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(54) **ROTARY TRANSFER DEVICE FOR A  
PAINTBALL MARKER**

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(57) **ABSTRACT**

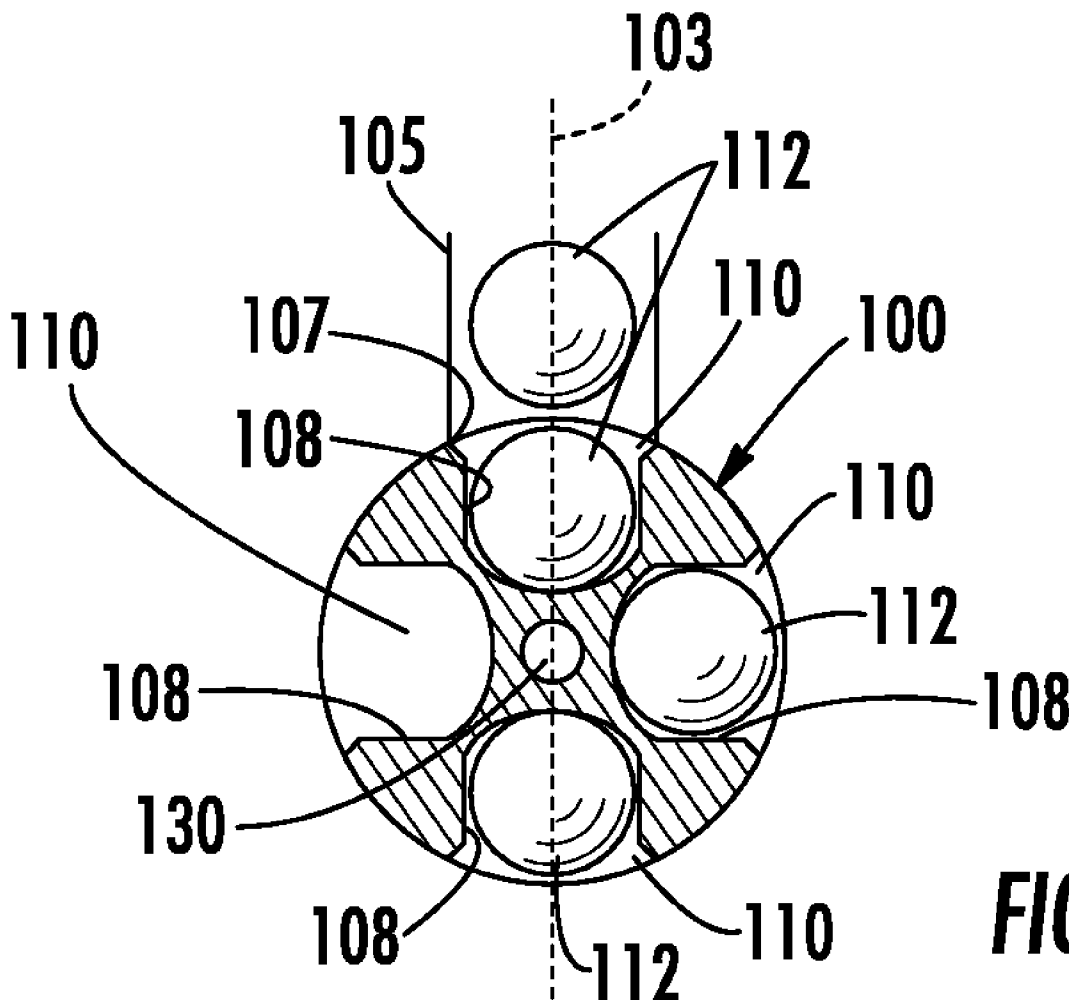
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The rotary transfer device assembly of the present invention has a cylindrical-shaped rotary transfer device, which rotates about a central shaft. About the circumference of the rotary transfer device are a number of chambers, each of which can accept a single projectile as it passes through a feed aperture. As the rotary transfer device rotates, it transports the projectiles from the feed aperture to the breech from where the projectile can be launched from the barrel of the launching device.

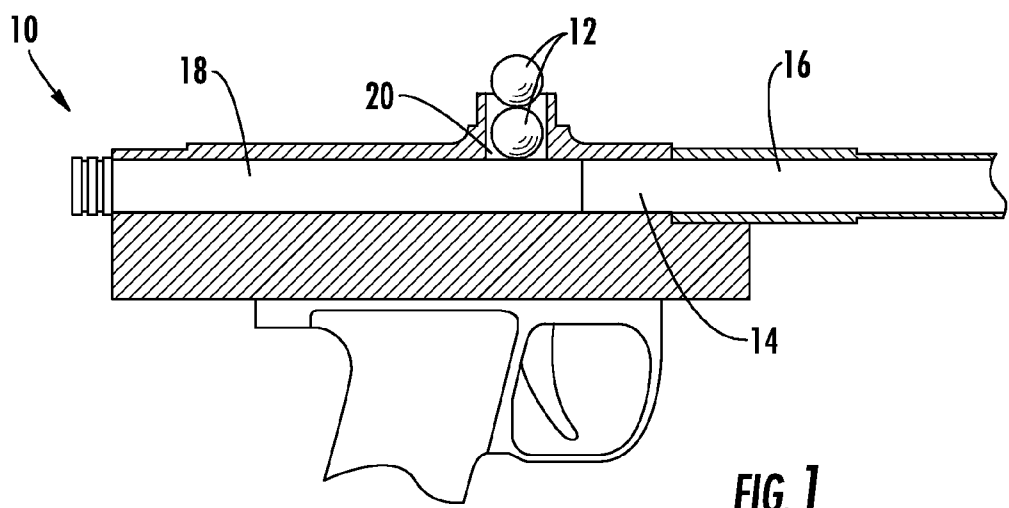
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**Related U.S. Application Data**

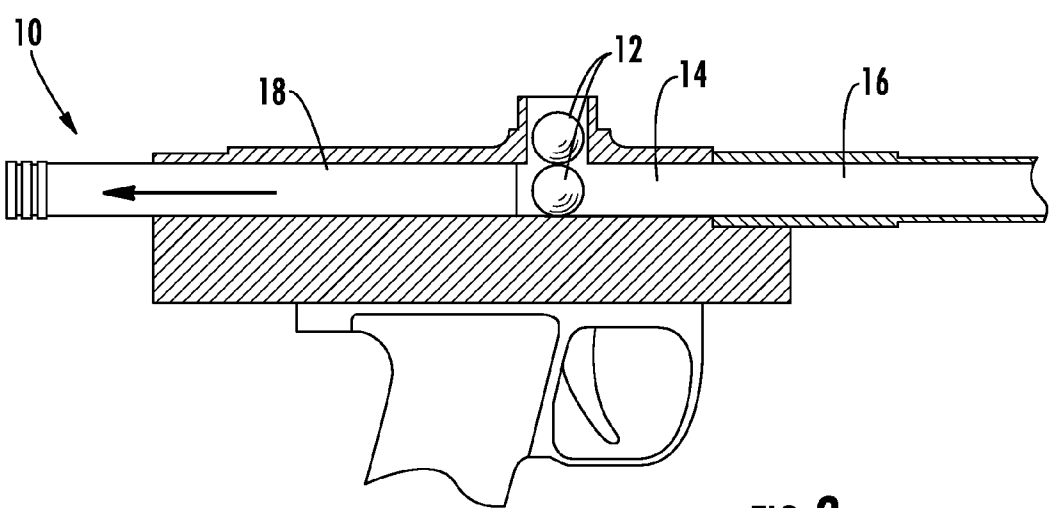
(63) Continuation of application No. 10/906,368, filed on Feb. 16, 2005.



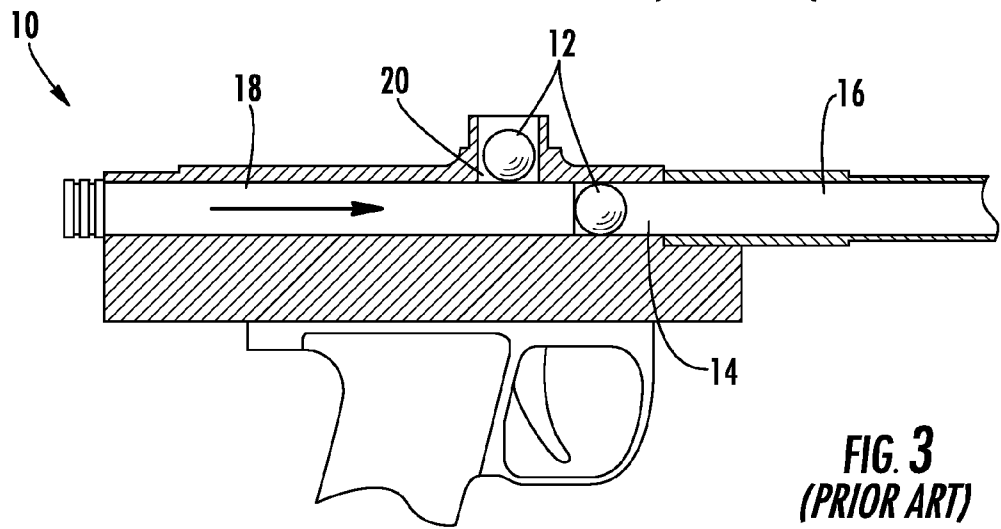
**FIG. 4**



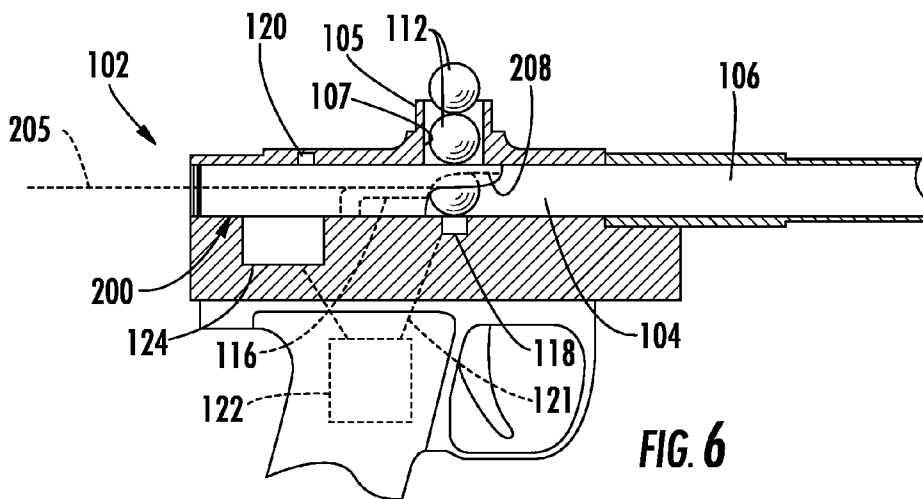
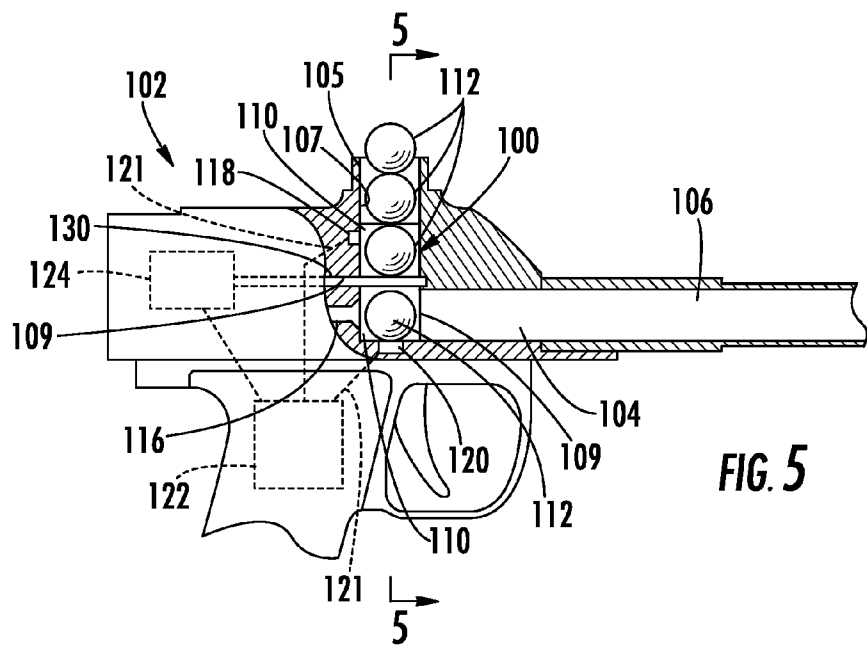
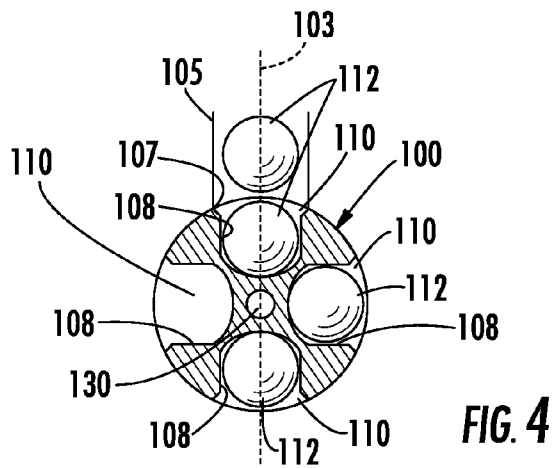
**FIG. 1**  
**(PRIOR ART)**



**FIG. 2**  
**(PRIOR ART)**



**FIG. 3**  
**(PRIOR ART)**



**ROTARY TRANSFER DEVICE FOR A  
PAINTBALL MARKER**

**CROSS-REFERENCE TO RELATED  
APPLICATION**

[0001] This application claims is a continuation application of U.S. application Ser. No. 10/906,368, filed Feb. 16, 2005, which claims priority to earlier filed U.S. Provisional Application Ser. No. 60/545,399, filed Feb. 17, 2004, the entire contents of which are incorporated herein by reference.

**BACKGROUND OF THE INVENTION**

[0002] 1. Field of the Invention

[0003] The present invention relates generally to firing mechanisms for pneumatically operated projectile launchers and more particularly to a rotary transfer device for a pneumatically operated projectile launcher.

[0004] 2. Description of the Related Art

[0005] Referring first to FIG. 1, in a prior art pneumatically or electromagnetically operated projectile launcher 10, projectiles 12 are loaded in to the breech 14 or barrel 16 of the pneumatic projectile launcher 10 by means of a reciprocating bolt 18, which moves back and forth below a feed aperture 20 through which projectiles 12 can pass. A typical projectile that is launched is a paintball, which is well known in the art. FIG. 1 shows a cross-sectional view of this type of prior art reciprocating bolt mechanism when the bolt 18 is in a resting or closed position. When the user initiates the loading cycle, the bolt 18 moves backwards to an open position, as shown in FIG. 2, to open the feed aperture 20 and allow a projectile 12 to fall into the breech 14 of the pneumatic projectile launcher 10. Projectiles, such as paintballs, are typically fed from a hopper (not shown) into the breech by gravity. Such hoppers need not be discussed herein as they are well-known in the art. Such projectile launchers are known as paintball markers or guns. The bolt 18 then moves forward, as shown in FIG. 3, to push a single projectile 12 further into the breech 14, to a launching position from which the projectile 12 can be propelled down the barrel 16 and out of the pneumatic projectile launcher 10. In general, as is well known in the art, the bolt controls the loading of projectiles into the breech for launching. The timing and nature of the bolt movement is very important to avoid jamming while maintaining high rates of launching.

[0006] Another variation (not shown) or the pneumatic projectile launcher has its feed aperture open when the bolt is the rest position. However, the loading principle remains the same in that the bolt reciprocates back and forth.

[0007] Pneumatic projectile launcher that use reciprocating bolts suffer several disadvantages that inherently limit the maximum rate of fire achievable. First, only one projectile is loaded at a time. Second, any interruption in the flow of projectiles, such as binding in the loading hopper, reduces the cycle speed. Finally, the bolt must reverse direction during the loading cycle, further reducing the maximum possible cycle speed.

[0008] Therefore, there is a need for a bolt mechanism that overcomes limitations of a reciprocating bolt in pneumatic projectile launchers of the prior art. There is a further need for a bolt system that has launch rates that are faster than prior art launchers.

[0009] There is yet another need for a paintball marker that has launch rates that are faster than prior art markers.

[0010] There is a need to make a paintball marker more efficient by reducing bolt movement while improving bolt performance.

**SUMMARY OF THE INVENTION**

[0011] The present invention overcomes the limitations of bolt mechanisms of the prior art by providing a novel rotary transfer device, which is capable of achieving higher rates of fire.

[0012] The preferred embodiment of the present invention has a preferably cylindrical-shaped transfer device assembly, which rotates about a central shaft. Around the circumference of the rotary transfer device are a number of chambers or seats, each of which can respectively receive projectiles as it passes proximal to the feed aperture. As the rotary transfer device rotates, it transports the projectiles from the feed aperture to a launch position within the breech from where the projectile can be propelled from the projectile launcher.

[0013] Accordingly, an object of the present invention is to provide a rotary transfer device capable of loading multiple projectiles at a time.

[0014] Yet another object of the present invention is to provide a rotary transfer device with a rate of fire superior to those found in the prior art.

[0015] Yet another object of the present invention is to provide a paintball marker that operates more efficiently than prior art markers and at higher launching rates.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0016] These and other features, aspects, and advantages of the present invention will become better understood with reference to the following description, appended claims, and accompanying drawings where:

[0017] FIG. 1 is a side cross-sectional view of a prior art projectile launcher with a reciprocating bolt in a closed resting position;

[0018] FIG. 2 is a side cross-sectional view of a prior art projectile launcher with the bolt in an open position;

[0019] FIG. 3 is a side cross-sectional view of a prior art projectile launcher with the bolt in the closed position with a projectile in the launching position;

[0020] FIG. 4 is front cross-sectional view of the preferred embodiment of the present invention;

[0021] FIG. 5 is a partial side cross-sectional view of the preferred embodiment of the present invention through line 5-5 of FIG. 4; and

[0022] FIG. 6 is a partial side cross-sectional view of an alternative embodiment of the present invention.

**DESCRIPTION OF THE PREFERRED  
EMBODIMENT**

[0023] Referring now to FIGS. 4 and 5, the preferred embodiment of the present invention is shown generally at 100 mounted within a representational projectile launcher 102. The rotary transfer device system of the present invention can be used in any projectile launching device. Such devices include paintball markers. For ease of illustration and discussion, the present invention is shown in a paintball marker; however, the invention is intended to cover use in any type of projectile launching device.

[0024] The projectile launcher 102, such as a paintball marker, has a central breech 104. Extending from the breech 104 is the barrel 106. A feed conduit 105 leads to the breech

104 of the paintball marker 102 forming a feed aperture 107. A hopper (not shown) can also be used to gravity feed paintball projectiles 112 into the feed aperture 107. Projectiles 112 flow down the feed conduit 105 and out the feed aperture 107. The rotary transfer device 100 of the present invention receives the projectile 112 from the feed aperture 107 and positions the projectile 112 within the breech 104 for subsequent launching.

[0025] The rotary transfer device 100 of the present invention preferably has a cylindrical shape, which rotates about a central shaft 130. The central shaft 130 is mounted within a pair of collars 109 of the paintball marker 102. Preferably, the central shaft 130 of the rotary transfer device 100 is mounted within the same vertical plane as that of the centerline 103 of the barrel 106, but the centerlines could easily be offset from one another, if desired. Thus the rotary transfer device 100 rotates about an axis through shaft 130. Preferably, the axis of central shaft 130 is parallel with the axes of the breech 104 and barrel 106. But axes of the central shaft 130 and breech 104 and barrel 106 could be in any number of relations to the longitudinal axis such as perpendicular in either a vertical or horizontal relationship or anywhere in between.

[0026] Around the circumference of the rotary transfer device 100 are a number of walls 108 defining chambers or seats 110, each of which can accept a single projectile 112 as it passes proximal to the feed aperture 107 of the paintball marker 102. As the rotary transfer device 100 rotates about the central shaft 130, it transports the projectiles 112 from the feed aperture 107 to the breech 104 of the paintball marker 102 from where the projectile 112 can be launched, typically by the rapid discharge of a compressed gas released through the fluid conduit 116. Such launching of paintball projectiles 112 using compressed gas is so well known in the art, it need not be discussed in detail herein.

[0027] Although there are four (4) chambers 110 shown, one skilled in the art would appreciate that the present invention could be easily implemented with any number of chambers or seats 110 desired.

[0028] Still further, FIG. 6 shows an alternative embodiment 200 of the present invention of a paintball marker 102 that includes a single projectile seat 208 rather than the multiple seats 110 of FIG. 4. Rotary transfer device 200 rotates about an axis 205 to face seat 208 upwards to receive a projectile 112. Then, the bolt can rotate to position the projectile 112 for launching while preventing other projectiles 112 from entering the breech 104. In this alternative embodiment, the rotary transfer device 200 rotates about an axis that is co-axial with the longitudinal axes of the breech 104 and barrel 106.

[0029] The rotary transfer device 100 of the preferred embodiment and rotary transfer device 200 of the alternative embodiment may be driven by a number of different means 124. Preferably, pneumatic power is used to rotate the rotary transfer device 100, but electric, electromagnetic, magnetic or even spring power could be used instead. For example, impellers impelled by a gas may be used to rotate the bolt.

[0030] A first sensor 118 may also be strategically positioned in order to detect whether a projectile 112 is present within one or more of the chambers or seats 110, 208. Preferably, the sensor 118 is an optoelectronic device, but other kinds of sensors such as of the ultrasonic, inductive, or pressure type could be used equally well. A second sensor 120 may also be positioned in order to detect the rotational position of the rotary transfer device 100. Preferably, this device

120 is an optoelectronic component as well, but an inductive or resistive sensor device could also be used with equal effectiveness. Signals from the sensors 118, 120 are passed by means of wires 121 to a controller 122, which determines when to rotate the rotary transfer device 100 and at what speed. The controller 122 operates the drive 124, which rotates the rotary transfer device 100. Preferably, the controller 122 is an electrical device, but it could also be implemented pneumatically also.

[0031] Further, an LED or LCD display may be provided in conjunction with the controller 122 to monitor the operation of the paintball marker 102. Optional control elements that interface with the controller 122 may include buttons or levers to modify settings within the marker 102 or an interface means so that the marker can be monitored by a remote device. Finally, the interface means may be through a wired connection or other wireless means that allow both monitoring and control of the marker 102 as well as allowing control programs to be downloaded into the marker 102 as desired.

[0032] While there is shown and described herein certain specific structure embodying the invention, it will be manifest to those skilled in the art that various modifications and rearrangements of the parts may be made without departing from the spirit and scope of the underlying inventive concept and that the same is not limited to the particular forms herein shown and described except insofar as indicated by the scope of the appended claims.

What is claimed is:

1. A rotary transfer device assembly for a device for launching a projectile having a breech with a breech longitudinal axis, a barrel extending from the breech, and a feed aperture formed on the breech, said rotary transfer device assembly comprising:

- a rotary transfer device having a longitudinal axis and an outer circumferential surface, rotatably mounted within said breech and rotatable about the longitudinal axis;
- the rotary transfer device defining a projectile seat in the outer circumferential surface; the rotary transfer device being rotatable between a closed position preventing a projectile from entering the breech from the feed aperture and an open position rotatably moving a projectile from the feed aperture into the breech in preparation for launching the projectile through the barrel;
- a first sensor configured and arranged to detect the presence of a projectile within the projectile seat; and
- a drive configured and arranged to rotate the rotary transfer device.

2. The assembly of claim 1, wherein the longitudinal axis is co-axial with the breech longitudinal axis.

3. The assembly of claim 1, wherein the rotary transfer device is rotated about the longitudinal axis by pneumatics.

4. The assembly of claim 1, wherein the rotary transfer device is rotated about the longitudinal axis by electromagnetics.

5. The assembly of claim 1, wherein the rotary transfer device is rotated about the longitudinal axis by an impeller.

6. The assembly of claim 1, wherein the rotary transfer device is rotated about the longitudinal axis by a spring.

7. The assembly of claim 1, wherein the rotary transfer device is rotated about the longitudinal axis by electronics.

8. The assembly of claim 1, further comprising:

- a second sensor configured and arranged to detect the rotational position of the rotary transfer device.

- 9. The assembly of claim 1, further comprising:  
a control unit connected to said first sensor and said drive to control the timing and speed of rotation of the rotary transfer device.
- 10. The assembly of claim 8, further comprising:  
a control unit connected to said second sensor and said drive to control the timing and speed of rotation of the rotary transfer device.
- 11. A rotary transfer device assembly for a device for launching a projectile, having a breech with a breech longitudinal axis, a barrel extending from the breech, and a feed aperture formed on the breech, said rotary transfer device assembly comprising:  
a rotary transfer device rotatably mounted about a longitudinal axis and having an outer circumferential surface;  
the rotary transfer device defining a plurality of projectile seats in the outer circumferential surface; the rotary transfer device being rotatable about the longitudinal axis to a first position to align one of the plurality of projectile seats with the feed aperture and a second position to move one of the plurality of projectile seats, with a projectile seated therein, into the breech in preparation for launching of the projectile through the barrel;  
a first sensor configured and arranged to detect the presence of a projectile within the projectile seat; and  
a drive configured and arranged to move the rotary transfer device between the first position and the second position.
- 12. The assembly of claim 11, wherein the longitudinal axis is parallel with the breech longitudinal axis.
- 13. The assembly of claim 11, wherein the bolt is rotated about the longitudinal axis by pneumatics.
- 14. The assembly of claim 11, wherein the rotary transfer device is rotated about the longitudinal axis by electromagnetics.
- 15. The assembly of claim 11, wherein the rotary transfer device is rotated about the longitudinal axis by an impellor.
- 16. The assembly of claim 11, wherein the rotary transfer device is rotated about the longitudinal axis by a spring.
- 17. The assembly of claim 11, wherein the rotary transfer device is rotated about the longitudinal axis by electronics.
- 18. The assembly of claim 11, wherein the bolt is rotatable to a third position corresponding to a second one of the plurality of seats aligned with the feed aperture.
- 19. The assembly of claim 11, further comprising:  
a second sensor configured and arranged to detect the rotational position of the rotary transfer device.
- 20. The assembly of claim 11, further comprising:  
a control unit connected to said first sensor and said drive to control the timing and speed of rotation of the rotary transfer device.

- 21. The assembly of claim 19, further comprising:  
a control unit connected to said second sensor and said drive to control the timing and speed of rotation of the rotary transfer device.
- 22. A paintball marker, comprising:  
a breech;  
a barrel extending from said breech;  
a feed conduit for paintballs connected to said breech by a feed aperture;  
a rotary transfer device rotatably mounted about a longitudinal axis and having an outer circumferential surface; the rotary transfer device defining a plurality of projectile seats in the outer circumferential surface; the rotary transfer device being rotatable about the longitudinal axis to a first position to align one of the plurality of projectile seats with the feed aperture and a second position to move one of the plurality of projectile seats, with a projectile seated therein, into the breech in preparation for launching of the projectile through the barrel;  
a first sensor configured and arranged to detect the presence of a projectile within the projectile seat; and  
a drive configured and arranged to move the rotary transfer device between the first position and the second position.
- 23. The paintball marker of claim 22, wherein the longitudinal axis of the rotary transfer device is parallel with the breech longitudinal axis.
- 24. The paintball marker of claim 22, wherein the rotary transfer device is rotated about the longitudinal axis by pneumatics.
- 25. The paintball marker of claim 22, wherein the rotary transfer device is rotated about the longitudinal axis by electromagnetics.
- 26. The paintball marker of claim 22, wherein the rotary transfer device is rotated about the longitudinal axis by an impellor.
- 27. The paintball marker of claim 22, wherein the rotary transfer device is rotated about the longitudinal axis by a spring.
- 28. The paintball marker of claim 22, wherein the rotary transfer device is rotated about the longitudinal axis by electronics.
- 29. The paintball marker of claim 22, further comprising:  
a second sensor configured and arranged to detect the rotational position of the rotary transfer device.
- 30. The paintball marker of claim 22, further comprising:  
a control unit connected to said first sensor and said drive to control the timing and speed of rotation of the rotary transfer device.
- 31. The paintball marker of claim 29, further comprising:  
a control unit connected to said second sensor and said drive to control the timing and speed of rotation of the rotary transfer device.

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