

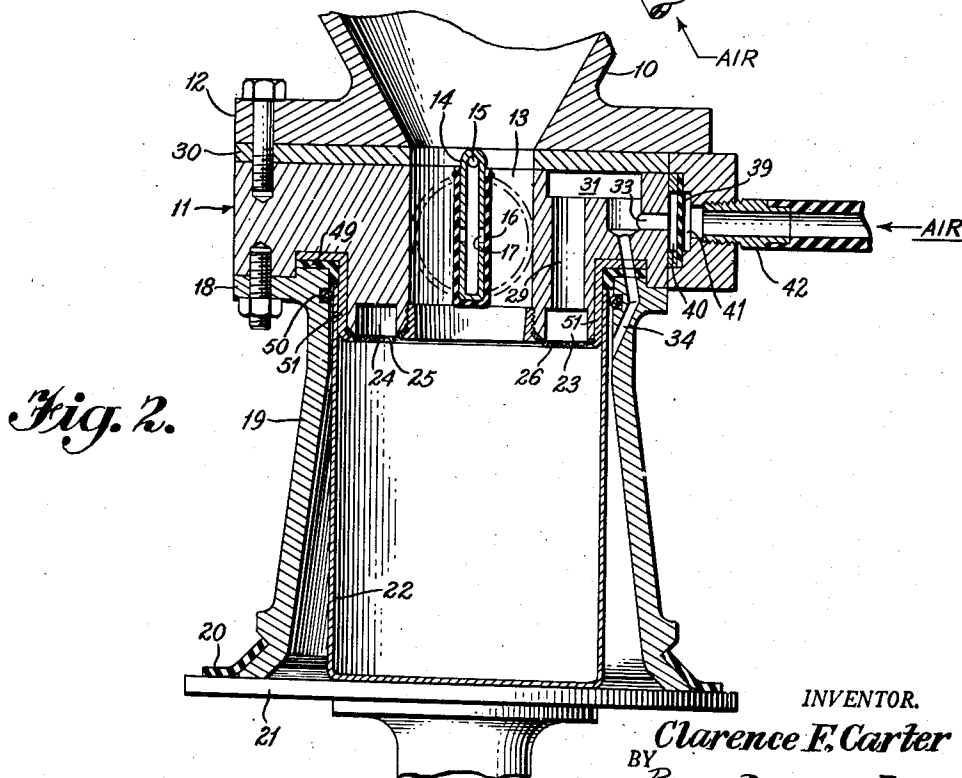
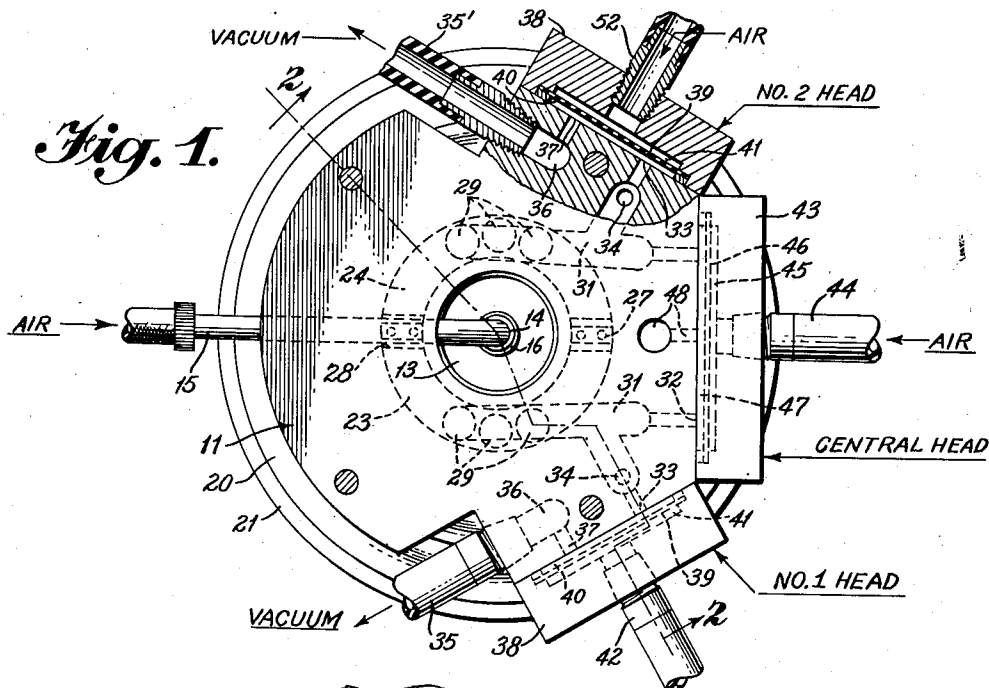
June 16, 1953

C. F. CARTER
OSCILLATING VALVE MECHANISM

2,642,215

Filed April 3, 1952

4 Sheets-Sheet 1



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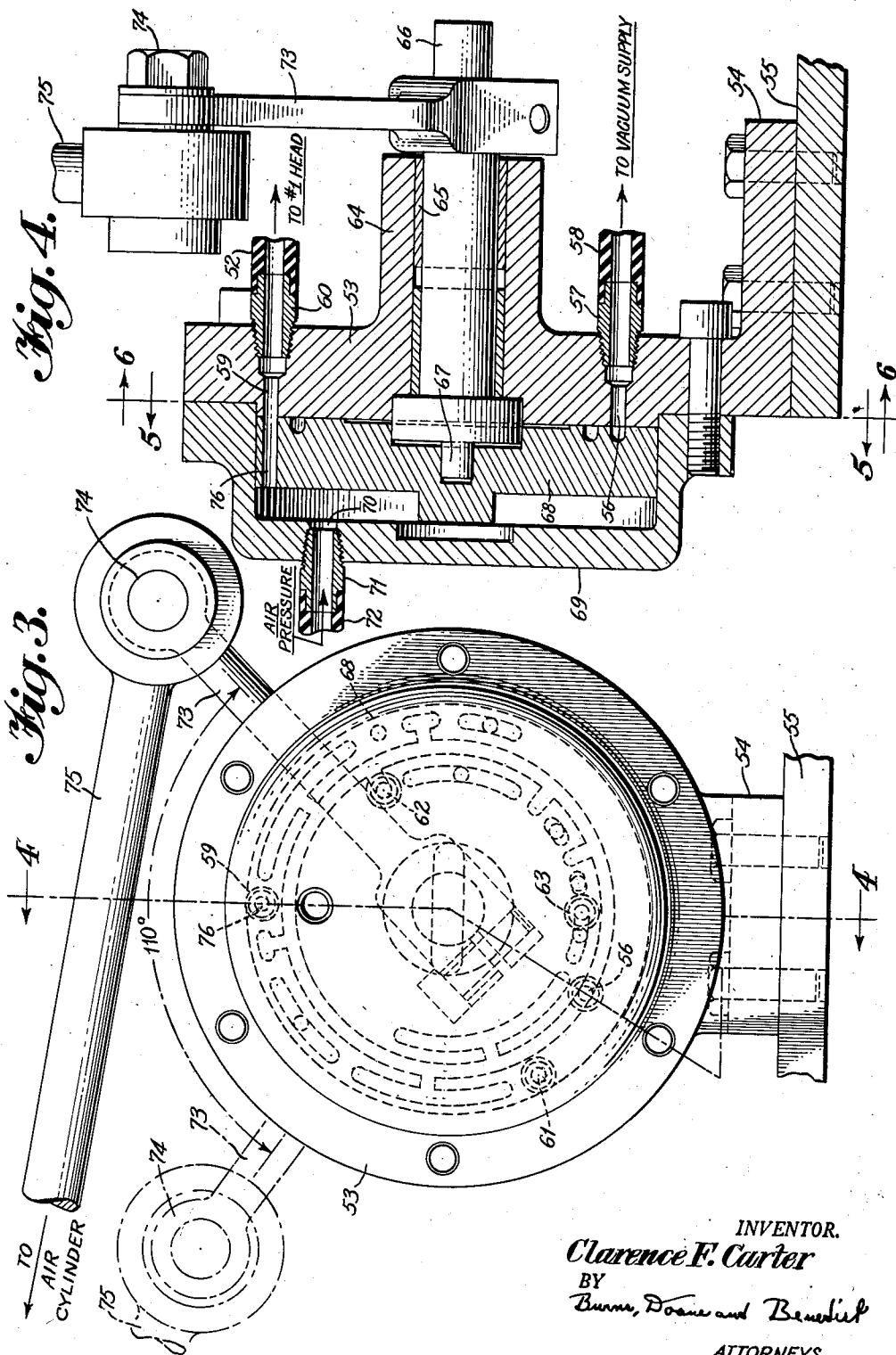
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4 Sheets-Sheet 2



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OSCILLATING VALVE MECHANISM

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Fig. 6.

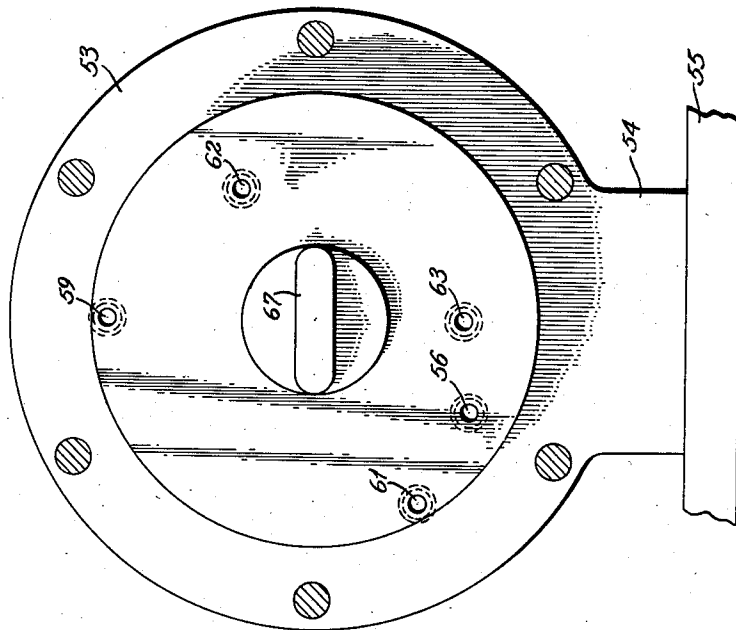
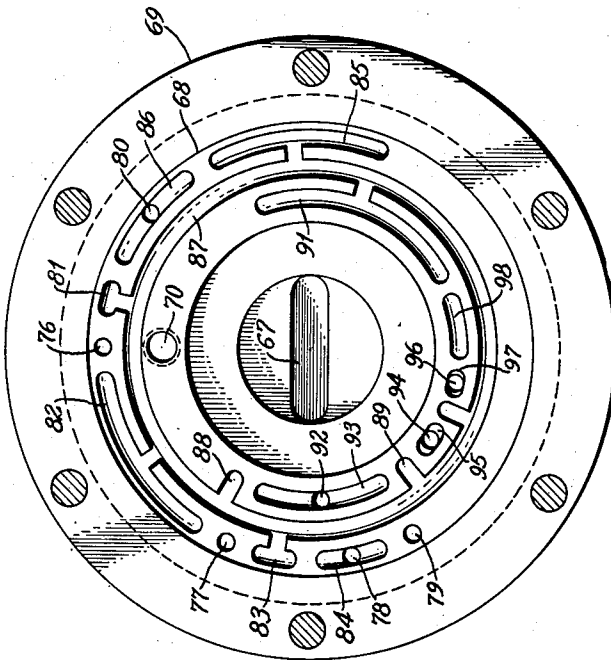


Fig. 5.



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Fig. 7.

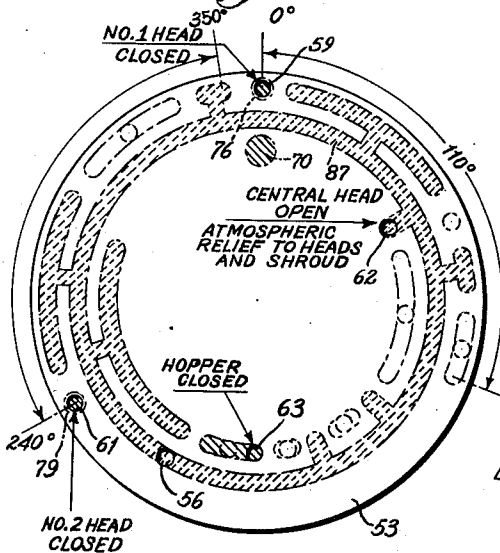


Fig. 8.

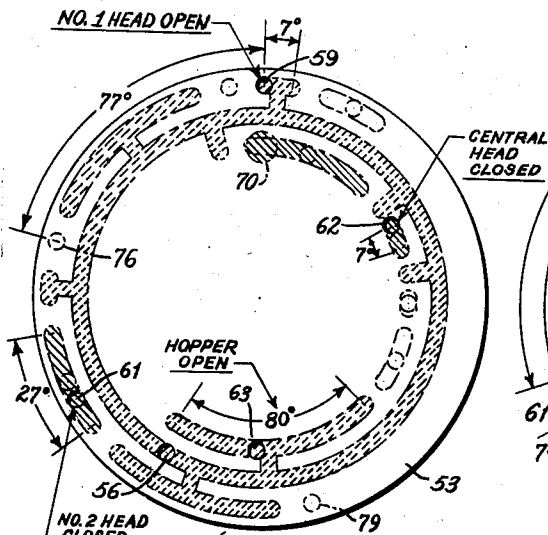
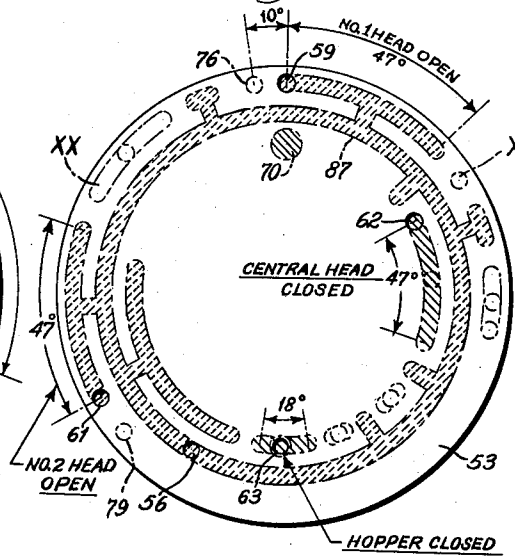


Fig. 9.

LEGEND

-  = VACUUM
-  = AIR PRESSURE

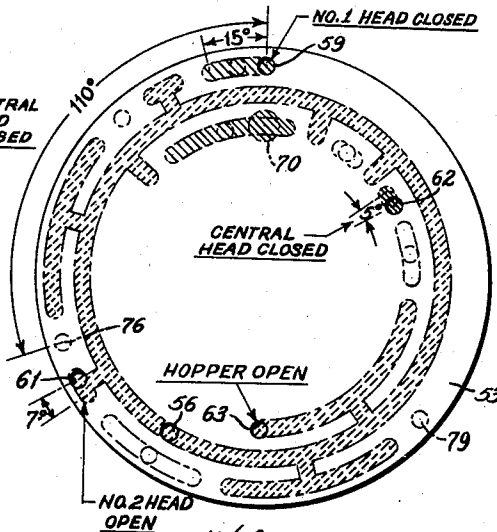


Fig. 10.

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OSCILLATING VALVE MECHANISM

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Application April 3, 1952, Serial No. 280,289

2 Claims. (Cl. 226-116)

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This invention relates to an oscillating valve mechanism, filling head and shroud useful for vacuum filling containers, particularly flexible or non-rigid containers such as bags, cardboard boxes, and the like, with powders.

The apparatus of this invention may be used in connection with vacuum filling machines of the type described in my U. S. Patents Nos. 2,170,469 and 2,443,182, and copending application Serial No. 593, filed January 5, 1948, now Patent No. 2,613,864.

It is an object of the invention to provide a compact filling head, shroud, and control valve mechanism, for use particularly in connection with multiple head powder filling machines wherein the rate of filling may be of the order of several hundred containers per hour.

It is a further object to provide a compact mechanism to control vacuum type filling heads for powder filling machines wherein the pressure is alternately reduced and then relieved to atmospheric, rapidly and repeatedly while filling a container, the purpose of such action being to obtain maximum uniform fill of the container with minimum settling of the contents after filling.

Figure 1 is a plan view in partial section of the filling head.

Figure 2 is a sectional elevation of the head and shroud taken along the lines 2-2 of Figure 1.

Figure 3 is an end view of the oscillating valve mechanism.

Figure 4 is a section along lines 4-4 of Figure 3.

Figure 5 is a view along lines 5-5 of Figure 4.

Figure 6 is an end view along lines 6-6 of Figure 4.

Figures 7 to 10 are views taken in the same direction as Figure 3, illustrating relative positions of the grooves and ports at various stages of the filling cycle.

10 is a hopper which may be of the rotary type disclosed in U. S. Patent No. 2,443,182. The filling head proper is generally designated as 11. The hopper 10 is attached to filling head 11 by means of flange 12, a plate 30 lying therebetween. Through the center of the body 11 is a powder passageway 13 in which may be disposed a valve of the type disclosed in my copending application Serial No. 271,748, filed February 15, 1952. The valve comprises a vertical tube 14 centrally located in the annular space 13. The tube 14 is supported on a line 15 which extends outwardly through the body of the filling head and may be connected to a source of air pressure and a source of vacuum. Thus the line 15 may be termed a

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vacuum-air line. Line 15 leads to the oscillating valve hereinafter described. Around the tube 14 is an inflatable rubber tube 16. This is attached at either end. There are perforations 17 in tube 14 and tube 16 lies over these. When air pressure is applied through line 15 the tube 16 is inflated to the position shown by the dotted lines, thus effectively closing the passage 13. When vacuum is applied, it deflates to the position shown. Positive deflation is needed to prevent wrinkling of the tube, and insure an unobstructed passageway from the hopper.

Attached by means of flange 18 to the filling head 11 is a shroud 19 which may have a rubber skirt 20 intended to coact with a platform 21 to seal the bottom of the shroud. This platform is pneumatically operated by means of an air cylinder or other suitable means for raising a container 22 into filling position and lowering it out of the shroud when the filling operation is completed.

Adjacent the passageway 13 are annular grooves or kerfs 23 and 24 over which are secured screens 25 and 26. These annular grooves 25 are divided from each other at 27 and 28. This structure is similar to that shown in my U. S. Patent No. 2,170,469. The structure associated with the annular kerf 23 will be hereinafter referred to as head No. 1 and that associated with kerf 24 will be referred to as head No. 2, as may be seen in Figure 1.

Extending into the annular kerf 23 is a series of vertical passageways 29. Similar passageways open into kerf 24. The vertical passageways 29 are branches of a horizontal main passageway 31, this passageway being closed at the top by plate 30. Relief port 32 opens from the main passageway 31, as does vacuum port 33. A second branch passageway 34 leads downwardly into the interior of the shroud externally of the container. Extending into the filling head is line 35 (or 35') which opens into passageway 36 and vacuum supply port 37. A valve block 38 is secured to the filling head 11. In the valve block 38 is a rectangular recess lying over ports 33 and 37. The recess is divided longitudinally by an inflatable diaphragm 39 of rubber or other suitable material. This forms a rectangular passageway 40 into which ports 33 and 37 open and a chamber 41 into which air vacuum lines 42 and 52 open. When air pressure is applied to line 42 (or 52), diaphragm 39 inflates into the passageway 40 and covers ports 33 and 37, thus preventing vacuum from being drawn through head No. 1 by way of line 35 (or head No. 2 by way of line

35'). When vacuum is applied to line 42 (or 52), diaphragm 39 is pulled away from ports 33 and 37 so that a continuous passageway is formed from line 35 through port 37, port 33 and passageways 29, 31 and 34, thus simultaneously evacuating the interior of container 22 and the space in the shroud surrounding container 22. Thus when the valve in passageway 13 is open, powder is withdrawn from hopper 10 into the container. Since the pressure inside and outside of the container is equal, the container cannot burst even though it be a paper bag, cardboard box or the like.

The construction and operation of head No. 2 is identical with that of head No. 1.

A block 43 is attached to the body of the filling head 11 and is of similar construction to the control valves of filling heads Nos. 1 and 2. An air vacuum line 44 leads into a recess 45 in block 43. The recess is divided longitudinally by a rubber diaphragm 46 leaving a passageway 47 between the diaphragm and the body 11 of the head. Leading from the passageway 47 is an exit port 48 which opens to the atmosphere. Thus when air pressure is applied to diaphragm 46 through line 44 it closes relief port 32 and exit port 48 and cuts off communication of the atmosphere with the interior of the container and shroud. When vacuum is drawn through line 44, diaphragm 46 is pulled away from ports 32 and 48 and there is communication of the interior of the shroud and the container with the atmosphere.

The operation of the filling head during the filling operation is similar to that disclosed in my U. S. Patent No. 2,170,469. The operation may be summarized as follows:

At the beginning of the filling operation the platform 21 has been lowered away from the shroud and a container is placed thereon. The platform 21 is then raised, putting the container 22 into filling position and sealing it within the shroud. If the container is rigid, or relatively so, it may thrust against the rubber gasket 49 to form a seal which prevents communication between the interior of the container and the shroud around it. This seal may be further improved by inflating an inflatable member 50 which lies in the upper part of the shroud and when inflated thrusts the wall of the container against that portion of the filling head (designated as 51) which extends downwardly into the open top of the container. This structure is not shown in detail but may correspond to that shown in my U. S. Patent No. 2,513,143. Modification of the present filling head to embody the features disclosed in said patent will be readily apparent to one skilled in the art. The one advantage of this type of sealing mechanism is to hold a container in place firmly and prevent powder from the container being drawn into the shroud surrounding it. Since the container is held in position at a point below the open top, it prevents the container from being split. This is particularly important in connection with paper bags.

Up to the point described, air pressure is applied through line 42 of filling head No. 1 and line 52 of filling head No. 2, thus thrusting the diaphragm 39 over the ports 33 and 37 and cutting off the vacuum which would otherwise be drawn through the two halves of the filling head. Vacuum is drawn through line 44, pulling diaphragm 46 away from ports 32 and 48 so that continuous open passageways lead from the interior of the container and of the shroud to

the atmosphere. At this time the passageway 13 is closed by applying air to line 15 and inflating the rubber tube 16 into the position shown in the dotted lines so that no powder can fall through the passageway.

When the filling operation begins air pressure is applied to line 44, thus closing off ports 32 and 48. A vacuum is drawn on lines 42 and 52, thus opening ports 37 and 33 so that vacuum is drawn through lines 35 and 35', evacuating the interior of the container and of the shroud to the same pressure as heretofore explained. The valve in passageway 13 is now deflated by applying vacuum to line 15. The vacuum existing within container 22 causes powder to flow from hopper 10 into the container. The major part of the filling occurs at this stage. Air pressure may then be applied to lines 42 and 52, closing ports 33 and 37. A vacuum is applied to line 44, opening ports 32 and 48. The air from the atmosphere rushes back through passageway 47 and ports 32 to the interior of the container and of the shroud. The air drawn through screens 25 and 26 dislodges particles of powder that may have accumulated there during the initial filling operation.

The central head valve (relief valve) is then closed by applying air pressure to line 44. Air pressure is still applied to line 52, thus effectively closing head No. 2. Head No. 1 is opened by applying vacuum to line 42, the valve in passageway 13 remaining open. This causes additional powder to be drawn from hopper 10 into the container. Head No. 1 is then closed and the central head valve is opened, thus restoring the interior of the container and shroud to atmospheric pressure. The central head valve is then closed, head No. 1 remaining closed and head No. 2 is opened by applying vacuum to line 52. This again evacuates the interior of the container and the shroud, causing additional powder to flow into the container. This operation may be repeated several times. It has the advantage of not only making certain that the container is completely filled with powder, but it exerts a vibrating effect on the contents of the container, causing it to be de-aerated and to pack down into the container, so that the contents will not settle after the package is sealed.

The oscillating valve mechanism which may be used to control the operation of the filling head just described, is illustrated in Figures 3 to 6. The mechanism comprises a body member generally designated 53, having a support bracket 54, which may be mounted on the frame 55 of a filling machine. In the body member 55 is a vacuum supply port 56, into which may be fitted a nipple 57 and a line 58 leading to a source of vacuum. In the body member 55 is a plurality of gas-delivery ports, through which air is supplied or vacuum applied to lines 42, 44 and 52 of the filling head. Port 59 is equipped with nipple 60, to which may be attached flexible tube 52. The location of these ports is best seen in Figure 6. Port 61 is connected to the No. 2 head by line 42, in a manner similar to that in which port 59 is connected to the No. 1 head. Port 62 is similarly connected to the central head by line 44. Port 63 is connected to line 15.

A bearing member 64, having a sleeve bearing 65, is integral with the body member. Extending through the bearing 65 is a rotatable shaft 66, which is keyed at 67 to a rotatable disk 68. The face of the disk 68, matching the face of the

body member 53, is grooved as shown in Figure 5 and in the dotted line of Figure 3. A plurality of ports or air passageways are drilled through disk 68. Covering the disk 68 and mounted on the body member 53, is a recessed face plate 69. The opposing faces of plate 69 and disk 68 are spaced from each other as illustrated, to form an air chamber. The periphery of the disk 68 bears in gas-tight relationship against the inner periphery of recessed face plate 69. Through the face plate, and opening into the chamber between the face plate and the disk, is a port 70 fitted with nipple 71 and line 72 leading to a source of air pressure.

Mounted on shaft 66 is a bell lever 73, pivotally connected at 74 to the piston 75 of an air cylinder. The air cylinder (not shown) is pivotally mounted on the frame of the filling machine. When the air cylinder operates to move lever 73 into the position shown by the dotted lines in Figure 3, the disk is rotated. The degree of rotation may be to any extent desired, but, as illustrated in connection with the operation of the filling head of Figures 1 and 2, the rotation is 110°. Instead of the air cylinder, any suitable means for rotating the disk and returning it to its original position may be employed.

As previously indicated, a plurality of air ports extend through disk 68; these are numbered 76, 77, 78, 79 and 80, all lying on one radius. This radius is the same as grooves 81, 82, 83, 84, 85 and 86, which are cut in the face of the disk matching the face of body member 53. These grooves and ports just described are on the same radius as delivery ports 59 and 61 in body member 53. Port 78 opens into groove 84, and port 80 opens into groove 86.

Grooves 81, 82, 83 and 85 interconnect with a circular groove 87, which has a radius corresponding to port 56. Grooves 88, 89, 90 and 91 lie on the radius of ports 62 and 63, and likewise interconnect with groove 87. Port 92 opening into groove 93; port 94 opening into groove 95; port 96 opening into groove 97 (all in disk 68) are likewise on the radius of ports 62 and 63. Another groove 98 lies on the same radius.

It should be understood that the pattern of the various ports and the various grooves can be modified, and the number thereof can be altered, to suit the particular type of service to which the valving mechanism may be adapted. The pattern shown is especially adapted to the operation of the filling head illustrated in Figures 1 and 2, the operation of which has been described generally above.

To illustrate the operation more exactly, in reference to the relative positions of the grooves and ports at any particular stage of a filling cycle, refer to Figures 7 to 10. In these figures, the stationary valve face and holes of the body member 53 are shown in solid lines. The grooves and ports in the oscillating disk 68 are shown in broken lines. The shading, for which see the legend, indicates the condition existing, whether under vacuum or air pressure, on the various delivery tubes. From this may be determined whether the various heads on the filling head are open or closed, which in turn determines whether the container and shroud are under vacuum or at atmospheric pressure. In a like manner, it determines whether the valve in powder passageway 13 is open or closed.

The oscillating disk, at the beginning of the cycle, is in the position shown in Figures 3 and 4. Figures 7 to 10 are viewed from the same direc-

tion as Figure 3, and thus are reverse images of Figure 5.

At the initial stage, air pressure is being supplied through port 70. Vacuum is being supplied through port 56, so that groove 87 and all the tributary grooves are under vacuum at all times. The delivery port 59, connecting with line 42 to head No. 1, coincides with port 76 in disk 68. Thus, air pressure is being supplied to head No. 1, causing the diaphragm 39 to expand and close off ports 33 and 37. Since port 61, connecting with head No. 2 through line 52, likewise coincides with a port in the rotary disk, head No. 2 is closed. Port 63, which leads to the powder inlet valve, is likewise under air pressure, and the powder valve is closed. Port 62, connecting by line 44 the central head, coincides with a tributary of groove 87; consequently, the diaphragm 46 is drawn away from ports 32 and 48, which leaves the container and shroud at atmospheric pressure. This condition exists until the container 22 is placed in filling condition by the raising of platform 21.

The oscillating disk is then rotated counterclockwise. When it reaches the position shown in Figure 8 (10°), ports 59 and 61 coincide with grooves tributary to groove 87 and a vacuum is pulled on heads No. 1 and No. 2, permitting evacuation of the container and the shroud through both heads. Simultaneously, a groove into which one of the ports through the disk opens, coincides with port 62 leading to the central head, thereby closing the relief ports. Thus the central head is closed, and both filling heads are opened, until the disk has been turned through 47°. During the first 18° of rotation, port 63 is under air pressure and the powder valve is closed, preventing flow of powder from the hopper into the container. After 18° of rotation, it can be seen by inspection of Figure 8 that a groove tributary to groove 87 will have moved over port 63, thus evacuating line 15 and tube 16, and the hopper will be open. During the initial 18° of rotation, the container and shroud will have been substantially evacuated, so that when the hopper valve is opened, there will be a sudden pull of powder into the evacuated container. The pressure differential will be sufficient to overcome any tendency for the powder to bridge across the hopper opening, and the powder will be drawn violently into the container, with the result that it tends to pack substantially and entrained air in the powder will tend to be forced out of it.

The disk continues to rotate until the port marked X and the groove marked XX coincide with ports 59 and 61. At this time a condition similar to that shown in Figure 7 will exist in the head; that is, the central head will be open, and heads Nos. 1 and 2 will be closed. The difference will be that the hopper will be open, since port 63 will still coincide with a groove tributary to groove 87.

As the disk continues to rotate, it reaches the position shown in Figure 9, No. 2 head is closed, the central head is closed, and No. 1 head is open for a period of rotation of 7°. As it continues to rotate, the No. 1 head will then close, No. 2 head remains closed, and the central head will open, relieving the shroud and the container to atmospheric pressure, the inrushing air being forced through the screen 23 of head No. 1, freeing it of powder that may have accumulated thereon. During all of this time the hopper remains open. As rotation continues, the central

head will be closed, the No. 1 head will be closed, and the No. 2 head will open for about 7° of rotation, until a total of 110° of rotation has been effected, as shown in Figure 10.

At this point the bell lever 73 is in the position shown by dotted lines in Figure 3. The air cylinder controlling the lever is then rapidly reversed, and the entire cycle is repeated in reverse but at a much more rapid rate, until the lever 73 reaches the starting position. The initial counterclockwise rotation of the disk 68 is relatively slow compared with the return movement. The principal filling operation occurs during the first 47° of operation. The filling is substantially completed during the alternating operations of heads Nos. 1 and 2. This portion of the operation may take place in a matter of seconds, the length of time depending to some extent upon the size of the container to be filled. Obviously, small containers will require less time than those of larger capacity, sometimes being of the order of a second for the entire cycle. The reverse operation, because of the rapidity with which the reverse cycle is repeated, causes what might be termed "jarring" or "vibrating" of the contents, so as to de-aerate and pack the powder. This insures a maximum fill with a minimum subsequent settling of the contents of the container in storage, which, if excessive, results in objectionable outage. Since the hopper is open during all except the last 18° of the reverse cycle, additional powder will be drawn into the container as the vibrating action causes the contents to settle. This "double valving" action, is one of the great advantages of the present type of oscillating valve.

The invention is not limited to the exact modification shown in the drawings, and changes in the pattern and numbers of ports and grooves will be readily apparent to one skilled in the art, in adapting the mechanism to the control of various devices in which the pressure is varied from normal atmospheric to super-atmospheric to normal atmospheric to sub-atmospheric, according to a predetermined cycle. The automatic control of a plurality of valves from a single source, and the timing of their operation, is one of the principal uses for the device. By addition of ports and grooves, more than four pneumatically controlled or operated mechanisms such as those illustrated in Figures 1 and 2, can be controlled and synchronized with each other.

I claim as my invention:

1. A vacuum powder filling machine comprising, in combination, a hopper, a filling head depending therefrom with a powder passageway therebetween, a pneumatic valve in said passageway, a shroud on the filling head, a pneumatically controlled vacuum valve, a pneumatically controlled relief valve, means for controlling and synchronizing the operation of the vacuum valve and relief valve and the valve in said powder passageway, said means comprising; a body member having a plurality of spaced delivery ports therein, means connecting the delivery

ports to said valves to control the operation thereof, a vacuum supply port in said body member, a disk mounted for rotation, the inner face of the body member and the matching face of the disk being in gas-tight bearing relationship, a plurality of ports in said disk positioned to coincide with the delivery ports in said body member, a circular groove in said matching face of the disk coinciding with the vacuum supply port, a plurality of arcuate grooves in said matching face interconnected with the circular groove and coinciding during some stage of rotation of the disk with said delivery ports, a face plate mounted on the body member in spaced relationship to the opposing face of the disk forming an air chamber therebetween, an air inlet into said chamber, and means for rotating said disk.

2. In combination, a vacuum filling apparatus wherein filling is effected by alternate evacuation and release to atmospheric pressure according to a predetermined cycle, a pneumatically controlled vacuum valve, a pneumatically controlled relief valve, and means for controlling and synchronizing the operation of said valves to produce the alternate evacuation and release to atmospheric pressure of the apparatus, said means comprising; a body member, a plurality of spaced delivery ports therein, a vacuum supply port therein, a bearing member in the body member, a rotatable shaft extending through the bearing member, a disk mounted for rotation on said shaft, the inner face of the body member and the matching face of the disk being in gas-tight bearing relationship, a plurality of ports in said disk positioned to coincide with the delivery ports in said body member, a circular groove in said matching face of the disk coinciding with the vacuum supply port, a plurality of arcuate grooves in said matching face interconnected with the circular groove and coinciding during some stage of rotation of the disk with said delivery ports, a plurality of short arcuate grooves into which ports in said disk open, a recessed face plate mounted on the body member and in spaced relationship to the opposing face of the disk forming an air chamber therebetween, the periphery of the disk bearing on the inner edge of the face plate, an air inlet port in the face plate opening into the chamber, and means for rotating said disk through a partial rotation and returning it to the starting position.

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