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Brindisi

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[54] **PRESSURE RELIEF VALVE UNIT**

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[62] Division of Ser. No. 219,274, Jan. 20, 1972, abandoned.

[52] **U.S. Cl.** **137/557,** 137/467, 137/527.4, 137/543, 137/613

[51] **Int. Cl.** **F16k 37/00,** F16k 17/08

[58] **Field of Search** 137/467, 469, 512.3, 527, 137/527.4, 527.6, 542, 543, 543.13, 543.19, 557, 613, 614.19

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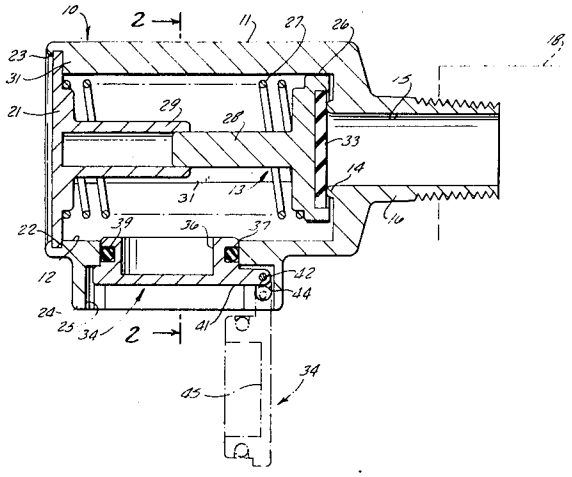
[57] **ABSTRACT**

A valve unit attachable to a fluid type transformer for automatically relieving it of excessive gas pressure developing therein. The unit includes a spring loaded control valve adapted in response to excessive pressure from the transformer to pop open and allow the pressurized gas to dump through an escape tube. A closure, protectively closing the escape tube against entry of moisture and dust, drops from the tube to a depending position under force of the escaping gas to present a brightly colored signal to inspectors that the transformer is possibly malfunctioning.

5 Claims, 3 Drawing Figures



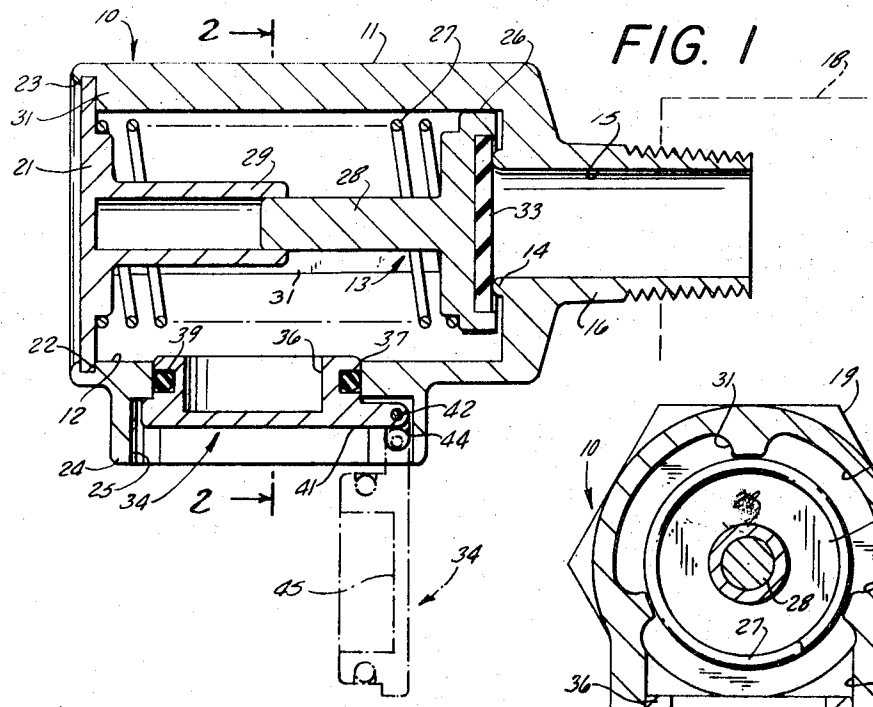


FIG. 1

FIG. 2

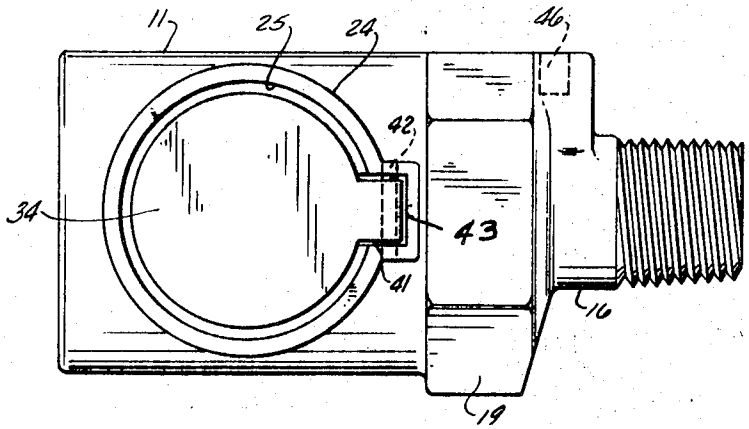


FIG. 3

PRESSURE RELIEF VALVE UNIT

BACKGROUND OF THE INVENTION

This application is a division of U.S. Pat. application Ser. No. 219,274 filed Jan. 20, 1972, now abandoned, for a Pressure Relief Valve Unit.

This invention is concerned with a valve unit adapted to be connected with a container for automatically relieving the latter of excessive pressure of gases that might develop therein.

While the valve unit of the present invention is subject to various applications, it is designed for and especially suited for use in association with the tank of a fluid type electrical transformer such as one that is located outdoors or is mounted upon a pole.

Transformers of the fluid type are likely, when overheated or malfunctioning, to develop gases in the tank which may build up to undesirable excessive pressure. It is the purpose of the valve unit of the present invention when connected to the container to be responsive to a predetermined gaseous pressure rise in the transformer so as to effectively relieve the transformer of such pressure. It is a further purpose of the present valve unit to provide means which will function automatically upon operation of the unit to visibly indicate to those concerned with proper operation of the related transformer that excessive pressure had for some reason developed in the transformer and has been relieved.

A particular advantage of the valve unit of the present invention results from the manner of association of a control valve therein relative to its seat and relative to a relief chamber in which it is movable whereby, when the valve is unseated, pressure gases from the transformer are enabled to pass rapidly and unimpeded through the chamber to an escape tube.

Another advantage results from the manner of the association of a closure with the escape tube, which closure serves in a normally closed condition to protectively seal the internal valve mechanism of the unit from undesirable dust and moisture. The closure is so arranged that it is caused to readily drop free of the escape tube under pressure of gases entering the unit from the transformer. The closure has a retaining connection with the unit whereby, when it is dropped from the escape tube, it depends externally of the latter to present a brightly colored surface as a signal that the transformer is in need of inspection.

Other advantages of the invention will appear as the specification is read in conjunction with the accompanying drawing in which the invention is illustrated.

BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawing:

FIG. 1 is a sectional view of a pressure relief valve unit illustrating a first embodiment of the invention;

FIG. 2 is a section on line 2—2 of FIG. 1; and

FIG. 3 is a bottom plan view of FIG. 1.

DESCRIPTION OF PREFERRED EMBODIMENT

The pressure relief valve unit illustrated in the drawing includes a hollow housing **10** having a main body portion **11** defining an internal cylindrical chamber **12** in which a spring loaded valve **13** is axially slidable relative to a valve seat **14** provided about the inner end of an inlet passage **15.** The inlet passage which is of a

smaller diameter than that of chamber **12** is defined by a spigot or pipe nipple **16** extending axially from the forward end of the housing. A threaded end of the nipple is intended to be connected in a port of the tank **18** (broken line) of a fluid type electrical transformer for the purpose of relieving the latter of excessive gas pressure that might develop therein. Flats **19** about the body provide a surface to which a wrench may be applied for mounting the unit to an associated tank.

The valve chamber **12** is closed at its rear end by means of a circular cover plate **21.** The plate is rigidly held seated upon an internal annular shoulder **22** of the housing by means of an end lip **23** of the housing turned inwardly, as by peening, upon the back of the plate.

A short depending escape tube **24** at the underside of the housing provides a relief passage **25** connecting the valve chamber with atmosphere. Passage **25** is of substantially greater diameter than that of the inlet passage **15** so as to allow an uninhibited and rapid escape of fluid from the valve chamber.

The valve has a circular head **26** which is constantly urged to closed condition upon the valve seat by the force of a return spring **27.** The latter is limited between an annular shoulder of the valve head and the inner face of the cover plate **21.**

The valve is movable axially of the chamber relative to its seat and is supported in this movement by means of an axially extending cylindrical tail or stem portion **28** which has sliding movement in an axially aligned sleeve **29** defined by a forwardly extending stem of the cover plate. A port (not shown) may be provided in the sleeve to avoid undesirable gas becoming trapped behind the valve stem.

The relation of the valve to the valve chamber and to its seat is designed to obtain a rapid dumping or exhaust of pressure fluid to the escape tube following opening of the valve. To this end, the valve chamber **12** is of greater diameter than that of the valve head **26.** Lengthwise of the wall surface of the valve chamber extends a group of equally spaced radially depending ribs **31** (here three) which serve as a guide for the head of the valve as the latter is moved to and from its seat. The ribs, together with the support provided by the sleeve **29** to the valve stem **28,** serve to stabilize the valve in its axial movement. The valve head presents a broad peripheral bearing surface to the ribs, which further serves to stabilize the valve in its movement.

The recessed areas **32** of the housing defined between the ribs are immediately brought into direct communication with the inlet passage **15** when the valve is forced from its seat by excessive gas pressure developing in the associated transformer. By means of this construction, pressurized gas from the inlet passage flows rapidly around the open valve into the recessed areas of chamber **12** from where it rapidly dumps through the escape tube **24** to atmosphere.

The valve is designed relative to its seat so that when a predetermined pressure of transformer gas in the inlet passage **15** is exerted upon the valve, the latter will suddenly pop open and rapidly move axially backward into chamber **12** a substantial distance from its seat. This allows an unimpeded flow of pressurized gas from the inlet passage into the chamber. To this end, the valve seat **14** is in the form of a rounded bead formed about the inner end of the inlet passage. This bead projects slightly into chamber **12.** In addition, the valve head **26** is of a greater diameter than that of the inlet passage.

By means of this advantageous construction, as gas pressure builds up sufficiently against the smaller diameter area of the valve head that is exposed to the inlet passage to move or "crack" the valve slightly from its seat against the load of its spring, the pressurized gas then leaks around the bead defining the valve seat and acts over the greater diameter area of the valve head. The rapidly developing pressure over the valve's entire forward surface forces the valve to pop open or abruptly move inwardly against the force of its spring and thereby allows a free and unimpeded dumping or flow of the in-rushing fluid to the escape tube.

Following relief of the pressurized gas from the escape tube, spring **27** relaxes to return the valve to its seat. A circular rubber gasket **33** seated in a corresponding recess of the valve head cushions the valve as it re-engages its seat under the force of the return spring.

Indicator means **34** that is visible from a distance is automatically releasable from the escape tube to a depending position (broken line, FIG. **1**) to indicate to those concerned that the valve has "blown," that is, had been operated by excessive pressure of gases developing in the associated transformer.

The indicator means **34** is in the nature of a closure or hinged plug in the escape tube. It comprises an annular base plate **35** from the inner face of which axially extends a short tubular portion **36** of lesser diameter. The plug **34** has a normally closed condition in which its tubular portion **36** is received in a correspondingly reduced diameter portion **37** of the escape tube, and the base plate **35** is seated upon an internal shoulder of a relatively larger diameter area **38** of the escape tube. An O-ring **39** about the tubular portion frictionally engaging the wall of the escape tube provides sufficient resistance to prevent the plug from dropping to open condition under its own weight. A lug **41** (FIGS. **1, 3**) extending from the periphery of the plug is pivoted upon a hinge pin **42** in a lateral recess **43** of the escape tube. In its closed condition, the plug seals the chamber against entry of dirt and moisture to the valve mechanism. This is of advantage since the valve unit is exposed to the various elements of the weather when attached to a transformer mounted upon a pole.

The hinge pin **42** extends through a vertical lost motion slot **44.** The slot is of an axial dimension that is adequate to allow the tubular portion **36** of the plug to be dropped axially out of the reduced diameter area **37** of the escape tube into the larger diameter area **38** under pressure of gas entering the valve chamber. When this happens, the plug **34** will swing on its hinge angularly downward and out of the escape tube to a depending vertical position (broken line, FIG. **1**), hanging from its hinge pin. A brightly colored surface **45** of the plug then becomes visible for a considerable distance to indicate to those concerned the need of inspecting the associated transformer for possible trouble.

A tapped hole **46** is provided in the housing for securing by means of a screw an electrical ground wire to the housing.

What is claimed is:

1. A pressure relief valve unit for automatically relieving a container of excessive pressure of gas developing therein, comprising a housing having an internal chamber, a pipe nipple extending from one end of the housing for coupling the unit to the container, the nipple defining an inlet passage to the chamber for conducting pressurized gas from the container into the chamber, a valve seat defined about the inner end of the passage at its juncture with the chamber, a valve movable axially in the chamber relative to the seat, a spring biasing the valve to a closed condition upon the seat, the valve being movable from its seat upon development of a predetermined pressure of gas in the pipe nipple, and an escape tube depending from the underside of the housing defining a relief passage communicating the chamber with atmosphere; wherein the chamber is axially aligned with the inlet passage and is of a greater diameter, a group of circumferentially spaced ribs extend lengthwise of the wall of the chamber and depend radially for guiding the valve as it is moved relative to the seat, the ribs defining between each other radially recessed areas having direct communication with the relief passage of the escape tube, and the recessed areas having direct communication with the inlet passage upon unseating of the valve, wherein the housing has a rear closure wall provided with a sleeve extending axially forwardly into the chamber, and the valve has a circular head that is engageable with the seat and is provided with a rearwardly extending stem slidably received in the sleeve; and wherein a plug closure is frictionally engageable in the tube for closing the relief passage, the plug closure when in closed position being adapted under pressure of fluid entering the chamber to drop out of the relief passage, the plug closure having when in closed condition a position entirely within the tube, and lost motion hinge means connected with the plug closure within the tube adjacent a bottom open end of the tube which allows movement of the plug closure from a position closing the passage to a position depending externally of the bottom end of the tube.

2. A pressure relief valve unit as in claim **1,** wherein the seat is defined by an annular bead about the inlet passage projecting into the chamber, which bead spaces the valve in its seated condition from a wall area of the chamber adjacent the bead.

3. A pressure relief valve as in claim **2,** wherein the valve has a circular head provided with a resilient gasket that is seated in a forward face thereof and is engageable with the seat.

4. A pressure relief valve as in claim **3,** wherein the forward face of the valve is of greater diameter than that of the inlet passage and that of the bead defining the seat.

5. A pressure relief valve unit as in claim **1,** wherein the plug has a brightly colored inner surface which is visible externally of the escape tube when the plug is depending from its hinge.

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