

June 11, 1968

R. F. KELLY ET AL

3,387,536

MINISTORE LAUNCHING SYSTEM

Filed Sept. 23, 1965

4 Sheets-Sheet 2

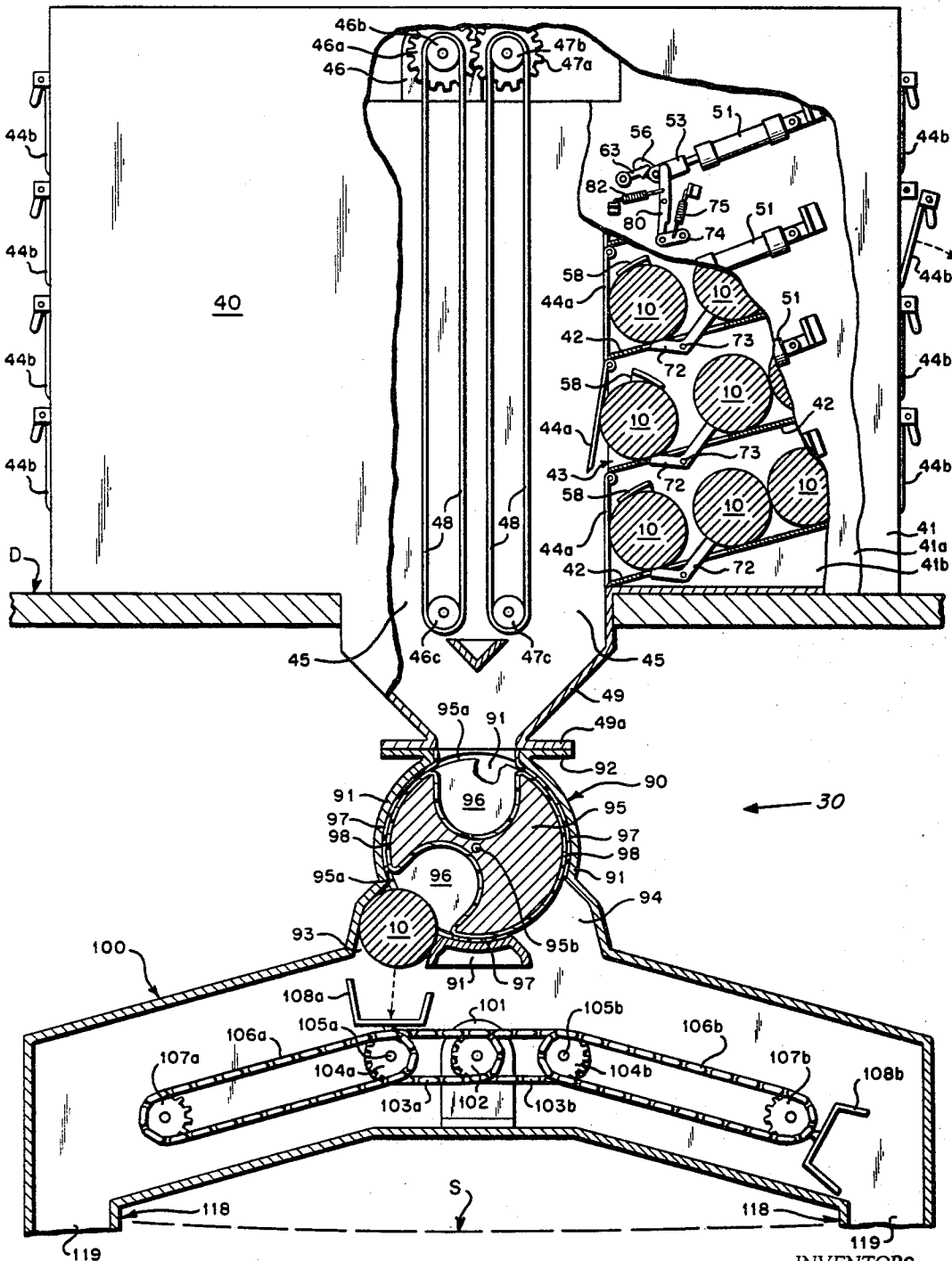


Fig. 2

INVENTORS
ROBERT F. KELLY
WALTER H. MYERS
WILLIAM H. HAZLETT, JR.
LESTER ROBERT DRUM
GEORGE A. GIMBER

BY *Henry Hansen*
J. A. Cooke
ATTORNEYS

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4 Sheets-Sheet 3

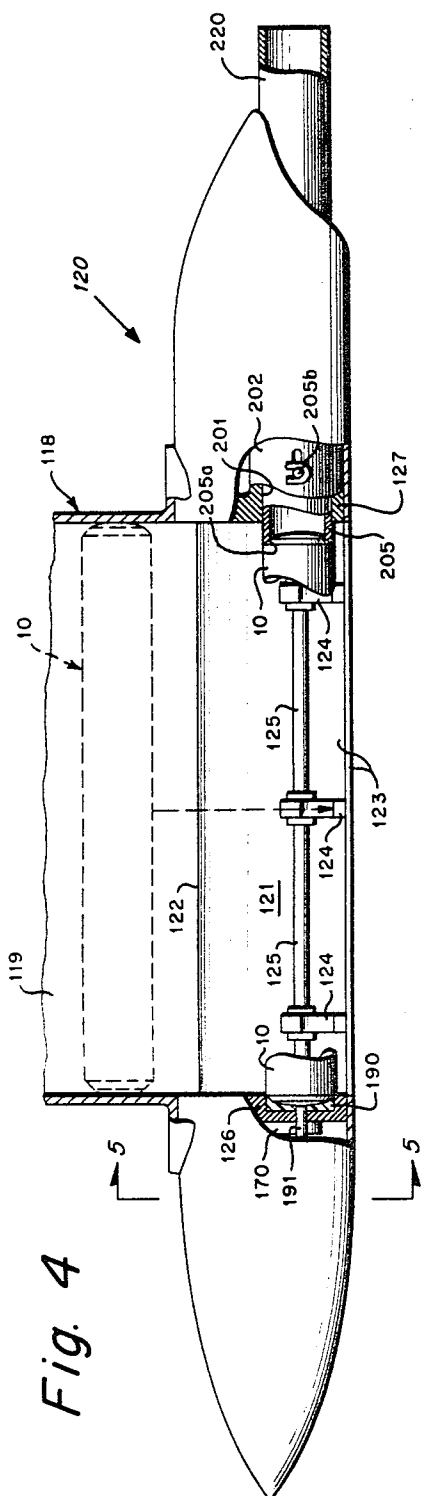


Fig. 4

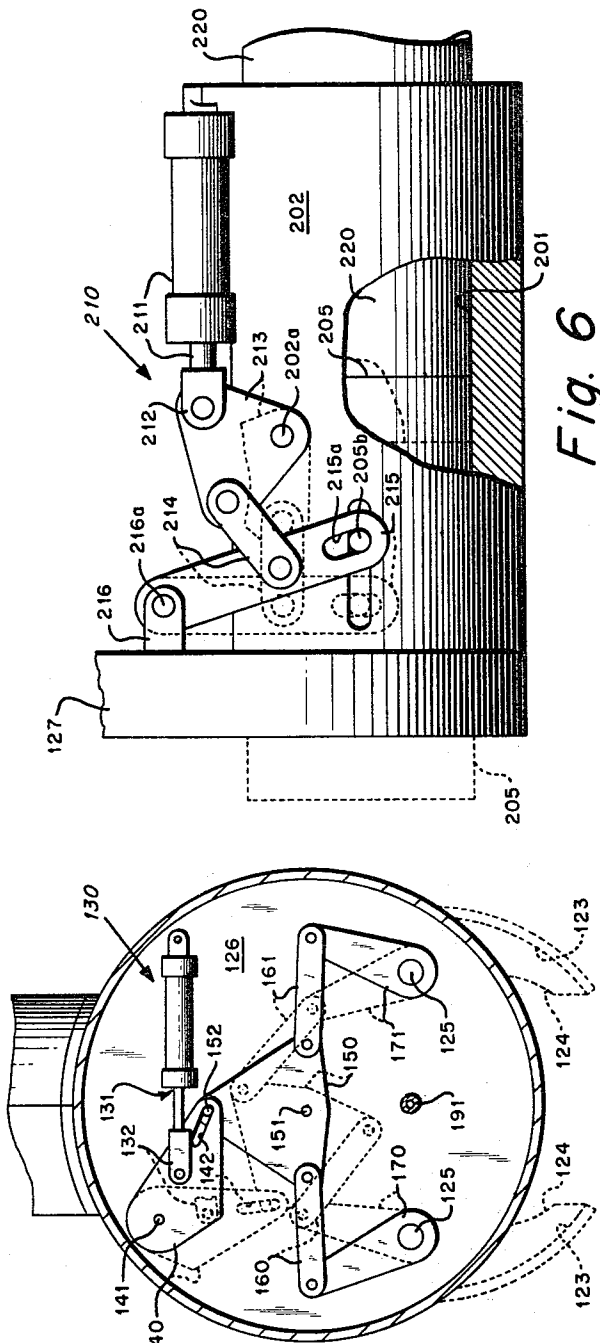


Fig. 5

Fig. 6

INVENTORS
 ROBERT F. KELLY
 WALTER H. MYERS
 WILLIAM H. HAZLETT, JR.
 LESTER ROBERT DRUM
 GEORGE A. GIMBER
 BY *Henry J. Cooke*
 J. R. Cooke ATTORNEYS

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4 Sheets-Sheet 4

Fig. 7

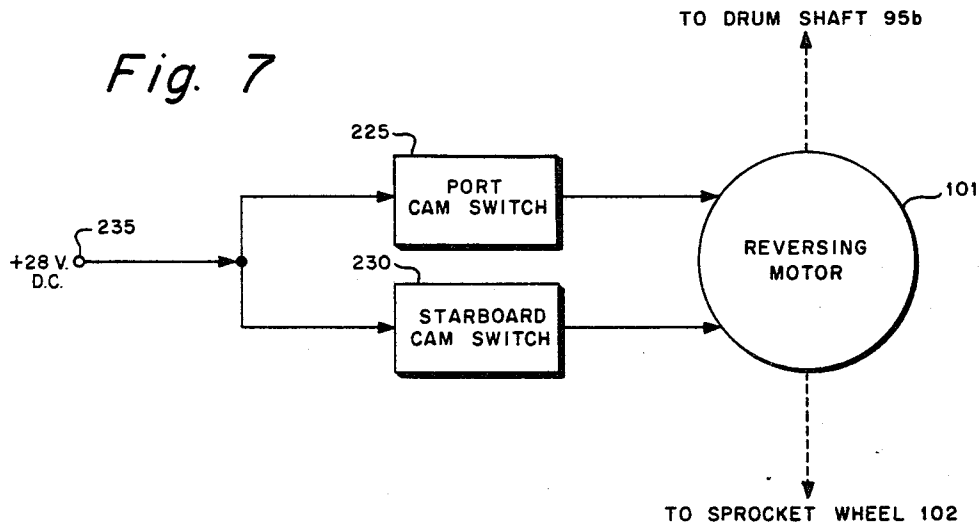
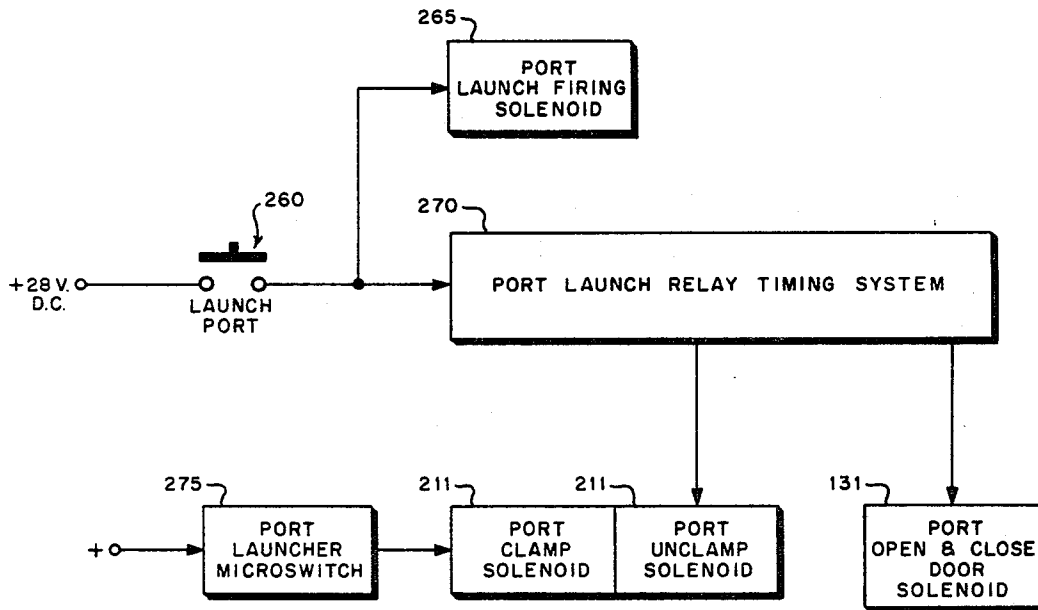


Fig. 8

INVENTORS
 ROBERT F. KELLY
 WALTER H. MYERS
 WILLIAM H. HAZLETT, JR.
 LESTER ROBERT DRUM
 GEORGE A. GIMBER
 BY *J. A. Cooke*
 ATTORNEYS

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MINISTORE LAUNCHING SYSTEM

Robert F. Kelly, Doylestown, Walter H. Myers, Chalfont, William H. Hazlett, Jr., Warrington, Lester Robert Drum, Southampton, and George A. Gimber, Hathboro, Pa., assignors to the United States of America as represented by the Secretary of the Navy

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10 Claims. (Cl. 89—1.5)

ABSTRACT OF THE DISCLOSURE

A launching system including a pair of magazines having inclined compartments each for receiving containerized stores of a respective type. Each compartment of each magazine includes a selectively operable store ejection mechanism which, when operated, allows the lowermost store in that compartment to pass into a chute. The chute includes a driven belt for controlling the lowering rate of an ejected store and directs it to a selector mechanism for automatically diverting the store to a selected one of port and starboard launchers. Each launcher is operable to eject a store from its container and eject the empty container from the launcher.

Disclosure

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates to an automatic store-launching system and more particularly to a system for storing, handling and launching mixed loads of stores, such as those used in the detection of underwater objects.

Each antisubmarine warfare (ASW) patrol aircraft is equipped with various air-launched miniature equipments for use in meeting the various tactical requirements which may exist in the detection of under water objects, such as submarines. These presently include, among others, the AN/SSQ-37 (XX-2) BUSS, the AN/SSQ-42 (XX-2) Miniature Sonobuoy and the AN/SSQ-46 (XX-1) Sonobuoy. It should be understood that these stores or equipments are of various sizes and many or all types may be used in a single detection mission. The stores are hand dropped or retro-launched from the conveying aircraft with use of the latter method necessitating a number of complicated launching mechanisms, each used to handle a particular store of a given size and configuration.

This unsophisticated approach to the stowage, handling and launching of the ASW stores gives rise to many problems, only some of which will be mentioned here. First, the stores of the type discussed above include a large amount of expensive and sensitive electronic apparatus. These equipments are presently packaged at the place of manufacture in expendable storage and shipping containers. Prior to loading in the aircraft the equipments are removed from their shipping containers and are then stacked in storage areas within the aircraft to await removal therefrom at the time of ultimate use. This operation necessitates an extreme degree of handling which, of course, reduces equipment reliability due to the damage received thereby. When the equipments are removed from the shipping and storage containers, they are exposed to ambient conditions. To insure reliability thereof, the exposed equipment must be used within 30 to 60 days, depending upon the nature of the particular equipment, after which time period the equipment is destroyed. The satisfaction of the above-stated out-of-container-life require-

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ments has necessitated complexity in equipment design with its concomitant added cost and unreliability.

Second, an aircraft required to be equipped with a launcher for each type of store would have an intolerable additional weight to carry which would severely reduce the operational performance of the aircraft.

To obviate the above-noted deleterious conditions, the present invention in part discloses the use of a novel combination shipping, storage and launching container having a common form factor for use with the various equipments presently known and utilized. The novel container seals the equipment therein and is provided with a cap at the forward end of the container having provisions for receiving a propelling force to urge the store or equipment from the container and a cap at the after end of the container designed to separate therefrom when a predetermined amount of force is exerted against it. The most significant advantage to be realized from adoption of the proposed container concept is in the increased reliability of equipment housed therein. This is brought about mainly by the elimination of the existing out-of-package requirements for the various stores.

Presently a store is on loaded and off loaded from an aircraft many times. By this required shifting of the unpackaged store damage could occur by rough handling, accidental dropping or inadvertent exposure to the elements. Therefore, by utilizing a sealed container as described below, protection against rough handling, shock, vibration and exposure to the elements is obtained and greater reliability is inherently provided.

Also, protection against corrosion and fungus is at a maximum when the equipment is in the novel sealed container. Although in current stores the components are plated or coated with a protective medium, areas of surfaces subjected to abrasion when handled are potentially starting points for corrosive and fungus action when the store is out of the package.

A further advantage realized by employing this type container is that a reduction in the manufacturing cost of the store can be realized. This saving is achieved primarily by eliminating the need for sealing batteries, for potting of cable glands leading to sealed battery areas and for eliminating the speed brake release device as used on the AN/SSQ-42 and the AN/SSQ-37 equipments. Since assembly requirements are more critical to achieve the sealing protection needed, the assembly costs are reduced accordingly. There is realized also a cost saving due to elimination of expensive protective finishes required for the predetermined time out-of-package life.

In addition, the shipping, launching container is compatible with the presently desired retro-launching concept which permits consistent deployment of the speed brake. By eliminating the air-operated speed brake release mechanisms the brake is allowed to immediately deploy upon ejection from the tube thereby enhancing water placement accuracy.

Lastly, the combination shipping and launching container provides for a simplified launcher design also forming part of the present invention by presenting to the launcher a package of common form factor regardless of the type store to be launched. This then allows not only a single launcher design for the existing stores but also eliminates the need for new launcher designs or modification of existing launchers with the development of each new store.

The present invention further contemplates a novel automatic launching system for handling mixed loads of miniature stores which system embodies an expandable container for the store during storage, shipping, handling and launching. Each individual store is packaged at the point of manufacture in a sealed container and the store

is never removed from the container until it is driven out by a propelling force introduced at the breech end. The launching system further embodies a magazine positioned above the deck of the aircraft and loaded with stores enclosed in the shipping-launching containers. The packaged stores are prearranged in multiple tiers. The number of storage layers or tiers can be varied depending upon space availability, weight limitations and airplane mission profile. The tactical coordinator or a tactical computer can electronically select and summon a packaged store from any tier. Thereafter, the package is delivered to a rotary selector and a pressure seal below deck will pass the package from the pressurized condition when in the fuselage to the atmospheric condition in the port or starboard pod located below the turbulent boundary of the fuselage outer shell. The launch attitude is nose forward. Therefore, the store trajectory follows the airplane flight path. A few seconds after the store is launched from the package the empty cylinder is expelled through a pair of doors on the undersurface of the pod to complete the automated cycle. This arrangement and method have been demonstrated to provide optimum aerodynamic stability and water placement accuracy sufficient for ASW tactics.

It is an object of the present invention to provide a system capable of launching stores from an aircraft.

Another object of the present invention is to provide an automatic system capable of launching mixed loads of stores from an aircraft in a reliable, fast and efficient manner.

A further object is to provide an expendable container for housing an equipment which must be launched prior to the use thereof.

A still further object of the present invention is to provide a sealed container which will protect the equipment contained therein during storage, shipment and handling thereof and at the same time provide a device for launching the contained equipment.

Still another object of the present invention is to provide a sealed combination storage, shipping and launching container of common form factor for enveloping various types and sizes of stores to provide shock, vibration and other forms of protection to the equipment contained therein during storage, shipment and handling thereof and at the same time to provide a device for launching these equipments.

Another object of the present invention is to provide an improved device for launching stores from a moving aircraft.

A further object of the present invention is to provide an improved device for launching stores in a horizontal position with an initial velocity from a moving aircraft.

A still further object of the present invention is to provide an improved launching device for ejecting stores from any sealed launching container and for ejecting the latter from the aircraft upon the launching of the store in a rapid and reliable manner.

Still another object of the present invention is to provide an improved selector mechanism for transferring a store from a pressurized area on the aircraft to the unpressurized launching area on the aircraft in a safe, reliable and rapid manner.

A still further object of the present invention is to provide a magazine for storing, selecting and handling the store.

Still another object of the present invention is to provide a magazine for storing, selecting and handling of equipments contained therein and for transferring the store to another position with a minimum of shock and vibration.

These and other objects and features of the invention will become apparent to those skilled in the art as the disclosure is made in the following description of an embodiment of the invention as illustrated in the accompanying drawings in which:

FIG. 1 represents a partial cross sectional view of the

novel combination, storage and launching container with the breech block portion of a launcher assembly adjacent thereto;

FIG. 2 represents an end view, partially in cross section and with parts broken away, of a portion of an automatic launching system according to the invention;

FIG. 3 represents an enlarged view of an ejection mechanism shown in FIG. 2;

FIG. 4 represents a side view with parts broken away of a launcher for use with the apparatus of FIG. 2;

FIG. 5 represents a cross-sectional view taken substantially along a line 5—5 of FIG. 4;

FIG. 6 represents an enlarged, detailed view of a sliding block mechanism partially shown in FIG. 4;

FIG. 7 is a schematic and block diagram of a control system for a selector mechanism shown in FIG. 2; and

FIG. 8 is a schematic and block diagram of a port launching control system for the launcher of FIG. 4.

Referring to FIGS. 1 and 4, a package generally indicated at 10 including a container 11 and a store 12 contained therein is illustrated adjacent a breech block 190, to be more fully described below. Breech block 190 forms a portion of a launching mechanism 120 for ejecting the store 12 from the container 11. The launcher 120 per se forms a part of the present invention and a detailed description will be provided below.

The container 11 encapsulates the store 12 and functions as a storage and shipping container as well as a vehicle from which the store 12 may be launched. The container 11 includes a right circular cylinder 11a sealed at the fore and aft ends thereof by caps 13 and 14, respectively.

The cylinder 11a, per se, may be constructed of any appropriate high strength-to-weight ratio material such as aluminum or other sheet metal, polycarbonate, polyvinyl, polypropylene, resin impregnated felt, paper laminate, and filament winding. The caps 13 and 14 may be constructed from any strong, sheerable, and impervious material such as a phenolic resin, or the like.

In order to negate the possibility of the package 10 jamming in the launcher passages, the caps 13 and 14 have been provided with spherical end surfaces 13a and 14a, respectively. Adjacent the extreme edge of cap 13, the spherical surface 13a terminates in sharper angular surface 13b.

The aft end of cylinder 11a is also formed with a sharp angular edge or surface 11b. These surfaces, together with complementary surfaces on the launching mechanism, such as surface 193 on breech block 190, serve to guide and properly position the package 10 within the launcher. In order to hermetically seal the store 12 within the container 11, the forward cap 13 is bonded to the cylinder 11a by a cement 15 of appropriate material and characteristics known and used in the art.

As viewed in FIGURE 1, the propelling force for ejecting and launching the store 12 from the cylinder 11a is supplied by a pneumatic source of pressure. The breech block 190 receives a source of pneumatic pressure through conduit 191 and includes a tapered nose portion 192 forming a seal with an O-ring 16 when the package is moved by the launcher toward the breech block 190. O-ring 16 is seated within a groove 13c formed on the spherical surface 13a of cap 13. A cylindrical section 13d forms an integral part of cap 13 and is sealed at the aft end thereof by a frangible seal 13e which is also formed integrally with the forward cap 13 and of the nature to rupture when a predetermined, preset force is applied thereto.

In order to provide consistent ejection of the store 12, a piston generally noted at 17 is provided. Piston 17 is of dish-like configuration and includes a circumferential skirt or sealing edge 17a and a base 17b. A plurality of rods 17c are formed integrally with and extend beyond the confines of sealing edge 17a from base 17b for engaging the edge of cylindrical portion 13d of forward cap 13. When piston 17 is placed in the operative position

with the dished portion facing forwardly, the rods 17c about cylindrical portion 13d and the skirt or sealing edge 17a is spaced from cap 13 to prevent damage thereto. The skirt 17a engages the inner side walls of cylinder 11a and forms a seal therewith for preventing the escape of the pressure generated for launching the store 12.

A forward spacer element generally noted at 18 is interposed between piston 17 and store 12 for properly positioning the center of gravity of store 12 within the container 10 and to give radial support from shock and vibration to the store 12. The size and configuration of spacer 18 depends upon the nature and size of the store to be interposed within container 10. The forward spacer element 18 includes a forward convex surface 18a for engaging the base 17b of piston 17 and a rearward or aft facing surface 18b of concave configuration for receiving the spherical nose of the store 12. The outer extremities of surfaces 18a and 18b are bounded by an annular rim 18c having a diameter substantially the same as the inner diameter of cylinder 11a. Spacer 18 is diametrically split at 18d to form two equal segments. By reason of this arrangement the adverse effects upon the aerodynamic stability of the store is eliminated since a positive separation of the spacer and piston from the store will occur simultaneously with ejection of the store from the launcher.

Store 12 is of the type described above and includes speed or dive brakes 12a at the rear thereof for retarding the descent of the store. The speed or dive brakes may be of the type illustrated in U.S. Patent No. 3,047,259, issued to G. J. Tatnall and A. F. Scarcelli for Speed Brake Retarding Mechanism for an Air Dropped Store on July 31, 1962, and Patent No. 3,114,315, issued to W. E. Trump for Dive Brake on Dec. 17, 1963.

An aft spacer generally noted at 19 is interposed between the store 12 and the aft cap 14 for purposes of shock mitigation and store positioning. The spacer 19 includes forward and aft disks 19a of Fiberglas or the like, bonded to a plurality of cushioning elements 19b interposed therebetween. Although two cushioning elements 19b are illustrated in FIG. 1, it should be understood that the number of these elements would depend upon the size of the store positioned within the container 11. The cushioning elements 19b are constructed of a resilient, compressible and shock absorbing material such as silicone sponge rubber or the like, and the individual cushioning elements are bonded together to preclude slipping with respect to each other. The spacer element 19 thereby constructed both cushions and protects the enclosed store 12 against impact and vibration. By selection of appropriate spacer thickness, the store 12 may also be positioned so that the center of gravity of the package 10 will be properly located. This is important to provide the launcher 120 with a package of common form factor regardless of the type store in the container 11.

The aft cap 14 is formed with an outer annular rim 14b which in turn includes an annular projection 14c and an adjacent annular groove 14d formed on the exterior surface thereof. Cylinder 11a has an interior notch 11c therein compatible with the projection 14c formed on cap 14 for obtaining a snap-lock fastening of the cap 14 to the cylinder 11a. The notch 11c and projection 14c are designed to permit separation of the cap from the cylinder when a predetermined amount of force is exerted against the cap. An O-ring 20 positioned within groove 14d seals the container and thereby eliminates breathing of the container with variation of aircraft altitude. Furthermore, the store 12 contained therein is thereby protected against moisture, corrosion and fungus. In order to insure uniform application of ejection forces to the aft cap 14, a plurality of rods 14e formed integrally as part of cap 14 extend forwardly and abut disk 19a. The rim 14b also extends forward to a position abutting the disk 19a. It should be understood that the aft cap 14 could also be bonded to cylinder 11a in a manner similar

to that shown by forward cap 13 and cylinder 11a, above, without departing from the scope of the present invention.

In operation, the package 10 is positioned within the launcher 120 and urged forwardly, as will be described below, against breech block 190. Mating and complementary surfaces 13b and 193 position the package 10 with respect to the breech block 190 and continued forward movement of the package 10 causes the tapered nose portion 192 on breech block 190 to engage and form a seal with the O-ring seal 16. Pneumatic pressure from an appropriate source is then passed through the conduit 191. When a sufficient preset and predetermined pressure is admitted, the frangible seal ruptures. The ensuing pressure then exerts a force against the piston 17 which transmits the same through the store 12 and spacer 19 to remove the aft cap 14 and permit free ejection of the store 12 from the container 11. Simultaneous with the ejection of the store 12 from the launcher, forward spacer 18 insures separation of the spacer and piston from the store and eliminates any adverse aerodynamic effects on the stability of the store that might otherwise occur.

In addition to the package 10 being sealed, the container may be filled with a dry inert gas, evacuated, or packaged and sealed in an atmosphere of controlled temperature and humidity.

In view of the novel container described above, a store may be protected and sealed from external deteriorating environmental forces and may be maintained in this condition until use thereof. Furthermore, the novel container described above provides a package of common form factor regardless of the type store placed in the container, this being obtained through the use of spacers which additionally provide shock insulation to the store contained within the package. Also, proper utilization of the spacers permits within an allowable range a common center of gravity location for the package. This allows not only a single launcher design for the various stores now in use but for all future stores as well and eliminates the need for new launcher designs or modification of existing launchers with the development of each new store. In addition, the container is compatible with the retrolaunching concept now utilized for launching airborne stores which concept permits consistent deployment of the speed brake. By eliminating the air-operated speed brake release mechanisms, as is accomplished by the novel container, the brake is allowed to immediately deploy upon ejection from the launching tube, thereby enhancing placement accuracy.

Referring now to FIG. 2, a portion of the automatic launching system generally indicated at 30 is illustrated as supported on the deck D of an aircraft, not shown. A portion of the launching system extends between the deck D of the aircraft and the skin S of the same while another portion (FIGS. 4, 5 and 6) extends below the skin S of the aircraft. In particular, the launching system 30 illustrated in FIG. 2 includes a magazine generally indicated at 40 constructed of a pair of parallel side walls 41a and 41b between which extends a series of sloping trays or racks 42 appropriately secured to the sidewalls 41a and 41b. The resulting chambers 43 formed by the trays 42 and sidewalls 41a-41b serve as the storage area for the packages 10. It should be understood that although one side of the magazine showing the internal mechanisms thereof is illustrated in FIG. 2, similar construction is found on the other side of the magazine 40.

Storage chambers 43 terminate at their inboard ends with closures 44a which are pivotally connected to the sidewalls 41a and 41b at the top of their respective chambers 43. Storage chambers 43 terminate at their outboard ends in loading doors 44b. It should be observed that when closures 44a are in the closed position the lower marginal edges thereof abut the adjacent trays 42 thereby permitting the closures 44a to only swing inboard of the magazine thereby providing a relatively flat wall which

forms the sidewall of a central vertical chute, generally noted at 45.

A motor 46 is appropriately secured within the magazine 40 and through gears 46a and 47a, associated drive rollers 46b and 47b and idler rollers 46c and 47c drives belts 48 of soft rubberlike material, such as polyurethane or the like, which are arranged with the outboard sides thereof spaced from the wall formed by closures 44a a distance slightly less than the diameter of the package 10. In operation, the package 10 is ejected from the storage area 43 and is squeezed between the soft belt face and the fixed face of the chute during downward movement of the former thereby lowering the package 10. This operation requires no synchronization and obtains positive control of the lowering rate of the container. The package 10 is released at the bottom of the belt run and the package 10 rolls down the inclined bottom surface 49 of the vertical chute 45 into the pressure-tight rotary selector 90 to be disclosed and discussed below.

A kicker or ejection mechanism generally noted at 50, is utilized to eject the package 10 from its position within the storage area 43 and will now be described with reference to FIGS. 2 and 3. The solid line position of FIG. 3 illustrates the various elements of the ejection mechanism 50 in the cocked or holding position prior to ejection with the inboard package 10a and the outboard package 10b held in their respective positions by kicker plate 58 and treadle arm 72, respectively. The broken line position of FIG. 3 illustrates the various elements of the ejection mechanism 50 during various stages of the operation thereof and does not reflect the position thereof at any one instant in time.

The latch mechanism 50 includes a solenoid actuated air cylinder 51, a piston rod 52 and an actuator arm 53 secured to the piston rod 52. An elongated lost motion slot 54 is formed in the actuator arm 53 and receives an outwardly extending actuator pin 55 which is formed as an integral part of an actuator lever 56. Lever 56 is rigidly connected through pin 57 to a kicker plate 58, the latter serving to restrain rotation of the container 10a and alternatively serving to eject the container 10a from the storage area 43. Kicker plate 58 includes a pin 59 for co-operation with a kicker plate latch, generally noted at 60, for latching the kicker plate 58 in the restraining or solid line position of FIG. 3.

Kicker plate latch 60 is pivotal about fixed pin 61 and includes a latch arm 62 which engages the pin 59 on the kicker plate 58. A lock actuator arm 63 is formed as part of the latch 60 and is engaged by a spring 64 which urges latch 60 in a clockwise direction. Lock actuator arm 63 includes a camming surface 65 engageable by actuator arm 53 to urge latch 60 against the action of spring 64 thereby urging latch arm 62 out of engagement with pin 59.

An angularly shaped treadle 70 including an inboard container engaging arm 71 and an outboard container engaging arm 72 is pivotally connected to sidewall 41a through rotatable shaft 73 which additionally has a treadle lever 74 rigidly secured thereto for movement therewith. A spring member 75 secured by spring anchor 76 to sidewall 41a is attached to the treadle lever 74 and urges the same and treadle 70 to rotate about shaft 73 in a clockwise direction. During various stages of the operation of the mechanism the treadle 70 is precluded from this clockwise rotation by either the weight of the container 10a resting on arm 71 or by a treadle latch 80 now to be described.

Treadle latch 80 is pivotally connected intermediate the length thereof to sidewall 41a through pivot pin 81. A spring 82 connected to a spring anchor 83 secured to the wall 41a and connected to the treadle latch 80 urges the latter in a counterclockwise direction as viewed in FIG. 3. The upper portion 84 of the treadle latch 80

abuttingly engages the actuator pin 55 and is precluded thereby from rotation in the aforementioned counterclockwise direction until the pin 55 moves as indicated by the broken line position thereof. Treadle latch 80 includes a lower portion 85 adapted for engagement with a treadle pin 77 extending outwardly from the treadle lever 74. Engagement of pin 77 with the lower portion 85 of the latch 80 precludes clockwise rotation of the treadle lever 74 and the associated treadle 70.

In operation, the various elements of the ejection mechanism 50 assume the solid line condition which is the battery or fully retracted position. When this position is assumed the following conditions exist: the actuator arm 53 is out of engagement with camming surface 65; arm 72 engages container 10b and thereby precludes the container 10b from moving downwardly; container 10a rests on arm 71 and is held in the holdback position by kicker plate 58; and, the lower portion 85 of treadle latch 80 is disengaged from pin 77 of the treadle lever 74. In order to eject container 10a from chamber 43 the air cylinder 51 is actuated thereby urging piston rod 52 and associated actuator arm 53 toward an inboard position. Initial movement of actuator arm 53 does not affect the position of actuator pin 55 because of the elongated lost motion slot 54. However, during this initial movement, actuator arm 53 engages the camming surface 65 of latch 60 thereby disengaging latch arm 62 from pin 59. Continued movement of actuator arm 53 toward the dotted line position 53a causes the actuator lever 56 and the associated kicker plate 58 to rotate in a clockwise direction. When actuator arm 53 reaches dotted line position 53b, kicker plate 58 is in position 58b and the store has been ejected from the chamber 43. During inboard movement of the actuator arm 53 and pin 55 the upper portion 84 of the treadle latch 80 follows pin 55 and the treadle latch 80 thereby rotates in a counterclockwise direction due to the urging of spring 82. Counterclockwise rotation of treadle latch 80 causes the bottom portion 85 thereof to engage the treadle pin 77 and to preclude the lever 74 and the associated treadle 70 from rotating in a clockwise direction toward the dotted line position 70c when the container 10a is ejected and thereby no longer provides a restraining force on treadle arm 71. When the actuator arm assumes the dotted line position 53b, the latch, kicker plate, and treadle lever also assume the illustrated dotted line positions 60a, 50b and 80b, respectively. Upon retraction of the actuator arm 53 to the solid line position the kicker plate 58 and latch arm 62 are rotated to the solid line positions wherein latch arm 62 engages the pin 59 on the kicker plate 58. During this retracting action the pin 55 engages the upper portion 84 of the treadle latch 80 and the lower portion 85 is cammed out of engagement with shaft 77. This unlocks the treadle lever 80 and associated treadle 70 and permits the aforementioned element to assume the dotted line position 70c. Upon the movement of the treadle to the dotted position 70c, the container 10b, heretofore restrained from downward and inboard movement by the treadle arm 72, moves downwardly and because of the weight thereof urges the treadle arm from the dotted line position shown at 71b to the solid line position. Treadle arm 72 is then in a position to engage a container 10c, not shown. At this stage all of the elements of the ejection mechanism 50 are again in the battery or fully retracted position.

Referring again to FIG. 2, the ejected container is carried by belt 48 to the inclined walls 49 of the magazine 40 and is deposited in the pressure tight rotary selector mechanism 90. The selector mechanism 90 is composed of a housing 91 secured by flanges 92 to flanges 49a on the magazine 40. Except for the slot formed between flanges 92 and chutes 93 and 94 formed by the housing 91, the housing 91 completely encloses a rotating drum 95 which includes a forward positioning bulkhead, not

shown, and an aft positioning bulkhead 95a. A pair of package receiving chambers 96 are formed within and extend the length of the drum 95.

In order to pass the package from the pressurized condition when in the fuselage to the atmospheric condition in the port or starboard pod illustrated in FIGS. 4, 5 and 6, the housing 91 and rotating drum 95 are provided with air seals between the outer surface of the drum 95 and the inner surface of the housing 91. The sealing is accomplished by a lining 97 secured to the inner surface of the housing 91 along the entire length thereof and a lining 98 appropriately secured to the surfaces of drum 95, each of the aforementioned linings being constructed of a Teflon-coated elastomer or the like secured by an appropriate adhesive, such as an epoxy resin adhesive, or the like. The drum 95 is rotated by a reversing motor 101, described below, through an associated shaft 95b and appropriate gearing, not shown, to obtain alternate delivery of containers 10 from their repository chambers 96 through chutes 93 and 94.

The rotary selector 90 transfers the containers from the magazine section 40 through one of the chutes 93 or 94 to a distributor unit, generally noted at 100. Distributor 100 includes a reversing motor 101 and a double sprocket wheel 102 associated therewith. Drive chains 103a and 103b are driven by sprocket wheel 102 and they in turn drive a pair of double sprocket wheels 104a and 104b which are journaled for rotation about fixed shafts 105a and 105b, respectively. A second pair of drive chains 106a and 106b engage the sprocket wheels 104a and 104b, respectively, and they in turn drive idler wheels 107a and 107b, respectively. Cradles 108a and 108b are secured to the drive chains 106a and 106b and are movable therewith between the inboard position beneath chutes 93 and 94, respectively, to an outboard position (shown by cradle 108b) adjacent pylons 118. Cradles 108a and 108b are constructed to receive container 10 and upon reaching the outboard position to deposit the container 10 into a passageway 119 formed within the pylon 118. Appropriately positioned limit switches, not shown, are utilized to reverse the rotation of the motor 101 after the cradles 108a and 108b have moved to their extreme outboard position adjacent the passageway 119.

Referring now to FIGS. 4, 5, and 6 there is shown illustrated therein one of an existing pair of launching pods generally noted at 120 which are located on the fuselage of the aircraft, not shown, outside of the skin line S and which are connected to the fuselage by the pylon 118. It is understood that the pylon 118 is properly aerodynamically streamlined and is internally dimensioned to permit the container 10 to pass from the distributor 100 to the launching pod or launcher 120. Pod or launcher 120 includes a cylindrical center section 121 having an opening 122 located at the top thereof having communication with the passageway 119 of the pylon 118 and of a length slightly larger than the length of the container 10. The bottom of the cylindrical section 121 comprises a pair of pivoting ejection doors 123, each of which is supported by and appropriately secured to a series of arcuate door support ribs 124. Each rib is rigidly secured to door support shafts 125, the ends of which are appropriately journaled within fore and aft bulkheads 126 and 127 positioned at the ends of the cylindrical central member 121. These bulkheads 126 and 127 serve to support a nose cone 128 and tail cone 129, respectively, within which are located the various mechanisms to be described below for positioning, clamping, firing and opening the doors 123 for ejecting the empty package.

As viewed in FIG. 5, the door opening mechanism generally indicated at 130, includes a solenoid actuated cylinder and piston rod assembly 131 secured to the bulkhead 126, the rod having an actuator member 132 pivotally secured to a toggle plate 140. Toggle plate 140 in turn is rotatably connected to bulkhead 126 through a toggle

plate shaft 141. Plate 140 additionally includes a lost motion slot 142 to permit the rotation of the toggle plate 140 from the solid line position to the dotted line position shown. A crank member 150 is pivotally connected to bulkhead 126 through crank shaft 151 and is of triangular configuration having a crank pin 152 at an apex extending into the lost motion slot 142 of toggle plate 140. A link member 160 is pivotally connected at one end thereof to another apex of crank member 150 and a similar link member 161 is pivotally secured to the other apex of the triangular crank 150. The other ends of the link members 160 and 161 are pivotally connected to one end of motion transmitting arms 170 and 171, respectively, while the other ends of these arms 170-171 are fixedly secured to door support shafts 125 for the purpose of transmitting rotational movement thereto.

It is therefore readily observed from FIG. 5 that outward movement of the actuator 132 causes the toggle plate 140 to rotate in a clockwise direction about toggle plate pin 141 to the dotted line position shown. This movement causes the crank plate member 150 to rotate in a counterclockwise position about shaft 151 to the dotted line position shown. This urges link member 160 and associated motion transmitting arm 170 to move in a clockwise direction to thereby open the door 123 and urges the link member 161 and associated motion transmitting arm 171 to move in a counterclockwise direction toward the dotted line position to open the door 123.

As may be viewed with reference to FIGS. 1 and 4, a breech block 190 is secured to the forward bulkhead 126 and receives a source of pneumatic pressure through conduit 191 and further includes a tapered nose portion 192 forming a seal with the O-ring 16 when the package is moved into engagement with the breech block 190 by the sliding block 205 to be described below. Beveled surfaces 193 are additionally formed on the breech block 190 and are complementary to the surfaces 13b of the cap 13 for the purpose of guiding and properly positioning the package 10 within the launching mechanism.

Referring now to FIGS. 4 and 6, the aft bulk head 127 is illustrated as having an aperture 201 therethrough having a diameter slightly larger than the outside diameter of the package or container 10. A cylindrical member 202 in registration with the aperture 201 acts as a housing for a sliding clamp mechanism 205. As viewed in FIG. 6, the cylindrical member also serves as a housing for the forward end of the launch tube 220. The sliding clamp 205 includes a beveled peripheral surface 205a for complementary engagement with the beveled surface 11b of the package 10 to properly position the same within the launcher 120.

FIG. 6 illustrates the actuating mechanism, generally noted at 210, for moving the sliding clamp 205 between an extended position wherein the clamp 205 engages the package 10 and urges the aft end thereof into the breech block 190 and the retracted position thereof wherein the empty package may be ejected through the doorway formed by the ejection doors 123. The ejection or actuating mechanism 210 includes a solenoid actuated cylinder and piston rod assembly 211 having an actuator end 212 pivotally connected to one apex of a triangular toggle lever generally indicated at 213. Toggle lever 213 is pivoted at another apex about shaft 202a extending outwardly from the housing 202 and includes a toggle link 214 pivotally connected to the other apex thereof. An actuating lever 215 is pivotally connected at one end thereof to a fixed bracket 216 secured to the bulkhead 127. The other end of the actuating lever includes a lost motion slot 215a which engages a sliding clamp pin 205b which is formed as an integral part of the sliding clamp 205 and which extends outwardly beyond an elongated, longitudinally extending slot 202a formed in the housing 202. The aforementioned toggle link 214 has the other

end thereof pivotally connected intermediate the length of the actuating lever 215 and upon clockwise movement of the toggle lever 213 urges the actuating lever 215 to rotate in a counterclockwise direction about the pin 216a and thereby urge the sliding clamp pin 205b and the associated sliding clamp 205 to the dotted line positions shown. This inboard movement causes the outer peripheral and tapered edge of clamp 205 to engage and position the container 10 and to urge the same against the breech block 190 and the conduit 191.

In operation, the package 10 drops through the passageway 119 of the pylon 118 and into the launcher 120 and rests against the door support ribs 124. Upon actuation thereof the sliding clamp 205 moves inwardly to engage the container 10 and urge the same against the breech block assembly 190. Upon firing of the package 10 the actuating mechanism 210 retracts the sliding clamp 205 and the door opening mechanism 130 is actuated to eject the empty container from the launcher 120.

Referring now to FIG. 7 for a more detailed description of the interrelationship between the rotation of both the drum 95 and the cradles 108a and 108b there is illustrated a port cam switch 225 and a starboard cam switch 230 each connected to a source of electrical energy 235. The port cam switch 225 is located in one of the chambers 96 while the starboard cam switch 230 is located in the other chamber 96 of the drum 95. Each of the cam switches 225 and 230 is electrically connected to the reversing motor 101 illustrated in FIGS. 2 and 7. Reversing motor 101 in turn is mechanically coupled to the drum shaft 95b and to the sprocket wheel 102 located in the distributor 100. Appropriate gearing, not shown, is interconnected between the latter elements to provide an arrangement whereby the port cradle 108a is positioned beneath the port chamber 96 when the latter is in alignment with chute 93 to receive the falling container 10. As indicated above, when the cradle 108a is in this aligned position the cradle 108b assumes the discharging position illustrated in FIG. 2. Similarly the gearing is so arranged that when the starboard chamber 96 is in alignment with the chute 94 the cradle 108b is in alignment therewith to receive any package 10 falling therein. It is further understood that when this position is assumed, the cradle 108a will be in the discharging position adjacent the passageway 119.

The operation of the above elements is now described with reference to FIGS. 2 and 7: an ejected package 10 is conveyed downwardly into the awaiting starboard chamber 96, passing through the same and causing the actuation of the starboard cam switch 230. This causes the reversing motor to rotate the drum 95 in a clockwise direction and the cradle 108b to move to a position in alignment with chute 94. When the starboard chamber 96 is in alignment with the chute 94, the cradle 108b is in alignment with chute 94 and the package 10 falls from the chamber into the awaiting cradle 108b. The movement of the package 10 from the starboard chamber 96 engages the cam switch 230 and cams the same to the "off" position thereby deenergizing the reversing motor 101 and preventing further rotation of drum 95. At this juncture port chamber 96 is in a position to receive another package 10 from the magazine. The succeeding package which enters the port chamber 96 cams the cam switch 225 to the "on" position causing the reversing motor to be energized and thereby rotating the drum 95 in a counterclockwise direction. Concurrently with the counterclockwise movement of the drum 95, the cradle 108a moves towards an aligned position beneath the chute 93 and the cradle 108b moves toward the discharging position adjacent the passageway 119. Upon the alignment of the port chamber 96 and the chute 93 the package 10 falls from the former and thereby engages the cam switch 225 to cam the same to the "off" position to deenergize the motor 101 and to preclude further movement of the drum and cradle 108a and 108b. It

should be observed that the starboard chamber 96 is again in a position to receive the succeeding ejected package. Also, it is understood that the motor 101 can be manually energized by a separate circuit in order to move the cradle when no subsequent store is positioned within the "ready" chamber to cam the camming switch and energize the motor 101.

Referring now to FIG. 8, the schematic diagram illustrated therein relates to the circuitry utilized in the launching from the port launcher 120 of the store from the container 11. It is understood that a similar arrangement is utilized to launch stores from the starboard launcher, not shown, and that a combination of the two arrangements could be utilized for the simultaneous launching from port and starboard pods. In FIG. 8 a port launch switch 260 is electrically interconnected between a power source and both a port launch firing solenoid 265 and a port launch relay timing system 270, the former functioning to permit the source of pneumatic pressure to pass through conduit 191 to the cap 13 of package 10. See FIGS. 1 and 4. The relay timing system in turn is electrically coupled to the unclamping side of solenoid 211 while the clamping side of solenoid 211 is connected to a source of power through a microswitch 275 appropriately located within the cylindrical portion 121 of the launcher 120 to sense the presence of a package 10 within the launcher 120. A port open and close door solenoid 131 is also electrically connected to the relay timing system 270 for the purpose of operating the door actuating mechanism 130 of FIG. 5.

In operation, the presence of a package 10 within the launcher 120 energizes the microswitch 275 which, in turn, actuates the solenoid 211 to cause the sliding clamp 205 to push the package 10 against the breech block 190. (See FIG. 4.) When the operator pushes switch 260 the firing solenoid 265 is actuated allowing the pneumatic energy to rupture the seal 13c on the package 10 and eject the store from the same. Immediately thereafter, due to the relay timing system 270, the solenoid 211 is again actuated to unclamp the empty package 10. A short interval thereafter solenoid 131 is actuated to first open and then close the doors 123.

In summary, the operation of the launching system 30 is as follows: A multiple position selector switch, not shown, is manually positioned by the operator to select the particular storage area 43 housing the desired stores. Actuation of this selector switch energizes the solenoid actuated air cylinder and piston 51-52 of FIGS. 2 and 3 which in turn eject the package 10 from storage area 43. Continuously moving belts 48 engage the ejected package 10 and convey the same into the chamber 96 of the drum 95. Movement of the package 10 into this chamber actuates one of the cam switches which energizes the motor 101 to rotate the drum 95, the pressure seals thereon maintaining the magazine area under pressure. Concurrently, the appropriate cradle is moved into position to receive the package 10 as it falls from the chamber and passes through the chute. This cams the cam switch to the "off" position and stops the motor 101. A subsequent package passing into the "ready" chamber similarly energizes the motor 101 which moves the cradle outwardly to discharge the package into the passageway 119 of pylon 118. When the package drops into the launcher 120, the microswitch 275 is actuated which energizes the clamping solenoid 211. This moves the sliding clamp into engagement with the package 10 and moves the latter against the breech block 190. Actuation of switch 260 causes the firing of the store 12 out of the container 11 and out of the launcher 120 through launch tube 220. The solenoid 211 is again energized to release the empty container 11 whereupon solenoid 131 opens the doors 123 which eject the container 11 and immediately thereafter close the same.

It will be understood that various changes in the details, materials, steps and arrangements of parts, which have been herein described and illustrated in order to

explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

What is claimed is:

1. A system for handling packaged stores and for launching the stores from their packages comprising:
 - a magazine for storing the packaged stores including a plurality of loading doors, a corresponding plurality of discharge doors, and trays extending between each corresponding loading and discharge door for receiving the packaged stores;
 - means on said magazine for selectively releasing and ejecting a selected packaged store from said magazine;
 - a plurality of launching means for discharging the store from the package and for ejecting the empty package;
 - selector means for selectively transferring the packaged store into one of said plurality of launching means; and
 - conveyor means including a continuously moving belt running parallel to said discharge doors and being spaced therefrom a distance slightly less than the diameter of the packaged stores, said belt being constructed of a soft rubber-like material for engaging a package released from said magazine and conveying the same toward said selector means.
2. The system as defined in claim 1 wherein said magazine and said conveyor means are enclosed in a pressurized compartment, and said selector means having pressure seals thereon for maintaining said compartment pressurized while transferring the packaged store from said conveyor to said launching means.
3. The system as defined in claim 2 wherein said selector means includes:
 - a housing;
 - said housing having a first slot means therein communicating with said pressurized compartment and configured to permit passage of the packaged store therethrough, said housing further including a second slot means communicating with said launcher and configured to permit the passage of the packaged store therethrough;
 - a drum rotatably mounted within said housing;
 - a plurality of package-receiving chambers formed within and about the periphery of said drum;
 - and sealing means between said drum and said housing for maintaining said compartment pressurized while transferring the packaged store therefrom.
4. The system as defined in claim 3 wherein said launcher includes:
 - a cylindrical member having an elongated aperture in the upper wall thereof configured to permit the passage of the packaged store therethrough and a pair of discharge doors forming the bottom wall of said cylinder;
 - bulkheads positioned at each end of said cylindrical member;
 - a breach block within one of said bulkheads for positioning one end of the packaged store and for providing an ejection force thereto;
 - and a sliding clamp associated with the other of said bulkheads for engaging the other end of the packaged store and urging said one end against said breach block.
5. A launching system for handling packaged stores of different types and for launching a store of a selected type from its package comprising:
 - a magazine having a plurality of compartments each for storing packaged stores all of the same respective type;
 - a plurality of ejection means each operatively connected to a respective said magazine compartment for selectively releasing and ejecting a packaged store of

- a predetermined type from said respective magazine compartment, said ejection means being actuatable in any order for releasing stores;
 - chute means positioned to receive ejected packaged stores selectively released from any of said magazine compartments;
 - a plurality of launching means for discharging a given store both from its package and from said launching means and for ejecting the empty package thereof; and
 - selector means communicating with said chute means for receiving a packaged store ejected into said chute means and for transferring the packaged store received to a selected one of said plurality of launching means.
6. The system as defined in claim 5 wherein said chute means includes means for controlling the lowering rate of an ejected store.
 7. The system as defined in claim 5 wherein each of said magazine compartments include:
 - a loading door;
 - a discharge door; and
 - an inclined tray extending between the said loading and discharge doors for receiving the packaged stores of a given type.
 8. The system as defined in claim 7 wherein each of said ejection means comprises:
 - a kicker plate pivotally mounted in said respective compartment adjacent said discharge door and movable between store retaining and store ejecting positions;
 - first latching means having a release operating member and connected to said magazine for normally latching said picker plate in said store retaining position; and
 - actuator means including an actuator arm connected to said kicker plate, said actuator arm being movable from a first position to a second position for actuating said release operating member to cause the release of said kicker plate and for moving said kicker plate to said store ejecting position.
 9. The system as defined in claim 8 wherein each said ejection means further comprises:
 - a treadle member pivotally connected to said magazine adjacent a respective said tray in spaced relation to said kicker plate, said treadle having a first arm movable to a first position for holding a store and to a second position for releasing a store and having a second arm engageable by a store released by said first arm for moving said first arm to said first position; and
 - second latching means having a release operating member and connected to said magazine for normally latching said treadle member with said first arm in said first position;
 - said actuator arm further being retractable from said second position to a third position for actuating said release operating member of said second latching means to release said treadle member.
 10. A launching system for handling packaged stores of different types and for launching a store of a selected type from its package comprising:
 - a magazine having a plurality of compartments for storing the packaged stores of different types, each of said magazine compartments including a loading door, a discharge door and an inclined tray extending between said loading and discharge doors for receiving the packaged stores of a given type;
 - means operatively connected to said magazine compartments for selectively releasing and ejecting a packaged store from said magazine compartments;
 - a plurality of launching means for discharging a given store both from its package and from said launching means and for ejecting the empty package thereof;

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selector means for transferring a packaged store to a selected one of said launching means; and
 chute means communicating with said selector means and positioned to receive packaged stores selectively released from any of said magazine compartments including a continuously moving belt running parallel to said discharge doors of said compartments and being spaced therefrom a distance slightly less than the diameter of the packaged stores, said belt being constructed of a soft rubber-like material for engaging the packaged store received and conveying same toward said selector means.

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SAMUEL W. ENGLE, *Primary Examiner.*