VACUUM CRIMPING AND FILLING HEAD FOR AEROSOL CONTAINERS

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ABSTRACT

Vacuum crimping and filling head apparatus for pressure filling an aerosol container. In sequential action air is withdrawn from the container, followed by simultaneous crimping of the valve assembly onto the mouth of the container and pressure filling. Downward movement of the head opens the valve of the container and the filling head check valve to permit pressure filling, while a ring cam-actuated inwardly contracting collet crimps the valve assembly.

5 Claims, 10 Drawing Figures
VACUUM CRIMPING AND FILLING HEAD FOR AEROSOL CONTAINERS

BACKGROUND OF THE INVENTION

This invention relates to a new and improved apparatus for sequentially evacuating air from a container, and crimping an aerosol valve assembly to an aerosol container while simultaneously pressure filling the container with propellant or product. Not only does the apparatus provide a smooth and effective seal between the valve assembly and the aerosol container, it also eliminates the need for propellant purging or separate vacuum crimping and filling operations, thereby reducing the cost of production.

Certain products sold commercially in aerosol form are packaged in glass aerosol containers, generally because of the corrosiveness or instability of the product in contact with metal. Glass aerosol containers typically have a relatively narrow rimmed mouth opening to which a prefabricated valve assembly is attached in such a manner as to make a hermetic seal with the glass container. A typical valve assembly used for this purpose comprises a tubular structure open at one end, the walls of the tube being made of a relatively soft deformable material such as steel, brass or aluminum, the closed end carrying the valve structure. To attach the assembly to the container, the open end of the assembly is positioned over the rimmed mouth of the container and the soft tubular wall is crimped under an enlarged bead on the rim, holding downward force on a deformable gasket, thereby producing an effective seal.

Although it is possible to fill the glass aerosol container with its contents before the valve assembly is secured to the mouth of the container, as by conventional cold filling method heretofore known, this method is wasteful of propellant and is therefore undesirable for commercial use. Another conventional method of filling an aerosol container, i.e., pressure filling through the valve of the aerosol container, while economical in terms of propellant losses, has heretofore required that the valve assembly be attached to the aerosol container prior to the filling operation. Accordingly, the cost of pressure filling in this manner was increased because of this additional costly step.

The combined vacuum filling and crimping head of the invention overcomes the deficiencies heretofore experienced, in that it sequentially withdraws air and then simultaneously crimps the valve assembly to the aerosol container while pressure filling the container through the valve at a high rate. The invention thus eliminates the disadvantages of the known methods of pressure filling rimmed aerosol containers, while maintaining the low propellant losses characteristic of such methods.

SUMMARY OF THE INVENTION

The filling and crimping apparatus of the invention employs a generally cylindrical structure equipped at its lower end with gasket sealing means which engage the shoulder of the container to be filled in an air-tight relationship. Within the structure are several other generally cylindrical structures mounted in a manner permitting relative longitudinal motion of each part. These moveable parts, however, are sealed against the atmosphere so that the gasket which bears against the container forms a sealed zone which is evacuated, thereby withdrawing air from the container also firmly attach-

ing the container to be filled to the filling apparatus. This position is held for a dwell period and then additional closing motion between the filling head and the container seats the valve and initiates pressure filling action. While filling of the bottle is under way, an additional closing movement of the apparatus crimps the deformable wall of the valve assembly against the neck of the container below its rim establishing deformation of an elastomeric gasket to form a seal.

While the vacuum crimping and filling head can be used individually, a commercial aerosol packaging operation using the filling head of the invention would, for example, use several of the filling and crimping heads on a walking beam. The beam is mounted so as to permit it to engage several aerosol containers spaced evenly on a conveyor belt, each container having resting on its mouth an unattached valve assembly. As each filling head approaches an aerosol container, the vacuum sealing gasket end of the head is initially positioned on the sloping walls of the container and a vacuum is established within the head and container, thereby firmly attaching the head to the container. After a finite time the downward movement of the filling head continues, bringing a seal within the head down onto the valve island of the aerosol valve assembly. A container valve opening section of the filling head depresses the aerosol valve stem, thereby opening the aerosol valve. Further downward movement of the filling head causes a check valve within the head to be opened, allowing the pressurized aerosol fluid to enter the aerosol container. At the same time the downward movement of the head causes a number of lugs spaced around the mouth of the aerosol container below its rim to contract radially inwardly, crimping the deformable wall of the valve assembly to the mouth of the bottle and thereby effecting gasket pressure forming a permanent seal.

As the container is being filled, the vacuum chamber to the filling head is exhausted before the walking beam is lifted. As the downward force is removed from the filling head, the check valve closes and at the same time the aerosol valve closes, sealing the aerosol container. The upward movement of the filling head also permits the crimping assembly to expand, thereby clearing the rim of the now filled and sealed container.

The invention will be better understood from the following detailed description thereof, taken in conjunction with the accompanying drawings, in which like numerals are used to refer to the same elements in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of a portion of an aerosol filling and crimping apparatus incorporating an embodiment of the invention;

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1 showing the apparatus approaching an aerosol container;

FIGS. 3, 4 and 5 are sectional views showing various stages in the filling and crimping operation;

FIG. 6 is a sectional view of the check valve and seal pilot assembly used in the invention, showing how the check valve is actuated by the seal pilot;

FIG. 7 is an elevational view of a retainer used to hold the moveable seal pilot in its proper position in the apparatus;

FIG. 8 is a top view of the retainer of FIG. 7;
FIG. 9 is an elevational view in partial section of the collet which is used to crimp the valve assembly; and FIG. 10 is a bottom view of the collet of FIG. 9.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. 1 and 2 illustrate a portion of an aerosol filling apparatus employing a filling head means 10 in accordance with the invention, suspended from a walking beam 11 by a mounting pin 12. Figuring head 12 is provided with a lower vacuum sleeve 13 at its lower extremity with lugs 14 to which are mounted stems 16. Coil springs 17 surrounding stems 16 cooperate with the bottom portion of walking beam 11 to urge the vacuum sleeve 13 to a downward position.

Reciprocally mounted in vacuum sleeve 13 is body sleeve 18, which is normally biased in a downward position by top outer spring 19 which bears against the top of walking beam 11, and permits some vertical movement of body sleeve 18 with respect to the walking beam 11. The lower end of body sleeve 18 terminates in a circumferential wedge portion 20 which tapers upwardly.

As shown in FIG. 2, body sleeve 18 is provided with diametrically opposed vertically elongated slots 21, 22 through which is passed hollow bolt 23 provided at one end with a head 24 and at the other end with a threaded section 26, onto which is screwed a hollow nut 27, having an inlet portion 28 for connection with a remote fluid source (not shown).

Hollow bolt 23 passes through appropriate holes in valve holder 29 and valve keeper 31 which are concentrically located. Slots 21, 22 in body sleeve 18 and slot 36 in walking beam 11 permit a limited amount of vertical movement of the assembly comprising bolt 23, keeper 31, and holder 29, relative to body sleeve 18 and the walking beam 11. Top outer spring 25 biases valve holder 29 downwardly and permits vertical movement independently of body sleeve 18. As shown in FIG. 2, the hollow stems of bolt 23, keeper 31, and valve holder 29 provide a fluid passage from the inlet end 28 of hollow nut 27 to the lower end of valve keeper 31, which has an enlarged bore which receives coil spring 35. Seal pilot 33, located below the lower end of valve holder 29, is supported by retainer 34, which is in turn supported by flange 36 encircling valve holder 29 and engaging lug portion 37 at the top of the retainer 34. As shown in FIGS. 7 and 8, the top portion of retainer 34 is provided with longitudinal slots 38 which permit mounting the retainer in the position shown in FIG. 2 by temporary deformation of the upper extremity of the retainer to clear flange 36 of valve holder 29. The lower portion of retainer 34 is provided with an inward ledge 39 on which rests a circumferential resilient annular seal 41 surrounding a lower mouth portion 40 of the seal pilot 33. Retainer 34 serves to limit movement of seal pilot 33 against the downward bias of spring 42 which urges seal pilot 33 and valve holder 29 apart.

Encircling valve holder 29 and attached thereto by threads 43 is collet 44 which extends downwardly past the lower extremity of retainer 34. As shown in FIG. 9, the lower portion of collet 44 is provided with closely spaced radial slots 46 which define flexible longitudinal fingers 47, each of which is terminated at its lower extremity in a lug portion 48 having a downwardly and outwardly tapering outer surface 49, the inner portion of each lug having a projection 51.

The construction of check valve 32 and its method of actuation by seal pilot 33 are illustrated in FIG. 6. As shown, check valve 32 consists of a hollow cylinder 52 enclosing a piston 53 which is normally biased in a downward direction to a closed position by spring 54. Valve 32 is provided with an inlet opening 56 on its top surface and an elongated channel 57 in its lower portion, into which closely fits the upper stem 58 of seal pilot 33. The head 59 of the valve is provided with horizontal grooves 59, which permit the flow of fluid through openings 61 and 62 in the oblique lower surface of piston 53 and into the hollow core of seal pilot 33 when stem 58 of seal pilot 33 is inserted into channel 57 to the position shown in FIG. 6, sufficient to lift cylinder 53 off its sealing position at the bottom of the check valve. A passage for fluid flow from the top of stem 58 to the mouth 40 of seal pilot 33 is provided by bore 63. Mouth portion 40 of seal pilot 33 is provided with an opening 64 adapted to receive the valve stem of an aerosol container to be filled and to actuate said valve stem to open the valve.

Check valve 32a is similarly constructed to valve 32, but is oppositely positioned, so that it can be opened by sufficient fluid pressure on its upper end. Its internal spring (corresponding to spring 54 of FIG. 6) is selected so as to require a pressure above a predetermined minimum value for opening the valve. The minimum pressure might be, for example, a pressure above the vapor pressure of a liquid aerosol product being dispersed into the container. Thus, if the supply pressure of the aerosol product drops below the value required to keep the aerosol in liquid form, (an undesired condition which prevents proper metering of the container contents), valve 32a will close and prevent filling of the containers until the condition is corrected.

It will be seen that, during routine operation with a liquid aerosol product, both of valves 32 and 32a are full of liquid. Accordingly, when at the end of each filling cycle, both valves will close in a liquid-filled condition which would inhibit opening of valve 32 by seal pilot 33 for the next fill, if valves 32 and 32a were held rigidly in position. Springs 35 and 35b, however, permit some longitudinal vertical movement of the valves to relieve a pressure build-up which may occur when valve 32 is actuated by seal pilot 33 and thus to facilitate the opening of this valve.

Vacuum sleeve 13 is provided with a vacuum tube 66 which passes through its wall and partially extends into a slot 67 in the wall of body sleeve 18. A suitably placed platform 68 in body sleeve slot 67 cooperates with the inwardly projecting extension 69 of vacuum tube 66 to support the body sleeve in its lowermost position as shown in FIG. 2.

The lower extremity of vacuum sleeve 13 is provided with a flanged portion which engages resilient gasket 72, which serves both to center an aerosol container 73 to be filled by guiding the container into the proper location and also as a hermetic seal with the wall of the container. Suitably placed O-ring seals, e.g., 74, 76, are located between the sliding surfaces of the various components of the apparatus to provide a completely sealed unit which can be evacuated via vacuum tube 66 when the lower extremity of the filling head is closed by the insertion therein of container 73.

The operation of the filling and crimping head of the invention is illustrated in FIGS. 2, 3, 4, and 5. In FIG. 2, the apparatus is shown positioned above an empty
aerosol container 73, into the mouth of which has been inserted a valve assembly 78. As shown, the valve assembly consists of a valve island 79, a protruding valve stem 81, and a generally tubular wall portion 82 having thin deformable walls, typically of steel, brass or aluminum. Enclosed within the tubular portion and positioned above the mouth of the container is a sealing resilient pad 83 which serves to seal the aerosol container in conjunction with an annular projection 84 circling the mouth of the bottle. The mouth is provided with an outwardly extending circumferential rim 86 over which deformable tubular wall 82 is crimped to hold the valve assembly in position and form a permanent seal.

In FIG. 3, the filling and crimping apparatus has been lowered to a sufficient extent to bring gasket 72 into sealing contact with the wall of container 73 surrounding its mouth. Container 73 has been guided by the bell-like structure of gasket 72 and the lower extremity of vacuum sleeve 13 into a position where valve stem 81 is inserted into the mouth 40 of seal pilot 33. At this time, with an effective seal created between gasket 72 and aerosol container 73, the air trapped within the container as well as the lower portion of vacuum sleeve 13 is exhausted through vacuum tube 66, causing the container to be held firmly by atmospheric pressure in the position shown.

In FIG. 4, the downward movement of walking beam 11 has progressed a small amount, bringing annular seal 41 surrounding the mouth 40 of seal pilot 33 into position in contact with the top surface of valve island 79. The valve of container 73, however, has not yet been opened, since as shown valve stem 81 is free and unactuated. At this point, there is no upward force on seal pilot 33, so that the seal pilot and check valve 32 remain urged apart as a result of the biasing action of spring 42.

In the position shown in FIG. 5, the downward movement of walking beam 11 and of body sleeve 18 relative to container 73 has continued. The downward force transmitted through the bottom surface of valve holder 29 and spring 42 to seal pilot 33 compresses gasket 41 into firm sealing relationship between seal pilot 33 and valve stem 79 of container 73 and causes stem 58 of seal pilot 33 to open check valve 32. At the same time the top of opening 64 in seal pilot 33 depresses valve stem 81 sufficiently to open the valve of container 73. At this time the aerosol propellant or product under pressure is supplied to the inlet 28 of hollow nut 27 and passes through the bores of bolt 23, keeper 31, check valve 32, and seal pilot 33 to the interior of container 73.

It will be seen that when the downward movement of seal pilot 33 is interrupted by contact with valve island 79 (FIG. 5), further downward travel of valve holder 29 and collet 44, which is connected thereto, is also prevented by reason of the contact of the lower portion of the valve holder with the seal pilot. Accordingly, as body sleeve 18 continues in its downward movement, the lower wedge portion 20 thereof contacts the outwardly tapered lugs 48 at the lower end of collet 44, forcing the lugs radially inward and crimping the wall 82 of valve assembly 78 into a tight sealing relationship as shown. At this point, the downward travel of walking beam 11 stops. As soon as the aerosol container is filled, the walking beam is moved upwardly, releasing the crimping action around the valve assembly of container 73, and permitting check valve 32 and the container valve to close. Prior to this the vacuum in vacuum sleeve 13 has been relieved, releasing container 73. The filling and crimping head apparatus 10 is now free for another cycle of operation.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

We claim:

1. A filling and crimping head assembly for attaching an aerosol valve assembly to an aerosol container while simultaneously pressure filling said container with fluid from a pressurized fluid source, said container having a mouth encircled by a rim, said valve assembly including a valve, a valve island, a valve stem protruding from said valve island, and a tubular portion having deformable walls adapted to be crimped over the rim of the mouth of said container for effecting a seal thereto, said filling and crimping head assembly comprising: vertical cylindrical vacuum sleeve means having an upper and a lower end; vacuum seal means attached to the lower end of said vacuum sleeve for forming a vacuum seal against the wall of an aerosol container; cylindrical body sleeve means reciprocably mounted in said vacuum sleeve means; cylindrical collet means reciprocably mounted within said body sleeve means, the lower end of said collet means being provided with crimping means adapted to crimp the tubular portion of said aerosol valve assembly to the rim of a container, said crimping means being actuated by relative longitudinal movement of said collet and said body sleeve means; seal pilot means reciprocably mounted within said collet means, said seal pilot being adapted to receive the valve stem of an aerosol container and being responsive to a downward force to open the valve of said container; annular seal means adapted to form a fluidtight seal between said seal pilot and valve of said aerosol container; fluid passage means within said head assembly communicating between said seal pilot means and said pressurized fluid source; check valve means in said fluid passage means, said check valve means being normally closed and being adapted to be actuated to an open position by relative longitudinal movement of said seal pilot means; biasing means normally urging said seal pilot means and said check valve means apart; retainer means for holding said seal pilot means against the urging of said biasing means; and hermetic seal means for sealing the interior of said assembly against the ingress of air, permitting a vacuum to be drawn in the interior of said assembly when said vacuum seal means is in sealing relationship against the wall of a container.

2. The assembly of claim 1 in which said vacuum seal means is a resilient gasket encircling the lower end of said vacuum sleeve means.

3. The assembly of claim 1 wherein said body sleeve means is provided at its lower end with a tapered circumferential wedge portion having a surface which tapers inwardly and upwardly, and said collet means is provided with a plurality of resilient elongated fingers
terminating in a lug means adapted to be urged radially inwardly when engaged by the wedge portion of said body means.

4. The assembly of claim 1 in which said seal pilot means has a top stem portion which enters and opens said check valve means on relative longitudinal movement thereof.

5. A filling and crimping head assembly for attaching an aerosol valve assembly to an aerosol container while simultaneously pressure filling said container with fluid from a pressurized fluid source, said container having a mouth encircled by a rim, said valve assembly including a valve, a valve island, a valve stem protruding from said valve island, and a tubular portion having deformable walls adapted to be crimped over the rim of the mouth of said container for effecting a seal thereto, said filling and crimping head assembly comprising: vertical cylindrical vacuum sleeve means having an upper end and a lower end; deformable gasket means encircling the lower end of said vacuum sleeve means, said gasket means being adapted to form an air-tight seal against the wall of a container around its said rimmed mouth portion; cylindrical body sleeve means reciprocably mounted in said vacuum sleeve means, said body sleeve means having a lower end provided with a tapered circumferential wedge portion; cylindrical collet means reciprocably mounted within said body sleeve means, the lower end of which is radially deformable and is provided with multiple lug means adapted to be urged radially inwardly when actuated by the wedge portion of said body sleeve means, for crimping the tubular portion of a valve assembly to the rim of a container; seal pilot means reciprocably mounted within said collet means, said seal pilot means having a top stem portion, a lower mouth portion, a longitudinal conduit communicating between said top stem portion and said mouth portion, said mouth portion being adapted to receive said valve stem and open said container valve; annular seal means surrounding the mouth portion of said seal pilot means adapted to engage said valve island and form a fluid-tight seal between said seal pilot means and said valve island; fluid passage means within said head assembly communicating between said seal pilot means and said pressurized fluid source; check valve means in said fluid passage means, said check valve means being normally closed and being adapted to be actuated to an open position by the top stem portion of said seal pilot means; biasing means normally urging said seal pilot means and said check valve means apart; retainer means for holding said seal pilot means against the urging of said biasing means; and hermetic seal means for sealing the interior of said assembly against the ingress of air, permitting a vacuum to be drawn in the interior of said assembly when said gasket means is in sealing relationship against the wall of a container.

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