# C. A. FENN & R. GROENINGER.

## GAS-REGULATOR.

No. 185,736. Patented Dec. 26, 1876.

FIG. 1.

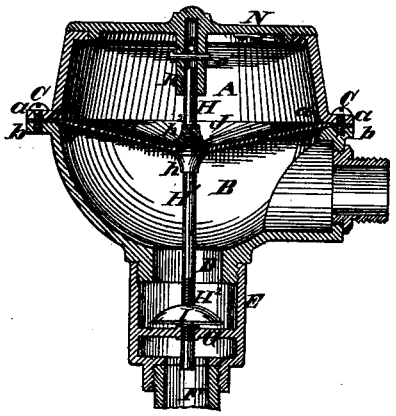


FIG. 4.

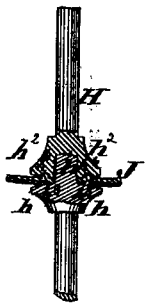


FIG. 5.

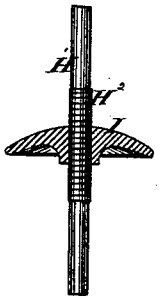


FIG. 2.

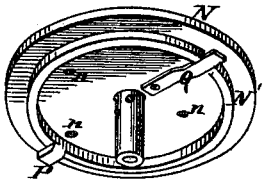
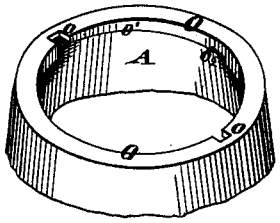


FIG. 3



ATTEST.

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# UNITED STATES PATENT OFFICE.

CHARLES A. FENN AND RUDOLPH GROENINGER, OF ST. LOUIS, MISSOURI.

## IMPROVEMENT IN GAS-REGULATORS.

Specification forming part of Letters Patent No. **185,736**, dated December 26, 1876; application filed October 4, 1876.

*To all whom it may concern:*

Be it known that we, CHARLES A. FENN and RUDOLPH GROENINGER, both of the city and county of St. Louis, and State of Missouri, have invented certain new and useful Improvements in Gas-Regulators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification.

Our invention relates to that class of gas-regulators in which the gas is received into a chamber beneath a flexible diaphragm, to whose center is attached the stem of a valve by which the flow of gas is regulated, the pressure of the gas beneath the diaphragm tending to close the valve, and thus the valve-port, through which the gas enters this chamber, is made smaller on an increase of pressure in the body of the gas, so that the pressure of the gas in the chamber between the valve and the diaphragm is kept nearly equal when the gas is passing through the burners, because the valve-port is kept open to the proper degree to allow the necessary amount of gas to pass through to supply the burners with gas at the desired pressure, whatever changes may take place in the pressure of the gas in the main pipes.

The pressure upon the burners is adjusted, as may be desired, by loading the valve-stem with the required weight, (an increase of weight causing an increase of said pressure.)

It is necessary to perfect working that the diaphragm should possess great flexibility, so that it will rise and fall with freedom on any increase or decrease of pressure beneath it, and owing to its flexibility the diaphragm cannot be depended upon to form any part of the valve-stem guide; and as, to insure good results, it is necessary that the valve should always be parallel with the valve-seat, we have provided guides at both top and bottom of the stem, the latter of which acts as a stop to the valve in its downward movement, and prevents the stretching of the diaphragm by the weight of the stem, in the absence of pressure beneath the diaphragm. This guide-stop also prevents the valve from descending to the bottom of the valve-chamber, and closing or partly closing the induction-opening.

The upper valve-stem guide is made in the removable cover, and has an arrangement for holding the valve down and inoperative, so that the value of the regulator may be demonstrated, by burning the gas for a time with the regulator inactive, and for a similar or proportionate time with the regulator in operation. This arrangement consists of a pin which is passed transversely into the guide-socket over the top of the valve-stem, and holds it down in such a position as to form no obstruction of consequence to the passage of gas. The combination of these valve-stem guides with the valve-stem and diaphragm constitutes one part of our invention. Such guides are necessary to insure the proper action of the parts when the regulator may be in a position somewhat inclined from the vertical.

Another part of our invention consists in the device for locking the cover. In this, around the inside of the top of the case, is a rib or inturned flange, notched at each side, to allow the downward passage of a locking-lug and spring-catch, respectively. These extend outwardly beneath the rib or flange when the lid is turned to its locking position, and as the lid is being turned into this position the spring-catch is sprung downward by the inclined lower side of the flange, and springs upward into a notch at the bottom of the rib, to prevent the lid from being turned either backward or forward until the catch is sprung down, which is done by a push-pin passed down through a hole in the lid. This hole is one of a number of holes which are in the lid to allow free communication between the chamber above the diaphragm and the outer air.

In the drawings, Figure 1 is an axial section of the regulator. Fig. 2 is an under perspective view of the lid. Fig. 3 is a perspective view of the top of the case. Fig. 4 is a side view of part of the valve-stem, showing the coupling in section. Fig. 5 is a side view of part of the valve-stem, showing the valve in section.

The apparatus has a case consisting of an upper part, A, and a lower part, B, attached together by flanges *a b*, with screws C. The lower part, B, has at bottom a screw-threaded neck, D, in which screws the valve-chamber

tube E, that forms the coupling between the gas-supply pipe F and the case A B. G is a bar extending diametrically across the valve-chamber, through which (bar) passes the lower end of the valve-stem H, the bar forming the lower guide of the stem, and also a stop to limit the descent of the valve I, so that no undue strain shall come on the flexible diaphragm J. It is necessary that the diaphragm should have great flexibility to insure the proper freedom of action, and it is important that it should not be subjected to any undue strain, which would stretch it and impair its action. The valve itself, or the upper guide, may limit the upper movement of the valve. The diaphragm consists of a disk of leather specially prepared for this purpose.

The outer edge of the diaphragm is clamped between the flanges *a b*, which are tightly held together by screws C, so as to form an air-tight joint. The inner corners *a' b'* of the parts A and B are rounded, so as to prevent the bending of the diaphragm in a sharp angle, (at this point,) which would cause it to crack, and in time to leak gas through into the upper chamber.

The diaphragm is coupled to the valve-stem by the following means: The valve-stem is divided into two parts, one, H, extending upward from the diaphragm J, and the other extending downward therefrom. At the upper end of the lower portion H' is a collar, *h*, having a rib, $h^3$, and above this collar is a screw, $h^1$, made in one piece with H'. This screw screws into the lower end of the portion H. At the lower end of H is a collar, $h^2$, having an annular groove, $h^4$, between which and that *h* the central part of the diaphragm J is held, the screw $h^1$ passing through the center of the diaphragm. This construction makes a tight joint, as any gas escaping would have first to pass through between the collar *h* and the diaphragm, and then between the collar $h^2$ and the diaphragm, and this it could not do; whereas with the joint as heretofore made when the diaphragm is held with one or two nuts on the stem, the gas is liable to leak through at the screw-thread. The edges of the collars or flanges *h* $h^2$ are rounded where they clamp the diaphragm, so as to prevent the cracking of the leather by causing it to bend with a sharp angle.

The lower portion $H^1$ of the valve-stem is screw-threaded at $H^2$, and on this part screws the valve I, so as to be easily adjusted in height upon the stem, as may be found necessary, the adjustment being made by access to the valve from beneath without taking the machine to pieces, further than unscrewing the valve-chamber tube. The part B of the case increases in diameter upward, so that as the gas enters through the valve-port it may act equally on all parts of the diaphragm.

The sides of the part A are made nearly upright, so as to give a wide opening and free access to all parts of the upper side of the diaphragm when the lid or cover N is removed. This free access to the diaphragm is of the utmost importance, as it is necessary that the diaphragm should be examined at intervals and cleaned from dust, &c., and lubricated, so as to keep it in a thoroughly flexible condition, to insure regularity of action at all times. In machines of this kind, in which the upper opening of the case is contracted in size, or the top of the diaphragm partly covered by a plate, the required freedom of access to the diaphragm cannot be had. The upper edge of part A of the case has an inturned flange, O, which is notched through at opposite sides at *o o* for the downward passage of the catches by which the lid is held down. The lid has a downwardly-extending circular rib, $N^1$, which fits inside the flange O of the case, and the edge of the lid lies on top of the case. P is a lug, extending outwardly from the rib $N^1$, and engaging beneath the flange O when the lid is turned, so as to lock it in position. Q is a straight spring extending radially beneath the lid, and engaging, like lug P, beneath the flange O when the lid is turned into the locking position, the lug P and spring Q holding the lid down by engagement beneath the flange O.

In putting the lid in place it is placed vertically on the case with the valve-stem in its upper guide (socket), and with the lug P and spring Q in such position as to descend through their notches *o o*. The lid is then turned so that the spring Q will be sprung down by passing beneath the incline $o^1$, and will catch in the notch $o^2$, and the lid can then be neither raised upward nor turned in either direction without pushing down the spring, which requires some force, and which can only be done by one acquainted with the construction of the fastening and manner of releasing it.

In the cover are a number of holes, *n*, allowing free access of the outer air to the chamber above the diaphragm, and by introducing a push-pin into the proper one of these holes the spring can be pushed down to disengage it from the notch $o^2$, and then the lid can be turned around into such a position that the spring Q and lug P can pass up through the notch *o o*, and the lid be lifted from the case.

At the center of the lid is the socket R, open at the bottom to allow the entrance of the top of the valve-stem, to which it forms the upper guides, and closed at top, so that the valve-stem cannot be manipulated when the regulator is intact and the lid locked upon it. The socket R has a diametric hole, *r*, to receive a pin, $r^1$, which may be put in above the top of the valve-stem to hold the stem down, and the valve down from its seat I, when it is desired that the regulator shall be inactive.

This is used chiefly for the purpose of proving the valve of the regulator, by testing as

to the quantity of gas used when the regulator is inactive, relatively to the amount used when it is in active operation.

The gas enters the chamber beneath the diaphragm through the pipe F and valve-port and escapes through the orifice S to the gas-burners.

We claim as our invention—

1. The combination, with the two-part case A B and flexible diaphragm J, of the two-part valve-rod H $H^1$, rigid guides R G, and valve I, the guide G with the valve I and its rod $H^1$, adapted to form a support to the diaphragm, as and for the purpose set forth.

2. In combination with the valve I, valve-stems H $H^1$, and guides G R, the holding-pin *r*, substantially as and for the purpose set forth.

3. The cover or lid N, having fixed lug P, spring-catch Q, and holes *n* with the inturned rim or flange O with notches *o o* and locking-notch $o^2$ for said spring-catch, substantially as and for the purpose set forth.

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Witnesses:
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C. H. BROWN.