuck 43 connected to the end of the tubular rod 34 opposite the end that is connected to the carriage 33.

[0033] With reference to Figures 1 and 2, the numeral 44 denotes a discharge channel for the mandrels 7 of the rivets 8. This channel is coaxial with the axis 5 and presents an inlet at the nozzle 40 and an outlet leading into the container 9 and extending further through the gripping head 6, the tubular rod 34, the carriage 33 and the walls 37 and 38.

[0034] As shown in more detail in Figures 2 and 3, the chamber 23 is connected, through a hole 45 made in the wall 38, to an annular chamber 46 extending around a sleeve 47 that is coaxial with the axis 5 connecting the wall 38 with an end wall 48 of the casing 39 of the body 4. With its outer cylindrical surface, the end wall 48 constitutes a connector element for an open end 9a of the container 9.

[0035] The aforementioned annular chamber 46 is connected, through a passage 46a, to a hole 49 that crosses the sleeve 47 at an angle towards the outlet of the discharge channel 44, in such a way that the fluid supplied by the source 21 flowing through the conduit 22 produces a Venturi effect that generates a vacuum inside the discharge channel 44 capable of creating a sucking action directed towards the outlet of the discharge channel 44.

[0036] The invention will now be described with reference to the operation of the riveting gun starting from the conditions illustrated in Figure 1, where a rivet 8, associated with the parts to be joined (not illustrated), has been inserted with its mandrel 7 into the nozzle 40 of the gripping head 6. When the trigger 17 is pulled, the valve 19, actuated by the rod 18, enables fluid under pressure supplied by the source 21 to flow into the first chamber 14 and to drive the piston 13 along the cylindrical cavity 12 from the position illustrated in Figure 1 towards the working position illustrated in Figure 2.

[0037] As a result of this, the rod 24 slides inside the sleeve 25 and enables the wedge 26 to move the carriage 33 in the direction of the axis 5 towards the container 9, as indicated by the arrow F1. More specifically, the face 27 parallel to the axis 3 runs on the contact and guide roller 31, while the angled face 28 of the wedge 26 cooperates and interacts with the cam follower push roller 30 in such a way as to drive the carriage 33 and hence the tubular rod 34, the gripping head 6 and the chuck 43 along the body 4. As a result of this movement and against the opposing action of the spring 36, the jaws 42 tighten around the mandrel 7, pulling it and breaking it off while at the same time upsetting the rivet 8 on the parts to be joined.

[0038] At this point, the vacuum generated by the Venturi effect inside the discharge channel 44 produces suction which draws the broken mandrel 7 into the container 9 through the discharge channel 44.

[0039] When the trigger 17 is released, the valve 19 stops the compressed air from flowing into the first chamber 14 and causes it to flow into the second chamber 15 so as to drive the piston 13 back to the rest position of Figure 1 so that the cam element 29 moves to the lowered position, causing the carriage 33 to move in the direction opposite that indicated by the arrow F1 under the action of the spring 36. This cycle is repeated for each rivet 8. As shown in more detail in Figures 3 and 4, the hole 45 reaches the annular chamber 46 through shutoff means 50 consisting of a valve 51 that opens and closes a conduit 52 which pneumatically connects the hole 45 to the annular chamber 46.

[0040] More specifically, the chamber 23, the hole 45, the conduit 52, the annular chamber 46, the passage 46a and the angled hole 49 together constitute a circuit that pneumatically connects the conduit 22 to the discharge chamber 44.

[0041] The valve 51 is located inside a radial seat 53 formed in the outer housing 39 with one end open to the outside environment and can move between two stable positions. In the first of these positions, illustrated in Figure 4, the conduit 52 is closed, when the container 9 is removed, under the thrusting action of the air present inside the pneumatic circuit acting between the head 55 of the valve 51 and the end wall of the annular chamber 46. In this position, the valve 51 is held inside its seat 53 by a stop screw 56.

[0042] The valve 51 moves to the second stable position, illustrated in Figure 3, in which the conduit 52 is open, when the container 9 is applied to the back of the end wall 48 of the casing 39 of the body 4. Specifically, the container 9 is applied to the end wall 48 by an axial movement such that the open end 9a of the container 9 fits over the outer surface of the end wall 48. Next, by a screwing action about the axis 5, the container 9, thanks to two helical sectors 57 made on the inside surface of its open end 9a, intercepts a cap 58 on the outside of the valve 51, causing the latter to gradually move radially in the direction of the axis 5 itself and overcoming the resistance of the compressed air and thus re-opening the connecting conduit 52.

[0043] From the above description, it is clear that when the container 9 is not fitted, the valve 51 is always in the position in which it closes the pneumatic conduit 52, thus closing the aforementioned pneumatic circuit and interrupting the flow of air through the discharge channel 44 so as to avoid any risk of rivet 8 mandrels 7 being accidentally ejected from the outlet of the channel 44 itself.

Claims

1. A riveting gun comprising a handgrip (2), extending along a longitudinal axis (3), and a substantially cylindrical body (4) attached to the handgrip (2) transversally to the latter along an axis (5) and equipped at one end (41) with a head (6) for gripping the rivet (8) mandrels (7), first actuating means (12, 13) associated with the handgrip (2), second actuating means (26, 30, 33) associated with the body (4) and controlled by the first actuating means (12, 13), designed to apply to the gripping head (6) a pulling force in the direction (F1) of the axis (5) of said cylindrical body (4), a discharge channel (44) coaxial with the body (4) and extending between an inlet at the gripping head (6) and an outlet leading into a container (9) that can be fixed to the body (4) at the end opposite the gripping head (6), pneumatic means (19, 20, 21, 22) connected to the discharge channel (44) and designed to produce a stream of fluid that discharges rivet (8) mandrels (7) into the container (9), the riveting gun being **characterised in that** the pneumatic means (19, 20, 21, 22) comprise shutoff means (50) for interrupting the stream of fluid.

2. The riveting gun according to claim 1, **characterised in that** the shutoff means (50) are activated and inactivated when the container (9) is fitted to and removed from body (4), respectively.

3. The riveting gun according to claim 1, **characterised in that** the means (19, 20, 21, 22) are connected to the discharge channel (44) by a pneumatic circuit (23, 45, 46, 46a, 49, 52); the shutoff means consisting of a valve (51) that closes and opens the circuit.

4. The riveting gun according to claim 3, **characterised in that** the valve (51) is mounted in a radial seat (53) formed in the body (4) with one end open to the outside environment; the valve (51) being able to move in a radial direction between two stable positions, in the first of which the pneumatic circuit (23, 45, 46, 46a, 49, 52) is closed, when the container (9) is removed, and in the second of which the pneumatic circuit (23, 45, 46, 46a, 49, 52) is opened when the container (9) is fitted to the body (4).

FIG.1

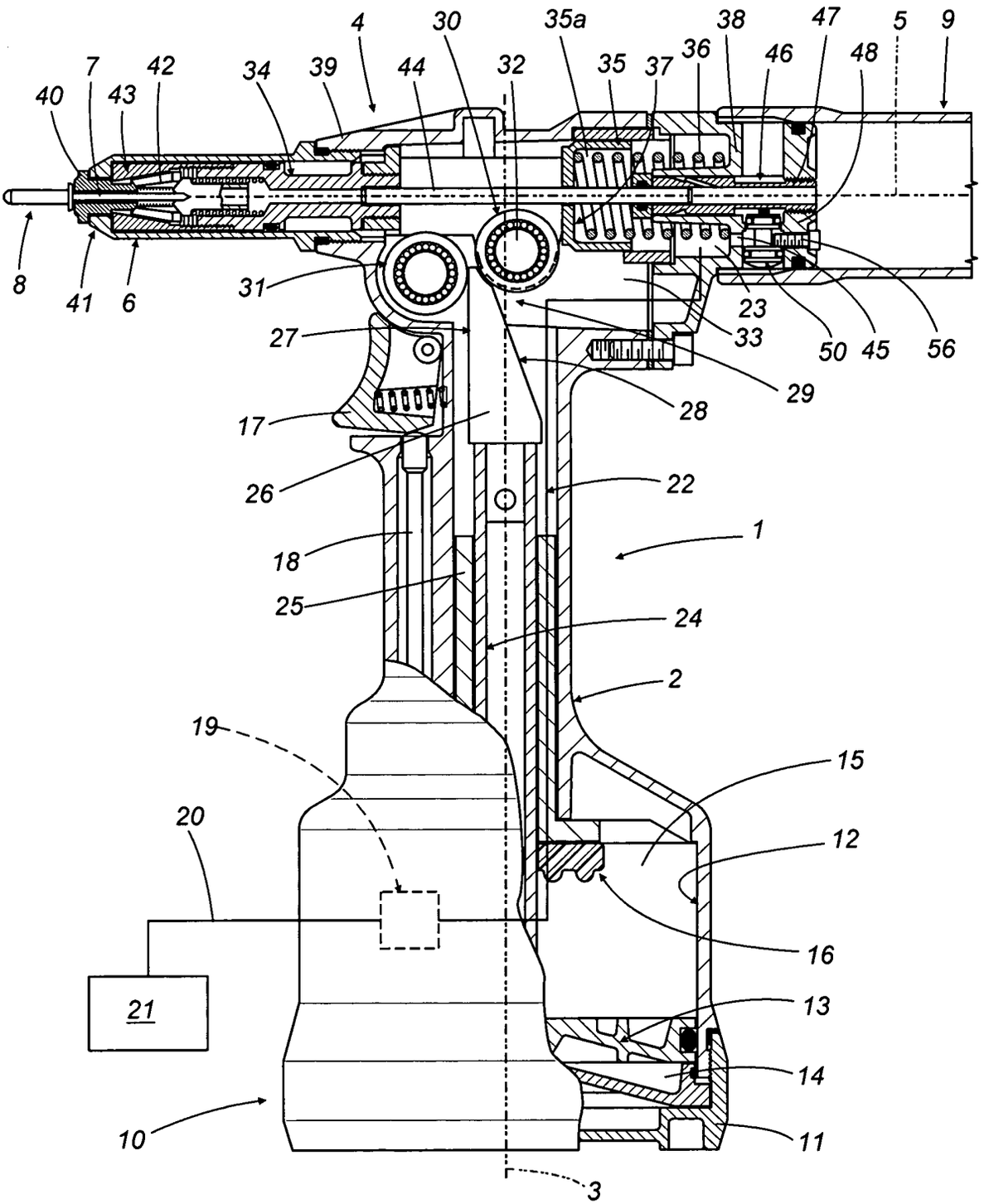
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FIG.2

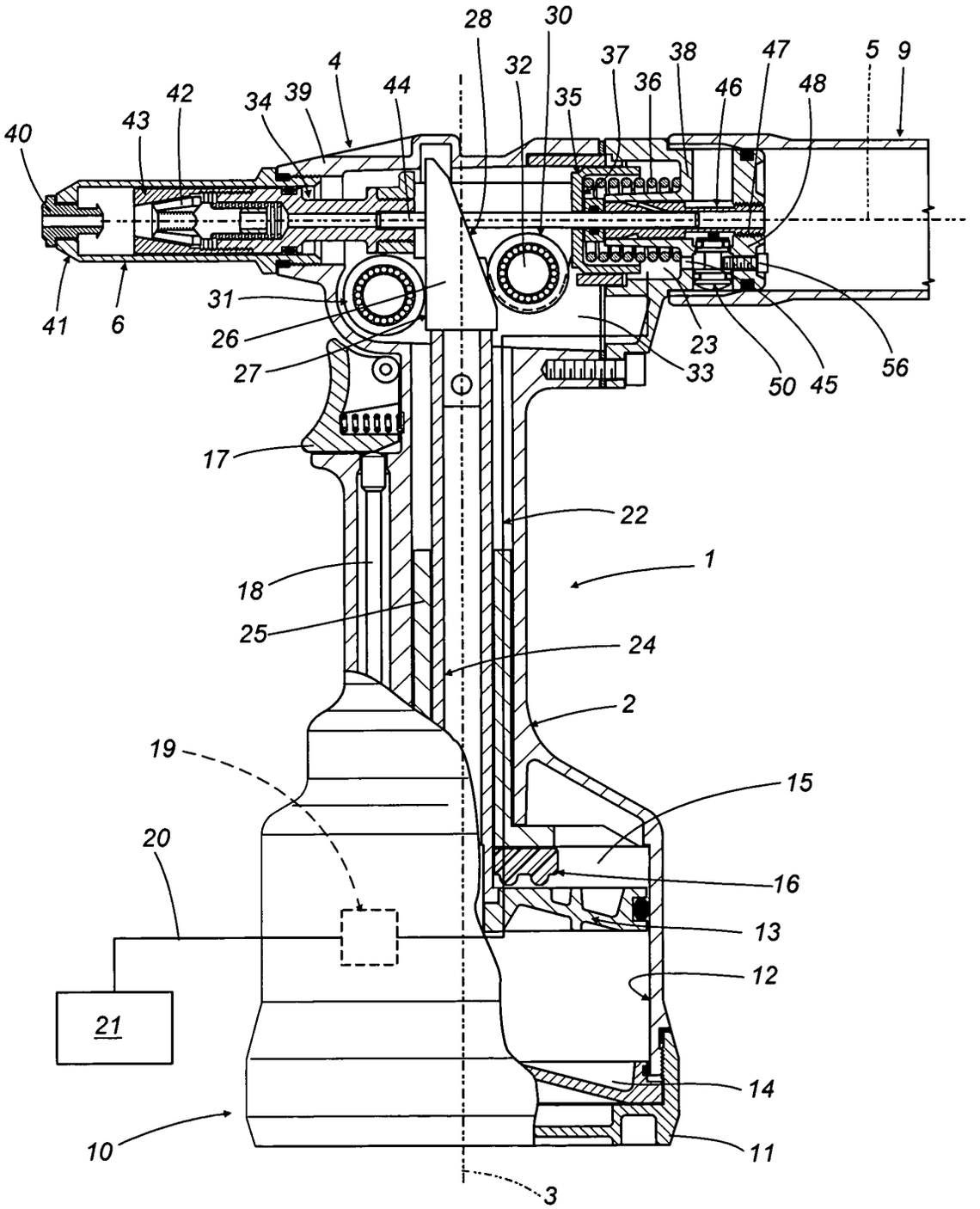
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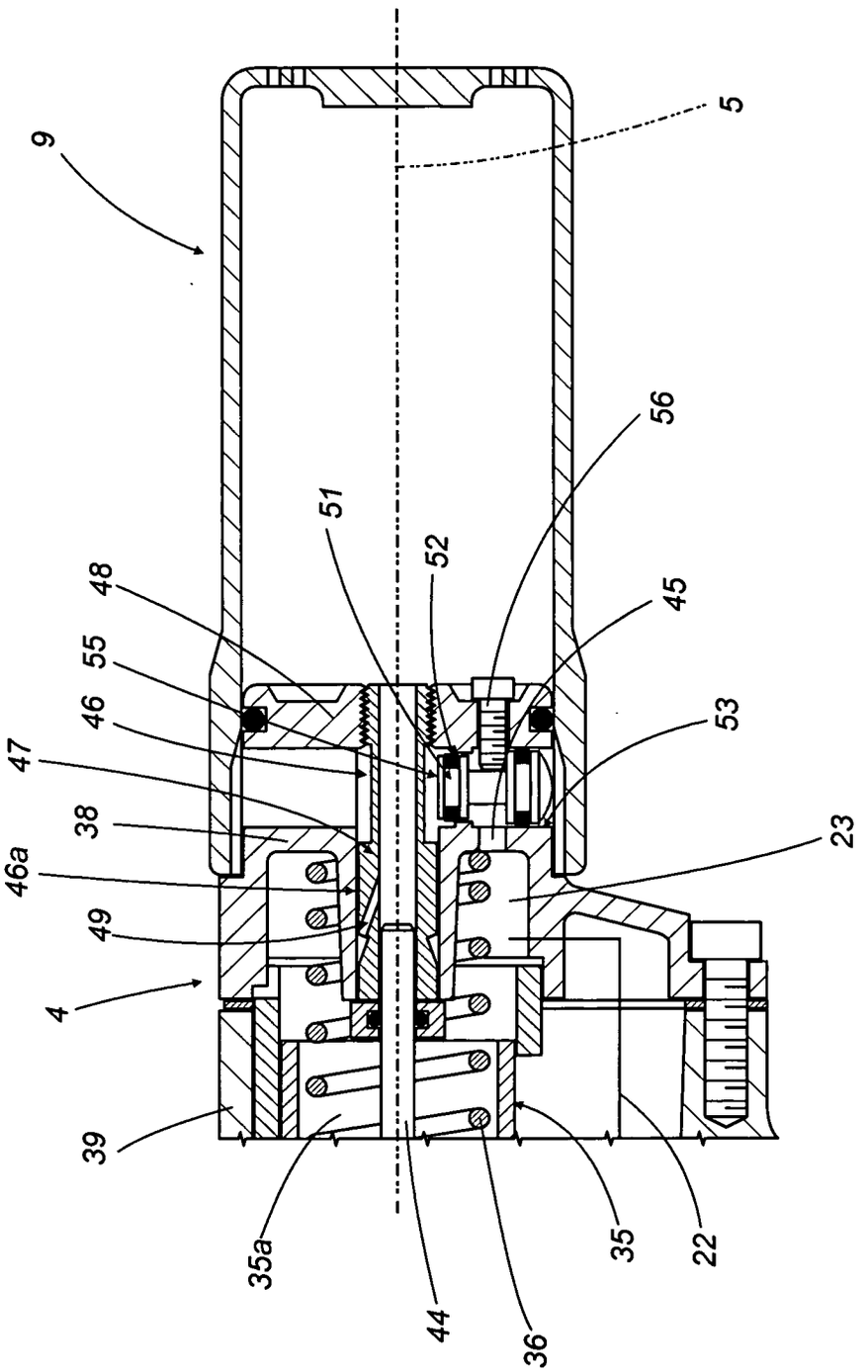
FIG.3



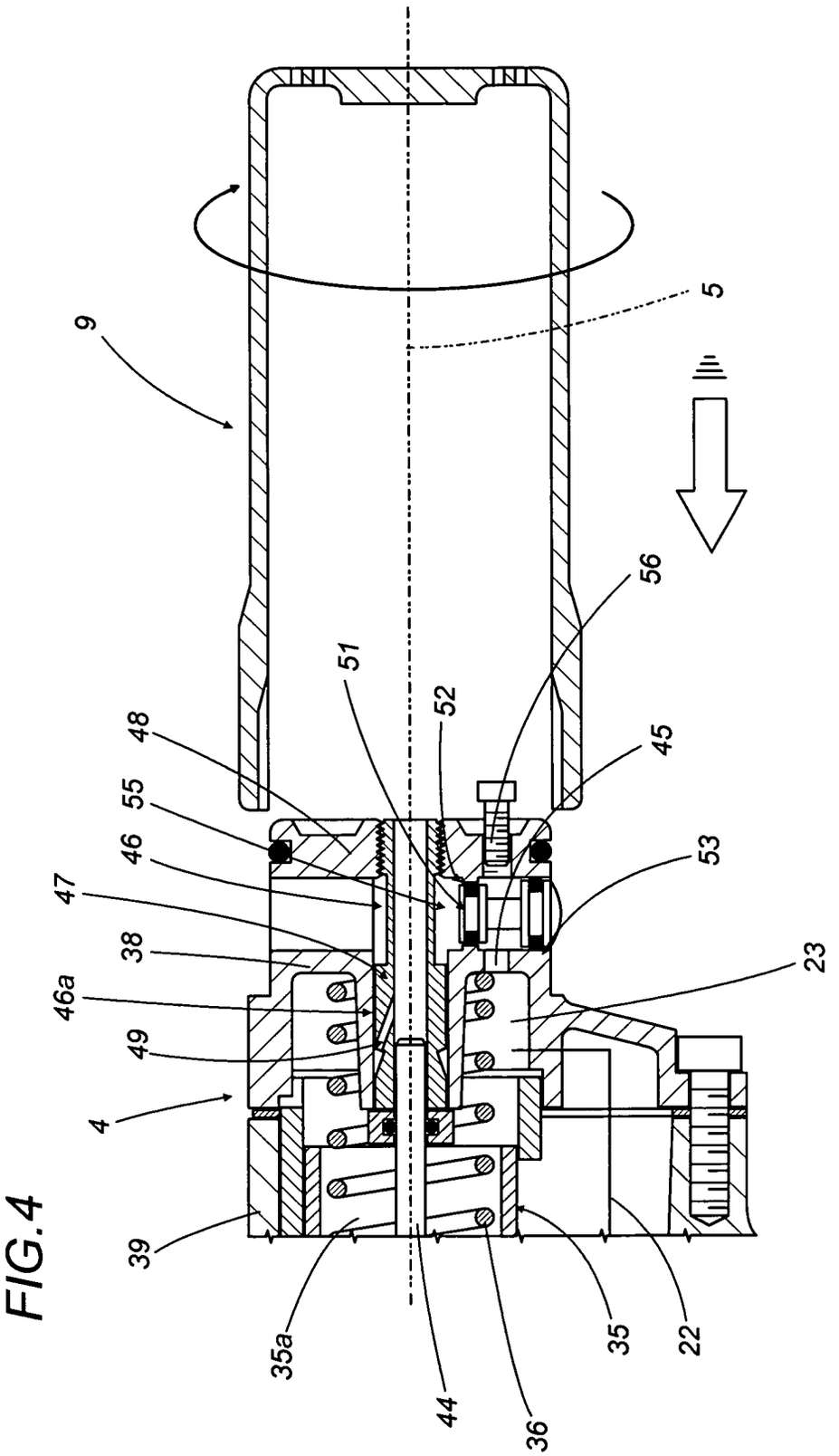


FIG.4