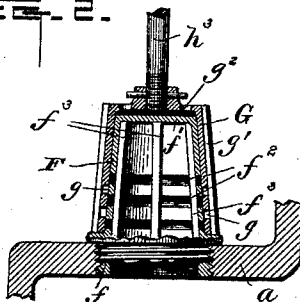
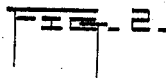
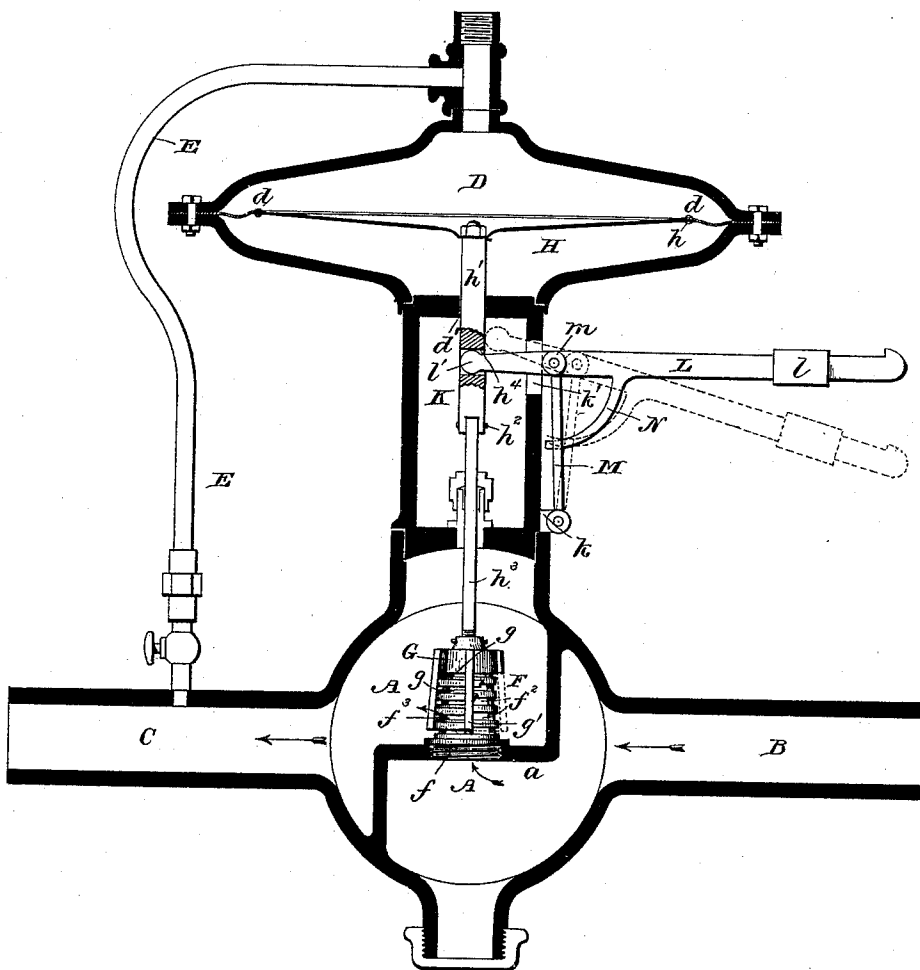
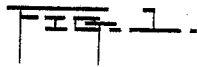


(No Model.)

L. B. FULTON.
PRESSURE REGULATOR.

No. 395,559.

Patented Jan. 1, 1889.



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UNITED STATES PATENT OFFICE.

LOUIS B. FULTON, OF PITTSBURG, PENNSYLVANIA.

PRESSURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 395,559, dated January 1, 1889.

Application filed May 3, 1888. Serial No. 272,679. (No model.)

To all whom it may concern:

Be it known that I, LOUIS B. FULTON, of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain
5 new and useful Improvements in Pressure-Regulators; 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 appertains to
10 make and use the same.

My invention relates to an improvement in pressure-regulators, and more particularly to the construction and arrangement of the valve and cut-off mechanism for use in connection
15 with the distribution of gas for general use.

The object is to provide a valve capable of effecting a maximum opening by a minimum amount of movement, and which at the same time shall be capable of regulating the flow
20 with the greatest precision.

A further object is to provide an automatic cut-off in which the same weight which is employed to hold the valve open against the pressure of the gas will assist to close the
25 valve when the pressure of the gas is for any cause removed.

A further object is to provide a valve and cut-off mechanism which shall be effective, simple, and durable, and well adapted to general
30 use.

With these ends in view my invention consists in certain features of construction and combinations of parts, as will be hereinafter described, and pointed out in the claims.

35 In the accompanying drawings, Figure 1 is a view of a pressure-regulator in vertical central section, showing the valve in side elevation and partially broken away to show its seat, the valve being in half-open adjustment.
40 Fig. 2 is a detail view of the valve and its seat provided with only three annular rows of openings, the valve being represented in position to completely close the openings in the seat.

The valve-chamber A, across which the partition α extends and to which the valve-seat is secured; the pipe B, which leads from a gas-supply (not shown) to the valve-chamber, and which is commonly termed the "high-pressure" pipe; the pipe C, which leads from the
50 valve-chamber to the burner, and which is commonly termed the "low-pressure" pipe, and the diaphragm-chamber D, located above

the valve-chamber and provided with a diaphragm, d , in connection with the valve, and having its portion above the diaphragm in communication with the low-pressure pipe through a branch pipe, E, are preferably quite similar in their general construction and arrangement to corresponding parts shown and described in Letters Patent No. 340,107, granted to me April 20, 1886.

My present invention embraces the valve and the devices for balancing and operating it.

The valve-seat and valve consist, essentially, of an inner and outer shell having the form of frustums of cones, the taper being very slight.

The valve-seat F is conveniently provided with a screw-threaded top, f , by means of which it is screwed into a corresponding threaded opening in the partition α . Its top f' is completely closed, and its side walls are provided with one or more annular slots, f^2 , which extend entirely through the walls proper, the portions of the walls above and below each annular slot being held together by longitudinal ribs f^3 , which extend along the interior faces of the walls. In practice the valve-seat is conveniently cast with the ribs on its interior and its side walls imperforate, and the annular slots f^2 are then cut out the thickness of the walls proper, leaving a free opening to the interior of the seat, excepting where the ribs cross the slots.

The valve G is constructed to fit snugly on the seat F, and is provided with one or more annular slots, g , which correspond in width with the slots f^3 in the valve-seat, but are so disposed that when the valve G is closed down over the seat into contact therewith the solid wall of the valve will be opposite the slot or slots in the valve-seat, and the slot or slots in the valve will be opposite the solid wall of the valve-seat, as shown in Fig. 2. The portions of the valve above and below each slot are held together by longitudinal ribs g' along the outside of the valve. In practice the valve is conveniently cast with its ribs on its exterior face and the annular slots g cut out from the inside, the thickness of the wall of the valve thereby leaving a free opening through the valve excepting where the ribs cross the slots.

The exterior face of the valve-seat F and

the interior face of the valve are fitted with the greatest nicety, so that a gas-tight closure is effected when the valve is in closed adjustment; but, because of the slight taper, the moment the valve is lifted ever so little there will no longer be any frictional contact between the valve and its seat. The taper is not sufficient, however, to admit of a lift upon the valve by the pressure of the gas from within the valve-seat, which under the highest pressure that can occur would not unseat it, and any tendency which an abnormally high pressure might have to expand the valve would at the same time tend to expand the seat and still keep the closure complete. Thus the valve possesses the advantages of the piston-valve, in its sliding movement gradually opening the passage for the gas, and yet is free from the frictional resistance the moment it is unseated. As the valve is lifted, the several annular slots in the seat will be brought gradually opposite the annular slots in the valve, so that a lift sufficient to open one of the slots will at the same time open all, thus effecting a full opening of the valve by a movement which is comparatively slight.

The slots may be so located that they will all begin to be opened at the same moment; but I find it advantageous to so arrange them that one of them—the upper one, for example, as shown in the enlarged view, Fig. 2—will begin to be opened slightly in advance of the lower, as this admits of a more delicate control of the admission of gas to the burner, where a very small quantity is required.

The valve G is provided with openings g^2 in its top, so that there may be no cushioning of air or gas when it is required to drop suddenly, and also that there may be a free escape for any gas which presses up between the valve and its seat.

The plate H, which is preferably about seven-eighths the diameter of the diaphragm d , is secured to the diaphragm by suitable fastenings, h , and a connecting-rod, h' , secured at its upper end to the plate, projects down through an opening, d' , in the bottom of the diaphragm-chamber, and is coupled at h^3 to a connecting-rod, h^3 , which extends on down through a suitable stuffing-box, I, at the top of the valve-chamber, and is connected at its lower end to the top of the valve.

The rod h' has a free sliding movement through the opening d' ; but the space around it is such that when the diaphragm d suddenly falls the air beneath it will be retained long enough to act as a cushion and prevent the valve from forcibly striking its seat.

The diaphragm-chamber is supported upon the valve-chamber by a suitable standard, K. In the present instance the standard is in the form of a skeleton pipe-section.

The lever L is provided with the sliding weight l , and serves to hold the valve open against the pressure of the gas on the low-pressure side of the valve as follows:

An elongated link, M, is pivoted at its

lower end to a lug, k , on the standard K, and the lever L is fulcrumed on the upper end of the said link. When the parts are in position to hold the valve half open, as shown in Fig. 1, the lever L is intended to be about horizontal, and its rounded end l' resting in engagement with the flat upper wall of the slot h^4 in the rod h' , and the link M pitched slightly past center toward the axis of the connecting-rod $h' l^3$, with the upper rounded ends, m , of the link bearing against the outer faces of the standard K at the sides of the slot h' , through which the lever L extends. The lever L is further provided with a depending arm, N, fixed thereto or formed integral therewith, which curves toward the standard K and extends freely through the link M, and when the parts are in the positions above described rests with its free end a slight distance away from the wall of the standard, as shown.

So long as the pressure of gas is normal the lever will retain its engagement with the connecting-rod h' , and the valve will rise and fall to suit the slight variations in pressure; but the moment the pressure fails, either from a break in the diaphragm or from cutting off the supply, or from any other cause whatsoever, the pressure above the diaphragm will no longer counterbalance the weighted lever L, and the diaphragm will be free to rise. Just as soon as the end of the lever L has risen enough to give the valve a full opening the free end of the arm N will come in contact with the wall of the standard, and as the end l' of the lever continues to rise the arm N will crowd the lever bodily away from the axis of the connecting-rods $h' l^3$, and will thereby throw the link M past center away from said axis. The moment the link passes center in this direction the weight on the lever and the weight of the lever itself will tend to throw the lever bodily outward, and will release the rounded end l' of the lever from the rod h' , and the valve will immediately fall into closed adjustment over the valve-seat, and will so remain until it is again intentionally opened, when the lever may be again engaged with the rod h' and the valve placed in working order.

The construction, as above set forth, is simple. It effectually provides against danger from the breaking of a diaphragm and from the many other possible things which might happen to stop the pressure or seriously reduce it, and at the same time affords a very small amount of wearing-surface and furnishes a very accurate means for regulating the supply.

In a pending application entitled "cut-off devices for gas," filed May 7, 1888, No. 273,075, I have shown and claimed, in conjunction with other parts, a valve of the same general shape as that herein described, but differing therefrom in that it has no openings in its side walls corresponding to openings in the seat.

It is evident that slight changes might be resorted to in the form and arrangement of

the several parts described without departing from the spirit and scope of my invention; hence I do not wish to limit myself strictly to the construction herein set forth; but,

5 Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a pressure-regulator, the combination, with a diaphragm adapted to receive pressure
10 from the pressure-regulator chamber, of a hollow valve-seat slightly tapered from its base to its top, and provided with an opening through its side wall, the valve adapted to fit the exterior wall of the valve-seat, and the
15 valve-operating rod connecting the valve with the diaphragm, whereby the valve is relieved of frictional resistance when raised, but is not subject to any considerable lift from the high-pressure side when seated, sub-
20 stantially as set forth.

2. In a pressure-regulator, the combination, with a diaphragm adapted to receive pressure from the pressure-regulator chamber, of a slightly-tapered valve-seat provided with an
25 opening through its side wall, the valve adapted to fit the exterior wall of the valve-seat, and provided with an opening in its side wall to register with the opening in the valve-seat when the valve is open, and the
30 valve-operating rod connecting the valve with the diaphragm, whereby the valve is relieved of frictional resistance when raised, but is not subject to any considerable lift from the high-pressure side when seated, substantially
35 as set forth.

3. In a pressure-regulator, the combination, with a diaphragm adapted to receive pressure from the pressure-regulator chamber, of a slightly-tapered valve-seat provided with a
40 series of annular openings through its wall, the valve adapted to fit the exterior wall of the valve-seat and provided with a series of annular openings adapted to register with the openings in the valve-seat when the valve
45 is open, and the valve-operating rod connecting the valve with the diaphragm, whereby

the valve is relieved of frictional resistance when raised, but is not subject to any considerable lift from the high-pressure side when seated, substantially as set forth. 50

4. The combination, with a valve under pressure from the gas tending to close the valve, of a lever having a detachable connection with the valve and adapted to hold the valve open against the gas-pressure, a mov-
55 able support for the lever, and means for moving the said support when the gas-pressure is removed, substantially as set forth.

5. The combination, with a diaphragm subject to gas-pressure from a gas-distributing
60 pipe, a valve in connection with said diaphragm, and a lever having a detachable connection with the connected valve and diaphragm, of a movable support for the lever and means for automatically moving the said
65 support when the gas-pressure is removed, substantially as set forth.

6. The combination, with the valve, the diaphragm connected therewith, and the lever having a detachable connection with the con-
70 nected valve and diaphragm, of a vibrating support for the lever and means for vibrating the said support as the lever is tilted, substantially as set forth.

7. The combination, with the valve, the
75 diaphragm connected therewith, and the lever having a detachable connection with the connected valve and diaphragm, of a swing-link forming a support for the lever, and an arm on the lever, whereby the swing-link support
80 is automatically swung past center as the lever is abnormally tilted, and the lever thereby detached from the connected valve and diaphragm, substantially as set forth.

In testimony whereof I have signed this
85 specification in the presence of two subscribing witnesses.

LOUIS B. FULTON.

Witnesses:

E. C. SEWARD,
C. S. DRURY.