United States Patent [19]

Waxlax

[11] **3,862,708**

[45] **Jan. 28, 1975**

[54] **CONTAINER FILLING DEVICE WITH FLOW CONTROL**

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[73] Assignee: **Horix Manufacturing Company,** Pittsburgh, Pa.

[22] Filed: **Oct. 11, 1973**

[21] Appl. No.: **405,441**

[52] **U.S. Cl.** **222/444,** 138/30, 141/128, 222/386.5

[51] **Int. Cl.** **B67c 3/04**

[58] **Field of Search** 222/253, 386.5, 444; 141/128; 138/30

[56] **References Cited**

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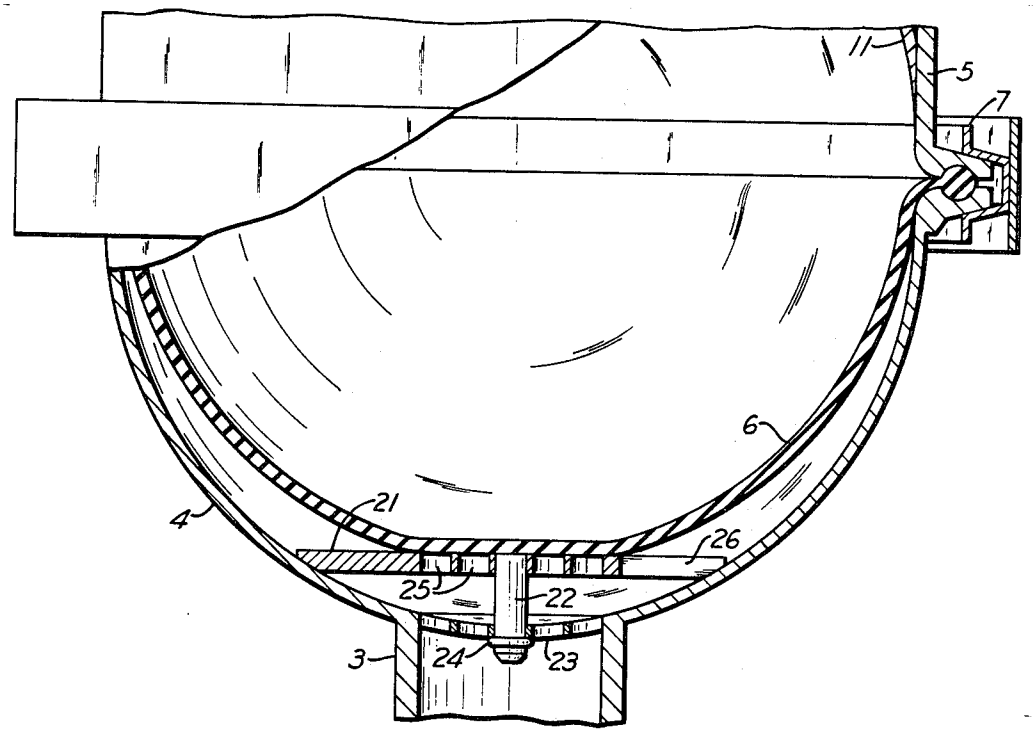
Assistant Examiner—Thomas E. Kocovsky
Attorney, Agent, or Firm—Brown, Murray, Flick and Peckham

[57] **ABSTRACT**

A measuring tank for a container filling machine has a central outlet opening in its bottom covered with a flow control member provided with holes through it for rapid flow of liquid to the outlet. The tank is divided by a resilient diaphragm into an upper air chamber and a lower liquid dispensing chamber. The device is provided with a restricted flow passage extending inwardly from the periphery of the flow control member. The upper chamber has an air inlet for stretching the diaphragm down into engagement with the flow control member to force liquid down through its holes and to then close them to reduce the rate of flow through the outlet opening. The restricted flow passage is in a position for continued flow of liquid through it after the holes have been closed by the diaphragm and until the lower chamber is emptied.

3 Claims, 6 Drawing Figures



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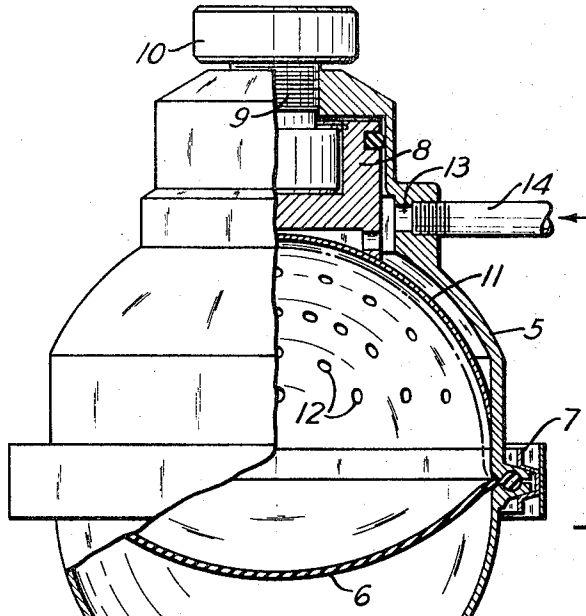

Fig. 1

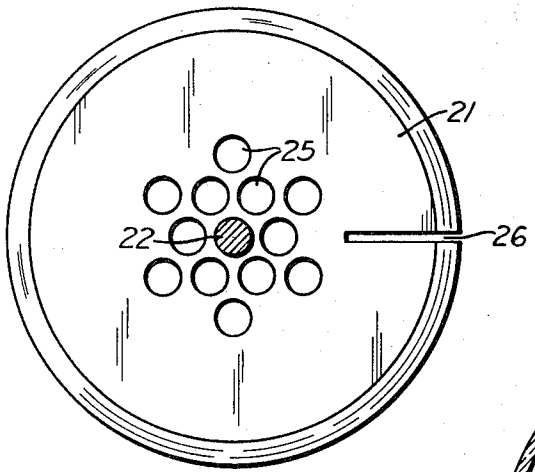

Fig. 2

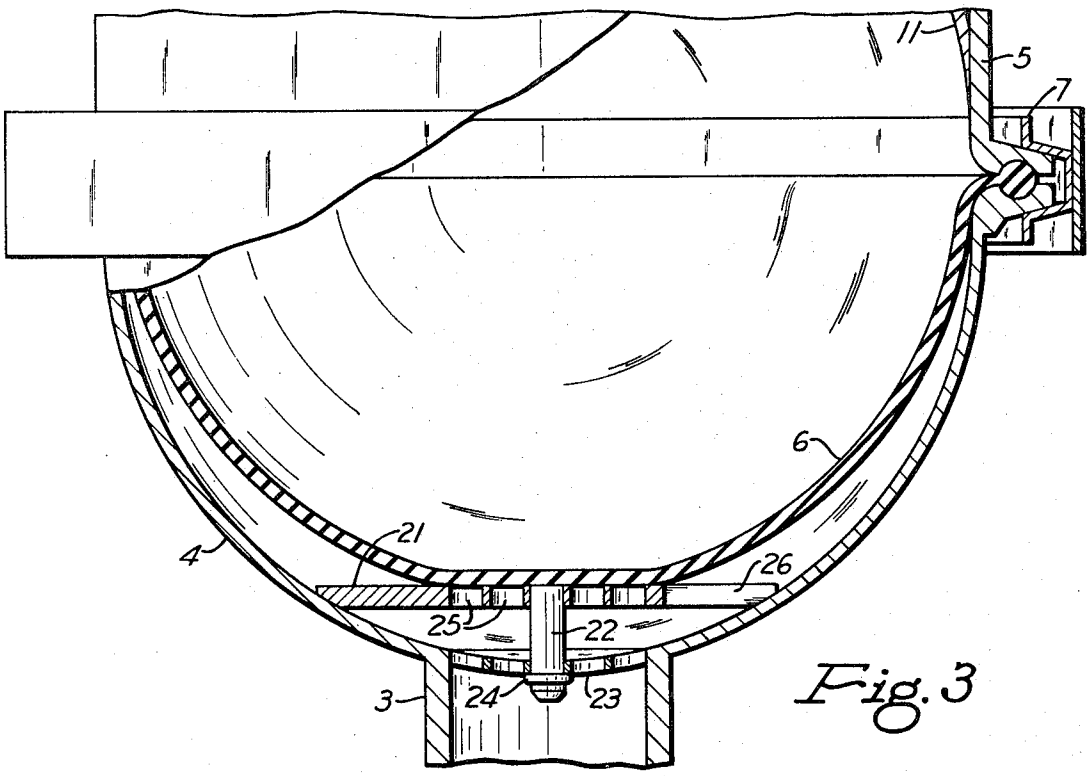

Fig. 3

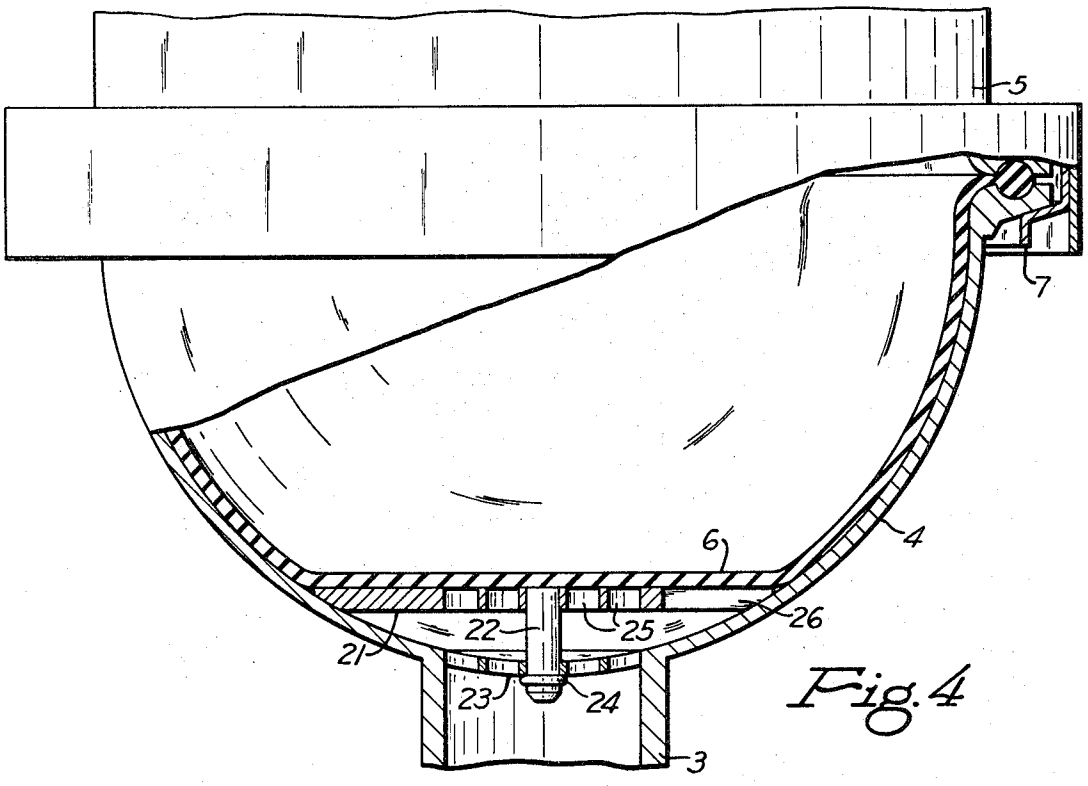

Fig. 4

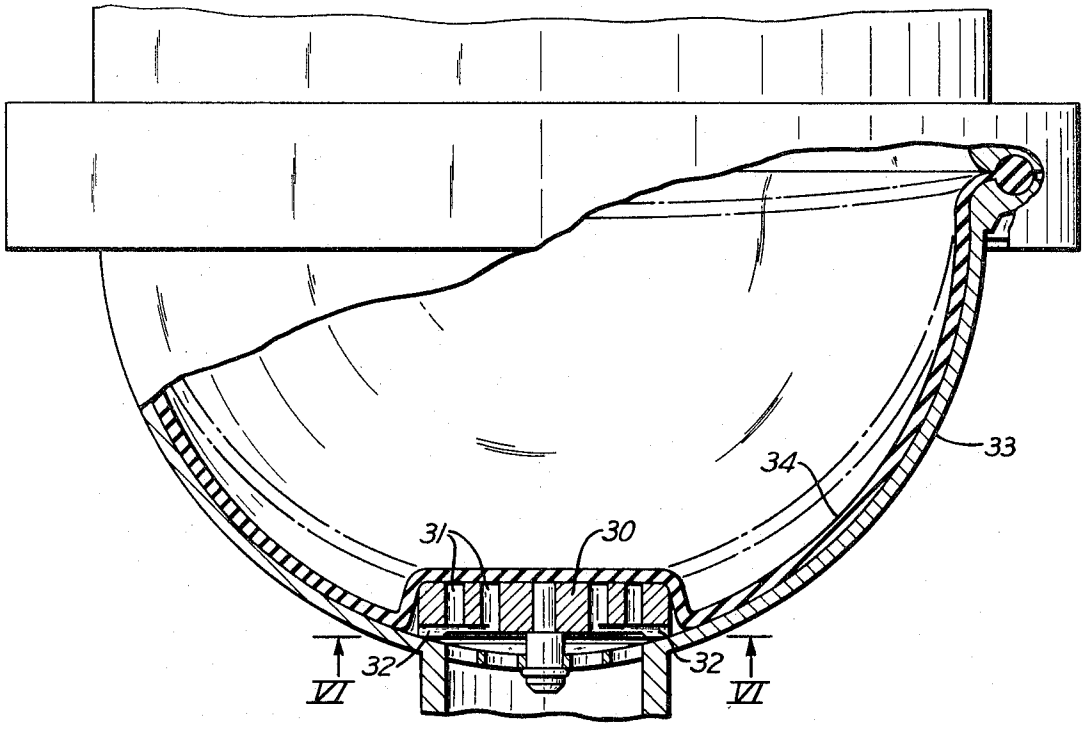

Fig. 5

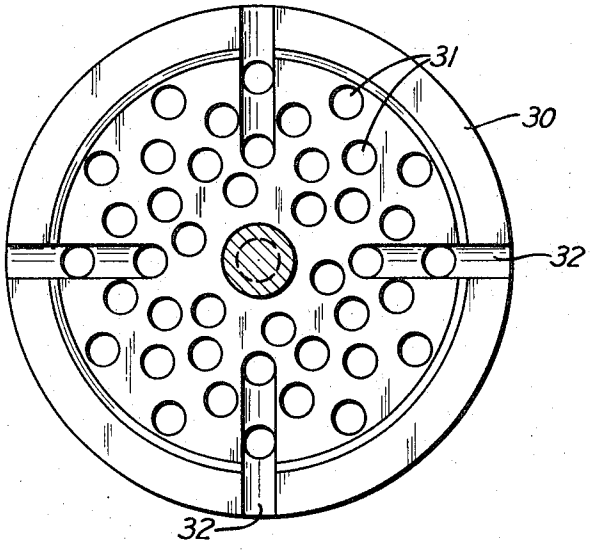

Fig. 6

CONTAINER FILLING DEVICE WITH FLOW CONTROL

In my U.S. Pat. No. 3,757,832 a container filling machine is shown that includes a number of hollow arms projecting radially from a central supply tank that is rotated continuously. Mounted on the outer ends of the arms are small measuring tanks, each of which has a diaphragm inside of it that is drawn upwardly by reduced air pressure to fill the tank with liquid product from the supply tank. Then the diaphragm is forced downwardly by air pressure to expel the liquid from the measuring tank in order to discharge it down through a filling tube into a container that is to be filled. For high production rates it is desirable to presure-fill containers in this manner as rapidly as possible, but if liquid enters a container at high velocity and does not slow down as the top of the container is approached, the high velocity is likely to cause some of the liquid to be expelled from the container.

It is therefore an object of this invention to provide a container filling device that can fill a container with liquid very rapidly without causing overflow.

This invention is illustrated in the accompanying drawings, in which;

FIG. 1 is a fragmentary vertical section through a container filling machine;

FIG. 2 is a bottom view of the flow control member taken on to line II—II of FIG. 1;

FIG. 3 is an enlarged fragmentary vertical section of the measuring tank showing the diaphragm in flow-retarding position;

FIG. 4 is a view similar to the preceding one, but showing the position of the diaphragm when the tank is emptied;

FIG. 5 is a view similar to FIG. 4 but showing a modification; and

FIG. 6 is an enlarged bottom view taken on to line VI—VI of FIG. 5.

The container filling machine of this disclosure may be similar to the one shown in my Pat. No. 3,757,832, the present invention being directed to the individual measuring tanks by which containers are filled with a predetermined volume of liquid product. As in my patent, there are a plurality of hollow horizontal conduit arms, only one of which is shown in FIG. 1. The right-hand end of the arm 1 receives liquid product from a continuously rotating central supply tank (not shown) to which the arm is connected and by which it is supported. The opposite or outer end of the arm has an opening in its top extending up through a boss 2 on which is rigidly mounted the lower end of a neck 3 around an opening in the bottom of a small tank, which is a volumetric measuring tank. The opening will be referred to herein as an outlet opening, although it serves periodically as an inlet opening also.

The tank preferably has a substantially hemispherical lower section 4, on which a dome-like upper section 5 is mounted. Between the two sections the edge of an elastic or resilient diaphragm 6 is clamped, the sections being held together by a clamping ring 7. The upper section has an upwardly extending central portion, in which a vertically movable plug 8 is disposed. The plug has a central threaded stem 9 that is screwed into an opening through the top of the tank. A hand wheel 10 is rigidly mounted on the projecting upper end of the stem to enable it to be turned in order to adjust the plug up and down. A hemispherical shell 11 may be secured

to the bottom of the plug, with its edge slidingly engaging a cylindrical portion of the side wall of the upper section of the tank. This shell is provided with a number of openings 12 to freely connect the inside of it with an opening 13 in the tank beside the plug. This last opening is connected by a pipe 14 and a suitable valve (not shown) alternately with a source of subatmospheric pressure and a source of air under pressure in order to reduce or to increase the air pressure in the air chamber above the diaphragm.

The diaphragm is elastic enough to be drawn upwardly into engagement with the inside of the shell 11 and to be forced down into engagement with the inner surface of the lower section of the tank. The vertical position of the shell 11 in the tank determines the distance that the diaphragm can be drawn upwardly, and consequently the capacity of the dispensing chamber below the diaphragm. That capacity is adjusted so that it will be only great enough to fill a single container with the desired volume or quantity of product, so after the tank has filled a container the tank must be refilled.

The bottom of the hollow arm 1 is provided with an outlet opening 16, normally closed by a valve 17, from which a filling tube 18 extends downwardly and into a container, such as a bottle 19. The measuring tank is filled from the central supply tank through the connecting arm. Liquid is drawn up into the tank by reducing the air pressure above the diaphragm in order to draw it up against the inside of shell 11, thereby causing liquid to flow out through the arm and up into the dispensing chamber. After the measuring tank has been filled in this way, air under pressure is supplied through pipe 14 to the tank above the diaphragm to force the latter down in order to discharge the liquid from beneath it, valve 17 having been opened in the meantime as shown so that the liquid will flow down through the filling tube and into the bottle to fill it. It is a feature of this invention that the bottle can be filled very rapidly, without overflow due to high velocity flow.

Accordingly, the meauring tank is provided with a flow control member covering the outlet opening in its bottom. This member permits most of the liquid in the tank to be discharged from it at a rapid rate, but then retards the flow of the last few ounces so that the uppermost part of the container receiving the liquid will be filled more slowly to avoid overflow. The flow control member may be a circular plate 21 that seats on the sidewall of the tank a short distance above the outlet opening as shown in FIG. 1. The center of the plate is provided with a downwardly extending stem or pin 22 that extends down through a perforated disc 23 secured in the upper end of the outlet opening. The lower end of the pin can be provided with an anular groove in which there is an O-ring or spring clip 24 to hold the pin and plate in place. As shown in FIG. 2, the central portion of the plate around the pin is provided with a number of holes 25 that will allow the liquid product to flow down through the plate rapidly. Extending from this central portion outwardly to the edge of the plate there is a radial slot 26, through which liquid also can flow from the dispensing chamber into the tank outlet.

OPERATION

In operation, after the dispensing chamber has been filled with liquid product as previously described, air under pressure is supplied to the tank above the diaphragm and forces it downwardly. The diaphragm in

turn forces liquid down through the holes and slot in the flow control plate **21** and out of the tank and into a bottle **19.** As long as the diaphragm does not touch the flow control plate the discharge of liquid from the tank is substantially unimpeded and bottle filling will be very fast. However, the center of the diaphragm will eventually engage the center of the plate and then the diaphragm will start to flatten out against the plate. This flattening starts at the center of the diaphragm and radiates therefrom and therefore closes the holes through the flow control plate, as shown in FIG. **3.** By the time all of the holes in the plate are closed by the diaphragm there are only a few ounces of liquid remaining to be discharged from the tank, and since this liquid can excape only through slot **26** in the plate the flow into the bottle is thereby greatly retarded. Consequently, the liquid rises slowly in the bottle neck and does not overflow it. In other words, the bottle is filled very rapidly for most of its height but filling is slowed down toward the end so that the entering liquid will not exert a force on the liquid below sufficient to cause the liquid to flow up and out of the top of the bottle. By the time the diaphragm has also closed slot **26,** it is in contact with the sidewall of the tank and the filling operation is completed, as shown in FIG. **4.** The valve **17** to the filling tube then is closed and the area in the tank above the diaphragm is subjected to subatmospheric pressure through pipe **14** to draw the diaphragm upwardly in order to fill the tank again with liquid product that will be discharged into the next bottle.

Instead of a thin flow control plate as just described, a much thicker plate **30** may be mounted in the tank in the same way, as shown in FIG. **5.** However, instead of having a slot extending through it at one side of the group of holes **31** through it, the bottom of the plate may be provided with one or more grooves **32** that extend inwardly from its edge towards its center as shown in FIG. **6.** One or more of the holes through the plate open into the inner end portion of each of these grooves. During filling of a container from the measuring tank **33,** the diaphragm **34** first forces liquid from the tank down through all of the holes and also inwardly through the grooves in the bottom of the plate. After the diaphragm engages the center of the plate it starts to flatten outwardly across the plate until it completely covers and thereby closes all of the holes. However, liquid continues to flow at a much slower rate from the area beneath the diaphragm around the plate inwardly through the grooves and to the outlet opening from the tank. This retarded flow continues until the diaphragm has folded down around the plate as shown in FIG. **5** and forced substantially all of the liquid out through the grooves.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A container-filling device comprising a measuring tank provided in its bottom with a central outlet opening, a resilient diaphragm mounted at its edge in the tank and dividing it into an upper air chamber and a lower liquid dispensing chamber, the side wall of said lower chamber curving downwardly and inwardly to said outlet opening, a separate flow control plate in said lower chamber covering said opening and seated at its edge on said side wall around the opening, said plate having a central stem extending down into said opening, the tank being provided with means extending across said outlet opening for anchoring said stem to hold the plate in place, the plate having holes through it for rapid flow of liquid through it to said outlet opening, the plate being provided with a restricted flow passage extending inwardly from its periphery for connecting said lower chamber with said outlet opening, and the upper chamber having an inlet for air under pressure for stretching the diaphragm downwardly and into engagement with said plate to force liquid down through said holes and to then close them to reduce the rate of flow through said outlet opening, said restricted passage being in a position for continued flow of liquid therethrough after said holes have been closed by the diaphragm and until the lower chamber is substantially emptied by the diaphragm.

2. A container filling device according to claim **1,** in which said restricted flow passage is a slot in the bottom of said plate extending inwardly from said edge.

3. A container filling device according to claim **1,** in which said holes are confined to the central portion of said flow control plate, and said restricted flow passage is a slot through said plate extending from said central portion outwardly to the edge of said plate.

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