

Filed Nov. 8, 1962

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FIG. 1

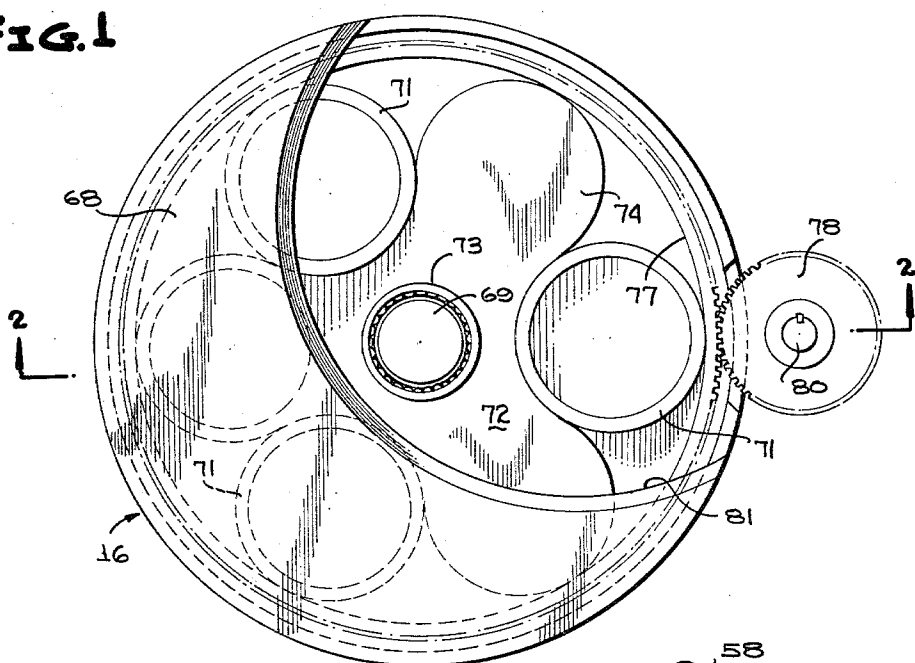
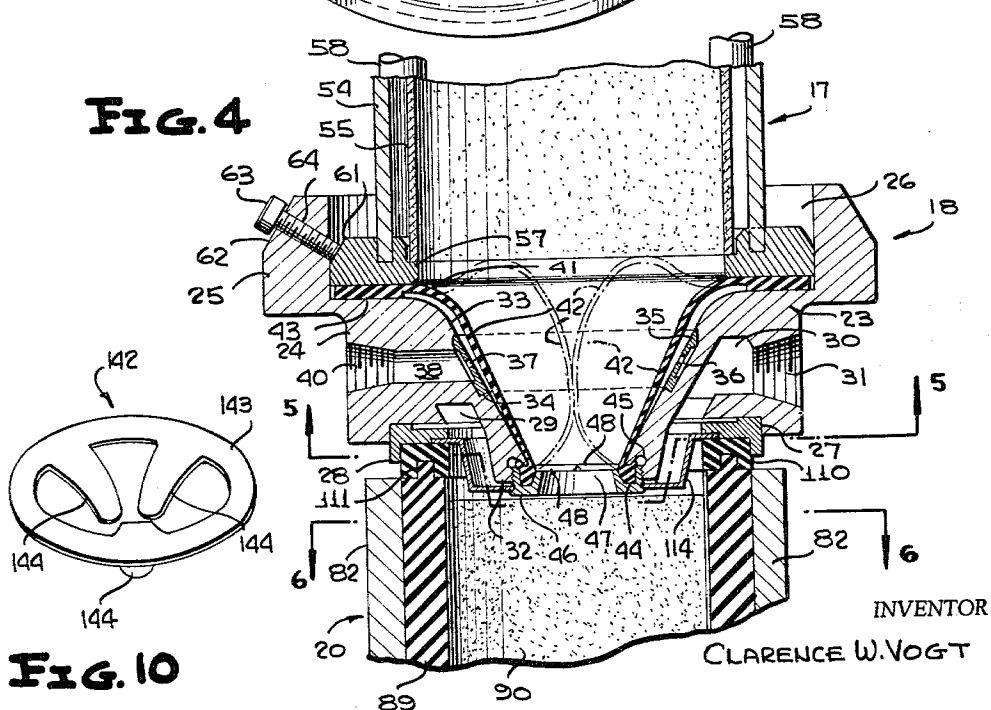


FIG. 4



INVENTOR

CLARENCE W. VOGT

BY

BY
Mason, Porter, Willing & Stewart
ATTORNEYS

July 20, 1965

C. W. VOGT
METHOD AND APPARATUS FOR ACCURATELY
DISPENSING DIVIDED MATERIAL

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FIG. 2

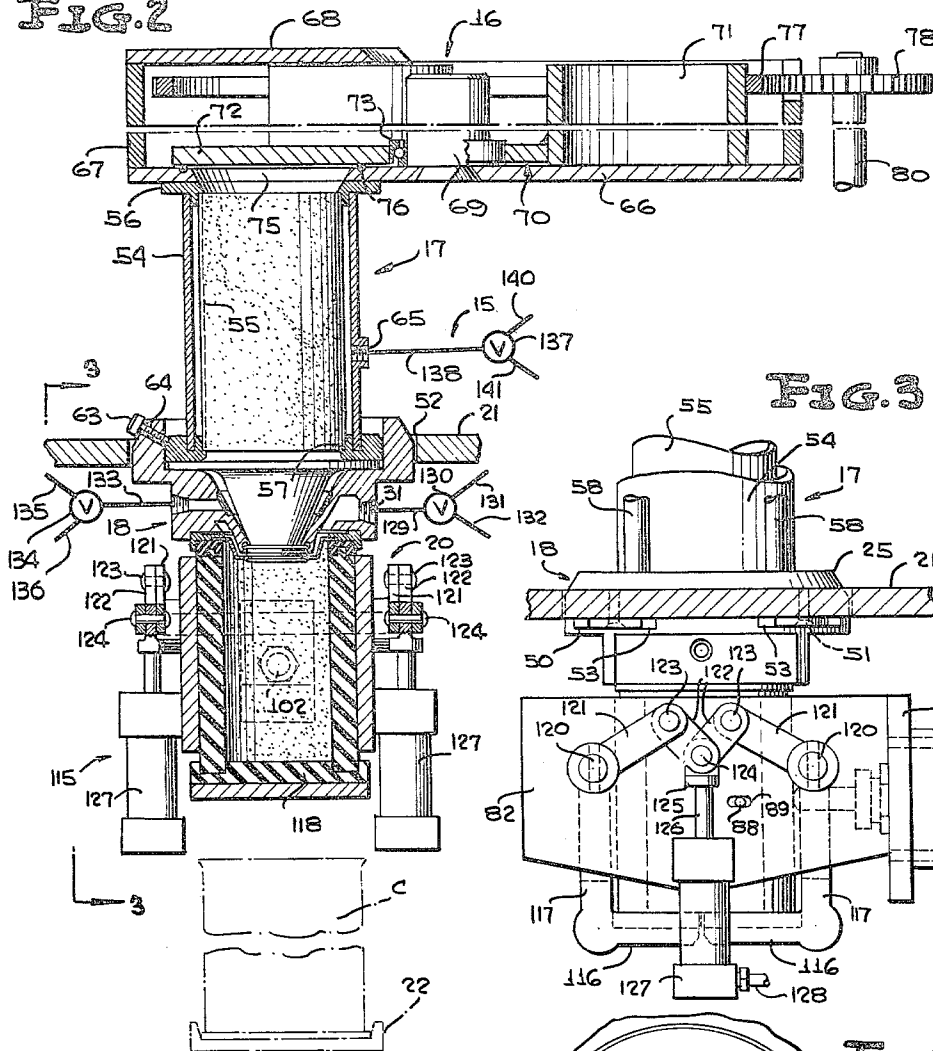


FIG. 3

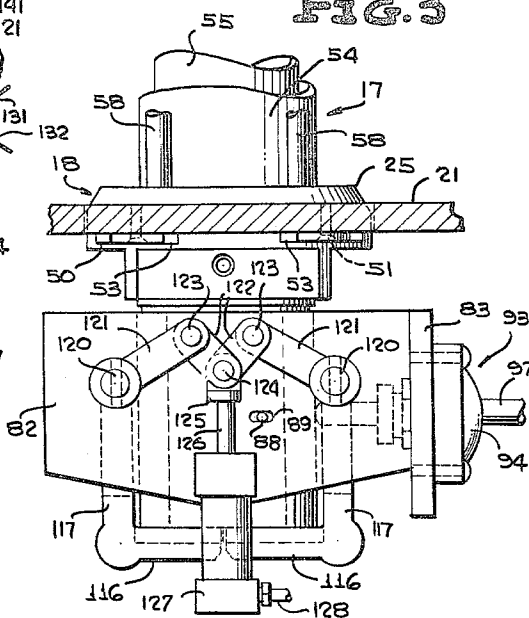


FIG. 8

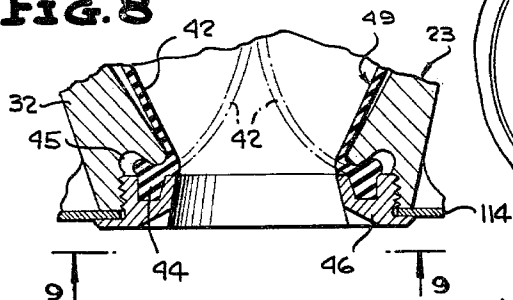
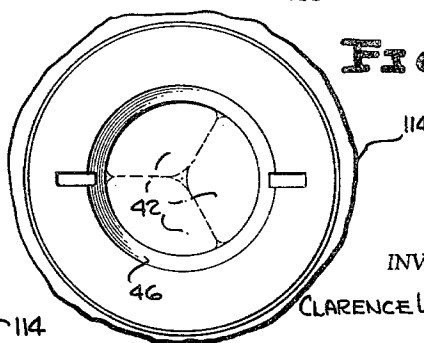


FIG. 9



INVENTOR
CLARENCE W. VOGT

BY
Mossm, Parter, Miller & Stewart
ATTORNEYS

July 20, 1965

C. W. VOGT
METHOD AND APPARATUS FOR ACCURATELY
DISPENSING DIVIDED MATERIAL

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FIG. 5

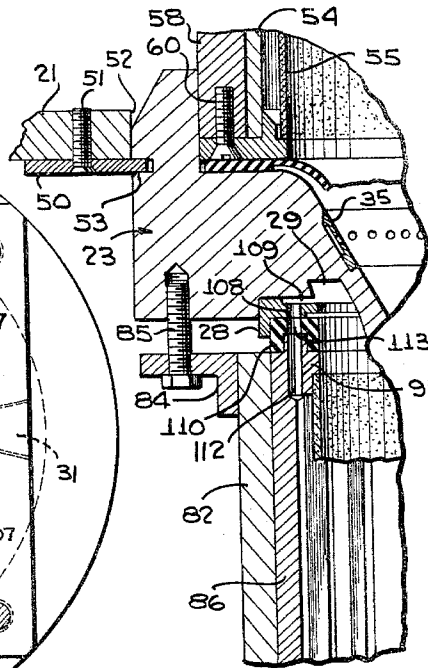
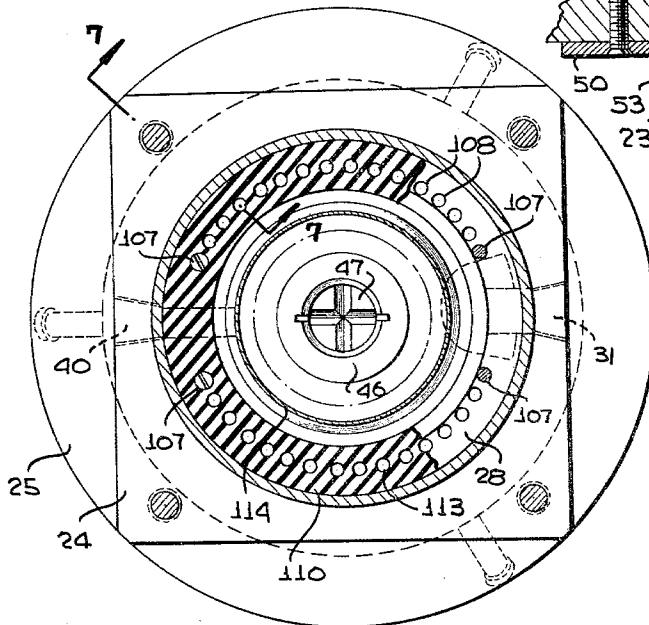
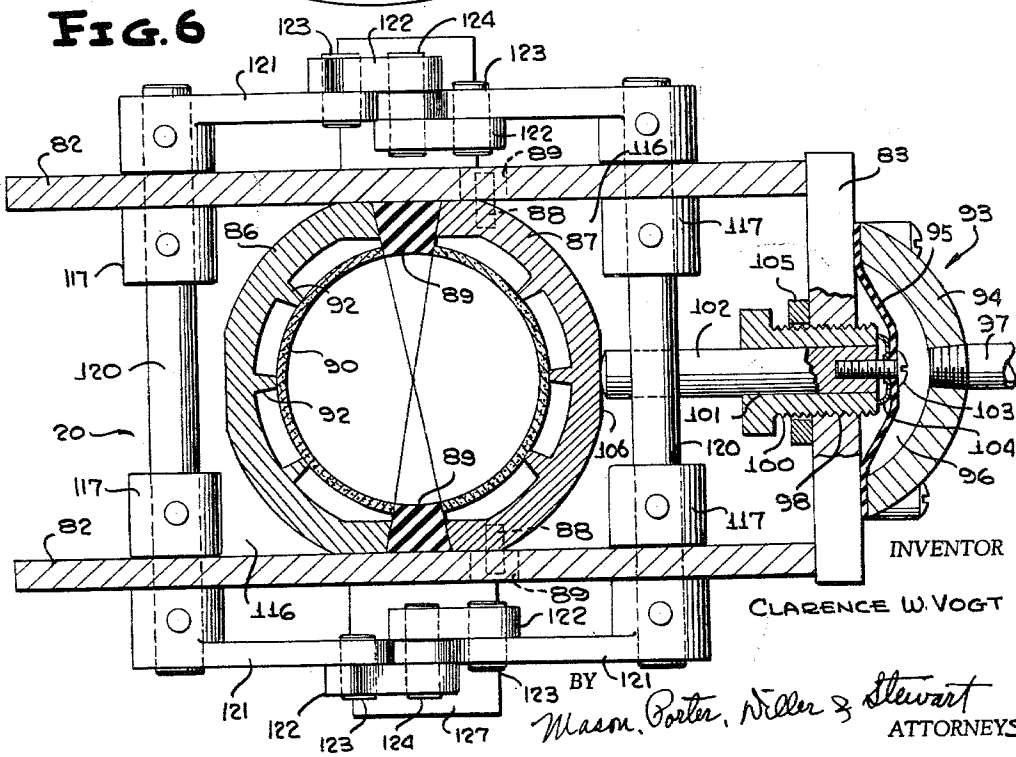


FIG. 7

FIG. 6



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3,195,586

METHOD AND APPARATUS FOR ACCURATELY DISPENSING DIVIDED MATERIAL

Clarence W. Vogt, Box 232, Westport, Conn.

Filed Nov. 8, 1962, Ser. No. 236,315

13 Claims. (Cl. 141-1)

This invention is a carrying forth of the invention disclosed in my application Serial No. 713,887, filed February 7, 1958, and entitled Method and Apparatus for Filling Containers, now U. S. Patent No. 3,063,477, and this application is a continuation-in-part thereof.

This invention relates in general to new and useful improvements in the dispensing industry, and more particularly relates to a method and apparatus for accurately dispensing predetermined weights of finely divided materials at a very high rate.

The term "finely divided materials," as used hereinafter, is intended to cover materials in the form of powders, grains, granules, etc., which are flowable under the influence of a gaseous pressure differential. Typical finely divided materials which may be readily dispensed in accordance with this invention are flour, baking powder cake mixes, puddings, soap powders, gelatins and other similar commonly packaged materials which are readily flowable and which may be considered of the air-entrained type.

At the present time the materials which may be dispensed and packaged in accordance with this invention are being packaged with difficulties by the packing industry. The difficulties fall into two classes, both of which are of a major importance. When the finely divided materials are permitted to flow solely due to the effect of gravitational forces thereon, the filling operation is extremely slow and therefore costly. The fill of packages vary in weight due to variations in the amount of air entrapped within the finely divided material. These variations in weight have become highly critical in that new standards have been set for weight control. This has resulted in a necessary overfilling of the packages to assure that each package has a weight at least equal to the weight indicated on the container of the package.

Attempts have been made in the past to decrease the packaging time and to compact the finely divided material within the container by filling under pressure. However, a gas under pressure many times channels through the material being dispensed with the result that the container will only be partially filled with material and therefore is a short weight package.

Great difficulties have also been experienced with valve construction in dispensing mechanisms in that when the flow of the finely divided material is interrupted by the closing of a valve, there is a tendency of the finely divided material to compact above the valve and form what may be considered a slug of material which will not freely fall when the valve is again opened.

In view of the foregoing difficulties now present in the packaging industry, it is the object of this invention to provide a novel apparatus for filling containers which is quick in operation, reliable and will dispense very accurately the desired weight of material.

A prime factor of this invention is the construction of a valve member for controlling the dispensing of the finely divided material, and it is another object of this invention to provide a novel valve member adapted to be closed by the application of external pressure thereon and when such external pressure is applied thereto, the valve member will simultaneously close and move in a direction opposed to the normal flow of material there-through so as to effect a loosening of the material as it

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has a tendency to compact against the valve member, thereby avoiding any possibility of the valve member being clogged.

Still another object of this invention is to provide a novel valve member which is formed of a resilient deformable material and which includes a downwardly tapering body which decreases in thickness from the upper end to the lower end thereof wherein the desired flexibility of the valve body is obtainable, and the deformation of the material of the valve member during a closing operation results in both the inwardly movement of the valve body to a sealed position, and an upward movement of the valve body at the point of seal to effect an upward movement of the material resting upon the valve member, thus an automatic loosening of the material due to the upward increase in cross-section of the valve member.

A further object of this invention is to provide a novel valve member which is of a construction wherein it may be readily closed either automatically by mechanical means, or by circumferential air pressure, and which is readily openable by the application of a vacuum therearound so that accurate control of the opening and closing of the valve member may be obtained.

Another object of this invention is to provide a novel valve member in accordance with the foregoing, wherein the valve member is movable to a closed position either by fluid pressure or by means of a resilient member mechanically acting on the valve member.

Yet another object of this invention is to provide in an apparatus for dispensing finely divided material a combined valve and receptacle assembly wherein the receptacle is sealed relative to a housing of the valve by means of a sealing ring which has vent openings there-through to effect the simultaneous venting of air from the receptacle during a filling operation through the upper end of the receptacle, and through the wall of a porous casing disposed within the receptacle.

Another object of this invention is to provide in an apparatus for accurately dispensing finely divided materials a filter which functions as a one-way valve member permitting the flow of air therethrough but preventing the loss of the finely divided material with the escaping air, the filter being generally of a hat-shaped configuration to provide sloping areas, thereby increasing the overall available area of the filter as compared to the transverse cross-section available for air flow from the receptacle.

A still further object of this invention is to provide a novel charging apparatus for filling and sealing a magazine of a dispenser in accordance with this invention, the charging apparatus being seated on the magazine and including a plurality of pockets which are alignable with the magazine for dispensing the contents thereof into the magazine, the magazine being part of a turret which includes closures for sealing the upper ends of the magazine when it is desired to dispense finely divided material utilizing the apparatus under the influence of a gaseous pressure in excess of atmospheric.

Still another object of this invention is to provide a novel receptacle for a dispensing apparatus for use in dispensing a controlled volume of material, the receptacle including an outer housing and inner porous casing spaced from the outer housing, the housing and the casing being of a split construction with resilient strips being disposed between adjacent portions thereof, and there being provided first motor means for effecting the clamping together of the housing and casing sections to reduce the volume of the casing to that desired in the particular dispensing operations and permitting the porous casing to expand so as to release the material deposited within the casing, and a second motor operated mechanism for auto-

matically closing and opening the bottom of the receptacle.

With the above, and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a plan view of the apparatus which is the subject of this invention as it appears from above.

FIGURE 2 is a vertical sectional view taken along the line 2—2 of FIGURE 1 and shows specifically the details of the dispensing apparatus and the relationship thereof with respect to a container to be filled in accordance with this invention.

FIGURE 3 is a fragmentary vertical sectional view taken along the line 3—3 of FIGURE 2 and shows in elevation the motor means for controlling the opening and closing of the receptacle of the apparatus.

FIGURE 4 is an enlarged fragmentary vertical sectional view taken through the valve of the apparatus and shows the specific details thereof, the valve member being shown in a sealed position by dotted lines.

FIGURE 5 is an enlarged fragmentary horizontal sectional view taken along the line 5—5 of FIGURE 4 and shows more specifically the details of a sealing ring for effecting the sealing of the receptacle with respect to the valve housing while providing vent passages between the two.

FIGURE 6 is an enlarged fragmentary horizontal sectional view taken along the line 6—6 of FIGURE 4 and shows more specifically the details of the receptacle and the motor means for effecting the opening and closing thereof.

FIGURE 7 is an enlarged fragmentary vertical sectional view taken along the line 7—7 of FIGURE 5 and shows more specifically the details of the vent passages extending between the receptacle and the valve housing.

FIGURE 8 is an enlarged fragmentary vertical sectional view showing the manner in which the lower flange of the valve member and the porous filter are clamped to the valve housing.

FIGURE 9 is a bottom view looking up into the valve member.

FIGURE 10 is a perspective view on a reduced scale of a mechanical closer for the valve member.

Referring now to the drawings in detail, reference is first made to FIGURE 2 wherein the overall details of the apparatus, which is the subject of this invention, are shown. The apparatus is generally referred to by the numeral 15 and includes an uppermost charging mechanism, generally referred to by the numeral 16, which is seated on a magazine, generally referred to by the numeral 17. The magazine 17 is, in turn, supported by a valve, generally referred to by the numeral 18. A receptacle, generally referred to by the numeral 20 depends from the valve 18. The entire apparatus 15 is supported by the valve 18 which, in turn, is supported from a table 21.

In accordance with this invention, the charging mechanism 16 periodically supplies the material to be dispensed through the magazine 17, and the valve 18 is utilized to control the flow of the material into the receptacle 20 in a manner wherein the weight of the material filling the receptacle 20 is accurately controlled. After a charge of material has been placed in the receptacle 20, it is opened at the bottom thereof, and the charge of material is permitted to freely drop within a container C which, for illustrative purposes, is shown as being carried by a conveyor 22.

The valve 18 forming the main support for the remainder of the apparatus 15, the details of this valve (FIG. 4) will be described first. The valve 18 includes a one-piece valve housing 23 which includes a generally square cross-sectional lower portion 24 and an enlarged generally circular cross-sectional upper portion 25. The

upper portion 25 of the valve housing 23 is of an annular construction to define a recess 26 in which the lower end of the magazine 17 is seated. The connection between the magazine 17 and the valve housing 23 will be described hereinafter. The valve housing 23 has a recess 27 formed in the underside thereof in which a sealing ring 28 is seated. The recess 27 is disposed outwardly of a downwardly opening annular recess 29 which extends more deeply into the interior of the valve housing 23. The valve housing 23 is provided with a radially extending vent passage 30 which is in communication with the recess 29 and which opens through the peripheral wall of the valve housing 23 in the form of a threaded opening 31 into which a suitable pipe or fitting may be readily threaded.

The valve housing 23 also includes a central portion 32 which projects down below the remainder of the valve housing and in part defines a generally conical opening 33 through the center of the valve housing 23. The conical opening 33 tapers downwardly. The wall defining the opening 33 is provided at its midheight with an annular recess 34 in which there is seated distributor ring 35. The outer surface of the distributor ring 35 is provided with a fluid passage 36, and the distributor ring 35 has a plurality of circumferentially extending openings 37 therethrough in direct communication with the fluid passage 36. A radially extending fluid passage 38 opens into the fluid passage 36, as is best shown in FIGURE 4, and terminates at its outer end in a threaded portion 40 into which a pipe or a fitting may be readily threaded.

The valve 18 also includes a valve member, generally referred to by the numeral 41, which is carried by the valve housing 23. The valve member 41 includes a generally conical valve body 42 which is provided at the upper end thereof with the thickened flange 43. The wall thickness of the valve body 42 progressively decreases so that it is much thinner at the lower end thereof with the result that the lower end is more pliant to readily move together and upwardly to form a seal. The valve member 41 is also provided at the lower end thereof with a thickened lower flange 44 which is suitably seated in a recess 45 in the lower portion of the projecting portion 32. The upper flange 43 is clamped against the valve housing 23 by the magazine 17 in a manner to be described hereinafter, and the lower flange 44 is clamped in place by means of a locking ring 46 which is threadedly engaged with the projecting portion 32 of the valve housing 23 as is clearly shown in FIGURE 4.

It is to be noted that the valve body 42 slopes at a different angle to the longitudinal axis of the opening 33 than does the wall of the opening 33. Thus, the valve body 42 is spaced from the wall of the opening 33 substantially full length thereof. It is also to be noted that the valve body 42 decreases in thickness from the upper portion thereof to the lower flange 44. Thus, as the valve body 42 decreases in diameter, it becomes more pliant due to the lesser material. The valve member 41 is preferably of a one-piece construction and is formed of a resilient deformable material, such as rubber and synthetic rubber products. A preferred material is neoprene.

In FIGURE 4 the valve member 41 is illustrated as being provided with the valve unit 47 in the vicinity of the lower flange 44. The valve unit 47 is in the form of a flap valve defined by a plurality of flaps 48. The valve unit 47 may be formed with a various number of valve flaps 48 although the most practical number appears to be 2, 3 or 4. It is to be understood that the valve flaps 48 have sufficient resiliency to normally return to a closing position when the pressure of material thereon has been removed.

At this time, reference is made to FIGURES 8 and 9 wherein there is illustrated a modified form of valve member which is generally referred to by the numeral 49. The valve member 49 is identical with the valve member 41 with the exception of the fact that it does not utilize

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a valve unit 47. It may be considered that the valve member 49 is a simplex valve whereas the valve member 41 is a duplex valve.

Referring now to FIGURES 3 and 7 in particular, it will be seen that the valve housing 23 is secured to the table 21 by means of a plurality of small plates 50 which are secured to the underside of the table 21 by means of fasteners 51. The table 21 is provided with an opening 52 receiving the valve housing 23 and the small plates 50 are received in recesses 53 formed in the peripheral surface of the valve housing 23.

The magazine 17 includes an outer sleeve 54 and an inner porous liner 55 which is spaced from the sleeve 54. The sleeve 54 and the liner 55 are held in position relative to one another by a pair of end plates 56 and 57 which are clamped against the ends of the sleeve 54 and the liner 55. A plurality of circumferentially spaced rods 58 extend between the end plates 56 and 57, and the end plates are secured to the opposite ends of the rods 58 by means of screws 60, as is best shown in FIGURE 7.

Referring now to FIGURE 4 in particular, it will be seen that the lower end plate 57 is provided with an upper and outer sloping surface 61 which is generally parallel to an upper and outer sloping surface 62 of the upper portion 25 of the valve housing 23. Clamp screws 63 are threaded in bores 64 spaced circumferentially around the upper portion 25 and have the inner ends thereof bearing against the surface 61 to clamp the lower end of the magazine 17 within the recess 26. This clamping action also serves to clamp the upper flange 43 of the valve member 41 in place within the valve housing 23.

At this time it is pointed out that the liner 55 is of a porous construction wherein the air may pass therethrough while the passage of the finely divided material is excluded. Liner 55 may be formed of material such as sintered stainless steel and sintered polyethylene which are commercially available. The sleeve 54 is provided with a fitting 65, as is shown in FIGURE 2, to which a suitable pipe or other fitting may be connected. Thus, there may be gas flow within the sleeve 54 and through the liner 55.

The charging mechanism 16 includes a bottom plate 66 which directly seats upon and is suitably secured to the upper clamp plate 56. The bottom plate 66 has a peripheral wall 67 extending upwardly therefrom, and a top wall 68 is seated on the upper edge of the peripheral wall 67. The bottom plate 66 supports a central pin 69 about which a turret, generally referred to by the numeral 70, rotates. In its simplest form, the turret 70 includes a plurality of charging pockets 71 which are circumferentially spaced about the pin 69. The charging pockets 71 are carried by a lower plate member 72 which is suitably journaled on the pin 69. The plate 72 is journaled on the pin 69 by means of a bearing 73 with the bearing 73 supporting the plate 72 slightly above the bottom plate 66. The plate 72, as is clearly shown in FIGURE 1, has a plurality of lobe portions 74 which are circumferentially spaced and disposed intermediate the charging pocket 71. The lobes 74 are positioned for overlying a charging opening 75 formed in the bottom plate 66 and aligned with the magazine 17 and sealing the same against the escape of fluid under pressure. To this end, the bottom plate 66 is provided with an upstanding O-ring 76 which bears against the underside of the plate 72 and facilitates the forming of the necessary seal with the plate 72.

The turret 70 may be rotated in any desired manner, and, for illustrative purposes, a gear ring 77 is shown encircling the charging pockets 71 and secured thereto. A drive gear 78 carried by a shaft 80 engages the gear ring 77 to facilitate the rotation and indexing of the turret 70.

The top plate 68 of the charging mechanism 16 is provided with a large opening 81 therein through which the charging pocket 71 may be filled by the material flowing downwardly in the direction of the arrow appearing at the top of FIGURE 2. The edge of the top plate

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68 defining the opening 81, as shown in FIGURE 1, serves as a wiper leveling off the top of the charges even with the tops of the pockets 71 as the latter pass out beyond 81. It will be noted in FIGURES 1 and 2 that the plate 72 covers the charging opening 75 during the filling of the receptacle 20 and when the plate 72 is in this position no material can fall into the magazine. This prevents any additional material falling into the magazine 17 after each fill and until the valve body 41 has been pushed inwardly and upwardly and allows the material which has moved upwardly in the magazine to do so freely without having to disturb any additional material other than the residual material in the then partially empty magazine.

The receptacle 20 includes a pair of spaced side plates 82 which are connected together at one end by a transverse plate 83. The plates 82 and 83 are vertically disposed, and, as is best shown in FIGURE 7, the plates 82 are provided with angle brackets 84 which are secured to the lower portion of the valve housing 23 by means of fasteners 85.

Referring now to FIGURE 6 in particular, it will be seen that the plates 82 support a pair of receptacle housing halves 86 and 87 which are of identical construction. However, the housing half 86 is fixedly secured to the plates 82 in any desired manner, while the housing half 87 is supported for movement towards and away from the housing half 86 by means of pins 88 seated in elongated slots 89 in the plates 82. A pair of resilient strips 89 extends between the opposed ends of the housing halves 86 and 87 and permits limited movement on the housing halves 86 and 87 relative to each other while maintaining a seal therebetween.

A casing 90 is mounted within the housing. These casings are of filter material and preferably of sintered stainless steel or sintered polyethylene. I have found that the porosity in the order of 30-40 microns will readily pass gases through the walls of the casing without passing very finely divided solid particles of material. While this is not true to the same extent when filtering solids from liquids it does apply in restraining powder particles which are not in suspension in a liquid medium. The casing 90 is also formed of two separate sections and has the opposed ends thereof engaging the resilient strips 89. The housing sections 86 and 87 are provided at the upper and lower ends thereof with inwardly directed flanges 91 which snugly engage the ends of the casing 90. In addition, the housing halves 86 and 87 are provided with longitudinal ribs 92 which support the casing 90 at circumferentially spaced points. It is to be noted that the resilient strips 89 are engaged by the opposed edges of the casing sections to form a seal relative thereto.

The transverse plate 83 carries an operator for effecting the contraction and expansion of the receptacle housing and the casing 90 carried thereby. This operator is generally referred to by the numeral 93 and includes a part spherical housing 94 which clamps a peripheral portion of a diaphragm 95 against the transverse plate 83 to thus form a sealed chamber 96. A pipe 97 is connected to the housing 94 and opens into the chamber 96 for varying the pressure therein.

The transverse plate 83 is provided with an internally threaded bore 98 in which there is threadedly engaged an adjustably positioned guide 100 having a bore 101 therethrough in which there is slidably mounted a pin 102. The pin 102 is secured to the diaphragm 95 by a fastener 103 and a resilient stop member 104 is mounted on the fastener 103 intermediate the pin 102 and the diaphragm 95 when in engagement with the opposed end of the guide 100. The guide 100 is locked in an adjusted position relative to the transverse plate 83 by means of a lock nut 105 so as to limit the amount of movement of the pin 102 to the left. The pin 102 engages a flat spot 106 on the exterior surface of the housing half 87 and

serves to force the housing half 87 to the left compressing the resilient strips 89 and varying the cross-section of the casing 90. By adjusting the guide 100, the cross-section of the casing 90 may be minutely varied.

At this time it is pointed out that the sealing ring 28 is secured to the underside of the valve housing 23 by means of a plurality of headed fasteners 107, as is best illustrated in FIGURE 5. In addition, as is clearly illustrated in FIGURES 5 and 7, the sealing ring 28 has a plurality of circumferentially spaced openings 108 extending vertically therethrough. The upper surface of the sealing ring 28 is provided with a relief 109 into which the upper ends of the openings 108 open. The relief 109 opens into the vent opening 29.

The receptacle housing halves 86 and 87 are sealed with respect to the sealing end 28 by an inverted U-shaped cross-sectional resilient sealing ring 110. The upper end of each of the housing halves 86 and 87 and the resilient strip 89 is provided with an arcuate outstanding rib 111, as is best illustrated in FIGURE 4, which is seated within the sealing ring 110. Thus, when the receptacle 20 is clamped upwardly with respect to the valve 13, the necessary seal will be provided between the valve housing 23 and the receptacle housing.

It is necessary in the operation of the apparatus 15 to permit the evacuation or venting of air from the spaces between the casing 90 and the housing halves 86 and 87. To this end, the housing halves 86 and 87 have vertical bores 112 through the upper portions thereof in alignment with the bores 108 in the sealing ring 28. Further, the resilient sealing ring 110 is provided with bores 113 which are in alignment with the bores 108 and 112 providing a continuous vent passage between the receptacle 20 and the valve housing 23. This is clearly shown in FIGURE 7. It is to be noted that the resilient sealing ring 110 is held in alignment with the sealing ring 28 by the passing of the heads of the fasteners 107 through the openings in the sealing ring 110.

When the receptacle 20 is being filled, there is an upward flow of air out of the casing 90 through the vent opening 29. It is necessary that this air be filtered to prevent the flow of some of the finely divided material therewith. To this end, there is provided a porous filter 114 which is best shown in FIGURE 4. The porous filter 114 has the inner peripheral edge thereof clamped against the downwardly projecting portions 32 of the valve housing 23 by the ring 46, and the outer peripheral edge of the filter 114 is clamped between the sealing ring 28 and the resilient sealing ring 110. It is to be noted that the filter 114 is of a hat-shaped configuration. By so forming the filter ring 114 a much greater area than normal is provided for the effective flow of air than if the filter 114 extended straight across. This is obvious when viewing FIGURE 4.

Referring now to FIGURES 2 and 3 in particular, it will be seen that the receptacle 20 includes a bottom closing structure generally referred to by the numeral 115. The bottom closing structure 115 includes a pair of bottom wall halves 116 which are carried by upstanding arms 117. Each of the bottom wall halves 116 is provided with a resilient pad 118, and the pads 118 engage one another edgewise to form a seal therebetween and engage the housing halves 86 and 87 in the casing 90 endwise to form seals therewith.

The upstanding arms 117 are bifurcated and each is secured to a transverse shaft 120. Thus, when the shafts 120 are rocked, the bottom wall halves 116 are swung between bottom forming positions and open positions.

The shafts 120 are rotatably journaled in the plates 82 and are provided at the outer ends thereof with crank arms 121. The crank arms 121 each has a link 122 connected thereto by means of a pin 123. Each pair of links 122 are connected together by a pin 124 to which there is also connected a fitting 125 carried by a piston rod 126 of an air cylinder 127. It is to be understood

that there are two air cylinders 127 disposed at opposite sides of the receptacle 20 for action in unison to effect the opening and closing of the bottom of the receptacle 20.

The air cylinders 127 are actuated by fluid directed thereto to suitable piping 128.

Referring once again to FIGURE 2 in particular, it will be seen that there is schematically illustrated a fluid flow system for the apparatus 15. This fluid flow system includes a pipe 129 which is threaded into the bore 31 and which is connected to a control valve 130. A pipe 131 leads from the control valve 130 to a vacuum source while a second pipe 132 leads from the valve 130 as a vent.

The pipe 133 is threaded into the threaded bore 40 and is connected to a valve 134. A pipe 135 leads from the valve 134 to a vacuum source whereas a pipe 136 leads from the valve 134 to a pressure source.

A pipe 138 is connected to the fitting 65 and leads to a valve 137. A pipe 140 extends from the valve 137 to a pressurized air source, while the pipe 141 leads from the valve 137 to the atmosphere to function as a vent or to a source of inert gas at substantially atmospheric pressure. If this is connected to a source of inert gas, such gas as enters the magazine will scrub out and replace atmospheric air in the magazine before and during its recharging with new material.

Operation

The apparatus 15 may be operated to provide for the filling of the receptacle 20 utilizing vacuum alone, air pressure alone, or a combination thereof. This is controlled by properly manipulating the valves 130, 134 and 137. These three valves are preferably solenoid operated although they may be of any conventional type.

The operation of the valve 134 will be first described here. When the valve 134 is set to connect together the pipes 133 and 136, a small pressure is exerted on the exterior of the valve body 42 and the same is caused to inwardly collapse and move upwardly to the dotted line position shown in FIGURE 4 with the seal being first formed adjacent the lower end of the valve body and then progressively moving upwardly to substantially the plane of the upper flange 43. With most materials, the deformation of the valve body 42 is sufficient to provide for a complete seal, as generally shown in FIGURES 8 and 9. When it is desired to fill the casing 90 of the receptacle 20, the valve 134 is operated to connect the vacuum line 135 to the pipe 133 with the result that a vacuum is pulled around the valve body 42 and the same is drawn outwardly slightly from the solid line position shown in FIGURE 4 and in the case of the modification shown in FIGURES 8 and 9, the material to be dispensed is free to flow therethrough. On the other hand, in the form illustrated in FIGURE 4, the valve unit 47 prevents the downward flow of the finely divided material when the valve body 42 is moved outwardly, there will be an elongated vertical path substantially devoid of material whereby when there is effective pressure differential acting on the material, the material will obtain relatively high velocity before entering the receptacle 20.

When it is desired to fill by vacuum alone, the valves 130 and 134 simultaneously operated so as to draw a vacuum through the valve 130 while drawing the vacuum through the valve 134. The drawing of the vacuum through the valve 130 evacuates the casing 90 both through the walls thereof and through the open upper end and the filter 114. Since the valve member 41 has now assumed its open position the finely divided material stored within the magazine 17 is drawn down through the valve member 41 and is tightly packed or compacted within the casing 90 until the material builds up to the filter 114 and the valve unit 47. During this filling operation, the valve 137 is in its vent position.

After the casing 90 has been filled, pressure is re-

moved from within the chamber 96 and from the air cylinders 127 so that the casing 90 is permitted to increase in cross-section and the bottom thereof is opened. The casing 90 should be extended slightly after the bottom has been opened, so as to prevent the charge therein from striking the bottom pads 118 as it is dropped from the casing 90 into the container C.

In view of the fact that the air entrapped within the finely divided material being dispensed into the receptacle 20 can escape through the wall of the casing 90 and through the upper end thereof, it will be readily apparent that the dispensed material will contain less air than normal and that in each instance the air content will be the same so that for a given volume casing 90 and with a controlled pressure differential, reliably accurate weight may be obtained.

When it is desired to fill the receptacle 20 utilizing pressure alone, the valve 130 is set so that when it is activated, it is open to vent. On the other hand, the valve 137 is set so that when it is opened it is opened through the pressurized air source. The valve 134 functions in its normal manner and the finely divided material within the magazine 17 is forced down therethrough by the air passing through the liner 55 from the exterior. The air within the receptacle and the air carried by the finely divided material is vented through the wall of the casing 90 and through the filter 114. At this time, it is pointed out that the pressurizing medium could be inert gas as opposed to air when it is desired to protect the package materials.

When it is desired to more tightly compact the finely divided material within the receptacle 20, the valve 130 may be set for vacuum when actuated, and the valve 137 set for pressure when actuated. Thus, when the valves 130 and 137 are actuated, there will be a combined effect of a vacuum pulling on the finely divided material to remove air therefrom and the pressure behind the finely divided material to more effectively compact the same by increasing the filling velocity due to higher available differentials.

At this time it is desired to more particularly set forth the function of the valve member 41 during a filling operation. It is to be understood that during a filling operation the finely divided material passing through the valve member 41 will back up after the receptacle 20 has been filled and when the finely divided material engages the valve unit 47, it will urge the same upwardly to a closed position. This, in itself is not sufficient to hold the finely divided material even though there is no pressure differential urging the same down through the valve member 41 and as a result there is dribbling of the finely divided material through the valve unit 47 of a nature to provide varying weights. However, when the valve member 41 is pressure-moved inwardly to its dotted line position, it provides a physical separation between the material in the magazine and the material resting upon the valve unit 47 so that the load of the column of the finely divided material on the valve unit 47 is relieved and actually the column of finely divided material is lifted upwardly by the closing operation of the valve member 41. In addition, the upward movement of the column of finely divided material results in the breaking up of any compaction of the residual material within the valve member 41, thus eliminating any change in density of the residual material between filling operations or before the next filling operation.

It is to be understood that with the valve member 49, shown in FIGURE 8, that is the valve member 41 without the valve unit 47, there is a likewise lifting up of the finely divided material at the end of the filling operation and when the valve member 49 is moved to its closed position, there will be an effective sealing off of the column of finely divided material so that a like weight of the finely divided material will be dispensed in each operation of the valve. This valve member 49 is preferred when

material being filled contains a percentage of hard substances such as pebbles or large granules.

At this time it is pointed out that the novel construction of the valve members 41 and 49 provide for a rapid opening thereof with a resultant great increase in velocities of the finely divided material during the filling operation. This increase in velocity of the finely divided material above that normally caused by the pressure differential operating on the fill material is primarily attributable to two factors. These include the loosening up of the resilient material in the magazine 17 by the previous unimpeded upward movement of the residual material when the magazine was then only partially full and the residual material was free to move upwardly while the displaced gas within the magazine moved outwardly through the porous liner 55 either to the atmosphere or to a source of inert gas at substantially atmospheric pressure. The other of these factors is that the action of the valve members 41 and 49 in each instance provides a definite space through which the finely divided material can fall before it leaves the magazine. As the valve member is rapidly opened, the support for the finely divided material is released and the finely divided material starts its descent out of the magazine as the valve member opens. In other words, there is a movement of the material in the magazine even before the valve member becomes fully opened.

With respect to the foregoing, it is pointed out that when the magazine is connected to a source of inert gas, such gas, as it enters the magazine, will scrub out and replace the atmospheric air in the magazine before and during the recharging of the magazine with additional finely divided material. In connection with this, it is also pointed out that the hopper or charging mechanism 16 is actuated in timed relation to the operation of the valve 18 so that no material is allowed to pass into the magazine until the upward movement of the valve member 41 has ceased.

Experimentations have proven that in order to obtain the most efficient operation of the valve 18, the volume of the magazine should not be larger than three times the volume of the receptacle to be filled so as to limit the residual material remaining in the magazine to be lifted by the upward movement of the valve member 41 or the valve member 49 in the closing thereof. There has also been found that the thickness of the valve body 42 adjacent the upper flange 43 is preferably twice the thickness of the valve body 42 adjacent the lower flange 44.

It is also to be understood that the apparatus is not limited to filling containers which are of generally the same volume as the receptacle 20. The apparatus 15 is suitable for filling containers of relatively a large volume and weight of materials, e.g., one-half pound or more with one shot, and by mounting the apparatus 15 in series with other ones of the apparatus, much larger containers may be filled by a series of filling operations. The filling operation being substantially instantaneous, and since the apparatus arranged in series may be simultaneously operated, no more time would be required to fill a large container with several shots than to fill a half-pound or like size smaller container.

It is to be noted that the construction of the valve 18 is such that it projects down into the receptacle being filled to thus leave a void in the top of the material filling the receptacle. When the valve is used for the purpose of directly filling a container which is to be marketed, the void is useful to receive the particles of the filled material which might remain on the undersurface of the filter, when the vacuum is released, whereupon air from the atmosphere or inert gas or the like under atmospheric or slightly greater than atmospheric pressure is forced back through the filter thus causing any such particles to drop into the void and without contaminating the upper inner surface of the container. Such particles, of course, would tend to prevent an effective sealing or closing of the top of the container.

In addition, the void permits the partial refluidizing of the filled material within the container making it more readily "spoonable" and of sifted consistency when the container is opened.

Reference is now made to FIGURE 10 wherein there is illustrated a closing device for the valve member 41, the closing device being generally referred to by the numeral 142. The closing device 142 includes a circular rim 143 from which a plurality of downwardly curving fingers 144 extend. It is to be understood that the closing device 142 is formed of a resilient material, preferably spring steel, and the fingers 144 have sufficient pressure to effect the closing of the valve member 41 to the position generally illustrated in FIGURES 4, 8 and 9. The rim 143 will be clamped between the flange 43 and the bottom of the recess 26. It is to be understood that the valve member 41 will be moved to an open position by the application of a vacuum in the manner stated above.

Although this application has been restricted to preferred embodiments of this invention, is to be understood that minor modifications may be made in the method and apparatus disclosed herein within the spirit and scope of the invention, as defined in the appended claims.

I claim:

1. A valve member particularly adapted for use in an apparatus for dispensing accurate measures of air-entrained finely divided materials, said valve member comprising a downwardly tapering frusto-conical body having upper and lower ends, and anchoring flanges at said upper and lower ends, said body definitely tapering in thickness between said upper and lower flanges and being formed of a resilient deformable material whereby when an external circumferential pressure is applied to said body, said body deforms inwardly and upwardly to simultaneously form a seal against material normally passing therethrough and upwardly lifting the material to break up any compaction of the material and to provide a space through which the material will initially fall to accelerate before the material passes through the valve member.

2. The valve member of claim 1 wherein said body is formed of neoprene.

3. The valve member of claim 1 wherein a secondary valve of the flap type is disposed at said body lower end.

4. A combined flow control and compaction preventing valve assembly particularly adapted for use in an apparatus for accurately dispensing measures of air-entrained finely divided materials, said valve assembly comprising a housing having a downwardly tapering opening therethrough, a valve member seated in said opening, said valve member including a downwardly tapering frusto-conical body having upper and lower ends, and anchoring flanges at said upper and lower ends, said body tapering in thickness between said upper and lower flanges and being formed of a resilient deformable material whereby when an external circumferential pressure is applied to said body, said body deforms inwardly and upwardly to simultaneously form a seal against material normally passing therethrough and upwardly lifting the material to break up any compaction of the material and to provide a space through which the material will initially fall to accelerate before the material passes through the valve member, means clamping said flanges to said housing, and valve closing means connected to said housing for exerting a circumferential pressure on said body for normally retaining said valve member sealed against the passage of material therethrough.

5. The valve assembly of claim 4 wherein said valve member has a secondary valve of the flap valve type disposed at said body lower end.

6. The valve assembly of claim 4 wherein said valve closing means includes a fluid passage through said housing into said opening, and a pressurized fluid source connected to said fluid passage.

7. The valve assembly of claim 4 wherein said valve closing means includes a fluid passage through said housing into said opening, a pressurized fluid source connected to said fluid passage, and valve opening means including a vacuum source connected to said fluid passage and a control valve for selectively communicating said pressurized fluid source and said vacuum source with said passage.

8. The valve assembly of claim 4 wherein said valve closing means includes a member having spring fingers engaging the exterior of said body.

9. The valve assembly of claim 4 wherein said valve closing means includes a member having spring fingers engaging the exterior of said body, and valve opening means including a fluid passage through said housing into said opening, and a vacuum source connected to fluid passage.

10. The valve assembly of claim 4 wherein said valve closing means includes a fluid distributor ring surrounding said opening, a fluid passage through said housing to said fluid distributor ring, and pressurized fluid source connected to said fluid passage.

11. A charging mechanism for use in an apparatus for accurately dispensing finely divided material, said charging mechanism comprising a magazine, a dispensing valve at the lower end of said magazine to control the flow of material through said magazine, means connected to said magazine for dispensing material therefrom through said valve, a rotary turret overlying said magazine and having charging pockets alignable with said magazine as said turret rotates, and cooperating means on said turret intermediate said charging pockets and on said magazine for sealing said magazine to restrict flow of material under pressure from said magazine to that passing through said valve.

12. A method of controlling the flow of a finely divided material utilizing a single resilient valve member comprising the steps of placing a circumferential inwardly directed force on the valve member to effect a closing of the valve member to shut off flow, and as the valve member is closing circumferentially inwardly effecting movement of the valve member in a direction opposed to the direction of flow of the material and generally normal to the direction of closing to thereby loosen any of the material having a tendency to compact against the valve member and not flow freely when the valve member is again opened.

13. An apparatus for quickly and accurately dispensing finely divided material comprising a magazine, a charging mechanism for periodically filling said magazine and closing the magazine, a dispensing valve connected to said magazine for controlling the flow of material from said magazine, a receptacle connected to said valve for receiving material from said valve, and motor operated means for opening said receptacle to release a charge of material therefrom, said charging mechanism including a rotary turret overlying said magazine and having charging pockets alignable with said magazine as said turret rotates, and cooperating means on said turret intermediate said charging pockets and on said magazine for sealing said magazine to restrict flow of material under pressure from said magazine to that passing through said valve, said valve including a housing having a downwardly tapering opening therethrough, a valve member seated in said opening, said valve member including a downwardly tapering frusto-conical body having upper and lower ends, and anchoring flanges at said upper and lower ends, said body tapering in thickness between said upper and lower flanges and being formed of a resilient deformable material whereby when an external circumferential pressure is applied to said body, said body deforms inwardly and upwardly to simultaneously form a seal against material normally passing therethrough and upwardly agitate the material to prevent packing thereof within said valve member, means clamping said flanges

to said housing, and valve closing means connected to said housing for exerting a circumferential pressure on said body for normally retaining said valve member sealed against the passage of material therethrough.

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LAVERNE D. GEIGER, *Primary Examiner.*