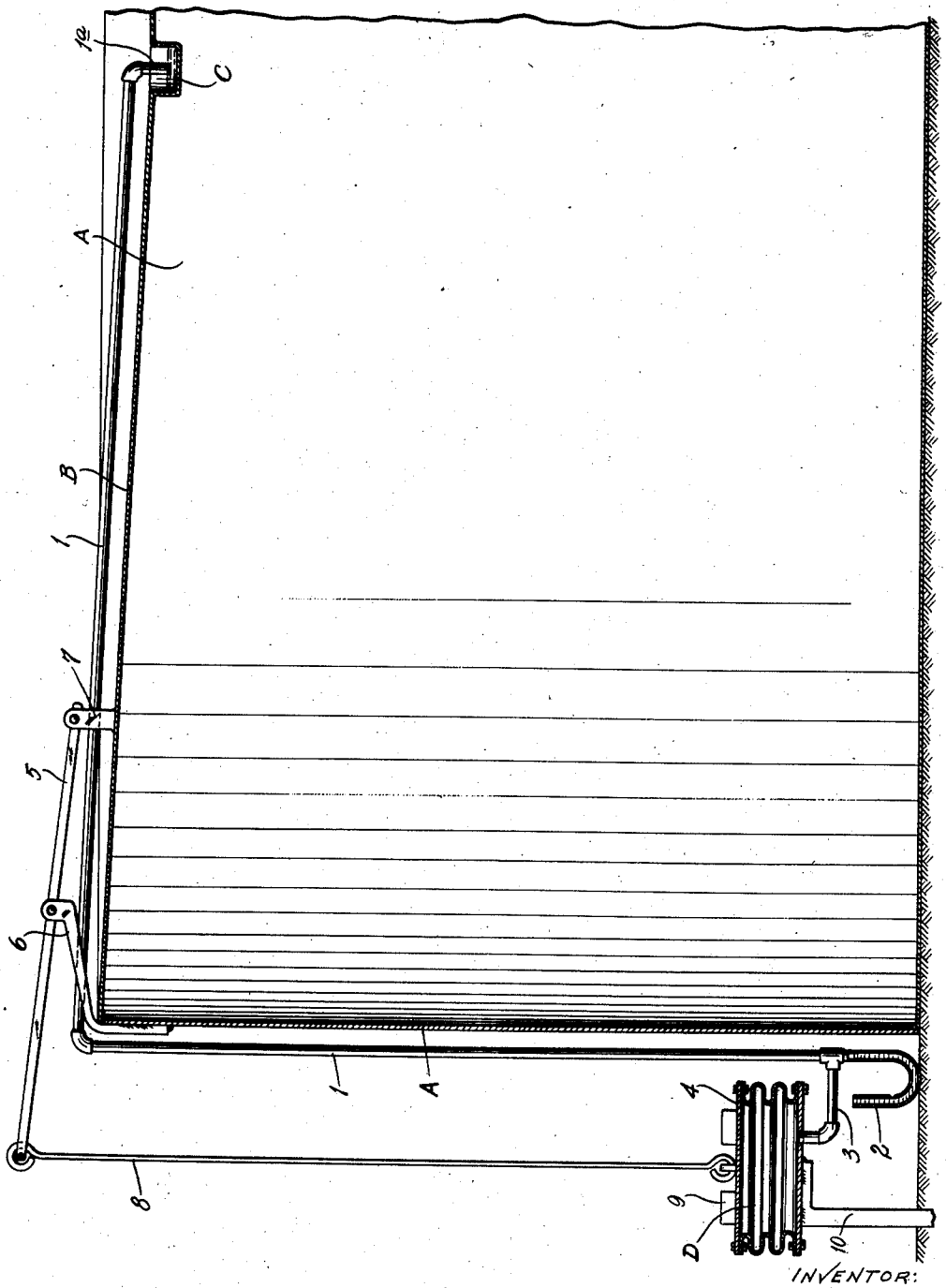
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TANK ROOF DRAIN

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TANK ROOF DRAIN

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This invention relates to gas and/or liquid storage apparatus of the type in which the gas-receiving space or chamber of the apparatus comprises a movable portion that rises and falls, or which moves upwardly and downwardly in response to variations in the internal pressure of said chamber, thereby causing a change in the internal volume of the gas space or chamber of the apparatus.

The main object of my present invention is to utilize the rise and fall or the vertical movement, of the movable portion of the gas space of an apparatus of the general type mentioned, to actuate a means which creates or induces a flow of water or condensate from a surface or portion of the apparatus on or within which water or condensate is liable to collect.

Another object of my invention is to provide an apparatus of the general type mentioned, in which the movable portion of the gas space or chamber is operatively connected with the movable part of a pump that is employed to prime a syphon drain which leads from a surface or portion of the apparatus on or within which water or condensate is liable to collect.

Another object is to provide an apparatus of the kind last mentioned, in which the pump used to prime the syphon consists of a vacuum pump that is operatively connected with the movable portion of the gas space which operates it, in such a way that only a very slight variation in the internal volume of the gas space is required to set said pump in operation.

I have herein illustrated my invention embodied in a roof drain for an oil storage tank provided with a breather type roof, but I wish it to be understood (1) that my invention is applicable to any type or kind of gas and/or liquid storage apparatus whose gas-receiving space or chamber comprises a movable part that flexes or moves in response to variations in the internal pressure of said gas space; and (2) that the syphon drain which is primed or set in operation by the action of the flexible or movable portion of the gas space, may be employed to drain any part of the apparatus on which or within which water or condensate is liable to collect.

The figure of the drawing is a fragmentary vertical transverse sectional view of an oil storage tank of the breather roof type, constructed in accordance with my invention.

In the drawing A designates a tank provided with stationary, vertically-disposed side wall, B designates a breather type roof or movable top for the gas space of the tank which rises and falls, or moves upwardly and downwardly, in response to changes in the internal pressure of the gas space, and C designates a sump on the top side of the roof, at the center of same, for receiving water which falls onto the roof and then drains into the said sump. Water is removed from the sump C by a syphon drain embodying my invention, and comprising a drain pipe 1 on the top side of the roof that leads outwardly from the sump C to the side wall of the tank, and thence extends downwardly over the top edge of said side wall, a means at the lower end of said pipe that permits liquid to escape therefrom without allowing air to enter the discharge end of said pipe, herein illustrated as consisting of a U-shaped liquid seal or inverted syphon 2 combined with said drain pipe and arranged near the ground or at the lower end of the tank, so as to virtually constitute the discharge end of the drain pipe 1, a vacuum pump D provided with a suction pipe 3 connected to the drain pipe 1 at a point above the inverted syphon 2, and means for utilizing the rise and fall or vertical movement of the roof B, for actuating the movable element 4 of the pump D. In the form of my invention herein shown the means for transmitting movement from the movable roof B to the movable element 4 of the vacuum pump, comprises a lever or walking beam 5 pivotally mounted on a stationary support 6 carried by the side wall of the tank A, a lug or arm 7 on the roof B pivotally connected to one end of said walking beam. A link 8 that connects the other end of said walking beam with the movable element 4 of the pump, and a load or force, herein illustrated as a weight 9, combined with the movable element 4 of the pump or with the walking beam 5 in such a way that it acts as a counterweighting mechanism for said walking beam. Any suitable type or kind of vacuum pump may be employed, and any preferred or suitable means may be used to operate said pump by the rise and fall of the roof B or equivalent movable portion of the apparatus.

The pump D herein shown is of the bellows type or Sylphon type, and the counterweighting mechanism is so designed and arranged that the point or portion of the roof B where the lug 7 is located, is more sensitive to the internal pressure of the gas space than any other point or portion of said roof. Preferably, the counterweight 9 is designed or constructed so that the roof B will lift or rise one inch at, say, zero internal pressure of the gas inside of the tank. Then, even under an internal vacuum, the point or portion of the

roof where the lug 7 is located will move downwardly and cause the syphon drain to start functioning, as hereinafter explained. The inverted syphon 2, or the U-shaped portion of the drain pipe, when filled with liquid, functions as a liquid valve that permits liquid to discharge or escape from the drain pipe 1 without liability of air entering said drain pipe at a point above the inverted syphon 2.

The method of operation of the apparatus above described is as follows: As the roof B or equivalent movable part of the gas space moves upwardly, the movable element 4 of the pump D moves downwardly, thereby causing air to be forced outwardly through the drain pipe 1. If there is no water in the sump C on the roof, no pressure will be set up in the drain pipe 1, and air will escape freely from the downturned terminal end 1a of the drain pipe that is positioned in the sump C. If the sump contains sufficient water to submerge the terminal end of the drain pipe, the maximum pressure set up in the drain pipe when the movable element 4 of the pump moves downwardly, is great enough to blow air downwardly through any water that may be in the sump C, thus insuring the expulsion of air from the drain pipe during each downward stroke of the movable element of the vacuum pump D. Subsequently, when the roof or equivalent movable part B of the apparatus moves downwardly, the movable element 4 of the pump ascends, or moves upwardly, thereby creating a suction or vacuum in the drain pipe 1, provided, of course, that the terminal end of the drain is sealed by water in the sump C. Said suction or vacuum causes the water in the sump to be drawn into the syphon formed by the horizontal, or substantially horizontally-disposed, portion of the drain pipe 1, the intake part 1a of said pipe and the portion of said drain pipe that extends over the top edge of the side wall of the tank, and thence downwardly over said side wall to the inverted syphon 2. As soon as the water starts flowing through the drain pipe, over the top edge of the tank side wall, the inverted syphon 2 starts priming itself, and when the pipe 1 is primed below the top of the tank a little more than the distance of the liquid level of the sump C below the top of the tank, the said pipe 1 constitutes a primed syphon, and it will continue to drain and thus effect the discharge of water that has collected in the sump C.

My invention greatly simplifies the construction and operation of gas and/or liquid storage apparatus of the general type referred to, as I utilize the movement or movements of a movable part of the apparatus which rises and falls during the normal use of the apparatus, to operate or actuate a pump which automatically primes or sets in operation a syphon drain through which water or condensate is removed from a part of the apparatus where the collection of a considerable quantity of liquid might interfere with the successful operation of the apparatus. As previously explained, any suitable type or kind of pump may be used to prime the syphon, the syphon may lead from any part of the apparatus where water, condensate, or liquid is liable to collect; and any suitable means may be used to transmit movement to the movable element of the pump from the movable part of the apparatus that moves in response to variations in the internal pressure of the gas space or chamber of the apparatus. The pump operating mechanism illustrated herein is desirable, because the counterweighting means 9 not only makes the point on the roof or equivalent part B of the apparatus where the lug 7 is located, the most sensitive point on said roof (to wit, the point that starts to move up before any other part of the roof), but it also takes out lost motion in the pump operating means. I have herein illustrated the said counterweighting means as being composed of a weight or weights mounted on or attached to the movable element 4 of the vacuum pump D, but it will be obvious that the counterweighting means could be constructed and arranged in various other ways without departing from the spirit of my invention.

The arrangement or location of the pump D and the inverted syphon 2 can be varied and the point where the suction pipe 3 of the pump is attached to the drain pipe 1 can be varied, but I prefer to have the pump suction pipe 3 tap the drain pipe 1 far enough below the top of the tank to insure that air will continue to be withdrawn from the drain pipe until the inverted syphon 2 primes itself. By setting or arranging the pump D in such a position with relation to the inverted syphon 2, I avoid the necessity of using a vacuum breaker for the pump to keep from failing it. In order to do this and get a full vacuum to operate the syphon by movement of the roof B, the pump D is arranged at a level considerably below the roof B, and is herein illustrated as being set near the ground and mounted on any suitable kind of a supporting structure 10. In designing or constructing an apparatus of the kind herein illustrated, it is necessary that the co-acting parts be so constructed and arranged, that the water head from the bottom of the trap 2 to the T-shaped pipe fitting that connects said trap to the suction pipe 3, is greater than the water head from the water level in sump C to the highest point in the syphon 1. Usually, the normal distance from the top of the tank to the top of the sump is about 1 foot to 2 feet on an apparatus equipped with a vertically-movable roof of the type shown. The trap 2 could be much higher or deeper, say, for example, 3'. Another thing that I desire to point out, is that in an apparatus equipped with a breather roof, as herein illustrated, the point on the roof where the lug 7 is located, will move from approximately twenty inches to approximately twenty-five inches in the process of filing or emptying. The area of the movable element D of the pump is so designed relative to the volume of air in the pipe 1, that about one half movement of the point 7 on the roof will cause ample vacuum inside pipe 1 to lift water up and over the sump and sufficient to prime the syphon.

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

1. A gas and/or liquid storage apparatus provided with a gas space that comprises a movable portion whose position is adapted to change to vary the volume of said gas space, a sump, a syphon drain having its intake end positioned in said sump and its discharge end located at the lower level than said sump, means for preventing air from entering the discharge end of said syphon drain, and a pump operated by the said movable portion of the gas space and having its suction connected with said syphon drain for exhausting air or the like therefrom so as to cause liquid to pass from the sump into said drain and prime the same.

2. A gas and/or liquid storage apparatus having a gas space or chamber provided with a movable roof that rises and falls in the normal use of the apparatus, a syphon drain with its intake end leading from a portion of said roof at or on which water is intended to collect, a liquid seal for the discharge end of said syphon drain, and a pump operated by the vertical movement of the roof for creating a suction in said drain so as to cause water to enter the intake end of said drain and then pass through same to said liquid seal to prime said drain.

3. A gas and/or liquid storage apparatus having a gas space or chamber provided with a movable roof that rises and falls in the normal use of the apparatus, a drain pipe leading from a portion of said roof at or on which water is intended to collect, said drain pipe being constructed and arranged so as to function as a syphon when primed with liquid, an inverted syphon combined with said drain pipe at a level lower than the water collecting portion of the roof from which the drain pipe leads, and a vacuum pump operated by the movement of said roof and having a suction pipe connected to said drain pipe at such a point that the suction exerted on the drain pipe by the pump will exhaust air from the drain pipe and then cause water to enter said pipe and convert it into a syphon in the event the terminal end of said pipe is submerged in water on the roof.

4. In a gas and/or liquid storage apparatus, a gas space or chamber provided with a movable roof that rises and falls in the normal use of the apparatus, a sump on said roof, a syphon drain having its intake end communicating with said sump and its discharge end located at a lower level than said sump, means for preventing air from entering the discharge end of said syphon drain, a vacuum pump for creating a suction in said drain so as to cause water to pass from said sump into said drain and cause said drain to function as a syphon, an operating mechanism attached to the roof and to the movable element of said pump, and means for causing the point or portion of the roof to which said operating mechanism is attached to be more sensitive to variations in the internal pressure of the gas space than any other portion of the roof.

5. A gas and/or liquid storage apparatus, comprising a tank provided with a breather type roof that rises and falls in the normal use of the apparatus, a sump on said roof arranged so that rain water drains into same, a drain pipe for said sump disposed on the top side of the roof and extending downwardly over the side wall of the tank, said drain pipe having a U-shaped portion located near the lower end of the tank, a vacuum pump arranged near the ground and provided with a suction pipe that is attached to said drain pipe at a point above the U-shaped portion of said drain pipe, and an operating mechanism for connecting the movable element of said pump with the movable breather roof, whereby the rise and fall of the roof will actuate the movable element of the pump and cause the pump to exert suction on said drain pipe during the downward movement or flexing of the breather roof.

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