Jan. 26, 1965 M. GORDON 3,167,089

ADJUSTABLE VACUUM VALVE

Filed Sept. 26, 1962

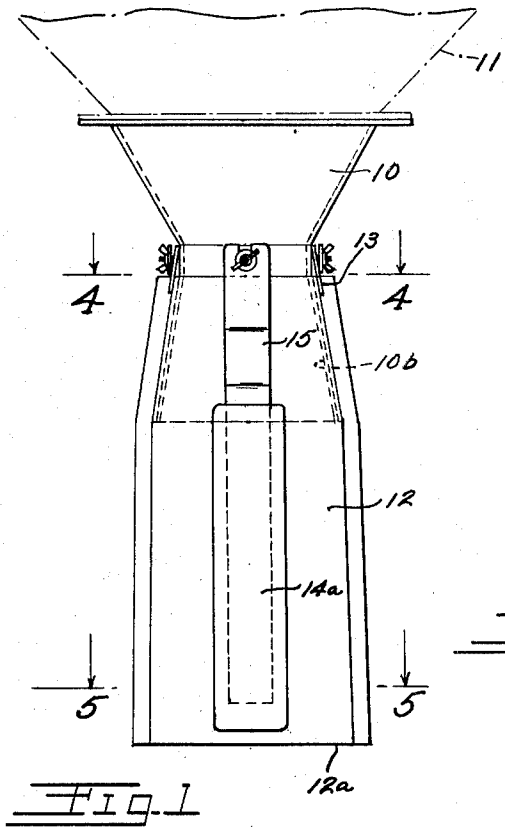


FIG. 1

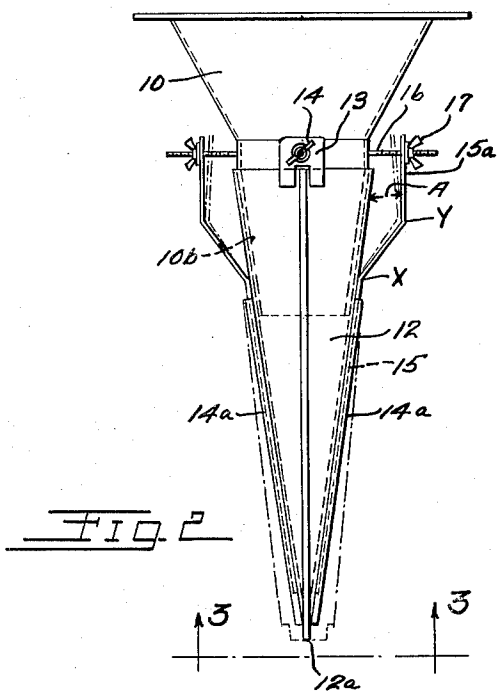


FIG. 2

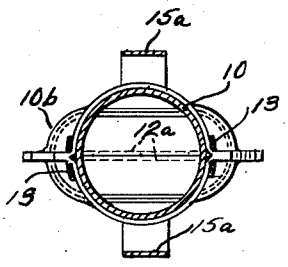


FIG. 4

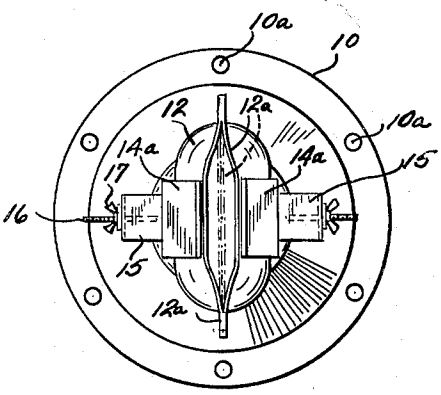


FIG. 3

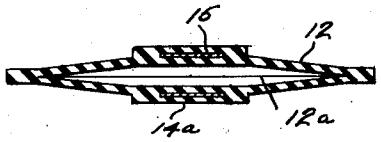


FIG. 5

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ADJUSTABLE VACUUM VALVE

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10 Claims. (Cl. 137—517)

This invention relates to an improvement in an adjustable vacuum valve having a pair of coacting resilient lips, and more particularly to a novel spring arrangement for urging the coacting lips of such a valve away from each other in unsealing direction whereby to aid in the opening of the valve by a load of finely divided material or fluid working against vacuum.

One of the objects of the invention is to provide in a valve of the type described above, a means for easily assembling and disassembling leaf spring means associated with a resilient rubber-like vacuum valve and wherein the shape of the spring provides its own fulcrum so that the spring may act as a lever in urging the sealing lips of the valve away from each other.

Other advantages of the invention are its simplicity, the easy adjustment of the tension of the spring urging the vacuum valve lips toward opening position, and the novel construction of the rubber-like valve itself, all as will more readily appear in the specification and claims appended hereto.

In the drawings,

FIG. 1 is a side elevational view of the improved valve of this inveniton as attached to the discharge spout of a hopper or the like;

FIG. 2 is a side elevational view of the device of FIG. 1;

FIG. 3 is a bottom plan view taken from the position of the line 3—3 of FIG. 2; while

FIGS. 4 and 5 are sectional views taken along similarly numbered lines of FIG. 1.

When finely divided material or liquid is stored in a hopper or container for discharge downwardly and when such hopper is under conditions of at least partial vacuum, problems arise in discharging the finely divided material or liquid from the hopper in overcoming the sealing effect of the usual vacuum valve utilized to close the discharge spout from the hopper. The present invention provides spring means in aiding the movement of the vacuum valve toward open position so that the problem of opening the valve by the weight of the finely divided material in the hopper finds a satisfactory solution.

In the drawings, a discharge spout **10** is indicated adapted to be attached to a hopper or the like, indicated in dot-dash lines at **11** in FIG. 1, by means of bolts fastening through the bolt holes **10***a*. The vacuum valve **12** is of resilient rubber-like material, preferably about 45 to 55 durometer, and generally having the character of a sleeve. In a preferred form, this comprises an integral molding which in one embodiment is about 14 inches long, 7½ inches wide and about ⅛ inch thick for approximately 7/16 inch in from the outer side edges after which the molding provides two flat sheets approximately ⅛ inch thick each and the whole device in unstressed condition lies flat. Suitable means is provided for retaining the upper end of the sleeve on the discharge spout **10**. In the form shown, the lower end of the spout at **10***b* flares outwardly in one dimension as seen in FIG. **1** and is narrowed inwardly in the other dimension as seen in FIG. 2. The sleeve **12** is telescoped over the spout portion **10***b* and suitably secured in position as for instance by means of clips **13** on opposite sides of the spout which are pulled up tight against the rubber sleeve by thumb nuts **14** so as to hold the sleeve securely in position.

Spring means is provided for urging the flat lips **12***a* at the lower end of the sleeve away from each other in the direction of the dot-dash position indicated in FIGS. 2 and 3. This position has been exaggerated in the drawings because, under actual conditions, the vacuum in the hopper **11** exerted through the discharge spout **10** would tend to suck the flat lips **12***a* against each other and the urging of the spring would only aid the weight of material in the hopper in causing an opening of the lips **12***a* toward the dot-dash position.

A preferred form of the spring means is shown in the accompanying drawings wherein pockets **14***a* are molded in the rubber-like material on the outside of the sleeve at opposite sides thereof, these pockets opening upwardly to receive a leaf spring **15** made of spring steel or the like. In the device first mentioned wherein the rubber-like sleeve is approximately 14 inches long and 7½ inches wide, the leaf spring **15** is about 1½ inches wide, approximately 9 inches from the lower end of the spring to the fulcrum point X, approximately 2 inches from X to Y along the offset portion of the spring and then approximately 2½ inches along the final upper end portion of the spring which is in general parallel to the portion embedded in the pocket. The amount of offset at the dimension indicated at A in FIG. 2 in this particular embodiment of the device is approximately ¾ inch.

Preferably, means is provided for adjusting the tension of the leaf spring urging the lips **12***a* away from each other. In the present embodiment, this involves a threaded member **16** rigid with the spout **10** and extending radially outward therefrom and a thumb nut **17** which engages outside of the bifurcated upper end of the spring **15** so that the upper end of the spring may be moved toward and away from the spout **10** causing the lever to fulcrum about the point X and thus urging the lower end of the lever or spring in a direction tending to separate the lips **12**.

The operation of this device should now be apparent. With a comminuted material or liquid stored in the hopper **11** and with a partial vacuum therein the vacuum will suck the lips **12***a* flat against each other and seal the material against flow through the valve **12**. A head of the finely divided material or liquid in hopper **11** will then build up above the valve **12** until the weight of this material plus the urging of the springs **15** causes the rubber-like lips **12***a* to separate sufficiently to permit the material to pass downwardly through the valve **12**. Whenever the weight of the material pressing downwardly on the valve from the hopper aided by the tension of the springs **15** is insufficient to overcome the effect of the partial vacuum in the hopper, then the rubber-like valve **12** will close again.

It has been found that in the case of materials having low specific gravity, and also when the negative pressures in the hopper are higher than 6 inches of water gauge, the heads of material in the hopper required to make a valve of this type operate (without the springs **15** of this invention) may be excessive. The valve herein described overcomes this disadvantage.

Under the conditions shown in FIGS. 1 and 2 of the drawings hereof, there is a tendency under high negative pressure within the hopper **11** to cause the rubber-like valve **12** to be sucked up into itself. The stiff leaf springs **15**, located at midpoints in the two sides of the flapper-like valve, resist this tendency of the valve to be sucked up.

It will be obvious that the leaf springs **15** are easily slipped into and out of the pockets **14***a* in assembly or repair of the parts.

It is obvious that the principle of biasing the resilient lips of this type valve could be reversed. If there were air pressure or excessive material pressure in the hopper **10**, then the springs **15** might be biased to urge the lips of the valve toward closed position by any desired amount of pressure.

What is claimed is:

1. In a valve having coacting flat resilient rubber-like lips positioned and arranged to engage each other and

completely close the valve when subjected to at least a partial vacuum interiorly of the valve; and spring means having an operative connection with said lips to urge the same away from mutual engagement and to hold said lips adjacent a closed position when said valve is not subjected to a vacuum, whereby to help comminuted material of liquid held back by the valve to open said lips.

2. The combination of claim 1 wherein means is provided for adjusting the tension of said spring means.

3. The combination of claim 1 wherein said valve is an uninterrupted sleeve having one end adapted to be attached to a discharge collar of a hopper, and having at its other end said pair of flat lips.

4. The combination of claim 3 wherein said valve is an integral molded article.

5. The combination of claim 3 wherein pockets are provided in the material of said lips, said pockets closed toward the inside of said valve and opening upwardly away from said lips, whereby leaf springs may be attached to said lips.

6. The combination of claim 5 including leaf springs adapted to fit in said pockets, each leaf spring being offset away from said valve at a zone outside said pockets, and means to apply force on said offset portion effective to urge each spring in its pocket in lip-separating direction.

7. The combination of claim 6 wherein each offset portion of each spring is again bent generally parallel to its pocket-encased portion to provide a lever whereby said force may be applied.

8. In combination a spout adapted to form a downwardly extending discharge passage from a hopper or the like, a resilient rubber-like sleeve surrounding and secured to the discharge end of said spout and having a portion depending therefrom, said depending portion comprising a pair of lips secured to each other along their side edges and in unstressed condition lying flat against each other entirely across the bottom of said sleeve, there being pockets in the outer portion of each of said lips opening upwardly, a leaf spring in each of said pockets and extending out of the upper end thereof, each of said springs being offset outwardly at a zone above its associated pocket, each spring being subsequently bent upwardly and there provided with adjustable means for holding the upper end of each leaf spring a predetermined distance from said spout, whereby said springs urge said lips away from each other.

9. In a valve having a pair of coacting flat resilient lips positioned and arranged to engage each other and to completely close the valve when subjected to negative pressure interiorly of the valve; spring means effective upon said lips to urge the latter in a direction partially counterbalancing the effect of said pressure upon said lips and holding said lips adjacent a closed position when said valve is not subjected to a negative pressure interiorly of the same.

10. In combination, a spout adapted to form a downwardly extending discharge passage from a hopper or the like, a connecting sleeve surrounding and secured to the discharge end of said spout and having a valve depending therefrom, said valve having coacting flat resilient rubber-like lips positioned and arranged to engage each other and completely close the valve when subjected to at least a partial vacuum interiorly of the valve; said connecting sleeve and valve structure being imperforate whereby any vacuum in said discharge passage is effective upon said lips; and means having an operative connection with said lips to urge the same away from mutual engagement and to hold said lips adjacent a closed position when said valve is not subjected to a vacuum, whereby to help comminuted material or liquid in said hopper or the like normally held back by said valve to press down upon and force open said lips, aided by said last named means to overcome the effect of said vacuum tending to close said lips.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,167,089 January 26, 1965

Mack Gordon

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 7, for "of liquid" read -- or liquid --.

Signed and sealed this 20th day of July 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents