United States Patent

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[54] **PNEUMATICALLY CONTROLLED DISPENSING SYSTEM**
5 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **222/36,** 222/70, 222/71
[51] **Int. Cl.** **B67d 5/22**
[50] **Field of Search** 222/38, 36, 26, 70, 59, 17, 20; 137/119, 624.14; 251/230

[56] **References Cited**
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ABSTRACT: The invention provides a pneumatically controlled dispensing system wherein the strokes of an air-operated fill pump, which is adapted to deliver a predetermined amount of fill material on each directional stroke, are sensed and a flow valve at a fill station is thereby controlled, which dispensing system comprises: (a) air-operated signal means for sensing each stroke of said pump and for producing an air pulse corresponding to each air pulse corresponding to each said stroke; (b) air-operated counter means for counting each air pulse produced by said signal means for producing an air pressure response signal after receiving a predetermined number of said air pulses; (c) flow valve means movable between a first and a second position for directing the flow of fill material delivered thereto from said pump between a first and a second outlet line; and (d) actuator means operated by said response signal of said counter means for moving said valve means between said first and second positions.

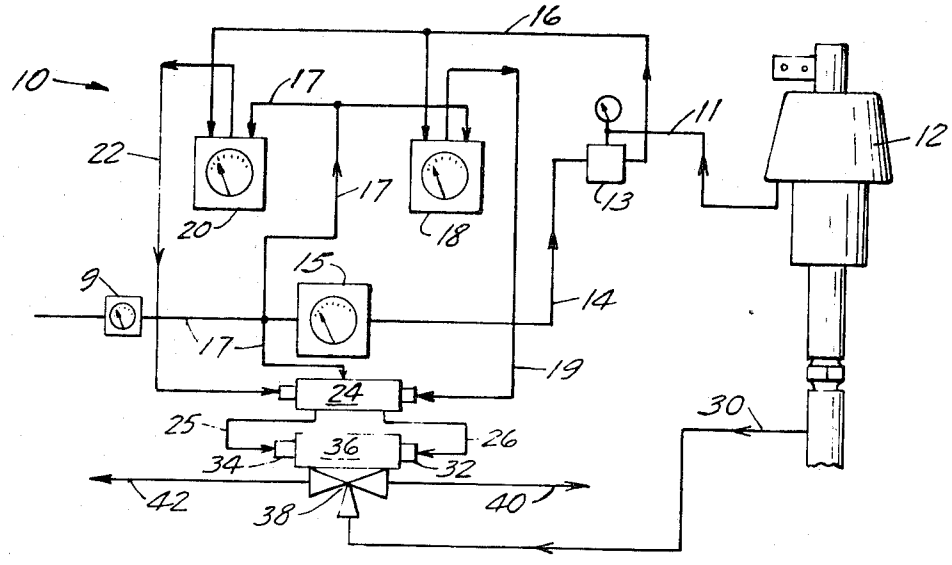


FIG. 1

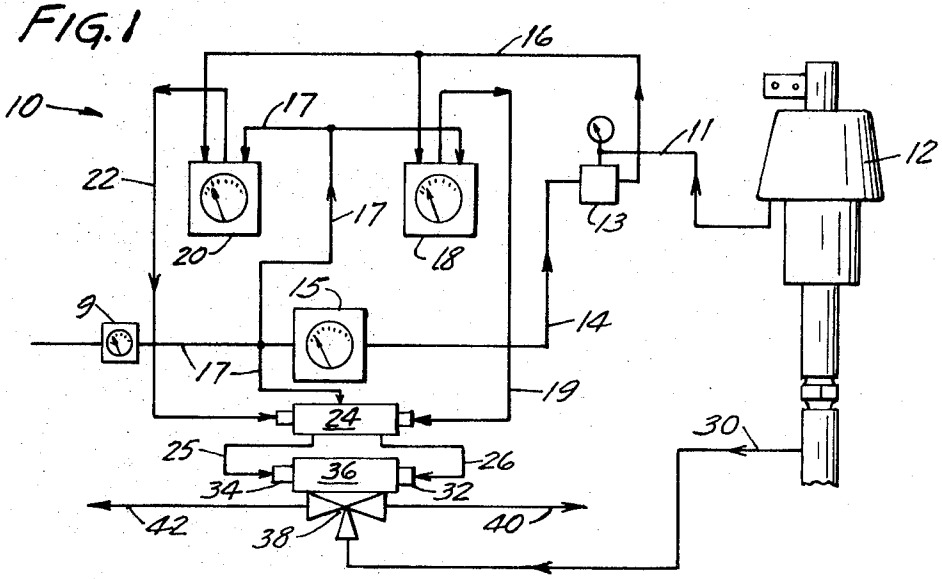


FIG. 2

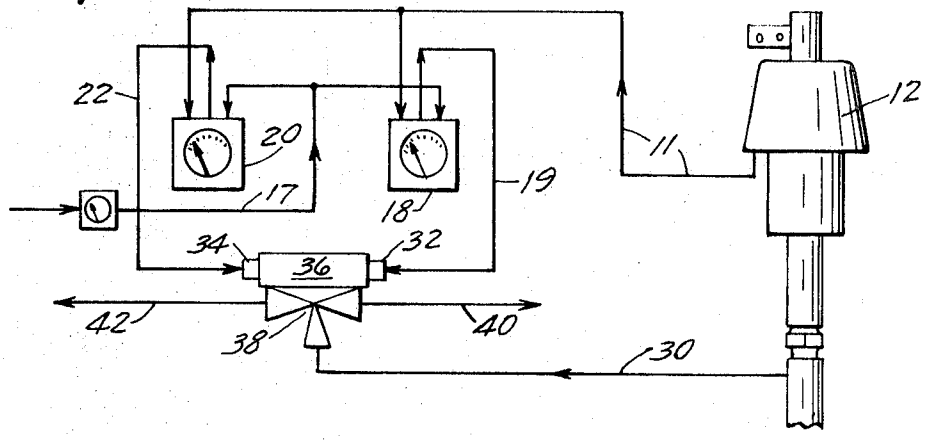
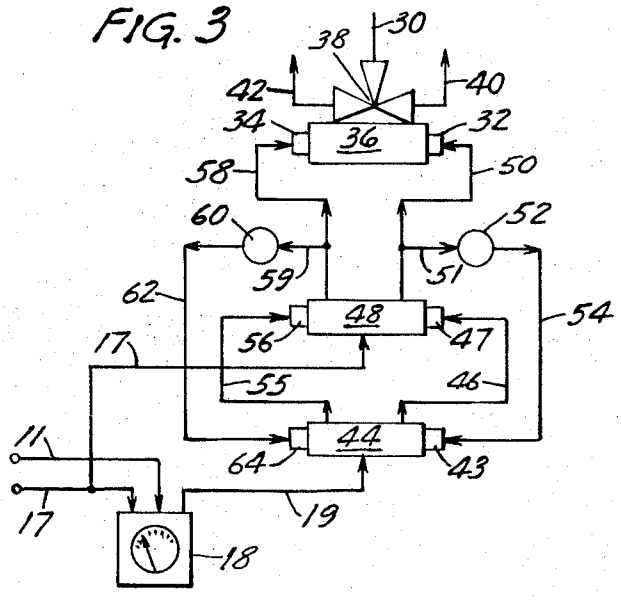


FIG. 3



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PNEUMATICALLY CONTROLLED DISPENSING SYSTEM

This invention relates to an inexpensive pneumatically controlled dispensing system in which the strokes of an air-operated fill pump are sensed and thereafter high-pressure air pulses are produced in such a manner that they control the switching of a follow valve to allow continuous filling of containers by the air-operated fill pump.

BACKGROUND OF THE INVENTION

It is common for numerous types of viscous materials to be sold in cartridge form as well as in other small containers. For example, adhesives, caulking compounds, greases, etc. are often sold in a cartridge form after being filled by the manufacturer. Heretofore, the filling of cartridges with such viscous materials has been accomplished either with expensive automatic filling machines or by simple pneumatic filling systems which are manually controlled.

Since many of these fill materials contain some amount of solvent, the system used for dispensing the fill material into cartridges must not generate any sparks so that fire hazards are reduced to a minimum. Therefore, whenever any type of electrical systems are used for the dispensing of fill material or for controlling the filling of cartridges and containers, elaborate precautions, such as explosion-proof housings, must be used. Consequently, the cost of electrically controlled filling systems may become prohibitive.

Some have used simple pneumatic filling systems. and since the system is pneumatic, no elaborate precautions need be taken in order to prevent a fire hazard. However, such pneumatic filling systems are not automatic, but rather require manual control of valves whereby the filling system is shutdown when one cartridge or container is full in order to replace the full cartridge or container with an empty one. As a result, manual filling systems are slow. Such filling systems are also inefficient because it is difficult to accurately control the exact amount of fill material dispensed into a container.

SUMMARY OF THE INVENTION

The invention provides an inexpensive pneumatic control system for use with an air-operated fill pump wherein the control system senses the number of strokes of the air fill pump and thereby automatically controls an actuator for a flow valve in a fill line so that when one cartridge or container at a first fill line receives a predetermined amount of fill material the flow valve is actuated so as to direct the follow of fill material to an empty cartridge or container at a second fill line which will be filled without stopping the operation of the said fill pump.

The dispensing of fill material is, therefore, automatic because cartridges and other containers may be filled on a continuous basis. The operation of the filling system requires only that filled cartridges or containers be replaced with empty containers while the system is filling an empty container. There is no need to stop the flow of fill material from the pump during the operation of the system because the flow valve is actuated automatically to fill another container when one container is full. Thus, cartridges and containers may be filled at a rate which is as fast as the fill pump can deliver the fill material. Because the entire filling system, including the control system, is pneumatic, no fire hazards are presented.

Thus, there is provided an inexpensive, automatic dispensing system for filling cartridges or other containers with fill material which may contain solvent. The system may be used where completely automatic systems are too expensive or cumbersome, and it may be used in areas where fire hazards are presented due to the presence of solvents. The system is also quite efficient in that a metered, predetermined amount of fill material is delivered to each container, and the automatic switching of fill material from one container to another minimizes spills and waste. The system is capable of controlling the amount of fill material delivered to each container within an accuracy of about 99 percent.

In one embodiment of the invention there is provided a pneumatically controlled dispensing system wherein the strokes of an air-operated fill pump, which is adapted to deliver a predetermined amount of fill material on each directional stroke, are sensed and a flow valve at a fill station is thereby controlled to direct Xa predetermined amount of fill material seriatim to a first and a second outlet line. The dispensing system comprises: (air-operated signal means for sensing each stroke of said pump and for producing an air pulse corresponding to each said stroke; (b) a first and a second air-operated counter means for counting each said air pulse produced by said signal means, wherein said first counter produces a first air pressure response signal after receiving a predetermined number of said air pulses and said second counter is adapted to produce a second air pressure response signal spaced from said first air pressure response signal by one-half the number of said predetermined number of said air pulses; (c) flow valve means movable between a first and a second position for directing the flow of fill material delivered from said pump between a first and a second outlet line; and (d) actuator means operated by said first and second air pressure response signals of said first and second counter means for moving said valve means between said first and second positions.

In another embodiment there is provided a pneumatically controlled dispensing system wherein the strokes of an air-operated fill pump, which is adapted to deliver a predetermined amount of fill material on each directional stroke, are sensed and a flow valve at a fill station is thereby controlled to direct a predetermined amount of fill material seriatim to a first and a second outlet line. The dispensing system comprises: (a) air-operated signal means for sensing each stroke of said pump and for producing an air pulse corresponding to each said stroke, (b) air-operated counter means for counting each said air pulse produced by said signal means and for producing an air pressure response signal after receiving a predetermined number of said air pulses, (c) flow valve means movable between a first and a second position for directing the flow of fill material delivered from said pump between a first and a second outlet line, and (d) actuator means operated by said response signal of said counter means for moving said valve means between said first and second positions.

The invention will be described in more detail herein after with reference to the accompanying drawings wherein like reference characters refer to the same part throughout the several views and in which:

FIG. 1 shows a schematic diagram of one embodiment of the invention;

FIG. 2 shows a schematic diagram of another embodiment of the invention; and

FIG. 3 shows a schematic diagram of still another embodiment of the invention.

Referring first to FIG. 1, there is shown generally a schematic diagram of a pneumatic control system **10** connected to an air-operated fill pump of the type which uses an air cylinder motor which is alternately driven in two directions by air pressure to effect the pumping action of the pump. The pneumatic control system receives an air signal from the air-operated fill pump **12** through air line **11**. The air signal so received by the control system corresponds to one directional stroke of said fill pump. Said air signal may be simply taken from the air exhaust of the motor on the fill pump or it may be produced by a separate air valve, e.g., the pump could be adapted to trigger an air valve on each directional stroke. The air signal may be amplified, or increased in pressure, by passing it through a valve **13**. Valve **13** is supplied with a fairly constant air pressure between the range of 40–60 p.s.i. through an air line **14** from air regulator **15** which in turn is fed by air line **17** feeding plant air supply pressure in the range between 60–125 p.s.i., as controlled by regulator **9**, to the regulator **15**. The valve **13** is of a common type which allows relatively low pressure air to work a diaphragm connected to a valve in a relatively high pressure air line. As a result, the low pressure air may exert

enough force to cause the valve in the high pressure airline to open momentarily. A typical such valve is one sold by Humphrey Products under model number 250AL. The valve **13** therefore produces an air pulse of relatively high, i.e., 40 –60 p.s.i., air pressure corresponding to each air signal received from the pump **12**.

The reason for passing the air signal from the fill pump through valve **13** and increasing its pressure to 40–60 p.s.i. is because the particular counters described below will not register an air pulse whose pressure is below 40 p.s.i. When using counters which will register air pulses of less than 40 p.s.i., or when operating the fill pump at a pressure above 40 p.s.i., it is not necessary to amplify the air signal received from the fill pump in order to have said signal or pulse registered by the counter.

Air line **16** transports this high pressure air pulse, whether it is produced by valve **13** or is taken directly from the pump, to each of two counters **18** and **20**. Each of the two counters is connected to a high pressure (60–125 p.s.i.) air supply line **17**. Each of the counters registers each said air pulse delivered to it and accumulates the count information. Typical pneumatic counters useful in the practice of the invention are those sold by Humphrey Products under model number SAC –24. Upon the receipt by a counter of the last of a predetermined number of air pulses, the counter opens an internal valve which momentarily connects air line **17** to an exit line; the exit line for counter **18** is line **19**, and the exit line for counter **20** is line **22**. As soon as a counter supplies a high-pressure air signal through the exit line, the counter resets itself for another cycle.

The two counters are staggered (offset) so that one counter trips or opens the high-pressure air line **17** after receiving a predetermined number of air pulses (measured by twice the number of strokes of the fill pump which are needed to fill a container) at a time when the other counter has received only one-half the required amount of said predetermined number of air pulses. Generally, the result of using the two counters in the manner just described is that the first counter supplies an air pressure signal at the same moment that one container has received a predetermined amount of fill material from the fill pump. This air pressure signal controls the switching of a flow valve from a first position to a a second position so that fill material coming from the pump will be directed toward a second container. When this second container receives a predetermined amount of fill material, the second counter will supply an air pressure signal which will control the switching of the flow valve back to its first position. A more specific description follows.

When an air pressure signal is sent by counter **18** through exit line **19**, it is received at a pilot valve **24** which may be any of those pilot valves well known in the art. Valve **24** is fed also by the exit line **22** from counter **20**, and is also fed by high-pressure air (60–125 p.s.i.) through line **17**. Said air pressure signal is received by one end of valve **24** through air line **19** and actuates valve **24** so as to allow the high-pressure air coming from line **17** to pass through valve **24** out the exit line **26**. This high-pressure air is received by actuator valve **36** at end **32** and actuates the three-way ball valve **38** so that fill material coming from the fill pump is directed toward outlet line **40**. Typical actuator valves which are useful in the practice of the invention are those sold by Contromatics Corporation in their 4,000 Series. Useful three-way ball valves are those available from Contromatics in various models and sizes. When valve **24** receives a high air pressure signal from counter **20** through line **22**, the valve **24** is actuated so as to allow the high pressure air from line **17** to pass through valve **24** to the exit line **28**. This high-pressure air is received by actuator valve **36** at end **34** and actuates the three-way ball valve **38** so that fill material is directed toward outlet line **42**.

Each counter is set so as to send an air pressure signal to an actuator valve after receiving a predetermined number of air pulses from the fill pump. The predetermined number of air pulses is actually equal to twice the number of directional strokes of said pump which are required to fill a container, but because the counters are offset, the overall effect is that one counter controls the switching of the flow valve to one outlet line and the other counter controls the switching of the flow valve to the other outlet line, and the flow valve is switched each time a container receives a predetermined amount of fill material. The counters thus are alternately controlling the flow valve.

The air-operated fill pump from which the air signals are received by the control system is a pump which is adapted to deliver a predetermined amount of fill material per stroke. A common type of fill pump is one sold under the trade designation "Graco" which is made by the Gray Co. Xand which is fitted with a stroke adjustor. A common such stroke adjustor is made by A. G. Barstow Company under model number 1,675. A preferred pump is a model 10 : 1 Bulldog, useful for pumping very viscous material. The stroke adjustor allows one to predetermine the amount of fill material delivered on each directional stroke of the fill pump. The amount of fill material delivered with each directional stroke of the air-operated pump is important because the counters must be set so as to produce a high air pressure signal upon the receipt of a predetermined number of air signals. The high air pressure signals produced by the counters eventually determine when a flow valve is to be switched from one container to another so it is imperative that the counter produce this high air pressure signal at the required time so that the flow of fill material is directed from a full container to an empty container without stopping the operation of the air fill pump.

Referring next to FIG. 2 there is shown a schematic view of a pneumatic control system, useful when the air fill pump is operated with air pressure above that required to have the counters register air signals, which receives an air signal from an air fill pump **12** through air line **11**. The air signal so received may correspond to one or two directional strokes of said air fill pump. Air line **11** transports said air signal to each of the counters **18** and **20** where it is registered and the count information accumulated. One of said counters is staggered, or offset, from the other in the manner previously described. When counter **18** receives the predetermined number of counts it opens a high air pressure line for an instant and allows a high air pressure signal to exit through air line **19** to one end **32** of an actuator valve **36**. At this point counter **20** is set so that it must still receive one-half of the predetermined number of counts in order for it to be activated. The high air pressure signal received by the actuator valve **36** at end **32** actuates the valve **36** so as to switch a three-way ball valve **38** so that fill material entering the three-way ball valve through fill line **30** is directed toward outlet line **40**. When counter **20** receives the required predetermined number of counts it will produce a high air pressure signal which will exit through air line **22** and will be received at actuator valve **36** at end **34**. The high air pressure signal will actuate the valve **36** causing it to turn the three-way ball valve **38** so as to direct the flow of fill material from fill line **30** to outlet **42**. The actuator valve **36** switches the three-way valve **38** very quickly so that there is no need to stop the pump when it is desired to switch the outlet of fill material from one container to another.

FIG. 3 shows a schematic view of a pneumatic control system utilizing only one counter. The counter **18** is connected to air line **11** which transports an air pulse or signal from an air-operated pump or motor. The counter is also connected to a high air pressure line **17**. The counter is also connected to a high air pressure line **17**. The counter has an air exit line **19** which goes to a first pilot valve **44**. As the counter receives the air signals through air line **11**, it accumulates the count information until the required predetermined number of air signals is received. When the last of the predetermined number of signals is received by the counter, it allows a short pulse of constant high air pressure (60–125 p.s.i.) to exit from the counter through air line **19** to the first pilot valve **44**. At this point the pilot valve is open so that the high air pressure pulse may pass through the valve into air line **46**. Air line **46**

carries this high air pressure pulse to a second pilot valve 48 where it is received at one end 47 of this pilot valve. Said pilot valve is also fed by a constant high air pressure (60–125 p.s.i.) line 17. The high air pressure pulse received by said valve at end 47 actuates said valve so as to Xallow a constant high air pressure from line 17 to pass through said valve into air line 50 which transports said constant high air pressure to an actuator valve 36 where it is received at one end 32 of said actuator valve. Said air line 50 is connected to a recycle air line 51. Said recycle air line 51 also receives part of said constant high air pressure and transports it to a pneumatic time delay valve 52 which may be any of those well known in the art. Said time delay valve will not allow the air pressure to pass through this valve immediately, but after a moment it will open and allow a constant high air pressure to pass through air line 54 to one end 43 of said first pilot valve 44. In this manner, the high air pressure has been received by actuator valve 36 so as to actuate a three-way valve 38 which in turn directs the flow of fill material between a first and a second outlet, and after the actuator valve 36 has been actuated, the high air pressure has been received by said first pilot valve 44 so as to actuate said valve. Thus, the high air pressure line has first switched or actuated the three-way ball valve 38 and then has actuated said first pilot valve 44 so that when the counter 18 counts the required number of air signals, and allows a pulse of high air pressure to exit through air line 19 to said first pilot valve, the first pilot valve will be open so as to allow the short high air pressure pulse to pass through said valve into air line 55 which will transport this pulse to said second pilot valve 48. The second pilot valve 48 receives this high air pressure pulse at end 56 and is thereby actuated so as to allow constant high air pressure to pass from line 17 through said pilot valve into air exit line 58. Air line 58 transports said constant high air pressure to actuator valve 36 where it is received at end 34. The actuator valve 36 is thereby actuated and causes the three-way valve 38 to turn and direct the flow of fill material to the other of said outlet lines. Air line 59 is connected to air line 58 so that when the high air pressure passes through line 58 a portion of it is received by air line 59 which transports it to a second time delay valve 60. Said time delay valve, after a moment, will allow said constant high air pressure to pass into air line 62 where it will eventually be received by said first pilot valve at end 64. In this manner, said first pilot valve is actuated and is set so as to receive another pulse of high air pressure from counter 18 through air line 19 so that the cycle can be carried through again.

As an alternative to controlling the switching of a three-way ball valve with the air pressure pulses from the counters, it is possible to have these air pressure pulses control other types of dispensing or flow valves. For example, any valve which is movable between a first position and a second position may be controlled with the pneumatic control system of the invention. For example, particularly useful dispensing or flow valves for some applications are those available from A. G. Barstow Company under the model Hi-Volume 3/4 inch Dispensing Valve. Two of these dispensing or flow valves may be operated and controlled in accordance with the control system of the invention so that continuous filling of containers is achieved without stopping the operation of the air-operated fill pump by connecting the dispensing valves in a parallel arrangement whereby the first dispensing valve delivers fill material while the second valve is closed, and then the second dispensing valve delivers fill material while the first valve is closed. The operation is thus an alternate dispensing of material between two valves on a continuous basis. Furthermore, other flow valves may also be connected in a parallel arrangement so that two or more delivers valves are controlled by the same air pressure signal. dispensing parallel pressure

The pneumatic control system of the invention is also useful for controlling the dispensing of liquids, including solvents, in addition to viscous solvent-containing materials up to a viscosity of 30,000 poise. The important aspect is that an air-operated pump or other air-operated device deliver a predetermined amount of material on each directional stroke so that the counters may be adapted to receive a number of air pulses from said air-operated device in a direct correlation with the number of strokes of said air-operated device.

What is claimed is:

1. A pneumatically controlled dispensing system wherein the strokes of an air-operated fill pump, which is adapted to deliver a predetermined amount of fill material on each directional stroke, are sensed and a flow valve at a fill station is thereby controlled, which dispensing system comprises: (a) air-operated signal means for sensing each stroke of said pump and for producing an air pulse corresponding to each said stroke; (b) air-operated counter means for counting each said air pulse produced by said signal an air pressure response signal after receiving a predetermined number of said air pulses; (c) flow valve means movable between a first and a second position for directing the flow of fill material delivered thereto from said pump between a first and a second outlet line; and (d) actuator means operated by said response signal of said counter means means for moving said valve means between said first and second positions.

2. A pneumatically controlled dispensing system in accordance with claim 3 wherein said flow valve means is a three-way bass valve.

3. A pneumatically controlled dispensing system wherein the strokes of an air-operated fill pump, which is adapted to deliver a predetermined amount of fill material on each directional stroke, are sensed and a flow valve at a fill station is thereby controlled, which dispensing system comprises: (a) air-operated signal means for sensing each stroke of said pump and for producing an air pulse corresponding to each said stroke; (b) a first and a second air-operated counter means for counting each said air pulse produced by said signal means, wherein said first counter produces a first air pressure response signal after receiving a predetermined number of said air pulses and said second counter is adapted to produce a second air pressure response signal spaced from said first air pressure response signal by one-half the number of said predetermined number of said air pulses; (c) flow valve means movable between a first and a second position for directing the flow of fill material delivered thereto from said pump between a first and a second outlet line, and; (d) actuator means operated by said first and second air pressure response signals of said first and second counter means for moving said valve means between said first and and second positions.

4. A pneumatically controlled dispensing system in accordance with claim 1 wherein said flow valve means is a three-way ball valve.

5. A pneumatically controlled dispensing system wherein the strokes of an air-operated fill pump, which is adapted to deliver a predetermined amount of fill material on each directional stroke, are sensed and a flow valve at a fill station is thereby controlled, which dispensing system comprises: (a) a first and a second air-operated counter means for sensing and counting each directional stroke of said pump, wherein said pump is operated with air having a pressure greater than required to operated said first and second counter means, and wherein said first counter produces a first air pressure response signal after sensing a predetermined number of said directional strokes and said second counter means is adapted to produce a second air pressure response signal spaced from said first air pressure response signal by one-half the number of said predetermined number of said directional strokes; (b) flow valve means movable between a first and a second position for directing the flow of fill material delivered thereto from said pump between a first and a second outlet line. and (c) actuator means operated by said first and second air pressure response signals of said first and second counter means for moving said valve means between said first and second positions.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,613,951 Dated October 19, 1971

Inventor(s) Wilfred L. Muir

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the Abstract, lines 8 -9 , delete the phrase "air pulse corresponding to each";
Column 2, line 8, delete "(" and insert --(a)--;
Column 4, line 13, delete "X";
Column 4, lines 65-66, delete the phrase "The counter is also connected to a high air pressure line 17."
Column 5, line 5, delete "X";
line 67, delete "delivers" and insert --flow--;
line 68, delete "dispensing parallel pressure"
Column 6, line 15, after "signal" and before "an" insert --means and for producing--;
line 25, delete "bass" and insert --ball--.

Signed and sealed this 11th day of April 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

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