(No Model.)

4 Sheets—Sheet 1.

M. O'GORMAN.

GAS REGULATOR.

No. 474,481. Patented May 10, 1892.

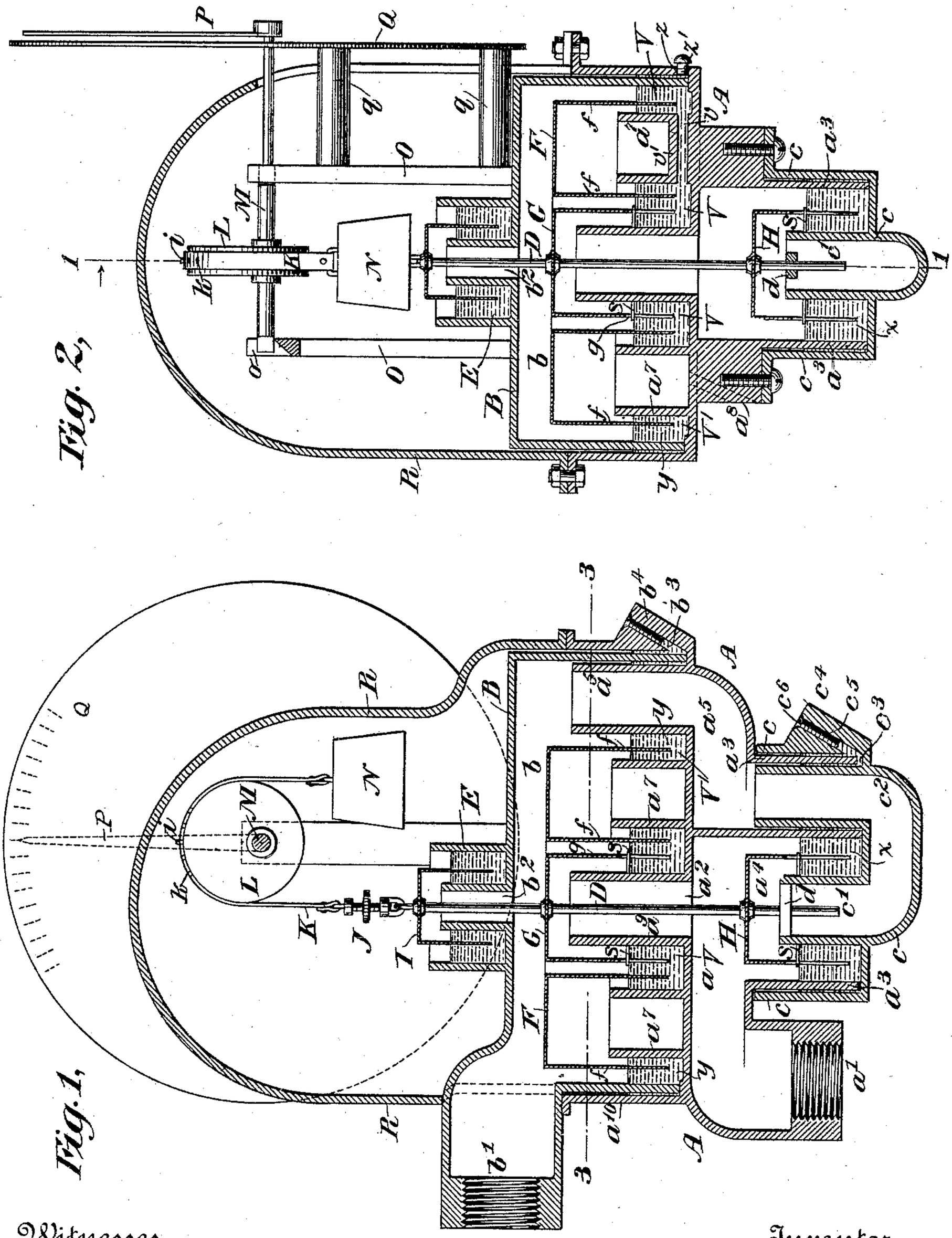

Fig. 1,

Fig. 2,

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(No Model.)

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Fig. 4,

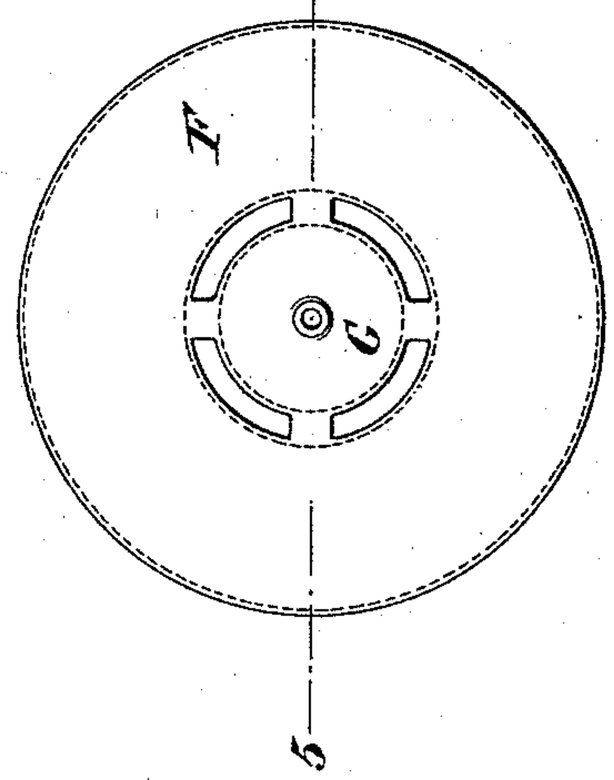

Fig. 5,

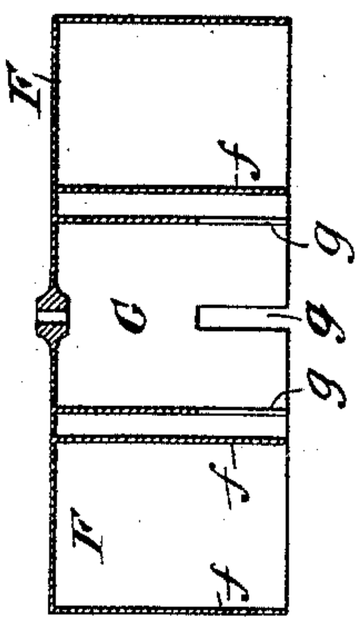

Fig. 3,

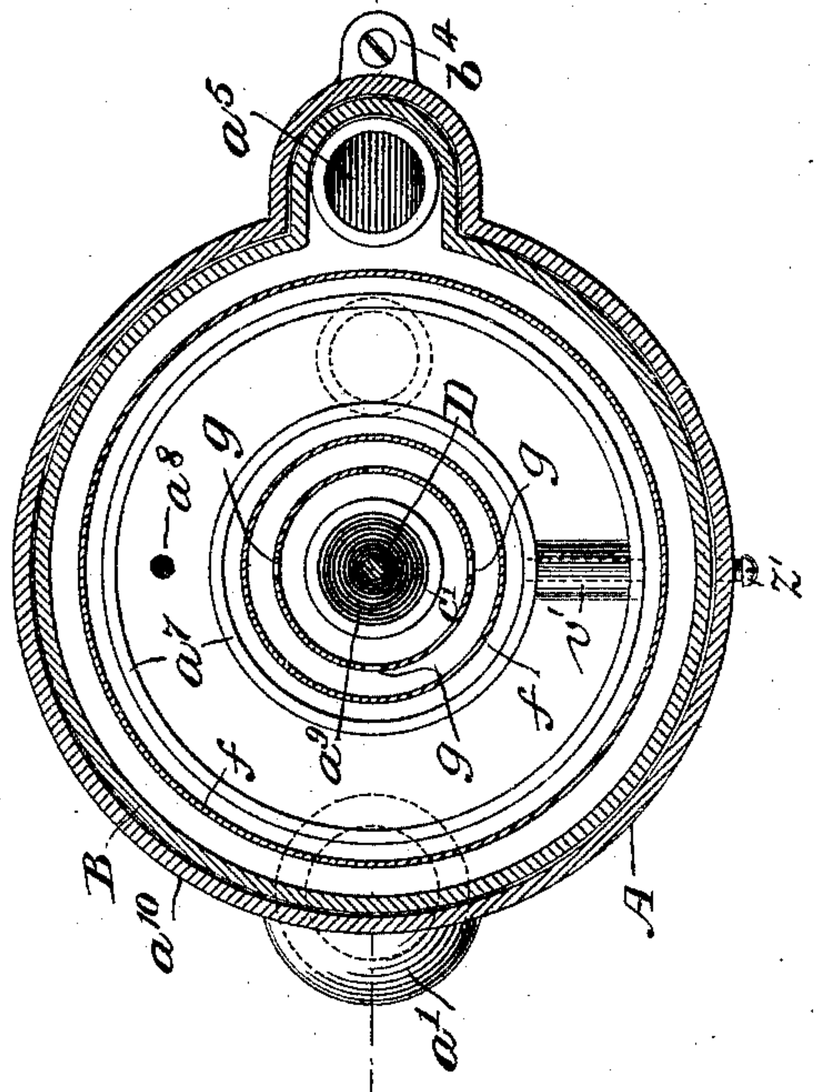

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Fig. 6,

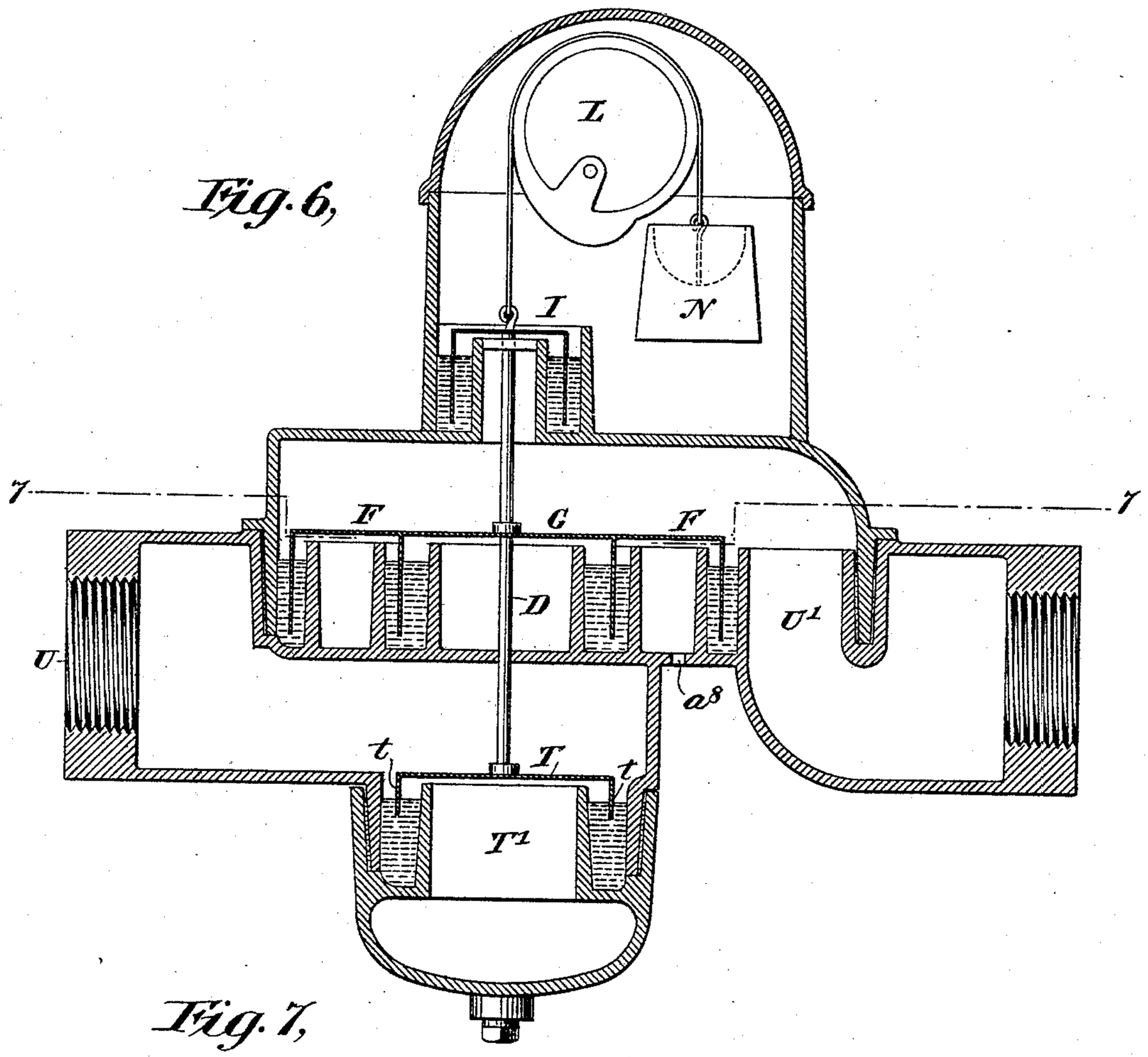

Fig. 7,

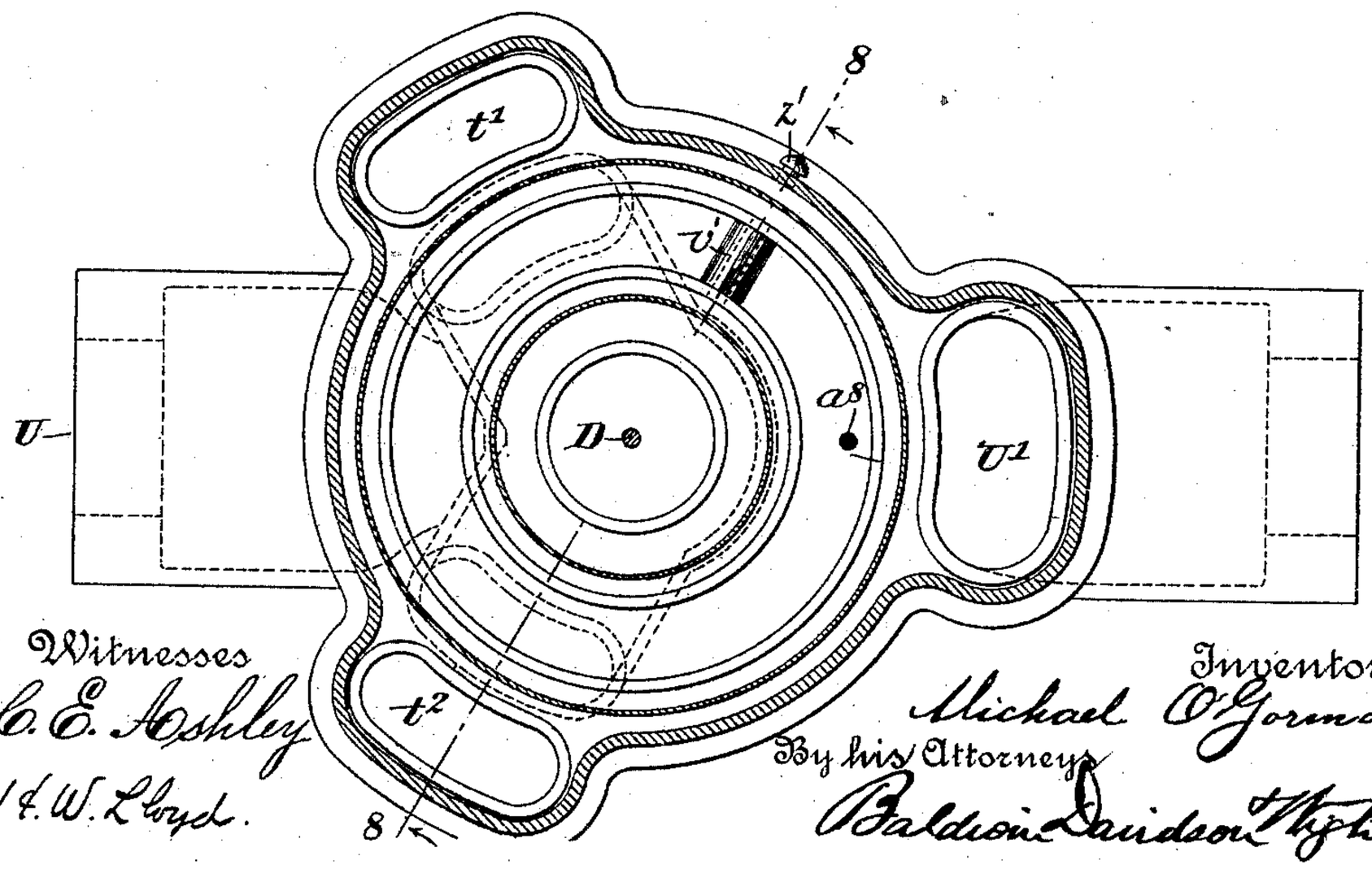

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Fig. 8,

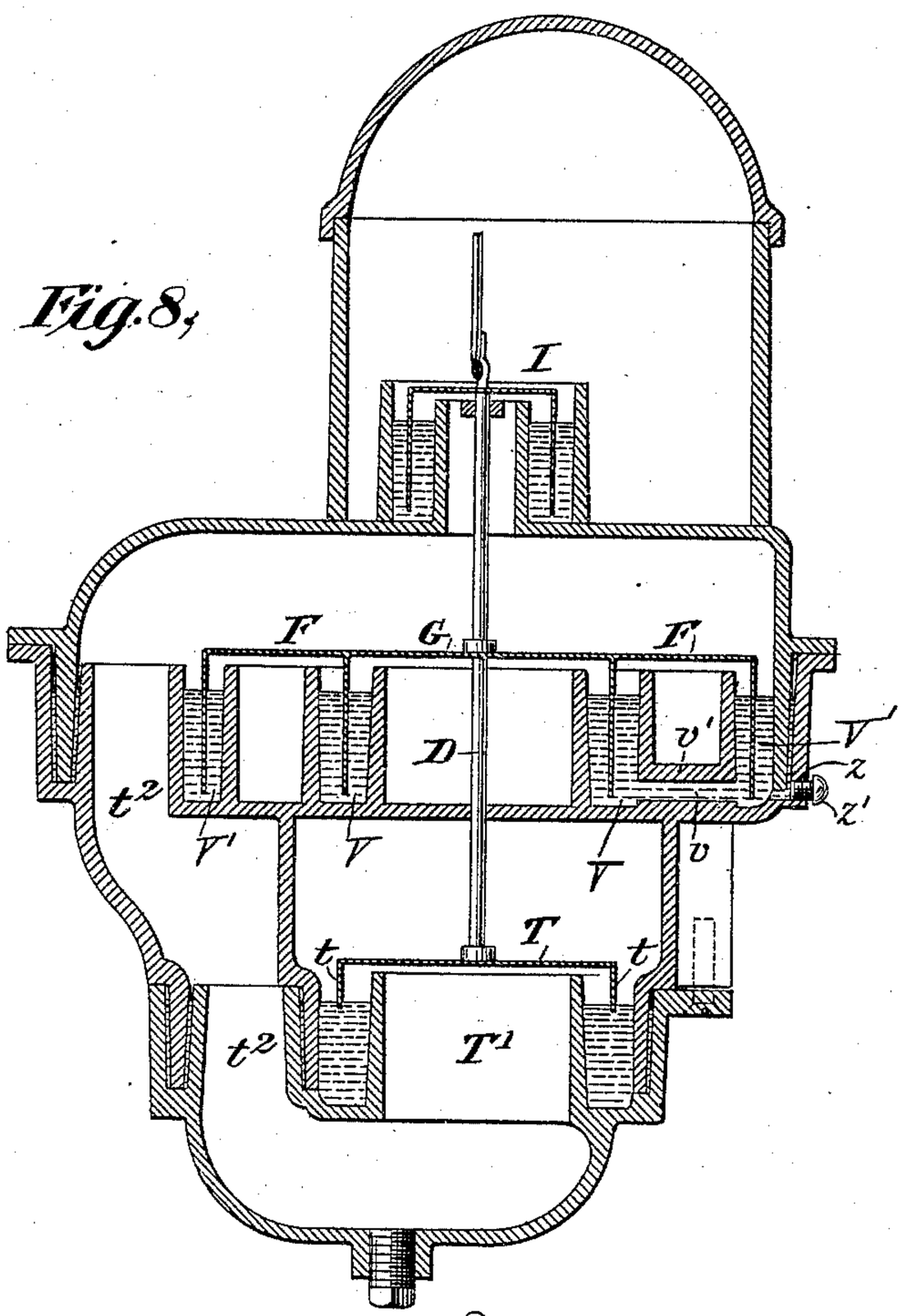
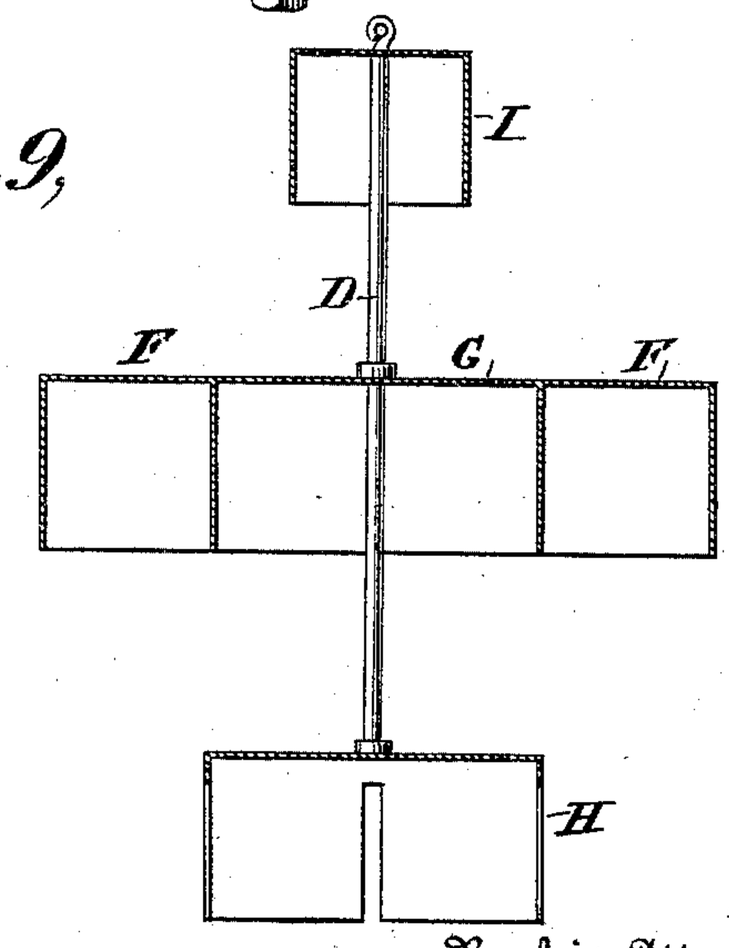


Fig. 9,



Witnesses
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UNITED STATES PATENT OFFICE.

MICHAEL O'GORMAN, OF JERSEY CITY, NEW JERSEY.

GAS-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 474,481, dated May 10, 1892.

Application filed February 19, 1892. Serial No. 422,148. (No model.)

To all whom it may concern:

Be it known that I, MICHAEL O'GORMAN, a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Gas-Regulators, of which the following is a specification.

My invention relates to that class of apparatus in which the variable pressure in a gas-distribution system is compensated or regulated by means of a counterpoised piston, to which are connected valves arranged to rise and fall in a fluid seal to regulate the amount of gas delivered to the service-pipe.

The object of my invention is to secure a simple and efficient apparatus in which a valve (or valves) in the regulator is closed by the gas-pressure when no burners are in use, and which automatically, by the variations in volume of gas in the pressure-chamber, caused by the use of a greater or less number of burners, opens and closes sufficiently to allow the requisite amount of gas to flow to the burners without waste.

A further object of my invention is to adjust the apparatus to vary the relation of the counterpoise and the valve or valves and also to indicate the amount of gas being consumed at any specified time. Improved apparatus for obtaining these results will be hereinafter fully described, and the subject-matter deemed novel set forth in the claims.

In the accompanying drawings, Figure 1 is a vertical central section through my apparatus on the line 1 1 of Fig. 2. Fig. 2 is a vertical central section taken at right angles to that of Fig. 1. Fig. 3 is a transverse section on the line 3 3 of Fig. 1. Fig. 4 is a plan view of the piston and the valve carried thereby. Fig. 5 is a central section of the piston on the line 5 5 of Fig. 4. Fig. 6 is a vertical central section of my governor suitably modified for use in gas-works. Fig. 7 is a transverse section on the line 7 7 of Fig. 6. Fig. 8 is a vertical central section of same on the line 8 8 of Fig. 7; and Fig. 9 is a detail view showing one way of constructing and arranging the piston, the valve, and the counterbalancing device or valve connected therewith.

A gas-receiving chamber a, formed in a casting A, is provided with an inlet-opening a', adapted to connect with a gas-main and an outlet a^2, which connects with a pressure-chamber b, formed in a casting B. A circular flange a^3 is formed on the walls of the receiving-chamber a and projects downwardly therefrom to form the side walls of the valve-chamber a^4, the bottom of which is closed by the coupling C, which is provided with a flange c, encircling the flange a^3. This coupling is formed with a cylindrical extension c' projecting into the valve-chamber a^4 and opening into it above the level of the fluid x therein. This opening also connects with a pipe or passage c^2, which extends below the valve-chamber and upwardly connecting with a pipe or passage a^5, leading into the pressure-chamber b and opening into it above the level of the fluid y. The coupling is provided with a recess c^3 between the pipe c^2 and a lateral offset c^4 to receive the downwardly-projecting flange a^3 of the casting A. This recess forms a continuation of the valve-chamber a^4, and the fluid in the valve-chamber also enters the recess. In this way a gas-tight connection is made between the coupling C and the casting A, and there is no necessity for particularly tight joints or packing.

A passage c^5 extends from the recess c^3 to the top of the offset c^4. The top of the passage is in line with the fluid-level in the valve-chamber—that is to say, when the mercury has been made to fill the valve-chamber to the desired height it rises to the top of the opening c^5 and it is known that sufficient mercury has been supplied. The opening should be tightly closed by a plug or screw c^6. The pressure-chamber is provided with a port b', adapted to be connected with a gas service-pipe. The casting B, which forms the casing of the pressure-chamber, rests at its lower edge on the top of the casting A inside the flange a^{10} thereof, and its top wall is provided with an opening b^2, through which extends a rod D, carrying the piston and valves, hereinafter referred to. Around the opening b^2 is a trough E, containing a fluid—such as mercury—to form a gas-tight seal. A fluid—such as mercury—fills the lower part of the pressure-chamber b, being supplied thereto through an opening b^3, formed in a lateral offset b^4 on the casting A. The upper end of this opening is on a level with the fluid y in the chamber b, and it can readily be determined when the desired level

is reached. The arrangement is such that the level of the mercury in the pressure-chamber corresponds with that of the mercury in the valve-chamber a^4, for a purpose hereinafter designated. The rod D carries within the pressure-chamber b an annular piston F and a cup-shaped valve G. The annular piston has two downwardly-projecting annular flanges f, which at their lower ends surround two upwardly-projecting displacement flanges a^7, between which is formed an annular chamber provided with an air-outlet opening a^8. The flanges f are immersed at their lower ends in the fluid seal. The displacement flanges divide the pressure-chamber into two mercury-containing troughs V and V′. The inner trough V is connected with the outer one V′ by a channel v, formed by drilling a hole through a solid portion v' of the casing. The opening z in the outer casing for the drilling-tool is closed by a screw-plug z'.

The cup-shaped valve G, to which the annular piston is connected, as shown in Fig. 4, surrounds the upwardly-projecting cylindrical flange a^9 above and around the opening or outlet a^2. The lower end of the flange of the valve G is provided with a series of slots g, as shown in Fig. 5, and through these slots gas may pass from the gas-receiving chamber to the pressure-chamber. In order to insure the efficient working of the apparatus, it is desirable that these slots should each be the same width from top to bottom, so that the escape from the gas-receiving chamber to the pressure-chamber will depend on the depth of immersion of the valve in the fluid and not on any variation in width in the slot.

The rod D extends downwardly through the opening a^2 and carries in the gas-receiving chamber a cup-shaped valve H, which is slotted similarly to the valve G and projects into the fluid seal in the valve-chamber a^4. The lower end of the rod D projects through a guide-bracket d, extending across the opening c^2. The upper end projects through the opening b^2 in the casting B and carries an inverted cup I, the downwardly-projecting side of which extends into the fluid seal in the trough E. The opening b^2 is sufficiently large to permit the rod D to work up and down freely without coming in contact with the case, while the cup I and its fluid seal afford a perfect gas-tight joint or closure for the opening. There would, of course, be some upward gas-pressure on the cup I; but this does not interfere with the operation or balancing of the apparatus, as the parts are so adjusted that the upward pressure on the cup I is compensated by the downward pressure on the piston. Above this cup the rod is connected by adjusting devices J with a strap K, passing over an eccentric or cam L, secured eccentrically to a shaft M. The opposite end of the strap is connected to a weight N, which acts as a counterpoise for the piston-rod and the piston and valve carried thereby. The strap is provided with a series of apertures k and the eccentric or cam carries a pin l, adapted to engage with the apertures. By changing the pin from one aperture to another the leverage of the cam may be varied and the counterbalancing effect of the weight on the piston-rod and the parts connected therewith correspondingly varied, so as to adjust the apparatus to give the desired pressure at which the gas is to be supplied to the service-pipe.

A more delicate adjustment may be attained by manipulating the adjusting devices J in case the adjustment by changing the pin from one aperture to another is not sufficiently accurate.

As the valves and piston descend into the mercury the buoyancy is increased, and this variation in the balancing of the apparatus would tend to interfere with the nice adjustment of the mechanism. To compensate this, as the eccentric L moves correspondingly with the piston and valves it shifts the position of the weight, so as to decrease its power in tending to raise the valves and the piston.

The shaft M is supported on knife-edged open bearings o in standards O. It is extended to the outside of the apparatus and carries an index-finger P, which points to a scale on a dial Q, which may be secured by arms q, as indicated, to one of the standards O. By this index and dial the amount of gas being used at any time is clearly shown, as the position of the index-finger is controlled by the position of the piston-rod D and the parts connected therewith. A cover R incloses the upper part of the apparatus and may be bolted to the casting A, as indicated in Fig. 2. This cover is provided with a slot or opening for the coupling, which connects the pressure-chamber with the service-pipe and also with a slot, which permits it to be passed over the shaft M and the arms q, which connect the dial with the upright O.

When gas is admitted to the gas-receiving chamber a, it presses equally on the valve H and the valve G, and these valves being of the same area the pressure is neutralized, so that they neither rise nor fall, but the gas passes through the slots in the valves. That passing through the slots in the valve G enters directly into the pressure-chamber b and passes to the service-pipe through the opening b'. The gas passing through the slots in the valve H passes through the openings c^2 and a^5 to the pressure-chamber b and into the service-pipe. If only a small amount of gas is required in the service-pipe, the pressure in the chamber b forces the piston F downwardly, carrying with it the valves G and H, thus reducing the area of the slots above the fluid-level. When more burners are used in the service-pipe or a greater supply of gas is required therefor, the piston rises so as to increase the area of the slots in the valve and enlarge the supply of gas. The arrangement is such that the valves are opened and closed proportionately with the amount of gas con-

sumed, and this arrangement may be accurately adjusted by adjusting the connection between the weight, the piston-rod, and the eccentric, as above explained. When no gas is being used from the service-pipe, the volume of gas and pressure in the chamber *b* are increased sufficiently to close the valves. As the area of the valves G and H is the same and as the fluid-pressure on them is the same, they are balanced by the fluid-pressure, and thus great delicacy in the operation of the apparatus is attained. Each valve is connected to the piston rigidly and moves correspondingly with it at all times and always in the same direction.

It will be observed that there is very little friction to interfere with the free movement of the piston-rod. Practically the only frictional obstruction, which is very slight, is caused by the connection of the rod with the guide-bracket *d*. I have found in practice that when mercury is used for the fluid seal and when the valves rise and fall therein there is a tendency for the mercury to adhere to the valves and to rise and fall with them. To remedy this I attach wires or fingers S to the casing and extend them through the slots in the valves. The arrangement of the openings in the offsets is such that the fluid-levels in the two chambers may be accurately gaged, so that they shall be the same, and thus the two valves will permit the escape of the same amount of gas.

The construction of the apparatus and its operation have now been fully described, and I would say in addition that the apparatus works efficiently and with uniform accuracy.

The several parts of the apparatus may be readily taken apart and put together, and there is no necessity for accurate grinding at the joints or for packing or fitting, as the mercury forms a gas-tight seal at those parts of the apparatus where there would be liability of leakage.

Obviously the depending flange of either valve or cup G or H need not be slotted. The other valve or cup would in that event still be counterbalanced by opposing pressures, exactly as has been described, but gas would enter the pressure-chamber through one valve or cup only. Where the depending flange of G or H is not slotted, it would not technically be a valve, because no gas would pass through it; but in the claims I designate each of them as a "valve." I intend, however, that such designation of these parts in the claims shall include the idea that one of them need not be slotted. In Fig. 9 I have shown only one of the cups constructed to work as a valve, the other cup being employed as a counterbalancing device.

Figs. 6, 7, and 8 show a slight modification of the apparatus especially adapted for use in gas-works or in large mains. The arrangement of the apparatus, except as hereinafter designated, is similar to that shown in Figs. 1 and 2. Gas enters from the incoming main at U. The valve T in the receiving-chamber controls the flow of gas to the pressure-chamber; but this valve, instead of being slotted, as shown in Figs. 1 and 2, has a short depending flange *t*, which dips into the mercury or fluid seal when the valve is closed and rises above it to a greater or less extent to permit the requisite amount of gas to pass. This valve controls the only opening from the receiving to the pressure chamber. The passage T′ below the valve divides into two branches t' t^2 to deliver the gas to the pressure-chamber at two points. There is a single passage U′ for the escape of gas from the pressure-chamber to the outgoing main. The cup G does not in this instance operate as a valve, as in Figs. 1 and 2, but serves to balance the valve T by means of the gas-pressure on its upper surface, so that the rising and falling or opening and closing of the valve T depends entirely upon the gas-pressure on the piston F. The other parts of the apparatus are substantially the same as those shown in Figs. 1 and 2, as above stated.

In Figs. 6, 8, and 9 the upper part of the piston F and the cup G are shown as made in one piece instead of being separated, as shown in Figs. 1 and 2; but the area of the part G in each instance is equal to the area of the upper surface of the valve H or T.

In Fig. 9 I have shown the piston, the two valves, the cup I, and the connecting-rod D detached from the other parts of the apparatus, and the arrangement is slightly different from that shown in the other figures. The rod, the cup G, and the piston F are like those shown in Fig. 8, while the valve H is like that shown in Figs. 1 and 2.

I claim as my invention—

1. The combination, substantially as set forth, of a casing having a gas-pressure chamber provided with an outlet to the service-pipe and having also a gas-receiving chamber provided with an inlet for connection with the source of gas-supply, a slotted cup-shaped valve working in a fluid seal interposed between said chambers, a similar valve in the receiving-chamber, controlling a passage-way connecting the valve-chamber of the latter valve with the pressure-chamber, a mechanical connection between the two valves, whereby they are caused to move together, a piston in the pressure-chamber connected with the former valve, whereby a relative increase of pressure in said chamber tends to depress both valves, and variable counterbalancing devices connected with the valves to compensate for variations in their effective weight, due to varying degrees of immersion in the fluid.

2. The combination, substantially as set forth, of a casing provided with a gas-pressure chamber having an outlet leading to the service-pipe, two valves controlling the supply of gas to the pressure-chamber, the areas of which are such that the pressure of gas upon them approximately balances them, a stiff

rigid connection between the valve, moving bodily with them in a vertical direction only, a fluid seal or seat for each of said valves, and a piston in the pressure-chamber unconfined at its periphery, having a fluid seal or seat and connected with one of said balanced valves, so as to move bodily therewith.

3. The combination, substantially as set forth, of a casing provided with a gas-pressure chamber having an outlet leading to the service-pipe and an inlet through which gas is admitted, a valve controlling said inlet, a fluid seal or seat for said valve, a counterbalancing-valve, a stiff rigid connection between the valves, moving bodily with them in a vertical direction only, a fluid seal or seat for the counterbalancing-valve, and a piston in the pressure-chamber unconfined at its periphery, having a fluid seal and rigidly connected with one of the valves, so as to move bodily therewith.

4. The combination, substantially as set forth, of a casing provided with a gas-pressure chamber having an outlet leading to the service-pipe, two valves controlling the entrance of gas to the pressure-chamber and each provided with a fluid seal or seat, the area of said valves being such that the pressure of gas thereupon approximately balances them, a stiff rigid connection between the valves, moving bodily with them in a vertical direction only, a piston in said chamber unconfined at its periphery, having a fluid-seal and connected with one of said valves so as to move bodily therewith, and a mechanical counterbalancing device connected with the valves.

5. The combination of a casing having a gas-receiving chamber and a pressure-chamber into which gas is admitted and from which it is discharged, the valves G and H, having fluid seals and which open and close passages between the two chambers, the rod connecting the valves, the piston in the pressure-chamber unconfined at its periphery, having a fluid seal and connected with one of the valves so as to move bodily therewith, the fluid-receptacle E, arranged above the pressure-chamber, the sealing-cup I, immersed therein and carried by the valve-rod, a counterbalancing-weight N, a flexible connection between the weight and valve-rod, and a pivoted eccentric over which the flexible connection passes and with which it is adjustably connected.

6. In a gas-regulator, the combination of a casing having a pressure-chamber provided with inlet and outlet ports, two cup-shaped balanced valves having fluid seals or seats and controlling the flow of gas to the pressure-chamber, a stiff rigid connection between the valves moving bodily with them in a vertical direction only, a piston in the chamber rigidly connected with one of the balanced valves, and variable counterbalancing devices connected with the valves and piston, substantially as and for the purpose set forth.

7. In a gas-regulating apparatus, the combination, substantially as set forth, of a casing provided with a pressure-chamber having entrance and exit ports, a slotted cup-shaped valve at the entrance-port extending into a fluid-seal recess in the casing, and devices for preventing the fluid adhering to the valve as it rises and falls.

8. The combination, substantially as set forth, of the casing A of the gas-receiving chamber, the casing B of the pressure-chamber, the fluid-seal recess in the casing A, in which the edge of the casing B is sealed, the fluid in said recess, which forms a gas-tight joint between said casings, a valve in the receiving-chamber controlling a passage for gas from the receiving-chamber to the pressure-chamber, and a valve in the pressure-chamber, controlling a second passage between the two chambers.

9. The combination, substantially as set forth, of the casings of the gas receiving and pressure chambers having inlet and outlet openings, a valve in the receiving-chamber controlling a passage from the receiving-chamber to the pressure-chamber, a valve in the pressure-chamber controlling a second passage from the receiving-chamber to the pressure-chamber, a stiff rigid connection between the valves moving bodily with them in a vertical direction only, a piston in the pressure-chamber rigidly connected with one of these valves, a counterbalancing-weight, an adjustable strap connected with the piston, a cam over which the strap passes, and a cover inclosing the cam and weight.

In testimony whereof I have hereunto subscribed my name.

MICHAEL O'GORMAN.

Witnesses:

EDWARD C. DAVIDSON,

M. J. KELLEY.