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GAS INJECTION NOZZLE ASSEMBLY

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Fig. 1.

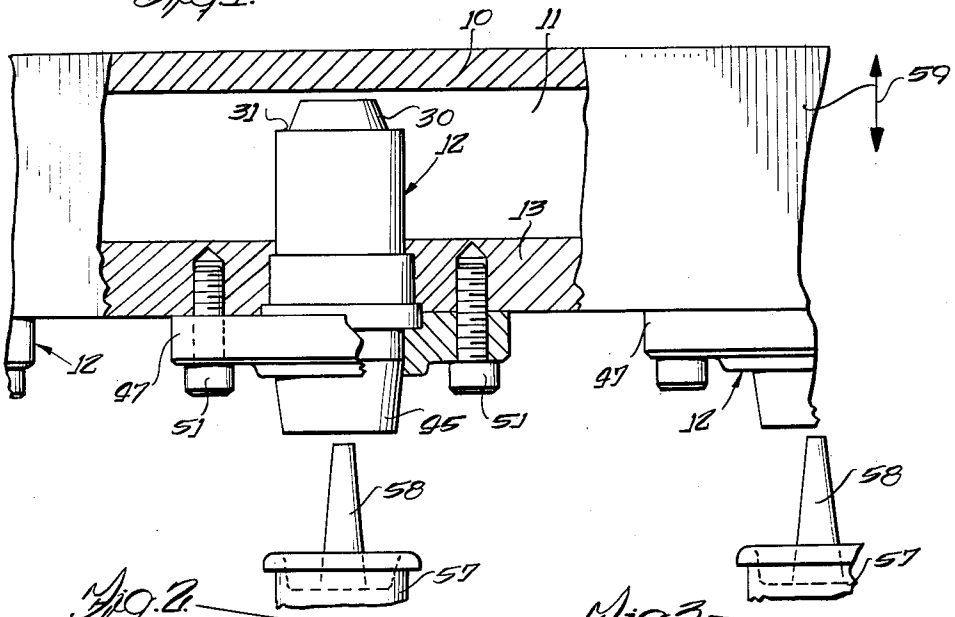


Fig. 2.

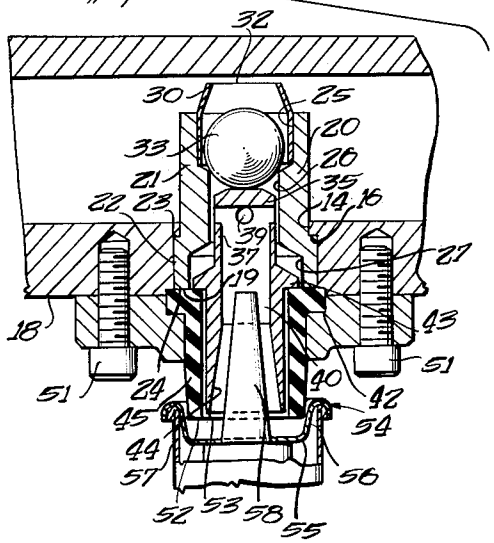
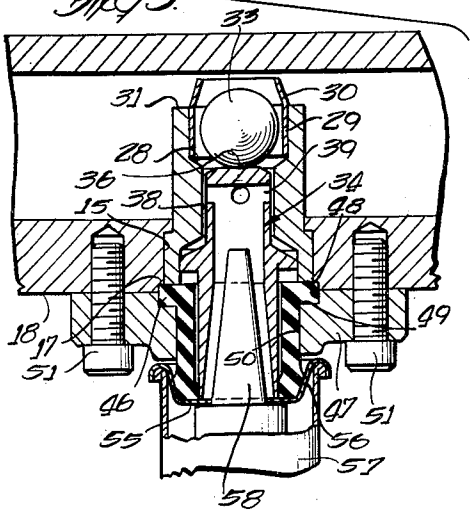


Fig. 3.



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GAS INJECTION NOZZLE ASSEMBLY

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This invention relates to a gas injection nozzle assembly and more particularly to a new and improved gas injection nozzle assembly for charging sealed, self-dispensing containers with propellant gas under pressure.

The present invention is primarily concerned with the processing of receptacles or containers wherein a product such as paint, insecticide, cream, etc. disposed within the receptacle is expelled therefrom by a gas under pressure also contained within the receptacle. 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. In the processing of the receptacles, subsequent to the operations wherein the cylindrical body is filled with a predetermined quantity of the product to be dispensed and a closure cap having a valve device incorporated therein to control dispensing of the product is permanently fixed and sealed to the neck opening, gas under a particular pressure is injected into the receptacle. It is, therefore, an important object of the invention to provide a novel gas injection nozzle assembly having valve means incorporated therein carried by a pressurized gas containing manifold which nozzle is adapted to conduct gas from the manifold to the receptacle in a gas-tight manner when the nozzle and receptacle are brought into operative engagement with each other.

Another object of the present invention is the provision of a novel gas injection nozzle assembly for charging sealed, self-dispensing containers containing a liquid product with gas under pressure.

Heretofore, injection nozzle assemblies of the type to which the present invention relates have been undesirably complicated, and hence, costly and/or not possessing sufficient precision in operation. Generally, the valve means involved a slide type valve adapted to cover and uncover an orifice or port to control gas flow through the port. Inasmuch as such valves are subject to accumulation of dirt and grease between the port and slide valve member, the valve oftentimes malfunctioned permitting the escape of gas from the nozzle assembly even though the valve means are closed. Further, prior nozzle assemblies had to be periodically disassembled to be cleaned and then reassembled again, all of which was time consuming and normally required the shutdown of the gas charging system. It is, therefore, another object of the invention to provide a self-cleaning valve means for a gas injection nozzle in which the entire valve seat and valve element are subjected to the scrubbing action of the gas as it flows through the valve when open.

A further object is the provision of a 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 long, trouble-free periods of time with very little attention.

A still further object of the invention is the provision of a gas injection nozzle assembly incorporating a self-seating valve member to insure against gas leakage when the valve is in its closed condition.

Another object is the provision of a novel valve actuator for the valve means of a gas injection nozzle assembly which is capable of positively and quickly unseating the valve element and of permitting relatively unrestricted flow of pressurized gas therethrough and which unseating of the valve element thereby only takes place after the nozzle assembly is in engagement with a container being charged in a gas-tight manner.

It is another object of the invention to provide a gas injection assembly wherein the movable valve element is made of a relatively light weight, slightly resilient non-metallic material capable of withstanding corrosion from the gas being discharged by the nozzle assembly.

The foregoing and other desirable features inherent in and encompassed by the invention, together with many of the purposes and uses thereof will become readily apparent from a reading of the ensuing description in conjunction with the annexed drawing, in which,

FIGURE 1 is a front elevational view of a portion of a gas injection manifold having a gas injection nozzle assembly embodying the invention incorporated therein, a portion of the manifold is broken away to better illustrate the invention;

FIGURE 2 is an enlarged detailed vertical sectional view of a gas injection nozzle assembly showing the various relative positions of the parts thereof with respect to each other when the valve means is closed; and

FIGURE 3 is a view similar to FIGURE 2 with the exception that the parts of the nozzle are shown in the various relative positions assumed thereby when the valve means is opened and the container is being charged with gas under pressure.

Referring to the drawings in detail, wherein like reference characters represent like elements throughout the various views, there is shown a portion of a hollow gas injecting manifold **10**. The interior **11** of the manifold is adapted to be supplied with gas under a particular pressure by means not shown. The nozzle assembly, designated generally by numeral **12**, is adapted to be secured to the lower wall **13** of the manifold **10**. It is to be understood that the manifold **10** could be provided with a plurality of spaced gas injection nozzle assemblies **12** to charge a plurality of receptacles simultaneously without departing from the spirit and scope of the invention. Two other gas injection nozzle assemblies **12** are partially shown in FIGURE 1.

The lower wall **13** is provided with a bore **14** leading from the interior **11** of the manifold **10** and a relatively longer bore **15** coaxial with and of larger diameter than the bore **14** to provide an annular radial shoulder **16**. A second relatively short bore **17**, coaxial with the bores **14** and **15**, extends from the outermost surface **18** of the bottom wall **11** inwardly. The diameter of the bore **17** is greater than the diameter of the bore **15** to provide an annular radial shoulder **19**.

As shown in FIGURES 2 and 3, a generally tubular valve body **20** is adapted to be positioned within the bores **14** and **15**. The outer surface of the valve body **20** is formed to provide two sections **21** and **22** of different diameters. The diameter of the section **21** is substantially equal to the diameter of the bore **14** and similarly the diameter of the section **22** is substantially equal to the diameter of the bore **15**. The shoulder **23** formed between the sections **21** and **22** is adapted to abut the annular shoulder **16** between the bores **14** and **15** as shown in FIGURE 2. The length of the section **22** substantially coincides with the length of the bore **15** and consequently when the valve body **20** is assembled on the manifold **10** the lower end surface **24** of the valve body **20** lies in substantially the same radially extending plane containing the annular shoulder **19**. The interior of the valve body **20** is formed provided with three coaxial and longitudinally spaced bores **25**, **26**, and **27**, which are all of different diameters. The intermediate bore **26**, having

one end in communication with the bore 25 and its opposite end in communications with the bore 27, is of the smallest diameter of the three bores 25, 26, and 27. The juncture of the bores 25 and 26 is defined by an annular conic valve seat 28. A valve guide and retainer element, designated generally by numeral 29, is adapted to be press fit into the bore 25. An inwardly tapered end portion 30 of the valve guide and retainer element 29 extends above the uppermost end 31 of the valve body 20 and is formed to provide a circular opening 32 of less diameter than the diameter of a movable spherical valve element 33 disposed within the element 29. From the foregoing it will be appreciated that the ball valve element is capable of seating on the annular valve seat 28 to prevent flow of gas from the interior 11 of the manifold 10 to the bore 26 and since the opening 32 is of less diameter than the ball valve element 33 the limits of movement of the ball valve element 33 with respect to the valve body 20 is defined by the valve seat 28 and the upwardly projecting tapered end portion 30 of the valve guide and retainer element 29. It will be observed that the conic wall constituting the valve seat 28 continues divergently somewhat beyond the annular surface thereof actually required to form a valve seat for ball valve element 33. Thus, the ball valve element 33 will be funneled or guided onto the valve seat 28 to insure an efficient seal between the ball valve element 33 and the valve seat 28. The interior diameter of the valve guide and retainer element 29 disposed within the bore 25 is sufficiently large when compared with the diameter of the ball valve element 33 to permit gas to flow around the ball valve element 33 and into the bore 26 when the ball element 33 is unseated. The ball valve element 33 is made of a relatively light weight non-metallic slightly resilient material, preferably nylon or the like, and consequently, is capable of deforming slightly by the pressure of the gas acting thereon to conform to the valve seat 28 and insure a gas-tight seal between the valve seat 28 and the valve element 33 when the valve is closed.

A valve actuator designated generally by numeral 34, is arranged for longitudinal movement with respect to the valve body 20 and is so operatively associated with the ball valve element 33 that longitudinal downward movement of the actuator 34 to a particular position will permit the ball valve element 33 to seat itself solidly against the valve seat 28 by the pressure of the gas within the interior 11 of the manifold 10 acting upon the ball valve element 33 and vertically upward movement of the actuator 34 will move the ball valve element 33 a longitudinal distance off of and away from the valve seat 28. The valve actuator 24 is in the form of an elongated tubular member closed at one end thereof by an end wall 35, the uppermost outer surface 36 thereof being adapted to engage the ball valve element 33. As shown in FIGURES 2 and 3, an end portion 37 of the actuator 34 is adapted to reciprocate within the bore 26. It will be noted that the outer surface of the end portion is spaced from the bore 26 to provide an annular space 38. A plurality of radially extending, circumferentially spaced ports 39 are formed through the end portion 37 adjacent the end wall 35 to provide gas communication between the annular space 38 and the interior of the valve actuator 34. The valve actuator 34 is provided with a radially extending flange 42. The flange 42 is longitudinally spaced between the ends of the actuator 34 and the peripheral edge 43 thereof lies closely adjacent to the bore 27. The interior of the valve actuator 34 is provided with a central passageway 40 which is substantially cylindrical with the exception of the lower portion 44 thereof which flares outwardly in a downward direction.

A generally cylindrical sealing member 45, preferably made of rubber or the like, is adapted to encircle the lower end of the valve actuator 34. One end of the sealing member 45 is provided with an integrally formed, radially outwardly extending annular flange 46. The annular flange 46 is adapted to be seated against the shoulder 19 and the bottom end surface 24 of the valve body 20 which lie in substantially the same plane. A peripheral edge portion of the annular flange 46 also engages the bore 17.

A mounting collar 47 is used to fasten the gas injection nozzle assembly 12 to the manifold 10. The collar 47 is provided with a circular recess 48 approximately in the center thereof. The recess 48 has substantially the same diameter as the bore 17 formed in the bottom wall 13 of the manifold 10 and is adapted to be placed in registration with the bore 17, as shown in FIGURES 2 and 3. One end of the recess 48 is defined by a radially inwardly extending annular shoulder 49. From the foregoing it will be appreciated that the shoulders 49, 19, the lower end surface 24 of the valve body 20, the recess 48 and the bore 17 define an annular pocket for receiving the flange 46, of the seating member 45. The mounting collar 47 is also provided with a central circular opening 50 therethrough which is coaxial with the recess 48 but of a smaller diameter through which the sealing member 45 extends. A plurality of bolts 51, two being shown in FIGURE 1, are adapted to firmly clamp the mounting collar 47 to the underside 18 of the bottom wall 13 of the manifold 10. It will be noted that the lowermost tip portion 52 of the sealing member 45 depends below the lowermost end 53 of the valve actuator 34 when the ball valve element 33 is seated on the annular valve seat 28 as shown in FIGURE 2.

As stated hereinbefore the purpose of the gas injection nozzle assembly 12 is to charge liquid-filled, sealed, self-dispensing containers with gas under pressure. Such containers 54, partially shown in the drawing, have a shape which has been standardized.

The containers 54 each include a closure cap having a valve device (not shown) incorporated therein for controlling discharge of the pressurized fluid therefrom. The closure member is generally cup-shaped in form to provide a generally radially extending circular wall 55 and an annular flange 56 integrally formed with an extending generally upwardly from the marginal edge of the circular surface 55. The uppermost edge of the flange 56 is in the form of a bead which is crimped to the upper end of the cylindrical neck portion 57 of the container 54. A centrally located dispensing spout 58 extends vertically from the wall 55 of the closure cap.

In operation, the manifold 10 is adapted to be reciprocated vertically toward and away from the containers 54, as indicated by the arrow 59, to effect operative engagement and disengagement of the gas injection assemblies and the containers. When the manifold 10 is raised as shown in FIGURE 1, the valve means of the gas injection nozzles are in their closed conditions. The pressure of the gas within the interior 11 of the manifold 10 acts on the ball valve element 33 and because of the spherical shape of the element 33 and the fact that it is made of relatively light weight, slightly resilient material it is firmly urged into a tight sealing relationship with the annular valve seat 28 to effectively prevent leakage of the gas from the interior 11 of the manifold 10 to the passageway 40 formed in the valve actuator 34. The pressure of the gas also urges the valve actuator 34 to its lowermost position as shown in FIGURE 2. When the ball valve element 33 is seated upon the valve seat 28, the valve actuator 34 is in its lowermost position as shown in FIGURE 2 with the radial flange 42 thereof resting upon an annular portion of the flange 46 of the rubber sealing member 45. As the manifold is advanced toward the container 54, the spout 58 of the container 54 is caused to enter the passageway 40 of the valve actuator 34. Further movement of the manifold 10 toward the container 54 causes the annular tip portion 52 of the rubber sealing 45 to engage the circular wall 55 of the container closure cap adjacent to the juncture of the wall 55 and the flange 56. Inasmuch as the tip por-

tion 52 is vertically spaced below the lowermost end 53 of the valve actuator 34, the instant the tip 52 of the rubber sealing member 45 engages the surface 55 the lower end 53 of the valve actuator 34 is still vertically spaced above and is not contacting the wall 55 of the closure cap. Upon further downward movement of the manifold 10 with respect to the container 54, the tip portion 52 of the rubber member 45 is firmly pressed into engagement with the wall 55 and flange 56 of the closure cap at the juncture of the flange 56 and wall 55 and the lowermost end of the valve actuator 34 is brought into engagement with the wall 55. As the manifold 10 continues to move vertically downwardly the valve actuator 34 is moved vertically upwardly with respect to the valve body 20 and consequently the ball valve element 33 is unseated permitting gas to flow through the radial ports 39 into the passageway 40 of the valve actuator. The pressure of the gas overcomes the valve device disposed within the closure cap and thus the gas flows into the container 54. It will be appreciated that gas is prevented from leaking from the passageway 40 by the rubber member 45 and the sealing engagement between the rubber member 45 and the closure cap 54 is established prior to the opening of the ball valve element 33 by the valve actuator 34.

Once the container has been charged with a predetermined quantity of gas, the manifold 10 is raised and the above sequence of operations is reversed. It will be appreciated that the valve element 33 is firmly seated on the annular valve seat 28 prior to the breaking of the seal between the rubber member 45 and the closure cap.

The embodiment of the invention chosen for the purposes of illustration and description herein is preferred for achieving the objects of the invention and developing the utility thereof in the most desirable manner, due regard being added to existing factors of economy, simplicity of design and construction and improvements sought to be perfected. 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 adaptations and modifications of the invention as fall within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A gas injection nozzle assembly for conducting and controlling the flow of gas under pressure from a manifold to a sealed receptacle through a valved opening provided in the receptacle, comprising, a generally tubular valve body disposed within an opening formed through a wall of the manifold, said valve body having a valve chamber partially defined at one end thereof by a frusto-conical valve seat formed in the valve body and being disposed within the manifold; a spherical valve element disposed within said valve chamber and freely supported on said valve seat, said valve element being movable toward and away from said valve seat to cause closing and opening thereof; a valve guide and retainer element carried by said valve body, said valve guide and retainer element having a portion thereof provided with a frusto-conical face spaced from said valve seat along the longitudinal axis of said valve body adapted to engage said valve element to limit longitudinal movement of said element away from said valve seat; a valve actuator mounted in said valve body for relative sliding movement along the longitudinal axis of said valve body, said valve actuator having one end contacting said valve element and its opposite end portion projecting from said wall of the manifold, said valve actuator having a central longitudinally extending passageway extending from the projecting end thereof and port means for establishing gas communication between said passageway and the interior of said valve body on the side of said valve seat opposite said valve chamber; a resilient member having an end portion immovably secured to said valve body, said resilient member encircling the projecting end portion of said valve actuator having a receptacle-engaging end portion longitudinally spaced outwardly from the end of the projecting end portion of said valve actuator when said valve element is seated on said valve seat; means for limiting the extent of longitudinal sliding movement permitted between said valve actuator and said valve body, said means including an annular end portion of said resilient member; and means for releasably mounting said valve body, valve actuator, and resilient member on the manifold.

2. A gas injection assembly substantially as set forth in claim 1, wherein one end of said resilient member is provided with a radially outwardly extending flange adapted to abut one end of said valve body; and said means for releasably mounting said valve body, valve actuator and said resilient member to said wall of the manifold includes a plate-like member having a central opening therethrough through which said resilient member is adapted to extend, said plate-like member being counterbored at one end of said opening to provide a radially extending annular surface, said annular surfaces partially defining a pocket for accommodating said resilient member flange; and means for clamping said plate-like member to said wall of the manifold.

3. A gas injection nozzle assembly for conducting and controlling the flow of gas under pressure from a manifold to a sealed receptacle through a valved opening provided in the receptacle, comprising, a generally tubular valve body disposed within an opening formed through a wall in the manifold, said valve body having a valve chamber partially defined at one end thereof by a frusto-conical valve seat formed in the valve body and being disposed within the manifold; a spherical valve element made of non-metallic, slightly resilient material disposed within said valve chamber and freely supported on said valve seat, said valve element being movable toward and away from said valve seat to cause closing and opening thereof; a valve guide and retainer element carried by said valve body, said valve guide and retainer element having a portion thereof provided with a frusto-conical face spaced from said valve seat along the longitudinal axis of said valve body and serving as an abutment to limit movement of said valve element away from said valve seat; a valve actuator mounted in said valve body for relative sliding movement along the longitudinal axis of said valve body having an end contacting said valve element and an opposite end portion projecting longitudinally from said wall of the manifold, said valve actuator having a central longitudinally extending passageway extending from the projecting end thereof and a plurality of circumferentially spaced, radially extending ports for establishing gas communication between said passageway and the interior of said valve body on the side of said valve seat opposite said valve chamber; a resilient member having an end portion immovably secured to said valve body, said resilient member encircling the projecting end portion of said valve actuator having a receptacle-engaging end portion longitudinally spaced outwardly from the end of the projecting end portion of said valve actuator when said valve element is seated on said valve seat; longitudinally spaced abutment means for operatively engaging said valve actuator to limit the relative longitudinal sliding movement permitted between said valve body and valve actuator, said abutment means including an annular end portion of said resilient member; and means for releasably mounting said valve body, valve actuator, and resilient member on the manifold.

4. A gas injection assembly for conducting and controlling the flow of gas under pressure from a manifold to a sealed receptacle through a valved opening provided in the receptacle, comprising, a generally tubular valve body disposed within an opening formed through a wall of the manifold, said valve body having three longitudinally extending bores of different diameters former therethrough and arranged end-to-end, the intermediate bore

having the smallest diameter and one of the end bores serving as a valve chamber, the annular shoulder at the junction of said intermediate bore and said valve chamber bore having a frusto-conical face serving as a valve seat, said valve seat being disposed in the manifold; a spherical valve element disposed within said valve chamber bore and freely supported on said valve seat, said valve element being adapted to be urged into sealing engagement with said valve seat by the pressurized gas in the manifold and to be moved away from said valve seat to cause opening thereof; a valve actuator mounted in said valve body for relative sliding movement along the longitudinal axis of said valve body having an end contacting said valve element and an opposite end portion projecting from said wall of the manifold, the end portion of said valve actuator opposite said projecting end portion extending into and being radially spaced from said intermediate bore, said valve actuator having a radially outwardly extending flange intermediate its ends, the peripheral edge of said flange being adapted to sliding engage said end bore opposite said valve chamber bore, said valve actuator having a central longitudinally extending passageway extending from the projecting end thereof and a plurality of circumferentially spaced, radially extending ports adjacent the end thereof contacting said valve element for establishing gas communication between said passageway and the space between said intermediate bore and said valve actuator; a resilient member having an end portion immovably secured to said valve body, said resilient member encircling the projecting end portion of said valve actuator having a receptacle-engaging end portion longitudinally spaced outwardly from the end of the projecting end portion of said valve actuator when said valve element is seated on said valve seat; abutment means for engaging said radially extending flange of said valve actuator for limiting the extent of relative longitudinal sliding movement permitted between said valve actuator and said valve body including an annular end portion of said resilient member; and means for releasably mounting said valve body, valve actuator, and resilient member on the manifold.

5. A gas injection assembly for conducting and controlling the flow of gas under pressure from a manifold to a sealed receptacle through a valved opening provided in the receptacle, comprising, a generally tubular valve body disposed within an opening formed through a wall of the manifold, said valve body having three longitudinally extending bores of different diameters formed therethrough and arranged end to end, the intermediate bore having the smallest diameter and one of the end bores serving as a valve chamber and being disposed within the manifold, the annular shoulders at the junction of said intermediate bore and said valve chamber bore having a frusto-conical face serving as a valve seat; a spherical valve element disposed within said valve chamber bore and freely supported on said valve seat, said valve element being adapted to be urged into sealing engagement with said valve seat by the pressurized gas in the manifold and to be moved away from said valve seat to cause opening thereof; a valve actuator mounted in said valve body for relative sliding movement along the longitudinal axis of said valve body having an end contacting said valve element and an opposite end portion projecting from said wall of the manifold, the end portion of said valve actuator opposite said projecting end portion extending into and being radially spaced from said intermediate bore, said valve actuator having a radially outwardly extending flange intermediate to its ends, the peripheral edge of said flange being adapted to slidingly engage said end bore opposite said valve chamber bore, said valve actuator having a central longitudinally extending passageway extending from the projecting end thereof and a plurality of circumferentially spaced, radially extending ports adjacent the end thereof contacting said valve element for establishing gas communication between said passageway and the space between said intermediate bore and said valve actuator; a resilient member encircling the projecting end portion of said actuator having a receptacle-engaging portion on one end and a radially outwardly extending flange on its opposite end, said receptacle-engaging end portion being longitudinally spaced outwardly from the end of the projecting end portion of said valve actuator when said valve element is seated on said valve seat, said flange of said resilient member abutting one end of said valve body; abutment means for engaging said radially extending flange of said valve actuator for limiting the extent of relative longitudinal sliding movement permitted between said valve actuator and said valve body including an annular end portion of said resilient member spaced radially inwardly of said resilient member flange; and means for releasably mounting said valve body, valve actuator, and resilient member on the manifold.

6. A gas injection assembly substantially as set forth in claim 5, wherein said means for releasably mounting said valve body, valve actuator, and resilient member on the manifold includes a plate-like member having a central opening therethrough though which said resilient member extends, said plate-like member being counterbored at one end of said central opening to provide a radially extending annular surface and an axially extending annular surface, said annular surfaces partially defining a pocket for accommodating said flange of said resilient member, and means for clamping said plate-like member to said wall of the manifold.

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