J. S. THURMAN.

RELIEF VALVE.

APPLICATION FILED MAY 5, 1910.

991,671.

Patented May 9, 1911.

2 SHEETS—SHEET 1.

FIG. 1.

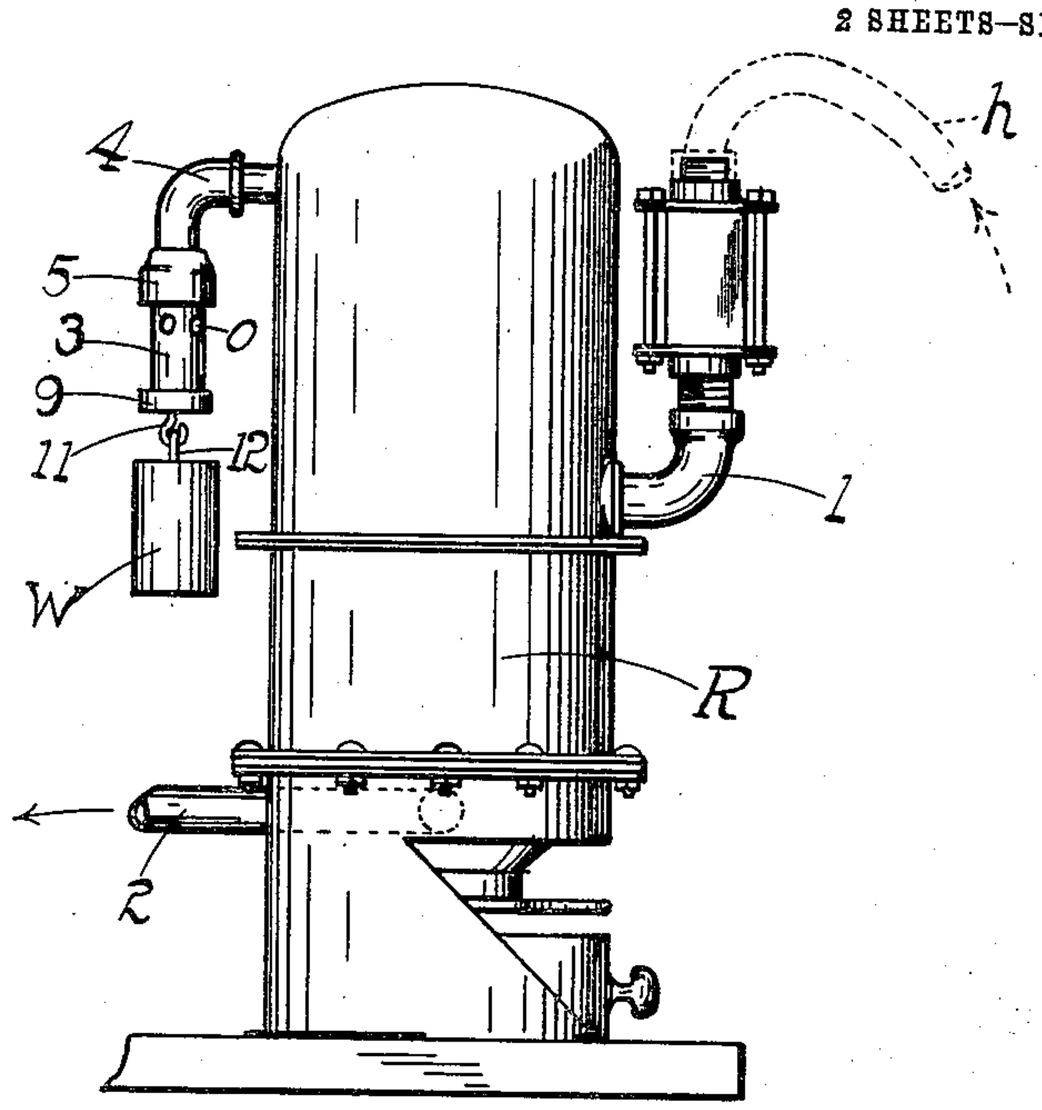


FIG. 2.

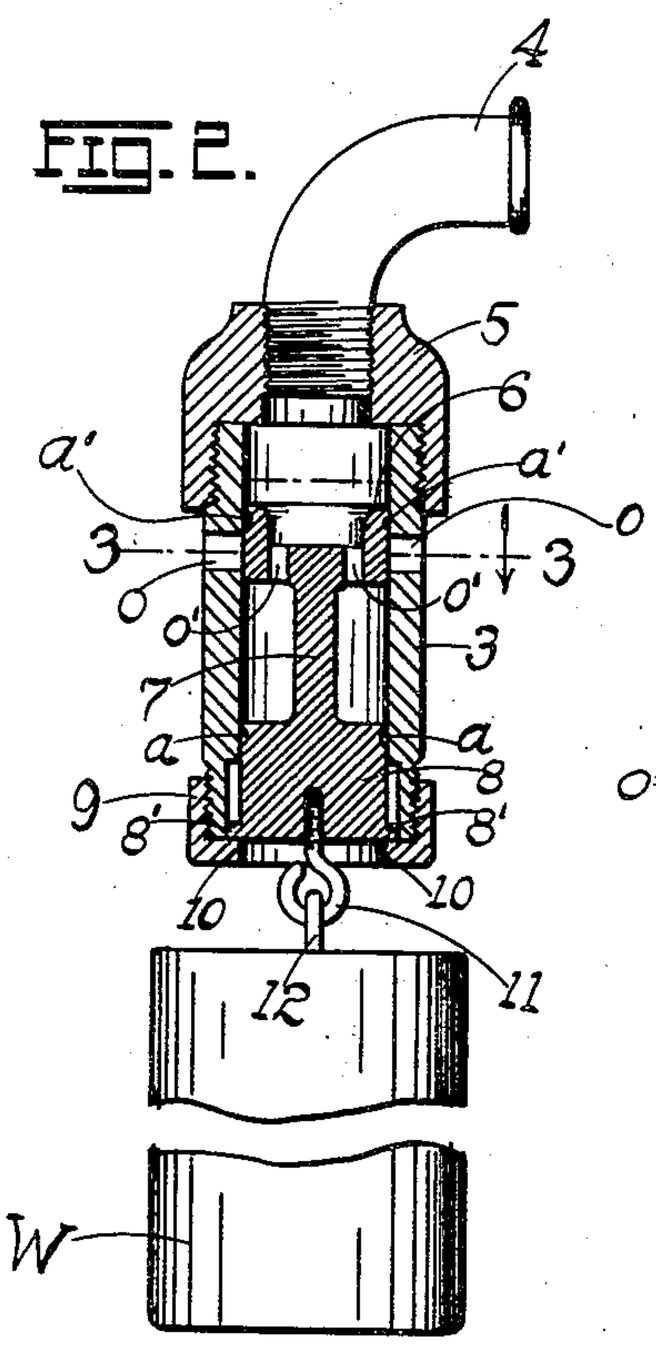
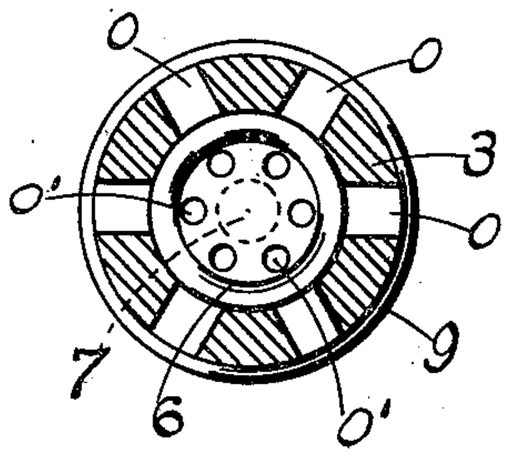


FIG. 3.



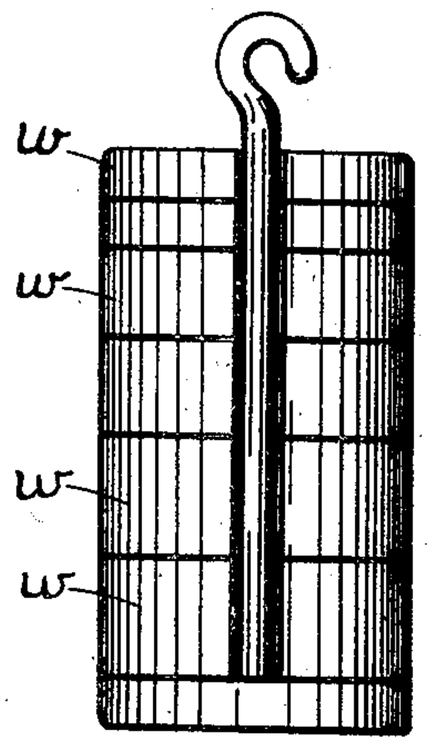


FIG. 4.

WITNESSES:

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RELIEF VALVE.

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2 SHEETS—SHEET 2.

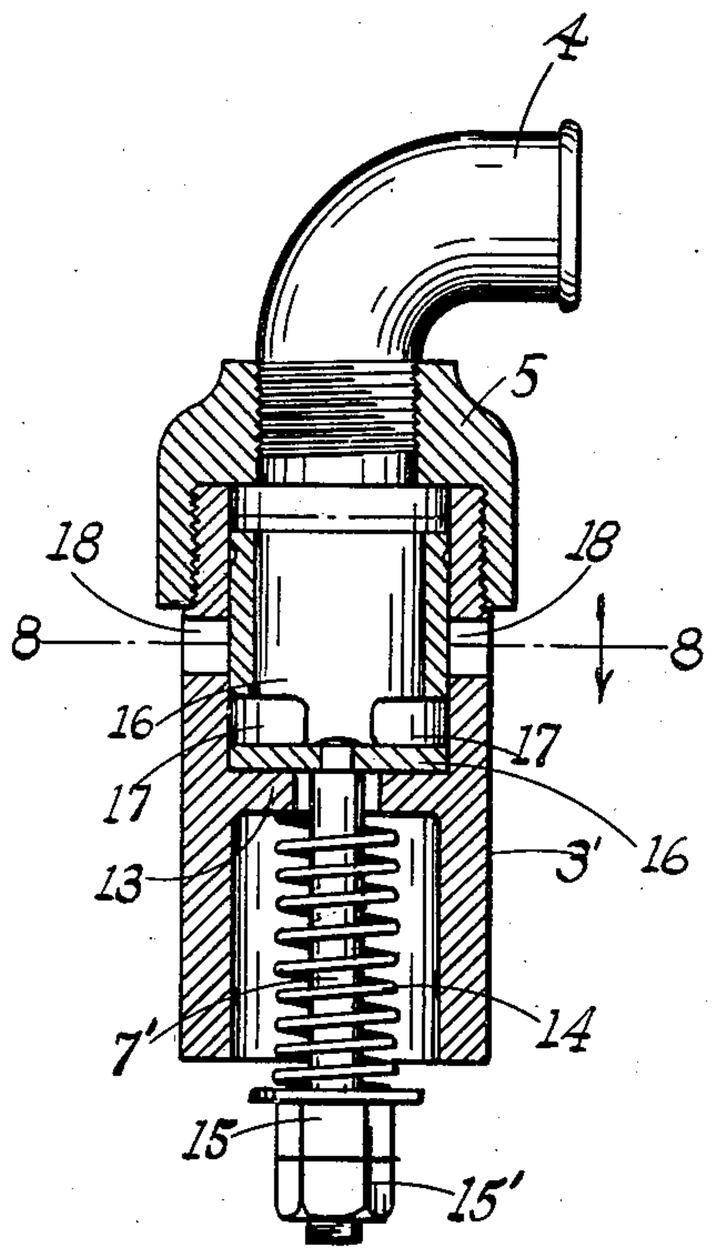


FIG. 5.

FIG. 6.

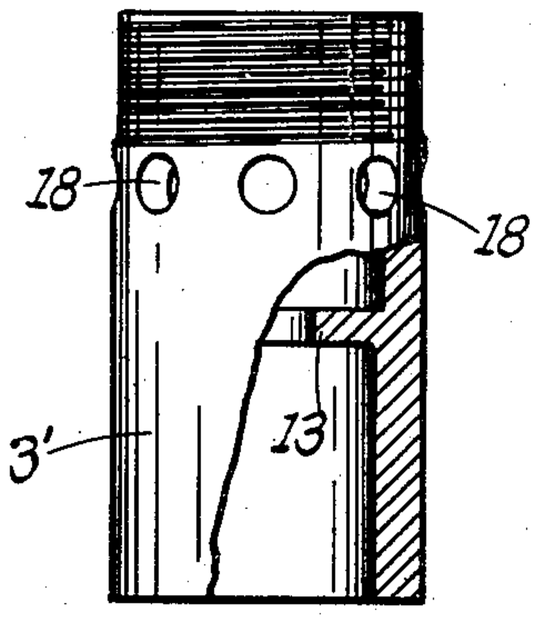
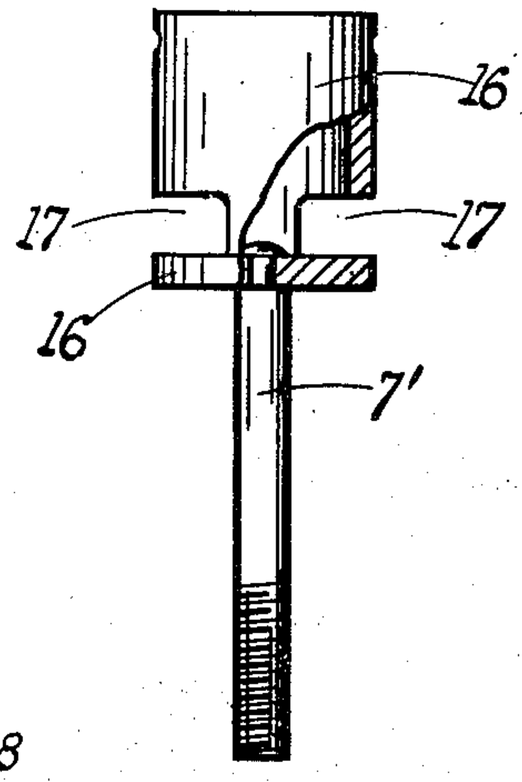


FIG. 7.



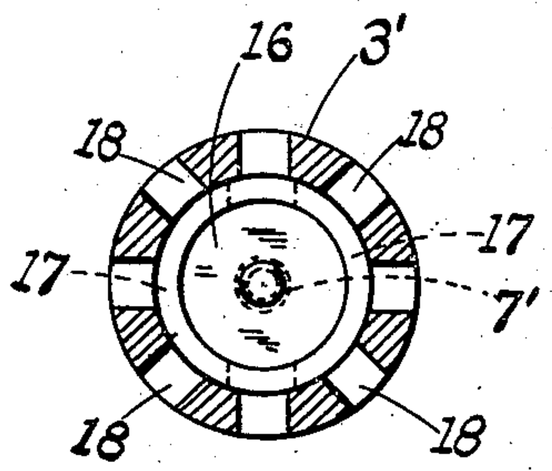


FIG. 8.

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UNITED STATES PATENT OFFICE.

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RELIEF-VALVE.

991,671. Specification of Letters Patent. Patented May 9, 1911.

Application filed May 5, 1910. Serial No. 559,487.

To all whom it may concern:

Be it known that I, JOHN S. THURMAN, citizen of the United States, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Relief-Valves, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has relation to improvements in relief-valves for vacuum cleaners; and it consists in the novel details of construction more fully set forth in the specification and pointed out in the claims.

In the drawings, Figure 1 is an elevation of a dust-receptacle showing one form of my invention applied thereto; Fig. 2 is a middle vertical section of the valve, the weight being in elevation; Fig. 3 is a cross-section through the valve-casing on the line 3—3 of Fig. 2, the valve being shown in top plan; Fig. 4 is an elevation of a modified form of weight, composed of a series of sections; Fig. 5 is a middle longitudinal section of a modification showing the weight replaced by a spring; Fig. 6 is an elevational view of the valve-casing, partly broken; Fig. 7 is an elevational view of the valve and stem, parts being broken; and Fig. 8 is a cross-section on the broken line 8—8 of Fig. 5.

The present invention is specially applicable to vacuum-tanks or dust receptacles of vacuum-cleaning systems wherein it is desirable to limit the back pressure exerted on the pump or equivalent exhauster by which the vacuum or reduced pressure is maintained within the tank. The response of the valve (which may be set to any degree of vacuum, depending on the horse power of the pump) at the critical moment in which it admits the required complement of atmospheric air into the tank, prevents the formation of a back pressure in excess of the motive power by which the pump is actuated, and insures a continuous operation for the pump without any attention on the part of the operator, the action of the valve being entirely automatic.

The invention is susceptible of at least two modifications, the one wherein the valve may be controlled by a weight adjusted to the horse power of the motor, or to the degree of vacuum desired in the tank, and the other wherein the control and adjustment of the valve is effected by a spring. These modifications are both shown in the drawings to which reference will now be made in connection with a detailed description of the invention, which is as follows:—

Referring to the drawings, and for the present to Figs. 1 to 3, inclusive, R represents a dust receptacle or tank such as employed in vacuum cleaning systems, the same being provided with an intake nozzle or pipe 1 to which the usual hose connection *h* carrying the suction-head or renovating tool (not shown) is made. The filtered air is drawn out of the receptacle by any form of vacuum-pump or exhauster (not shown) coupled to the outlet or discharge pipe or goose neck 2. Since the degree of suction exerted by the pump depends on the horse power of the motor by which it is driven, it is apparent that, if the vacuum in the tank is carried beyond a certain limit, a result which may flow from the clogging of the renovator tool, or by reason of the presence of any obstruction to the free flow of dust-laden air into the tank (or from other causes) the back pressure on the pump will be in excess of the motive power which drives it, and the motor will come to a stop. Such a stopping of the motor may occur at frequent intervals during the cleaning operation and thus become a source of annoyance. By the relief valve herein, the vacuum in the tank or receptacle R may be limited as required to prevent the stopping of the pump and motor. In the preferred form of my invention, I employ a valve-casing 3 which is screwed to, and depends from, a downwardly turned elbow or nozzle 4 screwed to the receptacle wall near the top thereof (to prevent the dust from entering the valve-casing and interfering with the free operation of the valve, it being remembered that the greatest portion of the dust is precipitated near the bottom of the receptacle). The connection between the valve-casing 3 and the nozzle 4 is made by a union or coupling 5, the casing wall adjacent the base of the threaded portion over which the union is passed being provided with a series of inlet openings *o* disposed circularly about the casing, said openings being normally closed by the cup-shaped upper terminal head 6 of the valve, the bottom of the cup or head being connected by a valve-stem 7 to a bottom head 8, the cup being provided with a series of ports or openings *o'* around the stem 7. To the lower outer screw-threaded end of

the casing 3 is screwed a nut or ring 9 formed with an inner stop flange or valve-seat 10 on which may rest the basal flange 8′ of the head 8 of the valve, the inner wall of the casing at that end being counterbored sufficiently to allow for the play of the flange 8′, and to serve as a receptacle for a lubricant which finds its way into the annular groove *a* formed on the head 8. The upper head 6 is provided with a similar oil-groove *a′* as shown. To the bottom of the head 8 is screwed an eye-bolt 11 which engages a staple 12 on a weight W, which is of a gravity properly proportioned to the degree of vacuum to be permitted in the tank R, or in other words to the power of the motor (not shown) by which the vacuum pump or exhauster (not shown) may be driven.

The operation of the invention is as follows:—As the filtered air is drawn from the tank R into the vacuum or exhaust pump through the nozzle or pipe 2, the pressure in the tank drops, and when the vacuum in the tank approaches the critical point where an excessive load would be imposed on the pump, by reason of back pressure, the valve 6, 7, 8, to whose upper head 6 the reduced pressure in the tank is communicated through the nozzle 4 responds to such reduced pressure, the atmospheric air pressing on the exposed face of the head 8, forcing the valve and its weight W upward, and uncovering the ports *o*. The air then enters the valve casing and rushes through the ports *o′* into the tank R thereby relieving the excessive vacuum and restoring equilibrium between the parts. As soon as this equilibrium is restored, the weight W draws the valve downward, closing the ports *o*. This operation is repeated automatically as often as the danger point in the tank R is reached.

As was stated above, a spring may be substituted for the weight W, and in Figs. 5 to 8 I show a valve which is in all essential particulars the same as the valve already described. Such parts as may be common to both valves are identified by the same reference numbers. In the spring-valve the valve-casing 3′ is provided with an inner flange or partition wall 13 serving as a valve-seat through which loosely operates the valve-stem 7′ about which is coiled a compression spring 14. The inner end of the spring bears against the wall 13 and the outer end against the tension-adjusting nut 15, the latter being protected by a lock-nut 15′ when once adjusted to effect proper tension in the spring. The upper end of the stem 7′ passes through the wall 13 with considerable clearance so as to freely admit atmospheric air against the bottom of the upper hollow cylindrical head 16 of the valve. The base of the peripheral walls of the head 16 has sections removed therefrom leaving elongated openings 17 normally out of register with the intake ports 18 of the valve-casing. When, however, the valve responds to the high vacuum in the tank R, it rises, thereby bringing the ports 18 opposite to, or into communication with the openings 17, allowing atmospheric air to rush into the tank and relieve the vacuum. The spring 14 takes the place of the weight W in the first form described, the atmosphere in the last form acting on the under surface of the bottom of the head 16, whereas in the first form the atmosphere acts against the head 8 to raise the valve. Again, while specific means are here shown for adjusting the tension of the spring, none are shown in connection with the weight W, but it is obvious that I need not limit myself to any size or gravity of weight, and that any degree of weight may be attached to the valve according to the vacuum desired, or according to the horse power of the motor by which the pump is actuated. In practice, a series of weights of different gravity may be kept on hand, or the weight W may be made in sections *w* like the counterpoise in a weighing scale (Fig. 4) and any number of sections employed to meet specific cases, to vary the resistance offered to the relief movement of the valve. In practice the valve should be connected to the dust receptacle R sufficiently above the intake for the dust-laden air, to be beyond the zone of dust precipitation in the tank, in order that the dust may not enter the valve-casing and clog the valve.

Having described my invention, what I claim is:—

1. In combination with a dust-receptacle having an air intake, and a discharge opening, a nozzle leading from the receptacle wall, a valve-casing open at both ends and provided with peripheral inlet ports, coupled to the nozzle, a member at one end of the casing forming a valve-stop, a valve having a head at one end normally resting on said stop and exposed to the atmosphere, and having a perforated head at the opposite end closing the ports aforesaid for a seated position of the valve, the latter being unseated by atmospheric pressure upon a reduction of pressure in the receptacle, thereby uncovering the ports of the casing and allowing an inrush of air into the receptacle through the perforated head aforesaid, and relieving the vacuum.

2. In combination with a dust-receptacle having an air intake and a discharge opening, a downwardly turned nozzle leading from the receptacle wall, a valve-casing, open at both ends and having peripheral air inlet ports coupled to said nozzle, a detachable open member at the lower end of the casing forming a valve-stop, a valve having a bottom head normally resting on said stop and exposed to the atmosphere, an interme-

diate stem, and an upper perforated head closing the ports aforesaid for a seated position of the valve, the valve being unseated by atmospheric pressure upon a reduction of pressure in the receptacle, thereby uncovering the ports of the casing and allowing an inrush of air into the receptacle through the upper perforated head of the valve, and relieving the vacuum.

3. In combination with a vacuum-tank provided with a downwardly turned nozzle, a tubular valve-casing having terminal screw-threaded portions, a union connecting the upper portion of the casing to the nozzle, a ring passed over the bottom screw-threaded end of the casing and provided with an inner flange forming a valve-stop, the inner wall of the casing being counterbored opposite the stop thus formed, a reciprocating valve having a central stem and top and bottom heads, the latter terminating in a marginal flange operating in the casing-counterbore and adapted to bear on the valve-stop aforesaid, the casing having circularly disposed openings or ports adjacent the upper screw-threads adapted to be covered by the upper head of the valve, the said head having perforations around the stem of the valve whereby upon the uncovering of the ports of the casing with the unseating of the valve, atmospheric air rushes through the perforations into the tank and relieves any excess of vacuum forming therein.

In testimony whereof I affix my signature, in presence of two witnesses.

JOHN S. THURMAN.

Witnesses:
EMIL STAREK,
JOS. A. MICHEL.