SPECIFICATION

TITLE OF THE INVENTION: VANE PUMP DEVICE FOR VAPOR COLLECTION IN OIL SUPPLY DEVICE

TECHNICAL FIELD

[0001.] The present invention relates to a technique for preventing a temperature rise in a vapor recovery pump device of a fueling device.

BACKGROUND ART

[0002.] Since a large amount of vapor is generated when a highly volatile liquid is supplied to a fuel tank of a vehicle, a fueling nozzle with a vapor recovery function as shown in Patent Document 1 is used. This device is constructed such that a vane pump 10 is connected in the middle of a pipe line 50 extending from a fueling nozzle 80 to a vapor discharge port, and vapor is sucked and collected into a storage tank.

[0003.] In such a device, if the suction port side or the discharge port side of the vane pump 10 is clogged or the differential pressure is generated due to an error in valve operation, and the operation is continued for a long time, as shown in Fig. 11, since the temperature of the vane pump rises with time as described above, a valve device 46 is connected to open the suction port and the discharge port at a predetermined differential pressure in order to decrease the temperature.

[0004.] With the configuration of the device, although an excessive pump load can be suppressed and an excessive temperature rise can be avoided, since the valve device operates at a predetermined pressure, there are problems that not only is the ability of the vane pump limited, but also the operation of the vane pump continues even in the state where a failure occurs in the pipe line 50.

PRIOR ART DOCUMENT

PATENT DOCUMENT

[0005.] Patent Document 1: US Patent No. 5567126 gazette

OUTLINE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006.] The present invention has been made in view of such problems, and an object of the present invention is to provide a pump device capable of reliably preventing an increase in the temperature of the vane pump by stopping function of the pump in the event of an abnormality in a flow path while maximizing the capacity of the vane pump.

MEANS OF SOLVING THE PROBLEMS

[0007.] In order to achieve these objects, the present invention provides a pump device including: a pump housing; a rotor eccentrically accommodated in the pump housing; a groove formed in the radiation direction of the rotor; and a vane accommodated so as to be slidable in the groove, wherein a bimetal is accommodated in the vane, and when the pump device is at or above a prescribed temperature the bimetal protrudes

into the rotor side facing the groove and regulates sliding of the vane to stop function of the pump .

EFFECTS OF THE INVENTION

[0008.] With the present invention, since the vane is kept in a retracted state only when the temperature rises, the pump is normally operated without lowering the performance and function of the pump, and the vane is retracted only when the temperature rises to stop the function as a pump, which prevents the pump from becoming abnormally high temperature.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009.] [Figure 1] A view showing an embodiment of an oil supply device of this invention.

[Figure 2] A cross-sectional view showing an embodiment of a vane pump suitable for the oil supply device of the present invention.

[Figure 3] A perspective view showing an example of a vane and a stopper of the vane pump.

[Figure 4] Figures (a), (b), and (c) show the shapes of the stopper when the temperature is normal, low and high, respectively.

[Figure 5] A view showing the vanes in a rotor in a high temperature state.

[Figure 6] A diagram showing temperature change of the vane pump at the time of abnormality in the device.

[Figure 7] A cross-sectional view showing a reference example of a vane pump suitable for the oil supply device of the present invention.

[Figure 8] A view showing the vanes in a high temperature state in the pump.

[Figure 9] A view showing a reference example of a vane pump suitable for the oil supply device of the present invention in a normal temperature state.

[Figure 10] A view showing the vanes of the pump in a high temperature state.

[Figure 11] A diagram showing temperature change over time of a conventional vane pump.

MODE FOR CARRYING OUT THE INVENTION

[0010.] The details of the present invention will be described below based on the illustrated embodiments. Figure 1 shows an embodiment of an oil supply device, in which liquid from a fueling pump 2 driven by a fueling motor 1 is supplied to a fueling nozzle 4 via a flow meter 3. A vane pump 6 for recovering vapor is connected to the downstream side of the vapor recovery port of the fueling nozzle 4 via a flow rate sensor 5. As is well known, this vane pump includes a pump housing, a rotor eccentrically housed in the pump housing, grooves formed in the rotor in the radial direction, and vanes slidably housed in the grooves. A vapor recovery

pipe line 7 communicates with a recovery device (not shown) via a maintenance valve 8.

[0011.] In this embodiment, when the nozzle 4 is removed from a nozzle hook 9, a control device 11 is actuated to return a display 12 to zero. Then, the flow meter 3 measures the amount of liquid to be fed, and the display 12 displays the result. The vapor generated in this process is sucked by the vane pump 6 through a vapor suction port of the nozzle 4 via the flow rate sensor 5 and sent to the recovery device.

[0012.] If the vane pump 6 malfunctions and the flow rate drops during the vapor recovery process, the control device 11 stops the vane pump 6 and the fueling pump 2 in response to a signal from the flow rate sensor 5 to prevent an accident from occurring.

[0013.] Figure 2 shows an embodiment of the vapor recovery vane pump of the present invention. A rotor 24 is arranged eccentrically in a pump chamber 23 of a pump casing 22 having a suction port 20 and a discharge port 21.

[0014.] A plurality of grooves 26 are formed in the rotor 24 at equal intervals to accommodate the vanes 25 so as to be able to move back and forth in a substantially tangential direction. At the rear end of these vanes 25, that is, at the portion on a rotating shaft 28 side, as shown in Fig. 3, a curved accommodation recess 30 is formed with the center of a bottom portion 30a for fixedly housing a stopper 29.

[0015.] Since the accommodation recess 30 is formed to have a depth sufficient to absorb a curved shape deformation of the stopper 29 at low temperatures, it is possible to prevent the stopper 29 from being pushed back by the bottom portion 30a of the recess 30 and protruding at low temperatures.

[0016.] Since the stopper 29 is made of a bimetal plate, it has a flat shape (Fig. 4 (a)) at room temperatures, a concave central portion (Fig. 4(b)) at low temperatures, and a convex central portion at high temperatures (Fig. 4(c)), and the stopper 29 protrudes from the surface of the vane 25 and abuts against the inner wall of the groove 26 at high temperatures.

[0017.] According to this embodiment, the stopper 29 maintains a flat plate shape at room temperatures and a concave state at low temperatures, so that the vanes 25 can protrude by centrifugal force, and tips thereof are brought into sliding contact with the inner wall 23a of the pump chamber 23 to exert a pump action.

[0018.] On the other hand, when pressure increases due to clogging or blockage of a pipe line and a load is applied to the vane pump, the temperature of the vane pump rises and the stopper 29 becomes convex (Fig. 4(c)) and elastically contacts the inner wall 23a of the groove 26. As a result, once the vanes 25 are pushed radially by the inner wall 23a, the vanes 25 do not protrude due to the centrifugal force caused by the rotation of the rotor 24 and cannot slidably contact the inner wall 23a of the pump

chamber 23 as shown in Fig. 5, the pump stops working, i.e., it spins.
[0019.] Since the temperature of the vane pump drops due to this idle rotation, the stopper 29 is deformed toward the bottom side of the recess 30 (Fig. 4(a)), the vane 25 is released from restraint, contacts the inner wall 23a of the pump chamber 23, and the pump function is restored. Repetition of such steps allows the pump temperature to be limited to a certain temperature range as shown in Fig. 6.
[00 20.] In the above-described embodiment, the stopper 29 is accommodated in the recess 30 of the vane 25. However, as shown in Fig. 7 as a reference example, a recess 47 is formed in a groove 46 of a rotor 45 that accommodates a vane 44, and a stopper 48 made of a bimetal is cantilevered in the recess 47 so that a rear end 44a of the vane 44 protrudes toward the groove 46 when the temperature is high. The vane 44 may be fixed in a beam shape, and a concave portion 44b that engages with a rear end 48a of the stopper 48 may be formed on the surface facing the stopper 48 of the rear end 44a of the vane 44.
[0021.] According to this reference example, when the temperature of the vane pump rises, as shown in Fig. 8, the vane 44 is pushed against the peripheral surface 43a of a pump chamber 43 to retract, the tip 48a of the stopper 48 protruding into the groove 46 engages with the concave portion 44b of the vane 44, the vane 44 is fixed in a retracted state, and the vane 44 cannot slidably contact the peripheral surface 43a of the pump chamber 43, thereby stopping the pump action.
[0022.] When the temperature drops due to the loss of the pumping action, the stopper 48 returns to its original state (Fig. 7), the restraint of the vane 44 is released, and the vane 44 protrudes again by centrifugal force and slides on the peripheral surface 43a of the pump chamber 43 to restore the pump action. Repetition of such steps allows the pump temperature to be limited to a certain temperature range as shown in Fig. 6.
[0023.] Further, Fig. 9 shows another reference example of the present invention. In this embodiment, a suction port 51 and a discharge port 52 of a vane pump 50 are connected by a bypass 53, which is usually closed, and a valve 56 is provided with a bimetal 55 biased by a spring 54 and deformed to press a shaft to open the valve at high temperatures.
[0024.] According to this reference example, since the bimetal 55 does not press the valve 56 at room temperatures or low temperatures, the closed state of the valve is maintained and the rated pump action is achieved. On the other hand, when the temperature of the pump 50 becomes high, the bimetal 55 opens the valve 56 against a biasing force as shown in Fig. 10, impairing the pump function.
[0025.] According to this reference example, since the bypass passage is formed and the valve device is connected thereto, a vane pump main body does not need to be machined, and the manufacturing process can be simplified.

[0026.] Furthermore, when load current of the motor that drives the vane pump exceeds a predetermined value, power supply to the motor can be cut off to stop the motor.

[0027.] A temperature sensor can be attached to the vane pump to stop it if the temperature exceeds a predetermined value.

[0028.]It is also possible to detect the differential pressure between the suction port and the discharge port of the vane pump, detect the load state of the vane pump from the differential pressure, and control the pump drive motor.

DESCRIPTION OF THE REFERENCE NUMERALS

[0029.]

1 fueling motor
2 fueling pump
3 flow meter
4 flow sensor
6 vane pump
7 vapor collection line
8 maintenance valve
11 control device
12 display
20 suction port
21 discharge port
22 pump casing
23 pump room
24 rotor
25 vane
26 groove
29 stopper

CLAIMS

[Claim 1] ~~(Amended)~~ A pump device comprising: a pump housing; a rotor eccentrically accommodated in the pump housing; a groove formed in the radiation direction of the rotor; and a vane accommodated so as to be slidable in the groove, wherein a bimetal is accommodated in the vane, and when the pump device is at or above a prescribed temperature the bimetal protrudes into the rotor side facing the groove and regulates sliding of the vane to stop function of the pump .

~~[Claim 2]~~

~~[Claim 3]~~

~~[Claim 4]~~

~~[Claim 5]~~