DISCHARGE AND FILL DEVICE FOR A GAS CYLINDER

The present invention relates to a discharge and fill device for use on a cylinder for storing gas at elevated pressure. The cylinder for storing gas is sometimes called a bottle. In many cases the gas stored at the elevated pressure is partly liquefied at ambient temperature. A suitable example of a gas stored in such a cylinder or bottle is a petroleum gas.

A conventional discharge and fill device for use on a cylinder for storing gas at elevated pressure comprises a housing having the shape of an elbow, which housing is provided with a fill end, a connector end having connection means for connecting the housing to a boss of the cylinder, an open-ended passage extending between the fill end to the connector end, and a manually-operated valve allowing or stopping fluid flow through the passage.

The fill end is provided with screw threads to which either a fill nozzle or a pressure regulator can be connected. The pressure regulator is provided with an inlet end which can be connected to the fill end of the housing, and with an outlet end to which an appliance is connected. A cylinder provided with conventional discharge and fill device is filled through the fill end of the housing, and through that same fill end the cylinder is also discharged.

In order to fill the cylinder, a fill nozzle is connected to the fill end of the housing. The manually-operated valve is opened and the cylinder is filled. When filling has been completed the valve is closed, and the fill nozzle is removed.

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The gas cylinder which has been filled in the above-described manner with liquefied petroleum gas can now be used to supply gas to an appliance for cooking or heating. Such an appliance is being connected by means of a conduit, such as a hose, to the outlet end of the pressure regulator pertaining to the appliance. In order to supply gas to the appliance the pressure regulator is connected to the fill end of the housing, and the valve is opened. To interrupt flow of gas to the appliance, the valve is closed.

When the cylinder is empty, the pressure regulator is disconnected from the discharge end of the housing, and the cylinder is exchanged for a full one. The empty cylinder is returned to a filling station in order to be filled. Prior to being filled the cylinder is inspected, which is highly desirable from a safety point of view. With the conventional discharge and fill device, the pressure regulator remains with the appliance.

A disadvantage of the conventional discharge and fill device is that, because the pressure regulator remains with the appliance, it is not returned with the empty cylinder, and consequently the pressure regulator cannot be inspected.

European patent application publication No. 393 234 discloses a recent discharge and fill device for use on a cylinder for storing gas at elevated pressure. This device comprises a tubular housing which is provided with a fill end, a connector end having connection means for connecting the tubular housing to a boss of the cylinder, an open-ended passage extending between the fill end to the connector end, a spring-loaded non-return inlet valve arranged in the open-ended passage near the fill end, a spring-loaded flow control valve arranged in the open-ended passage near the connector end, and a connector pin transferring the motion of the valve body of the non-

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return inlet valve to the valve body of the flow control valve.

The fill end is provided with a flange to which either a fill nozzle or a pressure regulator can be connected, so that the cylinder provided with conventional discharge and fill device is filled through the fill end of the tubular housing, and through that fill end the cylinder is also discharged.

In order to fill the cylinder, a fill nozzle is connected to the fill end of the tubular housing. The fill nozzle is provided with a valve control mechanism that can open the valves in the tubular housing pushing the valve body of the non-return inlet valve in the direction of the connector end against the action of the spring. The motion of the valve body is transferred by the connector pin to the valve body of the flow control valve, so that the flow control valve is opened as well. The cylinder can now be filled. When filling has been completed the non-return inlet valve and the flow control valve are closed, and the fill nozzle is removed.

The gas cylinder which has been filled in the above-described manner with liquefied petroleum gas can now be used to supply gas to an appliance for cooking or heating. Such an appliance is being connected by means of a conduit, such as a hose, to the outlet end of the pressure regulator pertaining to the appliance. In order to supply gas to the appliance the inlet end of the pressure regulator is connected to the fill end of the tubular housing. The pressure regulator is provided with means for operating the valves in the tubular housing, which means comprise an actuator and a control mechanism which includes a pin slideably arranged in the inlet end of the pressure regulator. The pressure regulator is further provided with an outwardly protruding inlet end which pushes the valve body of the non-return inlet valve

away from the fill end of the tubular housing. To allow gas flowing into the pressure regulator, one displaces the actuator from a first position to a second position, which displacement causes the end of the pin to move out of the inlet end of the pressure regulator. The movement of the pin displaces the valve body of the non-return inlet valve to an open position against the action of the spring, and the displacement is transferred via the connector pin to the valve body of the flow control valve so that also the flow control valve is opened. To interrupt flow of gas to the appliance, the actuator on the pressure regulator is returned to the first position causing the pin to retract into the inlet end of the pressure regulator so as to allow closing of the non-return inlet valve and the flow control valve.

When the cylinder is empty, the pressure regulator is disconnected from the discharge end of the tubular housing, and the cylinder is exchanged for a full one. The empty cylinder is returned to a filling station in order to be filled. Prior to being filled the cylinder is inspected, which is highly desirable from a safety point of view. With the conventional discharge and fill device, the pressure regulator remains with the appliance.

The more recent device has the same disadvantage as the conventional discharge and fill device.

A further disadvantage of the more recent discharge and fill device is that there are two valves arranged in the passage of the tubular housing. This had been done to reduce the chance of accidental escape of high pressure gas. However, even when the flow control valve is open, the presence of the flow control valve is a restriction to fluid flow which adversely affects the rate at which the cylinder can be filled.

It is an object of the present invention to provide a discharge and fill device in which the pressure regulator

is integrated.

To this end the discharge and fill device for use on a cylinder for storing gas at elevated pressure according to the present invention comprises a T-piece and a pressure regulator, wherein the T-piece has a fill end, a connector end having connection means for connecting the T-piece to a boss of the cylinder, and a discharge end, wherein the T-piece includes an open-ended main passage extending between the fill end and the connector end, and an open-ended discharge passage extending from the main passage to the discharge end, wherein the T-piece is provided with a non-return inlet valve arranged in the main passage near the fill end, and a discharge control valve arranged in the discharge passage, and wherein the pressure regulator is provided with an inlet end which is in fluid communication with the discharge end of the T-piece, an outlet end provided with means for connecting an appliance to it, and means for operating the discharge control valve.

An advantage of the device of the present invention is that the main passage does not contain the discharge control valve. A further advantage is that the main passage is only used for filling the cylinder, and that the discharge passage is only used for discharging the cylinder, and therefore the diameter of the discharge passage can be made smaller than the diameter of the main passage. This smaller diameter provides a restriction to uncontrolled fluid flow in the event that the pressure regulator is accidentally separated from T-piece.

The invention will now be described in more detail by way of example with reference to the accompanying Figure showing a partial cross-sectional view of the discharge and fill device according to the present invention.

Reference is made to the Figure. The discharge and fill device 1 according to the present invention is

arranged on a cylinder 2 for storing gas at elevated pressure. The device 1 comprises a T-piece 3 and a pressure regulator 4.

The cylinder 2 comprises a top cover 6, a cylindrical side wall 7, and a bottom cover (not shown). In an opening 8 in the top cover 6 a boss 9 is secured.

The T-piece 3 has a fill end 10, a connector end 11 having connection means 12 in the form of screw threads for connecting the T-piece 3 to the boss 9 of the cylinder 2, and a discharge end 13. The T-piece 3 includes an open-ended main passage 15 extending between the fill end 10 and the connector end 11, an open-ended discharge passage 16 extending from the main passage 15 to the discharge end 13. In the main passage 15, near the fill end 10 is arranged a non-return inlet valve 20, and in the discharge passage 16, near the discharge end 13 is arranged a discharge control valve 22. The discharge passage 16 begins at a location which is between the bottom of the valve body 23 and the connector end 11.

The non-return inlet valve 20 comprises a valve body 23 with a seal 24 which can seal against a tapered surface 25 of the main passage 15, and a spring 27 exerting a force on the valve body 23 so that the valve body 23 is pressed against the tapered surface 25. The discharge control valve 22 comprises a valve body 28 loaded by spring 29.

The pressure regulator 4 is provided with an inlet end 31 which is in fluid communication with the discharge end 13 of the T-piece 3. The inlet end 31 is attached to the discharge end 13, and part of the inner surface 32 of the inlet end 31 forms the valve seat of the discharge control valve 22. The pressure regulator is known as such, and its design will not be discussed in detail.

The pressure regulator 4 is further provided with an outlet end 33 provided with connector 34 for connecting

an appliance to it, and with means 37 for operating the discharge control valve 22. The means 37 for operating the discharge control valve 22 include an external actuator 40 and a control mechanism extending from the external actuator 40 to control the discharge control valve 22, wherein the control mechanism includes a pin 41 for displacing the valve body 23 of the discharge control valve 22.

In order to fill the cylinder 2, a fill nozzle (not shown) is connected to the fill end 10 of the T-piece 1. The fill nozzle is provided with a valve control mechanism that can open the non-return inlet valve 20 by pushing the valve body 23 in the direction of the connector end 11, so that the non-return inlet valve 20 is opened. The cylinder 2 can now be filled. When filling has been completed the non-return inlet valve 20 is closed, and the fill nozzle is removed.

The cylinder 2 filled in the above-described manner with liquefied petroleum gas can now be used to supply gas to an appliance (not shown) for cooking or heating. Such an appliance is provided with a hose (not shown) provided with a connector (not shown), and in order to supply gas to the appliance the connector is connected to the connector 34 of the outlet end 33 of the pressure regulator 4. The connectors on the outlet end and on the hose are known as such, and they will not be discussed in detail. To allow gas flowing into the pressure regulator 4, one displaces the external actuator 40 from a first position to a second position, which displacement causes the end of the pin 41 to move out of the inlet end 31 of the pressure regulator 4. The movement of the pin 41 displaces the valve body 28 of the discharge flow control valve 22 against the action of the spring 29 to an open position. To interrupt flow of gas to the appliance the external actuator 40 on the pressure regulator 4 is

returned to the first position, and the pin 41 retracts into the inlet end 31 of the pressure regulator 4 so as to allow closing of the discharge flow control valve 22.

When the cylinder 2 is empty, the hose of the appliance is disconnected from the connector 34, and the cylinder is exchanged for a full one. The empty cylinder is returned to a filling station in order to be inspected and filled. Since the pressure regulator 4 remains on the cylinder 2, the pressure regulator 4 can be inspected and serviced as well at the filling station.

The outlet end 33 of the pressure regulator may pass through an opening 42 in a rim 43 attached to the upper end of the cylinder 2. The outlet end 34 can also be secured in the opening 42. The rim 43 can be part of the cylindrical side wall 7 of the cylinder 2, or it can be a separate rim attached to the cylindrical side wall 7.

Suitably the control mechanism of the means for operating the discharge control valve includes a fusible component, and more suitably the pin 41 is made of fusible material.

Suitably the valve body 23 of the non-return inlet valve 20 includes a safety valve (not shown).

In an alternative embodiment, the inlet end of the pressure regulator is provided with a right-angle connector, and the actuator is arranged on the right-angle connector.

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1. Discharge and fill device for use on a cylinder for storing gas at elevated pressure, which device comprises a T-piece and a pressure regulator, wherein the T-piece has a fill end, a connector end having connection means for connecting the T-piece to a boss of the cylinder, and a discharge end, wherein the T-piece includes an open-ended main passage extending between the fill end and the connector end, and an open-ended discharge passage extending from the main passage to the discharge end, wherein the T-piece is provided with a non-return inlet valve arranged in the main passage near the fill end, and a discharge control valve arranged in the discharge passage, and wherein the pressure regulator is provided with an inlet end which is in fluid communication with the discharge end of the T-piece, an outlet end provided with means for connecting an appliance to it, and with means for operating the discharge control valve.

2. Discharge and fill device as claimed in claim 1, wherein the discharge control valve comprises a spring-loaded valve body and a valve seat arranged at the end of the discharge end.

3. Discharge and fill device as claimed in claim 1 or 2, wherein the inlet end of the pressure regulator is attached to the discharge end of the T-piece.

4. Discharge and fill device as claimed in claim 1, wherein the inlet end of the pressure regulator is attached to the discharge end of the T-piece, wherein the discharge control valve comprises a spring-loaded valve body, and wherein the valve seat of the discharge control valve is part of the inlet end of the pressure regulator.

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5. Discharge and fill device as claimed in anyone of the claims 1-4, wherein the means for operating the discharge control valve include an external actuator and a control mechanism extending from the external actuator to control the discharge control valve.

6. Discharge and fill device as claimed in claim 5, wherein the control mechanism includes a fusible component.

7. Discharge and fill device as claimed in anyone of the claims 1-6, wherein the non-return inlet valve includes a safety valve.

8. Cylinder for storing a gas at elevated pressure provided with the discharge and fill device as claimed in anyone of the claims 1-7.

9. Discharge and fill device substantially as described in the specification with reference to the drawing.

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