Nov. 1, 1938. M. M. BORDEN 2,135,383

VACUUM BREAKER

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Fig. 1

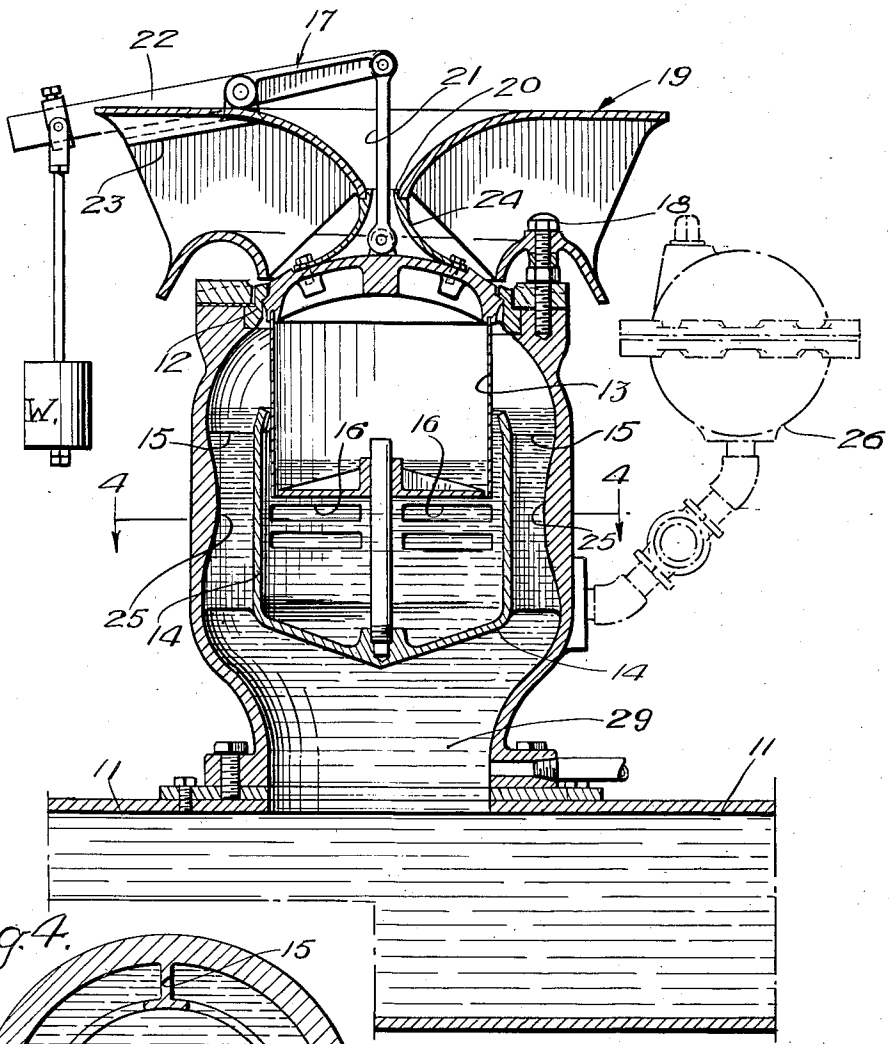
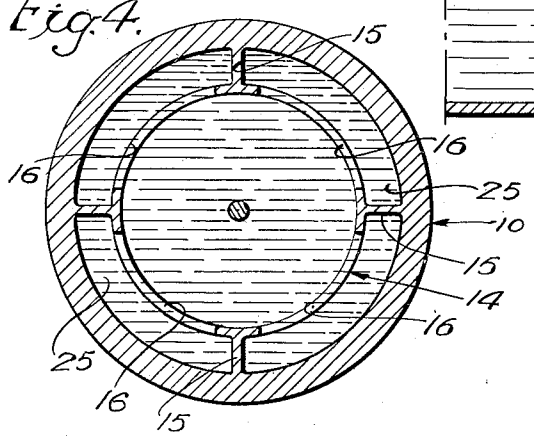


Fig. 4.



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Fig. 3

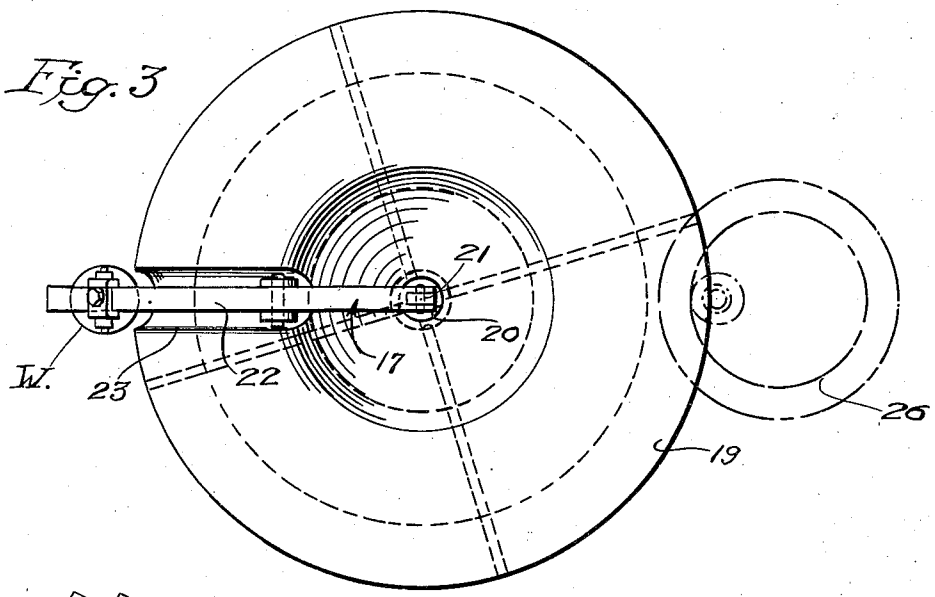
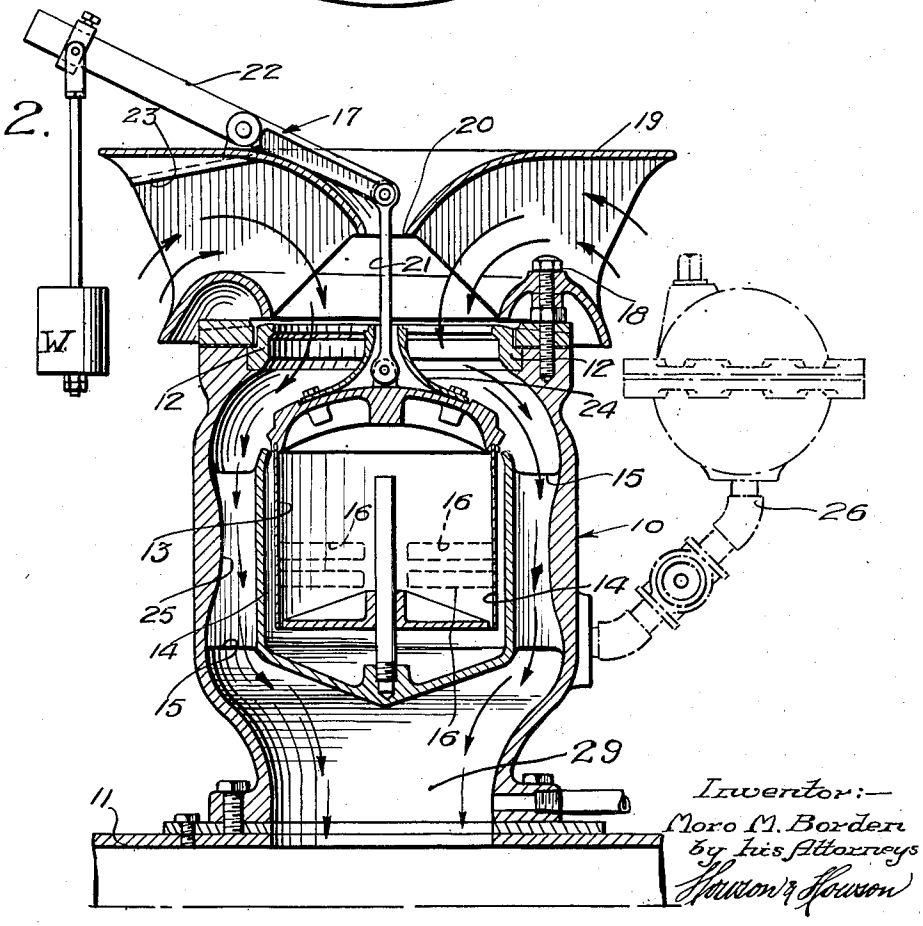


Fig. 2.



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Fig. 5.

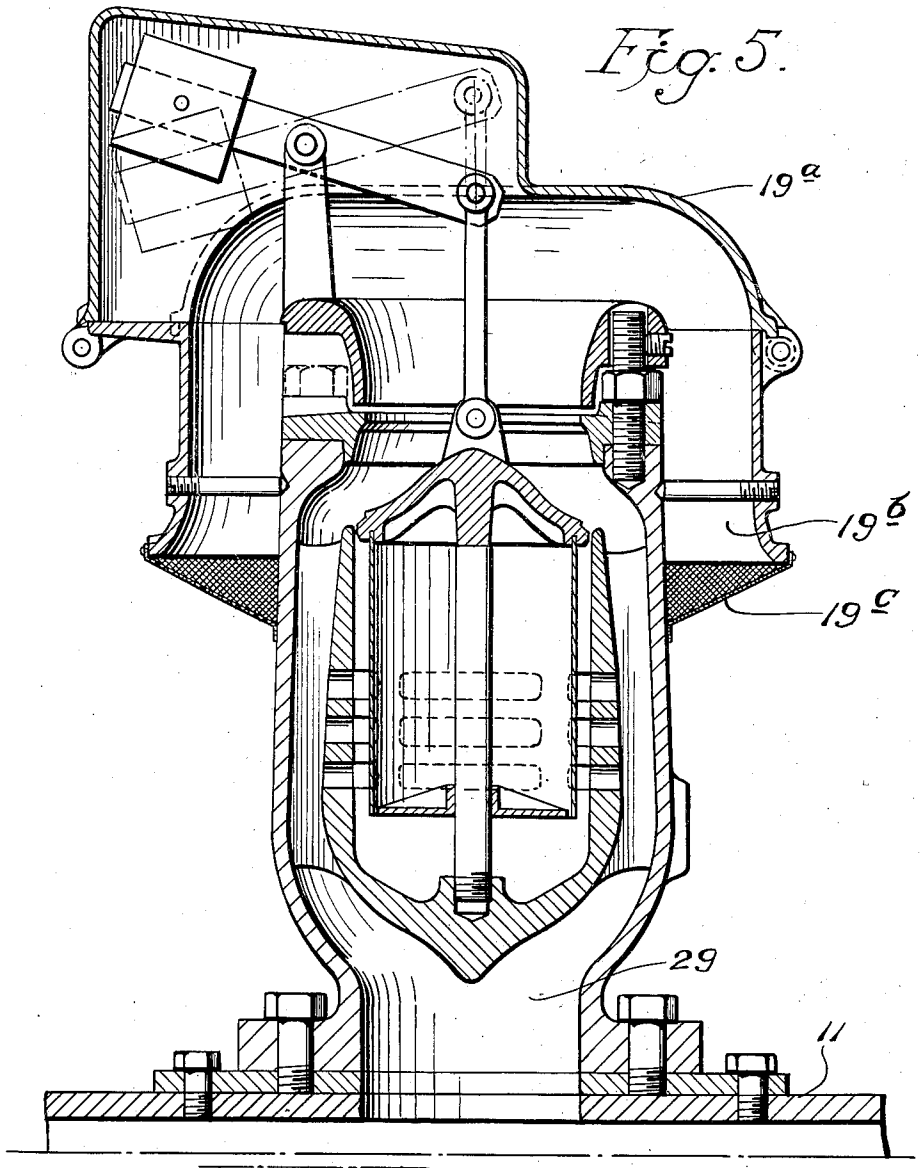
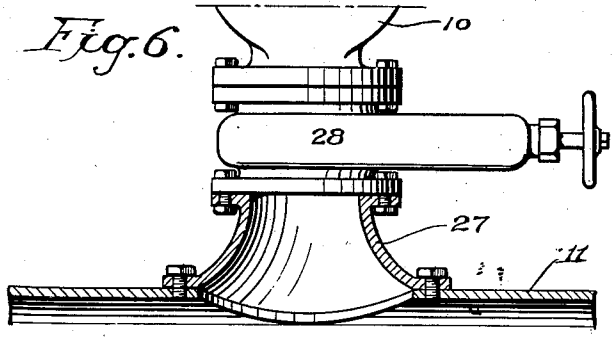


Fig. 6.



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UNITED STATES PATENT OFFICE

2,135,383

VACUUM BREAKER

Moro M. Borden, Philadelphia, Pa., assignor to Simplex Valve and Meter Company, Philadelphia, Pa., a corporation of Delaware

Application March 25, 1937, Serial No. 133,068

8 Claims. (Cl. 137—69)

This invention relates to improvements in vacuum breaking valves, and more particularly to valves of the general type shown in my prior Patent No. 1,936,537, granted November 21, 1933, for Air vacuum valve combined with air release valve.

The purpose of such valves is two-fold; first, that of breaking the vacuum occurring in thin-walled conduits or receptacles due to the sudden release or withdrawal of the contents thereof, for example, as a result of breakage of a conduit for transporting liquids over a rough terrain. In such an arrangement, valves of this type are arranged at the critical points of the line, and, in event of breakage at a low point, to admit air to replace the escaping fluid, preventing collapse of the thin-walled conduit usually employed. The second function is that of permitting escape of air during refilling of the pipe or initial filling thereof.

As ordinarily constructed, when the valve is opened to permit ingress of air to the line, the formation of the valve is such that the air, having to pass abrupt angles, is restricted in its passage with the result that a much larger valve must be employed to relieve a given vacuum than would otherwise be necessary. On the other hand, during filling of the line the escape of air is restricted usually at the outlet of the valve in such fashion that there is a tendency to reseat the valve prior to complete discharge of air from the conduit system, particularly where the refilling of the system is being rapidly effected.

An important object of this invention is the construction of the valve so that these detrimental features may be completely eliminated and the valve so formed that it may be made of much smaller size than heretofore, and at the same time function more efficiently.

A further object of the invention is the incorporation of these improvements in a valve of the type shown in my prior patent above mentioned without sacrificing the efficient features thereof.

These and other objects I attain by the construction shown in the accompanying drawings wherein, for the purpose of illustration, I have shown a preferred embodiment of my invention and wherein:

Fig. 1 is a vertical sectional view showing the valve in closed position;

Fig. 2 is a similar view showing the valve in the open postiion;

Fig. 3 is a plan view of the valve;

Fig. 4 is a section on line 4—4 of Fig. 1;

Fig. 5 is a sectional view showing a slightly modified cover arrangement permitting complete housing of the counterweight arm; and

Fig. 6 is a fragmentary view, partially in section, showing a modified conduit connection.

Referring now more particularly to the drawings, the numeral 10 generally designates a valve casing open at its top and bottom and adapted to have its base secured to a conduit 11. The opening at the upper end of the valve is surrounded by a valve seat 12 adapted for co-action with an open-bottomed float valve 13, the seat and valve being of the type described in my prior patent hereinbefore identified. The valve, as in said patent, operates within an inner casing member comprising a cup or basin 14 suitably concentrically supported in the valve casing as by means of webs 15, such cup or basin having apertures 16 to permit ingress and egress of air or liquid. This valve is adjustably counterbalanced through a weight W connected thereto through the link and lever system generally designated at 17.

The construction so far described is substantially identical with that of my prior patent, and forms no part of the present invention except in combination with the additional features hereinafter described.

In accordance with the present invention, I secure upon the upper surface of the valve casing, as at 18, in effect an annular funnel 19 the lower wall of which, at its inner edge, coincides substantially exactly with the inner periphery of the valve seat and the outer wall of which defines a central opening 20 through which passes link 21 of the link and lever system counterbalancing the valve. The lever 22 of this system may be conveniently pivoted upon the upper wall of the funnel which is preferably notched or grooved as at 23 to permit the lever to assume its lowered or "valve closed" position.

The cover may be a circular funnel in form, as shown at 19a in Fig. 5, this cover being so constructed that the adjustable counterweight is completely housed therein, thereby preventing collection of snow or ice about the counterweight or its connection to the valve. Additionally, in such a construction the downwardly opening annular mouth 19b of the air inlet formed by the combination of the casing and cover inhibits entrance of foreign matter and lends itself to the ready application of a wire guard 19c which will prevent the entrance of dirt, insects, or animals which might otherwise impair the operation of the mechanism.

Upon the upper surface of the valve proper I

secure a truncated conical member 24 the walls of which are curved in such fashion that when the valve is in its lowered position they combine with the casing wall in opposition thereto to form a suitably streamlined continuation of the passage of the funnel. In either case, the funnel and upper end of the valve structure combine to produce in the open position of the valve a tapered air passage equivalent to a similarly tapered pipe providing gradually converging and divering areas for the more effective passage of air into or out of the valve and its cover. The air ingress is thus facilitated, permitting a much larger volume to pass at a given time than would be possible where the air must change its angle rapidly as in the prior construction above identified so that the size of valve necessary to accomplish the vacuum-breaking function in a given line is materially reduced.

In order to prevent the tendency of the valve to close due to differences in air pressure set up during filling of the line, and consequent discharge of air about the cup or basin 14 and the upper end of the valve, I restrict the annular passage about this basin to form a Venturi throat 25, this throat being preferably in approximate alignment with the opening 16 of the basin. It will be obvious that with a rush of air from the conduit through the open valve, this Venturi throat will cause a corresponding reduction in pressure so that the pressure at a point above the valve will be higher than that at the throat. This reduction of pressure is reflected through the openings 16 in the basin 14 and serves to prevent the valve from seating until the liquid has entered the chamber and the proper moment has come for the valve to close.

The increased efficiency thus afforded again permits reduction in the size of the valve so that a much smaller valve can be employed than would ordinarily be necessary. Such a valve may be equipped with an air release valve of the type shown in the aforesaid prior patent as indicated in dotted lines at 26.

It will be obvious that the efficiency of the apparatus may be further increased by utilizing a bell-mouthed connection 27 between the base of the valve and the line 11, as suggested in Fig. 6, a valve 28 being preferably interposed between the connection and the release valve.

Such an arrangement combines with the outlet 29 of the release valve to produce a Venturi-form connection between this valve and line further promoting rapid transmission of fluids from one to the other thereof.

Since the construction is obviously capable of considerable modification without departing from the spirit of my invention, I do not wish to be understood as limiting myself thereto except as hereinafter claimed.

I claim:

1. In a valve structure of the type described, a valve casing having an opening defined by a valve seat, a valve within the casing coacting with said seat and movable to seated and unseated positions, said valve and casing being so constructed and arranged that in the unseated position of the valve they combine to form a Venturi-form passage a portion of the diverging walls of which comprises the seat-confronting face of the valve, the throat of the Venturi-form passage being in communication with the space confronting the opposite face of the valve, and a cover for said opening and valve providing a continuation of said Venturi-form passage.

2. In a valve structure of the type described, a valve casing having an opening defined by a valve seat, a valve within the casing coacting with said seat and movable to seated and unseated positions, said valve and casing being so constructed and arranged that in the unseated position of the valve they combine to form a Venturi-form passage a portion of the diverging walls of which comprises the seat-confronting face of the valve, the throat of the Venturi-form passage being in communication with the space confronting the opposite face of the valve, a counterweight mechanism tending to seat said valve and a cover for said valve opening and counterweight mechanism providing a continuation of said Venturi-form passage.

3. In a valve structure of the type described, a valve casing having an opening in its upper end defined by a valve seat, a valve within the casing coacting with said seat and movable to seated and unseated positions, means controlled by the liquid level in the casing to open and close said valve, said valve and casing being so constructed and arranged that in the unseated position of the valve they combine to form a Venturi-form passage a portion of the diverging walls of which comprises the seat-confronting face of the valve, and means defining a space confronting the opposite face of the valve, the throat of the Venturi-form passage being in communication with the space confronting the opposite face of the valve.

4. In a valve structure of the type described, a valve casing having an opening in its upper end defined by a valve seat, a valve within the casing coacting with said seat and movable to seated and unseated positions, means controlled by the liquid level in the casing to open and close said valve, said valve and casing being so constructed and arranged that in the unseated position of the valve they combine to form a Venturi-form passage a portion of the diverging walls of which comprises the seat-confronting face of the valve, means defining a space confronting the opposite face of the valve, the throat of the Venturi-form passage being in communication with the space confronting the opposite face of the valve, and a cover for said opening and valve providing a continuation of said Venturi-form passage.

5. In a valve structure of the type described, a valve casing having an opening in its upper end defined by a valve seat, a valve within the casing coacting with said seat and movable to seated and unseated positions, means controlled by the liquid level in the casing to open and close said valve, said valve and casing being so constructed and arranged that in the unseated position of the valve they combine to form a Venturi-form passage a portion of the diverging walls of which comprises the seat-confronting face of the valve, means defining a space confronting the opposite face of the valve, the throat of the Venturi-form passage being in communication with the space confronting the opposite face of the valve, a counterweight mechanism tending to seat said valve and a cover for said valve opening and counterweight mechanism providing a continuation of said Venturi-form passage.

6. In a valve structure of the type described, a valve casing comprising inner and outer members, the outer member having an opening defined by a valve seat, the inner member constituting a float chamber having an open upper end directed toward said seat, a float valve in said chamber for coaction with said seat, the upper surface of said valve and the inner and outer

casing members being so constructed and arranged as to provide, when the valve is in its lowermost position, an annular Venturi-form fluid passage a portion of the flaring walls of which comprises the seat-confronting face of said valve, and openings in said inner casing member at the throat of the Venturi-form passage.

7. In a valve structure of the type described, a valve casing comprising inner and outer members, the outer member having an opening defined by a valve seat, the inner member constituting a float chamber having an open upper end directed toward said seat, a float valve in said chamber for coaction with said seat, the upper surface of said valve and the inner and outer casing members being so constructed and arranged as to provide, when the valve is in its lowermost position, an annular Venturi-form fluid passage a portion of the flaring walls of which comprises the seat-confronting face of said valve, openings in said inner casing member at the throat of the Venturi-form passage, and a cover for said opening and valve providing a continuation of said Venturi-form passage.

8. In a valve structure of the type described, a valve casing comprising inner and outer members, the outer member having an opening defined by a valve seat, the inner member constituting a float chamber having an open upper end directed toward said seat, a float valve in said chamber for coaction with said seat, the upper surface of said valve and the inner and outer casing members being so constructed and arranged as to provide, when the valve is in its lowermost position, an annular Venturi-form fluid passage a portion of the flaring walls of which comprises the seat-confronting face of said valve, openings in said inner casing member at the throat of the Venturi-form passage, a counterweight mechanism tending to seat said valve and a cover for said valve opening and counterweight mechanism providing a continuation of said Venturi-form passage.

MORO M. BORDEN.