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(54) Automatic gas powered gun

(57) A gas powered gun for repeated discharge of projectiles, comprising a barrel adapted to receive a projectile from a magazine, a pressure chamber adapted to communicate with a compressed gas cartridge fitted to the gun, an open-close valve for exhausting compressed gas from said chamber to discharge a projectile in the barrel, and a hammer arranged to actuate said open-close valve. The gun comprises a chamber for collecting partly expanded compressed gas after said gas has been used to discharge said projectile, a piston arranged in a housing and being mechanically connected to said hammer, and a channel for directing said partly expanded gas into said housing, so that said gas will force said piston to move, thereby bringing said hammer to a ready-for-fire-position.

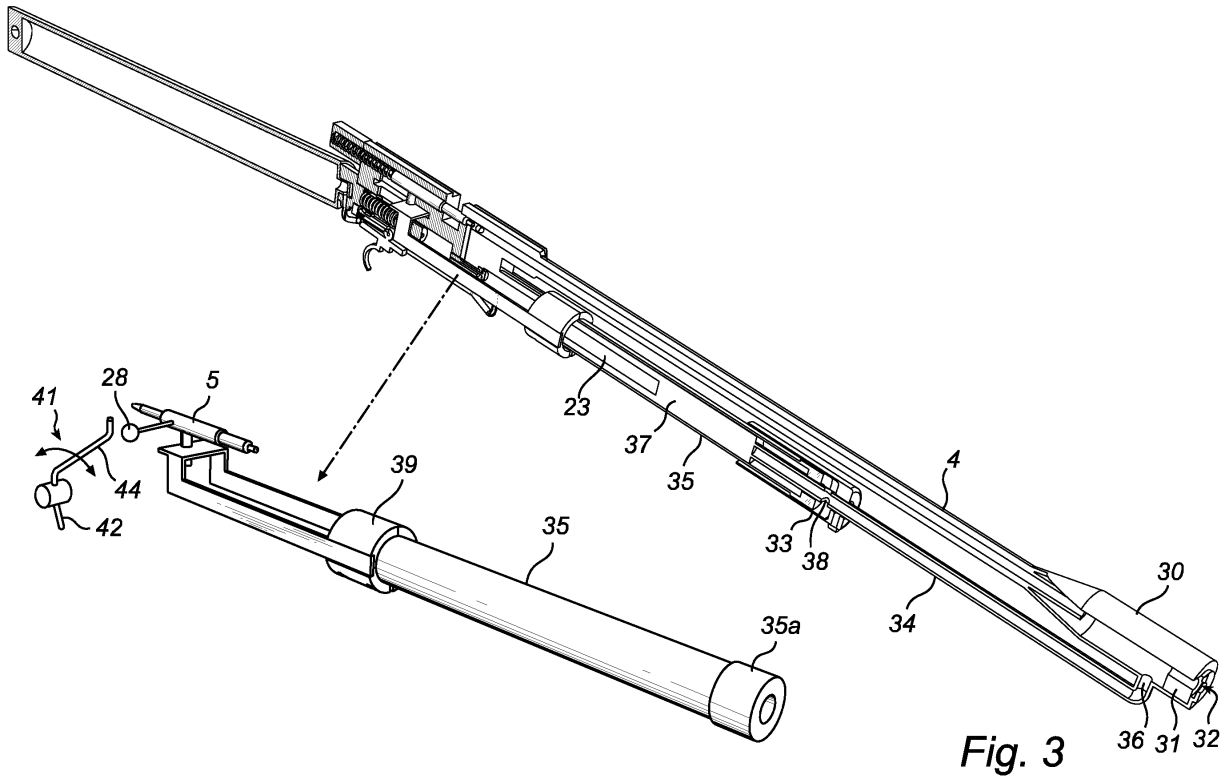

Fig. 3

EP 1 729 082 A1

Description

Field of the invention

[0001] The present invention relates to a gas powered gun for repeated discharge of projectiles, comprising a barrel adapted to receive a projectile from a magazine, a pressure chamber adapted to communicate with a compressed gas cartridge fitted to the gun, an open-close valve for exhausting compressed gas from said chamber to discharge a projectile in the barrel, and a hammer arranged to actuate said open-close valve. More specifically, the invention relates to automatic reloading of such a gun, to enable repeated firing.

Background of the invention

[0002] In a conventional gas powered gun, the user manually reloads the gun after firing, by moving a handle backwards and forwards. This motion brings the hammer back to a loaded position, while at the same time brings a feeder pin back to allow for a new bullet to be inserted, and then forward, to feed this bullet into the barrel. In case of a gun provided with a magazine, the back-forward motion can be consecutive, otherwise it will be a two-step motion, with the insertion of a bullet taking place between the back and forward movements.

[0003] There are examples of automatic gas powered guns, for example as disclosed in US 6,497,229. In such a gun, a change valve is used to direct compressed air from the cartridge altematingly through a first opening , to discharge the bullet, and through a second opening to reload the gun. A drawback with this type of solution is that the efficiency of the guns is reduced, as part of the compressed air in the cartridge will be used to reload the gun. A further drawback is that compressed gas from the cartridge will actuate the reload before the bullet has left the gun. The recoil from the reload will therefore risk lowering the precision.

Summary of the invention

[0004] It is therefore an object of the present invention to provide an automatic or semi-automatic gas powered gun, without reducing the efficiency of the gun.

[0005] This and other objects are achieved by a gun of the kind mentioned above, further comprising a chamber for collecting partly expanded compressed gas after said gas has been used to discharge said projectile, a piston arranged in a housing and being mechanically connected to said hammer, and a channel for directing said partly expanded gas into said housing, so that said gas will force said piston to move, thereby bringing said hammer to a ready-for-fire-position.

[0006] The invention is based on the insight that the gas that has been used to discharge the bullet is only partly expanded, and thus does still contain a considerable amount of energy. It is this energy that typically is transformed into sound waves, to result in a crack of the gun. According to the invention, this energy is instead used to reload the gun. As the energy in the partly expanded gas is extracted after the bullet has been discharged, the efficiency of the gun is not reduced. However, the noise of the gun is reduced.

[0007] Preferably, the partly expanded gas is collected only after the bullet has left the gun, and as a consequence, the recoil from the reload will not affect the precision of the gun.

[0008] The piston can be biased against the pressure of the gas by a biasing means, so that, after being forced back by the pressure of the partly expanded gas, the piston returns to its initial position by the force of said biasing means. This completes the reload action, which is thus fully automatic. The biasing means can be a return spring.

[0009] The piston is preferably connected to the hammer uni-directionally, so that the hammer, after being brought to a ready-to-fire-position by the piston, can be held in this position by a catch. When the piston is returned by the biasing means, the hammer will thus be held in place by the catch.

[0010] The gun can further comprise a feeder pin adapted to feed a projectile from the magazine into the barrel, and the piston can then be mechanically connected also to the feeder pin, so that, when said gas forces said piston to move, the feeder pin will be returned to a reload position. By use of a feeder pin, the insertion of a consecutive bullet is facilitated, and automated by the connection to the piston. In this case, the biasing means, e.g. the return spring, may be arranged in contact with the feeder pin, and the movement of the feeder pin and the piston are preferably synchronized in the longitudinal direction of the gun. In other words, when the piston moves, the feeder pin moves with it and vice versa.

[0011] According to one embodiment, the piston and the housing are aligned essentially in parallel with said barrel, for example underneath the barrel. According to another embodiment, the piston is arranged coaxially around the barrel.

Brief description of the drawings

[0012] This and other aspects of the present invention will now be described in more detail, with reference to the appended drawings showing two currently preferred embodiments of the invention.

Figure 1 is a side view of a gun according to a first embodiment of the present invention, in a ready-to-fire-condition.

Figure 2 is a side view of the gun in figure 1, in a condition immediately after firing.

Figure 3 is a perspective view of the gun in figure 1, in a condition during automatic reloading.

Figure 4 is a side view of a gun according to a second embodiment of the invention.

Detailed description of preferred embodiments

[0013] Figure 1 shows an air gun according to a first embodiment of the invention. The gun 1 is of the kind where a cartridge 2 of compressed air or other gas is fitted to the body 3 of the gun. Typically, the cartridge 2 is fitted in the back, and may be enclosed in the stock of the gun (not shown/see fig 3). The gun further comprises a barrel 4, and a feeder pin 5 slidably arranged in a housing 6 behind the barrel 4, biased in the forward direction by a biasing means, here a return spring 7. In a space between barrel and the feeder pin is fitted a magazine 8 for providing projectiles e.g. in the firm of diabolo bullets 9. The magazine can for example be of the kind disclosed in EP 341090. The feeder pin 5 is arranged to be slid back, thereby allowing a bullet 9 to be provided from the magazine 8, and then to be slid forward, thereby feeding the bullet 9a into a firing position in the barrel 4.

[0014] The gun further comprises an open-close valve 10 for allowing passage of compressed air from the cartridge 2 to a space 11 immediately behind a bullet 9a in the barrel 4, and a sliding hammer 12 for activating the valve 10 at the moment of firing. The hammer 12 is biased towards the valve 10 by suitable biasing means, here a biasing spring 13, and is held in a loaded position, against the force of the biasing spring, by a catch 14 engaging an abutment in the hammer, here an annular flange 15. A trigger 16 is arranged to actuate the catch 14 in order to release the hammer 12.

[0015] In the illustrated example, the catch 14 is pivotable around a point A behind the annular flange 15, and biased by a spring 17 out of engagement with the hammer. The catch 14 is kept in engagement with the flange 15 by a support surface 18 of the trigger 16. The trigger 16 is arranged to be pivoted around an axis B by action of the user, in order to slightly dislocate the support surface 18, thereby allowing the catch 14 to be forced by the spring 17 away from the hammer 12 and release it. The rear end of the flange 15, and the upper side of the catch 14 are further formed such that, when the hammer 15 is brought back to its loaded position, the flange 15 engages the catch 14 and the catch 14 is forced into its locking position, against the action of the spring 17. Many other solutions of trigger-stopper-cooperation are of course possible, and can implemented by the skilled person.

[0016] In the illustrated example, the open-close valve 10 has a main body 20 oriented essentially in the longitudinal direction of the gun, and ending with a valve head 21 adapted to cooperate with an opening of a pressure chamber 23 in front of the valve 10, the opening thus acting as a valve seat 22. A channel 24 is connected via suitable valve means (not shown) to the fitting 25 of the compressed air cartridge 2, and extends to the chamber 23, thus providing high pressure to the chamber. The pressure keeps the valve head 21 in place against the valve seat 22, thus effectively sealing the chamber 23. If required, or if considered advantageous, the valve head 21 can additionally be biased against the seat by a biasing spring (not shown). Another channel 26 connects a space behind the valve seat 22 with the space 11 behind a bullet 9a in the barrel. Many other solutions for an open-close valve 10, to be actuated by the hammer 12, are possible.

[0017] A follower 27 is attached to the feeder pin 5, and arranged to engage the hammer 12 and to move it backwards, against the force of the biasing spring 13. The engagement is unidirectional, so that when the feeder pin 5 and follower 27 is subsequently returned forward, the hammer 12 remains in its loaded position, held in place by the catch 14. In the illustrated example, the follower 27 is fixedly attached to the feeder pin, and the back side of the follower 27 engages the annular flange 15 of the hammer 12.

[0018] Figure 1 shows the gun in a ready-for-fire-position. In this condition, the feeder pin 5 has been slid into the barrel 4, and fed a bullet 9a into the firing position. The hammer 12 is in its loaded position, held in place by the catch, against the force of the biasing spring 13, and the valve 10 seals the chamber 23 which is filled with high pressure air from the cartridge 2.

[0019] Figure 2 shows what happens when the trigger is pulled. The trigger 16 pivots slightly, so that the catch 14 is allowed to disengage the hammer 12. The hammer 12 is thus released and forced by the spring 13 into contact with the rear portion of the main body 20 of the open-close valve 10. This briefly brings the valve head 21 out of sealing contact with the valve seat 22, to thereby allow an exhaust of air through the channel 26 to the space 11 behind the bullet 9a. As soon as the hammer has lost enough of its momentum, the valve head 21 is again pressed against the valve seat 22 to seal the chamber 23, which is again filled with compressed air. The compressed air exhausted into the space 11 behind the bullet 9a expands, to thereby discharge the bullet 9a through the barrel 4, thus firing the gun.

[0020] In a conventional, single-fire air gun, each firing sequence is followed by a manual reload using a handle 28 (see fig 3), connected to the follower 27. During such a reload motion, the follower is first moved back, thereby moving the feeder pin 5 back, to allow for a new bullet 9 to be provided by the magazine 8. The follower 27 also brings the hammer 12 back to be locked in the loaded position by the catch 14. Then, the handle 28 is moved forward, thereby moving the feeder pin 5 forward, to feed the bullet 9a into the barrel, as described above. The handle 28 may be fixed in the back position by a safety catch (not shown), in order to secure the gun, for example during insertion of a new magazine. According to the present invention, the reload procedure is instead performed automatically.

[0021] Figure 3 shows how the gun, for this purpose, is further provided with a chamber 30 for collecting partly expanded air that has been used to discharge the bullet 9a. In the illustrated example, this chamber 30 is arranged at the end of the barrel, in a similar way as a

silencer is fitted. The barrel 4 extends into one side of the chamber 30, and in the other side is fitted a plug 31 with a muzzle 32. The gun is also provided with a cylinder housing 33, here located below and along the barrel 4. The interior of the cylinder housing is connected to the chamber 30 by means of a channel 34. In the housing 33 is arranged the front end 35a of a piston 35. The rear end of the piston 35, which extends outside the housing 33, is mechanically connected to the follower 27 so as to transfer any movement of the piston 35 to the follower 27.

[0022] In the illustrated example, the channel is a tube 34, attached with one end to an opening 36 of the chamber 30, and the other end to a cylindrical portion 37 of the body 3 of the gun, which portion houses the pressure chamber 23. The housing 33 is in its front end secured to the tube 34 in an air-tight manner, here by means of a locking screw and a suitable seal (not shown). Inside the housing 33, the tube is provided with holes 38, allowing exhaust of gas into the housing 33. The piston 35 is formed as a cylinder, surrounding the cylindrical portion 37, and is in its front end 35a sealingly arranged against the tube 34 as well as the housing 33. In a preferred embodiment the piston is of plastic or other equivalent light weight material, and the sealing is achieved by piston rings of the same material. In the rear end of the cylindrical piston 35 is attached an annular fitting 39, e.g. made of aluminum, to which one end of a strut 40 of suitable form is attached. The other end of the strut 40 is attached to the follower 27. In the shown example, the strut is double, i.e. the follower 27 is connected to the piston 35 on both sides of the gun.

[0023] Figure 4a-c show a sequence after the gun has been fired.

[0024] First, in figure 4a, the shot goes off, and the bullet 9a is discharged. The effect of the chamber 30 is similar to that of a silencer. When a burst of air leaves the barrel it expands quickly, but is contained by the chamber 30 and is prevented from escaping and causing a crack. Instead, the partly expanded air will enter the opening 36, and follow the channel 34 to the housing 33. Here, the burst will force the piston 35 backwards as indicated by arrow C.

[0025] As shown in figure 4b, the piston 35 will be pushed to a withdrawn position. Through the mechanical connection to the follower 27, here by means of the strut 40, the movement will also move the hammer 12 and feeder pin 5 back. Any remaining energy in the burst of air will be absorbed by the walls in the chamber 30, channel 34 and housing 33, and the remaining pressure will eventually be let out through the muzzle 32.

[0026] As shown in figure 4b, when the pressure on the piston has been reduced, the return spring 7 will returned the feeder pin 5 and the piston 35 to their initial, forward positions, thus completing the reload motion. The gun is thereby essentially returned to the ready-to-fire-position shown in fig 1. It should be noted that, as the piston and feeder pin are connected to each other and move together, the return spring can equally well be arranged to engage the piston 35, for example in the housing 33.

[0027] Also shown in fig 3, 4b and 4c is a blocking mechanism 41, arranged to prevent the repeated firing of multiple shots by a single pull of the trigger. The mechanism comprises a depressing pin 42 adapted to pivot around an axis D. In a first position the pin 42 is located behind the trigger 16, without engaging the trigger, while in a second position, the pin 42 is adapted to cooperate with the rear portion 43 of the trigger 16, to press the trigger into a position where it supports the catch 14, preventing release of the hammer 12. The pin is actuated by a lever 44 adapted to be pushed back by the strut 40, thereby moving the pin into its second position.

[0028] The pin is biased toward the first position, e.g. by a biasing spring (not shown). However, the rear portion 43 of the trigger has a groove 45 formed to receive the pin 42, and to hold it in place against the action of the biasing spring, until any pressure on the trigger is removed.

[0029] In use, when the user presses the trigger and fires the gun, the piston 35 will be forced back, so that the strut 40 brings the feeder pin 5 and hammer 12 back, as described above with reference to fig 4b. At the same time, the strut 40 will abut the lever 44, and push it back, so that the depressing pin 42 is moved to its second position and engage the trigger 16. Due to the leverage of the lever, the force on the trigger 16 will be significant, and the trigger 16 will be returned to its original position against any pressure applied by the user (see fig 4b, lower part). Note that the hammer 12 on its way back engages the catch 14, to force it towards the hammer 12, out of engagement with the trigger 16. The blocking mechanism 41 is adapted to return the trigger 16 at the precise moment during which the catch 14 is pushed back, so that the supporting surface 18 of the trigger can return to support the catch 14, and prevent it from releasing the hammer 12. Further, as long as the user maintains a pressure on the trigger 16, the pin 42 will be held firm in the groove 45, preventing the subsequent firing. Only when the user releases the pressure on the trigger 16 will the biasing spring move the blocking mechanism 41 to its first position, thus again allowing the trigger to be pulled by the user. In this way, the pin and lever ensure a single-shot action of the gun, which is then a so called semi-automatic gun.

[0030] The blocking mechanism 41 is optional, and does not limit the present invention. Without it, the gun will be a fully automatic gun, allowing rapid fire of subsequent shots.

[0031] According to a second embodiment of the invention, shown in fig 5, the piston 135 is arranged coaxially with the barrel 104. A cover 101 is arranged coaxially outside the piston 135, to form a compartment 102 in front of the piston 135. A perforated annular member 103 is fitted on the barrel 4 in the cover 101, thereby dividing the compartment 102 into a chamber 130 and a housing

133. In this embodiment, there is no need for any channel between the chamber 130 and the housing 133. Instead, the burst of air having discharged the bullet will flow through the perforations in the member 103 into the housing 133 and push the piston back. Remaining details of the gun, including the connection between the piston 135 and the follower can be designed similarly as in the first embodiment.

Claims

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

a barrel adapted to receive a projectile from a magazine,
a pressure chamber adapted to communicate with a compressed gas cartridge fitted to the gun,
an open-close valve for exhausting compressed gas from said chamber to discharge a projectile in the barrel, and
a hammer arranged to actuate said open-close valve,
characterized by
a chamber for collecting partly expanded compressed gas after said gas has been used to discharge said projectile,
a piston arranged in a housing and being mechanically connected to said hammer, and
a channel for directing said partly expanded gas into said housing, so that said gas will force said piston to move, thereby bringing said hammer to a ready-to-fire-position.

2. A gas powered gun according to claim 1, wherein said piston is biased against the pressure of said gas by a biasing means, so that, after being forced back by the pressure of the partly expanded gas, the piston returns to its initial position by the force of said biasing means.

3. A gas powered gun according to claim 1 or 2, wherein the piston is connected to the hammer uni-directionally, so that the hammer, after being brought to a ready-to-fire-position by the piston, can be held in this position by a catch.

4. A gas powered gun according to any one of the preceding claims, wherein said gun further comprises a feeder pin adapted to feed a projectile from said magazine into the barrel, and wherein said piston is also mechanically connected to said feeder pin, so that, when said gas forces said piston to move, said feeder pin will be returned to a reload position.

5. A gas powered gun according to claim 4, wherein said biasing means is arranged in contact with said feeder pin.

6. A gas powered gun according to claim 4 or 5, wherein said piston is mechanically connected to the feeder pin in such a way that the movement of the feeder pin and the piston, in the longitudinal direction of the gun, are synchronized.

7. A gas powered gun according to any one of the preceding claims, wherein said piston and said housing are aligned essentially in parallel with said barrel.

8. A gas powered gun according to claim 7, wherein said piston is arranged coaxially around said barrel.

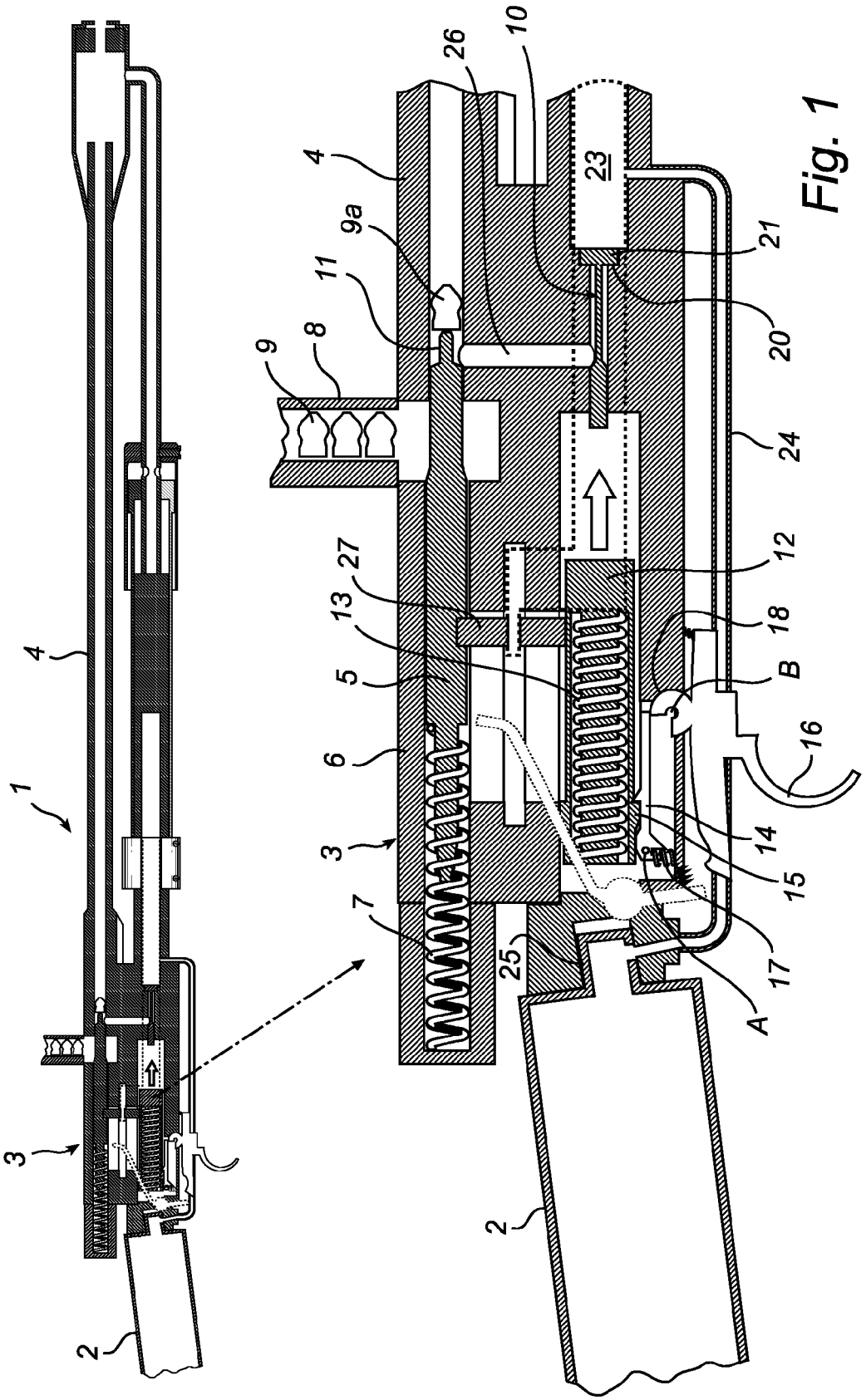

Fig. 1

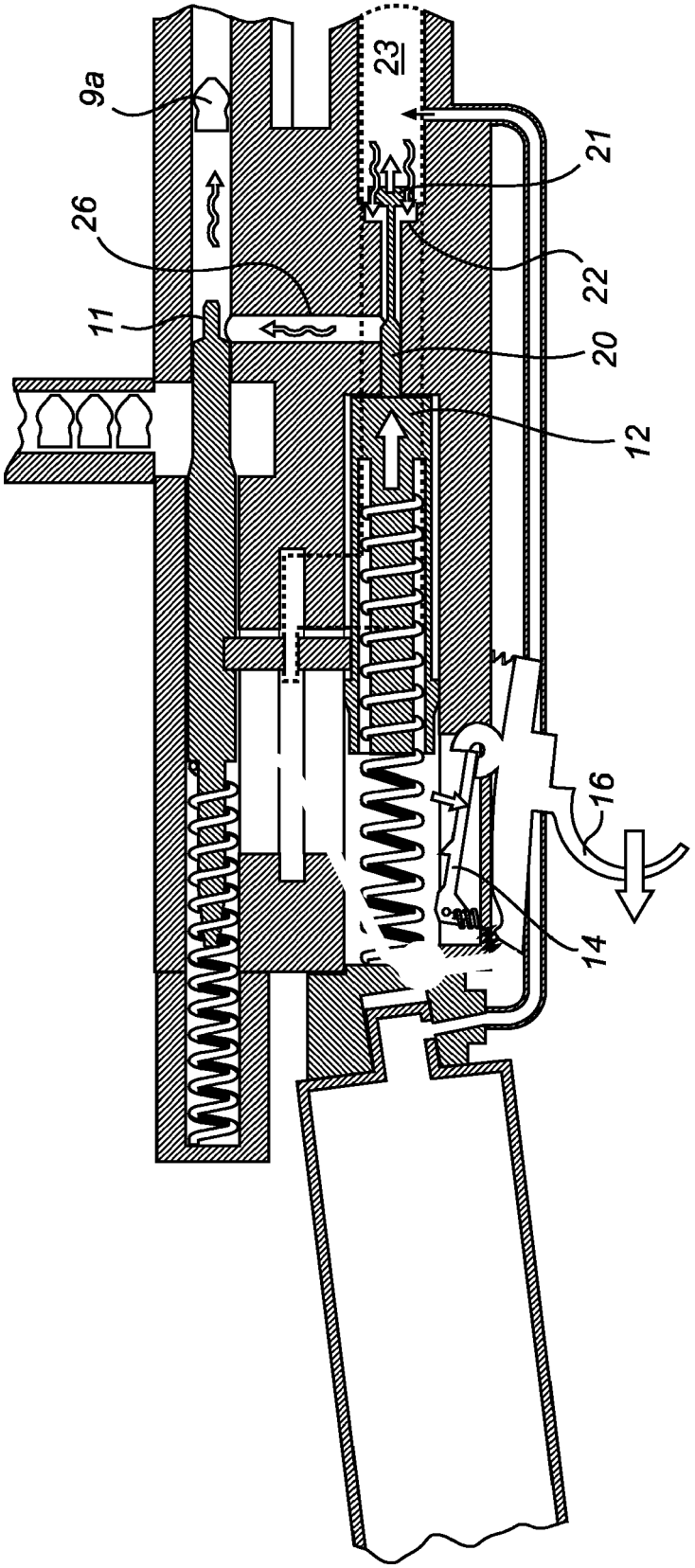

Fig. 2

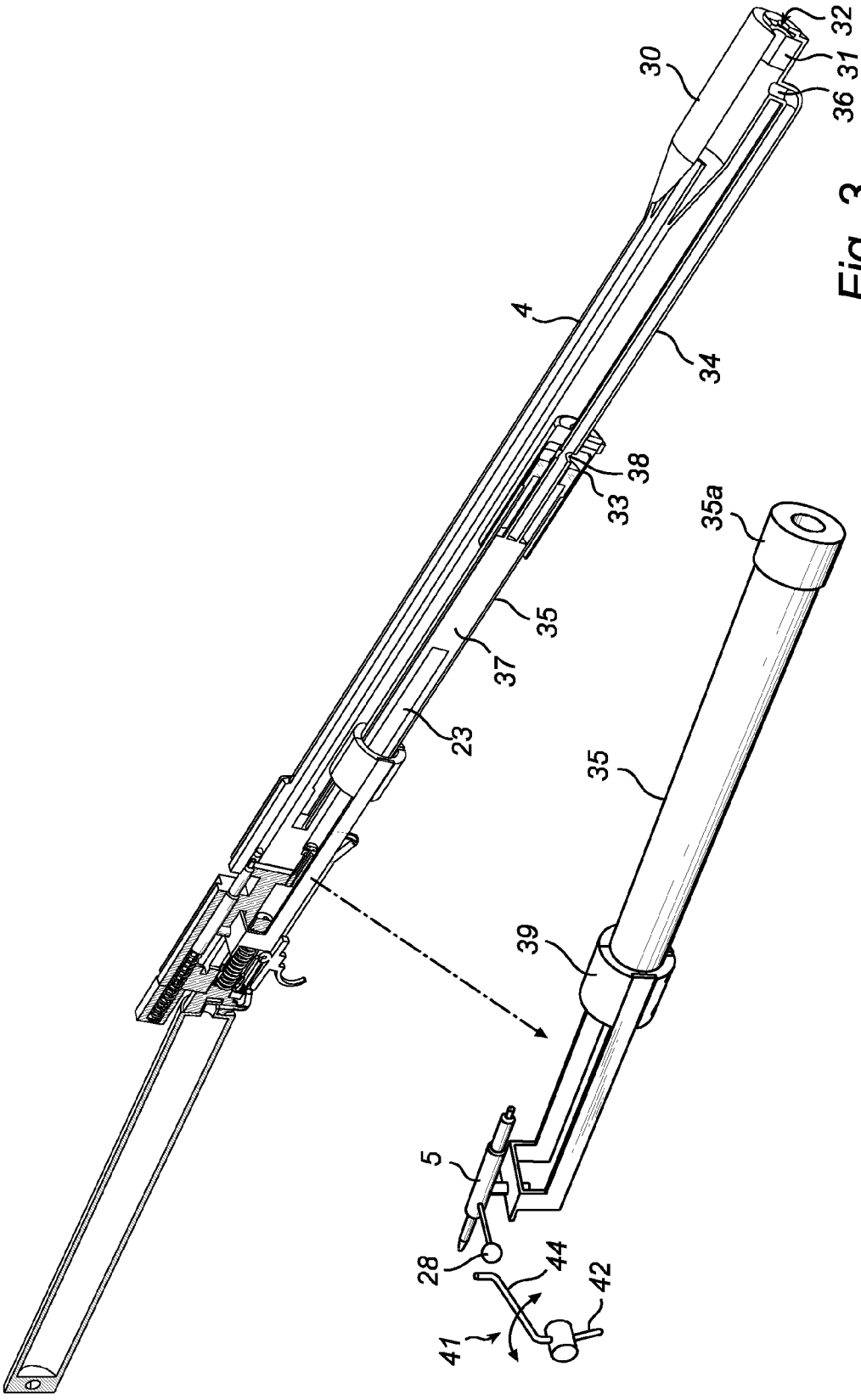

Fig. 3

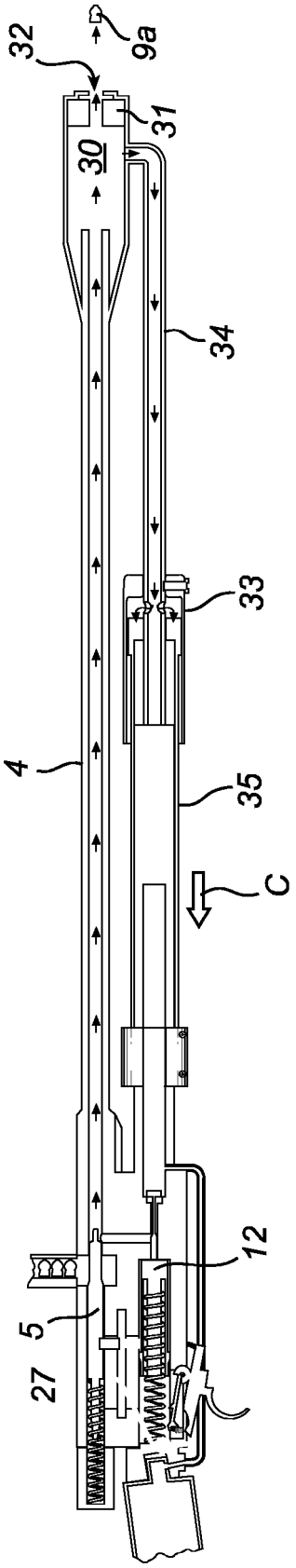

Fig. 4a

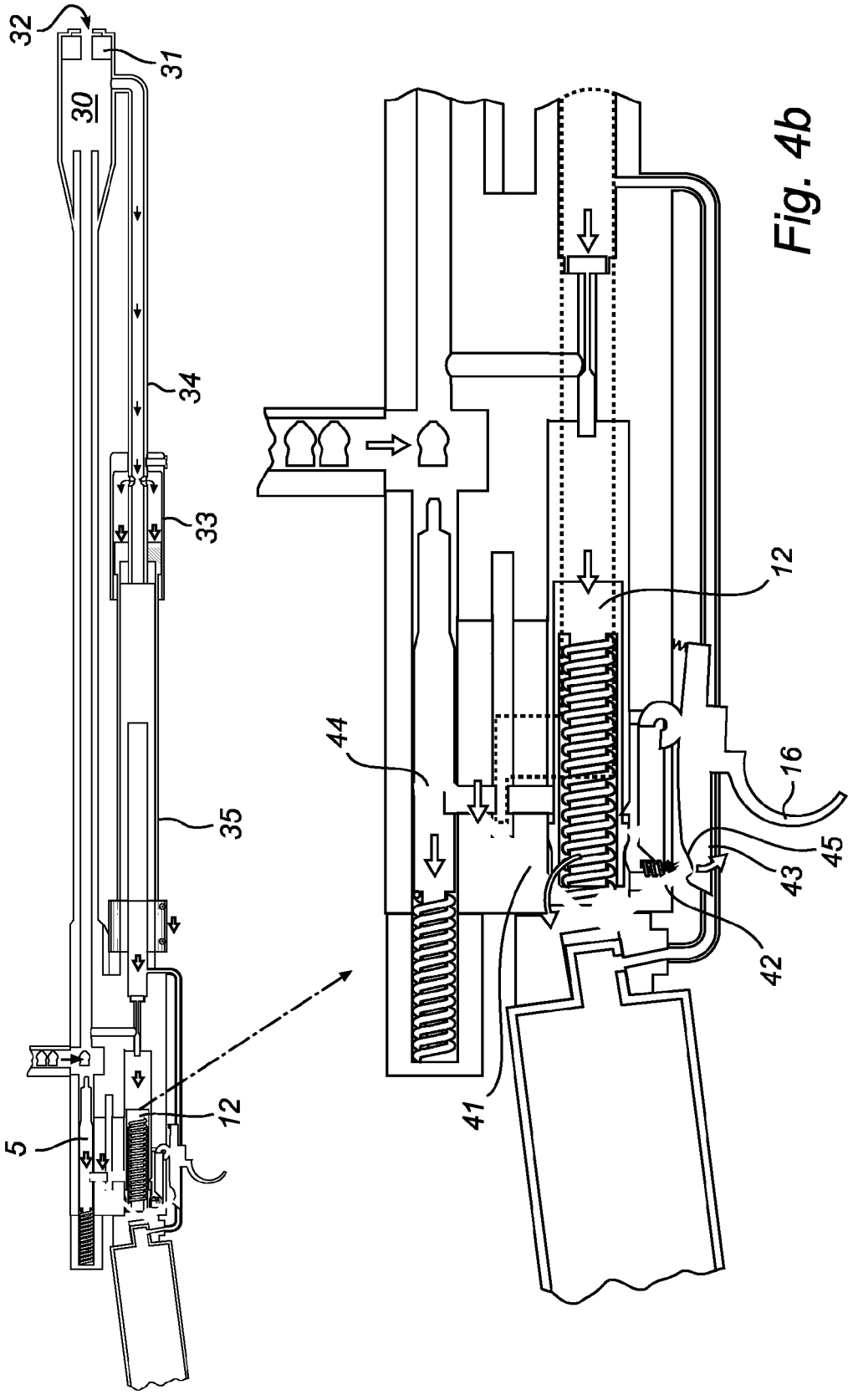

Fig. 4b

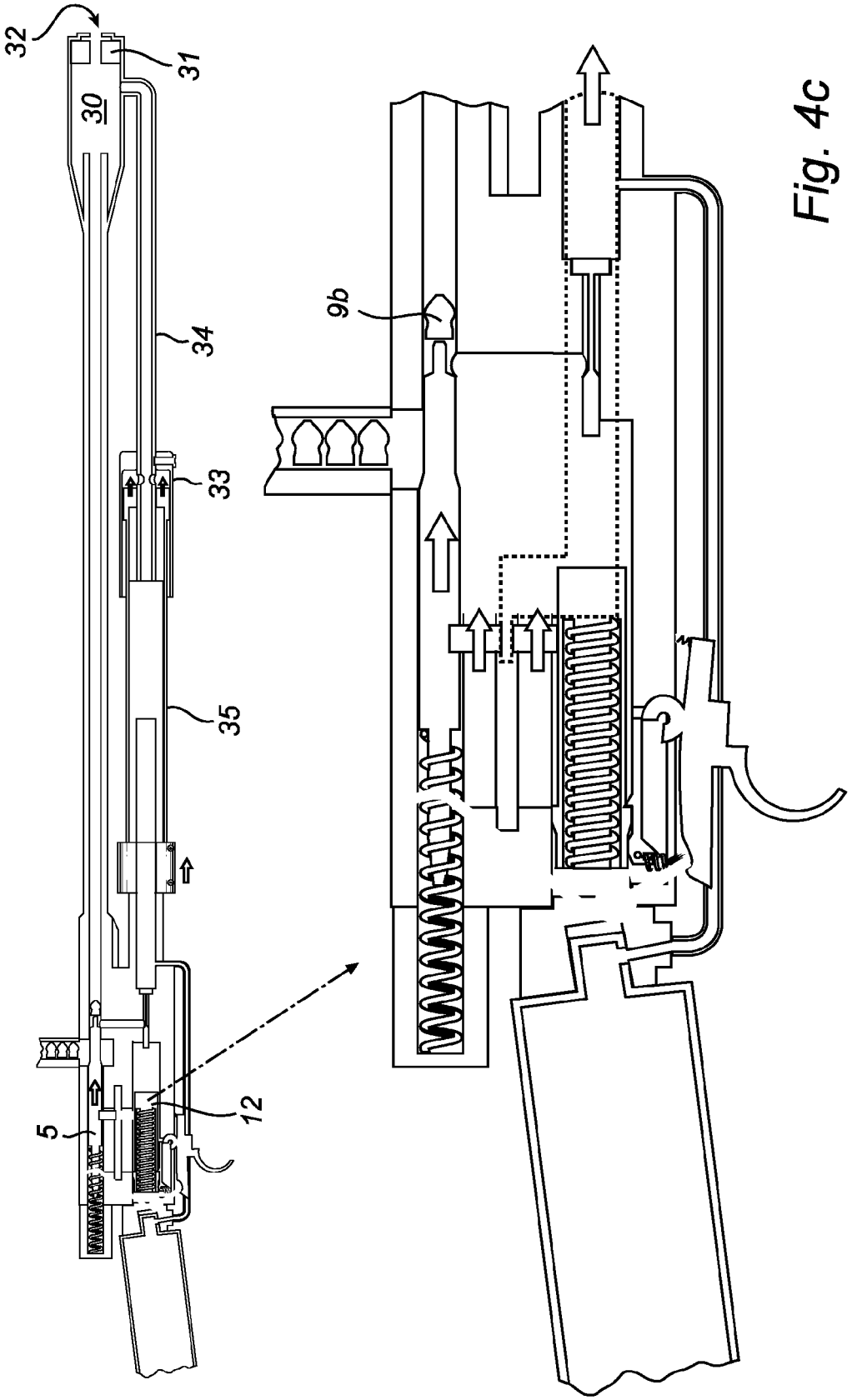

Fig. 4c

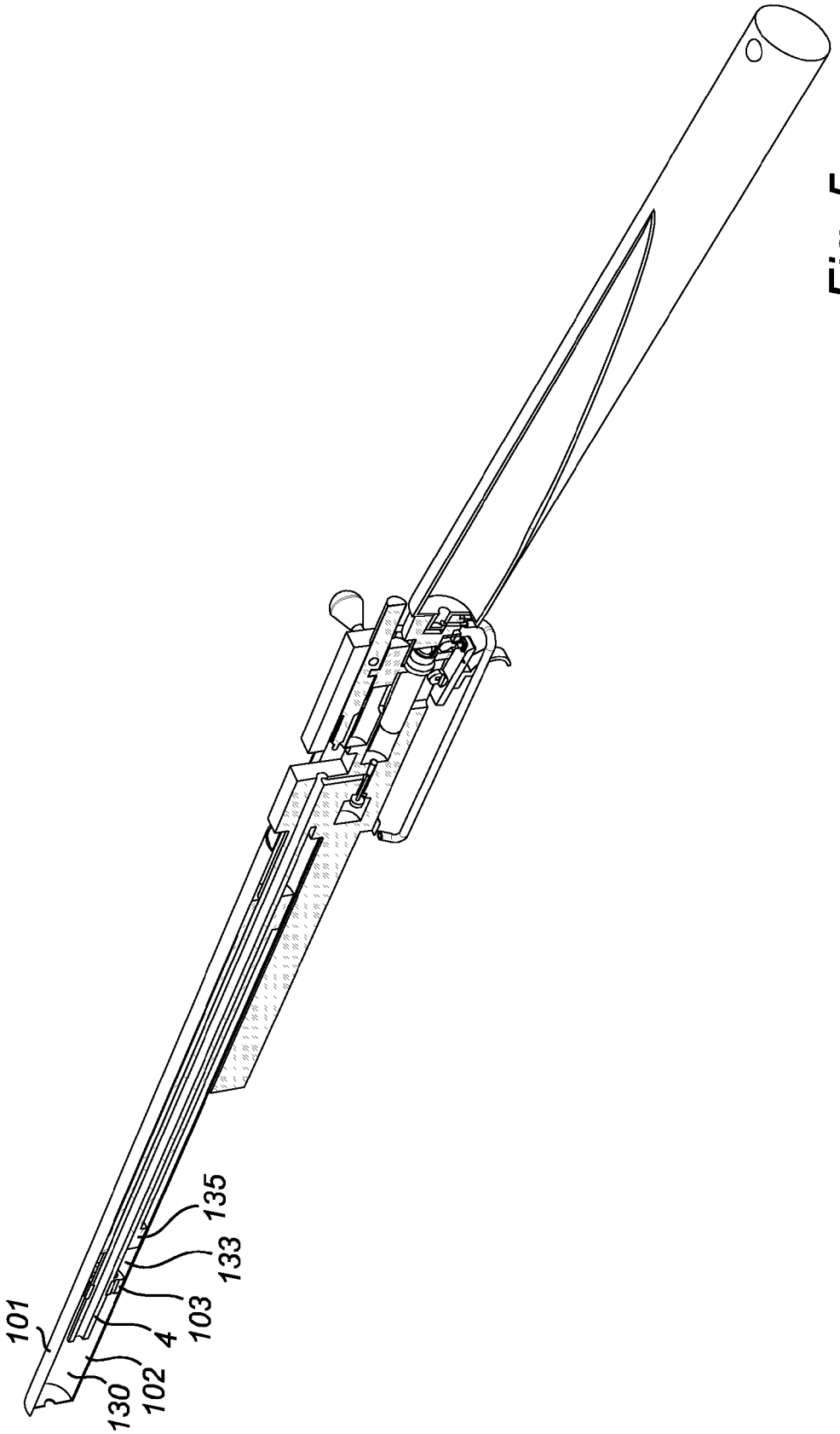

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 05 10 4862

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 1 416 244 A (WESTERN ARMS) 6 May 2004 (2004-05-06) * paragraphs [0003], [0007], [0024]; claims 1-5; figures 1,4-7 *	1-4,6,7	F41B11/06 F41B11/32
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F41B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	30 September 2005	Beaufumé, C

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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