March 13, 1956 E. D. HAYGARTH 2,738,119

VACUUM FILLING APPARATUS

Filed Sept. 25, 1952 2 Sheets-Sheet 1

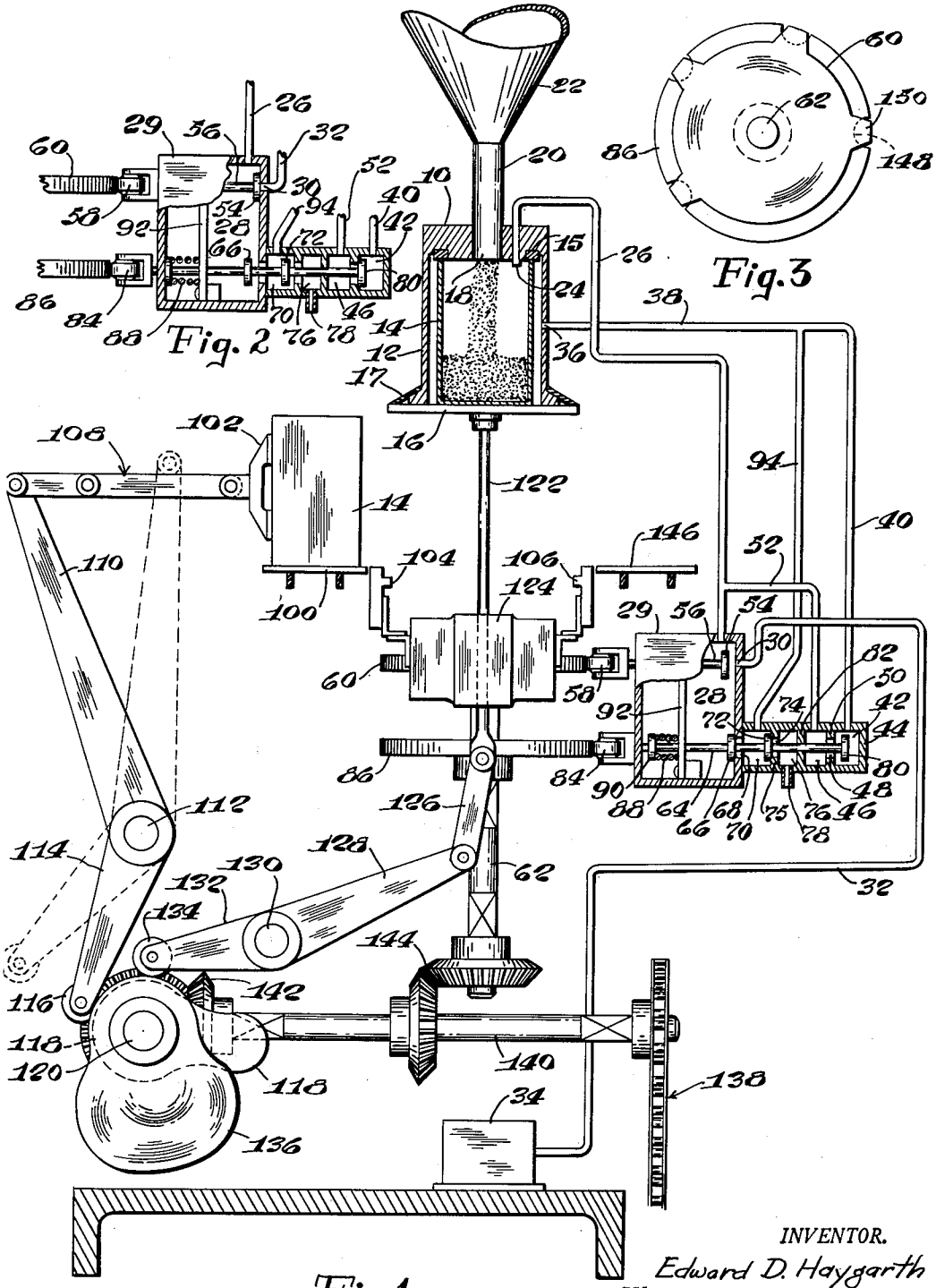


Fig. 1

Fig. 2

Fig. 3

INVENTOR.
Edward D. Haygarth
BY J. Stanley Churchill
ATTORNEY

March 13, 1956 E. D. HAYGARTH 2,738,119

VACUUM FILLING APPARATUS

Filed Sept. 25, 1952 2 Sheets-Sheet 2

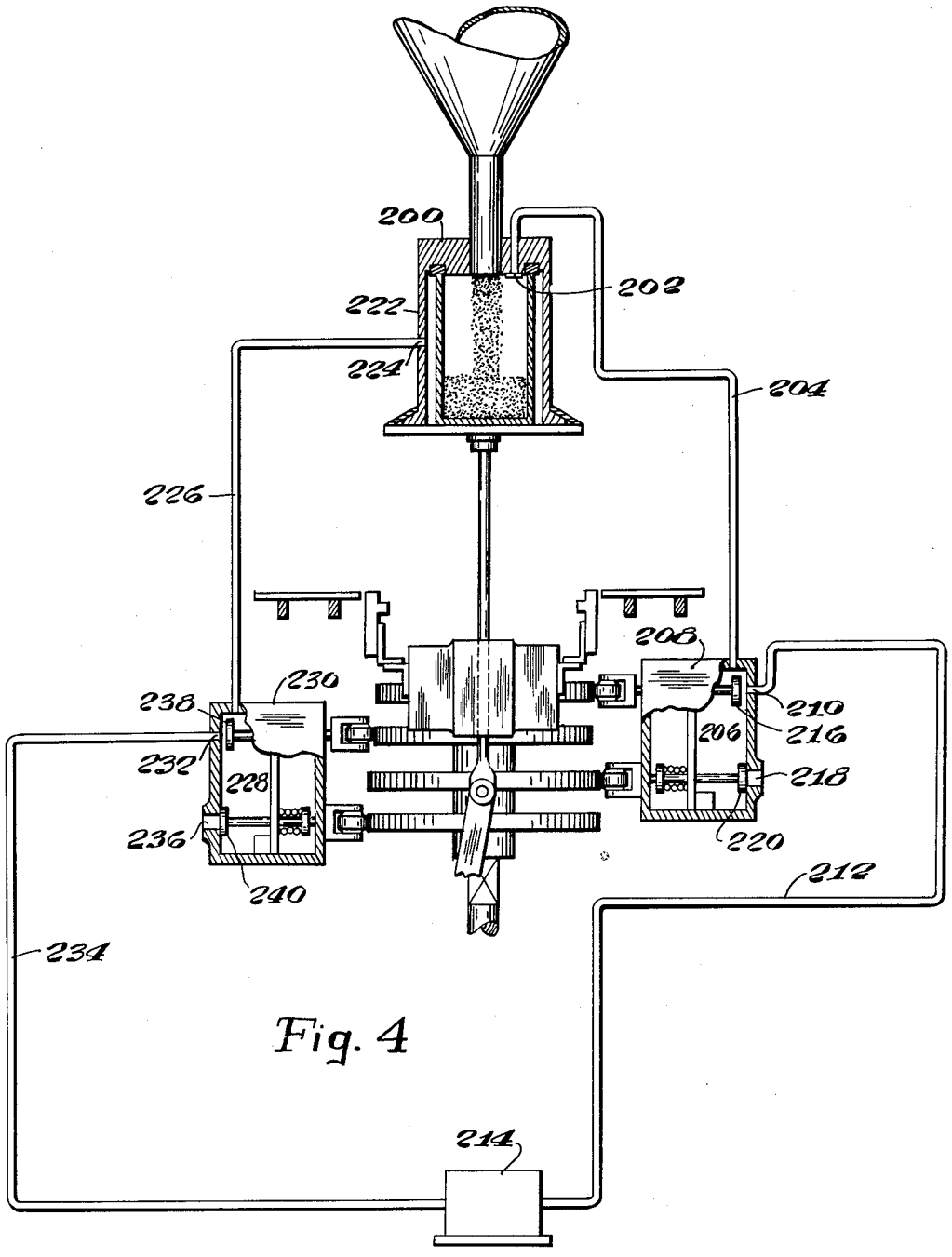


Fig. 4

INVENTOR.
Edward D. Haygarth
BY
J. Stanley Churchill.
ATTORNEY

United States Patent Office 2,738,119 Patented Mar. 13, 1956

2,738,119

VACUUM FILLING APPARATUS

Edward D. Haygarth, Wrentham, Mass., assignor to Pneumatic Scale Corporation, Limited, Quincy, Mass., a corporation of Massachusetts

Application September 25, 1952, Serial No. 311,488

10 Claims. (Cl. 226—116)

This invention relates to vacuum filling apparatus.

The invention has for an object to provide novel and improved vacuum filling apparatus for filling containers with finely divided materials and which is characterized by novel structure adapted to avoid in a simple and efficient manner the accumulation of fine particles of the material on the exterior of the container during the vacuum filling operation.

With this general object in view, and such others as may hereinafter appear, the invention consists in the vacuum filling apparatus hereinafter described and particularly defined in the claims at the end of this specification.

In the drawings illustrating the preferred embodiment of the invention:

Fig. 1 is a vertical sectional view of the present vacuum filling apparatus for finely divided or comminuted materials and illustrating novel valve mechanism for automatically controlling the flow of air to the filling mechanism;

Fig. 2 is a cross-sectional view of the valve mechanism shown in a different position of operation;

Fig. 3 is a plan view of the cams for actuating the valve mechanism; and

Fig. 4 illustrates a modified form of vacuum filling apparatus embodying the present invention.

In general, the present invention contemplates an improvement in vacuum filling apparatus of the type illustrated and described in the United States patent to Carter, No. 2,170,469 wherein a container to be filled is supported in operative relation to a filling head having a suction opening therein connected to a source of vacuum, and also with a material inlet opening connected to a supply of the material, such openings communicating with the interior of the container to effect filling thereof when the air in the container is evacuated. Provision is also made in such prior apparatus for providing a shroud or covering about the outside of the container being filled, and for maintaining a vacuum within the shroud to prevent collapse of the container during the filling operation.

One of the disadvantages of such prior vacuum filling apparatus is that the vacuum lines to the interior of the container and to the shroud surrounding the exterior of the container are connected to a valve or vacuum chamber in a manner such that any fine particles of material or dust drawn into the valve chamber during the vacuum filling operation may be conducted from the valve chamber to the shroud when the vacuum is cut off and the lines are opened to atmospheric pressure. In other words, in the operation of the prior art vacuum fillers, the air rushing in to fill the vacuum first passes through the dust-laden valve chamber, thus carrying the fine dust particles to the shroud to be deposited onto the exterior of the container. Obviously, such dust-covered containers are objectionable to the packaging industry and to the consumer.

In accordance with the present invention, provision

is made for by-passing the valve or vacuum chamber when the vacuum is cut off to permit fresh clean air to be drawn from the atmosphere into the shroud surrounding the container whereby the accumulation of dust on the exterior of the container is eliminated.

Referring now to the drawings, 10 represents a vacuum filling head provided with a depending shroud portion 12 open at its lower end and into which a container 14 supported on a platform 16 may be elevated to present the mouth of the container into airtight sealing engagement with a resilient sealing member 15 carried by the filling head, and to present the platform 16 into airtight sealing engagement with the bottom or open end of the shroud portion 12. As herein shown, the lower end of the shroud portion may be provided with a flexible skirt 17 of rubber or like material arranged to be drawn down into engagement with the surface of the platform 16 when suction is applied to assure an airtight seal with the platform during the filling operation.

The filling head 10 is provided with a material inlet 18 communicating with the interior of the container, the inlet 18 being connected by a pipe 20 to a material-supply hopper 22. The filling head is also provided with a suction opening 24 connected by an air line 26 to a valve or vacuum chamber 28 formed in a valve block 29. The chamber 28 is provided with a suction inlet 30 connected by an air line 32 to a source of vacuum, such as a vacuum pump, indicated diagrammatically at 34.

One wall of the shroud portion 12 is also provided with a suction inlet 36 connected by air lines 38, 40 to a small chamber 42 formed in an extension 44 from the valve block 29, and the chamber 42 communicates with a second small chamber 46 through a valve opening 48 in a wall 50 of the extension. The second small chamber 46 is connected by a branch air line 52 with the vacuum line 26. Thus it will be seen that in operation air is evacuated from the interior of the container by air line 26 connected to the valve chamber 28 to effect withdrawal of material from the inlet 18 into the container, and the air is simultaneously evacuated from the shroud surrounding the container through air lines 38, 40, chambers 42, 46 and branch line 52, as illustrated in Fig. 1.

As herein illustrated, the suction inlet 30 to the valve chamber 28 is arranged to be automatically opened and closed by a valve 54 formed on the end of a rod 56 which is slidingly mounted in the valve block 29, the outer end of the rod being provided with a cam roll 58 for cooperation with a cam 60 fast on a vertical cam shaft 62. The valve rod 56 may be spring pressed in a direction to open the suction inlet 30 and to hold the roll 58 against its cam.

In order to open the chamber 28 and the air lines to the atmosphere, a second cam-operated valve rod 64 is provided having a plurality of valves formed thereon for simultaneous operation. One valve 66 is arranged to open and close a valve opening 68 in the wall of the valve block 29 for communication with a small chamber 70 formed in the extension 44, and a second valve 72 is arranged to open and close a valve opening 74 formed in a partition wall 75 of the extension for communication with an atmospheric chamber 76 having a vent pipe opening 78. A third valve 80 mounted on the rod 64 is arranged to open and close the valve opening 48 formed in the partition wall 50. A partition wall 82 separates the atmospheric chamber 76 from the chamber 46. The valve rod 64 is slidingly mounted in the block 29 and in the partition wall 82 and is also provided with a cam roll 84 at its outer end for cooperation with a cam 86 fast on the cam shaft 62. A coil spring 88 interposed between a collar 90 on the rod and an upstanding partition 92 in the valve block serves to urge the rod in a

direction to open the chamber 28 to the atmosphere and to hold the roll 84 against its cam.

As illustrated in Fig. 1, the chamber 70 is provided with a branch or by-pass air line 94 in communication therewith and which is connected to the air line 38 leading to the shroud 12 about the exterior of the container. Thus, in operation when the vacuum inlet 30 is cut off at the end of the filling operation by closing the valve 54, the valve chamber 28 and the air lines are opened to the atmosphere by operation of the valve rod 64 to open valves 66, 72 and to close valve 80, such position of the valves being shown in Fig. 2. As a result, clean air at atmospheric pressure is permitted to enter through the vent pipe 78, valve opening 74 and chamber 70 from which the clean air enters the by-pass air line 94 and line 38 to the shroud. Simultaneously therewith air enters the valve chamber 28 through opening 68 from the chamber 70, and the air in chamber 28 passes through air line 26 to the interior of the container.

It will thus be seen that since the chambers 76, 70, which are closed off during the filling operation, are free of dust-laden air, no dust is carried to the shroud by the inrushing air at atmospheric pressure when the vent chamber 76 is opened. Also, any dust-laden air which may be carried through branch line 52 into chamber 46 during the venting operation cannot enter the chamber 42 communicating with the shroud air line 40 since the valve 80 is closed at this time, and thereafter when the suction is again applied and valve 80 opened, the direction of travel of the air is reversed so that any such dust-laden air is removed by the vacuum through branch line 52 to enter the valve chamber 28 and pass to the vacuum pump to be exhausted. With this construction it will be seen that the shroud 12 and the shroud air lines are maintained free of dust-laden air at all times, thus preventing accumulation of dust on the exterior of the container.

The vacuum filling apparatus is herein illustrated as embodied in a filling machine having an incoming supply conveyor 100 by which successive containers 14 may be advanced into operative relation to a pusher 102 arranged to transfer successive foremost containers from the conveyor onto the platform 16 when the latter is in its lowered position resting on the lateral supports indicated at 104, 106. The pusher 102 may be connected by linkage 108 to an arm 110 pivotally mounted at 112, and a second arm 114 is provided with a roller 116 for cooperation with a cam 118 fast on a cam shaft 120. The platform 16 is mounted on the end of a rod 122 mounted for reciprocation in a bearing 124. The lower end of the rod 122 is connected by a link 126 to an arm 128 rockingly mounted at 130, and a second arm 132 is provided with a cam roll 134 for cooperation with a cam 136 also fast on the cam shaft 120. The usual springs, not shown, may be connected to the cam-roll arms 114 and 132 for holding the rolls against their respective cams. As herein indicated, the cam shafts may be driven through any usual or preferred driving mechanism including a chain and sprocket drive 138 to a shaft 140 which may be connected to drive the cam shaft 120 through bevel gears 142, and the vertical cam shaft 62 may be similarly connected to the drive shaft through bevel gears 144.

In operation, a container placed on the platform 16 is elevated into airtight relation with the filling head 10 and the shroud 12, as described, and after the filling operation the platform is again lowered, the filled container being transferred onto an outgoing conveyer 146 to be delivered from the machine. A new container is placed on the platform by the pusher 102, as described, and the cycle is repeated. In practice, the pusher 102 and the conveyers 100, 146 may be arranged so that the transfer of a new container onto the platform 16 will effect pushing of the filled container onto the outgoing conveyer.

As illustrated in Fig. 3, the cams 60, 86 are provided with a plurality of cutouts 148 and high spots 150 respectively for alternately reversing the path of the air through the vacuum head several times each cycle of operation in order to provide successive partial filling and packing operations during each cycle of operation to progressively fill the container for most efficient vacuum filling performance.

Referring now to Fig. 4, a modified form of vacuum filling apparatus embodying the present invention may include separate independently operated valve or vacuum chambers for communication with the interior of the container and the shroud portion respectively. As herein shown, the filling head 200 is provided with a suction opening 202 connected by an air line 204 to a valve or vacuum chamber 206 formed in a valve block 208. The chamber 206 is provided with a suction inlet 210 connected by an air line 212 to a vacuum pump indicated at 214 for evacuating the chamber 206 and the interior of the container to effect the filling operation. The suction inlet 210 is arranged to be automatically opened and closed by a cam-operated valve 216, as shown, and the container-evacuating valve chamber 206 is also provided with an atmospheric inlet 218 which may also be automatically opened and closed by a second cam-operated valve 220.

A wall of the depending shroud portion 222 of the filling head 200 is provided with a suction inlet 224 which is connected by an air line 226 to a similar valve or vacuum chamber 228 formed in a second valve block 230. The shroud-evacuating vacuum chamber 228 is also provided with a suction inlet 232 connected by an air line 234 to the vacuum pump 214, and is also provided with an atmospheric inlet 236, each of the inlets 232, 236 being similarly controlled by cam-operated valves 238, 240 respectively. The valve-operating cams shown in Fig. 4 may and preferably will be similar to the valve-operating cams shown in Fig. 3 and are preferably arranged for simultaneous operation of the corresponding valves of their respective chambers.

In the operation of the modified form of the apparatus as shown in Fig. 4, it will be seen that the suction inlet valves 216, 238 may be simultaneously opened by their respective cams to evacuate the interior of the container and the shroud independently. Thereafter, the valves 216, 238 may be closed and the valves 220, 240 may be simultaneously opened to independently open the interior of the container and the shroud portion to the atmosphere. Obviously, since the air line the interior of the container and the air line to the shroud portion are entirely independent, the shroud-evacuating valve chamber 228 is free of dust at all times so that accumulation of dust on the exterior of the container is avoided when the shroud is opened to the atmosphere.

While the invention is herein shown as embodied in a single-head vacuum filling machine, it will be apparent that in practice the present valve mechanism may be employed in a multiple-head machine, such as a continuously operated rotary vacuum filling machine wherein each valve block may be provided with a clean air by-pass for the shroud, as described.

From the above description it will be seen that the present invention provides a clean air by-pass line for conducting clean air directly from the atmosphere to the shroud without passing through the valve or vacuum chamber connected to the interior of the container whereby to prevent dust-laden air from being carried to the shroud and deposited onto the exterior of the container.

While the preferred embodiment of the invention has been herein illustrated and described, it will be understood that the invention may be embodied in other forms within the scope of the following claims.

Having thus described the invention, what is claimed is:

1. In a vacuum filling machine for filling containers

with finely divided solid materials, a filling head having a material inlet opening and a suction opening for communication with the interior of a container, a shroud portion for surrounding the exterior of the container and also provided with a suction opening, means for moving the container into airtight and sealed relation to said filling head and to said shroud portion, a source of suction, means for evacuating the interior of the container after the latter has been moved into said sealed position, and means for controlling the flow of air to said filling head and said shroud portion including a vacuum chamber and vacuumizing lines operatively connected to said source of suction and to said filling head and said shroud portion, means for admitting air at atmospheric pressure to said vacuum chamber and said filling head including a clean air chamber in non-communicating relation to said vacuum chamber and said vacuumizing lines during the vacuumizing and filling operation and a by-pass line connected between said clean air chamber and said shroud portion for admitting clean air at atmospheric pressure to said shroud portion.

2. In a vacuum filling machine for filling containers with finely divided solid materials, a filling head having a material inlet opening and a suction opening for communication with the interior of a container, said filling head having a shroud portion for surrounding the exterior of the container and also provided with a suction opening, means for moving the container into airtight and sealed relation to said filling head and to said shroud portion, vacuum-producing means connected to the interior of the container after the latter has been moved into sealing position including a chamber and vacuumizing lines operatively connected to said filling head and said shroud portion, means for admitting air at atmospheric pressure to said chamber and said filling head including a clean air chamber in non-communicating relation to said vacuum chamber and said vacuumizing lines during the vacuumizing and filling operation, and a by-pass line connected between said clean air chamber and said shroud portion for admitting clean air at atmospheric pressure to said shroud portion.

3. In a vacuum filling machine for filling containers with finely divided solid materials, a filling head having a material inlet opening and a suction opening for communication with the interior of a container, said filling head having a shroud portion for surrounding the exterior of the container and also provided with a suction opening, means for moving the container into airtight and sealed relation to said filling head and to said shroud portion, a source of suction, means for evacuating the interior of the container after it has been moved into sealing position, and means for controlling the flow of air to said filling head and said shroud portion including a vacuum chamber connected to the source of suction, air lines connecting the vacuum chamber to the filling head and to the shroud portion, a clean air atmospheric chamber, said clean air chamber being in non-communicating relation to said vacuum chamber and air lines during the vacuumizing and filling operation, valve means for closing the vacuum chamber to the source of suction and for opening the vacuum chamber to the atmospheric chamber, valve means simultaneously closing the air line between the vacuum chamber and the shroud portion, and an air line connected between said clean air chamber and the shroud portion by-passing said vacuum chamber for admitting clean air directly from said atmospheric chamber to said shroud portion.

4. A vacuum filling machine as defined in claim 3 including cam-operated means for automatically actuating said valve means to successively create a vacuum in the filling head and shroud portion and to admit air at atmospheric pressure thereto.

5. A vacuum filling machine as defined in claim 3 including means for elevating the container and its supporting means into and out of operative relation to said filling head and said shroud portion respectively.

6. In a vacuum filling machine of the character described having a filling head and a shroud portion and means for moving a container in airtight relation to the filling head and shroud portion, vacuum-producing means for evacuating the interior of the container after it has been moved into sealing position including a vacuum chamber operatively connected to a source of vacuum, air lines connecting the vacuum chamber to the filling head and the shroud, means for admitting air at atmospheric pressure to the vacuum chamber and the filling head at the end of the filling operation including a clean air chamber in non-communicating relation to said vacuum chamber and said vacuumizing air lines during the filling operation, means for closing the air line between the vacuum chamber and the shroud, and a by-pass line connected between said clean air chamber and said shroud portion for admitting clean air at atmospheric pressure to said shroud whereby to prevent dust-laden air in said vacuum chamber from being carried to said shroud portion and deposited on the exterior of the container when the vacuum chamber and the vacuumizing air lines are opened to atmospheric pressure.

7. In a vacuum filling machine for filling containers with finely divided solid materials, a filling head having a material inlet opening and a suction opening for communication with the interior of the container, a shroud portion surrounding the exterior of the container and also provided with a suction opening, means for moving the container in airtight relation to said filling head and to said shroud portion, vacuum-producing means operative to evacuate the interior of the container after it has been moved into sealing position including connections including a vacuum chamber operatively connected to the vacuum-producing means and the filling head, means including a clean air chamber for admitting air at atmospheric pressure into said vacuum chamber and thence to said filling head, said clean air chamber being in non-communicating relation to said vacuum chamber during the vacuumizing and filling operation, and means operatively connected to said clean air chamber and independent of said vacuum chamber for admitting clean air at atmospheric pressure to said shroud portion.

8. In a vacuum filling machine for filling containers with finely divided solid materials, a filling head having a material inlet opening and a suction opening for communication with the interior of the container, a shroud portion surrounding the exterior of the container and also provided with a suction opening, means for moving the container into airtight relation to said filling head and to said shroud portion, a source of suction, means for connecting the source of suction and said filling head to vacuumize the interior of the container after the latter has been moved into sealing position, means for simultaneously vacuumizing the shroud portion around the container, means including a clean air chamber for admitting atmospheric air to within the container at the end of the filling operation, said clean air chamber being in non-communicating relation to said filling head vacuumizing means during the vacuumizing and filling operation, and by-pass means connecting said clean air chamber to said shroud portion for admitting clean atmospheric air directly into the shroud at the end of the filling operation, independently of said container-vacuumizing means.

9. In a vacuum filling machine for filling containers with finely divided solid materials, a filling head having a material inlet opening and a suction opening for communication with the interior of the container, a shroud portion surrounding the exterior of the container and also provided with a suction opening, means for moving the container into airtight relation to said filling head and said shroud portion, vacuum-producing means operative to evacuate the container after it has been moved into

sealing position, including two separate vacuum chambers comprising a filling head vacuum chamber operatively connected to the filling head, and a shroud portion vacuum chamber operatively connected to the shroud portion, a common source of vacuum conected to said two chambers, each of said chambers having independently operated means for admitting air at atmospheric pressure through their respective chambers and to the filling head and shroud portion, whereby to admit clean air at atmospheric pressure into said shroud portion and avoid the passage of dust-laden air from the filling head vacuum chamber to said shroud portion.

10. In a vacuum filling machine for filling containers with finely divided solid materials, a filling head having a material inlet opening and a suction opening for communication with the interior of a container, a shroud portion for surrounding the exterior of the container and also provided with a suction opening, means for moving the container into airtight and sealed relation to said filling head and to said shroud portion, a source of suction, means for evacuating the interior of the container after

the latter has been moved into said sealed position, means for controlling the flow of air to said filling head and said shroud portion including vacuumizing lines operatively connected between the source of suction and said filling head and said shroud portion, and means for admitting air at atmospheric pressure to said lines including a clean air chamber operatively connected to said shroud line, said clean air chamber being in non-communicating relation to said filling head during the vacuumizing and filling operation whereby to admit clean air at atmospheric pressure to said shroud portion.

References Cited in the file of this patent

UNITED STATES PATENTS

1,386,887	Malmquist	Aug. 9, 1921
2,302,693	Hoar	Nov. 24, 1942
2,428,598	Weaver	Oct. 7, 1947
2,448,733	Peebles et al.	Sept. 7, 1948
2,603,398	Fischer et al.	July 15, 1952
2,613,864	Carter	Oct. 14, 1952