(No Model.)

T. C. HOPPER.

AUTOMATIC PRESSURE REGULATOR.

No. 328,681. Patented Oct. 20, 1885.

FIG. 3.

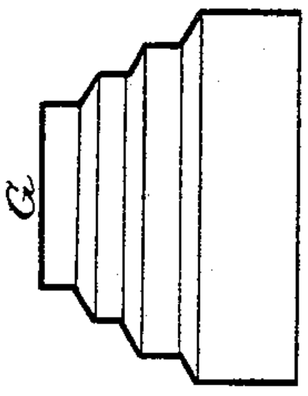

FIG. 4.

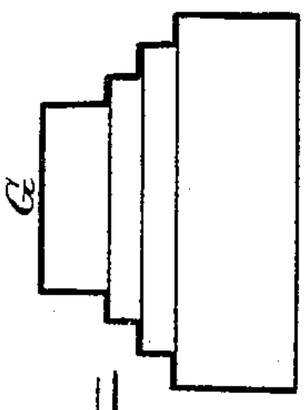

FIG. 5.

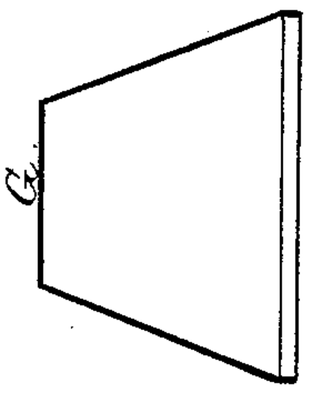

FIG. 2.

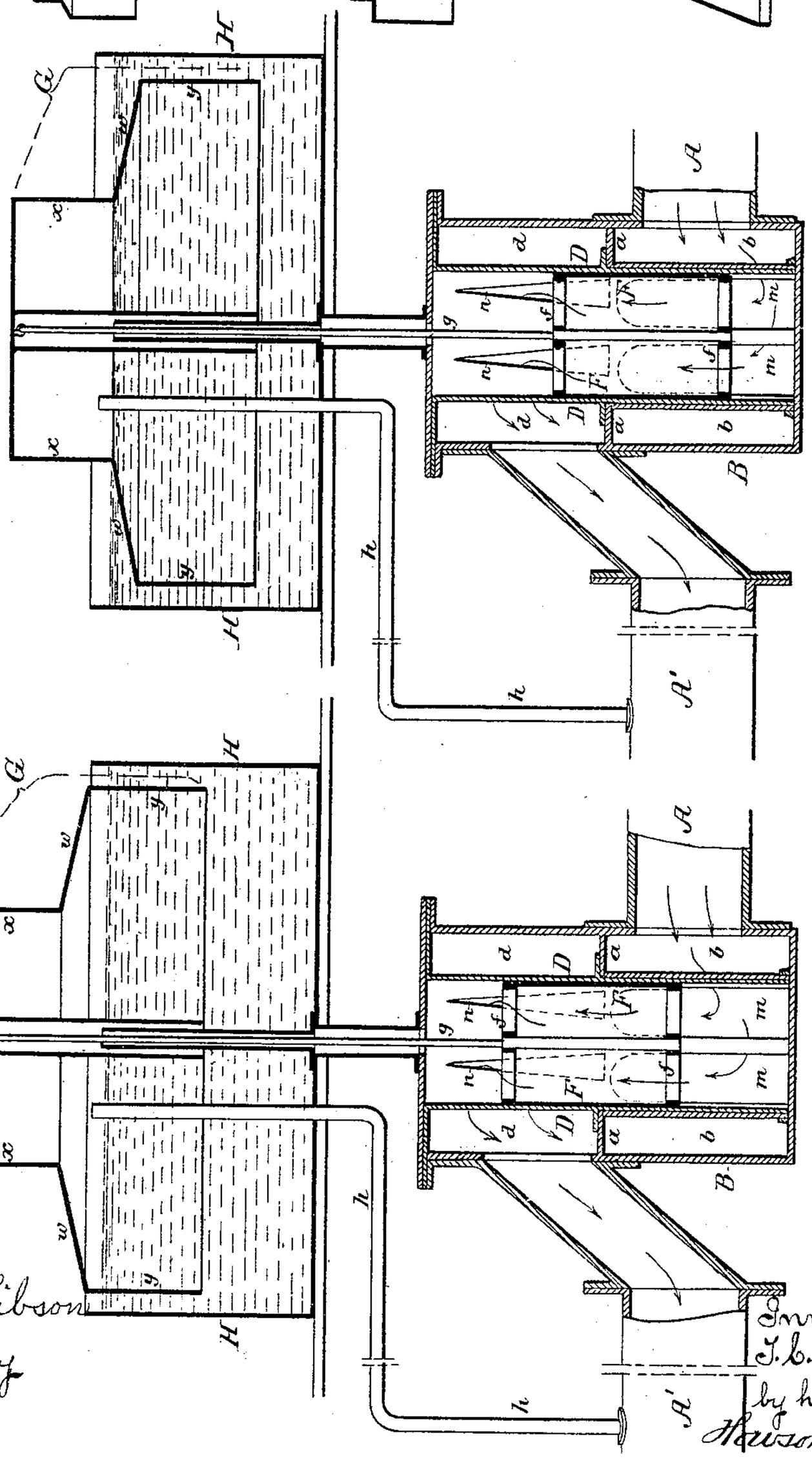

FIG. 1.

Witnesses:
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UNITED STATES PATENT OFFICE.

THOMAS C. HOPPER, OF PHILADELPHIA, PENNSYLVANIA.

AUTOMATIC PRESSURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 328,681, dated October 20, 1885.

Application filed July 23, 1885. Serial No. 172,367. (No model.)

To all whom it may concern:

Be it known that I, THOMAS C. HOPPER, a citizen of the United States, residing at Philadelphia, Pennsylvania, have invented certain Improvements in Automatic Pressure-Regulators, of which the following is a specification.

The object of my invention is to regulate the pressure of gas in mains or other conduits without the use of the variable or shifting weights now employed for the purpose, and this object I attain in the manner which I will now proceed to describe, reference being had to the accompanying drawings, in which—

Figures 1 and 2 are sectional views of apparatus embodying my invention, and Figs. 3, 4, and 5 views illustrating modifications of part of the apparatus.

In Fig. 1, A represents part of a pipe communicating with a gas-holder or other reservoir of gas under pressure, and A′ part of a distributing pipe or main, both of these pipes communicating with the valve-box B, in which is a valve-casing, D, the valve-box being divided by a partition, *a*, into two chambers, *b d*, the chamber *b* surrounding the lower portion of the valve-casing and communicating with the inlet-pipe A, and the chamber *d* surrounding the upper portion of said casing and communicating with the distributing-pipe A′.

Fitting snugly in the casing D is a cylindrical valve, F, to transverse bridges *f* in which is connected the valve-rod *g*, secured at the upper end to a bell-float, G, the lower edge of which is submerged in the water or other liquid in a tank, H, and with the interior of this bell above the level of the water in the tank communicates a pipe, *h*, which is in communication with the distributing-pipe A′, preferably at some distance from the valve-box.

In the lower portion of the valve-casing D are formed openings *m*, through which the gas has free access to the interior of said casing and to the interior of the hollow valve F, and in the upper portion of the valve-casing, above the partition *a*, are formed a series of tapering ports, *n*, which are closed by the valve when the latter is elevated to its full extent, but are opened as the valve descends, so that a passage of gradually-increasing area is afforded, through which the gas may pass from the inlet to the distributing pipe. This is a common form of pressure-regulating apparatus, the pressure of gas in the distributing main or pipe serving to maintain the bell G at such a height that the valve will be held so far open as to permit a flow of gas necessary to maintain the requisite pressure in said distributing-pipe, the lowering of the pressure therein permitting the bell to fall and opening the valve to such an extent that a freer flow of gas into the distributing-pipe is permitted, and the normal pressure therein restored, excess of pressure in the pipe lifting the bell and partially closing the valve, so as to restrict the flow through the valve-box.

In adapting this governing device to a distributing main it is necessary to provide for the maintenance of different pressures therein, a light pressure being carried during the day, and a heavier pressure at night; hence it has been usual to provide means for imparting additional weight to the bell at such times as it is necessary to increase the pressure of gas in the main, the extra weight being removed when a lowering of the pressure becomes necessary.

I dispense with the necessity of variably weighting the bell by so constructing the same that it will present a variable area for the pressure of gas. Thus, as shown in Fig. 1, the upper portion, *x*, of the bell is considerably less in diameter than the lower portion, *y*, there being an intervening flaring section, *w*.

The operation of this device is as follows: During the day the bell occupies the position shown in Fig. 1, and is exposed to the pressure of gas over the full area of the enlarged lower portion, *y*, the weight of the bell being thus distributed over this large area, and imparting a light pressure only per square inch to the gas in the distributing-pipe, the valve F occupying such a position as to restrict the flow of gas through the valve-box, and thus maintain this light pressure. In the evening, however, when the increased demand upon the distributing-pipe begins, there is a consequent reduction of pressure therein, and the bell falls, so as to open the valve and permit a freer flow of gas into the said pipe; but as a smaller area of the bell is now exposed to the pressure of gas than before, it will not be

raised by the increased pressure; hence the increase gained is held and becomes the normal pressure until, upon further demand, there is a reduction below this new normal pressure, whereupon there will be a further drop of the bell, a further opening of the valve, and a further increase in the pressure in the distributing-pipe. When the bell reaches the position shown in Fig. 2, the maximum pressure will have been reached, the weight of the bell, less than of the water displaced thereby, being now exerted upon an area only about one-fourth as large as that exposed when the bell was in the position shown in Fig. 1, and the pressure maintained in the pipe A′ being increased accordingly.

As the demand upon the distributing-pipe slackens the free flow into the same causes an excess of pressure therein, and the bell is raised so as to partially close the valve and reduce the flow, the movement continuing until the bell again reaches the position shown in Fig. 1, to maintain in the pipe A′ the normal day pressure.

The bell may have more than one contraction in diameter so as to effect an increase of pressure, and then hold this increase for a time prior to a further increase—for instance, in Figs. 3 and 4 I have shown a bell with three contractions—and on the other hand the bell may, if desired, be made in the form of a frustum of cone, as shown in Fig. 5, so as to effect a gradual increase of pressure as the bell falls.

Various forms of regulating-valves may be used in carrying out my invention, and I do not desire to limit myself to any particular form of valve for this purpose, that shown being preferred, however, as it is light and well-balanced, and therefore does not interfere with the sensitive action of the bell.

To avoid the use of a stuffing-box for the valve-rod, the latter passes through a central tube in the tank H, said tube extending above the level of water in the tank, and being adapted to a central tube in the bell, so as to serve as a guide therefor.

I am aware that a conical bell-float has been heretofore used in connection with the valve of a gas-regulator; but the coning of the bell in this case was intended simply to counteract the loss of pressure exerted by the bell as it descended, owing to the increase in displacement, the object being to maintain an exactly uniform pressure upon the gas in the distributing-pipe, whereas in carrying out my invention the taper of the bell must be such that there will be a gradual increase in the pressure as the bell descends, a result essentially different from that contemplated in the device referred to.

I therefore claim as my invention—

The combination of gas supply and distributing pipes, a valve controlling the flow from one to the other, a bell connected to said valve and having an internal chamber presenting differential areas, and a communication between said chamber and the distributing-pipe, the differential areas of the bell-chamber being such that as said bell changes its position the normal pressure of gas in the distributing-pipe will also change, as set forth.

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

T. C. HOPPER.

Witnesses:
JOHN E. PARKER,
HARRY SMITH.