

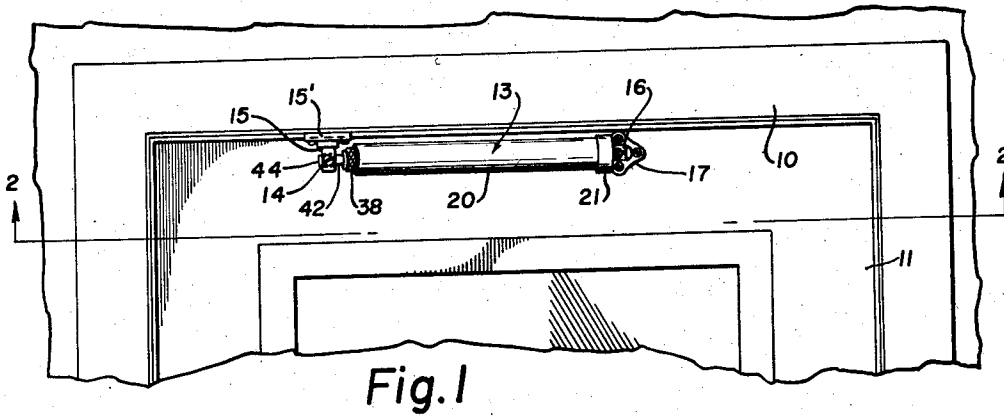
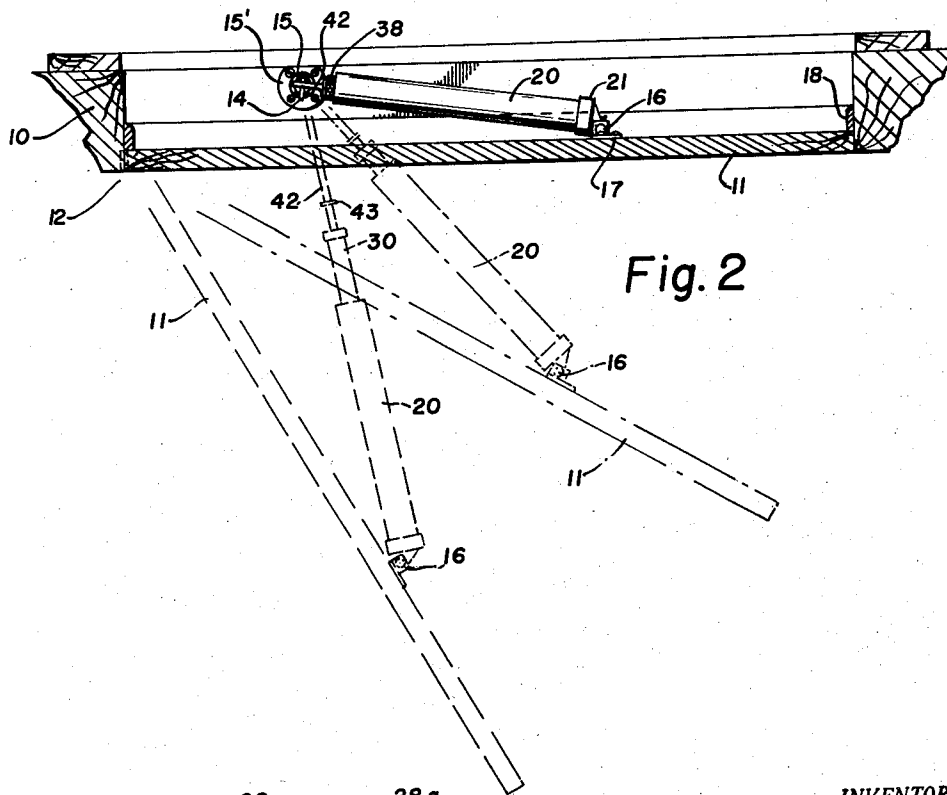
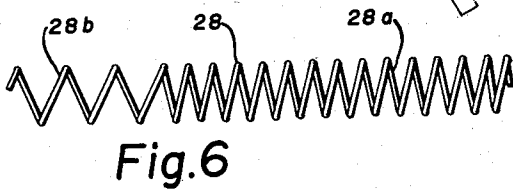
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J. STRUHAR
DOOR CHECK AND CLOSER

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2 Sheets-Sheet 1



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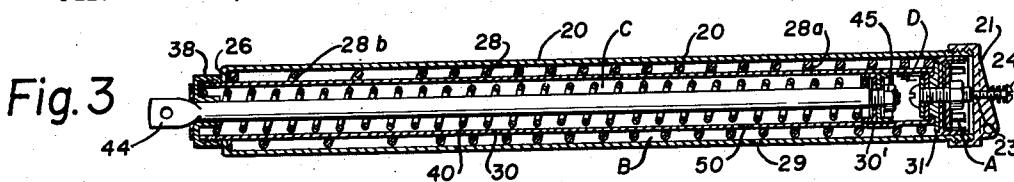
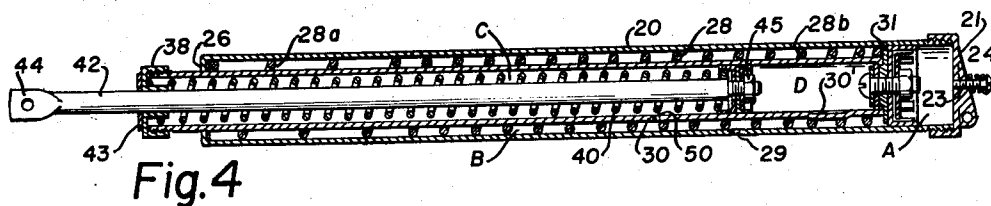
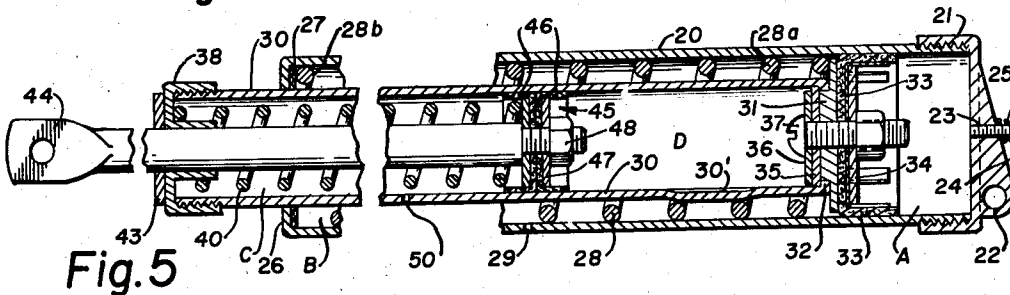
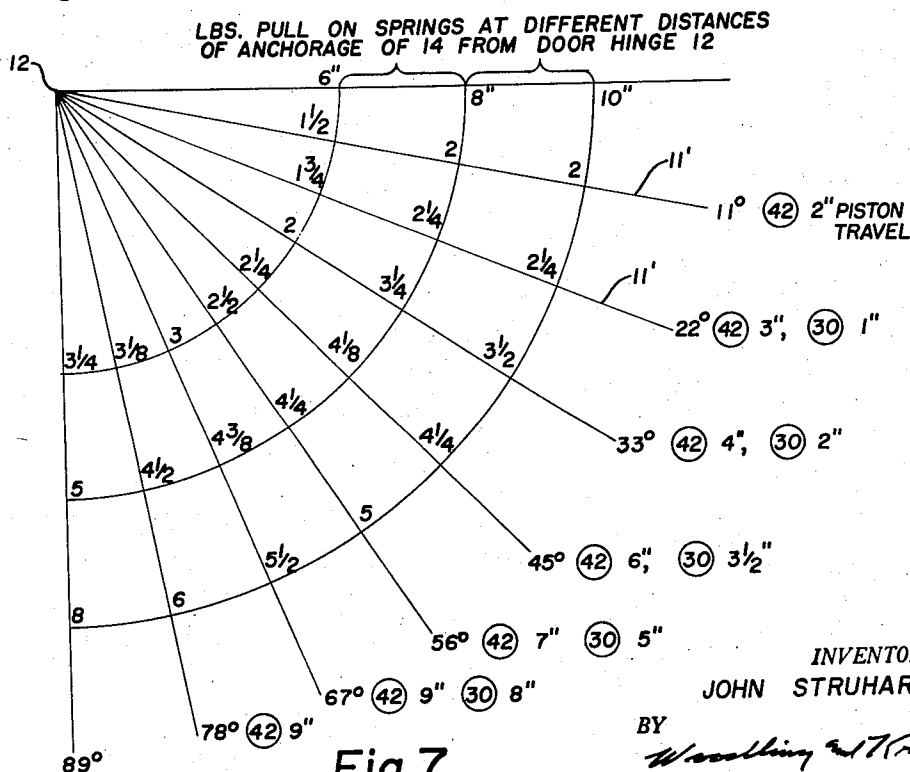
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DOOR CHECK AND CLOSER

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2 Sheets-Sheet 2



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DOOR CHECK AND CLOSER

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Application December 10, 1954, Serial No. 474,435

6 Claims. (Cl. 16-66)

This invention relates to new and useful improvements in door checks and closers, particularly for outside doors, which are frequently caught in gusts of wind and blown open so violently so as to damage the door and check.

An important object of the invention is the provision of a door check and closer which includes a construction having no hinged linkage, and yet will enable the door to be opened fully with ease and without damage or strain upon the door or check.

Another object is the provision of a door check which resiliently, yet positively, stops a door in approaching an extreme open position to avoid injury to the door and check from any violent opening.

Another object is the provision of a door check which cushions door closing to a degree allowing the door to close quickly, quietly, but firmly without slamming and to be held firmly closed.

A still further object is the provision of a door check which includes both spring and air cushioning in opening and closing movements of the door and one in which a special spring construction is employed to add vastly increased resistance only upon the door reaching dangerously extreme open positions.

A still further object is the provision of a door check which can be easily installed upon a door and frame without regard to delicate measurements for its placement and installation.

Other objects and advantages will become apparent during the course of the following description. In the accompanying drawings forming a part of the description and wherein like numerals are employed to designate like parts throughout the several views:

Figure 1 is an elevation of the inside of a door frame and door in closed position with the improved door check and closer applied thereto;

Figure 2 is a horizontal section through the same taken on the line 2-2 of Figure 1 and illustrating in broken lines, various open positions of the door;

Figure 3 is a longitudinal section through the improved door check and closer, illustrating the position of the parts when the door is closed;

Figure 4 is a similar section showing the position of the parts of the door check and closer when the door is in a partially open position;

Figure 5 is a view similar to Figure 4 but on an enlarged scale to more clearly illustrate the construction of the various parts;

Figure 6 is a side elevation of one of the springs employed in the device; and

Figure 7 is a diagrammatic illustration showing the door in various positions with the number of pounds pull on the springs of the door check measured at three different points from the door hinge, and with the approximate number of inches of movement of certain parts of the check opposite each degree of door opening.

In the accompanying drawings, wherein a preferred embodiment of the invention is shown for purposes of illustration and not for limitation, the numeral 10 designates

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a door frame or part with another door part such as a door 11 hinged to the frame in the usual manner by hinges 12 whereby the door can swing open to various degrees as shown by the dotted line positions in Figure 2 and by the angular lines 11' illustrating in Figure 7 the various degrees to which the door may open.

The door check casing is designated in its entirety by the numeral 13, having its piston end hinged on a horizontal pivot 14 carried by a vertical shaft 15 rotatable in a bracket 15' secured to the top of the door frame, and having its cylinder end hinged on a vertical pivot 16 carried by a bracket 17 secured to the door 11 adjacent its top edge. The door is firmly held closed against the usual abutment strips 18, as shown in Figure 2.

The door check comprises essentially two pistons and two cylinders telescopically arranged with two compression springs resisting their telescopic extension or projection. The outer of the two cylinders is about fourteen to sixteen inches in length and is designated by the numeral 20. Its outer end nearest the free vertical edge of the door is threaded to receive a closure cap 21 having a raised rib portion provided with an opening 22 to receive the pivot pin 16. This cap is also provided with a threaded perforation or air vent 23 to loosely receive an air vent screw 24 held in adjusted positions by a coil spring 25 to control the amount of air escaping from the closed end of the cylinder 20 ahead of a piston therein to thereby control the cushioning of door closing movements. The inner end of the cylinder 20 nearest the door frame bracket 15 is provided with an inwardly directed annular flange 26 which seats a fiber gasket 27 held thereon by one end of a high powered compression spring 28. The body of the cylinder 20 is provided with an air vent opening 29 located about three inches from the closure cap 21 to allow cylinder venting of air during initial door opening and to thereafter close to build up air pressure in the cylinder end 26 as the door opens wider. Opposite ends of cylinder 20 on opposite sides of this vent 29 constitute air pressure chambers A and B which are alternately communicated with the atmosphere as the piston 31 moves in the cylinder from one side of the vent 29 to the other side thereof. Conversely, this vent opening 29 is closed during final door closing movement to enable a piston to compress air in a gradually increasing degree in chamber A of cylinder 20 and thereby enable the door to close firmly and quietly without slamming.

A second cylinder 30 is telescopically mounted in the first cylinder 20 and slides through the opening in the flange 26 and packing 27. The inner end of this cylinder 30 which is within the cylinder 20 is provided with a piston head slidable in air-tight fashion upon the inner walls of cylinder 20. This piston head is composed of a disc 31 having a peripheral groove to snugly receive an annular flange 32 turned in from the cylinder 30. A cupped piston packing 33 of leather or other suitable material is held seated against the disc 31 by a pronged retainer disc 34. The inside of cylinder 30 is made air-tight by fiber and metal washers 35 and 36 held tightly against the piston disc 31 by a bolt 37 and nut, which latter also clamps the retainer disc 34 and cup packing 33 against this disc 31. The annular flange of the cup packing 33 is thus held in air-tight sliding engagement with the inner walls of cylinder 20. The outer end of this second cylinder 30 is threaded to receive a closure cap 38 which is normally drawn against the end of cylinder 20 by the spring 28 acting against the piston head 31 of cylinder 30. A second compression spring 40 is housed within the cylinder 30 with one end abutting the cap 38 and its other end abutting piston head 45 to be presently described.

A second piston indicated in its entirety by the numeral

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45 is slidably mounted in the second cylinder 30 and has its projection movement opposed by the spring 40. This second piston includes a piston rod 42 slidably mounted through a washer 43 and cap 38 and has a flattened apertured end 44 for pivotal attachment to the bracket 15 on the door frame. The inner end of the piston rod is provided with a piston head 45 slidably engaging the interior walls of the cylinder 30. This head supports a pair of opposed cup shaped packings 46 with their flanges extending in opposite directions and held against a reduced threaded end of the piston rod by a pair of metal washers 47 and a nut 48. The spring 40 engages this piston head 45 to normally retract the piston and rod 42 within the cylinder 30. Thus, both pistons are normally retracted within the casing or outer cylinder 20.

It will be observed that the inner or second cylinder 30 is, like the cylinder 20, also provided with an air vent opening 50 located about two and three-quarters inches from its piston head end. Opposite ends of this cylinder 30 on opposite sides of this vent 50 therefore constitute air pressure chambers C and D which are alternately communicated with the atmosphere as the piston 45 moves in the cylinder 30 from one side of the vent 50 to the other side thereof. As best seen in Figure 5, the inner surface of the side wall of cylinder 30 adjacent the piston head 31 in air chamber D is formed with a groove or outward depression 30' which by-passes trapped air in chamber D around the piston 45 when the latter comes to rest after cushioning the door to a closed position.

The first spring 28 as best seen in Figure 6 is a progressively acting two-powered spring by reason of about two-thirds of its length being wound on a smaller pitch 28a with lower power to have greater yieldability arranged adjacent to the cap 21 of cylinder 20, and with a larger pitch 28b with less yieldability for about one-third of its length arranged adjacent the flange 26 of cylinder 20. Thus, the end 28b of the spring offers more resistance to yieldability than the end 28a under the same load and therefore the portion 28a will yield first during initial opening movements of the door and the higher powered end 28b will not begin its slight yieldability until much greater door opening force is applied, which results in checking the door against extreme opening movement. Such checking or restraint of normal door opening is also due to air being compressed in air chamber B of cylinder 20 and in air chamber C of cylinder 30. Conversely, when the pistons 31 and 45 are rapidly moved to the right of the figures in the drawings by recoil of both springs 28 and 40 past the vents 29 and 50, air is trapped and compressed in air chambers A and D to cushion door closing. When these pistons move to the left of the figures in the drawings during initial door opening, air will be forced through the vents 29 and 50 to make for easy initial door opening until these pistons pass over the vents and begin compressing air in chambers B and C. Thus, initial door opening movements are resisted only by spring tension while subsequent increased door opening will be resisted by a combination of increasing spring tension and increasing air pressure in chambers B and C.

In Figure 7, there is diagrammatically indicated at three different arcs or distances from the door hinge 12, the pounds pressure required to open an average three-foot door to various degrees; and opposite each degree marking are the approximate travels in inches of the piston rod 42 and the inner cylinder 30. From this it will be apparent that in initial door opening movements, the piston rod 42 is opposed by the weaker spring 40 and will be extended or projected before any movement or extension of cylinder 30 takes place, which means that only the weaker spring 40 is compressed and resists door opening at this stage. As the door is opened farther and the piston 45 passes the vent 50 to compress the air in chamber C, the projection of cylinder 30 starts to

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compress the weaker end 28a of the spring 28, adding more resistance to door opening. When the door is opened about forty-five degrees, the piston rod 42 has been extended almost twice as far as the cylinder 30 has been extended, and when the door is opened to about seventy-eight degrees, the piston rod 42 and cylinder 30 are extended and moved practically as a unit and are resisted by the combined tension of both springs and the air compressed in chambers C and D. Any further opening tendencies of the door beyond eighty-nine degrees will be resisted by these forces in addition to the resistance afforded by the higher powered end 28b of spring 28 to thereby form a positive stop to any violent extreme opening of the door. Thus, the check offers progressively increasing spring and air resistance to door opening and provides a positive limit with only slight resilience to excessive door opening. From the foregoing, it will be apparent that the two springs 28 and 40 operate in succession in door opening, i.e., the weaker spring 40 will first be compressed before the stronger spring 28 begins to be compressed; and thereafter, as the door is opened farther, both springs will be proportionately compressed and will progressively add their power of resistance until they finally prevent any excessive or extreme door opening movement.

Conversely, in door closing from the extreme open position of the door, the foregoing operations are merely reversed so that there is a progressive diminution of resistance upon the door until it is firmly and quietly closed and is held in such position. During such door closing, the stronger end 28b of spring 28, if it has been compressed, operates first to the point of extending its full compressed energy to very forcibly and quickly start the door closing movement, after which the weaker spring end 28a begins to exercise its stored force to retract the piston 31. At this stage or shortly thereafter, the second spring 40 starts exercising its stored force to retract its piston 45 and rapidly move the door to almost closed position. During door closing movements, the retraction of piston 31 will force air from chamber B in cylinder 20 first through the vent 29 and thereafter into chamber A and through the vent controlled by the screw 24 in cap 21. This action affords a controlled cushion to the return or retraction of both pistons 31 and 45. As the piston 45 retracts, it will force air ahead of it in chamber C of cylinder 30 out through the vent 50; and after this piston moves farther to the right of the figures, it will pass over vent 50 and begin compressing air in chamber D to cushion door closing. As pistons 31 and 45 come to rest with the piston 45 over the groove 30', air trapped in chamber D will escape through this by-pass 30' to vent through vent 50 to the atmosphere. At the beginning of door closing from a wide open position, the full retractive power of both springs will act simultaneously to start rapid door closing with gradually diminishing force as the door moves toward a closed position. As the power of the weaker end 28a of the spring 28 nears a low ebb, the spring 40 will continue to close the door as air pressure in chamber A is finally exhausted through the vent controlled by screw 25 and pressure in chamber D is by-passed through by-pass 30' to the atmosphere, allowing the door to be closed quietly and firmly.

As will be appreciated, this check provides, by reason of the telescopic action of the two cylinders 20 and 30 with the two pistons 31 and 45 and two springs 28 and 40, a structure wherein the reach or extension of the check is increased immensely over the awkward hinged extension linkages of prior devices to achieve a full ninety degree opening of the door. Also, because of the confined rectilinear movements of the extensible parts of the check, all tendencies of their twisting and misalignment is avoided so that the packings will not be subjected to one-sided pressure or drag to require frequent re-placements. This telescopic arrangement also, not only

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presents a neater and more compact check which will prevent excessive door opening movements, but makes it possible to connect the check with the door and frame at various distances from the door hinge, which is another most desirable feature over prior art devices, in that it requires no accurate measurements for its installation. Furthermore, the construction is such as to make assembly and replacement of parts an extremely simple matter.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A door check connected between a door frame member and a door member comprising an outer cylinder having first and second closed end portions and an intermediate portion therebetween, said second end portion of said outer cylinder pivotally connected to one of said door frame and door members, said outer cylinder having an inner wall surface defining the interior of said outer cylinder, and first end portion of said outer cylinder having a first opening providing entrance to the interior of said outer cylinder, an inner cylinder having first and second end portions and an intermediate portion and residing coaxially within said outer cylinder, said first end portion of said inner cylinder slidably residing within and extending from said first opening in said outer cylinder, said first end portion of said inner cylinder having a second opening for providing entrance to the interior of said inner cylinder, said second end portion of said inner cylinder having a first piston connected thereto and adapted for movement therewith, said first piston snugly and slidably engaging the inner wall surface of said outer cylinder thereby forming first and second variable air chambers between said first and second end portions of said outer cylinder respectively, said second end portion of said outer cylinder having an air vent valve providing communication between the second variable air chamber and the outside atmosphere, said intermediate portion of said outer cylinder having a first vent opening therein, said first vent opening alternately providing communication between the first and second variable air chambers and the outside atmosphere, a first spring member residing within the interior of said outer cylinder and surrounding said inner cylinder, said first spring member engaging said first piston at one end portion thereof and engaging said first end portion of said outer cylinder at the other end portion thereof, said first spring member exerting a force on said first piston tending to maintain said first variable air chamber at a maximum and said second variable air chamber at a minimum, movement of said inner cylinder out of said outer cylinder through said first opening causing said first piston to reduce said first variable air chamber and initially to force air from said first variable air chamber through said first vent opening whereby said movement of said inner cylinder is resisted by said first spring, further movement of said inner cylinder causes said first piston to compress air within said first variable air chamber and cause said first vent opening to reside within said second variable air chamber whereby said further movement of said inner cylinder is resisted by the compression of the air within said first variable air chamber in addition to said first spring, a piston rod having first and second end portions and residing coaxially within said inner cylinder, said first end portion of said piston rod pivotally connected to the other of said door frame and door members, said first end portion of said piston rod slidably extending from said second opening in said inner cylinder, said second end portion of said piston rod having a second

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piston connected thereto and adapted for movement therewith, said second piston snugly and slidably engaging the inner wall surface of said inner cylinder thereby forming third and fourth variable air chambers between said first and second end portions of said inner cylinder respectively, said intermediate portion of said inner cylinder having a second vent opening therein, said second vent opening alternately providing communication between said third and fourth variable air chambers and the exterior of said inner cylinder, a second spring member residing within the interior of said inner cylinder and surrounding said piston rod, said second spring member engaging said second piston at one end portion thereof and engaging said first end portion of said inner cylinder at the other end portion thereof, said second spring member exerting a force on said second piston tending to maintain said third variable air chamber at a maximum and said fourth variable air chamber at minimum, movement of said piston rod out of said inner cylinder through said second opening causing said second piston to reduce said third variable air chamber and initially to force air from said third variable air chamber through said second vent opening whereby said movement is resisted by said second spring, further movement of said piston rod causes said second piston to compress air within said third variable air chamber and causes said second vent opening to reside within said fourth variable air chamber whereby said further movement of said piston rod is resisted by the compression of the air within said third variable air chamber in addition to said second spring.

2. A door check comprising an outer cylinder having first and second closed end portions and an intermediate portion therebetween, said outer cylinder having an inner wall surface defining the interior of said outer cylinder, said first end portion of said outer cylinder having a first opening providing entrance to the interior of said outer cylinder, an inner cylinder having first and second end portions and an intermediate portion and residing coaxially within said outer cylinder, said first end portion of said inner cylinder slidably residing within and extending from said first opening in said outer cylinder, said first end portion of said inner cylinder having a second opening for providing entrance to the interior of said inner cylinder, said second end portion of said inner cylinder having a first piston connected thereto and adapted for movement therewith, said first piston snugly and slidably engaging the inner wall surface of said outer cylinder thereby forming first and second variable air chambers between said first and second end portions of said outer cylinder respectively, said second end portion of said outer cylinder having an air vent valve providing communication between the second variable air chamber and the outside atmosphere, said intermediate portion of said outer cylinder having a first vent opening therein, said first vent opening alternatively providing communication between the first and second variable air chambers and the outside atmosphere, a first spring member residing within the interior of said outer cylinder and surrounding said inner cylinder, said first spring member engaging said first piston at one end portion thereof and engaging said first end portion of said outer cylinder at the other end portion thereof, said first spring member exerting a force on said first piston tending to maintain said first variable air chamber at a maximum and said second variable air chamber at a minimum, movement of said inner cylinder out of said outer cylinder through said first opening causing said first piston to reduce said first variable air chamber and initially to force air from said first variable air chamber through said first vent opening whereby said movement of said inner cylinder is resisted by said first spring, further movement of said inner cylinder causes said first piston to compress air within said first variable air chamber and causes said first vent opening to reside

within said second variable air chamber whereby said further movement of said inner cylinder is resisted by the compression of the air within said first variable air chamber in addition to said first spring, a piston rod having first and second end portions and residing coaxially within said inner cylinder, said first end portion of said piston rod slidably extending from said second opening in said inner cylinder, said second end portion of said piston rod having a second piston connected thereto and adapted for movement therewith, said second piston snugly and slidably engaging the inner wall surface of said inner cylinder thereby forming third and fourth variable air chambers between said first and second end portions of said inner cylinder respectively, said intermediate portion of said inner cylinder having a second vent opening therein, said second vent opening alternatively providing communication between said third and fourth variable air chambers and the exterior of said inner cylinder, a second spring member residing within the interior of said inner cylinder and surrounding said piston rod, said second spring member engaging said second piston at one end portion thereof and engaging said first end portion of said inner cylinder at the other end portion thereof, said second spring member exerting a force on said second piston to maintain said third variable air chamber at a maximum and said fourth variable air chamber at a minimum, movement of said piston rod out of said inner cylinder through said second opening causing said second piston to reduce said third variable air chamber and initially to force air from said third variable air chamber through said second vent opening whereby said movement is resisted by said second spring, further movement of said piston rod causes said second piston to compress air within said third variable air chamber and causes said second vent opening to reside within said fourth variable air chamber whereby said further movement of said piston rod is resisted by the compression of the air within said third variable air chamber in addition to said second spring.

3. A door check comprising a first cylinder having first and second closed end portions and an intermediate portion therebetween, said first cylinder having an inner wall surface defining the interior of said first cylinder, said first end portion of said first cylinder having a first opening providing entrance to the interior of said first cylinder, a second cylinder having first and second end portions and an intermediate portion, said second cylinder slidably residing within and extending from said first opening in said first cylinder, said first end portion of said second cylinder having a second opening for providing entrance to the interior of said second cylinder, said second end portion of said second cylinder having a first piston connected thereto and adapted for movement therewith, said first piston slidably engaging the inner wall surface of said first cylinder thereby forming first and second variable air chambers between said first and second end portions of said first cylinder respectively, an air vent valve providing an exitway for air from said second variable air chamber, said intermediate portion of said first cylinder having a first vent opening therein, said first vent opening alternately providing an exitway for air from said first and second variable air chambers, a first spring member exerting a force on said first piston tending to maintain said first variable air chamber at a maximum and said second variable air chamber at a minimum, said first spring member engaging said first piston at one end portion thereof and engaging said first end portion of said outer cylinder at the other end portion thereof, a piston rod having first and second end portions, said piston rod slidably extending from said second opening in said second cylinder, said second end portion of said piston rod having a second piston connected thereto and adapted for movement therewith, said second piston slidably engaging the inner wall surface of said second cylinder thereby forming third and

fourth variable air chambers between said first and second end portion of said second cylinder respectively, said intermediate portion of said second cylinder having a second vent opening therein, said second vent opening alternatively providing an exitway for air from said third and fourth variable air chambers, a second spring member engaging said second piston at one end portion thereof and engaging said first end portion of said inner cylinder at the other end portion thereof, said second spring member exerting a force on said second piston tending to maintain said third variable air chamber at a maximum and said fourth variable air chamber at a minimum.

4. A door check comprising a first cylinder having first and second end portions, a first piston slidable in said first cylinder and including a piston rod in the form of a second cylinder telescopically slidably in said first cylinder, a first compression spring in said first cylinder and having a first end portion engaging said first end portion of said first cylinder and having a second end portion engaging said first piston to resist projection of said first piston rod, said first compression spring having one end portion thereof wound with increased pitch to render it more resistant to compression than the other end portion thereof, a second piston telescopically slidable in said second cylinder and having a piston rod connectable to a door part, a second compression spring in said second cylinder and having a first end portion engaging an end portion of said second cylinder and having another end portion engaging said second piston to resist projection of said second piston rod, and by-pass means in said second cylinder providing for the by-pass of air upon movement of said second piston to one end portion of said second cylinder.

5. A door check comprising a first cylinder having first and second end portions, a first piston slidable in said first cylinder and including a piston rod in the form of a second cylinder telescopically slidable in said first cylinder, said end portions of said first cylinder being closed forming opposed air chambers, a controlled air vent valve in one of said closed ends and an air vent intermediate the end portions of said first cylinder and intermediate the piston travel therein, a first compression spring in said first cylinder and having a first end portion engaging said first end portion of said first cylinder and having a second end portion engaging said first piston to resist projection of said first piston rod, said first compression spring having one end portion thereof wound with increased pitch to render it more resistant to compression than the other end portion thereof, a second piston telescopically slidable in said second cylinder and having a piston rod connectable to a door part, said second cylinder having air chambers at opposite ends thereof with an air vent intermediate the ends of said second cylinder and intermediate the piston travel therein, a second compression spring in said second cylinder and having a first end portion engaging an end portion of said second cylinder and having another end portion engaging said second piston to resist projection of said second piston rod, and by-pass means in said second cylinder providing for the bypass of air upon movement of said second piston.

6. A door check comprising a first cylinder having first and second closed end portions and an intermediate portion therebetween, said first cylinder having an inner wall surface defining the interior of said first cylinder, said first end portion of said first cylinder having a first opening providing entrance to the interior of said first cylinder, a second cylinder having first and second end portions and an intermediate portion, said second cylinder slidably residing within and extending from said first opening in said first cylinder, said first end portion of said second cylinder having a second opening for providing entrance to the interior of said second cylinder, said second end portion of said second cylinder having

a first piston connected thereto and adapted for movement therewith, said first piston slidably engaging the inner wall surface of said first cylinder thereby forming first and second variable air chambers between said first and second end portions of said first cylinder respectively, an air vent valve providing an exitway for air from said second variable air chamber, said intermediate portion of said first cylinder having a first vent opening therein, said first vent opening alternately providing an exitway for air from said first and second variable air chambers, said first spring member engaging said first piston at one end portion thereof and engaging said first end portion of said outer cylinder at the other end portion thereof, said first spring member having one end portion thereof wound with a greater pitch than the other end portion thereof, said first spring member exerting a force on said first piston tending to maintain said first variable air chamber at a maximum and said second variable air chamber at a minimum, a piston rod having first and second end portions, said piston rod slidably extending from said second opening in said second cylinder, said second end portion of said piston rod having a second piston connected thereto and adapted for movement therewith, said second piston slidably engaging the inner wall surface of said second cylinder thereby forming third and fourth variable air chambers between said first and second end portions of said second

cylinder respectively, said intermediate portion of said second cylinder having a second vent opening therein, said second vent opening alternatively providing an exitway for air from said third and fourth variable air chambers, a second spring member engaging said second piston at one end portion thereof and engaging said first end portion of said inner cylinder at the other end portion thereof, said second end portion of said second cylinder having a bypass for air compressed by said second piston upon movement of said second piston toward the second end portion of said second cylinder, said second spring member exerting a force on said second piston tending to maintain said third variable air chamber at a maximum and said fourth variable air chamber at a minimum.

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