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Cox

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[54] **CONTAINER FILLING CONTROL**

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[52] **U.S. Cl.** **141/46;** 141/140; 141/198; 137/803

[51] **Int. Cl.²** **B65B 31/00;** B65B 57/14

[58] **Field of Search** 141/44, 45, 95, 140–144, 141/156–162, 40, 43, 46, 90, 91, 198; 137/803

[56] **References Cited**

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3,589,410 6/1971 Manas 141/45

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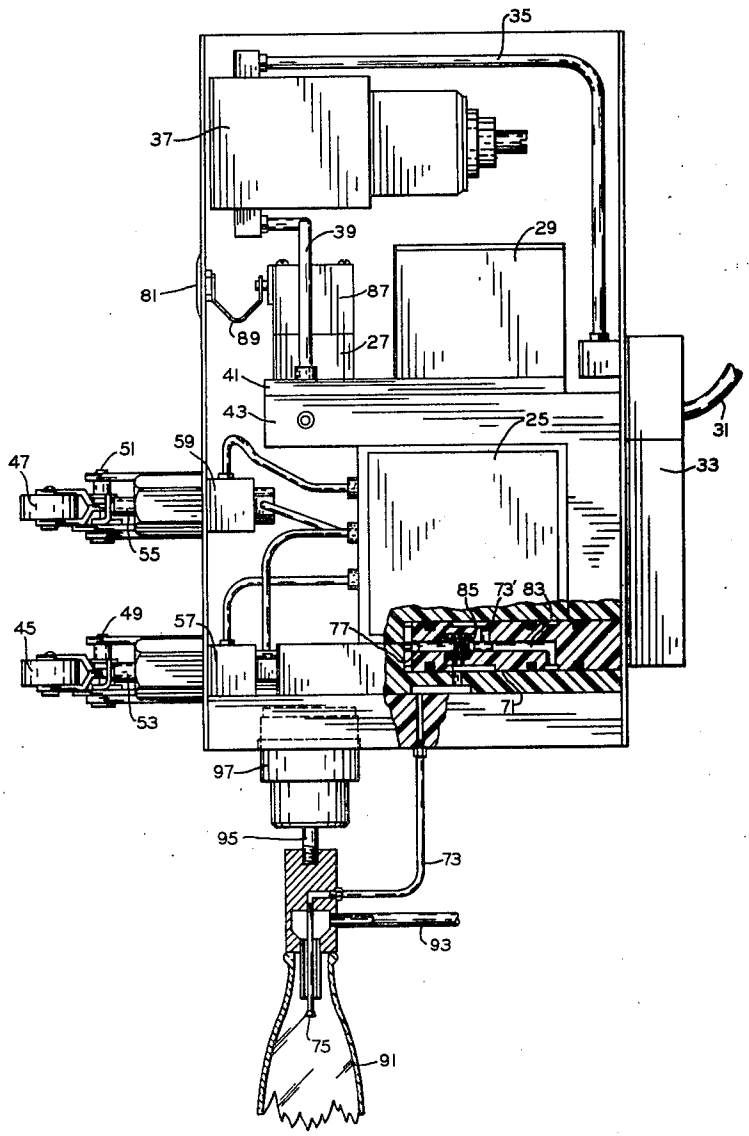
[57] **ABSTRACT**

A control unit for a container filling operation wherein the control unit moves with the container past a plurality of processing stations at least one of which is a filling station is disclosed. Fluid valves and a fluid logic circuit provide the control both to initiate and stop the filling operation and to purge a "full" sensor after each filling operation.

12 Claims, 2 Drawing Figures



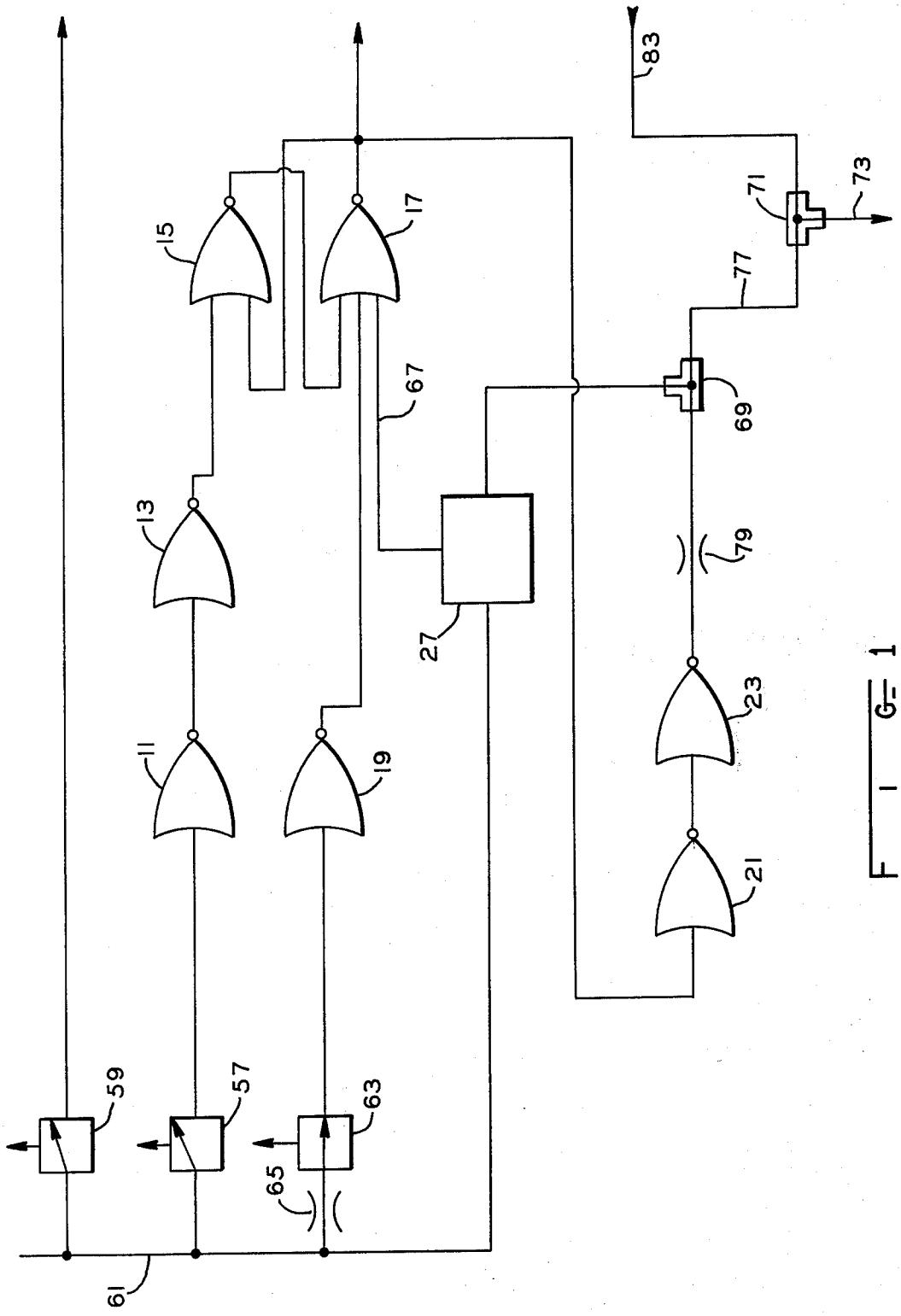


FIG. 1

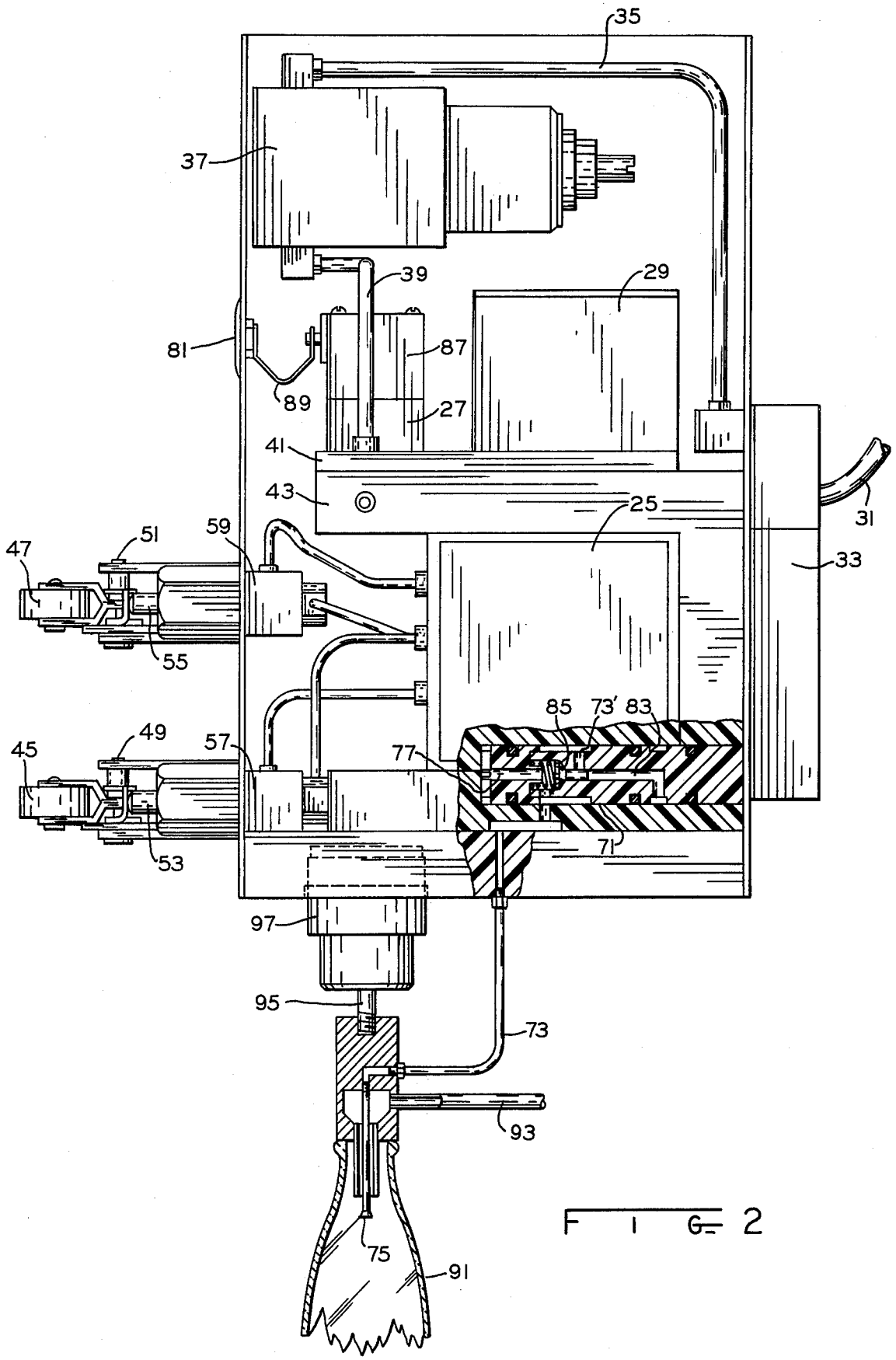

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FIG 2

CONTAINER FILLING CONTROL

BACKGROUND OF THE INVENTION

The present invention relates to a control unit for a processing operation such as a container filling operation and more particularly to such a control unit which moves from processing station to processing station with the product being processed. In an exemplary preferred environment the control unit controls a container filling operation where containers are presented to an indexing turntable at a first turntable station from a conveyor and ultimately passed to a second conveyor from the turntable at a second turntable station. Intermediate these first and second stations are other stations such as container filling, capping and labeling stations. The control unit is fastened to the turntable and one control unit is provided for each turntable location capable of accepting a container. Thus the processing stations are a series of fixed locations with the turntable supporting several containers and also supporting several control units, one for each container with the turntable being indexable to sequentially present a container and a corresponding control unit to each of the processing stations sequentially.

Prior art container filling machines have been plagued with problems including the difficulty of sensing accurately when such containers are filled and equipment failures causing an entire production line to be "down" due to the malfunction of but a single part.

It is accordingly a general object of the present invention to provide a more reliable container filling control unit.

A general object of the present invention is to provide a fluidic control unit which moves with a product being processed.

SUMMARY OF THE INVENTION

The foregoing as well as numerous objects and advantages of the present invention are achieved by providing a fluidic control unit having a first fluid valve actuated by a protruding member at a station to indicate arrival of the control unit at that station, a second fluid valve actuated by the container to provide one valve condition for example valve open when a container is present and another valve condition for example valve closed when no container is present and a fluid logic circuit having inputs coupled to the valve so as to provide an output signal indicating when both the container is present and is at a selected station. The fluid logic circuit output actuates a fluid actuable relay for initiating and terminating the filling operation. The filling operation is terminated when the air pressure in a line coupling a low pressure air source to a sensor extending into the container exceeds a predetermined value and thereafter the sensor is purged by a high pressure air source before again being used to sense a filling operation.

It is therefore another object of the present invention to provide a fluidic control system for a processing operation thereby eliminating the need for an excessive number of connections to the control unit.

Yet another object of the present invention is to more accurately sense when a container filling operation should be terminated.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of the specification. My invention itself, however, together with further objects and advantages thereof may best be understood by reference to the following description taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic diagram illustrating the input valve and fluid logic circuitry of the present invention; and

FIG. 2 is a partially broken away side view of a control unit embodying the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The fluid logic circuit depicted in FIG. 1 includes numerous NOR gates **11, 13, 15, 17, 19, 21** and **23.** These NOR gates may be individual fluid logic devices or may be a multi-gate unit **25** of FIG. 2 such as the "visi-logic" manufactured by Double A Products Company of Manchester, Michigan manufactured under U.S. Pat. No. **3,610,274.** The fluid logic circuit of FIG. 1 also includes an amplifier **27** and supplies an output signal to a relay **29** such as a "Flicr" valve which like the amplifier **27** and the multi-gate unit **25** is available from the Double A Products Company.

Considering FIGS. 1 and 2 simultaneously, air under pressure is supplied to the control unit through line **31** and after passing through an air filter **33** is supplied by way of line **35** to a pressure regulating device **37** to provide a well regulated air source for the logic system. This regulated air supply is then conveyed to the multi-gate unit **25** and other elements of FIG. 1 by way of line **39,** port plate **41** and manifold block **43.**

The control unit has a pair of rollers **45** and **47** supported on arms pivotable about the pins **49** and **51** respectively. When the unit moves past some protruding means at one of the stations, this protruding means will engage one of the rollers moving that roller to the right as viewed and depressing either plunger **53** or plunger **55.** These plungers, in turn, control the open or closed status of valves **57** and **59** respectively.

The valve **57** of FIG. 1 provides a so-called "fill" instruction when its roller **45** is depressed. The valve **57** is normally blocking and the "fill" instruction occurs when the valve is opened to allow air from the supply line **61,** which may for example be around **4** p.s.i., to pass to the input of NOR gate **11.** When NOR gate **11** receives an input signal its output (also an air flow) is disabled so that NOR gate **13** now no longer receives an input and its output is enabled to supply air to one input to NOR gate **15.** It will be noted that the same signal is present at the output of NOR gate **13** and the input of NOR gate **11** and thus functionally the valve **57** could be coupled directly to the input of NOR gate **15,** however, in some situations the presence of these two concatenated NOR gates provides a better regulation of the air flow input to the NOR gate **15.**

When roller **45** is depressed to indicate that a fill operation should take place, valve **57** closes providing an input to NOR gate **15** and thus the output of that NOR gate **15** is disabled. NOR gates **15** and **17** are coupled together with the output of each forming one input to the other and the pair constituting a sort of flip-flop circuit. Receipt of the fill instructions will at least allow the possibility of the output of NOR gate **17** being enabled to supply air to the output line since at least one

of its inputs is disabled. Another input for NOR gate 17 is determined by the status of the "no bottle present" valve 63. When a bottle is present, air from the supply passes through a resistor 65, through the valve 63 which is open when the bottle is present thus disabling the output of NOR gate 19 and insuring that at least two of the inputs to NOR gate 17 are disabled or a logical zero. If there is also no air signal on line 67, the NOR gate 17 will supply an output signal to the relay 29 initiating the filling operation and also supplying a signal to the concatenated pair of NOR gates 21 and 23, thus providing a well-regulated air flow from the output of NOR gate 23 through resistor 79 to a simple T connection 69, and through the fluidic valve 71 into the neck of the container by way of line 73. This air flow continues during the filling operation and when the container contents get close to the end 75 of the sensor conduit 73 the air flow will be restricted raising the air pressure in line 77 and increasing the air flow into amplifier 27. When this pressure exceeds a predetermined value (selectable by the sensitivity adjustment 81 of FIG. 2) a signal is supplied on line 67 to an input of NOR gate 17. This disables the output of NOR gate 17 and therefore also disables the fluid actuable relay 29 and stops the container filling operation.

At a station subsequent to the filling station having a protruding member for actuating the valve 59 to indicate arrival of the unit at that subsequent station, valve 59 is closed to enable relay 29 to supply air at a high pressure, for example, 60 p.s.i. to line 83 which by way of fluidic valve 71 functions to purge the sensor 75 of any residual material from the filling operation. Fluidic valve 71 should function to prevent the high pressure purge from feeding back into the logic circuit and the manner of accomplishing this is illustrated in FIG. 2.

A spring loaded valve plunger 85 is normally biased by that spring toward the right and in the position illustrated so that the low pressure air coming into the valve on line 77 may slip past the plunger and into conduit 73' which connects to the conduit 73. When high pressure air is applied to the line 83 the plunger 85 is forced to the left so that its right most end clears the passageway 73' allowing the high pressure air to purge the sensor and simultaneously blocking the line 77 so that none of the high pressure air gets back into the logic circuit. Of course, when the high pressure air is removed the plunger is forced by the spring back toward the right for a new sensing operation.

A more conventional fluidic valve may be substituted for the valve 71, however, energization of the relay 29 to commence the filling operation may induce transients in the purge portion of that relay which transients would be transmitted to the sensor circuit giving a false full indication and shutting off the fill operation. This may be overcome by introducing a surge control in the purge line or by employing the presently illustrated valve 71 which has sufficient inertia to prevent the transient from triggering the sensing system. In selecting such a more conventional valve, it must also be recognized that the pressure in the line subsequent to the resistor 79 is quite low and the fluidic valve 71 should present a minimum restriction to fluid flow therethrough.

Several further features of the control unit will now be readily understood from the foregoing discussion. The commercially purchased amplifier 27 is coupled to the sensitivity adjustment 81 by a gear box 87 and an interconnecting clip 89 which allows fine adjustment of the threshold where the amplifier provides a signal on line 67 to stop the filling operation. The actual material to be supplied to a container 91 is provided by way of a flexible conduit 93 and the outer one of the coaxial conduits which extend into the container. Both of these conduits are inserted into and removed from the container by movement of the shaft 95 of an air operated cylinder 97 which is controlled by the fluid actuable relay 29. The port plate 41 and manifold block 43 have numerous passageways therein to effect the connections depicted in FIG. 1.

In summary, the control unit has a pair of conduits adapted to extend into a container with the first conduit 93 for supplying material to the container and the second conduit 73 terminating in the sensing end 75 for sensing when the container is filled to a preferred level. This second conduit receives air at a relatively low pressure perhaps less than one pound per square inch from a low pressure air source such as the NOR gate 23 so that the air conveyed from the source through this sensing conduit may have its pressure sensed and inhibit the container filling operation when that sensed air pressure exceeds a predetermined value. The pressure of the source should be of the same order of magnitude as the change to be sensed and in a pressure of ⅛ inch of water was used. Fluid valves sense when the control unit is at a filling station and a container is present and fluid logic circuitry initiates the filling operation when both of these conditions are fulfilled. Thus, while the present invention has been described with respect to a specific embodiment, numerous modifications will suggest themselves to those of ordinary skill in the art. For example, the container filling operation may have only the fill and purge stations with capping and labeling occurring later in the process. Other types of logic elements and valves might be substituted and the control unit need not necessarily be limited to use in a container filling operation. Accordingly the scope of the present invention is to be measured only by that of the appended claims.

I claim:

1. In a container processing system wherein a container to be filled and a control unit individual to that container are both moved past a plurality of processing stations including at least a container filling station, an improved fluid logic control unit comprising:

a first fluid valve adapted to be actuated from one of its open and closed conditions to the other by means at the container filling station to indicate arrival of the control unit at that station;

a second fluid valve adapted to be actuated from one of its opened and closed conditions to the other by the presence of a container with its associated control unit for inhibiting the filling operation in the event that no container accompanies the control unit at the container filling stations;

a fluid logic circuit having at least one output and inputs coupled at least to said first and second valves, said fluid logic circuit providing an output signal indicating when both the container is present and the container is at the container filling station; and

fluid actuable relay means coupled to the fluid logic circuit output for initiating the filling operation when the fluid logic circuit provides an output signal.

2. The control unit of claim 1 further comprising a sensor for sensing when the container is filled to a desired level and for providing a signal to a fluid logic circuit input to disable the fluid logic circuit output signal and therefore also disable the fluid actuable relay means and stop the container filling operation.

3. The control unit of claim 2 further comprising a third fluid valve adapted to be actuated by means at a station subsequent to the filling station, and means responsive to actuation of the third fluid valve for purging the sensor of any residual material from the filling operation.

4. The control unit of claim 2 wherein the sensor comprises a fluid conduit extending into the container, a low pressure air source forcing air through the conduit into the container, and means monitoring the pressure of the air passing into the conduit for providing a disabling signal to a fluid logic input when the pressure exceeds a predetermined value.

5. The control unit of claim 13 wherein the fluid logic circuit comprises a plurality of NOR gates, a first of which receives an input from the first fluid valve and a second of which receives an input from the second fluid valve, means coupling the output of the first NOR gate to an input of the second NOR gate, means coupling the output of the second NOR gate to an input of the first NOR gate, and means coupling the output of the second NOR gate to the fluid actuable relay.

6. The control unit of claim 5 further comprising a sensor for sensing when the container is filled to a desired level and for providing a signal to an input of the second NOR gate to disable the fluid logic circuit output signal and therefore also disable the fluid actuable relay means and stop the container filling operation.

7. The control unit of claim 6 further comprising a third fluid valve adapted to be actuated by means at a station subsequent to the filling station, and means responsive to actuation of the third fluid valve for purging the sensor of any residual material from the filling operation.

8. The control unit of claim 6 wherein the sensor comprises a fluid conduit extending into the container, a low pressure air source for forcing air through the conduit into the container, and means monitoring the pressure of the air passing into the conduit for providing the disabling signal to a fluid logic input when the pressure exceeds a predetermined value.

9. A fluid logic control unit for a container filling operation comprising:

a pair of conduits adapted to extend into a container to be filled, the first conduit for supplying material to the container and the second conduit for sensing when the container is filled to a preferred level;

a low pressure air source;

means for conveying air from the source through the second conduit and into the container including means for sensing the air pressure in the conveying means; and

fluid logic means coupled to the sensing means for inhibiting the container filling operation when the sensed air pressure exceeds a predetermined value.

10. The control unit of claim 9 further comprising means for purging the second conduit of any residual material subsequent to each filling operation.

11. The control unit of claim 10 wherein the means for purging comprises a high pressure air source and a fluidic valve, the valve output being coupled to the second conduit, the high pressure air source being coupled to one valve input, and the low pressure air source being coupled to the other valve input.

12. The control unit of claim 11 wherein the fluidic valve comprises a spring loaded valve normally biased by the spring to pass air from the low pressure source to the second conduit and responsive to the presence of air of a higher pressure at the high pressure source input to pass air from the high pressure source through the conduit and to prevent the passage of air from the low pressure through the conduit.

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