Dec. 10, 1968 N. A. KELLY 3,415,294

METHOD AND APPARATUS FOR ANTIFOAM FILLING A CONTAINER

Filed May 1, 1967 2 Sheets-Sheet 1

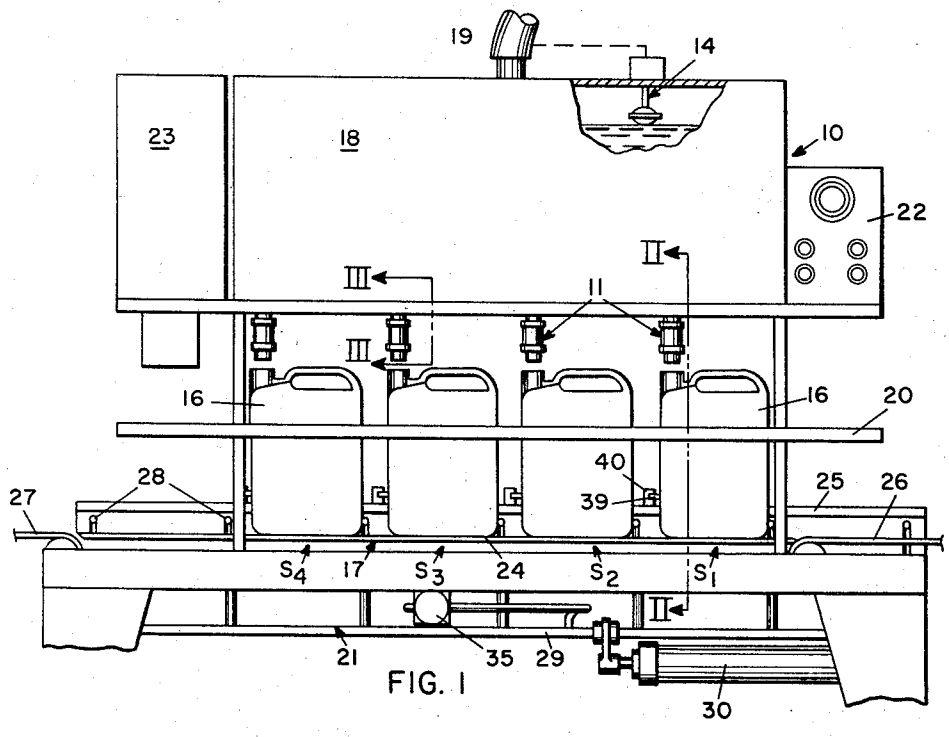

FIG. 1

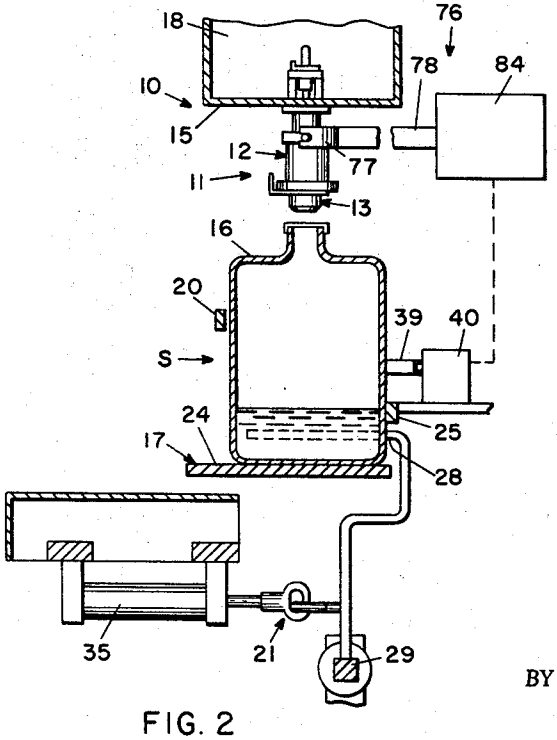

FIG. 2

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METHOD AND APPARATUS FOR ANTIFOAM FILLING A CONTAINER

Filed May 1, 1967 2 Sheets-Sheet 2

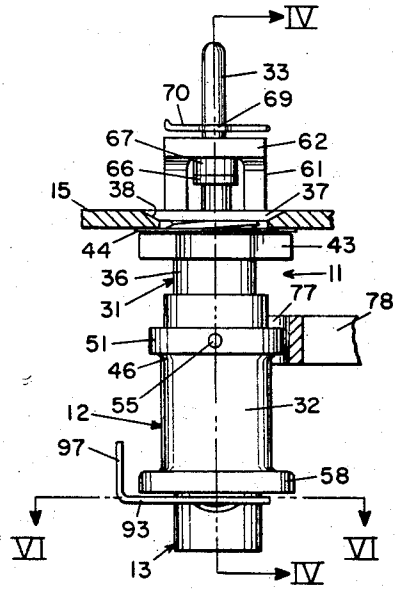

FIG. 3

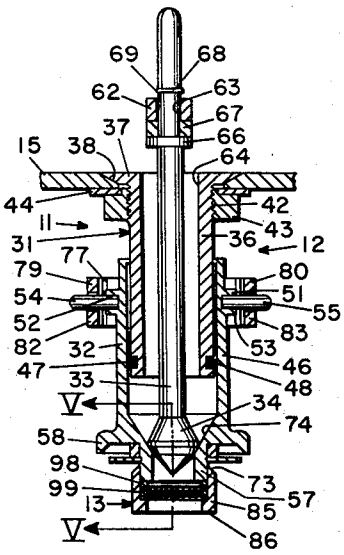

FIG. 4

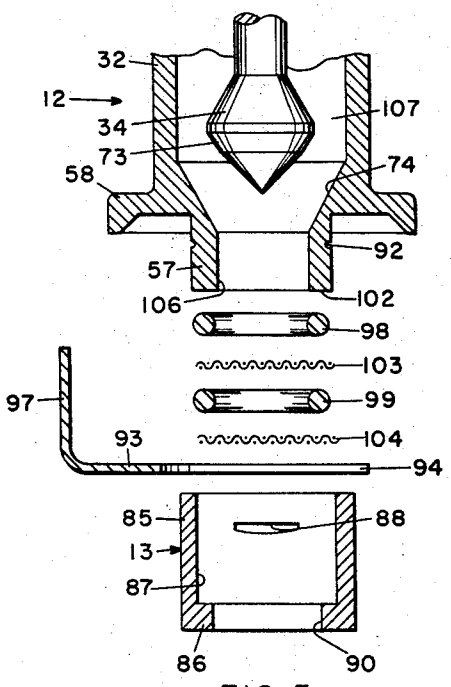

FIG. 5

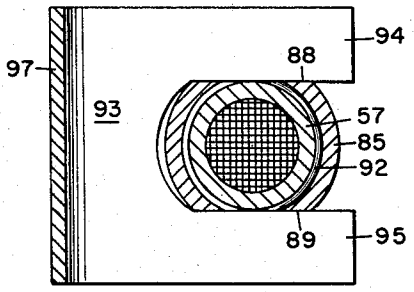

FIG. 6

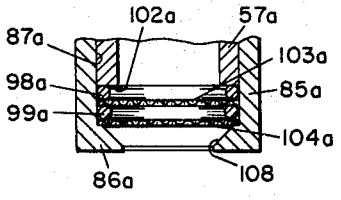

FIG. 7

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United States Patent Office 3,415,294 Patented Dec. 10, 1968

3,415,294

METHOD AND APPARATUS FOR ANTIFOAM FILLING A CONTAINER

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Continuation-in-part of application Ser. No. 418,987, Dec. 17, 1964. This application May 1, 1967, Ser. No. 635,006

11 Claims. (Cl. 141—1)

ABSTRACT OF THE DISCLOSURE

This invention relates to a filling machine for introducing liquids into a container while minimizing the formation of foam, and comprises a plurality of relatively closely spaced fine mesh screens at the discharge opening whereby the effective head on the liquid is substantially reduced. In this manner, a higher head pressure can be used while the liquid at discharge has a minimum of energy.

The present application is a continuation-in-part of my prior application Ser. No. 418,987, filed Dec. 17, 1964, which application has been abandoned upon filing this application.

This invention relates in general to a machine for filling containers and, more particularly, to a dispensing device for such a machine and to a method for minimizing, if not eliminating, the formation of foam which has heretofore occurred when certain types of liquids have been poured into containers.

Container filling machines have been used for many years in a wide variety of industrial and commercial situations, as for example, to fill containers with beverages. However, certain beverages, such as milk, tend to foam during a container filling operation, particularly where a relatively fast filling rate is employed. Numerous attempts hvae been made to overcome this troublesome problem and some of these attempts are disclosed in the S. D. Potter Patent No. 2,901,009, the E. P. King Patent No. 2,775,486, the C. L. Day et al. Patent No. 2,724,535, and the C. W. Heinle Patent No. 2,380,434. To the best of applicant's knowledge, none of the existing devices for minimizing the formation of foam have been both commercially acceptable and capable of completely satisfactory operation. In fact, it has become generally accepted by users and makers of container filling machines that it is not practicable to stop foaming. Thus, various types of apparatus have been developed for successfully removing the foam.

The most common procedure for removing foam involves the insertion of a tube into each bottle as it is being filled so that the foam can be drawn out of the bottle as it reaches the top thereof. In an average dairy or other filling operation, the milk or other beverage contained in the foam or, in other words, from which the foam is formed, can be rather substantial over a period of time. However, the laws governing the sanitation and handling of beverages for human consumption usually prohibit the use for human consumption of the beverage removed in the foam. Thus, the disposal of such foam produces a further problem and expense.

Where, for example, the filling machine is operated at a fairly high rate of speed, the loss of beverage through the foaming action can adversely affect the filling accuracy of the filling machine, particularly where the filling is controlled by a time rate of flow. Thus, the bottle is often slightly over-filled in order to ensure full measure, which creates a further loss or expense.

Specific reference is made herein to the use of the

invention on machines for filling containers with milk, because it was out of this background that the specific disclosure developed. However, the invention is clearly adapted for a variety of uses or for use in pouring liquids other than milk where reduction or elimination of foam is desired.

A brief discussion of the prior art relating to the specific details of the applicant's dispensing device is believed to be in order. One critical feature in applicant's dispensing device resides in a plurality, e.g., a pair, of relatively closely spaced screens located in the passageway from the control valve in the dispensing device, as shown in FIGURE 4 of the drawings. Heretofore, this arrangement of screens has been deemed wholly unsuited for the purpose of reducing foam, as evidenced by a number of prior art patents which have depended upon this very same arrangement for increasing the production of foam. For example, the Wager Patent No. 1,554,147 uses a plurality of spaced screens specifically for the purpose of "forming lather." The J. A. Rice Patent No. 2,089,813 discloses the use of spaced screens for the purpose of "introducing bubbles into the cement slurry . . . ." The Holmberg et al. Patent No. 2,100,165 shows a pair of spaced perforate members for the express purpose of "producing a large spray covering an area approximately four times the area covered by a solid column issuing direct from a half-inch spout or through the ordinary strainer nozzle, and the jets issuing through the spray holes will have much greater force, and the back pressure is correspondingly increased . . . ." The B. Sheldon, Jr., Patent No. 2,492,327 shows the use of a pair of spaced screens for the express purpose of producing "a larger and finer head" on beer as it is poured into a container. In fact, the Sheldon device is intended to produce "a longer lasting head or foam," which would completely defeat applicant's purposes. From the foregoing comments, it can be seen that, for the most part, the prior art disclosures, which resemble applicant's device, have taught the very reverse of that which applicant has accomplished.

Accordingly, the objects and purposes of this invention have been the provision of:

(1) A filling machine for filling containers with a liquid that normally tends to foam when poured, which machine includes an antifoaming head whereby the formation of foam is minimized, if not eliminated;

(2) A filling device, as aforesaid, which is adapted for use on existing filling machines with little or no change in the machine other than replacing the filling devices, which is adapted for use with a variety of different types of liquids having varying viscosities, which does not materially alter the operation of the machine except for the reduction of foam, which is easily and quickly disassembled and reassembled such as for cleaning purposes, and which has a minimum of parts;

(3) An antifoaming head, as aforesaid, which is foolproof in operation, small in size, inexpensive to manufacture and adapts itself readily to the normal functioning of the valve mechanism to which it is attached;

(4) A method of minimizing, if not eliminating, the formation of foam when certain liquids, such as milk, are poured by a filling machine into containers.

The objects and purposes of the invention, including those set forth above, have been met by providing an apparatus and a method for filling a container with a liquid that normally tends to foam, while minimizing such foaming. Specifically, the method and apparatus of this invention comprises passing the liquid through a dispensing device equipped with a discharge valve and an antifoaming head that includes a plurality of closely spaced screens. The dispensing device is embodied in a

filling machine wherein it is connected to a supply of liquid, such as milk, and is designed and arranged so that the liquid is dispensed into a container placed below and adjacent the dispensing device. In the preferred embodiment, a plurality of dispensing devices are used in a line so that the filled containers can be delivered individually at short intervals to a capping apparatus.

Other objects and purposes of this invention will become apparent to persons familiar with this type of equipment upon reading the following descriptive material and examining the accompanying drawings, in which:

FIGURE 1 is a fragmentary, front elevational view of a container filling machine having a plurality of filling devices including the antifoaming head of the invention.

FIGURE 2 is a sectional view substantially as taken along the line II—II in FIGURE 1.

FIGURE 3 is an enlarged sectional view taken along the line III—III in FIGURE 1.

FIGURE 4 is a sectional view taken along the line IV—IV in FIGURE 3.

FIGURE 5 is an exploded enlarged sectional view substantially as taken along the line V—V in FIGURE 4.

FIGURE 6 is an enlarged sectional view taken along the line VI—VI in FIGURE 3.

FIGURE 7 is a fragmentary detail sectional view of a modified form of the present invention.

For convenience in description, the terms "upper," "lower" and words of similar import will have reference to the filling device of the invention as appearing in FIGURES 1, 2 and 3. The terms "inner," "outer" and derivatives thereof will have reference to the geometric center of said filling machine, said filling device and parts thereof.

The filling machine **10** (FIGURES 1 and 2) is of the time-fill type and is equipped with four dispensing or filling devices **11**, each of which is equipped with a valve **12** and an antifoaming head **13**. A plurality of containers **16** can be supported upon the conveyor **17** for intermittent movement into and out of filling positions or stations S beneath said discharge devices **11**. The dispensing devices **11** (FIGURE 2) are secured to and located beneath the bottom wall **15** of a reservoir or tank **18** with which they are in communication for the purpose of dispensing the liquid, such as milk, from said tank into said containers **16**.

The tank **18** may be connected to a bulk supply of the liquid, not shown, in a conventional manner by means of the conduit **19**. Conventional flow control mechanism **14** (FIGURE 1) may be provided for controlling the flow of liquid from said supply through said conduit so that the level of liquid in said tank **18** is maintained at a substantially constant level, whereby accurate filling can be achieved. That is, since a time-fill type filling machine is dependent upon a constant rate of flow, it is essential that the head pressure, hence the liquid level, within the tank **18** be maintained substantially constant. When time-fill type machines are used for handling milk, the depth of the milk in the tank or reservoir is usually about 12 inches. However, the dispensing device can be adapted for use on filling machines wherein the depth of the liquid is substantially smaller or greater than 12 inches. The illustrated machine **10** also has a control panel **22** and a container capping apparatus **23**.

The conveyor **17** (FIGURE 1) includes a central platform **24** and endless belt **26** which moves the containers onto the central platform **24** at the right end thereof. An endless belt **27** receives the containers from the central platform at the left end thereof. A pair of guide bars **20** and **25** (FIGURES 1 and 2) extend along the sides of and above the conveyor **17** for the purpose of preventing frontward or rearward movement of the containers **16** out of their desired path beneath the dispensing devices **11**.

The conveyor **17** also includes a plurality of fingers **28** which are part of a transfer mechanism **21** which reciprocates the fingers **28** lengthwise and crosswise of said platform **24**, whereby the containers are engaged and accurately moved into and out of the filling stations S_1, S_2, S_3 and S_4, respectively, beneath the four dispensing devices **11**, which are located in a line substantially directly above and parallel with the path of movement of the containers. The fingers **28** (FIGURE 1) extend rearwardly and then downwardly where they are connected to a bar **29** which is pivotally supported upon the filling machine **10** for pivotal movement around its lengthwise axis. The bar **29** is also supported for movement lengthwise of the machine by means such as the power cylinder **30**, which is connected between the machine frame and the bar **29**. Pivotal movement of the bar **29** (FIGURE 2) may be effected by any convenient means such as a power cylinder **35**, which is connected between a pair of the fingers **28** and the machine frame.

As shown in FIGURE 2, a microswitch **40** having a sensing element **39** is mounted upon the rear side of the filling machine frame adjacent the platform **24** and near the leftward edge (FIGURE 1) of each filling station S. Thus, the sensing element **39** is engaged by the container **16** just as it is moved into its filling position in each filling station.

Each of the dispensers **11** (FIGURES 3 and 4) which are preferably identical is comprised of a mounting member **31**, a valve housing **32** and the control valve **12** which includes a valve stem **33** with a valve head **34** on the lower end thereof.

The mounting member **31** (FIGURE 4) is comprised of an elongated cylinder **36** having an annular, outwardly extending flange **37** connected to the upper end thereof. The flange may be beveled on its lower side for reception into a beveled opening **38** in the lower wall **15** of the tank **18**. The cylinder **36** is externally threaded at **42** adjacent the flange **37** for threaded engagement by a nut **43**, whereby the adjacent portion of the lower wall **15** and a washer **44** are clamped against the flange **37** in a liquid-tight connection.

The valve housing **32** has an upper, cylindrical portion **46** which is slideable and telescopically received upon the lower end of the cylinder **36** of the mounting member **31**. The cylinder **36** has an annular groove **47** near its lower end into which an O-ring **48** is received to provide a liquid-tight sliding seal between the mounting member **31** and the valve housing **32**. The upper cylindrical portion **46** has an annular outwardly extending flange **51** diametrically aligned, outwardly opening recesses **52** and **53** into which a pair of pins **54** and **55** are snugly received.

The valve housing **32** has a lower cylindrical portion **57** which is preferably coaxial with and of less diameter than the upper cylindrical portion **46**. An outwardly extending, annular flange **58** is secured upon the valve housing **32** at the junction of the lower cylindrical portion **57** with the upper cylindrical portion **46**.

The mounting member **31** (FIGURE 4) has an upwardly extending and downwardly opening, U-shaped support bracket **61** which is secured to the upper side of the flange **37** so that it straddles the bore **64** in the mounting member **31**. The web **62** of the bracket **61** has a central opening **63** which is preferably coaxial with the bore **64** of the mounting member **31**.

The valve stem **33** (FIGURE 4), which is substantially smaller in diameter than and is coaxially disposed within the bore **64** of the mounting member **31**, has an annular, outwardly extending flange **66** near its upper end. A preferably resilient washer **67** is sleeved upon the valve stem **33** directly above the flange **66** for engagement with the lower side of the web **62** when the upper end of the stem **33** extends upwardly through the opening **63** in said web **62**, as shown in FIGURE 3. The stem **33** has an annular groove **68**, above the flange **66**, into which the resiliently flexible elements **69** of a spring clip **70** are removably received for the purpose of supporting the stem **33** upon the bracket **61**.

The valve head 34 (FIGURE 4) is integral with the lower end of the valve stem 33 and is spaced downwardly from the lower end of the mounting member 31 when the flange 66 is against the web 62. The lower face 73 of said valve head is conically shaped in a downwardly converging direction for liquid-tight engagement with a downwardly converging, conical and annular valve seat 74, located at the junction between the cylindrical upper portion 46 and cylindrical lower portion 57 of the valve housing 32.

The valve housing 32 (FIGURE 2) is vertically reciprocated by an operating mechanism 76 including a yoke 77 which is connected to an arm 78 so that the yoke extends around the housing 32 in the vicinity of the flange 51. The free ends of the yoke 77 are bifurcated to provide a pair of upper elements 79 and 80 (FIGURE 4) and a pair of lower elements 82 and 83 spaced from the upper elements. The pins 54 and 55 extend snugly between the upper elements 79 and 80 and the corresponding lower elements 82 and 83 for effecting positive, upward and downward movement of the housing 32 with respect to the mounting member 31. The arm 78 may be connected to an actuating element 84 which, for example, may be a solenoid, for effecting the vertical movement of the arm 78, hence of the valve housing 32.

The antifoaming head 13 (FIGURE 5) is comprised of a cylindrical shell 85 having an inwardly extending, annular flange 86 connected to the lower end thereof. The inside diameter of the bore 87 in the shell 85 is preferably only slightly greater than the outside diameter of the lower cylindrical portion 57 of the valve housing 32. The shell 85 has a pair of diametrically disposed circumferentially elongated openings 88 and 89 (FIGURE 6) which are alignable with an annular groove 92 in the cylindrical lower portion 57 when the shell is sleeved on the lower portion 57 and the upper edge of the cylindrical shell 85 is spaced downwardly a short distance from the lower flange 58.

The shell 85 is supported upon the cylindrical lower portion 57 by means of a bifurcated plate 93 having a pair of spaced, substantially coplanar strips 94 and 95, the opposing edges of which are simultaneously and slideably receivable into the openings 88 and 89 and the adjacent portions of the groove 92, as shown in FIGURE 6. The plate 93 has a flange 97 at one end thereof for manually gripping the plate 93 to effect its attachment to and removal from the shell 85 and valve housing 32.

A pair of resiliently flexible, annular seals, such as the O-rings 98 and 99 (FIGURES 4 and 5) are snugly, but removably, disposed within the bore 87 between the flange 86 and the lower axial face 102 of the cylindrical portion 57. A pair of circular, perforate members, such as the screens 103 and 104, are removably disposed within the shell 85. The upper screen 103 is located between the O-rings 98 and 99, and the lower screen 104 is located between the lower O-ring 99 and the flange 86, in this particular embodiment. When the shell 85 is held in position upon the cylindrical portion 57 by means of the plate 93, with the O-rings 98 and 99 and the screens 103 and 104 in their above-described places in the bore 87, said O-rings 98 and 99 are held under slight compression. This compression causes the O-ring 98 to serve also as a seal between the cylindrical portion 57 of the housing 32 and the adjacent portion of the shell 85 to prevent the escape of liquid therebetween.

In applications wherein the liquid flowing through the dispensing devices is milk, the mesh of the screens 103 and 104 is preferably selected so that the open area through each screen is preferably less than about 50% of the cross-sectional area of the bore or passageway 106 in the lower portion 57. The cross-sectional area of the passageway 106 is preferably substantially less than the minimum cross-sectional area through the throat 107 between the valve head 34 and the valve seat 74, when the control valve 12 is in its open position of FIGURE 5. Thus, there is not possibility of starving the flow of liquid through the passageway 106 during the normal operation of the dispensing device 11.

The diameter of the passageway 106 is advantageously approximately three-quarters of an inch where the liquid stands approximately 12 inches deep in the tank 18. If the depth is increased, the mesh of the screens could be reduced and/or additional, spaced screens could be added to compensate for the increased head pressure, and thereby avoid an increase in foam.

Using dispensing devices 11 substantially identical with those described above, it was found under actual commercial use that a gallon container could be filled with milk, either by one continuous filling operation or in a series of partial filling operations, by means of said dispensing devices without creating more than a negligible amount of foam within the gallon container. Moreover, said containers could be filled by said dispensing devices at a speed comparable to that achieved by filling machines of the foam forming types, which are presently in general use. A negligible amount of foam, as stated above is intended to include a foam accumulation on the top of the milk in a filled gallon container which would be substantially less than a half inch above the top of the liquid immediately following a filling operation. In some instances, depending upon the filling procedure, the amount of foam occurring on top of the milk in a full gallon container immediately following the filling operation would be less than a quarter of an inch thick and, in most instances this foam dissipates quickly. In any event, the amount of foam which is formed does not spill out of the container and it does not affect in the slightest the accurate filling of the container.

In operation of the machine illustrated in FIGURE 1, a plurality of containers 16 (FIGURE 1) are placed upon the endless belt 26, the upper reach of which may be urged in a conventional manner toward the platform 24. The containers 16 are moved, one at a time, from the belt 26 onto the platform 24 by the transfer mechanism 21. In accomplishing this movement, each finger 28 is simultaneously moved rearwardly away from the platform 24 by the cylinder 35, then rightwardly by the cylinder 30, then frontwardly over the platform and the adjacent portion of the belt 26 by the cylinder 35 and finally leftwardly back into the initial position by the cylinder 30.

As each container 16 enters station S_1, the sensing element 39 on the microswitch 40 at station S_1 is engaged, energizing the actuating element 84 so that the arm 78 is moved downwardly whereby the yoke 77 will open the control valve 12 by lowering the valve housing 32 associated with the dispensing device 11 at station S_1. After a pre-selected time interval as determined by the setting of the controls 22, the operating mechanism 76 is automatically operated to close the valve and thereby terminate the filling operation. In the illustrated machine, the container at this time is one-fourth full. The transfer mechanism 21, including the fingers 28, is operated again, whereby the first container is moved into the second station S_2 and, simultaneously, a second container is moved into the first station S_1. The sequence of opening the valve 12 in the dispensing devices above stations S_1 and S_2 and filling the containers is now performed in stations S_1 and S_2, because their associated microswitches 40 are operated by the two containers.

This performance is repeated for each container until it is completely and finally filled by the dispensing device in station S_4, after which each filled container is moved by the mechanism 21 into the capping position beneath the capping apparatus 23. The transfer mechanism 21 then moves the filled and capped container onto the endless belt 27, which carries the container away to a position for loading, as into a crate.

It will be recognized that a result substantially similar to that achieved by the above-described structure can also be achieved wherein the valve housing 32 remains sta-

tionary and the valve head **34**, hence the valve stem **33** is vertically reciprocated. This would be accomplished by connecting the stem **33** to means for effecting its vertical reciprocation. In such case, it would be advantageous to integrate the valve housing **32** with the mounting member **31**.

The method of the invention can be carried out by using the equipment described above.

It would appear that the method and apparatus in accordance with this invention functions to reduce foaming by reducing the head pressure on the liquid at the discharge opening, that is, at the opening **90**, and by breaking up the stream discharging from the opening into a plurality of small streams to reduce the vortex action. Each of these points are hereinafter discussed.

The delivery rate of the liquid from the opening **90** is a function of the head pressure, the flow resistance in the flow path, and the area of the opening. If the head pressure or the area of the opening **90** were increased or decreased, or if the flow resistance were decreased or increased, the delivery rate of the liquid from the opening would be correspondingly increased or decreased. In the selection of any combination of values for these factors, the relevant considerations would be that:

(a) The container must be filled in a minimum of time and require a minimum investment in filling machinery, space and operating expenses.

(b) The delivery rate of the liquid can be increased by increasing the velocity of the liquid through the opening **90**, which can be accomplished by increasing the head pressure. However, the greater the velocity of the liquid at the opening, the greater will be its energy at impact upon the bottom of the container or the previously dispensed liquid in the bottom of the container and, thus, the greater will be foam formation.

(c) The delivery rate of the liquid can be increased by increasing the area of the opening **90**, but this is limited since the container to be filled is usually provided with a mouth of a certain size that is fixed by custom and usage, convenience, or filling and capping requirements—for example, with milk containers, the public is use to milk bottles having certain size mouths and the filling and capping equipment at the dairies is designed to operate with containers having such mouth dimensions, and the opening **90** must discharge a stream of liquid in a commercial operation that will pass through the bottle mouth without spilling.

(d) With respect to time-fill type operations wherein the filling accuracy is a function of maintaining a constant head pressure, and except when prohibitively expensive equipment is used, it is not uncommon to experience fluctuations of plus or minus one-quarter inch in the level of the liquid from the desired constant level, and to minimize the influence of such variations on the delivery rate, a substantial base level of fluid must be maintained, that is, for example, a one-half inch variation is percentagewise a smaller variation from a twelve inch level than it would be from a six inch level.

In accordance with this invention, it is proposed to reduce foaming in a filling operation substantially to the point of elimination by interposing a relaitvely fine mesh perforate member and preferably a screen in the flow path of the liquid whereby the resistance to the flow is increased and, with the resultant pressure drop across the screen, the pressure on the liquid at the discharge opening **90** is decreased. By increasing the number of screens employed, the resistance can be increased until the pressure on the liquid at the discharge opening is sufficiently low to avoid foaming. Minimum foaming would be present where the liquid pressure at the opening is substantially zero and the liquid has a dead fall from the opening into the container. It will however be apparent that in some circumstances less than a dead fall of the liquid would be satisfactory in that the amount of foam formed would be acceptable and would not be troublesome. At the same time, maximum liquid pressure at the discharge opening consistent with a tolerable foam level would be desirable since it increases the delivery rate.

Thus, the liquid pressure at the opening **90** is limited by the foam characteristics of the liquid and is established by the liquid pressure at the inlet to the screens and by the open area, mesh and the number and spacing of the screens. In a time-fill type installation, the pressure of the liquid at the inlet to the screens is in turn established by the head required in the tank to reduce to acceptable levels the effects of variations in the head that are inherent in commercial quality equipment.

As an example of a typical installation, it has been found that, with milk, substantially foam-free filling of a container can be obtained by the use of a pair of 30 x 30 mesh screens in a discharge opening **90** that is about 0.690" in diameter and with substantially 12" of head (a little more than 0.40 p.s.i.). The screens were formed of stainless steel wire about 0.012" in diameter so that the effective area of the discharge opening **90** was approximately 40% of the total area. The flow rate through this opening was sufficient to deliver one quart of milk in about 3.1 seconds.

While it is not intended to limit the invention to the theory involved, it would appear that the presence of the screens such as the screens **103** and **104** also tends to minimize the vortex action. As a single relatively large stream of liquid emerges from the discharge opening, it tends to assume a rotation which represents a certain amount of energy. Thus, when this stream falls into the liquid previously delivered into the container, this energy is absorbed by the liquid which thus tends to rotate with the incoming stream. The energy is eventually dissipated in friction in the liquid and between the liquid and the container, but in the meantime, the rotation of the liquid has developed a vortex which tends to permit more air to be trapped between the incoming stream and the converging wall of the vortex. This trapped air constitutes foam. At the same time, the rotation of the stream itself tends to trap air in fold-like formations in the liquid at the periphery of the stream, which air also constitutes foam. The rotating stream is also more stable and thus penetrates deeper into the liquid in the container. With the liquid passing through the large number of openings afforded by the screen openings, it would appear that there is eliminated whatever tendency there is for the individual streams to rotate. At the same time, with relatively low head pressure and small openings that are closely spaced, the surface tension of the liquid prevents the stream from breaking up into a plurality of small streams. As a result, the liquid emerges from the discharge opening as a single stream that is free of any discernible rotation about its axis.

A further advantage of the screens is that, through the surface tension of the liquid, they act to seal the discharge opening when the valve head **34** is engaged with the valve seat **74** and the valve is thus closed, the flow is stopped immediately. Normally it would be expected that the liquid beyond the closed valve would continue to drain into the container at a decreasing rate so that, either the container must be left beneath the discharge opening for an appreciable period of time to receive the drippings, or else these drippings will be spilled, which not only constitutes waste but also presents a sanitation and cleaning problem. With the apparatus in accordance with this invention, the surface tension of the liquid in the absence of any appreciable head, causes the liquid to adhere to the screens thereby forming a seal. Thus, the liquid that is past the valve when the valve is closed but is not past the last screen **104**, is held in the discharge opening **90** by atmospheric pressure and the surface tension of the liquid, and the flow is thus stopped immediately upon closing the valve.

Another feature of the present invention is that the flow path is so designed that there is no tendency for air

to be drawn into the discharge opening **90**. Normally, if the liquid were permitted to pass from one diameter to a larger diameter, or if the velocity were permitted to increase, for example as in a free fall, so that the diameter of the stream tended to neck down and thus become smaller than the diameter of the conduit in which it is confined, the tendency would be to create a vacuum that could draw air into the system. In the apparatus in accordance with this invention, the flow resistance imposed by the screens **103** and **104** tends to keep the liquid above the same under pressure so there is no tendency to create a vacuum. Between the screens **103** and **104**, the flow resistance imposed by the lower screen keeps the liquid under pressure.

While the perforate members **103** and **104** are preferably screens, since screens are relatively inexpensive and can be used as throw-away items, it will be apparent that equivalent screen-like elements such as a disc having a plurality of relatively fine holes drilled or punched therein could also be used. As herein used, the term perforate member refers to a screen or equivalent screen-like member having a plurality of relatively fine holes therein.

In FIGURE 7 there is illustrated a modification of the invention where in the inwardly extending annular flange **86***a* of the shell **85***a* has an inclined face **108** that converges downwardly. For supporting the screens **103***a* and **104***a* there is formed a small ledge **109** between the inside diameter **87***a* of the shell **85***a* and the inclined face **108** upon which the lower screen **104***a* is seated, with the O-rings **98***a* and **99***a* and the upper screen **103***a* being stacked thereon as in the construction of FIGURE 4 and compressed by the lower face **102***a* of the lower portion **57***a* of the valve housing. Thus, when the stream of liquid emerges from the lower screen **104***a*, it engages a converging surface which prevents the stream from separating from the wall as it accelerates in its free fall and thus tends to neck down. In this manner, air cannot be drawn into any void between the wall **108** and the stream and thus be trapped in the stream.

Although particular preferred embodiments of the invention have been described above for illustrative purposes, it will be understood that variations or modifications of such disclosure, which come within the scope of the appended claims, are fully contemplated.

What I claim and desire to protect by Letters Patent is:

1. Apparatus for dispensing into a container a liquid which tends to foam when it is poured while minimizing the amount of foam formed during the dispensing operation, comprising,

a frame structure having support means upon which the container can be placed in a filling station,

a dispensing device having a passageway and arranged to discharge liquid from said passageway into a container located in said filling station,

means for supplying liquid under pressure to said passageway,

valve means in said passageway,

means for opening and closing said valve means,

an antifoaming head having a bore open only at its opposite ends, means for mounting said antifoaming head on said dispensing device with said bore communicating at one end with said passageway downstream from said valve means and at its other end with atmosphere,

and a plurality of spaced, perforate members held within and extending across said bore, the open area in each perforate member not materially greater than one-half the minimum cross-sectional area of said passageway between said perforate members and said valve.

2. Apparatus in accordance with claim **1** in which the open area in each perforate member is substantially forty percent of the minimum cross-sectional area of said passageway between said perforate members and said valve.

3. Apparatus in accordance with claim **1** in which said plurality of perforate members comprises a pair of closely spaced screens.

4. Apparatus in accordance with claim **1** in which said means for supplying liquid under pressure to said passageway comprises a liquid reservoir means on said frame structure above said filling station, means for connecting said liquid reservoir means and said passageway, and means for maintaining a substantially constant pressure on said liquid in said passageway adjacent said valve means.

5. Apparatus in accordance with claim **4** in which said means for maintaining a substantially constant pressure on said liquid comprises means for maintaining a substantially constant level of liquid in said liquid reservoir means.

6. Apparatus in accordance with claim **5** for dispensing milk or a similar liquid into containers in which said plurality of perforate members comprises a pair of closely spaced screens, and wherein the diameter of said passageway is substantially 0.690 inch, the open area of said perforate members is substantially forty percent, and the level of liquid in said liquid reservoir means is substantially twelve inches.

7. Apparatus in accordance with claim **1** in which said valve means comprises an annular valve seat in a valve housing and a valve stem having a valve head for cooperating with said valve seat to close the inlet to said passageway, means for supporting said valve housing and said valve stem so that said valve head and said valve seat are movable with respect to each other and said passageway communicates with said reservoir.

8. Apparatus in accordance with claim **7** in which said valve stem is held in a fixed position relative to said liquid reservoir means and said valve housing cylindrical and telescopically mounted upon a cylindrical mounting member depending from said reservoir, said valve housing being movable endwise on said mounting member for movement of said valve seat into and out of engagement with said valve head.

9. Apparatus in accordance with claim **7** in which said antifoaming head is a shell telescopically received upon said valve housing and having an inwardly projecting annular flange remote from said valve housing, said perforate members being screens disposed within the bore of said shell between said flange and the end of said valve housing, and resilient packing elements disposed one between said screens and one between the end of said valve housing and the adjacent screen, and means for releasably securing said shell on said body member with said resilient packing elements under compression.

10. Apparatus in accordance with claim **1** in which said antifoaming head has a downwardly converging surface below said perforate members, said converging surface being disposed coaxially of said passageway and presenting a relatively sharp edge at the discharge end thereof.

11. In a process for dispensing milk into a plurality of containers while minimizing the amount of foam formed during the dispensing operation, the steps comprising:

placing a supply of milk in a reservoir;

controlling the level of said milk in said reservoir to maintain a substantially constant level;

moving said containers sequentially into and out of a filling station beneath said reservoir;

intermittently opening and closing a valve means to permit said milk to flow by gravity into a passageway communicating with said reservoir and located above said filling station;

passing said milk through a first plurality of relatively small openings in said passageway below said valve means during a preselected interval of time, said small openings being substantially within the same diametrical plane and having a total cross-sectional area not materially greater than one-half of

the minimum cross-sectional area of said passageway between said valve means and said first openings;

passing said milk during said preselected time interval through a second plurality of relatively small openings below and spaced from said first openings, said second openings having approximately the same total cross-sectional area as said first openings, the milk departing said second openings without substantial head pressure and in a substantially dead fall therefrom.

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