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Axelsson

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(54) **GAS-POWERED GUN**

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(51) **Int. Cl.**
F41B 11/00 (2013.01)
F41B 11/50 (2013.01)
F41B 11/723 (2013.01)

(52) **U.S. Cl.**
CPC ***F41B 11/723*** (2013.01); ***F41B 11/50*** (2013.01)

(58) **Field of Classification Search**
CPC F41B 11/52; F41B 11/62; F41B 11/60; F41B 11/723; F41B 11/50; F41B 11/73
USPC 124/50, 75, 74
See application file for complete search history.

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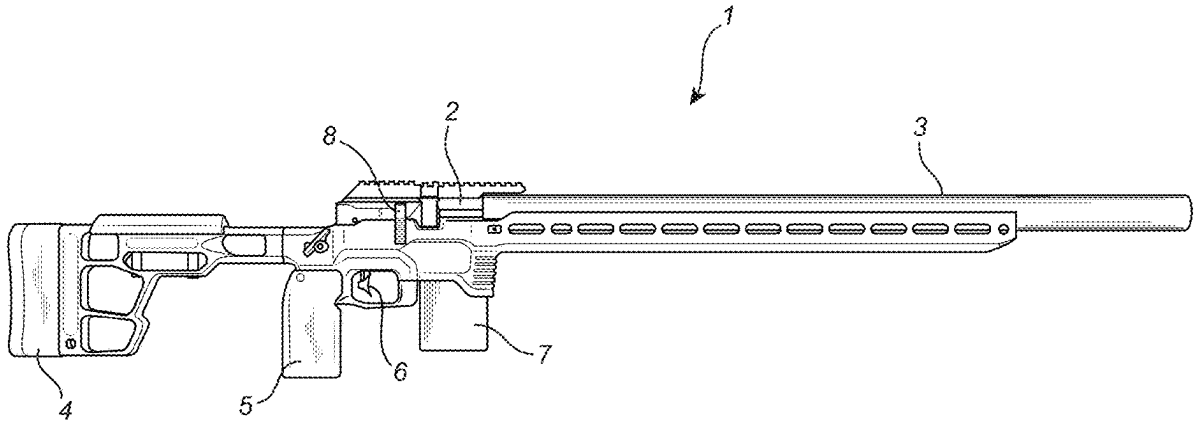
(57) **ABSTRACT**

A gas-powered gun comprising an inner barrel (**31**), a compartment (**40**) for compressed gas formed coaxially around the inner barrel (**31**), a pressure regulator (**42**) connected between the compartment (**40**) and a pressure chamber (**10**), so as to ensure a controlled pressure in the pressure chamber (**10**), and a valve (**15**) arranged to release compressed gas from the pressure chamber (**10**) to thereby discharge a projectile (**13**) provided in said inner barrel (**31**). The gas-powered gun further comprises a plenum chamber (**70**) in fluid connection with the pressure chamber (**10**), the plenum chamber being formed in a detachable module (**7**) arranged below the barrel during normal use.

5 Claims, 6 Drawing Sheets



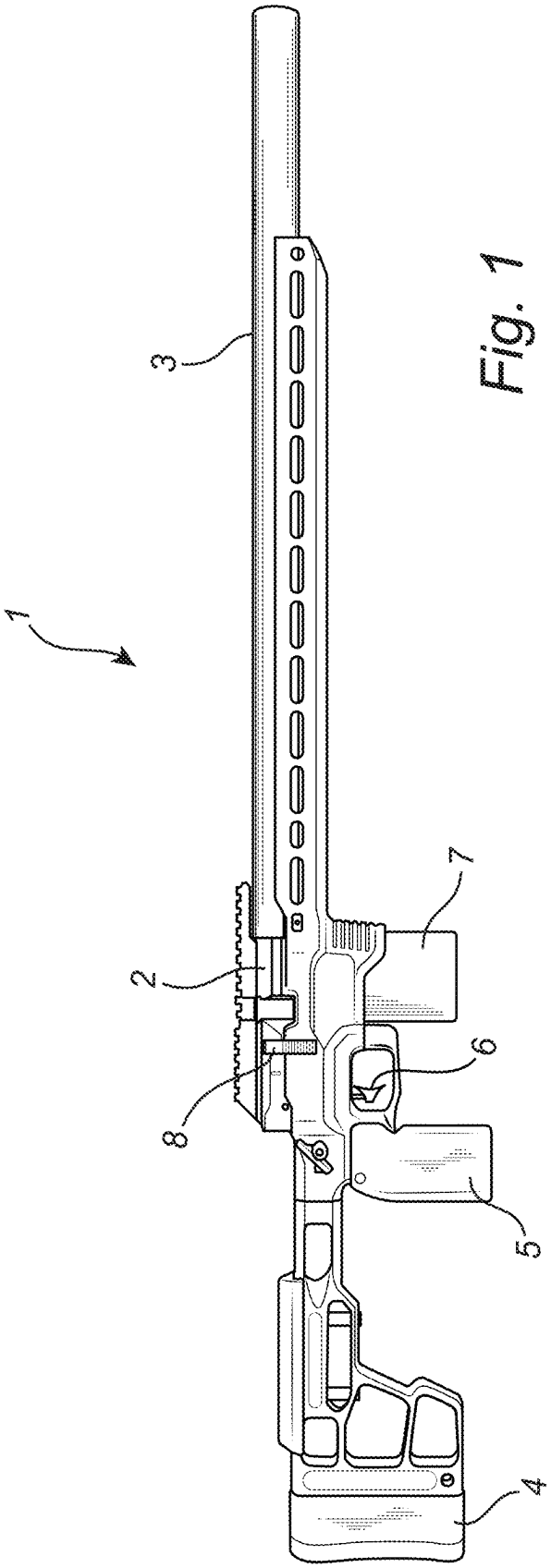
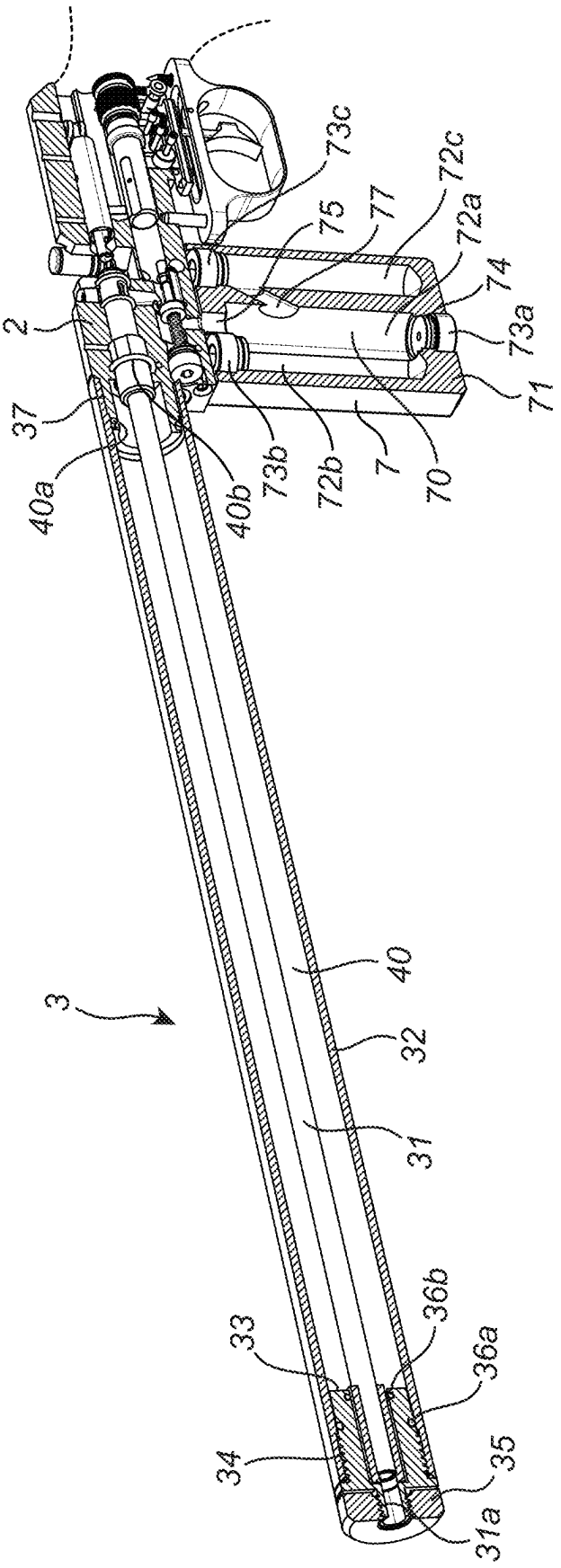


Fig. 1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31a

Fig. 2

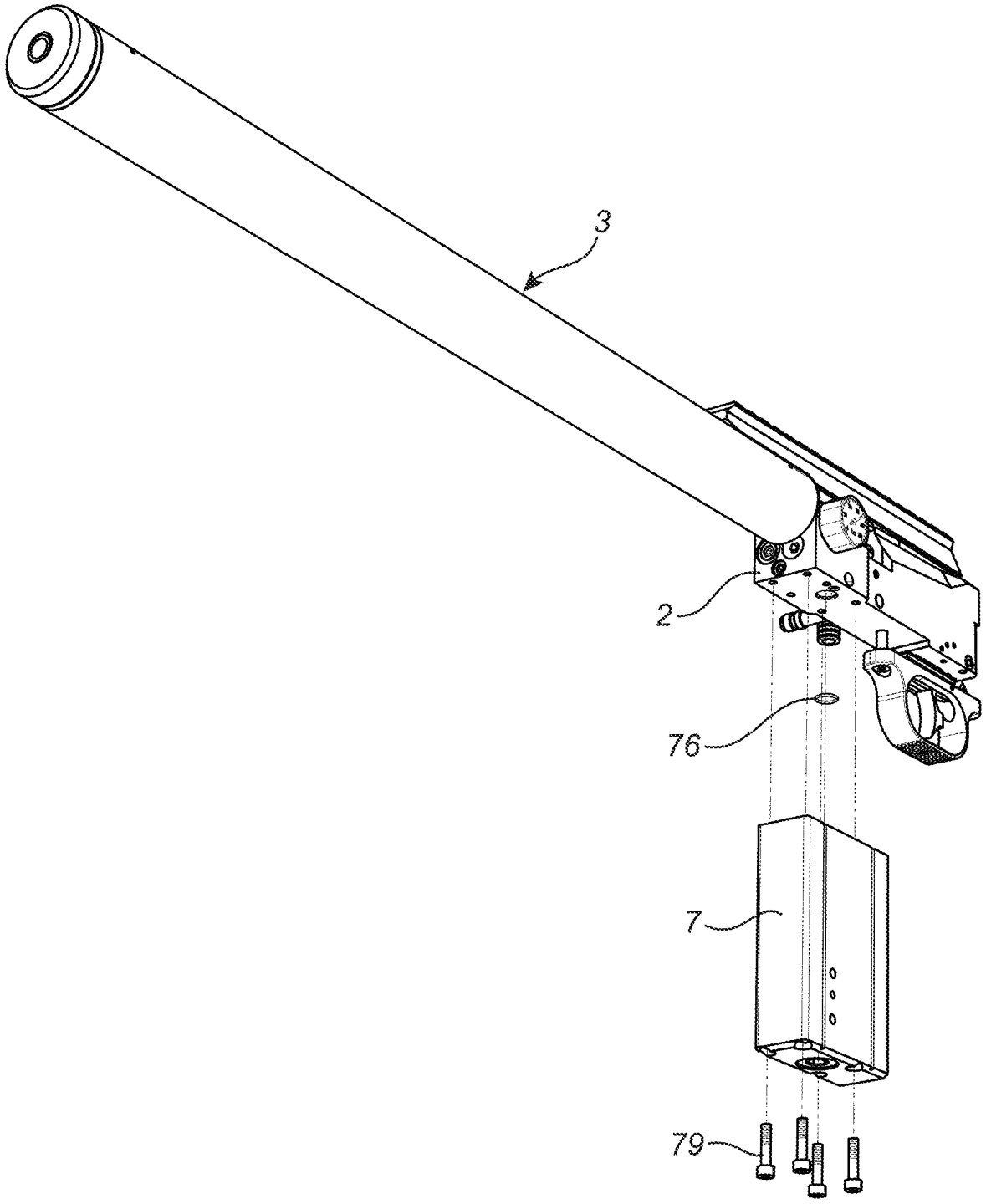

Fig. 3

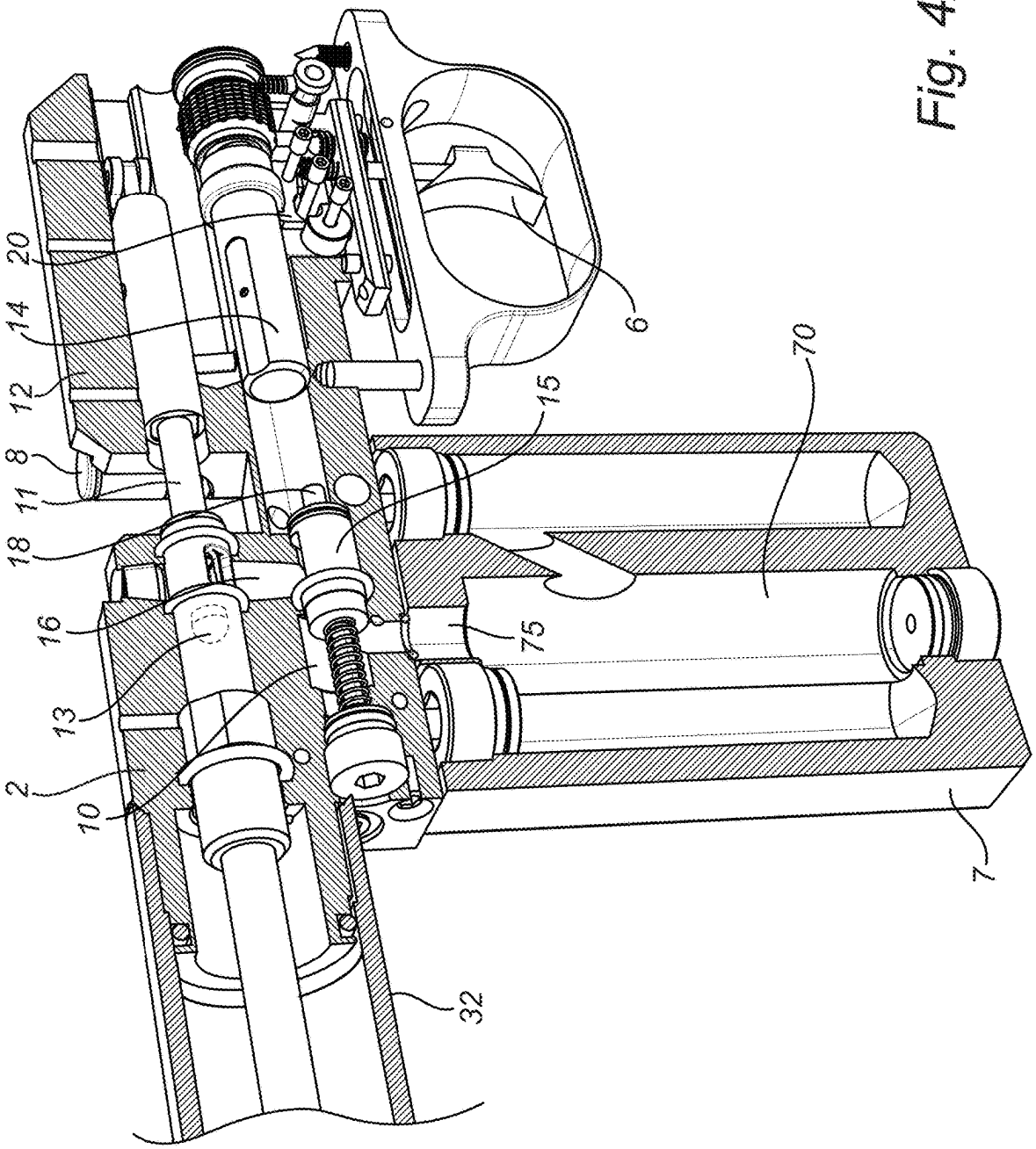

Fig. 4A

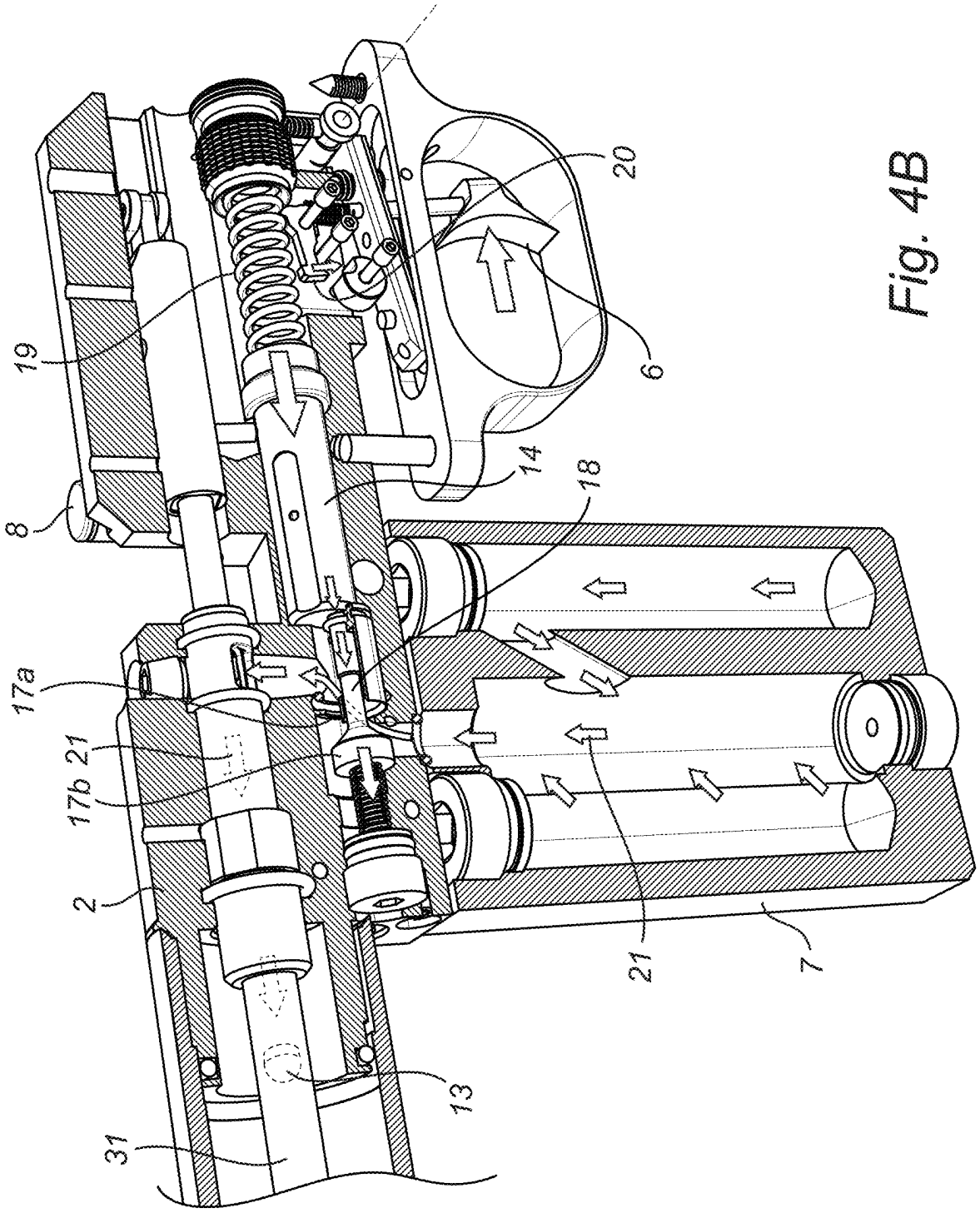

Fig. 4B

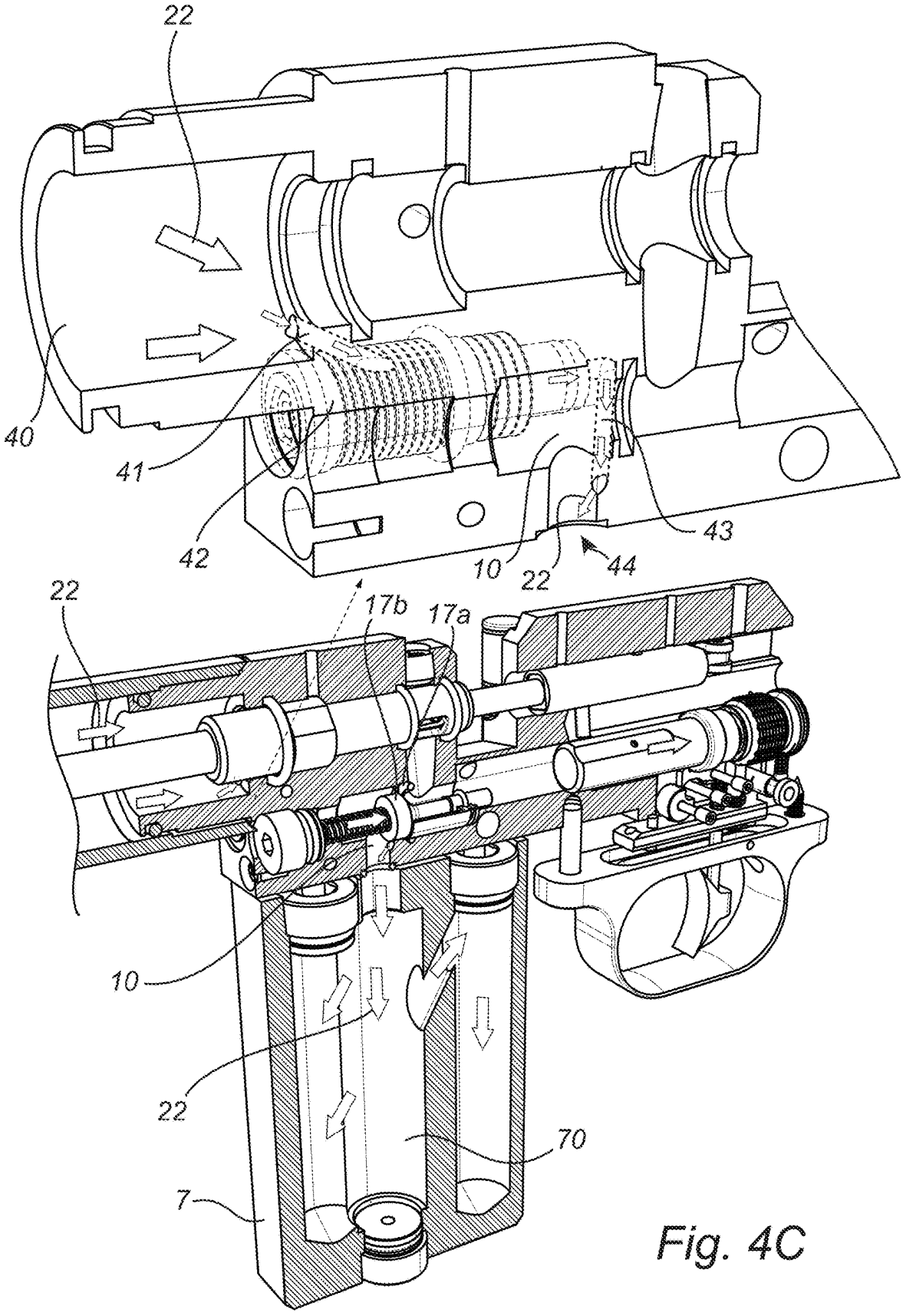

Fig. 4C

GAS-POWERED GUN

CROSS-REFERENCE TO RELATED APPLICATION

This Application claims priority from application Ser. No. 24/153,528.5 filed on Jan. 23, 2024 in European Patent Office. The entire contents of these applications are incorporated herein by reference in their entirety.

FIELD OF THE INVENTION

The present invention relates to a gas-powered gun comprising a pressure chamber holding compressed gas and a valve arranged to release compressed gas from the pressure chamber to thereby discharge a projectile provided in a barrel.

BACKGROUND ART

Gas powered guns of the above-mentioned kind are well known in the art, and the compressed gas may be e.g. air (air guns).

In most guns of this kind, a source of compressed gas, e.g. a gas canister, is detachably attached to the gun, e.g. below the barrel or behind the handle. This gives the gun a characteristic appearance, clearly signalling that this is a gas-powered gun.

It is also known to arrange the source of compressed gas in an annular compartment around the barrel of the gun. Such a design is shown in document GB 2 427 671. An esthetical advantage with such an "internal" source of compressed gas is that the gun may be perceived as a "real" gun. However, a drawback the gun disclosed in GB 2 427 671 is that it has very limited firing power.

In principle, the power of a gas-power gun is determined by the volume of the pressure chamber, from which gas is released to fire the gun. For this reason, is known to provide a gas-powered gun with an extension of the pressure chamber, a so-called "plenum".

Various add-on plenum devices are available to provide an increased firing power. Such conventional plenum devices are typically arranged between a detachable gas bottle and the pressure chamber. In order to ensure a controlled, pre-defined pressure in the plenum and pressure chamber, a regulator is typically arranged between the gas canister and plenum.

SUMMARY OF THE INVENTION

In view of the above, it is an object of the present invention to provide a gas-powered gun with an "internal" source of compressed gas resembling a "real" gun and also having a satisfactory firing power.

This and other objects are achieved by a gas-powered gun comprising an inner barrel, a compartment formed coaxially around the inner barrel, the compartment configured to be filled with compressed gas, a pressure regulator connected between the compartment and a pressure chamber, so as to ensure a controlled pressure in the pressure chamber, and a valve arranged to release compressed gas from the pressure chamber to thereby discharge a projectile provided in the inner barrel. The gas-powered gun further comprises a plenum chamber in fluid connection with the pressure chamber. The plenum chamber is formed in a detachable module arranged below the barrel during normal use, which detachable module has an interface configured to form an air-tight fluid connection with the pressure chamber when the module is secured to the gun.

This design provides a unique combination of an internal (*invisible*) source of compressed gas, and an increased firing power. While the detachable plenum module does have an impact on the visual appearance of the gun, its placement below the barrel during normal use makes it possible to design the module so that it resembles a magazine for bullets.

By making the plenum module detachable, with an interface for air-tight connection, different modules with different plenum chamber volume and different appearance may be provided.

It is noted that the gun disclosed in GB 2 427 671 is technically incompatible with a detachable plenum module according to the present invention.

In some embodiments, the detachable module includes a body having at least one cylindrical bore forming the plenum chamber, which cylindrical bores are in fluid connection with each other. Forming the plenum chamber as one or several cylindrical bores is an efficient way to form a volume capable of withstanding high pressure.

Each bore may have a closed inner end and an open outer end (from which the bore has been drilled), with the open outer end being sealed with a plug and optionally sealed with an appropriate sealing element such as an O-ring.

The module may further comprise a channel connecting the closed inner end of a primary bore with an outside of the body, with an opening of the channel being provided with a sealing element to form the air-tight interface. For example, the primary bore may be drilled with a first drill-bit, having a first, larger diameter, while the channel is drilled with a second drill-bit, having a second, smaller diameter.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be described in more detail with reference to the appended drawings, showing currently preferred embodiments of the invention.

FIG. **1** shows an air gun according to an embodiment of the present invention.

FIG. **2** shows parts of the gun in FIG. **1** partly broken away.

FIG. **3** shows parts of the gun in FIG. **1** in a partly exploded view.

FIG. **4**A shows the gun in FIG. **1** in a loaded, ready-to-fire state.

FIG. **4**B shows the gun in a state of firing.

FIG. **4**C shows the gun after firing.

DETAILED DESCRIPTION OF CURRENTLY PREFERRED EMBODIMENTS

The gas-powered gun **1** in FIG. **1** generally includes a body **2**, a barrel **3**, a stock **4** and a grip **5** with a trigger **6**. According to the present invention, the gun **1** is also provided with a detachable module **7** housing a plenum chamber as will be further discussed below. The gun also has a lever **8** which can be operated when loading the gun.

Turning to FIG. **2**, the body **2** and barrel **3** of the gun have been broken away to better illustrate the design of the gun **1**. As shown in FIG. **2**, the barrel **3** comprises an inner barrel **31** and a coaxial outer sleeve **32**.

In the front end of the gun **1**, an annular plug **33** is inserted between the inner barrel **31** and the outer sleeve **32**. The plug **33** is held in place in the outer sleeve **32** by a threaded

connection **34**. The inner barrel **31** extends through a central opening of the annular plug **33**, so as to be movable in the axial direction with respect to the plug **33** and hence with respect to the outer sleeve **32**. This is advantageous as the inner barrel **31** may be formed in a different material than the sleeve **32**, thereby exhibiting different heat expansion. In the illustrated example, an outer cap **35** is attached (e.g. threaded) to the outer portion **31***a* of the inner barrel **31**.

A first sealing element such as an O-ring **36***a* provides an air-tight seal between the plug **33** and the outer sleeve **32** and a second sealing element, such as an O-ring **36***b* provides an air-tight seal between the plug **33** and the inner barrel **31**.

In the rear end, the outer sleeve **32** is fitted to the body **2** of the gun **1**, with a threaded connection **37**, and air-tight sealed against the body with a third sealing element, such as an O-ring **38***a*. The inner barrel **31** extends into the body **2**, and a fourth sealing element, such as an O-ring **38***b*, provides an air-tight seal against the body **2**.

The annular space between the inner barrel **31** and the outer sleeve **32** thereby forms a pressure tight compartment **40** which can be filled with compressed gas **50**, such as air, to be used for firing the gun **1**. The compartment **40** is preferably provided with a suitable inlet (not shown) for filling the compartment **40**.

A channel **41** (see FIG. **4**C) is formed in the body **2** to connect the compartment **40** with a pressure regulator **42**. The outlet of the regulator **42** is in fluid connection with a pressure chamber **10** via another channel **43**. The pressure regulator **42** ensures a precisely controlled (regulated) pressure in the pressure chamber **10**. The pressure chamber has an opening **44** facing towards the detachable module **7**.

The detachable module **7** houses a plenum chamber **70** formed in a body **71**. The plenum chamber **70** may comprise one or several sub-chambers. In the illustrated example, the plenum chamber **70** comprises three cylindrical bores **72***a-c*, which have been drilled into the body **71**. Each sub-chamber **72***a-c* has a closed inner end, and an open outer end sealed by a threaded plug **73***a-c* and an O-ring **74**.

As shown in FIG. **3**, the module **7** is attached to the body **2** of the gun **1** by means of four screws **79**. Other attachment means, including snap-on mountings are also possible.

A primary bore **72***a* has its closed inner end facing the gun **1**. A channel **75** is formed to connect the primary bore **72***a* with the outside of the body **71**. For example, the primary bore **72***a* may be drilled from the outside with a large diameter drill-bit. Then, the channel **75** may be drilled in a subsequent step from the opposite direction (or from the same direction with a long drill).

The opening of the channel **75** is sealed by sealing element, such as an O-ring **76** (see FIG. **3**), to provide an air-tight seal between the plenum chamber **70** and the opening **44** of the pressure chamber **10** when the module **7** is screwed tight to the body **2** of the gun **1**. When the module **7** is secured to the body **2** of the gun **1**, the pressure chamber **10** is in fluid connection with the larger plenum chamber **70**. The plenum chamber **70** thus forms an extension of the pressure chamber **10**, and the pressure in the plenum is also regulated by the regulator **42**.

Bores **72***b* and **72***c* have here been drilled from the opposite direction with respect to primary bore **72***a*, such that their outer openings, where the plugs **73***b*, **73***c* are fitted, face towards the gun **1**. Bore **72***b* has been drilled at such a c-c distance with respect to the primary bore **72***a* that the two bores **72***a*, **72***b* are in fluid connection. Bore **72***c* is here formed separate from the primary bore **72***a*, and is connected to the primary bore **72***a* by a channel **77**.

Turning to FIG. **4**A-**4**C, the operation of the gun **1** will be discussed in more detail.

As shown in FIG. **4**A, the gun **1** comprises a feeder pin **11** slidably arranged in a housing **12** (part of the body **2**) behind the barrel **3**. The gun **1** further comprises a spring-loaded hammer **14**, arranged to operate an open-close valve **15**, which connects the pressure chamber **10** to a space **16** immediately behind and below the bullet. As shown more clearly in FIG. **4**B, the valve **15** includes a valve-seat **17***a* forming an opening of the pressure chamber **10**, and a valve-head **17***b* arranged inside the pressure chamber and being pressed against the valve-seat **16** to seal the chamber **10**. The valve-head **17***a* has a hammer cooperating portion **18** extending rearwards through the opening, so that it can be engaged by the hammer **14**.

The feeder pin **11** and hammer **14** are mechanically connected to the lever **8**. In order to load the gun **1**, the lever **8** is pulled out and back, thereby sliding the feeder pin **11** back to allow a bullet (projectile) **13** to be inserted in a space in front of the feeder pin **11**. In the same motion, the spring-loaded hammer **14** is brought back against the force of the biasing spring **19**, and held in place by a catch **20**, mechanically connected to the trigger **6**. The lever **8** is then pushed forward, sliding the feeder pin **11** forward, and pushing the bullet **13** into a firing position inside the inner barrel **31**, as shown in FIG. **4**A. The hammer **18** stays in spring loaded position, and the gun is in a loaded position (FIG. **4**A).

At the moment of firing (FIG. **4**B), the trigger **6** releases the catch **20** and the hammer **14** is pushed into contact with the portion **18**, thereby opening the valve **15**. Compressed gas **21** is now allowed to enter the space **16** from the pressure chamber **10** and plenum chamber **70**, thereby discharging the bullet **13**. The force transferred to the bullet will be determined by the regulated pressure and the combined volume of the pressure chamber **10** and plenum **70**.

As shown in FIG. **4**C, immediately after discharging the bullet **13**, compressed air **22** will flow from the compartment **40** via the regulator **42** into the pressure chamber **10** and plenum chamber **70**. The increasing pressure will push the valve head **17***b* against the valve seat, again sealing the pressure chamber from the space **16**. The valve head **17***b* may also be spring loaded to ensure fast sealing. As soon as the pressure in the pressure chamber **10** and plenum **70** has returned to the regulated pressure, the gun is ready to be loaded and fired.

The person skilled in the art realizes that the present invention by no means is limited to the preferred embodiments described above. On the contrary, many modifications and variations are possible within the scope of the appended claims. For example, the details of the firing mechanism are purely exemplary, and other options may be available. Further, the front end sealing of the compartment **40** may be designed in many ways, as long as the sealing is able to withstand the pressure in the compartment **40**.

The invention claimed is:

1. A gas-powered gun for discharge of projectiles, comprising:

an inner barrel;

a compartment formed coaxially around said inner barrel, said compartment configured to be filled with compressed gas;

a pressure regulator connected between the compartment and a pressure chamber, so as to ensure a controlled pressure in the pressure chamber; and

a valve arranged to release compressed gas from the pressure chamber to thereby discharge a projectile provided in said inner barrel;

wherein the gas-powered gun further comprises a plenum chamber in fluid connection with the pressure chamber, said plenum chamber being formed in a detachable module arranged below the barrel during normal use, said detachable module having an interface configured to form an air-tight fluid connection with the pressure chamber when the module is secured to the gun.

2. The gas-powered gun according to claim **1**, wherein said detachable module includes a body having at least one cylindrical bore forming said plenum chamber, said cylindrical bores being in fluid connection with each other.

3. The gas-powered gun according to claim **2**, wherein each bore has a closed inner end and an open outer end, said open outer end being sealed with a plug.

4. The gas-powered gun according to claim **2**, wherein the module further comprises a channel connecting the closed inner end of a primary bore with an outside of the body, an opening of said channel being provided with a sealing element to form the air-tight interface.

5. The gas-powered gun according to claim **3**, wherein the module further comprises a channel connecting the closed inner end of a primary bore with an outside of the body, an opening of said channel being provided with a sealing element to form the air-tight interface.

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