Sept. 15, 1959 M. A. NOVOTNY 2,904,305

DISCHARGE CONTROL APPARATUS FOR POWDER FIRE EXTINGUISHER

Filed July 11, 1957 2 Sheets-Sheet 1

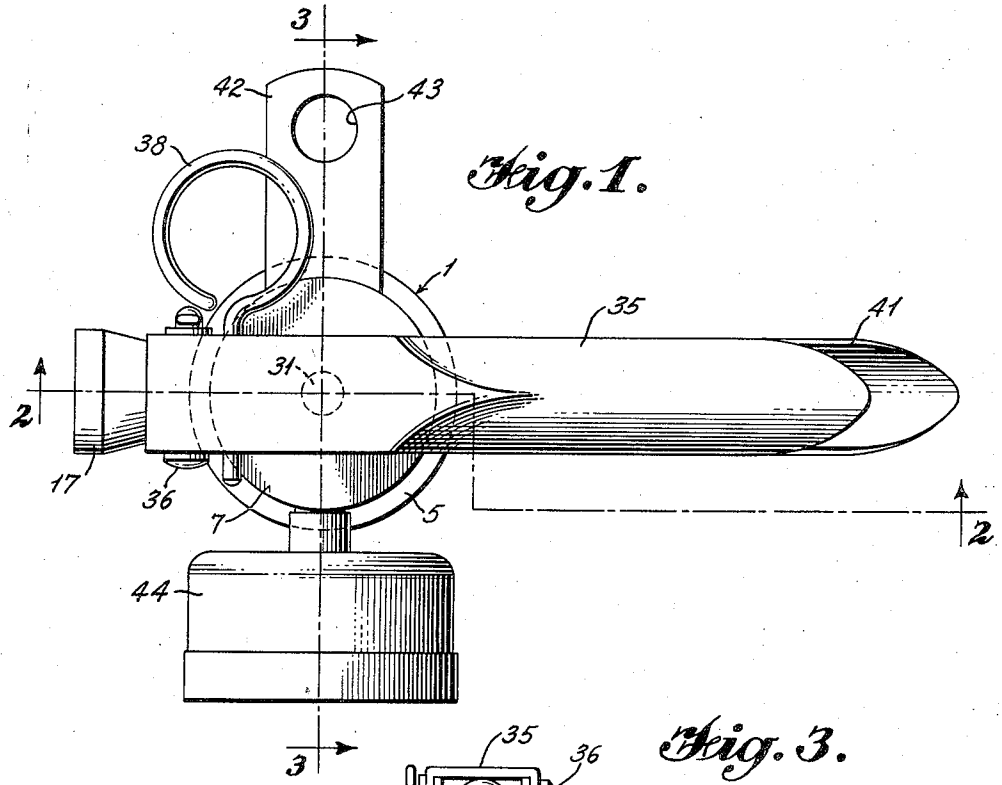

Fig. 1.

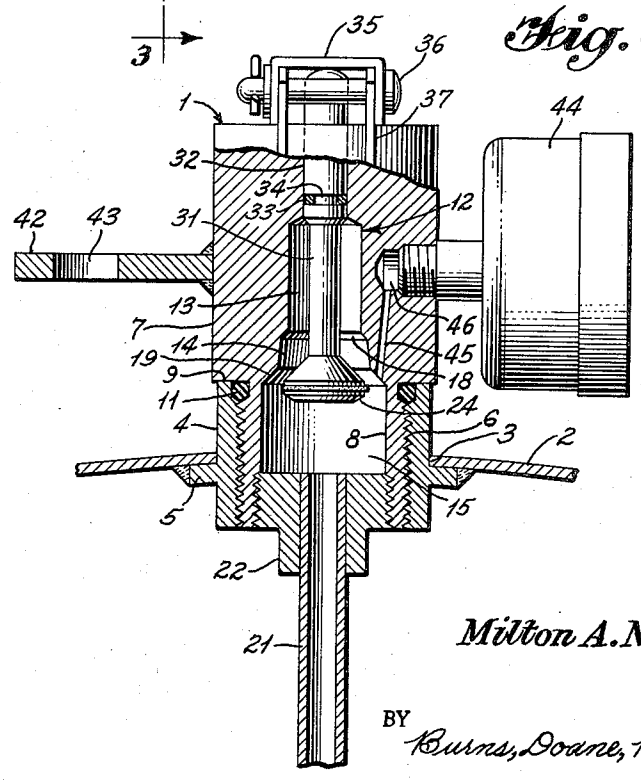

Fig. 3.

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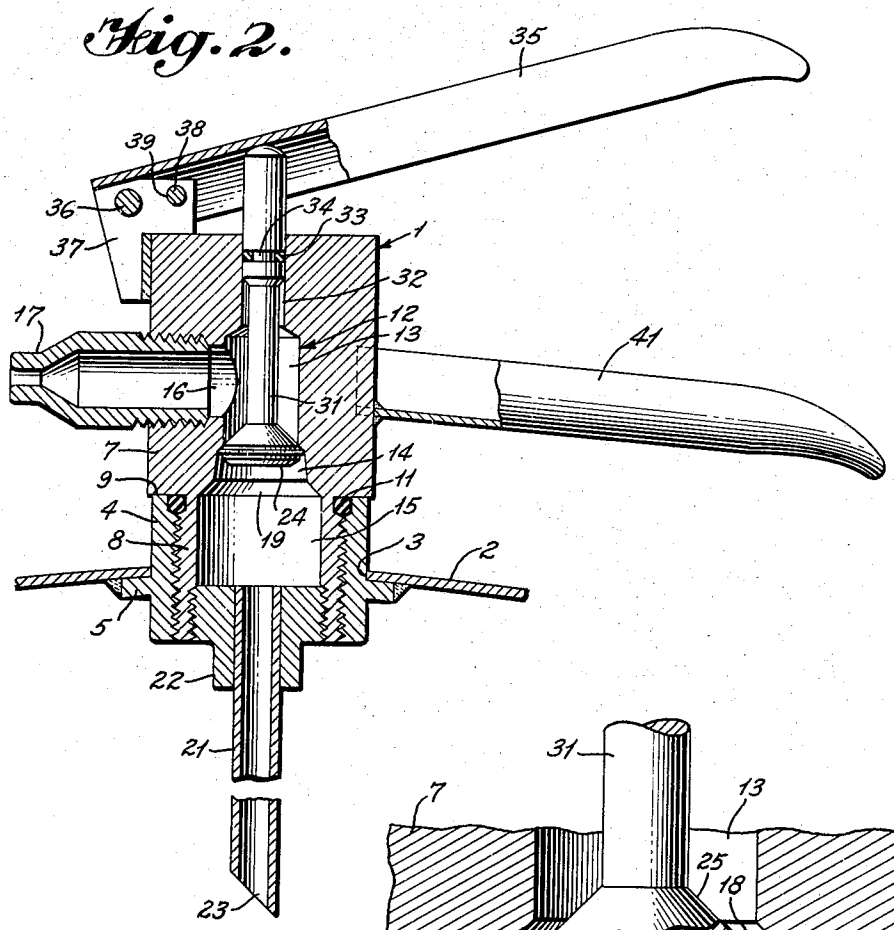
Fig. 2.



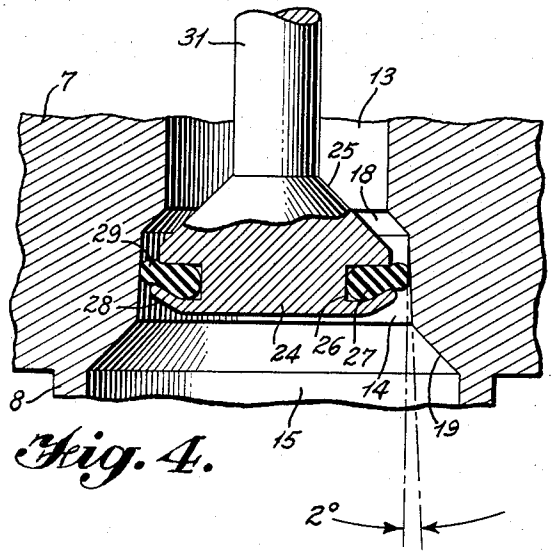


Fig. 4.

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DISCHARGE CONTROL APPARATUS FOR POWDER FIRE EXTINGUISHER

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5 Claims. (Cl. 251—175)

This invention relates to fire extinguishers and, more particularly, to fire extinguishers for dispensing a pressurized charge of dry powder.

Many commonly used devices of the foregoing character include generally a pressure-resistant receptacle and a dispensing mechanism mounted in the receptacle outlet. The receptacle is adapted to contain a quantity of a dry powder composition such as bicarbonate of soda in a finely divided state or any other dry pulverized material having good fire extinguishing characteristics, and a pressurizing fluid medium such as dry air or nitrogen. The dispensing mechanism comprises a housing having a discharge passageway terminating at one end in a syphon tube extending into the receptacle and at the other end in a spray nozzle. Also provided are a valve and valve seat disposed in the discharge passageway and a suitable mechanism for seating and unseating the valve to control the flow of powder through the discharge passageway to the nozzle.

Many specific fire extinguisher constructions conforming to the above general description have been developed with varying success but none has proved entirely satisfactory. A particularly difficult problem which has not been satisfactorily solved is caused by the deposit of the dry powder on the walls of the discharge passageway and particularly on the valve head and valve seat during operation of the fire extinguisher. Such deposits of powder frequently preclude the formation of a proper seal between the valve and its seat, thus causing leakage. Occasionally, when the powder has become caked after a long period of non-use of the extinguisher, relatively large lumps become lodged between the valve and valve seat making proper seating especially difficult.

In an attempt to overcome this problem and to insure an adequate seal, heavy springs urging the valve against its seat have been incorporated in many prior art powder extinguisher. This, of course, adds to the expense and increases the maintenance of the apparatus.

None of the heretofore-available extinguishers incorporating valves which are maintained in a closed position solely by the pressure within the receptacle, without the aid of springs, have been entirely satisfactory for dispensing powder. Generally, because of the deposit of powder between the valve and seat, the pressure in the receptacle has not been sufficient to maintain a seal sufficiently tight to prevent leakage. Such leakage is especially prevalent after long usage when the pressure in the receptacle and thus the valve closing power becomes low.

To overcome the disadvantages of prior art devices, it is a primary object of this invention to provide an apparatus of the character set forth above for dispensing a pressurized charge of dry powder embodying an economical easily maintained valve assembly for effecting an improved seal between the valve and valve seat.

It is another object of this invention to provide an improved valve assembly for powder fire extinguishers which effects removal of powder deposits from between

the valve and valve seat to achieve a more effective seal and to minimize leakage.

It is an additional object of this invention to provide a fire extinguisher for dispensing a pressurized charge of powder having an improved valve assembly for maintaining a more effective seal between the valve and valve seat solely by the pressure within the extinguisher without the aid of springs even when such pressure is low.

It is a further object of this invention to provide an improved valve assembly for a pressurized powder dispenser wherein the valve is urged toward seating position solely by the pressure within the extinguisher without the aid of springs to form, during such movement of the valve, a progressively tighter seal and to remove powder from between the valve and its seat.

Broadly described, the invention relates to an apparatus for dispensing a pressurized charge of dry powder comprising a receptacle for containing dry powder and a pressurizing medium, said receptacle having an outlet at its upper end, a valve body attached to said outlet, fluid communicating upper, intermediate and lower passageways formed in said valve body, a discharge conduit formed in said valve body in fluid communication with said upper passageway, a syphon tube connected to said valve body in fluid communication with said lower passageway and extending downwardly into said receptacle, said lower passageway being larger in cross section than said intermediate passageway, said intermediate passageway being generally cylindrical, an annular downwardly facing shoulder formed in said valve body adjoining said upper and intermediate passageways, a valve head engageable with said shoulder and slightly smaller in cross section than said intermediate passageway for reciprocation therein, a resilient sealing ring mounted around said valve head for slideable engagement with the wall of said intermediate passageway to wipe the powder from said wall and to form a seal when said valve is moved upwardly, a valve stem connected to said valve head and extending upwardly through the upper portion of said valve body for reciprocation therein, sealing means between said valve stem and said valve body, and means connected to said valve body to urge said valve stem downwardly to move said valve head through said intermediate passageway into said lower passageway to release a pressurized charge of dry powder, said valve body being urged upwardly into engagement with said shoulder by the pressure in said receptacle to effect a seal between said sealing ring and the wall of said intermediate passageway to stop the flow of powder.

Preferably, the intermediate passageway is formed with a slightly upwardly tapered wall. Thus, as the valve is moved toward seating position by the pressure within the extinguisher, the resilient sealing ring is urged into progressively tighter engagement with the tapered wall to wipe away the powder and to achieve an extremely effective seal even when the pressure within the extinguisher is low. To prevent the sealing ring from being dislodged from its groove in the valve head during its sliding engagement with the wall, such ring is preferably held firmly in its groove by an annular flange on the valve body. This flange is rolled into the sealing ring squeezing it together to form a thin edge portion which is highly effective in removing powder from the tapered wall. Moreover, the flange assists in the dissipation of heat generated by the friction between the sealing ring and the tapered wall.

The invention having been generally set forth, a preferred specific embodiment for the accomplishment of one or more of the stated objects and others will now be described in detail with reference to the accompanying drawings in which:

Figure 1 is a plan view of a valve body and valve-operating mechanism according to the invention;

Figure 2 is a fragmentary vertical sectional view taken in the direction of the arrows along the line 2—2 of Figure 1;

Figure 3 is a fragmentary vertical sectional view taken in the direction of the arrows along the line 3—3 of Figure 1; and

Figure 4 is a fragmentary vertical sectional view showing the details of construction of a valve head and seat according to the invention.

Illustrated on the drawings is a fire extinguisher designated generally by the reference numeral 1 for dispensing a pressurized charge of dry powder. The pressurized charge is contained in a receptacle 2 which is shown and described only to the extent necessary for a complete understanding of the invention. The top of the receptacle is provided with an opening 3 in which is mounted a bushing 4 which is provided with a flange 5 rigidly connected to the inner surface of the top wall of the receptacle 2 as by welding. The bushing 4 is provided with a screw threaded bore 6 which receives a correspondingly threaded annular skirt 8 depending from a valve body 7. A downwardly facing annular shoulder 9 is formed on the valve body 7 adjacent the top of the skirt 8. The shoulder 9 limits the extent to which the valve body 7 may be screwed into the bushing 4. A conventional O-ring 11 of rubber or similar resilient material is situated in a suitable recess between the bushing 4 and the skirt 8 to form a fluid-tight seal.

Formed within the valve body 7 is an elongated chamber designated generally by the reference numeral 12 which is divided into an upper passageway 13, an intermediate passageway 14, and an enlarged lower passageway or expansion chamber 15. Extending laterally from the upper passageway 13 is a conduit 16 in which is threadedly mounted a conventional spray nozzle 17.

The intermediate passageway 14 is somewhat larger in cross section than the upper passageway 13 and formed therebetween is a downwardly facing shoulder 18. As best seen in Figure 4, the generally cylindrical wall of intermediate passageway 14 is formed with a slight upward taper for a purpose more fully described hereinafter. The amount of taper may vary but is preferably about 2° from the vertical. The lower passageway 15 is considerably larger in cross section than the intermediate passageway 14 and formed therebetween is another annular, downwardly facing shoulder 19.

Extending downwardly in fluid communication with the lower passageway 15 is a syphon tube 21 which is connected to valve body 7 by threaded fitting 22. The bottom of the syphon tube 21 is positioned closely adjacent the bottom wall of receptacle 2 and, as seen in Figure 2, the lower end 23 of the syphon tube 21 is angularly inclined from the horizontal to enable fluid material to enter the bottom of the syphon tube even when the receptacle 2 is nearly empty.

Situated within the chamber 12 in valve body 7 is a head 24 which is provided with an inclined annular upper surface 25 adapted to seat against the shoulder 18 which functions as a valve stop. The cross section of valve 24 conforms generally in configuration to the cross section of the intermediate passageway 14, the valve head 24 being slightly smaller than the passageway 14 to permit the valve to be reciprocated without any metal-to-metal contact with the passageway wall. The valve head 24 is provided with an annular groove 26 to receive a resilient O-ring 27 of rubber, neoprene, or similar material which extends around the lateral side wall of the valve body 24. The bottom wall of the groove 26 is defined by a relatively thin, annular flange 28 extending outwardly from the valve body 7. The flange 28 is rolled upwardly to squeeze the O-ring 27 against the upper wall of the groove 26 to form a relatively thin, annular edge portion 29 which slideably and sealably

engages the tapered surface of passageway 14. It is apparent that, when the valve head 24 is moved upwardly, the O-ring 27 engages the tapered wall of passageway 14 in progressively tighter sliding relationship to form a progressively more effective seal. When the valve head 24 is moved to its uppermost position, an additional seal is formed by the metal-to-metal contact between the inclined surface 25 and the shoulder 18.

The valve head 24 is connected to an elongated vertical valve stem 31 which extends upwardly through an opening 32 in the upper portion of valve body 7. The valve stem may be reciprocated within the opening 32 and a fluid-tight seal is formed between the valve stem and the valve body 7 by a resilient O-ring 33 which is mounted in an annular groove 34 extending around the valve stem 31. A movable operating handle 35 is pivotally connected by pin 36 to a bracket 37 which in turn is rigidly secured as by welding to the valve body 7. When the valve-operating handle 35 is pivoted downwardly about the pin 36, the handle engages the top of valve stem 31 to urge such valve stem downwardly. To prevent unauthorized use of the fire extinguisher, the operating handle 35 may be locked in its upper position with the valve closed by a locking pin 38 which may be inserted through a suitable opening 39 extending through the operating handle 35 and the bracket 37. To facilitate operation of the movable handle 35, a fixed handle 41 is attached as by welding to the side of valve body 7 in such a position that the two handles 35 and 41 form a pistol-like grip which may be grasped in the hand of the operator.

Also attached as by welding to the side of the valve body 7 is a bracket 42 in which a hole 43 is formed to permit the fire extinguisher to be hung on any suitable support. Further, there is connected to the valve body 7 a conventional pressure gauge 44 which is screwed into the side of the valve body 7 and is in fluid communication with the lower chamber 15 through conduits 45 and 46.

In operation, a charge of dry fire extinguishing powder and fluid pressurizing medium is placed in the receptacle 2. To dispense the powder, the operator squeezes the handles 35 and 41 together to pivot the handle 35 downwardly thus urging the valve stem 31 and the valve head 24 downwardly until the sealing ring 27 is removed from its engagement with the tapered wall of the intermediate passageway 14. The dry powder is expelled through the syphon tube 21 into the expansion chamber 15 and around the valve head 24 into the passageways 14 and 13 and outwardly through the passageway 16 and nozzle 17. To discontinue the flow of powder, the handle 35 is released and the pressure within the receptacle urges the valve head 24 upwardly until the sealing ring 29 contacts the tapered surface of the passageway 14 to form a progressively tighter seal. The upward motion of the valve head 24 continues until the inclined surface 25 engages the shoulder 18 in metal-to-metal contact to form an additional seal.

It is apparent that the construction and operation of the apparatus of the invention is exceedingly simple and that superior results are obtained. During the operation of the extinguisher the dry powder, of course, collects on the surfaces of the valve head and the wall of passageway 14. The wiping action of the O-ring 27 removes the powder from the passageway wall to facilitate the formation of an effective seal. Moreover, the effectiveness of the wiping action and seal is greatly enhanced by virtue of the taper in the wall of the passageway 14 which causes the engagement between the sealing ring and the wall to be progressively tightened as the valve head moves upwardly. In conventional fire extinguisher valves wherein compressive, rather than wiping, contact is made between the valve and its seat, dry powder which collects on the seat and on the valve head often prevents the formation of an adequate seal.

Another decided advantage of the valve and seat construction of the invention is that the valve may be re-

tained closed without leakage entirely by the pressure within the receptacle **2** without the aid of springs or similar expedients. This springless retention of the valve in the closed position is materially facilitated by the valve wedging action effected by the tapered wall of the passageway **14**. It has been found that an effective seal can be maintained even when the receptacle pressure is relatively low.

Moreover, the particular structure of and relationship between the valve head **24** and the O-ring **27** is highly advantageous. The flange **28** which is bent into the O-ring **27** firmly retains the O-ring in the groove **26** to prevent its being rolled out of the groove by its progressively tightened sliding contact with the tapered wall of passageway **14**. The thin edge of the O-ring which is fashioned by the squeezing action of the flange **28** forms an effective squeegee to wipe the powder from the tapered wall as well as to effect a tight seal. To enable a thin squeegee edge to be formed, it is preferred that an O-ring having a relatively thin cross section be used. Furthermore, the flange **28**, by virtue of its thin construction and tight engagement with the O-ring **27**, dissipates a material portion of the heat generated by the friction between the sealing ring and the tapered wall.

There has been illustrated and described what is considered to be a preferred embodiment of the invention. It will be obvious, however, that various modifications may be made by persons skilled in the art without departing from the scope of the invention as set forth in the appended claims.

I claim:

1. An apparatus for controlling the discharge of powder under pressure which comprises a valve body, an elongate chamber in said valve body having an inlet zone to receive powder under pressure, an outlet zone, and an intermediate valve seating zone smaller in cross section than said inlet zone, said valve body having a discharge opening in fluid communication with said outlet zone, the intermediate zone of said chamber having a surface which is slightly tapered toward the outlet end of said intermediate zone, said surface comprising a valve seat, means providing a valve stop at the outlet end of said intermediate zone, a valve having a resilient peripheral portion cooperable with said valve seat and movable between an open position in said inlet zone and a closed position engaging said valve stop, said resilient peripheral portion sliding along said valve seat in progressively tighter engagement therewith upon closing movement of said valve to wipe powder from said seat and to form a seal against discharge of powder, and a valve stem connected to said valve and extending in sealing relationship through a wall of said valve body, said valve stem being movable to urge said valve toward open position, said valve and stem being so disposed relative to said valve body that a closing force will be exerted on said valve by pressure in said inlet zone.

2. An apparatus for controlling the discharge of powder under pressure which comprises a valve body, an elongate chamber in said valve body having an inlet zone to receive powder under pressure, an outlet zone, and an intermediate valve seating zone smaller in cross section than said inlet zone, said valve body having a discharge opening in fluid communication with said outlet zone, the intermediate zone of said chamber having a surface which is slightly tapered toward the outlet end of said intermediate zone, said surface comprising a valve seat, means providing a valve stop at the outlet end of said intermediate zone, a valve head movable between an open position in said inlet zone and a closed position engaging said valve stop, said valve head being slightly smaller in cross section than the valve seat immediately adjacent the valve stop, a resilient sealing ring mounted around said valve head and of such dimensions as to slide along said valve seat in progressively tighter engagement therewith upon closing movement of said valve to wipe powder from said seat and to form a seal against discharge of powder, and a valve stem connected to said valve and extending in sealing relationship through a wall of said valve body, said valve stem being movable to urge said valve toward open position, said valve and stem being so disposed relative to said valve body that a closing force will be exerted on said valve by pressure in said inlet zone.

3. An apparatus for controlling the discharge of powder under pressure comprising a valve body having fluid communicating upper, intermediate and lower passageways formed therein, a discharge conduit in said valve body in fluid communication with said upper passageway, said lower passageway being adapted for connection to a source of powder under pressure and being larger in cross section than said intermediate passageway, said intermediate passageway being generally cylindrical, an annular downwardly facing shoulder formed in said valve body adjoining said upper and intermediate passageways, a valve head engageable with said shoulder and slightly smaller in cross section than said intermediate passageway for reciprocation therein, a resilient sealing ring mounted around said valve head for slideable engagement with the wall of said intermediate passageway to wipe the powder from said wall and to form a seal when said valve is moved upwardly, a valve stem connected to said valve head and extending upwardly through the upper portion of said valve body for reciprocation therein, sealing means between said valve stem and said valve body, and means connected to said valve body to urge said valve stem downwardly to move said valve head through said intermediate passageway into said lower passageway to release a pressurized charge of dry powder, said valve head being urged upwardly into engagement with said shoulder by the pressure in said lower passageway to effect a seal between said sealing ring and the wall of said intermediate passageway to stop the flow of powder.

4. An apparatus for controlling the discharge of powder under pressure comprising a valve body, fluid communicating upper, intermediate and lower passageways in said valve body, a discharge conduit in said valve body in fluid communication with said upper passageway, said lower passageway being adapted for connection to a source of powder under pressure, said intermediate passageway being generally cylindrical with a slightly upwardly tapered wall, an annular downwardly facing shoulder formed in said valve body adjoining said upper and intermediate passageways, a valve head engageable with said shoulder and slightly smaller in cross section than said intermediate passageway for reciprocation therein, a resilient sealing ring mounted around said valve head for progressively tighter sliding engagement with said tapered wall to wipe the powder from said tapered wall and to form a seal when said valve is moved upwardly, a valve stem connected to said valve head and extending upwardly through the upper portion of said valve body for reciprocation therein, sealing means between said valve stem and said valve body, and means connected to said valve body to urge said valve stem downwardly to move said sealing ring out of contact with said tapered wall to release a pressurized charge of dry powder, said valve head being urged upwardly into engagement with said shoulder solely by the pressure in said lower passageway to effect a seal between said sealing ring and said tapered wall to stop the flow of powder.

5. An apparatus for controlling the discharge of dry powder under pressure comprising a valve body, fluid communicating upper, intermediate and lower passageways in said valve body, a discharge conduit in said valve body in fluid communication with said upper passageway, said lower passageway being adapted for connection to a source of powder under pressure, said intermediate passageway being generally cylindrical with a slightly upwardly tapered wall, an annular downwardly facing shoulder formed in said valve body adjoining said upper

and intermediate passageways, a valve head engageable with said shoulder and slightly smaller in cross section than said intermediate passageway for reciprocation therein, said valve head having an annular groove formed in the lower portion of its lateral side, a resilient sealing ring positioned in said groove, one wall of said groove being formed by a thin annular flange on said valve body turned inwardly to squeeze said sealing ring to form a thin edge portion of said sealing ring extending outwardly from said valve body, said edge portion being slidably movable along said tapered wall in progressively tighter engagement therewith to wipe the powder from said tapered wall and to form a seal when said valve is moved upwardly, a valve stem connected to said valve head and extending upwardly through the upper portion of said valve body for reciprocation therein, sealing means between said valve stem and said valve body, and means connected to said valve body to urge said valve stem

downwardly to move said sealing ring out of contact with said tapered wall to release a pressurized charge of dry powder, said valve head being urged upwardly into engagement with said shoulder solely by the pressure in said lower passageway to effect a seal between said sealing ring and said tapered wall to stop the flow of powder.

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