

2,594,626

SAFETY VALVE

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FIG. 1.

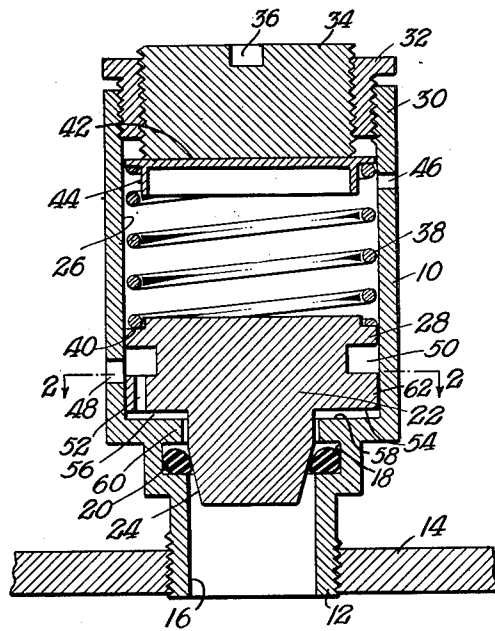
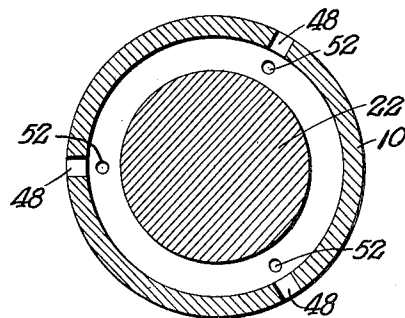


FIG. 2.



INVENTOR

CLARENCE E. EARLE,

BY

BY
Raymond Wharton
ATTORNEY

UNITED STATES PATENT OFFICE

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SAFETY VALVE

Clarence E. Earle, Washington, D. C.

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7 Claims. (Cl. 137—53)

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This invention relates to fluid apparatus and is primarily concerned with valves which are quick acting in both directions of movement for controlling fluid under pressure.

Many forms of safety or pop valves have been proposed in the past wherein a valve body presents a relatively small surface in its closed position to the fluid under pressure to be controlled and an increased surface when the body is first removed from its seat to effect a rapid movement of the body to relieve the pressure without chattering of the valve body or wire drawing the escaping fluid. This invention represents a marked improvement over valves of this type in that it enjoys rapid movement in both directions and avoids any cushioning effect which might otherwise be caused by entrapped fluid.

In achieving the improved operation, there is provided a housing having an inlet port and an outlet port which may normally be open, a seat provided in the housing intermediate the inlet and outlet ports, a body adapted to reciprocate in the housing to and from engagement with its seat, the body having a predetermined area exposed to inlet port pressure when it is seated, and a larger area exposed when unseated, and means movable with the body to restrict the outlet port during a portion of the travel of the body. The seat may be reciprocable to partake of a portion of the movement of the body and the seat may likewise be deformable so as to complement the seating portion of the body to assure proper sealing engagement. Such a reciprocable seat may be annular or toroidal and its composition of yieldable or resilient material.

The body may be biased toward its seat by means of a helical spring, the force of which may be adjustable to control the actuation point with respect to pressure conditions encountered in various applications. The control of the outlet port will preferably be such that it will be open when the body is seated, restricted during the initial travel of the body from its seat and reopened when the body becomes farther removed from its seat to permit the escape of sufficient fluid to restore the pressure being controlled to that for which the valve is designed and adjusted. When the fluid pressure has thus been restored, the body will migrate towards its seat and as soon as it engages the seat, the force of the fluid under pressure will again be confined to the reduced area of the body but since the chamber formed between the body and housing on the outlet side of the seat will be vented, the biasing effect will cause the body and reciprocable seat to seek their extreme positions rapidly.

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Inasmuch as the seat or gasket tends to become deformed between the housing and body under the force of the biasing means applied from one end of the housing, and due to the force of fluid under pressure from the inlet port at the other end of the housing to which it is exposed under sealing conditions, the seal achieved by these opposing forces when the valve is closed represents a vast improvement over current practice.

A more complete understanding of this invention will follow from a detailed description of the drawing wherein:

Fig. 1 is a sectional elevation of the valve fitted to a container of fluid under pressure; and

Fig. 2 is a section taken along line 2—2 of Fig. 1.

Housing 10 depicted in the drawings is provided with a threaded reduced end 12 for reception in the wall 14 of a container for fluid under pressure to be controlled. The bore 16 of the reduced end defines an inlet port for such fluid under pressure. The bore 16 intersects an annular recess 18 formed in the internal wall of the housing, the recess serving to retain a seat 20 of annular or toroidal cross section and which may be made of rubber or similar materials having characteristics of flexibility, yieldability, deformability and resilience. Inasmuch as the length of the recess is preferably greater than the diameter or height of the seat, the latter will partake of longitudinal movement of a limited amount together with the valve body 22, the tapered end 24 of which it engages and embraces while in sealing relationship therewith.

Beyond the seat receiving recess 18, the housing possesses an enlarged diameter forming an internal cylindrical wall 26 to serve as a guide or cylinder in cooperation with the enlarged cylindrical portion 28 of the body 22. The enlarged portion of the housing terminates in a threaded end 30 into which a bushing 32 is fitted, the bushing in turn being internally threaded to receive an adjusting nut 34 having a wrench socket 36. Interposed between the adjusting nut 34 and the body 22, there is provided a helical spring 38, one end of which bears upon a shoulder 40 formed near the enlarged end of the body, and the other end of which bears upon a plate 42 adjacent the adjusting nut. The plate 42 has a depending skirt 44 serving to guide the spring and as a limiting stop for the valve body. The wall of the valve body is perforated to form a vent 46 near the limiting position of the body when it is removed from its seat whereupon damping of the body due to entrapped fluid will be avoided.

The housing wall is also perforated to define

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one or more outlet ports 48 under the control of the valve body in its travel to and from its seat. The enlarged piston-like portion of the valve body is provided with an intermediate peripheral groove 50 depicted as partially registering with the outlet ports 48 with the body in its seated position. The groove 50 communicates with one or more longitudinal passages 52 opening at the shoulder 54 which constitutes a step between the reduced and enlarged ends of the body. Thus the chamber 56 defined between the shoulder 54 and the opposed shoulder 58 of the housing will be vented through the outlet port 48 when the body is seated.

Thus it will follow that the lower end of the body 22 provides a smaller effective cross-sectional area exposed to inlet port pressure when the valve is closed, while the enlarged cylindrical portion 28 provides a larger effective cross-sectional area of substantially the cross-section of the housing. The flange 62 containing the passages 52 is interposed between and has an effective cross-sectional area intermediate the larger and smaller effective areas. The opposed surfaces of the shoulder 58 and flange 62 relatively approach one another as the valve assumes its closed condition to define a restricted outlet passage whose opposed surfaces are of sufficient area and sufficiently proximate to one another to produce a rapid closing action.

With the parts adjusted to respond at a predetermined pressure within the container 14, when that pressure has been attained, the body will begin to move upwardly as viewed in Figure 1 and the seat 20 will partake of such movement until it engages the flange 60 formed internally of the housing. By the time the body and seat reach this position, the lower enlarged flange 62 on the body will restrict the outlet port or ports so that as the body separates from its seat, the fluid under pressure will have access to the increased area of the body, thus multiplying the force to overcome the biasing effect of the spring 38. This sudden increase in the force transmitted to the body will cause it to move upwardly rapidly to completely uncover the port or ports 48 and relieve the excessive pressure within the container. When the desired pressure conditions within the container have been restored, to the predetermined value represented by the larger exposed surface of the body and the adjusted strength of the spring, the body will migrate towards its seat. By the time the seating surface of the body has engaged the seat, the lower flange 62 on the body will have uncovered the outlet port or ports to vent the chamber 56 on the outlet port side of the seat so that there will be no cushioning or damping effect due to entrapped fluid. Accordingly, the valve will close rapidly under the effect of the spring which under these conditions opposes only the force of the fluid under pressure upon the reduced area of the body exposed thereto.

Where the passage of fluid through the valve produces precipitation of moisture, it will tend to collect predominantly on the seat, resulting in a highly desirable water seal between the body and seat.

Whereas the invention has been described with reference to only one practical embodiment, it is not intended that the depicted structure be construed as limiting beyond the scope of the appended claims.

What is claimed is:

1. A valve for controlling fluid under pressure

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comprising a housing having an inlet port and a lateral outlet port, a seat in said housing intermediate said ports, a body reciprocable in said housing to and from engagement with said seat, said body having a smaller effective cross sectional area exposed to inlet port pressure when seated and a larger effective cross sectional area of substantially the cross section of said housing exposed to said pressure when unseated, a flange interposed between said areas and movable with said body having an effective cross sectional area intermediate said smaller and larger areas controlling said outlet port during a portion of the travel of said body, and a shoulder spaced from said seat carried by said housing in opposition to said flange, the opposed areas of said flange and shoulder being sufficient, and sufficiently proximate to one another when said valve approaches its closed condition, to produce a rapid closing action.

2. A valve for controlling fluid under pressure comprising a housing having an inlet port and a lateral outlet port, a seat in said housing intermediate said ports, a body reciprocable in said housing to and from engagement with said seat, said body having a smaller effective cross sectional area exposed to inlet port pressure when seated and a larger effective cross sectional area of substantially the cross section of said housing exposed to said pressure when unseated, a flange interposed between said areas defining an axial passage between said areas and movable with said body, said flange having an effective cross sectional area intermediate said smaller and larger areas controlling said outlet port during a portion of the travel of said body, and a shoulder spaced from said seat carried by housing in opposition to said flange, the opposed areas of said flange and shoulder being sufficient, and sufficiently proximate to one another when said valve approaches its closed condition, to produce a rapid closing action.

3. A valve for controlling fluid under pressure comprising a housing having an inlet port and a lateral outlet port, a seat reciprocable in said housing intermediate said ports, a body reciprocable in said housing to and from engagement with said seat, said body having a smaller effective cross sectional area exposed to inlet port pressure when seated and a larger effective cross sectional area of substantially the cross section of said housing exposed to said pressure when unseated, a flange interposed between said areas and movable with said body having an effective cross sectional area intermediate said smaller and larger areas controlling said outlet port during a portion of the travel of said body, and a shoulder spaced from said seat carried by said housing in opposition to said flange, the opposed areas of said flange and shoulder being sufficient, and sufficiently proximate to one another when said valve approaches its closed condition, to produce a rapid closing action.

4. A valve for controlling fluid under pressure comprising a housing having an inlet port, and a lateral outlet port, a flexible seat reciprocably retained in said housing intermediate said ports, a body reciprocable in said housing to and from engagement with said seat, said body having a smaller effective cross sectional area exposed to inlet port pressure when seated and a larger effective cross sectional area of substantially the cross section of said housing exposed to said pressure when unseated, a flange interposed between said areas and movable with said body having

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an effective cross sectional area intermediate said smaller and larger areas controlling said outlet port during a portion of the travel of said body, and a shoulder spaced from said seat carried by said housing in opposition to said flange, the opposed areas of said flange and shoulder being sufficient, and sufficiently proximate to one another when said valve approaches its closed condition, to produce a rapid closing action.

5. A valve for controlling fluid under pressure comprising a housing having an inlet port and a lateral outlet port, a seat in said housing intermediate said ports, a body reciprocable in said housing to and from engagement with said seat, means biasing said body towards said seat, said body having a smaller effective cross sectional area exposed to inlet port pressure when seated and a larger effective cross sectional area of substantially the cross section of said housing exposed to said pressure when unseated, a flange interposed between said areas and movable with said body having an effective cross sectional area intermediate said smaller and larger areas controlling said outlet port during a portion of the travel of said body, and a shoulder spaced from said seat carried by said housing in opposition to said flange, the opposed areas of said flange and shoulder being sufficient, and sufficiently proximate to one another when said valve approaches its closed condition, to produce a rapid closing action.

6. A valve for controlling fluid under pressure comprising a housing having an inlet port and a lateral outlet port, a seat in said housing intermediate said ports, a body reciprocable in said housing to and from engagement with said seat, a spring biasing said body towards said seat, adjusting means for varying the force of said spring, said body having a smaller effective cross sectional area exposed to inlet port pressure when seated and a larger effective cross sectional area of substantially the cross section of said housing exposed to said pressure when unseated, a flange interposed between said areas and movable with said body having an effective cross sectional area intermediate said smaller and larger areas controlling said outlet port during a portion of the travel of said body, and a shoulder spaced from said seat carried by said

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housing in opposition to said flange, the opposed areas of said flange and shoulder being sufficient, and sufficiently proximate to one another when said valve approaches its closed condition, to produce a rapid closing action.

7. A valve for controlling fluid under pressure comprising a housing having an inlet port and a lateral outlet port, a substantially toroidal yieldable seat in said housing intermediate said ports, a body reciprocable in said housing to and from engagement with said seat, said body having a smaller effective cross sectional area exposed to inlet port pressure when seated and a larger effective cross sectional area of substantially the cross section of said housing exposed to said pressure when unseated, a flange interposed between said areas and movable with said body having an effective cross sectional area intermediate said smaller and larger areas controlling said outlet port during a portion of the travel of said body, and a shoulder spaced from said seat carried by said housing in opposition to said flange, the opposed areas of said flange and shoulder being sufficient, and sufficiently proximate to one another when said valve approaches its closed condition, to produce a rapid closing action.

CLARENCE E. EARLE.

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