(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 November 2021 (11.11.2021)

WIPO | PCT

(10) International Publication Number
WO 2021/225524 A1

(51) International Patent Classification:
F41B 7/08 (2006.01) *F41A 9/70* (2006.01)
F41B 11/50 (2013.01) *F41B 11/89* (2013.01)
F41B 11/73 (2013.01) *A63H 33/18* (2006.01)

(21) International Application Number:
PCT/SG2021/050248

(22) International Filing Date:
05 May 2021 (05.05.2021)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
63/020,086 05 May 2020 (05.05.2020) US
63/112,213 11 November 2020 (11.11.2020) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: SHORT PROJECTILE PISTOL

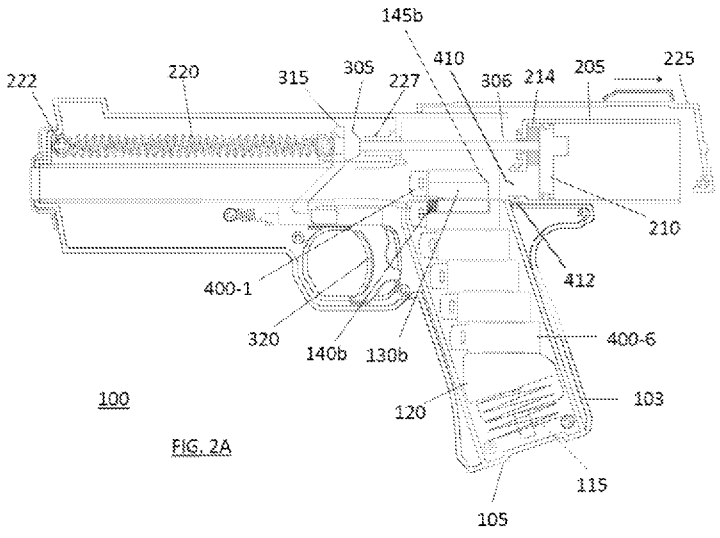


FIG. 2A

(57) Abstract: A toy projectile launcher pistol having a handle with an internal projectile storage area; at least one pair of inwardly biased resilient flaps; an air piston assembly having a barrel and a plunger element; a sliding handle coupled to the barrel, the sliding handle and barrel being movable between a forward position and a backward position; an extension spring that biases the plunger element to-wards a front portion of the toy projectile launcher pistol; and a latching assembly that couples the plunger element to a trigger assembly when the sliding handle is moved to the backward position, and the trigger assembly, upon toggling, releases the coupling of the latching assembly between the plunger element and the trigger assembly.

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Published:

— *with international search report (Art. 21(3))*

— *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

SHORT PROJECTILE PISTOL

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of and priority to the following applications: U.S. Provisional Application No. 63/020,086, filed May 5, 2020 and entitled Short Projectile Pistol With Storage Handle; and U.S. Provisional Application No. 63/112,213, filed November 11, 2020 and entitled Short Projectile Pistol. The contents of these application are incorporated herein by reference in their entirety.

FIELD

[0002] The present disclosure is generally related to a toy projectile launcher, such as a toy pistol, gun, and the like, for launching toy projectiles, such as foam bullets, darts, balls, and the like, with a spring-loaded air piston assembly arrangement for miniaturizing the launcher.

BACKGROUND

[0003] Traditional toy projectile launchers have utilized various forms of rifles, pistols, blasters, machine guns, and the like, for launching toy projectiles, such as foam balls, darts, to name a few. Such toy launchers have varied in size, power, storage capacity, to name a few. More specifically, toy launchers of foam projectiles—bullets (or "darts"), balls, and the like—have become ubiquitous. One standard for foam bullets has been marketed under the brand name Nerf® with a rubber tip and a foam body that totals approximately 71.5 mm in length. There have been various types of rifles, machine guns, and the like, that have been marketed for launching such foam projectiles.

[0004] In most cases, the launchers for these standard Nerf foam bullets have been large rifle-style launchers that can be inflexible and unwieldy during play. Accordingly, there has been a need for a more portable foam or plastic toy projectile launcher that provides for more flexible play without sacrificing launch velocity and accuracy.

SUMMARY

[0005] To address the above, the present disclosure is generally related to an improved toy launcher for launching a shorter foam bullet, where the launcher is in the form of a pistol that uti-

lizes a spring-loaded air piston assembly having a front anchor for miniaturizing the launcher. Advantageously, an effective, user-friendly, and high-performance blaster may be realized in a compact design for quick draw applications that, nevertheless, provides high velocity and accurate projectile launching.

[0006] Particularly, the present invention is directed to a toy launcher with a two-step loading/priming and firing mechanism that decreases the size of the launcher while realizing high launching force for compact projectiles.

[0007] According to an exemplary embodiment, the toy launcher incorporates a handle that houses an opening for receiving a detachable cartridge and a spring-loaded reciprocating cylindrical/air piston assembly that is configured to uncover an opening for loading the cartridge into the handle in a first rearward priming movement via a corresponding rearward movement of a cocking slide by a user. The simplified construction with the reciprocating air piston assembly of the present invention significantly reduces the size and material costs of the launcher in comparison to the conventional mechanisms.

[0008] According to an exemplary embodiment, a toy projectile launcher comprises: a handle comprising an opening for receiving a detachable cartridge; at least one pair of resilient flaps, the at least one pair of resilient flaps being inwardly biased and disposed on respective first and second sides at a top opening of the detachable cartridge; an air piston assembly that comprises a barrel and a plunger element; a sliding handle coupled to the barrel, the sliding handle being movable between a forward position and a backward position, thereby moving the barrel between corresponding forward and backward positions; a spring that biases the plunger element to a front anchor in the toy projectile launcher; and a latching assembly that couples the plunger element to a trigger assembly when the sliding handle is moved to the backward position and the barrel is moved to the corresponding backward position, where the barrel covers at least a portion of the top opening when in the corresponding forward position and the at least one pair of resilient flaps contact the respective first and second sides of the barrel, and the trigger assembly, upon toggling, releases the coupling of the latching assembly between the plunger element and the trigger assembly.

[0009] In embodiments, the plunger element extends the spring from the front anchor when the sliding handle is moved to the backward position.

[0010] In embodiments, a projectile from the detachable cartridge is held between the at least one pair of resilient flaps when the barrel is moved to the corresponding backward position.

[0011] In embodiments, the sliding handle, when moved to the backward position, creates an opening in the toy projectile launcher for receiving the detachable cartridge.

[0012] In embodiments, when the sliding handle is moved from the backward position to the forward position with the latching assembly coupling the plunger element to the trigger assembly, the barrel is moved to the corresponding forward position and forms an internal air chamber with the plunger element, the internal air chamber being filled with air drawn in from a front nozzle of the barrel.

[0013] In embodiments, a projectile is disposed immediately adjacent the front nozzle of the barrel when the sliding handle is moved from the backward position to the forward position.

[0014] In embodiments, the plunger element is pulled forward by the spring to expel the air from the internal air chamber through the front nozzle of the barrel when the coupling of the latching assembly between the plunger element and the trigger assembly is released.

[0015] A toy projectile launcher according to an exemplary embodiment of the present invention comprises: a launch barrel; a handle comprising an internal projectile storage area; at least one pair of resilient flaps, the at least one pair of resilient flaps being inwardly biased and disposed on respective first and second sides at a top opening of the internal projectile storage area; an air piston assembly that comprises a barrel and a plunger element; a sliding handle coupled to the barrel, the sliding handle being movable between a for-ward position and a backward position, thereby moving the barrel between corresponding for-ward and backward positions; a spring that biases the plunger element towards a front portion of the toy projectile launcher; and a latching assembly that couples the plunger element to a trigger assembly when the sliding handle is moved to the backward position and the barrel is moved to the corresponding backward position, wherein the barrel covers at least a portion of the top opening when in the corresponding forward position forming an airtight seal between the launch barrel and the barrel and the one or more pairs of resilient flaps contact the respective first and second sides of the barrel, and the trigger assembly, upon toggling, releases the coupling of the latching assembly be-tween the plunger element and the trigger assembly.

[0016] In an exemplary embodiment, the plunger element extends the extension spring away from the front portion when the sliding handle is moved to the backward position.

[0017] In an exemplary embodiment, a projectile from the internal projectile storage area is held between the at least one pair of resilient flaps when the barrel is moved to the corresponding backward position.

[0018] In an exemplary embodiment, the sliding handle, when moved to the backward position, creates an opening in the toy projectile launcher for loading projec-tiles into the internal projectile storage area.

[0019] In an exemplary embodiment, when the sliding handle is moved from the backward position to the forward position with the latching assembly coupling the plunger element to the trigger assembly, the barrel is moved to the corresponding forward position and forms an internal air chamber with the plunger element, the internal air chamber being filled with air drawn in from a front nozzle of the barrel.

[0020] In an exemplary embodiment, the plunger element is pulled forward by the extension spring to expel the air from the internal air chamber through the front nozzle of the barrel when the coupling of the latching assembly between the plunger element and the trigger assembly is released.

[0021] In an exemplary embodiment, the toy projectile launcher further comprise a projectile in the in-ternal air chamber immediately adjacent the front nozzle of the barrel.

[0022] In an exemplary embodiment, the barrel has an oval cross-section.

[0023] In an exemplary embodiment, the oval shape of the barrel in-corporates a 7:5 height-to-width ratio.

[0024] A toy projectile launcher according to an exemplary embodiment of the present invention comprises: a launch barrel; a projectile storage area; a pair of inwardly-biased resilient flaps disposed on respective first and second sides at a top opening of the projectile storage area;
an oval-shaped air piston assembly that comprises a barrel and a plunger element; a sliding handle coupled to the barrel, the sliding handle being movable between a for-ward position and a backward position, thereby moving the barrel between corresponding for-ward and backward positions; a spring that biases the plunger element towards a front portion of the toy projectile launcher; and a latching assembly that couples the plunger element to a trigger assembly when the sliding handle is moved to the backward position and the barrel is moved to the corresponding backward position, wherein the barrel covers the top opening when in the corresponding forward position forming an airtight seal between the launch barrel and the barrel and the pair of inwardly-biased resilient flaps contact the respective first and second sides of the barrel, and the trigger assembly, upon toggling, releases the coupling of the latching assembly be-tween the plunger element and the trigger assembly.

[0025] A toy projectile launcher according to an exemplary embodiment of the present invention comprises: a launch barrel; a handle comprising an internal projectile storage area; at least one pair of resilient flaps, the at least one pair of resilient flaps being inwardly biased and disposed on respective first and second sides at a top opening of the internal projectile storage area; an air piston assembly that comprises a barrel and a plunger element; a sliding handle coupled to the barrel, the sliding handle being movable between a for-ward position and a backward position, thereby moving the barrel between corresponding for-ward and backward positions;
a compression spring that biases the plunger element away from a rear wall in the toy projectile launcher; and a latching assembly that couples the plunger element to a trigger assembly when the sliding handle is moved to the backward position and the barrel is moved to the corresponding backward position, wherein the barrel covers at least a portion of the top opening when in the corresponding forward position forming an airtight seal between the launch barrel and the barrel and the one or more pairs of resilient flaps contact the respective first and second sides of the barrel, and the trigger assembly, upon toggling, releases the coupling of the latching assembly be-tween the plunger element and the trigger assembly.

[0026] In an exemplary embodiment, the plunger element compresses the compression spring against the rear wall when the sliding handle is moved to the backward position.

[0027] In an exemplary embodiment, a projectile from the internal projectile storage area is held between the at least one pair of resilient flaps when the barrel is moved to the corresponding backward position.

[0028] In an exemplary embodiment, the sliding handle, when moved to the backward position, creates an opening in the toy projectile launcher for loading projectiles into the internal projectile storage area.

[0029] In an exemplary embodiment, when the sliding handle is moved from the backward position to the forward position with the latching assembly coupling the plunger element to the trigger assembly, the barrel is moved to the corresponding forward position and forms an internal air chamber with the plunger element, the internal air chamber being filled with air drawn in from a front nozzle of the barrel.

[0030] In an exemplary embodiment, the plunger element is pushed forward by the compression spring to expel the air from the internal air chamber through the front nozzle of the barrel when

the coupling of the latching assembly between the plunger element and the trigger assembly is released.

[0031] In an exemplary embodiment, the toy projectile launcher further comprises a projectile in the in-ternal air chamber immediately adjacent the front nozzle of the barrel.

[0032] In an exemplary embodiment, the at least one pair of resilient flaps comprises a front pair of resilient flaps and a back pair of resilient flaps disposed at respective front and back portions of the top opening of the internal projectile storage area.

[0033] In an exemplary embodiment, the barrel has an oval cross-section.

[0034] In an exemplary embodiment, the oval shape of the barrel in-corporates a 7:5 height-to-width ratio.

[0035] A toy projectile launcher according to an exemplary embodiment of the present invention comprises: a projectile storage area; a front pair of inwardly-biased resilient flaps disposed on respective first and second sides at a front portion of a top opening of the projectile storage area;

a rear pair of inwardly-biased resilient flaps disposed on the respective first and second sides at a rear portion of the top opening of the projectile storage area; an oval-shaped air piston assembly that comprises a barrel and a plunger element; a sliding handle coupled to the barrel, the sliding handle being movable between a for-ward position and a backward position, thereby moving the barrel between corresponding for-ward and backward positions; a compression spring that biases the plunger element away from a rear wall in the toy projectile launcher; and a latching assembly that couples the plunger element to a trigger assembly when the sliding handle is moved to the backward position and the barrel is moved to the corresponding backward position, wherein the barrel covers the top opening when in the corresponding forward position and the front and rear pairs of the inwardly-biased resilient flaps contact the respective first and second sides of the barrel, and the trigger assembly, upon toggling, releases the coupling of the latching assembly be-tween the plunger element and the trigger assembly.

[0036] A toy projectile launcher according to an exemplary embodiment of the present invention comprises: a launch barrel; a body and a handle; a projectile storage area in the handle in communication with the body; and an air piston assembly in the body, the air piston assembly comprising a barrel, a plunger element and a nozzle, the barrel moveable relative to the plunger from an uncocked position to a cocked position wherein the nozzle is immediately adjacent the projectile

storage area adjacent the body in the cocked position forming an airtight seal between the barrel and the launch barrel.

[0037] In an exemplary embodiment, the air piston assembly has an oval shaped cross-section with a narrower side extending across a width of the body of the launcher.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] Exemplary embodiments of the present disclosure will be described with references to the accompanying figures, wherein:

[0039] FIG. 1A is a schematic partial cross-sectional side view of key elements of a toy projectile launcher with an empty handle according to an exemplary embodiment of the present disclosure.

[0040] FIG. 1B is a schematic cross-sectional rear view of a cartridge for use with the launcher of FIG. 1A in accordance with an exemplary embodiment of the present disclosure.

[0041] FIG. 1C is a schematic cross-sectional side view of the cartridge shown in FIG. 1B.

[0042] FIG. 2A is a schematic partial cross-sectional side view of a projectile launcher with a fully-loaded cartridge inserted into the handle and in a rearward loading and priming (cocked) position according to an exemplary embodiment of the present disclosure.

[0043] FIG. 2B is a schematic partial cross-sectional side view corresponding to FIG. 2A for illustrating slant angles of the launcher handle in accordance with another exemplary embodiment of the present disclosure.

[0044] FIG. 2C is a schematic cross-sectional side view corresponding to FIG. 1C for illustrating a slant angle of the cartridge in accordance with another exemplary embodiment of the present disclosure.

[0045] FIG. 3A is a schematic partial cross-sectional side view of the projectile launcher of FIG. 2A in a forward firing position according to an exemplary embodiment of the present disclosure.

[0046] FIG. 3B is a schematic partial cross-sectional side view corresponding to FIG. 3A showing the launcher in accordance with another exemplary embodiment of the present disclosure.

[0047] FIG. 3C is a cross-sectional front view across the A-A line in FIG. 3B.

[0048] FIG. 4 is a schematic partial cross-sectional side view of a projectile launcher in a position immediately after a first dart has been launched according to an exemplary embodiment of the present disclosure.

[0049] FIG. 5A is a schematic partial cross-sectional side view of key elements of a toy projectile launcher with an empty storage area in the handle according to an exemplary embodiment of the present invention.

[0050] FIG. 5B is a schematic cross-sectional front view of the launcher along the 5B-5B line in FIG. 5A.

[0051] FIG. 5C is an inset closeup side view illustrating details of an assembly at the top portion of an internal storage area in the handle according to an exemplary embodiment of the present invention.

[0052] FIG. 6A is a schematic partial cross-sectional side view of a projectile launcher with a fully-loaded storage area in the handle of a projectile launcher in a rearward loading and priming (cocked) position according to an exemplary embodiment of the present invention.

[0053] FIG. 6B is a schematic cross-sectional front view of launcher along the 6B-6B line in FIG. 6A.

[0054] FIG. 6C is a partial cross-sectional front view of the top portion of the internal storage area to illustrate loading of the projectiles while in the loading (cocked) position shown in FIG. 6A.

[0055] FIG. 7A is a schematic partial cross-sectional side view of a projectile launcher with a fully-loaded internal storage area in the handle of a projectile launcher in a forward firing position according to an exemplary embodiment of the present invention.

[0056] FIG. 7B is a schematic cross-sectional front view of launcher along the 7B-7B line in FIG. 7A.

[0057] FIG. 7C is a closeup view of the interface between the rear portion of a trigger assembly and a plate when the trigger of the launcher is activated according to an exemplary embodiment of the present invention.

[0058] FIG. 8 is a schematic partial cross-sectional side view of a projectile launcher in a position after a first dart having been launched according to an exemplary embodiment of the present invention.

[0059] FIG. 9 is a drawing illustrating a comparison between a conventional foam dart that is 71.5 mm long and a foam dart that is 37.5 mm long for use with the storage handle in accordance with an exemplary embodiment of the present invention.

[0060] FIG. 10 is a schematic sectional side view of key elements of a toy projectile launcher with an empty storage area in the handle in correspondence the side view of FIG. 5A but from an opposite side and according to another exemplary embodiment of the present invention.

[0061] FIG. 11A is a schematic cross-sectional side view that corresponds to FIG. 10 of a projectile launcher with an empty internal storage area in the handle of a projectile launcher in a forward firing position with one dart primed in a firing position according to an exemplary embodiment of the present invention.

[0062] FIG. 11B is a schematic cross-sectional front view of launcher along the 11B-11B line in FIG. 11A.

[0063] FIG. 11C is a closeup front partial cross-sectional view of an internal air cylinder of the launcher shown in FIGS. 11A and 11B according to an exemplary embodiment of the present invention.

[0064] FIG. 12 includes a number of diagrams illustrating the toy projectile launcher being inserted and housed in a corresponding holster according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION

[0065] The present invention is generally related to an improved toy launcher with a spring-loaded air piston assembly having a front anchor in the launcher.

[0066] In the disclosure below, reference numerals with a trailing letter a or b denote elements on respective sides of toy launcher 100 and each of these elements have the same corresponding features but in mirrored arrangements in launcher 100.

[0067] FIG. 1A is a schematic side partial cross-sectional view of key elements of a toy projectile launcher 100 with an empty handle 103 according to an exemplary embodiment of the present disclosure. FIG. 1B is a schematic rear partial cross-sectional view of a fully-loaded cartridge 105 for insertion into the handle 103 of launcher 100 shown in FIG. 1A. FIG. 1C is a schematic side partial cross-sectional view of the cartridge 105 shown in FIG. 1B. For clarity and simplicity in illustrating the key elements and mechanisms of toy projectile launcher 100 and cartridge 105, portions that are not necessary to understand the scope and the spirit of the present disclosure are not shown. One of ordinary skill in the art would readily understand the supporting elements needed to house and support the various illustrated elements with differing design choices that would not depart from the spirit and scope of the present disclosure.

[0068] As shown in FIG. 1A, projectile launcher 100 is shaped to resemble a pistol and handle 103 is shaped to resemble a pistol grip. In exemplary embodiments, launcher 100 may be in various other shapes and arrangements without departing from the spirit and the scope of the invention, as detailed below. As illustrated in FIG. 1A, a reciprocating air piston assembly comprised of a barrel 205 and a plunger 210 is located above the handle 103 and housed within the projectile launcher 100. Handle 103 incorporates an opening 130 for inserting cartridge 105 and for placing foam darts 400 stored therein into position for priming and launching by the air piston assembly, as will be described in further detail below. According to an exemplary embodiment, the barrel 205 of the air piston assembly has a generally rounded cylindrical cross section or, as described in further detail below, an oval shape cross section. A correspondingly shaped plunger element 210 is biased towards the front portion of launcher 100 by an extension spring 220, which is coupled to a front anchor 222 within the housing of launcher 100, via a plunger rod 306 and a dome-shaped catch portion 305. The plunger element 210 incorporates a size and a shape that correspond with an internal cross section of barrel 205 so as to form an airtight seal with an internal surface of barrel 205. According to an exemplary embodiment of the invention, plunger element 210 incorporates a resilient O-ring 212 (FIG. 1A) to form an improved seal.

[0069] As shown in FIG. 1A, plunger rod portion 306 extends from plunger element 210 towards the front of launcher 100 through a front opening in barrel 205. A resilient O-ring 213 (made from a resilient material, such as a polymer) is fitted on the outside of a front wall portion of barrel 205 around rod portion 306 for preserving an airtight seal within barrel 205 while allowing rod portion 306 to move backward and forward through the front opening in barrel 205 between the positions shown in FIGS. 1A and 2A. Correspondingly, a cushioning resilient O-ring 214 (made from a resilient material, such as a polymer) is incorporated around rod portion 306 at a front surface of plunger element 210 for cushioning the impact of plunger element 210 on the front wall portion of barrel 205, as well as to contribute to air compression within barrel 205 during projectile launch.

[0070] Referring to FIGS. 1B and 1C, cartridge 105 includes a loading compression spring 115 and a pusher block 120 that provide upward force on loaded foam darts 400-1…400-6. In the illustrative embodiment, cartridge 105 has a capacity for holding six (6) darts 400-1…400-6 and is dimensioned to fit in alignment with a bottom portion of handle 103 at opening 130, as shown in

FIG. 2A. In embodiments, cartridge 105 may have a higher or lower dart capacity and may be dimensioned to fit with a longer or shorter handle or may extend from the bottom portion of handle 103 shown in FIG. 2A.

[0071] As further illustrated in FIG. 1C, cartridge 105 incorporates a slanted profile and storage area wherein successively loaded darts are held in progressively forward positions—as reflected by topmost dart 400-1 being oriented in a forwardmost position in relation to the other loaded darts 400, including bottommost dart 400-6. Thus, the slanted profile of cartridge 105 provides for a fit into opening 130 that is also slanted at a same angle in accordance with the profile of handle 103 of launcher 100. As will be described in further detail, the slant angle of opening 130 and cartridge 105 may be approximately 18 degrees from vertical or thereabouts. Correspondingly, at least a portion of the front surface of handle 103 may also be 18 degrees from vertical based on grip comfort to the user. It should be appreciated that the slant angle of the opening 130 and cartridge 105, as well as that of the handle 103, is not limited to 18 degrees, and other angles are possible without departing from the spirit and scope of the present invention. As shown in FIG. 1C, cartridge 105 incorporates the slanted profile while providing for darts 400 that are aligned with the axis of launching barrel 415 and the firing direction of launcher 100. As will be described in further detail below, foam darts 400—which may be, in alternative embodiments, bullets, balls, and the like—would be advanced by spring 115 via block 120 such that topmost dart 400-1 would be delivered to a loading position in launcher 100 for launch by the aforementioned air piston assembly comprising barrel 205 and plunger element 210 through launching barrel 415. As shown in FIGS. 1B and 1C, cartridge 105 includes a set of resilient side flaps 130a and 130b that push inward against a topmost dart 400-1 for aligning it to the firing direction of launcher 100 and for placing into a launch position, as will be described in further detail below.

[0072] As shown in FIG. 1C, a torsion spring 140b exerts an inward force on flap 130b (and a similar spring 140a exerts a corresponding inward force on flap 130a, not shown) so that the flap 130b would be moved inward towards a loaded projectile—i.e., dart 400-1. According to an exemplary embodiment of the present invention, flap 130b (and 130a) includes a slanted trailing edge 145b (and 145a not shown) along which it may be pushed outward by barrel 205 when it is moved forward towards the position shown in FIG. 1A from a rearward priming (cocked) position, as described below and illustrated in FIG. 2A. Additionally, the slanted trailing edge 145b of flap 130b, along with a corresponding trailing edge of flap 130a (not shown), provide for loading projectiles

into cartridge 105 by sliding said projectiles along the trailing edges to push flaps 130a and 130b outward, and to allow the projectiles to be inserted into the storage area of cartridge 105. In embodiments, flaps 130a and 130b may be tapered outward towards the rear of launcher 100 when inserted into handle 103 via opening 130 for receiving, and for being pushed outward by, barrel 205 as it is moved forward towards the position shown in FIG. 1A from a rearward priming position described below and illustrated in FIG. 2A.

[0073] FIG. 2A is a schematic partial cross-sectional side view of projectile launcher 100 in a rearward priming and loading (cocked) position according to an exemplary embodiment of the present disclosure. As shown in FIG. 2A, barrel 205 is coupled to a sliding top handle or cocking slide 225. As a user pulls back on handle 225 in a first, pull-back, priming step— in a fashion similar to a cartridge-loaded pistol, see backward arrow adjacent cocking slide 225 in FIG. 2A—barrel 205 is pulled back to a rearward "cocked" position. Correspondingly, the front wall portion of barrel 205, via O-ring 214, pushes plunger element 210 to the rearward "cocked" position shown in FIG. 2A. As a result, spring 220 is extended between plunger element 210 and front anchor 222. Advantageously, plunger element 210 starts at a position near a front portion of barrel 205, as shown in FIG. 1A, and, therefore, extension spring 220 may be fully extended in the position illustrated in FIG. 2A. By providing a front anchored extension spring 220 (as opposed to a compression spring from the rear portion of launcher 100), a larger barrel 205 may be provided behind dart 400-1 shown in FIG. 2A while allowing for a spring of sufficient size and forward force to launch darts 400 at a high velocity.

[0074] As shown in FIG. 2A, plunger element 210 is coupled via rod portion 306 to a dome-shaped catch portion 305, both of which are extendible through an aperture 310 incorporated in a plate 315 (which may be spring-loaded) that is, in turn, coupled to a trigger assembly 320. When a user pulls cocking slide 225 backward, rod portion 306 and dome-shaped catch portion 305 are pulled backwards by plunger element 210. A leading edge of dome-shaped catch portion 305 is rounded and when it is pushed backward, the rounded leading sloped edge pushes upward on a top edge of aperture 310 (see FIG. 1A) in plate 315, so that catch portion 305 can be pushed through aperture 310 from the front of plate 315 to clear an opposing back side of plate 315, as illustrated in FIG. 2A. Once catch portion 305 is pushed sufficiently past plate 315 through aperture 310, plate 315 is moved back downward—for example, by a spring (not shown)—into engagement with a

notch or recess 330 (see FIG. 1A) opposite the rounded face of catch portion 305 so that catch portion 305—and, correspondingly, plunger element 210—is engaged with, and temporarily retained in place by plate 315. As shown in FIG. 2A, the notch 330 hooks to the opposing back side of plate 315 above aperture 310 once plate 315 is pushed downwardly—say, by a spring (not shown)—into notch 330 and, accordingly, a top edge of aperture 310 is pushed into a bottom surface of notch 330 (see FIGS. 1A and 2A)—thus, plate 315 and notch 330 together form a latching assembly for holding catch portion 305, and plunger element 210, in the backward position.

[0075] As further shown in FIG. 2A and described above, with catch portion 305 and rod portion 306 being pulled back by plunger element 210, spring 220 is extended from the front anchor 222 within launcher 100 and held in the extended state by plate 315 and notch 330, which are hooked and engaged with each other. As shown in FIG. 2A, a structural stop 227 is provided to abut a leading surface of catch portion 305 and to, thereby, limit the backward motion of cocking slide 225 to the above full extension position—i.e., the engagement position between notch 330 and plate 315.

[0076] Correspondingly, with barrel 205 and cocking slide 225 moved back to the configuration shown in FIG. 2A, an opening is created at a bottom portion of launcher 100 above opening 130 in handle 103 for the loading of cartridge 105 and darts 400. As shown in FIG. 2A, a fully loaded cartridge 105 is inserted into handle 103 and the uppermost dart 400-1 is pushed upward and maintained in a priming position in front of barrel 205 in the internal chamber of launcher 100—by spring 115 and block 120 exerting an upward force on dart 400-6 and the other darts 400 in cartridge 105. Again, while FIG. 2A illustrates a cartridge 105 with a capacity for six (6) foam darts, cartridge 105—and, optionally, handle 103—may have a different length and capacity for any number of darts 400-n up to a reasonable length so as not to render launcher 100 overly cumbersome.

[0077] As described above and as illustrated in FIG. 2A, spring-loaded flaps 130a (not shown) and 130b apply approximately equal inward force and approximately equal downward force so that dart 400-1 is held in place in an aligned priming position in front of barrel 205.

[0078] FIG. 2B is a schematic partial cross-sectional side view corresponding to FIG. 2A for illustrating slant angles of the launcher handle in accordance with an exemplary embodiment of the present invention. FIG. 2B illustrates launcher 1000 having a slightly longer handle 1030 than handle 100 of launcher 100 shown in FIG. 2A. Launcher 1000 is otherwise the same as launcher 100 and duplicative description of its elements are omitted. As illustrated in FIG. 2B, handle 1030 of

launcher 1000 includes a front grip surface 1031 and a rear grip surface 1032. As further illustrated in FIG. 2B, a main portion of front grip surface 1031 is at a 72 degree angle from horizontal—in other words, the main portion is at an 18 degree angle from vertical. Correspondingly, a main portion of the rear grip surface 1032 is at 66 degrees from horizontal, or 24 degrees from vertical. In other words, handle 1030 narrows slightly upward towards trigger 320 and widens slightly downward towards the butt of handle 1030. The aforementioned surface angles may be adjusted for user grip comfort without departing from the spirit and scope of the present disclosure.

[0079] FIG. 2C is a schematic cross-sectional side view corresponding to FIG. 1C for illustrating a slant angle of the cartridge in accordance with an exemplary embodiment of the present disclosure. In correspondence with FIG. 2B, FIG. 2C illustrates cartridge 1050 that is slightly longer than cartridge 105 shown in FIG. 1C for insertion into handle 1030 of launcher 1000. Cartridge 1050 otherwise the same as launcher 105 and duplicative description of its elements are omitted. As illustrated in FIG. 2C, a front surface 1051 of cartridge 1050 is at a 72 degree angle from horizontal—in other words, it is at an 18 degree angle from vertical. As illustrated in FIG. 2C, a rear surface 1052 of cartridge 1050 is parallel with front surface 1051—i.e., also 72 degrees from horizontal (18 degrees from vertical). Accordingly, handle 1030 of launcher 1000 includes an opening that corresponds to opening 130 shown in FIG. 1A with side walls that accommodate the angled surfaces of cartridge 1050 for guided sliding in and out.

[0080] Referring now to FIG. 3A, with the notch/recess 330 of catch portion 305 engaged with plate 315, the user can push cocking slide 225 forward in a second priming step—again, in a similar fashion to a cartridge-loaded pistol—see forward arrow adjacent cocking slide 225 in FIG. 3A. According to an exemplary embodiment, barrel 205 is compelled to slide forward towards the front of launcher 100 while catch portion 305 and plunger element 210 are held in place by plate 315. As shown in FIG. 3A, extension spring 220 remains fully extended by the return of cocking slide 225 to its original forward position. Accordingly, plunger element 210 forms an air chamber 405 within barrel 205 whereby air is drawn in through a front nozzle 410 (see FIG. 2A) of barrel 205. In accordance with an exemplary embodiment of the present invention, nozzle 410 may be of a substantially smaller diameter than that of the air chamber 405 so that a forward push by plunger 210 would expel the air through nozzle 410 at a higher pressure.

[0081] As further shown in FIG. 3A, as the cocking slide 225 is moved forward in the direction shown by the forward arrow, the topmost dart 400-1 that is primed into the position in front of

barrel 205 is pushed forward into launch barrel 415 in a firing position. According to an exemplary embodiment of the present invention, launch barrel 415 has an internal diameter that provides minimal clearance for darts 400 to allow for substantially airtight propulsion from launch barrel 415 upon release of the pressurized air in air chamber 405 from barrel 205 through front nozzle 410.

[0082] As illustrated in FIGS. 1A-3A, launch barrel 415 includes a rear portion that is of a slightly larger internal diameter for fittingly receiving front nozzle 410 of barrel 205, thereby, again, providing for a substantially airtight connection from air chamber 405 to the rear surface of dart 400-1 in the launch position within launch barrel 415. According to an exemplary embodiment of the present disclosure, nozzle 410 incorporates an O-ring 412 (made from a resilient material, such as a polymer)(see FIG. 2A) around its outer circumference to form a seal around the internal circumference of the rear portion of launch barrel 415 to further improve the airtight connection.

[0083] As shown in FIG. 3A, the two side flaps 130a (not shown) and 130b engage air piston barrel 205 on respective sides thereof. In operation, when barrel 205 is pushed forward, the sides of barrel 205 engage the slanted trailing edge 145b (see FIG. 1C) of flap 130b and a corresponding slanted trailing edge of flap 130a (not shown) to push flaps 130a (not shown) and 130b outward against their respective torsion springs 140a and 140b (see FIGS. 1B and 1C).

[0084] FIG. 3B is a schematic partial cross-sectional side view corresponding to FIG. 3A but showing launcher 1000 having a slightly longer handle 1030 according to the embodiment illustrated in FIG. 2B. Launcher 1000 is otherwise the same as launcher 100 and duplicative description of its elements are omitted. FIG. 3C is a cross-sectional front view across the A-A line in FIG. 3B to show the oval cross section of barrel 205 according to an exemplary embodiment of the present disclosure. As illustrated in FIG. 3C, when barrel 205 is in the forward firing position, spring-loaded side flaps 130a and 130b need not be unduly flexed outward to accommodate barrel 205, especially if compared with an air cylinder having a circular cross section that would achieve a similar internal volume. According to an exemplary embodiment of the present disclosure, plunger element 210 is also substantially oval in shape with a resilient O-ring 212 to form an airtight seal with the substantially oval-shaped barrel 205. FIG. 3C also shows cushioning resilient O-ring 214, which is described above with reference to FIG. 1A, having a circular shape to further illustrate the comparative volume advantage of the oval cross section of barrel 205 with consideration for reducing the needed flexion ranges of flaps 130a and 130b. In embodiments, barrel 205 may incorporate a 7:5 height-to-width ratio (35 mm : 25 mm), although the ratio is not limited to this.

[0085] Next, a trigger pull and launch action will be described. FIG. 4 is a schematic partial cross-sectional side view of launcher 100 illustrating a trigger pull and the launch of the topmost dart 400-1 according to an exemplary embodiment of the present invention. As shown in FIG. 4, trigger assembly 320 includes an inclined surface 420—which serves as a top camming surface of trigger assembly 320—so that, when trigger assembly 320 is pulled backward by the user, locking plate 315 is caused to move upward along inclined camming surface 420. Trigger assembly 320 may be biased forward in a default position by an extension spring 425, such that plate 315 lowers back down along the inclined surface 420 when trigger 320 is in the forward, default, non-firing position. More specifically, a user can pull trigger assembly 320 backward and, as trigger assembly 320 is slid backwards, inclined surface 420 is pulled backwards and, accordingly, slides plate 315 upward. Consequently, as plate 315 is pushed upward by the top camming surface (inclined surface 420) of trigger assembly 320, the engagement between plate 315 and notch/recess 330 of catch portion 305 is released as aperture 310 is moved upward to a position that clears notch/recess 330. Thus, as illustrated in FIG. 4, spring 220 is released from its fully extended state thereby pulling rod portion 306 and plunger element 210 forcefully forward (see forward arrow adjacent extension spring 220 in FIG. 4) to thereby expel the collected air from air chamber 405 inside barrel 205 through nozzle 410 to launch dart 400-1 through launch barrel 415. Thereafter, trigger assembly 320 is returned to the forward default position and plate 315 is returned to its lowered position by spring 425. According to an exemplary embodiment of the present disclosure, cocking slide 225 may be pulled backward again to the position shown in FIG. 2A either to prime a next dart 400 from the cartridge 105 into the firing position shown in FIG. 3A or to remove and replace cartridge 105 with a newly-loaded cartridge.

[0086] According to an exemplary embodiment of the present disclosure, flaps 130a and 130b of cartridge 105 are incorporated in place of conventional rigid frames in conventional foam dart cartridges to provide for aligning darts 400 when being pushed up into a priming position (in front of barrel 205 and nozzle 410 as shown in FIG. 2A) by spring 115 and block 120 from the storage area of 105.

[0087] Additionally, the resiliency of flaps 130a and 130b provided by torsion springs 140a and 140b allows barrel 205 to have a larger width than darts 400, by having flaps 130a and 130b flex outward to accommodate the sides of barrel 205 when barrel 205 is in the forward position shown in FIGS. 1 and 3A-4. In contrast, conventional magazine clips have two curved rigid arms to

contact and align a topmost dart 400 (e.g., 400-1 shown in FIG. 2) into a priming position. If such rigid arms are used, barrel 205 would be obstructed and a push rod mechanism would be required, with the push rod being equal at least in length to the dart 400. Such a launcher would, therefore, need to be longer than launcher 100 by at least 37.5 mm—thus, rendering it cumbersome and unacceptable for the quick draw uses of launcher 100. Alternatively, portions of conventional rigid arms of known cartridges may be shortened—and thereby widened with, optionally, a sloped top edge from front to back—to provide for a barrel 205 that is slightly wider than the clearance of such rigid arms. However, such rigid arms would be expected to flex outward each time barrel 205 moves forward between them and long-term plastic fatigue may result and affect the ability of the rigid arms to hold and align a dart 400 for priming, as described above with reference to FIG. 3A.

[0088] Thus, according to the present disclosure with flaps 130a and 130b, barrel 205 may embody a larger internal volume for air chamber 405—thus increasing the launch force of launcher 100 on darts 400. As shown in FIGS. 1-4, barrel 205 has an increased height when compared, for example, to launch barrel 415. For maintaining similar flexing ranges of spring-loaded flaps 130a and 130b while increasing the internal volume for air chamber 405, barrel 205 incorporates an elongated cross section in its height dimension—such as an oval shape. In embodiments, barrel 205 may incorporate a 7:5 height-to-width ratio (35 mm : 25 mm), although the ratio is not limited to this.

[0089] Advantageously, as shown in FIG. 1, launcher 100 is capable of launching a short foam dart 400 with high velocity and accuracy while having a relative compact profile of a traditional pistol at approximately 236.72 mm in length and 159.36 mm in height.

[0090] FIGS. 5A and 5B are schematic partial cross-sectional views of key elements of a toy projectile launcher 100 with an empty storage handle 105 according to another exemplary embodiment of the present invention. For clarity and simplicity in illustrating the key elements and mechanisms of toy projectile launcher 100 and storage handle 105, portions that are not necessary to understand the scope and the spirit of the present invention are not shown. One of ordinary skill in the art would readily understand the supporting elements needed to house and support the various illustrated elements including the spring-fed storage area in the handle 105 with various design choices that would not depart from the spirit and scope of the present invention.

[0091] FIG. 5A is a schematic side cross-sectional view of an empty storage handle 105 of a projectile launcher 100 in un-cocked position according to an exemplary embodiment of the present invention. As shown in FIG. 5A, projectile launcher 100 is shaped to resemble a pistol and handle

105 is shaped to resemble a pistol grip. In embodiments, launcher 100 may be in various other shapes and arrangements without departing from the spirit and the scope of the invention, as detailed below. As illustrated in FIG. 5A, a reciprocating air piston assembly 255 comprised of a barrel 205 and a plunger assembly 305 is located above and behind the handle 105 of the projectile launcher 100. As shown, a loading compression spring 115 of the empty storage handle 105 is in an expanded state where a pusher block 120 is pushed upward against the internal barrel 205, which, in the forward un-cocked position shown in FIG. 5A, covers a top opening of the empty storage handle 105. As described in further detail below, projectiles—such as foam darts/bullets, balls, and the like—would be advanced by spring 115 via block 120 such that a topmost projectile would be delivered to a loading position in launcher housing 110.

[0092] FIG. 5B is a schematic front cross-sectional view of launcher 100 along the 5B-5B line in FIG. 5A. As illustrated in FIG. 5B, block 120 abuts air piston barrel 205 at the top opening of the internal storage area of handle 105 when the internal storage area in handle 105 is empty. Additionally, the internal storage area of handle 105 includes a set of resilient side flaps 130a and 130b--which may be spring-loaded as described in further detail below--that, as described in further detail below, push inward against a projectile for alignment into a launch position. In the uncocked state shown in FIGS. 5A and 5B, the two side flaps 130a and 130b engage air piston barrel 205 on respective sides thereof.

[0093] FIG. 5C is an inset closeup side view illustrating details of an assembly 125a at the top portion of the internal storage area of handle 105. As shown in FIG. 5C, assembly 125a includes spring-loaded flap 130a on a front portion (towards launch barrel 415 of launcher 100, see FIG. 3A) and a rigid frame 135a on a rear (or back) portion (towards the rear of launcher 100). As described in further detail below, rigid frame 135a (along with rigid frame 135b on the other side of launcher 100) have a generally rounded shape for fitting around the outer surface of barrel 205 of air piston assembly 255 to serve as a movement guide for barrel 205 in the priming (cocking) process of launcher 100. FIG. 5C further illustrates a torsion spring 140a that exerts an inward force on flap 130a (and a similar spring exerts a corresponding force on flap 130b, not shown) so that the flap would be moved inward towards a loaded projectile, as will be described in further detail below. According to an exemplary embodiment of the present invention, flap 130a includes a slanted trailing edge 145a along which it may be pushed outward by barrel 205 when it is moved forward towards the position shown in FIG. 5A from a rearward priming (cocked) position, as described below

and illustrated in FIG. 6A. Additionally, the slanted trailing edge 145a of flap 130a, along with a corresponding trailing edge of flap 130b (not shown), provide for loading projectiles into handle 105 by sliding said projectiles along the trailing edges to push flaps 130a and 130b outward, and to allow the projectiles to be inserted into the storage area of handle 105 (as described in further detail below and illustrated in FIG. 6C). In embodiments, flap 130a (and flap 130b) may be tapered outward towards the rear of launcher 100 for receiving, and for being pushed outward by, barrel 205 as barrel 205 is moved forward towards the position shown in FIG. 5A from a rearward priming position described below and illustrated in FIG. 6A.

[0094] FIG. 6A is a schematic side cross-sectional view of the fully loaded storage area in the handle 105 attached to projectile launcher 100 in a rearward priming and loading (cocked) position according to an exemplary embodiment of the present invention. As shown in FIG. 6A, toy launcher 100 includes barrel 205 with a plunger element 210 that form an air piston assembly 255. According to an exemplary embodiment, the barrel 205 of air piston assembly 255 has a generally rounded cylindrical or, as described in further detail below, oval shape and plunger element 210 is biased against a back wall 215 of the rear part of launcher housing 110 by a compression spring 220. The plunger element 210 incorporates a size and a shape that correspond with an internal circumference of barrel 205 so as to form an airtight seal with an internal surface of barrel 205. According to an exemplary embodiment of the invention, plunger element 210 incorporates a resilient O-ring 212 (FIG. 5A) to form an improved seal.

[0095] As illustrated in FIG. 6A, barrel 205 is coupled to a sliding top handle or cocking slide 225 via a projection 230 that is fittingly coupled to a recess 235 in cocking slide 225. The engagement between projection 230 on barrel 205 and recess 235 of cocking slide 225 allows a user to pull back barrel 205 and plunger element 210 in a first, pull-back, priming step. As shown in FIG. 6A, spring 220 is compressed between plunger element 210 and back wall 215. Advantageously, plunger element 210 starts at a position near a front portion of barrel 205, as shown in FIG. 5A, and, therefore, compression spring 220 may be fully compressed in the position illustrated in FIG. 6A. By providing such a longer compression distance to spring 220 (as opposed to compressing and decompressing spring 220 only in the rear portion of main housing 110 behind dart 400-1 shown in FIG. 6A), a lower rated and longer spring may be used without requiring additional length or space within housing 110 to provide, when released, sufficient forward force to launch darts 400 at a high velocity.

[0096] As will be described in further detail below with reference to FIGS. 7A and 7C, back wall 215 includes an aperture that allows a dome-shaped rod portion 305 to extend through and past another aperture 310 that is incorporated in a spring-loaded plate 315 that is, in turn, coupled to a trigger assembly 320 (see FIG. 5A). When a user pulls cocking slide 225 backward in a fashion similar to a cartridge-loaded pistol (see rearward arrow adjacent cocking slide 225 in FIG. 6A), a front back-facing surface of recess 235 pushes on a front-facing surface of projection 230 so that rod portion 305 is pushed back as well. As illustrated in FIG. 5A, plate 315 is coupled to a compression spring 325 that biases plate 315 downward towards a trigger assembly 320. According to an exemplary embodiment of the invention, the leading edge of dome-shaped rod portion 305 is rounded and when it is pushed backward, the rounded leading sloped edge pushes upward on a top edge of aperture 310 in plate 315, compressing spring 325, so that rod portion 305 can be pushed through aperture 310 from the front of plate 315 to clear an opposing back side of plate 315, as illustrated in FIGS. 5A, 6A, and 7A. Once rod portion 305 is pushed sufficiently past plate 315 through aperture 310, spring 325 moves plate 315 downward into engagement with a notch or recess 330 opposite the rounded face of rod portion 305 (see FIG. 5A) so that rod portion 305—and, correspondingly, plunger element 210—is engaged with, and temporarily retained in place by plate 315. As shown in FIG. 6A, the notch 330 hooks to the opposing back side of plate 315 above aperture 310 once plate 315 is pushed downwardly by compression spring 325 into notch 330 and, accordingly, a top edge of aperture 310 is pushed into a bottom surface of notch 330 (see FIGS. 5A and 6A)—thus, plate 315, compression spring 325, and notch 330 together form a latching assembly for holding rod portion 305 in the backward position.

[0097] As further shown in FIG. 6A and described above, with plunger element 210 being pulled back by rod portion 305, spring 220 is compressed against the back wall 215 of main launcher housing 110 in the position at which plate 315 and notch 330 are hooked and engaged with each other. In alternative embodiments, a structural stop (not shown) may be used to limit the backward motion of cocking slide 225 to the above full extension position—i.e., the engagement position between notch 330 and plate 315.

[0098] Correspondingly, with barrel 205 and cocking slide 225 moved back to the configuration shown in FIG. 6A, an opening 335 is created at a top portion of main housing 110, which opening 335 provides for loading of darts 400. As shown in FIG. 6A, a fully loaded launcher 100—for

example, with six (6) darts 400-1…400-6—a top toy dart 400-1 in storage handle 105 is pushed upward and maintained in a priming position in front of barrel 205 in the internal chamber of launcher housing 110—by spring 115 and block 120 exerting an upward force on dart 400-6 and the other darts in storage handle 105. FIG. 6A illustrates a storage handle 105 with a capacity for six (6) foam darts but in embodiments, storage handles may have a different length and capacity for any number of darts 400-n up to a reasonable length so as not to render launcher 100 overly cumbersome.

[0099] FIG. 6B is a schematic front cross-sectional view of launcher 100 along the 6B-6B line in FIG. 6A. As illustrated in FIG. 6B, when the topmost foam dart 400-1 is in the internal chamber of launcher housing 110, the spring-loaded flaps 130a and 130b apply approximately equal inward force and approximately equal downward force so that dart 400-1 is held in place in an aligned priming position in front of barrel 205.

[0100] FIG. 6C is a partial front cross section view of a top portion of the internal storage area (or cartridge) of handle 105 to illustrate loading of the projectiles—e.g., foam bullets/darts 400. As illustrated in FIG. 6C, flaps 130a and 130b may be moved outwardly to give way to darts 400 being loaded into the storage area of handle 105—for example, by pushing darts 400 against the trailing edges (145a shown in FIG. 5C) of flaps 130a and 130b. Again, once the darts 400 are loaded into the storage area of handle 105, flaps 130a and 130b apply inward and downward force on topmost dart 400-1 to hold the loaded darts 400 in place.

[0101] Referring now to FIG. 7A, with the notch/recess 330 of rod portion 305 engaged with plate 315 via the downward bias of spring 325, the user can push cocking slide 225 forward in a second priming step—again, in a similar fashion to a cartridge-loaded pistol—see forward arrow adjacent cocking slide 225 in FIG. 7A. Consequently, according to an exemplary embodiment of the present invention, a back wall of recess 235 engages the back wall of projection 230 during the forward motion of cocking slide 225. Thus, barrel 205 is compelled to slide forward towards the front of launcher 100 while rod portion 305 and plunger element 210 are held in place by plate 315. As shown in FIG. 7A, compression spring 220 remains fully compressed by the return of cocking slide 225 to its original forward position. Accordingly, plunger element 210 forms an air chamber 405 within barrel 205 whereby air is drawn in through a front nozzle 410 of barrel 205. In accordance with an exemplary embodiment of the present invention, nozzle 410 may be of a substantially smaller diameter than that of the air chamber 405 so that a forward push by plunger 210 would expel the air through nozzle 410 at a higher pressure. FIG. 7B is a schematic front cross-sectional view of

launcher 100 along the 7B-7B line in FIG. 7A illustrating a cross section of air chamber 405 formed by air piston assembly 255.

[0102] As further shown in FIG. 7A, as the cocking slide 225 is moved forward in the direction shown by the forward arrow, the topmost dart 400-1 that is primed into the position in front of barrel 205 is pushed forward into launch barrel 415 in a firing position. According to an exemplary embodiment of the present invention, launch barrel 415 has an internal diameter that provides minimal clearance for darts 400 to allow for substantially airtight propulsion from launch barrel 415 upon release of the pressurized air from air cylinder assembly 255.

[0103] As illustrated in FIGS. 5A-7A, launch barrel 415 includes a rear portion that is of a slightly larger internal diameter for fittingly receiving front nozzle 410 of barrel 205, thereby, again, providing for a substantially airtight connection from air chamber 405 to the rear surface of dart 400-1 in the launch position within launch barrel 415. According to an exemplary embodiment of the present invention, nozzle 410 incorporates an O-ring 412 made from a resilient material, such as a polymer, around its outer circumference to form a seal around the internal circumference of the rear portion of launch barrel 415 to further improve the airtight connection.

[0104] Next, a trigger pull and launch action will be described. FIG. 7C is a closeup view of the interface between the rear portion of trigger assembly 320 and locking plate 315. As illustrated in FIG. 7C, trigger assembly 320 includes an inclined surface 420 and an upper surface 425—which collectively form a top camming surface of trigger assembly 320 so that, when trigger assembly 320 is pulled backward by the user, locking plate 315 is caused to move upward from inclined surface 420 to the upper surface 425 against spring 325. In embodiments, trigger assembly 320 may be biased forward in a default position by a spring (not shown), or the like, such that plate 315 returns to contacting the inclined surface 420 when trigger 320 is in the forward, default, non-firing position.

[0105] FIG. 7C, again, illustrates the configuration of the trigger pull according to an exemplary embodiment of the present invention. As shown in FIG. 7C, a user can pull trigger assembly 320 backward and, as trigger assembly 320 is slid backwards (see the extension element 320b of trigger assembly 320 that fits around storage (or cartridge) handle 105—to the rear portion with surfaces 420 and 425, i.e., the top camming surface—in the partial cross-sectional side view of FIG. 7A), inclined surface 420 is pushed backwards and, accordingly, slides plate 315 upward towards upper surface 425. Consequently, as plate 315 is pushed upward by the top camming surface (surfaces 420 and 425) of trigger assembly 320 (see upward arrow adjacent plate 315 in FIG. 7C), the

engagement between plate 315 and notch/recess 330 of rod portion 305 is released as aperture 310 is moved upward to a position that clears notch/recess 330. Thus, as illustrated in FIG. 8, spring 220 is released from its fully compressed state thereby driving plunger element 210 and rod portion 305 forcefully forward (see forward arrow adjacent compression spring 220 in FIG. 8) to thereby expel the collected air from air chamber 405 through nozzle 410 to launch dart 400-1 through launch barrel 415. Correspondingly, trigger assembly 320 is returned to the forward default position and plate 315 is returned to its lowered position by compression spring 325. According to an exemplary embodiment of the present invention, cocking slide 225 may be pulled backward again to the position shown in FIG. 6A either to prime a next dart 400 from the storage handle 105 into the firing position shown in FIG. 7A or to load additional darts 400 into the storage handle 105 through opening 335 shown in FIG. 6A.

[0106] FIG. 9 is a drawing illustrating a comparison between a standard foam dart 500 that is 71.5 mm long and a foam dart 400 that is 37.5 mm long for use with the storage (or cartridge) handle 105 in accordance with an exemplary embodiment of the present invention. The shorter dart 400 contributes to the portability of launcher 100 and reduces the friction at the minimal clearance with launch barrel 415 described above, thereby also providing for higher velocity and accuracy using the air pressure launching mechanism described above. In embodiments, storage handle 105 may be incorporated in a rifle-style launcher for either short darts (400) or standard darts (500). It should be appreciated that the shorter dart 400 is not limited to the dimensions mentioned herein, and other dimensions are within the spirit and scope of the present invention. In exemplary embodiments, the dart 400 may have a length within the range of, for example, 30 mm to 50 mm, or 40 mm to 60 mm, or 50 mm to 70 mm.

[0107] FIG. 10 is a schematic sectional side view of key elements of toy projectile launcher 100 with an empty storage area in the handle 105 in correspondence with the side view of FIG. 5A but from an opposite side and according to another exemplary embodiment of the present invention. As shown in FIG. 10, the internal storage area of handle 105 of toy projectile launcher may include two pairs of spring-loaded side flaps 130b (along with 130a on the other side of launcher 100, as shown in FIG. 5A) and 133b (along with 133a on the other side, not shown). In this embodiment, spring-loaded side flaps 133b (and 133a) are disposed at the top portion of the storage area of handle 105 in place of rigid frame 135a (and 135b) illustrated in FIG. 5C. Similar to side flaps 130a and 130b, in the uncocked state shown in FIG. 10, the two side flaps 133a and 133b engage barrel 205

on respective sides thereof. Correspondingly, side flap 133b (and 133a) also incorporates a torsion spring 143b (and 143a) that exerts an inward force on flap 133b so that the flap would be moved inward towards a loaded projectile. Flap 133b (and 133a) also includes a slanted trailing edge (similar to 145a shown in FIG. 5C) along which it may be pushed outward by barrel 205 when it is moved forward towards the position shown in FIG. 10 from a rearward priming (cocked) position, as described above and illustrated in FIG. 6A. Additionally, this slanted trailing edge of flap 133b, along with a corresponding trailing edge of flap 133a (not shown), provide for loading projectiles into handle 105 by sliding said projectiles along the trailing edges to push flaps 133a and 133b outward, and to allow the projectiles to be inserted into the storage area of handle 105 in correspondence with flaps 130a and 130b described above.

[0108] According to an exemplary embodiment of the present invention, flaps 133b (and 133a) are incorporated in place of rigid frame 135b (and 135a) to address angling and/or misalignment of darts 400 that may occur when being pushed up into a priming position (in front of barrel 205 and nozzle 410 as shown in FIG. 6A) by spring 115 and block 120 from the storage area of handle 105. For example, with rigid frames 135a and 135b, the tail end of a dart 400 (e.g., 400-2) may sometimes rise above the front end of the dart 400 (e.g., 400-2) on a horizontal plane when it is pushed up into the priming position because rigid frames 135a and 135b would not contact such a dart 400 to keep it in place, as illustrated in FIG. 6C. Consequently, the forward motion of the barrel 205 and nozzle 410 may cause the dart 400 to jam—and not advance properly to the firing position in launch barrel 415 shown in FIG. 7A. It was also found that fusing flaps 130a and 130b with frames 135a and 135b together to form elongated flaps—similar to flaps 130a and 130b but extended to the positions corresponding to the rear ends of frames 135a and 135b—would leave space for the front end of a dart 400 to rise above the horizontal plane, and launcher 100 would, likewise, jam. Therefore, converting rigid frames 135a and 135b into hinged spring-loaded flaps 133a and 133b on the rear (or back) portion (towards the rear of launcher 100) at a top opening of the storage area improved reliability of toy launcher 100. Additionally, conventional magazine clips have two curved fixed arms similar to rigid frames 135a and 135b. For such rigid arms to contact and align a topmost dart 400 (e.g., 400-1 shown in FIG. 6A) in the priming position, barrel 205 would be obstructed and a push rod mechanism would be required, with the push rod being equal at least in length to the dart 400. Such a launcher would, therefore, need to be longer than launcher 100 by at

least 37.5 mm—thus, rendering it cumbersome and unacceptable for the quick draw uses of launcher 100.

[0109] Thus, according to an exemplary embodiment of the present invention, the spring-loaded flaps 133a and 133b (in cooperation with flaps 130a and 130b described above with reference to FIGS. 6A and 6B) apply approximately equal inward force and approximately equal downward force so that a topmost dart or projectile 400-1 is held in place in an aligned priming position in front of barrel 205. Correspondingly, flaps 133a and 133b may be moved outwardly to give way to darts 400 being loaded into the storage area of handle 105—for example, by pushing darts 400 against the trailing edges of flaps 133a and 133b—in a similar manner with respect to flaps 130a and 130b described above with reference to FIG. 6C. Again, once the darts 400 are loaded into the storage area of handle 105, flaps 133a and 133b apply inward and downward forces on topmost dart 400-1 to hold the loaded darts 400 in place.

[0110] In accordance with an exemplary embodiment of the present invention and as will be described in further detail below, barrel 205 may embody a larger internal volume for air chamber 405—thus increasing the launch force of launcher 100 on dart 400. As shown in FIG. 10, barrel 205 has an increased height when compared, for example, to launch barrel 415. For maintaining similar flexing ranges of spring-loaded flaps 130a, 130b, 133a, and 133b while increasing the internal volume for air chamber 405, internal air cylinder assembly 255 incorporates an elongated cross section in its height dimension—such as an oval shape as illustrated in FIGS. 11A-11C. Accordingly, internal air cylinder assembly 255 may maintain a similar width to, say, that shown in FIGS. 5B and 7B while increasing its height so that spring-loaded flaps 130a, 130b, 133a, and 133b need not flex to an unduly larger degree than shown in FIGS. 5B and 7B to accommodate the increased internal volume of air cylinder assembly 255.

[0111] As further illustrated in FIG. 10, trigger assembly 320 may merely incorporate an inclined surface 420 at its rear portion to serve as a camming surface (without a discrete upper surface 425 shown in FIG. 7C) so that as inclined surface 420 is pushed backwards, it slides plate 315 upward until the engagement between plate 315 and notch/recess 330 of rod portion 305 is released as aperture 310 is moved upward to a position that clears notch/recess 330. Additionally, spring 325 described above may be embodied by a spring-loaded arm or a leaf spring, as illustrated in FIG. 10, in an exemplary embodiment of the present invention.

[0112] FIG. 11A is a schematic side cross-sectional view of barrel 205' in launcher 100 that corresponds to the illustration in FIG. 10 according to another exemplary embodiment of the present invention. Like elements shown in FIGS. 11A, 11B, and 11C are denoted by the same reference numerals as those in FIGS. 5A to 10, detailed descriptions of which will not be repeated. FIG. 11A shows a cross section of air cylinder assembly 255' in launcher 100 from a side opposite to the side shown in FIG. 10 and, therefore, spring-loaded flaps 130a and 133a, along with torsion springs 140a and 143a, are shown in FIG. 11A in correspondence with spring-loaded flaps 130b and 133b, along with torsion springs 140b and 143b, shown in FIG. 10, respectively. Launcher 100, as shown in FIG. 11A, is in a firing position with a foam dart 400 primed in a firing position, which corresponds to the firing position shown in FIG. 7A of primed foam dart 400-1.

[0113] As illustrated in FIG. 11A, launcher 100 may incorporate an enlarged internal air cylinder assembly 255' that incorporates a substantially larger cross-sectional area than launch barrel 415 and, correspondingly, nozzle 410. As a result, a larger internal volume of air chamber 405 may be formed by air cylinder assembly 255' to provide for more compressed air and larger launch force on primed dart 400 through nozzle 410. In order to accommodate such a larger air cylinder assembly 255' without unduly increasing the bulk of launcher 100, air cylinder assembly 255' and barrel 205 incorporate a substantially oval shape, as illustrated in FIGS. 11B and 11C.

[0114] FIG. 11B is a schematic cross-sectional front view of launcher along the 11B-11B line in FIG. 11A; and FIG. 11C is a closeup front partial cross-sectional view of barrel 205' of the launcher 100 shown in FIGS. 11A and 11B according to an exemplary embodiment of the present invention. As illustrated in FIG. 11C, internal air cylinder assembly 255' may incorporate a 7:5 height-to-width ratio (35 mm : 25 mm). Consequently, as shown in FIG. 11B, when air cylinder assembly 255' is in the forward firing position, spring-loaded side flaps 130a and 130b (and, correspondingly, spring-loaded side flaps 133a and 133b shown in FIGS. 10 and 11A, respectively) need not be unduly flexed outward to accommodate barrel 205', especially if compared with an air cylinder having a circular cross section that would achieve a similar internal volume. According to an exemplary embodiment of the invention, plunger element 210' is also substantially oval in shape with a resilient O-ring 212 to form an airtight seal with the substantially oval-shaped barrel 205'. As shown in FIGS. 11A and 11B, plunger element 210' may incorporate a center plug 910 to rein-

force the structural integrity of plunger element 210' during launch. According to an exemplary embodiment, center plug 910 also has a substantially oval shape that corresponds to the shapes of barrel 205' and plunger element 210'.

[0115] Advantageously, as shown in FIGS. 11A and 11B, launcher 100 is capable of launching a short foam dart 400 with high velocity and accuracy while having a relative compact profile of a traditional pistol at approximately 236.73 mm in length and 153.63 mm in height.

[0116] FIG. 12 includes a number of diagrams illustrating the toy projectile launcher 100 being inserted and housed in a corresponding holster 700 according to an exemplary embodiment of the present invention. Specifically, FIG. 12 illustrates a fitted holster 700 that includes a base having two loops 705 and 710 for receiving a belt, strap, harness, or the like (not shown) for fastening holster 700 to a user or the user's garment. As shown in FIG. 12, holster 700 is rotatable around its base along an arced track 715 so as to position launcher 100 at 0 degrees, 15 degrees, and 30 degrees, respectively. According to an exemplary embodiment of the present invention, holster 700 includes a locking mechanism (not shown) for fixing holster 700 to one of the three positions (0 degrees, 15 degrees, and 30 degrees)—or any position therebetween—according to a user's preference for quick draw play. Holster 700 may also be positioned beyond the 0 degrees and 30 degrees positions up to points where launcher 100 would not exit holster due to gravity.

[0117] Although the exemplary embodiment is described in the context of a foam bullet/dart launcher that utilizes shortened foam bullets/darts, it is to be understood that the two-step priming/loading and firing action according to the present disclosure could be applied to a toy projectile launcher of other types of projectiles (e.g. a ball or the like) or a fluid launcher whereby the fluid from a reservoir in the handle is driven by a plunger. In such environment the two-step priming/pumping action of the present disclosure enables a handheld high-velocity fluid burst launcher.

* * * * * * *

[0118] While particular embodiments of the present disclosure have been shown and described in detail, it would be obvious to those skilled in the art that various modifications and improvements thereon may be made without departing from the spirit and scope of the disclosure. It is therefore intended to cover all such modifications and improvements that are within the scope of this disclosure.

WHAT IS CLAIMED IS:

1. A toy projectile launcher, comprising:

a launch barrel;

a handle comprising an internal projectile storage area;

at least one pair of resilient flaps, the at least one pair of resilient flaps being inwardly biased and disposed on respective first and second sides at a top opening of the internal projectile storage area;

an air piston assembly that comprises a barrel and a plunger element;

a sliding handle coupled to the barrel, the sliding handle being movable between a forward position and a backward position, thereby moving the barrel between corresponding forward and backward positions;

a spring that biases the plunger element towards a front portion of the toy projectile launcher; and

a latching assembly that couples the plunger element to a trigger assembly when the sliding handle is moved to the backward position and the barrel is moved to the corresponding backward position, wherein

the barrel covers at least a portion of the top opening when in the corresponding forward position forming an airtight seal between the launch barrel and the barrel and the one or more pairs of resilient flaps contact the respective first and second sides of the barrel, and

the trigger assembly, upon toggling, releases the coupling of the latching assembly between the plunger element and the trigger assembly.

2. The toy projectile launcher of claim 1, wherein the plunger element extends the extension spring away from the front portion when the sliding handle is moved to the backward position.

3. The toy projectile launcher of claim 1, wherein a projectile from the internal projectile storage area is held between the at least one pair of resilient flaps when the barrel is moved to the corresponding backward position.

4. The toy projectile launcher of claim 1, wherein the sliding handle, when moved to the backward position, creates an opening in the toy projectile launcher for loading projectiles into the internal projectile storage area.

5. The toy projectile launcher of claim 1, wherein, when the sliding handle is moved from the backward position to the forward position with the latching assembly coupling the plunger element to the trigger assembly, the barrel is moved to the corresponding forward position and forms an internal air chamber with the plunger element, the internal air chamber being filled with air drawn in from a front nozzle of the barrel.

6. The toy projectile launcher of claim 5, wherein the plunger element is pulled forward by the extension spring to expel the air from the internal air chamber through the front nozzle of the barrel when the coupling of the latching assembly between the plunger element and the trigger assembly is released.

7. The toy projectile launcher of claim 5, further comprising a projectile in the internal air chamber immediately adjacent the front nozzle of the barrel.

8. The toy projectile launcher of claim 1, wherein the barrel has an oval cross-section.

9. The toy projectile launcher of claim 8, wherein the oval shape of the barrel incorporates a 7:5 height-to-width ratio.

10. A toy projectile launcher, comprising:

a launch barrel;

a projectile storage area;

a pair of inwardly-biased resilient flaps disposed on respective first and second sides at a top opening of the projectile storage area;

an oval-shaped air piston assembly that comprises a barrel and a plunger element;

a sliding handle coupled to the barrel, the sliding handle being movable between a forward position and a backward position, thereby moving the barrel between corresponding forward and backward positions;

a spring that biases the plunger element towards a front portion of the toy projectile launcher; and

a latching assembly that couples the plunger element to a trigger assembly when the sliding handle is moved to the backward position and the barrel is moved to the corresponding backward position, wherein

the barrel covers the top opening when in the corresponding forward position forming an air-tight seal between the launch barrel and the barrel and the pair of inwardly-biased resilient flaps contact the respective first and second sides of the barrel, and

the trigger assembly, upon toggling, releases the coupling of the latching assembly between the plunger element and the trigger assembly.

11. A toy projectile launcher, comprising:

a launch barrel;

a handle comprising an internal projectile storage area;

at least one pair of resilient flaps, the at least one pair of resilient flaps being inwardly biased and disposed on respective first and second sides at a top opening of the internal projectile storage area;

an air piston assembly that comprises a barrel and a plunger element;

a sliding handle coupled to the barrel, the sliding handle being movable between a forward position and a backward position, thereby moving the barrel between corresponding forward and backward positions;

a compression spring that biases the plunger element away from a rear wall in the toy projectile launcher; and

a latching assembly that couples the plunger element to a trigger assembly when the sliding handle is moved to the backward position and the barrel is moved to the corresponding backward position, wherein

the barrel covers at least a portion of the top opening when in the corresponding forward position forming an airtight seal between the launch barrel and the barrel and the one or more pairs of resilient flaps contact the respective first and second sides of the barrel, and

the trigger assembly, upon toggling, releases the coupling of the latching assembly between the plunger element and the trigger assembly.

12. The toy projectile launcher of claim 11, wherein the plunger element compresses the compression spring against the rear wall when the sliding handle is moved to the backward position.

13. The toy projectile launcher of claim 11, wherein a projectile from the internal projectile storage area is held between the at least one pair of resilient flaps when the barrel is moved to the corresponding backward position.

14. The toy projectile launcher of claim 11, wherein the sliding handle, when moved to the backward position, creates an opening in the toy projectile launcher for loading projectiles into the internal projectile storage area.

15. The toy projectile launcher of claim 11, wherein, when the sliding handle is moved from the backward position to the forward position with the latching assembly coupling the plunger element to the trigger assembly, the barrel is moved to the corresponding forward position and forms an internal air chamber with the plunger element, the internal air chamber being filled with air drawn in from a front nozzle of the barrel.

16. The toy projectile launcher of claim 15, wherein the plunger element is pushed forward by the compression spring to expel the air from the internal air chamber through the front nozzle of the barrel when the coupling of the latching assembly between the plunger element and the trigger assembly is released.

17. The toy projectile launcher of claim 15, further comprising a projectile in the internal air chamber immediately adjacent the front nozzle of the barrel.

18. The toy projectile launcher of claim 11, wherein the at least one pair of resilient flaps comprises a front pair of resilient flaps and a back pair of resilient flaps disposed at respective front and back portions of the top opening of the internal projectile storage area.

19. The toy projectile launcher of claim 18, wherein the barrel has an oval cross-section.

20. The toy projectile launcher of claim 19, wherein the oval shape of the barrel incorporates a 7:5 height-to-width ratio.

21. A toy projectile launcher, comprising:

a projectile storage area;

a front pair of inwardly-biased resilient flaps disposed on respective first and second sides at a front portion of a top opening of the projectile storage area;

a rear pair of inwardly-biased resilient flaps disposed on the respective first and second sides at a rear portion of the top opening of the projectile storage area;

an oval-shaped air piston assembly that comprises a barrel and a plunger element;

a sliding handle coupled to the barrel, the sliding handle being movable between a forward position and a backward position, thereby moving the barrel between corresponding forward and backward positions;

a compression spring that biases the plunger element away from a rear wall in the toy projectile launcher; and

a latching assembly that couples the plunger element to a trigger assembly when the sliding handle is moved to the backward position and the barrel is moved to the corresponding backward position, wherein

the barrel covers the top opening when in the corresponding forward position and the front and rear pairs of the inwardly-biased resilient flaps contact the respective first and second sides of the barrel, and

the trigger assembly, upon toggling, releases the coupling of the latching assembly between the plunger element and the trigger assembly.

22. A toy projectile launcher, comprising:

a launch barrel;

a body and a handle;

a projectile storage area in the handle in communication with the body; and

an air piston assembly in the body, the air piston assembly comprising a barrel, a plunger element and a nozzle,

the barrel moveable relative to the plunger from an uncocked position to a cocked position wherein the nozzle is immediately adjacent the projectile storage area adjacent the body in the cocked position forming an airtight seal between the barrel and the launch barrel.

23. The toy projectile launcher of claim 22, wherein the air piston assembly has an oval shaped cross-section with a narrower side extending across a width of the body of the launcher.

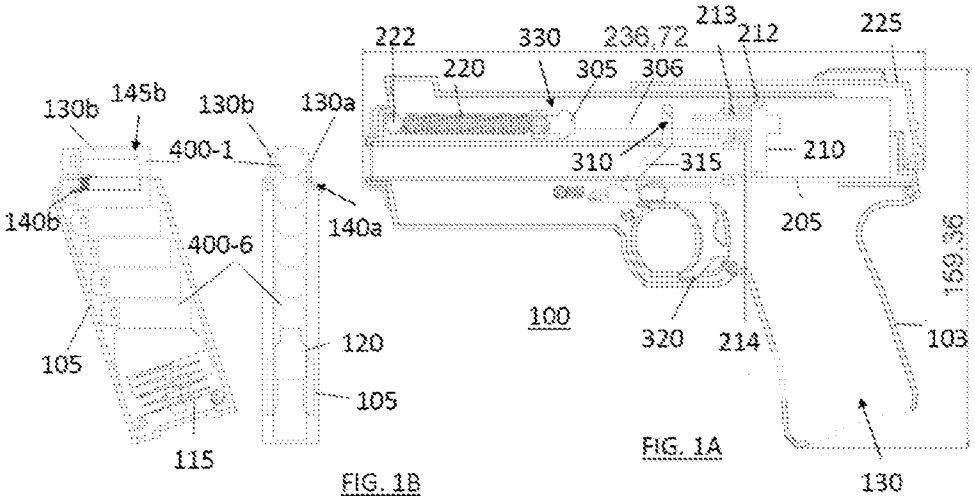


FIG. 1C FIG. 1B FIG. 1A

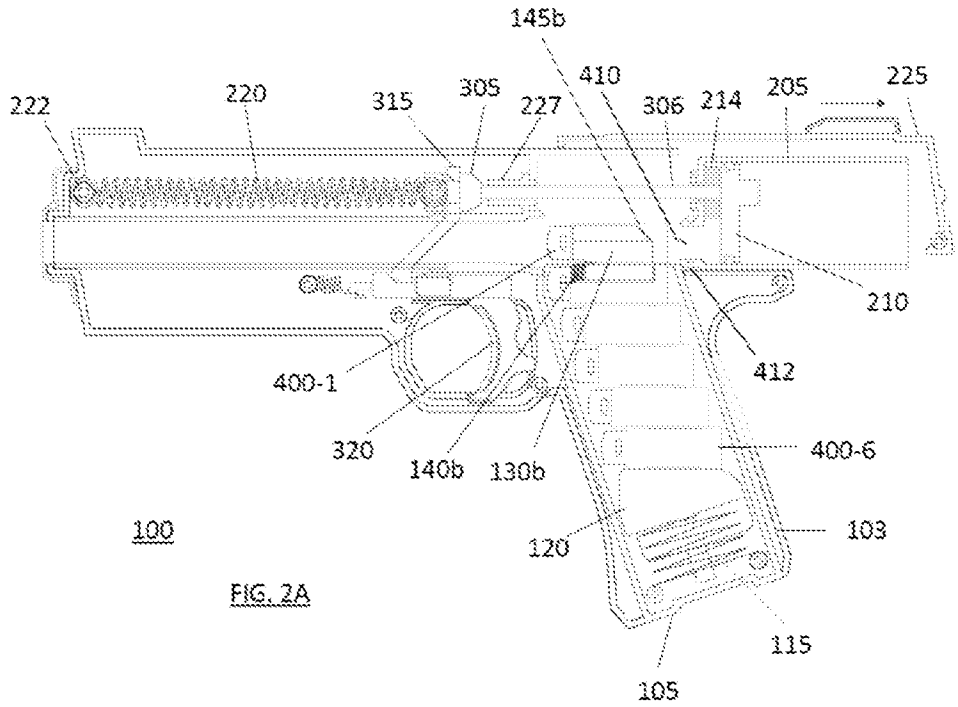

145b
410
222
220
315
305
227
306
214
205
225
210
412
400-1
320
140b
130b
400-6
100
120
103
115
105

FIG. 2A

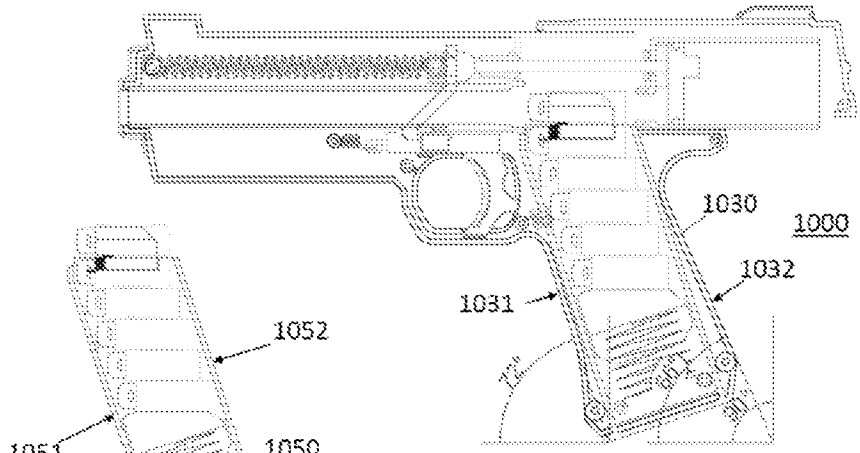


FIG. 2B

FIG. 2C

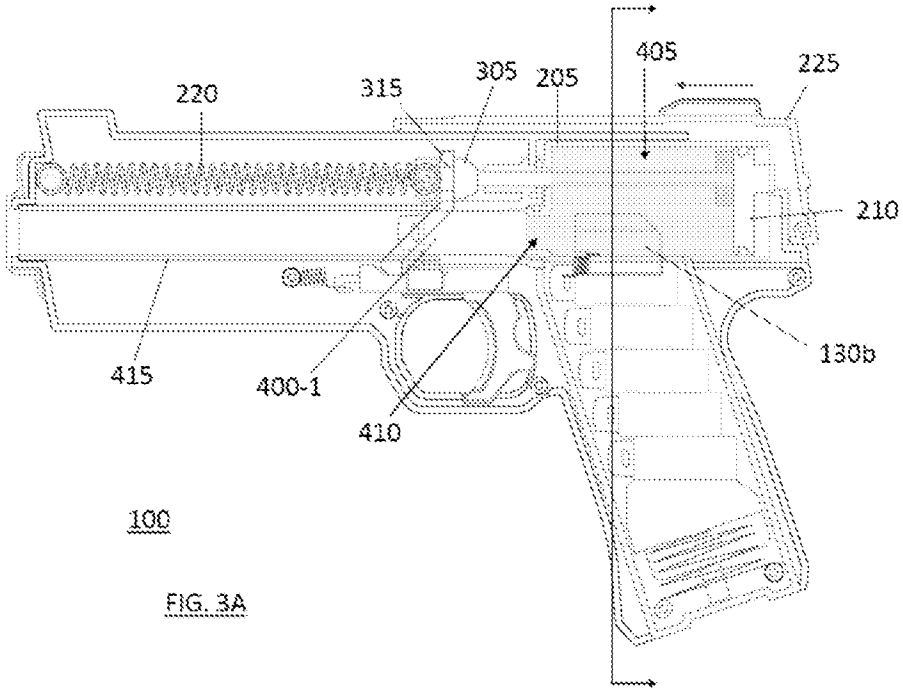


FIG. 3A

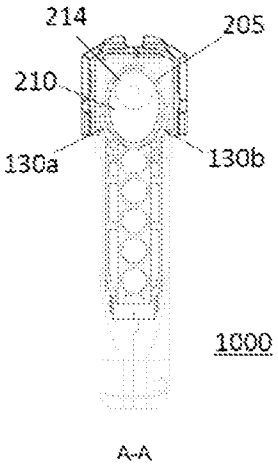


FIG. 3C

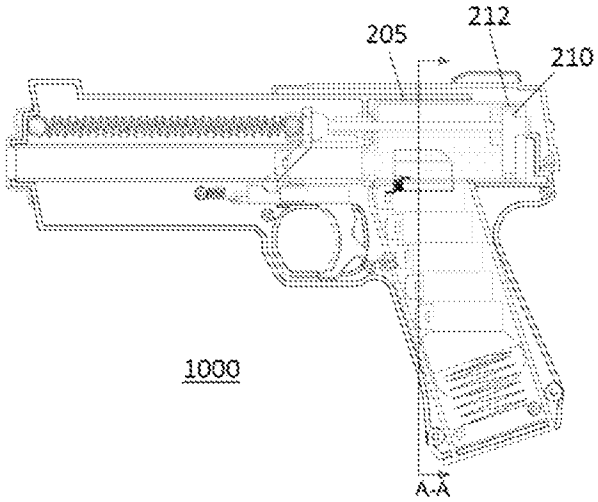


FIG. 3B

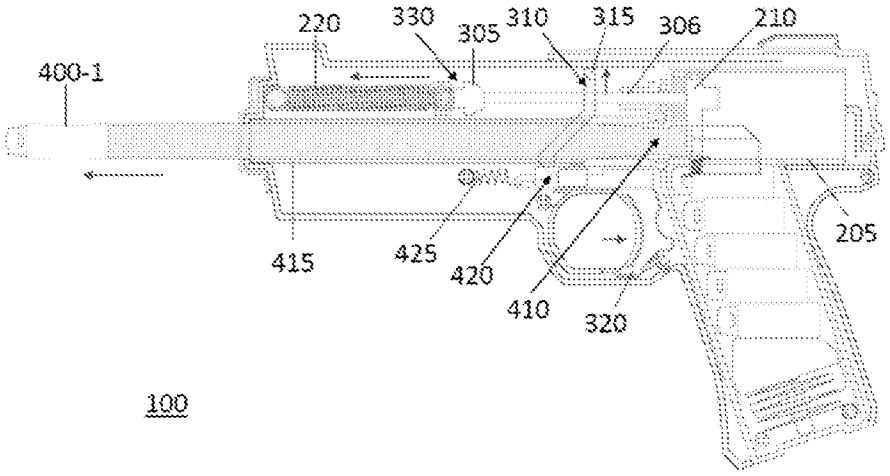


FIG. 4

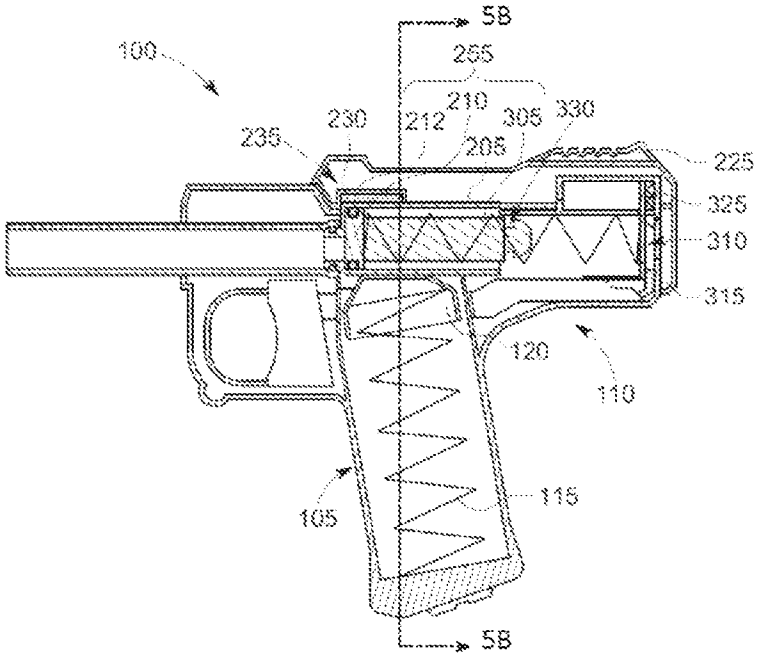

5B
100
255
210
212
230
235
208
305
330
225
325
310
315
120
110
105
115
5B

FIG. 5A

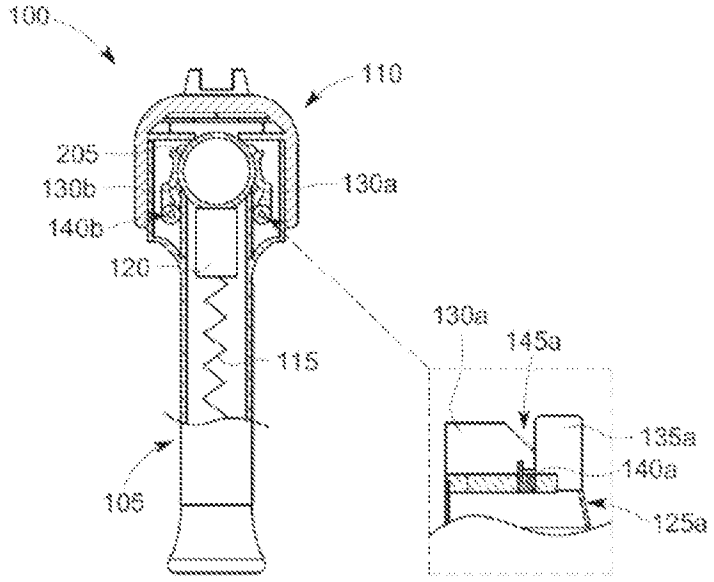

100
110
205
130b
130a
140b
120
115
105
130a
145a
135a
140a
125a

FIG. 5B FIG. 5C

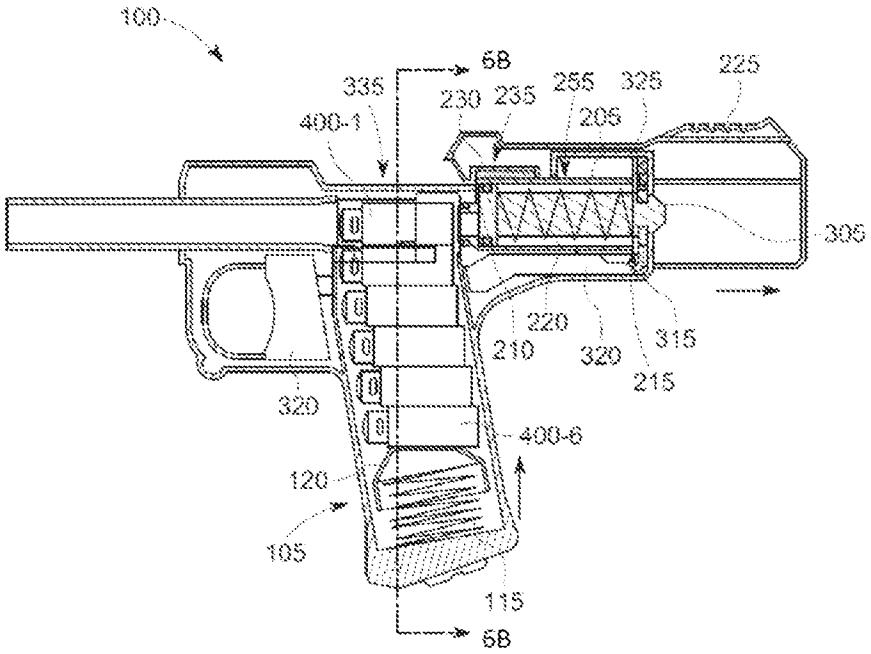

100
6B
335
400-1
230
235
255
205
325
225
305
220
210
320
315
215
320
400-6
120
105
115
6B

FIG. 6A

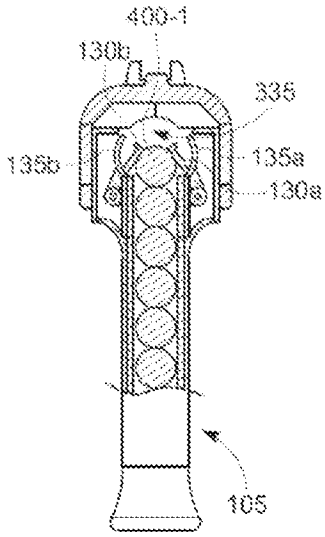


FIG. 6B

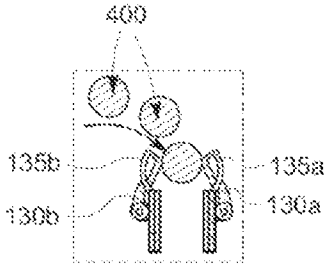


FIG. 6C

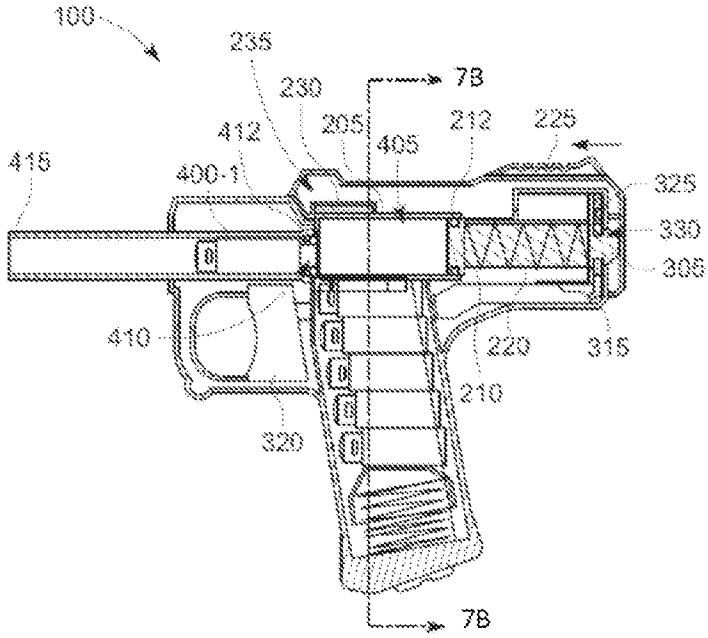

100
235
230
7B
205
212
225
412
405
415
400-1
325
330
305
410
220
315
210
320
7B

FIG. 7A

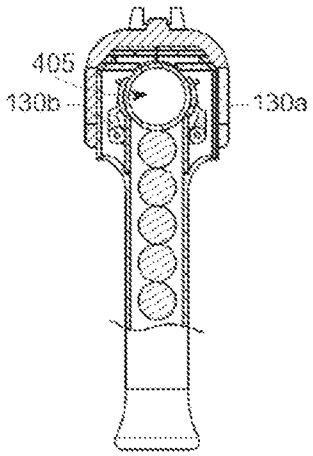


FIG. 7B

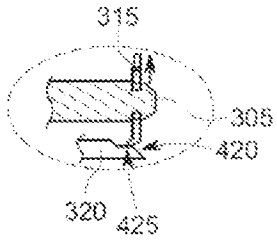


FIG. 7C

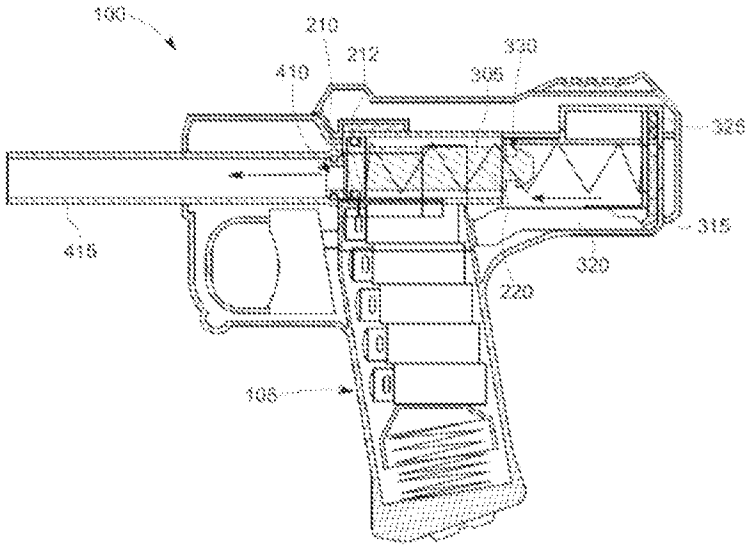


FIG. 8

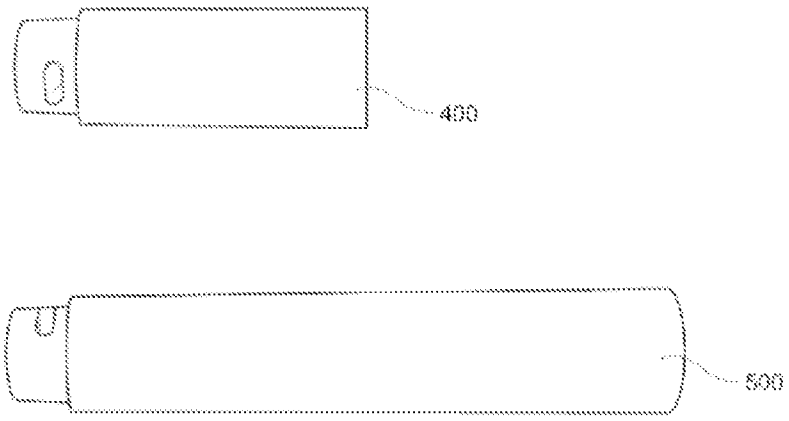


FIG. 9

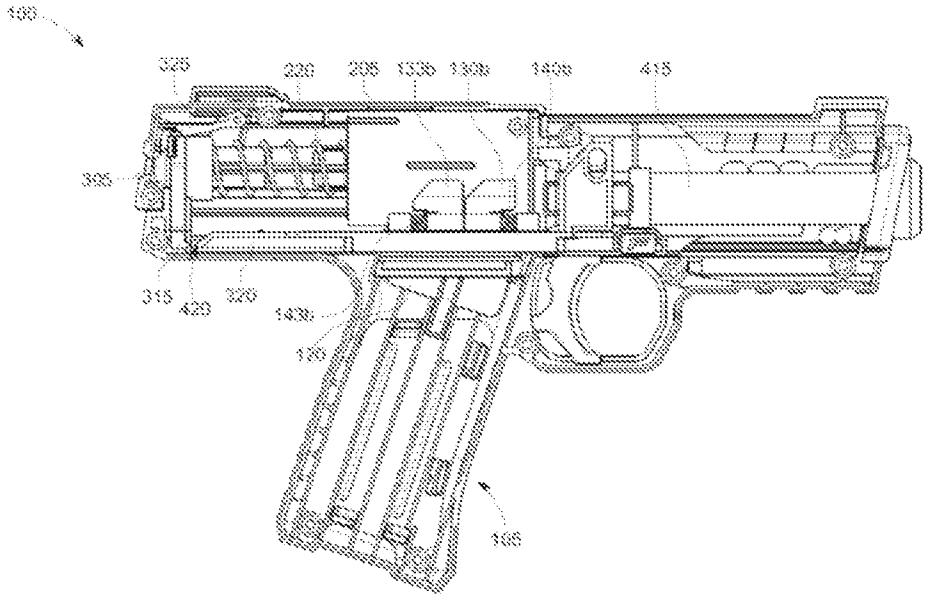


FIG. 10

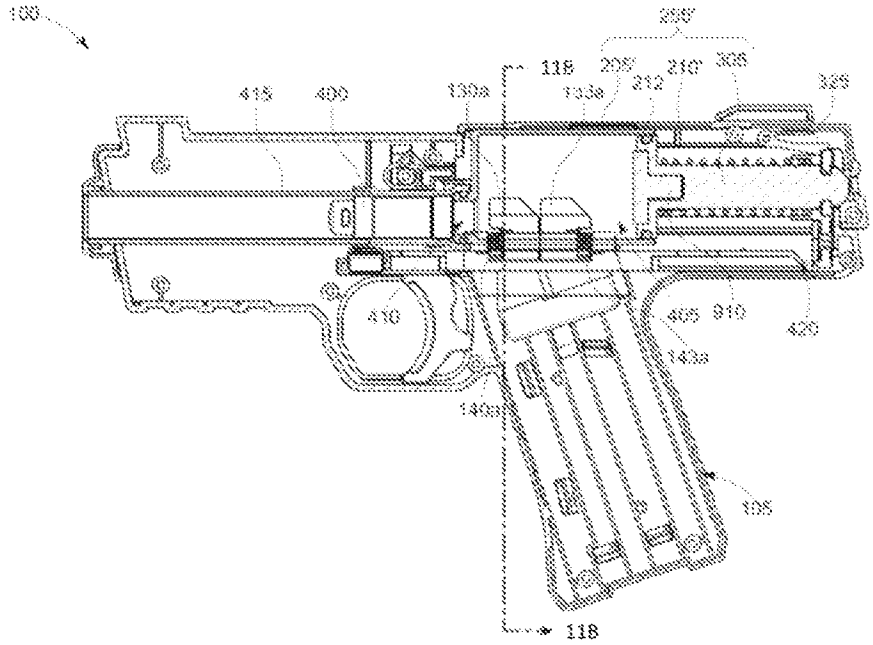

100
250'
118
205'
210'
306
325
415
400
130a
138
212
410
405
910
420
140a
140b
105
118

FIG. 11A

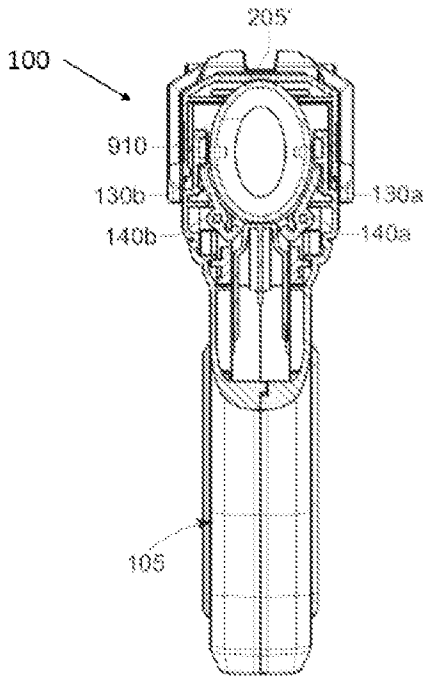


FIG. 11B

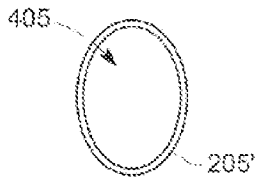


FIG. 11C

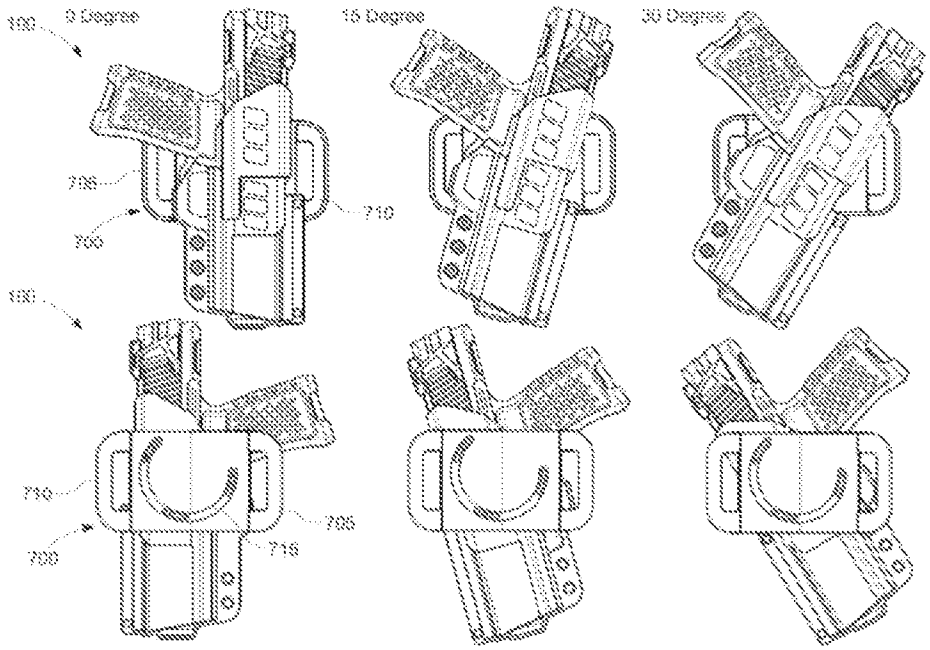

100
0 Degree
15 Degree
30 Degree
705
710
700
100
710
705
700
715

FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG2021/050248

A. CLASSIFICATION OF SUBJECT MATTER

See Supplemental Box

According to International Patent Classification (IPC)

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F41B, A63H, F41A

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

FAMPAT: toy launcher, plunger, magazine, projectile storage, cocking, slide and related terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2003-322496 A (WESTERN ARMS CO LTD) 14 November 2003 fig. 1, 5 & 7; para. 0023; 0055 of the machine translation	22-23
X A	GB 2206055 A (FERRI G.) 29 December 1988 fig. 1-2; pg. 2, ln. 32-pg. 4, ln. l8	22-23 1-21
X	US 4843751 A (FERRI G.) 4 July 1989 fig. 1-4; col. 1, ln. 46-col. 3, ln. 35	22-23
A	CN 208026132 U (WU G.) 30 October 2018 para. 0016 of the original non-English language document (a machine translation is enclosed **only** for your reference)	-

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

*Special categories of cited documents:

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"D" document cited by the applicant in the international application

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28/06/2021 *(day/month/year)*	*30/07/2021* *(day/month/year)*

Name and mailing address of the ISA/SG	Authorized officer
IPOS INTELLECTUAL PROPERTY OFFICE OF SINGAPORE **Intellectual Property Office of Singapore** 1 Paya Lebar Link, #11-03 PLQ 1, Paya Lebar Quarter Singapore 408533	Liu Dan (Dr)
Email: pct@ipos.gov.sg	IPOS Customer Service Tel. No.: (+65) 6339 8616

INTERNATIONAL SEARCH REPORT	International application No. PCT/SG2021/050248

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4756297 A (SINDEL G.) 12 July 1988 pg. 4, ln. 36-45	-
A	GB 616909 A (OERLIKON BUEHRLE AG) 28 January 1949 the whole document	-
A	US 2735206 A (BUTLER W. B. ET AL.) 21 February 1956 the whole document	-

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/SG2021/050248**

Note: This Annex lists known patent family members relating to the patent documents cited in this International Search Report. This Authority is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2003-322496 A	14/11/2003	NONE	
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Supplemental Box
(Classification of Subject Matter)

Int. Cl.

F41B 7/08 (2006.01)

F41B 11/50 (2013.01)

F41B 11/73 (2013.01)

F41A 9/70 (2006.01)

F41B 11/89 (2013.01)

A63H 33/18 (2006.01)