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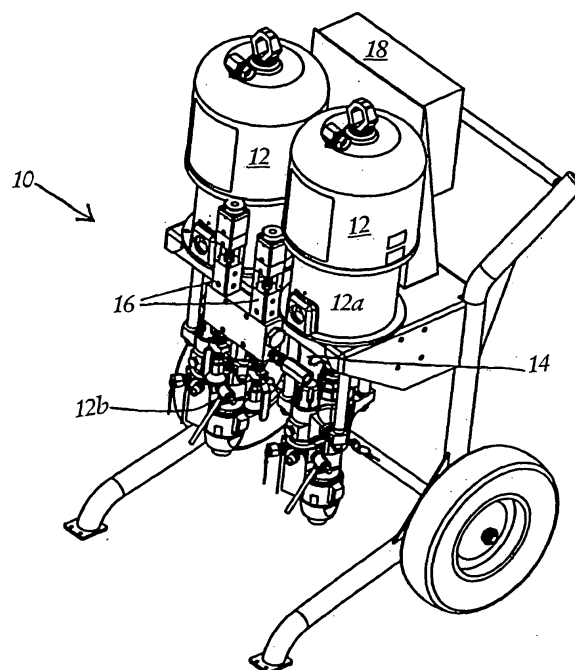
Remarks:

This application was filed on 23 - 10 - 2006 as a divisional application to the application mentioned under INID code 62.

(54) **Electronic porportioner using continuous metering and correction**

(57) A method for compensating for changeover in a reciprocating pump having a check valve, a displacement transducer and a valve at the outlet of the pump, includes the steps of: closing the fluid valve as the pump reaches changeover, to allow the pump to compress any gases and positively close the check valve; and, when the pump stalls, opening the fluid valve. Any travel and imputed flow during the portion of the cycle when the valve is closed is disregarded.

FIG. 1



Description**TECHNICAL FIELD**

[0001] Related applications include US Application serial number 60/186405, filed March 2, 2000, PCT application serial number PCT/US01/069, filed March 2, 2001 and US Application serial number 60/333,697, filed November 27, 2001.

BACKGROUND ART

[0002] Proportioners such as those shown and described in the above applications, the contents of which are hereby incorporated by reference, are sold in the market by the assignee of the instant invention under the trademark VALUEMIX®.

DISCLOSURE OF THE INVENTION

[0003] In the instant invention, each of a pair (or more) of air-operated reciprocating piston pumps (such as those sold by the assignee of the instant invention under the trademark KING™) is provided with a linear displacement transducer (LDT) which is capable of communicating (as discussed in the aforementioned applications) a precise indication of the linear position of the air motor and pump rod. Also provided is a controllable valve connected to the output of each of the pumps.

[0004] Unlike the aforementioned VALUEMIX (which sequentially dispenses first one component and then the other of a plural component material), the controller of the instant invention dispenses both components (or all three if a three component material) simultaneously and maintains ratio at the end of each predetermined volume of material.

[0005] For example, if a material calls for a 2:1 (for components A and B) ratio, both valves will be open initially. The controller then looks at whichever side has hit its mark first (2 for the A side and one for the B side) and closes the valve on that side until the other side "catches up" and hits its mark.

[0006] Cavitation, air entertainment, compressibility, or poor inlet check performance all can result in a loss of correlation between pump travel and fluid dispensing. The following process is meant to correct for these issues. First, the controller determines when the pump has changed over. (This is predictable from previous cycles, or observable from the LDT reading) The controller will then close the fluid valve. This allows the pump to compress any gases and positively close the check valve. When the pump stalls, the fluid valve is reopened. The position of the pump at that point is starting value for fluid dispensed on that stroke.

[0007] These and other objects and advantages of the invention will appear more fully from the following description made in conjunction with the accompanying drawings wherein like reference characters refer to the

same or similar parts throughout the several views.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

Figure 1 is a front perspective view of the instant invention.

Figure 2 is a rear perspective view of the instant invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0009] In the instant invention 10, each of a pair (or more) of air-operated reciprocating piston pumps 12 (such as those sold by the assignee of the instant invention under the trademark KING™) is provided with a linear displacement transducer (LDT) 14 which is capable of communicating (as discussed in the aforementioned applications) a precise indication of the linear position of the air motor 12a and pump rod 12b. Of course any reciprocating power source may be used to power the pump rod 12b. The LDT 14 provides an output in units of travel or resolution which may vary with the model used. In the preferred embodiment, the resolution may be in the range of ¼ to ½ inch. Also provided is a controllable valve 16 connected to the output of each of the pumps 12.

[0010] Unlike the aforementioned prior art VALUEMIX (which sequentially dispenses first one component and then the other of a plural component material), the controller of the instant invention dispenses both components (or all three if a three component material) simultaneously (at least initially) and maintains ratio at the end of each predetermined volume of material.

[0011] For example, if a material calls for a 2:1 (for components A and B) ratio, both valves will be open initially. The controller 18 then looks at whichever side has hit its mark first (2 units of travel for the A side and one for the B side) and closes the valve on that side until the other side "catches up" and hits its mark. Thus, the system truly controls both sides rather than letting one run and trying to match the other as commonly occurs.

[0012] Cavitation, air entertainment, compressibility, or poor inlet check performance all can result in a loss of correlation between pump travel and fluid dispensing. The following process is meant to correct for these issues. First, the controller determines when the pump has changed over. (This is predictable from previous cycles, or observable from the LDT reading) The controller will then close the fluid valve. This allows the pump to compress any gases and positively close the check valve. When the pump stalls, the fluid valve is reopened. The position of the pump at that point is starting value for fluid dispensed on that stroke.

[0013] The air pressure can be varied so as to effectively run both pumps simultaneously and continuously. Also, the control may be set to control flow rather than

pressure. If desired and sufficient length is available, the hose may be used as an integrator to aid in mixing. In another alternative embodiment, the lower volume side or material may be run at a higher pressure and with a single dosing valve.

[0014] The interface is divided into three sections. The basic section are a run and a stop button. Under a cover are a display that shows ratio, and a cycle counter and a 4-position rotary switch for

- Run
- Test
- Independent Run A Pump
- Independent Run B Pump
- 5-digit 7-segment with decimal point to display ratio
- Lighted "Start" button (light while running) - momentary, non-latching
- Stop button - momentary, non-latching
- Ratio setting increments are 0.1, range is 0 to 10.
- Error code displayed in digital display (e.g. E:27).

Following are operational modes:

[0015] Run (proportion): Open both fluid valves. Monitor travel of each pump. If one pump has traveled disproportionately ahead of the other pump, close its fluid valve. Monitor travel of the remaining pump. Once the trailing pump has caught up, open the other fluid valve. Repeat.

[0016] Within the run mode, and pump test mode the controller will compensate for physical problems associated with top change-over. Cavitation, air entertainment, compressibility, or poor inlet check performance all result in a loss of correlation between pump travel and fluid dispensing. The following algorithm is meant to correct for these issues.

[0017] Determine when the pump has changed over. (This is predictable from previous cycles, or observable from the LDT reading) Close the fluid valve. This allows the pump to compress any gases and positively close the check valve. When the pump stalls reopen the fluid valve. The position of the pump at that point is starting value for fluid dispensed on that stroke.

[0018] Independent run: Run any one (and only one) pump just like a normal pump. Fluid valve is constantly open throughout cycle. Do not repeat change-over in less than 500ms (Runaway control). Stop after 5 cycles.

[0019] Pump test: Run each pump through 3 full cycles plus extra distance necessary to compensate for top change-over error. (See Run Mode for description of

change-over error compensation algorithm). Close the fluid valve once during the middle of each stroke and measure time delay until the pump stalls. This checks for a failed fluid valve, piston packings or check valve, or inlet valve failure.

[0020] Stop: Fluid valves and air valves closed.

[0021] Error: Special case of the stop mode. Fluid valves and recirculation valves closed. Error must be "acknowledged".

[0022] Calibration: Each LDT has a different offset and gain. The controller needs this data to work properly.

[0023] It is contemplated that various changes and modifications may be made to the proportioner without departing from the spirit and scope of the invention as defined by the following claims.

Claims

1. A method for compensating for changeover in a reciprocating pump having a check valve where said pump has a displacement transducer and a valve at the outlet of said pump, the method comprising the steps of:

closing said fluid valve as the pump reaches changeover to allow said pump to compress any gases and positively close the check valve; and when said pump stalls, opening the fluid valve; and disregarding any travel and imputed flow during the portion of the cycle when said valve is closed.

2. A method for dispensing plural component materials having at least first and second parts to be mixed in a predetermined ratio, said apparatus having first and second reciprocating pumps connected to said first and second parts, each said pump having a displacement transducer and a valve at the outlet of said pump, the method comprising the steps of:

predetermining the output of each said transducer which corresponds with the resolution of said transducer and said predetermined ratio; running said first and second pumps with said valves open until one of said transducers reaches said predetermined output; closing the valve associated with the pump which has reached said predetermined output and continuing to run the other of said pumps until it has reached said predetermined output.

3. The method of claim 2, further comprising the steps of:

closing each said fluid valve as the pump associated therewith reaches changeover to allow said pump to compress any gases and positively

close the check valve; and
when said pump stalls, opening the fluid valve;
and
disregarding any travel and imputed flow during
the portion of the cycle when said valve is closed. 5

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FIG. 1

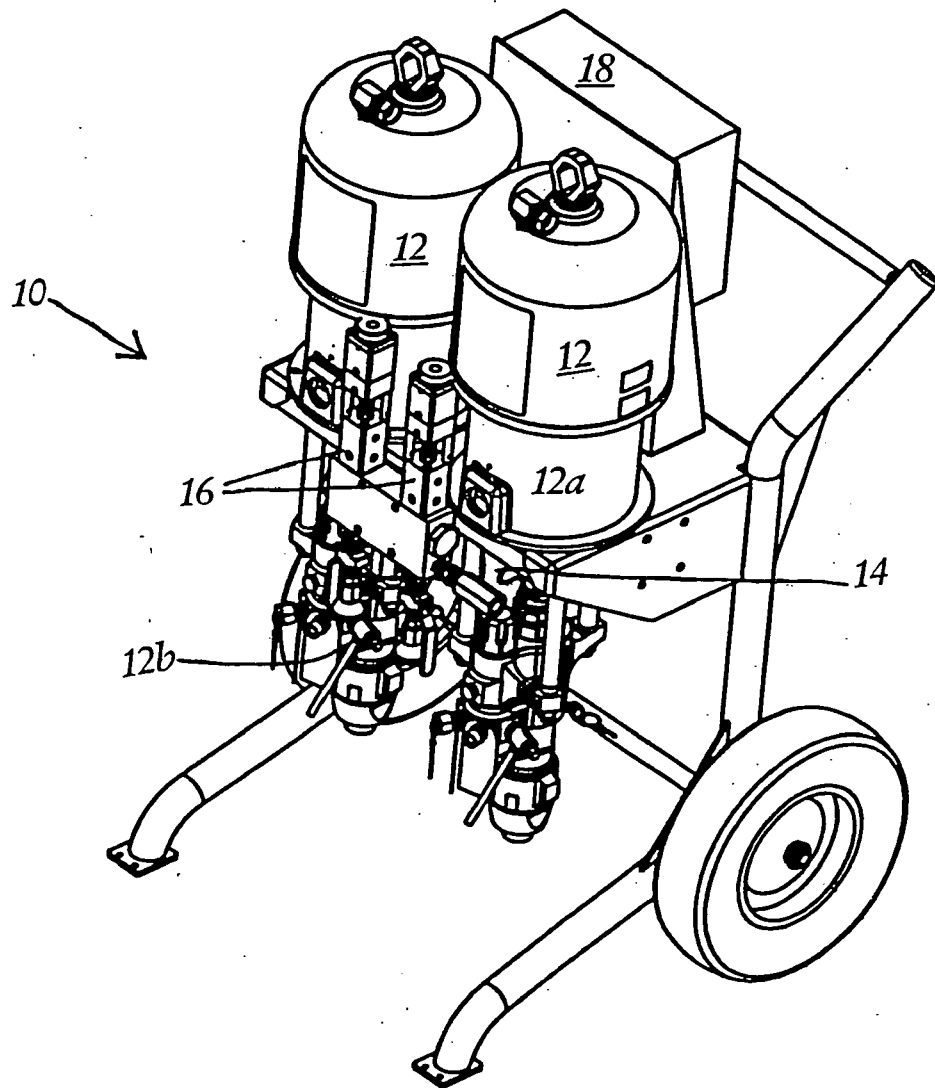
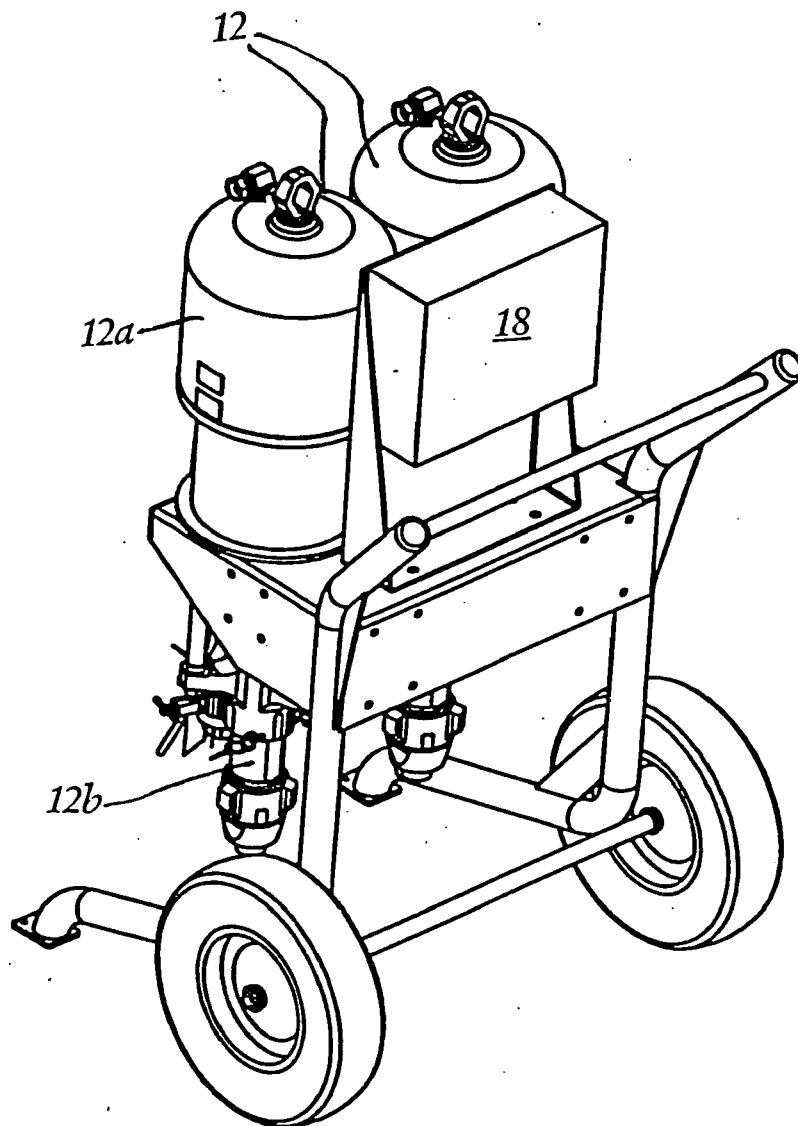


FIG. 2





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 07 6914

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 February 2007	Examiner Groen, Fokke
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 06 07 6914

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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02-02-2007

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