June 30, 1970 C. W. ELROD 3,517,692

PRESSURE RELIEF VALVE ASSEMBLY

Filed July 10, 1968

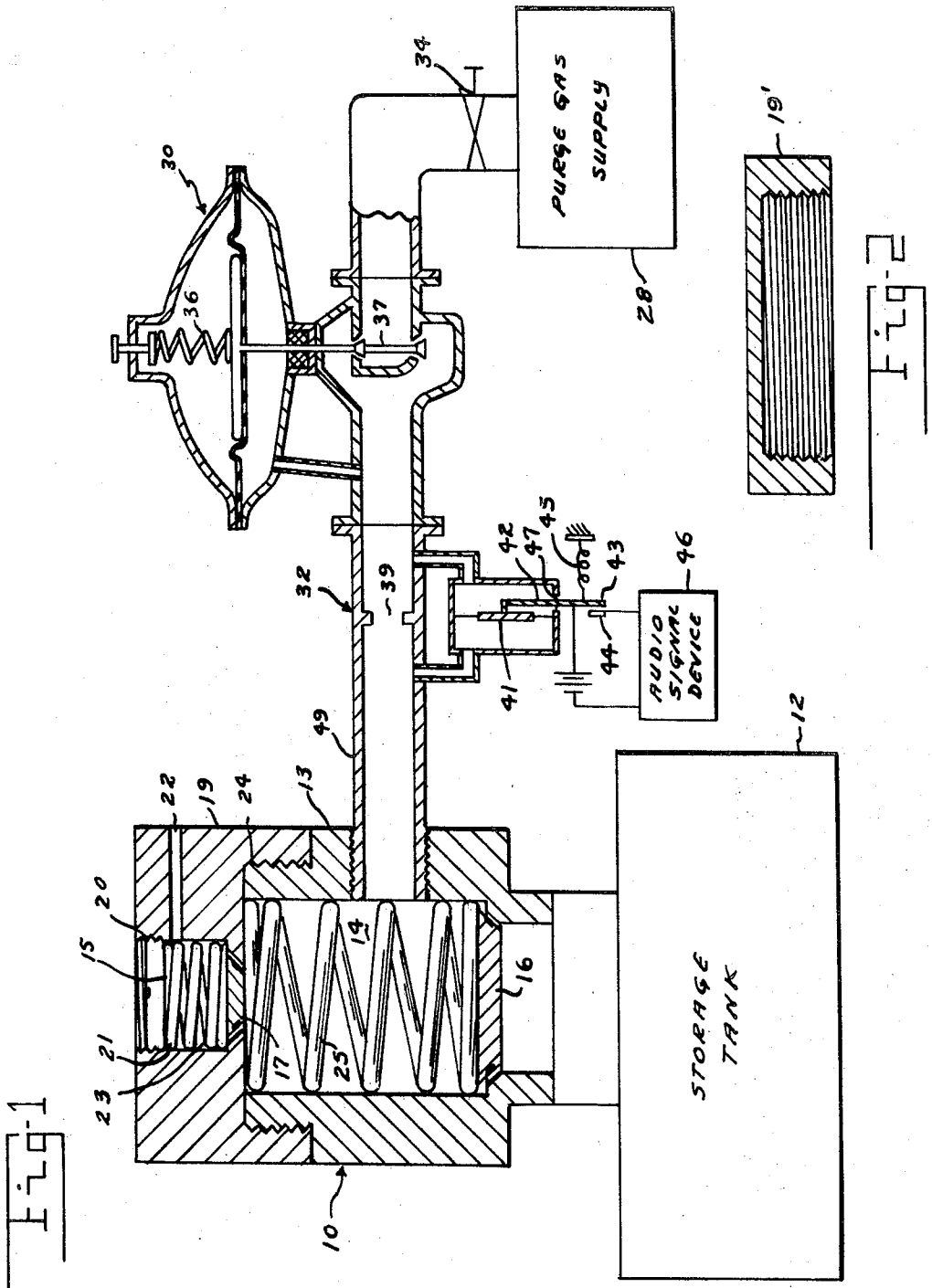


Fig. 1

Fig. 2

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United States Patent Office 3,517,692 Patented June 30, 1970

3,517,692

PRESSURE RELIEF VALVE ASSEMBLY

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Filed July 10, 1968, Ser. No. 743,811
Int. Cl. F16k 17/04, 21/06
U.S. Cl. 137—557 6 Claims

ABSTRACT OF THE DISCLOSURE

A pressure relief valve assembly for a vessel containing a vaporizable fluid has a pair of spring-loaded valve plungers with a purge chamber positioned between the plungers. A high pressure gas supply which contains a gas, either of the same composition as that in the vessel or a neutral gas, is connected to the purge chamber through a pressure regulator and flow sensor. When either of the two plungers remain unseated, purge gas flows from the purge gas supply through the purge chamber and the unseated plunger. The flow of gas through the flow sensor operates an audio signal device.

BACKGROUND OF THE INVENTION

In some storage systems leakage into the tank is hazardous or otherwise deleterious to the system. For example, with the use of pressure relief valves in a vessel containing slush hydrogen or other readily oxidizable material, a very dangerous condition would be present if the relief valve did not completely close and air were to leak into the vessel.

SUMMARY OF THE INVENTION

According to this invention, a purge gas chamber is provided between two spring-loaded plungers of a relief valve connected to a tank or vessel containing hazardous liquid or gas. A purge gas, which is either a neutral gas or the same gas as in the tank, is supplied to the purge chamber from a purge gas supply. A pressure regulator senses a drop in pressure in the purge chamber and starts the flow of purge gas into the purge chamber. A flow of gas from the purge supply is sensed to provide an audio signal to indicate a malfunction in one of the plungers.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 shows a pressure relief valve assembly according to the invention; and

FIG. 2 shows a cap structure for converting the device of FIG. 1 to conventional use.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawing reference number **10** shows a pressure relief valve connected to a storage tank shown schematically at **12**. The tank **12** may contain slush hydrogen or other readily oxidizable material such as methane or other fuels.

The relief valve has a body member **13** with a central passage forming a purge chamber **14** positioned between two spring-loaded plungers **16** and **17**. A vent port **22** communicates with central passage **23** in cap member **19**. The plunger **17** is located in a cap member **19** and separates the cavity in members **13** and **19** into two chambers **14** and **15**. An adjustable threaded plug **20** closes chamber **15** and adjusts spring **21**. Cap member **19** is threaded to body member **13** at **24** and acts as an adjustment means for spring **25**. Springs **21** and **25** are adjusted so that plunger **17** opens at a lower pressure than plunger **16**.

Purge gas from supply **28** is supplied to purge chamber

14 through a pressure regulator shown generally at **30** and a flow sensor shown generally at **32**. A shutoff valve shown schematically at **34** may also be provided. The spring **36** of pressure regulator **30** is adjusted to open valve **37** when the pressure on the purge chamber side of valve **30** drops to a predetermined level. A flow of gas through orifice **39** causes diaphragm **41** and arm **42** to move contact **43** into engagement with contact **44** against the action of spring **45** thus energizing signal device **46**. A flexible seal **47** is provided around contact arm **42**.

A cap member **19'** is shown in FIG. 2 and may be used in place of cap member **19** to convert the relief valve to the conventional operation. In this case tube **49** would be removed to provide a vent for the valve.

In the operation of the device when the pressure in tank **12** exceeds the level as determined by spring **25**, plunger **16** opens allowing gas to leak into purge chamber **14**. Since spring **21** is adjusted to permit operation of plunger **17** at a lower pressure than plunger **16**, plunger **17** opens almost immediately to vent gas through port **22**. In normal operation, the plungers **16** and **17** close again when the pressure in tank **12** drops below the desired pressure as set by spring **25**. If plungers **16** or **17** malfunction and do not close, or if both malfunction and the pressure in purge chamber **14** drops below the level set by spring **36**, valve **37** is opened permitting the flow of purge gas from supply **28** through regulator valve **37**, flow sensor **32**, and into purge chamber **14** and through the open plunger or plungers. A flow of gas through sensor **32** operates signal device **46**, thus giving an alarm that there is a malfunction. The spring **36** is set to open valve **37** at a pressure higher than the pressure in the atmosphere outside port **22** but lower than the pressure required to open plunger **16** as determined by the setting of spring **25**. Thus, there will always be a flow out through plunger **17** whenever it is open. If only valve **16** remains open due to malfunction, purge gas will flow into tank **12** if the tank pressure drops below the pressure as determined by the setting of spring **36**.

There is thus provided a pressure relief valve assembly for preventing the hazardous leakage of gas into a storage tank due to a malfunction of the valve plunger.

While a certain specific embodiment has been described, it is obvious that numerous changes may be made without departing from the general principles and scope of the invention.

I claim:

1. A pressure relief valve assembly comprising a body member having a first and a second port communicating with a cavity within the body member; spring-operated valve means positioned between said ports for dividing said cavity into a first and a second chamber; a second spring-operated valve means for admitting gas from a storage tank to the first of said chambers when the gas in the tank exceeds a first predetermined pressure; means closing the second chamber for adjusting said first spring-operated valve means to a lower opening pressure than said second valve means; means for admitting a purge gas to said first chamber when the pressure therein drops below a second predetermined level lower than the opening pressure of said first valve means.

2. The device as recited in claim **1** including means for indicating a flow of said purge gas.

3. The device as recited in claim **2** wherein said indicating means includes an audio signaling device.

4. A pressure relief valve assembly comprising; a first member having a central passage therethrough; a first valve means for closing one end of said passage; a first spring within said passage abutting said valve means; means, closing the other end of said passage for adjusting said spring to thereby adjust the opening pressure for said valve means; a passage through the wall of

said first member; a second member having a central passage therethrough; a second valve means closing one end of the passage in said second member; a second spring within the passage of said second member and abutting said second valve means; said first member closing the other end of the passage of said second member to thereby provide a closed chamber in said second member; said first member being adjustable on said second member for adjusting the second spring to thereby adjust the opening pressure for the second valve means; a passage through the wall of said second member; a purge gas supply connected to the passage through the wall of said second member; means connected between the purge gas supply and said second member for admitting purge gas to the chamber in said second member when the pressure therein drops below a predetermined pressure.

5. The device as recited in claim 4 including means for indicating a flow of gas from said purge gas supply into said chamber.

6. The device as recited in claim 5 wherein said indicating means includes an audio signaling device.

References Cited

UNITED STATES PATENTS

3,033,220	5/1962	St. Clair	137—557 XR
3,324,872	6/1967	Cloud	137—113 XR
3,349,793	10/1967	Balch	137—322

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U.S. Cl. X.R.

73—46; 137—512