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Burbank, Calif.
Continuation-in-part of application Ser. No. 638,114, May 12, 1967, now abandoned.

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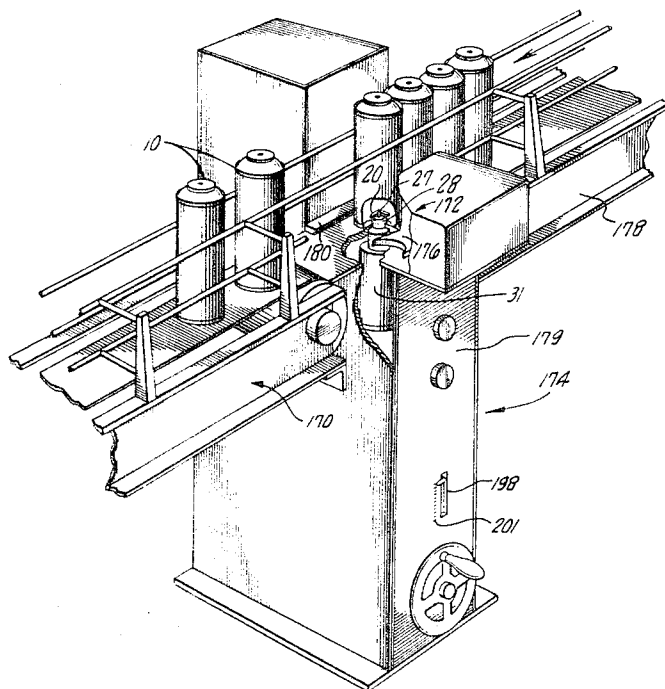
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[54] **APPARATUS FOR INJECTING PROPELLANT INTO A DISPENSING CONTAINER**
6 Claims, 15 Drawing Figs.

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222/309, 222/334, 417/401
[51] Int. Cl. **B65b 31/08**
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260, 261, 279, 284, 329, 330, 352, 356, 113;
184/15 A; 222/162, 287, 309, 322, 334, 335, 341;
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ABSTRACT: An apparatus for injecting propellant into a dispensing container has a ram which advances a cylinder toward the container to be injected through a fluid coupling provided by propellant in a propellant chamber. A normally closed injector valve is mounted on the cylinder and opens by engagement with a dispenser to be filled to communicate the interior of the dispenser through an axially hollow injection needle with the propellant chamber. The volume of the propellant chamber is varied by varying the stroke of the ram. Propellant injection is accomplished in conjunction with an indexing star wheel and control means which accurately positions each dispenser for injection, prevents operation until such positioning, and prevents other dispensers from interfering with the dispenser being injected.



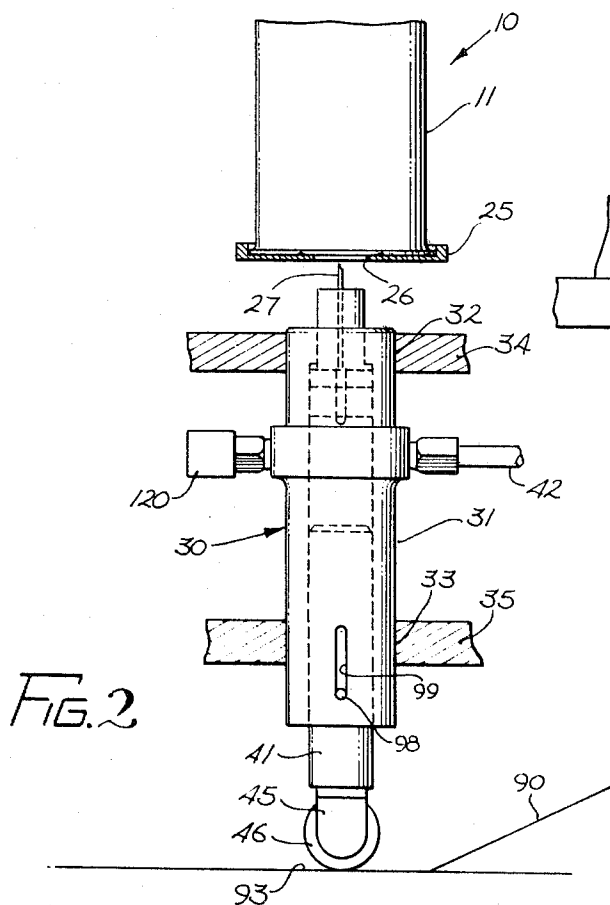
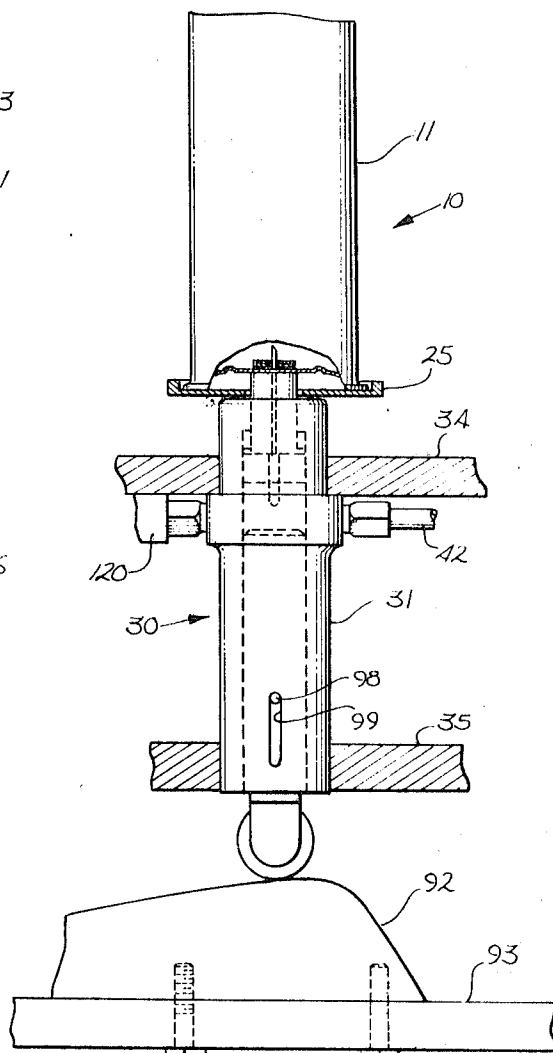
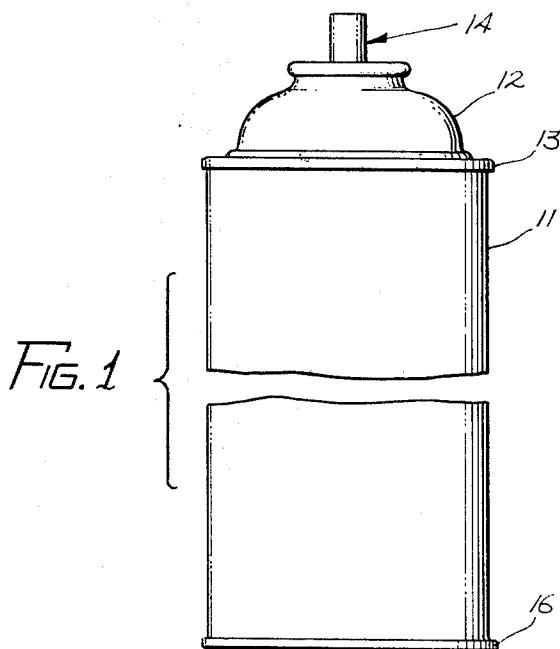


FIG. 3

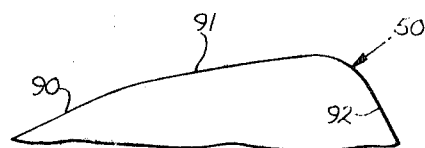


FIG. 6

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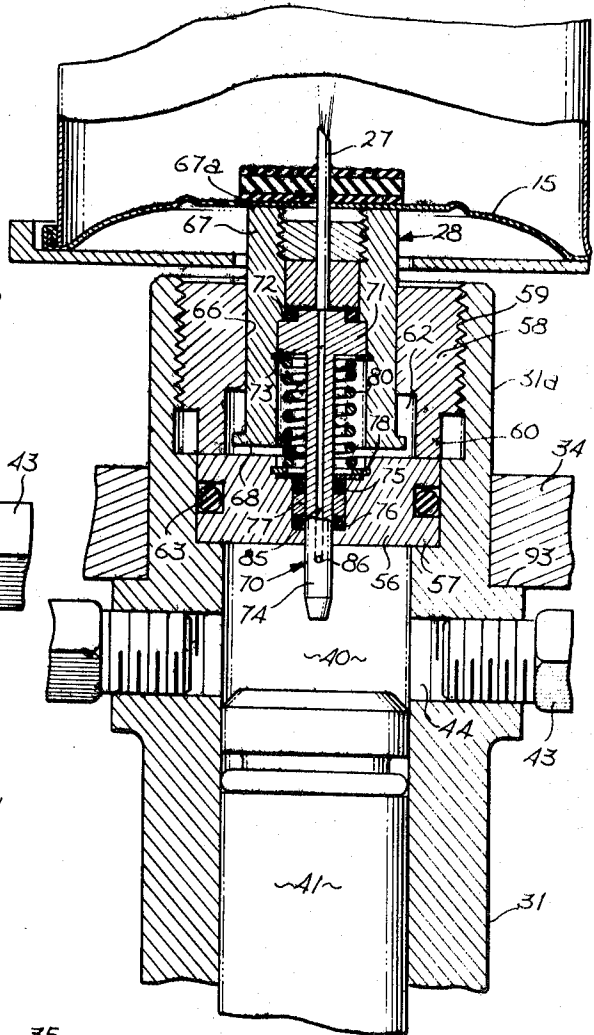
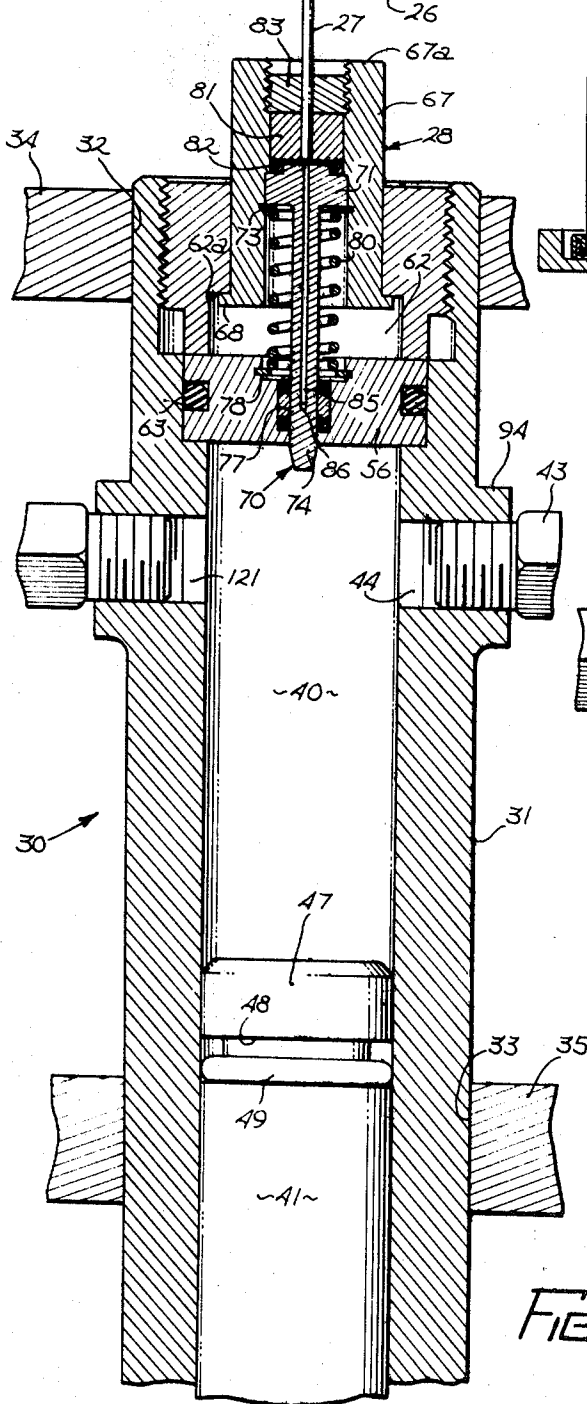
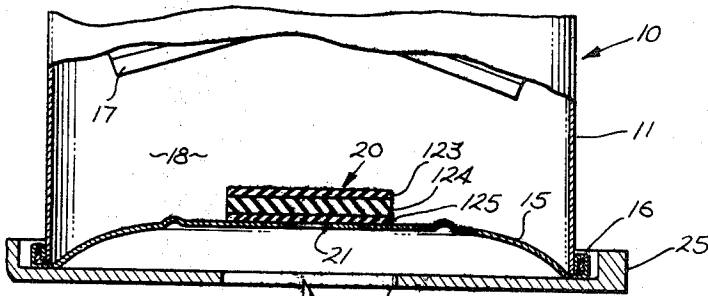
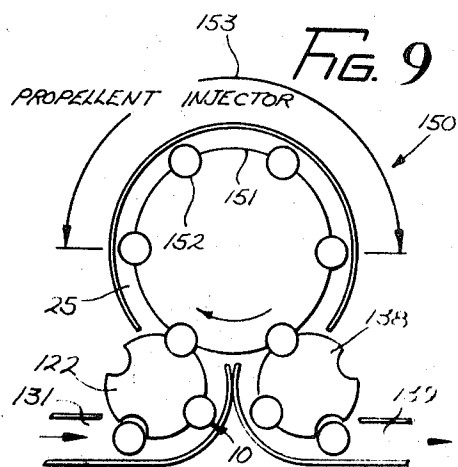
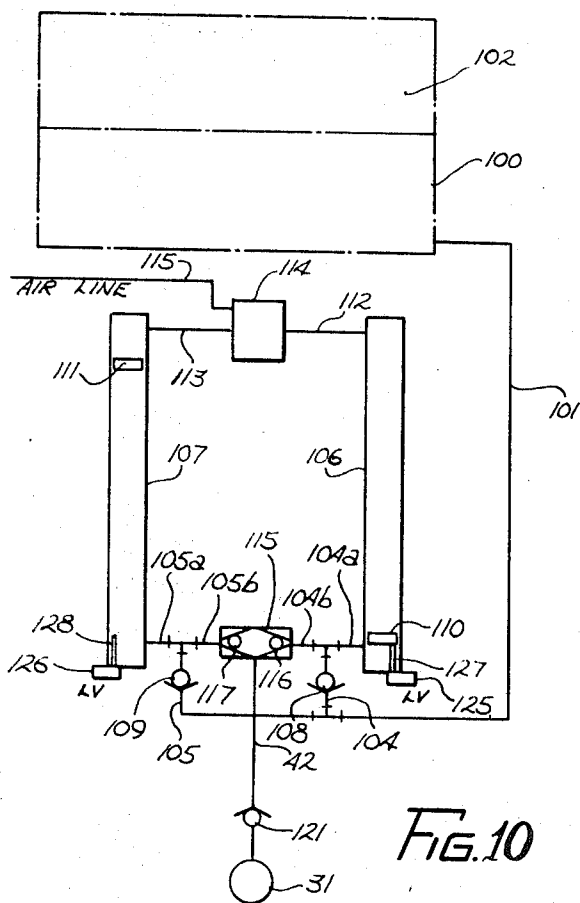
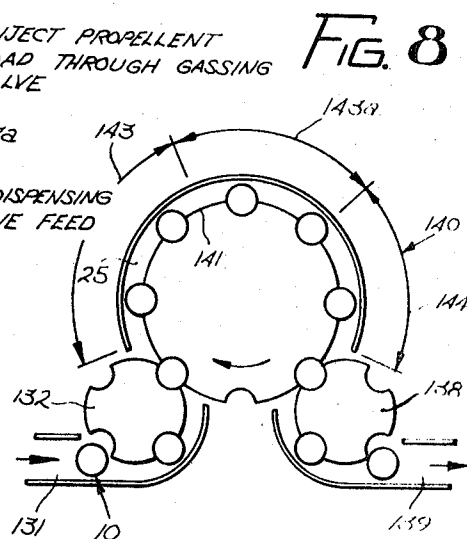
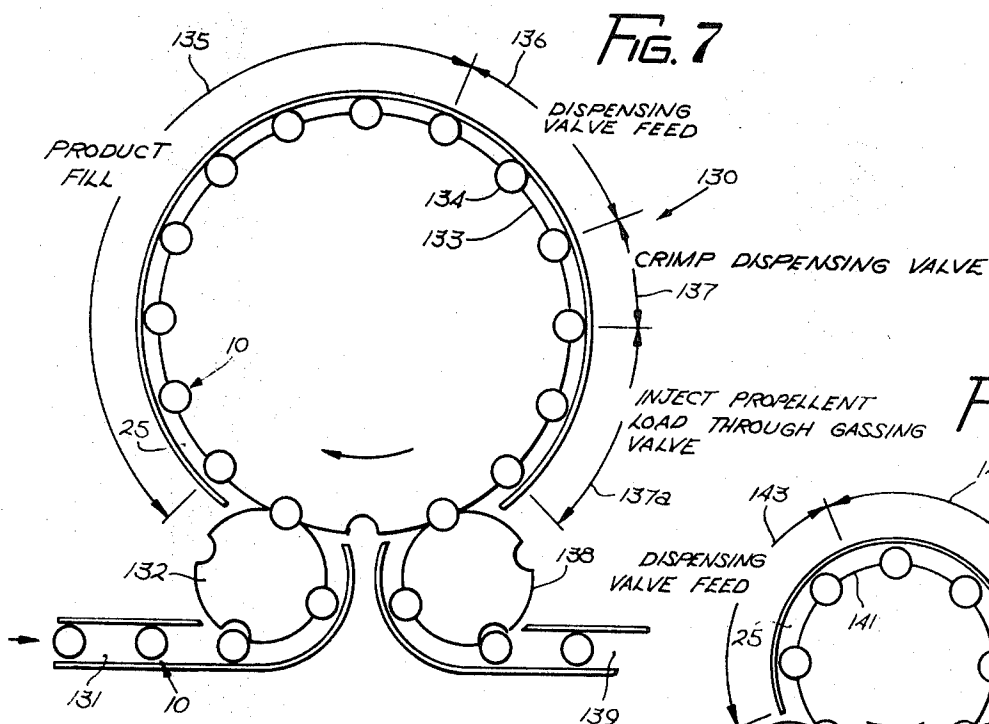


FIG. 5

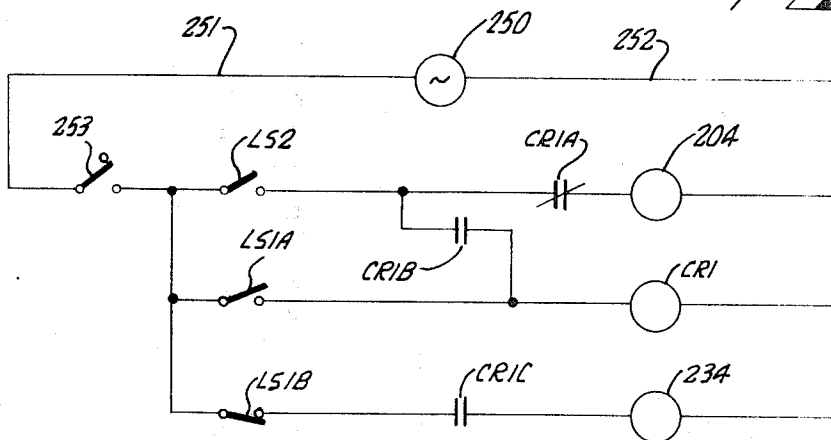
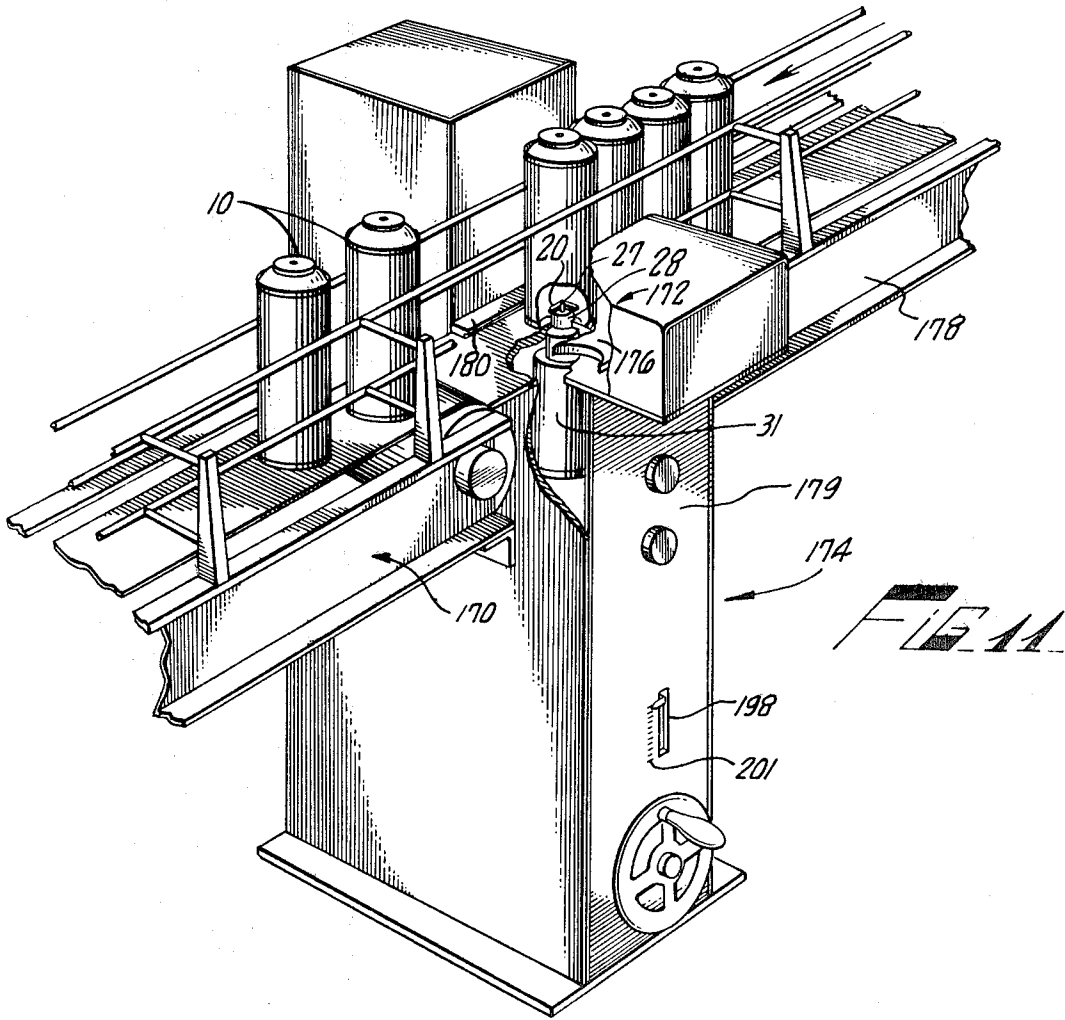
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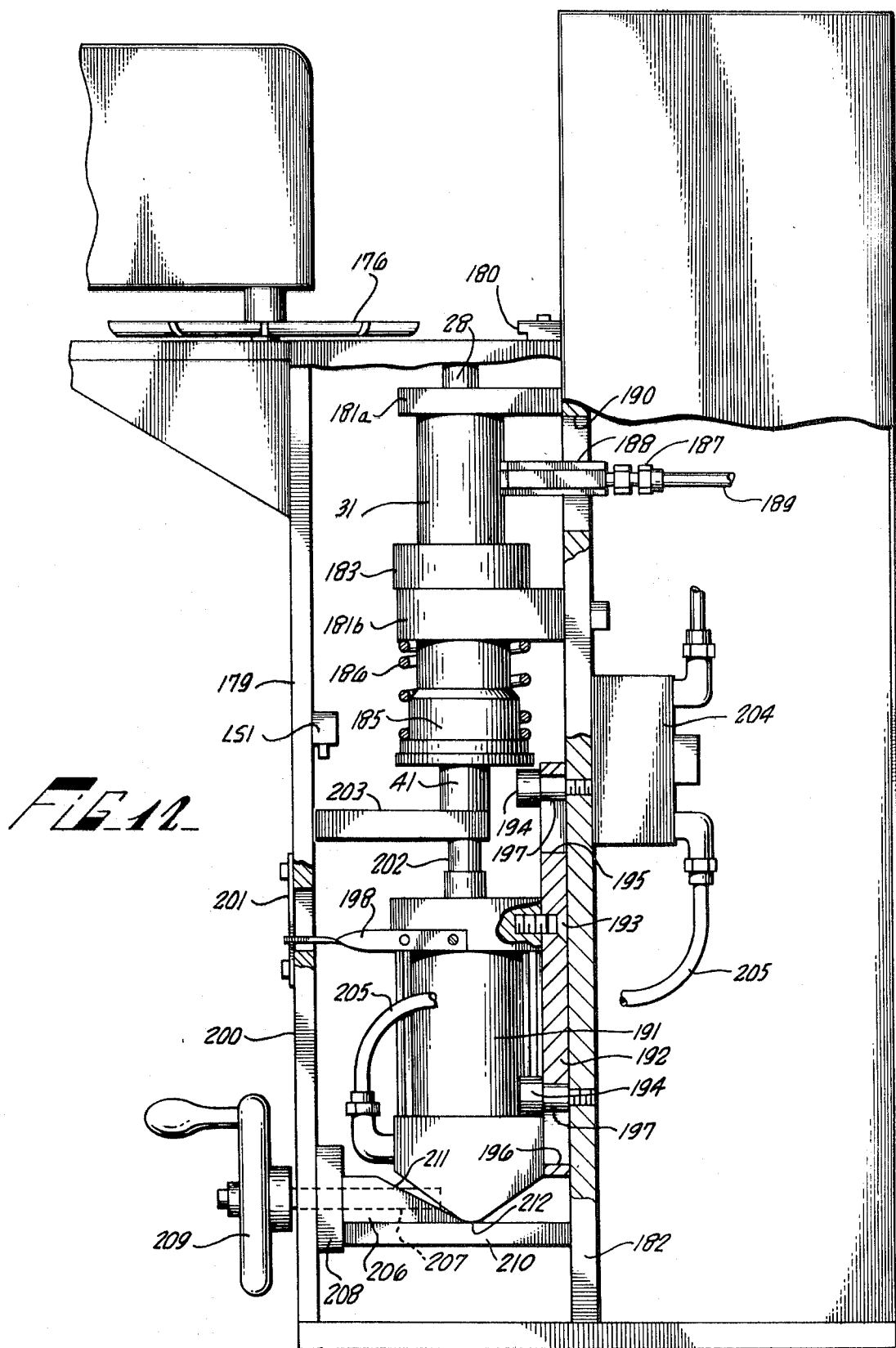
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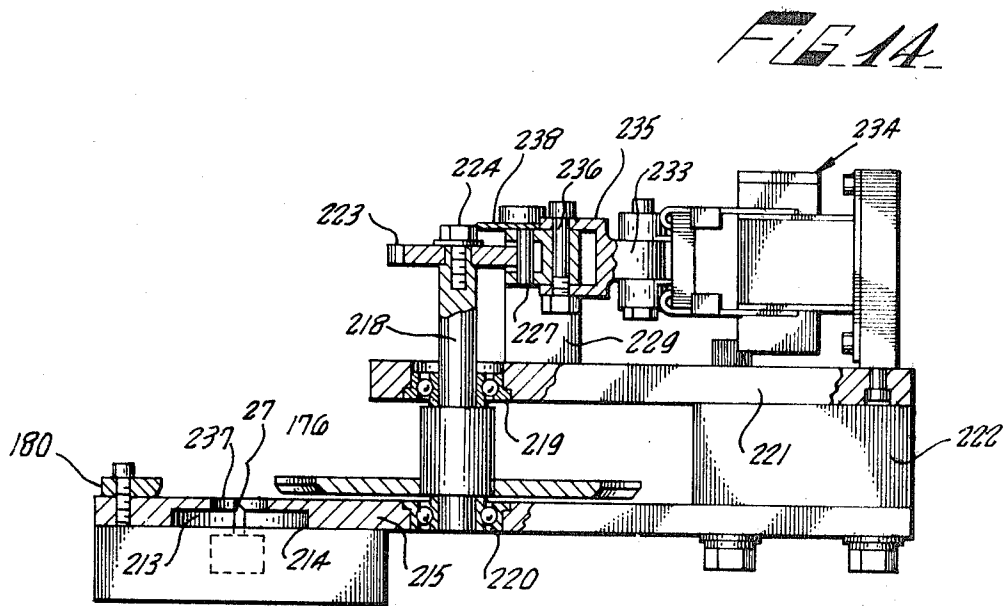
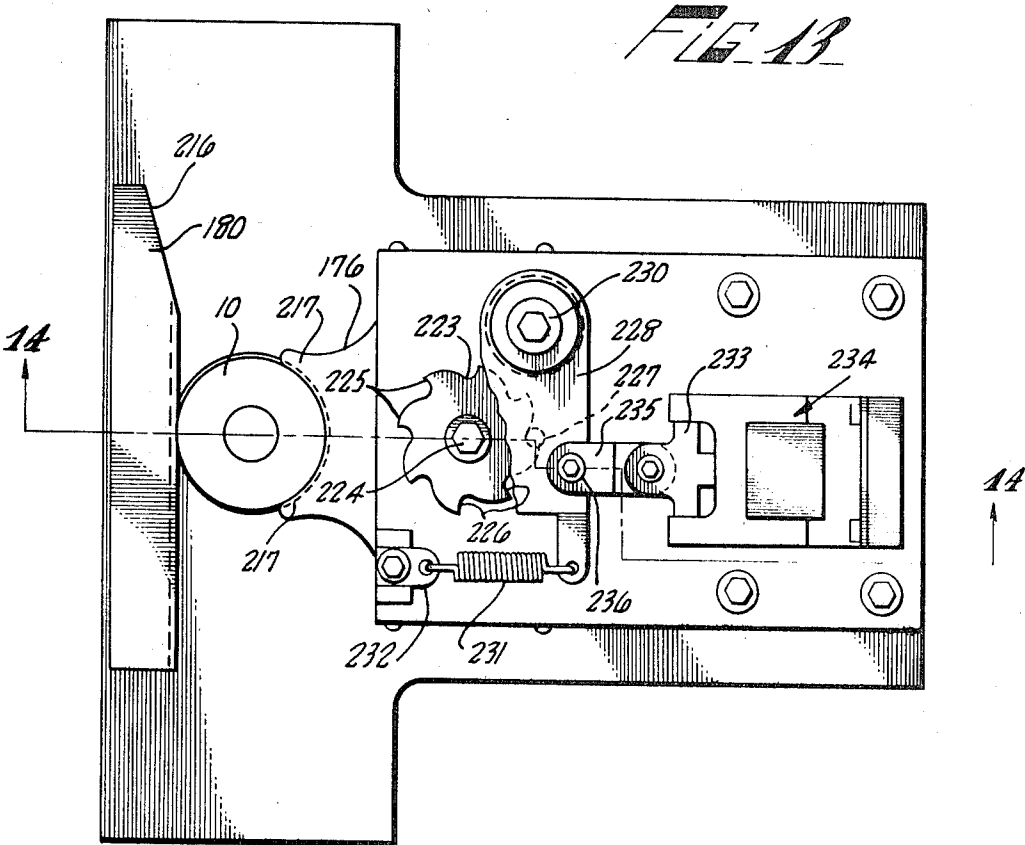


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APPARATUS FOR INJECTING PROPELLANT INTO A DISPENSING CONTAINER

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is a continuation-in-part of U.S. Pat. application, Ser. No. 638,114, filed May 12, 1967, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for injecting a pressurizing propellant into dispensing containers and, more particularly, to injecting into such containers a propellant through an injection needle by passage of the needle through the container's gassing valve and actuating an injector valve to communicate the container's interior through the needle with the propellant upon actuation of the valve by the container.

Pressurized containers are becoming increasingly popular as packaging media for various types of products. These containers are sometimes referred to as "aerosol" dispensers or "bombs." Generally, these containers are in the form of cylindrical cans filled with a mixture of the product to be dispensed and a propellant such as Freon. When a finger-operated dispensing valve on the container is actuated, the product together with the propellant are dispensed through the valve.

The use of pressurized dispensers having their propellant and product mixed together, however, has proven very unsatisfactory in many respects.

Initially, the propellant must be miscible with the product to be dispensed, a criteria which cannot be met for many products which would be desirably contained in pressurized dispensers.

Oftentimes, a particular product is not suitable for pressurized dispensing because the combination of the product and the propellant results in an unacceptable change of product characteristics and performance. For example, in food products there is a definite requirement for a given texture and flavor which often cannot be produced when the food product is mixed with propellant. Catsup, for example, becomes a pink foam.

Moreover, many products are not suitable for pressurized dispensing because of chemical interaction between the product and the propellant or the product and its metal container.

As a result of the inherent inadequacies in pressurized dispensers having product and propellant mixed together, pressurized dispensers having their propellant and the product separated have been designed.

One of the most satisfactory of the new generation of pressurized dispensing containers is disclosed in U.S. Pat. No. 3,393,842 to John K. and Theodore R. Bruce.

The patentees disclose a pressurized dispensing container which utilizes a flexible bag or tube disposed within the container body and retained at the seam between the body and the container's top or cover. A dispensing valve is located in the cover in product communication with product in the bag. Propellant is present on the outside of the bag to pressurize the product and force product through an actuated dispensing valve.

The propellant is introduced into the patentees' dispenser by an injection needle passing through a small orifice in the bottom of the dispenser and a self-sealing gassing valve covering the orifice. Pressurization occurs after the product has been introduced into the bag and the dispensing valve installed in the cover of the container. This procedure is a marked contrast to the propellant charging procedure employed with the aforementioned aerosol-type dispenser.

With aerosol dispensers, propellant and product are introduced into the top of dispenser. Propellant, for example, has been back-charged through the aerosol dispenser's dispensing valve. Alternately, very low temperature introduction of propellant into the container has been contemplated. In any event, the propellant has not been introduced by way of

an injection needle which passes through a small orifice at the bottom of the dispenser.

The requirements for successful introduction of a pressurizing propellant into a dispenser such as that described in the Bruce et al. patent requires an injection apparatus which is uniquely suited for injecting propellant into this type of pressurized container. The injection apparatus must reliably index on each container in order to find the small orifice in the container's bottom through which an injection needle can pass. Moreover, the apparatus must not inject propellant until the container is in position to receive it to avoid propellant loss and, especially in production on a mass scale, uncharged containers. In addition, propellant injection apparatus should accurately and reliably meter the amount of propellant charge for each container in order to avoid excessive propellant consumption.

SUMMARY OF THE INVENTION

The present invention provides a propellant injector apparatus which firmly holds a dispenser to be pressurized with propellant while a ram advances an injection needle through the gassing valve of the dispenser and carries an injector valve to the dispenser's bottom where it is actuated to admit propellant into the dispenser through the injection needle.

In one form, the present invention contemplates the use of a propellant in a propellant chamber defined by a translatable cylinder and the ram to carry the injector valve and the injection needle to the dispenser to be pressurized. The motion of the cylinder is arrested in a first terminal position, a position corresponding to the actuated position of the injector valve, while the ram's motion within the cylinder continues to force propellant from the propellant chamber through the open injector valve, the injection needle, and into the propellant chamber of the container being pressurized.

The present invention contemplates means on a frame for receiving and firmly holding a container to be pressurized in an injection position. These means effectively hold the container in one position against the force exerted on the container by the injection needle and the injector valve. The means may be in the form of undercut rails which receive the bottom seam flange of a container to be pressurized.

In more specific form the invention contemplates a cylinder having a leading end and a bore, the cylinder being mounted on the frame for translation to the first terminal position and a second terminal position. As was previously mentioned, the first terminal position corresponds to the position at which the injector valve is actuated and the injection needle is within the propellant chamber of the dispenser being pressurized. The second terminal position is spaced from the first and, of course, is in the line of movement of the cylinder. As before, the ram cooperates with the cylinder to define a propellant chamber in the leading end of the cylinder. Means are also provided to introduce propellant into the propellant chamber. These means may comprise a source of pressurized propellant and a port leading into the propellant chamber.

Means is also provided to selectively move the ram towards the injection position and to thereby carry the cylinder towards its first terminal position through a fluid coupling provided by propellant in the propellant chamber and to continue movement of the ram after the cylinder reaches its first terminal position to force propellant through the then open injector valve and injection needle into the interior of the dispenser being pressurized.

The injector valve, more specifically, has means responsive to engagement with the dispenser being pressurized to open the valve at the cylinder's first terminal position. The injection needle is carried by this injector valve and extends therefrom axially towards the gassing valve of a dispenser to be pressurized in position to pass through the gassing valve as the cylinder approaches its first terminal position. The injection needle is propellant communicated with the propellant chamber when the injector valve is open.

It is preferred that the propellant chamber volume be variable to accommodate different propellant charge requirements of different dispensers. To this end, means is provided to change the effective propellant chamber volume, that is, the volume in the cylinder displaced by the ram after the cylinder position its terminal position but while the ram is still moving towards the injection position.

A specific form of the means to accomplish propellant chamber volume variation employs a fluid actuated cylinder and piston. A piston rod of the piston engages the end of the ram opposite the propellant chamber. The position of the piston and cylinder relative to the injection position is variable. The fluid cylinder is controlled such that when the injector valve is actuated by its engagement with the dispenser, the fluid cylinder is deactivated to allow the return of the ram and the cylinder to their initial or starting position. The variation of the position of the fluid cylinder relative to the injection position effects a difference in the volume displaced by the ram in the cylinder because as the ram reaches a predetermined point in the cylinder, the fluid cylinder is deactivated and the ram returns to its initial position. Effectively, the stroke or displacement of the piston is varied.

The present invention also contemplates the use of a unique dispenser lock. Briefly, this unique dispenser lock includes means such as a star wheel to positively hold a dispenser in the propellant injection position and act as a gate against the advance from a dispenser input of dispensers into the propellant injection position. The star wheel is locked in place during propellant injection by, for example, a spring-biased pin in a ratchet wheel.

The present invention provides an effective, reliable and economical propellant injection device especially adapted for use in injecting propellant into bag-in-can-type dispensers through their gassing valves. The ram simply and reliably brings the injector valve into contact with the dispenser and thereafter effects injection of a metered amount of propellant into the dispenser. There is no danger of discharging propellant until a dispenser is in position to be injected because the injector valve cannot be actuated until a dispenser is in place.

These and other features, aspects and advantages of the present invention will become more apparent from the following description, appended claims and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a dispenser which can be loaded or charged with a propellant by the apparatus of the present invention;

FIG. 2 is a side elevational view of the propellant loading cylinder of the present invention in its position furthest from the propellant injection position showing the injection needle thereof at its leading end and the ram at the opposite end;

FIG. 3 is a side elevational view similar to FIG. 2 showing the cylinder in its uppermost or first terminal position with the container partly in section;

FIG. 4 is a vertical section of the loading cylinder in its lower or second terminal position and a partial vertical section of the container;

FIG. 5 is a vertical section loading cylinder in its uppermost position, as illustrated in FIG. 3, and a partial vertical section of the container;

FIG. 6 is a side elevational view of the section of the cam track which can move the propellant discharge ram and cylinder through a complete propellant loading cycle;

FIG. 7 is a diagrammatic illustration of a container conveyor in which a single conveyor table handles product fill, dispensing valve feed, and crimping of the dispensing valve and injection of the propellant;

FIG. 8 is a diagrammatic illustration of a packaging in which the conveyor table handles dispensing valve feed, crimping dispensing valves and injection propellant;

FIG. 9 is a diagrammatic illustration of the container conveyor in which only the injection of the propellant takes place on the conveyor table;

FIG. 10 is a schematic illustration of the automatic control system for feeding the propellant loading cylinder;

FIG. 11 is a perspective view of an alternate form of a propellant loading apparatus of the present invention;

FIG. 12 is a rear elevational view, somewhat in section and fragmented, of the embodiment of the invention shown in FIG. 11;

FIG. 13 is a top plan view of the unique dispenser lock of the present invention, shown in general in FIGS. 11 and 12;

FIG. 14 is an elevational view, partly in section, taken generally along lines 14—14 in FIG. 13; and

FIG. 15 is a line schematic of the preferred control circuit of the embodiment illustrated in FIGS. 11 through 14.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

To facilitate an understanding of the propellant injection device of the present invention, a dispenser or container which can be injected with a pressurizing propellant will be described. A typical dispensing container consists of a can 10 having a rigid body 11 formed of cylindrical tubing. The can has a cover or cap 12 which is secured to cylindrical body 11 at a seam 13 in a well-known manner. Cover 12 contains a dispensing valve 14 which dispenses the contents of the can when the valve is actuated. The bottom of the can is closed by a bottom cap or cover 15 which is secured to body 11 at a seam 16 in a well-known manner. The can contains a flexible liner or bag 17 formed of thin-walled plastic tubing. The bag is within the body and extends along its interior wall towards the can bottom. The bag is secured within seam 13. The product to be dispensed is loaded into bag 17 after the top and bottom covers are attached. Thereafter, the dispensing valve is attached to the top cover and propellant is charged into the propellant cavity. The operations of attaching bottom cover 15, top cover 12 and dispensing valve 14, as well as the filling operation for the bag, can be accomplished on a conveyor line by well-known means. As indicated, bag 17 stops short of the bottom cover 15 to provide a propellant space or cavity 18 within the can.

A self-sealing valve 20 is attached to the interior surface of bottom cover 15 and covers an opening or orifice 21 in the bottom cover. Propellant may be injected into propellant cavity 18 while the container is riding on a conveyor 25. For propellant injection, the conveyor has an opening 26 for permitting passage of an injection needle 27 and its supporting injector valve or plunger 28.

Referring to FIGS. 2 through 5, a propellant injection apparatus 30 for injecting propellant into a dispenser of the type just described includes a loading cylinder 31 which can slide vertically in openings 32 and 33 in horizontally movable plates 34 and 35, respectively. Plates 34 and 35 can move horizontally along with the conveyor 25 in order to maintain cylinder 31 underneath a can 10 so that needle 27 follows the can for its injection at the appropriate time. Cylinder 31 has a bore which includes a propellant chamber 40. The bore receives a discharge ram or piston 41. The propellant chamber is, as a consequence, determined by the position of ram 41 within the bore. The ram extends through the lower end of cylinder 31 for displacement and resulting carriage of cylinder 31 and injection of propellant. Propellant is introduced to propellant chamber 40 through a propellant line 42 which connects with a fitting 43 in an opening 44 in the side of the cylinder. The exposed, lower end of ram 41 carries a fork or clevis 45 which rotatably supports a roller 46. A head end 47 of the ram contains a groove 48 for sealing O-ring 49. The movement of ram 41 towards and away from dispenser 10 between a lower terminal position and an upper terminal position, respectively, is controlled by a cam 50. Cam 50 is stationary and located along the path of movement of cylinder 31.

An upper or leading end 31a of the cylinder 31 is closed by a plug 56. This plug is held against a shoulder 57 of cylinder 31 by means of an end plug 58 which is secured by threads 59 in complementary threads in the leading end of the cylinder. End plug 56 has a cylindrical flange 60 abutting plug 56 to main-

tain its axial position in cylinder 31. A displacement space 62 is defined within flange 60 for axial movement of plunger 28. Leakage of propellant past plug 56 is prevented by a sealing O-ring 63 located in a circumferential groove in the plug. End plug 58 also has an axial bore 66 which slidably receives plunger 28. The plunger includes a cylindrical sleeve 67 received in bore 66. This sleeve has a lower flange 68 within space 62 to limit displacement of the plunger axially away from ram 41 by engagement with an upper radial shoulder 62a bounding space 62. Plug 56 provides a stop against which sleeve 67 can abut in the opposite direction.

A passage member 70 has a head 71 which is held in position against a flange 72 of sleeve 67 by means of a snap ring 73. A stem 74 of the passage member projects downwardly from head 71 and through an opening in plug 56. Sealing rings 75 and 76 are located within an axial recess in plug 56 and around stem 74 in order to provide a seal against propellant passage from propellant chamber 40. These rings are separated by a bushing 77. A snap ring 78 located in an enlarged portion of the recess in plug 56 holds the sealing rings and bushings in place.

Compression spring 80 is located between snap rings 73 and 78 to continually exert a force on plunger 28 which urges the plunger towards the position shown in FIGS. 2 and 4 with flange 68 engaging radial shoulder 62a of displacement space 62.

Needle 27 is secured in a base 81 which is positioned in the bore of sleeve 67 adjacent head 71. A sealing O-ring 82 is located between base 81 and head 71. A threaded plug 83 is received in complementary threads in the bore at the upper end of sleeve 67 to hold base 81 in position against O-ring 82. Needle 27 extends through plug 83 and base 81 into communication with one end of a propellant passage 85 in passage member 70. The other end of passage 85 has a propellant inlet opening 86 spaced from its lower end and extending radially through the wall of stem 74.

Since passage member 70 and needle 27 are locked in the bore of sleeve 67 by plug 83, it is apparent that these members move together with sleeve 67 and that sleeve 67 can move downwardly from the position shown in FIG. 4 to the position shown in FIG. 5 against the force of spring 80. When plunger 28 is in its upper position, as shown in FIG. 4, inlet opening 86 in passage member 70 is located opposite bushing 77 and is sealed so that no propellant can enter passage 85 from propellant chamber 40. However, when the plunger 28 is moved downwardly against spring 80 into the position of FIG. 5, inlet opening 86 clears the bottom of plug 56 and communicates with propellant chamber 40.

The operation of the injecting apparatus just described follows. During the time for the injection of the propellant, dispenser 10 is moving on the conveyor 25 and propellant injection apparatus 30 is being moved along with it by plates 34 and 35 to maintain needle 27 in proper position for injecting propellant into dispenser 10.

At the start of propellant injection, roller 46 rides up section 90 of cam 50 (see FIG. 6) in order to move the cylinder from the position of FIGS. 2 and 4 into the position of FIGS. 3 and 5, that is, to move the cylinder from a terminal "at rest" position to a terminal injecting position. During upward movement of roller 46 along cam section 90, fluid propellant in propellant chamber 40 provides a fluid link between cylinder 31 and ram 41 so that cylinder 31 moves upwardly with roller 46 while injection valve or plunger 28 is in its upward position with flange 68 engaging radial shoulder 62a. The needle first passes through orifice 21 in bottom cover 15 of the dispenser and then through gassing valve 20 without compressing spring 80, since the spring is sufficiently strong to resist the force required to insert the needle through valve 20.

Thereafter, over the last portion of cam section 90, upper surface 67a of sleeve 67 engages bottom cover 15 of the container and moves the sleeve downwardly against the force of spring 80 until inlet opening 86 moves into the propellant chamber 40.

Roller 46 now engages section 91 of cam 50. Over this section the roller moves ram 41 up into the cylinder from its position in FIGS. 2 and 4 to its position in FIGS. 3 and 5 to force propellant in propellant chamber 40 through inlet opening 86 into passage 85, through needle 27 and into the propellant cavity 18 of the dispenser.

After the propellant charge is injected into the dispenser, roller 46 rides downwardly on section 92 of the cam. During this withdrawal portion of the cycle, ram 41 first moves downwardly in the cylinder 31 while propellant chamber 40 fills with propellant until stops 98 of the ram hit the bottom of slots 99 in the wall of cylinder 31. Thereafter, the weight of cylinder 31 and ram 41 pulls the needle 27 out of valve 20, after flange 68 abuts shoulder 62a and all of the parts of apparatus 30 again return to the initial position shown in FIG. 2.

Upward movement of cylinder 31 is limited by the stop flange 95 on the cylinder which engages bottom of top plate 34 after the plunger 28 has been moved downwardly to the propellant charging a loading position. Thus, stop 95 prevents upward movement of the cylinder which might cause the end of the plunger 28 to deform the bottom wall 15 and enable ram 41 to discharge propellant from propellant chamber 40.

The schematic of FIG. 10 illustrates a system for automatically supplying propellant chamber 40 with propellant at the desired liquid state and pressure. The propellant is stored in liquid form in a tank 100 and is fed in a line 101 to inlet lines 104 and 105 of accumulators 106 and 107, respectively. A check valve 108 is located in line 104 and permits the propellant to flow only to the accumulator and not in the reverse direction. In a similar manner, a check valve 109 is located in line 105 and permits propellant to flow only to accumulator 107 and not in the reverse direction. Accumulator 106 contains a free floating piston 110 while accumulator 107 contains a free floating piston 111. The top of accumulator 106 is connected to air line 112 and the top of accumulator 107 is connected to air line 113. These air lines lead to a four-way air valve 114 which is supplied by pressurized air from a line 115.

Discharge lines 104b and 105b connect portions 104a and 105a of lines 104 and 105, respectively, to a discharge valve 115 which contains a ball check valve 116 for line 104b and a ball check valve 117 for line 105b. Each of these ball valves permits flow in only one direction from its associated accumulator to cylinder 31 through line 42 and a check valve 121. The lower end of accumulators 106 and 107 mount limit switches 125 and 126, respectively, having actuating arms 127 and 128 which are moved respectively by pistons 110 and 111 when they reach their lowest position. As illustrated in FIG. 10, piston 110 has just reached the limit arm 127 and the piston 111 is in its upper position. The pistons of the accumulators move in opposite directions since one accumulator is being filled with propellant while the other is discharging.

In operation, when the piston 110 operates limit switch 125, this limit switch shifts valve 114 to remove the air pressure from line 112 and direct air pressure solely to line 113. Prior to this time, accumulator 107 has been filled with propellant and air pressure drives piston 111 downward in order to discharge propellant through lines 105a and 105b and through valve 115 to the line 42. At the same time, the pressure in line 105a keeps valve 109 closed and the pressure in propellant valve 115 keeps valve 116 closed. At the same time, propellant from supply line 101 is directed past valve 108 and through line 104a into the accumulator 106 below piston 110. Accumulator 106 fills with propellant and raises piston 110 while piston 111 discharges propellant until it hits limit arm 128 of switch 126. At this time, piston 110 has reached its uppermost position and accumulator 106 has filled with propellant. Actuation of switch 126 cuts off air pressure from line 113 and opens line 112 in order to drive piston 110 downwardly to discharge propellant through lines 104a and 104b and through valve 115 to line 42. The pressure in line 104a keeps valve 108 closed and the pressure in valve 115 keeps the valve 117 closed. At this time, propellant is again supplied past valve 109 and through line 105a to commence the filling of accumulator 107.

The pressure of the propellant in line 101 is exerted by propellant gas pressure in the upper space 102 of tank 100 plus the force of gravity and this pressure is sufficient to raise pistons 110 and 111. The pressure of the air entering line 115 is sufficient to move pistons 110 and 111 against the propellant pressure in the accumulators in order to discharge the accumulators into cylinder 31.

It is therefore apparent that the propellant supply system provides a steady supply of liquid propellant to line 42 of cylinder 31 at a predetermined propellant pressure and, of course, line 42 could connect in parallel with additional propellant loading cylinder 31. Four-way valve 114 and limit switches 125 and 126 are of well-known construction and are connected in a well-known manner such that valve 114 is open either to line 112 or 113 and is held in one position by the actuation of one switch until it is moved into another position by the actuation of the other switch. Check valve 121 prevents reverse flow of the propellant to an accumulator during upward movement of the ram which develops a higher pressure in propellant chamber 40 than exists in the loading accumulator. It also follows that during the ram upward movement, no additional propellant will enter propellant chamber 40. A pressure relief valve 120 is connected to cavity 40 to discharge propellant in case a container is not in position to receive the propellant as the ram moves upwardly. Since a constant supply of pressurized propellant is available to line 42 and propellant chamber 40, it is apparent that when the roller 46 moves down incline portion 92 of cam 50 that the propellant fluid will immediately flow into propellant chamber 40 and thereafter the weight of the cylinder will move the needle out of the valve 20. During rise, portion 90, return portion 92, and dwell portion 93 of cam 50, propellant will enter propellant chamber 40. As follower 46 reaches cam section 91, the propellant charge has been loaded and will be discharged thereafter into the dispenser by movement of the ram into the cylinder.

Self-sealing valve 20 consists of a top layer 123 of natural rubber, an intermediate layer 124 of uncured rubber, and a bottom layer 124 of natural rubber. Layer 125 is bonded to bottom cover 15 and all the layers are bonded together. As indicated in FIG. 5, the outer layers prevent the uncured rubber from following needle 27 as it is injected through the self-sealing valve and withdrawn. After withdrawal of the needle, valve 20 immediately seals because of the self-healing property of the intermediate uncured rubber layer to prevent leakage of propellant out of the dispenser through the valve.

Various conveyor stations are illustrated in FIGS. 7, 8 and 9 which accomplish a different number of operations of a dispenser. In FIG. 7, dispensers 10 enter a conveyor station 130 on a conveyor 131 and are moved by a drive 132 onto conveyor plate 25. As the dispensers enter conveyor 25, they are held in position by cutouts in a plate 133. During movement around an arc 135, product is filled into the bag or liner 17 of the dispensers. Over an arc 136, dispensing valves 14 are placed over openings in covers 12. Over an arc 137, the dispensing valves are crimped to covers 12. Over an arc 137a, propellant is charged into the dispensers by needle 27. Plates 34 and 35 rotate injecting apparatus 30 with and under the dispenser as they move over arc 137. By the time the dispensers reach the end of arc 137, the needle has been withdrawn so that the dispenser can be moved by a drive 138 onto a conveyor section 139. It is understood that a certain portion of the raising of the cylinder 31 can be accomplished through arc 137 prior to final crimping of the dispensing valves 14.

In FIG. 8, a conveyor station 140 is fed with dispensers 10 from conveyor 131. Drive 132 moves the dispenser onto conveyor 25 and into the cutouts of a drive plate 141. At station 140, dispensing valves 14 are placed on covers 12 over an arc 143. The dispensing valves are crimped to the cover over an arc 143a. Propellant is injected into the dispenser over an arc 144. Thereafter, drive 138 moves the cans onto conveyor 139.

In FIG. 9, a station 150 is fed dispensers 10 from conveyor 131. The dispensers are moved by drive 132 onto conveyor 25 where they are driven around the conveyor by cutouts in a

plate 151. The only operation conducted at station 150 is the injection of propellant over an arc 153. The dispensers are removed by drive 138 from conveyor 25 onto conveyor 139. Thus, the propellant injection operation can be the only operation accomplished at one station along with a plurality of other operations.

The embodiment of the invention illustrated in FIGS. 11 through 15 will now be described.

This embodiment of the invention has in common with the previously described embodiment propellant injection cylinder 31, ram 41, injection needle 27, and injector valve 28. Accordingly, these will not be described in detail. However, the means of actuating the propellant-discharging ram and for advancing, indexing and locking a dispenser in a propellant injection position are different.

In generalized form, this embodiment of the invention contemplates an input conveyor 170 which advances dispensers to be pressurized towards a locking and indexing assembly 172 of a propellant injector apparatus 174.

The locking and indexing assembly includes a star wheel 176 which, during a portion of the injection cycle, is free to rotate in response to dispensers arriving from the input conveyor to allow dispensers to reach their injection position. When each dispenser reaches the injection position, however, the star wheel locks. Dispensers which have been injected with a pressurizing propellant are discharged onto an output conveyor 178 in response to rotation of the star wheel by advancing dispensers. Each dispenser, during injection, is vertically retained by rail 180 and the star wheel; as illustrated in FIGS. 12 and 14, rail 180 and each recess of star wheel 176 have undercuts to engage the lower seam of the dispenser to be injected with propellant and to vertically retain the dispenser during injection.

Injection needle 27, again during a predetermined portion in the cycle, advances through gassing valve 20 of each dispenser 10 in preparation for the injection of propellant into the dispenser. After a dispenser has been charged, the star wheel will discharge it onto output conveyor 178 while receiving a new dispenser from input conveyor 170 for injection with propellant. The locking and indexing assembly and the input and output conveyors present a substantially continuous surface for dispensers 10. The conveyors, locking assembly and the propellant injection apparatus may all be mounted on a pedestallike frame 179.

Cylinder 31 of the propellant injection apparatus illustrated in FIG. 12 is translationally disposed in a pair of horizontal bosses 181a and 181b, which may have slide bearings for the easy translation of the cylinder. These bosses are attached to upright wall 182 of frame 179. A collar 183 is secured around the outside of the cylinder and determines by its abutment with boss 181b the lower or second terminal position of the cylinder. The cylinder has a shoulder 185. This shoulder and boss 181b provide bearing for a compression return spring 186 which encompasses the lower portion of the cylinder. The compression spring urges the cylinder into the position shown in FIG. 12, that is, away from the first terminal position of the cylinder.

Means are provided to inject propellant into the cylinder's bore above the upper terminus of the ram, as in the previously described embodiment. These means may include a fitting 187, a check valve 188 and a propellant hose 189. The propellant hose is connected to the fitting, and through the fitting, to the check valve. The check valve serves to prevent back flow from the propellant chamber into the propellant line. Wall 182 of frame 179 is cut out at 190 in order to provide for vertical movement of check valve 188, the latter, of course, being carried by cylinder 31.

Wall 182 also mounts a pneumatic cylinder and piston assembly 191. Cylinder assembly 191 is mounted on a plate 192 as by flush head screws 193. Plate 192, in turn, is mounted for translation towards and away from the injection position by shoulder screws 194, these screws being secured in wall 182. For the purpose of translation, plate 192 is cut out at 195 and

196 to allow the plate to move with respect to the shoulder screws. The shoulder of the screws, indicated by reference numeral 197, provide increased bearing area for plate 192.

An indicator 198 is secured to cylinder 191 and extends outwardly through a hole in a wall 200 of frame 179 to register the cylinder's position on a scale 201. The scale is secured to wall 200. The scale reflects the propellant volume in propellant chamber 40.

A reciprocating piston rod or shaft 202 is attached to the piston of cylinder 191 and serves as a ram-driving member. Shaft 202 carries a switch actuator 203. It also engages ram 41. The switch actuator is responsible for the energization of a solenoid-actuated valve 204. This solenoid-actuated valve controls the flow of air through a line 205 to cylinder 191. As a consequence, the position of switch actuator 203 determines the point that shaft 202 begins to lower, and therefore the end of the propellant injection stroke of ram 41.

As was previously mentioned, pneumatic cylinder 191 is vertically adjustable. This adjustment is very simply effected by a slide 206 which has female threads that receive a male threaded screw 207. The screw is journaled in a bearing block 208 and wall 200. An adjustment wheel 209 is keyed to the screw. A track 210 guides the slide and provides support against the weight of cylinder 191. The slide has an inclined surface 211 which engages a rounded bearing surface 212 of the cylinder. Movement of the slide towards and away from the axis of the cylinder produces positioning of the cylinder towards and away from the injection position, respectively. The cylinder's position relative to the injection position, in turn, determines the lower or initial position of ram 41. Inasmuch as the position of cylinder 31 at its initial position is determined by collar 183, the volume of propellant chamber 40 is determined by the position of cylinder 191.

Switch actuator 203 is mounted on shaft 202, as previously mentioned. The switch actuator is responsible for actuating a limit switch LS1 which controls the circuit of solenoid-actuated valve 204. (This switch corresponds to limit switch element LS1A and LS1B in the circuit diagram of FIG. 15.) Because the position of this switch is fixed and the position of the actuator is variable, the latter being carried by shaft 202 which is vertically adjustable because of slide 206, the volume of propellant chamber 40 is variable. Thus with cylinder 191 in the position illustrated in FIG. 12, the actuator is relatively far from the switch at the beginning of the injection stroke. Therefore, shaft 202 carries ram 41 a relatively great distance. During this travel, cylinder 31 goes a prescribed distance, the distance between boss 181b and a surface 213 of a recess 214 in a baseplate 215 of locking assembly 172. The volume swept by the ram, however, is relatively large. Conversely, when the switch actuator is relatively close to the switch, as when cylinder 31 is moved closer to the injection position by slide 206, a smaller propellant chamber volume results. This is because the stroke of shaft 202 to carry actuator 203 to limit switch LS1 is small. As a consequence, the percentage of the ram's displacement of propellant within the cylinder after the cylinder has reached its first terminal position is relatively small.

With specific reference to FIGS. 13 and 14, the unique indexing and locking mechanism of the present invention is shown.

Briefly, a guiding surface 216 of rail 180 on baseplate 215 forces dispensers advancing from input conveyor 170 into star wheel 176. Star wheel 176 has a plurality of recesses defined by dispenser guiding and locking fingers 217. The recesses have a periphery conforming to the circumference of containers to be pressurized. As was previously mentioned, fingers 217 are undercut to hold a dispenser firmly in place.

The star wheel is mounted on an axle 218 which is journaled in bearings 219 and 220. These bearings are secured in baseplate 215 and a platform 221. The platform is secured above the base by bolts and a spacer block 222. Axle 218 extends upwardly from the platform 221 for the mounting of a ratchet wheel 223. The ratchet wheel is mounted to the axle as

by a bolt 224. The wheel has a plurality of teeth 225. These teeth define recesses 226 for the receipt of a locking pin 227 which locks the ratchet wheel and the star wheel against rotation. The periphery of each tooth is configured to act as a camming surface when pin 227 is forced against it to allow advance of the star wheel through force applied on it by advancing containers on conveyor 170. The amount of free rotation permitted the star wheel is somewhat arbitrary but it is less than the angle measured from the axis of rotation of the star wheel between two adjacent recess defining fingers.

Pin 227 is mounted in an arm 228 which is mounted for rotation through a limited arc on stand 229 through a bolt 230. The arm is spring-biased to force the pin into a locking recess of ratchet wheel 223, as shown in FIG. 13, by a spring 231 which is secured to the arm and to an anchor 232 on platform 221. The arm is also controlled by a displaceable element 233 of a solenoid 234. The displaceable element is pivotally connected to the arm through a clevis 235 and a pin 236, the pin being in the form of a bolt. A similar clevis-type arrangement of arm 228 provides for the mounting of pin 227. At any rate, energization of the solenoid overcomes spring 231 to rotate the arm counterclockwise in FIG. 13 to free the star wheel for the advance of a new dispenser to be pressurized into the injection position.

The injection position is a position immediately over the line of movement of the axis of the injection cylinder and, consequently, the injection needle. Baseplate 215 has a hole 237 for the passage of injection needle 27. Counterbore or recess 214 receives the top of injection cylinder 31 and, as a consequence, determines the cylinder's first terminal position or the position corresponding to the cylinder's injection position.

With reference to FIG. 15, a line schematic illustrates the controls of the embodiment of the invention shown in FIGS. 11 through 14. Briefly, the controls include a source of AC current 250, a hot lead 251 and a ground lead 252, both leads being wired to this source of current. An on-off switch 253 controls the balance of the illustrated circuit. The coil of the solenoid of air valve 204 is in series circuit with normally closed contacts CR1A of control relay CR1 and normally open limit switch LS2. Limit switch LS2 is positioned to close when it senses the presence of a dispenser in the injection position and open when star wheel 176 rotates a limited angle after a dispenser has been injected and during the positioning of a new dispenser to be injected. This angle is less than the 45° spacing of the star wheel fingers illustrated, an angle of 15° being found satisfactory. Limit switch element LS1A is in series circuit with control relay CR1. Holding contacts CR1B of relay CR1 are wired between the junction of limit switch LS2 and contacts CR1A, and the junction between limit switch element LS1A and control relay CR1. Limit switch element LS1B is wired in series with on-off switch 253 and the series combination of normally open contacts CR1C of relay CR1 and solenoid 234. Limit switch elements LS1A and LS1B are of the limit switch controlled by actuator 203 and therefore close and open, respectively, when the ram completes its injection stroke.

The operation of the embodiment of FIGS. 11 through 15 will now be described.

With a dispenser 10 to be injected with pressurizing propellant in the injection position, shown in FIG. 13, limit switch LS2 is closed, control relay CR1 is out of circuit and air valve 204 is deenergized, the on-off switch being off. The ram, as a consequence, is at the starting point of its stroke. Solenoid 234 is also out of circuit and, as a consequence, star wheel 176 is locked in position by pin 227 being in engagement with a recess 226 of ratchet wheel 223. The locking pin is kept in position by the force of spring 231.

When on-off switch 253 is closed with a dispenser in the injection position, a circuit is completed to the solenoid of air valve 204 and it is energized. The ram will then rise and inject propellant into the dispenser. At the end of its stroke, the ram will close limit switch elements LS1A an open limit switch element LS1B. Limit switch element LS1B, by being open,

prevents a circuit from being established to solenoid 234. Control relay CR1 is therefore energized to open its contacts CR1A and close its contacts CR1B and CR1C. With contacts CR1A open, air valve 204 is deenergized and the ram returns to its starting position, though limit switch LS2 remains closed for at least a portion of the ram's return to allow complete withdrawal of needle 27 from a gassing valve 20 before dispensers on input conveyor 170 rotate the star wheel.

Slightly after the ram's departure from the injection position, limit switch element LS1A opens and limit switch element LS1B closes. But relay CR1 is still in circuit because its holding contacts CR1B remain closed as does limit switch LS2. As a consequence, solenoid 234 is energized after the ram leaves the injection position to free star wheel 176.

A new dispenser from input conveyor 170 will thereupon force the star wheel to turn until limit switch LS2 opens, before a full star wheel's advance of one recess. With limit switch LS2 open, control relay CR1 drops out of circuit to open its contacts CR1C and drop solenoid 234 out of circuit. Pin 227 then contacts a cam following surface of one of the ratchet teeth of ratchet wheel 223. The wheel rotates under the impetus of advancing dispensers until the next dispenser is in the injection position and limit switch LS2 is closed. With the new dispenser in position, the star wheel is locked by pin 227 to prevent dispensers from conveyor 170 displacing the dispenser in the injection position during injection. The star wheel remains locked until after ram 41 begins its return after injection.

It should be noted that injection is impossible until a dispenser is in the injection position because limit switch LS2 controls the circuit to the air valve. It should also be noted that a dispenser to be injected is always indexed accurately in position by pin 227 engaging the ratchet wheel.

I claim:

1. An apparatus for injecting a pressurizing propellant into a product dispensing container through a gassing valve thereof comprising:

- a. a frame;
- b. means on the frame for receiving and firmly holding a container to be pressurized in an injection position;
- c. a cylinder having a leading end and a bore, the cylinder being mounted on the frame for translation between a first cylinder terminal position towards the injection position and a second cylinder terminal position away from the injection position, the leading end facing the injection position;
- d. a ram disposed in the bore for axial movement therein towards and away from the injection position, the ram and the cylinder defining a propellant chamber within the bore proximate the leading end;
- e. means for introducing propellant into the propellant chamber through the wall of the cylinder between the ram and the leading end;
- f. a normally closed propellant injector valve carried by the cylinder in the leading end, the injector valve having means independent of propellant pressure in the propellant chamber which is responsive to engagement with the dispenser to open the valve when the cylinder is in its first terminal position, including a plunger disposed in the leading end of the cylinder for movement along the bore's axis between a closed position relatively away from the propellant chamber and an open position relatively close to the propellant chamber, means to bias the plunger into the closed position, and an end disposed to engage the surface of the container proximate the gassing valve thereof to overcome the bias means and move the plunger to its open position as the cylinder moves to its first terminal position;
- g. an axially hollow injection needle carried by the injector valve and extending therefrom towards the injection position, the needle being disposed in the valve to pass through the gassing valve as the cylinder approaches its first terminal position an for subsequent propellant com-

munication with the propellant chamber when the valve is open;

- h. means to selectively move the ram towards the injection position and carry the cylinder through a fluid coupling provided by propellant in the propellant chamber to the cylinder's first terminal position to open the injector valve, communicate the dispenser's interior with the propellant chamber through the injection needle, and force propellant through the injection needle by continued movement of the ram towards the injection position, the ram moving means including a displaceable ram-driving member coupled to the ram to determined the ram's movement and means to displace the ram driving member;
 - i. means for returning the cylinder to its second terminal position after propellant injection into the dispenser's interior; and
 - j. means for varying the volume of the propellant chamber including means to vary the amount of axial movement of the ram in the bore after the cylinder reaches its first terminal position, means to adjust the position of the displacing means and thereby vary the position of the ram in the bore in the cylinder's second terminal position, and means to terminate the action of the displacing means, such latter means being sensitive to the position of the displacing means and responsive to the displacement of the ram driving member such that the amount of displacement of the driving member and therefore the amount of axial movement of the ram in the bore after the cylinder reaches its first terminal position is determined by the position of the displacing means.
2. The propellant injecting apparatus claimed in claim 1 wherein:
- a. the displaceable ram driving member is a shaft axially aligned with the ram and engaged therewith;
 - b. the displacing means includes a fluid actuated cylinder and piston coupled to the shaft for the latter's displacement; and
 - c. the adjusting means is operable to vary the position of the piston and cylinder with respect to the ram's cylinder.
3. The propellant-injecting apparatus claimed in claim 2 wherein the termination means includes a switch actuator carried by the shaft and a switch means mounted on the frame in position to be actuated by the switch actuator, the switch means controlling the fluid circuit to the cylinder and piston to terminate their actuation when the switch actuator actuates the switch means.
4. An apparatus for injecting a pressurizing propellant into a product-dispensing container through a gassing valve thereof comprising:
- a. a frame;
 - b. means on the frame for receiving and firmly holding a container to be pressurized in an injection position;
 - c. a cylinder having a leading end and a bore, the cylinder being mounted on the frame for translation between a first cylinder terminal position towards the injection position and a second cylinder terminal position away from the injection position, the leading end facing the injection position;
 - d. a ram disposed in the bore for axial movement therein towards and away from the injection position, the ram and the cylinder defining a propellant chamber within the bore proximate the leading end;
 - e. means for introducing propellant into the propellant chamber through the wall of the cylinder between the ram and the leading end;
 - f. a normally closed propellant injector valve carried by the cylinder in the leading end, the injector valve having means independent of propellant pressure in the propellant chamber which is responsive to engagement with the dispenser to open the valve when the cylinder is in its first terminal position;

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- g. an axially hollow injection needle carried by the injector valve and extending therefrom towards the injection position, the needle being disposed in the valve to pass through the gassing valve as the cylinder approaches its first terminal position and for subsequent propellant communication with the propellant chamber when the valve is open;
- h. means for selectively moving the ram towards the injection position and carry the cylinder through a fluid coupling provided by propellant in the propellant chamber to the cylinder's first terminal position to open the injector valve, communicate the dispenser's interior with the propellant chamber through the injection needle, and force propellant through the injection needle by continued movement of the ram towards the injection position;
- i. means for returning the cylinder to its second terminal position after propellant injection into the dispenser's interior;
- j. means for adjusting the amount of axial displacement of the ram in the bore of the cylinder after the cylinder reaches its first terminal position to vary the effective volume of the propellant chamber, the adjusting means including a ram-driving member of the ram-moving means, the ram-driving member being coupled to the ram

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to effect its movement towards and away from the injection position, means to displace the ram-driving member, means to vary the position of the ram-driving member displacement means relative to the injection position, an actuator on the ram-driving member, and means fixed in position relative to the injection means and responsive to the actuator to stop the ram-driving member displacement means.

5. The propellant injecting apparatus claimed in claim 4 wherein:

a. biasing means is included to urge the cylinder towards its second terminal position;

6. The propellant injection apparatus claimed in claim 4 wherein:

a. the ram-driving member is a shaft;

b. the ram-driving member displacement means includes a piston and cylinder combination, the shaft being drive coupled to the piston; and

c. the position-varying means includes a slide translatablely disposed on the frame having an inclined surface disposed in engagement with a cooperating surface of the cylinder such that upon translation of the slide the position of the piston and cylinder with respect to the injection position changes.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,601,164 - Dated August 24, 1971
Inventor(s) Roger K. Bruce

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 21, cancel " - "; line 22, 'boms.'" should read -- "boms." --. Column 3, line 6, "position", first occurrence, should read -- reaches --. Column 7, line 40, "124" should read -- 125 --; line 49, "of" should read -- on --; line 66, "in" should read -- In --. Column 8, line 5, after "station" insert -- or it can be accomplished at one station --. Column 9, line 10, "ran-driving" should read -- ram-driving --.

Signed and sealed this 27th day of June 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents