(No Model.) 2 Sheets—Sheet 1.

# J. S. SHRAWDER.

## PNEUMATIC DOOR CHECK AND CLOSER.

No. 476,932. Patented June 14, 1892.

Fig. 1.

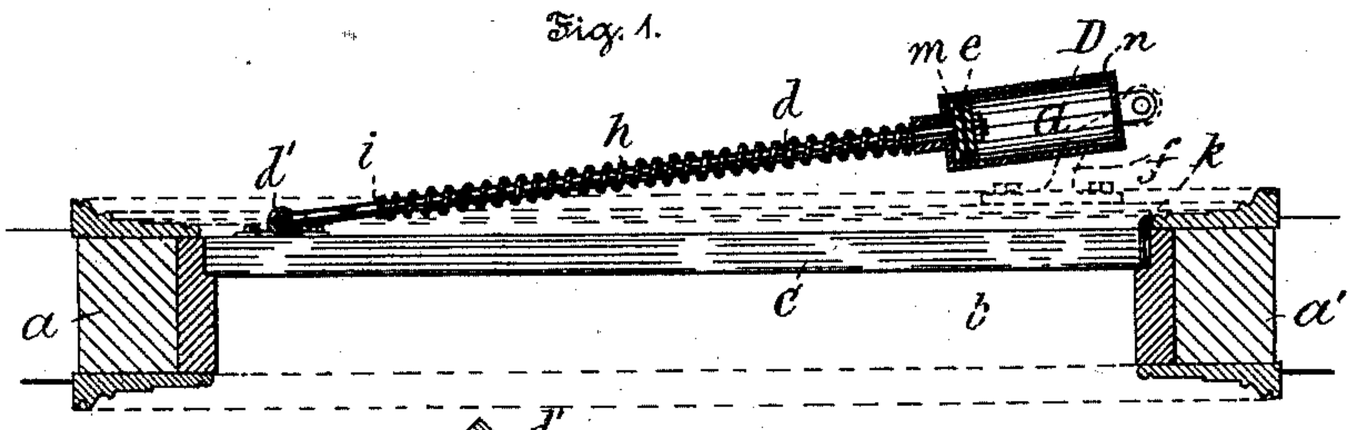



Fig. 2.

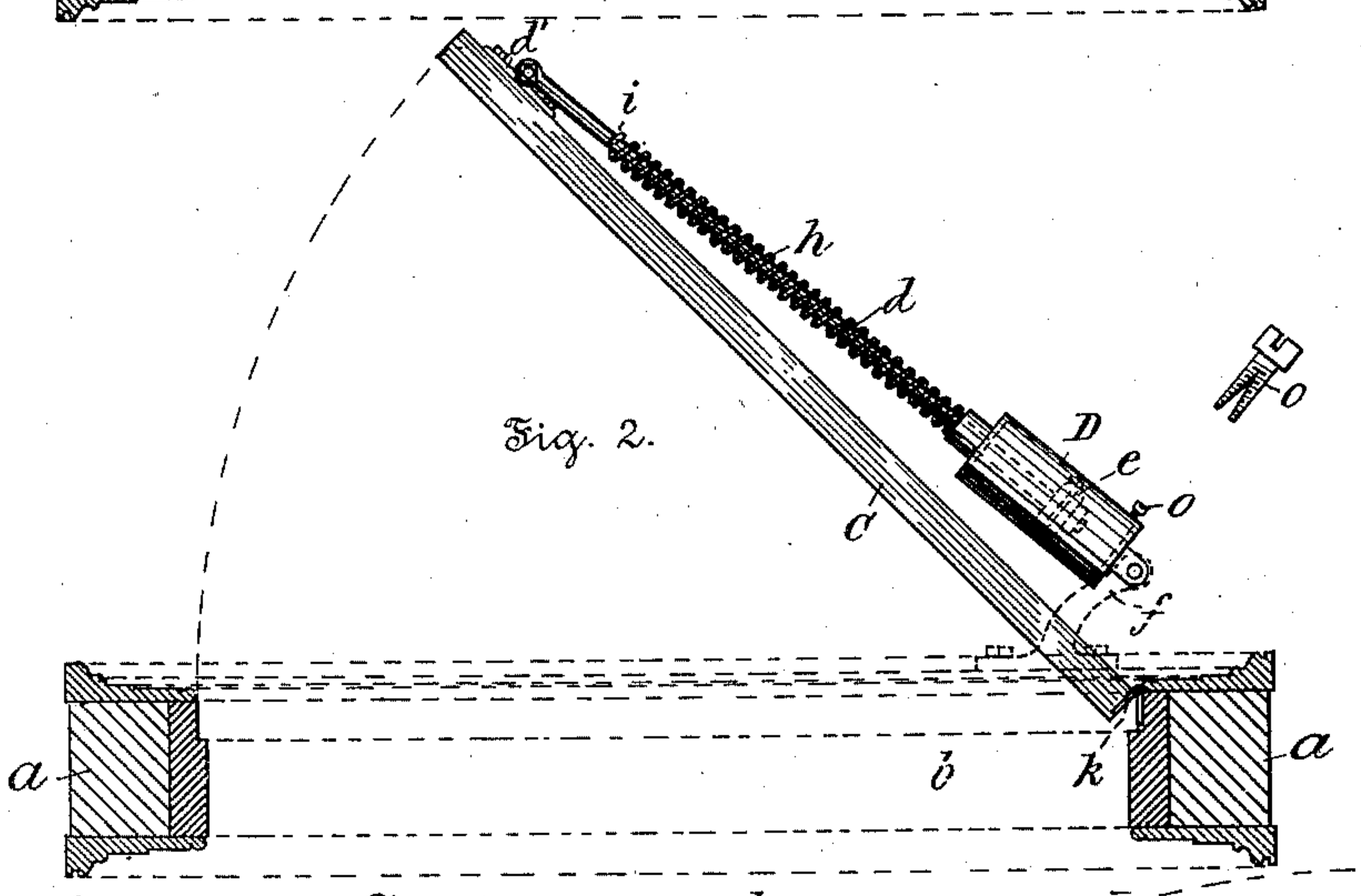
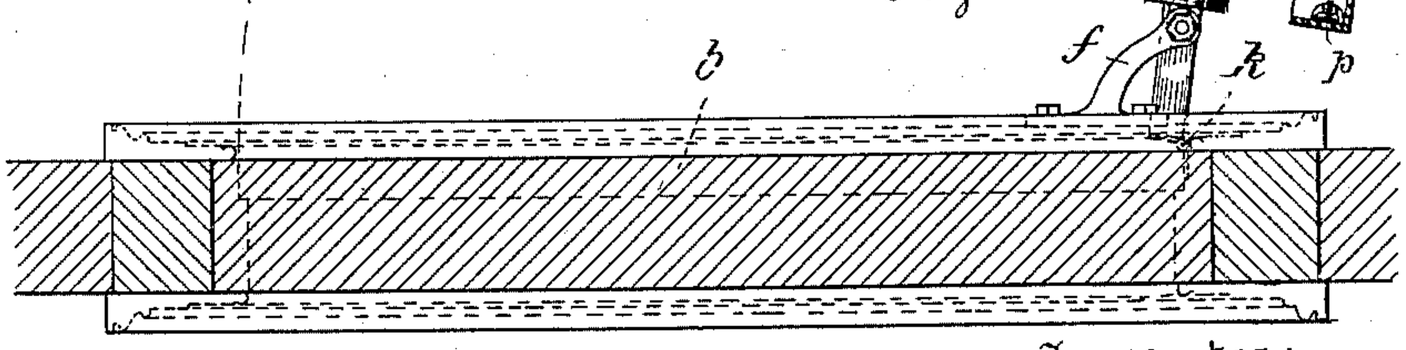



Fig. 3.




Fig. 4.




Witnesses:
Hermann Bormann.
Thomas M. Smith.

Inventor:
John S. Shrawder,
by J. Walter Douglass.
Atty

(No Model.) 2 Sheets—Sheet 2.

# J. S. SHRAWDER.

## PNEUMATIC DOOR CHECK AND CLOSER.

No. 476,932. Patented June 14, 1892.

Fig. 5.

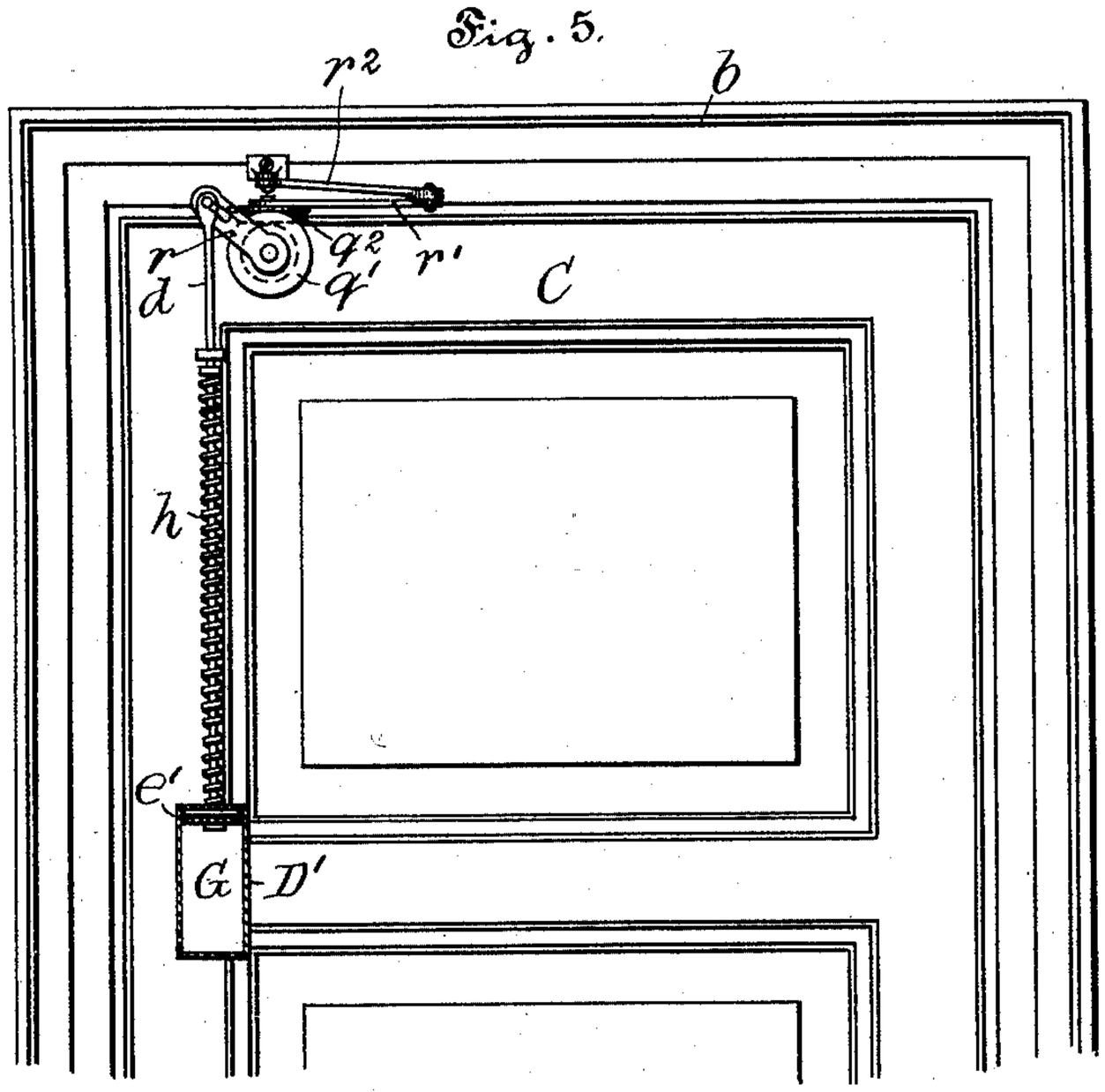



Fig. 6.

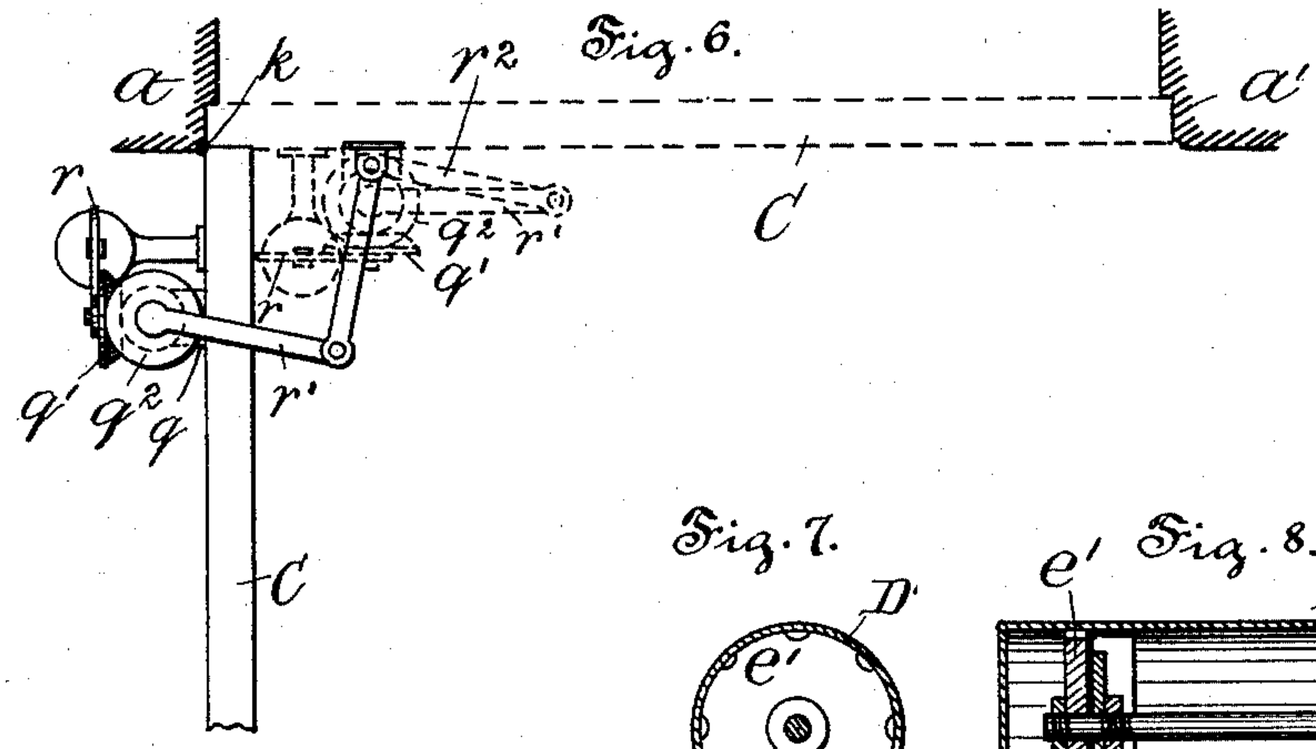



Fig. 7.


Fig. 8.


Witnesses:
Hermann Bormann
Thomas M. Smith

Inventor:
John S. Shrawder,
by J. Walter Douglass
Att'y.

# UNITED STATES PATENT OFFICE.

JOHN S. SHRAWDER, OF NORRISTOWN, ASSIGNOR TO THE VACUUM DOOR CHECK COMPANY, OF COLLEGEVILLE, PENNSYLVANIA.

## PNEUMATIC DOOR CHECK AND CLOSER.

SPECIFICATION forming part of Letters Patent No. 476,932, dated June 14, 1892.

Application filed December 26, 1891. Serial No. 416,105. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN S. SHRAWDER, a citizen of the United States, residing at Norristown, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Pneumatic Door Checks and Closers, of which the following is a specification.

My invention has relation to a door-spring which operates in conjunction with a piston and cylinder.

The principal objects of my invention are, first, to provide a pneumatic door check and closer in which the parts are not subjected to more than a limited and predetermined pressure or strain, and consequently the apparatus made of light and inexpensive material which will not in use be broken or otherwise injured; second, to construct and arrange the parts of a pneumatic door check and closer for operation in such manner that leakage is of rare occurrence and that will in no wise interfere with the operation of the apparatus, and, third, to provide a pneumatic door check and closer constructed and arranged to permit of pressure being exerted upon the curved wall of the cylinder thereof from without instead of from within the same.

My invention consists of a pneumatic door check and closer so constructed and the parts thereof so arranged as that the force of a spring tending to close a door will be opposed by the influence of a vacuum exerted upon one face of the piston of the device suitably connected with the door.

My invention further consists of a pneumatic door check and closer constructed and arranged so that strain thereon will not exceed the pressure of the atmosphere on the face of the piston partially counterbalanced by a vacuum created in rear of the same, whereby the door is permitted to gently close under the influence of a spring.

My invention further consists of a pneumatic door check and closer constructed and the working parts thereof arranged for operation in such manner as that the pressure thereon will not exceed at any time the pressure of the atmosphere, irrespective of any pressure manually brought to bear against the door in the opening and closing thereof; and my invention further consists of the improvements hereinafter described and claimed.

The characteristic features and general scope of my present invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming a part hereof, and in which—

Figure 1 is a top or plan view, partly in section, of a spring device embodying the features of my invention in application to a door shown in a closed position. Fig. 2 is a similar view of the spring device, showing the door in a partially-open position. Fig. 3 is an elevation of the door in a closed position with the spring device applied thereto and to one of the jambs thereof. Fig. 4 is a top or plan view, partly in section, of Fig. 3, showing the door held in open position by the door-spring. Fig. 5 is an elevation of a door, showing a modified form of door-spring of my invention applied thereto. Fig. 6 is a top or plan view of a door in open position showing also in dotted lines the positions assumed by the levers of the modified form of door-spring when the door is in a closed position. Figs. 7 and 8 are respectively transverse and longitudinal sectional views, drawn to an enlarged scale, of the cylinder and its complemental piston as illustrated in Figs. 5 and 6.

In the drawings, $a$ and $a'$ are the vertical jambs, and $b$ and $b'$ the horizontal jambs, of a door C.

Referring now more particularly to Figs. 1 to 4, inclusive, $d$ is a rod provided at one end with a piston $e$. This rod $d$ is pivotally connected with a right-angular bracket $d'$, suitably secured to the door C. The cylinder D, within which the piston $e$ is permitted a freedom of movement back and forth, is pivoted, preferably, to a curved bracket $f$, which is suitably fastened to the frame of the door. Around the piston-rod $d$ is mounted a helical or coiled spring $h$, which is in engagement at one extremity with the cylinder D and at its opposite extremity is held in a recess in said rod or attached to a pin $i$, projecting therefrom, so that when pressure is exerted against the door the piston is moved forward, compressing the spring $h$, and the air within the

cylinder D is allowed to escape around the piston to permit of the automatic return of the door to a closed position when said pressure has been removed. The action of the spring *h* (when the door is open at an angle less than the given angle between it and the jamb *b*) is to close it violently, and when the door is opened at an angle greater than the given angle the spring *h* tends to open the door, Fig. 4, and causes the piston *e* to assume a position at the extreme end of the cylinder D.

The point in the swing of the door from which the spring tends to open or close the same may be varied by changing the relative positions of the hinges *k* of the door and of the pivotal connection between the bracket *f* and cylinder D. Any tendency of the spring to close the door violently is overcome by means of the partial vacuum that is created in the cylinder D as soon as the piston *e* is shifted forward therein. The piston *e* is preferably provided with a cup-shaped leather section which permits air to pass freely around the same when the door is being opened, and consequently affords the piston freedom of movement in the cylinder, and which fits the cylinder snugly enough to avoid the entrance of air between it and the wall of the cylinder when the door is closed.

In most instances the cup-shaped construction of the piston will afford the same sufficient freedom of motion into the cylinder. However, if preferred, the cylinder-head through which the piston-rod plays may be perforated or the wall of the cylinder may be provided with an aperture *m*, in order to permit of the free ingress and egress of air to the end of the cylinder farthest or remote from the bracket *f*, the object being to subject the side of the piston adjacent to the free end of the cylinder to normal or atmospheric pressure.

When the door is being closed by the action of the spring and the piston is being drawn out of the cylinder, there is created a partial vacuum in the space G, and the pressure of the atmosphere on the opposite side of the piston tends to overcome the force of the spring. It should be borne in mind that the extent of the vacuum created in the space G is controlled or regulated by the size of an aperture *n*, and hence the pressure of the atmosphere on the opposite side of the piston is partially counterbalanced, whereby the door is permitted to close gently under the influence of the spring. The variation of the size of the aperture *n*, and consequently the variation of the extent or degree of the vacuum created in the cylinder D, may be effected by means of the screw *o*, Fig. 2, having a notch cut radially or otherwise in the body thereof and varying in width from the end of the screw toward the head thereof.

A valve *p*, Fig. 4, of any ordinary construction, may be employed for permitting the air to escape from the cylinder D when the door is being opened. This valve is not absolutely essential, because the piston *d*, by reason of its cup-shaped constructions, permits the air to pass freely around it when the door is being opened and the piston is being forced into the cylinder D. When the door is being closed, the valve *p* is forced by atmospheric pressure firmly against its seat and held closed, as will be readily understood.

The construction and mode of operation of the modified form of door-spring shown in Figs. 5, 6, 7, and 8 are, as above described, with reference to Figs. 1 to 4, inclusive, with the following exceptions: The cylinder D′ is rigidly connected with the door and the door is provided with a bracket *q*, having a pair of miter-wheels *q′* and *q²* journaled thereto. These miter-wheels *q′* and *q²* are respectively provided with radial arms *r* and *r′*. One of these arms *r′* is connected with the door-jamb *b* by a link *r²* and the other arm *r* is connected with the piston-rod *d* of the cylinder D′. This arrangement of miter-wheels does not tend to maintain the door in open position; but it may be readily applied to the right and left hand doors by the simple operation of throwing the bevel-gear *q′* out of engagement and rotating the arm *r* into position for attachment to the piston-rod *d*, which is always in proximity with the hinges of the door C. In this instance the piston *e′*, Figs. 7 and 8, is provided with a recessed periphery, which, in connection with the cup-shaped leather above described, forms a check-valve for permitting of the escape of air from the cylinder while the door is being opened.

The particular features of novelty and advantages incident to the use of a pneumatic door-check and closing device, such as hereinbefore explained, are as follows: The piston is exposed on one side to the pressure of the atmosphere and on the other to the influence of a vacuum to which air is gradually admitted. In other words, the force of the spring, tending to close the door, is restrained by a vacuum acting upon a piston contained in the cylinder. From this mode of operation it follows, first, that in the said device the pressure is exerted from without inward upon the curved wall of the cylinder, so that the same may be made very light and thin, and in practice sheet-tin has been employed with good results, and, second, that the pressure upon the curved wall of the cylinder cannot exceed fifteen pounds, or thereabout, to the square inch—that is, normal atmospheric pressure—because after all the air has been exhausted from the cylinder by the withdrawal of the piston, due to the closing movement of the door, it is impossible to increase the degree of the resulting vacuum in the cylinder by pushing on the door or in any other manner as long as the exterior surface thereof is exposed to the pressure of the atmosphere. Under such circumstances the door would be moved and closed, and none of the parts of the said device could

be broken or injured. Moreover, in the said device the closing of the door causes a piston to be withdrawn from the cylinder, whereby at the utmost limit all the air is exhausted from the cylinder, so that the face of the piston and exterior wall of the cylinder are subjected to atmospheric pressure and no more. If the force tending to close the door—for example, the force exerted by an ambitious person who is unwilling to allow the device time to accomplish this result—exceeds the pressure of the atmosphere on the face of the piston, such excess of force exerted will cause the door to close and will be expended upon the door-jambs.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, in a pneumatic door check and closer, of a cylinder, a piston movable in said cylinder and having its face exposed to atmospheric pressure, an inlet at the head of the cylinder communicating with the atmosphere and controlling the extent of vacuum created in rear of the piston, and means, substantially as described, for connecting the piston and door, the construction being such that the strain on the working parts of the device does not at any time exceed the pressure of the atmosphere on the face of the piston, which is partially counterbalanced by the vacuum in rear thereof, so that the door is thereby allowed to gently close under the influence of a spring.

2. The combination, in a pneumatic door check and closer, of a cylinder, a piston movable in said cylinder and having its face exposed to atmospheric pressure, means, substantially as described, for permitting air to escape into the atmosphere from the head of the cylinder during the movement of the piston therein, an air-inlet communicating with the atmosphere and controlling the extent of the vacuum created at the head of the cylinder by the withdrawal of the piston, and mechanism, substantially as described, for connecting the piston and door, whereby the pressure on the working parts of the device does not exceed at any time the pressure of the atmosphere irrespective of any pressure manually brought to bear against the door in the opening or closing thereof.

3. The combination, in a pneumatic door check and closer, of a cylinder, a piston, a piston-rod, a coiled spring connected with said rod and cylinder, means, substantially as described, connected with said piston to permit of the escape of air from the cylinder past said piston, a vent for slowly admitting air to the cylinder in rear of the piston, and mechanism, substantially as described, interposed between the piston-rod and door, substantially as and for the purposes set forth.

In witness whereof I have hereunto set my signature in the presence of two subscribing witnesses.

JOHN S. SHRAWDER.

Witnesses:
THOMAS M. SMITH,
A. B. STOUGHTON.