

No. 667,046.

Patented Jan. 29, 1901.

J. W. WEEKS.
PRESSURE REDUCING VALVE.

(Application filed June 23, 1899.)

(No Model.)

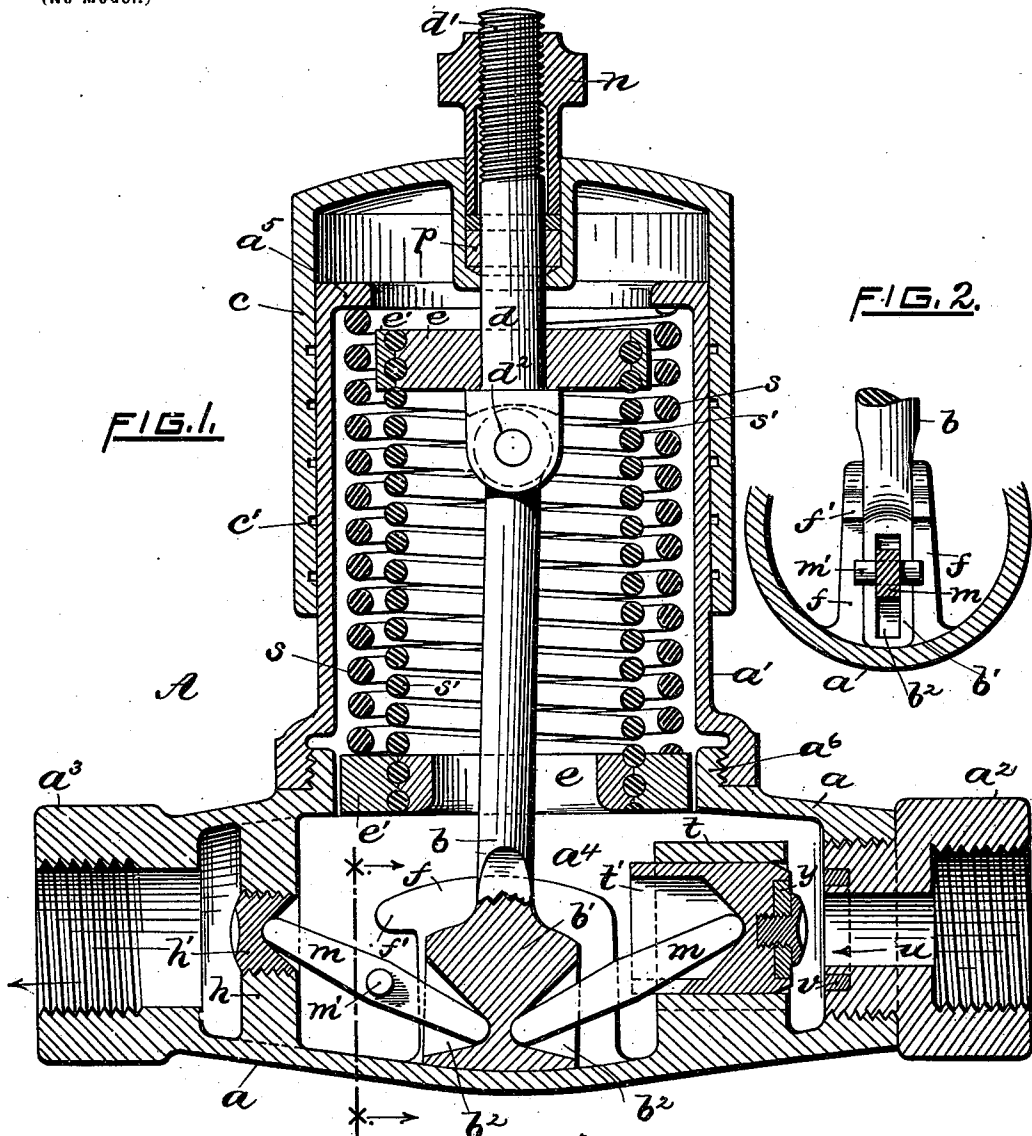


FIG. 2.

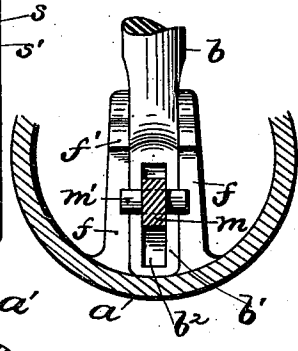
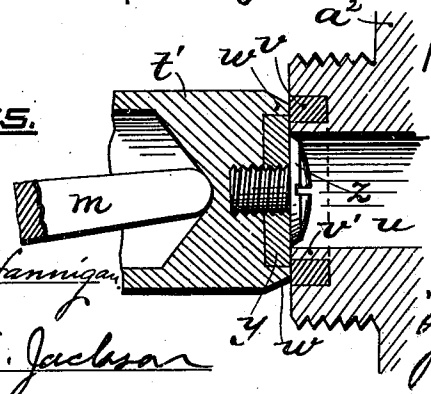


FIG. 3.



WITNESSES.

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PRESSURE-REDUCING VALVE.

SPECIFICATION forming part of Letters Patent No. 667,046, dated January 29, 1901.

Application filed June 23, 1899. Serial No. 721,573. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. WEEKS, a citizen of the United States of America, and a resident of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Pressure-Reducing Valves, of which the following is a specification.

My invention relates to certain novel improvements in pressure-reducing valves adapted for steam or other fluid or gas under pressure, whereby the initial or high-pressure steam or fluid used may be taken direct from the generator and reduced to any desired pressure through the medium of said valve, the latter when once set or adjusted being automatic in its action—that is to say, in case the pressure in the valve increases slightly beyond the predetermined or normal limit such excess in pressure operates to instantly close the valve against the inflowing steam or fluid, thereby shutting off the latter until the pressure in the valve falls below the normal, at which instant the valve again opens and admits steam into it, the above operation being repeated automatically whenever the reduced pressure in the valve exceeds the normal pressure.

My improved pressure-reducing valve consists, essentially, in the combination, with the valve body or casing provided with inlet and outlet passages for the steam or other medium, of a suitably packed and guided vertically-movable cylinder or cap member in direct communication with the valve-chamber, a pair of springs mounted within the valve, the valve proper for controlling the inlet-passage, a toggle-jointed connection through which the valve is actuated, and a connection adjustably secured to said cap and springs and forming a combined holder and joint for the toggle-levers.

It also consists in the employment of a pair of suitably-wound adjustable helical expansion and contraction springs, one mounted within the other, secured to suitable couplings or heads and arranged whereby the vertical movement due to the force or tension of the springs when in use is reduced one-half, thereby correspondingly lessening the valve's movement.

It further consists of a pair of links or levers having their inner ends pivoted in a vertically-movable connection through which the

valve-closing force is transmitted and an adjustable socket in which the outer end of one of said levers is pivoted and having the corresponding end of the other lever mounted in a slidable plug carrying the valve proper; and it consists, finally, in the combination, with an annular valve-seat, of a disk-like valve member (composed of material similar to the said seat) recessed into a slidable plug, the members being constructed and arranged whereby when the valve is closed the narrow annular rim of the plug inclosing and surrounding the valve bears against said annular seat, while at the same time the valve itself bears against the annular ring of metal formed between the central inlet-passage and the said annular seat. By means of this construction the valve when closed is practically provided with a double bearing or seat, the same being readily renewable in case of wear, &c.

In the accompanying sheet of drawings, Figure 1 is a vertical sectional view taken through the center of my improved pressure-reducing valve, the valve being open as in use. Fig. 2 is a partial transverse section taken on line $x x$ of Fig. 1; and Fig. 3 is a sectional view, enlarged, showing the construction of the valve proper and its seat, the valve being closed.

A, again referring to the drawings, indicates my improved pressure-reducing valve complete. The shell or body portion a may have any suitable form. The inlet-nozzle a^2 is adapted to be connected with the initial or high-pressure pipe, while the opposite or outlet end of the shell has a nozzle a^3 , through which the steam or fluid under reduced pressure is conducted from the valve to the place of use. The upper side of the shell has an enlarged short central nozzle a^4 , to which is firmly secured an annular guide or cylinder a^5 , the upper end having an inwardly-extending flange a^5 . Surrounding the said guide is the movable cap member c , provided with a series of packing-grooves c' . The top end of the cap has a central stuffing-box, with packing p and gland-nut n , the latter fitting the screw-threaded portion d' of the stem d , as clearly shown.

Within the valve-chamber a^4 and integral with the shell a are formed the vertical tie or bridge h , the bearing t for the slidable plug t' , and the pair of central parallel guide-

flanges f . The center of the said tie h is provided with an adjustable screw-threaded plug h' , having its inner side recessed to receive and form a seat or step for the corresponding end of the link m , the latter forming one member of the toggle-joint connection. The other member m is correspondingly seated in the plug t' , while the inner ends of the two links are pivoted in oppositely-arranged openings b^2 , formed in the enlarged lower end or head portion b' of the connecting-rod b . This rod extends upwardly and is jointed to the lower portion d^2 of the said screw d .

Within the chamber of the fixed cylinder a' are mounted the double helical suitably-proportioned springs s and s' . The outer spring s may be "open-wound" and the inner one may be a "close-wound" spring. The reaction or natural tendency of the outer spring is to elongate when the pressure is removed, while the inner one s' correspondingly contracts. The manner of mounting and supporting the springs is as follows: The upper end of spring s bears against the under side of the fixed abutment or flange a^5 , its opposite end bearing on the outer member of the combined abutment and coupling constituting the movable lower coupling e' . The bottom end of the inner spring s' is secured to said lower coupling, the follower member e thereof serving to firmly secure it in position. The upper end of the inner spring is secured to a similar coupling e' , the latter in turn being supported by the enlarged portion d^2 of the screw d . As thus constructed it will be seen that the normal tendency, say, of the inner spring to contract will be counteracted by the natural expansion of the spring s . The tension of the springs is within certain limits capable of being regulated or controlled by the nut n . The engagement of the head b' of the rod b with the lower side of the valve-body forms a stop for limiting the downward movement of the parts.

The valve-seat and inlet-passage u may form a part of the inlet-nozzle a^2 , the same being screwed into the valve-casing, as shown in Fig. 1. The said seat portion v is annular and is fitted into a corresponding recess formed in the inner face of the nozzle a^2 , thus forming an annular metallic rim v' , contiguous to the opening u . (See Fig. 3.) The adjacent face of the plug member t' is recessed centrally to receive the disk-shaped valve y , which is inclosed by the peripheral rim w . The said valve is retained in place by means of the screw z , its head being enlarged and beveled, so as to practically fill the inlet-passage u . As thus constructed the valve when closed will have a double seat—that is, the metal rim w will bear against the seat v , while the rim v' will bear against the valve-disk y . It is to be understood that the said parts v and y are composed of some slightly-yielding material, as vulcanite, thus insuring a more efficient joint.

In the arrangement of the valve-operating mechanism represented it will be seen that h' forms a fixed fulcrum for the toggle-joint members, so that the force acting to elevate the rod b operates to correspondingly raise the inner ends of the levers m , fulcrumed in the head b' , the result being to advance the plug t' , thereby forcing the valve y outwardly against the seat and closing the inlet-passage u . The ribs f not only prevent the rod b from turning axially, but they further serve as a guide for the head b' of the rod.

One of the levers m is provided with short lateral projections m' , adapted to contact with ears f' , extending from the upper side of the said ribs f . (See Figs. 1 and 2.) This construction forms a stop in that it limits the upward movement of the rod and its connected parts, the arrangement of the ears and projections being such that the levers m cannot assume a horizontal position.

The operation of my improved pressure-reducing valve may be described as follows: Assuming the total pressure in the passage u and bearing against the valve y when closed to be two hundred pounds, while the pressure required to be utilized is, say, not to exceed fifty pounds per square inch, in such case the two springs are to be set or first adjusted by the nut n until the tension or force upon them is two hundred pounds, the corresponding position of the parts then being substantially as shown in Fig. 1, wherein the valve is represented as being open for the instant and permitting the passage of the fluid under high pressure into the enlarged valve-chamber and from which it flows at the reduced pressure through the outlet or discharge passage of the nozzle a^3 . Now assuming the net internal area of the movable cap c to be four inches, it follows that an internal pressure of fifty pounds per square inch upon the cap practically equals and balances the two hundred pounds tension of the springs, so that any slight excess of pressure in the valve-chamber a^4 —say to fifty and one-half pounds per square inch—operates to force the cap upwardly, carrying with it the springs and rod b , thereby at the same time through the medium of the increased leverage due to the toggle-jointed connection quickly closing the valve y and shutting off the inflowing steam or fluid. As soon as the pressure in the chamber falls to or below fifty pounds the reaction of the springs immediately operates to depress the toggle-joint, thereby again opening the valve, the relation of the parts then being substantially as shown in Fig. 1.

I may state here that I do not claim, broadly, as my invention the use of double helical springs, one arranged within the other, as such construction is old, springs of this type having been employed in car-trucks, as well as in valves, &c. In such former arrangements, however, both springs were simply confined between upper and lower bearing-

surfaces or abutments which were common to both springs. In my invention one end of the outer spring s bears against a fixed abutment a^5 , while the other end bears against the movable abutment e' , which also forms a coupling or abutment for the corresponding end of the inner spring s' , the opposite end of the latter being secured to the upper abutment or coupling, which in turn carries the connecting-rod b , &c., through which the valve proper is actuated, as before stated. The said springs s s' when connected and arranged substantially as shown and described constitute what may be termed an "adjustable balanced helical spring," the same when properly adjusted being adapted to keep the valve normally open, while any pressure of the steam or fluid exceeding that of the predetermined or working pressure operates to close it.

A valve of the class described embodying my improvements may be produced more cheaply, while having greater efficiency than valves of this type heretofore produced. By means of the duplex springs employed the net working movement is reduced one-half as compared with a single spring having equal power or force. The combination of said springs with the toggle-jointed connection and cap member c forms a quick-acting and powerful valve-closing device, the force or leverage increasing rapidly as the levers m approach a horizontal position. As thus constructed, less pressure is required to operate the cap c than would have to be used in case a long single spring were employed in combination with the said toggle-jointed connection for closing the valve, or, in other words, while a given weight will produce a movement of the outer spring alone, say, of one-half of an inch the same weight will when connected with both springs produce a movement of one inch. Consequently in the latter case a movement of one-half an inch would be effected by a weight having one-half the averdupois of the former.

I claim as my invention—

1. In a pressure-reducing valve, the combination with the valve-casing provided with suitable inlet and outlet passages and a vertically-movable guided cap or cylindrical member in direct communication with the pressure in the valve-chamber, of a pair of helical springs arranged one within the other and mounted substantially as herein described and having said springs adjustably connected to said cap member, a valve proper adapted to close said inlet-passage, a toggle-jointed connection through which the valve's movements are effected and a connecting member jointed to the toggle-links and the spring-holder, whereby excess of pressure beyond the normal in the valve-chamber raises the spring-resisted cap and closes the valve.

2. In a pressure-reducing valve, the combination with an adjustably-mounted movable cap member in direct communication with the

pressure in the valve-chamber, and a pair of helical springs arranged one within the other, substantially as described, and connected with said cap member, of a toggle-jointed valve-controlling connection arranged to be actuated by the movements of said cap member, substantially as described.

3. In a pressure-reducing valve, the combination with the valve-seat, the slidable valve and the fixed lever-fulcrum h' , of the two toggle-levers m , m , mounted in said valve and fulcrum members, a movable spring-resisted cap c in direct communication with the pressure in the valve-chamber a^4 , and a connecting-rod b jointed to said cap and having the inner ends of the toggle-levers m fulcrumed therein, substantially as described.

4. In a pressure-reducing valve, the combination with a pair of laterally-separated guide-ribs f formed within the valve-chamber and a movable connecting-rod b having its lower end or head portion mounted between and guided by said ribs, of the two toggle-levers m m fulcrumed in said head, and having extensions f' and m' formed on said ribs and levers respectively, arranged when in engagement with each other to prevent the levers from assuming a horizontal position, substantially as described.

5. The combination, in a pressure-reducing valve, of a vertically-movable cap member in communication with the valve-chamber connected to and arranged to operate the valve, and having a pair of suitably-mounted spiral springs interposed between said cap and valve and forming a part of the connection through which the valve is operated, substantially as described.

6. In a pressure-reducing valve, the combination with a movable cap member arranged to be operated by the pressure in the valve-chamber, and the valve proper for closing the inlet-passage, of a pair of spiral springs, s , s' , arranged one within the other, connected at one end by a coupling and having the upper or free end of the inner spring fixed to a suitable connection uniting said cap and valve members, whereby the upward movement of the cap operates to close the valve, substantially as described.

7. In an organized valve, the combination of the valve-seat consisting of the faced or surfaced parts v and v' composed of dissimilar materials, and the movable valve member t' also consisting of the faced or surfaced parts y and w of dissimilar materials, arranged whereby when the valve is closed the part w will bear against the seat v while the end of the part v' bears against the face of the valve member y , substantially as shown and described.

Signed by me at Providence, Rhode Island, this 22d day of June, A. D. 1899.

JOHN W. WEEKS.

Witnesses:

GEO. H. REMINGTON,
ORLANDO L. JACKSON.