BAG ON VALVE FILLING MACHINE

Applicant: Darin Brown, Stevenson Ranch, CA (US)

Inventor: Darin Brown, Stevenson Ranch, CA (US)

Appl. No.: 13/786,019

Filed: Mar. 5, 2013

Related U.S. Application Data

Provisional application No. 61/634,842, filed on Mar. 8, 2012.

ABSTRACT

A process and machine for refilling and reusing or recycling spent “bag on valve”-type aerosol cans. The process includes drawing a premeasured amount of liquid product into a refilling module, followed by pushing the product into the product bag (that surrounds the bag on valve), acting against the pressure of the gas already in the can. Opposite-acting, one-way valves in the inlet and outlet of the refilling module enable the drawing and pushing action. One size or type of refilling module is easy to swap with another.
BAG ON VALVE FILLING MACHINE

TECHNICAL FIELD

[0001] The present invention relates to a specific type of aerosol can that uses a valve called the “bag on” valve. More specifically, the invention described and claimed here relates to an improvement that enables “bag on” valve aerosol cans to be refilled and/or reused rather than discarded after a one-time use.

BACKGROUND

[0002] Bag on valve cans are significantly different from conventional aerosol cans in that they physically separate the product to be dispensed (“dispensed product”) from the propellant gas. The dispensed product is self-contained within a flexible bag inside the can, surrounded by the propellant gas (gas that is under pressure). The pressure of the propellant gas squeezes the bag when the valve is open, pushing the dispersed product through the valve and then typically out through a spray nozzle.

[0003] Other aerosol cans typically do not use gas to propel the product in the same way. Today, it is common to use liquid hydrocarbon fluids or other highly volatile fluids in aerosol cans that are mixed with the can’s product in the same interior space (the product might be a chemical like a glass cleaner, for example). In some cases pressurized gas like nitrogen or carbon dioxide is used, with the gas sitting in the top portion of the can and the liquid sitting below. The liquid product covers the end of a straw-like outlet tube. The pressure of the gas above pushes the liquid down and then back up through the tube when the can’s valve is pushed open, usually by depressing a spray nozzle.

[0004] All of these designs are well-known. However, the “bag on” design is environmentally friendly because the propellant gas never exits and remains sealed in the can after product discharge. The basic “bag on” design involves a valve that is connected to a rolled up bag (rolled up before filling). The valve/bag arrangement is inserted into a canister-type container (“the can”) and the region surrounding the bag, inside the can, is permanently pressurized with a gas, like nitrogen. After this is done, the liquid product is pumped into the empty bag, through the valve, thus unfurling and filling the bag against the pressure of the gas inside the can—with the gas functioning as a propellant gas that pushes against the outside of the bag’s wall. The valve is opened in the same way as conventional aerosol cans to spray out the product, but with the propellant gas squeezing the liquid product bag and ejecting product through the opened valve and a spray nozzle.

[0005] However, once the product in the “bag on” can is fully discharged, the can remains pressurized with the collapsed bag inside. And it remains pressurized during the course of being discarded or recycling the metal that is used to make the can’s walls. At some point in time during that process, the pressurized gas is released.

[0006] The problem with bag on valve cans is that they require highly sophisticated and expensive machines to fill them—which is done on a mass production basis. These machines commonly use metered pumps to fill the bag inside the can after pressurization, with the pump running a certain amount of time to fill each can to the appropriate level, in sequence, one after another. Pressurization and sealing of the propellant gas in the can is done as part of the same process.

[0007] Because of the complexity of these filling machines, they are usually installed in locations where manufacturers are filling large numbers of cans and then shipping them out for distribution. It is also not easy to do line changes with these machines (that is, filling cans with one type of product and then switching to another) because of machine cleaning requirements. As a consequence, no one has recognized that bag on valve cans could be refilled and reused if an economical and efficient means was developed to refill cans in the field, i.e., in lieu of collecting cans in the distribution network and returning them to a filling machine location.

[0008] The present invention provides a simplified process and machine that enables a small business to cheaply refill bag on valve cans on-site. As an example, the automotive industry uses large numbers of bag on valve cans for brake cleaning fluid or other kinds of oils or solvents. A typical automotive shop might buy and discard cans by the case, as consumables, during the normal course of doing auto repair work. The present invention allows the shop to easily refill the cans on site—which means the shop only needs to buy replacement product in bulk and not individual cans that are refilled, thus providing a means for reducing overall costs over time.

SUMMARY

[0009] The invention or inventions disclosed in this document relate to a process and machine for refilling an empty liquid product bag inside a bag on valve can (sometimes called the “container” or “dispensing container”). The dispensing container has a certain volume of pressurized gas that collapsed the bag (“the liquid product bag”), on the “bag on” valve, during the course of spraying product from the can.

[0010] According to the present disclosure, the can or container is coupled to a liquid product refilling chamber of an apparatus, with the refilling chamber containing a measured amount of liquid product that is to be used to refill the collapsed liquid product bag. The liquid product is delivered into the refilling chamber before coupling the can, although there may be ways of altering the sequence. Once coupled, however, the measured amount of liquid product is pushed into the liquid product bag from the refilling chamber, at a sufficient pressure to counteract the pressure of the gas inside (surrounding the product bag), thus inflating the liquid product bag (with the product) against the pressure of the gas. The can is decoupled after refilling is completed.

[0011] Preferably, the liquid product is delivered into the refilling chamber via a “drawing” action, similar to a vacuum effect, although there may be other ways of putting product into the chamber. It might be possible to push the product into the chamber by an external pump, for example, during the course of the filling action. Either way, the refilling chamber is preferably constructed as a swappable module that houses a reciprocating piston. When the piston retracts inside the chamber, it allows liquid product to be drawn into the refilling chamber through a one-way check valve or one-way inlet. The size of the chamber is defined by the diameter of the piston and the linear distance of its travel, back-and-forth.

[0012] Reversing direction of the piston causes it to push the liquid product out from the refilling chamber, through a needle valve mechanism, and into the liquid product bag. The needle valve mechanism also has a one-way flow control design that operates opposite to the one-way inlet. In other words, when the one-way inlet into the refilling chamber is “open,” during the drawing and filling process summarized

1

Mar. 20, 2014
above, the one-way flow mechanism in the valve mechanism is closed. Reversal of the piston’s direction causes these functional directions to switch as well.

[0013] The piston in the liquid refilling module is driven by an air pump mechanism. According to the design disclosed below, one possible version of an air pump mechanism consists of an independent air-driven piston member that reciprocates back and forth by using an air valve mechanism to create high/low pressure differentials on each side of the air piston.

[0014] Because it is swappable, one size of liquid filling module can be exchanged with another. This would be done to accommodate different sizes of the liquid product bag for different cans or when it is desired to put different kinds of liquid products (typically different chemicals) in different cans. Swapping modules reduces time spent in cleaning lines when the same machine is used to put different product into different cans.

[0015] The foregoing summary will become better understood after reviewing the accompanying description below and the accompanying schematics.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0016] In the drawings, like reference numbers refer to like parts throughout the various views, and wherein:

[0017] FIG. 1 is a frontal view of a filling machine for a bag on valve can that is constructed according to the invention described here;

[0018] FIG. 2 is a view like FIG. 1, but illustrates a portion of the machine that is the swappable liquid product refilling module;

[0019] FIG. 3 is a schematic that illustrates operation of the liquid product refilling module illustrated in FIG. 2;

[0020] FIG. 4 is a view like FIGS. 1 and 2, but illustrates an air piston pump mechanism for operating the liquid product refilling module illustrated in FIG. 2;

[0021] FIG. 5 is a view of a portion of the machine that provides a base for resting the can during a filling operation and pushing the can into coupling registration with a needle valve mechanism;

[0022] FIG. 6 is a view of a portion of the machine that is the needle valve mechanism for providing a filling needle for the empty bag on valve can; and

[0023] FIG. 7 is an exploded view of FIG. 6.

**DETAILED DESCRIPTION**

[0024] Referring now to the drawings, and first to FIG. 1, shown generally at 10 is a filling machine designed to refill “bag on” valve aerosol cans. The machine consists of several different portions, each of which will be described in series below.

[0025] First, the lower portion of the machine has a base, indicated generally at 12, for creating a support for holding the can 14 during the filling operation (The can 14 is schematically shown in FIG. 3 and indicated in dashed lines in FIG. 1). FIG. 5 better illustrates the base portion 12 of the machine 10. Directing attention there, the can 14 sits on a spring-biased platform 16. The platform 16 is connected to the upper end of a shaft 18. The lower end of the shaft 18 carries a piston 20 that is within a cylindrical chamber, indicated generally at 22.

[0026] When the can 14 is placed on the platform 16 (see FIG. 1), the can occupies the lower area (generally indicated by arrow 24 in FIG. 1) of the machine 10. All of the stages and sequencing of the refilling process are described below, but one stage involves lifting the can 14. Focusing on FIG. 5 for the time being, pressurized air is injected into the chamber area (indicated by arrow 26 in FIG. 5) below the piston 20. This drives the piston 20 upwardly (in the direction indicated by arrow 27) against the bias of spring 30 that is coiled around shaft 18, for the purpose of vertically raising the can 14. The delivery of pressurized air can be handled in different ways. Arrow 28 indicates a suitable connection port to an air source. This is a simple valve-operated arrangement that allows chamber 26 to be pressurized for lifting and then vented to allow spring 30 to return the platform 16 to its initial position.

[0027] During the coupling stage of the filling operation (which is also described in greater detail later), the can 14 is placed on platform 16 and piston 20 (FIG. 5) is driven upwardly. Before the piston 20 is actuated, however, the can 14 is positioned correctly via machine guide structure. In other words, in order to be refilled, the can 14 needs to be brought into registration with or coupled with a needle valve mechanism (described below) for refilling the can. The needle needs to align with the can’s “bag on” valve structure. This means that the can 14 has to be located and properly aligned in the machine 10, and held in the same aligned position, as it is raised by platform 16. The can 14 cannot be allowed to move a large distance, off-axis, during the filling process.

[0028] There are different ways of creating can-guiding structure that can perform the needed alignment/holding function described above. In the present design, and referring now to FIG. 1, the machine described here has a guide structure that generally follows the outer circumference of the can 14. The location of the guide structure is generally indicated at 32. However, the guide structure 32 could take different forms and still perform the same function. In this respect, it could be a half-moon shaped scallop (where arrow 32 points) in a support 34 that extends between opposite sidewalks at 36, 38 of the machine 10. Looking at the machine 10 frontally, the user places the can 14 on the platform from the front, against the scallop or guide structure 32, and the can is close to the aligned position or place it needs to be during the filling operation. The guide structure 32 then helps keep the can on-axis as it is lifted and slides upwardly along the guide structure by air-actuation of piston 20 (FIG. 5).

[0029] While it may be possible to change operational sequences, before the can 14 is lifted into position for refilling, the machine has a liquid refilling module that is loaded with a measured amount of liquid product that is to be put into the can 14. The liquid refilling module portion of the machine is generally indicated at 40 and illustrated, specifically, in FIG. 2.

[0030] Directing attention to FIG. 2, the liquid refilling module 40 has a lower part 41 that defines a collar (hereafter “collar 41” or “collar part 41”) for guiding and holding the can 14 during the refilling process. In essence, the collar 41 includes a circular recess and bore, indicated by lines 44 that is shaped to register with the top neck/shoulder portion of the can 14 when it is lifted into contact with the collar part 41. This is also schematically illustrated in the lower portion of FIG. 1.

[0031] Before specific details of the filling operation are further described, and as was generally described earlier, it should be appreciated that the liquid refilling module 40 is designed to be a fully “swappable” unit to and from the
machine 10. Referring back to FIG. 1, to describe this point, the module 40 is a cylindrical unit having a rectangular top plate 42. The top plate 42 makes it possible for the entire module 40 to be adapted to slide in and out from the machine 10, from the front. The module 40 has a drive shaft 48 (further described below) that passes laterally through a slot 50 in the machine’s top panel or top plate 52, during module swapping. Two side brackets 44, 46 accommodate the sliding action of the module’s top plate 42. While not shown in the drawings, the brackets 44, 46 work in conjunction with a back stop (mounted to machine top plate 52) that stops the module 40 in the proper location, when it is slid into place. At that point, it is also in the proper position relative to the guide structure 32 below and previously described (for guiding the can 14 up to the liquid filling module 40).

[0032] FIG. 2 focuses on illustrating the operation of the liquid refilling module 40, and its relative position in the machine 20, without the side brackets 44, 46 just described. The module 40 has cylindrical walls, generally indicated at 54. The cylinder 54 is closed at the top by the rectangular top plate 42 described above and at the bottom by another plate 56. The lower plate 56 has an orifice or inlet 58 that leads into a passageway through the body of the lower plate 56 and opens upwardly into the region immediately below a hydraulic piston 60. The inlet is connected to a reservoir 62 that contains the liquid product that is used to refill the can 14. In FIG. 3, the reservoir 62 is labeled “liquid product.” This is further described below—and attention is now directed to FIGS. 2 and 3 together.

[0033] The area below piston 60 defines a product refilling chamber. When the piston 60 is in the position shown in FIG. 2 (and the upper portion of FIG. 3), the volume of the refilling chamber is essentially zero. The piston 60 is a reciprocating member or, in other words, it moves back and forth as schematically illustrated in FIG. 3. It is to be appreciated that, while the machine 10 is generally an arrangement of vertical parts, FIG. 3 shows the parts laid down horizontally so that the reader can understand how the piston 60 is driven and how it works to fill the can 14.

[0034] The piston 60 is moved up (vertically) by an air pump mechanism portion of the machine, shown generally at 62 in FIGS. 4 and 3. The air pump mechanism 62 is double-acting and driven by a combination of valve and air compressor system illustrated, respectively, at 64, 66 in FIG. 3. The compressor system 66 can consist of a shop compressor system, conventional air compressor, or the like. The valve would be well-known and easy to obtain off-the-shelf based on the description set forth here.

[0035] Referring to the upper-right-hand corner of FIG. 3, the valve 64 is first operated to pressurize the left-hand side of an air piston 68 in the air pump mechanism 62. Arrow 70 generally indicates the direction of airflow. At the same time, the region to the right of air piston 68 is allowed to vent via the valve mechanism 64. This drives the air piston 68 in the direction indicated by arrow 72 in the upper-right-hand portion of FIG. 3.

[0036] The air piston 68 is connected to a shaft 74 that slides through a plate 76 that defines the bottom part of the air pump mechanism 62. Similar to the refilling module 40 previously described, the air pump mechanism 62 has a cylindrical housing 78, closed at the top by plate 80 and at the bottom by plate 76 just described.

[0037] The shaft 64 is connected to the shaft 48 on the liquid refilling module 40 via a removable pin 82 or the like (see FIG. 1). This connection causes the piston 60 in the refilling module 40 to be pulled upwardly as the air piston moves from the left-to-right position illustrated in FIG. 3. Once again, FIG. 3 illustrates these parts in horizontal position for the sake of describing the machine’s operation, when normally everything would stand vertically, as shown in FIG. 1.

[0038] As piston 60 inside the refilling module 40 moves, in the direction indicated by arrow 84 in the upper part of FIG. 3, it creates a vacuum effect or “draw” that pulls liquid from the reservoir 62 (to help the reader, the reservoir is identified by the legend “liquid product” in FIG. 3). When the piston 60 is at its topmost position, the interior volume of the refilling chamber corresponds to the volume of the liquid product to be put into the can 14. In other words, the displacement of piston 60 defines a measured amount of product for refilling the can 14 that is specific to the sizing of the piston 60 and cylinder walls 54 that make up the refilling module 40. The product volume for refilling the can is pointed out by arrow 86 in the lower left-hand portion of FIG. 3.

[0039] The definition of the term “liquid product” would be understood by anyone knowledgeable about bag on valve cans. It could be any type of liquid that is normally dispensed by a bag-on-valve can. A penetrating oil or solvent might be an example.

[0040] As illustrated in FIG. 3, the inlet 58 into chamber 86 is “one-way” and controlled by a check valve 88. Therefore, when the direction of piston 60 is reversed (arrow 89 in the lower part of FIG. 3), the inlet/check valve combination 58, 88 is closed. The reversal is accomplished by the air pump mechanism 62. More specifically, valve 64 is operated to open air pressure to the right-hand side of air piston 68 while the left-hand side is vented. This drives air piston 68 in the direction indicated by arrow 90 in the lower right-hand portion of FIG. 3, thus driving piston 60 in module 40, for the liquid module-filling operation.

[0041] However, referring to the earlier description of the base structure illustrated in FIG. 5, before the direction of the pistons 60, 68 are reversed, the base portion 12 of the machine lifts the can 14 into position. At this point in the description, it is appropriate to describe the machine’s can-filling needle valve mechanism, indicated at 92 in FIGS. 6 and 7.

[0042] Directing attention there, the needle valve mechanism 92 also functions as a one-way check valve that closes when the liquid module 40 is filled. There are many different ways this can be done. However, when the can 14 is lifted, it comes into registration and couples with the needle 94 of the valve mechanism 92. The can pushes against collar part 41 on the module 40 (see FIG. 2). The collar part rides on a pair of vertical shafts 96, 98 that have springs 100, 102. This arrangement enables the collar part 41 to be pushed upwardly against springs 100, 102 and, simultaneously, the needle 94 on the valve mechanism protrudes through the collar part 41. As the can 14 couples with the needle 94, the can also pushes the needle 94 up against the bias of a spring 104 inside the valve mechanism 92. This serves to open the valve mechanism. In essence, the operation of the base 12 pushes the can 14 against the collar part 14 of the liquid refilling module 40 and contracts it relative to the module 40 structure that houses piston 60.

[0043] Referring now to the exploded view of the valve mechanism 92 illustrated in FIG. 7, this mechanism includes a housing 106 mounted to the lower or bottom plate 56 of the module 40. The needle 94 has an annular member 108 with
orifices 110, 112. When the needle 94 is in the position shown in FIG. 6, the orifices are closed by an end plate 114 that is shaped like a washer. When the can 14 pushes the needle 94 upwardly against spring 104, the orifices 110, 112 open and allow fluid to pass through annular member 108 and into conventional needle orifices (not shown) that feed liquid product into the needle 94.

[0044] To explain the above in terms of the sequence of filling the module 40 and then driving product into the can 14, the valve mechanism 92 functions like a one-way valve that works oppositely to the one-way inlet into the module (items 58, 88 in the upper left-hand portion of FIG. 3). In other words, before the can 14 is lifted, the valve mechanism 92 is in the position shown in FIG. 6. There is a fluid flow path, illustrated by arrow 116 in FIG. 6, that carries through a collar 118 in the upper part of the valve mechanism 92 that leads into a needle valve chamber 120, in which spring 104 is retained. The spring 104 pushes the annular member 108 tightly against washer 114, thus closing orifices 108, 110 while the module 40 is refilled.

[0045] After the module 40 is refilled, then the can 14 is lifted into position. When the needle 94 enters the can, the can then pushes the needle (and annular member 108 upwardly, almost off the washer 114. This opens orifices 110, 112 and allows the product to flow through the valve into needle orifice structure. Thus, according to the sequence described above, the liquid module 40 draws product into its refilling chamber via one-way inlet/check valve 58, 88. The needle valve mechanism 92 is closed during that operation. The bag on valve inside the can 14 is also closed, which would be its normal state. Then, the base 12 lifts can 14 in a coupling action with needle 94. This action pushes the valve mechanism 92 “open.” At the same time, the bag on valve inside the can is pushed “open.” At that point, the can 14 (the liquid product bag inside the can) is coupled to the refilling chamber of module 40 via the bag on valve that was initially built into the can. The direction of piston 60 is reversed and it pushes the liquid product through the bag on valve (product pressure created by the piston 60 opens the bag on valve) and into the empty product bag inside the can 14, against the pressure of the propellant gas that is already there. When the travel of piston 60 is complete, the base 12 is allowed to retract, as described above, so that the refilled can 14 can be decoupled from module 40 and removed. That bag on valve inside the can closes to retain the product inside the can.

[0046] The foregoing description is not intended to limit the scope of the invention. For example, the liquid filling module is described as a “draw” then “push” filling mechanism. It might be possible to fill the module in a different way with some sort of pump mechanism. Also, an advantage to swapping the module 40 is that a user can have one module that contains one kind of liquid product and, rather than clean the module to use a different kind, the user can instead simply swap in a different module. Commercial grade filling machines require cleaning when the product is changed.

[0047] The above description sets forth a design that is under development and has not been released for marketing purposes. This means that the design could be changed during the reasonable course of developing a marketable machine. That means the mechanical structures described above could be altered that nevertheless follow the overall framework of the machine design described above. For this reason, the invention and scope of patent right is to be limited only by the claims that follow, the interpretation of which is to be done in accordance with the standard conventions of patent claim interpretation.

What is claimed is:

1. A process for refilling an empty liquid product bag in a dispensing container that uses a bag on valve, the dispensing container including a volume of pressurized gas that is pre-sealed within the container, the empty liquid product bag being collapsed by the pressurized gas, the method comprising:
   delivering a measured amount of liquid product into the refilling chamber;
   coupling the dispensing container to a liquid product refilling chamber via the bag on valve;
   pushing the measured amount of liquid product from the refilling chamber through the bag on valve and into the collapsed liquid product bag at sufficient pressure to inflate the bag with liquid product against the pressure of the gas inside the container, for refilling the liquid product bag; and
   decoupling the dispensing container from the refilling chamber.

2. The process of claim 1, wherein delivering a measured amount of liquid product into the refilling chamber comprises drawing the liquid product into the refilling chamber.

3. The process of claim 1, wherein delivering a measured amount of liquid product into the refilling chamber comprises:

4. The process of claim 1, including using a reciprocating piston to respectively deliver liquid product into the refilling chamber and then push the liquid product through the bag on valve.

5. An apparatus for refilling an empty liquid product bag in a dispensing container that uses a bag on valve, the dispensing container including a volume of pressurized gas that is pre-sealed within the container, the empty liquid product bag being collapsed by the pressurized gas, the apparatus comprising:
   a liquid product refilling module adapted to provide a chamber that holds a measured volume of liquid product specific to refilling the empty liquid product bag;
   a one-way inlet for delivering liquid product to the chamber; and
   a coupling for creating a liquid fluid flow path from the chamber to the collapsed liquid product bag by using fluid pressure to push the measured amount of liquid product from the chamber, through the bag on valve, and into the collapsed liquid product bag at sufficient pressure to expand and fill the bag with liquid product against the pressure of the gas inside the container.

6. The apparatus of claim 5, wherein the liquid refilling module includes a reciprocating piston member that draws liquid product through the one-way inlet into the chamber when the piston member moves in one direction and pushes the liquid product into the collapsed liquid product bag when the piston member moves in the opposite direction.

7. The apparatus of claim 6, including an air pump mechanism for reciprocating the piston member.

8. The apparatus of claim 7, wherein the air pump mechanism comprises a reciprocating air piston within a cylinder, means for using air pressure to drive the air piston back and forth within the cylinder, and a member connecting the air piston to the reciprocating piston member of the refilling module, for driving reciprocating movement of the piston member.
9. The apparatus of claim 5, wherein the liquid product refilling module is swappable with another liquid product refilling module.