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(54) **PNEUMATIC PAINTBALL LOADER DRIVE**

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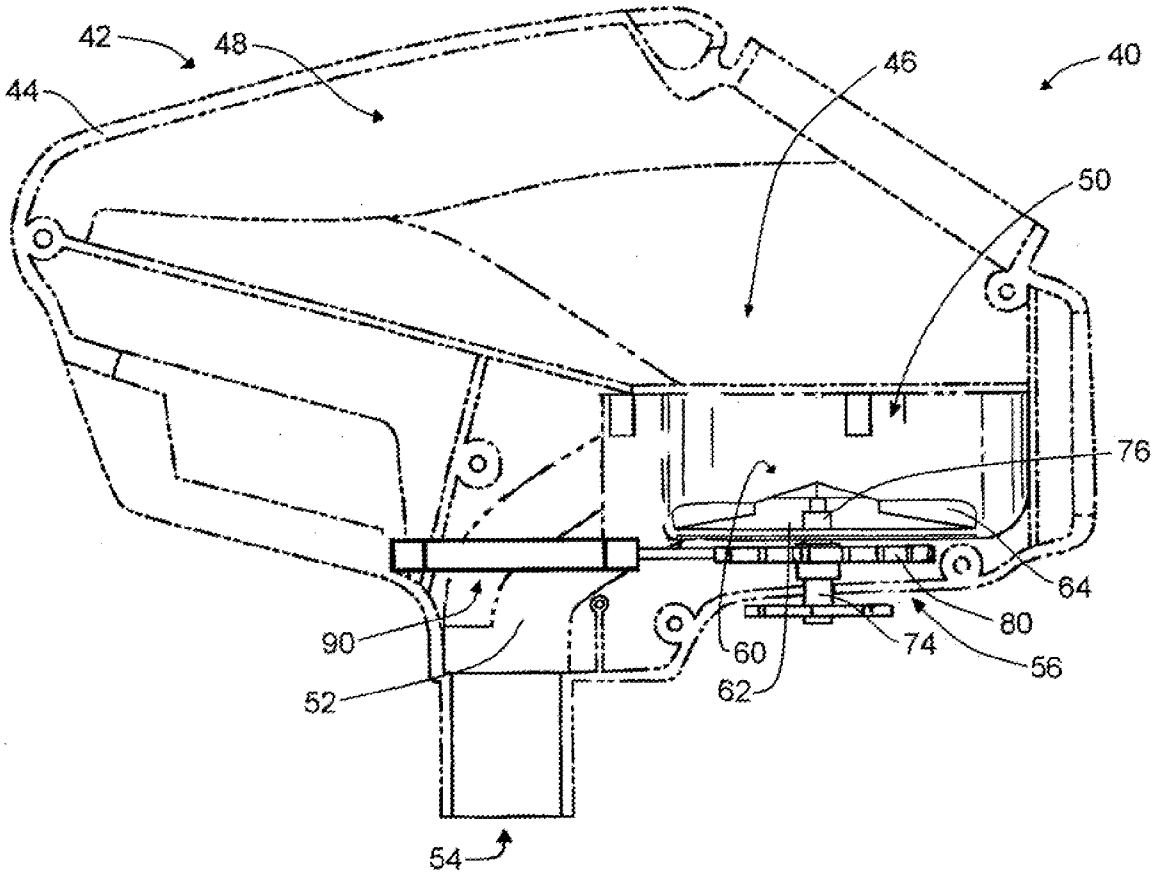
(57) **ABSTRACT**

A pneumatic drive for an active paintball loader capable of supplying paintballs to a paintball marker at a sufficiently high rate that is coordinated with firing the marker using compressed gas to a provide the motive power.



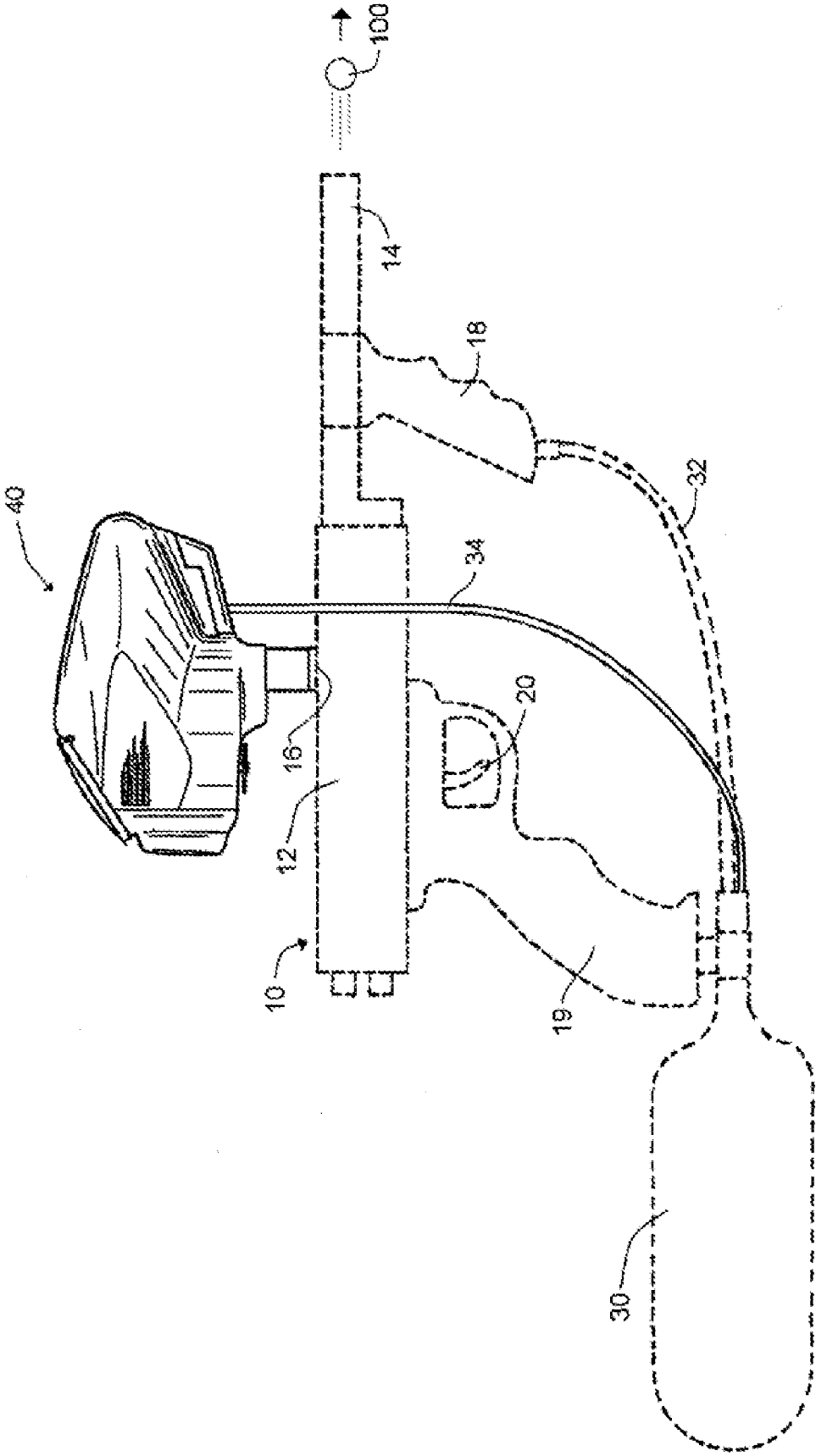


FIG. 1

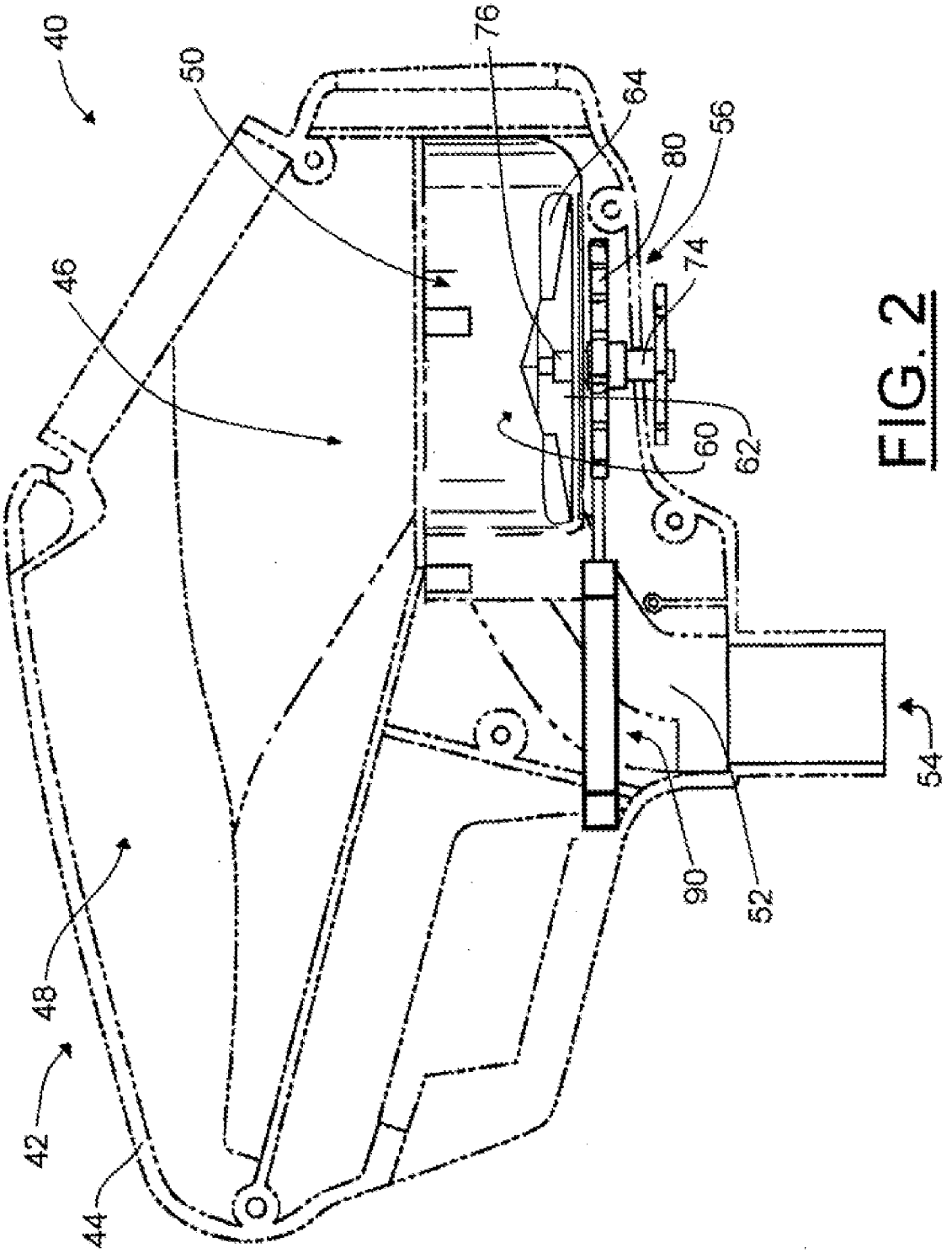


FIG. 2

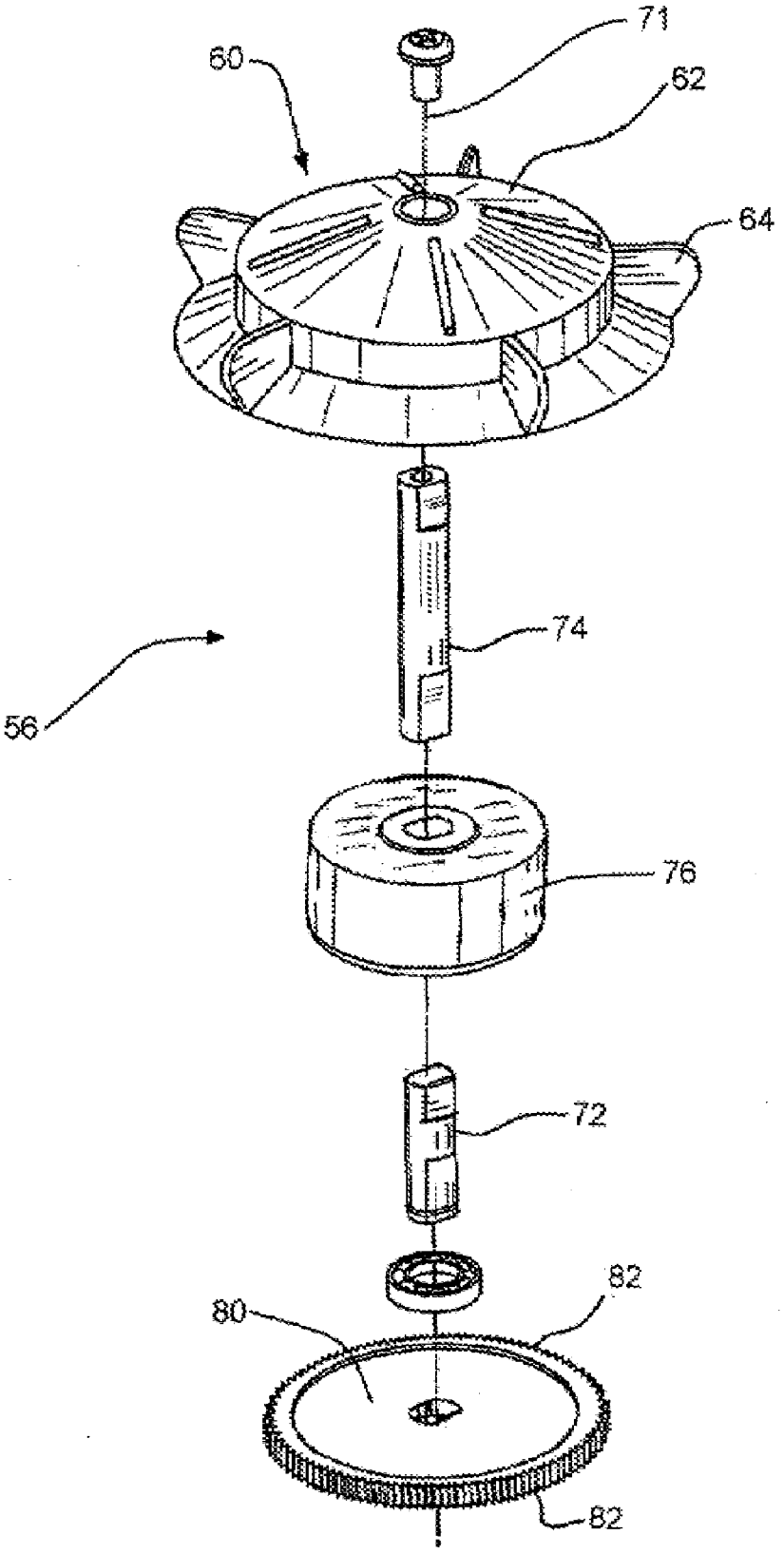


FIG. 3

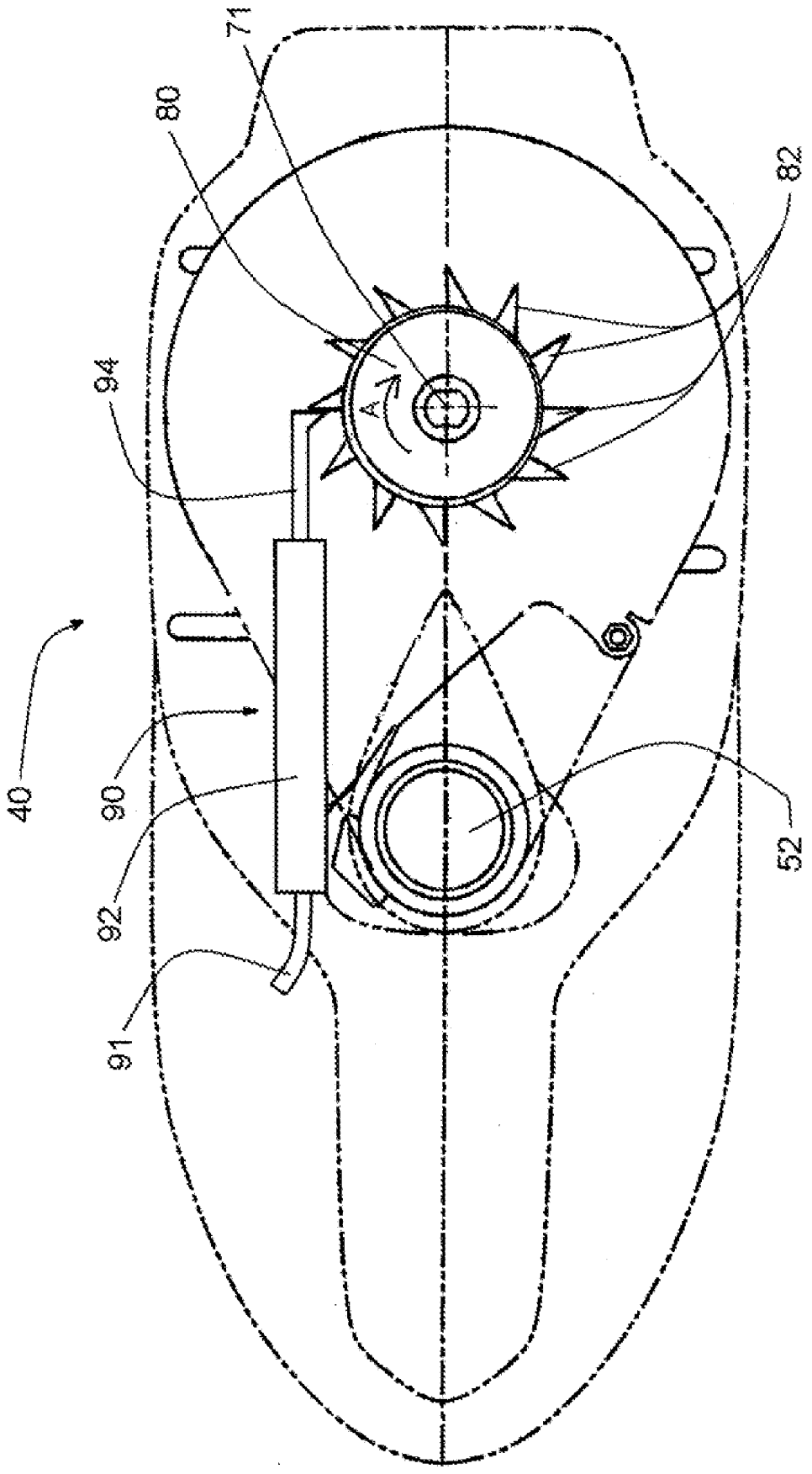


FIG. 4

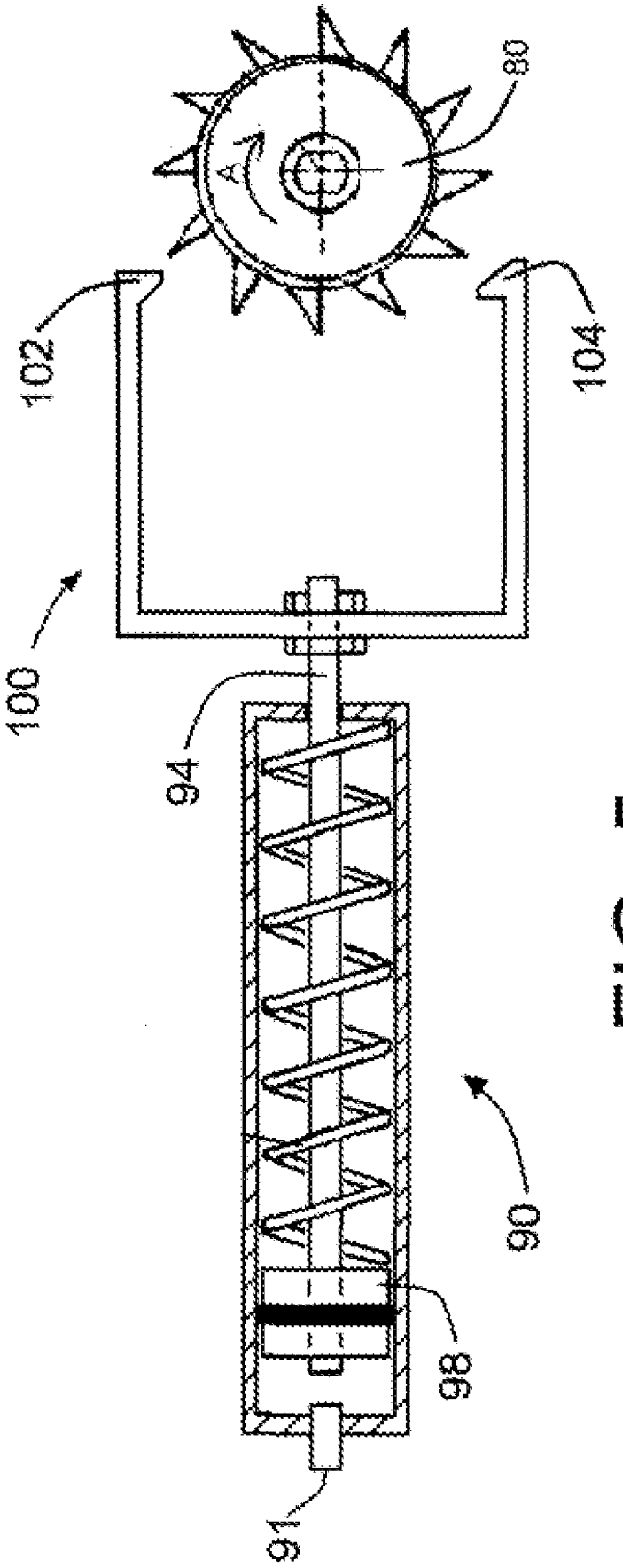


FIG. 5

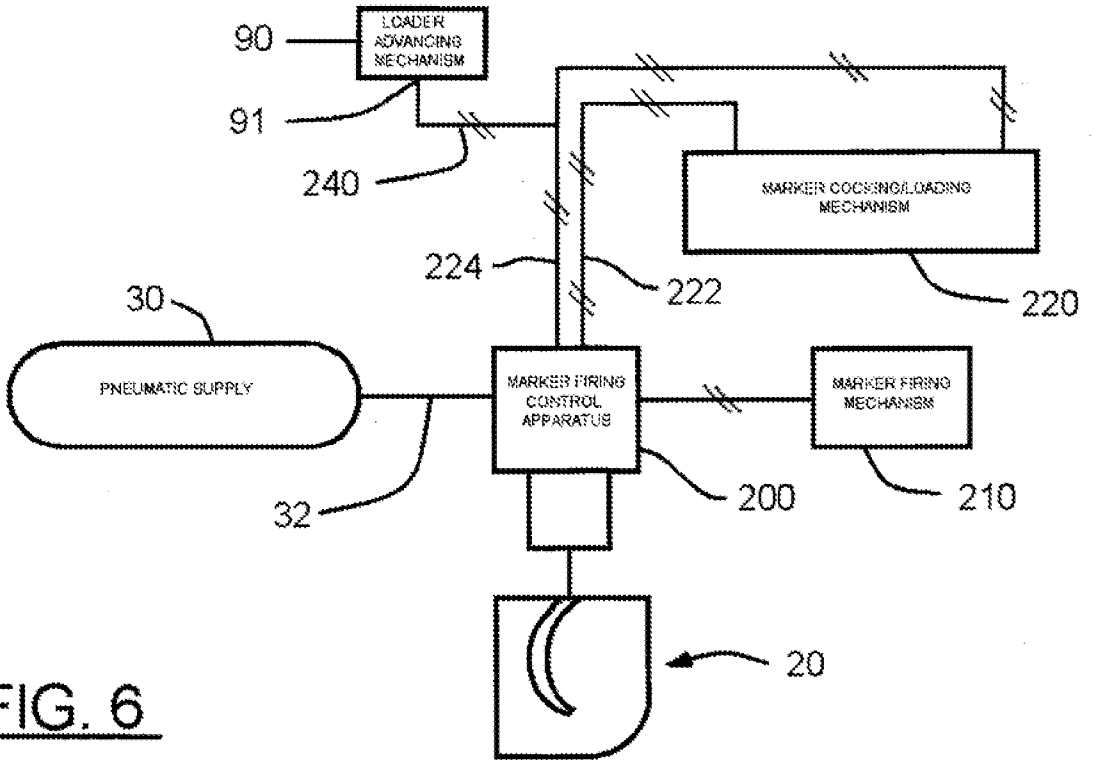

90
LOADER ADVANCING MECHANISM
91
240
MARKER COCKING/LOADING MECHANISM
224
222
220
30
PNEUMATIC SUPPLY
MARKER FIRING CONTROL APPARATUS
MARKER FIRING MECHANISM
32
200
210
20

FIG. 6

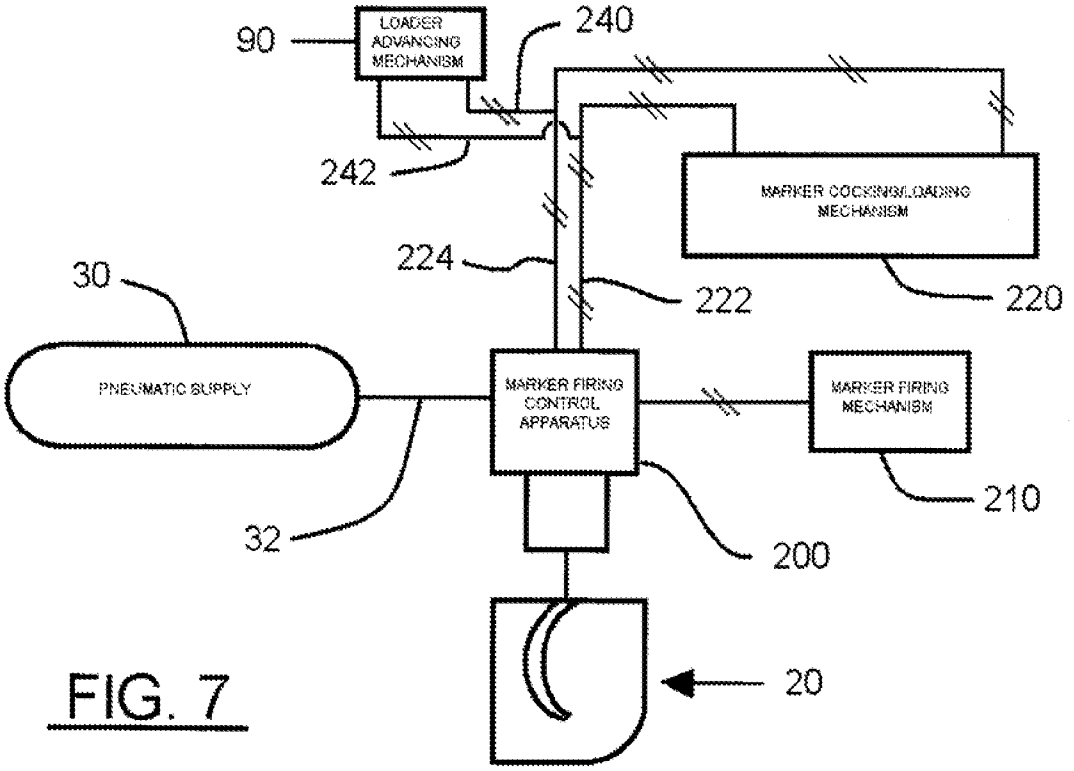

90
LOADER ADVANCING MECHANISM
240
242
MARKER COCKING/LOADING MECHANISM
224
222
220
30
PNEUMATIC SUPPLY
MARKER FIRING CONTROL APPARATUS
MARKER FIRING MECHANISM
32
210
200
20

FIG. 7

PNEUMATIC PAINTBALL LOADER DRIVE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] This invention relates generally to a paintball loaders and, more specifically to a pneumatically operated drive mechanism for rotating a drive cone in an active feed paintball loader.

[0003] 2. Description of the Prior Art

[0004] The sport of paintball war games continues to grow in popularity. During these war games, participants shoot frangible plastic balls full of a liquid dye at their opponents. The games are sometimes intensely competitive, requiring a participant to aim a gun, known also as a marker, at an opponent while pursuing, fleeing, dodging, or running for cover. Participants are excluded from further play once they have been hit and marked by a paintball. Success in the game requires the capability to fire a large number of paintballs in a short amount of time. A participant might discharge between several hundred and one thousand or more paintballs during the typical game lasting only a few minutes. Success in the game also requires player agility, which include being able to move run, dive, and roll for cover while carrying the marker.

[0005] Agitating paintball loaders are well known in the art of paintball sports, and operate by having a paintball agitator advance balls from the bottom of a loader into an outfeed tube. Active or force feeding paintball loaders are technologically advanced loaders that use battery-operated motors to forcibly drive paintballs from the loader, into an outfeed tube, and into the breech of a paintball marker. Examples of such loaders can be found in U.S. Pat. Nos. 6,213,110, 6,502,567, 6,701,907, and 6,792,933. As paintball loaders have evolved into electronically controlled devices capable of actively or forcibly feeding increasingly greater numbers of paintballs into a paintball gun, the demands upon the electric storage devices powering such loaders has increased accordingly. One problem now arising in such active paintball loaders occurs when the batteries powering the drive mechanisms become discharged, rending the paintball loader, and indeed the entire marker, effectively inoperable.

[0006] It would therefore, be a great advantage to provide a paintball marker drive mechanism using a more capable motive power supply. It is also desirable that such a mechanism utilize an energy supply already present in conventional paintball markers.

SUMMARY OF THE INVENTION

[0007] Accordingly, it is an object of the present invention to provide a pneumatic mechanism that uses compressed gas to operate the loader drive mechanism. Paintball markers typically carry substantial volumes of compressed gas in cylinders to supply the paintball marker firing mechanism. The cylinders may be recharged following each paintball game thereby providing an easily replenished source of motive power for both the marker and the loader.

[0008] It is a further object of the present invention to provide a pneumatically driven, active paintball loader capable of supplying paintballs to the marker at least as rapidly as the marker's firing rate. Many modern paintball markers are capable of firing up to 25 paintballs per second. The present invention receives input from the marker firing mechanism causing the drive to advance, moving paintballs to the marker inlet each time a paintball is discharged.

[0009] It is a further object of the present invention to provide a pneumatically driven, active paintball loader capable of supplying a quantity of paintballs to the marker sufficient to allow a participant to continue firing at a high rate for the duration of a paintball war game. A participant might discharge over one thousand paintballs during such a paintball game.

[0010] It is a further object of the present invention to provide a pneumatically driven, active paintball loader offering highly reliable performance. Many paintball games continue for only a few minutes during which time participants discharge thousands of paintballs. A participant with a non-functional marker is quickly "marked" and eliminated from the competition.

[0011] It is a still further object of the present invention to provide a pneumatic mechanism for advancing the drive cone in an active paintball loader that is compatible with a variety of known active loader designs and therefore easily retrofit as an improvement to existing designs.

[0012] It is a still further object of the present invention to provide a pneumatically driven, active paintball loader that is durable in construction, inexpensive of manufacture, carefree of maintenance, easily assembled, and simple and effective to use.

[0013] These and other objects are achieved by providing a pneumatic driver for an active paintball loader capable of feeding paintballs at a sufficiently high rate coordinated with firing the paintball marker using compressed gas to provide the motive power.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The advantages of this invention will be apparent upon consideration of the following detailed disclosure of the invention, especially when taken in conjunction with the accompanying drawings wherein:

[0015] FIG. **1** shows a side view of a typical paintball marker and loader of the type the present invention proves useful;

[0016] FIG. **2** shows a side view of a paintball loader and the present invention;

[0017] FIG. **3** shows an exploded view of a paintball feeder structure in conjunction with the present invention;

[0018] FIG. **4** shows the present invention as it interacts with the feed cone of a typical paintball loader;

[0019] FIG. **5** shows a partial detail view of the preferred embodiment of the present invention;

[0020] FIG. **6** is a schematic diagram showing interaction of the present invention with the firing controls of a typical paintball marker; and

[0021] FIG. **7** is a schematic diagram showing interaction of the preferred embodiment of the present invention with the firing control of a typical paintball marker.

DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0022] Many of the fastening, connection, processes and other means and components utilized in this invention are widely known and used in the field of the invention described, and their exact nature or type is not necessary for an understanding and use of the invention by a person skilled in the art, and they will not therefore be discussed in

significant detail. Various components shown or described herein for any specific application of this invention can be varied or altered as anticipated by this invention and the practice of a specific application of any element may already by widely known or used in the art by persons skilled in the art and each will likewise not therefore be discussed in significant detail. When referring to the figures, like parts are numbered the same in all of the figures.

[0023] FIG. **1** shows a side elevation view of a typical paintball marker **10**, illustrated in phantom, having an attached active feed loader **40** of the type in which the present invention is useful. Paintball marker **10** is a pneumatically-operated gun for discharging paintballs and is well-known in the art. Paintball marker **10** includes a main body **12**, a barrel **14**, a compressed gas supply cylinder **30**, a front handgrip **18**, and a rear handgrip **19**. The front handgrip **18** projects downwardly from the barrel **14** and, along with read handgrip **19**, provides areas for gripping by an operator of the paintball marker **10**. Paintball marker **10** also includes an inlet opening **16** leading to a firing chamber (not shown) in the interior of the main body **12** and a trigger **20**. The firing chamber also opens to barrel **14** through which projectiles, paintballs **100** in the preferred embodiment, are propelled. The compressed gas cylinder **30** is typically secured to a rear portion of the paintball marker **10**. Compressed gas is supplied to the marker via a pressure regulator (not shown) by gas supply line **32**. Loader feed line **34** may be used to provide compressed gas to loader **40** containing the present invention. Alternatively, loader feed line **34** may be connected to compressed gas control line within marker **10**, thereby taking advantage of the pneumatic sequencing controls occurring with the marker. The compressed gas cylinder **30** normally contains CO_2, although any compressible gas may be used.

[0024] Operation of marker **10** is selectively controlled by trigger **20** which directs the admission of compressed gas, supplied by storage cylinder **30** via gas supply line **32**, to a marker firing control apparatus (shown in FIGS. **6** and **7**) for a firing mechanism. The marker firing control apparatus coordinates pressurized gas supply to mechanisms with the marker to fire, reload, and prepare the marker to fire again. The bursts of gas are used to eject paintballs outwardly through the barrel **14** by operation of a firing mechanism. After firing, compressed gas is used to reposition a bolt in the firing chamber to open inlet opening **16** thereby allowing another projectile to be loaded into the firing chamber from the loader **40**. Compressed gas in then used to re-position the bolt so that the marker is ready to fire the projectile in response to a pull of the trigger **20**. The paintballs are continually fed by the paintball loader **40** through the inlet tube **16** to the firing chamber. Although FIG. **1** depicts an automatic paintball marker **10**, the paintball marker **10** may also be a semi-automatic marker.

[0025] FIG. **2** shows a side view of a paintball loader **40** of the type in which the present invention will prove useful. Active feed paintball loaders are well-known in the art and described in detail in U.S. Pat. No. 6,213,110, "Rapid Feed Paintball Loader," and U.S. Pat. No. 6,502,567, "Rapid Feed Paintball Loader With Pivotable Deflector," the entire contents of which are each incorporated herein by reference. The active fed paintball loader **40** includes a paintball container **42** having a container wall **44** forming an interior area **46**. The container **42** may be divided into an upper portion **48** and a lower portion **50**. Generally, an exit tube **52** leads from the lower portion **50** of the container **42** to an outlet opening **54**, although the exit tube **52** may be positioned at another location in the container **42**. The exit tube **52** is positioned adjacent the inlet tube **16** of the paintball marker **10**. Feed structure **56** is used to drive or urge the paintballs toward the exit tube **52** and into the inlet tube **16**.

[0026] Referring now to FIGS. **2** and **3**, a variety of feed structures **56** can be used with the present invention, including an impeller, drive cone, paddle wheel, fin, carrier or other device which can direct or otherwise force or urge paintballs into the exit tube **52**. Feed structures are disposed within loaders such that rotation occurs in one direction (e.g. a feed direction) only so that paintballs cannot move away from the paintball marker inlet as a result of reverse rotation of the feed structure. By way of example and not limitation, a drive cone **60** is shown in FIGS. **2** and **3**. Drive cone **60** includes base **62** and a plurality of fins **64** which preferably extend in a radial direction from the base **62**. The drive cone **60** is connected to a connecting shaft **74** which rotates drive cone **60** thereby forcing movement of the paintballs. Connecting shaft **74** is connected to drive shaft **72** by a slip clutch **76** which is interposed between the two shafts to allow relative motion between them when the resistance on drive cone **60** and connecting shaft **74** exceeds a predetermined value. Drive shaft **72**, connecting shaft **74**, slip clutch **76** and drive cone **60** are rotatably disposed along a central axis of rotation **71**. In an alternate embodiment, one end of slip clutch **76** may be connected directly to drive cone **60** thereby eliminating the connecting shaft **74**. Drive gear **80** is rotated about the central axis of rotation **71** by advancing mechanism **90** which interacts with drive gear **80**. Drive gear **80** is connected to drive shaft **72** so that as it is rotated by advancing mechanism **90**, rotational motion is transferred to drive shaft **72**. When rotational resistance of drive cone **60** is within predefined torque limit, this rotational motion is transferred through slip clutch **76** to connecting shaft **74** whereby drive cone **60** is rorated. By employing slip clutch **76** to allow relative rotational movement between the drive cone **60** and the drive gear **80** and limiting the torque that can be transferred, drive cone **60** will not be advanced by further rotation of drive gear **80** when the exit feed tube **52** is completely filled with paintballs thereby creating excessive resistance to rotation of the drive cone. In such circumstances, the slip clutch **76** limits torque transferred from drive shaft **72** to drive cone **60** and prevents paintballs from being ruptured in the loader exit tube **52** by the drive cone **60**. Ruptured paintballs can cause the loader to jam rendering the marker useless and leaving a paintball player vulnerable during a paintball game. Slip clutch **76** may be in the form of a mechanical torque-limiting clutch such as a serrated clutch, friction clutch, detent clutch, or the like, or the slip clutch may rely on other designs such as a magnetic coupling.

[0027] Referring now to FIG. **4**, a partial view of one embodiment of advancing mechanism **90** is depicted and includes pneumatic cylinder **92**, advancing shaft **94**, and drive gear **80**. Advancing mechanism **90** is located on the lower side of loader **40** (shown in shadow). Motive force to advancing mechanism **90** is provided by first inlet opening **91** which receives sequenced, pressurized gas pulses from the marker firing control apparatus, shown in FIG. **6**. In an alternate embodiment, an advancing mechanism controller may be disposed within loader **40** and receive sequencing input signals from the marker trigger **20** or other suitable

sources within the marker **10**. The pressurized gas causes advancing shaft **94** to extend from pneumatic cylinder **92**. When the pressured gas is relieved, the advancing shaft **94** retracts into the pneumatic cylinder **92**, preferably by the force of a spring (not shown). The process may be reverse (e.g., gas pressure to retract the advancing shaft and spring to extend) with equal effectiveness. Engaging structure **100** is connected to the exposed end of advancing shaft **94** and includes a first engaging pawl **102** at its distal end. Drive gear **80** has a generally circular, planar structure and includes a plurality of drive teeth **82** substantially uniformly arranged about the circumference of the drive gear. The profile of the teeth **82** and the first engaging pawl **102** is such that the interaction between them forms a ratchet. The first engaging pawl **102** engages the profile of at least one drive tooth **82** as the advancing shaft **94** extends from pneumatic cylinder **92**, shown as movement of the engaging structure **100** to the right in FIG. **4**, thereby causing drive gear **80** to rotate in a first direction, referred to as a forward direction and shown as direction arrow "A" in FIG. **4**. The arrangement of first engaging pawl **102** and the drive teeth **82** on the drive gear **80**, and the amount of travel from the advancing shaft **94** as it moves from fully retracted to fully extended provides sufficient rotational input to drive cone **60** as advancing shaft **94** extends so that a paintball is supplied to the marker by the rotation of the drive cone. Insufficient rotation of the drive cone **60** may cause a mis-feed (e.g., no paintball is urged into the firing chamber) while excessive rotation may cause excessive slipping of slip clutch **76** and failure of the clutch due to wear.

[0028] Rotation of drive gear **80** is transferred by drive shaft **70** to the input of slip clutch **76**. Engaging structure **100**, including first engaging pawl **102** is constructed of a flexible material, such as plastic, to allow the engaging structure **100** to flex slightly as the advancing shaft **94** retracts into the pneumatic cylinder **92** drawing the engaging structure across the perimeter of drive gear **80**. This slight flexing is essential to enable the engaging pawl **102** to move away from the perimeter of the drive teeth **82** and slip past a drive tooth without causing the drive gear **80** to be rotated in a reverse direction. In the preferred embodiment, the advancing structure **100** is made from delrin.

[0029] FIG. **5** shows a partial detail view of the preferred embodiment of advancing mechanism **90** of the present invention. In this embodiment, the advancing structure **100** includes a first engaging pawl **102** and a second engaging pawl **104** spaced apart to allow the pawls to interact with drive gear **80** on opposite circumferential sides of drive gear **80**. The profiles of first and second engaging pawls **102**, **104** are reversed relative to one another so that as the advancing shaft **94** extends, moving engagement structure **100** into contact with drive gear **80** in a first direction, first engagement pawl **102** will interact with at least one drive tooth **82** and cause rotation of drive gear in the forward (feed) direction. After the advancing shaft **94** is fully extended and begins retracting into the pneumatic cylinder **92**, second engagement pawl **104** interacts with at least one drive tooth **82** generally on the opposite circumferential side so that drive gear **80** is rotated, still in the forward direction. In this manner, each movement of advancing shaft **94**, whether extending from or retracting into pneumatic cylinder **92**, causes drive gear **80** to be rotated in the forward direction thereby increasing the efficiency of the advancing mechanism **90**. The arrangement of first engaging pawl **102**, second engaging pawl **104**, the drive teeth **92** on drive gear **80**, and the amount of travel of advancing shaft **94** provides sufficient rotational input to drive cone **60** as a result of the extension/retraction of advancing shaft **94** to supply a paintball to the marker by the resultant rotation of the drive cone **60**. Compared to the advancing mechanism shown in FIG. **4**, the two-pawl engaging structure **100** is capable of providing sufficient rotational input using an advancing cylinder **92** having a shorter stroke between fully retracted and fully extended. A shorter stroke generally requires less input air thereby reducing the overall air demand of the two-pawl engagement structure.

[0030] Also shown in FIG. **5** is a cross-sectional view of pneumatic cylinder **92** in which advancing shaft **94** is axially disposed and allowed to move in opposing axial directions. Piston **98** is connected to one end of advancing shaft **94** and positioned within pneumatic cylinder **92** so that pressurized gas supplied through first inlet opening **91** acts on piston **98** and forces it away from first inlet opening **91**. Movement of piston **98** causes advancing shaft **94** to be extended from pneumatic cylinder **92** as long as the supply of pressurized gas is present. Movement of advancing shaft **94** by piston **98** is resisted by return spring **96** which is disposed within pneumatic cylinder **92** so that extension of advancing shaft **94** from pneumatic cylinder **92** compresses the return spring **96**. In this manner, when the pressurized gas force is removed from piston **98**, return spring **96** will force the piston toward the first inlet opening **91** thereby retracting advancing shaft **94** into the pneumatic cylinder **92**. The process may be reversed (e.g., gas pressure to retract the advancing shaft and spring to extend) with equal effectiveness.

[0031] In an alternate embodiment, return spring **96** may be removed, a second inlet opening into the pneumatic cylinder **92** added opposite end to first inlet opening **91**, and a second pressurized gas pulse supplied drives piston **98** to retract advancing shaft **94** into pneumatic cylinder **94**. A schematic for this alternate embodiment is provided in FIG. **7**.

[0032] In yet another embodiment, advancing mechanism **90** and drive gear **80** are replaced by a pneumatic stepper drive (not shown). The stepper drive is a commercially available item that provides a predetermined amount of rotational movement in response to a pneumatic input signal or pressure pulse. The amount of rotation provided by the stepper drive is selected to provide sufficient rational of the drive cone **60** to urge a paintball into the marker inlet **16**, but not so much rotation that excessive slip of slip clutch **76** occurs. Commonly available units include those providing 90 and 180 degrees of shaft rotation when supplied with the pneumatic pulse. One preferable stepper drive is the vane type rotary actuator series NCRB1BW by SMC Corporation having a 180 degree rotation per pulse. Stepper drives generally require slightly larger gas volumes for operation compared to the preferred embodiment, but offer greater simplicity in design and improved reliability.

[0033] In FIG. **6**, shown in a schematic diagram of the firing controls of a typical paintball marker in which the present invention is useful. In the embodiment shown, pressurized gas to operate advancing mechanism **90** is provided from the same pneumatic controls that fire and load the paintball marker. In other embodiments, a solenoid may be provided to actuate the loader advancing mechanism **90** using a variety of readily available inputs from the marker

to indicate that the marker has been fired and the loader should provide paintballs to the marker.

[0034] Marker firing control apparatus **200** is selectively actuated by a person using trigger **20**. Firing control apparatus **200** is connected to pneumatic gas supply **30** from a regulated supply line **32**. Firing control apparatus **200** directs a pneumatic firing signal to marker firing mechanism **210**. It also directs pneumatic signals to marker cocking/loading mechanism **220** along pneumatic cocking line **222** and pneumatic loading line **224** to manage the position of a firing bolt within the marker. The position of the firing bolt determines when marker is ready to receive a paintball through inlet opening **16** (not shown in FIG. **6**). The pneumatic loading signal present in pneumatic loading line **224** may also be used to signal the loader advancing mechanism **90** to actuate feed structure **56** and supply paintballs to the marker. Pneumatic advancing line **240** conveys the pneumatic signal present in pneumatic loading line **224** to the advancing mechanism **90** through inlet opening **91** in the advancing mechanism's pneumatic cylinder thereby cycling advancing mechanism **90** as the marker is being reloaded.

[0035] FIG. **7** shows a variation of the firing controls in which the loader advancing mechanism uses pneumatic pressure to move the advancing shaft in both direction (e.g., a return spring **96** is not present). Operation is as described in connection with FIG. **6**, except that a pneumatic retracting line **242** is connected to the pneumatic cocking line **222** to provide a pneumatic pulse to retract advancing shaft **94**. Marker cocking and loading signals are commonly inverse to one another, that it when one is present, the other is not. Using these inverse alternating signals provides a convenient source to cause advancing mechanism **90** to reciprocate and drive the marker feed structure **56** to cause a near-constant supply of paintballs to the marker.

[0036] Although the invention has been described in connection with specific examples and embodiments, those skilled in the art will recognize that the present invention is capable of other variations and modifications within the scope of the invention but beyond those described herein. Changes in the details, materials, steps and arrangements of part which have been described and illustrated to explain the nature of the invention will occur to and may be made by those skilled in the art upon a reading of this disclosure within the principles and scope of the invention. The foregoing description illustrates the preferred embodiment of the invention, however, concepts, as based upon the description, may be employed in other embodiments without departing from the scope of the invention as presented in the following claims.

Having thus described the invention, I claim as new and for which a Letters Patent of the United States is desired to be secured is:

1. A drive mechanism for use with an active paintball loader comprising:

a drive shaft positioned along a central axis and rotatable about said central axis;

a feeder structure positioned along said central axis and rotatable in one direction about said central axis;

a slip clutch controlling the connection between said drive shaft and said feeder structure;

a drive member connected to said drive shaft and rotatable about said central axis generally in unison with said drive shaft;

a compressed gas supply; and

an advancing mechanism moved by gas from said compressed gas supply with a controller selectively coordinating the gas supplied to said advancing mechanism, said advancing mechanism rotating said drive member.

2. The drive mechanism as described in claim **1**, further comprising a paintball marker generating a signal indicating the said marker is ready to receive a paintball and sending said signal to said controller, said controller upon receiving said input signal causes a loading signal to be directed to said advancing mechanism.

3. The drive mechanism as described in claim **1**, wherein said advancing mechanism is a pneumatic actuator connected to said drive shaft that causes said drive shaft to rotate.

4. The drive mechanism as described in claim **3**, wherein said pneumatic actuator is a pneumatic stepping motor and said drive member connects said pneumatic stepping motor to said drive shaft.

5. The drive mechanism as described in claim **1**, wherein said slip clutch is a friction clutch.

6. The drive mechanism as described in claim **1**, wherein said slip clutch is a serrated clutch.

7. The drive mechanism as described in claim **1**, wherein said slip clutch has a magnetic coupling.

8. The drive mechanism as described in claim **1**, wherein said drive member is a generally circular planar structure having a perimeter with a plurality of ratchet teeth extending radially from said perimeter.

9. The drive mechanism as described in claim **8**, wherein said advancing mechanism further comprises:

a cylinder containing a piston;

at least one inlet opening into said cylinder;

an elongate link linearly movable in first and second opposing directions and having first and second opposing ends, said first end connected to said piston; and

a first pawl and a second pawl connected to said second end of said elongate link, said first pawl and second pawl separated by said drive member and arranged to interact with said drive member on opposite sides of said perimeter, movement of said link in said first direction engages said first pawl into at least one tooth of said plurality of ratchet teeth and said second pawl at least one tooth thereby rotating said drive member in a feeding rotational direction, movement of said link in said second direction engages said second pawl into at least one tooth of said plurality of ratchet teeth and said first pawl moves past without engaging from said ratchet teeth and thereby causing rotation of said drive member in said first rotational direction.

10. The drive mechanism as described in claim **9**, further comprising a spring disposed within said cylinder such that a compressed gas supplied to said at least one inlet opening of said cylinder causes said piston to move in one direction, and said spring causes said piston to move in an opposite direction.

11. The drive mechanism as described in claim **9**, further comprising a first and a second opening in said cylinder such that a compressed gas supplied only to said first opening causes said piston to move in one direction, and a compressed gas supplied only to said second opening causes said piston to move in an opposite direction.

12. The drive mechanism as described in claim **8**, wherein said advancing mechanism further comprises:

a cylinder containing a piston;

at least one inlet opening into said cylinder;

an elongate link linearly movable in first and second opposing directions and having first and second opposing ends, said first end connected to said piston; and

a pawl connected to said second end of said elongate link, said pawl arranged to interact with said perimeter of said drive member, movement of said link in said first direction engages said pawl into at least one tooth of said plurality of ratchet teeth thereby rotating said drive member in a feeding rotational direction, movement of said link in said second direction causing said pawl to move past without engaging said ratchet teeth.

13. In a paintball marker powered by a compressed gas supply having a firing chamber, a firing chamber inlet tube, a trigger apparatus initiating discharge of a first paintball from said chamber and introduction of a second paintball into said chamber via said inlet tube; an active loader having a container for holding a plurality of paintballs, a rotating feeder structure mounted on a bottom portion of said container, and an exit tube exiting from the bottom portion of said container and leading to said inlet tube of the paintball gun, the improvement comprising:

a drive shaft positioned along a central axis and rotatable about said central axis;

a feeder structure positioned along said central axis and rotatable in one direction about said central axis;

a slip clutch controlling the connection between said drive shaft and said feeder structure, said slip clutch limiting torque transferred from said drive shaft to said feeder structure;

a drive member connected to said drive shaft and rotatable about said central axis generally in unison with said drive shaft; and

an advancing mechanism moved by gas from said compressed gas supply with a controller selectively coordinating the gas supplied to said advancing mechanism, said advancing mechanism rotating said drive member, rotation of said drive member being generally transferred to said feeder structure within torque transfer limits of said slip clutch, rotation of said feeder structure causing paintballs from said container to be moved into said exit tube.

14. The improvement of claim **13**, further comprises an input signal generated by said marker indicating that said marker is ready to receive a paintball, said marker sending said signal to said controller, said controller, upon receiving said input signal, generates a loading signal and directs a loading signal to said advancing mechanism.

15. The improvement of claim **13**, wherein said advancing mechanism is a pneumatic actuator connected to said drive shaft that cuases said drive shaft to rotate.

16. The improvement of claim **15**, wherein said pneumatic actuator is a pneumatic stepper motor and said drive member connects said pneumatic stepper motor to said drive shaft.

17. The improvement of claim **16**, wherein said drive member is a generally circular planar structure having a perimeter with a plurality of ratchet teeth extending radially from said perimeter, said advancing mechanism further comprising:

a cylinder containing a piston;

at least one inlet opening into said cylinder;

an elongate link linearly movable in first and second opposing directions and having first and second opposing ends, said first end connected to said piston; and

a first pawl and a second pawl connected to said second end of said elongate link, said first pawl and second pawl separated by said drive member and arranged to interact with said drive member on opposite sides of said perimeter, movement of said link in said first direction engages said first pawl into at least one tooth of said plurality of ratchet teeth and said second pawl at least one tooth thereby rotating said drive member in a feeding rotational direction, movement of said link in said second direction engages said second pawl into at least one tooth of said plurality of ratchet teeth and said first pawl moves past without engaging from said ratchet teeth and thereby causing rotation of said drive member in said first rotational direction.

18. The improvement of claim **17**, further comprising a spring disposed within said cylinder such that a compressed gas supplied to said at least one inlet opening of said cylinder causes said piston to move in one direction, and said spring causes said piston to move in an opposite direction.

19. The improvement of claim **17**, further comprising a first and a second opening in said cylinder such that a compressed gas supplied only to said first opening causes said piston to move in one direction, and a compressed gas supplied only to said second opening causes said piston to move in an opposite direction.

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