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(54) **FLUID DISTRIBUTION SYSTEM FOR PRE-CHARGED PNEUMATIC (PCP) CARBINES OR PISTOLS**

(57) The system comprises a firing mechanism (20), which comprises a trigger (22) and a main valve (23), which is connected to a barrel (21), and a first reservoir (1), wherein the fluid to be distributed to the main valve (23) is provided at a pre-determined pressure; said first reservoir (1) being arranged inside a tubular element (3), **characterised in that it comprises:**

- a second reservoir (2), arranged inside the tubular el-

ement (3), having the same pressure as the first reservoir (1), and

- a spacing element (4), which operates as a moving piston, arranged inside the tubular element (3), which separates the first reservoir (1) from the second reservoir (2), and in that the tubular element (3) at least partially surrounds the first reservoir (1), the spacing element (4) and the second reservoir (2).

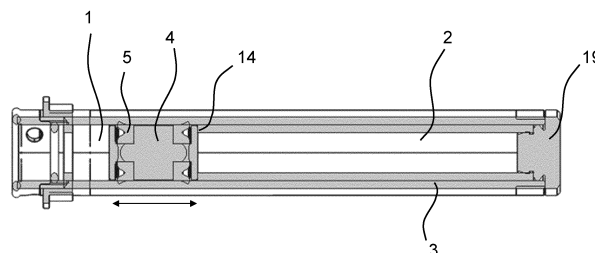


FIG. 3

EP 4 276 402 A1

Description

[0001] Fluid distribution system for PCP-propelled carbines or pistols, of the type comprising a firing mechanism comprising a trigger and a main valve, which is connected to a barrel, and a first reservoir where the fluid to be delivered to the main valve is provided at a pre-determined pressure; said first reservoir being arranged inside a tubular element, characterised in that it comprises: a second reservoir, arranged inside the tubular element, having the same pressure as the first reservoir, and a spacing element that operates as a moving piston, arranged inside the tubular element, which separates the first reservoir from the second reservoir; the tubular element at least partially surrounds the first reservoir, the spacing element and the second reservoir; and which, in an active position after the shot is fired, as the pressure of the fluid from the first reservoir drops, the fluid in the second reservoir pushes the spacing element in the direction of the first reservoir until the pressure of the fluid of the first reservoir and the pressure of the fluid in the second reservoir are balanced; and which, in a loading position, once the fluid has been supplied to the first reservoir at a pre-determined pressure, said fluid of the first reservoir pushes the spacing element in the direction of the second reservoir until the fluid pressures of the first reservoir and the second reservoir are balanced.

BACKGROUND OF THE INVENTION

[0002] Different systems for sports weapons using PCP (Pre-Charged Pneumatic) are known in the state of the art.

[0003] State of the art is Patent WO2017196274 "SEMI-AUTOMATIC AIR CARBINE WITH PNEUMATIC SYSTEM", of the year 2017, in the name Bahtiyar TASYAGAN, which refers to a semi-automatic air carbine and air pistol with a pneumatic system (PCP) operating in such a way that the air, which carries the ammunition in the pneumatic air carbines and air pistols, hits, without changing its direction, the piston at the instant it leaves the barrel to set said piston in motion in the direction of the muzzle, and at the same time, the other members of the system that the inventors have developed also start to move, thereby enabling the carbine and the pistol, after each shot, to become automatically prepared for the next shot.

[0004] Known in the art is also Patent GB2539399 "PNEUMATIC APPARATUS", of the year 2015, in the name DAYSTATE LIMITED, referring to an ambidextrous pneumatic weapon, such as a PCP-type air carbine, comprising a body, a barrel, a magazine or clip for providing a supply of pellets or other projectiles for firing from the gun, and a mechanism for inserting a new pellet from the magazine into the barrel ready for firing. The mechanism comprises a bolt which is pivotally attached thereto by means of a side lever, which is in turn pivotally mounted, by means of a pivoting shaft, to a portion of the body

of the gun. The side lever can be selectively configured for either a left or a right-handed configuration to either side of the weapon body of a user of the weapon.

[0005] This Applicant is also the owner of European Patent N° 2386186 "AUTOMATIC SPORTS CARABINE", of the year 2008, which comprises a barrel having a sheath, an air-compressed or CO₂ bottle, a hand-guard for said bottle, a valve, a butt, a trigger, a trigger-guard, a safety catch, a hammer affixed to its disc, said hammer facing the valve having an anti-fall safety device arranged between both elements, and a chassis; characterised in that it consists of a drag skid, a sliding rod, joined by one of its ends to the drag skid and by the other to a slider device, the mentioned slider device consisting of an interior stop, an upper face supporting a tilting part having an upper arm that surrounds a chamber.

BRIEF DESCRIPTION OF THE INVENTION

[0006] The present invention belongs to the field of PCP-type sports weapons.

[0007] The nearest document is Patent WO2017196274.

[0008] This patent solves the problem of operating even though there are low air pressures coming from the cylinder.

[0009] The problem in the cited invention is that, on the one hand, the shot loses efficiency at low pressures, and besides, the final speed will not be the same as in the final shots.

[0010] This invention solves the efficiency problem as well as the problem of maintaining the final speed of the pellet as it comprises a first reservoir (or firing reservoir) and a second reservoir (or auxiliary reservoir) which are separated by a spacing element of the reservoirs; the spacing element operates as an inner moving piston, so that both reservoirs have the same pressure and, when the shot is fired, due to the exit of the fluid and the resulting drop in pressure in the firing reservoir, the fluid of the auxiliary reservoir pushes the spacing element, thus reducing the size of the firing reservoir until the fluid pressures of both reservoirs are balanced. This guarantees that the pellet will be delivered pressure by the fluid while it runs inside the barrel without there being any pressure drops, in contrast to what occurs in the background document. In other words, while the pellet runs inside the barrel, the spacing element keeps simultaneously moving by the effect of the pressure exerted by the fluid of the second reservoir on such spacing element, which fluid of the second reservoir compresses the first reservoir, such that the pressure received by the pellet from the fluid exiting the first reservoir is the same throughout the whole path run by of the pellet inside the barrel.

[0011] When the firing reservoir is loaded with the pre-determined pressure, the fluid in this latter reservoir pushes the spacing element in the direction of the auxiliary reservoir compressing the fluid in the auxiliary reservoir until the pressures of the fluids of both reservoirs

are balanced again and the gun is ready for firing again.

[0012] In this manner, it is possible to maintain greater firing efficiency since there is hardly any drop in the pressure curve.

[0013] Other benefits are less leaks or pressure loss, less mechanical demands thanks to the novel configuration of the system, simpler design needs for the main valve, the hammer that opens the main valve is smoother, as it carries less weight, and the springs are softer; last, both the manual and the automatic loading system have fewer requirements and need less effort.

[0014] An object of the present invention is a fluid distribution system for PCP-propelled carbines or pistols, of the type comprising a firing mechanism comprising a trigger and a main valve, which is connected to a barrel, and a first reservoir where the fluid to be delivered to the main valve is provided at a pre-determined pressure; said first reservoir being arranged inside a tubular element, characterised in that it comprises: a second reservoir, arranged inside the tubular element, having the same pressure as the first reservoir, and a spacing element that operates as a moving piston, arranged inside the tubular element, which separates the first reservoir from the second reservoir; the tubular element at least partially surrounds the first reservoir, the spacing element and the second reservoir; and which, in an active position after the shot is fired, as the pressure of the fluid from the first reservoir drops, the fluid in the second reservoir pushes the separator element in the direction of the first reservoir until the pressure of the fluid of the first reservoir and the pressure of the fluid in the second reservoir are balanced; and which, in a loading position, once the fluid has been supplied to the first reservoir at a pre-determined pressure, said fluid of the first reservoir pushes the spacing element in the direction of the second reservoir until the fluid pressures of the first reservoir and the second reservoir are balanced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] In order to facilitate the explanation, the present specification includes five sheets of drawings that represent a practical case of embodiment, which is cited by way of example and will not limit the scope of the present invention:

- Figure 1 is a general view of a carbine comprising the object of the present invention.
- Figure 2 is a longitudinal section through the II-II line of Figure 1.
- Figure 3 shows a detailed section of Figure 2, particularly, the tubular element.
- Figure 4 is an embodiment showing a section of a spacing element having an inner valve,
- Figure 5 is a graph of the pressure curves of the fluid of a standard PCP-type weapon according to the present invention.

SPECIFIC EMBODIMENT OF THE PRESENT INVENTION

[0016] Figure 1 shows a tubular element 3, a barrel 21, a cap 19 and a trigger 22.

[0017] Figure 2 depicts a first reservoir 1, a second reservoir 2, the tubular element 3, a spacing element 4, a firing mechanism 20 having a main valve 23, the trigger 22 and barrel 21.

[0018] Figure 3 shows the first reservoir 1, the second reservoir 2, the tubular element 3 and its cap 19, a limit stop 14 and the spacing element 4 with its retaining means 5.

[0019] Figure 4 shows the spacing element 4 with its main body 9 arranged in its housing 18, its pin 10, its joint 16, a rod 11 having a transversal groove 6, a spring 12, an outlet 7, an inlet 8, retaining means 5 and a set screw 13.

[0020] Last, Figure 5 depicts the first reservoir 1, the second reservoir 2, the spacing element 4, the main valve 23, the trigger 22, the barrel 21, P_i which represents the pressure when the pellet is at starting end of the barrel and P_f , which is the pressure when the pellet finds the end exit of the barrel.

[0021] The fluid distribution system for PCP-propelled carbines or pistols is of the type comprising a firing mechanism 20. Said firing mechanism comprises, in brief, a trigger 22 and a main valve 23, which is connected to a barrel 21. Although more elements exist, only these elements of the firing mechanism are mentioned in explaining this invention, which are described by way of an example, to simplify the understanding of this text.

[0022] The system also comprises a first reservoir 1 where the fluid to be delivered to the main valve 23 is provided. Said first reservoir 1 contains a fluid (for instance CO₂ or compressed air) having a predetermined pressure. Said first reservoir 1 is located inside the tubular element 3.

[0023] The system also comprises a second reservoir 2, located inside the tubular element 3, having the same pressure as the first reservoir 1.

[0024] In addition, the system comprises a spacing element 4, which operates as a moving piston and is positioned inside the tubular element 3 and separates the first reservoir 1 from the second reservoir 2.

[0025] In addition, the tubular element 3 at least partially surrounds the first reservoir 1, the spacing element 4 and the second reservoir 2. The advantage of this configuration is that it provides rigidity to the system.

[0026] Thus, in the active position, once the shot is fired, as the pressure of the fluid from the first reservoir 1 drops, the fluid in the second reservoir 2 pushes the spacing element 4 in the direction of the first reservoir 1 until the pressure of the fluid of the first reservoir 1 and the pressure of the fluid of the second reservoir 2 are balanced and the spacing element 4 is stopped.

[0027] When the fluid is loaded into the first reservoir 1, after the fluid has been supplied to the first reservoir

at a pre-determined pressure 1, said fluid of the first reservoir 1 pushes the spacing element 4 in the direction of the second reservoir 2 until the pressures of the fluids of the first reservoir 1 and of the second reservoir 2 are balanced, and the spacing element 4 stops.

[0028] These inventors have verified that when the volume of the first reservoir 1 is the same as the volume of the barrel 21 in the resulting shot the pellet is continuously pushed along the barrel 21 without pressure drops and movement such as shown in Figure 5 for a standard PCP-type weapon.

[0029] By "no drop of pressure" it is understood that the drop of pressure, if any, would be insignificant and would not affect the pellet run.

[0030] Optionally, the spacing element 4 comprises retaining means 5 to retain the tubular element 3. These retaining means 5 have a double function: on one side, they prevent that the fluid inside a reservoir from passing through to the other reservoir and on the other, they contribute to a controlled movement of the spacing element 4 when it is pushed by the reservoir fluids.

[0031] In one possible embodiment of this invention, the spacing element 4 is a valve, as shown in Figure 4. The spacing element 4 may also be a solid element, as shown in Figure 3. Where it is desirable that the spacing element 4 should weigh less, it would be possible to make drill holes therein (not shown) in order to reduce its mass.

[0032] The first option has the advantage that if the weapon is not used for a long period and the second reservoir 2 has lost some fluid, the fluid can be passed from the first reservoir 1 through the valve to the second reservoir 2, and refill it, to optimise the shot.

[0033] For this, a limit stop 14 has been provided which limits the progress of the spacing element 4 and allows that the pressure of the fluid of the first reservoir 1, being higher than the pressure of the fluid of the second reservoir 2, to open the valve of the spacing element 4 and let the fluid pass from the first reservoir 1 to the second reservoir 2.

[0034] The limit stop 14 may be configured in different ways. For example, a limit stop may be arranged in the tubular element 3, or else the second reservoir 2 may be a structure within the tubular element 3, so that the edges of the second reservoir 2 serve as a limit stops 14 (as shown in Figure 3).

[0035] The spacing element, being solid, reduces costs.

[0036] One manufacturing option for the spacing element 4, is by way of a moving piston, as above described and as illustrated in Figure 4, where the spacing element comprises a main body 9, having a pin 10 that blocks the inlet 8 when the first reservoir 1 is not loaded, and having a rod 11 in the direction of the outlet 7 where the spring 12, which rests in the outlet 7, is provided and which separates said outlet 7 from the rod 11. In other words, the rod 11 never closes the outlet 7.

[0037] Another manufacturing option is to configure a set screw 13 at the outlet 7, which comprises said outlet

hole 7, which brings the outlet 7 closer to or away from the free end of the rod 11. In addition, the spring 12 rests on said set screw 13 which is positioned in the rod 11. This configuration allows to regulate the level of compression of the spring 12 and the opening reaction of the inlet 8 when the pressure changes.

[0038] Another configuration is possible, in which the rod 11 comprises a transversal groove 6 in its free end, facing the outlet 7. This facilitates that even when the rod 11 would touch the outlet 7, it may never block it because the fluid would go through the transversal groove 6 and would scatter therein. This would allow the fluid to exit through the outlet 7 and fill the second reservoir 2.

[0039] Last, to improve the sealing of the outlet 5, it has been envisaged that the pin 10 be surrounded by a tight joint 16 which, in its rest position is located next to the inlet 8, blocking said inlet 8 (Figure 4).

[0040] In a practical embodiment, before the shot, the pressure of the fluid (e. gr. pre-compressed air or CO₂,) in the first reservoir 1 is the same as the pressure of the fluid in the second reservoir 2.

[0041] In this way, when pulling the trigger 22, the main valve 23 opens and lets the fluid of the first reservoir 1 in, then to be delivered until the starting end Pi of the barrel.

[0042] At the same time, due to the difference in pressure of the fluid originating in the first reservoir 1 comparatively with that of the second reservoir 2, the spacing element or moving piston 4 moves in the direction of the first reservoir 1, being pushed by the fluid of the second reservoir 2, until the fluid pressures of the first reservoir 1 and the second reservoir 2 are compensated.

[0043] This allows that fluid pressure in the first reservoir 1 to rapidly compensate and to extend to P_i as well as to P_f as the pressure is kept constant because the second reservoir 2 gradually reduces the space in the first reservoir 1 by means of the moving piston, while the fluid of the first reservoir 1 keeps pushing the pellet through the run of said pellet inside the barrel 21, until the pressures of both fluids in both reservoirs are compensated.

[0044] Thus, the pressure inside the barrel in P_i and in P_f is kept constant, as shown in the graph of Figure 5, contrarily to what occurs in the background document, where a drop of pressure affects the pellet.

[0045] It has been found of relevance that the volume inside the barrel 21, where the pellet runs, equals the volume of the first reservoir 1 before the shot occurs.

[0046] The reverse operation would occur when loading the first reservoir 1. The fluid that enters the first reservoir 1, as the pressure increases, pushes the spacing element 4 in the direction of the reservoir 2, until the fluid pressures are balanced.

[0047] If, as indicated above, the carbine or the pistol had not been used for a long time, a loss of the fluid in the second reservoir 2 could occur. In order to solve this problem, the moving piston 4 could be configured as a one-way-only-pressure valve.

[0048] The moving piston 4 would operate in the following way: as the first reservoir 1 is being loaded with fluid, due to the difference in fluid pressure of the first reservoir 1 with respect to the second reservoir, the fluid pressure of the first reservoir 1 will push the moving piston 4 towards the second reservoir 15 until it is stopped by the limit stop 14.

[0049] Next, because of the higher pressure of the fluid of the first reservoir 1 in relation to the fluid in the second reservoir 2, the fluid moves the pin 10, which in turn moves the main body 9 and the rod 11, allowing the inlet 8 to open.

[0050] The fluid from the first reservoir 1 enters through said inlet 8 and moves through the housing 18 to the outlet 7.

[0051] When the difference in pressure occurs in the first reservoir 1, wherein the fluid has more pressure than in the second reservoir 2, the main body 9 moves in the direction of the outlet 7, so that the pin 10 and its joint 16 leave the inlet 8 open to let the fluid in the housing 18.

[0052] At the same time, the spring 12 is compressed against the set screw 13, so that when the pressures in the first reservoir 1 and in the second reservoir 2 equalize, the spring 12 will move the main body 9 in the direction of the inlet 8, and the pin 10 and its joint will block the inlet 8. It should be noted that when in a rest position, the set screw 13 is separated from the rod 11 in order to prevent the blocking of the outlet 7.

[0053] El rod 11 comprises a transversal groove 6 that is located opposite to the outlet 7, which is formed in the set screw 13, so that if the rod 11 should contact the outlet 7 or the set screw 13, the fluid would still continue to enter into the second reservoir 2 from the first reservoir 1 through the transversal groove 6.

[0054] It is possible to regulate the motion reaction of the moving piston 4 by means of the set screw 13 by bringing it closer or moving it away from the rod 11, which compresses or decompresses the spring 12 and, therefore, its resistance to compression.

[0055] The present invention describes a new system of fluid distribution for PCP-propelled carbines or pistols. The examples provided herein are not limitative of the present invention, which may therefore have different applications and/or adaptations, all of which within the scope of the following claims.

Claims

1. Fluid distribution system for PCP-propelled carbines or pistols, of the type comprising a firing mechanism (20) which comprises a trigger (22) and a main valve (23), which is connected to a barrel (21); and a first reservoir (1) wherein the fluid to be distributed to the main valve (23) is provided at a pre-determined pressure, said first reservoir (1) being arranged inside a tubular element (3), **characterised in that it comprises:**

- a second reservoir (2), arranged inside the tubular element (3) and having the same pressure as the first reservoir (1); and
- a spacing element (4), which operates as a moving piston, arranged inside the tubular element (3), which separates the first reservoir (1) from the second reservoir (2),
and **in that** the tubular element (3) at least partially surrounds the first reservoir (1), the spacing element (4) and the second reservoir (2), which, in an active position after the shot is fired, when the fluid pressure of the first reservoir (1) drops, the fluid of the second reservoir (2) pushes the spacing element (4) in the direction of the first reservoir (1) until the fluid pressure of the first reservoir (1) and the fluid pressure of the second reservoir (2) are balanced; and
which, when in a loading position, once the fluid has been supplied to the first reservoir at a pre-determined pressure (1), said fluid of the first reservoir (1) pushes the spacing element (4) in the direction of the second reservoir (2) until the fluid pressures of the first reservoir (1) and of the second reservoir (2) are compensated.

2. The system according to claim 1 **characterised in that** the volume of the first reservoir (1) is equal to the volume of the barrel (21).
3. The system according to claim 1 **characterised in that** the spacing element (4) comprises retaining means (5) for retaining the tubular element (3).
4. The system according to claims 1 or 3, **characterised in that** the spacing element (4) is a valve.
5. The system according to claim 4, **characterised in that** it comprises a stop limit (14) for limiting the advance of the spacing element (4) in the direction of the second reservoir (2).
6. The system according to claim 5, **characterised in that** the spacing element (4) comprises a main body (9), having a pin (10), which blocks the inlet (8), and a rod (11) in the direction of the outlet (7), where a spring (12) is provided that rests in the outlet (7) and which separates said outlet (7) from the rod (11).
7. The system according to claim 6, **characterised in that** the outlet (7) comprises a set screw (13) which brings the outlet (7) near or pushes the outlet (7) away from the free end of the rod (11), the spring (12) that is arranged in the rod (11) resting on said end screw (13).
8. The system according to claim 7 **characterised in that** the rod (11) comprises at its free end a transversal groove (6) facing the inlet (7).

9. The system according to claim 6, **characterised in that** the pin (10) is surrounded by a joint (16), which joint (16), when in a rest position, is located next to the inlet (8) and blocks said inlet (8).

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10. The system according to claim 1 or 3, **characterised in that** the spacing element (4) is solid.

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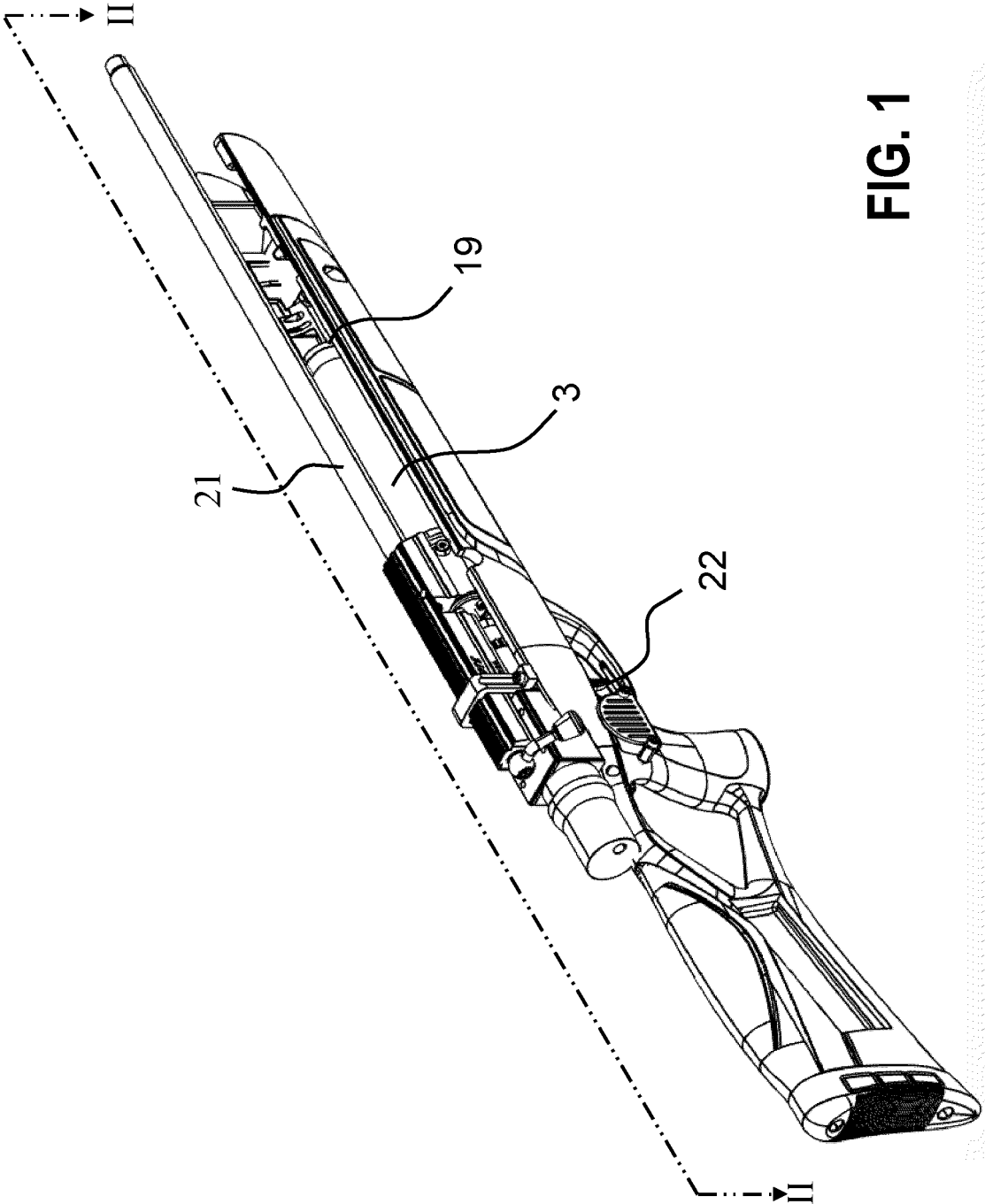


FIG. 1

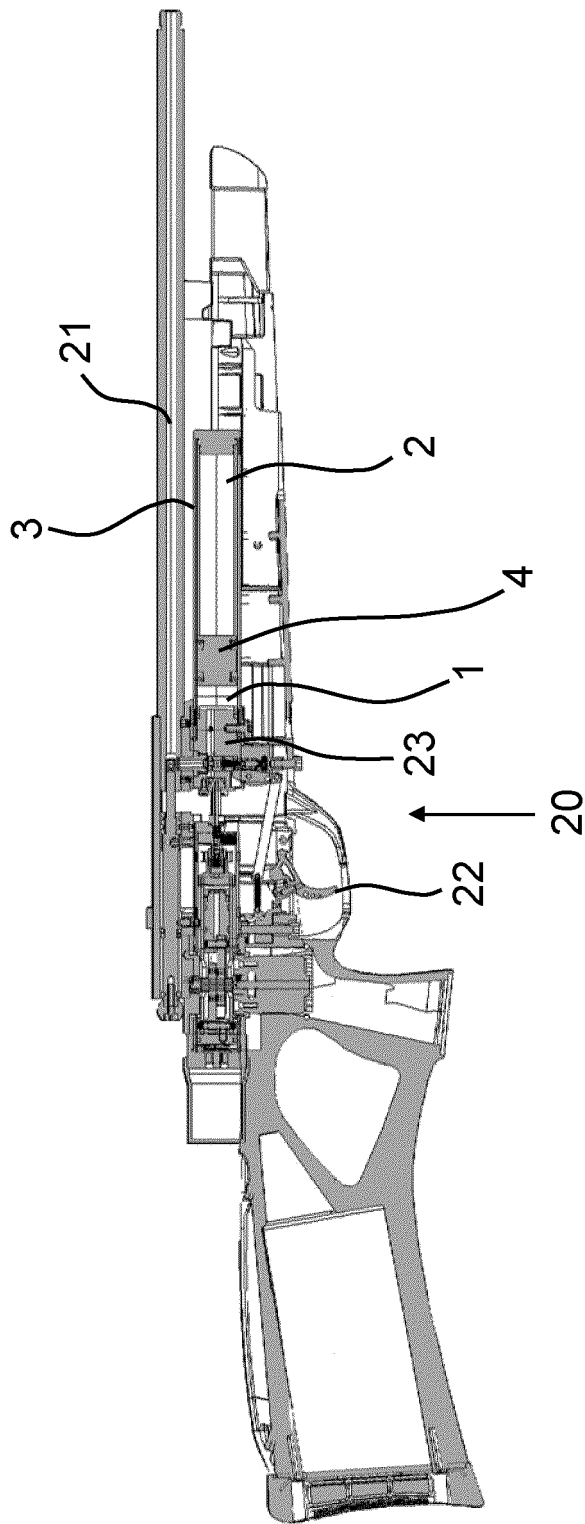


FIG. 2

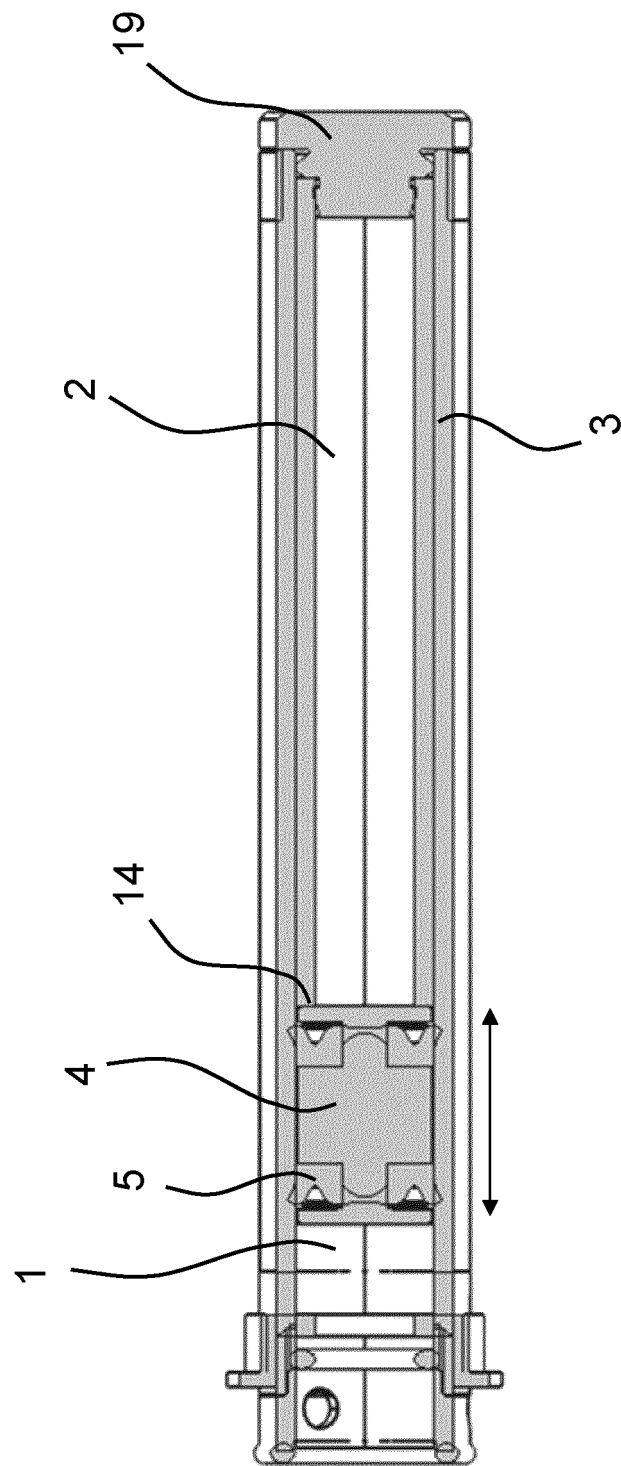


FIG. 3

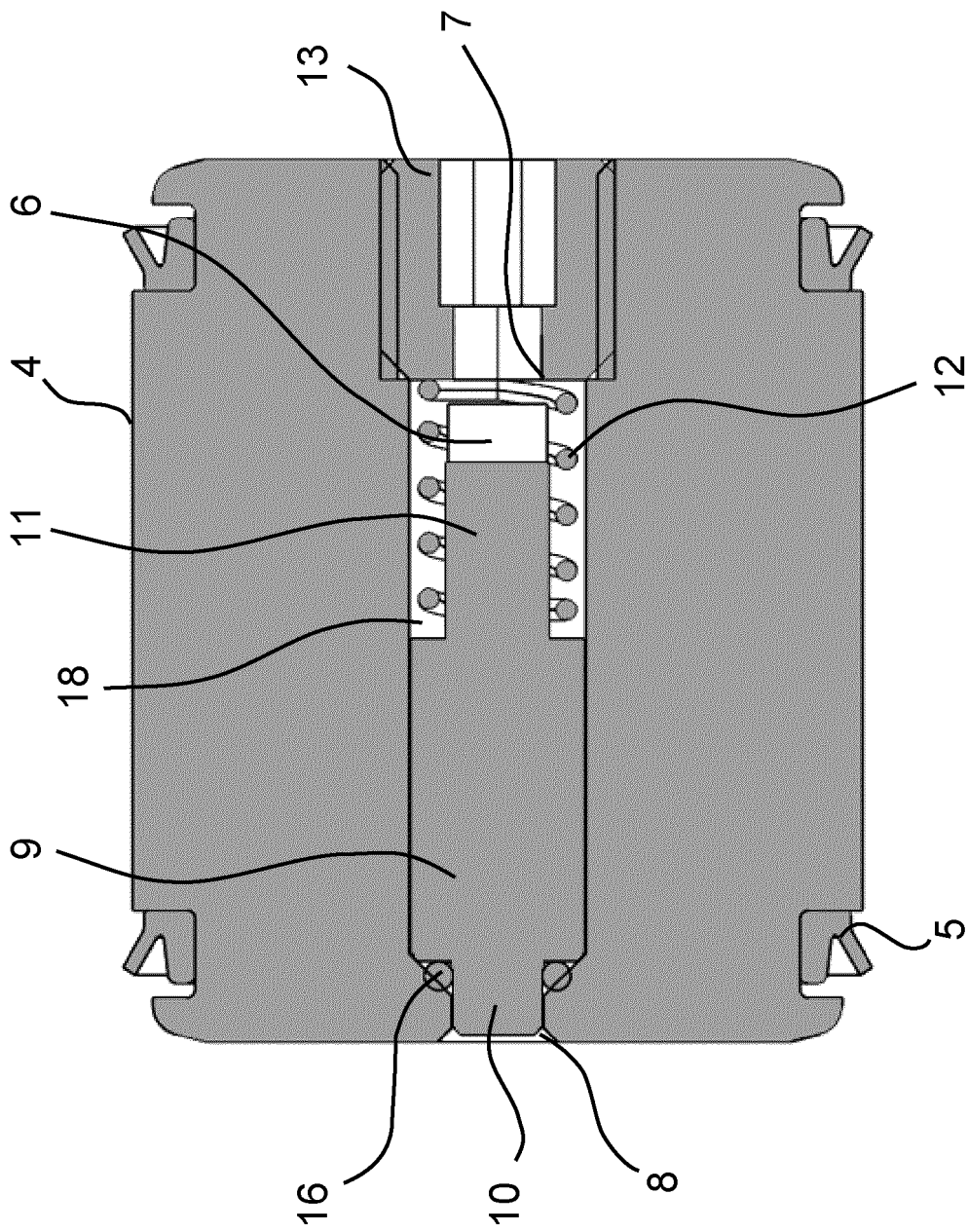


FIG. 4

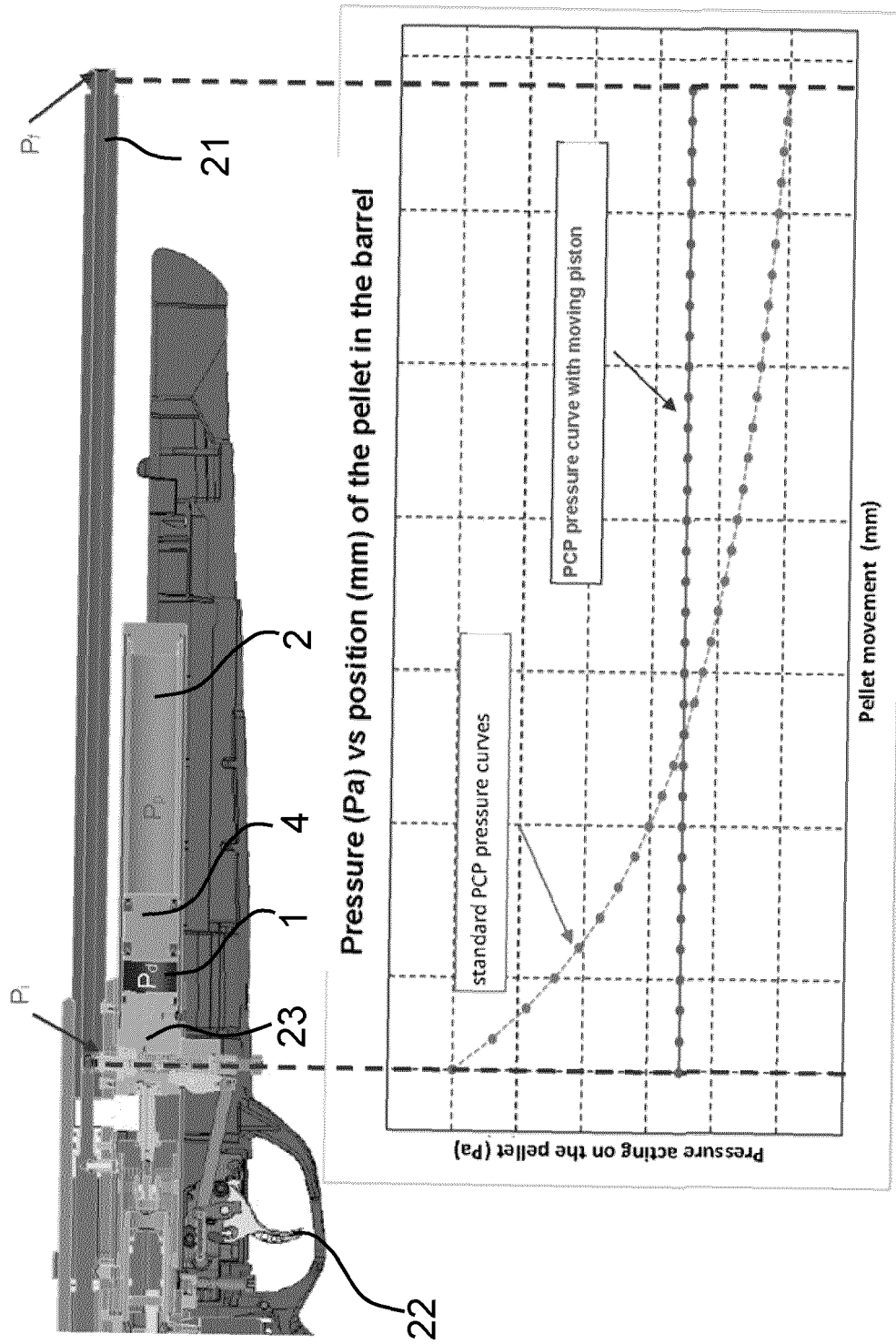


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/ES2021/070006

A. CLASSIFICATION OF SUBJECT MATTER

INV. F41B11/68 F41B11/642 F41B11/62 F41B11/682
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F41B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2018/135937 A1 (ZHU ZUOPENG [CN]) 17 May 2018 (2018-05-17) paragraphs [0001], [0002], [0006], [0011], [0012], [0013], [0016]; figure 3	1-10
X	US 2003/094167 A1 (NIBECKER ALFRED F [US]) 22 May 2003 (2003-05-22)	1
A	the whole document	4,6-9
X	DE 38 19 649 A1 (WAFFENTECHNIK GMBH [DE]) 30 November 1989 (1989-11-30) the whole document	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

10 September 2021

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/ES2021/070006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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REFERENCES CITED IN THE DESCRIPTION

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- GB 2539399 A [0004]
- EP 2386186 A [0005]