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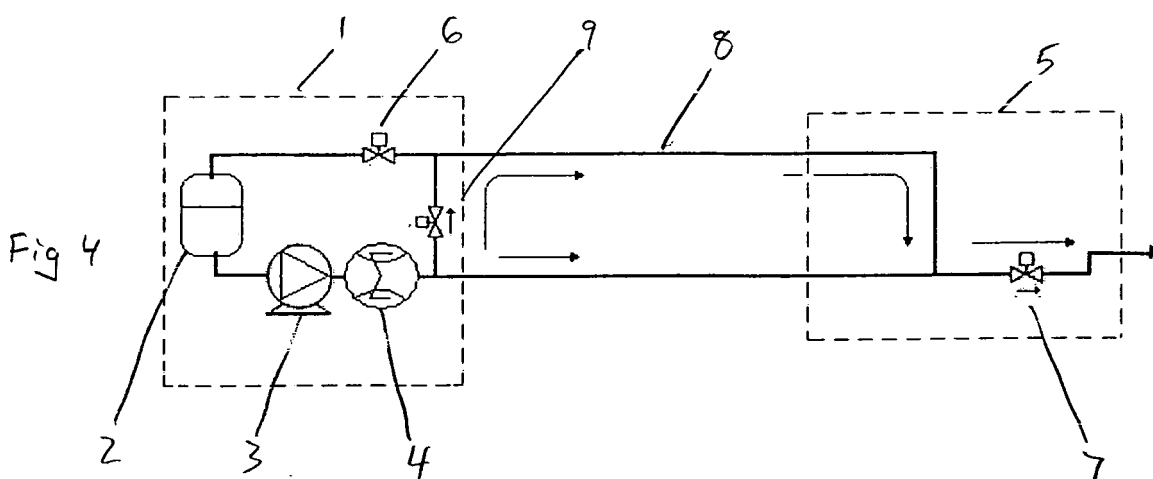
(54) **A method for temperature control of CO₂ as well as metering and filling of CO₂ systems**

(57) The invention relates to a method for temperature control of CO₂ as well as metering and filling of CO₂ systems by means of a system having a process unit and a filling unit, wherein CO₂ is continuously pumped through a hose (8) from the process unit (1) at a temperature below 31.1 °C and comprising a container (2), a pump (3) and a meter (4), through a circulation valve (6) in the filling unit (5), which comprises a circulation valve (6) and a filling valve (7), and back to the process unit again for cooling, following which the circulation valve (6)

is closed and the filling valve (7) is opened, whereby CO₂ is metered by the passage through the meter (4) and is filled into the CO₂ system through the filling valve (7).

An alternative method, wherein the process unit (1) additionally comprises a circulation valve (6) and a parallel valve (9), wherein the circulation valve (6) is closed, the parallel valve (9) and the filling valve (7) are opened, and CO₂ is metered and filled into the CO₂ system.

Formation of gas is avoided hereby, so that the amount of CO₂ may be metered correctly.



Description

[0001] The present invention relates to a method for temperature control of CO₂ as well as metering and filling of CO₂ systems by means of a system having a process unit and a filling unit.

Prior art

[0002] The use of the fluorine-containing CFC refrigerants and the subsequent HCFC and HFC refrigerants are being phased out because of their damaging impact on the environment, including the ozone layer.

[0003] Refrigerants, e.g. R22 (contains chlorine), R134a (HFC) and R717 (naturally inorganic) typically have a critical point, which means that the contents of liquid and gas are the same at 70 - 130 °C, and, therefore, they are far from normal ambient temperatures.

[0004] An alternative to the environmentally harmful substances is the gas CO₂, which has a critical point at 31.1 °C and 73.91 bars, which thus means that the contents of CO₂ in liquid gas and gas form are the same here, and that, accordingly, no distinction can be made between these two forms. At temperatures above 31.1 °C, liquid cannot be formed merely by increasing the pressure, which is the case at temperatures below 31.1 °C, where CO₂ condenses at an increased pressure.

[0005] It is known to fill CO₂ systems by means of a system having a process unit and a filling unit.

[0006] The drawback of these systems, however, is that they can exceed the critical point at 31.1 °C, so that the CO₂ becomes a mixture of liquid and gas, and the metering unit used for the metering of the CO₂ amount thus cannot meter correctly, and that, thus, the amount of gas is not recorded.

The object of the invention

[0007] Accordingly, the object of the invention is to provide a method of the type stated in the opening paragraph, which makes it possible to avoid formation of gas and thereby to keep CO₂ in liquid form, thereby allowing the amount of CO₂ to be metered correctly.

Summary of the invention

[0008] The object stated above is achieved by a method as described in the introductory portion of claim 1, wherein CO₂ is pumped continuously through a hose from the process unit at a temperature below 31.1 °C and comprising a container, a pump and a meter, through a circulation valve in the filling unit, which comprises a circulation valve and a filling valve, and back to the process unit again for cooling, following which the circulation valve is closed and the filling valve is opened, whereby CO₂ is metered by the passage through the meter and is filled into the CO₂ system through the filling valve.

[0009] This makes it possible to avoid formation of gas

in the system at standstill for an extended period of time, when the CO₂ is thereby heated by the surroundings, if the said method is followed and the system is in continuous operation, and, moreover, the amount of CO₂ may be metered correctly.

[0010] As will appear from claim 2, the invention also comprises an alternative method, wherein CO₂ is continuously pumped through a hose from the process unit at a temperature below 31.1 °C and comprising a container, a pump, a meter, a circulation valve and a parallel valve, through the filling unit, which comprises a filling valve, and back to the process unit again for cooling, following which the circulation valve is closed, the parallel valve and the filling valve are opened, whereby CO₂ is metered by the passage through the meter and is filled into the CO₂ system through the filling valve.

[0011] That the parallel valve is opened and the filling thereby takes place through both hoses, is necessary, as a closed parallel valve will have as a result that a relative negative pressure is generated in the hose which serves as a return hose during the cooling.

[0012] If the said method is followed and the system is in constant operation, it is likewise possible to avoid formation of gas in the system at a standstill for an extended period of time, when the CO₂ is thereby heated by the surroundings, and, moreover, the amount of CO₂ may be metered correctly. In addition, the filling adapter used may be constructed more compactly, which may be an advantage depending on the circumstances.

The drawing

[0013] Exemplary embodiments of the invention will be described more fully below with reference to the drawing, in which

- fig. 1 shows a system for temperature control of CO₂, and
- fig. 2 shows a system for metering and filling of CO₂ systems, and
- fig. 3 shows an alternative system for temperature control of CO₂, and
- fig. 4 shows an alternative system for metering and filling of CO₂ systems, and

in which the following reference numerals and designations are used:

- 1. Process unit
- 2. Container
- 3. Pump
- 4. Meter
- 5. Filling adapter
- 6. Circulation valve
- 7. Filling valve
- 8. Hose
- 9. Parallel valve

Detailed description of the invention

[0014] Figure 1 shows a system for temperature control of CO₂, in which CO₂ is pumped continuously through a hose 8 from the process unit 1, which is cooled to below 31.1 °C and comprises a container 2, a pump 3 and a meter 4, through a circulation valve 6 in the filling unit 5, which comprises a circulation valve 6 and a filling valve 7, and back to the process unit again for cooling.

[0015] Figure 2 shows the same system, now used for metering and filling of CO₂ systems, as the circulation valve 6 is closed and the filling valve 7 is opened, whereby CO₂ may be metered by the passage through the meter 4 and be filled into the CO₂ system through the filling valve 7.

[0016] Figure 3 shows an alternative system for temperature control of CO₂, in which CO₂ is pumped continuously through a hose 8 from the process unit 1, which is cooled to below 31.1 °C and comprises a container 2, a pump 3, a meter 4, a circulation valve 6 and a parallel valve 9, through the filling unit 5, which comprises a filling valve 7, and back to the process unit again for cooling.

[0017] Figure 4 shows an alternative system for metering and filling of CO₂ systems, as the circulation valve 6 is closed, the parallel valve 9 and the filling valve 7 are opened, whereby CO₂ may be metered by the passage through the meter 4 and be filled into the CO₂ system through the filling valve 7.

[0018] The cooling of the process unit may take place by means of any known cooling system.

the process unit again for cooling, following which the circulation valve (6) is closed, the parallel valve (9) and the filling valve (7) are opened, whereby CO₂ is metered by the passage through the meter (4) and is filled into the CO₂ system through the filling valve (7).

Claims

1. A method for temperature control of CO₂ as well as metering and filling of CO₂ systems by means of a system having a process unit and a filling unit, **characterized in that** CO₂ is pumped continuously through a hose (8) from the process unit (1) at a temperature below 31.1 °C and comprising a container (2), a pump (3) and a meter (4), through a circulation valve (6) in the filling unit (5), which comprises a circulation valve (6) and a filling valve (7), and back to the process unit again for cooling, following which the circulation valve (6) is closed and the filling valve (7) is opened, whereby CO₂ is metered by the passage through the meter (4) and is filled into the CO₂ system through the filling valve (7).
2. A method for temperature control of CO₂ as well as metering and filling of CO₂ systems by means of a system having a process unit and a filling unit, **characterized in that** CO₂ is pumped continuously through a hose (8) from the process unit (1) at a temperature below 31.1 °C and comprising a container (2), a pump (3), a meter (4), a circulation valve (6) and a parallel valve (9), through the filling unit (5), which comprises a filling valve (7), and back to

