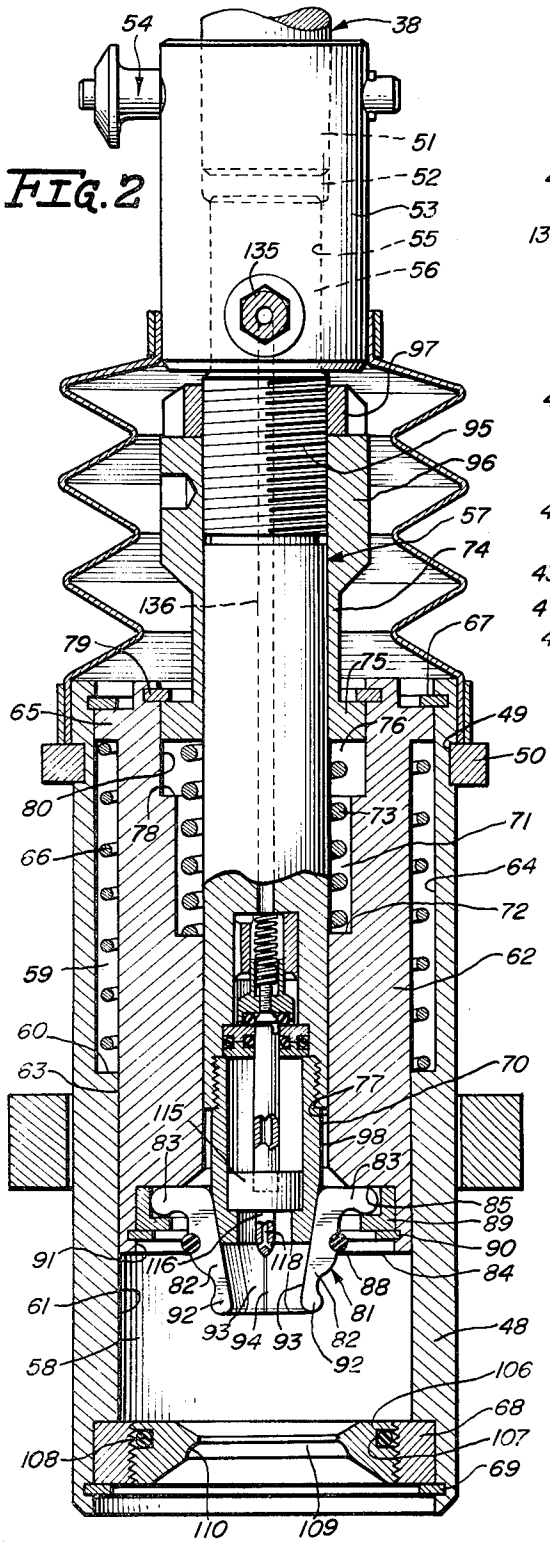
Feb. 15, 1966 L. G. WESTON 3,234,707

APPARATUS FOR SECURING AND SEALING A CLOSURE CAP TO A RECEPTACLE AND FOR CHARGING THE RECEPTACLE WITH GAS UNDER PRESSURE

Filed Oct. 8, 1962 2 Sheets-Sheet 1

FIG. 2



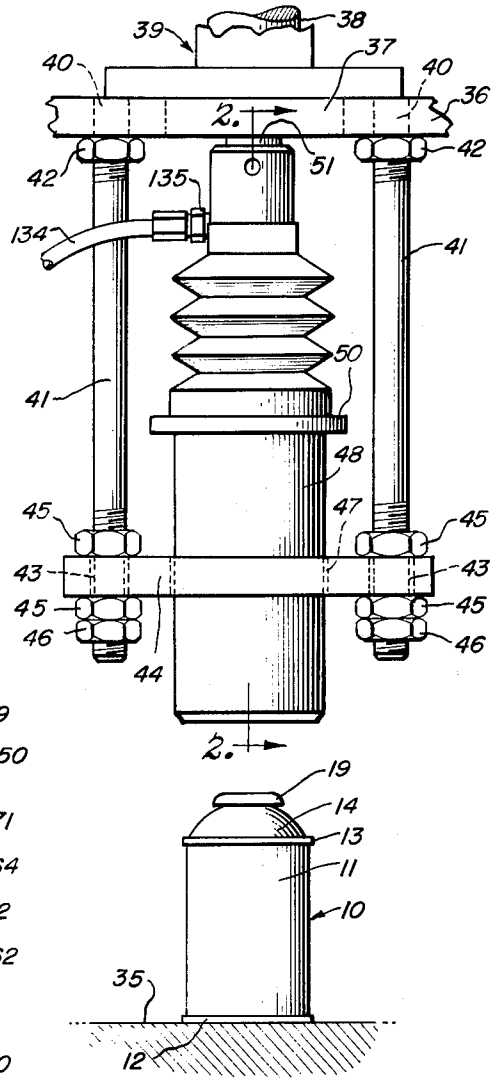


FIG. 1

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Filed Oct. 8, 1962 2 Sheets-Sheet 2

FIG. 3

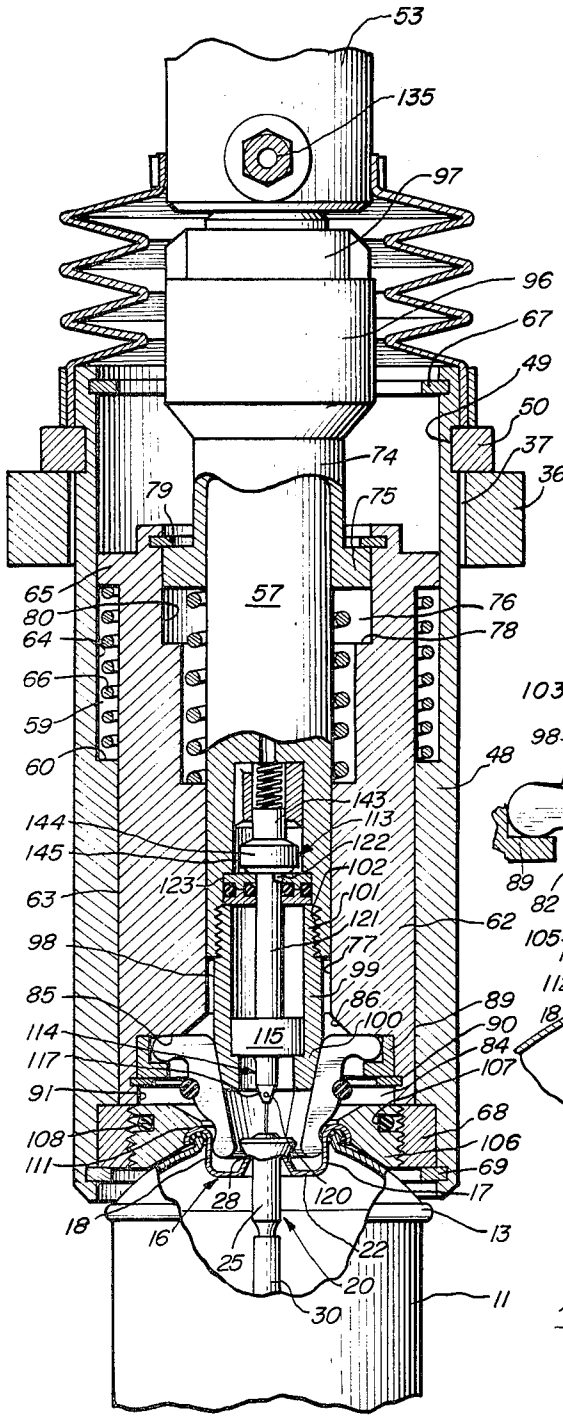


FIG. 5

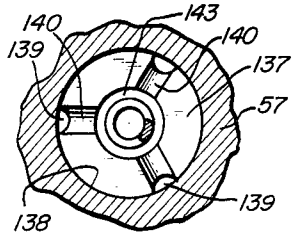
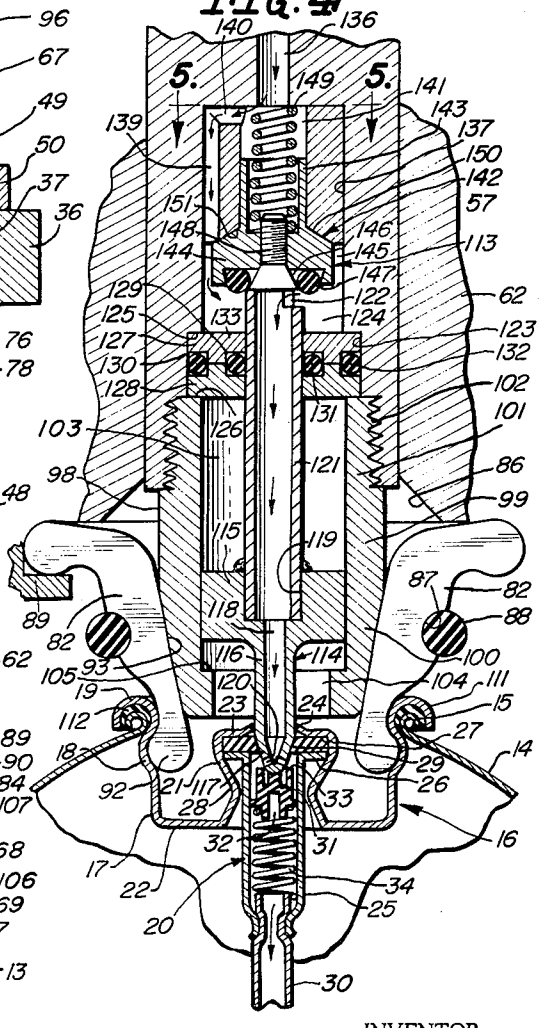


FIG. 4



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APPARATUS FOR SECURING AND SEALING A CLOSURE CAP TO A RECEPTACLE AND FOR CHARGING THE RECEPTACLE WITH GAS UNDER PRESSURE

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17 Claims. (Cl. 53—88)

This invention relates to an apparatus for securing and sealing a closure cap to a receptacle and for charging the receptacle with gas under pressure, and more particularly, to an improved crimping mechanism of the type for permanently attaching a closure cap within a complimentary opening in a thin wall receptacle such as a can or container in a gas-tight manner which has incorporated therein a gas injection nozzle assembly for charging the sealed can or container with propellant.

The present invention is primarily concerned with the manufacture and processing of receptacles or containers such as aerosol bombs or the like wherein a product such as paint, insecticides toothpaste, etc., disposed within the receptacle is expelled therefrom in a well known manner by means of a conventional propellant also contained within the receptacle with the dispensible product. Conventional propellants may be in the form of liquefied gases which have vapor pressures considerably above atmospheric pressure at ordinary room temperature such as "Freon" and "Genetron" or in the form of a gas such as ordinary air under pressure. It is to be understood that for the sake of simplification and to avoid needles redundency in the description of elements in the specification and claims as much as possible, the phrase "gas under pressure and word "gas" when employed herein to describe the propellant and in conjunction with the propellant injecting heads, shall mean all forms and kinds of propellants including those of the liquefied-gas type. The receptacle usually includes a cylindrical body closed at its bottom end and having an upper neck portion provided with a central circular filling opening which is defined by an outwardly-rolled annular bead, the outer surface of which serves as a seat for the closure cap. In the manufacture of aerosol bombs, subsequent to the operation wherein the cylindrical body is filled with a predetermined quantity of the product to be dispensed, the closure cap, which has a valve device incorporated therein to control dispensing of the product, is placed by hand or machine within the filling opening. The closure cap is generally preformed with a cup-shaped bottom portion partially defined by a cylindrical wall of slightly less external diameter than the diameter of the body opening so as to loosely enter the opening and with a peripheral flange extending radially outwardly from the normally upper end of the cylindrical wall. The flange has a substantially semi-circular cross section and is adapted to engage and overlie the annular bead. Thereafter the lower portion of the cylindrical wall of the closure cap is expanded radially outwardly into sealing relation with the cam body by means of an expandable and contractable crimping collet. A suitable gasket carried by the flange is compressed between the wall of the bead and the flange during the closure cap securing operation. Heretofore, in the processing of the receptacle, it was necessary, subsequent to the closure cap securing and sealing operation, to transfer the can to another separate machine capable of injecting the product propellant into the receptacle. Obviously, the time consumed to transfer the can to the propellant or gas injection machine is wasted insofar as

the overall processing time is concerned. Furthermore, the cost of the gas injection machine increases the equipment expenditure of the aerosol can processer. It is, therefore, a primary objective of the present invention to substantially decrease the time heretofore necessary to process pressure-propelled product containers by eliminating the transferring step from the closure cap securing and sealing machine to a second gas injecting machine. This is accomplished by doing away with the need of a separate propellant or gas injection machine and providing a single machine having a gas injection nozzle assembly as well as a closure cap crimping mechanism.

A further object is to provide a unique and novel apparatus for permanently fixing and sealing a closure cap to the neck opening of a receptacle and for simultaneously injecting gas under pressure into the container.

A further object is the provision of a combination closure cap crimping mechanism and gas injection nozzle assembly of the type referred to above which is simple in design and construction and thus economical to manufacture but which is capable of operating efficiently and accurately for a long trouble-free period of time with very little attention and maintenance.

Another object is the provision of means for automatically injecting gas under pressure into the can body during the crimping stroke for securing the closure cap within the can body opening of the crimping mechanism.

Still another object of the invention is to provide a crimping collet and actuator therefore which has incorporated therein valve means of a gas injection nozzle assembly which is capable of being positively and quickly opened to permit relatively unrestricted flow of pressurized gas therethrough and which opening of the valve means only takes place after the completion of the crimp-forming movement of the crimping collet and when the closure cap is permanently fixed and sealed to the container body and the nozzle assembly is in engagement with the closure cap of the container being charged in a gas-tight manner.

The foregoing and other important objects and desirable features inherent in and encomposed by the invention, together with many of the purposes and uses thereof, will become readiy apparent from a reading of the ensuing description in conjunction with the annexed drawings in which

FIGURE 1 is a front elevational view of a closure cap securing and gas injection nozzle assembly apparatus embodying the invention;

FIGURE 2 is a vertical sectional view taken substantially along line 2—2 of FIGURE 1;

FIGURE 3 is a view similar to FIGURE 2 illustrating the relative positions assumed by the various parts and components of the apparatus at one point during the operational cycle of the apparatus;

FIGURE 4 is a view similar to FIGURE 3 but of a slightly larger scale and illustrating the arrangement of the parts and components of the apparatus at still another point during the cycle of operation of the apparatus;

and FIGURE 5 is a horizontal sectional view taken substantially along line 5—5 of FIGURE 4.

Referring to the drawings in detail, wherein like reference characters represent like elements throughout the various views, numeral 10 represents an exemplary form of a can or container adapted to be operated upon by the apparatus forming the subject matter of the invention. The can 10 includes a generally cylindrical body 11 having the bottom thereof sealed by a wall 12 integrally formed therewith or secured thereto in an suitable manner. In a similar manner the upper end of the cylindrical body 11 is provided with a head 13 having a generally

frusto-conically shaped neck-portion **14**. As best illustrated in FIGURE 4, the neck portion **14** is provided with a central circular filling opening defined by an annular outwardly-rolled bead **15** having a substantially circular cross-section.

The filling opening is adapted to be closed and sealed, after the body **11** is filled with the product to be dispensed, by a closure cap designated generally by numeral **16**. The closure cap **16** is preformed to have a substantially cup-shaped portion **17**. The upper end of the generally cylindrical wall **18** of the cup-shaped portion **17** is integrally formed with a radially outwardly extending annular flange **19** having a substantially semicircular cross section. The closure cap **16** also includes a valve device designated generally by numeral **20** of a type which is conventional and well known in the aerosol dispenser field. The valve device **20** includes a supporting structure which is in the form of a centrally upwardly extending cylindrical projection **21** which is integrally formed with the bottom **22** of the cup shaped portion **17**. The upper end wall **23** of the projection **21** is provided with a small circular opening **24** therethrough. The valve housing is in the form of an elongated, cylindrical member **25** having a radially outwardly extending flange **26** at one end thereof. A ring-like sealing gasket **27** made of rubber or material having comparable physical and functional characteristics is positioned between the under side of the end wall **23** of the projection **21** and the flange **26**. The projection **21** is crimped, as indicated by numeral **28**, to rigidly secure the valve housing **25** and the gasket **27** to the projection **21**. The central opening **29** of the gasket **27** is in axial alignment with the opening **24** provided in the upper wall **23** but is of smaller diameter than the opening **24**. Attached to the lower end or the end of the valve housing **25** opposite the flange **26** is the end of a flexible tube **30** (partially shown in FIGURE 4) which extends into the body **11** of the container **10**. Slidably mounted within the valve housing **25** is a valve element **31**, the lower end of which is provided with a diametrically extending recess **32** and the uppermost end thereof is defined by an annular surface **33**. A helically-wound spring **34** is also disposed within the valve housing **25**. The spring **34** is adapted to resiliently urge the annular surface **33** into abutting and sealing engagement with the annular portion of the gasket **27** adjacent to the central opening **29** therethrough. The diametrically extending recess **32** affords fluid communication between the interior of the container body **11** and the annular space defined by the valve housing **25**, gasket **27** and the outer surface of the upper portion of the valve element **31** when the valve element **31** is in its closed position with the annular surface **33** in sealing engagement with the gasket **27**. While the closure cap valve device **20** forms no part of the present invention per se it is to be understood that when the valve element **31** is moved downwardly causing the annular surface **33** of the valve element **31** to move out of sealing engagement with the gasket **27** fluid communication is established between the interior and exterior of the container **10**. Upon release of downward pressure on the valve element **31**, the spring **34** moves the valve element **31** to its closed position to disestablish fluid communication between the interior and exterior of the container **10**.

That portion of the apparatus which forms the subject matter of the invention for permanently securing and sealing the closure cap **16** within the opening in the neck **14** of the container body head **13** includes a horizontal receptacle supporting base or platform **35**, shown somewhat diagrammatically in FIGURE 1. After the cylindrical bodies **11** are filled with their product contents, a closure cap **16** is loosely placed in each neck opening by hand or by machine. Each container **10** is transported by hand or by means of a suitable can handling machine to the supporting base **35** in an upright position.

A horizontally disposed support plate **36**, spaced vertically above and parallel to the top surface of the supporting base **35**, is suitably supported above the base **35** by an upright standard or column (not shown). The support plate **36** is provided with a circular opening **37** through which a piston rod **38** is adapted to extend vertically. The piston rod **38** is part of an air-actuated piston and cylinder assembly **39**, partially shown in FIGURE 1, suitably mounted on the support plate **36**. Suitable control means (not shown) are provided for controlling the supply and exhaust of air under pressure to the piston and cylinder assembly **39** to effect vertical reciprocating movement of the piston rod **38** between its fully retracted position shown in FIGURE 1 and a fully extended position.

The support plate **36** is provided with a pair of threaded holes **40** on diametrically opposite sides of the opening **37** adapted to threadingly receive respective threaded ends of a pair of elongated support posts **41**. Suitable lock nut means **42** are utilized to firmly fasten the support post **41** to the plate **36**. As illustrated in FIGURE 1, the support posts **41** depend from the plate **36** and are arranged parallel with respect to each other. The lower end sections of the support posts **41** are provided with threads and are adapted to extend freely through apertures **43** formed through a stop plate **44**. A pair of clamping nuts **45** carried by the lower end section of each post **41** on respective opposite surfaces of the stop plate **44** are used to secure the stop plate **44** to the posts **41**. It will be appreciated that the position of the stop plate **44** along the longitudinal axes of the support posts **41** may be changed by rotating the clamping nuts **45** which varies the vertical spacing in between the stop plate **44** and the supporting base **35** as well as between the support plate **36** and the stop plate **44**. A suitable lock or jam nut **46** is also threaded on the lower end section of each support post **41** for maintaining the adjusted vertical position of the stop plate **44**.

The stop plate **44** is provided with a circular opening **47** in vertical alignment with the opening **37** of the support plate **36** and of slightly larger external diameter than an open-ended cylindrical sleeve **48** which extends vertically through the opening **47**. An external groove **49** is formed in the sleeve **48** adjacent the upper end thereof in which a snap ring **50**, of conventional design, is disposed. The snap ring **50** serves as stop means inasmuch as it is adapted to engage the top annular surface of the stop plate **44** encircling the opening **47** to limit the extent of vertical downward movement permitted between the sleeve **48** and the stationary stop plate **44**.

The piston rod **38** has a reduced-diameter, lower end section **51** of which is adapted to be inserted in a vertically extending recess **52** provided in the upper end of a cylindrical coupling **53**. Suitable quick releasable pin means of conventional and well known design, designated by numeral **54**, are provided for rigidly securing the coupling **53** to the piston rod **38**. The coupling **53** is also provided with a recess **55** which extends from the lowermost edge of the coupling **53** and opens into the recess **52**. The recess **55** is of smaller diameter than the recess **52** and is adapted to have the uppermost end section **56** of an elongated mandrel, designated generally by numeral **57**, either press fitted or secured therein in any suitable manner. From the foregoing it will be appreciated that the mandrel **57** and the piston rod **38** are capable of reciprocating vertically in unison.

The sleeve **48** is provided with aligned bores **58**, **59**, the latter bore **59** being of slightly greater diameter than the former to provide an intermediate shoulder **60**. The surface **61** of the bore **58** serves as a bearing surface to support an inner sleeve **62** for relative vertical sliding

movement. As shown in FIGURE 2, the exterior surface 63 of the inner sleeve 62, surface 64 of bore 59 which is radially spaced from the surface 63, shoulder 60 and an annular flange 65, integrally formed with the upper end of the inner sleeve 62 and extending radially from the surface 63, define a pocket in which a helically-wound compression spring 66 is disposed. The lower end of the spring 66 bears against the shoulder 60 and its upper end reacts against the annular flange 65. A snap ring 67 is expanded in an internal groove formed in the surface 64 of the bore 59 and serves as a stop ring for limiting sliding movement of the outer sleeve 48 with respect to the inner sleeve 62 in one direction by engaging the flange 65. The spring 66 yieldably urges the flange 65 into abutting engagement with the stop ring 67, as shown in FIGURE 2. Relative vertical sliding movement between the inner and outer sleeves 48, 62 in the opposite direction is limited by a ring-like element 68 secured to the lower end of the outer sleeve 48 by means of a snap ring 69 which is adapted to engage the lower end of the inner sleeve 62, as shown in FIGURE 3.

Referring to FIGURE 2, it will be noted that the inner sleeve 62 is provided with an axial extending bore 70 which has one end opening into an aligned bore 71 of a larger diameter. The junction of the bores 70 and 71 is defined by an annular shoulder 72 which serves as a seat for one end of a helically-wound compression spring 73 encircling the mandrel 57. An adjusting sleeve 74, through which the mandrel 57 extends, has its lower end provided with a radially extending annular flange 75 which has a diameter greater than the diameter of the bore 71 but smaller than the diameter of a bore 76 opening into and in axial alignment with the bore 71. The opposite end of the spring 73 bears against the under side of the flange 75. The mandrel 57 extends through the aligned bores 70, 71, and 76 and the surface 77 of the bore 70 is adapted to slidingly engage and support the outer surface of the mandrel portion disposed within the bore 70. The annular shoulder 78 defining the juncture of the bores 71 and 76 is adapted to engage the flange 75 of the adjusting sleeve 74 to limit relative vertical sliding movement of the mandrel 57 and the inner sleeve 62 in one direction and a snap ring 79 disposed in a groove formed in the surface 80 of the bore 76 adjacent the upper end of the inner sleeve 62 limits relative sliding movement of the same parts in the opposite direction. The spring 73 yieldably maintains the mandrel 57 and the inner sleeve 62 in the position shown in FIGURE 2 wherein the annular flange 75 is resiliently urged into abutting engagement with the snap ring 79.

An expandable and contractable crimping collet, designated generally by numeral 81, is adapted to be mounted on the lower end of the inner sleeve 62 in such a manner that it may be quickly and easily disassembled from the apparatus for repair, inspection, replacement, etc. and reinstalled on the apparatus without the need of special tools or without the need of dismantling the apparatus. The crimping collet 81 comprises a plurality of segmental jaws or fingers 82, each of which has an arcuate, radially extending rounded rib 83 formed on its upper end. As shown in FIGURE 2, an axial bore 84 extends from the lower end of the inner sleeve 62. The upper end of the bore 84 is defined by an annular shoulder 85. An annular tapered surface 86 slopes upwardly and inwardly from the inner circular edge of the shoulder 85 to the lower end of the surface 77 of the bore 70. The outer face of each segmental finger 82 is provided with a groove 87 which is in circular alignment with the grooves 87 formed in the other fingers 82 of the collet 81. A resilient "O"-ring or circular spring 88 is seated in the grooves 87 to maintain the fingers 82 in their assembled relationship and to yieldably urge the collet 81 to its contracted condition, illustrated in FIGURE 2. The assembled crimping collet 81 is adapted to be inserted in the bore 84 with the ribs 83 adjacent the shoulder 85. A collet support ring 89 having a substantially L-shaped cross section, adapted to engage the under sides and the radial outer sides of the ribs 83, is held in place by a snap ring 90 expanded in a groove formed in the surface 91 defining the bore 84 adjacent the lower end of the inner sleeve 62. From the foregoing it will be appreciated that the support ring 89 and the shoulder 85 define a pocket in which the ribs 83 are confined and the surfaces defining the pocket permit the collet fingers 82 to pivot between a position corresponding to the contracted condition of the collet 81, shown in FIGURE 2, and a position corresponding to the radially expanded condition of the collet 81, illustrated in FIGURE 4. It will also be appreciated that the entire collet 81 may be quickly and easily disassembled from the inner sleeve 62 merely by removing the snap ring 90 and the collet support ring 89 without disturbing the assembled relationship of the other parts of the apparatus. The fingers 82 depend below the lower end of the inner sleeve 62 and each of the fingers 82 opposite the rib 83 thereof is provided with a rounded crimp-forming tip 92. As illustrated in FIGURE 2, when the collet 81 is in its contracted condition the inner faces 93 are inclined upwardly and outwardly forming an upwardly-flaring or inverted frusto-conically shaped bore 94 extending through the collet 81.

A section 95 of the mandrel 57 adjacent the end section 56 press fitted into the coupling 53 is provided with external screw threads which are cooperable with internal screw threads formed within an enlarged uppermost end portion 96 of the adjusting sleeve 74. A lock nut 97 is also threaded on the threaded section 95 above the adjusting sleeve 74. It will be appreciated that by rotating the adjusting sleeve 74 relatively to the mandrel 57 the effective length of the mandrel 57 may be varied. The significance of being able to adjust the effective length of the mandrel 57 will be pointed out hereinafter. Once the desired adjustment of the mandrel is made the lock nut 97 is tightened and jammed into engagement with the adjusting sleeve 74 to maintain the adjustment.

The collet actuator or expander member 98 includes an enlarged cylindrical head 99 provided with an inverted frusto-conically shaped caming tip 100. The inner wedge faces 93 of the collet 81 are adapted to be engaged by the camming tip 100 when the mandrel 57 is moved axially downwardly with respect to the collet 81 to rock the fingers 82 and radially expand the collet 81. The end of the collet actuator 98 opposite the camping tip 100 is in the form of an externally threaded section 101 which is adapted to be threaded into a threaded recess 102 extending axially from the lower end face of the mandrel 57. As best shown in FIGURE 4 the collet actuator 98 is provided with a relatively long cylindrical bore 103 extending from the uppermost end thereof and a relatively short bore 104 extending from the lowermost or opposite end thereof. The bores 103 and 104 are in axial alignment and open into each other. The juncture of the bores 103 and 104 is defined by an annular shoulder 105.

As illustrated in FIGURES 2 and 3, and as pointed out hereinbefore, the ring-like element 68 serves as stop means for limiting relative movement between the outer and inner sleeves 48, 62 respectively in one direction and is provided with internal screw threads which are cooperable with external screw threads formed on a bell or closure cap seat, designated generally by numeral 106. It will be appreciated that by turning the bell 106 with respect to the ring like element 68 the vertical position of the bell 106 with respect to the collet 81 and the supporting base 35 may be varied. The bell 106 is provided with an external annular groove 107 in which is disposed an "O"-ring 108 which is adapted to engage the screw threads of the ring-like element 68 and the surfaces of the bell 106 defining the groove 107. The frictional re-

sistance afforded by the "O"-ring **108** is utilized to maintain the desired adjustment of the bell **106**.

The bell **106** is formed with a central opening **109** for accommodating the collet fingers **82** as the inner sleeve **62** descends during the crimping and gassing operation. The opening **109** is encircled by an annular anvil surface **110** which is arcuately-shaped in cross-section and corresponds approximately to the curvature of the outer surface of the closure cap flange **19** so that during the crimp-forming operation when the outer sleeve **48** is lowered and assumes the position shown in FIGURE 3, the anvil surface **110** will engage the major portion of the cap flange **19** and thereby hold the closure cap **16** firmly in place on the neck **14** of the container **10** and prevent distortion of the flange **19** as the collet **81** is expanded to crimp the closure cap **16** to the container body **11**.

The crimp-forming operation of the apparatus is sequentially illustrated in FIGURES 2, 3, and 4. Referring to FIGURE 2, the apparatus is shown in the position it normally occupies at the commencement of the crimp-forming stroke. The piston rod **38** is fully retracted and the inner sleeve **62** and the mandrel **57** are resiliently urged into abutting engagement with the upper stop rings **67** and **79**, respectively. It will be noted that the stop ring **50** fastened to the upper end of the outer sleeve **48** is vertically spaced above the stop plate **44** and consequently the bell **106** is vertically spaced sufficiently above the top surface of the container supporting base **35**, as illustrated in FIGURE 1, to permit the positioning of a container body **11** having a closure cap **16** loosely mounted thereon beneath the bell **106** in axial alignment therewith. Locating means (not shown) may be provided on the support base **35** for accurately positioning the container body **11** in axial alignment with the bell **106**. Air control means (not shown) is then conditioned so as to admit air under pressure to the air-actuated piston and cylinder assembly **39** to cause the mandrel **57** to move vertically downwardly. The inner and outer sleeves **62**, **48** respectively descend in unison with the mandrel **57** until the anvil surface **110** of the bell **106** loosely overlies the outer surface **111** of the rounded, annular flange **19** of the closure cap **16**, as shown in FIGURE 3, and the stop ring **50** of the outer sleeve **48** engages the top surface of the stop plate **44** too limit further downward movement of the outer sleeve **48**. It will be appreciated that the vertical disposition of the stop plate **44** with respect to the base **35** is adjusted along the support post **41** prior to the commencement of the crimp-forming stroke of the apparatus so that the stop ring **50** engages the stop plate **44** simultaneously with the engagement of the anvil surface **110** with the outer surface **111** of the rounded closure cap flange **19**.

The compression spring **73** exerts a considerably greater biasing force on the inner sleeve **62** than the spring **66** and, consequently, the spring **66** is compressed as the mandrel **57** and the inner sleeve **62** continue to move downwardly with respect to the outer sleeve **48** from the position shown in FIGURE 2 to the position shown in FIGURE 3. Referring to FIGURE 3, it will be noted that the crimp-forming tips **92** of the fingers **82** are disposed within the cup shaped portion **17** of the closure cap **16** and are radially spaced inwardly of the cylindrical wall **18** when further downward movement of the inner sleeve **62** is arrested by engagement of a lower end thereof with the ring-like element **68**. Downward movement of the mandrel **57** is now effected against the action of the inner spring **73**. The relative downward movement of the mandrel **57** with respect to the inner sleeve **62** will cause the inverted frusto-conical tip **100** of the collet actuator **98** to engage the inclined inner faces **93** of the fingers **82** and pivot the fingers **82** causing the crimp-forming tips **92** to be forced radially outwardly against the biasing action of the circular collet contracting "O"-ring **88**. The fully expanded condition of the collet **81** is reached when further downward movement of the mandrel **57** is arrested by engagement of the radial flange **75** of the adjusting sleeve **74** with the inner sleeve shoulder **78**. As the collet **81** is being expanded from its contracted condition shown in FIGURE 3 to its fully expanded condition illustrated in FIGURE 4, the metal of the cylindrical wall **18** of the closure cap cup-shaped portion **17** is crimped or radially expanded outwardly by the rounded crimp forming tips **92** of the collet fingers **82** into rigid engagement with the bead **15**. A suitable gasket **112** carried by the under side of the rolled flange is tightly compressed between the flange **19** and the bead **15** during the expansion of the collet **81** and, as a result, a permanent, leak-proof joint is provided between the closure cap **16** and the neck **14** of the container body **11**. The anvil surface **110** which constantly engages substantially the entire outer surface **111** of the rolled flange **19** as the collet **81** is being expanded serves as a support or backing therefore to prevent unwanted deformation or collapse of the flange **19** and/or the bead **15** by the outwardly directed force exerted by the crimp-forming tips **92**.

At the end of the cap-crimping operation, the piston rod **38** is retracted causing the mandrel **57** and the collet actuator **98** to be elevated relatively to the collet **81**. As the camming tip **100** slides vertically upwardly with respect to the inclined inner faces **93** of the collet fingers **82**, the circular "O"-ring or spring **88** contracts the fingers **82**. The mandrel **57** continues to be elevated alone until the flange **75** engages the stop ring **79** whereupon the inner sleeve **62** and the collet **81** are elevated therewith. It will be appreciated that the collet **81** is in its fully contracted condition at the point during the return stroke when the inner sleeve **62** begins to move upwardly with the mandrel **57**. The mandrel **57** and the inner sleeve **62** are elevated in unison with respect to the outer sleeve **48** until the flange **65** engages the stop ring **67**. During this phase of the return stroke the collet **81** is in its retracted condition and is withdrawn from the cup-shaped portions **17** of the closure cap **16**. Thereafter the mandrel **57** in the sleeve **62** and the outer sleeve **48** are raised in unison and when the mandrel **57** is in its normal position, illustrated in FIGURES 1 and 2, corresponding to the fully retracted position of the piston rod **38** the bell **106** is spaced vertically sufficiently above the secured closure cap **16** to permit removal of the processed container **10** from the can-supporting base **35**.

As pointed out hereinbefore, the apparatus is provided with various adjustment means. By virtue of these adjustment means the height and depth of the metal crimp resulting from the operation of the apparatus may be varied. The height of the metal crimp is determined by the vertical distance between the collet finger tips **92** and the anvil surface **110** when the collet **81** and bell **106** are in their lowermost positions and the collet **81** is fully expanded. Thus the crimp-height may be varied by adjusting the vertical disposition of the anvil surface **110** with respect to the collet finger tips **92** which adjustment is accomplished by rotating the bell **106** with respect to the ring-like element **68**. As an example, assuming that it was desired to increase the height of the crimp from that illustrated in the drawings, the bell **106** would be turned with respect to the ring-like element **68** in a direction to cause the bell **106** to move vertically upwardly with respect thereto. When the desired vertical spacing between the anvil surface **110** and the collet finger tips **92** was obtained, the frictional resistance afforded by the "O"-ring **108** would maintain the adjusted position of the bell **106** within the ring-like element **68**.

The depth of the metal crimp, on the other hand, is determined by the radial spacing of the collet finger tips **92** with respect to the vertical longitudinal axis of the mandrel **57** when the collet **81** is in its fully expanded condition and such radial spacing of the collet finger tips **92** in turn is dependent upon the vertical position of the

collet actuator camming tip **100** with respect to the inclined inner faces **93** of the collet fingers **82** when the radial flange **75** of the adjusting sleeve **74** is in engagement with the annular shoulder **78** of the inner sleeve **62**. Thus, by varying the maximum vertical distance that the camming tip **100** can extend into the tapered bore **94** from the large upper end thereof during the crimp-forming stroke of the apparatus or stated in another way by varying the effective length of the mandrel **57** the maximum radial spacing of the collet finger tips **92** with respect to the longitudinal axis of the mandrel **57** is varied and consequently the depth of the metal crimp is also varied. Hence, as an example, to increase the depth of the metal crimp that is illustrated in the drawings the lock or jam nut **97** would be unthreaded sufficiently to permit rotation of the adjusting sleeve **74** with respect to the mandrel **57** in a direction to increase the vertical distance between the camming tips **92** and the annular flange **75** on the adjusting sleeve **74**. Thereafter, the lock nut **97** would be retightened and caused to firmly abut the uppermost end of the adjusting sleeve **74** to prevent inadvertent turning of the adjusting sleeve **74** with respect to the mandrel **57** while the apparatus is in use. Thus, the newly adjusted camming tip **100** would extend further into the frusto-conical bore **94** than illustrated in the drawings and because of the conical nature of the bore **94** a greater radial outward expansion of the collet finger tips **92** would be effected.

As stated hereinbefore, it is a primary objective of the present invention to substantially decrease the overall time required to process pressure-propelled product type containers when compared with prior operations. As also stated hereinbefore, the phrase "gas under pressure" and term "gas" where used throughout the specification and claims when referring to the propellant and propellant injecting means are intended to typify, define and are synonymous with any and all propellants conventionally employed to propel products from pressure-tight containers. This is partially accomplished by eliminating the container transferring step which was heretofore required between the closure cap securing machine and a second separate machine for injecting gas under pressure into the container. The present apparatus incorporates gas injecting means in a closure cap crimping mechanism whereby propellant gas is injected under pressure into the cam body **11** during the crimping stroke of the apparatus for securing the closure cap **16** within the can body opening. The gas injection nozzle assembly portion of the apparatus, designated generally by numeral **113**, is best illustrated in FIGURE 4 and includes a propellant or gas injecting nozzle **114**. The nozzle **114** has an enlarged disc-like head **115** slidably mounted within the relatively long bore **103** of the collet actuator **98**. Integrally formed with and extending axially downwardly from the enlarged head **115** is an elongated projection or needle **116**. The free end or tip portion **117** of the needle is cone shaped shown in FIGURE 4. The needle **116** is provided with a passageway **118** which is in axial alignment with and has one end opening into a recess **119** provided in the enlarged head **115**. A plurality of ports **120** formed through the tip portion **117** provide fluid communication between the passageway **118** and the exterior of the needle **116**. One end of an elongated valve actuator or tube **121** is inserted in the recess **119** and is rigidly connected to the head **115** of the gas injection nozzle **114** by means of silver soldering or the like. It will be noted that the upper end of the valve actuator tube **121** is provided with a notch **122** the purpose of which will be pointed out hereinafter.

Referring to the construction of the mandrel **57** it will be noted that a relatively short bore, defined by a cylindrical surface **123**, in axial alignment with and of smaller diameter than the threaded recess **102**, is provided therein, which has one end opening into the threaded recess **102** and its opposite end opening into a relatively long bore **124** also provided in the mandrel **57**. The junction of the relatively long bore **124** and the surface **123** of the relatively short bore is defined by an annular shoulder **125**. It will also be noted that the diameter of the bore **103** formed in the actuator **98** is of smaller diameter than the diameter of the relatively short bore defined by surface **123** formed in the mandrel **57**. Consequently, an annular portion **126** of the uppermost end of the actuator **98** is in axial alignment with the shoulder **125** when the actuator **98** is secured to the lower end of the mandrel **57**. Disposed within the annular pocket defined by the cylindrical surface **123**, shoulder **125**, and annular portion **126** are a pair of identical ring-like spacers or seal retainers **127, 128**. The spacers **127, 128** have a substantially T-shaped cross section and are arranged face-to-face within the pocket defined by the cylindrical surface **123**, shoulder **125**, and annular portion **126** whereby a pair of annular concentric pockets **129, 130** are provided. The valve actuator or tube **121** is adapted to extend through the central aligned openings of the spacers **127, 128** and an "O"-ring **131** is disposed within the annular pocket **129**. A similar "O"-ring **132**, of larger diameter than the "O"-ring **131**, is disposed within the pocket **130**. It will be appreciated that as the collet actuator **98** is being secured to the mandrel **57** by threading the threaded section **101** into the threaded recess **102**, the spacers **127, 128** are tightly clamped between the annular portion **127** of the collet actuator **98** and the shoulder **125**. When the collet actuator **98** is firmly secured to the mandrel **57** and ready for use the outer "O"-ring **132** provides a gas-tight seal between the spacers **127, 128** and the cylindrical surface **123** of the relatively shorter bore and in a similar fashion the inner "O"-ring **131** provides a gas-tight seal between the spacers **127, 128** and the outer surface of the elongated tube **121**. Thus, it will be appreciated that the mandrel bore **124** is sealed in a gas-tight manner from the collet actuator bore **103**, and gas-tight guide means are provided for slidably supporting the tube **121** for axial sliding movement with respect to the spacers **127, 128**. The uppermost surface portion **133** of the uppermost spacer **127** encircling the opening therethrough, through which the valve actuator tube **121** extends serves as a valve seat as will be pointed out hereinafter.

The product propellant gas for charging the containers **10** is supplied to the apparatus through a conduit **134** (partially shown in FIGURE 1). One end of the conduit **134** is connected to a source (not shown) of the propellant gas under a particular pressure and the other end thereof is connected to a pipe fitting **135** carried by the coupling **53** and the mandrel **57**. A radially extending passageway (not shown) extends from the pipe fitting **135** to one end of a central, longitudinally extending passageway **136** formed in the mandrel **57** and which has its opposite end opening into the bore **124** provided in the mandrel **57**. As best illustrated in FIGURES 4 and 5, a cylindrical plug **137** is press fitted into the bore **124** of the mandrel **57** and is adapted to be disposed at the bottom or closed end of the bore **124**. The axially extending outer cylindrical surface **138** of the plug **137** is provided with a plurality of circumferentially spaced, axially extending grooves **139** therein. While three grooves **139** are shown, it is to be understood that a greater or smaller number of grooves could be utilized without departing from the spirit and scope of the invention. The uppermost end of the plug **137** is also provided with a plurality of radially extending grooves **140**, each of which extends radially inwardly from an end of a respective vertical groove **139** to a central axially extending, open-ended bore **141** formed through the plug **137**. The cylindrical surface of the bore **141** serves as means for slidably supporting a plunger or movable valve element **142**. The plunger **142** includes a hollow cylindrical section **143** which is adapted to extend into the bore **141** and be slidingly supported by the surface defining the bore **141**. Integrally formed with the end of the section **143**

disposed without the bore **141** is a disc-like, enlarged portion **144**. It will be noted that the diameter of the enlarged portion **144** is smaller than the diameter of the surface defining the bore **124** and, consequently, an annular space **145** is always provided regardless of the position of the enlarged portion **144** within the bore **124**. The lowermost face of the enlarged portion **144** is provided with a shallow, undercut recess **146** in which an "O"-ring **147** is disposed. A retainer **148**, in the form of a screw having an enlarged head, is threaded into the enlarged portion **144** of the plunger **142** and is adapted to secure the "O"-ring **147** to the lowermost face of the enlarged portion **144**. It will be noted that an annular portion of the "O"-ring **147** depends below the lowermost face of the enlarged portion **144**. A helically-wound compression spring **149**, disposed within a recess in the cylindrical section **143** of the plunger **142** and the bore **141**, reacts against the mandrel **57** at the bottom of the bore **124** and the plunger **142** at the bottom of the recess in the cylindrical section **143** to yieldably urge the "O"-ring **147** into gas-sealing engagement with the uppermost surface portion **133** of the uppermost spacer **127** encircling the opening therethrough through which the tube **121** extends. Movement of the plunger **142** in a direction away from the surface portion **133** is limited by an annular tapered surface **150** formed on the enlarged portion **144** engaging a similar annular tapered surface **151** provided on the lower end of the plug **137**.

As stated hereinbefore, the purpose of the gas injection nozzle assembly **113** is to charge liquid-filled, self-dispensing containers with propellant such as liquefied-gas on gas under pressure simultaneously with the securing and sealing of the container closure caps on the container bodies. During the crimp-forming operation of the apparatus, which was sequentially described in detail hereinbefore, the gas injection nozzle assembly **113** is adapted to be reciprocated vertically toward and away from a container **10** to effect operative engagement and disengagement thereof with the container. When the piston rod **38** is fully retracted, corresponding to the commencement of the crimp-forming stroke, the plunger-carried "O"-ring **147** is firmly pressed into sealing engagement with the uppermost surface **133** of the upper spacer **127** by the spring **149** and the enlarged head **115** of the gas injection nozzle **114** is abutting the shoulder **105** formed in the collet actuator **98**. It will be noted that when the plunger **142** and the nozzle **114** are in this position, the notched end of the valve actuator or tube **121** is closely adjacent to the head of the seal retainer **148**. Prior to the operation of the apparatus, the conduit **134** is supplied with pressurized propellant gas which flows to the annular space **145** by way of passageway **136**, radial grooves **140**, and vertical grooves **139**. The pressure of the gas within the annular space **145** acts in conjunction with the biasing action of the spring **149** to firmly urge the plunger **142** into a tight sealing relationship with the uppermost surface **133** of the spacer **127** encircling the central opening therein and thus effectively prevent leakage of the gas from the annular space **145** to the interior of the valve actuator or tube **121** through the notch **122**. The gas injection gas valve remains in its closed condition during the entire crimp-forming stroke of the apparatus prior to the point in the cycle where relative downward movement of the mandrel **57** with respect to the inner sleeve **62** causes the inverted frusto-conical tip **100** of the collet actuator **98** to engage the inclined inner faces **93** of the fingers **82** and commences pivoting the fingers **82** radially outwardly. At this point in the operation, the tip portion **117** of the needle **116** enters the circular opening **24** of the closure cap upper end wall **23**. As the fingers **82** are being pivoted further radially outwardly, the needle **116** is simultaneously forced into the central opening **29** of the sealing gasket **27** and engages the valve element **31** to open the valve device **20** by moving the annular surface **33** away from the gasket **27** against the biasing action of the valve spring **34**. It will be appreciated that the needle ports **120** are below the gasket **27** at this time. It is to be also understood that the diameter of the needle **116** is larger than the diameter of the gasket opening **29** and, consequently, the gasket **27** frictionally grips the needle **116** in a gas-tight manner. Because of the frictional resistance afforded by the gasket **27** to penetration and the increasing biasing force exerted by the spring **34** as it is being compressed, the mandrel **57** moves downwardly further relatively to the gas injection nozzle **114** until further movement is arrested by engagement of the radial flange **75** of the adjusting sleeve **74** with the inner sleeve shoulder **78** which, as stated hereinbefore, corresponds to the fully expanded condition of the collet **81**. The instant the mandrel **57** moves relatively to the gas injection nozzle **114**, the notched end of the valve actuator or tube **121** moves into engagement with the enlarged head of the "O"-ring retainer **148** and upon further relative movement between the gas injection nozzle **114** and the mandrel **57**, the plunger **142** is moved vertically upwardly with respect to the upper spacer **127**, and, consequently, the "O"-ring **147** is moved out of sealing engagement with the surface **133**. The notch **122** is then above the surface **133**, as illustrated in FIGURE 4, and pressurized propellant gas is permitted to flow through the notch **122** into the interior of the valve actuator or tube **121**. The gas flows from the interior of the tube **121** to the needle passageway **118** and is emitted from the needle ports **120** and since the closure cap valve device **20** is in its opened condition at this time, as stated hereinbefore, the gas being emitted from the needle ports **120** flows into the valve housing **25** and then into the container body **11**. It will be appreciated that gas is prevented from leaking from the closure cap valve housing **25** by the ring-like gasket **27** and the sealing engagement between the gasket **27** and the needle **116** is established prior to the unseating of the valve plunger **142** by the valve actuator or tube **121**. Furthermore, the closure cap **16** is substantially sealed and secured to the annular bead **15** of the container body **11** before propellant gas is emitted from the nozzle ports **120**.

Once of the collet **81** has reached its fully expanded condition when further downward movement of the mandrel **57** is stopped and the container **10** has been charged with a predetermined quantity of propellant gas, the piston rod **38** is retracted and the above sequence of crimp-forming and gas injecting operations is reversed. It will be appreciated that the valve plunger **142** is firmly seated on the annular valve seat surface **133** and the closure cap valve device **20** is in its closed condition prior to the withdrawal of the nozzle needle **116** from the opening **24** in the closure cap upper portion end wall **23** and the breaking of the seal between the nozzle needle **116** and the sealing gasket **27**.

From the foregoing it is believed apparent the apparatus described above fully achieves the objects of the invention. The need for providing a container transferring mechanism for moving containers from a closure cap crimping machine to a gas injection apparatus as well as the cost of a separate gas injection apparatus has been eliminated. Furthermore, the overall processing time of the container has been shortened considerably.

The embodiment of the invention chosen for the purposes of illustration and description herein is that preferred for achieving the objects of the invention and developing the utility thereof in the most desirable manner, due regard being had to existing factors of economy, simplicity of design and construction, production methods, and the improvements sought to be effected. It will be appreciated, therefore, that the particular structural and functional aspects emphasized herein are not intended to exclude, but rather to suggest, such other modifications and adaptations of the invention as fall within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. An apparatus for manufacturing and pressurizing a sealed container, comprising, means for injecting gas under pressure into a receptacle body having an opening in a wall thereof; and means having a portion thereof substantially encircling said means for injecting gas under pressure into a receptacle body for simultaneously securing a closure cap to said wall in said opening.

2. An apparatus for manufacturing and pressurizing a sealed container, comprising, a gas injection nozzle assembly for injecting gas under pressure into a receptacle body having an opening in a wall thereof; and a mechanism having a portion thereof substantially encircling said gas injection nozzle assembly for simultaneously securing a closure cap to said wall in said opening to form a sealed container.

3. An apparatus for securing a closure cap within an opening in a wall of a receptacle body to form a sealed container simultaneously with the injection into a receptacle body of a gas under pressure, comprising, a mechanism movable into operative engagement with the closure cap to secure the closure cap to said wall in said opening, said mechanism having an open central area; and a gas injection nozzle assembly carried by said mechanism and operatively engageable with said container in the open central area of said mechanism for simultaneously charging said container with gas under pressure during movement of said mechanism into operative engagement with said closure cap.

4. An apparatus for securing a closure cap within an opening in a wall of a receptacle body to form a sealed container simultaneously with the injection into the receptacle body of a gas under pressure, comprising, an expansible and contractible crimp-forming mechanism having a portion thereof movable closely adjacent said closure cap and having an open central area, said mechanism being expandible from a contracted condition, when said portion is closely adjacent said closure cap, into operative engagement with said closure cap to secure said closure cap to said receptacle body; and a gas injection nozzle assembly movable closely adjacent to said closure cap as said portion of said mechanism is moved closely adjacent said closure cap, said gas injection nozzle assembly being operatively engageable with said closure cap in the open central area of said crimp-forming mechanism and being conditionable to charge said container with gas under pressure simultaneously with expansion of said mechanism from its contracted condition.

5. An apparatus for securing a closure cap of the type having a cup-shaped portion within an opening in a wall of a receptacle body to form a sealed container simultaneously with the injection into the receptacle body of a gas under pressure, the vertical cylindrical wall of said cup-shaped portion extending into said opening, comprising, an expansible and contractible crimp-forming mechanism having a portion thereof movable into the space defined by said vertical cylindrical wall and having an open central area, said mechanism being expandible from a contracted condition into operative engagement with said vertical cylindrical wall to secure said closure cap to said receptacle body; and a gas injection nozzle assembly movable closely adjacent to said closure cap as said portion of said mechanism is moved into the space defined by said vertical cylindrical wall, said gas injection nozzle assembly being operatively engageable with said closure cap in the open central area of said crimp-forming mechanism and being conditionable to charge said container with gas under pressure simultaneously with expansion of said mechanism from its contracted condition.

6. An apparatus for securing a closure cap of the type having a cup-shaped portion within an opening in a wall of a receptacle body simultaneously with the injection into the receptacle body of a gas under pressure, the vertical cylindrical wall of said cup-shaped portion extending into said opening, comprising, an expansible and contractible collet having a plurality of circumferentially spaced crimp-forming tips and an open central area, said tips being positionable within said cup-shaped portion and being movable radially outwardly from a contracted position to an expanded position into operative engagement with said vertical cylindrical wall to secure said closure cap to said receptacle body; and a gas injection nozzle assembly movable closely adjacent to said container as said tips are positioned within said cup-shaped portion, said gas injection nozzle assembly being operatively engageable with said container in the open central area of said collet and being conditionable to charge said container with gas under pressure simultaneously with movement of said tips from said contracted position to said expanded position.

7. An apparatus for securing a closure cap of the type having a cup-shaped portion to a wall of a receptacle body having an opening therein defined by an annular bead, the vertical cylindrical wall of said cup-shaped portion extending into said opening, simultaneously with the injection into the receptacle body of a gas under pressure, comprising, an expansible and contractible collet having a plurality of circumferentially spaced crimp-forming tips and an open central area, said tips being positionable within said cup-shaped portion and being movable radially outwardly from a contracted position to an expanded position; actuator means movable relatively to said collet when said collet tips are disposed within said cup-shaped portion a predetermined distance in a particular direction, said actuator means being adapted to operatively engage said collet and effect radial movement of said tips to their expanded position to crimp said cylindrical wall into abutting engagement with said bead; and a gas injection nozzle assembly supported by said actuator means movable closely adjacent to said closure cap as said tips are being positioned within said cup-shaped portion, said gas injection nozzle assembly being operatively engageable with said closure cap in the open central area of said collet and being conditionable to charge said receptacle body with gas under pressure simultaneously with radial movement of said tips from said contracted position to said expanded position.

8. An apparatus for securing a closure cap of the type having a normally closed, check valve-controlled opening therein to a wall of a receptacle body to form a sealed container simultaneously with the injection into the receptacle body of a gas under pressure, comprising, a vertically arranged, vertically movable mechanism, said mechanism being movable vertically toward and away from a position wherein an end portion thereof is closely adjacent to the closure cap to be secured to the receptacle body, said mechanism being operable when in said position to secure the closure cap to the receptacle body; a vertically arranged, generally elongated actuator means movable vertically downwardly with respect to said mechanism when said mechanism is in said position for operating said mechanism to secure said closure cap to said receptacle body; and a gas injection nozzle assembly including a chamber formed in said actuator means adapted to receive gas under pressure, a gas injection nozzle having a tip portion insertable into said closure cap check valve-controlled opening to open the same, means operatively connecting said gas injection nozzle and said actuator means whereby said tip portion is inserted into said check valve-controlled opening during operation of said mechanism by said actuator means, passageway means leading from said chamber and opening into said tip portion, a valve device at one end of the passageway means, said valve device being spring-biased to its closed condition, and a valve actuator, said valve actuator being constructed and arranged to open said valve device during operation of said mechanism by said actuator means.

9. An apparatus as set forth in claim 8, wherein said valve actuator is rigidly connected to said gas injection

nozzle and is provided with a passageway therethrough, said passageway forming a part of said passageway means leading from said chamber and opening into said gas injection nozzle tip portion.

10. An apparatus as set forth in claim 9, wherein said means operatively connecting said gas injection nozzle and said actuator means permits said actuator means to move vertically downwardly with respect to said gas injection nozzle and said valve actuator when said mechanism is in said position and the operation to secure the closure cap to the receptacle body commences.

11. An apparatus as set forth in claim 8, wherein one end of said chamber is defined by a generally horizontal wall having an outlet opening therethrough and one end of said passageway means extends to said outlet opening, the wall surface encircling said outlet opening serving as a valve seat, and said valve device includes a valve plunger disposed within said chamber and movable into sealing engagement with and away from said valve seat to cause closing and opening thereof, said valve actuator slidably engaging said wall and having an end portion thereof disposed in said outlet opening below said valve seat, when said valve plunger is in sealing engagement with said valve seat, said valve actuator end portion being movable above said valve seat to engage said valve plunger and move the valve plunger away from said valve seat during operation of said mechanism by said actuator means.

12. An apparatus for securing a closure cap of the type having a cup-shaped portion to a wall of a receptacle body having an opening therein defined by an annular bead, the vertical cylindrical wall of said cup-shaped portion extending into said opening, simultaneously with the injection into the receptacle body of a gas under pressure, said closure gap being provided with a check valve-controlled opening, comprising, an expansible and contractible collet having a plurality of circumferentially spaced crimp-forming tips, said tips being positionable within said cup-shaped portion and being movable radially outwardly from a contracted position to an expanded position; actuator means movable relatively to said collet when said collet tips are disposed within said cup-shaped portion a predetermined distance in a particular direction, said actuator means being adapted to operatively engage said collet and effect radial movement of said tips to their expanded position to crimp said cylindrical wall into abutting engagement with said bead; and a gas injection nozzle assembly supported by said actuator means movable closely adjacent to said closure cap as said tips are being positioned within said cup-shaped portion; said gas injection nozzle assembly being operatively engageable with said closure gap and being conditionable to charge said receptacle body with gas under pressure simultaneously with radial movement of said tips from said contracted position to said expanded position, said gas injection nozzle assembly including a gas injection nozzle mounted in said collet actuator means for relative sliding movement along the longitudinal axis thereof, said gas injection nozzle having an elongated nozzle needle provided with passageway means therethrough, said nozzle needle being insertable into said closure cap check valve-controlled opening and being effective to place said passageway means in fluid communication with the interior of said receptacle body, said nozzle needle being moved closely adjacent to said closure cap check valve-controlled opening when said tips are positioned within said cup-shaped portion said predetermined distance, said nozzle needle being inserted into said closure cap check valve-controlled opening as said tips move radially from their contracted position when disposed within said cup-shaped portion said predetermined distance to their expanded position, conduit means having one end in fluid communication with said passageway means, said conduit means being adapted to be supplied with gas under pressure, a valve device in said conduit means for controlling the flow of gas under pressure therein, and a valve actuator carried by said collet actuator means and movable with respect thereto to effect opening of said valve device upon relative sliding movement of said gas injection nozzle with respect to said collet actuator means.

13. An apparatus as set forth in claim 12, further including biasing means for yieldably urging said valve device to its closed condition.

14. An apparatus for securing a closure cap of the type having a cup-shaped portion to a wall of a receptacle body having an opening therein defined by an annular bead, the vertical cylindrical wall of said cup-shaped portion extending into said opening, simultaneously with the injection into the receptacle body of a gas under pressure, comprising, an expansible and contractible collet having a plurality of circumferentially spaced crimp-forming tips and an open central area, said tips being movable vertically downwardly so as to be positioned within said cup-shaped portion and being movable radially outwardly from a contracted position to an expanded position; actuator means movable vertically downwardly with said collet until said tips are positioned within said cup-shaped portion, said actuator means being movable relatively to said collet in a particular direction when said collet tips are disposed within said cup-shaped portion a predetermined distance, said actuator means being adapted to operatively engage said collet and effect radial movement of said tips to their expanded position to crimp said cylindrical wall into abutting engagement with said bead; a gas injection nozzle assembly movable vertically downwardly in unison with said actuator means in the open central area of said collet so as to be closely adjacent to said closure cap as said tips are being positioned within said cup-shaped portion, and means for providing a lost motion connection between said actuator means and said gas injection nozzle assembly and said actuator means whereby said actuator ing vertically downwardly with respect to said gas injection nozzle assembly into operative engagement with said closure cap and is conditioned to charge said receptacle body with gas under pressure simultaneously with radial movement of said tips from said contracted position to said expanded position.

15. An apparatus for securing a closure cap of the type having a cup-shaped portion and an annular, curved flange extending radially from the upper end of the vertical cylindrical wall of the cup-shaped portion to a wall of a receptacle body having an opening therein defined by an annular bead, said cylindrical wall extending into said opening and said curved flange overlying and resting upon the upper surface of said bead, simultaneously with the injection into the receptacle body of a gas under pressure, comprising an annular anvil surface, the radius of curvature of said surface in vertical cross section conforming substantially to the radius of curvature of said closure cap flange, said anvil surface being movable vertically downwardly into abutting engagement with said closure cap flange; an expansible and contractible collet having a plurality of circumferentially spaced, crimp-forming tips vertically spaced above said anvil surface and having an open central area, said crimp-forming tips being movable radially outwardly from a contracted position to an expanded position, said collet being movable vertically downwardly in unison with said anvil surface until said anvil surface abuts said closure cap flange; means for providing a lost motion connection between said collet and said anvil surface whereby said collet is capable of moving vertically downwardly with respect to said anvil surface a predetermined distance to a position wherein said anvil surface encircles said collet and said tips are disposed within said cup-shaped portion below said anvil surface; actuator means movable vertically in unison with said collet and anvil surface, said actuator means being movable vertically a predetermined distance with respect to said collet and anvil sur-

face when said anvil surface abuts said closure cap flange and said tips are disposed within said cup-shaped portion below said anvil surface to operatively engage said collet and effect radial movement of said tips to their expanded position to crimp said cylindrical wall into abutting engagement with said bead; a gas injection nozzle assembly operatively engageable with said closure cap in the open central area of said collet and conditionable to charge said receptacle body with gas under pressure said gas injection nozzle assembly being movable vertically downwardly in unison with said actuator means until said anvil surface abuts said closure cap flange, said tips are disposed within said cup-shaped portion below said anvil surface and said gas injection nozzle assembly is closely adjacent to said closure cap; and means providing a lost motion connection between said gas injection nozzle assembly and said actuator means whereby said actuator means is capable of moving vertically with respect to each other, said gas injection nozzle assembly operatively engaging said closure cap and conditioned to charge said receptacle body with gas under pressure as said actuator means moves vertically said predetermined distance with respect to said collet surface.

16. An apparatus for securing a closure cap of the type having a cup-shaped portion, an annular, curved flange extending radially from the upper end of the vertical cylindrical wall of the cup-shaped portion, and a check valved-controlled opening to a wall of a receptacle body having an opening therein defined by an annular bead, said cylindrical wall extending into said opening and said curved flange overlying and resting upon the upper surface of said bead, simultaneously with the injection into the receptacle body of a gas under pressure, comprising, a vertically arranged outer sleeve; a plate-like bell having a central opening therethrough defined by an annular anvil surface; means for detachably connecting said bell to the lower end of said sleeve; a vertically movable inner sleeve within said outer sleeve; means operatively connecting said sleeves whereby said sleeves are movable vertically downwardly in unison until said anvil surface abuts said bead, said means providing a lost motion connection whereby said inner sleeve is capable of moving further vertically downwardly with respect to said outer sleeve a predetermined distance; an expansible and contractible collet including a plurality of circumferentially-spaced fingers; each of said fingers having its lower end provided with a crimp-forming tip and the inner faces of said fingers being inclined downwardly and inwardly from the upper ends thereof and defining a tapered bore extending vertically through the collet, said tips being movable radially outwardly from a contracted position to an expanded position; an endless spring means encircling and engaging said fingers for biasing said tips to their contracted position; quick detachable means for pivotally connecting the upper ends of said fingers to the lower end of said inner sleeve; a vertically movable mandrel extending into said inner sleeve and in vertical alignment with the longitudinal axes of said tapered bore and said bell opening, said mandrel having a valve chamber formed therein adapted to receive gas under pressure, said valve chamber being partially defined at one end by an annular outlet valve seat, means operatively connecting said inner sleeve and mandrel whereby said inner sleeve and mandrel are movable vertically downwardly in unison said predetermined distance with respect to said outer sleeve until said fingers extend through said bell opening and said crimp-forming tips are disposed within said cup-shaped portion, said means including means providing a lost motion connection whereby said mandrel is capable of moving further vertically downwardly with respect to said sleeves, stop means carried by said mandrel, and stop means on said inner sleeve engageable with said stop means carried by said mandrel for positively limiting relative vertical downward movement with respect to said sleeves; a collet actuator member having one end provided with a frusto-conical camming surface; means operatively connecting said actuator member to the lower end of said mandrel whereby said mandrel and actuator member are movable vertically in unison, said camming surface moving vertically downwardly through said tapered bore as said mandrel moves vertically downwardly with respect to said sleeves and adapted to slidingly engage said inner faces of said fingers and thereby effect outward pivoting of said fingers; a valve plunger disposed within said valve chamber and supported on said valve seat, said valve plunger being movable toward and away from said valve seat to cause closing and opening thereof; a gas injection nozzle mounted in said collet actuator member for relative sliding movement along the longitudinal axis of said collet actuator member, said gas injection nozzle having an elongated nozzle needle provided with passageway means extending therethrough, said nozzle needle being insertable into said closure cap valved opening as said mandrel moves vertically downwardly with respect to said sleeves and being effective to place said passageway means in fluid communication with the interior of said receptacle body; and a valve actuator having one end rigidly connected to said gas injection nozzle and its opposite end closely adjacent to said valve plunger when said valve plunger is in its closed condition, said valve actuator having passageway means therein extending between said valve seat and one end of said nozzle needle passageway means, said valve plunger being engaged by the end of the valve actuator closely adjacent thereto to be moved away from said valve seat upon relative sliding movement between said gas injection nozzle and said collet actuator member as said mandrel moves vertically downwardly with respect to said sleeves to place said valve chamber in fluid communication with the interior of said receptacle body.

17. An apparatus for securing a closure cap of the type having a cup-shaped portion to a wall of a receptacle body having an opening therein defined by an annular bead, the vertical cylindrical wall of said cup-shaped portion extending into said opening, simultaneously with the injection into the receptacle body of a gas under pressure, said closure cap being provided with a central valved opening, comprising, an expansible and contractible collet having a plurality of circumferentially spaced crimp-forming tips, said tips being positionable within said cup-shaped portion and being movable radially outwardly from a contracted position to an expanded position; actuator means movable relatively to said collet when said collet tips are disposed within said cup-shaped portion a predetermined distance in a particular direction, said actuator means being adapted to operatively engage said collet and effect radial movement of said tips to their expanded position to crimp said cylindrical wall into abutting engagement with said bead; said actuator means including a mandrel arranged in vertical alignment with the longitudinal axis of said collet and a collet actuator member having one end operatively connected to the lower end of said mandrel for vertical movement in unison; and a gas injection nozzle assembly supported by said actuator means movable closely adjacent to said closure cap as said tips are being positioned within said cup-shaped portion, said gas injection nozzle assembly being operatively engageable with said closure cap and being conditionable to charge said receptacle body with gas under pressure simultaneously with radial movement of said tips from said contracted position to said expanded position, said gas injection nozzle assembly includes a valve chamber formed in said mandrel adapted to receive gas under pressure, said valve chamber being partially defined at one end by an annular outlet valve seat, a valve plunger disposed within said valve chamber and supported on said valve seat, said valve plunger being movable toward and away from said valve seat to cause closing and opening thereof, spring means for biasing said valve plunger to its closed condition; a gas injection nozzle mounted in said

collet actuator member for relative sliding movement along the longitudinal axis of said collet actuator member, said gas injection nozzle having an elongated nozzle needle provided with passageway means extending therethrough, said nozzle needle being movable closely adjacent said closure cap valved opening when said collet tips are positioned within said cup-shaped portion said predetermined distance, said nozzle needle being insertable into said closure cap valved opening and being effective to place said passageway means in fluid communication with the interior of said receptacle body as said tips move radially from their contracted position when disposed within said cup-shaped portion said predetermined distance to their expanded position, a valve actuator having one end rigidly connected to said gas injection nozzle and its opposite end closely adjacent to said valve plunger when said valve plunger is in its closed condition, said valve actuator having passageway means therein having one end in fluid communication with one end of said nozzle needle passageway means and its opposite end opening into said valve seat, said valve plunger being engaged by the end of said valve actuator closely adjacent thereto to be moved away from said valve seat after said nozzle needle is inserted into said closure cap valved opening and upon relative movement of said collet actuator means with respect to said gas injection nozzle as radial movement of said collet tips from their contracted position to their expanded position is being effected to permit flow of pressurized gas from said valve chamber to the interior of said receptacle body.

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