(No Model.)

W. HASKELL.

GAS REGULATOR.

No. 424,199. Patented Mar. 25, 1890.

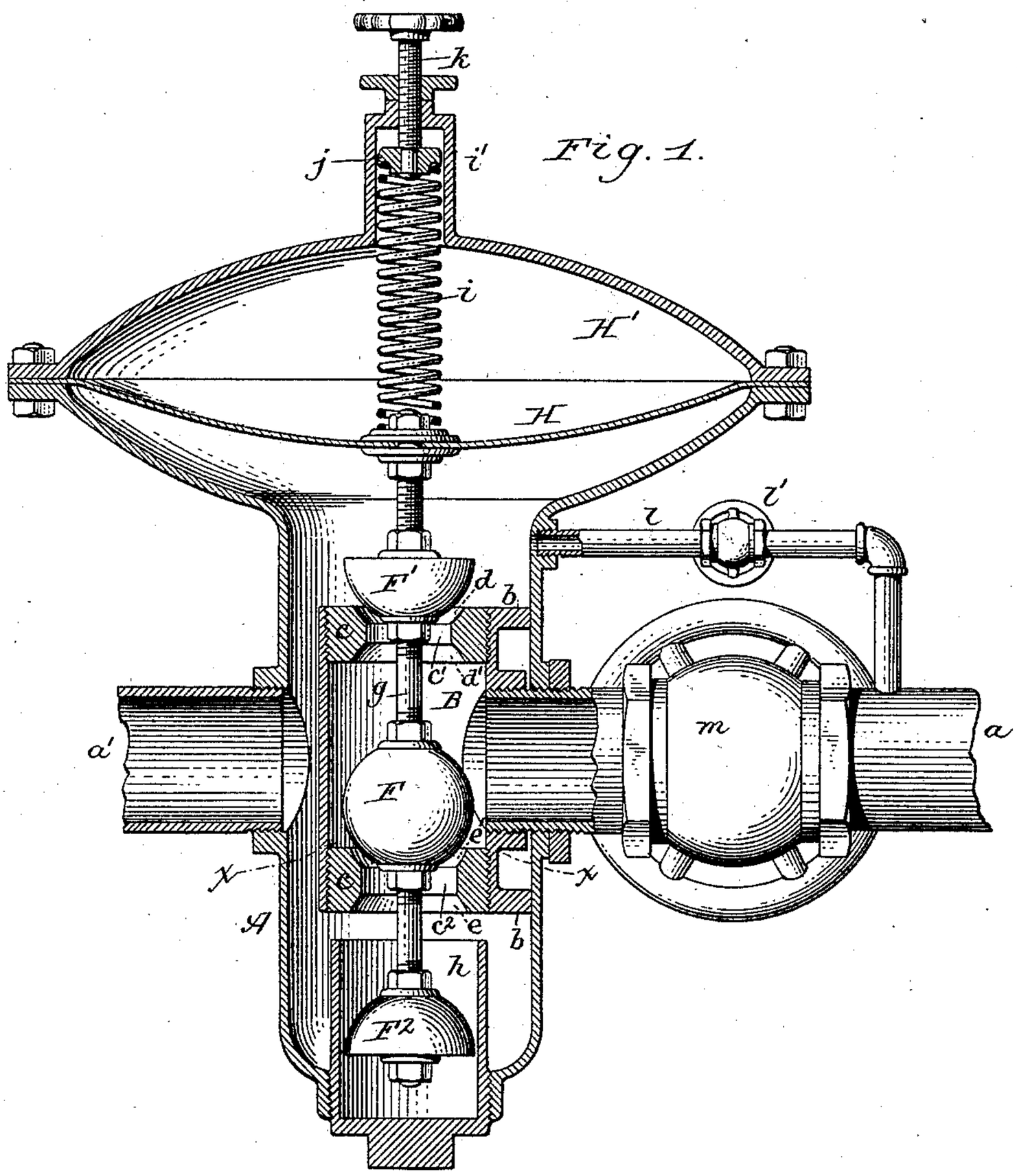
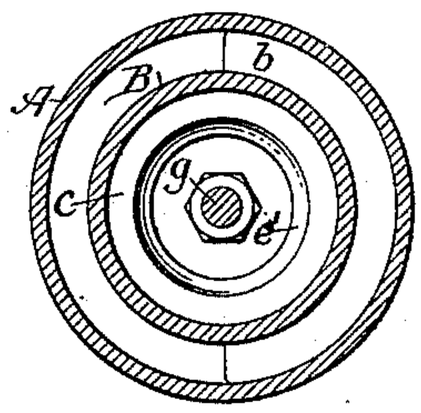


Fig. 1.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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GAS-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 424,199, dated March 25, 1890.

Application filed May 6, 1889. Serial No. 309,677. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HASKELL, a citizen of the United States, residing at Smethport, in the county of McKean and State of Pennsylvania, have invented new and useful Improvements in Gas-Regulators, of which the following is a specification.

This invention relates to a regulator which is especially desirable for use in connection with natural gas, and belongs to devices of that class in which the regulating-valves are carried by a flexible diaphragm, or a float against which the gas acts, and which is caused to rise and fall by the varying pressure of the gas opening or closing the valve to a greater or less extent and rendering the supply practically uniform. The pressure in natural-gas mains varies considerably, and sometimes falls so low that burners are extinguished from an insufficient supply of gas, allowing the gas to escape, and frequently resulting in explosions.

The object of my invention is to construct a simple regulator which will effectually and automatically shut off the supply of gas when the pressure in the main falls to the point at which the burners are liable to be extinguished.

The invention consists of the improvements which will be hereinafter fully described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical sectional elevation of my improved regulator. Fig. 2 is a cross-section on line *x x*, Fig. 1.

Like letters of reference refer to like parts in both figures.

A represents the cylindrical shell or casing of the regulator, *a* the inlet-pipe arranged on one side of the casing, and *a'* the outlet-pipe at the opposite side thereof.

B is a cylindrical valve-chamber arranged within the casing A and made of smaller diameter than the bore of the casing, so as to leave an annular gas-passage between the latter and the valve-chamber. The screw-threaded end of the inlet-pipe *a* passes through an opening in the side of the casing A and enters a threaded opening in the adjacent side of the valve-chamber, the latter being supported within the casing A by being attached to said inlet-pipe. The valve-chamber is provided at its upper and lower ends with curved lugs *b*, extending partly around the chamber and bearing against the adjacent inner wall of the shell A, whereby the valve-chamber is prevented from turning on the inlet-pipe *a*. The valve-chamber B is closed at both ends by screw-plugs *c*, engaging with internal threads formed in the ends of the valve-chamber and having openings or passages c' c^2, through which the gas passes from the valve-chamber into the surrounding casing A.

d d' represent tapering or concave valve-seats arranged at opposite ends of the upper opening or passage c', and *e* e' are similar seats arranged at opposite ends of the lower passage c^2.

F represents a spherical valve arranged within the valve-chamber B and adapted to fit against either of the inner valve-seats d' e', so as to regulate or entirely shut off the supply of gas through the passages c' c^2.

F' is a hemispherical or convex valve arranged above the outer valve-seat *d* of the upper passage c', and designed to close against the same, and F^2 is a similar valve arranged below the outer valve-seat *e* of the lower passage c^2 and adapted to regulate the passage of the gas through the latter. The three valves F F' F^2 are attached to a vertical stem *g*, passing through the valve-chamber B and suspended from a flexible diaphragm H. This diaphragm is arranged in a lenticular chamber or casing H', located at the upper end of the main casing A and communicating with the interior of the latter, so that the gas in the casing will enter the lower portion of the diaphragm-chamber underneath the diaphragm and act upon the latter. The lower valve F^2 moves in a vertical tube or socket *h*, arranged in the lower portion of the shell A, and thereby serves to guide the valve-stem in its movements.

i represents a spiral spring arranged in the upper portion of the diaphragm-chamber H', and pressing with its lower end against the upper side of the diaphragm, so as to increase the resistance thereof. The upper portion of

the pressure-spring *i* fits in an upright socket *i'* at the upper end of the diaphragm-chamber. In this socket is arranged a follower *j*, which bears against the upper end of the spring and is attached to the lower end of an adjusting-screw *k*, projecting through the upper end of the socket *i'*, whereby the follower may be raised or depressed and the tension of the spring *i* regulated to render the resistance of the diaphragm about equal to the normal pressure of the gas. When the pressure is normal, the diaphragm H is unaffected and the valves F F' are partly open, the upper valve F' regulating the passage of the gas through the upper passage *c'* and the lower surface of the spherical valve F controlling the lower passage c^2, while the lower valve has no valve function and acts merely as a guide for the valve-stem. In this position of the valves, which is represented in Fig. 1, the gas entering the valve-chamber B passes through the openings or passages *c' c²* into the surrounding casing A and the lower portion of the diaphragm-chamber H', underneath the diaphragm, and thence through the exit *a'*. When the pressure rises above the normal, the diaphragm is raised by the increasing pressure elevating the valve-stem *g* and causing the lower valve F^2 to approach the outer valve-seat *e* of the lower passage c^2 and the upper surface of the spherical valve F to approach the inner valve-seat *d'* of the upper passage, thereby closing the exit-passages *c' c²* of the valve-chamber to a greater extent and maintaining a practically uniform supply. As the pressure again approaches the normal, the valves recede from the valve-seats and permit the passage of a normal supply of gas. When the pressure rises to such an extent that the central valve approaches the inner valve-seat of the upper passage *c'*, the upper valve becomes inoperative for the time being. In the event of the pressure falling so low and the supply becoming so meager as to render the burner liable to be extinguished, the valves by their weight, and assisted by the spring *i*, will descend, and the upper valve F' will close against the outer seat *d* of the upper passage *c'* and the central valve F against the upper seat *e'* of the lower passage c^2, thereby shutting off the gas-supply and preventing the further passage of the gas through the regulator. To prevent the valves from being again opened automatically and the gas escaping into the dwelling or building in case of a subsequent rise in the pressure, the lower opening or passage c^2 of the valve-chamber is made larger than the upper passage *c'*, so that a larger portion of the area of the intermediate valve F will be presented to the gas-pressure in the valve-chamber than of the upper valve. By thus giving the intermediate valve a larger pressure-area than the upper valve, a greater pressure is exerted against the former than the latter, thereby causing the middle valve to overbalance the upper valve and firmly closing the two valves against their seats.

l represents a pipe connecting the portion of the diaphragm-chamber H' below the diaphragm with the inlet or supply pipe *a*, and whereby gas may be admitted below the diaphragm for the purpose of raising the latter and opening the valves connected therewith when it desired to again allow the gas to pass through the regulator. The pipe *l* is provided with a stop-cock or valve *l'*. Upon admitting gas below the diaphragm the latter is raised, and the valves regulate the supply, as before described, the supply through the pipe *l* being shut off as soon as the diaphragm is raised. In this manner the gas is positively and entirely shut off when the pressure is excessively low, and the valves cannot be opened except by admitting gas through the pipe *l*.

The main supply-pipe *a* is provided with a stop-cock *m*, which is located between the regulator and the point at which the supplemental pipe *l* enters the main pipe.

I claim as my invention—

1. In a gas-regulator, the combination, with the shell or casing having an inlet and an outlet, of a valve-chamber arranged within the casing and provided at opposite ends with gas-escape openings or passages, valves controlling the outer ends of said passages, and an intermediate valve connected with said outer valves and controlling the inner ends of said passages, one of said outer valves having a smaller pressure-area than the intermediate valve, whereby the gas-pressure causes the intermediate valve to overbalance said outer valve, and a regulating device connected with said valves, substantially as set forth.

2. In a gas-regulator, the combination, with the shell or casing having an inlet and an outlet, of a valve-chamber arranged within the casing and provided at opposite ends with gas-escape openings or passages of unequal area, a valve arranged in said valve-chamber and controlling the inner ends of said passages, valves connected with said first-mentioned valve and controlling the outer ends of said passages, and a regulating device connected with said valves, substantially as set forth.

3. In a gas-regulator, the combination, with the shell or casing having an inlet and an outlet, of a valve-chamber arranged within the casing and provided at opposite ends with gas-escape openings or passages, valves controlling the outer ends of said passages, and an intermediate valve connected with said outer valves and controlling the inner ends of said passages, one of said outer valves having a smaller pressure-area than the intermediate valve, whereby the gas-pressure causes the intermediate valve to overbalance said outer valve, a diaphragm-chamber communicating with said regulator-casing, a dia-

phragm arranged in said casing and connected with said valves, and a supplementary gas-supply pipe connected with the diaphragm-chamber and with said inlet, substantially as set forth.

4. The combination, with the shell or casing A, having an inlet-pipe *a*, of the valve-chamber B, attached to the inlet-pipe and provided with lugs *b*, bearing against the interior of the shell, substantially as set forth.

Witness my hand this 11th day of March, 1889.

WILLIAM HASKELL.

Witnesses:
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