April 27, 1965 J. E. MULLER 3,180,374

COMBINED FILLING AND DISPENSING VALVE FOR CONTAINERS FOR COMPRESSED FLUIDS

Filed Aug. 31, 1961 2 Sheets-Sheet 1

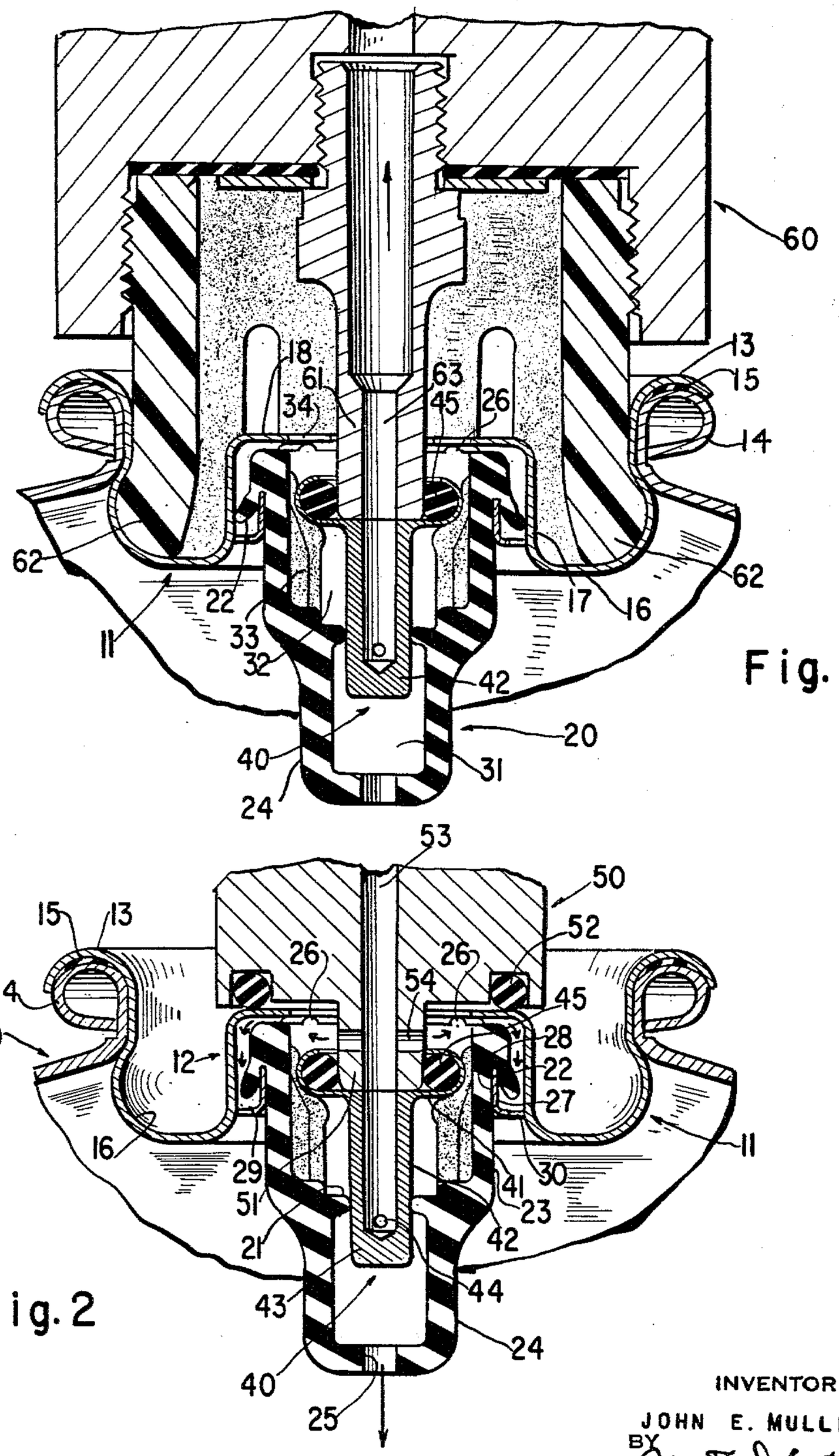

Fig. 1

Fig. 2

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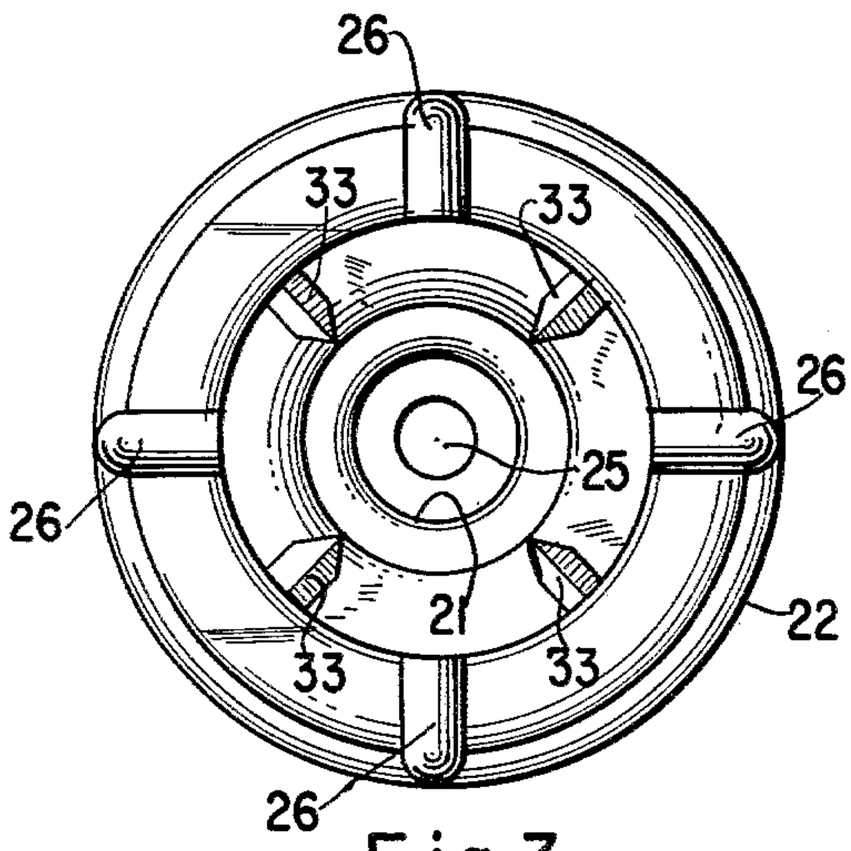


Fig. 3

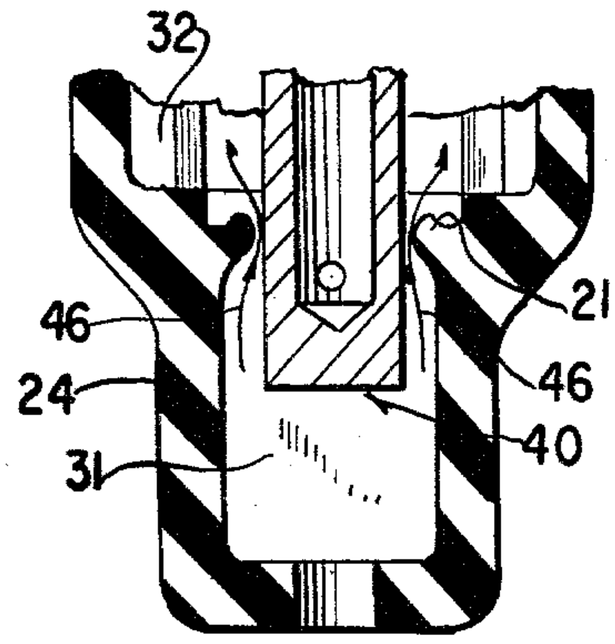


Fig. 4

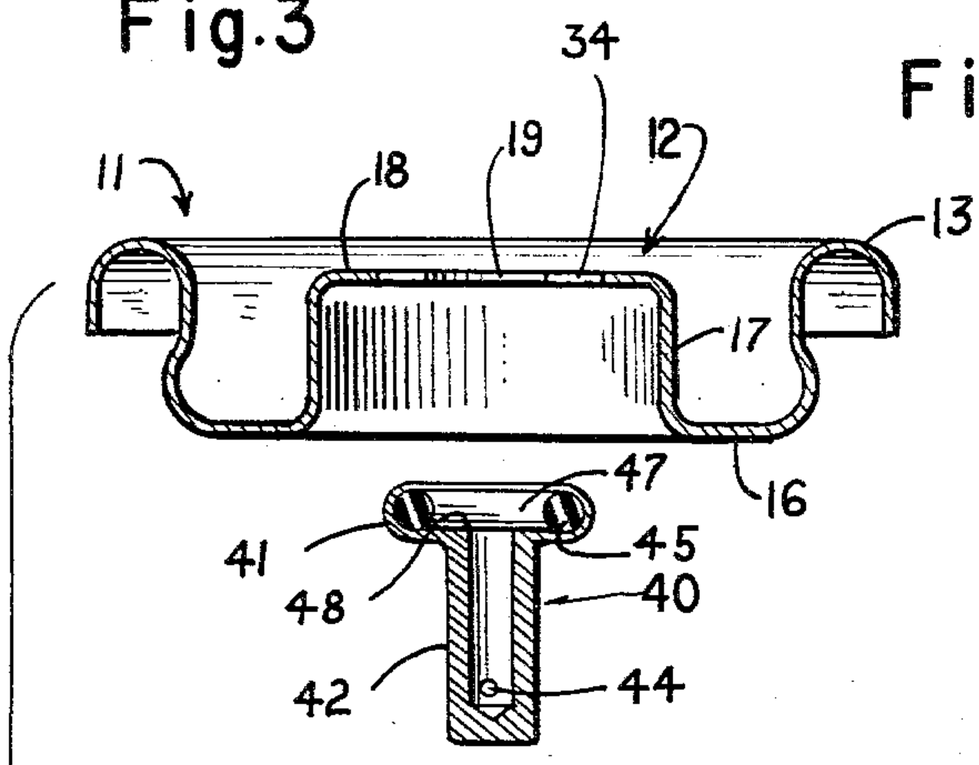
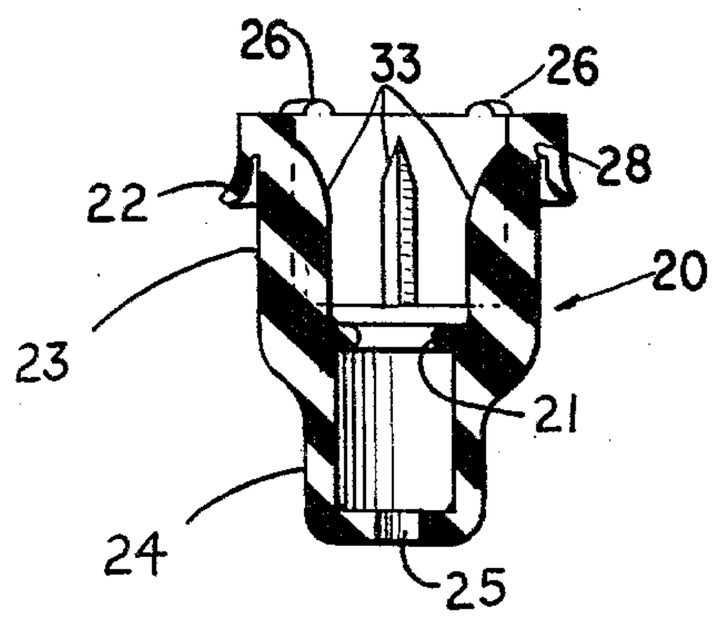
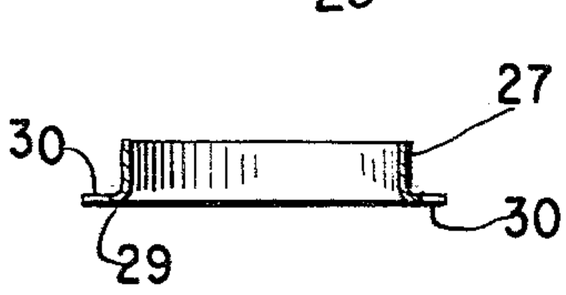


Fig. 5





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COMBINED FILLING AND DISPENSING VALVE FOR CONTAINERS FOR COMPRESSED FLUIDS

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12 Claims. (Cl. 141—20)

This invention relates to a valve structure and more particularly to a filling and dispensing valve for vessels which contain liquefied, semi-liquid, or gaseous material under superatmospheric pressure.

The filling of compressed fluids into containers from which they may be dispensed for use is presently accomplished for the most part by either of two procedures. According to one procedure, the material with which the container is to be filled is chilled to liquefy it and the liquefied material is poured into an opening of the container. A closure is then sealed to the opening. This procedure requires that the filling and sealing operations be carried out at a temperature below the vaporization temperature of the material and, therefore, requires the use of expensive refrigeration equipment.

According to another procedure, sometimes referred to as "undercap filling," the closure is held in sealed relation to but above the container opening by a tubular member disposed between the container and the closure. This tubular member provides jet openings through which the container is filled with the compressed fluid, following which the closure is lowered and crimped onto the container body. While this procedure may be carried out at room temperatures, it is nevertheless time consuming and cumbersome.

In the use of either of the practices above mentioned, the assembly of the closure with the container cannot be completed until after the container is filled, a fact obviously detrimental to mass production techniques. Once the dispensing closure is fixed to the body of the container, filling of the container is no longer feasible except by use of the minute orifice provided in the dispensing valve for regulating the delivery of the pressurized material.

While it has been proposed to fill containers through the dispensing orifices of valves previously fixed to the containers, such a practice is obviously of limited value since those orifices are made quite small in order to provide the required limited rate of delivery of the material.

It is a principal object of the present invention to provide a combined filling and dispensing valve which can be completely assembled with a container for a compressed fluid material before the container is filled and yet through which the filling can be carried out quickly and efficiently.

Another object of the invention is to provide an improved valve construction for containers for compressed fluids which is quite simple and is inexpensive to manufacture and assemble.

Still another object of the invention is to provide a dispensing and filling valve which serves also as a relief or safety valve to release any pressure in the container in excess of a predetermined safe pressure. Thus a single valve structure fulfills three important functions, becoming a combined filling, dispensing and relief valve.

According to the present invention, a valve body member adapted to be assembled with a housing member, such as a closure cap or other protruding portion of the wall of a container, is made to form two distinct passageways for conducting fluid between the interior and the exterior of the container, one of the passageways normally being closed by a valve element or stem that is movable by a force applied to it from outside the container, such as by finger pressure, to open this passageway for the dispensing of fluid under pressure from the container; and the other passageway, which is made with a size suitable for the desired quick filling of the container, by-passes the dispensing passageway and normally is kept closed by yieldable sealing means that move so as to open, and to enable quick filling of the container through, the filling passageway in response to the pressure of a compressed fluid material supplied into its outer end.

By virtue of this construction, the valve can be completely assembled and sealed on the container before the filling of the container, and the filling still can be effected quickly and inexpensively; and when the container is full, or when the pressure of the material within it reaches a desired value in relation to the filling pressure, the sealing means return to closed position and will keep the filling passageway securely closed during the use of the container.

According to a further feature of the invention, the valve element or stem that is movable to open the dispensing passageway is provided with a head coacting with and positionable by elastically deformable means provided as an integral part of the body member of the valve, which means yield and build up a counterpressure on the head under the force used to move the stem from its normal position, so that the counterpressure will move the stem back to its original position when the force displacing it is released. By virtue of this feature, the invention provides a dispensing valve for containers for compressed fluids which is self-closing but which does not require the use of a coil spring for biasing the valve to closed position. Further, all of the parts of this valve can be made of non-metallic materials which will resist and will not contaminate or be corroded by substances to be stored in and dispensed from the containers.

According to still another feature of the invention, the combined dispensing and filling valve is made to serve as a relief valve too, by providing it with further yieldable sealing means which will move in response to an excessive or unsafe fluid pressure within the container so as to release the excess pressure and thus give protection against explosion of the container. These means may be provided, for example, in accordance with the disclosure of a copending United States patent application of Paul F. Shmid and John E. Muller, Serial No. 54,001, filed September 6, 1960, now United States Patent No. 3,083,-882.

The valve structure provided by this invention may be used advantageously, for example, for Feon gas containers used in refrigeration systems or for portable compressed propane or butane containers used for gas burners.

The foregoing and other objects, features and advantages of the invention will be further apparent from the following detailed description and the accompanying drawings of an illustrative embodiment of the invention.

In the drawings:

FIG. 1 is an axial cross-sectional view of the valve structure mounted in a top wall of a container and having a dispensing adaptor coupled thereto;

FIG. 2 is a view similar to FIG. 1 but with a filling adaptor shown coupled to the structure;

FIG. 3 is a top plan view of the valve body;

FIG. 4 is a fragmentary axial sectional view of the valve body and stem in pressure relieving conditions; and

FIG. 5 is an exploded view of the several parts.

The valve construction illustrated in the drawings is an assembly of five distinct parts or pieces having forms which are evident from the exploded view of FIG. 5. These parts include a housing member **11** in the form of an end closure as commonly used for aerosol containers, a tubular body **20**, a tubular valve stem **40** which holds a sealing ring **45** and is reciprocable within the body **20**, and

a mounting ring or ferrule **27** by which the body **20** is assembled and held securely within an upstanding hollow portion **12** of the housing member **11**.

The closure **11** is shaped to be received in a central opening formed in the top wall of the container **10**. The container opening is bordered by a rolled rim **14** over which a peripheral flange **13** of the closure is crimped, preferably with a sealing gasket **15** inserted in-between, so as to seal the closure tightly to the container.

The hollow housing portion **12** protrudes upwardly and centrally from the bottom wall **16** of the closure and comprises a tubular side wall **17** and an end wall **18** in which a central aperture **19** is formed. Radial slots **34** extend from the margin of aperture **19** through part of the end wall **18**.

The tubular valve body **20** as shown is formed entirely of rubber or other suitable elastomer material, as a unitary molded piece thereof. It includes an upper tubular portion **23** and a lower tubular portion **24** of reduced diameter. The lower portion terminates in an end wall having an opening **25** formed in it to keep its interior in communication with the interior of the container. The upper portion **23** is formed near its upper end with an external elastic rib or ring **22** which surrounds and is sloped downwardly and outwardly from the body **20** so as normally to bear around its free edge in fluid-tight contact with the inner surface of the surrounding housing wall **17** and thus keep a space or passageway provided between that wall and the body **20** sealed against the escape of pressurized fluid from the container.

The upper portion **23** of the body **20** is secured within the hollow portion **12** by a ferrule **27** of sheet metal or other suitably rigid material, which firmly encompasses the body **20** and butts against the base of an annular recess **28** bordered by the elastic sealing ring **22**, so as to be overhung by that ring. The ferrule or mounting ring **27** has a flange **29** projecting radially from it for tight engagement with the inner surface of housing wall **17**. For assembly of these parts, the mounting ring **27** is moved onto the body **20** until it butts against the base of recess **28**, and then it is forced with body **20** into housing portion **12** until its flange is tightly fitted against wall **17** and the upper end of body **20** is located at the lower surface of wall **18**.

The body **20** as so assembled is spaced from the surrounding wall **17** by ring **27** and from the end wall **18** by beads or raised portions **26** which are formed integrally with and spaced apart about the end of the upper tubular portion **26**. The flange **29** of ring **27** is cut away at suitable locations, being, for example, slotted radially at several spaced points as indicated at **30**, so as not to block or seal the fluid passageway provided by the spacing of the upper body portion **23** from the housing portion **12**.

While that passageway normally is kept sealed by the engagement of the elastic rib or ring **22** with wall **17**, as indicated in FIG. 1, the elastic ring **22** slopes downwardly and outwardly to wall **17** so that it is free to be elastically deformed inwardly and out of sealing contact with wall **17** by fluid pressure admitted into the upper end of the space between body portion **23** and housing portion **12**, as indicated in FIG. 2 and described more particularly hereinafter.

The valve stem **40** is formed of metal or other suitably rigid material and includes a radially enlarged head portion **41** and an elongated tubular portion **42** closed by wall **43** at its lower end. The outer surface of the tubular portion **42** is normally in fluid-tight sealing engagement with an elastic rib or ring **21** formed integrally with and extending radially inwardly from body **20** at a location intermediate the upper and lower body portions **23** and **24**. The tubular portion **42** and the inner sealing ring **21** together divide the interior of body **20** into lower and upper chambers **31** and **32**. The lower chamber is always in communication with the interior of container **10** through

the opening **25**, and the upper chamber is normally isolated from the interior of the container but always in communication with the aperture **19** in the closure end wall **18**.

The stem **40** has a small dispensing port **44** leading radially into its tubular portion **42** at a location near its end wall **43**. When the stem is in its upper or normal position within body **20**, the dispensing port **44** is sealed off by the rib or ring **21** from communication with the lower chamber **31**; and thus the valve structure is closed so that pressurized material is held securely in the container. When the stem **40** is depressed to its lower or open position, as shown in FIG. 1, the dispensing port is disposed below rib **21** in communication with the lower chamber **31**, hence with the interior of the container. In this position, fluid under pressure inthe container enters port **44** and passes axially through the valve stem for delivery to the exterior of the container.

The valve stem **40** is normally held in its closed or upper position and is biased back to that position when depressed to open port **44** for dispensing, by the coaction of the enlarged head portion **41** with elastic ribs **33** which extend longitudinally of and radially inwardly from the inside of the upper tubular body portion **23**. These ribs are molded as an integral part of the body **20**. They are spaced apart about the inside of portion **23**, and they slope inwardly progressively from their upper ends, as seen in FIG. 5. They engage the rounded periphery of head **41** so as normally to hold that head and stem portion **42** in their upper position. When the valve stem is moved downwardly to its dispensing position, the ribs **33** are elastically deformed by the head **41**, substantially as indicated in FIG. 1; and when the force causing the downward movement is released, the elasticity of the deformed ribs thrusts the head **41** and the stem back to their original position as the ribs spring back to their original shape.

By virtue of this construction, there is no need for the coil spring usually required in self-closing container valves, and important advantages can be realized in the manufacture, use and maintenance of such valves.

The inner sealing ring or rib **21** is made with such a resistance to deformation that it will stay in tight sealing engagement with the valve stem **40** as long as the fluid pressure in the container does not exceed a predetermined safe value. Yet it is made with sufficient elasticity or flexibility that if the pressure in the container exceeds a predetermined safe value, it will yield and be moved out of sealing engagement with the valve stem under the excess pressure, as shown in FIG. 4, so that the fluid under excess pressure will escape around the stem in the direction of the arrows **46** into the upper chamber **32**, passing therein between the ribs **33** and around head **41** and then through the aperture **19** and slots **34** to the exterior of the container. This releasing of the excess fluid pressure takes place irrespective of the position of the valve stem. It serves the important purpose of preventing explosion of the container in the event of an inadvertent building up of excess pressure therein, for example, if the container is used for a volatile material and happens to become overheated.

The radially enlarged head **41** of the stem **40**, as shown, fulfills a function in addition to that of coacting with the elastic ribs **33** to bias the valve stem to closed position. It defines centrally within it a cavity **47** which is open at its upper end and communicates with the axial passage in the stem, and which is aligned with the aperture **19** in the end wall **18** of member **11**. The cavity is bordered by an elastic sealing ring **45**, for example, an O-ring, which surrounds and overlies an abutment surface **48** at the head end of the tubular stem portion **42**.

By virtue of this construction, the head serves as a seating and sealing device for either a filling adapter to be used for charging pressurized material into the container or a dispensing adapter to be applied to the container and used for dispensing fluid under pressure from the container.

A suitable filling adapter assembled with and acting to charge pressurized material through the valve structure is shown at 50 in FIG. 2.

This adapter has a neck 51 which passes through aperture 19 and into cavity 47 of head 41 so as to butt at its end against surface 48 and be gripped and sealed circumferentially by ring 45. An axial bore 53 in the adapter communicates with a suitable source of the pressurized material. Ports 54 open radially from bore 53 through neck 51 at a location above the sealing ring 45. The body of the adapter carries at its end outside hollow portion 12 another sealing ring 52, for example, another O-ring, in position to bear and form a fluid-tight seal against the face of wall 18 when the adapter is pressed downward with its neck 51 seated in the head of the valve stem.

Accordingly, when the adapter is so assembled with the valve structure and the pressurized material is passed through bore 53, the material flows freely from the neck ports 54 into the upper end of the space between body 20 and housing portion 12 and then through that space, as indicated by the arrows in FIG. 2, so as to press against and deform inwardly the outer sealing rib or ring 22 and thus flow past that ring into the container. When the container has been filled, the filling adaptor is withdrawn, whereupon the elastic outer rib or ring 22 returns to its sealed position against wall 17 and the elastic ribs 33 return the valve stem 40 to its closed position.

A suitable dispensing adapter assembled with the valve structure and in dispensing position is shown at 60 in FIG. 1. This adapter has a neck 61 formed with an axial passageway 63 for carrying away the fluid delivered from the container. The neck 61 extends through aperture 19 and is seated and sealed in the head of stem 40 as described in connection with neck 51 of adapter 50. Spaced about the neck 61 and mounted on the body of the adapter 60 are resilient legs 62 of rubber or other suitable material, which snap slidingly inside the rim of closure member 11, so as to be retained in the annular recess provided around hollow portion 12 by the dished formation of the closure member.

The dispensing adapter having been placed in its operative position, as seen in FIG. 1, the valve stem 40 is held in open position with its dispensing port 44 disposed below ring 21 and in communication with the interior of the container; so pressurized fluid flows out of the container through the valve stem and through the aligned axial passageway 63 in the dispensing adapter. The flow of the fluid may be further controlled by a valve (not shown) beyond the adapter. When the container is empty or its use is to be discontinued, the dispensing adapter 60 is pulled away from the closure 11, whereupon stem 40 is moved to closed position by the action of the elastic ribs 33.

It will thus be evident that the valve structure provided by the present invention enables the rapid filling of the container with which it is employed, after the container and the valve have been completely assembled. It further provides for the desired controlled dispensing of material from the container and gives protection against explosion of the container in the event of an excessive fluid pressure building up within the container.

The stem 40 and the ferrule 27, as well as other parts of the valve structure, may be formed of an inert material, such as a suitable rubber, synthetic resin or other plastics composition, when the valve structure is to be used on containers for foodstuffs or other substances that may be adversely affected by or may be corrosive to metals.

Although a particular embodiment of the invention has been illustrated and described in detail herein, it is to be understood that the invention is not limited to this embodiment and that various changes and modifications may be made without departing from the invention which is intended to be defined by the appended claims.

What is claimed is:

1. A combined filling, dispensing and relief valve for a compressed fluid container or the like, comprising

a housing member,

a body member carried by said housing member and forming a passageway for dispensing from the container material under pressure therein,

a movable valve element disposed within said body member and normally closing said passageway, said element being movable relative to said body member by a force applied to it from outside the container to open said passageway for dispensing,

means on said body member forming a filling passageway by-passing said dispensing passageway,

sealing means normally closing the filling passageway against the escape of said material from within the container but displaceable by the pressure of pressurized material supplied to the filling passageway from outside the container to charge such material into the container, and

an elastic sealing rib on said body member normally in sealing contact with said movable valve element but displaceable by an excess pressure of material within the container to discharge said material through said body member for relief of the excess pressure.

2. A valve comprising

a tubular housing member,

a tubular body member disposed within and spaced from said housing member,

a tubular valve stem disposed within said body member,

said body member having thereon an external elastic rib normally closing the space between said members by sealing engagement with the inner surface of said housing member, and having thereon an internal elastic rib normally in sealing engagement with the outer surface of said stem,

said stem having a dispensing port leading thereinto and being movable axially relative to said body member between a closed position where said port is disposed to one side of said internal rib and a dispensing position where said port is disposed to the other side of said internal rib to open the valve for the discharge of fluid under pressure therethrough from one end of said body member,

said external rib being displaceable out of sealing engagement with said inner surface by fluid pressure admitted into said space around the other end of said body member and being sloped toward said one end to prevent flow of fluid under pressure through said space from said one end,

said internal rib being movable out of sealing engagement with said stem by an excess of pressure at said one end to release the excess pressure between said internal rib and said stem.

3. A combined filling and dispensing valve for a compressed fluid container or the like, comprising

a housing member having a hollow portion centrally apertured at one end,

a tubular body member disposed within said portion and spaced from the inner surface thereof,

a tubular valve stem reciprocable axially within said body member,

said body member having an internal sealing rib thereon normally in sealing engagement with said stem,

said stem having a dispensing port leading radially thereinto and normally disposed to one side of said rib but movable to the other side thereof by movement of said stem to open the valve for dispensing,

said body member further having an external elastic rib thereon normally bearing in sealing engagement against said inner surface but movable out of such engagement by fluid pressure admitted to the space between said body member and said hollow portion at said one end for the filling of pressurized material

into the container, said external rib being sloped toward the other end of said body portion so as to keep said space sealed under fluid pressure admitted to it from said other end,

a plurality of longitudinal elastic ribs extending radially inwardly from and spaced apart about the inner side of the portion of said body member between said internal rib and said one end, and

a radially enlarged head on said stem engaging and positioned by said longitudinal ribs and for elastically deforming them upon movement of said stem to open the valve for dispensing so that upon release of the force causing such movement said stem is returned to its original position by the pressure of said longitudinal ribs on said head.

4. A valve as claimed in claim 3, said head forming a socket that opens toward and is aligned with the aperture in said hollow portion and communicates with the interior of said stem, said socket being adapted to receive and to be sealed against a tubular end of either a filling adaptor inserted thereinto for the delivery of pressurized fluid into said space from said one end or a dispensing adaptor inserted thereinto for the dispensing of pressurized fluid through the valve.

5. A valve comprising a molded tubular body member, a valve stem disposed within said body member and reciprocable therein to open and close the valve, said stem having a radially enlarged head thereon, an inner surface of said body member having thereon elastic portions engaging said head to position said stem, said portions sloping inwardly toward one end of said body member so as to bear elastically against said head increasingly with movement of said stem toward said one end and being operative to return the stem to its original position upon release of the force causing such movement.

6. A valve as claimed in claim 5, said elastic portions comprising ribs molded integrally with said body member and extending longitudinally along said surface at locations spaced about said surface.

7. A valve structure for a compressed fluid container or the like, comprising

a housing member having an upstanding hollow portion and adapted to close an opening in the container,

a tubular body of molded elastomeric material having an upper portion received within said hollow portion,

a mounting ring encompassing said upper portion and having a flange pressed into tight engagement with the inner surface of said hollow portion to hold said body securely in said hollow portion,

a tubular valve stem movable axially within said body,

an inner sealing ring within said body normally in fluid tight contact with the outer surface of said stem,

said stem having a dispensing port opening thereinto and normally blocked by said sealing ring from communication with the lower portion of said body but movable into such communication for dispensing fluid under pressure from the container by axial movment of said stem,

said hollow portion having an apertured end wall,

said body being spaced from said end wall and from said inner surface to provide between said body and said hollow portion a passageway for filling pressurized material into the container, and

an outer elastic sealing ring extending from said upper portion normally into fluid-tight contact with said inner surface to close said filling passageway, said outer ring being displaceable out of such contact by fluid pressure admitted into the upper end of the space between said body and said hollow portion but being held in such contact by fluid pressure at its lower side.

8. The valve structure of claim 7,

said mounting ring being seated on said upper portion beneath and being overhung by said outer sealing ring,

said flange being cut away so as not to close said passageway.

9. The valve structure of claim 7,

said stem having a radially enlarged head thereon and said upper portion having longitudinal elastic ribs extending radially inward from its inner side and engaging said head to bias said stem upwardly to closed position.

10. A combined filling and dispensing valve for a compressed fluid container or the like, comprising

a housing member having a hollow portion including a substantially cylindrical wall,

a tubular body mounted in said housing and having an elongated annular wall in annularly spaced relation to said housing wall to define therebetween a filling passageway,

a valve element movable within said body to provide a passageway for dispensing from the container material under pressure therein,

said annular wall being formed between its extremities with an integral elastic annular sealing rib extending therefrom across the space between said walls and normally bearing against said housing wall,

said rib being sloped relative to said housing wall so as to be maintained in sealing engagement therewith by fluid pressure in the container acting on one side of the rib and being displaceable out of sealing engagement therewith to open said filling passageway by fluid pressure acting against the other side of said rib when filling the container.

11. A valve according to claim 10, including a mounting ring seated against the lower side of said sealing rib and having a flange pressed into tight engagement with said housing wall to hold said body securely in said hollow portion and in the aforesaid spaced relation thereto.

12. A valve according to claim 10, said housing hollow portion having an upper end wall formed with a central aperture,

and means holding the upper end of said body spaced below said housing end wall to provide between said body and said hollow portion a passageway extending from said aperture around said body for filling compressed fluid into the container.

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