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(54) **NON-LETHAL PROJECTILE BELT AND FEEDING APPARATUS**

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(52) **U.S. Cl.** **124/41.1**

(57) **ABSTRACT**

A non-lethal projectile belt and feeding apparatus for improving prior art components of a non-lethal projectile launch system including the non-lethal projectiles and the non-lethal projectile feeding apparatus that are, when used in conjunction, mechanically deterministic, jam-free, gravitationally independent, cost efficient, while achieving a higher accuracy, a longer effective range, a feed rate not limited by gravity and maintaining a high capacity. These non-lethal projectiles are made of non-spherical and elongated outer shells **20** with tailfins **22** and index holes **21.** The projectiles are either filled with an application-specific liquid or a powdered substance **29.** In a paintball application, the shell is usually made of gelatin, filled with a water-based dye. The shell **20,** index holes **21** and tailfins **22** are held together by a tape **27** with perforations **26** that define the boundaries between successions of the non-lethal projectile units. When the shell **20** is made of gelatin, the tape **27** may be made of the extra material that would otherwise be cut away during the manufacturing process of conventional unconnected non-lethal projectiles. In the desired embodiment, some material is retained for the tape **27** that holds the non-lethal projectiles together.

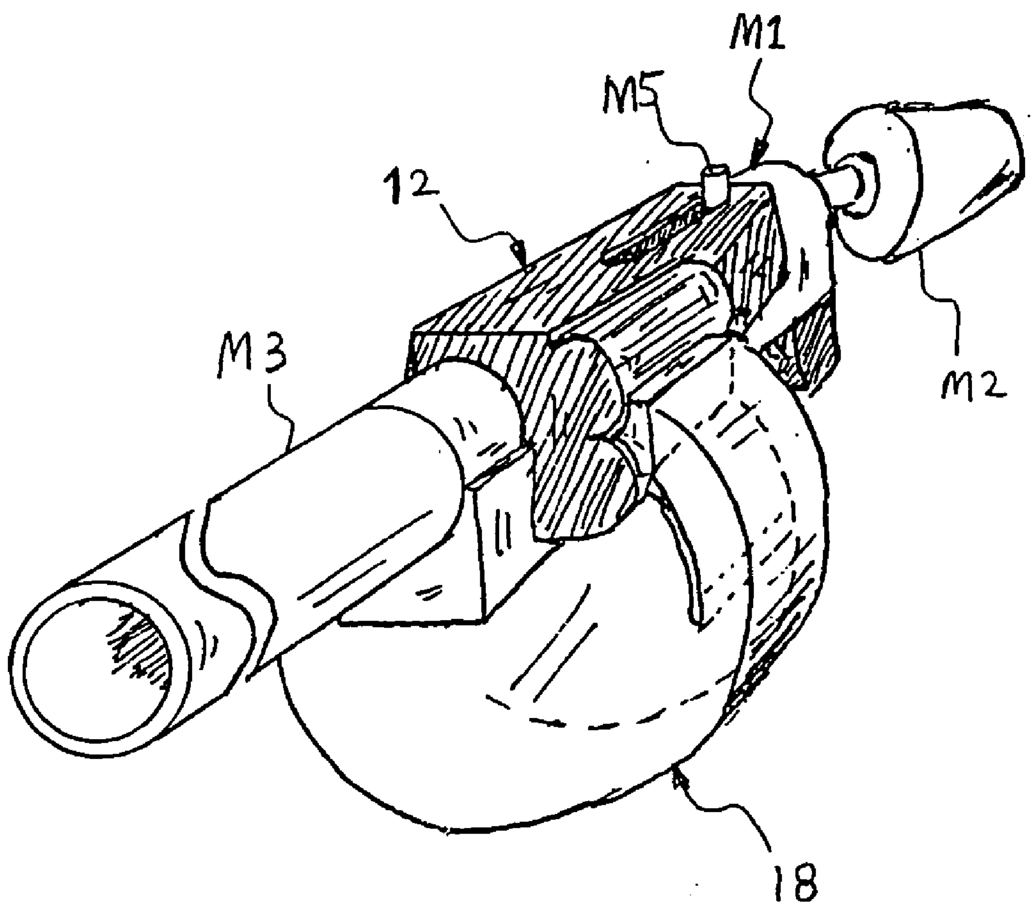
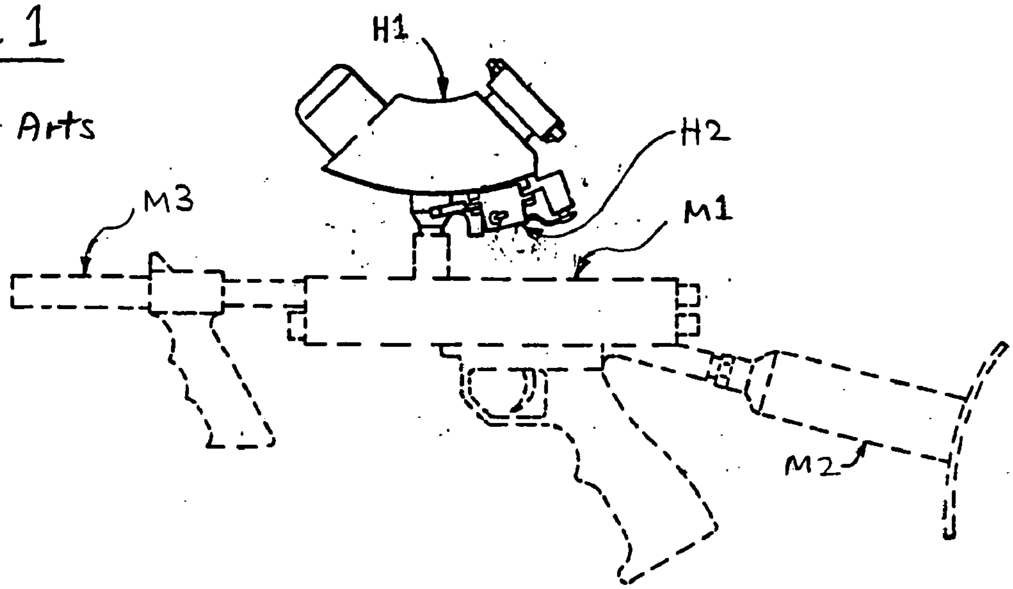


FIG. 1

Prior Arts



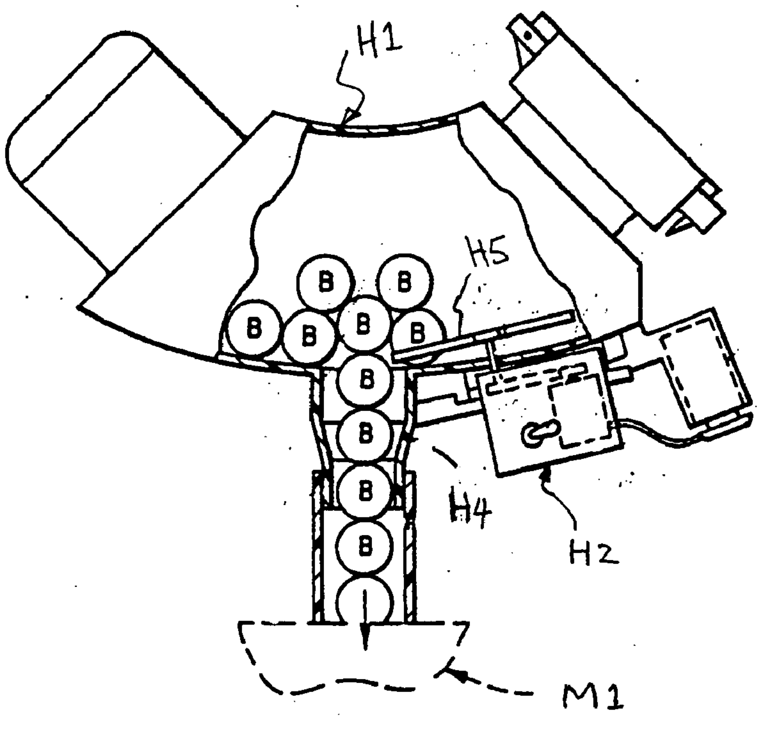


FIG. 2

Prior Arts

FIG. 3

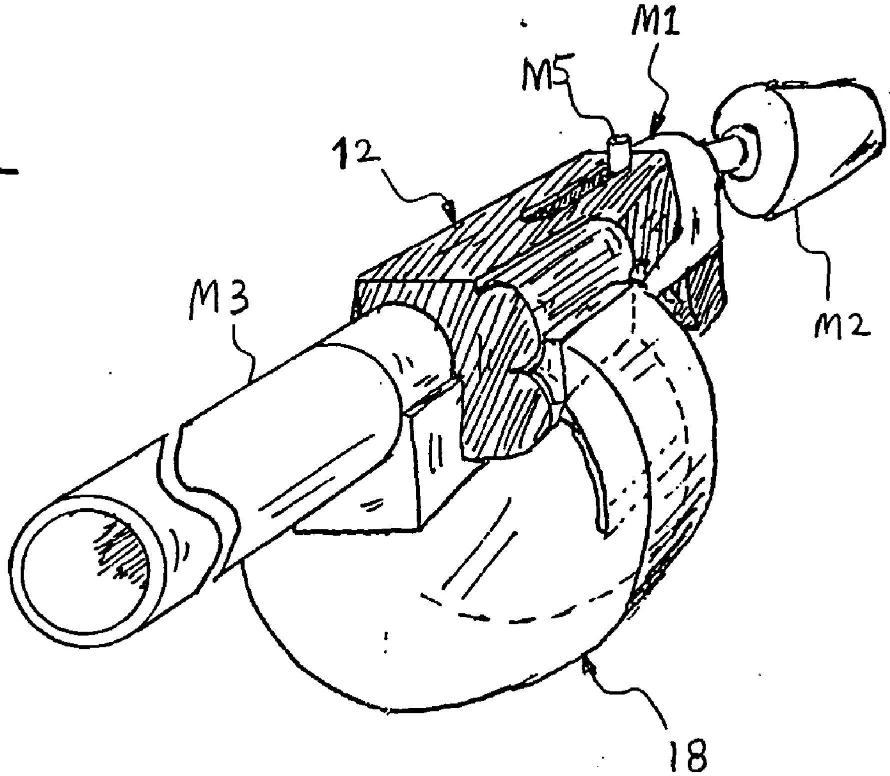


FIG. 4

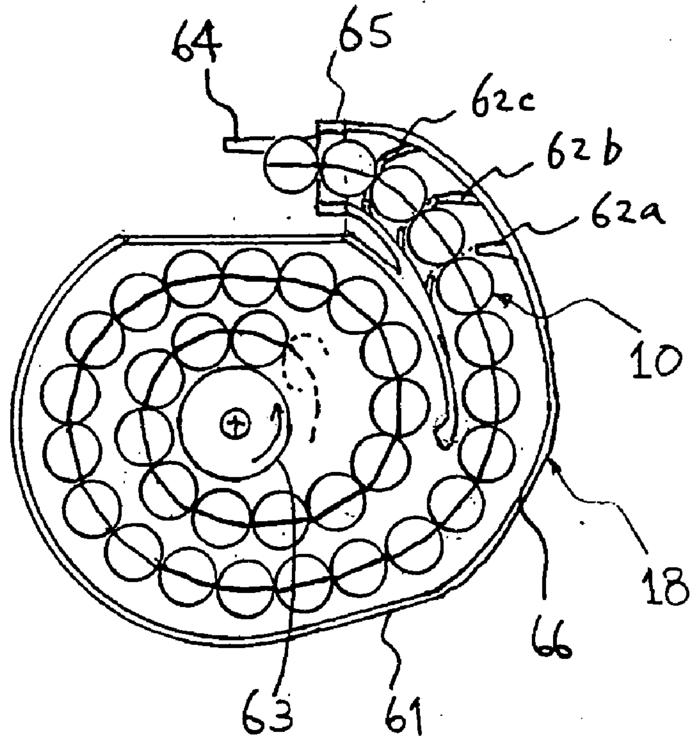


FIG. 5

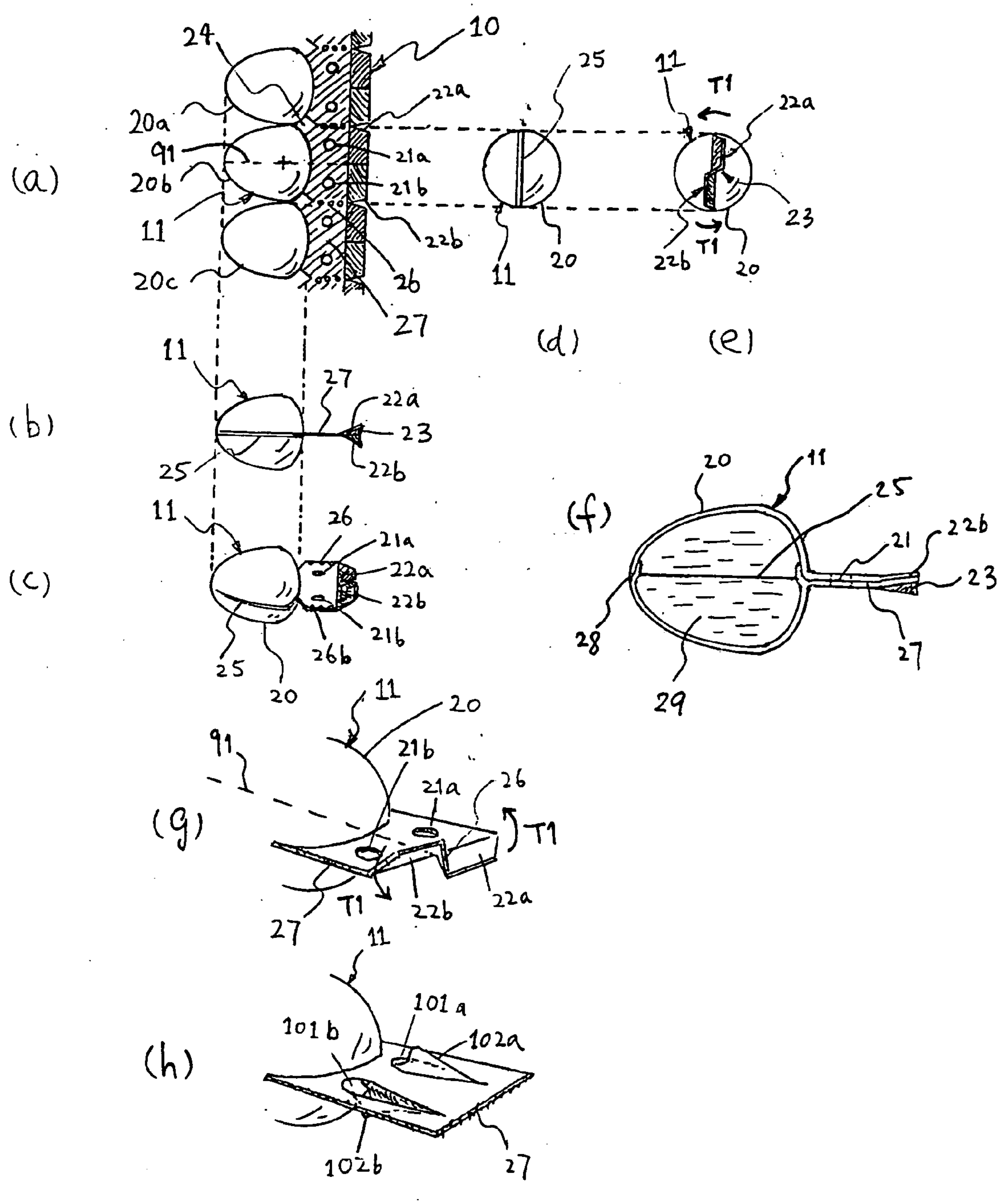

(a)
(b)
(c)
(d)
(e)
(f)
(g)
(h)
10
11
20
20a
20b
20c
21
21a
21b
22a
22b
23
24
25
26
26b
27
28
29
91
T1
101a
101b
102a
102b

FIG. 6

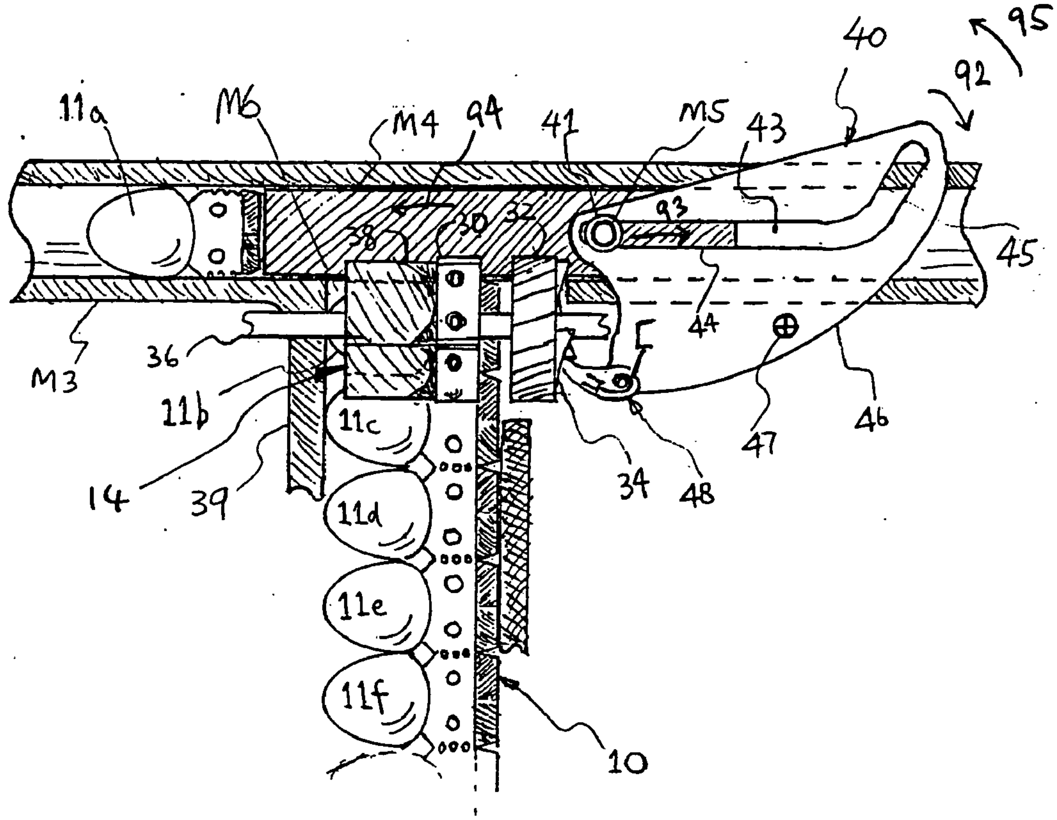

11a
M6
M4
94
41
M5
43
40
92
95
93
45
30
32
38
44
M3
36
11b
14
39
11c
11d
11e
11f
34
48
47
46
10

FIG. 7

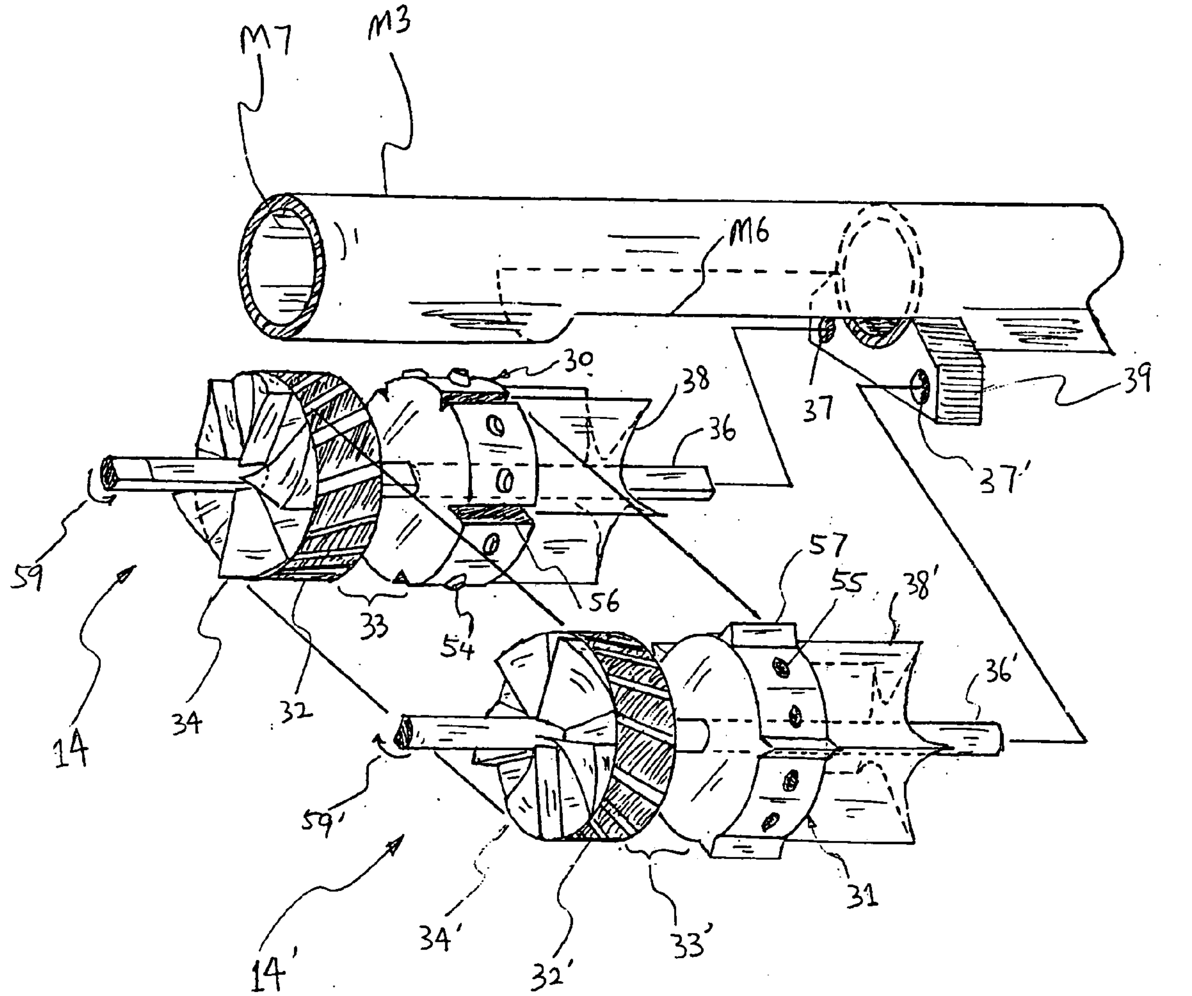

M7
M3
M6
30
38
36
37
39
37'
59
56
57
55
38'
33
54
34
32
36'
14
59'
31
34'
33'
32'
14'

FIG. 8

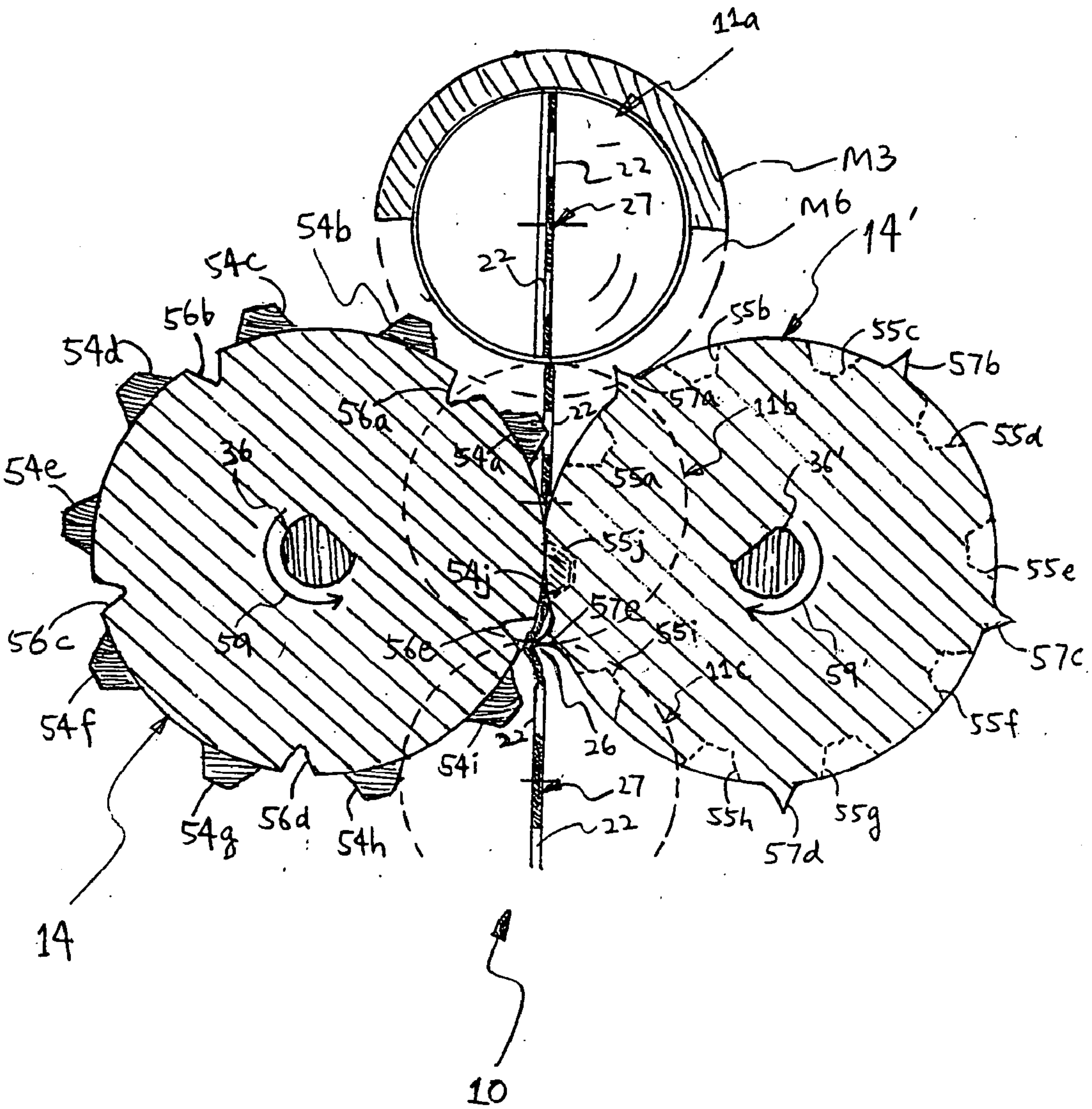
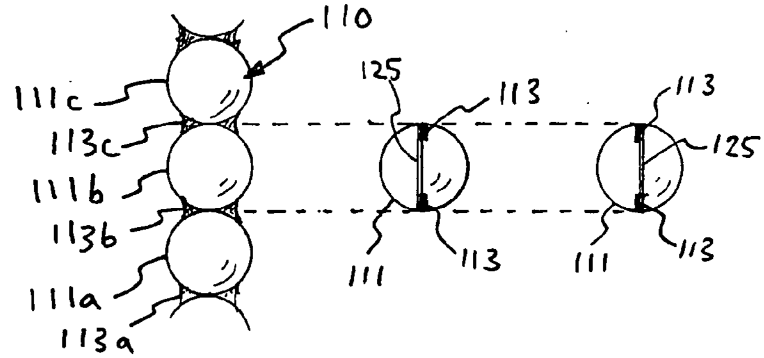

11a
M3
M6
22
27
14'
54b
54c
56b
54d
55b
55c
57b
56a
57a
11b
54a
55d
54e
36
55a
36'
55j
54j
55e
57e
59
56e
55i
59'
57c
56c
11c
54f
26
55f
54i
27
55h
55g
54g
56d
54h
57d
14
10

FIG. 9

(a)


110
111c
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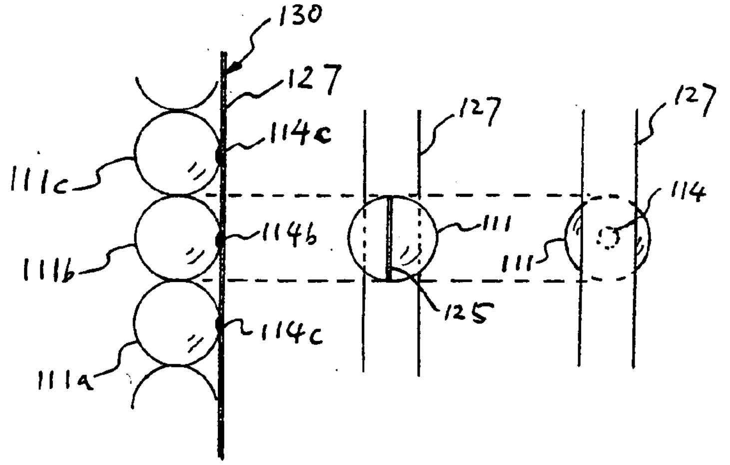
111b
113b
111a
113a
125
113
113
111
113
125
111
113

(b)


130
127
114c
111c
114b
111b
114c
111a
127
111
125
127
114
111

(c)

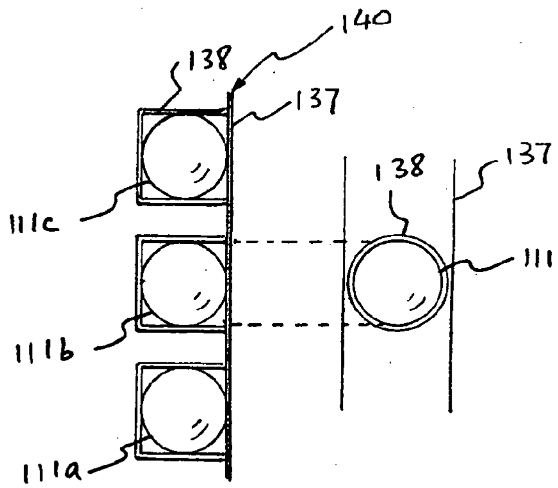

140
138
137
111c
111b
111a
138
137
111

FIG. 10

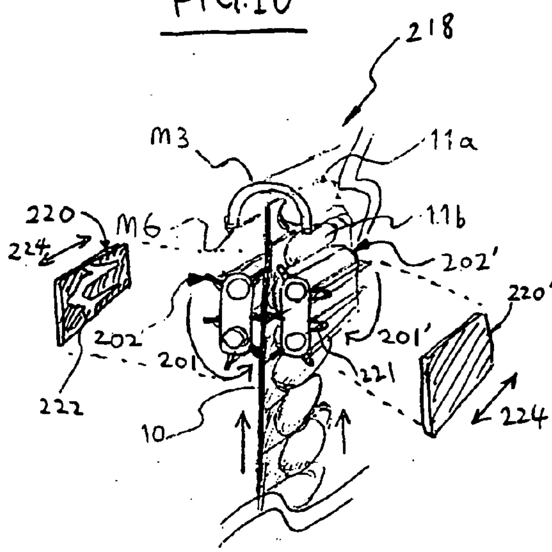


FIG. 11

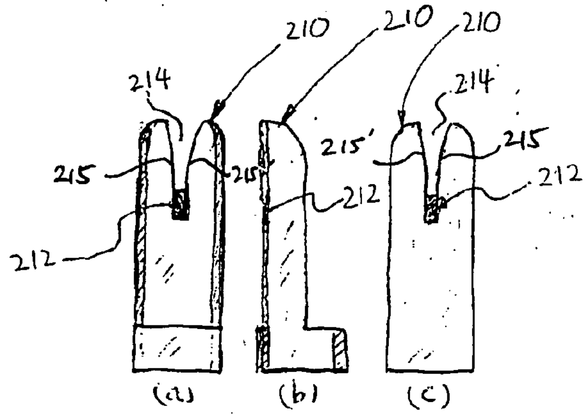
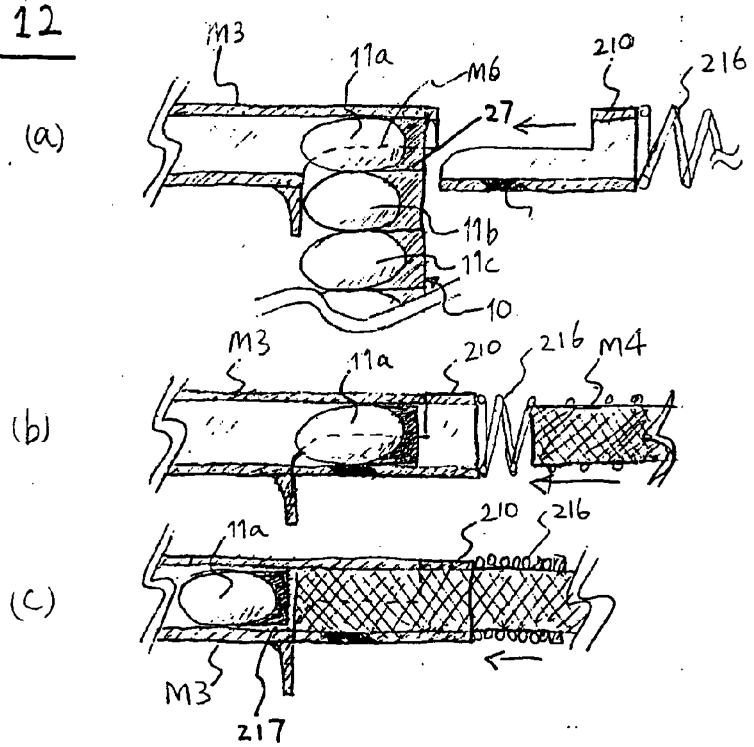


FIG. 12



NON-LETHAL PROJECTILE BELT AND FEEDING APPARATUS

PRIORITY

[0001] The present invention claims priority under 35 USC section 119 and U.S. provisional application 60/648564 filed on Jan. 31, 2005.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates generally to non-lethal projectiles and more specifically it relates to a non-lethal projectile belt and feeding apparatus for improving prior art components of a non-lethal projectile launch system including the non-lethal projectiles and the non-lethal projectile feeding apparatus that are, when used in conjunction, mechanically deterministic, jam-free, gravitationally independent, cost efficient, while achieving a higher accuracy, a longer effective range, a feed rate not limited by gravity and maintaining a capacity comparable to prior art feeding devices.

[0004] 2. Description of the Prior Art

[0005] It can be appreciated that non-lethal projectiles have been in use for years. Typically, non-lethal projectiles are comprised of conventional paintballs; U.S. Pat. No. 5,448,951 is one example of non-lethal projectiles that is spherical in shape. They are usually made of two gelatin hemispheres and contain a colored liquid. U.S. Pat. No. 5,448,951 describes both non-spherical projectiles with tail-fins as well as linkages between adjacent projectiles that allow higher feed rate. Additionally, non-spherical non-lethal projectiles, such as U.S. Pat. No. 5,448,951 and variants with tailfins, U.S. Pat. No. 5,936,190 and U.S. Pat. No. 5,009,165 further improves accuracy and safety. This type of projectiles is directional and must be loaded in a predetermined orientation before it is fed (chambered) into the barrel for launching. Conventional hoppers, U.S. Pat. No. 5,166,457, have funnel shaped geometries. Non-lethal projectiles are loaded loosely into the hopper. The hopper is attached to the non-lethal projectile launch system and feeds the non-lethal projectiles into the breech in the launch system's barrel. Conventional hoppers rely on gravity to pull the non-lethal projectiles downwards into the barrel, and, for that reason, the conventional hoppers are usually positioned above the breech. Spring-loaded magazines such as U.S. Pat. No. 6,470,872, U.S. Pat. No. 6,701,909 and U.S. Pat. No. 6,273,079 provides a means to feed the directional non-lethal projectiles into the barrel, regardless of the orientation of the device. Powered hopper loaders, U.S. Pat. No. 6,305,367, U.S. Pat. No. 6,609,511, U.S. Pat. No. 6,502,567 and U.S. Pat. No. 6,488,019, partially resolves gravity-related feed rate limitation. Spring loaded hoppers, U.S. Pat. No. 6,644,293, achieved gravity-free operation.

[0006] The main problem with conventional non-lethal projectiles is that the spherical non-lethal projectiles are inaccurate. Uncontrolled spinning of the projectiles causes imbalanced air pressure on one side of the projectile during flight versus the other. The difference in air pressure causes the projectile to accelerate towards the side with lower air pressure, thus bending its trajectory. One proven way to improve the accuracy of spherical non-lethal projectiles is to use a precisely fabricated gun barrel. These barrels reduce the spinning of the projectiles. Another way to make shots accurate is to use specially fabricated non-lethal projectiles with extremely smooth surfaces, thus reducing the disturbance of nearby air due to uncontrolled rotation. Any of these ways are highly expensive, and is generally used only by enthusiasts. U.S. Pat. No. 5,640,945 and U.S. Pat. No. 6,526,685 describe variations that put back-spin on the paintballs. This improves the predictability of the trajectory but the barrel needs to be held perfectly level. Any slight deviation in the spin axis will cause the projectile to curve away from the desired trajectory. Elongated, aerodynamic and spin-stabilized projectiles such as U.S. Pat. No. 5,936,190 and U.S. Pat. No. 5,009,165 are more accurate and safer. They correct their trajectory on the fly and do not require specialized equipment (such as a precisely fabricated barrel) in order to fire accurately. However, these projectiles are practically unusable unless a proper receiver mechanism and/or magazine is developed. They cannot be loaded directly into a conventional hopper or marker due to the fact that they need to be aligned with the gun barrel's longitudinal axis. This loading and alignment function is better performed at, for instance, a factory. Another problem with conventional non-lethal projectiles are that hoppers H1 (see **FIGS. 1 and 2**), whether passive or active, by definition, are challenged by gravity, orientation of the device and/or the inability to properly align non-spherical projectiles. For conventional passive hoppers such as U.S. Pat. No. 5,166,457 and even agitated hoppers H2 such as U.S. Pat. No. 5,282,454 and U.S. Pat. No. 5,947,100 the feed rate is limited by gravity. The feed rates of prior art device that primarily rely on gravity are continuously being challenged by the ever increasing demand for higher cycle rates. Another problem with the agitated hoppers and hoppers with conveyor mechanisms, like U.S. Pat. No. 6,502,567, U.S. Pat. No. 6,609,511 and U.S. Pat. No. 6,305,367 is that they may not be used up-side down. Hoppers with conveyor mechanisms also suffer from not having a deterministic behaviors when the hopper is close to empty, due to the fact that the slots in the conveyor mechanisms cannot be completely filled when there are fewer projectiles than the number of slots available. Not one of anti-jamming devices for hoppers described above guarantees continuous feeding down to the last projectile in the container. Spring loaded hoppers, like U.S. Pat. No. 6,644,293 may be used up-side down but it may not be used to align and deliver non-spherical projectiles. The linked projectiles in U.S. Pat. No. 5,448,951 partially addressed the rate problem but it is impractical until the proper receiver mechanism is developed. The linked projectiles in U.S. Pat. No. 5,448,951 also produces debris during use, which is undesirable and would degrade the performance of the receiver over time. Another problem with conventional non-lethal projectiles is that magazines or clips, U.S. Pat. No. 6,470,872, U.S. Pat. No. 6,701,909 and U.S. Pat. No. 6,273,079 may resolve the gravity problem but the capacity of one magazine is usually considerably below the amount required for a single uninterruptible event, such as a paintball game. Frequent reloading of the clips hinders the performance of a human user.

[0007] While these devices may be suitable for the particular purpose to which they address, they are not as suitable for improving prior art components of a non-lethal projectile launch system including the non-lethal projectiles and the non-lethal projectile feeding apparatus that are, when used in conjunction, mechanically deterministic, jam-free, gravitationally independent, cost efficient, while achieving a higher accuracy, a longer effective range, a feed rate not limited by gravity and maintaining a capacity comparable to prior art feeding devices. The main problem with conventional non-lethal projectiles is that the spherical non-lethal projectiles are inaccurate. Uncontrolled spinning of the projectiles causes imbalanced air pressure on one side of the projectile during flight versus the other. The difference in air pressure causes the projectile to accelerate towards the side with lower air pressure, thus bending its trajectory. One proven way to improve the accuracy of spherical non-lethal projectiles is to use a precisely fabricated gun barrel. These barrels reduce the spinning of the projectiles. Another way to make shots accurate is to use specially fabricated non-lethal projectiles with extremely smooth surfaces, thus reducing the disturbance of nearby air due to uncontrolled rotation. Any of these ways are highly expensive, and is generally used only by enthusiasts. U.S. Pat. No. 5,640,945 and U.S. Pat. No. 6,526,685 describe variations that put back-spin on the paintballs. This improves the predictability of the trajectory but the barrel needs to be held perfectly leveled. Any slight deviation in the spin axis will cause the projectile to curve away from the desired trajectory. Elongated, aerodynamic and spin-stabilized projectiles, such as U.S. Pat. No. 5,936,190 and U.S. Pat. No. 5,009,165, are more accurate and safer. They correct their trajectory on the fly and do not require specialized equipment (such as a precisely fabricated barrel) in order to fire accurately. However, these projectiles are practically unusable unless a proper receiver mechanism and/or magazine is developed. They cannot be loaded directly into a conventional hopper or marker due to the fact that they need to be aligned with the gun barrel's longitudinal axis. This loading and alignment function is better performed at, for instance, a factory. Another problem is that hoppers H**1** (see **FIGS. 1 and 2**), whether passive or active, by definition, are challenged by gravity, orientation of the device and/or the inability to properly align non-spherical projectiles. For conventional passive hoppers, such as U.S. Pat. No. 5,166,457 and even agitated hoppers H**2**, such as U.S. Pat. No. 5,282,454 and U.S. Pat. No. 5,947,100, the feed rate is limited by gravity. The feed rates of prior art device that primarily rely on gravity are continuously being challenged by the ever increasing demand for higher cycle rates. Another problem with the agitated hoppers and hoppers with conveyor mechanisms, like U.S. Pat. No. 6,502,567, U.S. Pat. No. 6,609,511 and U.S. Pat. No. 6,305,367 is that they may not be used up-side down. Hoppers with conveyor mechanisms also suffer from not having deterministic behaviors when the hopper is close to empty, due to the fact that the slots in the conveyor mechanisms cannot be completely filled when there are fewer projectiles than the number of slots available. Not one of anti-jamming devices for hoppers described above guarantees continuous feeding down to the last projectile in the container. Spring loaded hoppers such as U.S. Pat. No. 6,644,293 may be used up-side down but it may not be used to align and deliver non-spherical projectiles. The linked projectiles, U.S. Pat. No. 5,448,951 partially addressed the rate problem but it is impractical until the proper receiver mechanism is developed. The significant improvements on the projectiles and the corresponding feeding assembly described in the present invention shall be considered the first to reduce such linked projectiles to practice. The linked projectiles such as found in U.S. Pat. No. 5,448,951 also produces debris during use, which is undesirable and would degrade the performance of the receiver over time. Also, another problem is that magazines or clips, U.S. Pat. No. 6,470,872, U.S. Pat. No. 6,701,909 and U.S. Pat. No. 6,273,079 may resolve the gravity problem but the capacity of one magazine is usually considerably below the amount required for a single uninterruptible event, such as a paintball game. Frequent reloading of the clips hinders the performance of a human user.

SUMMARY OF THE INVENTION

[0008] In these respects, the non-lethal projectile belt and feeding apparatus according to the present invention substantially departs from the conventional concepts and designs of the prior art, and in so doing provides an apparatus primarily developed for the purpose of improving prior art components of a non-lethal projectile launch system including the non-lethal projectiles and the non-lethal projectile feeding apparatus that are, when used in conjunction, mechanically deterministic, jam-free, gravitationally independent, cost efficient, while achieving a higher accuracy, a longer effective range, a feed rate not limited by gravity and maintaining a capacity comparable to prior art feeding devices.

[0009] In view of the foregoing disadvantages inherent in the known types of non-lethal projectiles now present in the prior art, the present invention provides a new non-lethal projectile belt and feeding apparatus construction wherein the same can be utilized for improving prior art components of a non-lethal projectile launch system including the non-lethal projectiles and the non-lethal projectile feeding apparatus that are, when used in conjunction, mechanically deterministic, jam-free, gravitationally independent, cost efficient, while achieving a higher accuracy, a longer effective range, a feed rate not limited by gravity and maintaining a capacity comparable to prior art feeding devices.

[0010] The general purpose of the present invention, which will be described subsequently in greater detail, is to provide a new non-lethal projectile belt and feeding apparatus that has many of the advantages of the non-lethal projectiles mentioned heretofore and many novel features that result in a new non-lethal projectile belt and feeding apparatus which is not anticipated, rendered obvious, suggested, or even implied by any of the prior art non-lethal projectiles, either alone or in any combination thereof.

[0011] To attain this, the present invention generally includes the Projectile Belt **10**, the Feeding Assembly **12**, the Extractor **14**, and the Magazine **18**, which will be described subsequently in greater detail. In addition, actions M**1**, pressurized gas tanks M**2**, barrels M**3** and bolts M**4** are other components that may be found in virtually all existing pneumatic non-lethal projectile launch systems in the market today. The action M**1**, also known as the "operating system", of pneumatic non-lethal projectile launch system is the assembly that houses the bolt M**4** and all the major moving parts. The action M**1** is also the part to which peripherals, like a pressurized gas tank M**2**, a barrel M**3** or a magazine **18** would attach. The present invention is independent to the internal mechanism of the action M**1**, as long as the bolt M**3** is mechanically accessible and kinetic energy can be tapped via, for example, a bolt knob M**5**, and that the action M**1** can supply enough power to drive the Feeding Assembly **12**. In a gas blow-back action, the residual gas in the action after the projectile is ejected drives the bolt M4 back to their pre-firing positions. In a manual pump action, the bolt M4 is reset manually. Any existing bolts M4 and actions M1, fully-automatic, semi-automatic, manual, closed-bolt and open-bolt alike, may be adapted, with or without modifications, to fire non-lethal projectiles supplied by the present invention. The Projectile Belt **10** is an interconnected chain of non-lethal projectiles **11**. These non-lethal projectiles are made of non-spherical and elongated outer shells **20** with tailfins **22** and index holes **21**. The projectiles are either filled with an application-specific liquid or a powdered substance **29**. In a paintball application, the shell is usually made of gelatin, filled with a water-based dye. The shell **20**, index holes **21** and tailfins **22** are held together by a tape **27** with perforations **26** that define the boundaries between successions of the non-lethal projectile units. When the shell **20** is made of gelatin, the tape **27** may be made of the extra material that would otherwise be cut away during the manufacturing process of conventional unconnected non-lethal projectiles. In the desired embodiment, some material is retained for the tape **27** that holds the non-lethal projectiles together. In other applications, the tape **27** may be made from a different material. The Feeding Assembly **12** consists of the Extractor **14**, a cam **40** with a pivot **47**, a roller **41** mounted on the bolt knob M**5** and a spring-loaded lever **48**. The roller **41** travels within the rail **43** inside the cam **40**, and by doing so, the roller **41** pushes the cam **40** along the edge **45** and causes it to rotate around its pivot **47**. The lever **48** is forced into the one-way gear **34** on the back of the Extractor **14** and causing the Extractor **14** to rotate. The Extractor **14** is a sub-component of the Feeding Assembly **12**. The Extractor **14** includes of four pairs of counter-rotating sub-components around two symmetrical drive shafts **36**. The four sub-component pairs are the index drums **30** and **31**, synchronization gears **32**, one-way gears **34** and sets of flaps **38**. The pairs of synchronization gears **32**, one-way gears **34** and set of flaps **38** are longitudinally symmetrical to their counterparts, with the exception of the index drums **30** and **31**, which may have distinctive, asymmetrical features determined by the construction of the tape **27** being used. On one side, the index drum **30** has a set of index teeth **54**; and, on the other side **31**, there are matching index holes **55**. The relative positions of index teeth **54** and index holes **55** must match the index holes **21** on the tape **27** being used. Amongst the indexing features **54** and **55**, there are blades **57** on one side and matching trenches **56** on the other. Similarly, the relative positions of blades **57** and trenches **56** should match the positions of the perforation **26** on the tape **27** being used. The two index drums **30** and **31** are synchronized by a pair of synchronization gears **32**. There is also a pair of one-way gear **34** driven by the cam **40** and lever **48** during the re-cocking action of the bolt M4. The sets of flaps **38** mechanically assist the insertion of the extracted non-lethal projectile **11***a* into the breech M**6**. The flaps **38** may be used, should the index drums **30** alone be insufficient. In the Extractor **14**, there is a gap **33** allowing the tailfins **22** to pass through. The Magazine **18** is a storage device made of durable but inexpensive material, such as nylon. The Magazine's body **61** is round in shape, resembling the drum magazines used by the military. The Magazine **18** optionally has a removable cover. When the cover is removed, the Magazine can be refilled and serviced. At one end of the Magazine is a ramp **66** guiding the Projectile Belt **10** traveling into the Feeding Assembly **12**. A spin wheel **63** or bearing facilitates the unwinding of the Projectile Belt **10**. The adapter **65** secures the whole Magazine **18** to the action M**1**. The adapter **65** may optionally implement a push rod **64**, or similar mechanism to induce some movement of the Extractor **14** as the Magazine **18** is being inserted into the action M1, primarily to ensure the first projectile properly aligns with the index drums **30** and **31** of the Extractor **14**. Along the interior of the Magazine **18**, there may be soft rubber flaps **62** that prevent the Projectile Belt **10** from traveling in reverse due to gravity or vibration, although this is optional as well.

[0012] There has thus been outlined, rather broadly, the more interesting features of the invention in order that the detailed description thereof may be better understood, and in order that the present contribution to the art may be better appreciated. There are additional features of the invention that will be described hereinafter.

[0013] In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of the description and should not be regarded as limiting.

[0014] A primary object of the present invention is to provide a non-lethal projectile belt and feeding apparatus that will overcome the shortcomings of the prior art devices.

[0015] An object of the present invention is to provide a non-lethal projectile belt and feeding apparatus for improving prior art components of a non-lethal projectile launch system including the non-lethal projectiles and the non-lethal projectile feeding apparatus that are, when used in conjunction, mechanically deterministic, jam-free, gravitationally independent, cost efficient, while achieving a higher accuracy, a longer effective range, a feed rate not limited by gravity and maintaining a capacity comparable to prior art feeding devices.

[0016] Another object is to provide a non-lethal projectile belt and feeding apparatus that shall improve the usability and producible of the spin-stabilized, non-spherical, non-lethal projectiles described by the prior art. Empirical data shows that spin-stabilized projectiles have higher tolerances for manufacturing defects, thus eliminating the needs for any expensive components and/or the use of exotic materials in the marker's components.

[0017] Another object is to provide a non-lethal projectile belt and feeding apparatus that shall be gravity independent, in other words, non-gravity feed, which is capable of delivering non-lethal projectiles under any orientation of the device and it allows ultra high feed rate to satisfy high rate automatic non-lethal projectile launch systems.

[0018] Another object is to provide a non-lethal projectile belt and feeding apparatus that shall be deterministic, by inserting exactly one projectile into the barrel's chamber during each launches cycle; unless the magazine is empty, in that case no projectile will be loaded. This deterministic behavior practically eliminates jamming and breakages of the non-lethal projectiles in the launch system and reduces the chance of malfunction of the launch system.

[0019] Another object is to provide a non-lethal projectile belt and feeding apparatus that shall be easily manufactured, stored and used. The shape of the non-lethal projectiles shall be made such that it can be manufactured using existing technologies, such as rotary die machines in a gelatin paintball application, with slight or no modifications.

[0020] Another object is to provide a non-lethal projectile belt and feeding apparatus that shall align non-spherical, directional, non-lethal projectiles so that they are chambered in a predetermined and proper orientation every time.

[0021] Another object is to provide a non-lethal projectile belt and feeding apparatus that shall produce no waste or debris during use, other than the non-lethal projectiles themselves, which are ejected from the launch system, and the propellants.

[0022] Another object is to provide a non-lethal projectile belt and feeding apparatus that shall have a capacity comparable to conventional hoppers in terms of the number of rounds of non-lethal projectiles that a launch system may carry at a time.

[0023] Other objects and advantages of the present invention will become obvious to the reader and it is intended that these objects and advantages are within the scope of the present invention.

[0024] To the accomplishment of the above and related objects, this invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that changes may be made in the specific construction illustrated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] Various other objects, features and attendant advantages of the present invention will become fully appreciated as the same becomes better understood when considered in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the several views, and wherein:

[0026] **FIG. 1** is a side view of a typical non-lethal projectile launch system with a prior art hopper loader H**1**, with the optional agitator H**2**.

[0027] **FIG. 2** is a partial cut-out side view of a prior art hopper loader with prior art non-lethal projectiles B being loaded into action M**1**. The hopper H**1** is connected to the action M**1** using an adapter H**4**. This figure also shows the agitator H**2** and its agitator blades H**5**.

[0028] **FIG. 3** is a perspective view of the present invention, showing the Feeding Assembly **12** and Magazine **18** connected to a typical non-lethal projectile launch system with an action M**1**, a pressurized gas tank M**2**, a barrel M**3** and a bolt knob M**5**.

[0029] **FIG. 4** is a front cross-sectional view of the Magazine **18** of the present invention with a Projectile Belt **10** coiled around its center.

[0030] **FIG. 5**(*a*) is a side view of the Projectile Belt **10** of the present invention;

[0031] FIGS. **5**(*b*), **5**(*c*), **5**(*d*) and **5**(*e*) are the bottom view, the perspective view, the front view and the rear view of the same single non-lethal projectile unit respectively.

[0032] **FIG. 5**(*f*) illustrates a cross-sectional side view of the same single non-lethal projectile unit.

[0033] **FIG. 5**(*g*) illustrates a perspective view of a single non-lethal projectile unit showing the tailfins **22** in the desired embodiment.

[0034] **FIG. 5**(*h*) illustrates an embodiment of the non-lethal projectile unit.

[0035] **FIG. 6** illustrates a top view of the Feeding Assembly **12** of the present invention with the enclosure removed.

[0036] **FIG. 7** illustrates a partial exploded view of the Extractor **14** of the present invention showing all of the components and its connection to the barrel M**3**.

[0037] **FIG. 8** illustrates a front view of the index drums **31** of the Extractor **14** of the present invention, shown with the relative positions of incoming non-lethal projectiles **11** and barrel M**3**.

[0038] **FIG. 9** illustrates embodiments of the Projectile Belt **10**.

[0039] **FIG. 10** illustrates an embodiment of the Feeding Assembly **12**.

[0040] **FIG. 11** illustrates an embodiment and of the Extractor **14**.

[0041] **FIG. 12**(*a*) illustrates a cross-sectional view of an embodiment prior to firing.

[0042] **FIG. 12**(*b*) illustrates a cross-sectional view of the embodiment after it has separated the first non-lethal projectile **11***a* but the bolt M**4** is beginning to move in.

[0043] **FIG. 12**(*c*) illustrates a cross-sectional view of the bolt M**4** and the embodiment having formed a gas seal behind the chambered non-lethal projectile **11***a*.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0044] Turning now descriptively to the drawings, in which similar reference characters denote similar elements throughout the several views, the attached figures illustrate a non-lethal projectile belt and feeding apparatus, which comprises the Projectile Belt **10**, the Feeding Assembly **12**, the Extractor **14**, and the Magazine **18**, which will be described subsequently in greater detail. In addition, actions M**1**, pressurized gas tanks M**2**, barrels M**3** and bolts M**4** are other components that may be found in virtually all existing pneumatic non-lethal projectile launch systems in the market today. The action M**1**, also known as the "operating system", of pneumatic non-lethal projectile launch system is the assembly that houses the bolt M**4** and all the major moving parts. The action M**1** is also the part to which peripherals, including a pressurized gas tank M**2**, a barrel M**3** or a magazine **18** would attach. The present invention is independent to the internal mechanism of the action M**1**, as long as the bolt M**3** is mechanically accessible and kinetic energy can be tapped via, for example, a bolt knob M**5**, and that the action M1 can supply enough power to drive the Feeding Assembly **12**. In a gas blow-back action M1, the residual gas in the action M1 after the projectile is ejected drives the bolt M4 back to pre-firing positions of the bolt M4. In a manual pump action, the bolt M4 is reset manually. Any existing bolts M4 and actions M1, fully-automatic, semi-automatic, manual, closed-bolt and open-bolt alike, may be adapted, with or without modifications, to fire non-lethal projectiles supplied by the present invention. The Projectile Belt **10** is an interconnected chain of non-lethal projectiles **11**. These non-lethal projectiles **11** include a non-spherical and elongated outer shell **20** with a tailfin **22** and an at least one index hole **21**. The projectiles **11** may be with an application-specific liquid or a powdered substance **29**. In a paintball application, the shell is usually made of gelatin, filled with a water-based dye. The shell **20**, index holes **21** and tailfins **22** are held together by a tape **27** which may be continuous with weakened areas that includes perforations **26** that define the boundaries between successions of the non-lethal projectile units. When the shell **20** is made of gelatin, the tape **27** may be constructed integral with the shell **20** and from the extra material that would otherwise be cut away during the manufacturing process of conventional unconnected non-lethal projectiles. In one embodiment, some integral material is retained for the tape **27** that holds the non-lethal projectiles together. In other embodiments, the tape **27** may be made from a different material. The Feeding Assembly **12** includes the Extractor **14**, a cam **40** with a pivot **47**, a roller **41** mounted on the bolt knob M5 and a spring-loaded lever **48**. The roller **41** travels within the rail **43** inside the cam **40**, and consequently, the roller **41** pushes the cam **40** along the edge **45** and causes the cam **40** to rotate around its pivot **47**. The lever **48** is forced into the one-way gear **34** on the back of the Extractor **14**, and rotating the Extractor **14**. The Extractor **14** is a sub-component of the Feeding Assembly **12**. The Extractor **14** includes four pairs of counter-rotating sub-components to rotate around two symmetrical drive shafts **36**. The four sub-component pairs are the index drums **30** and **31**, synchronization gears **32**, one-way gears **34** and sets of flaps **38**. The pairs of synchronization gears **32**, one-way gears **34** and set of flaps **38** are longitudinally symmetrical to their counterparts, with the exception of the index drums **30** and **31**, which may have distinctive, asymmetrical features determined by the construction of the tape **27** being used. On one side, the index drum **30** has a set of index teeth **54**; and, on the other side **31**, there are matching index holes **55**. The relative positions of index teeth **54** and index holes **55** should match the index holes **21** on the tape **27** being used. Including among the indexing features **54** and **55**, there are blades **57** on one side and matching trenches **56** on the other. Similarly, the relative positions of blades **57** and trenches **56** should match the positions of the perforation **26** on the tape **27** being used. The two index drums **30** and **31** are synchronized by a pair of synchronization gears **32**. There is also a pair of one-way gear **34** that is driven by the cam **40** and lever **48** during a re-cocking action of the bolt M4. The sets of flaps **38** mechanically assist the insertion of the extracted non-lethal projectile **11***a* into the breech M6. The flaps **38** may be used, should the index drums **30** alone be insufficient. In the Extractor **14**, there is a gap **33**, allowing the tailfins **22** to pass through. The Magazine **18** is a storage device which can be made of durable but inexpensive material or any suitable material, such as nylon. The body **61** of the magazine may be round in shape or any other suitable shape and may resemble the drum magazines used by the military. The Magazine **18** optionally has a removable cover. When the removable cover is removed, the Magazine **18** can be refilled and serviced. At one end of the Magazine is a ramp **66** for guiding the Projectile Belt **10** traveling into the Feeding Assembly **12**. A spin wheel **63** or bearing facilitates the unwinding of the Projectile Belt **10**. The adapter **65** secures the whole Magazine **18** to the action M1. The adapter **65** may optionally include a push rod **64**, or similar mechanism to induce some movement of the Extractor **14** as the Magazine **18** is being inserted into the action M1, primarily to assist the first projectile being properly aligned with the index drums **30** and **31** of the Extractor **14**. Along the interior of the Magazine **18**, the Magazine **18***e* may optionally includes flaps **62** which may be constructed from soft rubber to prevent the Projectile Belt **10** from traveling in reverse due to gravity or vibration.

[0045] The Projectile Belt **10** is an interconnected chain of non-lethal projectiles **11**. These non-lethal projectiles may be include a non-spherical and elongated outer shells **20** with tailfins **22** and index holes **21**. The projectiles may be filled with an application-specific liquid or a powdered substance **29** or other suitable materials. The shell may have a sub-sonic cone shape. In a paintball application, the shell **20** may be made of gelatin, filled with a water-based dye. The shell **20**, index holes **21** and tailfins **22** are held together by a tape **27** with perforations **26** that define the boundaries between successions of the non-lethal projectile units. When the shell **20** is made of gelatin, the tape **27** may be made of the extra material that would otherwise be cut away during the manufacturing process of conventional unconnected non-lethal projectiles. In the desired embodiment, some material is retained for the tape **27** that holds the non-lethal projectiles together. In other applications, the tape **27** may be made from a different material. The Projectile Belt **10** generally includes a plurality of similar constructed non-lethal projectiles **11** connected by the tape **27**. The non-lethal projectiles **11** are segregated from the Projectile Belt **10** before they are chambered in the barrel M4 for launching. The non-lethal projectiles **11** may be filled with a liquid or powdered substance **29** such as a dye (in a paintball application) or pepper-derived irritants (in a law-enforcement application) or other such material. In the embodiment of such Projectile Belt **10**, the non-lethal projectiles **11** are held together by a tape **27** that is integral with or an extension of the shells of the non-lethal projectiles **11** themselves. A series of oblong and aerodynamic non-lethal projectiles **11** are connected together by a tape **27** with tailfins **22** and index holes **21**. The boundaries between adjacent non-lethal projectile units are defined by perforations **26** which are shown formed in a transverse direction with respect to the longitudinal direction of the tape **27**. The perforations **26** allow the tape **27** to be cut more precisely and with less force. The index holes **21** are used to increase the mechanical precision of the feeding process; the index holes **21** are used in conjunction with the matching teeth **54** and holes **55** which are incorporated into the Extractor **14** component. A cutout **24** is made to enhance the proper separation of adjacent non-lethal projectiles **20** and also to prevent the tension on the tape **27** from being transfer into the shells **20** that have lower tension strengths due to their shapes. A tailfin section **22** is positioned behind the shell **20** and possibly behind the tape **27**. Each tailfin **22***a* is rotationally symmetrical with its counterpart tailfin **22***b* around the longitudinal axis **91** of a non-lethal projectile unit **11** so that when the non-lethal projectile **11** travels through air, the tailfins **22** collectively produce a torque T**1** that rolls the non-lethal projectile around its longitudinal axis **91**. Supporting material **23** formed along the edge of the tape **27** is retained to maintain the angle of attack on the tailfins **22** at all times. Such rotation is commonly known as spin-stabilization, which increases accuracy of the projectile by nullifying the effects of minor imperfections in the projectiles, such as scratches on the outside surface, imbalanced payload, or unintended asymmetry. The segment of the tape **27** and the tailfins **22** produce a center of pressure behind the center of gravity of the non-lethal projectile unit **11**, thus causing the orientation of the projectile **11** to stay aligned with the predetermined flight path, like a dart. The seam **25** which may be formed from the junction of two layers or sheets of tape **27**, inherently a structurally weak spot, is typically in the front **28** of the shell **20**, encouraging the shell **20** to break upon impact and subsequently releasing the payload **29**. In other words, the non-lethal projectile **11** of the present invention will break more easily than conventional non-lethal projectiles at the same impact velocity. Assuming the same muzzle velocity and drag, the non-lethal projectile **11** of the present invention therefore has an increased effective range than conventional projectiles that cannot maintain orientation. Similar to conventional methods for manufacturing paintballs and other gelatin capsules, the embodiment of the Projectile Belt **10**, including the shells **20**, the tape **27**, the tailfins **22** and all other features on the tape **27**, may be manufactured in an uninterrupted or continuous fashion using an industrial rotary die encapsulation machine. Some material that would otherwise be cut away during the manufacturing of prior arts is now retained during the press process to hold the non-lethal projectiles **11** together to form the Projectile Belt **10**. The cooling, drying and polishing process for such long chain of non-lethal projectiles **10** and other downstream post-processes are similar to as the ones for segregated conventional gelatin capsules, except for the differences described herein including a making use of the index holes **21** on the tape **27** during the process could potentially increase the yield and the overall quality of the product. Specifically, in a paintball application, the shells **20** and the tape **27** are both made out of the same soft gelatin sheets, therefore, the paintball Projectile Belt **10** may be manufactured in a continuous fashion using a rotary die encapsulation machine. The shape and layout of the desired embodiment of the present invention described in FIGS. **5**(*a*) through **5**(*g*) are purposefully created to satisfy the requirements of such rotary die machines. Utilizing such process significantly increases the predictable of such non-lethal projectiles **11** and Projectile Belt **10**. Non-lethal projectiles **11** may be connected in different ways. In each of the constructions, a matching Extractor **14** should be developed to effectively segregate the projectiles **11** from the Projectile Belt **10**. **FIG. 9**(*a*) illustrates the first embodiment **110** of such non-lethal projectile belt **10**. Projectiles **111** are connected together by connecting material **113**. The material **113** should be removed and discarded before a projectile **111** is chambered. Although spherical projectiles **111** are depicted in FIGS. **9**(*a*) through **9**(*c*), non-spherical projectiles may also be connected in a similar manner. **FIG. 9**(*b*) shows another embodiment **130** of such Projectile Belt. Non-lethal projectiles **111** are glued **114** to a tape **127**. The tape **127** may optionally include indexing aids to assist loading. The non-lethal projectiles **111** are removed from the tape **127** during the feeding process. The tape **127** is subsequently discarded. **FIG. 9**(*c*) illustrates a third embodiment **140** of such non-lethal projectile belt **10**. Each of the projectiles **111** may have a shape, such as spherical or oblong or other appropriate shape, and may have a soft gelatin or plastic pocket **138**, which can be mechanically punctured. The content of the pocket **138** is removed and chambered afterwards. Although this embodiment is more mechanically robust, disadvantages of such belt **140** of pockets **138** include higher manufacturing costs and increased design complexity of the marker due to the need for discarding the spent cases. Yet another embodiment similar to the pocket embodiment **140** could be that non-lethal projectiles are contained within a series of interlocking cases (also known as links). The links are severed and discarded during the feeding process. Another alternative embodiment of the non-lethal projectile unit **11** is to combine the index holes **101** and the tailfins **102** as shown in **FIG. 5**(*h*). The combined structure may use a matching set of index drums **30** and **31** on the Extractor **14** which may cause a slight increase in cost in the launch system. However, this embodiment may reduce drag and improve the robustness of tailfins **102**. In conclusion, the disadvantages of any spherical embodiment include the lack of spin-stabilization and low aerodynamic efficiency. Without the index holes, the probability of a misfeed or jamming increases. Also, if the connecting material needs to be discarded during the feeding process, the complexity and cost of the feeding apparatus increases.

[0046] The Feeding Assembly **12** includes of the Extractor **14**, a cam **40** with a pivot **47**, a roller **41** mounted on the bolt knob M**5** and a spring-loaded lever **48**. The roller **41** travels within the rail **43** inside the cam **40**, and in so doing, the roller **41** pushes the cam **40** along the edge **45** and causes it to rotate around its pivot **47**. The lever **48** is forced into the one-way gear **34** on the back of the Extractor **14**, and causes the Extractor **14** to rotate. The Feeding Assembly **12** is a conveyor mechanism that separates the projectiles from the Projectile Belt **10** and delivers the segregated projectile **11***a* into the breech M**6** in the Barrel M**3**. The Feeding Assembly **12** includes the Extractor **14**, a cam **40**, a lever **48**, a roller **41** attached to the bolt knob M**5** (commonly found in today's market) on the bolt M**3**. The cam **40** and the lever **48** is synchronized and driven by the movements of the bolt M**5**. During re-cocking, the bolt M**5** moves backward **93** and causes the roller **41** to travel along the rail **43**. When the roller **41** is traveling within the linear edge **44** of the cam **40**, no movement is induced on the cam **40**. The length of the linear edge **44** is determined by the length of the projectiles **11** that is, how far the bolt M**3** has to travel in order to clear the breech M**6** for the incoming projectile **11***b*. After that, the incoming projectile **11***b* may move into the breech M**6**. When the roller **41** reaches the up ramp **45**, any further movement will cause the cam **40** to rotate around its pivot **47** in the clockwise direction **92**, which in turns, causes the lever **48** to push the one-way gear **34** on the back of the Extractor **14**. By doing so, the Extractor **14** separates the projectile closest to the breech M**6** from the remaining Projectile Belt **10**. The Extractor **14** advances the Projectile Belt **10** by one width of the projectile **11** and delivers the separated projectile **11***b* into breech M**6**. Prior to firing, the bolt M3 moves forward **94** and drives the cam **40** in the opposite direction **95**. The spring-loaded lever **48** slides to the next tooth on the one-way gear **34**, without causing any movement in the Extractor **14**. The projectile **11***a* is chambered. When the re-cocking sequence begins, the process repeats. An embodiment of the Feeding Assembly **12**, shown in **FIG. 10**, uses a pair of symmetrical conveyor belts **202** to drag the Projectile Belt **10** into the breech M**6**. The conveyor belts **202** are driven by the movement of the bolt M**4**. As the bolt M**4** opens and moves backward during re-cocking, it provides kinetic energy to drive the Feeding Assembly **12**. Besides using the cam **40** and lever **48** to synchronize the bolt M**4** with the conveyor belts **202**, the precise timing of the two conveyor belts **202** relative to the bolt M**4** may also be encoded in the trenches **222** on the surfaces of two timing plates **220**. Glide pins **221** are created on the outside of the conveyor belts **202**. The conveyor belts **202** are sandwiched between the timing plates **220** that are directly connected to the bolt M**4**. The glide pins **221** are inserted into the trenches **222** that encode the one-way movement of the pins **221** relative to movement **224** of the bolt M**4**. In other words, the conveyor belts **202** are driven by the movement of the timing plates **220**. Another embodiment employs a similar concept but the timing is encoded in a timing ring built around the bolt M**4** instead of the timing plates **220**. A bolt knob M**5** traveling back and forth will cause the timing ring to rotate along the longitudinal axis of the bolt M**4**. The rotational movement is transferred to the conveyor belt **202** or to the desired embodiment of the Extractor **14** and provides conveyor belt **202** and extractor **14** with kinetic energy and synchronized movement. Other embodiments that converts the linear motion of the bolt M**4** into unidirectional rotational motion is through gear set, such as a rack-and-pinion combined with a unidirectional freewheel, are within the scope of the invention. All of the structural embodiments variants of Feeding Assembly **12** described here are more complex than the desired embodiment, and may be less efficient, less reliable, less robust and/or more costly.

[**0047**] The Extractor **14** is a sub-component of the Feeding Assembly **12**. The Extractor **14** includes of four pairs of counter-rotating sub-components around two symmetrical drive shafts **36**. The four sub-component pairs are the index drums **30** and **31**, synchronization gears **32**, one-way gears **34** and sets of flaps **38**. The pairs of synchronization gears **32**, one-way gears **34** and set of flaps **38** are longitudinally symmetrical to their counterparts, with the exception of the index drums **30** and **31**, which may have distinctive, asymmetrical features determined by the construction of the tape **27** being used. On one side, the index drum **30** has a set of index teeth **54**; and, on the other side **31**, there are matching index holes **55**. The relative positions of index teeth **54** and index holes **55** must match the index holes **21** on the tape **27** being used. Amongst the indexing features **54** and **55**, there are blades **57** on one side and matching trenches **56** on the other. Similarly, the relative positions of blades **57** and trenches **56** should match the positions of the perforation **26** on the tape **27** being used. The two index drums **30** and **31** are synchronized by a pair of synchronization gears **32**. There is also a pair of one-way gear **34** driven by the cam **40** and lever **48** during re-cocking action of the bolt M**4**. The sets of flaps **38** mechanically assist the insertion of the extracted non-lethal projectile **11***a* into the breech M**6**. The flaps **38** may be used, should the index drums **30** alone be insufficient. In the Extractor **14**, there is a gap **33** allowing the tailfins **22** to pass through. The Extractor **14** is a sub-component of the Feeding Assembly **12**. The Extractor includes four pairs of counter-rotating sub-components around two symmetrical drive shafts **36**. The four subcomponent pairs are the index drums **30** and **31**, the pair of synchronization gears **32**, the pair of one-way (unidirectional) gears **34** and the pair of flaps **38**. The pairs of synchronization gears **32**, one-way gears **34** and set of flaps **38** are longitudinally symmetrical to their counterparts, with the exception of the index drums **30** and **31**, which may have distinctive, asymmetrical features determined by the tape **27** being used. On one side, the index drum **30** has a set of index teeth **54**; and, on the other side **31**, there are matching index holes **55**. The relative positions of index teeth **54** and index holes **55** should match the index holes **21** of the tape **27** being used. Amongst the indexing aids **54** and **55**, there are blades **57** on one side and trenches **56** on the other. Similarly, the relative positions of blades **57** and trenches **56** should match the positions of the perforations **26** on the tape **27** being used. The action of the blades **57** are illustrated in **FIG. 8**. The blade **57***e* is cutting through the perforations **26** between projectile **11***b* and **11***c*. The two index drums **30** and **31** are synchronized by a pair of synchronization gears **32**. There is a pair of one-way gear **34** driven by the cam **40** and lever **48** during re-cocking action of the bolt M**4**. The sets of flaps **38** mechanically assist the insertion of the extracted non-lethal projectile **11***b* into the breech M**6**. The flaps **38** may be implemented, should the index drums **30** and **31** alone provide insufficient mechanical support. The Extractor **14** must be placed in close proximity to the breech M**6**, see **FIG. 8**, so that the last projectile **11***a* in the belt **10** will be held up in breech M**6** with the absence of the next projectile **11***b*. It is desirable and possible for a blade **57***a* and an index tooth **54***b* to temporarily intrude into the breech M**6**, as long as they do not interfere with the bolt M**4**. There is a gap **33** in the Extractor **14** and **14'** that allows tailfins **22** on the Projectile Belt **10** to pass through. Referring now to **FIGS. 11 and 12** which illustrate an embodiment of the Extractor **10**, this embodiment of the Extractor **10** moves longitudinally along the axis of the barrel M**3**. Its motion is synchronized with the bolt M**4**, which can be achieved through a spring **216**. This embodiment **210** of the Extractor **14** leads the bolt M**4**. Additionally, re-cocking of this embodiment **210** of the Extractor **14** is delayed relative to the bolt M**4**. This embodiment **210** of the Extractor **14** has a very sharp blade **212** for removing non-lethal projectiles **11** from the Projectile Belt **10** by cutting through the connecting material **27** between the first projectile **11***a* and the second **11***b*. On both sides of the blade, there are ramps **215** that guide the tape **27** into the blade **212** as the Extractor **210** is pushed forward by the bolt M**4**. The other purpose of the ramps **215** is to narrow the blade opening **214** to reduce the chance of injury. The embodiment **210** and the bolt M**4** then form a gas seal behind the chamber.

[**0048**] The Magazine **18** is a storage device made of durable but inexpensive material, such as nylon. The Magazine's body **61** is round in shape, resembling the drum magazines used by the military. The Magazine **18** optionally has a removable cover. When the cover is removed, the Magazine can be refilled and serviced. At one end of the Magazine is a ramp **66** guiding the Projectile Belt **10** traveling into the Feeding Assembly **12**. A spin wheel **63** or bearing facilitates the unwinding of the Projectile Belt **10**. The adapter **65** secures the whole Magazine **18** to the action

M1. The adapter **65** may optionally implement a push rod **64**, or similar mechanism to induce some movement of the Extractor **14** as the Magazine **18** is being inserted into the action M1, primarily to ensure the first projectile properly aligns with the index drums **30** and **31** of the Extractor **14**. Along the interior of the Magazine **18**, there may be soft rubber flaps **62** that prevent the Projectile Belt **10** from traveling in reverse due to gravity or vibration, although this is optional as well. The Magazine **18** provides an enclosure for the Projectile Belt **10** and protects the Projectile Belt **10** from being damaged before it enters the breech M6, although the absence of such magazine **18** will not affect the normal operation of the present invention. The Projectile Belt **10** may be fed directly into the Feeding Assembly **12** with or without the Magazine **18**. In the desired embodiment, Projectile Belt **10** coils around the center spin wheel **63** of a drum Magazine **18**. The optional spin wheel **63** facilitates the unwinding of the Projectile Belt **10** inside the Magazine **18**. And, for easier packaging and retailing, the Magazine **18** may be made of disposable materials so that the Magazine **18** may be conveniently discarded after use. Although the round-shaped drum Magazine **18** may be the most space- and weight-efficient, a magazine can take many other shapes, such as straight rectangular or curved. These variants are commonly known as box magazines. The magazines may be made of metals, plastics and/or other materials, depending on the requirements of the target environments. If the Magazine **18** is re-usable, the actual construction may also include a removable lid, secured by screw or clips.

[0049] The action M1 is the assembly where all other components are connected to. The bolt M4 is attached to the cam **40** of the Feeding Assembly **12** through a roller **41** on the bolt knob M5. The lever **48** is actuated by the cam **40**. The spring-loaded lever **48** sits on a one-way gear **34** of the Extractor **14**. The Feeding Assembly **12** is connected to the breech M6 of the barrel M3 so that the Extractor **14** may insert the segregated non-lethal projectile **11***a* into the breech M6. The Extractor **14** aligns the incoming non-lethal projectiles **11** along the barrel's M3 longitudinal axis (or at an otherwise predetermined angle) using the index holes **21** on the Projectile Belt **10**. The Magazine **18**, containing the Projectile Belt **10**, is attached to the Feeding Assembly **12** through an adapter **65** such that the incoming Projectile Belt **10** is properly aligned with the action M1. Unlike conventional gravity-feed mechanism, the Magazine **18** and the Feeding Assembly **12** may be positioned in any orientation. The position of the Magazine **18** relative to the action M1 is not restricted to the positions vertically above or below the breech M6. It may be positioned at any angle around the action M1. However, under most circumstances, the use of a Magazine **18** is optional. The Feeding Assembly **12** will accept a Projectile Belt **10** without a Magazine **18**, although the use of a Magazine **18** as a protective cover will prevent contaminants such as sand and dust from entering the action M1. Contaminants increase the likelihood of failures of the action M1. Furthermore, for illustrative purposes, only the non-lethal embodiment of the projectile belt and the feeding apparatus and their embodiments has been presented. However, it is obvious that harmful or even lethal payloads may also be delivered using the same projectile belt concept and the same feeding apparatus. Harmful fill materials include, but not limited to, biological agents, chemical agents, pesticides, hard solids, explosives and sharpened tips.

[0050] To begin using the invention, a user acquires a pre-fabricated belt **10** of non-lethal projectiles potentially in the form of a loaded Magazine **18**. The user inserts the Magazine or the belt into the Feeding Assembly. By doing so, the first non-lethal projectile **11** would be situated next to the breech M6 opening of the barrel M3. For most pump-action, semi-automatic and fully-automatic actions, the user is required to perform an initial cocking of the bolt M4 into its rear-most position. The bolt's M4 movement causes the cam **40** and the lever **48** to move, whose actions are synchronized with the bolt M4. The movement of the cam **40** causes the Extractor **14** in the Feeding Assembly **12** to rotate. The rotating Extractor **14** extracts the first non-lethal projectile from the Projectile belt by cutting through its perforation **26** and pushes the loose non-lethal projectile **11** into the breech and pulls the remainder of the Projectile Belt **10** towards the breech M6. The action M1 is loaded and ready to fire. During firing, the bolt M4, which is usually spring loaded, is released. The bolt M4 chambers the loose non-lethal projectile **11***a* and seals the barrel M3 from behind. The next non-lethal projectile **11***b* remains outside of the barrel M3 at this time. The cam **40** driven by the bolt M4 returns to its original position. The lever **48** also returns to its original position by skipping over to the next tooth on the one-way gear **34** without causing any movement in the Extractor **14**. After the chambered projectile **11***a* is ejected from the barrel M3, the bolt M4 returns to its pre-firing position either by the residual gas pressure, as in semi- or fully automatic action, or by manual action. The bolt's M4 movement causes the cam **40**, the lever **48** and the Extractor **14** to move, as described previously in the description of the preferred embodiment of the Extractor **14**. The rotating Extractor **14** extracts the next non-lethal projectile **11***b*, pushes the loose projectile **11***b* into the breech and pulls the remainder of the Projectile Belt **10** towards the breech M6. The Action is again in a ready-to-fire configuration. The cycle repeats when the user releases the bolt M4 again. In a closed-bolt action, the cycle is almost the same, with the exception that the bolt M4 remains in the forward most position (breech M6 closed) before the trigger is pulled. When the breech M6 is closed and locked, the action M1 is said to be ready to fire.

[0051] As to a further discussion of the manner of usage and operation of the present invention, the same should be apparent from the above description. Accordingly, no further discussion relating to the manner of usage and operation will be provided.

[0052] With respect to the above description then, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function and manner of operation, assembly and use, are deemed readily apparent and obvious to one skilled in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention.

[0053] Therefore, the foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

1) A non-lethal projectile belt and feeder, comprising:

a continuous tape to be separated;

a non-spherical shell connected to said tape for holding a substrate to be released on impact;

wherein said tape includes a weakened area for separating said non-spherical shell; and

a feeding apparatus to separate said weakened area to detached said non-spherical shell.

2) A non-lethal projectile belt and feeder as in claim 1, wherein said feeding apparatus includes a blade to separate said weakened area.

3) A non-lethal projectile belt and feeder as in claim 1, wherein said weakened area includes perforations.

4) A non-lethal projectile belt and feeder as in claim 1, wherein said feeding apparatus includes a trench to correspond to said weakened area.

5) A non-lethal projectile belt and feeder as in claim 1, wherein said tape includes an index hole.

6) A non-lethal projectile belt and feeder as in claim 5, wherein said feeding apparatus includes an index tooth to engage said index hole.

7) A non-lethal projectile belt and feeder as in claim 6, wherein said feeding apparatus includes a matching index hole to accept said index tooth.

8) A non-lethal projectile belt as in claim 1, wherein said tape includes a fin to guide said non-spherical shell.

9) A non-lethal projectile belt as in claim 8, wherein said fin includes supporting material to support said fin.

10) A non-lethal projectile, comprising:

a tape which has been separated;

a non-spherical shell connected to said tape for holding a substrate to be released on impact;

wherein said tape includes a portion of a weakened area for separating said non-spherical shell; and

wherein said non-spherical shell includes a seam to affect a trajectory of said non-spherical shell.

11) A non-lethal projectile as in claim 10, wherein said tape is formed from two layers.

12) A non-lethal projectile as in claim 11, wherein said seam is formed by the overlap of said layers.

13) A non-lethal projectile as in claim 10, wherein said tape includes an index hole.

14) A non-lethal projectile as in claim 10, wherein said seam rolls said non-spherical shell substantially along a longitudinal axis of said non-spherical shell.

15) A non-lethal projectile as in claim 12, wherein said non-spherical shell is substantially a sub-sonic cone shape.

16) A non-lethal projectile as in claim 10, wherein said tape includes a fin to guide said non-spherical shell.

17) A non-lethal projectile as in claim 16, wherein said fin includes supporting material to support said fin.

18) A non-lethal projectile and feeder as in claim 1, wherein said feeder assembly includes a flap to assist the insertion of said non-spherical shell.

19) A non-lethal projectile and feeder as in claim 1, wherein said feeder assembly includes a gap to allow a tail of said non-spherical shell to pass through said feeder assembly.

20) A feeding apparatus to feed a non-lethal projectile on the tape, comprising:

a blade to separate said non-lethal projectile from said tape;

a trench to cooperate with said blade to separate said non-lethal projectile from said tape;

an index tooth to engage an index hole of said tape;

a matching index hole to cooperate with said index tooth to engage said index hole of said tape;

a flap to assist the insertion of said non-lethal projectile;

a gap to allow a tail of said non-lethal projectile to pass through said feeding apparatus;

wherein said feeder apparatus includes a bolt to power the feeder assembly.

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