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(54) APPARATUS AND METHOD FOR INTRODUCING A GAS INTO A DISPENSER

(57) The present invention relates to a method for introducing a propellant gas into a dispenser for dispensing an aerosol, the method comprising the steps of:
i. providing a dispenser containing a liquid product to be dispensed;
ii. providing a propellant gas;
iii. performing a data collection step;
iv. using the data obtained from the data collection step to control the introduction of the propellant gas into the dispenser, and
v. introducing the propellant gas into the dispenser, thereby forming an aerosol within the dispenser.

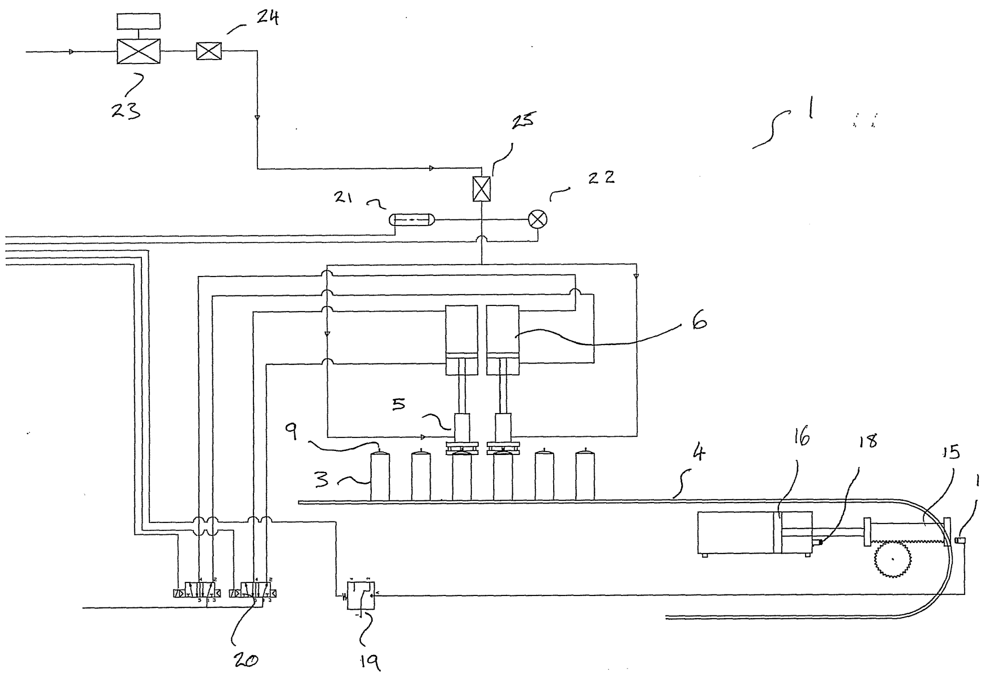

Fig. 2

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Description

Technical Field of the Invention

[0001] The present invention relates to an apparatus and method for introducing a propellant gas into a dispenser for dispensing an aerosol.

Background to the Invention

[0002] Dispensers of the aerosol type typically comprise a container, a liquid product to be dispensed and a propellant for expelling the liquid product from the dispenser. Propellants typically fall into two main categories, namely, liquefied gases and compressed gases. Common liquefied gases include volatile hydrocarbons such as propane, n-butane and isobutane, but these have the disadvantage of being flammable and are known to be difficult to handle. Frequently used compressed gases include nitrous oxide and carbon dioxide, the latter being found in multi-purpose lubricants, degreasers, specialty cleaners and other products that will accept carbon dioxide into solution.

[0003] A disadvantage of using compressed gas propellants is that it is often difficult to obtain a high dispensing pressure within the dispenser due to fluctuations in pressure and temperature when gassing the dispenser. Moreover, insufficient pressure in the dispenser may lead to inefficient expulsion of the liquid product during use and/or incomplete expulsion of the liquid product. The process of dissolving a compressed propellant gas into the liquid product is also known to be a complex process and one which requires continual monitoring by an operator when existing equipment and manufacturing methods are employed. The equipment used to manufacture dispensers with compressed gas propellants is also known to be expensive and is often labor intensive to maintain. Consequently, there is a desire for an apparatus that is less expensive and more reliable.

[0004] It is therefore an object of embodiments of the present invention to provide an apparatus and a method for obtaining a high initial dispensing pressure within a dispenser when the propellant is derived from a compressed gas.

[0005] It is another object of embodiments of the present invention to provide an apparatus and a method for introducing a propellant gas derived from a compressed gas into a dispenser that is less expensive.

[0006] It is a further object of embodiments of the present invention to provide an apparatus and a method for introducing a propellant gas derived from a compressed gas into a dispenser that requires less monitoring by an operator.

Summary of the Invention

[0007] According to a first aspect of the invention there is provided a method for introducing a propellant gas into a dispenser for dispensing an aerosol, the method comprising the steps of:

i. providing a dispenser containing a liquid product to be dispensed;
ii. providing a propellant gas ;
iii. performing a data collection step;
iv. using the data obtained from the data collection step to control the introduction of the propellant gas into the dispenser; and
v. introducing the propellant gas into the dispenser, thereby forming an aerosol within the dispenser.

[0008] The method according to the first aspect of the invention affords the operator greater control when introducing the propellant gas into the dispenser to form an aerosol, such that a dispenser having the desired pressure can be obtained. Improvements in the rate of production have also been observed when dispensers were manufactured in accordance with the method of the first aspect of the invention. It was also found that, relative to existing methods, the method according to the first aspect of the invention is more energy efficient and consumes less air thereby reducing the overall manufacturing costs. The method of the present invention has a further environmental benefit in that the number of dispensers that are scrapped when the apparatus is first started may be reduced significantly when compared to existing methods.

[0009] The propellant gas may be provided at a consistent temperature and pressure.

[0010] The data collection step may comprise the step of detecting the pressure and/or temperature of the propellant gas. In particular, the data collection step may comprise the step of detecting the pressure and/or temperature of the propellant gas from the vaporiser to the gassing head.

[0011] The data collection step may also comprise the step of calculating the density of the propellant gas. By detecting the pressure and temperature of the propellant gas and calculating its density, it is possible to calculate the optimal time (t) for introducing the propellant into the dispenser such that the desired pressure within the dispenser may be obtained. The desired pressure may be from around 5.5 bar (80psi) to around 8.3 bar (120psi).

[0012] By introducing the propellant gas into the dispenser for the time (t) as calculated, dispensers having the desired pressure may be obtained together with improvements in liquid product expulsion. This is in contrast to existing methods where the period for introducing a propellant gas into a dispenser is determined by the time it takes a gassing pump cylinder piston to reach a switch at the bottom of the cylinder, which in turn, sends a signal for the gassing operation to cease.

[0013] The detected pressure and temperature values may be used to control the alignment and/or the actuation of one or more gas heads with one or more dispensers. Thus, if the detected pressure or temperature values do not correspond with respective predicted values, alignment or actuation of the gas head with the dispenser is prevented until the actual and predicted data values are in agreement.

[0014] The propellant gas may comprise carbon dioxide, although other compressed gases such a nitrous oxide or air may be used.

[0015] The pressure of the gas introduced into the dispenser may not be less than 40 bar, and preferably not less than 46 bar, since this may result in an undesirable decrease in temperature that may limit the maximum pressure that can be achieved inside the dispenser. The introduced gas preferably has a pressure of 46 bar to 55 bar, more preferably of 48 bar to 53 bar.

[0016] The temperature of the introduced gas may be from 40°C to 70°C.

[0017] The pressure within the dispenser may be adjusted manually by adjusting the time allocated for introducing the gas into the dispenser. This may be achieved by referring to a data table. The data table may contain relevant information about the size, weight and volume of the dispenser, the liquid product or the aerosol, the valve type and/or predicted times for obtaining a desired pressure within each type of dispenser. The predicted times may be based on collected data obtained from one or more production runs. Having selected the appropriate time, the time may be adjusted automatically in response to any fluctuation in pressure or temperature. For instance, the period for introducing the propellant may automatically be extended in response to a pressure drop, whereas the period may be reduced in response to a pressure increase.

[0018] According to a second aspect of the invention there is provided an apparatus for introducing a propellant gas into a dispenser containing a liquid product to be dispensed in order to form an aerosol, the apparatus comprising a control unit for controlling the introduction of the propellant gas into the dispenser, the control unit comprising pressure detection means, temperature detection means and a processor operable to compare the detected pressure and temperature values with pre-determined pressure and temperature values.

[0019] The processor may be programmed to calculate the density of the propellant gas. The processor may also be programmed to calculate a period of time (t) for introducing the gaseous propellant into the dispenser. The calculation of time (t) may be based on the detected pressure and temperature and the calculated density of the propellant gas.

[0020] The pressure detection means may comprise a pressure transducer and the temperature detection means may comprise a thermocouple. It is preferred that the pressure and temperature detection means are located adjacent or close by one or more gas heads that may be used for introducing the propellant into the dispenser. This permits accurate detection of the pressure and temperature at the gas head just before the propellant gas is introduced into the dispenser.

[0021] The processor may be operable to output an alarm if the detected pressure and/or temperature values do not correspond with the pre-determined pressure and temperature values. In response thereto, the operator may adjust the pressure or temperature of the propellant gas so that the gas pressure and/or temperature falls within the predicted values.

[0022] The control unit may comprise means for adjusting the pressure within the dispenser manually. The manual adjustment means may comprise means for adjusting the time allocated for introducing the propellant gas into the dispenser, e.g. one or more buttons on a touch screen display may be used to adjust the time (t).

[0023] The apparatus may comprise a gas head for introducing the propellant into the dispenser and a valve for adjusting the position of the gas head with respect to the dispenser. Preferably the valve is a solenoid valve.

[0024] The processor may be programmed to send a signal to the valve when the time (t) for introducing the propellant into the dispenser has elapsed so that the position of the gas head is adjusted and positioned away from the dispenser. This may be used to terminate the gassing operation.

Detailed Description of the Invention

[0025] In order that the invention may be more clearly understood an embodiment will now be described, by way of example only, with reference to the accompanying drawings, of which:

Figure 1 is a schematic representation of an apparatus for introducing a propellant into a dispenser according to the prior art.

Figure 2 is a schematic representation of an apparatus for introducing a propellant into a dispenser according to the present invention.

Referring to Figure 1, the apparatus comprises a storage tank (not shown) for storing a propellant gas at a pressure of 20 bar. In this embodiment, the propellant gas is carbon dioxide. The carbon dioxide is fed into a pump and the pressure of the carbon dioxide is increased to 50 bar. The carbon dioxide is then provided in six vaporisers (not shown) where it is heated to a temperature of 110°C. From the vaporisers the carbon dioxide is passed through four buffer cylinders (not shown) before being delivered to gassing sheds (1) where gassing of the dispensers will take place.

[0026] The incoming supply of carbon dioxide having a pressure of 50 bar is regulated down to the pressure that is required for the production run. The pressure is typically reduced to between 26 bar and 36 bar by a regulator (2). The selected pressure depends on the size of the dispenser (3) to be filled, which is typically from around 50ml to around 600ml.

[0027] The apparatus additionally comprises a crank arm (not shown) and a conveyer belt (4). In operation, the crank arm, which is powered by a piston (not shown), causes the conveyer belt to move in a forwards direction. When the crank arm has reached its full stroke, a first pneumatic switch (not shown) is activated and the drive to the conveyer belt is disengaged to allow the crank piston to return to its starting position. This activates a second pneumatic switch (not shown) on the piston cylinder and the cycle is repeated.

[0028] The apparatus comprises two gas heads (5) that are used for introducing the carbon dioxide into the dispenser. Each gas head is connected to a gas head air cylinder (6) that is used to deploy and retract the gas head. A 'track' switch (7), provided directly below a respective gas head, is used to track the location and presence of dispensers (3) on the conveyer belt (4) and to trigger the deployment of the gas head. When a dispenser travelling on the conveyer belt activates the track switch, the pneumatic pressure that powers the return stroke of the crack arm is used as a signal to deploy each gas head and to activate a gassing pump piston (8) that forces the carbon dioxide into the dispenser under pressure. Carbon dioxide is only introduced into the dispenser while a valve (9) located at the top of the dispenser is depressed. The depression time is determined by the time it takes the gassing pump piston to activate a pump switch (10) located at the bottom of gassing pump piston cylinder. Once activated, the pump switch sends a signal to retract the gas heads which terminates the gassing operation. The same signal is used to trigger an air regulator (11) so that air pressure from the gassing pump piston is released. The carbon dioxide pressure then returns the gassing pump piston to its starting position so that the cycle may be repeated.

[0029] Referring to Figure 2, and unlike the apparatus of the prior art, the apparatus of the present invention does not comprise a regulator (2), gassing pump pistons (8), pump switches (10) or a one way valve (12). The apparatus also comprises a reduced number of manual valves (14) for controlling the flow of carbon dioxide. This has the advantage that the apparatus according to the present invention is easier to operate, more reliable and less expensive to manufacture and maintain.

[0030] The carbon dioxide is delivered to the gassing shed (1) in the same way as described above when discussing the apparatus of the prior art. However, unlike the prior art, the incoming carbon dioxide pressure is not reduced to between 26 bar and 36 bar by a carbon dioxide regulator. Instead, the pressure of the carbon dioxide typically ranges from 48 bar to 53 bar, and the temperature of the carbon dioxide typically ranges from 40°C to 70°C. This pressure and temperature is substantially maintained until the carbon dioxide is introduced into the dispenser (3). The apparatus does not comprise a carbon dioxide regulator because it was found that reducing the pressure to between 26 and 36 bar corresponded with an undesirable temperature decrease. Since the apparatus according to the present invention does not comprise gassing pump pistons (8), the duration of the gassing is no longer determined by the time it takes a pump switch (10) to be activated. Instead, the duration of the gassing has been determined by carrying out a raft of experiments and trials to define a set of tolerances that ensure that the desired pressure within the dispenser is obtained following the introduction of carbon dioxide into the dispenser. The tolerances have been programmed into a control unit (not shown) that is used to control the gassing operation. The tolerances are checked before each gassing operation, and if the tolerances are not met, the next dispenser will not be actuated with the gas head (5). Further, the operator will be alerted by way of alarm that the tolerances have not been met so that appropriate action may be taken.

[0031] The apparatus according to Figure 2 also comprises a crank arm (15) and a conveyer belt (4). In operation, a piston (16) causes the crank arm to extend, driving the conveyer belt in a forwards direction. A first pneumatic switch (17) is activated when the crank arm reaches its full stroke which disengages the drive to the conveyer belt so that the piston may return to its starting position. This activates a second pneumatic switch (18) on the piston cylinder and the cycle is repeated until the apparatus is stopped. The pneumatic pressure that powers the return stroke triggers a pressure switch (19), which in turn sends a signal to the control unit. The control unit then checks the incoming carbon dioxide pressure, the carbon dioxide temperature and calculates the density of the carbon dioxide gas. This information is then used to calculate the optimum time, in milliseconds, for gassing the dispenser (3) so that the desired pressure in the dispenser may be obtained following the gassing operation. When the time allocated to gas the dispenser elapses, a signal is sent to solenoid valves (20) that activate gas head air cylinder (6) so that the gas heads (5) are positioned away from the valve (9) in order to terminate the gassing operation.

[0032] A thermocouple (21) and a pressure transducer (22) are provided as close to the gas heads (5) as possible in order to increase the accuracy of the pressure and temperature data being collected. If the pressure and/or temperature fluctuates during the production run, this information is fed to the control unit so that the control unit can adjust and optimise the pressure and/or temperature and/or timing of the carbon dioxide being introduced into the dispenser (3).

[0033] The operator of the apparatus may also adjust the pressure within the dispenser (3) manually. This may be achieved by increasing or decreasing the time allocated by the control unit for gassing the dispenser. A touch screen display with control buttons for each gas head (5) may be used to effect the manual adjustment of the gassing time. The operator may also select an appropriate time from a data table that contains data obtained from previous data collection steps. The table may also contain information about the dimensions and volume of the dispensers to be filled and the weight and type of the liquid product to be dispensed. Having selected an appropriate time from the data table, the time may still be adjusted manually or automatically by the control unit in response to any changes in either the liquid component temperature or composition or the propellant gas temperature and/or pressure, so as to ensure the desired pressure within the dispenser is achieved.

[0034] The apparatus additionally comprises a pneumatic actuator valve (23) and manual valves (24) and (25) for controlling the flow of carbon dioxide within the apparatus.

[0035] The above embodiment is described by way of example only. Many variations are possible without departing from the scope of the invention.

Claims

1. Method for introducing a propellant gas into a dispenser for dispensing an aerosol, the method comprising the steps of:

i. providing a dispenser containing a liquid product to be dispensed;
ii. providing a propellant gas;
iii. performing a data collection step;
iv. using the data obtained from the data collection step to control the introduction of the propellant gas into the dispenser, and
v. introducing the propellant gas into the dispenser, thereby forming an aerosol within the dispenser.

2. Method according to claim 1, wherein the data collection step comprises the step of:

detecting the pressure of the propellant gas; or detecting the temperature of the propellant gas.

3. Method according to any one of the preceding claims, comprising the step of calculating the density of the propellant gas.

4. Method according to any one of the preceding claims, wherein the data obtained from the data collection step is used to:

calculate a time (t) for introducing the propellant gas into the dispenser; or
control the actuation of the dispenser with a gas head for introducing the propellant gas into the dispenser.

5. Method according to claim 4, wherein the propellant gas is introduced into the dispenser for time (t).

6. Method according to any one of claims 1-4, wherein the propellant gas is introduced into the dispenser for a time (t), time (t) being selected from a data table.

7. Method according to any one of the preceding claims, 4-6, wherein time (t) is adjusted in response to changes in the detected pressure and/or temperature.

8. Apparatus for introducing a propellant gas into a dispenser containing a liquid product to be dispensed in order to form an aerosol, the apparatus comprising a control unit for controlling the introduction of the propellant gas into the dispenser, the control unit comprising pressure detection means, temperature detection means and a processor operable to compare the detected pressure and temperature values with pre-determined pressure and temperature values.

9. Apparatus according to claim 8, wherein the processor is programmed to calculate the density of the propellant gas.

10. Apparatus according to either claim 8 or claim 9, wherein the processor is programmed to calculate a period of time (t) for introducing the propellant gas into the dispenser.

11. Apparatus according to any one of claims 8-10, wherein the apparatus comprises a gas head for introducing the propellant gas into the dispenser and a valve for adjusting the position of the gas head with respect to the dispenser.

12. Apparatus according to any one of claims 8 to 11, wherein the processor is programmed to send a signal to the valve when the time (t) for introducing the propellant gas into the dispenser has elapsed so that the position of the gas head is adjusted away from the dispenser.

13. Apparatus according to any one of claims 8 to 12, wherein the pressure and temperature detection means are provided adjacent to one or more gas heads used for introducing the propellant gas into the dispenser.

14. Apparatus according to any one of claims 8 to 13, wherein the processor is operable to output an alarm if the detected pressure and/or temperature values do not correspond with the pre-determined pressure and temperature values.

15. Apparatus according to any one of the claims 8 to 14, wherein the apparatus does not comprise a regulator for reducing the pressure of the propellant gas before the propellant gas is introduced into the dispenser.

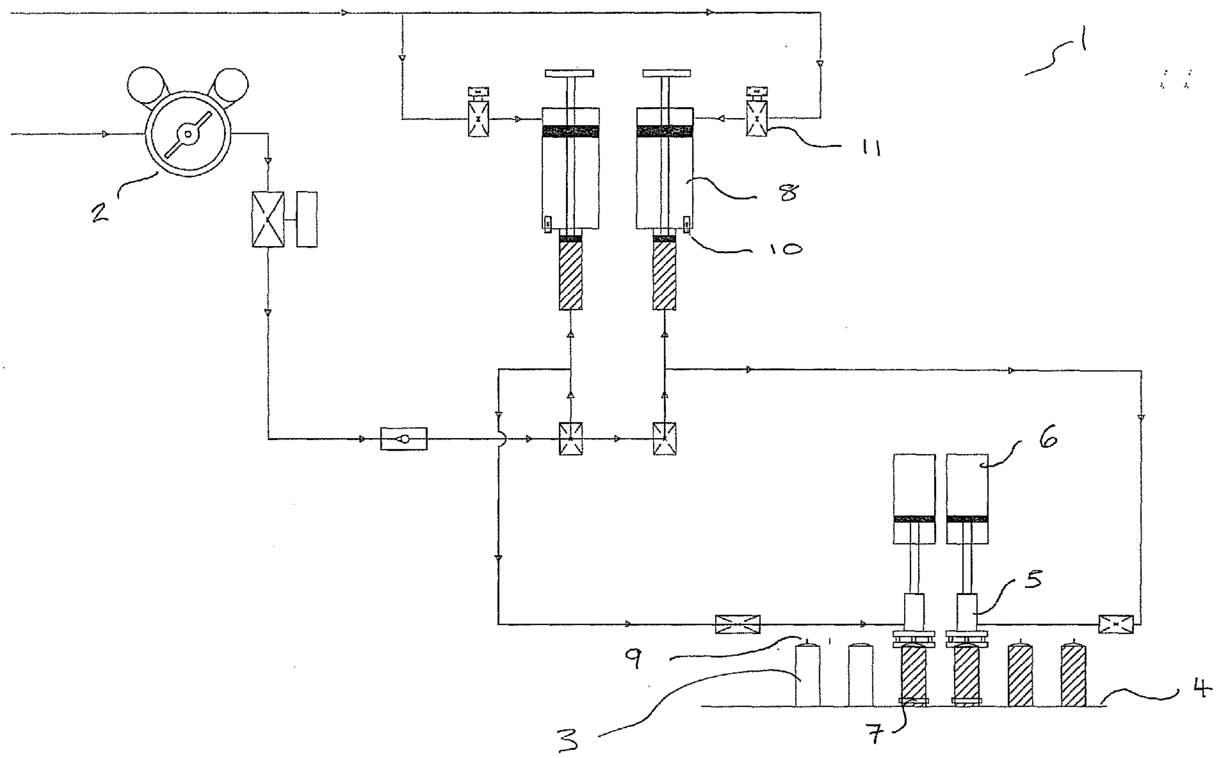

Fig. 1

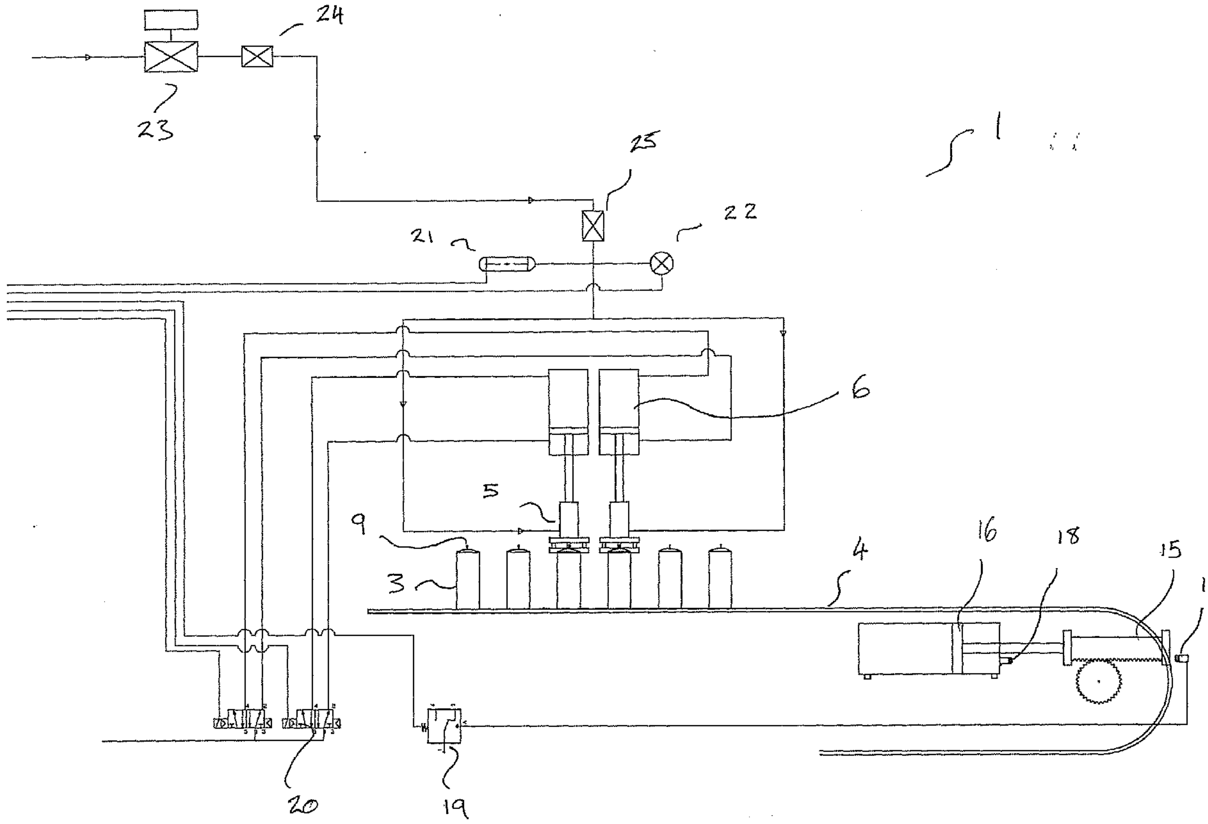

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 15 20 1511

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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	14 March 2016	Yazici, Baris

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

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The present search report has been drawn up for all claims

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