

March 24, 1970

W. J. SIEVERIN

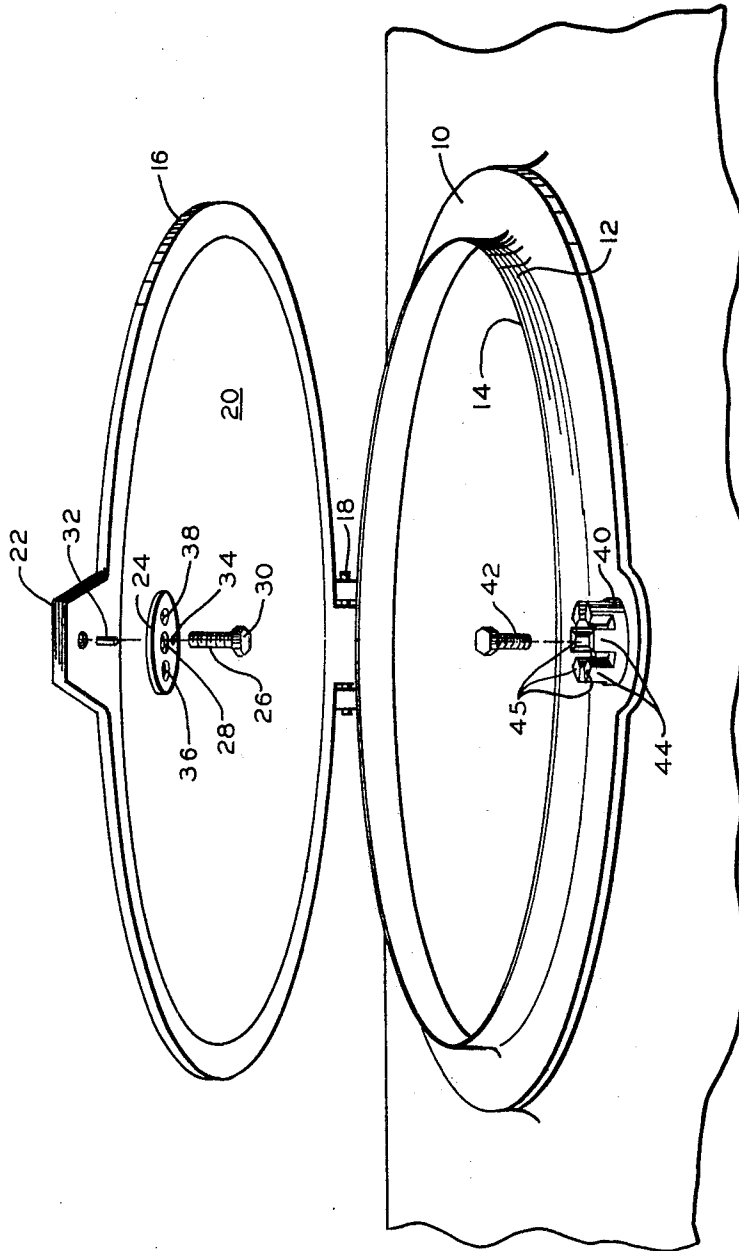
3,502,361

MAGNETICALLY BIASED TANK VENT

Filed May 29, 1968

2 Sheets-Sheet 1

FIG. 1



INVENTOR.
WALTER J. SIEVERIN

BY

Charles S. McGuire
ATTORNEY

March 24, 1970

W. J. SIEVERIN

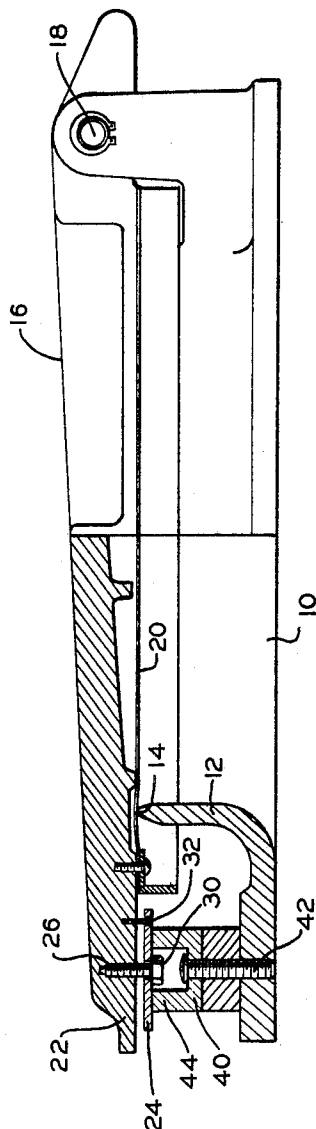
3,502,361

MAGNETICALLY BIASED TANK VENT

Filed May 29, 1968

2 Sheets-Sheet 2

FIG. 2



INVENTOR.
WALTER J. SIEVERIN

BY

Charles S. Sieverin
ATTORNEY

1

2

3,502,361

MAGNETICALLY BIASED TANK VENT

Walter J. Sieverin, Buffalo Grove, Ill., assignor to GPE Controls, Inc., Morton Grove, Ill., a corporation of Illinois

Filed May 29, 1968, Ser. No. 732,972

Int. Cl. E05c 17/56, 19/16

U.S. Cl. 292—251.5

2 Claims

ABSTRACT OF THE DISCLOSURE

A tank vent fitting having a cover which is held in the closed position by the biasing force of a permanent magnet and also having means for preventing breakage of the magnet due to impact upon closure of the cover.

The present invention relates to the vent fittings such as breather or emergency vents for storage tanks, and the like, and more particularly to novel means for magnetically biasing the hinged mounted pallet or cover of such a device in the closed position.

In co-pending U.S. application Ser. No. 625,758, filed Mar. 24, 1967, now Patent No. 3,454,040 and assigned to applicant's assignee, there is disclosed a valve device wherein the biasing force of a permanent magnet is utilized to hold the valve pallet in the closed position until the pressure differential on opposite sides of the pallet is sufficient to overcome the magnetic biasing force. As is common in valves of this type, the pallet is arranged for movement with respect to the valve seat along an essentially straight line path, as opposed to the arcuate path of a hinged mounted vent cover as in the present invention. While preserving the advantages associated with magnetic biasing pointed out in the aforementioned application, the present invention provides a structure which allows magnetic biasing for a hinged mounted cover for a tank opening in a manner which achieves superior performance.

In the illustrated embodiment of the invention, the cover is provided with a lip portion extending outwardly from one edge thereof, outside the valve seat. Preferably, the lip is diametrically opposite the hinged mounting of the cover upon the base. In the illustrated embodiment, the permanent magnet is fixedly attached to the base with its pole pieces facing upwardly toward the lip on the cover. Loosely affixed to the lip is a plate of magnetically permeable material. The loose mounting may be accomplished, for example, by means of a bolt affixed to the lip and passing through an oversized hole in the plate of magnetically permeable material. The plate is retained by the head of the bolt, which allows a certain amount of movement of the plate between the bolt head and the lip on the cover. The dimensioning and arrangement of parts is such that when the cover closes to make contact with the seat, the amount of impact transmitted to the magnet is far below the force required to cause any damage thereto since only the relatively light plate and not the cover transmits force to the magnet. At the same time, however, the cover is held firmly in position on the seat by virtue of the plate being pulled into firm contact with the head of the bolt which is affixed in the lip on the cover.

It is a principal object of the present invention to provide a vent cover construction biased in the closed position by a permanent magnet in a manner providing superior operating characteristics at relatively low cost.

It is a further object to provide a cover construction mounted for hinged movement between open and closed positions with respect to a base portion with means pre-

venting damage to elements which provide a magnetic biasing for the cover through impact when the cover moves to closed position.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

FIG. 1 is a perspective view of a preferred embodiment of the invention showing the cover in the open position with certain elements axially exploded; and

FIG. 2 is a side elevation, partially in section, showing the cover in the closed position.

The invention is intended for incorporation in hinged mounted cover constructions for tank fittings such as breather or emergency vents, and the like. Although the illustrated embodiment shows the invention in an application for the relief of over-pressure with a tank or other enclosed structure with which it is associated, it will be immediately apparent that conventional modifications in the manner of mounting would allow its use to relieve a vacuum within the tank. Likewise, it will be readily apparent that the nature of many conventional elements, shown by way of example in the present disclosure, is subject to variation within scope of the art.

Annular base portion 10 is designed for fixed attachment to a tank structure, or like enclosure, in registration with an appropriate opening therein. Base 10 includes an upstanding flange 12 terminating in an upper surface defining annular seat 14. Generally circular cover 16 is hinged attached in a conventional manner such as hinge pin 18 to base 10 for movement between open and closed positions with respect to seat 14. A conventional diaphragm structure, such as that indicated by reference numeral 20 in FIG. 2, may be provided to insure sealing of the cover against the seat, thus preventing or minimizing leakage through the opening when the cover is in the closed position.

Cover 16 includes lip portion 22 extending outwardly from the side thereof opposite the connection of cover 16 to base 10 by hinge pin 18. Plate 24 is loosely affixed to the side of lip 22 facing base 10 by means of bolt 26 which extends through central opening 28 in plate 24 into an appropriately threaded opening in lip 22. That is, opening 28 is somewhat larger than the outer diameter of bolt 26, but smaller than head 30 of the bolt, so that plate 24 is loosely retained between lip 22 and head 30 of bolt 26. As best seen in FIG. 2, bolt 26 is threaded into lip 22 by such an amount that a desired distance of clearance or movement is provided for plate 24. Roll pin 32 extends fixedly from lip 22 loosely through opening 34 in plate 24. Thus, roll pin 32 prevents rotation of plate 24 about bolt 26, but still allows the aforementioned axial travel along the bolt of the plate. Plate 24 includes two further openings 36 and 38, for a purpose which will be presently described.

Permanent magnet 40 is fixedly attached to base 10 by means of screw 42 which passes through a central opening in the magnet and is threaded in an opening in the base. Magnet 40, in the illustrated embodiment, is generally circular and includes segmented pole pieces 44 which face upwardly toward lip 22 and in registration with plate 24, when the magnet is affixed as shown in FIG. 2. Pole pieces 44 terminate in face surfaces 45, all of which lie in a single, flat plane.

The dimensioning and arrangement of the afore-described elements is such that when cover 16 is in the closed position, as seen in FIG. 2, the lower, planar surface of plate 24 contacts face surfaces 45 of the pole pieces of magnet 40 and the plate is held in firm engagement with head 30 of bolt 26. Thus, the biasing force of magnet 40 tends to hold cover 16 firmly in its closed position with diaphragm 20 in sealing engagement with seat 14. Pressure within the tank with which the device is associated is exerted on the lower side of cover 16 within seat 14, in opposition to the atmospheric pressure on the upper side of the cover. When the tank pressure exceeds atmospheric pressure by an amount sufficient to overcome the combined loading force of magnet 40 and the weight of cover 16, the latter will be lifted off seat 14, thereby breaking the magnetic bond between magnet 40 and plate 24. The force of magnetic attraction between the magnet and plate decreases rapidly, of course, as the distance between the two increases. Since the magnetic biasing force is an appreciable portion of the total force tending to hold cover 16 in the closed position, the slight lifting of the cover required to essentially break the magnetic bond between the magnet and plate will remove enough of the biasing force to allow rapid movement of the cover to substantially the fully opened position.

When the pressure within the tank has dropped to the point that the unit weight of the cover is greater than the upward force exerted thereon by the gas escaping from the tank, the cover will return to the closed position. Since the cover represents an appreciable mass which may be moving about hinge pin 18 at a relatively high velocity when it reaches the closed position, magnet 40 could be seriously damaged by absorbing this impact. As previously mentioned, however, the elements are so dimensioned and positioned that cover 16 (or diaphragm 20) makes contact with valve seat 14, thereby stopping the movement of cover 16, before any impact is transferred from the cover to magnet 40. Although plate 24 makes contact with pole pieces 44 of the magnet during movement of cover 16, the mass of plate 24 is low enough that no damage to the magnet will result. The space provided for movement of plate 24 between head 30 of bolt 26 and the lower surface of lip 22 insures that substantially no impact will be transmitted from cover 16 to magnet 40.

Means are provided for quickly and easily adjusting the amount of force exerted by the magnet on cover 16. Holes 36 and 38 in plate 24 are so positioned with respect to the segmented pole pieces 44 of magnet 40 that the relative rotational positions of plate 24 and magnet 40 determine the degree of alignment between these holes and face surfaces 45 of two of the pole pieces. In the illustrated embodiment, pin 32 prevents rotational movement of plate 24. However, magnet 40 may be set in any desired rotational position and retained therein by tightening screw 42. The total pulling force exerted by magnet 40 is a function of the degree of magnetization of the magnet and the contacting area of face surfaces 45 and plate 24.

The magnet is designed to have a predetermined total area on the faces of pole pieces 44. This is the maximum area over which the face surfaces of the magnet and plate 24 can be in mutual contact, assuming holes 36 and 38 are no greater in diameter than the spaces between the pole pieces. Thus, by fixing the rotational position of magnet 40 with holes 36 and 38 in registration with two of the spaces between face surfaces 45, magnet 40 will exert a maximum biasing force on cover 16. By rotating the magnet to a position where the faces of two pole pieces are aligned with holes 36 and 38, the magnet will exert a biasing force about 25% less than maximum. The pole pieces, as well as the holes in the magnet plate, may be provided in any desired number and configuration. For example, rather than being round, the

holes could be made in the same shape as the pole pieces.

The magnet material is initially formed in the desired configuration and is then fully magnetized or saturated in conventional manner. The magnet is then "knocked down" or stabilized at a point preferably between 5% and 15% below saturation. Plate 24, for most applications, may be formed by a stamping operation followed by deburring or polishing. The plate is made, of course, from a material with a high degree of magnetic permeability such as stainless steel.

For normal applications in conjunction with petroleum storage tanks, emergency vents of the type described herein are typically loaded to open at a tank pressure of a few ounces per square inch above atmospheric pressure. A permanent magnet of the type illustrated, having six pole faces of equal size and shape with one another and with the spaces therebetween may easily be fabricated to exert a pulling force on the cover of 15 pounds with an outer diameter of about 1¼ inches. Since the cover is held on one side by the hinge and the magnet is placed diametrically opposite the hinged mounting, the pressure required to lift the cover would be double the pulling force exerted by the magnet. Hence, a magnet exerting 15 pounds pulling force would provide the required holding force for a set pressure of about 9 ounces per square inch on an 8 inch emergency vent. This loading may be continuously varied down to about 6¾ ounces per square inch since the force adjusting means illustrated provides the capability of setting the pulling force exerted on the cover anywhere between about 11¼ and 15 pounds. Obviously, larger and more strongly magnetized magnets may be used in conjunction with larger cover constructions, or those in which a larger unit loading is desired.

From the foregoing description it may be seen that the invention provides a vent construction which may be loaded or biased in the closed position in an extremely simple and inexpensive manner. The cost of making and assembling the component parts will normally be as low or lower than that for a conventionally weight-loaded cover construction. Since the heavy and bulky lead weights normally attached directly to the cover are eliminated by the present invention shipment, storage and maintenance costs are minimized. Furthermore, operating efficiency is improved since the cover tends to move to the fully opened position as soon as the set pressure has been reached. The unique manner of mounting the elements provided by the present invention insures against damage to any of the parts due to impact.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained, and since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A pressure-responsive vent comprising, in combination:

- (a) a fixed base portion adapted to be mounted on a tank in conjunction with which said vent is used having an opening therethrough defining a seat and vent opening;
- (b) a cover member hingedly mounted on said base portion and movable between open and closed position with respect to said seat;
- (c) a diaphragm on said cover for sealing the cover to the seat when the cover is in closed position;
- (d) a lip portion arranged on the opposite side of said cover member from the latter's hinged mounting on said base extending outwardly from the portion thereof which engages said seat in spaced relation

5

to an opposing portion of said base when said cover is in its closed position;

(e) a permanent magnet member mounted on one of said lip and said opposing portion of said base;

(f) a magnetically permeable member mounted on the other of said lip and the opposing portion of said base;

(g) one of said magnet members and said permeable members being fixedly mounted and the other being mounted for free movement relative to the portion of the vent upon which it is mounted for movement of said cover member between said open and closed positions; and

(h) said magnet member and said permeable member being so constructed and arranged with respect to one another when said cover is in said closed position that a predetermined biasing force is provided, resisting movement of said cover away from said closed position.

2. The invention according to claim 1 wherein said magnet member is fixedly mounted on said base with its pole pieces facing toward one side of said lip portion and said magnetically permeable member is

6

mounted on said one side of said lip portion for movement with respect thereto and for contact with said pole pieces when said cover is in its closed position, thereby exerting a predetermined biasing force on said lip portion which restrains said cover member against movement away from said closed position.

References Cited

UNITED STATES PATENTS

10	2,693,382	11/1954	Teeter	292—251.5
	2,733,092	1/1950	Teeter	292—251.5
	2,801,870	8/1957	Davey	292—251.5
	2,970,857	2/1961	Squire	292—251.5

FOREIGN PATENTS

15 629,903 9/1949 Great Britain.

MARVIN A. CHAMPION, Primary Examiner

20 EDWARD J. MCCARTHY, Assistant Examiner

U.S. Cl. X.R.

220—44