

J. H. WIGGINS ET AL

CONTROL MECHANISM FOR GAS AND LIQUID STORAGE APPARATUS

Filed June 21, 1937

FIG. 1.

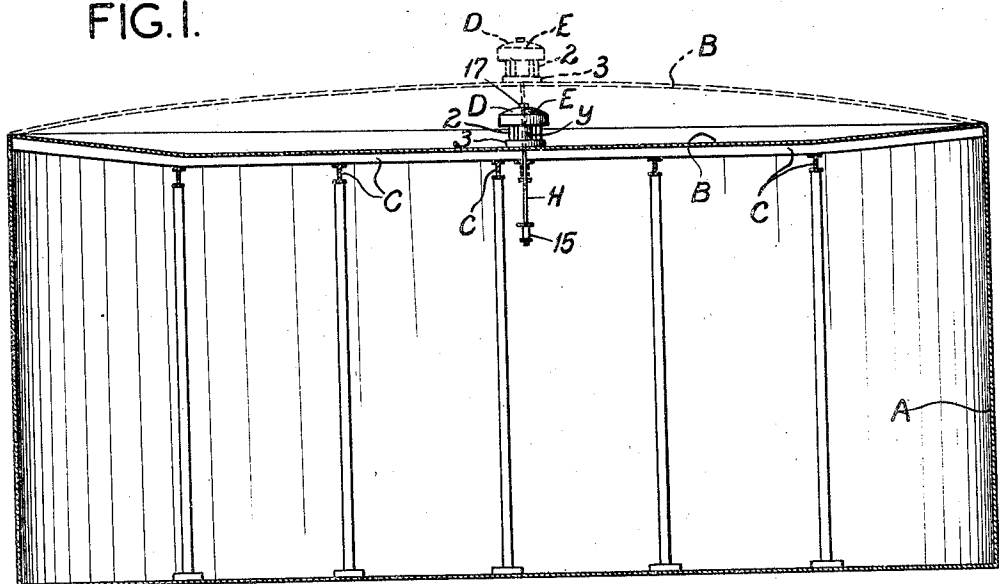


FIG. 2.

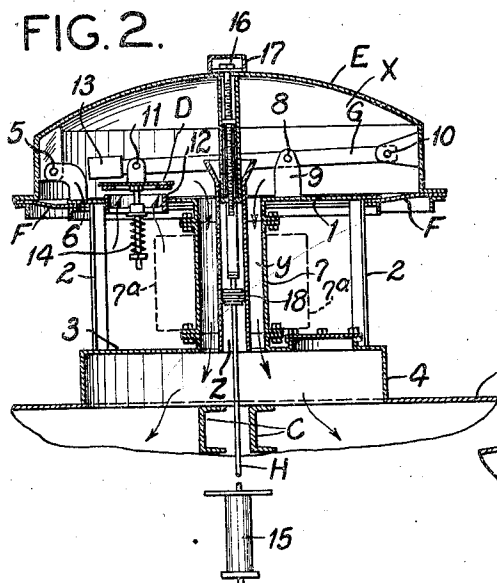


FIG. 3.

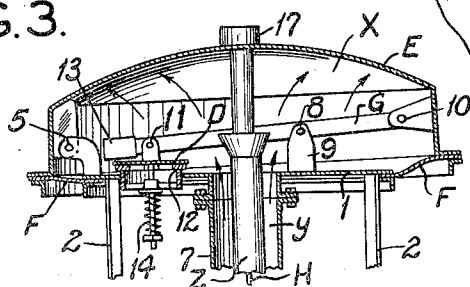
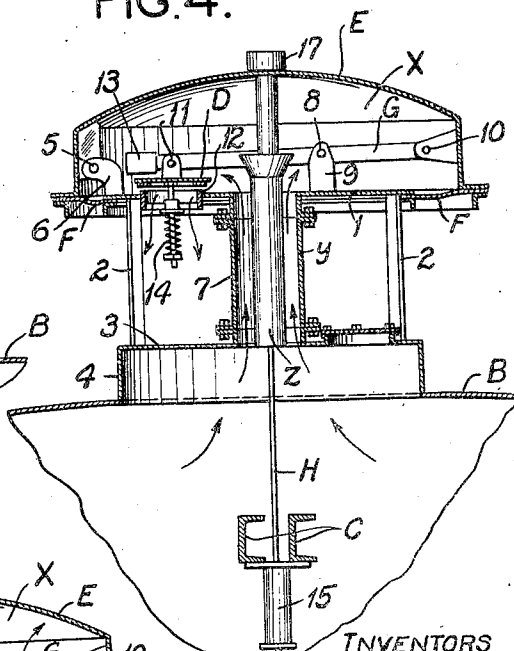


FIG. 4.



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## UNITED STATES PATENT OFFICE

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## CONTROL MECHANISM FOR GAS AND LIQUID STORAGE APPARATUS

John H. Wiggins and Donald E. Larson, Chicago, Ill., assignors, by direct and mesne assignments, of one-half to said Wiggins and one-half to Chicago Bridge & Iron Company, a corporation of Illinois

Application June 21, 1937, Serial No. 149,462

16 Claims. (Cl. 220-85)

This invention relates to control mechanisms for gas and/or liquid storage apparatus of the kind in which the gas space or vapor space of the storage apparatus comprises a breather type roof or equivalent movable part, that is adapted to move in opposite directions so as to vary the volume of the gas space.

One object of our invention is to provide a control mechanism which, in addition to embodying the basic idea described in the application for patent of John H. Wiggins, Ser. No. 149,461, filed June 21, 1937, is composed of parts of such construction and arrangement that the structure as an entirety is very compact and easy to install.

Another object is to provide a control mechanism for gas and/or liquid storage apparatus of the general type mentioned, which is of such design that the valve operating apparatus is effectively protected from the weather and the vent valve is so arranged that liquid cannot collect on the seat of same and thus freeze the valve shut in cold weather.

Other objects and desirable features of our invention will be hereinafter pointed out.

Figure 1 of the drawing is a vertical transverse sectional view illustrating our improved control mechanism mounted in operative position on a storage tank equipped with a breather type roof that is capable of moving vertically so as to vary the volume of the gas space or vapor space of the tank.

Figure 2 is an enlarged vertical sectional view of said control mechanism showing the vent valve in its open position so as to permit air to enter the gas space of the tank to relieve an internal vacuum.

Figure 3 is a cross-sectional view of said control mechanism illustrating how the vent valve is held tightly seated when the roof of the tank moves upwardly due to an increase in the internal pressure of the gas space; and

Figure 4 is a cross-sectional view of said control mechanism showing the vent valve opened so as to permit gases to escape from the tank to relieve the internal pressure of same.

The control mechanism herein illustrated is identical to the control mechanism described in the Wiggins application for patent previously referred to in that the operating mechanism for the venting means comprises a prime mover consisting of a part carried by the vertically movable roof of the tank, and designed so that an internal pressure in the gas space causes said prime mover to move in one direction and thus effect a change in the position or condition of the vent-

ing means, and a partial vacuum or minus pressure in the gas space causes said prime mover to move in the opposite direction and thus effect a change in the position or condition of the venting means, but the specific details of construction and arrangement of the prime mover and other parts of the valve operating mechanism of our improved control mechanism are different from that of the corresponding parts of the apparatus described in said Wiggins application. In our improved mechanism the prime mover consists of a member which forms a movable wall of a gas chamber inside of which is arranged parts that transmit movement from said movable wall to a combined pressure relief and vacuum relief vent valve to seat and unseat the same, said gas chamber being connected with the gas space or vapor space of the tank in such a way that an internal pressure in the tank is capable of causing said movable wall or prime mover to move in one direction and an internal vacuum or minus pressure in the tank is capable of causing said movable wall or prime mover to move in the opposite direction. In such a control mechanism the prime mover may be made only about one-half as large as the prime mover of the apparatus described in the said Wiggins application without interfering with the efficiency of the mechanism, and it has the added advantage of being of such design that snow is very unlikely to collect and remain upon the parts that are used to operate the vent valve and thus interfere with the successful operation of the mechanism.

In the accompanying drawing, A designates the tank or container of the storage apparatus which may be of any suitable or preferred construction, and B designates a movable member, for example, the roof of the tank A that forms the top wall of the gas space or vapor space, said roof being herein illustrated as consisting of a metal diaphragm constructed and arranged so that it will rest upon and be supported by roof rafters C under certain conditions and is capable of moving upwardly into the position shown in broken lines in Figure 1, due to an increase in the internal pressure in the container A as is common or usual in breather type and balloon type devices that are used for storing gases and volatile liquids.

Our improved control mechanism comprises coacting parts which form a gas-tight chamber x that is carried by and arranged in an elevated position on the vertically movable roof B of the

container, a passageway *y* for establishing communication between the chamber *x* and the gas space or vapor space of the container *A*, a combined pressure and vacuum relief vent valve *D* for the gas chamber *x*, and an operating mechanism for said vent valve that comprises a prime mover *E* constructed in the form of a dome-shaped rigid member that forms a movable top wall for the gas chamber *x*. The gas chamber *x* is provided with a stationary bottom portion *1* formed preferably by a metal plate supported by standards *2* that project upwardly from a cover plate *3* attached to a circular collar *4* which surrounds an opening in the roof *B* of the tank through which air is admitted to said tank and through which gases can escape from said tank. The dome-shaped member *E* that forms the top wall of the gas chamber *x* is also made of metal and is mounted in such a way that it is capable of moving relatively to the stationary bottom portion of the gas chamber. In the form of our invention herein illustrated, the dome-shaped member or prime mover *E* is pivotally connected at *5* to a bracket *6* on the stationary bottom portion *1* of the gas chamber and is of greater diameter than said bottom portion, so that it is capable of rocking vertically relatively to the same. A sealing element made of gas-tight and flame-proof fabric *F* is attached to the lower edge of the rim of the dome-shaped member *E* and to the peripheral edge of the stationary bottom portion *1* of the gas chamber, so as to produce and maintain a gas-tight joint between said parts and still permit the member *E*, that constitutes the top of the gas chamber *x*, to rock on its pivot *5* when the pressure in the container *A* varies as hereinafter described. The passageway *y* previously mentioned, that establishes communication between the gas space of the container and the gas chamber *x* of the control mechanism, may be formed either by an open-ended tubular member *7* as shown in full lines in the drawing, or by a conventional flame arrester *7a* shown in broken lines in Figure 2, arranged in alignment with holes in the cover plate *3* and in the bottom portion *1* of the gas chamber.

The movements of the prime mover *E* are transmitted to the vent valve *D* by a lever *G* pivotally mounted at *8* on a support *9* carried by the stationary bottom portion *1* of the gas chamber, one end of said lever being connected by a pivot *10* to an inwardly projecting lug on the rim of the dome-shaped member *E* and the opposite end portion of said lever being connected by a pivot *11* to a lug on the top side of the vent valve *D*. Said vent valve *D* is formed by a horizontally disposed valve element that is arranged above an annular valve seat *12* which surrounds a combined air inlet and gas outlet in the bottom portion *1* of the gas chamber and a weight *13* is mounted on the free end of the lever *G* so as to exert pressure on the same in a direction tending to hold the vent valve closed or seated. Preferably, a spring *14* is combined with the vent valve so as to prevent the same from chattering but said spring *14* is not relied upon to hold the vent valve shut or in its closed position. When the prime mover *E* rocks upwardly on its pivot *5* the free end or weighted end of the lever *G* will move downwardly and thus force the vent valve towards its seat *12*, and when said prime mover *E* rocks in the opposite direction the lever *G* will lift the vent valve *D* or raise it from its seat.

In addition to the parts just described, the valve operating mechanism comprises a means that is used to open the vent valve *D* to provide pressure relief. Said means preferably consists of a rod or equivalent device *H* projecting downwardly from the center of the prime mover *E* and provided at its lower end with a trip device *15* arranged so that during the upward movement of the roof *B* of the container *A*, said trip device *15* comes in contact with a stationary part on the interior of the container such, for example, as one or a pair of the roof supporting beams *C*, with the result that if the roof *B* continues to move upwardly the rod *H* will effect a change in the position of the prime mover *E* and the parts controlled or moved by said device. The rod *H* extends vertically through a passageway *z*, separate and distinct from the passageway *y* through which air and gases flow into and out of the container, and at the upper end of said rod *H* is an adjusting device *16* that may be manipulated to vary the effective length of the rod *H* or, in other words, vary the point in the upward movement of the roof *B* that the trip device *15* comes into engagement with its co-acting stationary part or abutment on the interior of the container. A removable sealing cap *17* mounted on the dome-shaped cover *E* of the gas chamber prevents gases from escaping through a hole in the member *E* that receives the adjusting device *16* and a flame-proof packing *18* is mounted on the rod *H* so as to maintain a tight joint between the same and the open-ended tubular member that forms the passageway *z*.

The operation of the apparatus above described is as follows:

As the roof *B* rises carrying with it the vent valve *D* and the operating mechanism for said vent valve, the increase in pressure on the interior of the container *A* will exert pressure on the prime mover *E* in such a direction as to rock said device upwardly on its pivot *5* and thus cause the lever *G* to hold the vent valve *D* tightly against its seat as shown in Figure 3. When the roof *B* reaches a certain approximate position during its upward movement, the stop device *15* contacts the pair of roof rafters *C* arranged in the path of travel of said stop device as shown in Figure 4 and thus arrests the upward movement of the rod *H* which depends from the prime mover *E*. If the roof continues to move upwardly, the prime mover *E* will remain at rest due to the fact that the stop device *15* is then in engagement with its co-acting roof beams *C* and the free end of the lever *G* will swing upwardly, thus causing the vent valve *D* to open as shown in Figure 4 and permit gases to escape from the gas chamber *x*, thereby providing pressure relief for the container *A*. After such venting of the gas space of the container the roof *B* will start to move downwardly and while said roof is descending, the vent valve remains in its closed position, the roof finally coming to rest on the roof rafters *C* as shown in full lines in Figure 1. If thereafter the pressure decreases and finally reaches a degree where a partial vacuum or minus pressure is set up in the gas space of the container and in the gas chamber *x*, a downward force is exerted on the prime mover *E* which causes said device *E* to rock downwardly on its pivot *5*, thereby raising the free end or weighted end of the lever *G* and causing the vent valve *D* to open as shown in Figure 2 and permit air to enter the gas chamber *x* and also the gas

space of the container so as to provide vacuum relief.

In a control mechanism of the construction above described, the parts are so compactly arranged that it is practicable to make the prime mover E not over five or six feet in diameter and still obtain a control apparatus that is absolutely reliable in operation as there is very little liability of snow collecting and remaining upon the prime mover E in sufficient quantities to interfere with the operation of same. Such a valve operating mechanism is easy to install; most of the parts of same are positioned inside of a gas-tight chamber and are thus protected from the weather and the vent valve and its coacting seat are so constructed and arranged that it is impossible for a liquid to collect on the seat of said valve and thus freeze it shut.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A storage apparatus of the general kind described, comprising a container whose gas space is provided with a movable part that is adapted to move to vary the volume of said gas space, a gas chamber carried by said movable part and provided with a prime mover formed by a rockable part of said chamber that is capable of moving relatively to the said movable part of said container, a hollow member for connecting said gas chamber with the gas space of the container, a venting means for said gas chamber, and apparatus positioned inside of said gas chamber and hollow member for actuating said venting means.

2. A storage apparatus of the general kind described, comprising a container whose gas space is provided with a movable part that is adapted to move to vary the volume of said gas space, a gas chamber carried by said movable part and arranged in communication with the gas space of the container, a vent valve for said gas chamber arranged inside of same, and an operating mechanism for said valve comprising a prime mover formed by a hinged wall of said gas chamber that is capable of moving relatively to the said movable part of said container.

3. A storage apparatus of the general kind described, comprising a container whose gas space is provided with a movable part that is adapted to move to vary the volume of said gas space, a gas chamber carried by said movable part and arranged in communication with the gas space of the container, a vent valve for said chamber, and an operating mechanism for said valve comprising a prime mover formed by a rigid top wall for said chamber that is pivotally mounted and arranged so as to be capable of being moved relatively to the said movable part of the container by the pressure in the gas space of the container.

4. A gas and/or liquid storage apparatus, comprising a container provided with a vertically movable roof, a gas chamber mounted on said roof and arranged in communication with the gas space of the container, said gas chamber having a wall that is adapted to be moved in one direction by a certain approximate positive pressure in the container and to be moved in the opposite direction by a certain approximate minus pressure in the container, a vent valve for said gas chamber, and a valve operating means in said chamber for causing the movement of the movable wall of said gas chamber to effect a change in the condition or position of the vent valve.

5. A gas and/or liquid storage apparatus of the

kind described in claim 4, in which the vent valve is arranged on the interior of the gas chamber.

6. A gas and/or liquid storage apparatus of the kind described in claim 4, provided with means for utilizing the bodily movement of the roof to cause the movable wall of the gas chamber to effect the unseating of the vent valve to provide pressure relief.

7. A gas and/or liquid storage apparatus of the kind described in claim 4, in which the movable wall of the gas chamber is attached to a means arranged so that during the upward movement of the roof said means will exert pressure on said movable wall in a manner to cause the same to effect the unseating of the vent valve to provide pressure relief.

8. A gas and/or liquid storage apparatus, comprising a container provided with a roof that is adapted to move upwardly and downwardly to vary the volume of the gas space of the container, a gas chamber mounted on the top side of said roof and provided with a movable top wall, the interior of said gas chamber communicating with the gas space of the container, a vent valve, means inside of said gas chamber for utilizing the movement of the top wall of said chamber in one direction to seat said valve and in the opposite direction to unseat said valve, and an operating device depending from the movable top wall of the gas chamber and arranged to cooperate with a stationary part to cause said top wall to assume a position to effect the unseating of said valve to provide pressure relief when the roof of the container reaches a certain approximate position during its upward movement.

9. A gas and/or liquid storage apparatus of the kind described in claim 8, provided with means for enabling said operating device to be adjusted and also provided with a separate passageway for said operating device, leading from the gas chamber to the gas space of the container.

10. A gas and/or liquid storage apparatus of the kind described in claim 8, in which the movable top wall of the gas chamber is formed by a pivotally mounted dome-shaped member whose rim is connected by a flexible sealing element to a stationary portion at the bottom of the gas chamber.

11. A gas and/or liquid storage apparatus of the kind described in claim 8, in which the means inside of the gas chamber that is employed to seat and unseat the vent valve consists of a lever pivotally mounted on a stationary part at the bottom of the gas chamber and having one of its ends attached to the movable top wall of the gas chamber and its opposite end attached to the vent valve.

12. A gas and/or liquid storage apparatus of the kind described in claim 4, in which the movable wall of said gas chamber causes said vent valve to be held tightly seated during a portion of the upward movement of the roof.

13. A gas and/or liquid storage apparatus of the kind described in claim 4, in which the movable wall of said gas chamber causes said vent valve to open to provide vacuum relief for the gas space of the container under certain conditions.

14. A gas and/or liquid storage apparatus of the kind described in claim 4, in which the said approximate minus pressure in the container is capable of causing the movable wall of the gas chamber to move in a direction to open the vent valve to provide vacuum relief when the roof of the container is in its extreme downwardly deflected condition.

15. A gas and/or liquid storage apparatus of the kind described in claim 4, in which the gas chamber is provided with a stationary bottom part, the movable wall of said chamber is formed by a hinged or pivoted part at the top of said chamber, and the vent valve is mounted on the stationary bottom part of said chamber.

16. A gas and/or liquid storage apparatus of the kind described in claim 4, in which the valve operating means comprises a trip device in the gas space of the container, carried by a part that is attached to the movable wall of said gas chamber. 6

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