

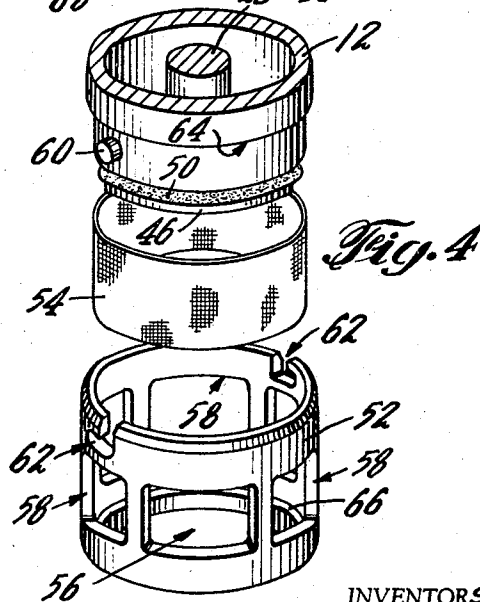
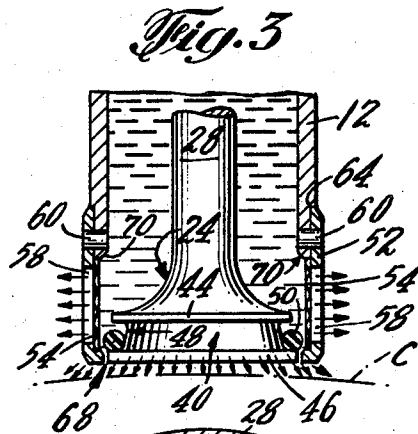
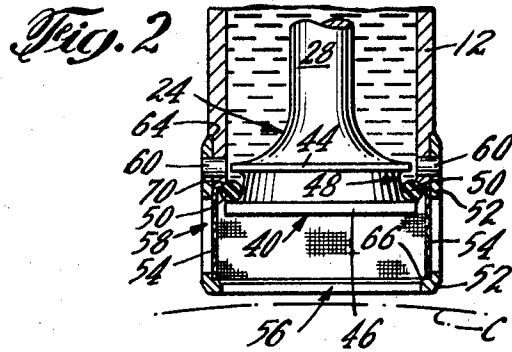
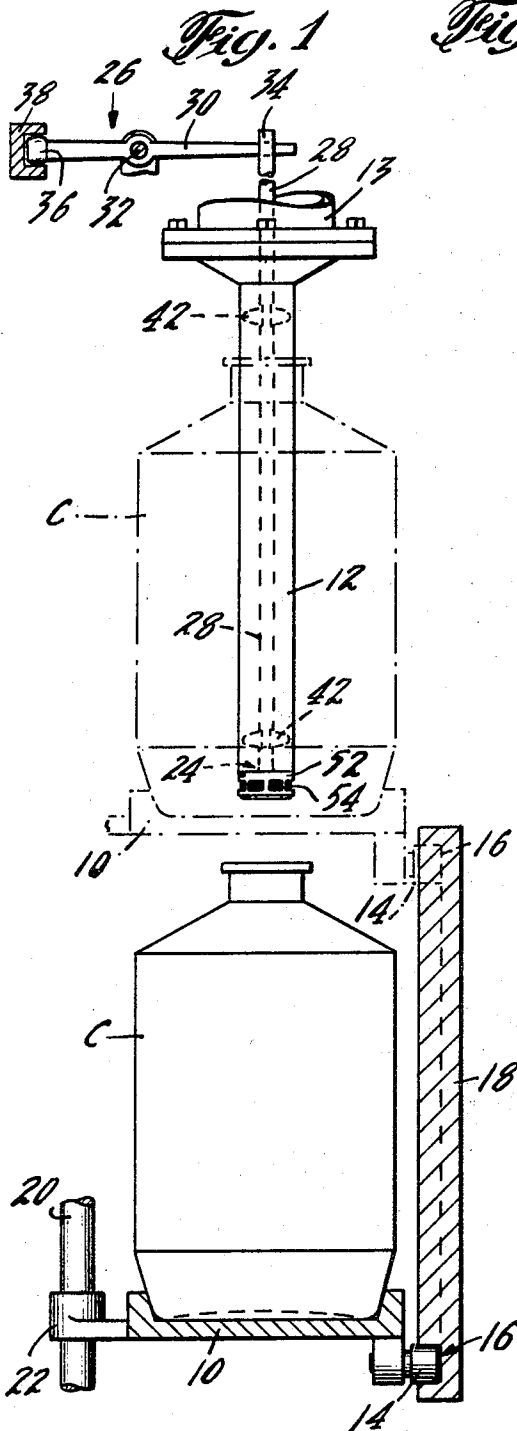
Sept. 24, 1968

O. F. ECKLUND ETAL

3,402,857

NOZZLE FOR MILK FILLER VALVE

Filed March 28, 1967



INVENTORS
OSCAR FREDERICK ECKLUND
ROYCE KENNETH HARKER
BY

Frank J. Jordan
ATTORNEY

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3,402,857

NOZZLE FOR MILK FILLER VALVE

Oscar Frederick Ecklund, Barrington, and Royce Kenneth Harker, Lombard, Ill., assignors to American Can Company, New York, N.Y., a corporation of New Jersey
Filed Mar. 28, 1967, Ser. No. 626,586
6 Claims. (Cl. 222—189)

ABSTRACT OF THE DISCLOSURE

A liquid-filling apparatus has a fill tube in which a foot valve is longitudinally movable between opened and closed positions. A discharge nozzle disposed at a longitudinal end of the fill tube downstream of the foot valve seat has a longitudinal end opening and at least one transverse side opening adaptable to discharge liquid both in a longitudinal and lateral direction respectively when the foot valve is in its open position thereby to reduce turbulence during filling.

Background of the invention

This invention relates to liquid-dispensing apparatus and particularly to an arrangement for discharging a liquid into a container whereby turbulence is reduced, permitting an increase in the filling rate.

Heretofore, attempts to increase the rate of filling containers with liquids have been hampered by the turbulence caused in the container at the discharge end of a filling tube. This is particularly true for liquids such as milk, which tends to foam. Discharging in a completely downward, axial flow, or in a completely transverse, radial outward flow has not given the best results. It has been determined, in accordance with this invention, that results superior to that achieved from the aforesaid arrangements, may be obtained by dividing a liquid discharge between a downward, axial and a radial, outward flow. This arrangement has proved to be more effective in reducing turbulence. By reducing the liquid turbulence, the container may be filled at a faster rate and when used for milk, the reduction in liquid turbulence also reduces the degree of foaming.

Liquid turbulence which occurs during a filling operation is caused by the combined effects of high-velocity liquid discharge and the deflection of said liquid by the interior surfaces of the container bottom and sidewalls. The turbulence, and resulting foam when the said liquid is milk, is not conducive to accurate high-speed filling of containers, since liquid loss is experienced as a result of foaming and excessive agitation. It is theorized that the interaction of the opposing liquid flow lines resulting from dividing the liquid discharge between an axial, downward and a radial, outward flow, effects a quieting or depressing influence in reducing the liquid turbulence to permit faster filling rates.

Accordingly, an object of this invention is to provide a filling apparatus in which the liquid turbulence in the container is reduced thereby permitting an increase in the filling rate, and in the cases of handling liquids which tend to foam (e.g. milk), by reducing this degree of foaming.

Summary of the invention

A filling apparatus for filling a container with a liquid comprises a longitudinal extending fill tube adapted to be inserted in the container. A foot valve is longitudinally movable in said fill tube between open and closed positions, a valve seat associated with the fill tube being provided for the foot valve when the latter is in its closed position. At the longitudinal end of the fill tube downstream of the valve seat, there is provided a discharge

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nozzle means in which the foot valve is accommodated when in its open position. The discharge nozzle means has a longitudinal end opening and one or more transverse side openings adapted to discharge liquid both in a longitudinal and lateral direction respectively, when the foot valve is opened. The lateral and longitudinal discharge flow reduces turbulence and permits higher filling rates.

Description of the drawings

FIGURE 1 is a schematic representation in elevation of a filling head of a filling machine showing a container and a fill tube for filling the container with milk or the like and also showing a mechanism for elevating and lowering the container.

FIGURE 2 is a section of the lower end of the fill tube showing the foot valve in a closed position.

FIGURE 3 is similar to FIGURE 2 but shows the foot valve in an open position.

FIGURE 4 is an exploded view of the lower end of the fill tube and the discharge nozzle means.

Description of the preferred embodiments

As an exemplary embodiment of the invention, FIGURE 1 shows schematically the filling head of a filling machine which is adapted to fill the container C with milk. The container C is supported on a platform 10 which is adapted to be raised and lowered between the solid line and broken-line positions shown in FIGURE 1. In the lower, solid-line position, the container C is free and clear of an overlying fill tube 12 whereby the container is free for lateral movement relative to the fill tube 12. The broken-line, elevated position of the container indicates the relative position thereof at the commencement of the filling operation, i.e. at the time the milk is first introduced into the container. As the filling progresses, the container C is lowered gradually relative to the fill tube 12 to keep the discharge end of the latter just below the liquid surface, the milk being supplied to the fill tube 12 via a supply pipe 13.

To effect raising and lowering of the container C, the platform 10 for the container carries a cam roller 14 adapted to engage and follow the contour of a groove 16 within the outer cylindrical surface of a cam element 18, only a section of the latter being shown in FIGURE 1. Rotation of the cam element 18 about a vertical axis (not shown) will effect raising and lowering of the container between the solid line and broken-line positions. Suitable guide and support rods 20 slidable in sleeves 22, fixed to the platform 10 may be provided.

As the container is being elevated, no milk is introduced into the container. However, once it reaches its elevated broken-line position shown in FIGURE 1, a foot valve, indicated generally at 24, is opened to start the milk flowing. To this end, an actuating means shown schematically at 26 is operable to lower the foot valve stem 28, to start the flow and to raise it, after the container has been filled, to stop the flow. The actuating means 26 may comprise a lever 30 pivotally mounted at 32 and having one end passing through an eyelet 34 in the end of the foot valve stem 28 and the other end mounting a cam follower 36 adapted to be actuated by a cam element 38. The cam element 38 is adapted to operate in conjunction with the previously mentioned cam element 18 to effect actuation of the foot valve stem 28 to start the filling when the container is in the elevated, broken-line position. The aforesaid cam elements 16 and 38 are also adapted to operate in conjunction with other elements (not shown) of the filling machine whereby the foot valve 24 is closed after the correct amount of milk has been introduced into the container, the shut-off occurring while the discharge end of the fill

tube 12 is still in the upper portion of the container and the latter has not yet reached its fully lowered, solid-line position shown in FIGURE 1.

It will be understood the above-described apparatus effects relative vertical movement between the fill tube 12 and the container C thereby to keep the discharge of the fill tube 12 just below the liquid surface during the filling operation. Accordingly, it will be understood that various other mechanisms may be employed to effect this relative movement. For example, the container may be raised and lowered by chain drive elements or the fill tube 12 may be raised and lowered relative to the container. Similarly, it will be understood that the actuating means 26 for lowering and lifting the foot valve stem may be replaced by alternative operating mechanisms.

The foot valve 24 for controlling the flow of milk through the fill tube 12 comprises the aforementioned axial stem 28 on the end of which is an enlarged head 40. Guide vanes 42 disposed radially of the stem 28 are adapted to guide and center the foot valve 24 as the latter is lowered and raised. The head 40 of the foot valve 24 includes two spaced flange-like portions 44 and 46 between which is formed an annular groove 48, the latter accommodating a resilient sealing member in the form of an O-ring 50 as will be further described.

Mounted in the discharge end of the fill tube 12 is a discharge nozzle means comprising a screen frame 52 and a cylindrical screen 54. The screen frame 52 has an end opening 56 and a plurality of side openings 58 in its cylindrical sidewall. In order to mount the screen frame 52 at the end of the fill tube 12, the latter is provided with a pair of diametrically opposed lugs 60 which are adapted to be received in two diametrically opposed bayonet-type slots 62. The lugs 60 may be suitably secured to the end of the fill tube 12, for example, by a force fit or welding. The end portion of the fill tube 12 may have a reduced diameter to accommodate the internal diameter of the screen frame 52 and thereby providing a shoulder 64 against which the screen frame 52 abuts in its assembled position. As shown in the drawings, the cylindrical screen 54 is held between the end of the fill tube 12 and a shoulder 66 in the screen frame, the screen being thereby held in position at the inside cylindrical face of the screen frame and traversing the side openings 58. It will be apparent that the screen frame 52 and screen 54 may be easily removed and replaced by a simple twisting motion for cleaning and repairs.

The bottom or end opening 56 in the screen frame 52 has a diameter slightly larger than that of the end flange 46 of the foot valve so that when the latter is in its lowered (open) position (FIGURE 3), milk may flow in a general axial direction through the annular space 68 between the flange 46 and the edge of the end opening 56. Milk will also flow in a radial direction through the perforations in the screen 54 and through the side openings 58. Thus, when the foot valve is in its opened position (FIGURE 3), milk will be discharged both in an axial and radial or transverse direction.

In its closed position (FIGURE 2), the foot valve O-ring 50 carried in the groove 48 is adapted to abut the end of the fill tube, the latter having a conical surface 70 at the end thereof adapted to form a valve seat as clearly shown in FIGURE 2.

In operation, at the start of the filling cycle, the container is elevated to the broken-line position of FIGURE 1, so that the screen frame 52 just clears the container bottom. The foot valve 24 is then opened (FIGURE 3 position) and the container C lowered during the filling cycle, the arrangement being such that the discharge nozzle is maintained just below the rising liquid surface. Lowering the container during the filling operation to keep the discharge nozzle on the fill tube just below the liquid surface minimizes the liquid displaced by the submerged portion of the fill tube and discharge nozzle

which, consequently, minimizes the empty headspace below the cap-seat in the filled container. It also improves overall indexing efficiency since the major portion of the lowering cycle is concurrent with the filling cycle. Further, it allows the radial, outward flow to have a maximum depressing effect on the liquid turbulence caused by the downward, axial flow into the confined space of the container without direct impingement on the inside walls of the container.

During filling, the radial outward flow through the screen 54 reduces turbulence in the container and by so doing, the degree of foaming, in the case of milk, is also reduced, thereby permitting an increase in the filling rate.

It is difficult to measure, in actual operation, the proportion of axial versus radial flow. However, it may be in the order of approximately 50 percent but may range from 25 to 75 percent, depending on particular conditions. By way of example, the screen 54 may be No. 100 mesh stainless steel.

It will be apparent that alternate arrangements may be provided for effecting the radial and axial flow. For example, in place of the screen, an integral, cylindrical member may have perforations therein and the axial flow may be through an opening having a configuration other than the annulus in the illustrated embodiment. It may also be employed with liquids other than milk.

It will be apparent that the present invention, as represented by the illustrated embodiment, fulfills and meets the objectives and advantages set forth in the opening statements of this specification.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction, and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

We claim:

1. A filling apparatus for filling a container with a liquid comprising:

- a fill tube;
- a foot valve longitudinally moveable in said tube between open and closed positions;
- a valve seat associated with said fill tube adapted to provide a seat for the foot valve when the latter is in said closed position;

discharge nozzle means on an end portion of said fill tube disposed generally downstream of said valve seat;

said nozzle means comprising a cylindrical frame member having a longitudinal end opening and at least one transverse side opening adaptable to discharge liquid into the container in a longitudinal and lateral direction respectively, when said foot valve is in said open position;

said cylindrical frame member having support means longitudinally aligned with the end of the fill tube; and

a cylindrical imperforate member within said frame member extending across said side opening and supported between said support means and the end of the fill tube.

2. A filling apparatus for filling a container with a liquid comprising:

- a fill tube;
- a foot valve having a stem and an enlarged head longitudinally moveable in said fill tube between open and closed positions;
- a valve seat associated with said fill tube adapted to provide a seat for the foot valve when the latter is in said closed position;

a discharge nozzle means on an end portion of said fill tube disposed generally downstream of said valve seat;

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said nozzle means having a longitudinal end opening and at least one transverse side opening adaptable to discharge liquid into the container in a longitudinal and lateral direction respectively, when said foot valve is in said open position;

said foot valve being positioned to obstruct said end opening thereby to restrict said longitudinal discharge when the foot valve is in said open position.

3. A filling apparatus according to claim 2 wherein said enlarged head is adapted to be positioned in said end opening of said discharge nozzle means when the foot valve is in said open position to define in part an annular discharge opening.

4. A filling apparatus according to claim 2 wherein said enlarged head mounts a ring member of resilient material defining a seal adapted to engage said valve seat when the foot valve is in its closed position.

5. A filling apparatus according to claim 2 wherein said enlarged head has an annular groove defined in part by a flange at the longitudinal end of the foot valve, and a resilient sealing member carried in said groove, said end flange having an outer diameter larger than the

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inner diameter of said fill tube whereby said flange is adaptable to urge said resilient sealing member against the end of said fill tube when the foot valve is in said closed position.

6. A filling apparatus according to claim 2 further comprising a reduced diameter end section on an end portion of the fill tube on which the discharge nozzle means is received, and means on said fill tube and discharge nozzle means cooperable to define a manually operable connection therebetween to facilitate cleaning and maintenance of the discharge nozzle means.

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20 SAMUEL F. COLEMAN, *Primary Examiner.*

HADD S. LANE, *Assistant Examiner.*