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(54) **PAINTBALL GUN HAVING A PNEUMATIC ASSEMBLY**

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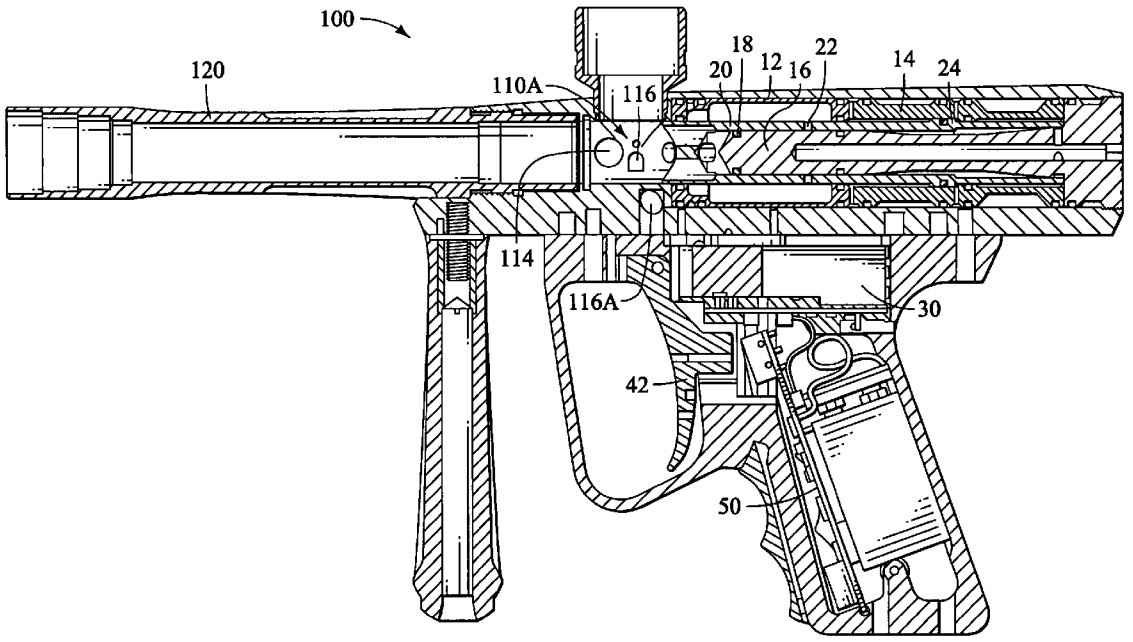
(57) **ABSTRACT**

A pneumatic paintball gun preferably includes a bolt slidable between an open and a closed position. The bolt preferably operates as a firing valve by permitting compressed gas to flow through the bolt and out of the paintball gun when the bolt is closed, but preventing the transfer of compressed gas through the forward end of the bolt when open. This can be accomplished, for instance, by arranging a sealing member in communication with a surface of the bolt. A port is also arranged through a lateral sidewall of the bolt at a predetermined location. The bolt preferably slides in relation to the sealing member such that when the bolt is in an open position, the sealing member prevents compressed gas from flowing into the bolt, but when the bolt is in a closed position, compressed gas is permitted to flow into the bolt.



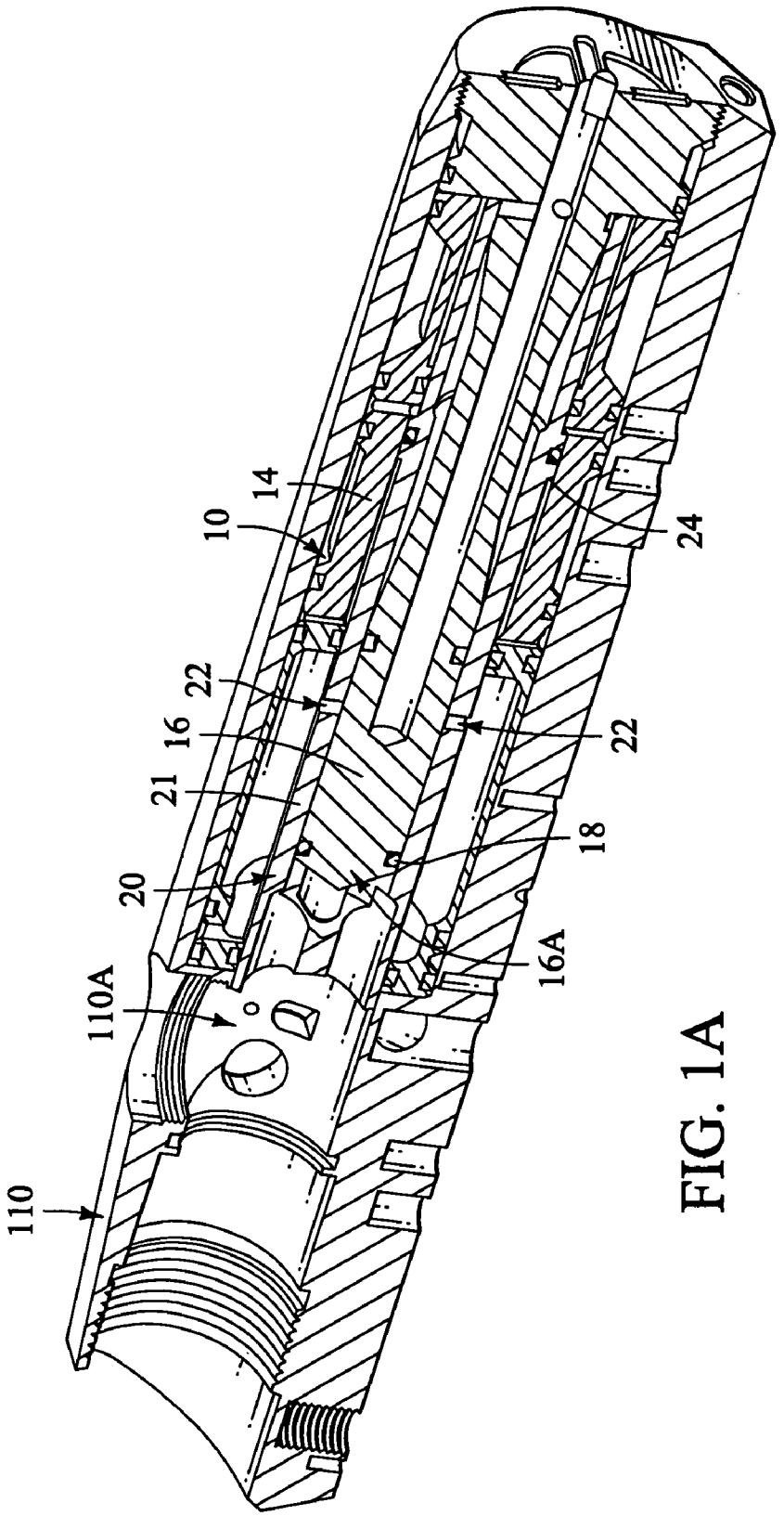


FIG. 1A

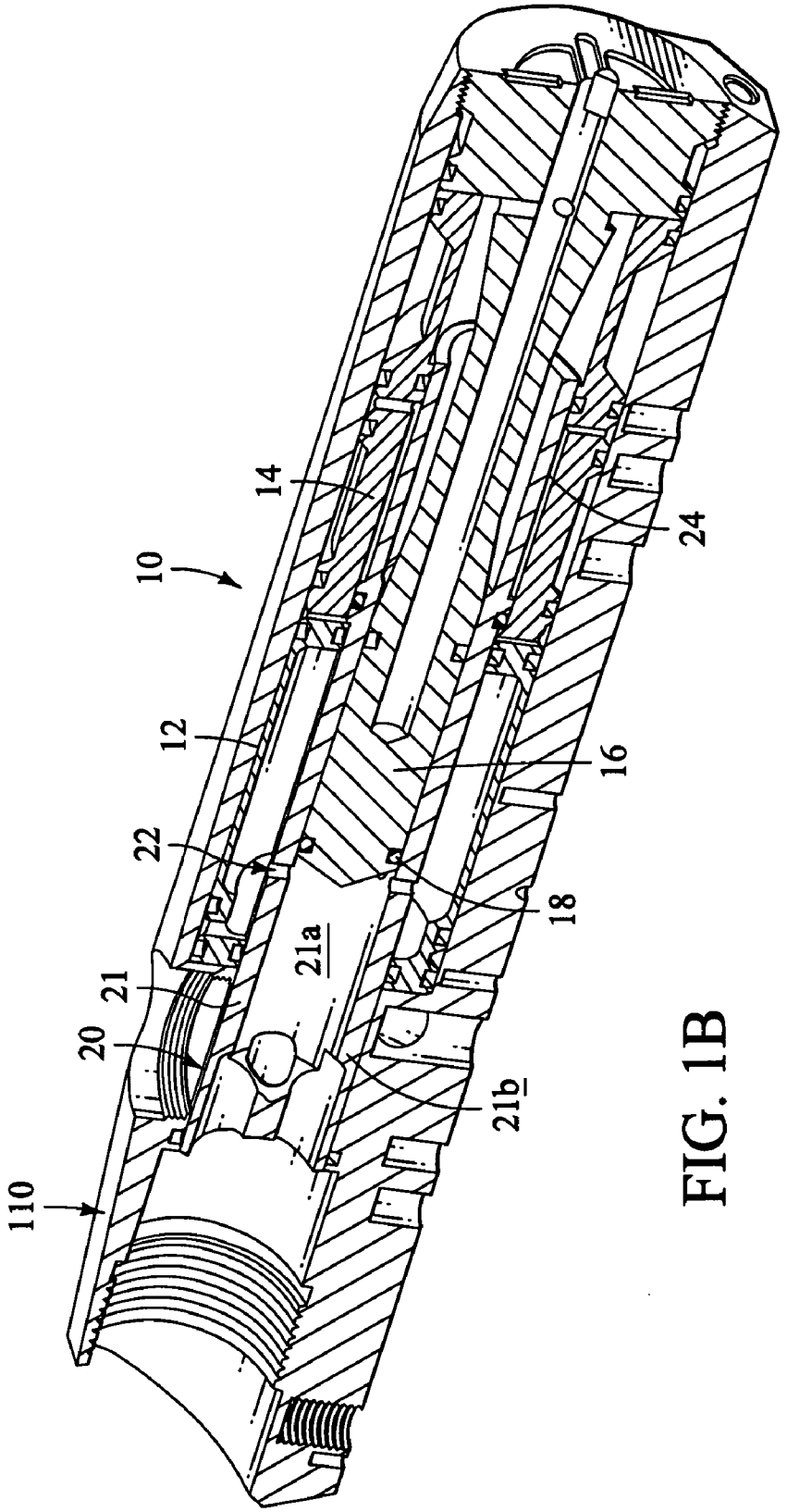


FIG. 1B

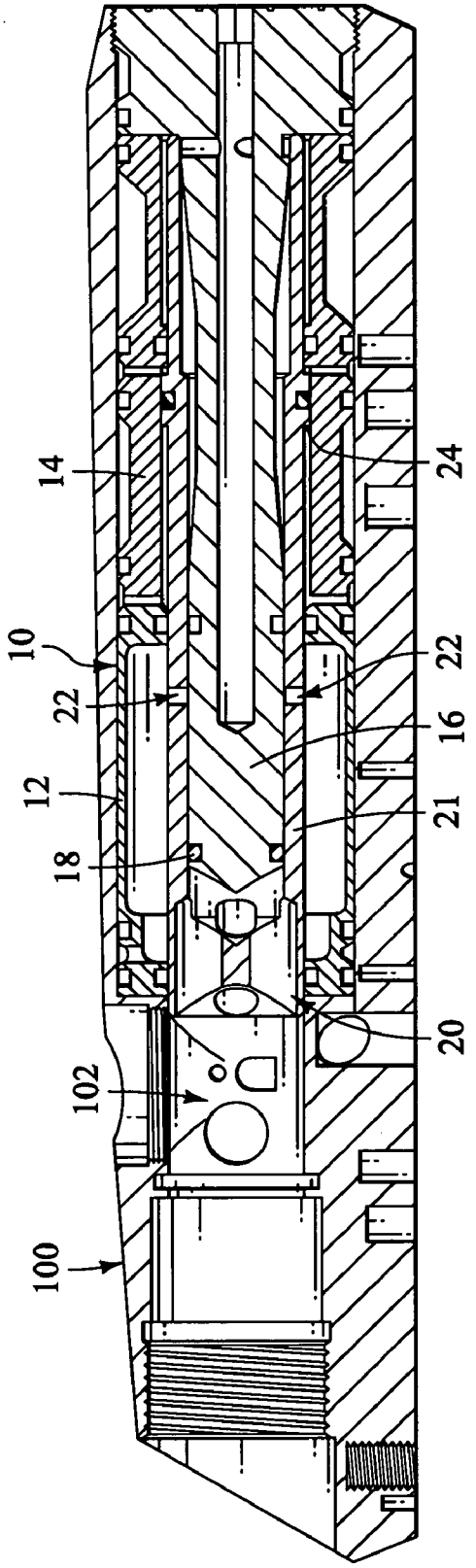


FIG. 2A

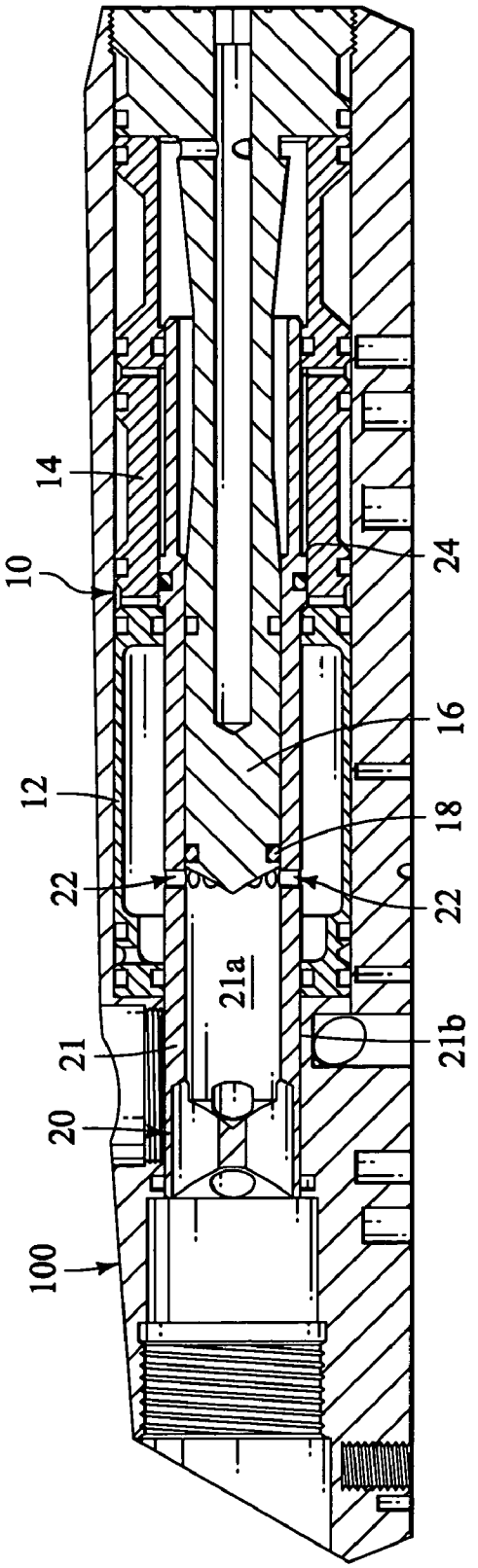


FIG. 2B

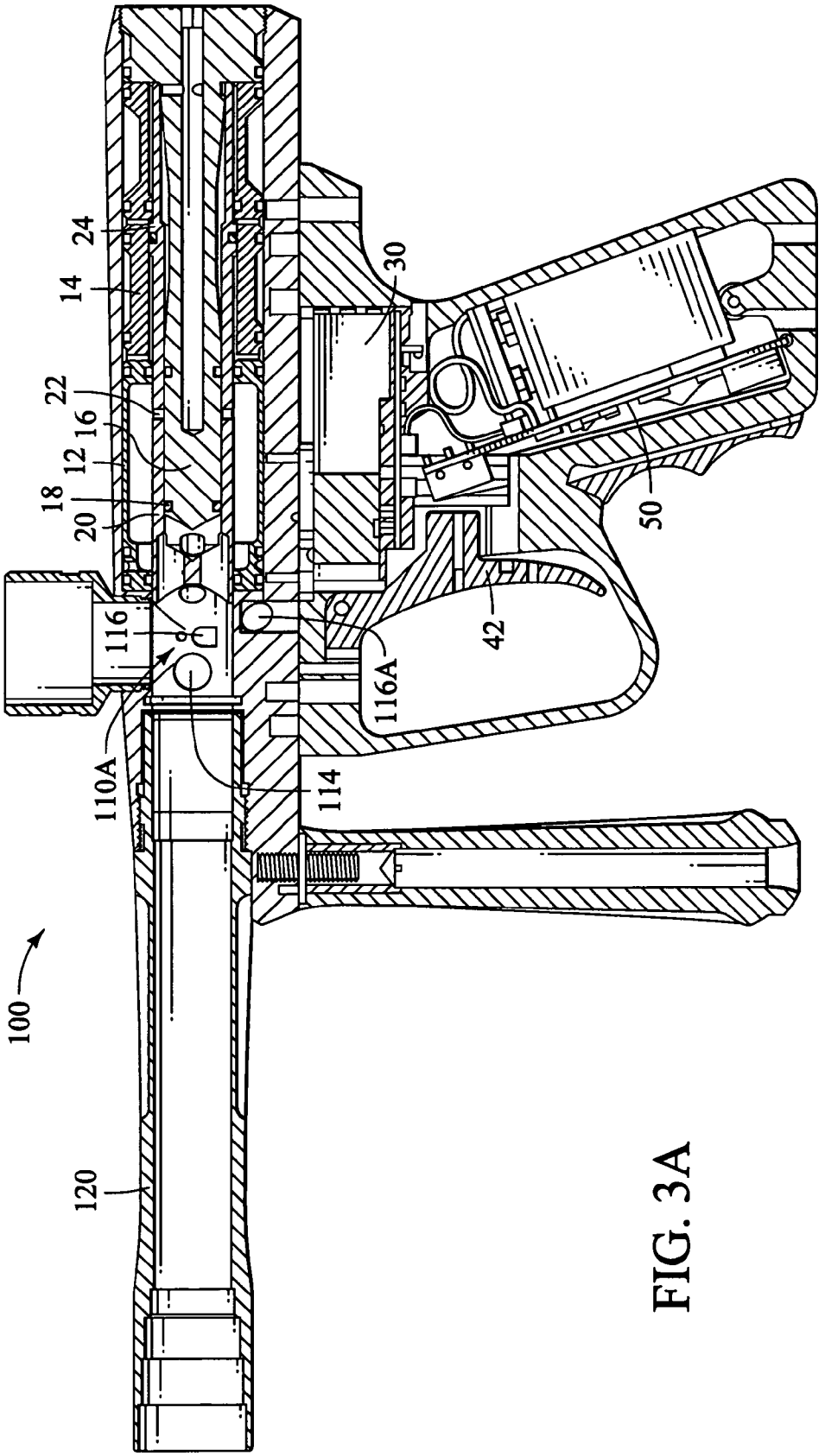


FIG. 3A

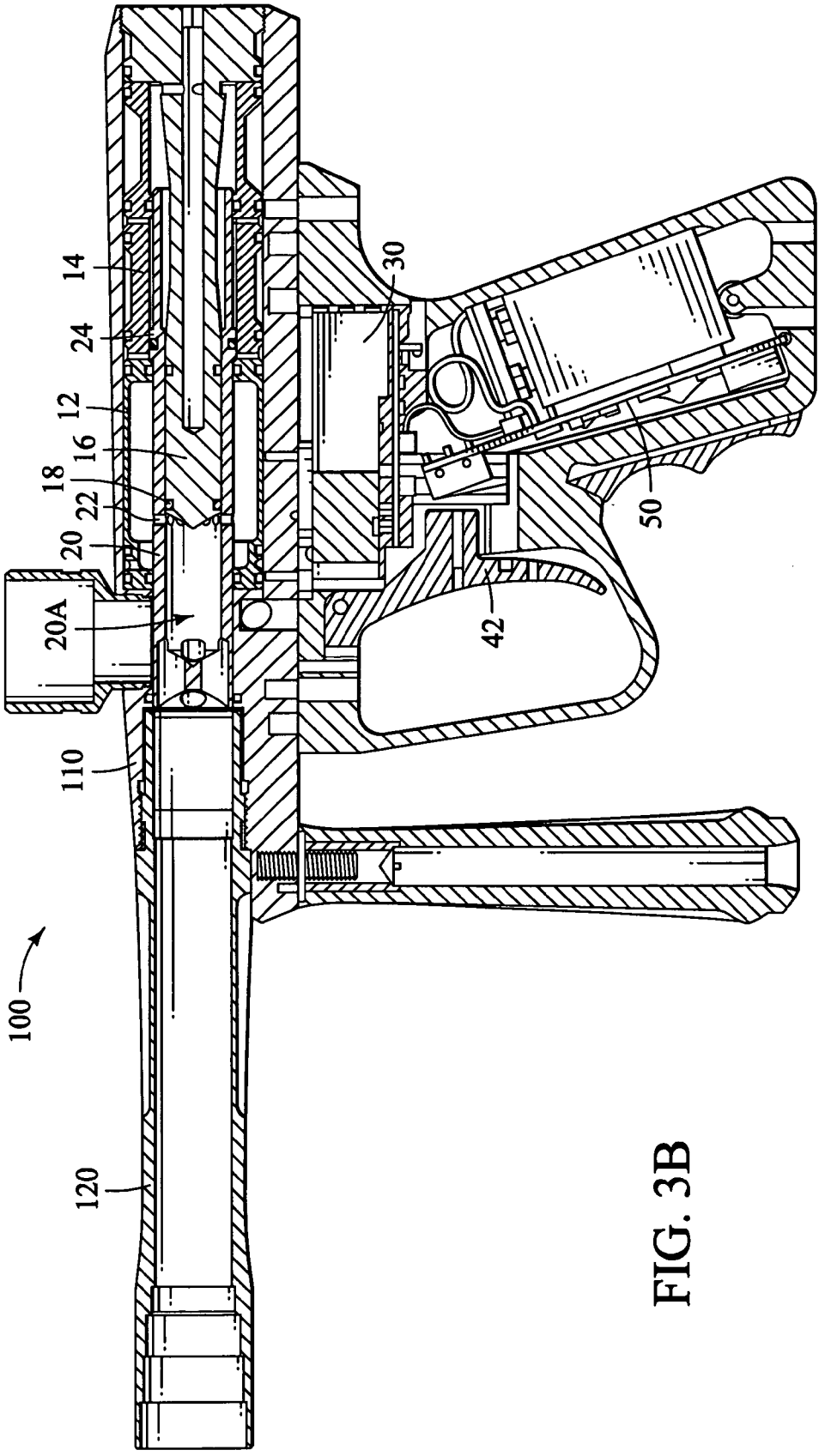


FIG. 3B

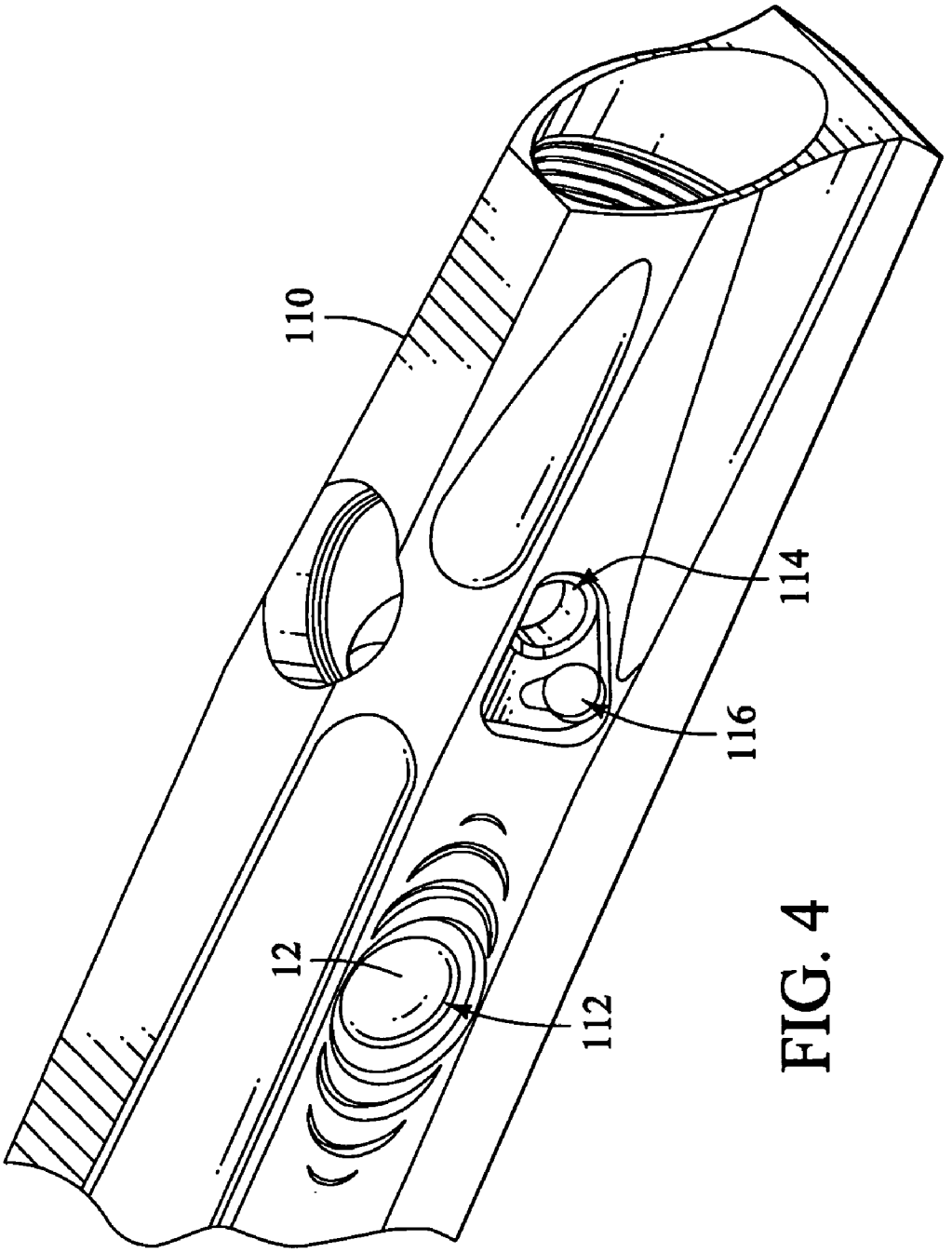


FIG. 4

PAINTBALL GUN HAVING A PNEUMATIC ASSEMBLY

[0001] This application is a divisional of prior application Ser. No. 10/695,049, filed Oct. 27, 2003, the contents of which are incorporated herein by reference in their entirety.

BACKGROUND OF THE INVENTION

[0002] This invention relates generally to pneumatic paintball guns ("markers") and their operating components. In the sport of paintball, it is generally desirable to have a marker that is as small and light as possible. Smaller and lighter markers increase a players' mobility. Players benefit from increased mobility by being able to move more quickly from bunker to bunker, making it easier to avoid being hit. Further, in the sport of paintball, the marker is treated as an extension of the body such that a hit to the marker counts as a hit to the player. It is desirable, therefore, to have a paintball gun with as small a profile as possible while substantially maintaining or improving performance characteristics of the marker, such as firing rate and accuracy.

SUMMARY OF THE INVENTION

[0003] In one embodiment of the present invention, a pneumatic assembly for a paintball gun includes a compressed gas storage chamber and a bolt. The storage chamber can be configured to receive a regulated supply of compressed gas. The bolt is configured to slide back and forth between an open (preferably rearward) and a closed (preferably forward) position to load a paintball into a breech of the paintball gun and to control the release of compressed gas from the compressed gas storage area into the bolt to launch the paintball.

[0004] In a preferred embodiment, the bolt is configured to operate as part of a firing valve of the pneumatic assembly. More particularly, one or more ports are preferably disposed through a lateral wall of the bolt at a predetermined distance from an end (preferably a forward end) of the bolt. The bolt port(s) are preferably arranged to selectively permit the transfer of compressed gas into the bolt from a compressed gas storage area. Most preferably, the bolt port(s) convey compressed gas into the bolt when the bolt is disposed in a closed position, but not when the bolt is in an open position. This can be accomplished in any number of different ways.

[0005] In one embodiment, a sealing member is arranged in communication with the bolt at a predetermined distance from the front of the assembly. The sealing member preferably keeps compressed gas from passing through the bolt port(s) into the bolt when the bolt is in an open position. In a closed position, however, compressed gas is allowed to pass through the port(s) into the bolt. The compressed gas then flows through the bolt to launch a paintball.

[0006] In one specific embodiment, for example, the bolt can be arranged on a valve stem. A sealing member is preferably arranged on a forward end of the valve stem. In this embodiment, the sealing member is preferably in communication with an internal surface of the bolt. In another embodiment, a sealing member could be arranged in communication with an external surface of the bolt at a predetermined distance from the front of the assembly. In these specific embodiments, as the bolt travels toward its closed position, the bolt port(s) preferably slide past the sealing member and permit compressed gas to flow from the compressed gas storage area into the bolt as the bolt closes.

[0007] According to another aspect of the present invention, a paintball gun comprising a pneumatic assembly preferably includes a body having a breech. The pneumatic assembly preferably includes a compressed gas storage chamber and a bolt. The bolt is preferably configured to move to a closed position in the breech to move a paintball into a firing position and to cause compressed gas to be released through the bolt into the breech.

[0008] Interchangeable compressed gas storage chambers can be provided having varying internal volumes. These chambers can be color-coded and/or provided with other visual indicia that correspond to their volumes. A viewing aperture can be provided through a lateral wall of the paintball gun body to permit viewing of the storage chamber or other internal components.

[0009] The paintball gun may also include a control valve, such as an electronic solenoid valve or a mechanical valve configured to initiate forward movement of the bolt in response to a trigger pull. The control valve can also be used to control rearward movement of the bolt. An electronic eye can also be arranged in the paintball gun in a manner such that no external wiring is required.

[0010] Various other aspects, embodiments, and configurations of this invention are also possible without departing from the principles disclosed herein. This invention is not limited to any of the particular aspects, embodiments, or configurations described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The foregoing objects, features, and advantages of the present invention will become more readily apparent from the following detailed description of preferred embodiments thereof, made with reference to the accompanying figures, in which:

[0012] **FIG. 1A** is a cross-sectional perspective view of a paintball gun body having a pneumatic assembly according to one aspect of the present invention, wherein a bolt thereof is disposed in an open position;

[0013] **FIG. 1B** is a cross-sectional perspective view of the paintball gun body and pneumatic assembly of **FIG. 1A**, wherein the bolt is disposed in a closed position;

[0014] **FIG. 2A** is a cross-sectional side view of the paintball gun body and pneumatic assembly of **FIG. 1A**, wherein the bolt is disposed in the open position;

[0015] **FIG. 2B** is a cross-sectional side view of the paintball gun body and pneumatic assembly of **FIG. 1A**, wherein the bolt is disposed in the closed position;

[0016] **FIG. 3A** is a cross-sectional side view of a paintball gun employing the paintball gun body and pneumatic assembly shown in **FIG. 1A**, wherein the bolt is disposed in the open position;

[0017] **FIG. 3B** is a cross-sectional side view of a paintball gun employing the paintball gun body and pneumatic assembly shown in **FIG. 1A**, wherein the bolt is disposed in the closed position; and

[0018] **FIG. 4** is a perspective view of a paintball gun employing a pneumatic assembly according to yet another embodiment of the present inventive concepts.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0019] The accompanying drawings illustrate the construction of preferred embodiments of the present inventive concepts. Referring first to **FIGS. 1A, 1B**, 2A, and 2B, a pneumatic assembly **10** is preferably arranged in a paintball gun body **110**. The pneumatic assembly **10** preferably includes a compressed gas storage chamber **12** and a pneumatic cylinder **14**. A piston **24** is slidably arranged in the pneumatic cylinder **14**. A bolt **20** is preferably disposed through the compressed gas storage chamber **12** and coupled to (or formed integrally with) the piston **24**. In this embodiment, the bolt **20** is slidably mounted on a valve stem **16**. The valve stem **16** preferably comprises a sealing member **18** arranged on a forward end **16**A thereof. The bolt **20** preferably comprises one or more ports **22** arranged through a lateral sidewall **21** of the bolt **20**.

[0020] Referring specifically to **FIGS. 1A and 2A**, when the bolt **20** is open (in this case, rearward), the sealing member **18** prevents compressed gas from flowing through the bolt ports **22** into the bolt **20**. When the bolt **20** is closed (in this case, in a forward position), as shown in **FIGS. 1B and 2B**, however, compressed gas from the compressed gas storage chamber **12** is permitted to flow through the bolt ports **22** into the bolt **20**.

[0021] As noted previously, the bolt **20** is preferably connected to a pneumatic piston **24** (such as through a separate mechanical linkage, by integral formation therewith, or in some other manner). The pneumatic piston **24** is, in turn, preferably configured to slide back and forth in the pneumatic cylinder **14**. Movement of the bolt **20** is therefore preferably controlled by controlling movement of the pneumatic piston **24**. Movement of the pneumatic piston **24** can be controlled, for instance, by a mechanical or electrical pneumatic valve.

[0022] Referring now to **FIGS. 3A and 3B**, operation of a preferred embodiment of a paintball gun **100** employing the pneumatic assembly **10** of **FIGS. 1A-2B** is as follows. When the bolt **20** is disposed in an open position, a paintball is permitted to drop into the breech area **110**A of the paintball gun body **110**. A mechanical or electrical pneumatic valve **30** (preferably an electronic solenoid valve) initiates a firing operation in response to a pull on the trigger **42**. During the firing operation, the pneumatic piston **24** moves forward under control of the pneumatic valve **30**. The bolt **20** is carried forward by the movement of the pneumatic piston **24**. As the bolt **20** moves forward, the paintball is loaded into a firing position in a barrel **120** connected to the breech end of the paintball gun body **110**. At the same time, the bolt ports **22** slide past the sealing member **18** and an internal chamber **20**A of the bolt **20** is exposed to the compressed gas from the compressed gas storage chamber **12** through the bolt ports **22**. Compressed gas from the compressed gas storage chamber **12** is thereby permitted to flow into and through the bolt **20** to launch the paintball.

[0023] According to this embodiment, the bolt **20** of the pneumatic paintball gun preferably operates as a portion of a firing valve. More specifically, the bolt ports **22**, formed through the bolt wall **21** at a predetermined position along the bolt **20**, are configured to selectively permit and prevent compressed gas from entering the bolt **20**. This is preferably accomplished by positioning the ports **22** in a desired relation to the sealing member **18**. When the bolt **20** is open, a sealing engagement between the bolt **20** and the sealing member **18** preferably prevents compressed gas from entering the ports **22**. When the bolt **20** closes, however, the ports **22** transmit compressed gas from a compressed gas storage area **12** into an internal bolt chamber **20**A. The compressed gas then flows through the bolt **20** to launch a paintball.

[0024] Where the bolt **20** is slidably mounted on a valve stem **16**, a sealing member **18** (such as an O-ring, plug, or any other sealing structure) is preferably arranged at a forward end **16**A of the valve stem **16**. The sealing member **18** thereby prevents compressed gas from entering the bolt **20** from the compressed gas storage area **12** until the bolt **20** reaches a predetermined forward position. As the bolt **20** approaches its predetermined forward position, the bolt ports **22** slide past the sealing member **18** and expose an internal bolt chamber **20**A to compressed gas from the storage chamber **12**.

[0025] It should be noted, however, that many alternative embodiments are possible, without departing from the inventive principles disclosed herein. In one alternative embodiment, for example, a sealing member can be arranged in communication with an external surface of the bolt. As in the earlier embodiment, the sealing member prevents compressed gas from entering the bolt from a compressed gas source until the bolt reaches a closed position. As the bolt closes, the gas entry ports preferably slide past the sealing member and permit compressed gas to enter the bolt and flow into communication with a paintball, thereby launching the paintball from the marker.

[0026] Referring to **FIGS. 1A-3B**, movement of the bolt **20** is preferably accomplished using an electronic solenoid valve **30**. The bolt **20** can, for instance, include two, oppositely arranged piston surface areas **24**A, **24**B formed on a rearward portion of the bolt **20**. The solenoid valve **30** can then be configured to alternately supply compressed gas to and vent compressed gas from the two surface areas **24**A, **24**B. More particularly, compressed gas is preferably supplied from the solenoid valve **30** to a forward surface area **24**A and vented from a rearward surface area **24**B to move the bolt to a rearward position. The compressed gas is preferably supplied to the rearward surface area **24**B and vented from the forward surface **24**A area to move the bolt to a forward position.

[0027] Although this configuration preferably uses a single, four-way solenoid valve, various types, numbers, and configurations of solenoid valves can be used to shuttle the bolt between a forward and rearward position. In one alternative embodiment, for instance, a constant supply of compressed gas can be directed to a first piston surface area, with compressed gas being selectively supplied through a three-way solenoid valve to an opposite, larger surface area to operate the bolt. Furthermore, the bolt could be connected to a separate pneumatic piston rather than have piston surface areas formed directly thereon.

[0028] Referring now to **FIG. 4**, a paintball gun body **100**, embodies various additional inventive principles. In particular, the paintball gun body **110** shown in **FIG. 4** preferably

includes a viewing aperture **112** arranged through a lateral wall **101** of the paintball gun body **110**. A detent aperture **114** can be provided for positioning of a ball detent to prevent double feeding of paintballs. An eye aperture **116** can be provided through the body wall **101** for the positioning of an electronic eye (not shown). The electronic eye preferably senses the presence or absence of a paintball in the breech area **110**A of the paintball gun body **110** to prevent misfiring. A wiring aperture **116**A can also be provided from the breech area **110**A to a grip **111** of the paintball gun **100** (see **FIG. 3A**) to permit attachment of the electronic eye to a circuit board **50** (see **FIG. 3A**) of the paintball gun **100** without any external wiring.

[**0029**] According to yet another aspect of this invention, a plurality of compressed gas storage chambers **12** can be provided, the compressed gas storage chamber **12** having different internal volumes. Different internal volumes may be desirable to permit firing of a paintball at a desired velocity using a different gas pressure. Selecting an appropriate chamber volume can also improve gas efficiency. In one embodiment, the plurality of compressed gas storage chambers **12** can be provided with different colors, numbers, or other indicators **12**A that represent an internal volume of the chamber **12**. When arranged in the paintball gun body **110**, this indicator **12**A can preferably be viewed through the viewing aperture **112** in the gun body **110** to permit quick visual determination of the internal volume of the compressed gas storage chamber **12**. These indicators **12**A can indicate an actual volume, a relative volume (as compared to other chambers or some independent reference value), or both.

[**0030**] Having described and illustrated the principles of the invention through the descriptions of various preferred embodiments thereof, it will be readily apparent to those skilled in the art that the invention can be modified in arrangement and detail without departing from such principles. The claims should be interpreted to cover all such variations and modifications.

What is claimed is:

1. A paintball gun, comprising:

a body;

a compressed gas storage area;

a bolt slidably disposed in said body, the bolt comprising a bolt port arranged through a sidewall of the bolt in communication with the compressed gas storage area;

a sealing member arranged in communication with the sidewall of the bolt, wherein the sealing member prevents compressed gas from entering a forward end of the bolt through the bolt port when the bolt is in an open position; and

wherein said bolt port is configured to slide past the sealing member and convey compressed gas into the bolt when the bolt moves from the open position to a closed position.

2. A paintball gun according to claim 1, further comprising:

a pneumatic piston arranged in communication with the bolt, wherein movement of the piston controls movement of the bolt; and

a pneumatic cylinder housing said pneumatic piston, said pneumatic cylinder configured to receive compressed gas from a control valve to control movement of the pneumatic piston.

3. A paintball gun according to claim 2, wherein the control valve is an electronic solenoid valve.

4. A paintball gun according to claim 1, wherein the body is configured to receive a separately formed compressed gas storage chamber that provides the compressed gas storage area.

5. A paintball gun according to claim 4, further comprising an aperture formed through an external wall of the body to permit viewing of the compressed gas storage chamber when arranged in the body of the paintball gun.

6. A pneumatic assembly according to claim 1, wherein the sealing member is arranged in communication with an external surface of the bolt.

7. A paintball gun according to claim 1, wherein the bolt is slidably mounted on a valve stem.

8. A paintball gun according to claim 7, wherein the sealing member is arranged on the valve stem in communication with an internal surface of the bolt.

9. A paintball gun according to claim 8, wherein the sealing member is arranged on a forward end of the valve stem.

10. A paintball gun according to claim 9, wherein the bolt comprises a plurality of bolt ports disposed through the sidewall of the bolt.

11. A paintball gun, comprising:

a body;

a compressed gas storage area arranged within the body;

a bolt slidably arranged within the body and comprising a bolt port arranged within the compressed gas storage area, wherein a forward passageway of said bolt is configured to selectively receive compressed gas from the compressed gas storage area through the bolt port; and

a sealing member arranged in a fixed position with respect to the body of the paintball gun, the sealing member further arranged in communication with a surface of the bolt, and wherein the sealing member prevents compressed gas from the compressed gas storage area from entering the forward passageway of the bolt when the bolt is in an open position and allows the forward passageway of the bolt to receive compressed gas from the compressed gas storage area through the bolt port when the bolt is in a closed position.

12. A paintball gun according to claim 11, wherein the sealing member is arranged in communication with an external surface of the bolt.

13. A paintball gun according to claim 11, wherein the bolt is slidably mounted on a valve stem.

14. A paintball gun according to claim 13, wherein the sealing member is arranged in communication with an internal surface of the bolt.

15. A paintball gun according to claim 14, wherein the sealing member is arranged on a forward end of the valve stem.

16. A paintball gun, comprising:

a body having an internal chamber configured to house a pneumatic assembly;

said pneumatic assembly comprising a compressed gas storage chamber and a bolt slidably mounted in the pneumatic assembly;

said bolt comprising a plurality of bolt ports disposed through a sidewall of said bolt and arranged in an internal area of the compressed gas storage chamber, said bolt further comprising an internal passageway arranged in a forward end of the bolt; and

a sealing member arranged in communication with a surface of the bolt to prevent compressed gas from the compressed gas storage chamber from entering the internal passageway in the forward end of the bolt when the bolt is in a first position and wherein compressed gas from the compressed gas storage chamber is permitted to enter the internal passageway in the forward end of the bolt through the bolt ports when the bolt is in a second position.

17. A paintball gun according to claim 16, wherein the sealing member is arranged in communication with an external surface of the bolt.

18. A paintball gun according to claim 16, further comprising a valve stem, wherein the bolt is slidably mounted on the valve stem, and wherein the sealing member is arranged in communication with an internal surface of the bolt.

19. A paintball gun according to claim 18, wherein the sealing member is arranged on a forward end of the valve stem.

20. A paintball gun according to claim 16, wherein the plurality of bolt ports are configured to slide across the sealing member to release compressed gas from the compressed gas storage chamber from the paintball gun.

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