No. 678,872. Patented July 23, 1901.

R. E. HAWARD.

PRESSURE REGULATOR.

(Application filed Aug. 7, 1899.)

(No Model.)

Fig. 1

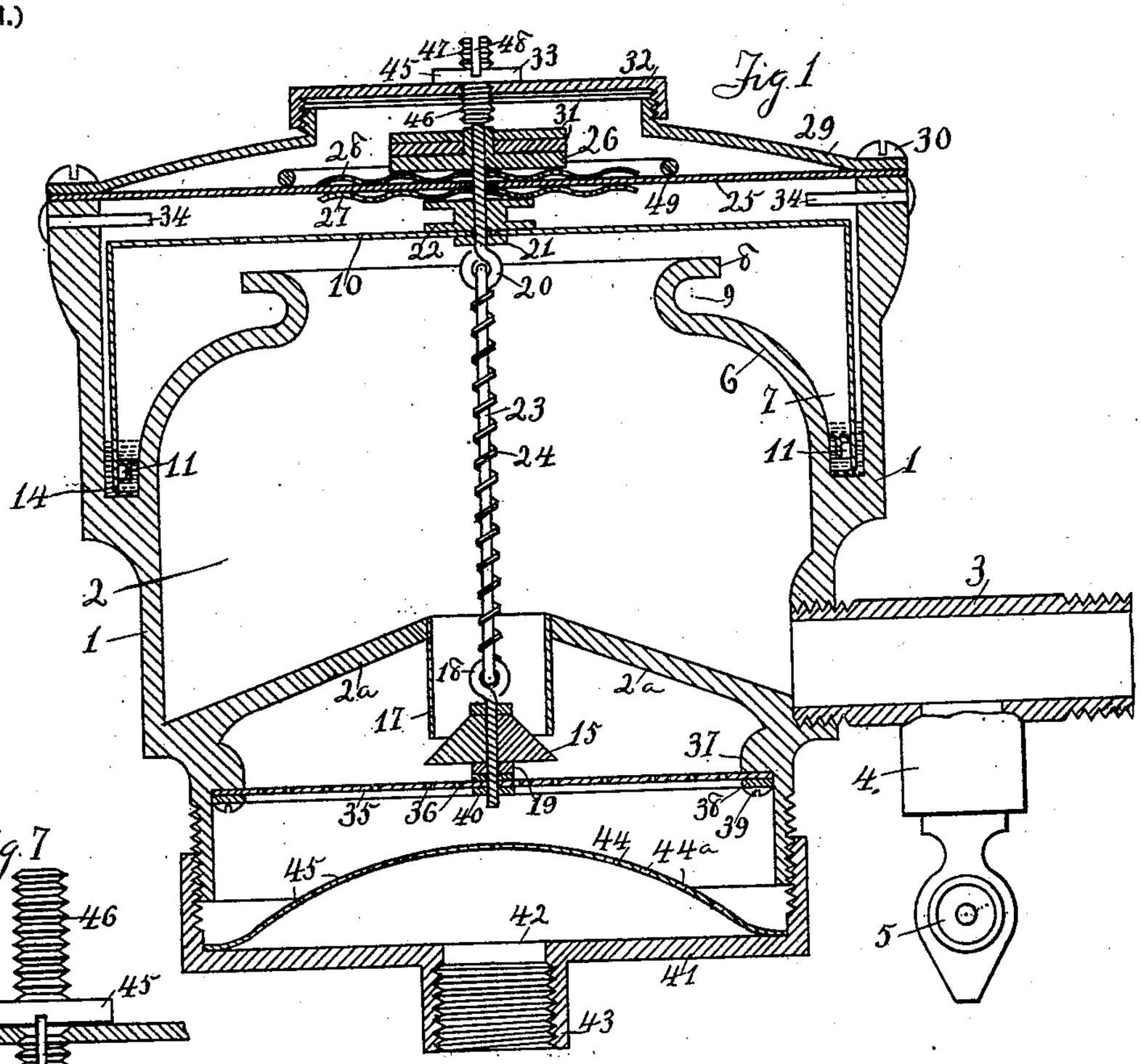


Fig. 7

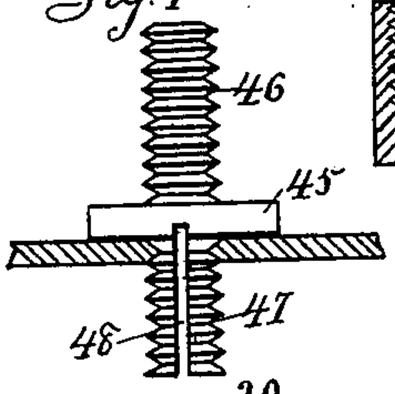


Fig. 2

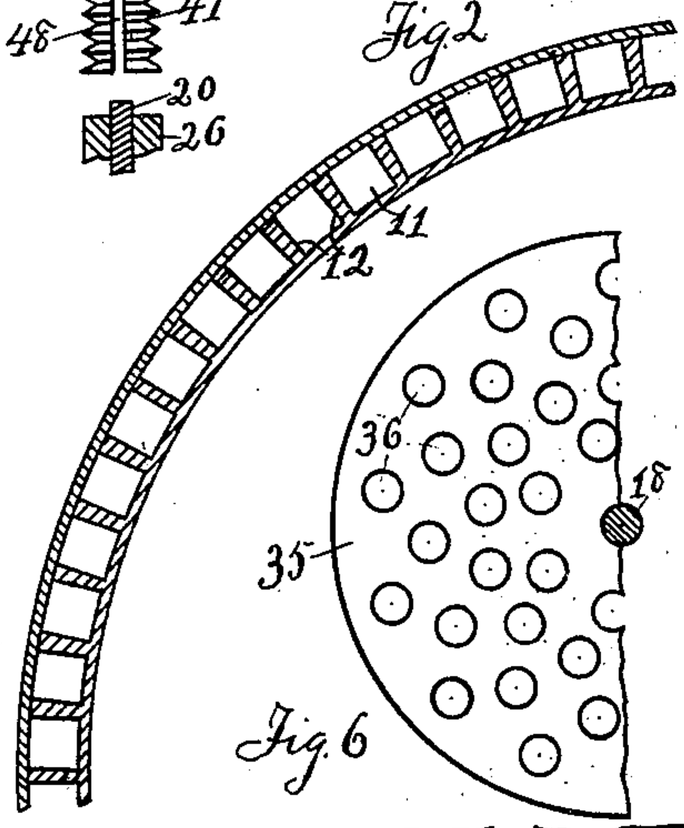


Fig. 3.

Fig. 6

Fig. 5

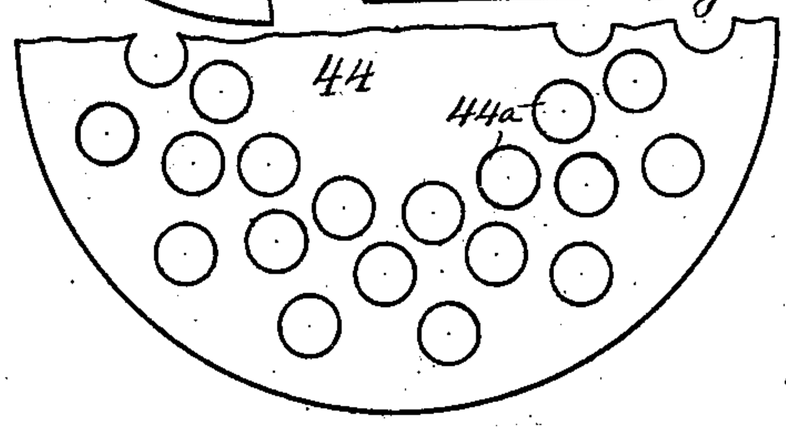
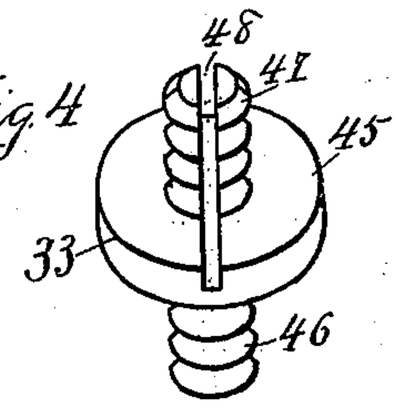


Fig. 4



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UNITED STATES PATENT OFFICE.

ROBERT E. HAWARD, OF KANSAS CITY, MISSOURI, ASSIGNOR OF ONE-HALF TO LEWIS F. McCLURE, OF SAME PLACE.

PRESSURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 678,872, dated July 23, 1901.

Application filed August 7, 1899. Serial No. 726,400. (No model.)

To all whom it may concern:

Be it known that I, ROBERT E. HAWARD, of Kansas City, in the county of Jackson, in the State of Missouri, have invented certain new and useful Improvements in Gas-Pressure Regulators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to certain new and useful improvements in gas-pressure regulators of that class in which there is a mercury or liquid cell or chamber in which is supported a bell or float controlling a valve for regulating the admission of gas from the supply-pipe to the liquid-sealed chamber formed by said bell or float; and my invention consists of certain features of novelty hereinafter described, and pointed out in the claims.

Figure 1 represents a vertical cross-section of a gas-pressure regulator embodying my invention and improvements. Fig. 2 represents an enlarged horizontal cross-section of a portion of the lower part of the bell, showing the arrangement of the separated independent air-cells therein. Fig. 3 represents a partial vertical section of a bell provided with a cellulous material, such as cork or the like, which in its constituency is made up largely of air-containing cells. Fig. 4 represents an isometric view of the reversible plug which constitutes an important feature in my invention. Fig. 5 represents a top view of the deflector. Fig. 6 represents a top view of the perforated diaphragm located below the valve. Fig. 7 represents a detail elevation, somewhat enlarged, of the reversible slotted screw-plug, showing a portion of the cap in cross-section and showing also the relation of the plug to the valve when the slotted screw is inserted in the cap.

Similar numerals refer to similar parts throughout the several views.

1 represents the body of the regulator, preferably cylindrical in form and having a gas-chamber 2, provided with an inverted funnel-shaped bottom 2^a, forming next the wall of the regulator a drainage-cup to catch and drain off the tar, water, sediment, and other deleterious matter which separates from the gas and gathers in the cup, from which by the arrangement of said cone-shaped bottom it is drained off into the service-pipe 3 and thence falls into the drainage-trap 4, from which it may be drawn off by the valve 5, and thus preventing such deleterious matter from passing to the valve-seat 17 and interfering with the free action of the valve. Within the regulator is provided an interior wall 6, forming with the outer wall or body of the regulator a cylindrical cup 7, containing a liquid, preferably mercury. Said interior wall extends inwardly and upwardly and terminates in the reverse flange 8, forming the channel 9, arranged to prevent the spilling and escape of the liquid from the cup 7 in case of accidental tilting of the regulator to one side.

10 represents the bell or float, provided near its bottom with a series of separated independent air-cells 11. Said air-cells may be provided, as shown in Fig. 2, by a ring or collar inserted within the bell and provided with a series of flanges 12, bearing against the face of the bell, and thus forming the cells 11, or, as shown in Fig. 3, by inserting within the mouth of the bell a ring 13 of cork or other like cellulous material the cellular structure of which provides a series of air-containing cells performing the same function and in the same manner as the air-cell structure shown in Fig. 2. Said bell is arranged in the liquid-sealing cup 7, the flange 14 of the bell projecting below the air-cells dipping into the liquid and the air-cells themselves resting upon and partly immersed in the liquid. The object and advantage in forming said air-chamber in a series of independent cells is this: In a number of regulators heretofore presented to the public an air-chamber is provided formed as a continuous passage or chamber extending uninterruptedly entirely around the bell, in which form it has been observed that when from additional weight or other cause one side of the bell is borne down, the flow of the air in said chamber being uninterrupted, it will pass around to the opposite and upper side and that side will be borne up and that portion of the air-chamber and bell be lifted entirely out of the sealing liquid, and thus permit flowing or escaping of the gas, while the bell, becoming for the time useless for the performance of its in-

tended function, the valve regulating the flow of gas into the regulator will be thrown wide open, permitting the gas to enter under full pressure from the supply-pipe, and thus increasing the escape under the open edge of the bell, and, further, having the air-chamber thus divided into a series of independent cells tends to keep the bell in a perfectly level position, so that contact with the walls of the seal-chamber cannot take place and friction caused thereby, tending to interfere with the free rise and fall of the bell, will be prevented. Said cells may be open at the bottom or the top or may be closed at both the bottom and the top, the effect in the buoyancy of the bell being the same whichever form may be used. To prevent tilting of the bell, however, the action is more effective when the cells are open on the bottom or under side, as shown, for which reason this form is preferred.

15 represents a valve for regulating the admission of gas from the supply-pipe (not shown) into the liquid-sealed chamber formed by the bell. The valve-seat is formed by the tube 17, fixed in the bottom 2^a and having thin walls or terminating in a thin edge, so that a thin edge is presented for the valve to seat itself against, thus preventing the accumulating of tar and waxy and sticky substances from the gas, which tend to interfere with the free action of the valve. The valve is carried on the eyebolt 18, on which is provided a nut 19 on the under side of the valve for setting and adjusting the same.

20 represents an eyebolt passing through the bell, the bell being secured between the nut 21 below and the flanged nut 22 above the same, and thus leakage around the bolt is securely prevented.

23 represents a rod connecting the eyebolt 20 with the eyebolt 18 and forming a flexible connection between the bell and the valve supported therefrom.

24 represents a coiled spring surrounding said rod and bearing against said eyebolts to maintain stability of the valve, while not interfering with the flexibility of the connection.

Above the bell is arranged a diaphragm 25 of such flexibility as to permit the free vertical action of the bell and valve, but of sufficient stability to prevent lateral action and retain the valve in its proper vertical relation to its seat. Above and below said diaphragm and between the flanged nuts 22 and 26 are arranged the corrugated tension-plates 27 and 28, adapted to be pressed together between said nuts to take up any slack that may arise or occur in the diaphragm, said diaphragm secured at its periphery upon the wall of the regulator, being compressed thereon by the lap of the head 29 of the regulator, which is fastened down upon the wall by the screws 30 passing through the same. Said diaphragm is so secured at its periphery and at its center around the eyebolt as to form an air-tight chamber below the same.

31 represents weights which, if desired or found necessary, may be placed upon the nut 26 above the diaphragm to regulate the pressure that will cause the rise and fall of the bell.

On the head 29 of the regulator is threaded the cap 32, having a central threaded opening in which is inserted the reversible screw-plug 33, hereinafter more particularly noted.

Pins or stops 34 are arranged in the wall of the regulator a suitable distance above the bell to prevent accidental tilting thereof out of the sealing liquid.

Immediately below the valve is provided a diaphragm 35, having the perforations 36 secured at its periphery upon the lug 37 by the ring 38 and screws 39 passing through the same, and at its center connected with the valve by compression between the nuts 19 and 40 on the eyebolt 18. Said diaphragm, like the diaphragm 25, is of such flexibility as to permit the vertical action of the valve, while sufficiently stable to prevent lateral action, its function being to retain the valve in the line of its seat.

Upon the body of the regulator is threaded a cap 41, having an inlet-opening 42, provided with a threaded external collar 43 for the attachment of the regulator to the supply-pipe. Immediately within said inlet-opening is arranged a deflector 44, provided toward its periphery with the perforations 44^a, its central portion being without perforations, by which arrangement of the perforations the inflow of gas under pressure from the supply-pipe is deflected laterally and enters the valve-chamber at the side of and away from the valve and is thus prevented from acting upon and interfering with the free action of the valve.

The operation is similar to that in all this class of regulators. The gas entering from the supply-pipe through the inlet-opening passes the valve and enters through the port into the gas-chamber formed under the bell, and this chamber being sealed by the immersion of the edge of the bell in the sealing liquid no gas can escape therefrom, and it passes out through the service-pipe to the point where it is to be used. The weight on the bell is regulated by the weights 31 to give such pressure upon the gas in the gas-chamber under it as will yield in the service-pipe such a supply of gas as may be required and will be properly consumed in the service and no more. When greater pressure than this is given through the supply-pipe, such pressure acting upon the bell will lift the valve toward its seat, thus shutting off the supply admitted to the gas-chamber and the pressure on the bell, so that the supply of gas admitted to the gas-chamber and the consequent supply to the service are regulated and controlled by the rise and fall of the bell, and by proper adjustment of the weights upon

the bell this pressure to the service may be regulated to a very great nicety, and the upper diaphragm being so secured as to form an air-tight chamber no gas can escape therefrom if by accident any escape from the gas-chamber below the bell, nor can any dust or other foreign matter enter the chamber from without or the mercury escape if the regulator be accidentally upset. When for any reason it is desired to cut out the regulator and give the full pressure of the supply-pipe to the service-pipe, the screw-plug 33, which is formed with a head 45, a solid screw-threaded portion 46, and a slotted screw-threaded portion 47, the slot 48 therein extending partly through the head, has the solid screw thereof inserted in the cap, said screw being of such length as to bear upon the end of the valve-stem and depress and hold open the valve. When the apparatus is in use as a regulator, said plug is reversed and the slotted screw inserted in the cap, which, being shorter, does not reach the valve-stem, while the slot in the screw and head gives an indirect channel for the in and out flow of the air to the chamber above the diaphragm, thus providing for the free action of the diaphragm and of the bell. Such air-passage forming an indirect communication between the inside and outside of said chamber is of great advantage in preventing the entrance of dust, bugs, and the like into said chamber to lodge upon the diaphragm and interfere with its proper action.

49 represents a weight which may be in the form of a ring lying upon the diaphragm to automatically regulate the tension thereof until it may become necessary to take up the slack therein by compression between the tension-plates 27 and 28.

I claim—

1. In a gas-pressure regulator, having a liquid-sealed gas-chamber the combination with the bell forming said chamber of a port for admitting the gas into said chamber, a sleeve surrounding said port providing a thin-edged valve-seat, a valve for closing and regulating the flow of gas through said port, and a spring-controlled flexible valve-stem connecting said valve with the bell substantially as set forth.

2. In a gas-pressure regulator having a liquid-sealed gas-chamber, the combination with the bell forming said chamber of a valve for regulating the flow of gas into said chamber, a flexible valve-stem connecting said valve with said bell, and a spring arranged between the valve and the bell, substantially as and for the purpose set forth.

3. In a gas-pressure regulator having an internal liquid-containing seal-cup and an inlet-port, the combination with a bell or float arranged in said cup, and a valve connected with the bell for regulating the flow of gas through said port, of an imperforate diaphragm arranged above the bell, embracing the valve-stem and secured at its periphery upon the body of the regulator, substantially as set forth.

4. In a gas-pressure regulator having an internal liquid-containing seal-cup, and an inlet-port, the combination with a bell or float arranged in said cup, and a valve connected with the bell for regulating the flow of gas through said port, of a diaphragm arranged above the bell embracing the valve-stem and secured at its periphery upon the body of the regulator, opposing corrugated tension-plates embracing said diaphragm, and oppositely-disposed flanged nuts on the valve-stem bearing upon said plates for compressing the same to regulate the tension of the diaphragm; substantially as set forth.

5. In a gas-pressure regulator having an internal liquid-containing seal-cup, an inlet-port, the combination with a bell or float arranged in said cup, and a valve connected with said bell for regulating the flow of gas through said port, of a diaphragm arranged above said bell embracing the valve-stem, and secured at its periphery upon the body of the regulator, a weight arranged upon the diaphragm to automatically regulate the tension thereof, opposing corrugated tension-plates embracing said diaphragm, and oppositely-disposed flanged nuts on the valve-stem bearing upon said plates for compressing the same to take up any slack in the diaphragm and regulate the tension thereof; substantially as set forth.

6. In a gas-pressure regulator having an internal liquid-containing seal-chamber, and an inlet-port, the combination with a bell or float arranged in said cup, and a valve connected with said bell for regulating the flow of gas through said port; of an imperforate diaphragm arranged above said bell embracing the valve-stem and secured at its periphery upon the body of the regulator, a cap secured upon the head of the regulator, having a central opening, and a reversible slotted screw-plug in said opening providing an air-passage into the chamber above said diaphragm to permit the free action thereof substantially as set forth.

7. In a gas-pressure regulator a cap secured upon the head of the regulator and having a central opening, and a reversible slotted screw-plug in said opening, substantially as and for the purpose set forth.

8. In a gas-pressure regulator having a bell or float, and a diaphragm secured to the body of the regulator above the bell, a cap secured upon the head of the regulator having a central opening, and a reversible slotted screw-plug in said opening providing an air-passage into the chamber above the diaphragm.

9. In a gas-pressure regulator a reversible screw-plug consisting of the head 45, the solid screw-threaded portion 46 on one side of said head, and a slotted screw-threaded portion on the other side, said slot extending into said head substantially as set forth.

10. In a gas-pressure regulator having liq-

uid-containing seal-chamber, and a port for admitting gas into the regulator, the combination with a bell or float arranged in said seal-chamber, an imperforate diaphragm arranged above said bell, embracing the valve-stem and secured at its periphery upon the body of the regulator, and a valve having a flexible spring-controlled valve-stem connected with said bell for regulating the flow of gas through said port; of a perforated diaphragm below said valve embracing the valve-stem and secured at its periphery upon the body of the regulator; substantially as set forth.

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Witnesses:
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