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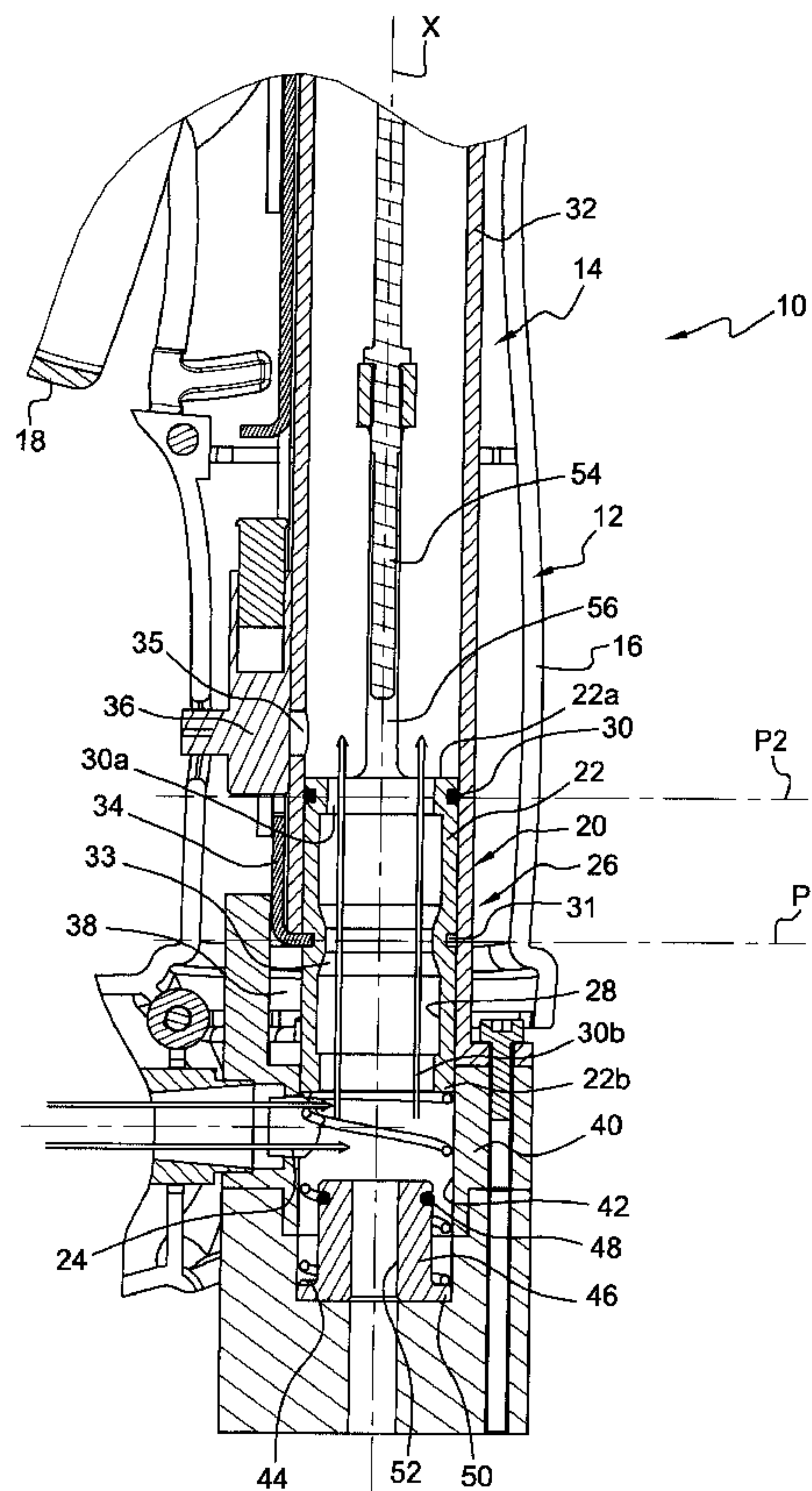
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(54) **Titre : CHAMBRE DE COMBUSTION DESTINEE A UN OUTIL D'INSTALLATION ALIMENTE AU GAZ**

(54) **Title: COMBUSTION CHAMBER FOR A GAS-POWERED FIXING TOOL**



(57) **Abrégé/Abstract:**

Combustion or precombustion chamber (14) for a gas-powered fixing tool (10), comprising at least one valve (20), such as a gas intake or exhaust valve, said valve comprising a body (22) that is mobile between a first closed position and a second open position, characterized in that said body has a tubular elongate form and comprises an internal bore (28) emerging at the two longitudinal ends (22a, 22b) of said body to form, respectively, two orifices (30a, 30b) for the longitudinal passage of gas.

A B S T R A C T**Combustion chamber for a gas-powered fixing tool**

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Combustion chamber for a gas-powered fixing tool

TECHNICAL FIELD

The invention relates to a combustion or precombustion chamber for a
5 gas-powered fixing tool such as a nail gun for example.

PRIOR ART

The invention relates to anchoring or fixing tools, said to be gas-
powered, which means to say tools comprising an internal combustion engine
which works by igniting an air-fuel mixture inside a combustion chamber, the
10 fuel being injected into the chamber by an injection device from a fuel
receptacle referred to as a gas cartridge. Such tools are intended to drive
fixing elements into supporting materials so that components can be fixed
thereto. Gas-powered nail guns are very commonplace these days. As
examples of fuels for the internal combustion engine, mention may be made of
15 gasoline, alcohol, in liquid and/or gas form.

In general, such a tool is portable and comprises a casing in which the
internal combustion engine that propels a piston that drives a fixing element is
mounted. Such a tool may also comprise an electric battery as well as a
holding, handling and firing handgrip on which a trigger by means of which the
20 tool is actuated is mounted.

A firing cycle comprises several steps such as the distribution of a
quantity of fuel via the cartridge, the admission of the fuel into the chamber,
the mixing of the fuel with air in the chamber, the ignition and combustion of
the mixture in order to drive the piston, and the evacuation of the combustion
25 gases from the chamber.

A combustion chamber comprises at least one gas intake or exhaust
valve. This valve comprises a body that is mobile between a closed first
position in which a gas intake or exhaust orifice is closed and an open second
position in which this orifice is open.

30 The valves used in the state of the art have disadvantages.
Specifically, their configurations give rise to significant pressure drops when

the gas is being admitted or exhausted, and these lengthen the duration of the firing cycle. A valve is known for example in which the mobile body has an elongate form along an axis and comprises orifices for the passage of gas which are oriented radially with respect to this axis. The gas has a pass radially through these radial orifices then circulate
5 longitudinally along the axis. This winding path leads to the aforementioned pressure drops and has a tendency to slow down the firing cycle of the tool.

The present invention proposes a solution to the problem which is simple, effective and economical.

SUMMARY OF THE INVENTION

10 In a broad aspect, the invention pertains to a combustion or pre combustion chamber for a gas-powered fixing tool, comprising at least one valve. The valve comprises a body that is mobile between a first valve closed position and a second valve open position. The body has a tubular elongate form and comprises an internal cylindrical bore emerging at two opposed open ends of the body to form, respectively,
15 two longitudinal orifices axially in line for axial and longitudinal passage of gas therethrough.

In the present application, a precombustion chamber is intended to mean a chamber in which precombustion of an air-fuel mixture is intended to take place, before this mixture is injected into a combustion chamber to complete the combustion of the
20 mixture.

According to the invention, the mobile body of the valve is “hollow” which means to say that its internal bore is open at the two longitudinal ends of the body. The body thus comprises two axial or longitudinal orifices that allow the gas to to circulate more or less in a straight line, and therefore without twists and turns. This makes it
25 possible to limit the pressure drops as gas is being admitted to or exhausted from the chamber, thus making it possible to optimize the duration of the firing cycle of the tool.

The chamber according to the invention may comprise one or more of the following features, considered in isolation from one another or in combination with one another.

- said body has a generally cylindrical shape,
- said body bears, at its outer periphery, at least one seal,
- said at least one seal extends in a transverse plane passing substantially through one of the abovementioned two orifices,
- 5 - said body is mounted to be mobile in longitudinal translation in a casing, preferably formed by an assembly of parts or of elements,
- said casing comprises a first tubular cylindrical element of elongate form in which said body is housed and can slide,
- said casing comprises a second cylindrical element configured to be
- 10 engaged in said body when the latter is in the closed position,
- said second element bears, at its outer periphery, at least one seal configured to cooperate with said body, said at least one seal preferably extending in a transverse plane passing substantially through one of the abovementioned two orifices,
- 15 - said second element comprises an outer annular flange and is surrounded by a return spring bearing respectively on said flange and on said body, in order to stress the latter into its open position,
- said casing comprises a third element comprising an internal bore in which said body is intended to slide, said third element comprising at least one
- 20 orifice for the passage of gas emerging in this bore and oriented substantially radially relative to the longitudinal axis of said body, this orifice being configured to be blocked by said body when it is in its closed position and left free when it is in its open position,
- said body is linked by a member of elongate form to a valve shutter or disc
- 25 and/or to another mobile body of a valve,
- said body is linked to a rectilinear rod extending along the longitudinal axis of said body and having an outer diameter less than the inner diameter of the bore of said body,
- said rod is linked by legs to one of the longitudinal ends of said body,
- 30 - said body is linked either to a sheath having an inner diameter substantially identical to the inner diameter of the bore of said body, or to one or more

rectilinear rods extending over a circumference of a diameter substantially identical to that of said body,

- said orifices for the passage of gas have circular passage cross sections,
- said orifices for the passage of gas have substantially identical passage cross sections,
- said orifices for the passage of gas have passage cross sections that are defined by internal diameters of said two longitudinal ends of the body.

The present invention also relates to a gas-powered fixing tool, characterized in that it comprises at least one combustion chamber as described hereinabove.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and further details, features and advantages of the present invention will become more clearly apparent from reading the description which follows, given by way of nonlimiting example, and by referring to the attached drawings, in which:

- Figure 1 is a schematic partial view in axial section of a combustion chamber of a gas-powered fixing tool, according to the invention, this chamber comprising a valve the mobile body of which is in the open position;
- Figure 2 is a view corresponding to Figure 1 and in which the mobile body is in the closed position;
- Figure 3 is another partial schematic view in axial section of the combustion chamber of Figure 1;
- Figure 4 is a view corresponding to Figure 1 and illustrates an alternative form of embodiment of the invention.

DETAILED DESCRIPTION

The fixing tool 10 is partially visible in the drawings. This tool comprises a casing 12 in which there is an internal combustion engine with a combustion chamber 14 (or a precombustion chamber and a combustion chamber) that is intended to contain a mixture of air and fuel the ignition of which propels a piston intended to drive a fixing element taken from a feed magazine, the fixing element being intended to be anchored in a support material, at the

outlet of a nail guide extending at the front of the casing. All of these components of gas-powered fixing tools are perfectly well known to those skilled in the art and have therefore not all been depicted in the drawings.

The supply of fuel to the combustion chamber 14 of the motor is
5 effected via an injection member, from a fuel gas cartridge.

The casing 12 of the tool comprises a handgrip 16 for holding and handling the tool. The handgrip 16 is also used for firing, by means of an actuating trigger 18 mounted thereon.

In the example depicted, the combustion chamber 14 comprises an
10 intake valve 20 for the fuel gas delivered by the cartridge. This valve 20 is hollow or, more precisely, its mobile body 22 is hollow.

The mobile body 22 is mobile between a position in which an intake orifice 24 is open, which position is depicted in Figure 1, and a position in which the intake orifice 24 is closed, which position is depicted in Figure 2.

15 The mobile body 22 is able to move in a fixed casing 26 of the combustion chamber, which in this instance is formed by an assembly of parts or elements which will be described in detail in what follows.

The body 22 has a tubular elongate form and comprises an internal bore 28 emerging at the two longitudinal ends 22a, 22b of the body to form,
20 respectively, two orifices 30a, 30b for the longitudinal passage of gas.

The body 22 has a generally cylindrical form in the example depicted. It comprises an outer cylindrical surface and has an outside diameter that is substantially constant. At its end 22a it comprises an outer annular groove in which there is mounted a seal 30 intended to collaborate with the casing 26. It
25 also comprises, substantially in its middle, an outer annular groove 31 in which one end of a finger 34 actuated by the trigger 18 is intended to engage.

The end 22a of the body comprises an inner annular flange defining the orifice 30a, which is a gas exhaust orifice. The end 22b of the body comprises an inner annular flange defining the orifice 30b, which is a gas intake orifice.
30 These flanges have substantially the same inside diameter.

Although this is not in any way limiting, the bore 28 of the body has a restriction 33 of its passage cross section substantially in the middle of the body. This restriction 33 defines an inside diameter substantially equal to that of the aforementioned flanges.

5 The restriction 33 and the groove 31 are situated substantially in the same plane P1 transverse to the longitudinal axis X of the mobile body 22. The seal 30 is situated in another transverse plane P2 passing substantially through the orifice 30a of the body 22.

10 The casing 26 of the chamber comprises a tubular cylindrical element 32 in which the body 22 is housed and can slide. This element 32 has an elongate form with longitudinal axis X.

The element 32 comprises an internal cylindrical surface collaborating with the seal 30 borne by the body 22.

15 In the example depicted, the element 32 comprises an orifice 35 that is radial (with respect to the axis X) and through which one end of an igniter plug 36 can pass to initiate combustion of the air-fuel mixture in the chamber. This plug 36 may be of the piezoelectric type and be actuated by the aforementioned finger 34 when the user operates the trigger 18.

20 The element 32 further comprises a radial through-slot 38 which has a form that is elongate along the axis X. The finger 34 comprises an end which passes through the slot 38 and is engaged in the groove 31 of the body. When the trigger 18 is actuated, the finger 34 is moved translationally along the axis X, and its end slides in the slot to drive the mobile body 22 into the casing 26 of the chamber. It will thus be appreciated that the length of the slot (the
25 dimension along the axis X) is dependent on the expected travel of the body 22. Advantageously, and as may be seen in the drawings, whatever the position of the body 22 along the axis, the slot 38 is covered and therefore closed off by the body 22.

30 The casing 26 comprises another element 40 mounted at one longitudinal end of the element 32. This other element 40 comprises an internal bore 42 communicating with the internal housing of the element 32.

The bore 42 has a generally cylindrical form with axis X of revolution and is therefore coaxial with the internal housing of the element 32. This bore 42 preferably has an inside diameter substantially equal to the inside diameter of this internal housing.

5 The body 22 of the valve is able to slide in the bore 42.

The element 40 comprises a radial orifice emerging into the bore 42 and forming the aforementioned intake orifice 24. This orifice 24 communicates with the aforementioned injection member to supply the combustion chamber with fuel.

10 As may be seen in the drawings, when the body 22 is in its open position (Figure 1), the orifice 24 is left uncovered, allowing fuel to enter the bore 42 then pass longitudinally along the body 22 (cf. arrows). When the body 22 is in its closed position (Figure 2), the orifice 24 is hermetically closed off by the body 22.

15 It will thus be appreciated that the travel of the body, between its two extreme positions, is greater than the diameter of the orifice 24, so that the body does not impede the passage of gas through the orifice 24 in the open position (in this instance the high position), and so that the body completely closes off the orifice in the closed position (in this instance the low position).

20 The casing 26 further comprises another element 46 of generally cylindrical form aligned with the axis X. This element 46 is arranged at one end of the chamber and is intended to be partially housed in the bore of the body 22 when the latter is in the closed position (Figure 2).

25 This element 46 at its outer periphery comprises an outer annular groove to house a seal 48 intended to collaborate with the flange of the end 30b of the body 22. The seal 48 is situated in another transverse plane P3.

30 The element 46 at its opposite longitudinal end to the body 22 comprises an outer annular flange 50 the outside diameter of which is here substantially identical to that of the body 22. A return spring 44, in this instance a helical spring, is mounted around the element 46 and comprises a

first end bearing against the flange 50 and an opposite end bearing against the end 30b of the body in order to stress it into its open position.

As can be seen in the drawings, the element 46 may comprise an internal axial bore 52 for the passage of an igniter plug (not depicted) in the place of the aforementioned one. The bore 52 here is aligned with the axis X.

The end 30a of the body is connected to a cylindrical rod 54 of longitudinal axis X. This rod 54 has a diameter smaller than the inside diameter of the body. Its diameter is preferably comprised between 0.1 and 0.3 times the inside diameter of the body, and is, for example, from 0.15-0.16 times the inside diameter of the body.

The rod 54 has a length that is markedly greater than that of the body 22 and extends into the element 32 of the casing 26. Its longitudinal end situated on the body side is connected to the end 30a of the body by two or three legs 56 or more. These legs 56 are uniformly distributed about the axis X and are therefore diametrically opposed when there are two of them. The legs 56 are intended to have the gas passing between them and are preferably profiled in order to limit operational pressure drops (arrows).

As can be seen in Figure 3, the opposite end of the rod 54 to the body may be connected to a valve shutter 58 and/or to another valve 60, such as an exhaust valve.

The valve shutter 58 for example comprises a disc 62 through which the rod 54 passes and which is secured thereto. The disc 62 is intended to collaborate with an annular seat 64 of the element 32 of the casing. Figure 3 illustrates the valve shutter 58 in the open position, the disc 62 being away from its seat. This scenario corresponds to the open or upper position of the body 22 (Figure 1). In the closed or lower position of the body 22, the disc 62 collaborates in a sealed manner with the seat 64. The seat 64 may define an orifice for the passage of gas from the combustion chamber 14, which is a precombustion chamber, to another combustion chamber 66.

In the example depicted, the valve 60 comprises a mobile body 68 in the form of a disc or piston which at its external periphery bears a seal 70

intended to collaborate with an internal cylindrical surface of an orifice 72 for exhausting combustion gases from the combustion chamber 66.

It is important to note that this valve 60 could be equipped with a mobile body similar to that 22 of the other valve.

5 The fixing tool 10 and the combustion chamber 14, 66 may operate as follows. In general, the placing of one end of the tool on the support material into which a fixing element is to be affixed allows a quantity of fuel to be released from the cartridge, this fuel being conveyed from the cartridge to the intake orifice 24 of the element 40. The fuel enters the precombustion
10 chamber 14 because of the opening of the valve (mobile body 22 in the upper or open position - Figure 2). The user generally has a few seconds to spare before the fuel is diffused into the atmosphere and in which to actuate the trigger 18. When the trigger 18 is actuated, the finger 34 is moved, causing both the body 22 to move from its open position into its closed position, and
15 the generation of a spark by the igniter plug 36. This spark brings about precombustion of the air-fuel mixture in the combustion chamber 14, which causes an increase in pressure in the chamber 14, which means to say inside the element 32. When this pressure overtakes a certain threshold, the valve shutter 58 opens and allows the mixture to pass into the combustion chamber,
20 the pressure in which increases. Shortly afterwards, the flame passes in turn through the valve shutter 58 and ignites the combustion chamber 66 and causes the piston to move and a fixing element to be ejected into the support material. After the piston has returned to its rest position, the valve 60 opens to expel the combustion gases through the exhaust orifice 72.

25 Figure 4 illustrates an alternative form of embodiment of the invention in which the rod 54 is replaced by a sleeve 54' having an inside diameter substantially identical to the inside diameter of the bore 28 of the body 22, or rectilinear rods extending over a circumference of diameter substantially identical to that of the body.

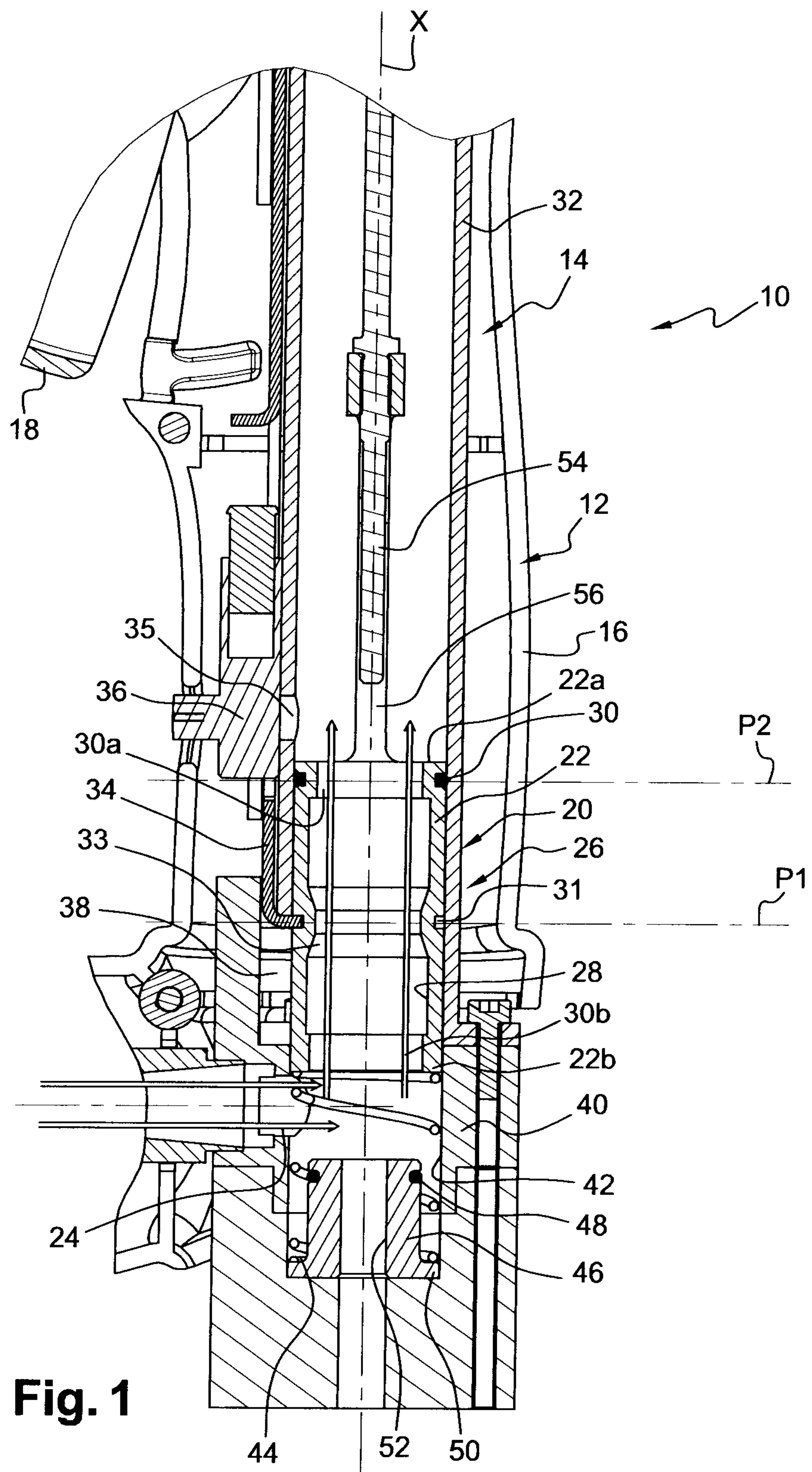
WHAT IS CLAIMED IS:

1. A combustion or precombustion chamber (14) for a gas-powered fixing tool (10), comprising at least one valve (20), said valve (20) comprising a body (22) that is mobile between a first valve closed position and a second valve open position, characterized in that said body (22) has a tubular elongate form and comprises an internal cylindrical bore (28) emerging at two opposed open ends (22a, 22b) of said body to form, respectively, two longitudinal orifices (30a, 30b) axially in line for axial and longitudinal passage of gas therethrough.
2. The chamber (14) according to claim 1, in which said body (22) has a substantially cylindrical form.
3. The chamber (14) according to claim 1 or 2, in which said body (22) having, at an outer periphery, at least one seal (30).
4. The chamber (14) according to claim 3, in which said at least one seal (30) extends in a transverse plane (P2) passing substantially through one (30a) of the abovementioned two orifices.
5. The chamber (14) according to any one of claims 1 to 4, in which said body (22) is mounted to be mobile in longitudinal translation in a casing (26).
6. The chamber (14) according to claim 5, in which said casing (26) comprises a first tubular cylindrical element (32) of elongate form in which said body (22) is housed and can slide.
7. The chamber (14) according to claim 5 or 6, in which said casing (26) comprises a second cylindrical element (46) configured to be engaged in said body (22) when the body (22) is in the closed position.

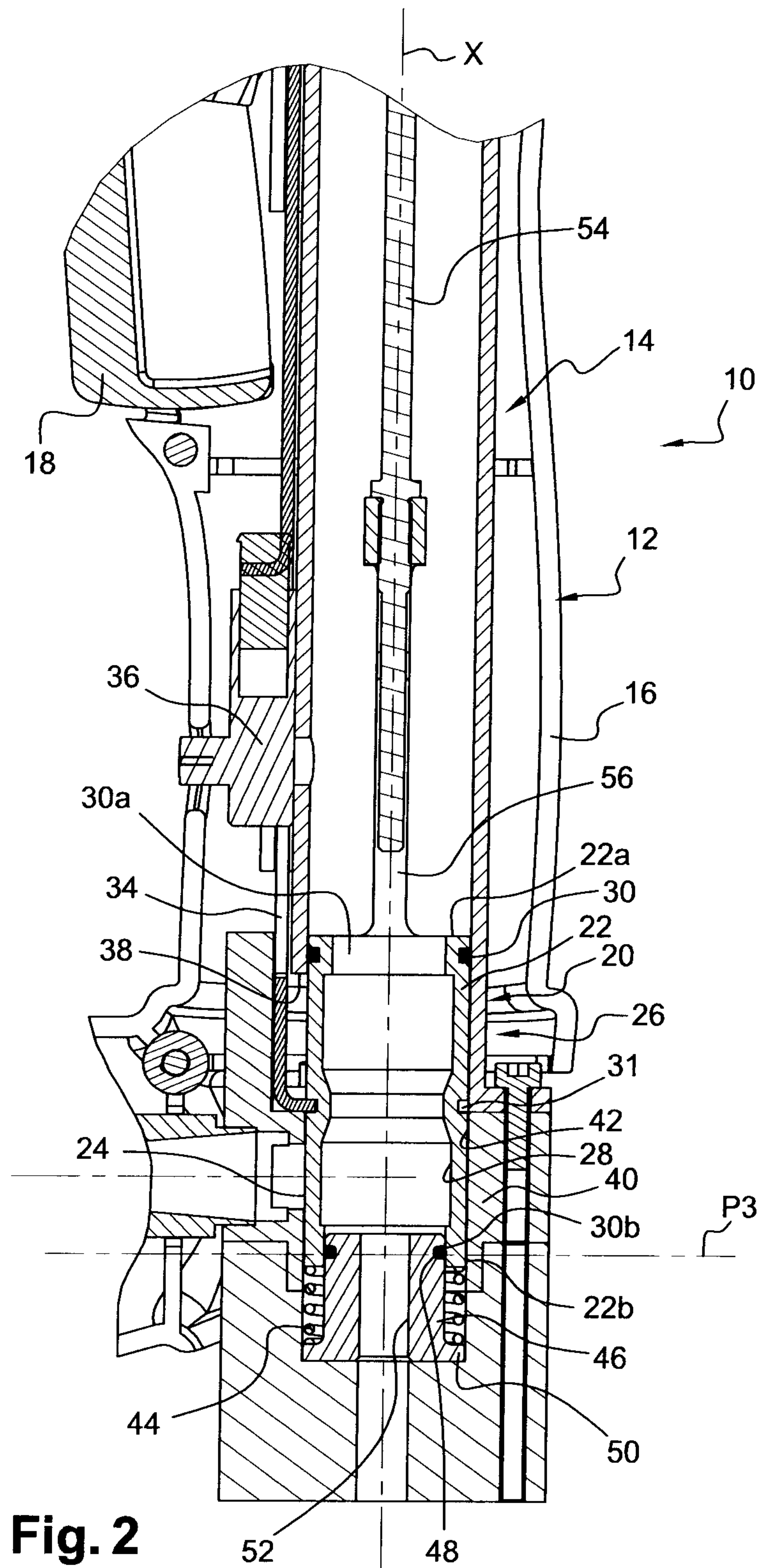
8. The chamber (14) according to claim 7, in which said second cylindrical element (46) has, at its outer periphery, at least one seal (48) configured to cooperate with said body (22), said at least one seal (48) extending in a transverse plane (P3) passing substantially through one (30b) of the abovementioned two orifices.
9. The chamber (14) according to claim 7 or 8, in which said second cylindrical element (46) comprises an outer annular flange (50) and is surrounded by a return spring (44) bearing respectively on said flange and on said body (22), in order to stress the body (22) into its open position.
10. The chamber (14) according to any one of claims 5 to 9, in which said casing (26) comprises a third element (40) comprising an internal bore (42) in which said body (22) can slide, said third element comprising at least one orifice (24) for the passage of gas emerging in the internal bore (42) of the third element and oriented substantially radially relative to the longitudinal axis (X) of said body, the at least one orifice (24) being configured to be blocked by said body when the body is in the closed position and left free when it is in its open position.
11. The chamber (14) according to any one of claims 1 to 10, in which said body (22) is linked by an elongate member (54) to one of a valve shutter, a disc (58), and another mobile body (68) of a second valve (60).
12. The chamber (14) according to any one of claims 1 to 10, in which said body (22) is linked to a rectilinear rod (54) extending along the longitudinal axis (X) of said body (22) and having an outer diameter less than the inner diameter of the internal cylindrical bore (28) of said body (22).
13. The chamber (14) according to claim 12, in which said rod (54) is linked by legs (56) to one of the longitudinal open ends (22a) of said body (22).

14. The chamber (14) according to any one of claims 1 to 10, in which said body (22) is linked to a sheath having an inner diameter substantially identical to the inner diameter of the bore of said body.
15. Gas-powered fixing tool (10), comprising at least one combustion chamber, wherein the at least one combustion chamber (14) is according to any one of claims 1 to 14.

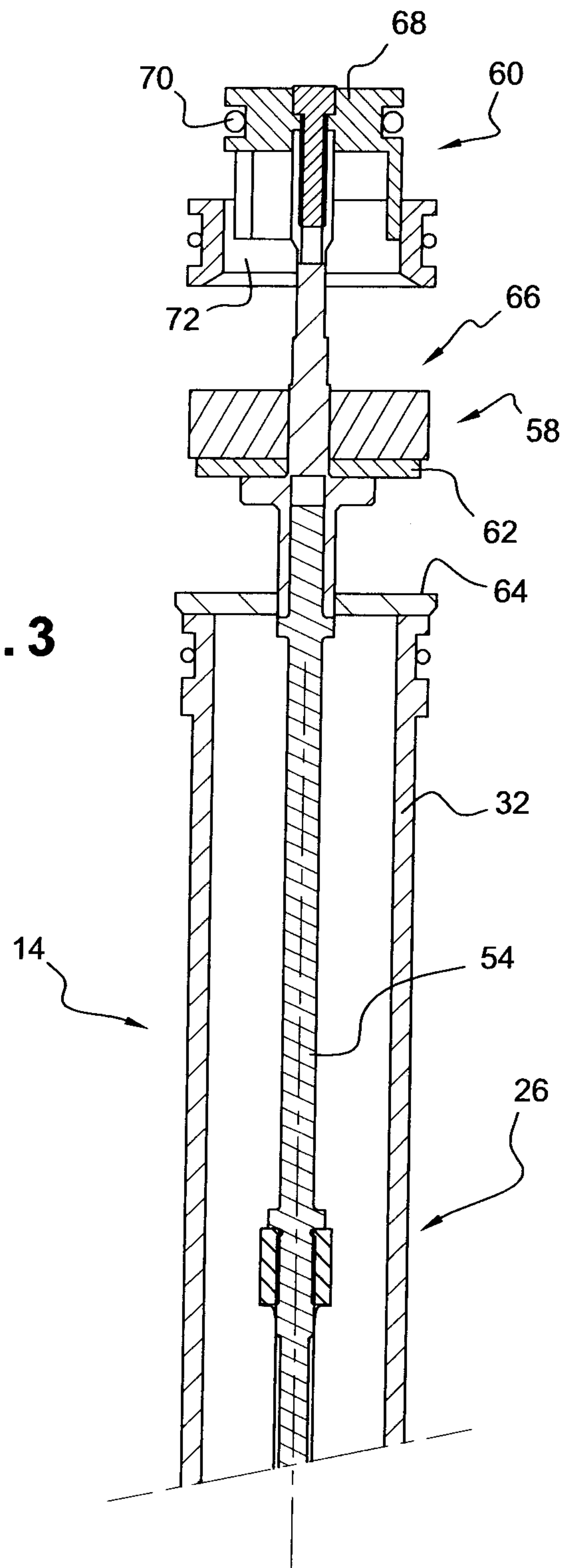
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**Fig. 2**

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Fig. 3

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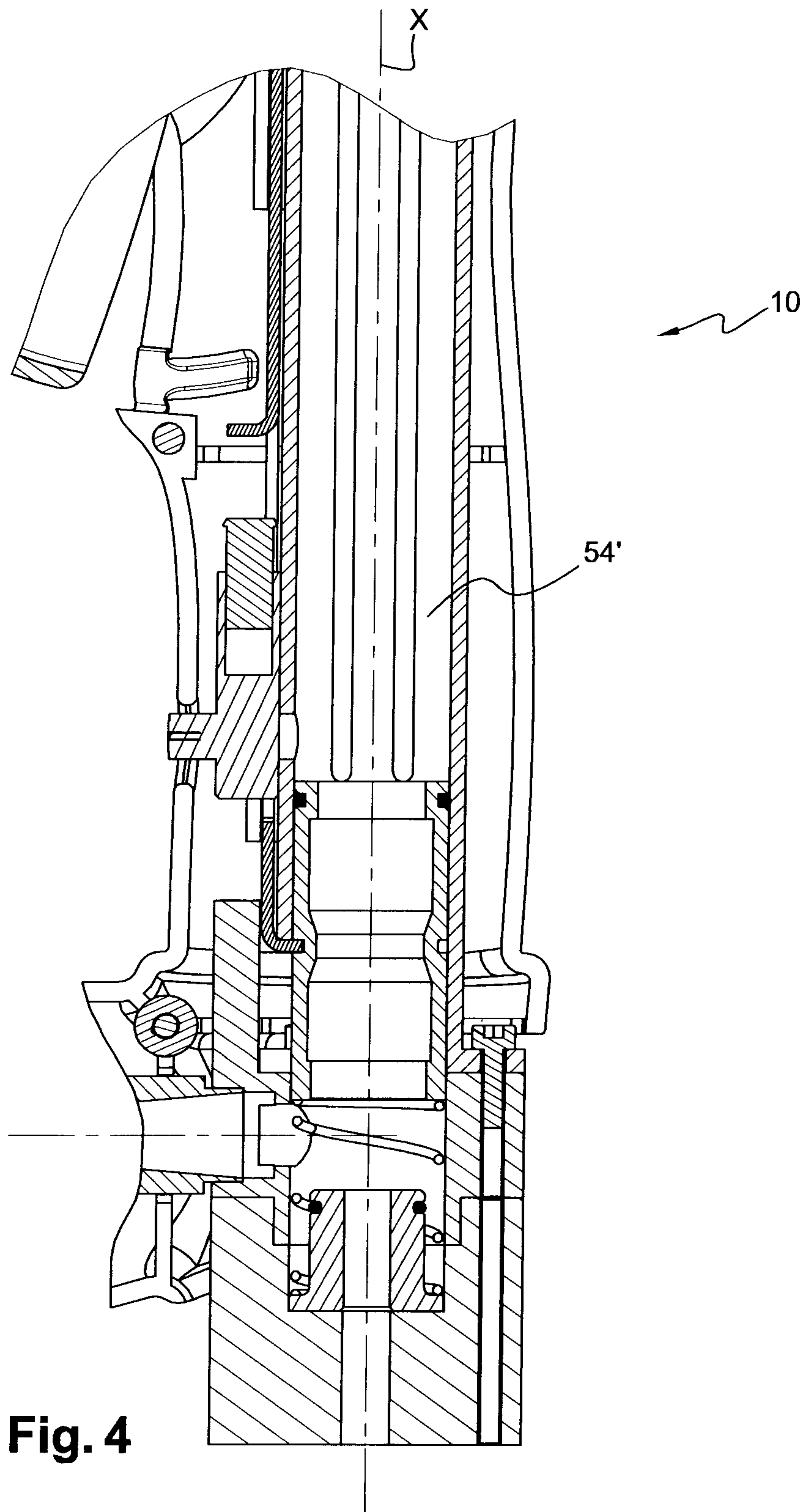


Fig. 4

