March 4, 1969 J. H. RIESENBERG 3,430,668

CONTAINER FILLING MACHINE HEAD

Filed Aug. 1, 1966 Sheet 1 of 3

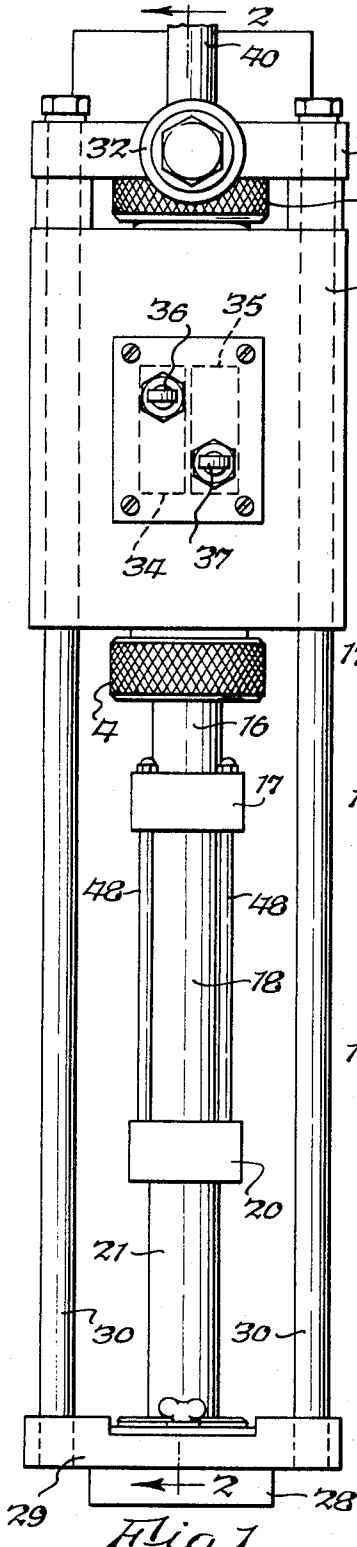


Fig. 1.

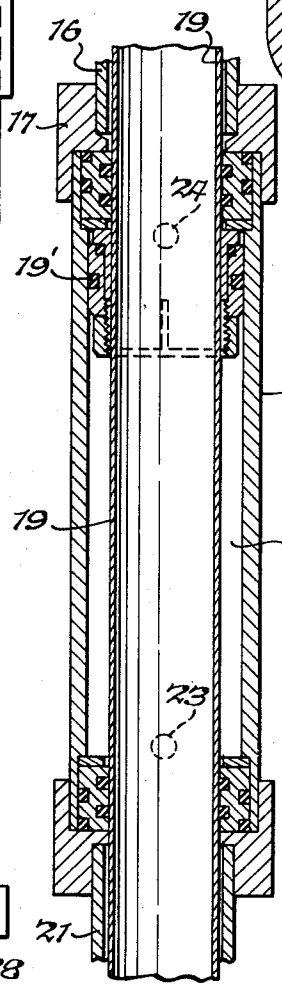


Fig. 3.

Fig. 2.

INVENTOR.
James H. Riesenberg.
BY
Christel & Bean
ATTORNEYS

March 4, 1969 J. H. RIESENBERG 3,430,668

CONTAINER FILLING MACHINE HEAD

Filed Aug. 1, 1966 Sheet 2 of 5

Fig. 5.

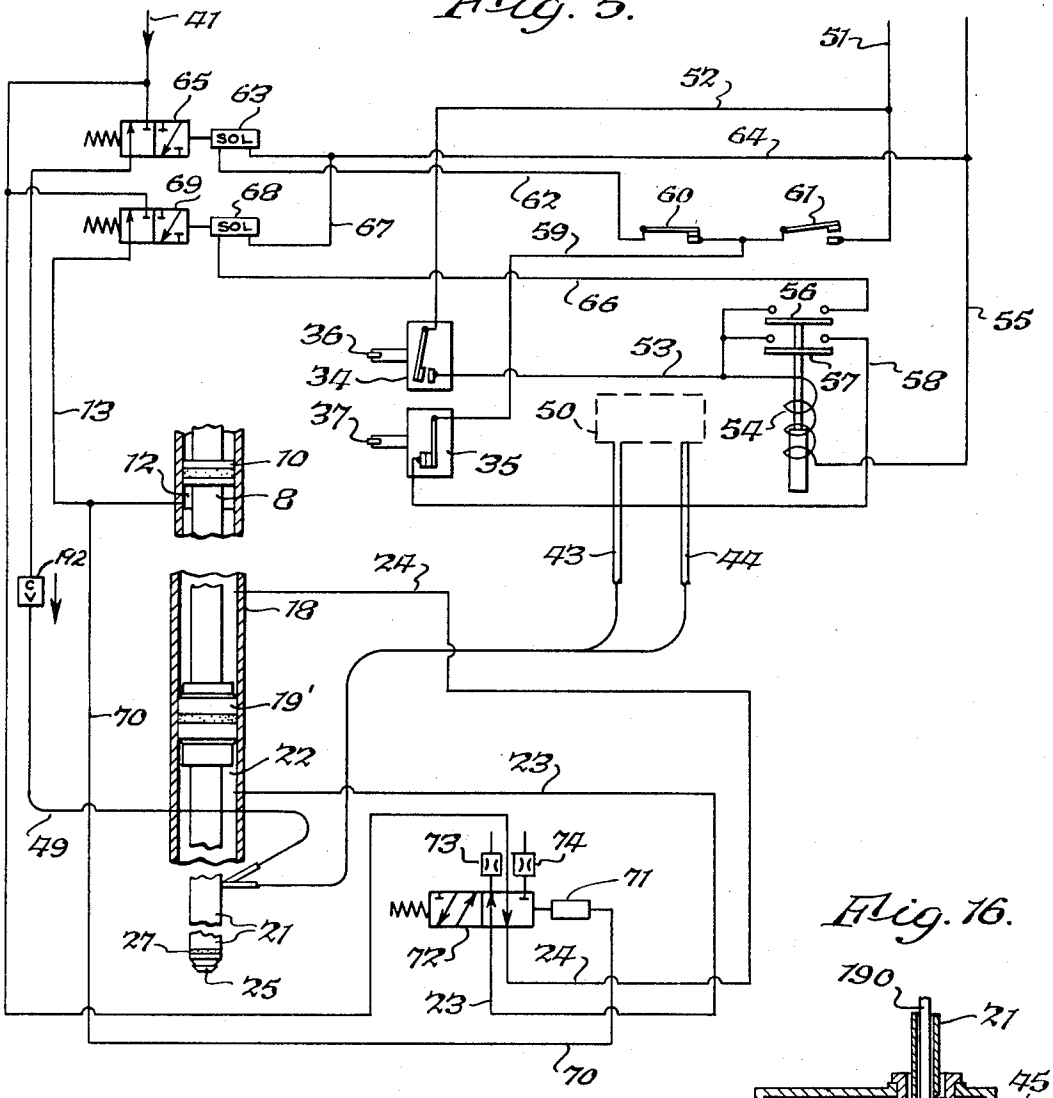


Fig. 16.

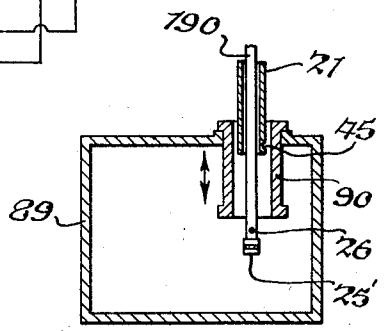
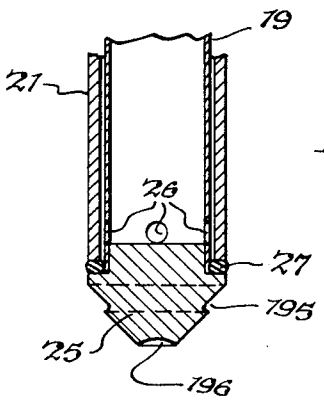


Fig. 4.



INVENTOR.
James H. Riesenberg.
BY
Christel + Bean
ATTORNEYS.

March 4, 1969 J. H. RIESENBERG 3,430,668

CONTAINER FILLING MACHINE HEAD

Filed Aug. 1, 1966 Sheet 3 of 3

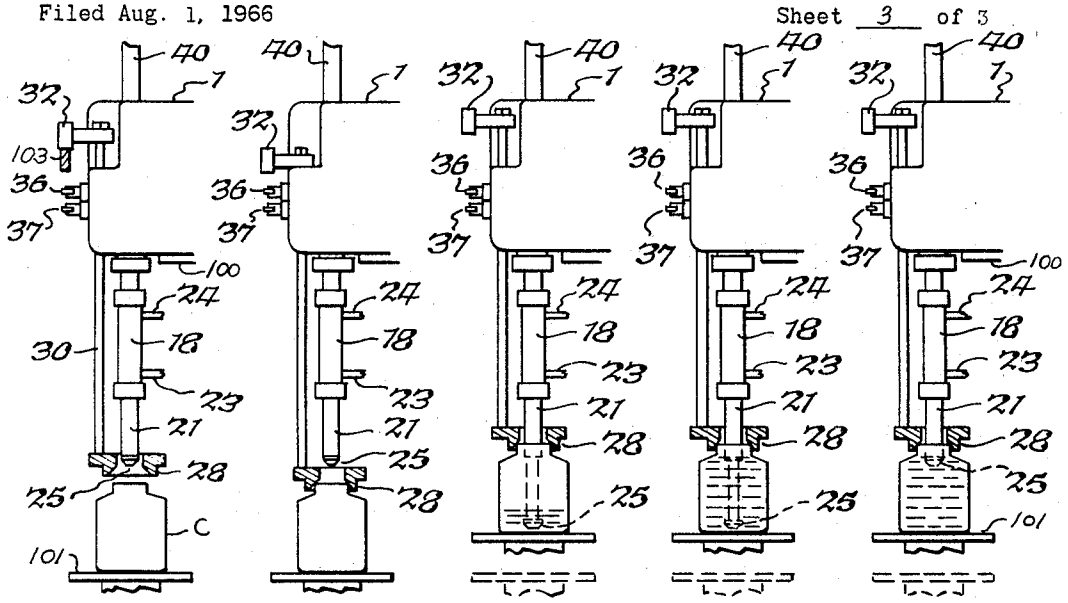


Fig. 6. Fig. 7. Fig. 8. Fig. 9. Fig. 10.

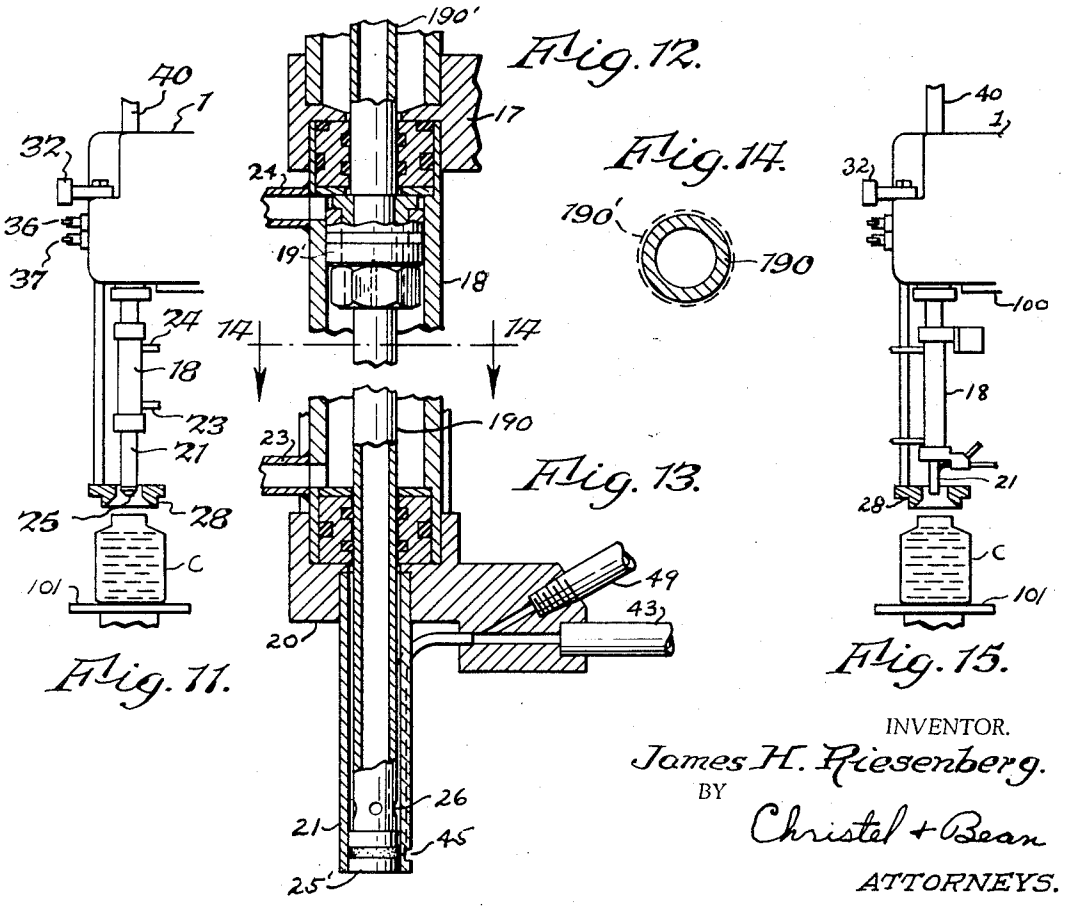


Fig. 12.

Fig. 14.

Fig. 13.

Fig. 11.

Fig. 15.

INVENTOR.
James H. Riesenberg.
BY
Christel + Bean
ATTORNEYS.

United States Patent Office 3,430,668 Patented Mar. 4, 1969

3,430,668

CONTAINER FILLING MACHINE HEAD

James H. Riesenberg, Amherst, N.Y., assignor to Consolidated Packaging Machinery Corp., Buffalo, N.Y.

Filed Aug. 1, 1966, Ser. No. 569,241
U.S. Cl. 141—198 9 Claims
Int. Cl. B65b *1/04, 1/30, 57/00*

ABSTRACT OF THE DISCLOSURE

Product level sensing means responsive to the rising level of product in a supported container are associated with a filling head having a filling stem with a product dispensing passage therethrough communicating with a product inlet passage through a product chamber. The filling stem is extended relative to the sensing means for submerged filling of a supported container, and is retractable into the product chamber for displacement of product therefrom through the stem to compensate for the displacement by the stem of product in a supported container.

This invention relates generally to the filling art, and more particularly to a new and useful product dispensing head for container filling machines.

In constant level filling it is desired to maintain a predetermined fill height as successive containers are filled with product. Often this presents several problem. For example, many products are packaged in containers which are formed of plastic or other yieldable material, making it difficult as a practical matter to effectively utilize positive pressure sensing systems because the pressure tends to distort the container. In my pending application Ser. No. 507,288 filed Nov. 12, 1965, for Contant Level Filling Machine, now Patent 3,385,328 issued May 28, 1968, I disclose a sonic sensing control arrangement which avoids this and other problems associated with vacuum and positive pressure sensing system.

However, another problem is presented when the filling stem is submerged in the product, which is desirable with many types of products. Some product in the container is displaced by the filling stem, and upon retracting the filling stem after the level of product in the container has reached the sonic sensing means, the product level will drop. This can be offset, when filling containers having a low fill height relative to the top of the container, by positioning the sensing means above the desired fill height a distance such that the product level drops to the desired fill height upon retracting the filling stem. However, this solution is not available when filling containers having relatively high fill heights.

Therefore, the submergible, contant level filling of high fill height, flexible wall containers presents a serious problem. The filling head of my invention solves this problem, and in addition is useful in a variety of other applications.

A primary object of my invention is to provide a submergible filling head having means dispensing, into a container which has been filled with product to the level of the sensing means, additional product in an amount proportional to the displacement of the product in the container by a submerged filling stem, automatically upon retraction of the latter. The additional product can equal to the amount displaced, or can be either a lesser or a greater amount where requirements permit.

In one aspect thereof, a container filling machine head constructed in accordance with my invention is characterized by the provision of a filling stem having a product dispensing passage therethrough, product level sensing means associated with the filling head and responsive to the rising level of product in a container being filled, a product inlet passage communicating with the product

dispensing passage through a product chamber, the filling stem being movable relative to the sensing means and being extended for submerged filling of a container, product flow control means responsive to the sensing means for interrupting the flow of product from the inlet passage into the product chamber, the filling stem being retracted into the product chamber for displacement of product therefrom through the stem to compensate for displacement of product by the stem in the container.

The foregoing and other objects, advantages and characterizing features of my invention will become clearly apparent from the ensuing detailed description of two illustrative embodiments thereof, reference being made to the accompanying drawings depicting the same wherein like reference numerals denote like parts throughout the various views and wherein:

FIG. 1 is a front elevational view of a container filling head constructed in accordance with my invention;

FIG. 2 is a view thereof partly in vertical section and partly in side elevation, being broken away for convenience in illustration;

FIG. 3 is a fragmentary vertical sectional view on an enlarged scale taken about on line 3—3 of FIG. 2;

FIG. 4 is a fragmentary vertical sectional view taken about on line 4—4 of FIG. 2;

FIG. 5 is a diagrammatic representation of the sonic sensing and electrical control circuit;

FIGS. 6–11 are generally schematic views showing successive relative positions of a container and the filling head of FIGS. 1–4;

FIG. 12 is a fragmentary vertical sectional view through the upper portion of a modified form of container filling head of my invention;

FIG. 13 is a corresponding view of the lower portion thereof;

FIG. 14 is a detail sectional view on an enlarged scale, taken about on line 14—14 of FIG. 12;

FIG. 15 is a schematic view corresponding to that of FIG. 11, but with the container filling head of FIGS. 12–14; and

FIG. 16 is a schematic, vertical sectional view showing the filling head of FIGS. 12–14 in use with a container having a retractable pour spout.

The filling head assembly of this invention is adapted for use in container filling machines, such as that shown in my aforesaid pending application Ser. No. 507,288. In the illustrative embodiment depicted in the drawings, each filling head comprises a housing 1 adapted to be mounted on the machine frame, a portion of which is shown at 100 in FIGS. 6–11 and 15, by any suitable means. A vertical tube 2 extends through housing 1 at its upper and lower ends, and a valve sleeve 3 is secured in the lower end of tube 2 as by a nut 4 threaded on the projecting lower end of tube 2 and bearing against a positionally adjustable stop ring 5 carried by sleeve 3. Several inlet openings 6 extend obliquely through the upper end wall of sleeve 3, the openings 6 being annularly arranged around a valve seat 7.

A tubular valve 8 is vertically reciprocable in a flanged sleeve 9 secured in the upper end of tube 2, under control of a piston 10 carried by valve 8 and adapted to be shifted upwardly against a return spring 11 under the influence of positive air pressure supplied to a chamber 12 between piston 10 and the lower end of sleeve 9 via inlet 13. Sleeve 9 and a flanged bearing guide 14 are secured in position as by a clamp nut 15 threaded on the upper end of tube 2.

A sleeve 16 extends downwardly from valve sleeve 3, to which it is fixed, and carries at its lower end a bracket 17 which is secured to the upper end of a cylinder sleeve 18. A tubular filling stem 19 extends through sleeves

16 and 18, bracket 17, a sensor bracket 20 and a sensing sleeve 21. Stem 19 is vertically reciprocable by a piston 19' mounted on stem 19 and movable therewith in cylinder sleeve 18 under the influence of positive air pressure supplied to the cylinder chamber 22 on opposite sides of piston 19' via inlets 23 and 24.

The lower end of filling stem 19 is closed by a plug 25, and a plurality of dispensing openings 26 (FIG. 4) are provided through the side wall of tubular stem 19 adjacent the plugged lower end thereof, for dispensing product whenever stem 19 is lowered or extended relative to sensing sleeve 21. In the retracted position shown in FIGS. 2 and 4, an O-ring seal 27 carried by plug 25 around stem 19 engages against the lower end of sleeve 21 to seal the dispensing route and prevent dripping of product from stem 19.

A centering bell 28 is carried by a yoke 29 for engaging containers adjacent the neck thereof to center the same relative to sensing sleeve 21, as shown in FIGS. 7–10. Yoke 29 is carried by a pair of rods 30 which are mounted in housing 1 for vertical reciprocation relative thereto, the upper ends of rods 30 carrying a crossbar 31 having a roller type cam follower 32 bolted thereto.

Housing 1 mounts a micro-switch assembly 33 containing a pair of switches 34, 35 having outwardly projecting, roller type actuating members 36, 37, respectively. Member 36 is adapted to be engaged and actuated by a retractible cam on the machine, indicated at 38 in FIG. 2, and member 37 is adapted to be engaged and actuated by a fixed cam also on the machine frame, as indicated at 39.

A product supply line is connected to the upper end 40 of inlet tube 8, and a high pressure air supply line 41 is connected to housing 1. A sensor control assembly housing 42 is mounted on housing 1, and sonic sensing tubes 43 and 44 extend therefrom to bracket 20. Extensions of tubes 43 and 44 extend downwardly from bracket 20 along sleeve 21, within the confines thereof, the tube extensions 43, 44 opening into a cavity 45 in the side wall of sleeve 21 at the lower end thereof. An electric supply conduit, not shown, is connected to sensor housing 42.

An air control valve assembly generally designated 47 is mounted on bracket 17, and brackets 17 and 20 are reinforced by means including tie rods 48. Sensor tube clearing supply lines 49 communicate therewith through bracket 20.

Referring now to the circuit diagram of FIG. 5, sonic sensing tubes 43 and 44 are connected to a transducer in the form of an ultrasonic, variable frequency generator-receiver 50 of a type known in the art. Such a transducer is available, for example, from Delavan Manufacturing Company of West Des Moines, Iowa, under the name "Sonac" whereby a detailed disclosure thereof is believed unnecessary. For further details, reference may be had to United States Patent 3,065,455. Tranducer 50 generates an ultrasonic signal of relatively low power having a frequency of 38,000 c.p.s. The signal thus generated is transmitted via one of tubes 43, 44 to cavity 45 where it is coupled to the receiver of transducer 50 via the other one of tubes 43, 44. As long as tubes 43, 44 are ultrasonically coupled at cavity 45 the filling operation continues as will be described. Transducer 50 is energized under control of the master switch, not shown, for the machine drive. When the sonic coupling through tubes 43, 44 is interrupted, as by the presence of liquid product in cavity 45, the signal is cut off and this is utilized in a manner to be described to stop filling operation.

Assume that a container C is present on a supporting tray 101 of the machine, in position to be filled. Centering bell 28, which has been held retracted by a cam 103 on the machine, as shown in FIG. 6, lowers and engages the container as shown in FIG. 7. Under these circumstances the actuating member 36 of start switch 34 is engaged by cam 38, closing switch 34. This completes an energizing circuit from a suitable source via leads 51 and 52, switch 34 and lead 53 to the coil of a relay 54 having a return connection via lead 55 to the source. When energized, relay 54 closes switches 56 and 57, the latter completing a holding circuit via lead 58, normally closed stop switch 35, lead 59 and switch 61 which is controlled by the sonic signal generator and receiver 50 and which closes before switch 34 opens.

Assuming that some product from a previous filling operation has adhered to the wall of cavity 45, blocking sonic coupling through tubes 43 and 44, switch 60 will be closed thereby completing an energizing circuit via leads 62 for solenoid 63. Solenoid 63, when energized, moves a valve 65 against a return spring to admit air from the high pressure conduit 41 through valve 65 and air lines 49 to each of sensing tubes 43, 44, to clear them of product. A separate clearing blast air line 49 is provided for each sensing tube. Once tubes 43 and 44 are cleared and sonic coupling is established therethrough, transducer 50 opens switch 60 and closes switch 61 to establish the aforesaid holding circuit. This occurs while cam 38 maintains switch 34 closed.

Simultaneously, an energizing circuit is completed via switches 35, 57 and 56, leads 66 and 67 to a solenoid 68 which then shifts a valve 69 against its return spring to admit positive pressure air from conduit 41 via conduit 13 to the chamber 12 below piston 10. This lifts the product inlet control valve 8 from its seat 7, whereupon product flows into the product chamber provided by tube 2 and sleeve 3 between filling stem 19 and inlet tube 8. High pressure air also passes via conduit 70 to a pilot valve 71 which shifts a valve 72 against its return spring to the position shown in FIG. 5, to admit high pressure air via conduit 24 to chamber 22 above piston 21, while exhausting chamber 22 below piston 21 via conduit 23. As a result, stem 19 is lowered, the container C and its supporting tray 101 having been raised, by any desired means not shown, relative to the filling head to position the lower end of sleeve 21 and cavity 45 in the neck of the container, as shown in FIG. 8. A controllable, regulated exhaust 73 is provided for controlling the rate of lowering.

Product is dispensed into the container as soon as stem 19 is extended relative to sleeve 21. Filling stem 19 is maintained submerged throughout the filling operation which continues until the product level in the container reaches the height of the sonic cavity 45, as shown in FIG. 9. When this happens, the sonic coupling through tubes 43 and 44 is interrupted, thereby discontinuing the aforesaid coupling signal. This causes switch 61 to open, and switch 60 to close, thereby interrupting the holding circuit for relay 54, whereby it opens switches 56 and 57, interrupting the energizing circuit to solenoid 68. Valve 69 is spring returned to the position shown in FIG. 5, opening the inlet valve chamber 12 to atmosphere and permitting spring 11 to shift valve 8 to its closed position. This interrupts the flow of product into the product chamber communicating with filling stem 19.

The return of valve 69 to its closed position also interrupts the supply of high pressure air to pilot valve 71, whereupon valve 72 is reversed by its return spring.

In its normal, spring biased position, valve 72 admits high pressure air from conduit 41 to chamber 22 below piston 19' via lead 23, while exhausting chamber 22 above piston 19' via lead 24, an adjustable, regulated exhaust 74 being provided for controlling the rate of retraction. As a result, stem 19 is retracted, from the position shown in FIG. 9 to that shown in FIG. 10 and in FIG. 4.

As stem 19 is retracted from the lower end of container C into cylinder sleeve 21, the upper end of filling stem 19 is moved into the product chamber previously defined, between the closed inlet 8 and the filling stem. This chamber has been filled with product, as a result of the immediately preceding filling operation. Therefore, product

is displaced from the chamber by the upper end of stem **19** through the stem and its discharge passages **26**, compensating for the removal of the stem from the product. If this were not done, the product level would drop below the desired height. Instead of that happening, however, it is a particular feature of my invention that as the stem is removed from the container after cessation of the filling cycle, it displaces additional product into the container, to compensate for the previous displacement of product by the stem when the latter was extended into the container.

In the embodiment of FIGS. 1–4, the displacement of product from the product chamber resulting from retraction of the filling stem is equal to the difference between the displacement of product in the container by the stem in its extended position of FIG. 9 and the displacement of product in the container by the stem in its retracted position of FIG. 10. As a result, the product level remains constant, at the sensing height, during retraction of the stem. Consequently, when the supporting platform or tray **101** lowers, the product level will drop slightly because of the displacement of product caused by the plug **25** at the lower end of the filling stem and the lower end of cylinder sleeve **21**. Thus, the sensing level of the filling head of FIGS. 1–4 will be slightly above the desired fill height.

In the form shown in FIGS. 12–14, the upper end of the filling stem **190** is arranged so that, upon retraction of the stem, it displaces from the product chamber an amount of product greater than that displaced by the lower end of the filling stem in its extended position, in a manner completely compensating for the product displaced by the filling stem and the lower end of the cylinder sleeve. While this can be accomplished in various ways, in FIGS. 12–14 it is accomplished by providing a greater volume of filling stem wall at its upper end **190'** than that provided at its lower end. This can be done by forming the lower end of the stem to provide a portion **191** of reduced wall thickness, this portion extending from the cylinder sleeve **21** to the lower end of the filling stem.

In the embodiment of FIGS. 12–14 the lower end of filling stem **19** is closed by a plug **25'** which is retracted into cylinder sleeve **21**, whereby once the filling stem has been retracted, only the extreme lower end of the sleeve **21** and filling stem plug **25'** are in the product. This lower extremity of the filling head displaces only a slight amount of product, whereby upon lowering the container C from the filling head the product level remains substantially at the sensing level. Of course, the sensing level can be at a height slightly above the desired product fill height, if necessary. Thus, in the embodiment of FIGS. 12–14 the greater total wall thickness at the upper end **190'** of the filling stem compensates for the lower end of the filling stem and for the plug **25'**, and indeed it also can compensate for product displacement by the lower extremity of the filling head when the stem has been retracted.

In operation, the embodiment of FIGS. 12–14 otherwise is identical with that of the embodiment first described. The circuit diagram is the same as shown in FIG. 5, and it will be noted that at least one of the sonic tube clearing lines has a check valve **192**, to preclude sonic coupling through these lines while permitting clearing air to pass therethrough to the sensing tubes. It will be appreciated that switches **60** and **61** can be actuated by any means such as a relay, not shown, energized by or under control of the sonic coupling signal.

The filling head can be constructed and arranged so that the additional product displaced from the product chamber upon retraction of the filling stem can be greater in amount than the product displaced in the container by the extended stem, its end plug and the lower end of the sensing sleeve, whereby the fill height will be above the sonic sensing level. This is useful, for example, in filling containers into the neck but with the sonic cavity positioned below the neck to avoid the problems incident to the increase in the rate of use as the product begins to fill the neck. It can be accomplished by increasing the size of stem portion **190'** relative to portion **190**.

In each instance, should there be no container C in position to be filled, the centering bell **28** lowers to an extreme position, below that shown in FIG. 7, and roller **32** or its attaching bolt engages a control mechanism for holding cam **38** retracted, whereby the filling cycle is not commenced. Also, cam **39** is positioned on the machine frame to engage switch actuator **37** at a point when the filling cycle has completed, to interrupt the aforesaid circuit should the sonic sensing means for any reason fail to operate.

It will be appreciated that the broken line representation of tray **101** in FIGS. 8–10 is solely for the purpose of showing that, in those positions, the container supporting tray has been elevated relative to the filling head.

The filling head of this invention is also useful in filling containers having pour spouts, as shown in FIG. 16. Here there is shown a container **89** having a pour spout **90** which can be extended and retracted in the direction of the arrow. To prevent splash-back, the product discharge must be below the spout **90**. However, the container must be filled to a level above the spout. That is readily accomplished with the filling head of my invention by positioning sonic cavity **45** at the desired fill height, with stem **190** being extended to position the dispensing outlets below the lower end of the retracted pour spout **90**.

Accordingly, it is seen that my invention fully accomplishes its intended objects. While I have disclosed and described in detail but two embodiments of my invention, that has been done by way of illustration only, without though of limitation.

Having fully disclosed and completely described my invention, and its mode of operation, what I claim as new is:

1. A filling head for a container filling machine having means for supporting a container to be filled, said filling head comprising a filling stem having a product dispensing passage therethrough, product level sensing means associated with said filling head, said sensing means being responsive to the rising level of product in a supported container, means providing a product inlet passage communicating with said product dispensing passage through a product chamber, means for extending and retracting said filling stem relative to said sensing means, said filling stem being extended for submerged filling of a supported container, and control means responsive to said sensing means for interrupting the flow of product from said inlet passage and retracting said stem, said stem being retractable into said chamber for displacement of product therefrom through said stem to compensate for the displacement by said filling stem of product in a supported container.

2. A container filling head as set forth in claim **1**, wherein said sensing means include sensing tube means carried by said filling head, and sonic generating means associated with said tube means for establishing a sonic circuit therethrough, said control means being responsive to interruption of said sensing circuit.

3. A container filling head as set forth in claim **1**, wherein upon retraction said stem displaces from said chamber an amount of product equal to the amount of product displaced by said stem when extended in a supported container filled with product to the level of said sensing means.

4. A container filling machine as set forth in claim **1**, wherein upon retraction said stem displaces from said chamber an amount of product less than the amount of product displaced by said stem when extended in a supported container filled with product to the level of said sensing means.

5. A container filling machine as set forth in claim 1, wherein upon retraction said stem displaces from said chamber an amount of product greater than the amount of product displaced by said stem when extended in a supported chamber filled with product to the level of said sensing means.

6. A container filling head as set forth in claim 1, wherein said control means includes an inlet valve operable to close said inlet passage against reverse flow of product from said chamber, whereby product is displaced from said chamber through said stem upon retraction of the latter into the former.

7. A container filling head as set forth in claim 1, wherein said means for extending and retracting said stem includes a fluid motor piston on said stem, said stem having an outlet portion on one side of said piston and an inlet portion on the opposite side thereof, said inlet portion of said stem being retracted into said chamber.

8. A container filling head as set forth in claim 7, wherein said control means includes a tubular inlet valve operable to close said inlet passage into said chamber, a fluid motor piston on said inlet valve, and fluid control means common to said pistons.

9. A container filling head as set forth in claim 1, wherein said filling stem has an inlet portion retracted into said chamber and an outlet portion which is extended for submerged filling of a supported container, the cross sectional area of said inlet portion being greater than that of said outlet portion.

References Cited

UNITED STATES PATENTS

786,621	4/1905	Beebe	141—279 X
2,512,966	6/1950	Quam	141—374 X
3,037,536	6/1962	Fechheimer	141—198 X
3,043,349	7/1962	Bennett	141—198 X
3,207,189	9/1965	Vergobbi	141—198 X

SAMUEL ROTHBERG, *Primary Examiner.*

E. J. EARLS, *Assistant Examiner.*

U.S. Cl. X.R.

141—260, 374