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Waxlax

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[54] CONTAINER FILLING APPARATUS WITH LEVEL-SENSING SHUT-OFF

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[51] **Int. Cl.** **B65b 31/00**

[58] **Field of Search** 137/393, 403; 141/39–43, 59, 198, 214, 215, 225, 226, 156–162

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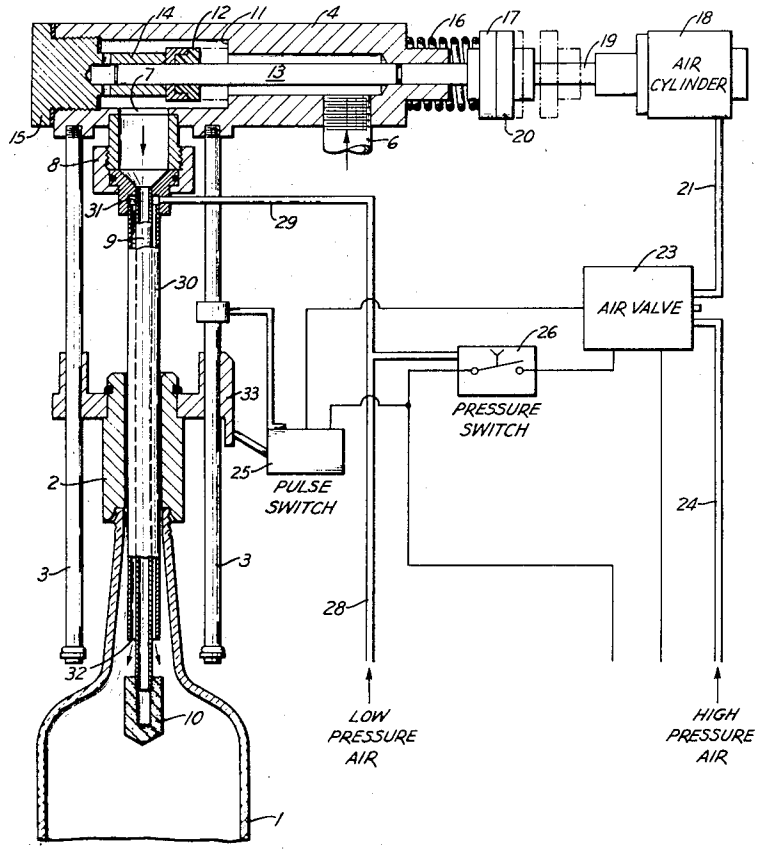
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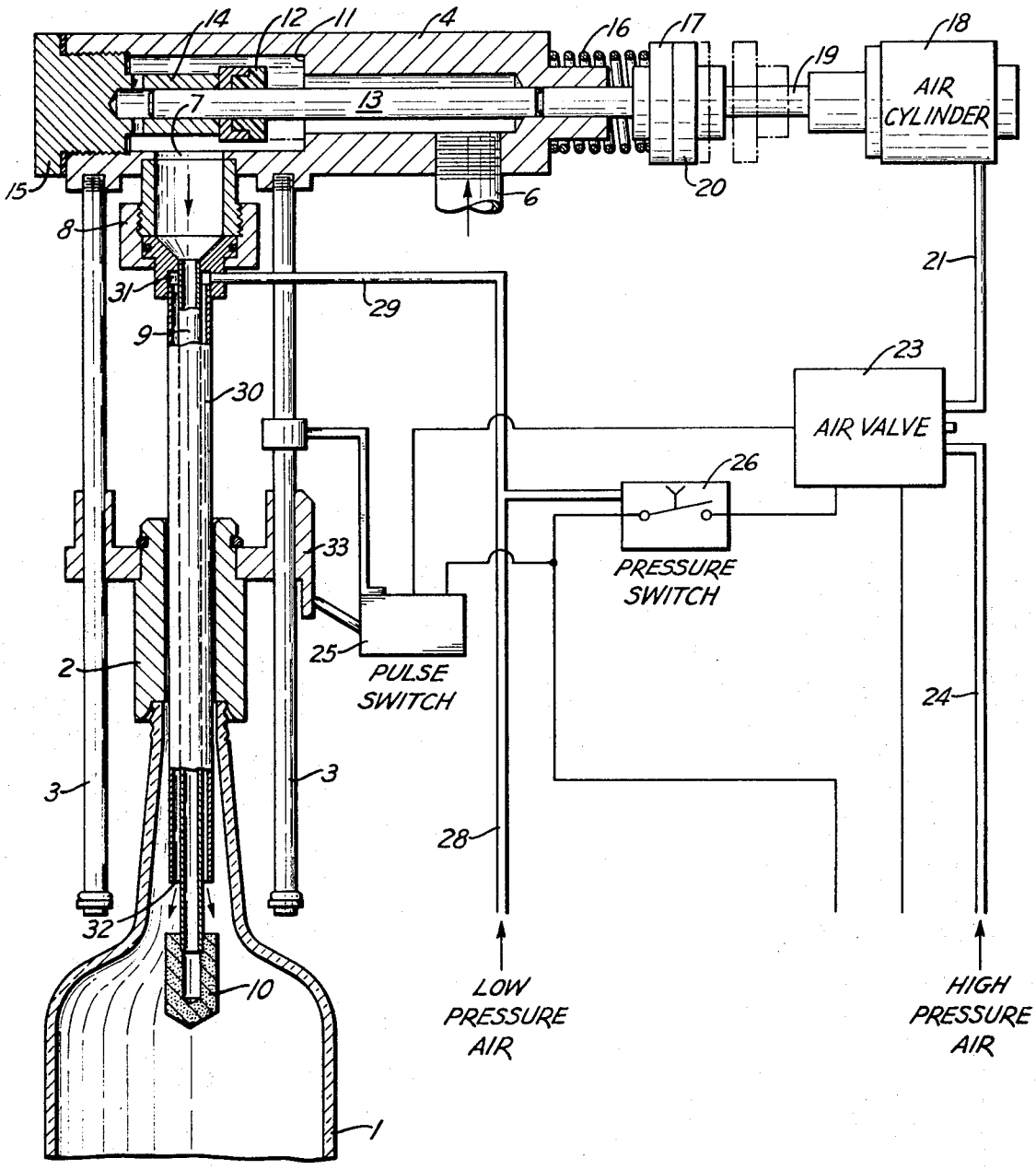
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[57] **ABSTRACT**

A container filling machine is provided with a vertical nozzle having an outlet at its lower end for discharging a liquid product into a surrounding container. Supply of the product to the upper end of the nozzle is controlled by a normally closed valve. A vertical level-sensing tube encircles the nozzle in spaced relation with it and has a lower end above the nozzle outlet. The upper end of the tube is connected with a source of air pressure to normally cause a stream of air to issue from the lower end of the tube intermittently or continually. There are means for closing the valve which are actuated by increase in air pressure in the sensing tube caused by liquid product in the container closing its lower end. The annular space between the nozzle and the encircling lower end of the sensing tube forms the tube outlet, and this outlet must be closed all around the nozzle by liquid product in the container in order for the air pressure in the tube to increase and cause the valve to close.

2 Claims, 1 Drawing Figure





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CONTAINER FILLING APPARATUS WITH LEVEL-SENSING SHUT-OFF

Automatic container filling machines must be provided with some means for shutting off the flow of liquid product into each container when it has been filled the desired amount. One way of doing this has been to connect a small vertical tube to the nozzle, with the lower end of the tube above the nozzle outlet and at the level above which the liquid in a container is not supposed to rise. A stream of air under low pressure normally flows continually out of the lower end of this level-sensing tube but, when the liquid in the container rises high enough to close the tube outlet, air pressure in the tube immediately starts to increase. The tube is connected with pressure-operated means, by which the liquid product valve is closed as soon as the pressure in the tube increases.

Such a liquid level control generally operates satisfactorily, but there are occasions when it does not. The sensing tube has a very small internal diameter and therefore a very small outlet. If the liquid that is introduced into the container rises quietly without any turbulence or foaming, the supply will not be shut off until the liquid level reaches the lower end of the tube. However, if there is turbulence or if the liquid is a type that foams as it is poured into the container, a drop of liquid may splash upwardly and close the lower end of the sensing tube momentarily before the general level of the liquid has risen that high. Since the increase in air pressure that will cause the product valve to shut off the liquid supply is very slight, even a drop of liquid momentarily occluding the outlet of the tube will cause the valve to close. The container, in such a case, therefore leaves the machine without the desired amount of liquid in it.

It is an object of this invention to provide liquid level sensing apparatus of the type just discussed, in which the sensing tube will not prematurely shut off filling of containers.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which the single FIGURE is a fragmentary vertical section of a single filling station of a container filling machine while a container is being filled, with some parts shown in elevation or diagrammatically.

The type of container filling machine with which this invention is most useful is the kind in which several filling stations are spaced circumferentially around a center post. At each station a container **1** is raised in a well known manner to cause its open upper end to first engage a guide **2** slidably mounted on vertical rods **3,** and then to move the guide up the rods a predetermined distance. Above the guide and supporting the rods there is a radial arm **4** supported from the rest of the machine in any suitable manner and movable in a circle around the axis of the center post. The arm is hollow and is provided near one end with an inlet connected to a pipe **6** that delivers liquid product to the arm from a tank carried by the machine. The opposite end of the arm has an outlet **7** in its bottom between rods **3.** This outlet is connected by a suitable coupling **8** to the upper end of a vertical nozzle **9** that is long enough to extend down into the container **1** that is being filled with the product. The lower end of the nozzle has an outlet, which may be simply an opening or a porous tip **10.** Between the inlet and the outlet of arm **4** there is a vertical valve seat **11** that normally is closed by a

movable valve member **12** rigidly mounted on a rod **13** that extends out through the inlet end of the arm, in which the rod is slidable. The inner end of the rod is slidably mounted in a sleeve **14** forming part of the closure plug **15** for that end of the arm. The valve rod is urged outwardly to close the valve by means of a coil spring **16** compressed between the end of the arm and a head **17** on the end of the rod.

For opening the valve, an air cylinder **18** is spaced from the outer end of the valve rod and contains a piston urged away from the arm by a spring inside the cylinder. The piston rod **19** extends toward the valve rod and is provided with a head **20.** When air pressure is delivered to the outer end of cylinder **18** through an air line **21,** the piston rod head engages the valve rod head and pushes the valve rod into the arm which opens the valve as shown. When air pressure is released from the cylinder, the spring inside of it retracts the piston to its normal position.

Air is admitted to and released from cylinder **18** by means of an electrically operated air valve **23,** to which high pressure air is delivered through a line **24** from a suitable source. This valve normally connects the air cylinder with the atmosphere, but when the valve is actuated to its other position it connects the high pressure air line to the cylinder. To operate the valve for this purpose, an electric pulse switch **25** is electrically connected with it. The switch may be supported from one of the vertical rods **3.** Among the various types of air valves that can be used, a satisfactory valve is the Magnelatch valve manufactured by the Skinner Electric Valve Division of Skinner Electric Industries, Inc., New Britain, Conn. When this valve is energized by a pulse of electric current, it assumes a latched position in which it is held by a permanent magnet until unlatched by the subsequent closing of another electric circuit. This second circuit contains a normally open pressure switch **26.** In its latched position, valve **23** connects the high pressure air line with the cylinder. In its unlatched position, the valve releases the air from the cylinder so that the product valve **12** can close.

To provide the air pressure for closing switch **26,** an air line **28** leads from it to a source of low pressure air. The line has a branch **29** leading to the upper end of a level-sensing tube **30** extending downwardly from the coupling **8.** As long as the outlet at the lower end of the sensing tube is open and air is supplied to its upper end, a stream of low pressure air will issue from the tube and the pressure in it will not be great enough to affect the pressure switch. However, it is nearly great enough for that purpose so that if the lower end of the sensing tube is closed, the immediate build up of pressure in the tube and the air line **20** feeding it will close the pressure switch at once and cause it to unlatch the air valve **23** so that filling will stop.

It is a feature of this invention that the air valve will not be reversed prematurely to close the product valve before the liquid has risen to the desired height in a container. Accordingly, contrary to the practice heretofore, the sensing tube **30** is large enough in diameter to encircle the nozzle and be spaced from it. The upper end of the tube opens into an annular chamber **31** in the coupling around the upper end portion of the nozzle. This chamber is connected with the air line **29** that leads to the pressure switch. Since the outlet **32** of the sensing tube is formed by the space between its lower end and the nozzle, the outlet is annular and extends all

around 'the nozzle. When a container is raised up around the nozzle and the lower end portion of the sensing tube, a lateral projection **33** on the guide **2** closes the pulse switch **25** and thereby causes the product valve **12** to open so that liquid can pour into the container. The liquid will rise in the container until the upper surface of the liquid closes the outlet of the sensing tube, which immediately causes the pressure switch **26** to close so that the product valve likewise will close.

Since the outlet **32** of the sensing tube extends all around the nozzle, splashing or foaming of drops of liquid up into the tube outlet will not close the tube momentarily nor cause an appreciable increase in air pressure inside of it. Therefore, the pressure switch will not be affected and the product valve will remain open until the liquid rises around the nozzle to a level where it closes the tube outlet all around the nozzle. Only then will the air pressure in the sensing tube increase sufficiently to close the pressure switch. The result is that all containers will be filled to the same level.

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. In a container filling machine, the combination with a vertical nozzle provided at its lower end with an outlet for discharging a liquid product into a surrounding container, a normally closed valve for controlling supply of the product to the upper end of the nozzle, and means operated by movement of a container into filling position for opening said valve; of a vertical level-sensing tube encircling said nozzle in spaced relation therewith and having a lower end above the nozzle outlet, means for connecting the upper end of said tube with a source of air pressure to normally cause a stream of air to issue from the lower end of the tube, and means for closing said valve actuated by increase in air pressure in the sensing tube when liquid product closes its lower end and stops said air stream, the annular space between the nozzle and the encircling lower end of the sensing tube forming the tube outlet, whereby air pressure in said tube will not increase until its outlet is closed all around the nozzle by rising liquid product.

2. In a container filling machine according to claim **1**, said valve opening and closing means including (a) a pneumatic cylinder operatively connected with the normally closed product valve, (b) an electrically operated air valve connected to the cylinder, (c) means operated by said movement of a container into filling position for actuating the air valve to deliver air pressure to the cylinder for opening said product valve, (d) a normally open electric pressure switch connected with the air valve, and (e) means connecting the sensing tube with the switch for closing it when said increased air pressure in the tube occurs, the air valve being designed to release air pressure from the cylinder when the switch is closed.

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