US005505188A

United States Patent [19]

Williams

[11] **Patent Number: 5,505,188**

[45] **Date of Patent: Apr. 9, 1996**

[54] **PAINT BALL GUN**

[76] Inventor: **Robert A. Williams**, 2721 White Settlement Rd., Fort Worth, Tex. 76107

[21] Appl. No.: **210,010**

[22] Filed: **Mar. 17, 1994**

[51] **Int. Cl.**[6] **F41B 11/02**; F41B 11/06

[52] **U.S. Cl.** **124/74**; 124/49; 124/76; 221/200

[58] **Field of Search** 221/200; 414/288, 414/304; 124/45, 49, 50, 56, 70–76

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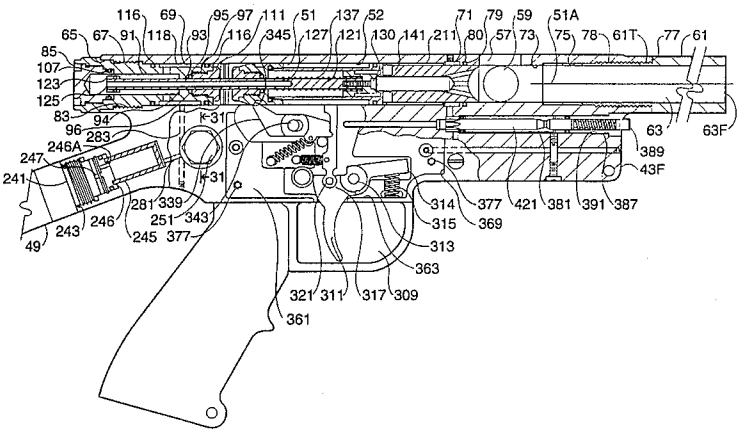
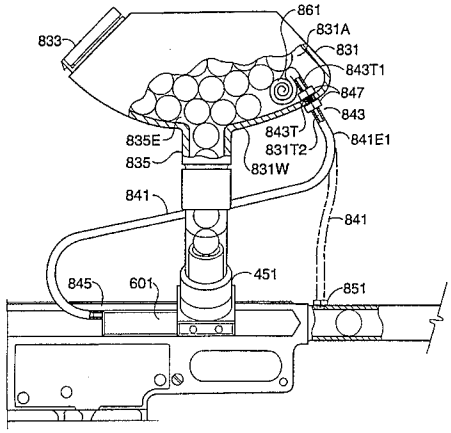
Primary Examiner—John A. Ricci
Attorney, Agent, or Firm—Arthur F. Zobal

[57] **ABSTRACT**

A bolt having an opening formed therethrough is slidably located in the bore of the gun. The bolt is held in a rear position by a sear with the bolt opening closed by a valve which extends into the bolt opening and engages a rear facing bolt seat. A passageway extends into the bolt opening by way of a valve for allowing pressurized gas to flow into the bolt opening. A trigger mechanism releases the bolt for allowing the bolt to be moved forward for allowing the valve and seat to separate for allowing the gas to flow through the bolt opening for forcing a ball from the rear end of the barrel out of the gun. Forward movement of the bolt is stopped by a lock member located in an aperture formed through the wall of the bolt which is forced outward into a slot of the gun body when the lock member reaches the slot. A cock valve located in a cock valve chamber releases gas from the cock valve chamber to force the lock member back into the bolt aperture and to force the bolt back to the rearward position. A ball inlet extends into the bore forward of the bolt when the bolt is in its rear position for allowing balls sequentially to pass into the bore. The bolt return gas is allowed to pass into a feed tube coupled to the ball inlet for forcing the next ball into the ball inlet.

53 Claims, 13 Drawing Sheets





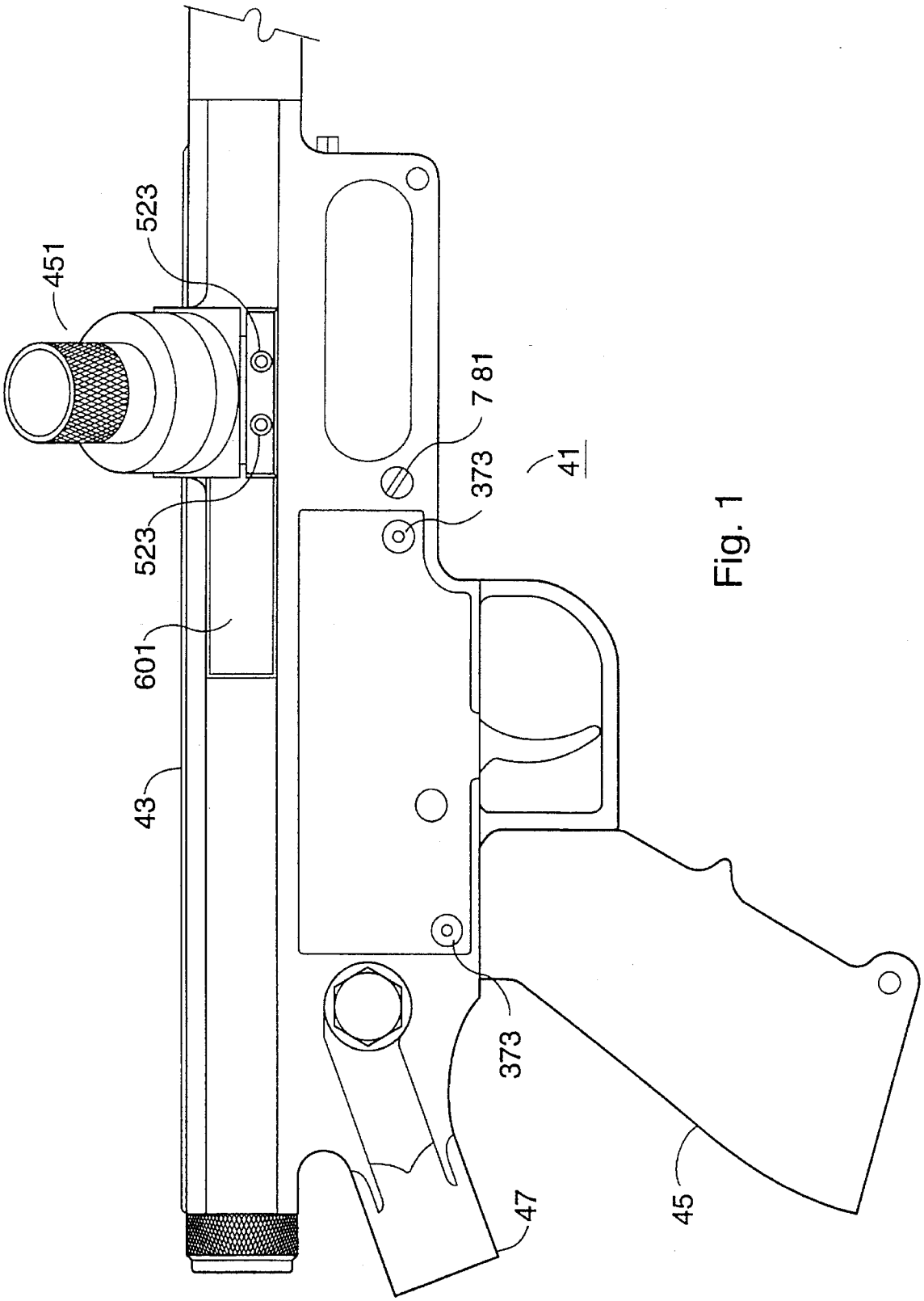
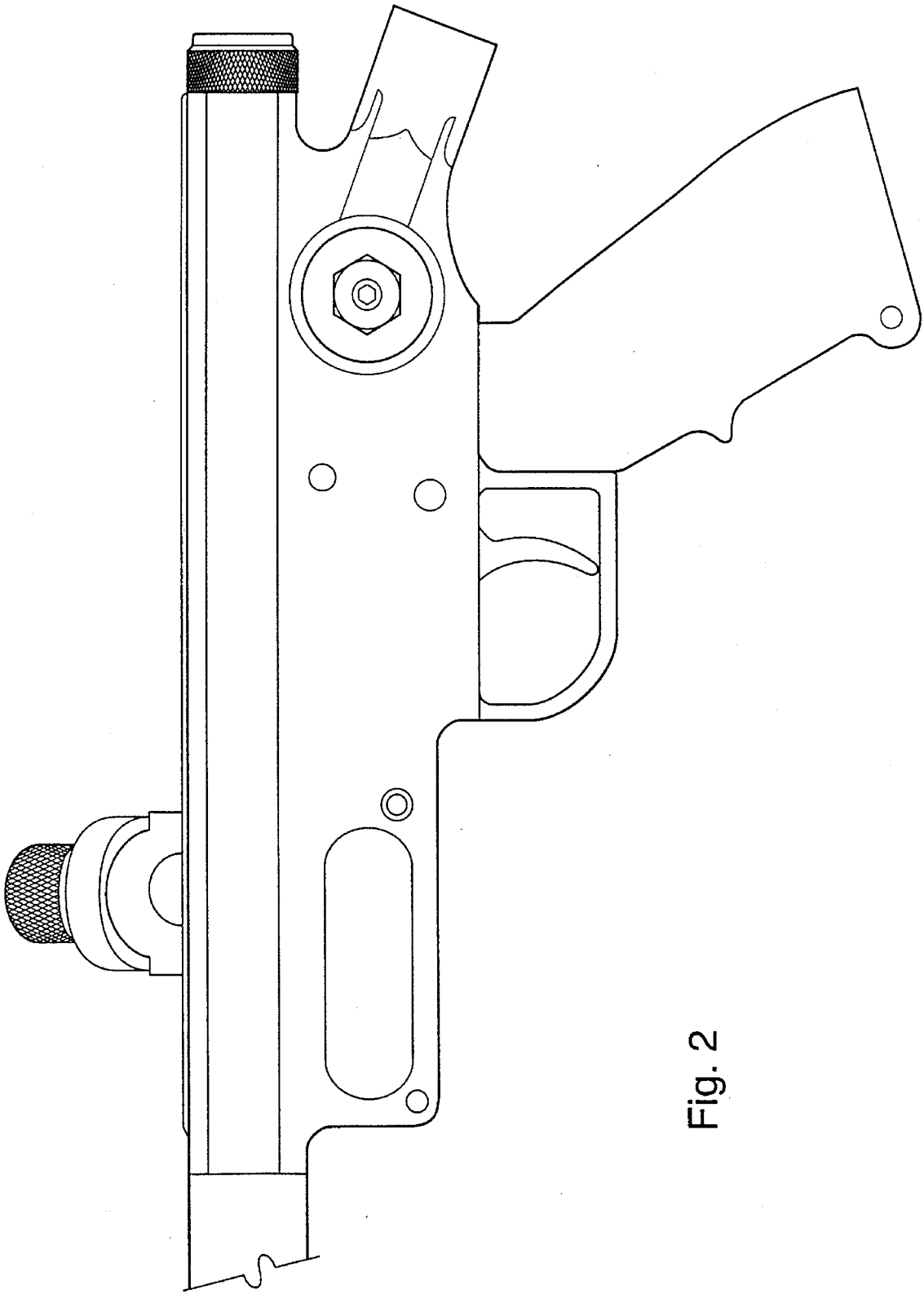


Fig. 1



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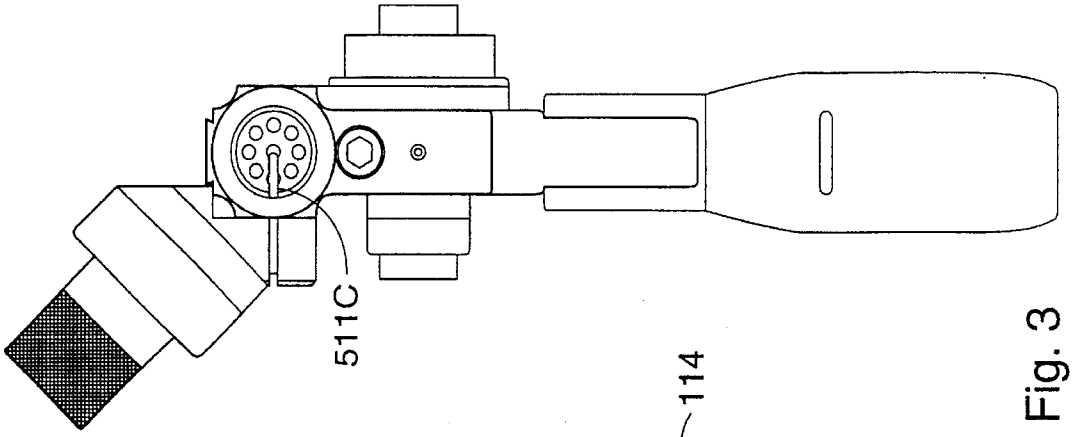

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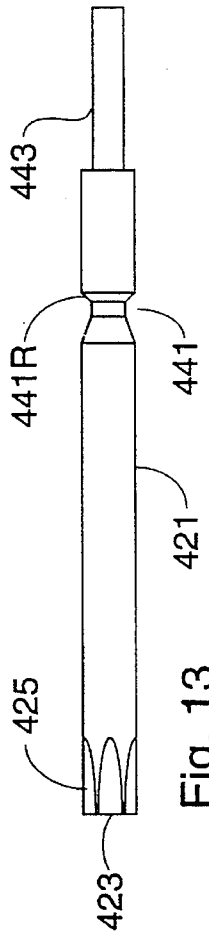
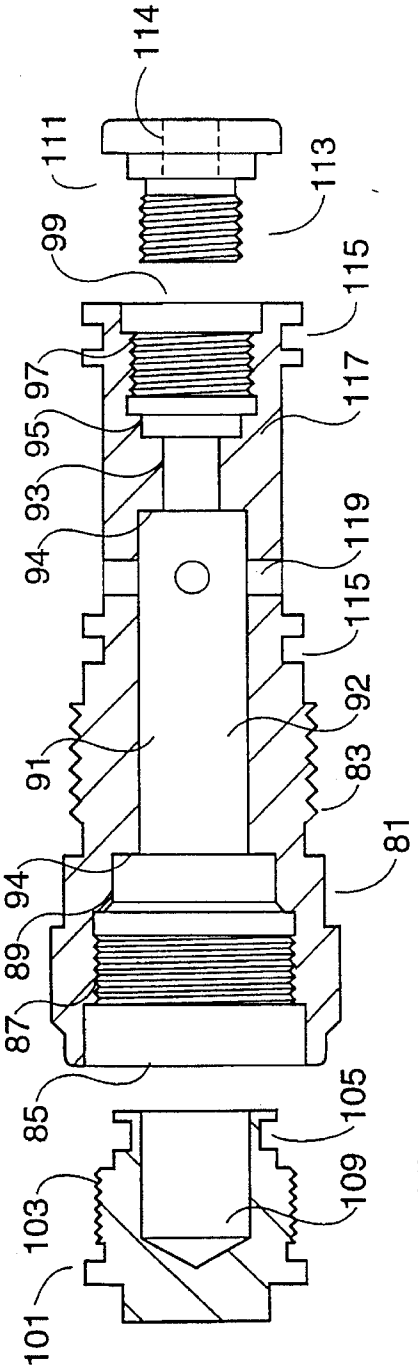


Fig. 13



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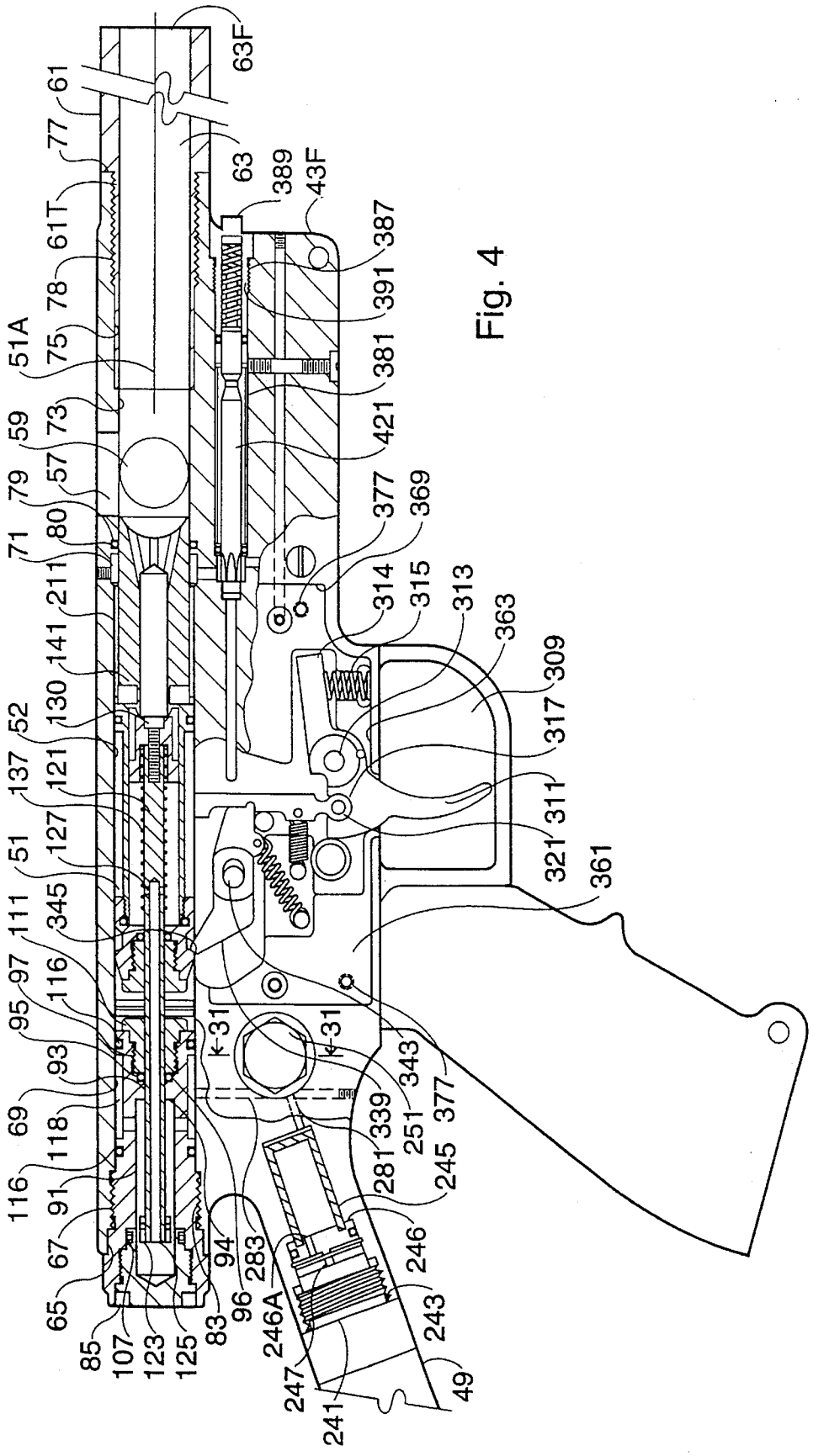
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Fig. 4

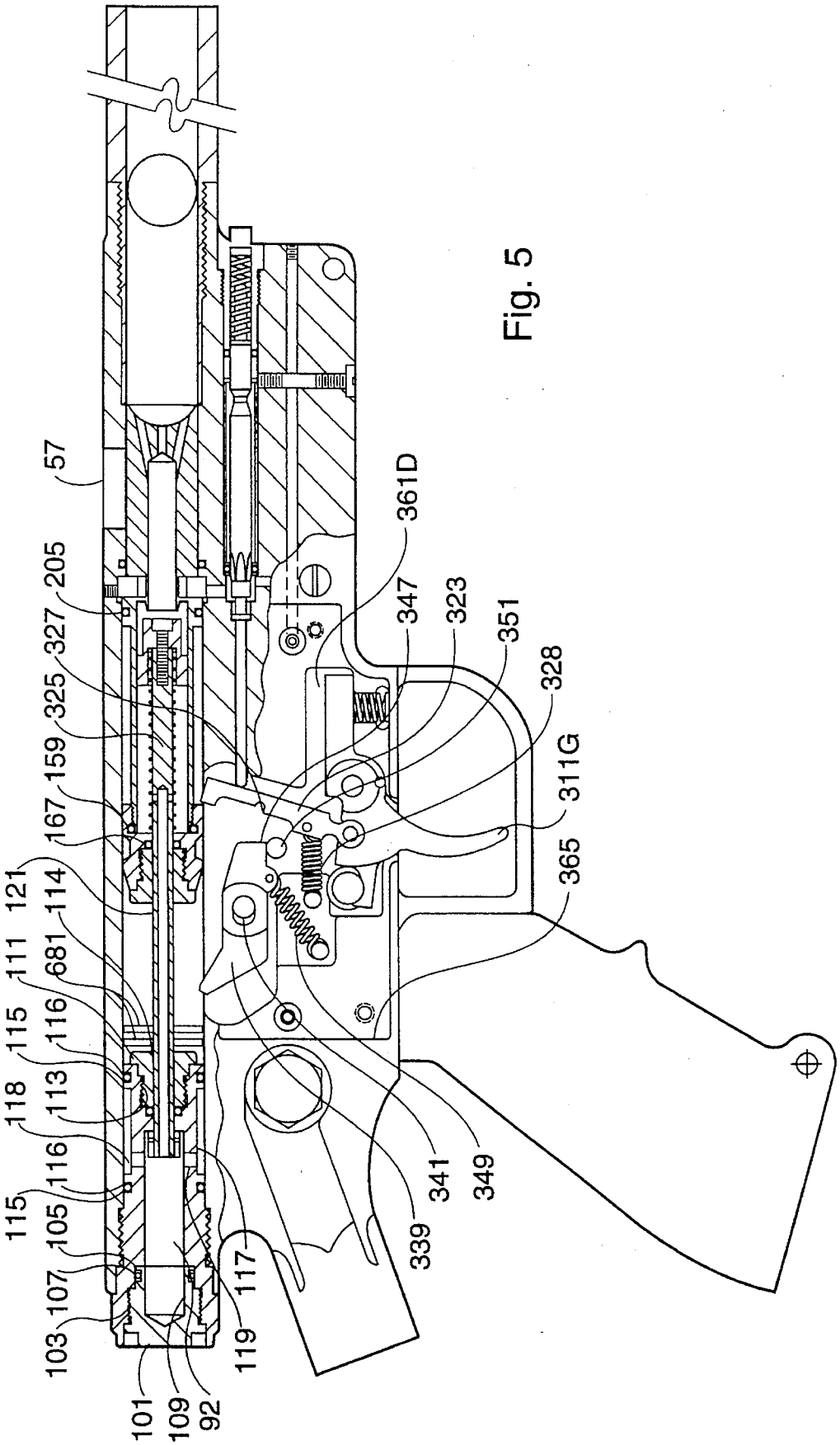
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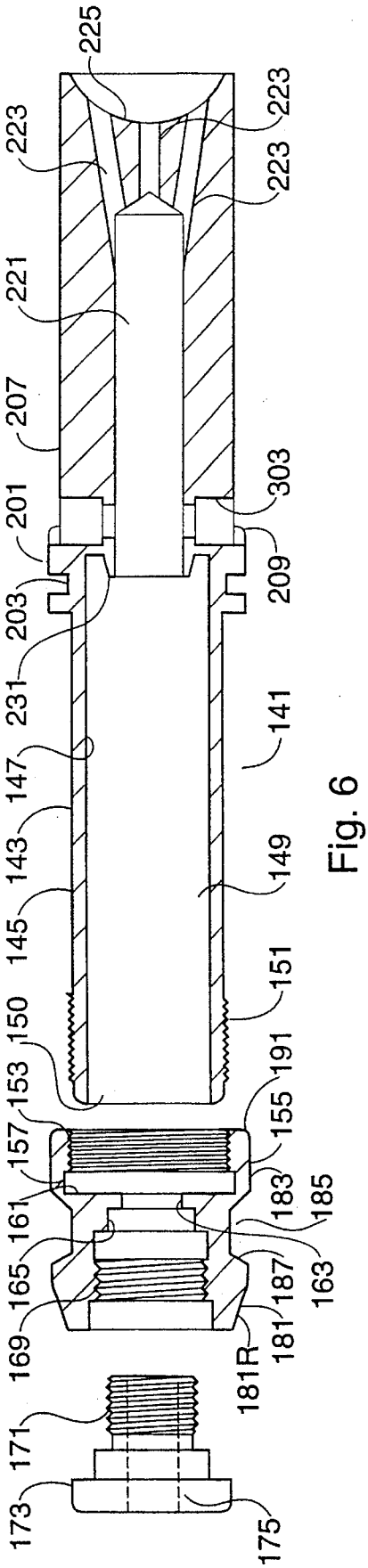
Fig. 5



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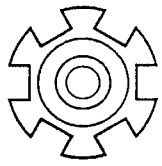

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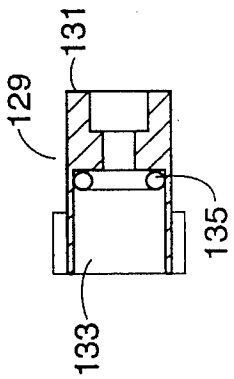

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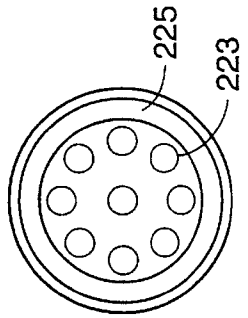

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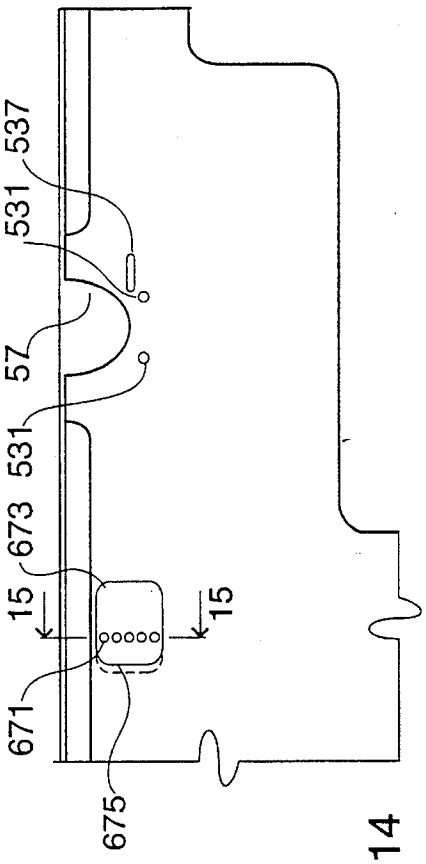

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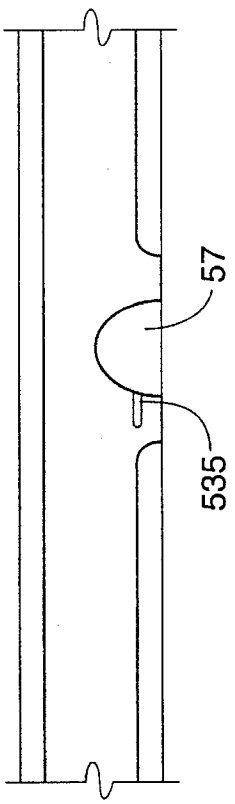

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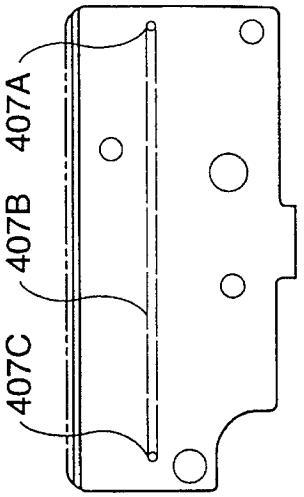

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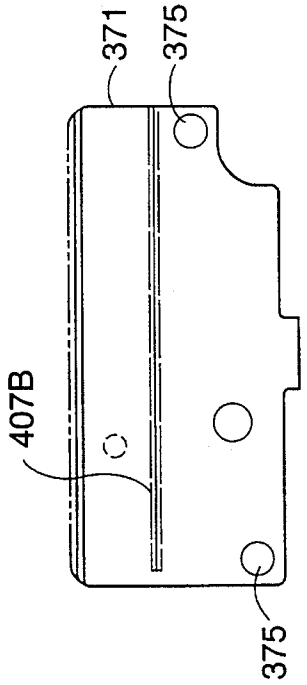

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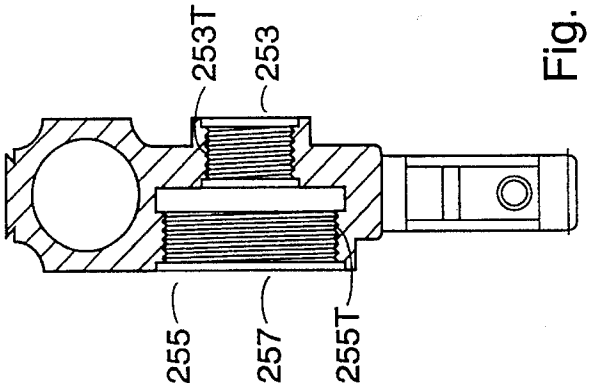

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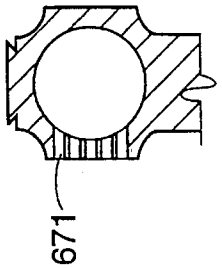

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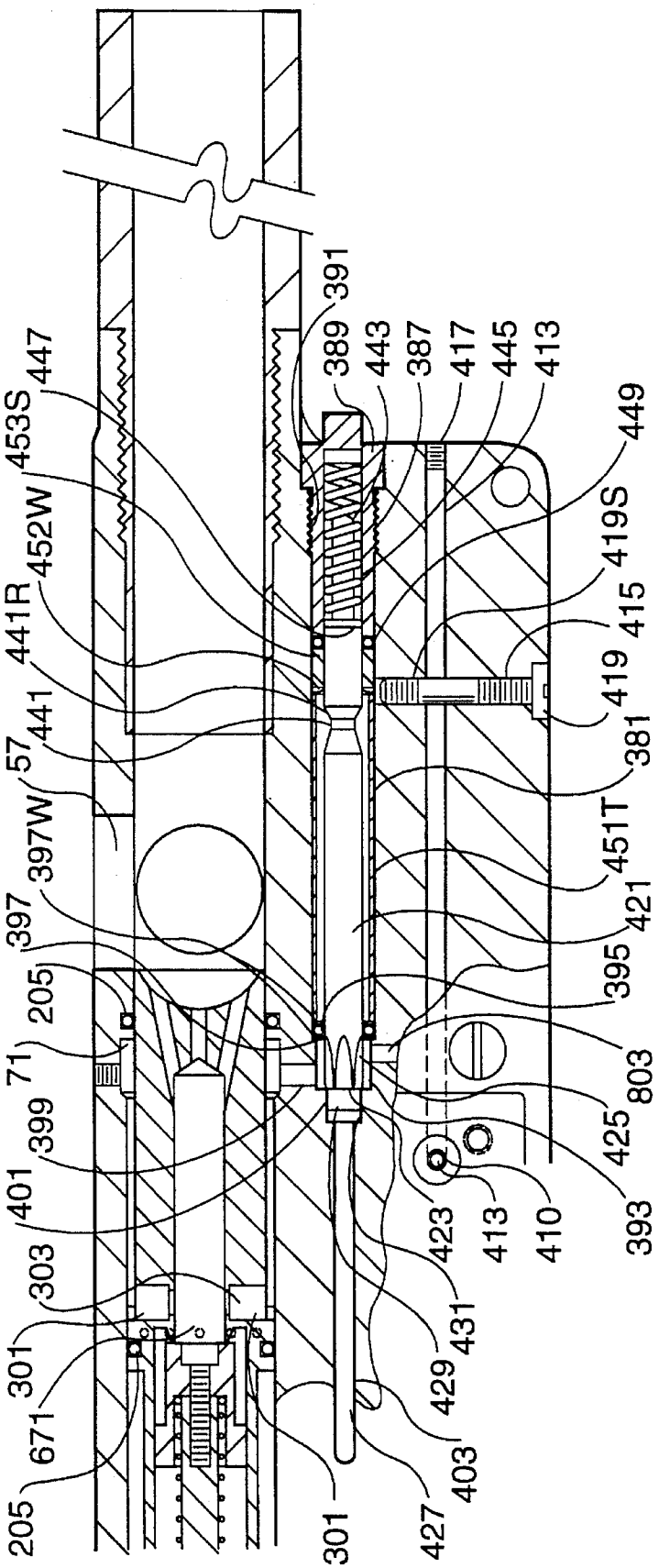
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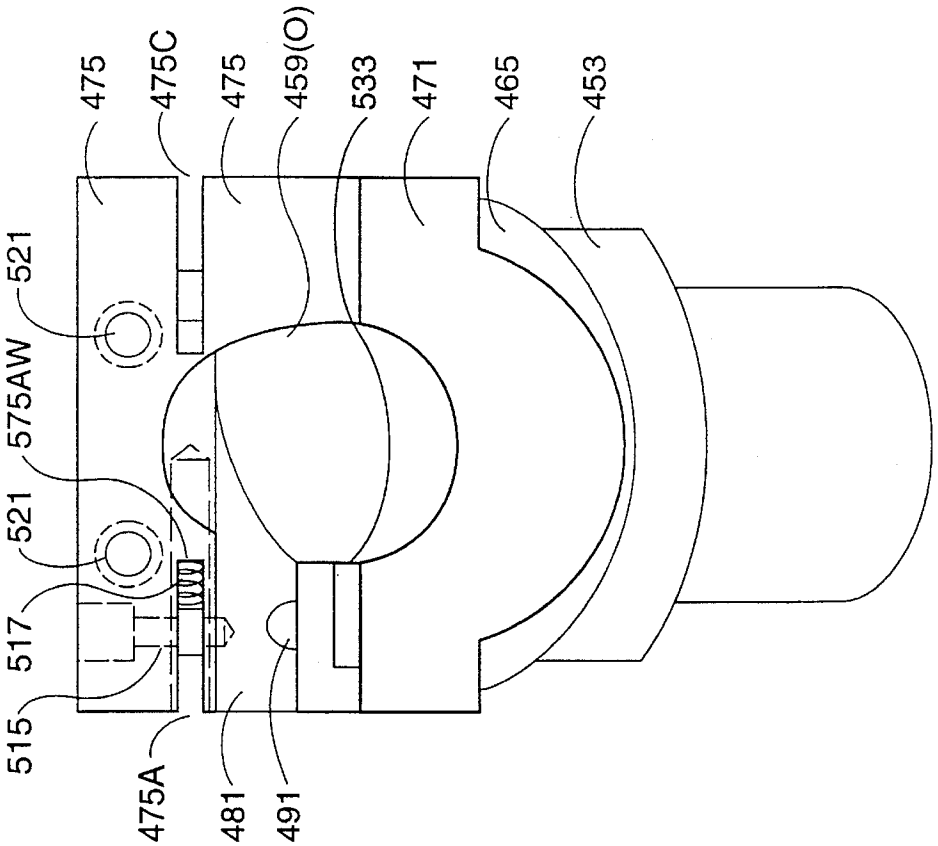
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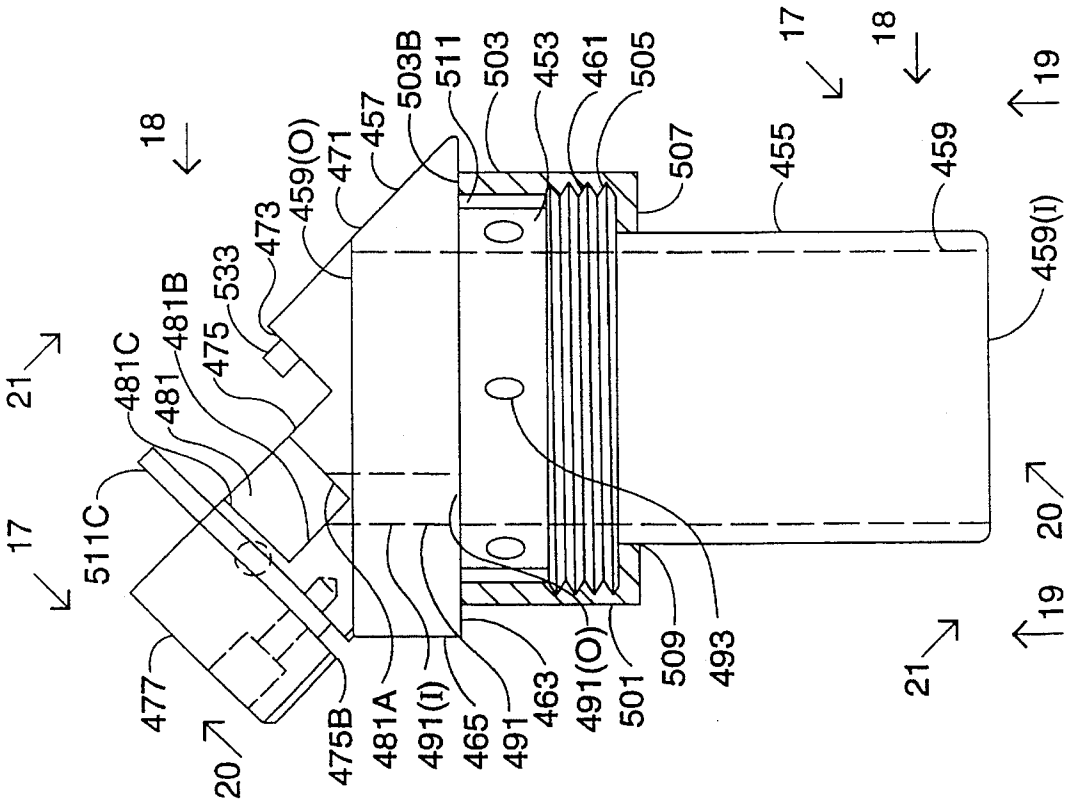
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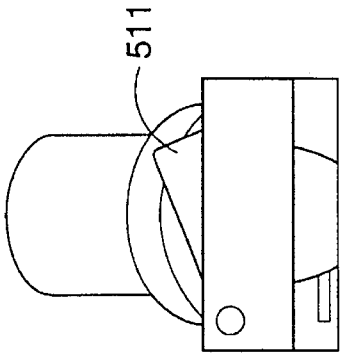

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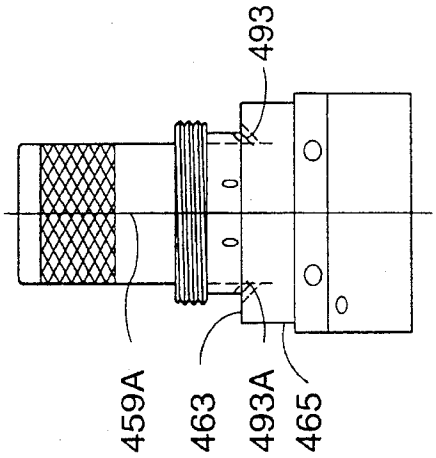

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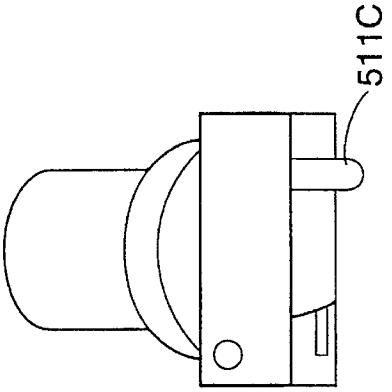

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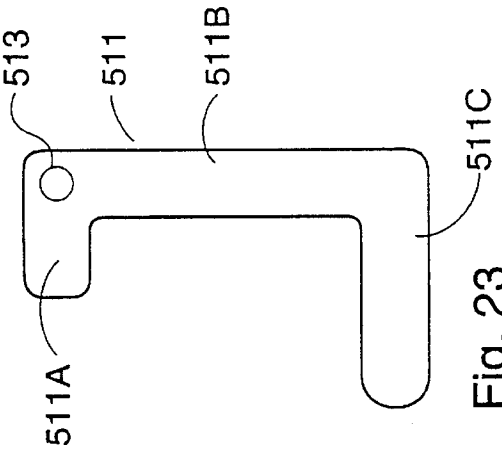

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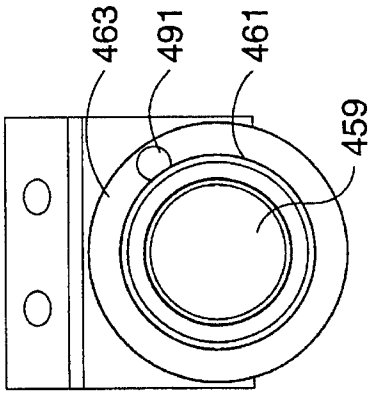

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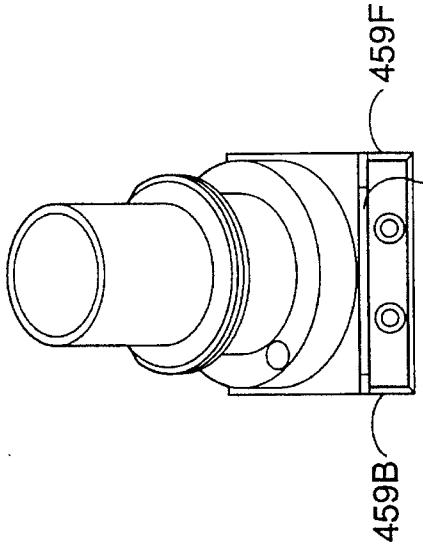

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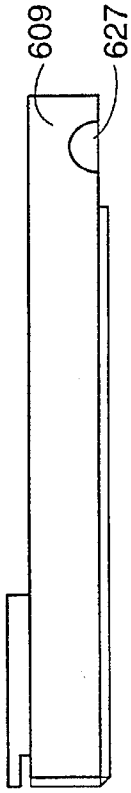

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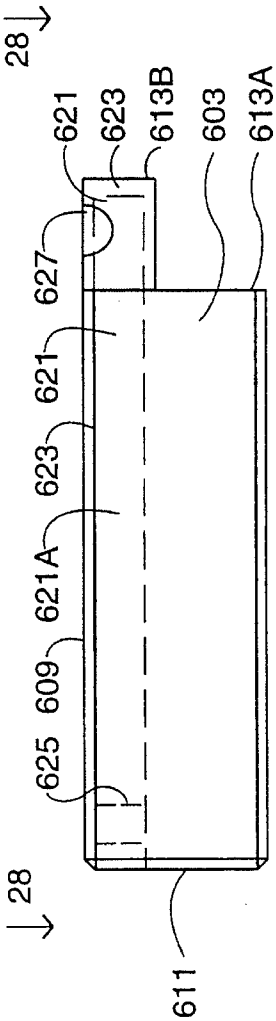

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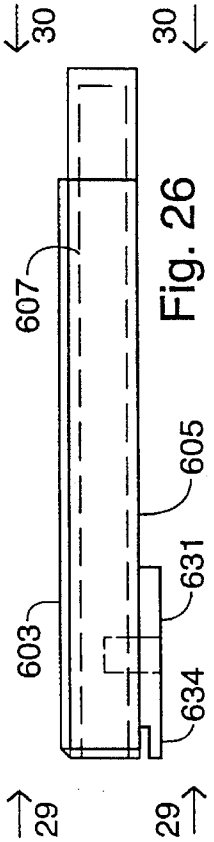

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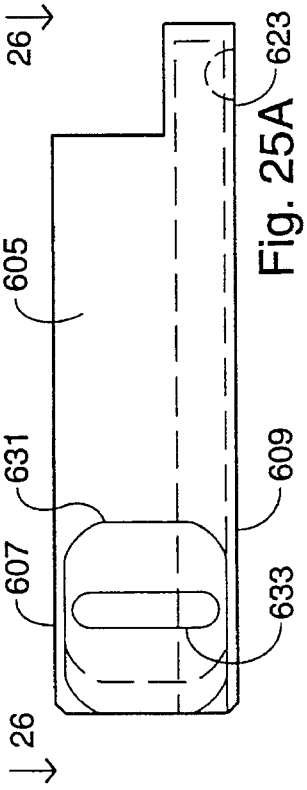

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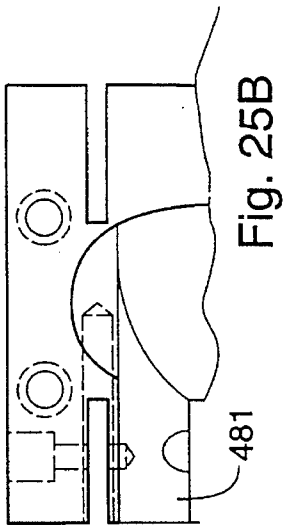

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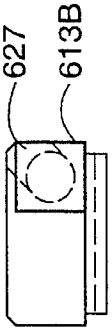

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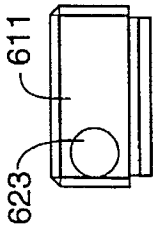

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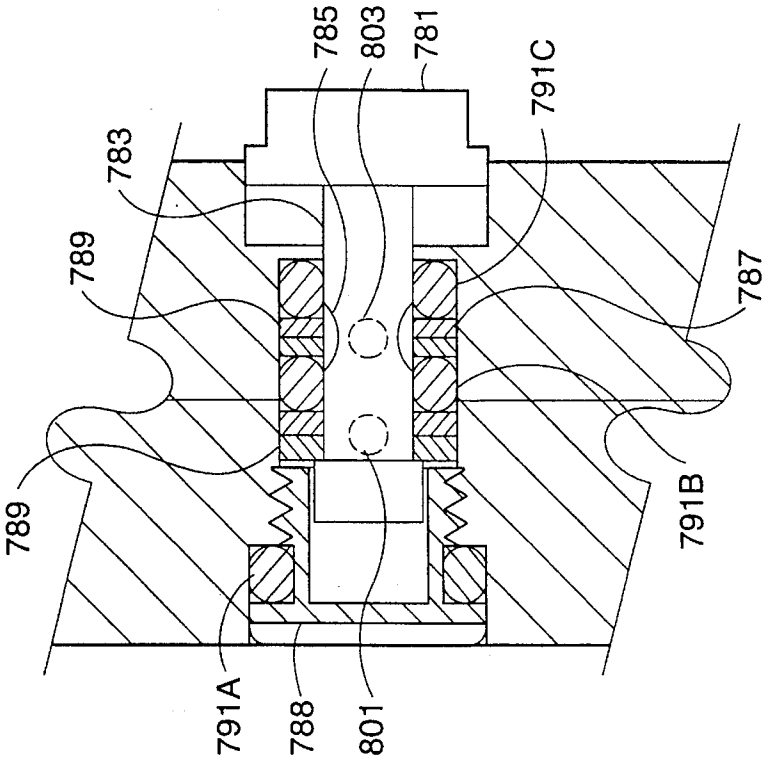
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Fig. 33

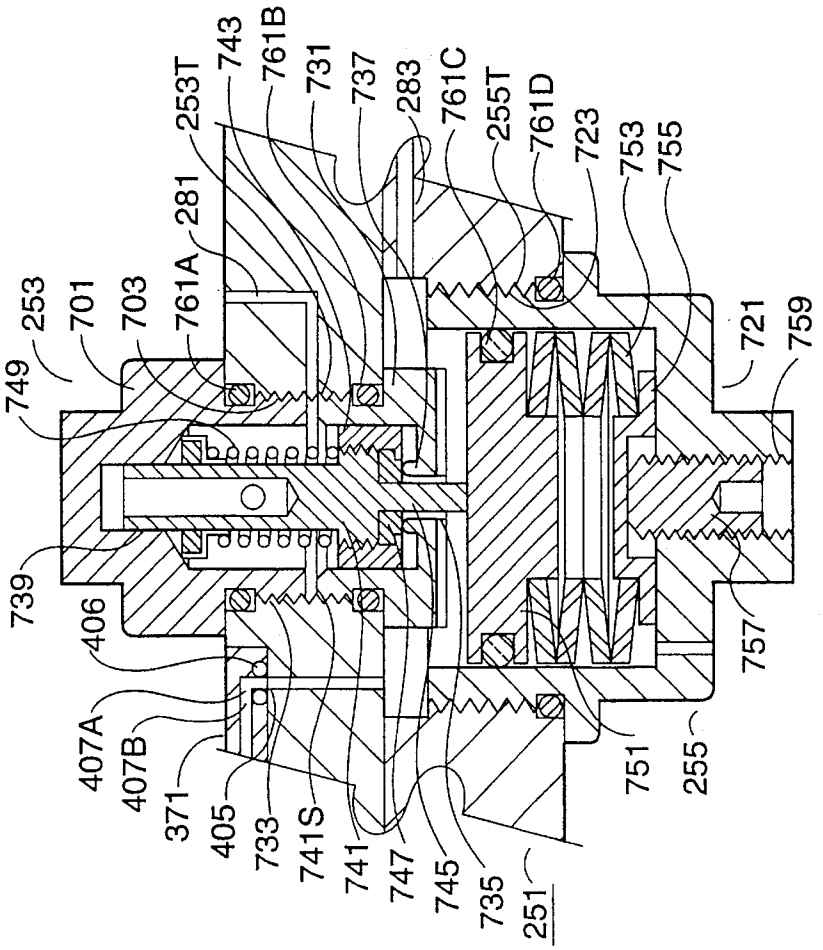
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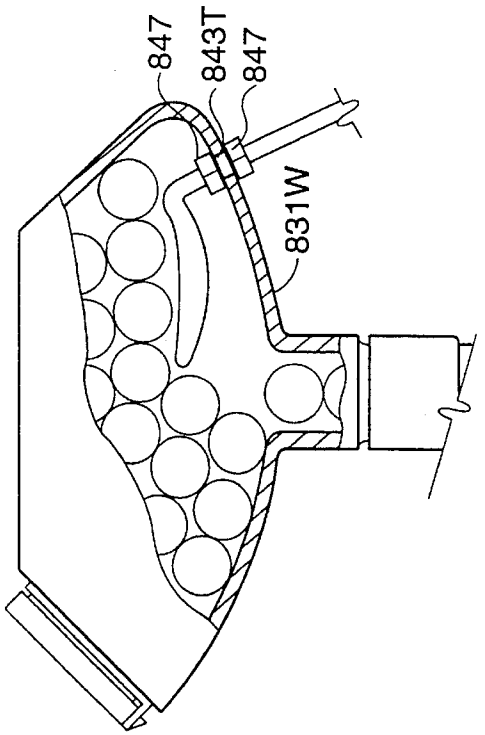
Fig. 32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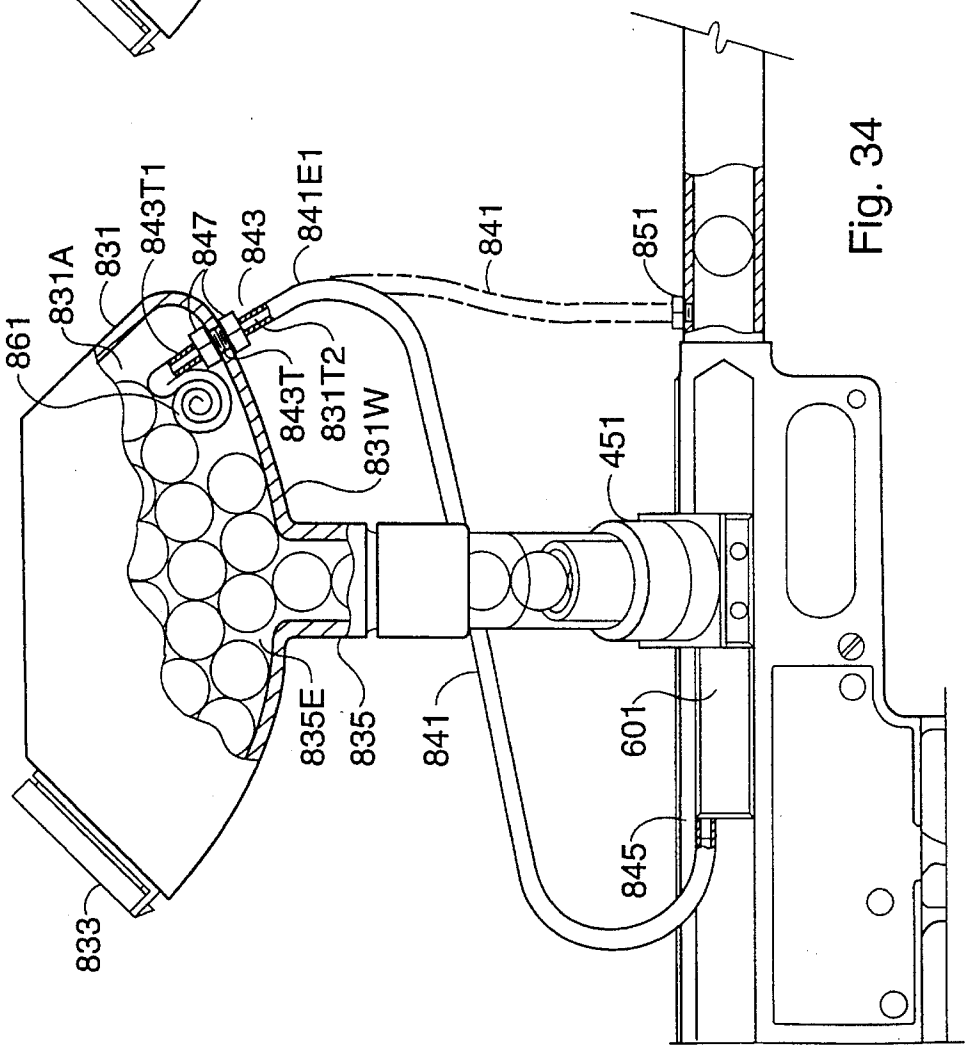
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Fig. 34

PAINT BALL GUN

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a pneumatic gun for shooting balls such as balls filled with liquid paint for sporting events.

2. Description of the Prior Art

U.S. Pat. Nos. 4,819,609; 4,936,282; 5,097,816; 5,161,516; 5,166,457; and 5,228,427 disclosed different types of pneumatic ball guns and ball feed mechanisms.

SUMMARY OF THE INVENTION

It is an object of inventions to provide a new and useful pneumatic ball gun which has a number of advantages over the prior pneumatic ball guns.

The gun comprises a body having an elongated chamber with a front end and rear end, a gun barrel supported by the body and having an aperture extending from the front end of the chamber to a forward open end such that the chamber and aperture form a continuous bore. A ball inlet extends into the bore near the front end of the chamber for allowing a ball to enter the bore for movement in the bore forward of the inlet and out of the forward open end of the barrel. A bolt is located in the chamber for movement between rear cocked and forward positions. The bolt has a central opening with a gas outlet at the front end of the bolt. A valve is provided for closing the gas outlet of the bolt when the bolt is in its rear position in the chamber. A flow path is provided for allowing pressurized gas to flow into the rear portion of the chamber and into the central opening of the bolt. A sear is provided for holding the bolt in its rear cocked position. A trigger mechanism is provided for releasing the sear for allowing the gas in the rear portion of said chamber to move the valve forward for moving the bolt forward for allowing the gas to flow through the gas outlet of the bolt for forcing a ball in the bore out of the forward open end of the gun barrel.

In a further aspect, a slot is formed in the body which extends outward from the front end of the chamber rearward of the ball inlet. At least one lock member aperture is formed through the sidewall structure of the bolt and which leads to the central opening of the bolt. A lock member located in the aperture is movable outward into the slot by the gas in the central opening of the bolt for stopping forward movement of the bolt. The lock member is moveable inward of the lock member aperture to allow the bolt to move in the chamber. The lock member also stops rearward movement of the bolt.

In a further aspect, a cock valve chamber is provided with a cock valve located in the cock valve chamber for movement between forward and rearward positions. A rod is located next to the rear end of the cock valve and extends out of the rear end of the cock valve chamber. A channel is coupled to the cock valve chamber for the passage of pressurized gas into the cock valve chamber. The cock valve is normally held in its rearward position. A connecting channel extends from the rearward portion of the cock valve chamber to the front end of the elongated chamber by way of the lock member slot. A seal surrounding the cock valve normally seals the cock valve chamber from the connecting chamber. The trigger mechanism when moved to its release position, is moved by the bolt to engage the rod and moves the rod and hence the cock valve forward for releasing gas from the cock valve chamber by way of the connecting channel for moving the lock member inward and for flow into the elongated chamber for moving the bolt to its rear position in the elongated chamber for allowing the trigger mechanism and sear to hold the bolt in its cocked position.

In the embodiment disclosed the bolt has a seat in its central opening for engagement with the valve for closing the bolt outlet and a flow path extends into the central opening of the bolt by way of an opening formed through the shaft of the bolt. In addition, means is provided for limiting forward movement of the valve.

In a further aspect a feeder tube is connected to the ball inlet. Bolt return gas is flowed into the feeder tube to enhance movement of the next ball into the inlet.

A ball holding chamber is coupled to the feeder tube. Gas from the gun is directed to an inflatable mechanism in the ball holding chamber for preventing balls from blocking the outlet of the ball holding chamber into the feeder tube.

Means also is provided for mixing oil with the gas in the elongated chamber for lubricating the balls.

In addition, a pressure regulator is provided for regulating the gas pressure applied to the various channels and chambers of the gun.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a right side view of the gun of the invention.

FIG. **2** is a left side view of the gun of the invention.

FIG. **3** is a front view of the gun of the invention.

FIG. **4** is a partial cross-sectional view of the right side of the gun with the bolt in a rearward cocked position.

FIG. **5** is a partial cross-sectional view of the right side of the gun with the bolt in forward released position.

FIG. **6** is an exploded cross-sectional view of the bolt of the gun.

FIG. **7** is a front end view of the bolt of the gun.

FIG. **8** is an exploded cross-sectional view of the valve plug and components thereof.

FIG. **9** is a cross-sectional view of the front cap of the valve which extends into the bolt.

FIG. **10** is a rear end view of the cap of FIG. **9**.

FIG. **11A** is a plan view of the outside of the trigger mechanism cover plate.

FIG. **11B** is a plan view of the inside of the trigger mechanism cover plate.

FIG. **12** is an enlarged view of the cock valve chamber and cock valve in the position of FIG. **4**.

FIG. **13** is a side view of the cock valve.

FIG. **14** is a right side view of a portion of the gun with the air passage block and feeder tuber removed.

FIG. **15** is a cross-sectional view of FIG. **14** taken along lines **15—15** thereof.

FIG. **16** is a view of the top of a portion of the gun with the air passage block and feeder tube removed.

FIG. **17** is a side view of the feeder tube.

FIG. **18** is a view of the feeder tube of FIG. **17** as seen from lines **18—18** thereof.

FIG. **19** is a view of the feeder tube as seen from lines **19—19** of FIG. **17**.

FIG. **20** is a view of the feeder tube as seen from lines **20—20** of FIG. **17**.

FIG. **21** is a view of the feeder tube as seen from lines **21—21** of FIG. **17**.

FIG. **22** is a view similar to that of FIG. **21** with the ball stop in the out of the way position.

FIG. **23** is a side view of the ball stop.

FIG. **24** is a side view of the feeder tube.

FIG. **25A** is an inner side view of the air passage block.

FIG. **25B** is a partial view of the feeder tube block similar to that to FIG. **18** illustrating the attachment of the air passage block to the feeder tube block.

FIG. **26** is a view of FIG. **25A** as seen from lines **26— 26** thereof.

FIG. **27** is an outer side view of the air passage block.

FIG. **28** is a view of the air passage block of FIG. **27** as seen from lines **28—28** thereof.

FIG. **29** is an end view of the air passage block of FIG. **26** as seen from lines **29—29** thereof.

FIG. **30** is an end view of the air passage block of FIG. **26** as seen from lines **30—30** thereof.

FIG. **31** is a cross-section of FIG. **4** taken along lines **31—31** thereof and with the regulator valve removed.

FIG. **32** is a cross-section of the gas regulator valve.

FIG. **33** is a cross-section of a bolt return button.

FIG. **34** illustrates a ball holding chamber coupled to the feeder tube with a pneumatic tongue agitator in a deflated condition.

FIG. **35** illustrates the pneumatic tongue agitator in an inflated condition.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. **1–5** of the drawings, the gun of the invention is identified by reference numeral **41**. It comprises a metal body **43** having a handle or hand grip **45**; an inlet **47** to which a bottle **49** of pressurized gas such as CO2 is coupled; an elongated chamber **51** which a slidable valve **121** and a slidable bolt **141** are located, a ball inlet **57** for receiving a ball **59**, a feeder tube **451** coupled to the ball inlet; a barrel **61** with an aperture **63** coupled to the front end of the body such that the elongated chamber **51** and aperture **63** form a continuous bore, a sear **339**, a trigger mechanism **309**, and cock valve chamber **381** in which a cock valve **421** is slidably located.

The chamber **51** has a rear open end **65** with inner threads **67**, an inner cylindrical wall **69**, a larger diameter inner cylindrical slot **71**, a forward inner cylindrical wall **73** of lesser diameter than wall **69**, and a larger diameter inner cylindrical wall **75** with an open end **77** and inner threads **78**. A small cylindrical slot **79** has a sealing O-ring **80** located therein.

The barrel **61** has outer threads **61T** at its rear end which is located in the end **77** of the chamber **51** and screwed to the threads **78**.

Referring also to FIG. **8**, a valve plug **81** having outer threads **83** is inserted into the rear end **65** of the chamber **51** and removably screwed to the threads **67**. The valve plug **81** has an opening formed therethrough comprising a rear open cylindrical end **85** with inner threads **87**; a smaller cylindrical portion **89** which leads to a smaller cylindrical portion **91** which leads to a still smaller cylindrical portion **93** having a rearward facing shoulder **94**. Wall **93** leads to a cylindrical slot **95** in which a sealing O-ring **96** is located which in turn leads to a larger diameter portion with threads **97** and an open end **99**. A rear end plug **101** having threads **103** and an annular slot **105** with an O-ring **107** is screwed to the threads **87**. The rear end plug **101** has a cylindrical opening **109** formed therein with the same diameter as opening **91**. A front end O-ring plug **111** having threads **113** is screwed to the threads **97**. The O-ring plug **111** has a cylindrical opening **114** with the same diameter as opening **93**. Annular slots **115** are formed in the outer wall of the valve plug **81** for receiving O-rings **116**. A smaller diameter outer wall **117** is formed between the slots **115** defining an annulus **118** with apertures **119** formed through the wall **117** communicating the annulus **118** with the opening **92** within the cylindrical wall **91**.

A valve tube **121** is slidably located in the openings **93** and **114** and within the valve plug **81**.

Referring also to FIG. **6**, the bolt **141** comprises a cylindrical member **143** having an outer cylindrical wall **145** and an inner cylindrical wall **147** forming a rear cylindrical open portion **149** leading to a rear open end **150**. The outer wall **145** has threads **151** which are screwed into the threads **153** of a rear bolt cap **155**. The bolt cap **155** has an annular slot **157** for holding an O-ring **159**; a forward facing shoulder **161**, a small cylindrical opening **163** for slidably receiving the valve tube **121**, an annular slot **165** for receiving an O-ring **167** and inner threads **169** into which the threads **171** of an O-ring plug **173** are screwed. The O-ring plug **173** has a cylindrical opening **175** for slidably receiving the valve tube **121**.

The bolt cap **155** has outer cylindrical wall portions **181** and **183** for slidingly engaging the chamber wall **52**. An outer annular slot **185** is formed between wall portions **181** and **183** with a canted forward facing wall **187** for engaging the end **345** of the sear **339**. The bolt member **155** also has a forward facing outer annular wall **191**.

The cylindrical member **143** leads to a forward outer cylindrical wall **201** for slidingly engaging the chamber wall **52**. An annular slot **203** is formed in wall **201** for receiving an O-ring **205**. The outer wall **201** leads to a smaller diameter outer wall **207** with a forward facing shoulder **209** formed therebetween. The wall **207** forms an annulus **211** when located in chamber wall **52** and is slidingly received in chamber wall **73**.

A cylindrical outlet opening **221** is formed in the front portion of the bolt **141** which is in fluid communication with opening **149** and which has smaller diameter outlet openings **223** leading to the forward end of opening **221**. One of the openings **223** is at the axis of the bolt and the other openings **223** fan out to the front end **225** of the bolt **143**.

Between openings **149** and **221** a rearward facing annular seat **231** is formed.

The valve tube **121** has a rear stop member **123** secured around the rear end of the valve tube **121**. A bore **125** is formed into the valve tube **121** from its rear end forward with radial outlet openings **127** formed into the valve tube **121** such that they communicate with the bore **125** and are located in the bolt opening **149** at all positions of the bolt and valve. The forward portion of the valve is solid. A forward cap **129** is attached to the forward end of the valve tube **121** by way of a bolt **130**. The cap has an annular forward facing surface **131** for engaging the bolt seat **231** when the bolt is in its cocked position as shown in FIG. **4**. The cap **129** has a rear opening **133** surrounding the forward portion of the valve tube **121** and an O-ring **135**. A coiled spring **137** surrounds the valve tube **121**. Its forward end engages the O-ring **135**. The rear end of the spring **137** engages the shoulder **161** of the bolt cap **155** and urges the valve tube forward relative to the bolt.

The gas inlet **47** has an opening **241** formed therein with threads **243** to which the threaded outlet end of a source **49**

of gas under pressure is screwed. A filter **245** is located in the opening **241**. The filter **245** is connected to an adapter **246** which has three apertures **246**(A) formed therethrough and a pin **247**. When the source **49** is screwed into the threads **243**, the pin **247** opens the valve on the bottle **49** and allows gas to flow into the channel **281** by way of the openings **246**A and the filter **245**.

A pressure regulator **251** having a high pressure side **253** and a low pressure side **255** is located in an opening **257** (See FIGS. **31** and **32**) formed through the gun body.

An inlet channel **281** is formed in the gun body from the opening **241** to the side of the opening **257** in which the high pressure side of the regulator **251** is located such that the channel **281** leads to the high pressure side **253** of the gas regulator **251**. An outlet channel **283** is formed in the gun body from the opening **257** in which the lower pressure side **255** of the regulator **251** is located through the wall **52** of the chamber **51**. Thus the channel **283** extends from the low pressure side of the regulator **251** to the annulus **118** formed between the valve plug wall **117** and the chamber wall **51**.

Gas from the source **49** passes through channel **281** to the high pressure side **253** of the regulator, to the low pressure side **255**, from the low pressure side through the channel **283**, into the annulus **118**, through the apertures **119** of the bolt to the opening **92**, into the valve bore **125**, through the apertures **127** and into the bolt opening **149** forcing the surface **131** of the valve cap **129** against the seat **231** when the bolt is in its cocked position.

The bolt is held in this position by the sear **339**. When the end **345** of the sear **339** is released from the wall **187** of the bolt, the pressurized gas in the valve plug **81** forces the valve tube **121** forward which in turn forces the bolt forward to a position as shown in FIG. **5**. The valve tube **121** moves forward until it is stopped by the rear stop member **123** engaging the surface **94** of the valve plug **81** allowing the valve cap surface **131** to separate from the seat **231** as the bolt continues to move forward. This allows the pressurized gas in the bolt opening **149** to flow through the bolt opening **221** and through openings **223** for forcing a ball **59** in the bore **63** out of the front open end **63**F of the barrel.

Forward and rearward movement of the bolt **141** is stopped by resilient lock members **301** slidably located in radial extending apertures **303** formed into bolt wall **207**. The lock members **301** slide with the bolt until they reach the annular slot **71**. At this position, the pressurized gas in the opening **221** forces the lock members **301** out into the slot **71** stopping forward movement of the bolt. In one embodiment there are six apertures **303** formed through the bolt wall with six lock members **301** located therein respectively.

The trigger mechanism **309** comprises a trigger member **311** pivotally coupled to the body by pin **313**. The forward end of the trigger **311** has a bar **314** with a spring **315** engaging the underside of the bar and bottom wall **363** of a deeper cavity **361**D formed in cavity **361** for normally urging the trigger member counter-clockwise as shown in FIG. **4**. A partially round slot **317** is formed in the rear end of the trigger member for pivotally receiving a round end **321** of a trip member **323** also located in the cavity **361**D. The trip member **323** has an upper end **325** and an engaging surface **327**. A spring **328** is coupled to the trip member **323** and to the gun body for normally urging the trip member counter-clockwise as shown in FIG. **4**.

The sear **339** has an elongated slot **341** in which a pin **343** connected to the gun body is located to allow the sear **339** to pivot about the pin **343**. The sear also is located in the cavity **361**D. It has an end **345** for engaging the surface **187** of the bolt member **155** for holding the bolt in a cocked position. The sear **339** has an opposite end **347** for engaging the surface **327** of the trip member **323**. A spring **349** is coupled to the sear **339** and to the gun body for normally urging the sear **339** in a clockwise direction as shown in FIG. **4**. A stop **351** limits clockwise movement of the sear **339**. Members **311**, **323** and **339** are located in the deeper cavity **361**D.

When the trigger member finger grip **311**G is moved clockwise as shown in FIG. **4**, the trip member **323** is moved upward which pivots the sear **339** counter-clockwise as shown in FIG. **4**, releasing the sear end **345** from the bolt surface **187** to allow the gas in the valve plug **81** to move the tube valve **121** forward which moves the bolt forward to fire the gun.

The cavity **361** is formed by a bottom wall **363**, a rear wall **365**, and a front wall **369**. The top of the cavity **361**D is open to the chamber **51**. A removable plate **371** covers the cavity. The plate is held in place by screws **373** extending through apertures **375** formed through the plate **371** and screwed into threaded apertures **377** formed in the gun body. Removal of the plate **371** allows easy access to the sear and trigger mechanism for repair or replacement purposes.

The cock valve chamber **381** comprises a cylindrical opening formed in the forward end **43**F of the body rearward. Threads **387** are formed in the chamber **381** at its forward end in which a cap **389** having threads **391** is inserted and screwed to the threads **387**. The chamber **381** has a smaller diameter rear end **393** with an O-ring **395** located between two washers **397**W one of which engages a shoulder **397** formed between walls **381** and **393**. The chamber portion **393** has an aperture **399** leading to the annular slot **71**. A smaller front diameter aperture **401** leads to a rod aperture **403** which opens into the cavity **361**D.

A connecting channel extends through the gun body from the low pressure side **255** of the regulator **251** to a channel **413** which is in fluid communication with a threaded aperture **415** which leads to the chamber **381**.

Referring to FIGS. **11**A, **11**B, and **32**, the connecting channel comprises an aperture **405** formed through the wall of the gun body, O-ring **406** surrounding aperture **405**; an inlet **407**A, channel **407**B, an outlet **407**C formed in the trigger plate **371** and O-ring **410** surrounding the inlet to the channel **413**. The front end of the channel **413** is plugged by a threaded member **417**. An integral seal screw **419** is screwed into the aperture **415**. Gas from the low pressure side of the regulator passes into the chamber **381** by way of the connecting channel **413** and aperture **415**. The flow of the gas through aperture **415** is controlled by adjustment of a set screw **419**S which is separate from screw **419**. Adjustment of set screw **419**S is carried out before screw **419** is screwed into the aperture.

The cock valve **421** is a solid cylindrical member having a rear end **423** with slots **425** at its rear end. A rod **427** having a larger diameter portion **429** is slidably located in aperture, **401**, **403** with the end of rod portion **429** abutting against the end **423** of the valve **421** and with its rear end extending into the cavity **361**D. Member **431** is an O-ring.

An annular slot **441** is formed in the valve **421**. The front of the cock valve has a smaller diameter portion **443** around which a coiled spring **445** is located. The spring engages the plug **389** and shoulder **447** and urges the cock valve **421** rearward such that the slot **441** is rearward of the aperture **415** and the slots **425** are rearward of the O-ring **395**. Member **449** is an O-ring. In the cock valve chamber **381**,

member **451T** is a tube for holding the front washer **397W** in place and for holding a wave spring washer **452W** against a spacer **453S**.

When the finger grip **311G** of the trigger member is pulled backward to release the sear end **345** from the bolt surface **187** to allow the gas in the valve plug **81** to move the valve plug **121** forward which moves the bolt forward, the surface **191** of the bolt engages the top of the trip member **323** as shown in FIG. **5** and moves it forward causing the trip member to engage the rear end of the rod **427** and move it and the valve **421** forward to locate the slots **425** forward of the O-ring **395** and the annular slot **441** forward of the aperture **415**. This allows gas in the chamber **381** to flow to engage the forward side of the annular slot **441** and momentarily hold the valve in the forward position and allows gas in the chamber **381** to flow under the O-ring **395** by way of the slots **425** into the aperture **399** and into the annular slot **71** forcing the lock members **301** inward in the apertures **303** and by way of the annular slot **71** forcing the bolt **141** rearward to its cocked position. The rearward surface **181R** of the bolt member **155** forces the end **345** of the sear **339** downward allowing it to fit into the slot **185** and hold the bolt **141** in its cock position. When the trigger grip is released, the trigger member and trip member are rotated backward. The trip member is stopped by pin **351** with its surface **327** under the sear end **347** ready for another shot.

As the gas flows into the cock valve chamber **381**, upon movement of the cock valve **421** forward, the pressure acts against the surface **441R** to hold the valve **421** in its forward position momentarily. When the pressure in the chamber **381, 393, 399** and **71** equalizes, the spring **445** will push the valve **421** and its slots **425** rearward of the O-ring **395** to terminate flow of gas through aperture **399**. As the valve **421** is pushed rearward by the spring **445**, it pushes the rod **427** rearward ready for the next shot.

The lock out members **301** stop forward and rearward movement of the bolt and until they are pushed back into their apertures **303** which in effect allows the bolt to be held in a stationary position momentarily. This allows the ball to be forced completely out or nearly out of the barrel before the bolt starts returning to its cocked position. This allows the gun to shoot a ball further than if this timing feature was not employed. This timing feature simulates a pump gun with a closed bolt and allows a pressure of 435 psi to push a ball to 300 fps.

Referring now to FIGS. **1, 3, 12, 14–30**, there will be described the feeder tube **451** and air passage block **601** for feeding balls to the inlet **57**. The inlet **57** is formed on the top right and right side of the gun such that it extends into the chamber **51** at an angle of 45° relative to the central axis **51A** of the chamber **51**. The feeder tube **451** has a cylindrical wall **453, 455** extending from a block **457** with a cylindrical opening **459** extending therethrough from an inlet or top end **459(I)** to an outlet or lower end **459(O)**. The wall **453** is thicker than wall **455**. Threads **461** are formed between walls **453** and **455**. A shoulder **463** formed on block **457** surrounds the base of cylindrical wall **453**. Wall **465** is partially cylindrical.

The block **457** has a flat surface **471** at an angle of 45° relative to shoulder **463** which cuts into wall **465**, a surface **473**, 90° relative to surface **471**, a surface **475** 90° relative to surface **473** and a surface **477**, 90° relative to surface **475**. Thus surfaces **471** and **475** are parallel and surfaces **473** and **477** are parallel. A slot **481** having walls **481A, 481B**, and **481C** is formed in surface **475** from the outer wall to the opening **459**. An aperture **491** is formed through annular wall **465** from walls **481A** and **481B** of slot **481** which extends through shoulder **463**. The inlet of the aperture is identified at **491(I)** and its outlet is identified at **491(O)**. A plurality of apertures **493** extend through wall **453** at an angle of 55° relative to the axis **459A** of aperture **459** such that their axes **493A** intersect the axis **459** below the shoulder **463** and near the outlet **459(O)**.

A cap **501** comprising a cylindrical wall **503** with threads **505** and an inward extending top wall **507** with a circular opening **509** is located around the wall **455** with its threads **505** screwed to threads **461** with its bottom edge **503B** engaging shoulder **463** to form an annulus **511** around the wall **453** and the apertures **493**. The aperture **491** extends through the shoulder **463** such that gas injected through aperture **491** within the slot **481** flows into the annulus **511**, through the apertures **493** toward the outlet opening **459(O)**.

The block portion **457** has slots **475A, 475B** and **475C** in which member **511** having arm portions **511A, 511B**, and **511C** is located with arm **511A** located in slot **475A**, arm **511B** located in slot **475B**, and arm **511C** located in slot **475C** and extending beyond surface **475** as shown in FIG. **17**. The juncture of arms **511A** and **511B** has an aperture **513** extending therethrough for receiving a screw **515** allowing the member **511** to pivot about the screw **515**. A coiled spring **517** is secured to the inside of arm **511A** and to the wall **475AW** to normally urge the arm **511C** out and perpendicular to wall **475** as shown in FIG. **17**.

Two apertures **521** are formed through block portion **475** for allowing two bolts **523** to attach the feeder tube to the body of the gun by way of two threaded apertures **531**. When attached, the flat surface **475** of the block will engage the flat right side of the body of the gun and tab **533** of the block **457** will fit in slot **535** formed in the top side of the gun next to inlet **57**. A slot **537** is formed through the wall of the gun next to the inlet **57** which extends to the chamber **51** for receiving the arm **511C** of member **511** which arm will extend into the chamber **51** as shown in FIG. **3** and act to hold a ball in the chamber when the gun is not being fired. The arm **511C** can pivot in the slot **475C** out of the chamber **51** in the manner shown in FIGS. **21** and **22**. The side **459F** of the feeder tube blocks is located in front of the side **459B** such that the ball when pushed by the bolt will move the arm **511C** out of the chamber **51**. The bolt will continue to move forward separating the valve cap **131** from the seat **231** allowing the pressurized gas to force the ball out of the bore. In this position the bolt will hold the arm **511C** out of the chamber. The bolt then is returned to its rearward position allowing the arm **511C** to return into the chamber **51**.

An air block **601** is provided for channeling bolt return air from the chamber **51** to the inlet **491(I)** of the feeder tube **451**. Referring to FIGS. **1, 12, 14, 15**, and **23–30**, the air block **601** has an outer side **603**, an inner side **605**, a bottom side **607**, a top side **609**, a rear end **611**, and a front end **613A, 613B**. An aperture **621** extends from the rear end to near the end of a front extension **623**. The aperture **621** is plugged by a screw **625** at the rear end. An opening **627** is formed through the wall of the extension **623** from sides **609** and **603** at an angle of 45° relative to the axis **621A** of the aperture **621**. The opening leads to the aperture **621**. An extension **631** extends from the inner side **605** of the block near its rear end. The extension has a slot **633** formed therein which communicates with the aperture **621**. The extension **631** has a rear extending tab **634**.

The extension **623** fits in the slot **481** of the block **457** such that the opening **627** of the extension communicates with the opening **491** of the block **457**.

Formed through the wall of the gun and communicating with the chamber **51** between the slot **71** and the O-ring **205** of the bolt when it is in its rear cocked position, are five apertures **671** as shown in FIGS. **12**, **14**, and **15**. These five apertures lead to a slot **673** formed in the right outside of the gun for receiving the projection **631** of the block. The slot **673** has a lip **675** for receiving the tab **634** of the block **601**. Thus when the feeder tube and block are secured to the gun, and with the air passage block extension **623** in the slot **481** of the feeder tube block **457** and with the tab **633** under the lip **675** of the slot **673**, the air passage block is secured to the outside of the gun, with the slot **633** in communication with the apertures **671**. Thus gas passage is provided from the chamber **51**, through the apertures **671**, through the slot **633**, aperture **621**, and outlet opening **627** of the block **601** to the opening **491**(I), aperture **491**, outlet **491**(O), into the chamber **511** and through the apertures **493** of the feeder tube directing the gas toward the inlet **57** to facilitate movement of the balls from the feeder tube **451** into the chamber **51**. The bolt return gas from the valve chamber **381** is applied to this gas passage when the bolt is returning to its cocked position when the O-ring **205** passes rearward of the apertures **671**. The gas in chamber **51** flows between the inner wall of the chamber **51** and the outer wall **201** of the bolt ahead of the O-ring **205**. Upon return of the bolt to the cocked position, there also is some over travel of the bolt in that the front end of the bolt surface **201** moves rearward of the apertures **671**.

Also provided are fibrous washers **681** located around the valve tube **121** between the front O-ring plug **111** of the valve plug **81** and the rear O-ring plug **173** of the bolt **141** such that the bolt **141** engages the front washer **681** each time the bolt is moved to its cocked position. The washers **681** are filled with a light oil which is squeezed into the chamber **51** and eventually mixes with the bolt return gas which is injected into the feeder tube through apertures **493**. The oily gas is applied to the balls in the feeder tube to facilitate their movement through the inlet **57** into the chamber **51** for firing.

Referring now to FIG. **32**, the regulator valve **351** comprises a high pressure side cover **701** having threads **703** which are screwed into the threads **253**T of the opening **257** and a low pressure side cover **721** having threads **723** screwed into the threads **255**T of the opening **257**. A brass inner fitting **731** having threads **733** is screwed into the threads **253**T. The fitting has a small aperture **735** with a surrounding seat **737**. A pin **739** has an enlarged portion **741** is screwed to an annular fitting **743** which is slidably located in the fitting **731**. The pin **739** has a small diameter rod **745** with a annular member **747** located around the rod **745** and adapted to engage the seat **737**. A spring **749** is located around the pin **739** and has an end effectively engaging the cover **701** and a shoulder **741**S of portion **741** urging the rod **745** through the opening **735**.

On the low pressure side there is slidably located a disc member **751** which is urged toward the rod pin **745** by spring like washers **753** one of which also engages a movable seat **755**. A set screw **757** screwed into threads **759**.

If the high pressure gas used is CO_2 its pressure on the high side of the regulator may vary to 450 psi at 26° F. to 1800 psi at 100° F. Thus the pressure of CO_2 varies with the temperature. The pressure on the low side preferably is regulated to 435 psi by screwing the set screw **757** in until the desired pressure of 435 psi is achieved. Screwing the set screw **757** in allows the gas to flow into the low side between the member **747** and the seat **737**. Members **761**A, **761**B, **761**C, and **761**D are O-rings.

Thus the use of the regulator allows a constant pressure to be obtained using pressurized CO_2 even though the ambient temperature may vary.

Referring to FIG. **33**, there is disclosed a bolt return button **781** which is used to return the bolt in the event that the cock valve chamber and valve fail to operate properly. The button **781** has a shaft **783** with slots **785**, located in one end of an aperture **787** formed through the body of the gun. A cap **788** is screwed into the other end of the aperture **787**. Members **789** are lock washers and members **791**A, **791**B, and **791**C are O-rings.

An aperture **801** extends from the chamber **413** to aperture **787** and an aperture **803** extends from aperture **787** to the cock valve chamber portion **393**. When the button **781** is pushed to the left as seen in FIG. **33**, the slots **785** provide a passage from the left side of aperture **787** as shown in FIG. **33**, pass the O-ring **791**B and to the right side thereby allowing pressurized gas from chamber **413** to flow to chamber portion **393** through aperture **399** for moving the bolt to its cocked position.

Referring now to the FIGS. **34** and **35**, there is disclosed a ball chamber or loader **831** for receiving paintballs **59** by way of a lid **833** and for serially or sequentially feeding the paintballs to the gun by way of the feeder tube **451**. The chamber **831** has a neck **835** coupled to the feeder tube **451**. A gas conduit **841** is provided having end **843** coupled to the chamber **831** and an end **845** coupled to the aperture **621** of the air passage block **601**. In this embodiment the screw **625** of the block **601** is removed. In the embodiment disclosed, the end **843** comprises tubular fitting **843**T that extends through the chamber wall **831**W and which is held in place by nuts **847**. Inner and outer tubular members **843**T1 and **843**T2 extend from the inner and outer ends of member **843**T with the member **843**T1 being located in the interior **831**A of the chamber **831**. The conduit **841** is a flexible tube and its end **841**E1 is fitted around tube **841**T2.

Coupled to tubular member **843**T1 in the chamber **831** is an inflatable member **861** which normally is in a coiled position as shown in FIG. **34**.

After the gun fires, the bolt return gas from the gun passes through the tube **841** and inflates members **861** to an inflated position as shown in FIG. **35** over the entrance **835**E of the neck **835**. This causes the member **861** to agitate and clear any jammed balls. The gas then exhausts out of the tube **841** back into the gun, thus allowing it to roll up into its deflated position. The inflation and deflation process only takes tenths of a second after each firing thereby allowing a constant agitation of the paintballs during a rapid fire situation. The pneumatic tongue agitator **861** makes no noise.

In one embodiment the inflatable member **861** may be formed of a suitable thin plastic which normally is in the deflated coiled position as shown in FIG. **34**.

The end **845** of the tube also could be attached to the gun barrel **61** in communication with its interior downstream of the ball inlet **57** as shown in dotted form in FIG. **34**. Attachment is by way of a fitting **851**. In this embodiment a portion of the gas used in forcing the ball out of the barrel is fed to the member **861**.

Thus the preferred embodiment of the pneumatic ball gun includes a sealed receiver; a forward locking bolt; in-line removable bolt assembly; dirt resistant trigger; gas regulation; pneumatic bolt return with the bolt duplicating pump gun action; gas assist in feeder tube; bolt return timing valve assembly; a removable plate for exposing the trigger mechanism and a pneumatic mechanism for preventing the balls

from jamming in the ball holing chamber. Use of the gun for firing paint balls results in exceptionally low ball breakage. If ball breakage does occur, it occurs in the barrel of the gun and does not clog the operating mechanism.

I claim:

1. A gun for firing balls, comprising:

a body having an elongated chamber with a front end and a rear end,

a gun barrel supported by said body and having an aperture extending from said front end of said chamber to a forward open end such that said chamber and aperture form a continuous bore,

a ball inlet extending into said bore near said front end of said chamber for allowing a ball to enter said bore for movement in said bore forward of said inlet and out of said forward open end of said barrel,

a bolt located in said chamber for movement between rear and forward positions,

said bolt comprises side wall structure having a rear end and a front end with a central opening extending therethrough,

said central opening of said bolt comprising a front opening portion and a rear opening portion with an annular seat located between said front and rear opening portions and facing rearward,

in said rear position of said bolt, said front end of said bolt being located rearward of said inlet,

a valve member located in said chamber for movement between rear and forward positions,

said valve member having a rear end and a forward end with a valve opening extending into said valve member from said rear end to a forward position,

said forward end of said valve member being located in said rear opening portion of said bolt with said valve opening being in fluid communication with said rear opening portion of said bolt,

said valve member being movable relative to said bolt,

said valve member having valve structure adapted to engage said seat of said bolt when said bolt and said valve members are in said rearward positions and form a seal with said seat,

stop structure secured to the rear end of said valve member,

a stop member located in said rear portion of said chamber for engaging said stop structure of said valve member for limiting forward movement of said valve member,

a main channel for allowing pressurized gas to flow into said rear portion of said chamber, through said opening of said valve member and into said rear opening portion of said bolt,

a sear for holding said bolt in its rear position, and

a trigger mechanism for releasing said sear for allowing pressurized gas in said rear portion of said chamber to move said valve member forward for moving said bolt forward for allowing said valve structure and said seat to separate for allowing pressurized gas to flow through said forward opening of said bolt for forcing a ball in said bore out of said forward open end of said gun barrel.

2. The gun of claim **1**, comprising:

a rear opening formed in said body leading to said rear end of said chamber,

a valve support member located in said rear end of said chamber for supporting said valve member for movement in said chamber,

said valve support member being removably secured in said rear end of said chamber for allowing said valve support member, said valve member, and said bolt to be removed from said chamber by way of said rear opening.

3. The gun of claim **1**, comprising:

at least one slot formed in said body and extending outward from said front end of said chamber rearward of said ball inlet,

a lock member aperture formed through said sidewall structure of said bolt and leading to said front opening portion,

a lock member located in said lock member aperture for movement to inward and outward positions,

said lock member being movable outward into said slot by the gas pressure in said front opening portion of said bolt stopping forward movement of said bolt,

said lock member being movable to said inward position in said lock member aperture to allow said bolt to move in said chamber.

4. The gun of claim **3**, wherein said trigger mechanism comprises:

a trigger member,

means for pivotally coupling said trigger member to said body for movement to first and second positions,

means for normally urging said trigger member to said first position of said trigger member,

a trip member pivotally coupled to said trigger member for movement to first and second positions relative to said trigger member

said trip member having an engaging end and an engaging surface,

means for normally urging said trip member to said first position of said trip member,

said sear having first and second ends,

means for pivotally coupling said sear to said body for movement to first and second positions,

means for normally urging said sear to said first position of said sear,

said bolt having first and second spaced apart engaging surfaces facing forward, with said first surface being located rearward of said second surface,

when said sear, trip member and said trigger member are located in said first positions respectively, said first end of said sear engages said first surface of said bolt to hold said bolt in said rearward position of said bolt,

when said trigger member is moved to said second position of said trigger member, said engaging surface of said trip member pivots said sear to said second position of said sear to release said first end of said sear from said first surface of said bolt and allows said bolt to move to said forward position of said bolt, and

bolt return means for moving said bolt to said rearward position of said bolt to allow said first end of said sear to engage said first surface of said bolt and hold said bolt in said rearward position of said bolt.

5. The gun of claim **4**, comprising:

a cock valve chamber having forward and rearward portions,

a cock valve slidably located in said cock valve chamber for movement between said forward and rearward portions of said cock valve chamber,

said cock valve having a rear end,

a rod aperture in communication with said rearward portion of said cock valve chamber,

a rod located in said rod aperture and having a rear end and a forward end adapted to engage said rear end of said cock valve,

means for normally holding said cock valve in said rearward position of said cock valve,

a second channel for allowing gas to flow into said cock valve chamber,

a connecting channel extending from said rearward portion of said cock valve chamber to said front end of said elongated chamber by way of said slot,

seal means for normally sealing said cock valve chamber from said connecting channel,

when said trigger member is moved to said second position of said trigger member said trigger member and said bolt moves forward, said second surface of said bolt engages said trip member and moves said trip member to its second position for causing said trip member to engage said rear end of said rod of said cock valve and move said rod and hence said cock valve to said forward position of said cock valve for releasing gas from said cock valve chamber by way of said connecting channel and said slot into said front end of said elongated chamber for moving said bolt to said rear position in said elongated chamber to allow said trigger mechanism to move to said cocked position for holding said bolt in said rear position of said elongated chamber.

6. The gun of claim **5**, wherein:

said seal means comprises an O-ring,

said cock valve comprise an elongated cylindrical member which engages the inside of said O-ring and forms a seal with said O-ring,

said elongated cylindrical member having a smaller diameter portion at said rear end of said cock valve which is moved within said O-ring when said cock valve is moved to said forward position by said rod to allow gas in said cock valve chamber to pass between said O-ring and said smaller diameter portion for releasing gas from said cock valve chamber into said front end of said elongated chamber by way of said connecting channel and said slot.

7. The gun of claim **3**, comprising:

a cock valve chamber having forward and rearward portions,

a cock valve slidably located in said cock valve chamber for movement between said forward and rearward portions of said cock valve chamber,

said cock valve having a rear end,

a rod aperture in communication with said rearward portion of said cock valve chamber,

a rod located in said rod aperture and having a rear end and a forward end adapted to engage said rear end of said cock valve,

means for normally holding said cock valve in said rearward position of said cock valve,

a second channel for allowing gas to flow into said cock valve chamber,

a connecting channel extending from said rearward portion of said cock valve chamber to said front end of said elongated chamber by way of said slot,

seal means for normally sealing said cock valve chamber from said connecting channel,

said trigger mechanism being movable from a cocked position for holding said bolt in said rear position in said elongated chamber to a release position for engaging said rear end of said rod and moving said rod and hence said cock valve to said forward position of said cock valve for releasing gas from said cock valve chamber by way of said connecting channel and said slot into said front end of said elongated chamber for moving said bolt to said rear position in said elongated chamber to allow said trigger mechanism to move to said cocked position for holding said bolt in said rear position of said elongated chamber.

8. The gun of claim **1**, wherein said trigger mechanism comprises:

a trigger member,

means for pivotally coupling said trigger member to said body for movement to first and second positions,

means for normally urging said trigger member to said first position of said trigger member,

a trip member pivotally coupled to said trigger member for movement to first and second positions relative to said trigger member

said trip member having an engaging end and an engaging surface,

means for normally urging said trip member to said first position of said trip member,

said sear having first and second ends,

means for pivotally coupling said sear to said body for movement to first and second positions,

means for normally urging said sear to said first position of said sear,

said bolt having an engaging surface facing forward,

when said sear, trip member and said trigger member are located in said first positions respectively, said first end of said sear engages said engaging surface of said bolt to hold said bolt in said rearward position of said bolt,

when said trigger member is moved to said second position of said trigger member, said engaging surface of said trip member pivots said sear to said second position of said sear to release said first end of said sear from said engaging surface of said bolt and allows said bolt to move to said forward position of said bolt, and

bolt return means for moving said bolt to said rearward position of said bolt to allow said first end of said sear to engage said first surface of said bolt and hold said bolt in said rearward position of said bolt.

9. The gun of claim **1**, comprising:

a cock valve chamber having forward and rearward portions,

a cock valve slidably located in said cock valve chamber for movement between said forward and rearward portions of said cock valve chamber,

said cock valve having a rear end,

a rod aperture in communication with said rearward portion of said cock valve chamber,

a rod located in said rod aperture and having a rear end and a forward end adapted to engage said rear end of said cock valve,

means for normally holding said cock valve in said rearward position of said cock valve,

a second channel for allowing gas to flow into said cock valve chamber,

a connecting channel extending from said rearward portion of said cock valve chamber to said front end of said elongated chamber,

seal means for normally sealing said cock valve chamber from said connecting channel,

said trigger mechanism being movable from a cocked position for holding said bolt in said rear position in said elongated chamber to a release position for engaging said rear end of said rod and moving said rod and hence said cock valve to said forward position of said cock valve for releasing gas from said cock valve chamber by way of said connecting channel into said front end of said elongated chamber for moving said bolt to said rear position in said elongated chamber to allow said trigger mechanism to move to said cocked position for holding said bolt in said rear position of said elongated chamber.

10. The gun of claim **9**, comprising:

a feed tube comprising wall structure having an inner end coupled to said ball inlet and an outlet end coupled to a ball chamber for holding and feeding balls sequentially into said bore.

11. The gun of claim **10**, comprising:

a bolt seal supported by said front end of said bolt for movement with said bolt for forming a seal with said bore,

a gas aperture extending outward from said bore through said body at a position such that bolt seal moves rearward of said gas aperture when said bolt is moved to said rearward position by gas released from said cock valve chamber,

a gas inlet aperture formed through said wall structure of said feed tube and which extends in a direction to direct gas toward said outlet end of said feed tube, and

a connecting passageway coupled between said gas outlet aperture of said body and said gas inlet aperture of said feed tube to allow gas flowing into said bore from said cock valve chamber to be applied into said feed tube to enhance movement of balls in feed tube into said bore when said bolt seal is moved rearward of said gas outlet aperture by gas from said cock valve chamber.

12. The gun of claim **11**, comprising:

a fibrous member containing oil located in said bore rearward of said bolt in a position to be engaged by said rear end of said bolt when said bolt is moved to said rear position in said elongated chamber for mixing oil with gas in said bore for lubricating balls introduced into said bore by way of said ball inlet.

13. The gun of claim **9**, comprising:

a gas pressure regulator supported by said body,

said pressure regulator having a high pressure side and a low pressure side,

said main channel and said second channel being coupled to said low pressure side, and

an inlet coupled to said high pressure side for the application of gas under high pressure for flow into said low pressure side for applying lower pressure gas to said main channel and said second channel and for maintaining the gas applied to said main channel and said second channel to a generally constant pressure.

14. The gun of claim **1**, comprising:

means for moving said bolt to said rear position in said elongated chamber for allowing said sear to hold said bolt in said rear position in said elongated chamber, and

a fibrous member containing oil located in said bore rearward of said bolt in a position to be engaged by said rear end of said bolt when said bolt is moved to said rear position in said elongated chamber for mixing oil with gas in said bore for lubricating balls introduced into said bore.

15. The gun of claim **1**, comprising:

a feed tube having an outlet end coupled to said ball inlet,

a bolt seal supported by said front end of said bolt for movement with said bolt for forming a seal with said bore,

a gas aperture extending outward from said bore through said body at a position such that bolt seal moves rearward of said gas aperture when said bolt is moved to said rearward position by gas released from said cock valve chamber,

a gas inlet aperture formed through said wall structure of said feed tube and which extends in a direction to direct gas toward said outlet end of said feed tube, and

a connecting passageway coupled between said gas outlet aperture of said body and said gas inlet aperture of said feed tube to allow gas flowing into said bore from said cock valve chamber to be applied into said feed tube to enhance movement of balls in feed tube into said bore when said bolt seal is moved rearward of said gas outlet aperture by gas from said cock valve chamber.

16. The gun of claim **15**, comprising:

a fibrous member containing oil located in said bore rearward of said bolt in a position to be engaged by said rear end of said bolt when said bolt is moved to said rear position in said elongated chamber for mixing oil with gas in said bore for lubricating balls introduced into said bore.

17. The gun of claim **1**, comprising:

a feed tube comprising wall structure having an inner end coupled to said ball inlet and an outlet end coupled to a ball chamber having an outlet for holding and feeding balls sequentially into said bore,

a gas conduit having a first end coupled to said ball chamber and a second end for receiving gas from the gun,

an inflatable member coupled to said first end of said gas conduit and located in said ball chamber near said outlet of said ball chamber for inflation by the gas for moving the balls to prevent the balls from becoming jammed.

18. The gun of claim **17**, comprising:

a cock valve chamber having forward and rearward portions,

a cock valve slidably located in said cock valve chamber for movement between said forward and rearward portions of said cock valve chamber,

said cock valve having a rear end,

a rod aperture in communication with said rearward portion of said cock valve chamber,

a rod located in said rod aperture and having a rear end and a forward end adapted to engage said rear end of said cock valve,

means for normally holding said cock valve in said rearward position of said cock valve,

a second channel for allowing gas to flow into said cock valve chamber,

a connecting channel extending from said rearward portion of said cock valve chamber to said front end of said elongated chamber,

seal means for normally sealing said cock valve chamber from said connecting channel,

said trigger mechanism being movable from a cocked position for holding said bolt in said rear position in

said elongated chamber to a release position for engaging said rear end of said rod and moving said rod and hence said cock valve to said forward position of said cock valve for releasing gas from said cock valve chamber by way of said connecting channel into said front end of said elongated chamber for moving said bolt to said rear position in said elongated chamber to allow said trigger mechanism to move to said cocked position for holding said bolt in said rear position of said elongated chamber,

a bolt seal supported by said front end of said bolt for movement with said bolt for forming a seal with said bore,

a gas aperture extending outward from said bore through said body at a position such that bolt seal moves rearward of said gas aperture when said bolt is moved to said rearward position by gas released from said cock valve chamber,

a gas inlet aperture formed through said wall structure of said feed tube and which extends in a direction to direct gas toward said outlet end of said feed tube, and

a connecting passageway coupled between said gas outlet aperture of said body and said gas inlet aperture of said feed tube to allow gas flowing into said bore from said cock valve chamber to be applied into said feed tube to enhance movement of balls in feed tube into said bore when said bolt seal is moved rearward of said gas outlet aperture by gas from said cock valve chamber.

19. The gun of claim **18**, comprising:

a fibrous member containing oil located in said bore rearward of said bolt in a position to be engaged by said rear end of said bolt when said bolt is moved to said rear position in said elongated chamber for mixing oil with gas in said bore for lubricating balls introduced into said bore.

20. The gun of claim **1**, comprising:

a cavity formed in one side of said body in which are located said trigger member, said trip member, and said sear, and a plate removably secured to said one side of said body for covering said cavity when said plate is secured to said one side of said body and for exposing said cavity when said plate is removed from said one side of said body.

21. The gun of claim **1**, comprising:

a gas pressure regulator supported by said body,

said pressure regulator having a high pressure side and a low pressure side,

said main channel being coupled to said low pressure side, and

an inlet coupled to said high pressure side for the application of gas under high pressure for flow into said low pressure side for applying lower pressure gas to said main channel and for maintaining the gas applied to said main channel to a generally constant pressure.

22. A gun for firing balls, comprising:

a body having an elongated chamber with a front end and a rear end,

a gun barrel supported by said body and having an aperture extending from said front end of said chamber to a forward open end such that said chamber and aperture form a continuous bore,

a ball inlet extending into said bore near said front end of said chamber for allowing a ball to enter said bore for movement in said bore forward of said inlet and out of said forward open end of said barrel,

a bolt located in said chamber for movement between rear and forward positions,

said bolt comprises side wall structure having a rear end and a front end with a central opening having a gas outlet at said front end of said bolt,

a valve for closing said gas outlet of said bolt when said bolt is in said rear position in said chamber,

a flow path for allowing pressurized gas to flow into said rear portion of said chamber and into said central opening of said bolt,

a sear for holding said bolt in its rear position,

a trigger mechanism for releasing said sear for allowing pressurized gas in said rear portion of said chamber to move said valve forward for moving said bolt forward for allowing said valve to open said gas outlet for allowing pressurized gas to flow through said gas outlet of said bolt for forcing a ball in said bore out of said forward open end of said gun barrel,

said trigger mechanism comprising:

a trigger member,

means for pivotally coupling said trigger member to said body for movement to first and second positions,

means for normally urging said trigger member to said first position of said trigger member,

a trip member pivotally coupled to said trigger member for movement to first and second positions relative to said trigger member

said trip member having an engaging end and an engaging surface,

means for normally urging said trip member to said first position of said trip member,

said sear having first and second ends,

means for pivotally coupling said sear to said body for movement to first and second positions,

means for normally urging said sear to said first position of said sear,

said bolt having an engaging surface facing forward,

when said sear, trip member and said trigger member are located in said first positions respectively, said first end of said sear engages said engaging surface of said bolt to hold said bolt in said rearward position of said bolt,

when said trigger member is moved to said second position of said trigger member, said engaging surface of said trip member pivots said sear to said second position of said sear to release said first end of said sear from said engaging surface of said bolt and allows said bolt to move to said forward position of said bolt,

bolt return means for moving said bolt to said rearward position of said bolt to allow said first end of said sear to engage said first surface of said bolt and hold said bolt in said rearward position of said bolt, and

a cavity formed in one side of said body in which are located said trigger member, said trip member, and said sear, and a plate removably secured to said one side of said body for covering said cavity when said plate is secured to said one side of said body and for exposing said cavity when said plate is removed from said one side of said body.

23. A gun for firing balls, comprising:

a body having an elongated chamber with a front end and a rear end,

a gun barrel supported by said body and having an aperture extending from said front end of said chamber

to a forward open end such that said chamber and aperture form a continuous bore,

a ball inlet extending into said bore near said front end of said chamber for allowing a ball to enter said bore for movement in said bore forward of said inlet and out of said forward open end of said barrel,

a bolt located in said chamber for movement between rear and forward positions,

said bolt comprises side wall structure having a rear end and a front end with a central opening having a gas outlet at said front end of said bolt,

a valve for closing said gas outlet of said bolt when said bolt is in said rear position in said chamber,

a flow path for allowing pressurized gas to flow into said rear portion of said chamber and into said central opening of said bolt,

a sear for holding said bolt in its rear position,

a trigger mechanism for releasing said sear for allowing pressurized gas in said rear portion of said chamber to move said valve forward for moving said bolt forward for allowing said valve to open said gas outlet for allowing pressurized gas to flow through said gas outlet of said bolt for forcing a ball in said bore out of said forward open end of said gun barrel,

at least one slot formed in said body and extending outward from said front end of said chamber rearward of said ball inlet,

a lock member aperture formed through said sidewall structure of said bolt and leading to said front opening portion,

a lock member located in said lock member aperture for movement to inward and outward positions,

said lock member being movable outward into said slot by the gas pressure in said central opening of said bolt stopping forward movement of said bolt,

said lock member being movable to said inward position in said lock member aperture to allow said bolt to move in said chamber.

24. The gun of claim **23**, comprising:

a cock valve chamber having forward and rearward portions,

a cock valve slidably located in said cock valve chamber for movement between said forward and rearward portions of said cock valve chamber,

said cock valve having a rear end,

a rod aperture in communication with said rearward portion of said cock valve chamber,

a rod located in said aperture and having a rear end and a forward end adapted to engage said rear end of said cock valve,

means for normally holding said cock valve in said rearward position of said cock valve,

a second channel for allowing gas to flow into said cock valve chamber,

a connecting channel extending from said rearward portion of said cock valve chamber to said front end of said elongated chamber,

seal means for normally sealing said cock valve chamber from said connecting channel,

said trigger mechanism being movable from a cocked position for holding said bolt in said rear position in said elongated chamber to a release position for engaging said rear end of said rod and moving said rod and hence said cock valve to said forward position of said cock valve for releasing gas from said cock valve chamber by way of said connecting channel into said front end of said elongated chamber for moving said bolt to said rear position in said elongated chamber to allow said trigger mechanism to move to said cocked position for holding said bolt in said rear position of said elongated chamber.

25. A gun for firing balls, comprising:

a body having an elongated chamber with a front end and a rear end,

a gun barrel supported by said body and having an aperture extending from said front end of said chamber to a forward open end such that said chamber and aperture form a continuous bore,

a ball inlet extending into said bore near said front end of said chamber for allowing a ball to enter said bore for movement in said bore forward of said inlet and out of said forward open end of said barrel,

a bolt located in said chamber for movement between rear and forward positions,

said bolt comprises side wall structure having a rear end and a front end with a central opening having a gas outlet at said front end of said bolt,

a valve for closing said gas outlet of said bolt when said bolt is in said rear position in said chamber,

a flow path for allowing pressurized gas to flow into said rear portion of said chamber and into said central opening of said bolt,

a sear for holding said bolt in its rear position,

a trigger mechanism for releasing said sear for allowing pressurized gas in said rear portion of said chamber to move said valve forward for moving said bolt forward for allowing said valve to open said gas outlet for allowing pressurized gas to flow through said gas outlet of said bolt for forcing a ball in said bore out of said forward open end of said gun barrel,

a cock valve chamber having forward and rearward portions,

a cock valve slidably located in said cock valve chamber for movement between said forward and rearward portions of said cock valve chamber,

said cock valve having a rear end,

a rod aperture in communication with said rearward portion of said cock valve chamber,

a rod located in said rod aperture and having a rear end and a forward end adapted to engage said rear end of said cock valve,

means for normally holding said cock valve in said rearward position of said cock valve,

a second channel for allowing gas to flow into said cock valve chamber,

a connecting channel extending from said rearward portion of said cock valve chamber to said front end of said elongated chamber,

seal means for normally sealing said cock valve chamber from said connecting channel,

said trigger mechanism being movable from a cocked position for holding said bolt in said rear position in said elongated chamber to a release position for engaging said rear end of said rod and moving said rod and hence said cock valve to said forward position of said cock valve for releasing gas from said cock valve chamber by way of said connecting channel into said

front end of said elongated chamber for moving said bolt to said rear position in said elongated chamber to allow said trigger mechanism to move to said cocked position for holding said bolt in said rear position of said elongated chamber.

26. A gun for firing balls, comprising:

a body having an elongated chamber with a front end and a rear end,

a gun barrel supported by said body and having an aperture extending from said front end of said chamber to a forward open end such that said chamber and aperture form a continuous bore,

a ball inlet extending into said bore near said front end of said chamber for allowing a ball to enter said bore for movement in said bore forward of said inlet and out of said forward open end of said barrel,

a bolt located in said chamber for movement between rear and forward positions,

said bolt comprises side wall structure having a rear end and a front end with a central opening having a gas outlet at said front end of said bolt,

a valve for closing said gas outlet of said bolt when said bolt is in said rear position in said chamber,

a flow path for allowing pressurized gas to flow into said rear portion of said chamber and into said central opening of said bolt,

a sear for holding said bolt in its rear position,

a trigger mechanism for releasing said sear for allowing pressurized gas in said rear portion of said chamber to move said valve forward for moving said bolt forward for allowing said valve to open said gas outlet for allowing pressurized gas to flow through said gas outlet of said bolt for forcing a ball in said bore out of said forward open end of said gun barrel,

a gas pressure regulator supported by said body,

said pressure regulator having a high pressure side and a low pressure side,

said flow path being coupled to said low pressure side, and

an inlet coupled to said high pressure side for the application of gas under high pressure for flow into said low pressure side for applying lower pressure gas to said flow path and for maintaining the gas applied to said flow path to a generally constant pressure.

27. The gun of claim **26**, comprising;

at least one slot formed in said body and extending outward from said front end of said chamber rearward of said ball inlet,

a lock member aperture formed through said sidewall structure of said bolt and leading to said front opening portion,

a lock member located in said lock member aperture for movement to inward and outward positions,

said lock member being movable outward into said slot by the gas pressure in said front opening portion of said bolt stopping forward movement of said bolt,

said lock member being movable to said inward position in said lock member aperture to allow said bolt to move in said chamber.

28. The paint ball gun of claim **27**, comprising:

a cock valve chamber having forward and rearward portions,

a cock valve slidably located in said cock valve chamber for movement between said forward and rearward portions of said cock valve chamber,

said cock valve having a rear end,

a rod aperture in communication with said rearward portion of said cock valve chamber,

a rod located in said rod aperture and having a rear end and a forward end adapted to engage said rear end of said cock valve,

means for normally holding said cock valve in said rearward position of said cock valve,

a second channel for allowing gas to flow into said cock valve chamber,

a connecting channel extending from said rearward portion of said cock valve chamber to said front end of said elongated chamber,

seal means for normally sealing said cock valve chamber from said connecting channel,

said trigger mechanism being movable from a cocked position for holding said bolt in said rear position in said elongated chamber to a release position for engaging said rear end of said rod and moving said rod and hence said cock valve to said forward position of said cock valve for releasing gas from said cock valve chamber by way of said connecting channel into said front end of said elongated chamber for moving said bolt to said rear position in said elongated chamber to allow said trigger mechanism to move to said cocked position for holding said bolt in said rear position of said elongated chamber.

29. The gun of claim **26**, comprising:

a cock valve chamber having forward and rearward portions,

a cock valve slidably located in said cock valve chamber for movement between said forward and rearward portions of said cock valve chamber,

said cock valve having a rear end,

a rod aperture in communication with said rearward portion of said cock valve chamber,

a rod located in said rod aperture and having a rear end and a forward end adapted to engage said rear end of said cock valve,

means for normally holding said cock valve in said rearward position of said cock valve,

a second channel for allowing gas to flow into said cock valve chamber,

a connecting channel extending from said rearward portion of said cock valve chamber to said front end of said elongated chamber,

seal means for normally sealing said cock valve chamber from said connecting channel,

said trigger mechanism being movable from a cocked position for holding said bolt in said rear position in said elongated chamber to a release position for engaging said rear end of said rod and moving said rod and hence said cock valve to said forward position of said cock valve for releasing gas from said cock valve chamber by way of said connecting channel into said front end of said elongated chamber for moving said bolt to said rear position in said elongated chamber to allow said trigger mechanism to move to said cocked position for holding said bolt in said rear position of said elongated chamber.

30. A gun for firing balls, comprising:

a body having an elongated chamber with a front end and a rear end,

a gun barrel supported by said body and having an aperture extending from said front end of said chamber

to a forward open end such that said chamber and aperture form a continuous bore,

a ball inlet extending into said bore near said front end of said chamber for allowing a ball to enter said bore for movement in said bore forward of said inlet and out of said forward open end of said barrel,

a bolt located in said chamber for movement between rear and forward positions,

said bolt comprises side wall structure having a rear end and a front end with a central opening having a gas outlet at said front end of said bolt,

a valve for closing said gas outlet of said bolt when said bolt is in said rear position in said chamber,

a flow path for allowing pressurized gas to flow into said rear portion of said chamber and into said central opening of said bolt,

a sear for holding said bolt in its rear position,

a trigger mechanism for releasing said sear for allowing pressurized gas in said rear portion of said chamber to move said valve forward for moving said bolt forward for allowing said valve to open said gas outlet for allowing pressurized gas to flow through said gas outlet of said bolt for forcing a ball in said bore out of said forward open end of said gun barrel,

a feed tube comprising wall structure having an inner end coupled to said ball inlet and an outlet end coupled to a ball chamber having an outlet for holding and feeding balls sequentially into said bore,

a gas conduit having a first end coupled to said ball chamber and a second end for receiving gas from the gun,

an inflatable member coupled to said first end of said gas conduit and located in said ball chamber near said outlet of said ball chamber for inflation by the gas for moving the balls to prevent the balls from becoming jammed.

31. The gun of claim **30**, comprising:

a bolt seal supported by said front end of said bolt for movement with said bolt for forming a seal with said bore,

a gas aperture extending outward from said bore through said body at a position such that bolt seal moves rearward of said gas aperture when said bolt is moved to said rearward position by gas released from said cock valve chamber,

a gas inlet aperture formed through said wall structure of said feed tube and which extends in a direction to direct gas toward said outlet end of said feed tube, and

a connecting passageway coupled between said gas outlet aperture of said body and said gas inlet aperture of said feed tube to allow gas flowing into said bore from said cock valve chamber to be applied into said feed tube to enhance movement of balls in feed tube into said bore when said bolt seal is moved rearward of said gas outlet aperture by gas from said cock valve chamber.

32. The gun of claim **31**, comprising:

a fibrous member containing oil located in said bore rearward of said bolt in a position to be engaged by said rear end of said bolt when said bolt is moved to said rear position in said elongated chamber for mixing oil with gas in said bore for lubricating balls introduced into said bore.

33. The gun of claim **31**, comprising:

a block having a passage for forming said connecting passageway,

said passage having an inlet and outlet,

said block being connectable to said gun body such that said passage inlet and said passage outlet are in fluid communication with said gas aperture and said gas inlet aperture of said feed tube,

a stop aperture formed through said body of said block in communication with said elongated chamber forward of said ball inlet,

a movable stop coupled to said block for insertion through said stop aperture for location in said elongated chamber for holding a ball in said chamber until said gun is fired,

means for moveably coupling said movable stop to said block in a manner to allow a ball when moved in said bore to engage and move said movable stop outward through said stop aperture to allow passage of said ball through said bore and out of said forward open end of said gun barrel.

34. A gun for firing balls, comprising:

a body having an elongated chamber with a front end and a rear end,

a gun barrel supported by said body and having an aperture extending from said front end of said chamber to a forward open end such that said chamber and aperture form a continuous bore,

a ball inlet extending into said bore near said front end of said chamber for allowing a ball to enter said bore for movement in said bore forward of said inlet and out of said forward open end of said barrel,

a bolt located in said chamber for movement between rear and forward positions,

said bolt comprises side wall structure having a rear end and a front end with a central opening having a gas outlet at said front end of said bolt,

a valve for closing said gas outlet of said bolt when said bolt is in said rear position in said chamber,

a flow path for allowing pressurized gas to flow into said rear portion of said chamber and into said central opening of said bolt,

a sear for holding said bolt in its rear position,

a trigger mechanism for releasing said sear for allowing pressurized gas in said rear portion of said chamber to move said valve forward for moving said bolt forward for allowing said valve to open said gas outlet for allowing pressurized gas to flow through said gas outlet of said bolt for forcing a ball in said bore out of said forward open end of said gun barrel,

a feed tube having an outlet end coupled to said ball inlet,

a bolt seal supported by said front end of said bolt for movement with said bolt for forming a seal with said bore,

a gas aperture extending outward from said bore through said body at a position such that bolt seal moves rearward of said gas aperture when said bolt is moved to said rearward position by gas released from said cock valve chamber,

a gas inlet aperture formed through said wall structure of said feed tube and which extends in a direction to direct gas toward said outlet end of said feed tube, and

a connecting passageway coupled between said gas outlet aperture of said body and said gas inlet aperture of said feed tube to allow gas flowing into said bore from said cock valve chamber to be applied into said feed tube to enhance movement of balls in feed tube into said bore

when said bolt seal is moved rearward of said gas outlet aperture by gas from said cock valve chamber.

35. The gun of claim **34**, comprising:

a fibrous member containing oil located in said bore rearward of said bolt in a position to be engaged by said rear end of said bolt when said bolt is moved to said rear position in said elongated chamber for mixing oil with gas in said bore for lubricating balls introduced into said bore.

36. A gun for firing balls with pressurized gas, comprising:

structure forming a passage for the passage of gas upon firing of said gun,

a ball loading chamber for holding a plurality of balls,

a feed conduit having an inlet coupled to said loading chamber for feeding balls serially to said gun,

a gas conduit having a first end coupled to said loading chamber and a second end for receiving gas from said gun,

an inflatable member coupled to said first end of said gas conduit and located in said loading chamber near said inlet of said feed conduit for inflation by the gas for moving the balls to prevent the balls from becoming jammed,

said second end of said gas conduit being coupled to said passage of said gun for allowing gas to flow into said gas conduit for inflation of said inflatable member and then to flow back into said gun after the pressure therein decreases.

37. A gun for firing balls, comprising:

a body having an elongated chamber with a front end and a rear end,

a gun barrel supported by said body and having an aperture extending from said front end of said chamber to a forward open end such that said chamber and aperture form a continuous bore,

a ball inlet extending into said bore near said front end of said chamber for allowing a ball to enter said bore for movement in said bore forward of said inlet and out of said forward open end of said barrel,

a bolt located in said chamber for movement between rear and forward positions,

said bolt comprises side wall structure having a rear end and a front end with a central opening having a gas outlet at said front end of said bolt,

a valve for closing said gas outlet of said bolt when said bolt is in said rear position in said chamber,

a flow path for allowing pressurized gas to flow into said rear portion of said chamber and into said central opening of said bolt,

a sear for holding said bolt in its rear position,

a trigger mechanism for releasing said sear for allowing pressurized gas in said rear portion of said chamber to move said valve forward for moving said bolt forward for allowing said valve to open said gas outlet for allowing pressurized gas to flow through said gas outlet of said bolt for forcing a ball in said bore out of said forward open end of said gun barrel,

a ball loading chamber for holding a plurality of balls,

said loading chamber having an outlet coupled to said ball inlet for feeding balls serially to the gun,

a gas conduit having a first end coupled to said loading chamber and a second end coupled to said bore for receiving gas from said bore following the release of said sear by said trigger mechanism, and

an inflatable member coupled to said first end of said gas conduit and located in said loading chamber near said outlet of said loading chamber for inflation by the gas for moving the balls in said loading chamber to prevent the balls from becoming jammed.

38. A ball feeding apparatus for a gun for firing balls, comprising:

a ball loading chamber for holding a plurality of balls,

a feed conduit having an inlet coupled to said loading chamber for feeding balls to the gun,

a gas conduit having a first end coupled to said loading chamber and a second end for receiving gas from the gun,

an inflatable member coupled to said first end of said gas conduit and located in said loading chamber near said inlet of said feed conduit for inflation by the gas for moving the balls to prevent the balls from becoming jammed,

said ball loading chamber comprises a lower wall and an upper wall,

said first end of said gas conduit extends into said chamber to a position such that said inflatable member when inflated is located above and spaced from said lower wall.

39. The ball feeding apparatus of claim **38**, wherein:

said ball loading chamber comprises a lower wall and an upper wall with opposite end walls,

said inlet of said feed conduit is located between said end walls at a position such that said lower wall is located on opposite sides of said inlet between said inlet and said end walls and extends downward toward said inlet from said end walls with said chamber having space on opposite sides of said inlet between said inlet and said end walls for holding the balls,

said gas conduit is coupled to said loading chamber between said inlet and one of said end walls,

said inflatable member is positioned to extend toward said inlet when inflated.

40. The ball feeding apparatus of claim **39**, wherein:

said inflatable member comprises an elongated member which when inflated has a given length and a dimension transverse to said length which is less than the maximum cross-sectional dimension of said inlet.

41. The ball feeding apparatus of claim **38**, wherein:

said inflatable member comprises an elongated member which when inflated has a given length and a dimension transverse to said length which is less than the maximum cross-sectional dimension of said inlet.

42. The ball feeding apparatus of claim **41**, wherein:

said inflatable member is normally in a coiled position when deflated.

43. A ball feeding apparatus for a gun for firing balls, comprising:

a ball loading chamber for holding a plurality of balls,

a feed conduit having an inlet coupled to said loading chamber for feeding balls to the gun,

a gas conduit having a first end coupled to said loading chamber and a second end for receiving gas from the gun,

an inflatable member coupled to said first end of said gas conduit and located in said loading chamber near said inlet of said feed conduit for inflation by the gas for moving the balls to prevent the balls from becoming jammed,

said inflatable member comprises an elongated member which when inflated has a given length and a dimension transverse to said length which is less than the maximum cross-sectional dimension of said inlet.

44. The ball feeding apparatus of claim **43**, wherein:

said inflatable member is normally in a coiled position when deflated.

45. A ball feeding apparatus for a gun for firing balls, comprising:

a ball loading chamber for holding a plurality of balls,

a feed conduit having an inlet coupled to said loading chamber and an outlet adapted to be coupled to the gun for feeding balls serially to the gun,

said feed conduit has a cross-sectional dimension sufficient to allow the balls to be fed only serially therethrough to the gun

a gas conduit having a first end coupled to said loading chamber and a second end for receiving gas from the gun,

an inflatable member coupled to said first end of said gas conduit and located in said loading chamber near said inlet of said feed conduit for inflation by the gas for moving the balls to prevent the balls from becoming jammed,

said ball loading chamber has a lower wall and an upper wall,

said first end of said gas conduit extends into said chamber to a position such that said inflatable member when inflated is located above and spaced from said lower wall.

46. The ball feeding apparatus of claim **45**, wherein:

said ball loading chamber comprises a lower wall and an upper wall with opposite end walls,

said inlet of said feed conduit is located between said end walls at a position such that said lower wall is located on opposite sides of said inlet between said inlet and said end walls and extends downward toward said inlet from said end walls with said chamber having space on opposite sides of said inlet between said inlet and said end walls for holding the balls,

said gas conduit is coupled to said loading chamber between said inlet and one of said end walls,

said inflatable member is positioned to extend toward said inlet when inflated.

47. The ball feeding apparatus of claim **46**, wherein:

said inflatable member comprises an elongated member which when inflated has a given length and a dimension transverse to said length which is less than the maximum cross-sectional dimension of said inlet.

48. The ball feeding apparatus of claim **45**, wherein:

said inflatable member comprises an elongated member which when inflated has a given length and a dimension transverse to said length which is less than the maximum cross-sectional dimension of said inlet.

49. A ball feeding apparatus for a gun for firing balls, comprising:

a ball loading chamber for holding a plurality of balls,

a feed conduit having an inlet coupled to said loading chamber and an outlet adapted to be coupled to the gun for feeding balls serially to the gun,

said feed conduit has a cross-sectional dimension sufficient to allow the balls to be fed only serially therethrough to the gun,

a gas conduit having a first end coupled to said loading chamber and a second end for receiving gas from the gun,

an inflatable member coupled to said first end of said gas conduit and located in said loading chamber near said inlet of said feed conduit for inflation by the gas for moving the balls to prevent the balls from becoming jammed,

said ball loading chamber comprises a lower wall and an upper wall with opposite end walls,

said inlet of said feed conduit is located between said end walls at a position such that said lower wall is located on opposite sides of said inlet between said inlet and said end walls and extends downward toward said inlet from said end walls with said chamber having space on opposite sides of said inlet between said inlet and said end walls for holding the balls,

said gas conduit is coupled to said loading chamber between said inlet and one of said end walls,

said inflatable member is positioned to extend toward said inlet when inflated.

50. A ball feeding apparatus for a gun for firing balls, comprising:

a ball loading chamber for holding a plurality of balls,

a feed conduit having an inlet coupled to said loading chamber and an outlet adapted to be coupled to the gun for feeding balls serially to the gun,

said feed conduit has a cross-sectional dimension sufficient to allow the balls to be fed only serially therethrough to the gun,

a gas conduit having a first end coupled to said loading chamber and a second end for receiving gas from the gun,

an inflatable member coupled to said first end of said gas conduit and located in said loading chamber near said inlet of said feed conduit for inflation by the gas for moving the balls to prevent the balls from becoming jammed,

said inflatable member comprises an elongated member which when inflated has a given length and a dimension transverse to said length which is less than the maximum cross-sectional dimension of said inlet.

51. The ball feeding apparatus of claim **50**, wherein:

said inflatable member is normally in a coiled position when deflated.

52. A ball feeding apparatus for a gun for firing balls, comprising:

a ball loading chamber for holding a plurality of balls,

a feed conduit having an inlet coupled to said loading chamber for feeding balls to the gun,

a gas conduit having a first end coupled to said loading chamber and a second end for receiving gas from the gun,

an inflatable member coupled to said first end of said gas conduit and located in said loading chamber near said inlet of said feed conduit for inflation by the gas for moving the balls to prevent the balls from becoming jammed,

said ball loading chamber comprises a lower wall and an upper wall with opposite end walls,

said inlet of said feed conduit is located between said end walls at a position such that said lower wall is located

on opposite sides of said inlet between said inlet and said end walls and extends downward toward said inlet from said end walls with said chamber having space on opposite sides of said inlet between said inlet and said end walls for holding the balls,

said gas conduit is coupled to said loading chamber between said inlet and one of said end walls,

said inflatable member is positioned to extend toward said inlet when inflated,

said inflatable member comprises an elongated member which when inflated has a given length and a dimension transverse to said length which is less than the maximum cross-sectional dimension of said inlet.

53. The ball feeding apparatus of claim **52**, wherein:

said inflatable member is normally in a coiled position when deflated.

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