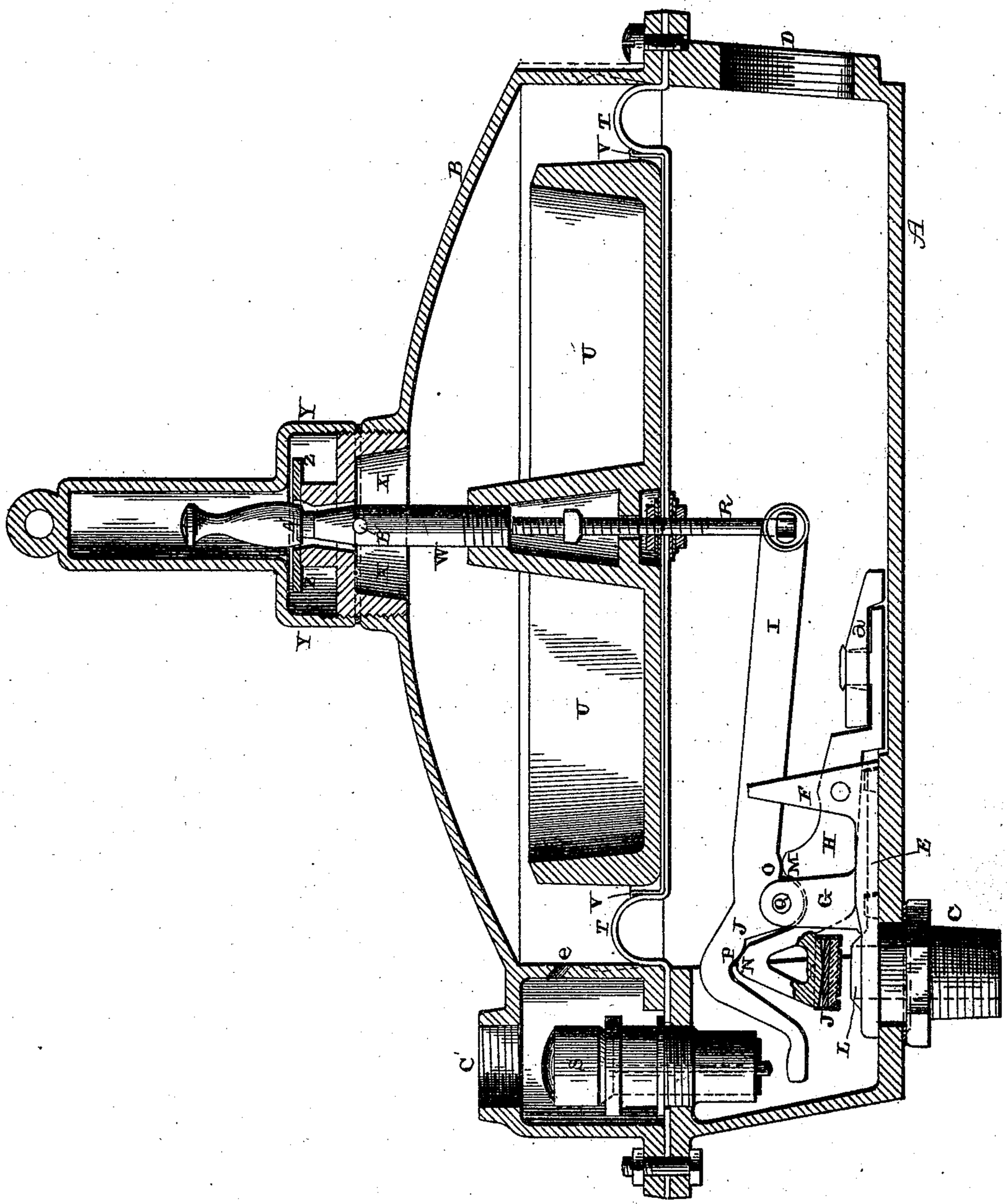
(No Model.)

F. E. YOUNGS.

FLUID PRESSURE REGULATOR AND CUT-OFF.

No. 501,814. Patented July 18, 1893.



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UNITED STATES PATENT OFFICE.

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FLUID-PRESSURE REGULATOR AND CUT-OFF.

SPECIFICATION forming part of Letters Patent No. 501,814, dated July 18, 1893.

Application filed July 30, 1889. Serial No. 319,206. (No model.)

To all whom it may concern:

Be it known that I, FRED E. YOUNGS, of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Fluid-Pressure Regulators and Cut-Offs; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawing, which forms part of this specification.

My invention relates to an improvement in fluid pressure regulators; and the object of my invention is to provide a regulator which shall accurately maintain the pressure of the gas as delivered from the regulator under all conditions of flow; which in case of a failure of the pressure in the supply line will automatically close the inlet valve and prevent the gas or fluid from entering the regulator again until properly adjusted therefor; and which in case the pressure in the main line falls to a point lower than that at which the regulator is supposed to deliver the gas, may be adjusted so as to hold the inlet valve open and allow whatever pressure there is in the main line to pass through the regulator; and which while in this condition should the supply line pressure increase will automatically regulate the pressure in the delivery and readjust itself so that the cut off may act when again required by failure in the pressure of the supply line; which shall have means provided for holding the diaphragm weight during handling or shipping so as to prevent injury to any of the parts of the regulator; which shall be provided with an automatic dead weight safety valve adapted to open and relieve the pressure in the regulator in case of failure of any of the other parts to act; which shall have efficient means for preventing fluttering or pumping of the diaphragm; the mechanism for accomplishing all of which will be more fully described hereinafter.

The accompanying drawing represents a vertical section of a regulator which embodies my invention.

A, B, represent the case of the regulator, which is made in two parts, and bolted together as shown. The gas enters the lower part of the casing through the inlet pipe C, and escapes through the opening D. Cast with the inlet pipe C, as a matter of convenience is the base plate E, from which rise the two pair of lever bearings and guides F, G, in which the two operating levers H, I, are pivoted. The seal J, may either be of the construction here shown, or any other that may be preferred, and which forms a tight joint with the valve seat L, when the valve lever H, is depressed so as to cut off the flow of gas into the casing. The counter weight *a* may be of any desired construction and is sufficiently heavy to keep the opposite end of the valve lever pressed upward against the diaphragm lever I. This valve lever H, is provided with two bearing surfaces M, N, which come in contact with corresponding bearing surfaces O, P, upon the diaphragm lever I. These operating levers H, I, are preferably given the shapes here shown, so as to reduce as much as possible the friction between the bearing surface P, on the diaphragm lever I, and the bearing surface N, on the valve lever H.

The diaphragm lever I, is pivoted in the bearings G, at Q, and passes between the upper ends of the bearings E, so as to be guided in its vertical movements, and has the rod R, secured to its inner and longer end. Its shorter and outer end may be shaped as here shown, or in any other way that may be preferred, and is intended to open the safety valve S, when the diaphragm drops to its lowest point. The valve lever H, is pivoted at a point near the bottom of the lever bearings F, as shown, and passes between the lever bearings G, which act as a guide for the vertical motion of the lever H. A straight line being drawn through the centers of the pivots of the operating levers will pass at a point just below the bearing surfaces P and N, as shown in the drawing or at a point half way between the extreme upper position of the bearing surface N, and its extreme lower position. The arcs of the circles described by the bearing surfaces P and N of the levers I and H, thus coincide in position, the only friction of the bearing surfaces being due to the differences in the heights of these arcs.

The diaphragm T, is made of leather, rubber, or any other suitable material, and has

the weight U, placed upon its top and between this weight and the diaphragm is placed a diaphragm pan V, which has vertical edges as shown. The upper portion of the casing B, is made perfectly straight inside, or may be inclined outward slightly so as to be larger at the top than at the bottom, so that as the diaphragm T, rises and falls its area remains the same, or increases as it rises instead of decreasing as it necessarily would where only a sufficient amount of material is used to allow for the stroke of the diaphragm. The vertical inner sides of the casing B, and the vertical sides of the diaphragm pan V, cause the roll of the material of the diaphragm to remain at constantly the same curve and thus the effective area of the diaphragm remains constantly the same, while the pressure of the gas delivered from the regulator will remain constantly the same, no matter what the volume or flow may be, or what position the diaphragm may occupy within the limits of the capacity of the regulator. In case it is desired to increase the pressure of the gas delivered from the regulator as the volume increases so as to in a measure make up for the loss of pressure due to the flow of the gas in the pipes leading from the regulator, the upper part of the casing may be made tapering to increase in diameter for a distance sufficient to allow for the stroke of the diaphragm. This allows the fold of the leather to increase in diameter as the diaphragm moves upward, thus increasing the effective area of the diaphragm, and reducing the pressure. As the diaphragm moves upward by means of the rod R, the inner end of the diaphragm lever I, is raised, depressing the outer end of the diaphragm lever I, and causing the bearing surface P of the diaphragm lever I, to press downward on the bearing surface N, of the valve lever H, thus closing the opening in the valve C, and throttling the inflow of the gas. As the diaphragm moves downward the reverse action takes place, the counter weight *a*, keeping the valve lever H, pressed upward against the diaphragm lever I, and opening the inlet valve. As the flow increases from the regulator the diaphragm falls lower and lower so as to allow the gas to pass freely in from the inlet, and maintain the pressure in the regulator. When the upper part of the casing is made to increase in diameter upward the motion of the diaphragm downward folds the material of the diaphragm over in such a manner as to decrease its effective area of the diameter, thus increasing the pressure of the gas in the regulator. By this construction, I am enabled to make the regulator far more sensitive than could be possible with the ordinary form of diaphragm, large changes in the volume or flow having little or no effect to change the pressure of the gas delivered from the regulator.

The diaphragm in the upper part of its stroke serves by means of the rod R, diaphragm lever I, and bearing on the bearing surface N, of the valve lever H, to regulate the inflow of the gas and maintain the pressure as described. In case the pressure of the gas at the inlet pipe C, is cut off so that there is no gas to flow into the regulator the diaphragm falls. When it reaches the point shown in the drawing, the bearing surface O, of the diaphragm lever I, comes in contact with the bearing surface M, of the valve lever H, and as the diaphragm falls farther presses down on the valve lever H, and closes the inlet opening at the same time that the outer end of the diaphragm lever I, lifts up the dead weight safety valve S, thus relieving all pressure in the regulator. While in this position if the gas in the inlet pipe C, be again turned on it cannot enter the regulator as the weight on the diaphragm firmly holds the valve seal J, on to the valve seat L. In case this valve seal should leak slightly from any cause, the fact that the dead weight safety valve is held open will prevent sufficient pressure from accumulating under the diaphragm T, to raise it and open the valve. To the top of the diaphragm weight U, is attached the pull up rod W, which extends up through the bushing X, in the top of the case B. By unscrewing the cap Y, and pulling up on the pull up rod W, so as to lift the diaphragm and valve lever I, the gas is again permitted to enter through the inlet valve into the regulator.

In the distribution of fuel gas under pressure, it often occurs that the pressure in the main line becomes less than the pressure at which the regulators are supposed to deliver. When this occurs the diaphragm T, would not have sufficient pressure under it to hold open the valve C, and would fall and entirely cut off the gas from the regulator. As it is desirous under such circumstances to get all of the gas that can be got some means for supporting the diaphragm other than by the pressure of the gas must be provided. Around the pull up rod W, is placed a common bolt washer Z, which may be slipped to one side a sufficient amount to allow the pull up rod W, to hang on the washer at the notched portion A′. Below this notched portion the pull up rod is tapered to its full size which is sufficient to form a guide in passing through the bushing X, and thus maintain a vertical movement of the diaphragm. This tapered portion of the pull up rod W, serves to slip the washer back to a position concentric with the opening in the bushing, when the pressure of the gas becomes sufficient to support and raise the diaphragm to its operating position. Near the larger part of the tapered portion of the pull up rod W, a small hole B′, is bored passing through the rod. By pulling the rod upward until the weight U, comes in contact with the inside of the top of the case the hole B′, comes to a position just above the washer Z. By passing a short piece of wire or metal through this hole so as to rest on each side of the washer Z, the weight will be held up against the casing when by slightly turning the rod

W, so as to tighten the weight against the casing by means of the thread in the top of the weight, the weight will be held so firmly that all injury to the diaphragm from jarring or otherwise will be prevented. The dead weight safety valve is usually made so as to open at a pressure about double that at which the regulator is supposed to deliver gas. In case of any accident to the diaphragm, or failure in the action of any of the parts of the regulating valve so that the pressure of the gas becomes too high in the regulator this safety valve will open and allow the surplus gas to pass off through the escape outlet C′. In the partition between the space in the upper part of the casing above the diaphragm, and the space in the upper part of the casing around the safety valve is bored a small vent hole *e* to permit the air to pass in or out above the diaphragm. This hole is made quite small so as to prevent the diaphragm from "pumping" the air in the space above the diaphragm acting as a check or cushion to prevent fluttering.

Having thus described my invention, I claim—

1. In a fluid pressure regulator, the combination of the diaphragm, the diaphragm lever operated thereby, and provided with the bearing surface P, and the valve lever provided with the bearing surface N, with a valve which controls the inflow of the gas, substantially as shown.

2. In a fluid pressure regulator, the combination of the diaphragm, the diaphragm lever operated thereby, and provided with the bearing surfaces O, P, and the valve lever provided with the bearing surfaces N, M, with a valve which controls or entirely cuts off the flow of the gas, substantially as described.

3. In a fluid pressure regulator, the combination of a diaphragm, the diaphragm lever operated thereby, and provided with the bearing surface O, and the valve lever provided with the bearing surface M, with a valve which will entirely cut off the flow of gas when the pressure becomes too low to support the diaphragm, substantially as shown.

4. The combination of the diaphragm, a diaphragm lever connected thereto, a valve lever which is operated by the diaphragm lever, and a safety valve which is operated by the diaphragm lever when the diaphragm drops, substantially as set forth.

5. In a fluid pressure regulator, the combination of a casing provided with a separate escape chamber, a safety valve placed therein, a diaphragm, and the operating levers which are operated thereby, an opening being made through the partition between the diaphragm chamber, and the escape chamber, substantially as specified.

6. The combination of the casing provided with a separate escape chamber, the safety valve placed in this chamber, the diaphragm and the diaphragm chamber, an opening being made through a partition between the diaphragm and the escape chambers, substantially as shown.

7. The combination of the diaphragm, the weight, the pull up rod connected to the weight and provided with shoulders A′, and a laterally moving washer placed upon the top of the casing and adapted to catch under the shoulders upon the rod, substantially as described.

8. The combination of the diaphragm, the weight placed thereon, the pull up rod provided with the shoulders A′, and a tapered portion below the shoulders, and the laterally movable washer Z, placed upon the casing, substantially as set forth.

9. The combination of the casing, provided with a perforated bushing in its top, the diaphragm, the weight placed upon the diaphragm and provided with upturned edges, the pull up rod W, provided with a hole B′, whereby the weight and the diaphragm may be held for transportation, substantially as specified.

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

FRED E. YOUNGS.

Witnesses:
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