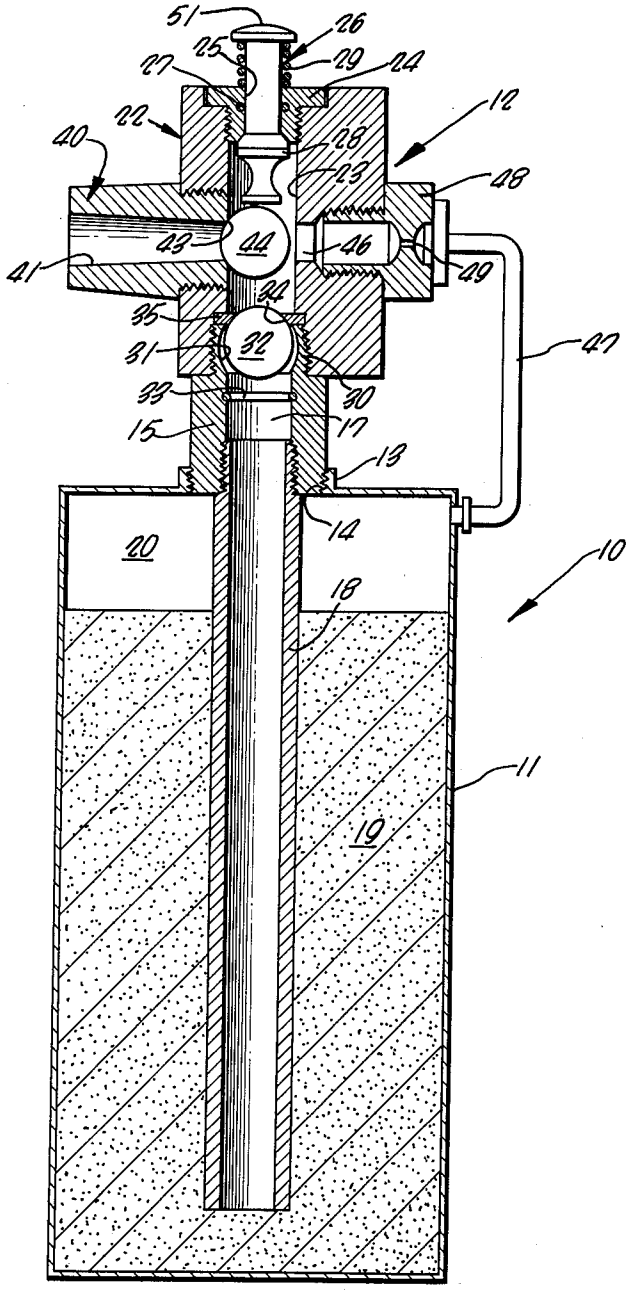
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SELF-CLEANING VALVE MECHANISM

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SELF-CLEANING VALVE MECHANISM

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This invention relates to valve mechanisms and, more particularly, to self-cleaning valve mechanisms for powder-type fire extinguishers and the like.

Powder-type fire extinguishers of conventional manufacture have a short useful life because of the valve mechanisms used in such fire extinguishers and because of the granular nature of the material discharged through the valve mechanisms. Furthermore, conventional powder-type extinguishers are more expensive than necessary to maintain because fire inspectors require that each such extinguisher be recharged after each use regardless of the extent of the use, not because the contents of the extinguisher are exhausted, but because the valve mechanism of the device may not be properly closed. Because fire extinguishers must be ready for use on a moment's notice, complete safety requires that conventional powder-type fire extinguishers be recharged after each use.

The valve mechanisms used in conventional powder-type fire extinguishers theoretically are capable of properly seating themselves so that recharging the extinguisher after consumption of only a fraction of the powder contained therein is unnecessary. In practice, however, the granular material discharged from the extinguisher fouls the valve mechanism so that the valve does not completely close and the gas charge of the extinguisher is allowed to be dissipated with the result that the extinguisher is not suitable for use when the next fire emergency arises. It is for this reason that conventional extinguishers are recharged after each use, no matter how slight the use.

This invention provides an improved valve mechanism for use especially in powder-type fire extinguishers. The valve mechanism is self-cleaning with the result that the valve is completely closed when the actuator of the mechanism is moved to a position corresponding to closure of the mechanism. Moreover, the improved valve mechanism permits convenient means for refilling the extinguisher with fire extinguishing material and for recharging the extinguisher with a gas charge.

Generally speaking, the present invention provides a valve for controlling the discharge under pressure of flowable material from a container having a quantity of gas therein under pressure for charging the container. The valve comprises a housing defining a passage therethrough, one end of the passage communicating with the material in the container. First and second check valves are disposed in the passage. Means are provided for supplying a gas under pressure from the container to the passage at a point intermediate the valves. The second valve is located more remote from the one end of the passage than the first valve. Selectively operable means are provided and are operable for forcing open the valves against pressure biasing them closed. The selectively operable means includes means for opening the first valve only when the second valve has opened a predetermined amount.

The above-mentioned and other features of the present invention are more fully set forth in the following detailed description taken in conjunction with the accompanying drawing which is a cross-sectional elevation view of a fire extinguisher equipped with an improve valve mechanism.

The drawing illustrates a fire extinguisher **10** which is comprised of a container **11** and a discharge valve mechanism **12**. The container includes a cylindrical collar **13** extending upwardly from the upper end of the container and disposed about an aperture **14**. The collar is threaded

internally for engagement with an externally threaded sleeve **15** having an axial bore **17** therethrough. The lower end of sleeve **15** is connected to the upper end of a hollow tube **18** which extends downwardly through the interior of the container to terminate at a location spaced from the bottom of the container in a body of powdered fire extinguishing material **19** disposed in the lower portion of the container. A void space **20** is formed in the container above the powder; this space is filled with pressurized charging gas.

The upper end of sleeve **15** is connected to a valve block **22** which has a bore **23** formed therethrough. The combination of block **22**, sleeve **15** and nozzle **40** (described below in greater detail) defines a valve housing. Bores **17** and **23** are coaxial with one another when the sleeve is connected to the block and, in combination with nozzle discharge duct **41**, define a passageway through the valve housing. The upper end of bore **23** opposite from sleeve **15** is closed by a plug **24** which has formed therethrough a small diameter bore **25** aligned coaxially of bore **23**. A plunger-type actuation member **26** is slidably mounted in plug bore **25** and is sealed in gastight relation to the plug by means of an O-ring **27**; it is within the scope of this invention, however, that any conventional gasketing material may be used to seal the plunger to the plug. Internally of the valve housing passageway, the plunger defines an enlarged head **28** which is configured to cooperate with the lower end of the plug to limit the upward movement of the actuator relative to valve housing. The plunger is biased upwardly from the valve housing by a spring **29** disposed about the plunger between plug **24** and an enlarged upper head **51** of the plunger.

The upper end of sleeve **15** defines an externally threaded nipple **30** which is engaged with an internally threaded, enlarged diameter lower portion of bore **23**. Bore **17** is enlarged in the vicinity of the nipple (as shown at **31**) to receive a first valve member provided in the form of a ball **32** which preferably has a diameter smaller than the diameter of bore **17**. An O-ring **33**, for example, is engaged in a recess formed annularly of bore **17** below the nipple. The O-ring is provided for retaining ball **32** in the vicinity of the nipple so that it does not pass through the sleeve into tube **18**.

A first valve seat **34** is provided transversely of the valve housing passageway and is defined by an annular washer **35** disposed between the upper end of nipple **30** and a downwardly opening shoulder formed in the valve block at the upper end of the enlarged diameter lower portion of bore **23**. As seen from below, i.e., from the direction of ball **32**, the walls of the opening in washer **35** which define the valve seat are spherically concave so that the ball may mate intimately with the seat.

A powder discharge nozzle **40** is connected to the valve block above the first valve seat and defines a nozzle discharge duct **41** which extends through the nozzle block and communicates with bore **23** above ball **32**. As shown in the drawing, the nozzle discharge duct increases in diameter proceeding away from bore **23**. The intersection of the nozzle duct with bore **23** defines a second valve seat **43**. A second valve member in the form of a ball **44** is disposed in bore **23** above the first valve seat and is engageable in closure relation with seat **43**. When ball **44** is engaged with its seat, a slight clearance is provided between the ball and the lower end of valve actuator **26**.

A by-pass gas duct **46** communicates with bore **23** on the side of ball **44** opposite from seat **43**. Preferably, as shown in the drawing, duct **46** is coaxial with discharge duct **41**, although such need not be the case for successful practice of this invention. A length of small diameter tubing **47** has one end thereof connected in fluid flow communication with gas duct **46** by means of a fitting **48**. The other end of tubing **47** is connected in fluid flow com-

munication with the gas charge contained in space 20 in the upper end of fire extinguisher container 11.

In considering the operation of the apparatus described above, let it be assumed that the fire extinguisher is properly filled with powder 19 and is suitably charged with a quantity of charging gas. Assume also that the valve mechanism is in the unactuated condition shown in the drawing. Ball 44 is then engaged in closure relation with seat 43 and is held in such relation by means of the pressure drop existing across the ball, the pressure of the gas charge in the fire extinguisher being substantially greater than atmospheric pressure. When ball 44 is seated as shown in the drawing, there will be no gas flow through tubing 47 and ball 32 may be disengaged from closure relation with its valve seat because the gas pressure in bore 23 is equal to the pressure in tube 18.

The valve mechanism is operated by depressing actuator plunger 26 so that actuator head 28 engages ball 44 and moves the ball out of closure relation with seat 43. A small quantity of charging gas will then commence to flow through duct 47, but since the duct has a very small diameter there is a substantial head loss as the gas flows through the duct. To assure the desired head loss, fitting 48 defines an orifice 49 in the by-pass duct, but the orifice may be omitted where tube 47 itself provides the desired pressure drop. Charging gas, however, is caused to flow transversely of bore 23 with a velocity sufficient to manifest an eductor effect to raise ball 32 into engagement with its seat 35. Continued depression of the actuator, however, quickly brings ball 44 into engagement with ball 32 and disengages ball 32 from closure relation with its seat so that the valve passageway is completely opened. When the valve is operated according to the process described above, the resistance to gas flow through tube 18 is substantially less than the gas flow resistance through tubing 47 and, therefore, the charging gas in the upper end of the container forces powder 19 upwardly through the tube and out of the fire extinguisher through discharge duct 41. The powder contained in the lower portion of the fire extinguisher is finely divided so that it is readily flowable through the valve mechanism in the escaping stream of charging gas.

To close the valve mechanism completely, it is only necessary for the operator of the fire extinguisher to remove his finger from the upper end of actuator 26 so that spring 29 is effective to return the actuator to the position shown in the drawing. As the actuator returns to its unoperated position, the gas flowing out of the fire extinguisher through the valve housing passageway causes ball 32 to engage with its seat. Charging gas continues to flow, however, through tubing 47 and forces ball 44 into closure relation with seat 43. As the ball moves into engagement with its seat, the small quantity of charging gas escaping from the fire extinguisher washes the ball of all particles of powder which may adhere thereto. Seat 43 is also cleansed of residual powder particles. As a result, the engagement of ball 44 with seat 43 is complete and the valve mechanism is securely closed so that no charging gas can escape from the fire extinguisher. The upper ball is thereafter maintained across discharge duct 41 by reason of the pressure drop existing across the ball.

The apparatus described above has the feature that the valve member and valve seat which cooperate to effect terminal closure of the mechanism are automatically cleansed by the operative fluid of the extinguisher. Accordingly, the fire extinguisher is completely sealed and there is no chance that the gas charged in the extinguisher may leak between uses of the device. It is therefore not necessary for the extinguisher to be serviced after a use in which only a fraction of the powder enclosed in container 11 is discharged.

The apparatus described above also has the feature that it provides for convenient recharging and refilling of the extinguisher. Tubing fitting 48 may be disengaged from block 22 and the entire valve mechanism including tube 18 may be disconnected from the container by means of the threaded connection between collar 18 and sleeve 15. After a quantity of powder 19 is introduced into the container, the valve mechanism is replaced and fitting 48 is reconnected to the mechanism. A quantity of charging gas is then injected into the container merely by coupling a suitable fitting to the nozzle of the fire extinguisher through which charging gas may be introduced into space 20 at the upper end of the fire extinguisher container. The charging gas is inserted into the container by way of tubing 47 as well as through the valve housing passageway.

The foregoing description is made with reference to the discharge of a finely divided powder through the valve mechanism. It will be apparent to those skilled in the art that the improved valve mechanism may be used to regulate the discharge of liquids, and that the invention has utility in devices other than fire extinguishers.

While the invention has been described above in conjunction with specific apparatus, this has been by way of example only and is not to be considered as limiting the scope of this invention.

What is claimed is:

1. A valve for controlling the discharge under pressure of flowable material from a container having a quantity of gas therein under pressure for charging the container, the valve comprising: a housing defining a passage therethrough, the housing being adapted for connection to the container so that one end of the passage communicates with the interior of the container; first and second valve seats positioned across the passage at spaced apart locations along the passage; first and second movable valve members disposed in the passage engageable in closure relation with the first and second valve seats, respectively; the valve members being disposed toward said one end of the passage from their respective seats, the second valve member being more remote from said one end of the passage than the first valve member; selectively operable means operable in one direction for moving the first and second valve members from closure relation with their seats and operable in a reverse direction to engage first the first valve member and then the second valve member with their respective seats; and charging gas duct means communicating with the passage adjacent the second valve seat and adapted remotely from the passage for gas flow communication with the interior of the container.

2. A valve for controlling the discharge under pressure of material from a container having a quantity of gas under pressure therein for charging the container, the valve comprising a valve housing adapted for connection to the container and defining an internal valve chamber, tube means communicating with the chamber and extending from the valve housing for directing flow of the material therethrough to the valve chamber, a first valve seat positioned across the valve chamber, a movable first valve member disposed in the valve chamber between the tube means and the first seat and engageable in closure relation with the seat, and valve housing defining a discharge duct intersecting the valve chamber adjacent the side of the first valve member opposite from the tube means and defining a second valve seat about the intersection of the discharge duct with the valve chamber, a movable second valve member disposed in the valve chamber and engageable in closure relation with the second valve seat, selectively operable means for moving the second valve member and the first valve member sequentially from closure relation with their respective seats upon operation thereof, and gas duct means communicating with the valve chamber adjacent the second valve member and adapted for connection remotely from the valve chamber with the container for flow of said charging gas therethrough.

3. A valve for a pressure charged container adapted for containing a quantity of dispensible material in a lower portion thereof and a gaseous pressure charge in

an upper portion thereof, the valve comprising a valve housing connected to the container and defining a valve chamber internally thereof, tube means communicating the valve chamber with the container lower portion, the valve housing defining a first annular valve seat across the valve chamber, a first valve ball disposed in the valve chamber between the tube means and the first seat and engageable with the seat, the valve housing defining a discharge duct intersecting the valve chamber opposite the first seat from the tube means, a second annular valve seat disposed about the intersection of the discharge duct with the valve chamber, a second valve ball disposed in the valve chamber engageable with the second valve seat, selectively operable means for moving first the second valve ball and then the first valve ball from engagement with their respective seats upon operation thereof, and gas duct means communicating from the upper portion of the container to the valve chamber opposite the second valve seat.

4. A valve for a pressure charged container, the container containing a quantity of dispensible material in a lower portion thereof and a gaseous pressure charge in an upper portion thereof in communication with the dispensible material, the valve comprising a valve housing connected to the upper end of the container and defining a vertically disposed internal valve chamber, means communicating the chamber with the container lower portion for flow of the dispensible material therethrough to the valve chamber, the valve housing defining a first annular valve seat intermediate the vertical extent of the valve chamber, a first valve ball disposed in the valve chamber below the first seat and engageable with the seat, means carried by the valve housing for maintaining the first valve ball in the vicinity of the first seat, the valve housing defining a discharge duct transversely intersecting the valve chamber above the first seat and defining a second annular valve seat at the intersection of the discharge duct with the valve chamber, a second valve ball disposed in the valve chamber engageable with the second valve seat, selectively operable means for moving first the second valve ball from the second valve seat and then the first valve ball from the first valve seat upon operation thereof, and gas duct means communicating from the upper portion of the container to the valve chamber opposite the second valve seat.

References Cited by the Examiner

UNITED STATES PATENTS

1,197,832	9/1916	La May	169—31
2,513,377	7/1950	Stroop.	
2,717,804	9/1955	White	239—353 X

FOREIGN PATENTS

1,040,155	5/1953	France.
916,495	8/1954	Germany.

EVERETT W. KIRBY, *Primary Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,223,173 December 14, 1965

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It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 67, for "improve" read -- improved --; column 2, line 21, after "plunger-type" insert -- valve --; column 4, line 59, for "and" read -- the --.

Signed and sealed this 27th day of September 1966.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents