A. KIPP, Jr. & H. MURPHY.

GAS-REGULATOR.

No. 188,740. Patented March 27, 1877.

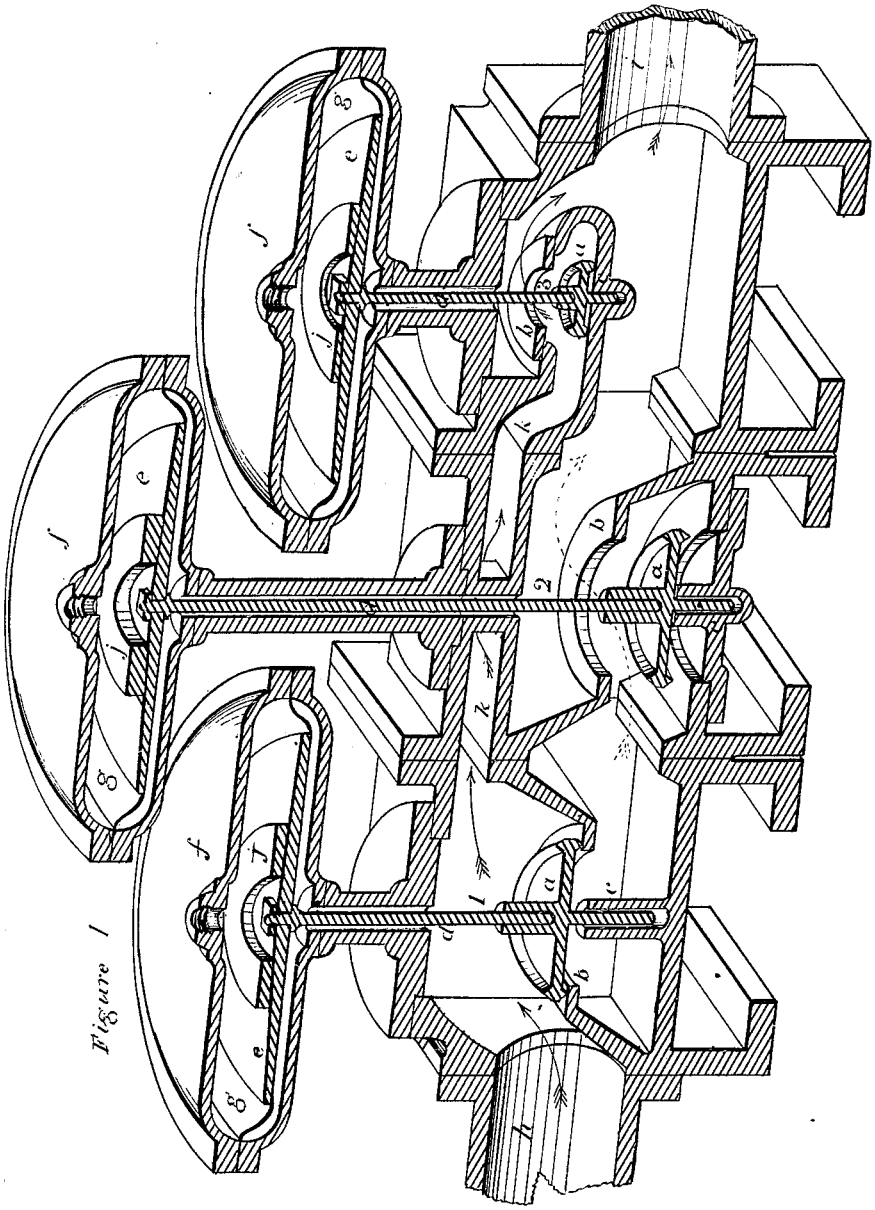

Figure 1

Witnesses:

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ABRAHAM KIPP, JR., AND HUGH MURPHY, OF SING SING, NEW YORK.

IMPROVEMENT IN GAS-REGULATORS.

Specification forming part of Letters Patent No. **188,740**, dated March 27, 1877; application filed November 23, 1876.

To all whom it may concern:

Be it known that we, ABRAHAM KIPP, Jr., and HUGH MURPHY, both of Sing Sing, Westchester county, State of New York, have invented an Automatic Gas-Regulator for Night and Day, of which the following is a specification:

In towns where there are great differences in the altitude of the streets a difficulty is found to exist in the effects of the unequal pressures of the illuminating-gas at the varying levels above the source of supply. It is estimated that for every one hundred feet of elevation an increase of pressure of about one inch of the water-gage is experienced, so that when the pressure at the lower level is barely sufficient the excess of pressure at positions one hundred, two hundred, or three hundred feet higher is so great as to cause wasteful blowing at the burners and excessive leakage of the pipes, mains, &c., especially in the daytime, when but little gas is legitimately used. Numerous regulators have been tried, or are now in use, to remedy the difficulties alluded to; but they are more or less troublesome or inefficient. To avoid excessive waste by leakage it is customary to partially shut off the gas at the works to about one-third of the pressure used at night; but this, though effective in districts near the same level with the gas-works, is of little avail in stopping the waste at points of much higher altitude, where the different specific gravity of the gas, compared with the outside air, causes great increase of internal pressure as the mains ascend above the level of the works.

To obviate this by ordinary means requires much attention to regulation at numerous points on the line of mains; and the object is at best but imperfectly attained by the means in use.

The object of our invention is by a self-acting device to maintain either a day or a night pressure at all altitudes, controlled at the works alone, which, at either the greater or lesser pressure, shall be constant and equal at the several levels on which the regulators are situated without regard to their elevation, the only variation being that due to the rise of the main between one regulator and another. The sudden increase of pressure, and consequent blowing at burners, following the extinguishment of lights in numerous stores when the hour of shutting up arrives, is also obviated by this invention.

The invention consists in the combination of three valves, each controlled by a flexible diaphragm, with a system of gas passages, the same being situated between the supply and distributing mains, and forming a part thereof.

The accompanying drawing, Figure 1, represents a longitudinal section, in perspective, of the apparatus.

Three valves, numbered, respectively, 1, 2, and 3, being of similar construction, one description will suffice; therefore they are lettered alike. *a a a* are disk-valves, having V-edges, which close onto flat seats *b b b*, this form of edge having advantages over cones or other forms in their non-liability to stick to their seats. *c c c* are guides. *d d d* are vertical stems connecting the valves with disks of metal *e e e*, which disks are joined to the internal peripheries of flattened cases *f f f* by membranes or other suitable fabrics, *g g g*, together forming flexible gas-tight diaphragms, which, being acted on by the gas, raise their respective valves, when the pressure on their under surfaces exceeds the weight with which they are loaded. The upper sides of the diaphragms are exposed to atmospheric pressure admitted through openings in the cases. The valve-stems rise through necks connecting the space under the diaphragms with the passages below, the gas in which is to control the valves. Valve No. 1 opens, and valves Nos. 2 and 3 close, by the upward pressure of the gas on their respective diaphragms. *h* is the inlet or main from the works, and *i* the outlet or distributing main. *j j j* are the weights on the valves.

For further explanation, we will suppose that it is desirable to maintain a pressure of 1.5 inch of water at night, when the gas is in full demand, and one-third of that, or 0.5, in the day time. When the gas coming from the holder is turned on under the night-pressure, it enters by the main *h*, passing to the closed valve No. 1, which, being loaded only to resist a pressure of, say, 1.2 on the under side of its flexible diaphragm, rises and admits the gas to pass to the valve-opening No.

2, and through it to the distributing-main *i*, as shown by the arrows. This valve No. 2 is designated the "night-pressure valve," and is loaded, so as to remain open at any pressure in the distributing-main under 1.5, and at any pressure above that begins to close by the rising of its diaphragm. This valve therefore cuts off any excess of pressure above that it may be adjusted for, so long as a higher pressure is maintained at the works. When the gas at the works is reduced to the day-pressure, 0.5, or any pressure under 1.2, the valve No. 1 fails to be sustained by its diaphragm, and consequently closes. The gas then seeks the outlet by the passage *k*, leading to valve No. 3, or "day-pressure valve," which is similar in construction to No. 2, except that it is of smaller size, and is so loaded as to close at the outlet gas-pressure, 0.5, and to remain closed at all pressures exceeding that, thus cutting off any higher pressure of gas flowing through the passage *k* from the mains below it.

The effect, then, of the combination is, when the entering gas has a pressure of anywhere between 0.5 and 1.2, to maintain a constant pressure of 0.5 at the outlet. When, however, the initial pressure is raised above 1.2, the passage to the night-pressure valve No. 2 is opened by the rising of valve No. 1. All pressure above 1.5 is checked by the partial closing of valve No. 2, which thus maintains a constant night-pressure, whatever the pressure over 1.5 in the main below may be. In ascending mains a difference of about 1.0 in the pressure of the gas per one hundred feet of altitude is said to exist, dependent on the varying specific gravity of the gas. It is therefore necessary to place regulators at such frequent intervals as may be required to keep the pressures within a certain limited range of variation. For instance, if a regulator near the works maintains the pressures, respectively, at 0.5 and 1.5, by the time the mains had attained the altitude of fifty feet, the pressures would be 1.0 by day and 2.0 by night, each having increased five-tenths of an inch by water-gage by the levity of the gas. In this case the load on the valve No. 1 must be such that the combined day-pressure and that caused by the elevation may not cause it to lift. Another of the regulators there placed would again reduce the pressures to the normal standards—viz., 0.5 and 1.5—and maintain those pressures in the mains above it, subject to the gradual increase due to the continued ascent of the mains, as before. It will be observed that the change of pressure from that of the day to that of the night, and vice versa, being made at the works, all the regulators, being properly adjusted in the first instance, are at once affected in the same manner as the first or lower one, at whatever elevation they may be placed, by the pressure in the mains alone without necessitating any local or other attention, or requiring an auxiliary pipe leading to the works, as in some regulators. The regulators must not, however, be situated at altitudes so distant from each other as to cause the ascending pressure to exceed the difference between the day-pressure and that which valve No. 1 is loaded to resist.

No water being employed in this device, it is not subject to the troubles which occur in instruments using fluids. No dangerous leaks are liable to occur, and should the diaphragms become defective, they are easy of access and not costly to replace. The whole apparatus may be securely placed in chambers on the line of the mains, of which it forms a part, out of reach of accident. Small tubes leading to the surface will afford atmospheric connection with the upper sides of the flexible diaphragms, and with this arrangement the apparatus would work as well submerged in water as it would in air. Another important point in this invention is, that it will not increase the number of connections above what are usually employed.

We claim as our invention—

The combination of the shut-off valve No. 1 with the night-pressure valve No. 2 and the day-pressure valve No. 3, in conjunction with the several gas-passages and appurtenances, substantially as described, for the purpose of regulating automatically either a day or a night pressure, the change from one to the other being effected through the medium of the pressure of the gas turned on or off at the works.

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Witnesses:
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