(No Model.)

T. O. PERRY.

GAS GOVERNOR.

No. 557,696. Patented Apr. 7, 1896.

Fig. 1.

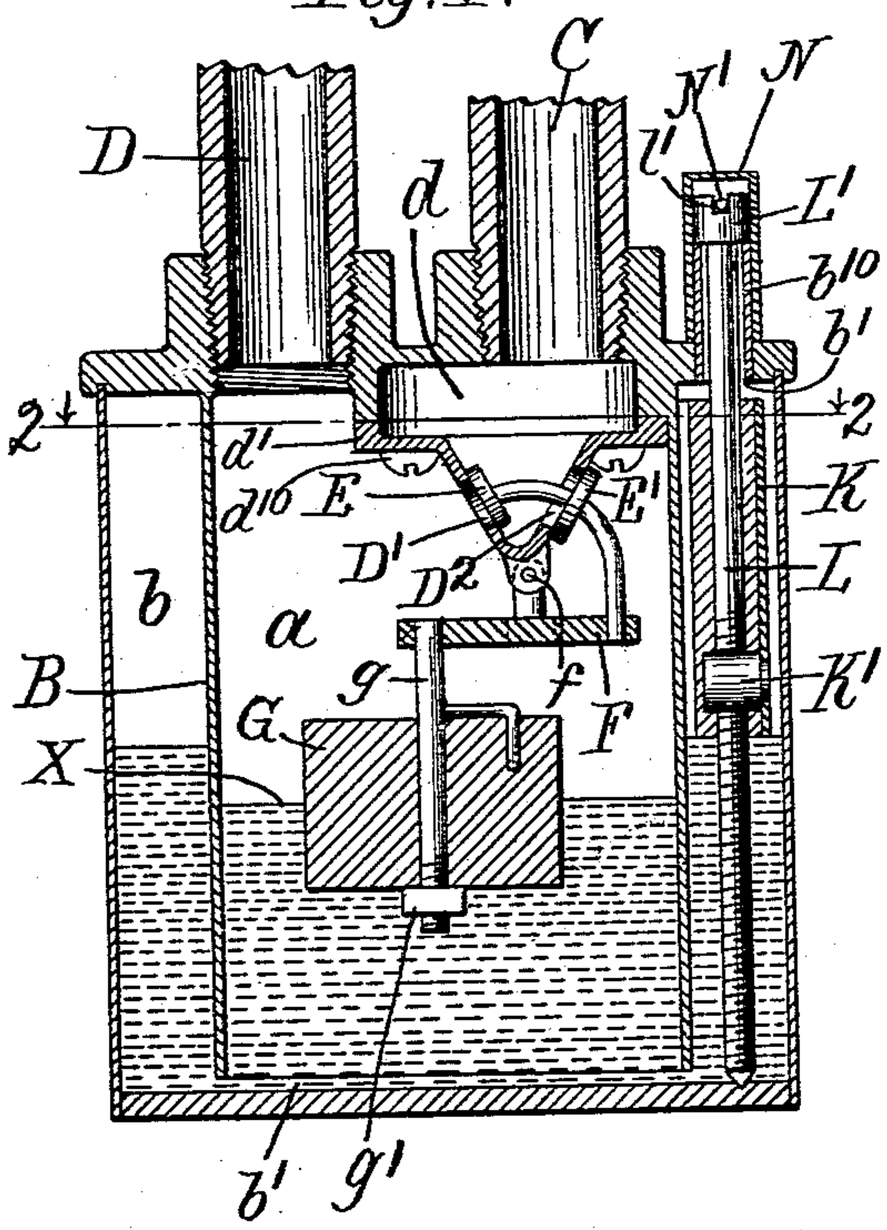


Fig. 3.

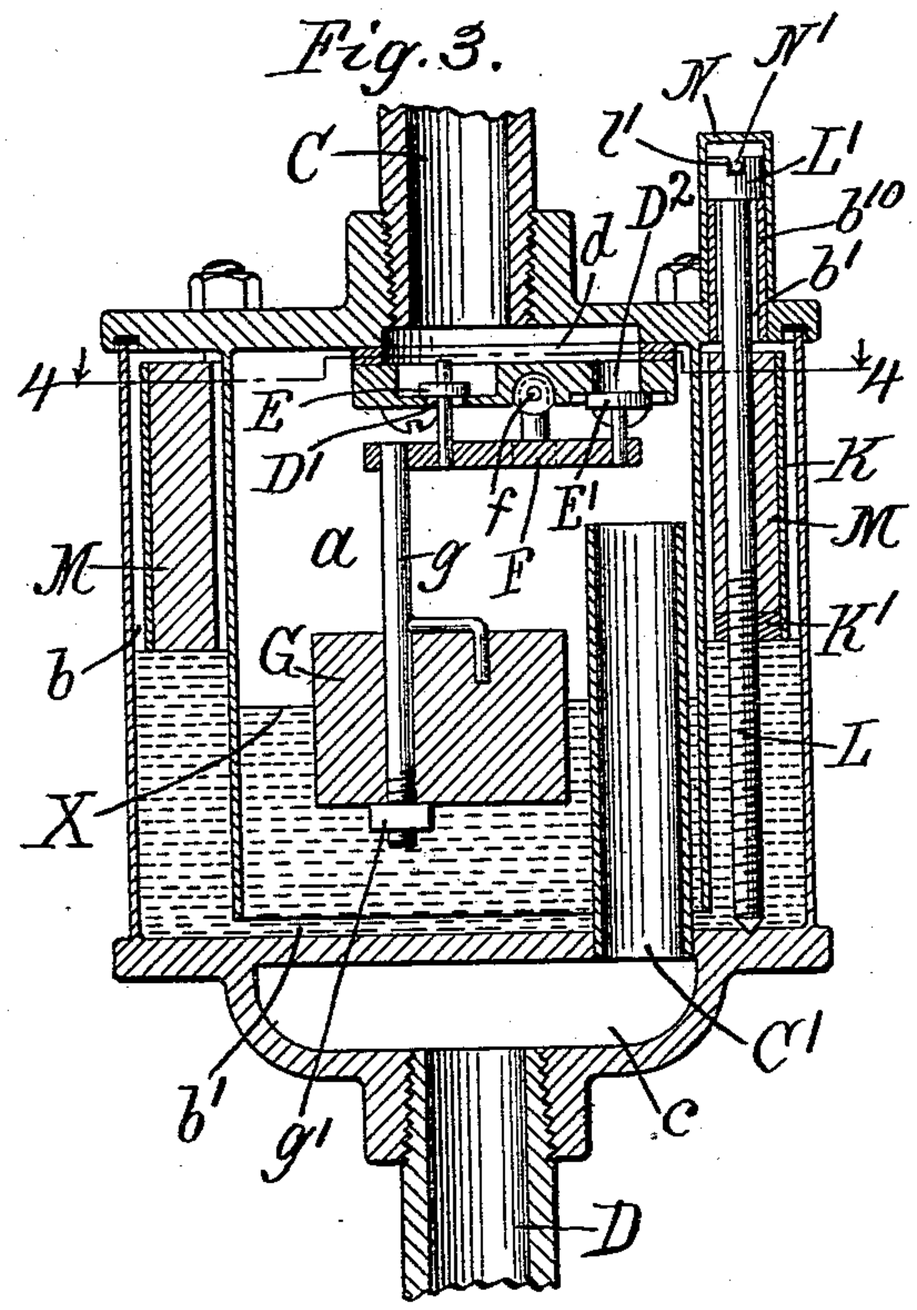


Fig. 2.

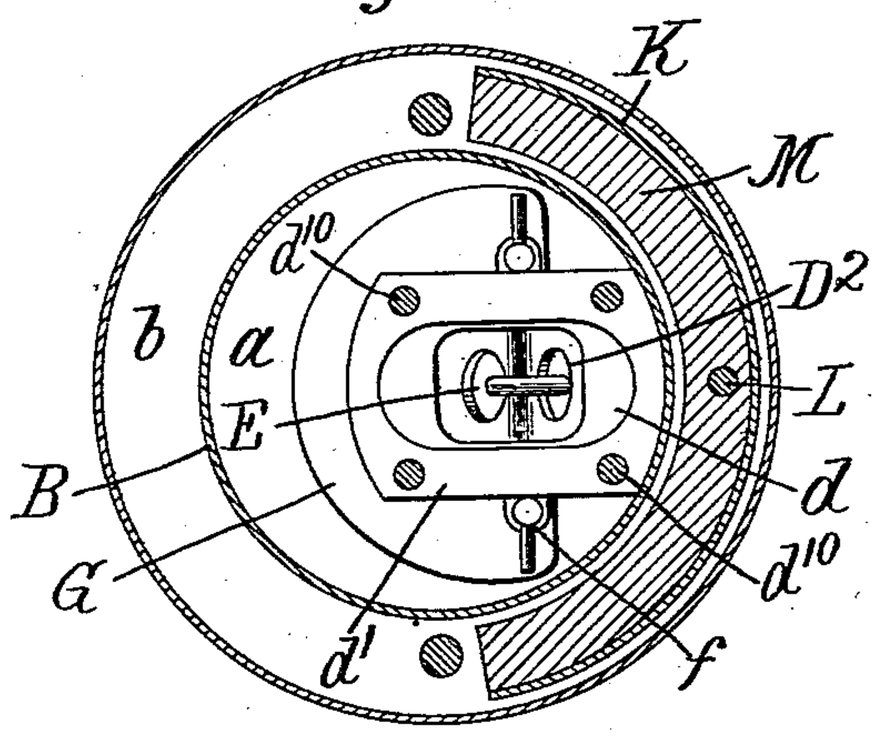
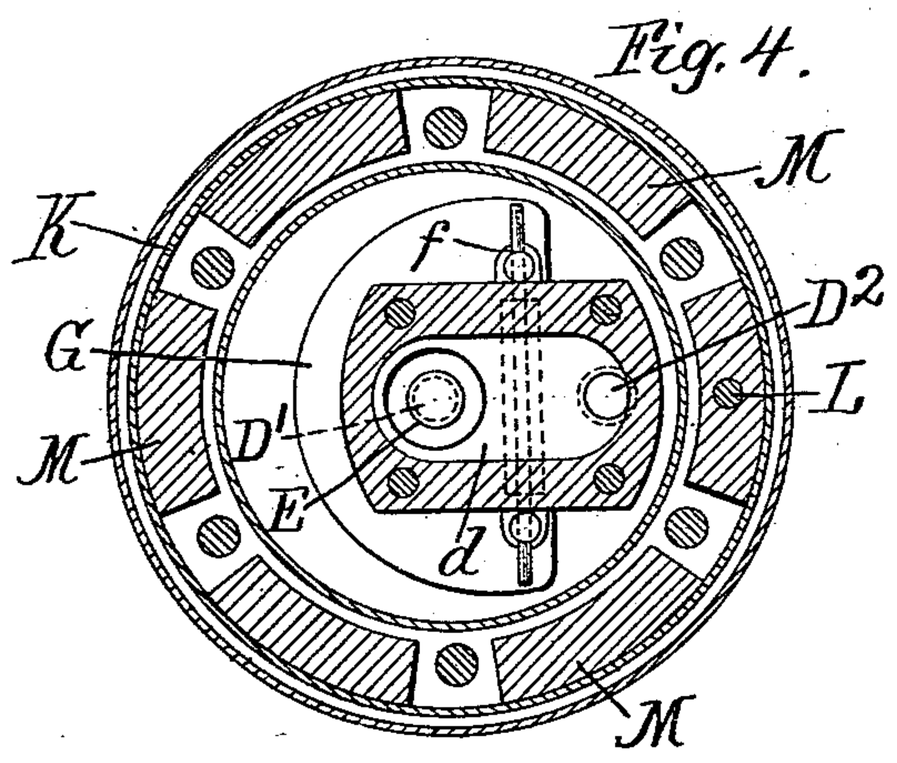


Fig. 4.



Witnesses,
E. T. Wray,
Jean Elliott.

Inventor.
Thos. O. Perry
by Burton & Burton
his Attys.

UNITED STATES PATENT OFFICE.

THOMAS O. PERRY, OF CHICAGO, ILLINOIS.

GAS-GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 557,693, dated April 7, 1896.

Application filed June 29, 1894. Serial No. 516,111. (No model.)

To all whom it may concern:

Be it known that I, THOMAS O. PERRY, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Gas-Governors, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

In the drawings, Figure 1 is a vertical section of a gas-governor adapted to be attached to a meter and embodying my invention. Fig. 2 is a section at the line 2 2 on Fig. 1. Fig. 3 is a vertical section of a governor embodying the same invention, but adapted in detail form to be attached in the vertical supply-pipe for a vertical chandelier or burner. Fig. 4 is a section at the line 4 4 on Fig. 2.

My improved governor comprises two chambers *a* and *b*, which communicate at the bottom and are adapted to contain liquid which shall seal this communication. As illustrated and as most convenient in construction, the two chambers are made concentric, one within the other, separated by an annular partition B, which depends from the top wall of the entire structure nearly to the bottom wall, leaving the interval *b'* below its lower edge as the means of communication between the two chambers, said interval being sealed by the liquid with which the chambers are intended to be partly filled, as illustrated. The inner chamber *a* has the gas inlet and outlet, both communicating with the cavity of the chamber above the liquid.

D is the gas-inlet pipe, and C the gas-outlet pipe. In the form shown in Figs. 3 and 4, in order to adapt the device to be interposed in a straight vertical run of pipe, I provide a vestibule-chamber *c* at the bottom and a short pipe C' leading from it through the liquid and opening in the upper part of the chamber *a*. This expedient is not necessary when it is convenient to have both the inlet and outlet pipes connected at the top, as in the form shown in Fig. 1. As a matter of preference and in order to supply a balanced valve to control the gas-inlet, I provide in both forms illustrated a vestibule *d* at the upper part of the chamber, from which two gas-inlet openings D' and D^2 lead into the upper part of the chamber *a*. These openings are controlled by flat-seating valves E and E', respectively, which seat upon opposite sides of the diaphragm, through which the openings are made, so that the gas-pressure from the main tends to open one and close the other, and the surfaces of the valves exposed to such pressure are designed to be made substantially equal in order to equalize these opposite tendencies and adapt the device to be operated by very slight force either to open it or close it.

In order that the exposed surfaces of the valves may be substantially equal, as stated, one of the openings may be a little smaller than the other, and the valve which closes these openings, being on the side toward the incoming gas, and the surface exposed to the pressure, including, therefore, in addition to the diameter of the opening, a margin for seating, may be made only equal to the other opening, which is therefore larger than the first by the amount of the margin allowed for seating.

Both the valves are secured rigidly to a lever-arm F, pivoted at *f* equally distant from the centers of the two seats, and in order that the valves may come into contact with the seats by direct contact toward the latter and may leave them in the same manner I make the seating-faces of the valves and the valve-seats both in planes which contain the axis of the pivot *f*.

In case of the device intended for attachment to meters, and where it is necessary, therefore, to have large openings, in order to obtain space for such openings conveniently I make the vestibule *d* in the form shown in Fig. 1, constituting an angle protruding down into the chamber *a*, having the walls of the angular protrusion, the one with its inner face and the other with its outer face, radial with respect to the pivot *f*, and the one whose inner face is so situated is that which has the smaller of the two gas-inlet openings, and the valve E which seats at this opening is of such size as to pass through the other opening, and the two valves are secured to a stem curved about the axis of the pivot, so that they approach their seats in the same direction, one ahead of the other, but seating simultaneously. This construction enables me to assemble the parts in the first instance by

inserting the smaller valve through the larger aperture in order to bring it to its own seat.

Rigid with the lever-arm F is a float G, which is thereby suspended from the pivot *f* in the liquid in the lower part of the chamber. The center of gravity of the float may be approximately in vertical line below the pivot when the valves are on their seat, but it is preferably a little out of that vertical line on the side toward which the float should swing to carry the valves away from their seats, in order that it may not by any inaccuracy in mounting the device be upon the opposite side of that line, which would prevent the device from operating, as will hereinafter appear. I therefore prefer to construct the device so that the float shall have its center of gravity and bulk very perceptibly out of the vertical line of the pivot, said line being at the side of the center of gravity toward that to which the center of gravity of the float should move to seat the valves. It need, however, be very little to one side of this line, but the distance may be varied in the construction of the device according to the degree of sensitiveness which is desirable. It should not be so far from the vertical line as to materially interfere with the principle of operation, which is that the change of level in the liquid into which the float dips, since it can produce change of level of the float only by swinging it about its pivot, shall in so doing give the float a range of lateral movement large relatively to the change of level of the liquid, whereby there is attained the desirable result that the float is very sensitive to slight changes of the liquid-level, moving perceptibly for imperceptible changes of that level. This necessitates that the pivot *f* should be a considerable distance above the surface of the liquid, so that the float may be said to hang from the pivot into the liquid, so that its range of movement will be mainly in one-half of the lower ninety degrees of a vertical circle about its pivot.

Independently of the specific advantage which is obtained by locating the fulcrum of the float at a point relatively remote from the surface of the liquid there is attained the further advantage from fulcruming the float on the fixed pivot that the float requires no other guide than its pivot affords, and no counterbalancing over that pivot in order to adapt it to operate the valve by its movement in both directions and that, therefore, the friction of the device is reduced to a minimum, and it is made to respond by the movement of the float and consequent movement of the valve to changes of level of the liquid almost as promptly and perfectly as the latter responds to the change of tension of the gas which presses upon it. The importance of diminishing friction in this class of devices cannot be overestimated, as will be appreciated when account is taken of the actual gas-pressure which is the subject of regulation. Ordinary gas-pressure for lighting, as measured at the house meter, is equal to about a one-inch column of water, which is a little over half an ounce to the square inch. The variations of this pressure, independent of the number of burners lighted, but dependent upon the variation in the mains, will not ordinarily exceed half the total or a quarter of an ounce, and for this slight variation the governor must operate; but this variation is great as compared with the very much smaller quantities to be considered when the device is adapted to compensate and regulate for the varying consumption due to lighting more or less of the burners supplied through the same governor. Taking a very simple instance of ten burners supplied through one meter and governor with a pressure at the meter of one inch, the total change of level of the liquid in the governor due to lighting all and then extinguishing all the burners will not exceed a sixteenth of an inch; but the governor must regulate accurately for all changes due to extinguishing one or more up to the entire ten burners. The change due to extinguishing one burner will be one one-hundred-and-sixtieth of an inch, and to this change, imperceptible to the eye and almost incapable of measurement, the float must respond and move the valve an amount sufficient to keep the supply proportioned to the demand, so that the pressure upon each burner shall be unchanged. My device in practice I find capable of regulating as closely as this. When it is considered that the pressure measured by a column of water one one-hundred-and-sixtieth of an inch high is only about one two-hundred-and-fiftieth of an ounce, the importance of the slightest friction in the action of the parts which are to be moved by this very small force will be understood; and one important advantage of the structure shown in my device is that by the location of the float with its center of gravity very nearly under the pivot the weight is taken off the pivot and the friction at this, the only point of friction, is thereby reduced to the minimum.

The operation of this device, it will be understood, will be that the gas admitted into this chamber *a*, exerting its expansive force therein, tends to depress the surface of the liquid in that chamber and to raise it in the chamber *b*, the difference of level of the liquid in the two chambers being the measure of the pressure or tension of the gas and of its tendency to flow. The lowering of the level in the chamber *a* permits the float to descend correspondingly, and descending in the arc about its fulcrum *f*, as it must, the distance which it moves, measured in the arc of the circle, is much greater than the absolute descent or change of level of the liquid, and the corresponding movement of the valves is much more accurately and minutely regulated, since such movement depends upon the relatively long circumferential movement of the float and not upon the relatively slight vertical movement or change of level of the

liquid. As the pressure diminishes the level of liquid in the chamber *a* rises and the float, rising correspondingly, swings laterally and opens the valves and admits a greater supply of the gas to restore the pressure or maintain the outflow for consumption to the burners.

Assuming that the device has been set so that a given pressure, which may be marked *x*, measured by a difference of level in the two chambers represented in Fig. 1 gives a level of liquid in the chamber *a* such that the float is suspended in the position which closes the valve, no gas will be admitted until the consumption or outflow through the outlet-pipe D has somewhat diminished the pressure and permitted the level of the liquid in the chamber *a* to rise, and thereupon gas will be admitted past the partly-open valves sufficiently to maintain the outflow, and if such outflow should increase, the pressure being correspondingly diminished in the chamber *a*, the liquid would rise and the valve be opened still wider. Now it will be evident that the maximum tension that can ever be obtained is that which is measured by the difference of level of the liquid in the two chambers when the valves are seated. If a higher pressure is desired, it may be obtained by raising the level of the liquid in the chamber *b*, and this obviously could be done by pouring in a larger quantity of liquid, which would remain chiefly in the chamber *b*, because the tension in the chamber *a* would prevent it from rising therein except by compressing to greater tension the gas in that chamber above the liquid. Any desired tension may therefore be obtained to the limit of that which will be measured by the maximum difference of level possible in the two chambers—that is to say, by the height to which the liquid can rise in the outer chamber above the level in the inner chamber which maintains the valves seated. The device will therefore be constructed in the first instance with sufficient height to permit a level of liquid in the chamber *b* above that which in the chamber *a* seats the valves equal to the maximum tension ever to be desired. Two and one-half inches, when the liquid is water or glycerin, are sufficient for ordinary purposes, and if a heavier liquid were employed a shorter distance would be sufficient or a higher pressure possible.

Since the pouring in of additional liquid would not be a convenient method of regulating the pressure to the varying necessity, I provide as an equivalent of that, and as a means of raising the level in the chamber *b* without increasing the quantity of liquid, the device illustrated in the drawings, which consists of a displacement block or blocks in the chamber *b*, which may be depressed to displace more or less of the liquid therein and raise the level accordingly.

K is a sheet-metal ring or partial ring—an entire ring being employed in the form shown in Figs. 3 and 4 and a partial ring or segment only being employed in the other form—which is located in the outer chamber *b* and has secured to it near its lower edge at any convenient point a nut or threaded lug K′, through which a threaded post or screw L passes, said post being adapted to be inserted down through the filling-opening *b′* in the top of the chamber *b* and screwed through the nut K′ down to the bottom of the chamber on which the lower point of the post may rest and on which there may be provided a seat to center it, though this is not essential. The filling-opening *b′* is guarded by a thimble b^{10}, which extends up some distance above the top of the chamber and to an extent guards against accidental overflow of the chamber when through any temporary cause the tension exceeds that for which the device is constructed. The post L is provided with a head L′, which may stop on the upper end of the thimble b^{10} and which is slotted to afford means for screwing it through the nut K′. A cap N, adapted to fit snugly about the thimble *b′* and close it, also incloses the head L′ of the post L, and a pin N′, inserted diametrically through this cap a little distance below its upper end, may take into the slot *l′* in the head L′, and thereby, without removing the cap, it serves as a screw-driver or means for rotating the post L.

To the ring or segment K, I secure one or more pieces of cork or any like material M M M, &c., occupying a large portion of the annular space of the chamber *b* above the normal surface of the liquid therein. By rotating the screw L the ring or segment K and the displacement-blocks M secured to it are depressed in or lifted out of the liquid, and to raise and lower its level thereby in the chamber *b*, enabling the operator to adjust the device to any desired degree of tension within the limits which may be measured in the possible difference of level of the liquid in the two chambers.

It will be understood from the foregoing description that the liquid in the chamber *b* is designed to be exposed to atmospheric pressure, but if it is freely exposed there is liable to result an oscillation of the water from the occasional changes of pressure—that is, an increase of pressure which forces down the level in the chamber *a* and raises it in the chamber *b*, when occurring suddenly, will produce a greater change in level than can be maintained—and the column in the chamber will subside slightly below the normal level, and thus oscillate back and forth for a considerable time before settling at the proper level, and in the meantime, other changes of pressure having occurred, will be likely to cause the oscillation to continue. Thus the ordinary changes of pressure will produce a perpetual oscillation of the water, which will cause a fluctuation in the lights instead of contributing to steadiness, as intended. This defect, I find, can be prevented by admitting the atmospheric pressure to the chamber *b* through so very slight an aperture that the

air permitted to pass thus very slowly in and out as the level changes oscillates to smother the oscillation of the water. I make the cap or stopper M, therefore, over the final aperture fit the thimble, as stated, quite snugly, but not absolutely air-tight, and I find that with this construction the oscillation is prevented in the manner described, while at the same time the atmospheric pressure is admitted sufficiently for the purpose of the device.

I have shown the form in Figs. 1 and 2 without any packing between the cap and cylindrical wall; but I fit it tight enough at this joint to prevent the free access of the air, which would permit the oscillation of the water, as described. In the form shown in Figs. 3 and 4, adapted for attachment of the chandelier, when the inconvenience which results from an occasional overflow would be more serious and where it is therefore more important to prevent this, I prefer to pack this joint, as shown, since only by making this joint air-tight can I obtain the benefit of the upwardly-projecting thimble as a means of preventing overflow and affording possibility of a liquid column higher than the general vertical extent of the outer chamber.

The form shown in Figs. 1 and 2 is especially contrived with a view to convenience in taking the device apart for cleaning or repairs, and such convenience is furthered by the following details of construction: The inlet and outlet connections are both made in the top cap, and this cap need never be detached from the pipes in order to clean the device, because all the parts necessary to be removed for such purpose are removable downwardly from the cap. The bolts S S, which bind the structure together, being removed, the bottom and outer cylindrical walls, which are made as integral, forming an upwardly-open cup, being withdrawn downwardly, carry all the liquid in it without danger of wasting or spilling. The float G is secured upon a stem g by means of the nut g' at the bottom of the latter, and this being removed the float can be withdrawn downwardly. This leaves freely exposed below the screws d^{10}, which secure the casting d', which forms the outer wall of the vestibule d, to the cap and permits it to be removed, carrying with it the valves and lever F. The pin f, which constitutes the pivot of the lever, is a simple rod which is inserted from side to side through the lugs which afford it bearing in the casting and the posts which afford connection with the lever, and this pin is made long enough so that when the device is in place within the cylindrical wall B it cannot come out; but when the casting d' is withdrawn from the cylinder this pin can be removed and the valves taken out for cleaning.

I claim—

1. In a gas-governor, in combination substantially as set forth, two fixed chambers communicating at the bottom and containing a liquid which seals their communication, one of said chambers having gas inlet and outlet ports; a float adapted to be buoyed by the liquid in such chamber and suspended from, and adapted to oscillate only in the arc of a circle about, a fixed pivot; whereby changes of level of the liquid in the chamber give the float such oscillatory movement; the valve which controls the inlet-port connected to the float and actuated by such oscillatory movement thereof.

2. In a gas-governor, in combination substantially as set forth, two fixed chambers communicating at the bottom and containing a liquid which seals communication between them; one of said chambers having gas inlet and outlet ports; a float suspended from a fixed pivot in such chamber into and adapted to be buoyed by the liquid, and adapted to move only in the arc of a circle about its said pivot; whereby the changes of level of the liquid tends to impart to the float such movement; a valve which controls the inlet-port rigid with said float.

3. In a gas-governor, in combination substantially as set forth, two fixed chambers communicating at the bottom and containing liquid which seals their communication, one of said chambers having gas inlet and outlet ports; a float suspended from a fixed pivot in said chamber into the liquid and adapted to be buoyed thereby and to be oscillated only in the arc of a circle about its said pivot; a valve which controls the inlet-port connected to and operated by such oscillatory movement of the float; the vertical line of the center of gravity of the float at the position at which the valve is closed, being slightly aside from the vertical plane which contains said pivot; whereby change of level of the liquid causes relatively great angular movement of the float about its pivot.

4. In a gas-governor, in combination substantially as set forth, two fixed chambers communicating at the bottom, and containing a liquid which seals their communication, one of said chambers having gas inlet and outlet ports; a float suspended from a fixed pivot in said chamber into, and adapted to be buoyed by said liquid, and adapted to move only in the arc of a circle about its said pivot; whereby such movement is caused by change of level of the liquid; the valve which controls the inlet-port connected to the float and adapted to be operated by such movement of the latter; said pivot being at a distance above the level of the liquid which is great relatively to the distance of the vertical line of the center of gravity of the float when it is at the position at which the valve is seated, from the vertical plane which contains the pivot; whereby change of level of the liquid produces relatively great lateral movement of the float.

5. In a gas-governor, in combination substantially as set forth, two fixed chambers communicating at the bottom and containing

a liquid which seals communication between them; one of said chambers having gas inlet and outlet ports; a float suspended from a fixed pivot in such chamber into and adapted to be buoyed by the liquid, and adapted to move only in the arc of a circle about its said pivot; whereby the change of level of the liquid tends to impart to the float such movement; a valve which controls the inlet-port rigid with said float; the vertical line of the center of gravity of the float at the position at which the valve is seated being slightly removed from the vertical plane which contains the pivot of the float.

6. In a gas-governor, in combination substantially as set forth, two chambers communicating at the bottom and containing liquid which seals such communication; one of said chambers having gas inlet and outlet ports and a balanced valve to control the inlet; a float in such chamber suspended from a fixed pivot into and adapted to be buoyed by the liquid and adapted to move only in the arc of a circle about such pivot; whereby change of level of the liquid tends to cause such movement of the float; the valve being connected to the float and adapted to be operated by such movement of the latter; the center of gravity of the float at the position at which the valves are seated being in a vertical line which is only slightly aside from the vertical plane which contains the said pivot.

7. In a gas-governor, in combination substantially as set forth, two fixed chambers communicating at the bottom and containing liquid which seals their communication; one of said chambers having gas-inlet and gas-outlet above the level of the liquid; the gas-inlet comprising two ports; a float in said chamber suspended from a fixed pivot therein into and adapted to be buoyed by the liquid, and adapted to move only in the arc of a circle about such pivot; whereby change of level in the liquid tends to cause such movement of the float; the valves which control the inlet-ports rigid with the float; said pivot being at a line which is in the planes of the seats of both the valves.

8. In a gas-governor, in combination substantially as set forth, the two chambers *a* and *b* communicating at the bottom and containing liquid which seals their communication, the gas-inlet vestibule *d* partitioned from the chamber *a* by converging walls which form an angle protruding into the chamber *a;* the inlet-ports being made through said walls respectively, and the valves which seat upon the inner surface of the one and the outer surface of the other of said converging walls; the float in said chamber pivoted at the intersection of the planes of said valve-seats; and a stem for said valves rigid with the float; whereby the oscillation of the float caused by the change of level of the liquid swings the two valves in a curved path about the pivot of the float toward and from their seats respectively.

9. In combination with the chambers *a* and *b* communicating at the bottom and containing liquid which seals their communication, the vestibule *d* protruding angularly into the chamber *a* at the top and having the two inlet-ports, one smaller than the other; the float pivoted at the intersection of the plane of the face toward the vestibule, of the smaller port, with the plane of the face toward the chamber, of the larger port, the valve-stem rigid with said float and protruding into the vestibule through the larger port, and carrying at the extremity a valve adapted to pass through the larger port and seat over the smaller: substantially as set forth.

10. In a gas-governor, in combination with two chambers communicating at the bottom and containing liquid adapted to seal their communications; a float in one of said chambers and the valve which it operates to control the gas-inlet; a displacement-block in the other chamber and means for raising and lowering it positively in the liquid in said chamber: substantially as and for the purpose set forth.

11. In a gas-governor, in combination with the two chambers which communicate at the bottom and containing liquid which seals their communication, the gas inlet and outlet of one chamber, and the valve which controls the inlet, and the float in said chamber which operates the valve; a displacement-block in the other chamber; a screw-post which passes through it and protrudes from the chamber, and means for vertically stopping the post vertically with respect to the chamber and for rotating it to raise and lower the displacement-block: substantially as set forth.

12. In combination with the chambers *a* and *b*, the chamber *a* having gas inlet and outlet; a valve which controls the inlet and the float which operates the valve; the other chamber having a filling-mouth and cylindrical thimble about the same; a displacement-block in said chamber; a threaded stem or post which extends through the filling-thimble and is vertically stopped with respect to the chamber and screwed through the displacement-block and provided with a slotted head at the top; the cap or stopper N, adapted to close the upper end of the filling-thimble, and having the cross-pin N′ adapted to enter the slotted head of the post when the stopper is in place, whereby said stopper serves as a tool or handle to rotate the post to raise or lower the displacement-block: substantially as set forth.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 25th day of June, 1894.

THOMAS O. PERRY.

Witnesses:
CHAS. S. BURTON,
JEAN ELLIOTT.