2 Sheets--Sheet 1.

L. BAUMEISTER.

Apparatus for Lighting, Extinguishing, and Regulating Gas-Flames.

No. 158,887. Patented Jan. 19, 1875.

Fig. 1.

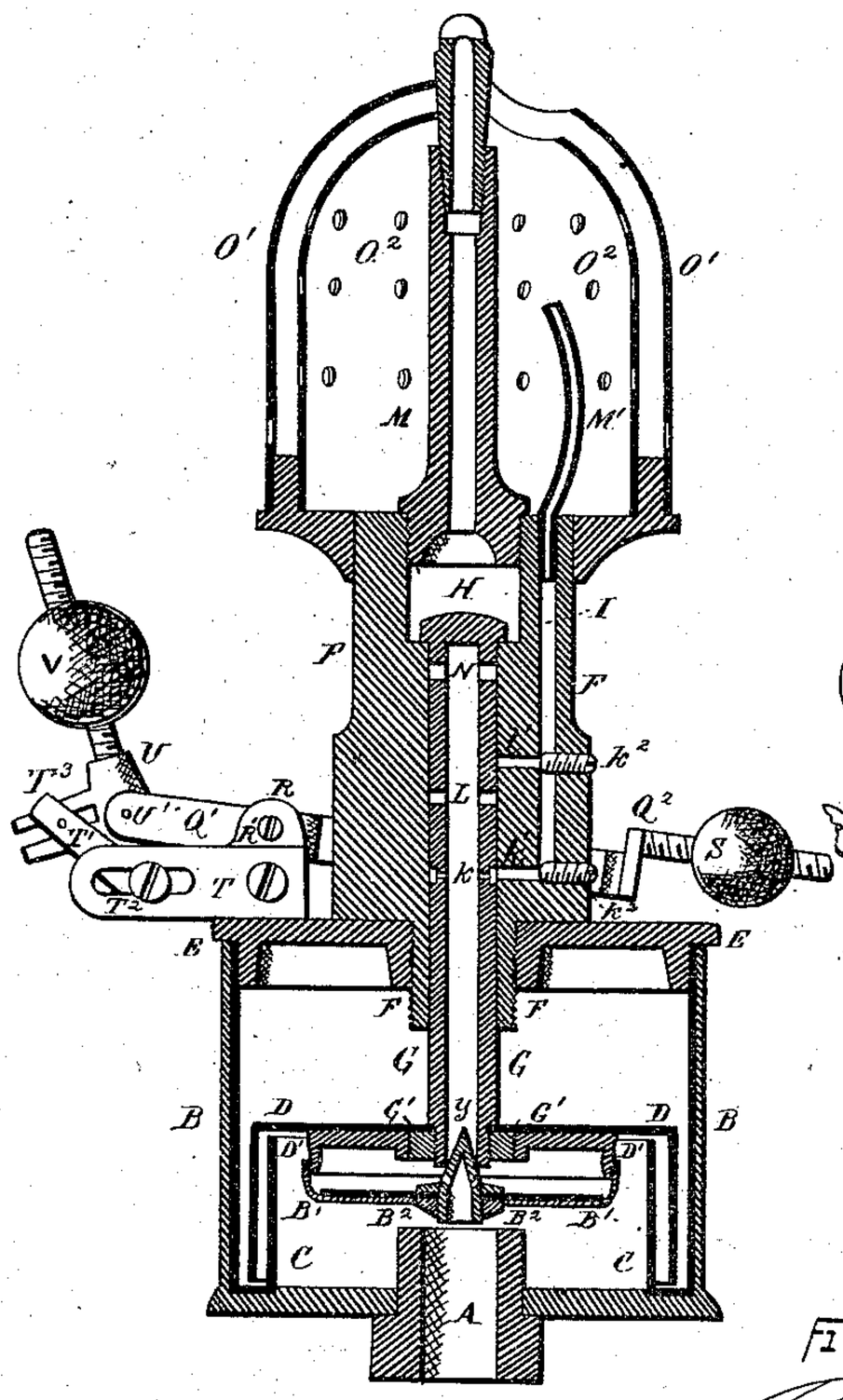


Fig. 2.

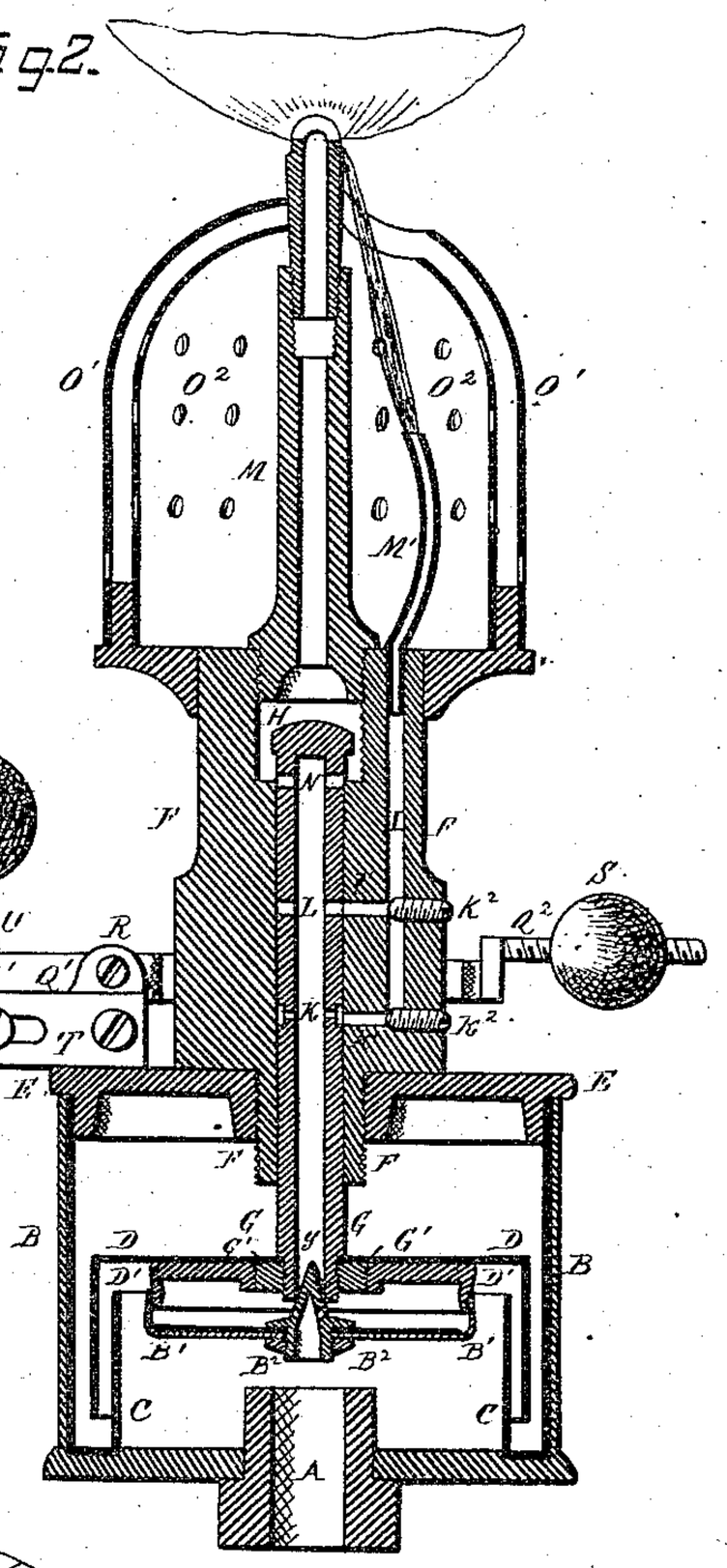
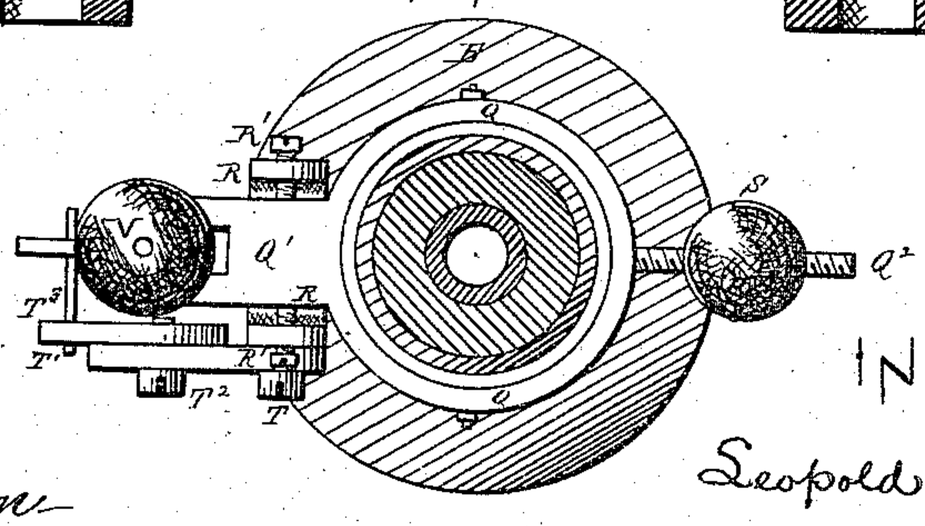


Fig. 3.



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2 Sheets--Sheet 2.

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Fig. 3.

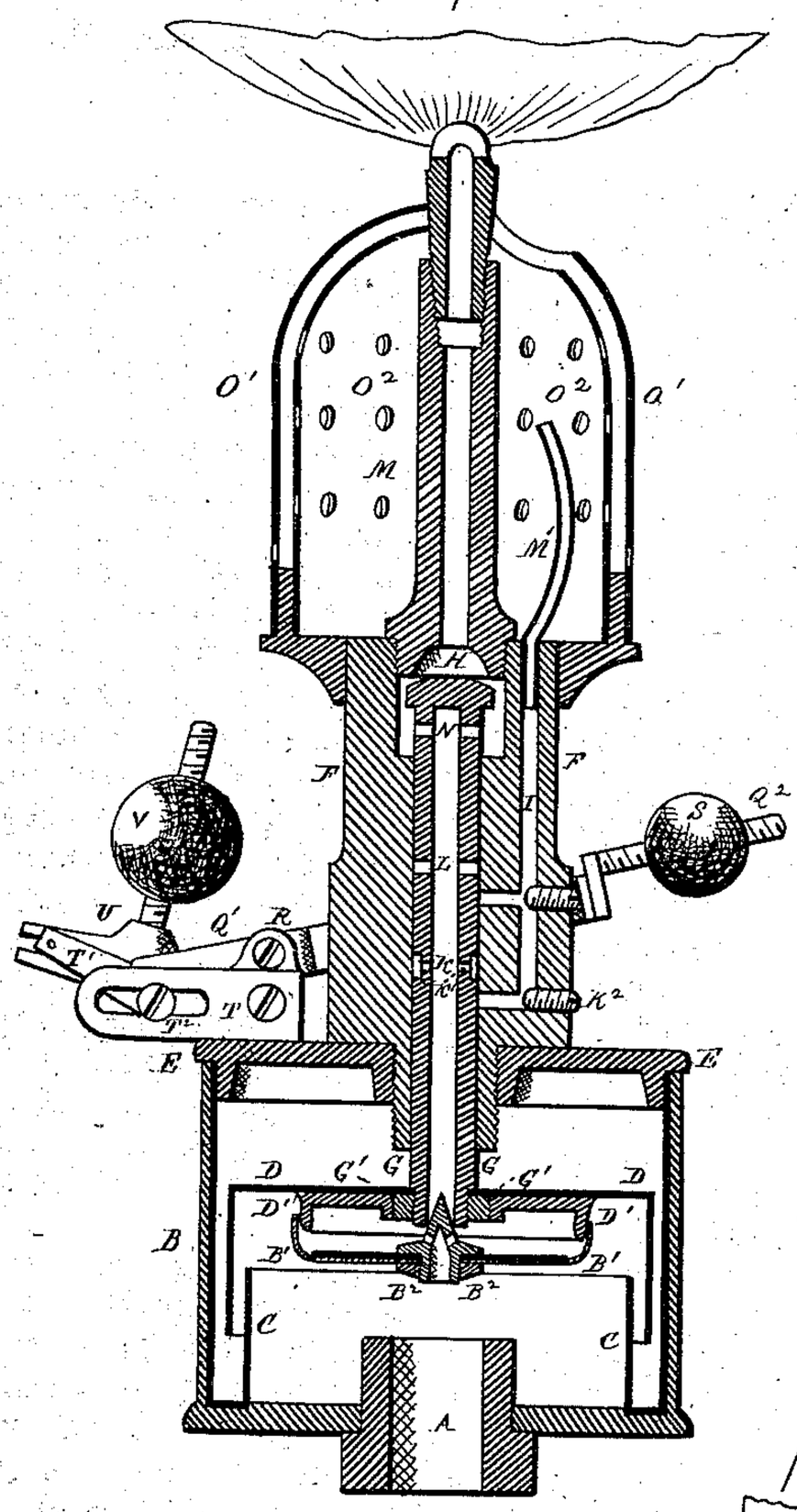


Fig. 4.

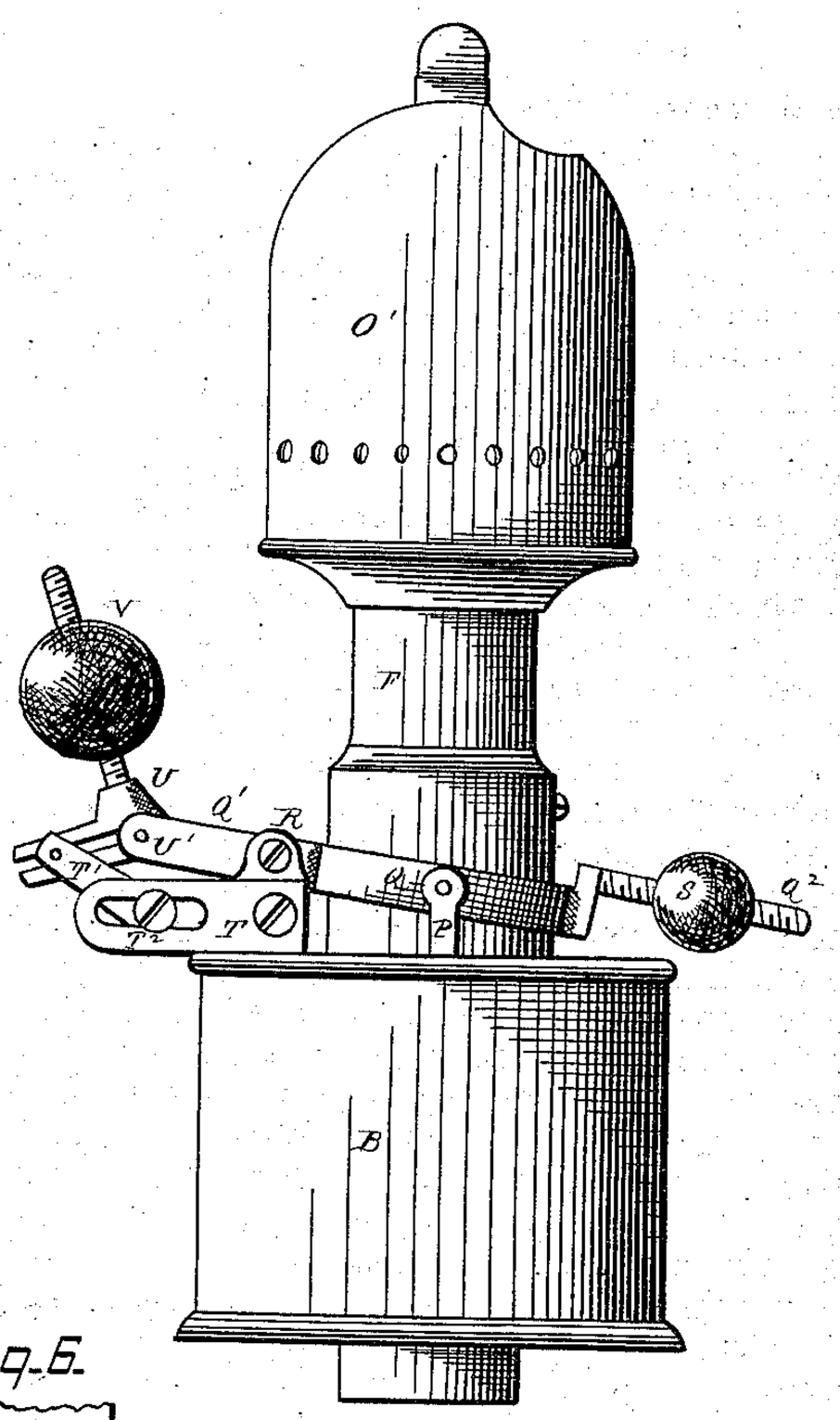
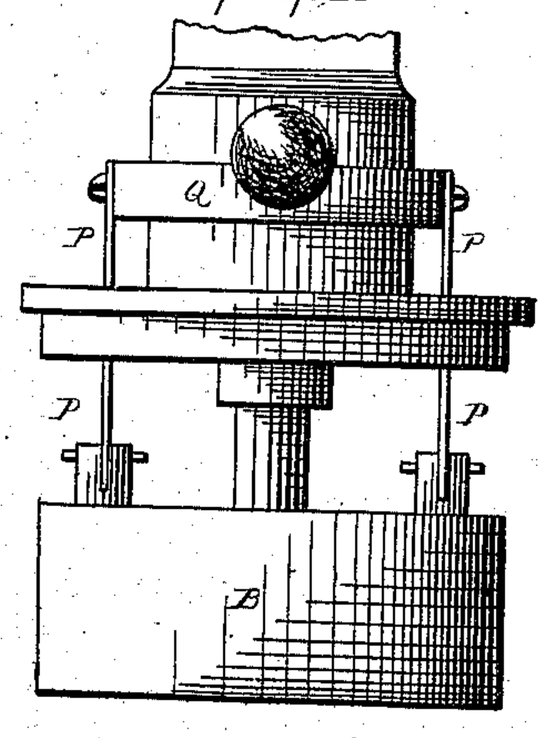


Fig. 6.



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UNITED STATES PATENT OFFICE

LEOPOLD BAUMEISTER, OF GAGGENAU, GERMANY, ASSIGNOR TO HIMSELF AND MICHAEL FLÜRSCHEIM.

IMPROVEMENT IN APPARATUS FOR LIGHTING, EXTINGUISHING, AND REGULATING GAS-FLAMES.

Specification forming part of Letters Patent No. **158,887**, dated January 19, 1875; application filed December 28, 1874.

To all whom it may concern:

Be it known that I, LEOPOLD BAUMEISTER, of Gaggenau, in the Grand Duchy of Baden and the Empire of Germany, have invented certain new and useful Improvements in the Construction of Apparatus for Lighting, Extinguishing, and Regulating Gas-Flames, of which the following is a specification:

My invention has for its object to enable gas-burners to be lighted, extinguished, and regulated automatically, and to this effect to maintain a minute flame in an auxiliary burner, by which the main burner is ignited; to admit the gas to the main burner and shut it off therefrom by alternately increasing and reducing the gas-pressure; to regulate the ignition and extinction of the flame at different stages, which may themselves, to a certain degree, be independent of each other; to make the ignition and extinction momentaneous as soon as certain stages of the pressure are reached, and to maintain the flame at a uniform size irrespectively of the pressure of gas; and it consists in the employment of a sliding tube or slide-valve, with orifices corresponding to the main and auxiliary burners respectively, through which, when such sliding tube or slide-valve is actuated by the gas-pressure, the gas is admitted to the main burner and shut off from the auxiliary one, and vice versa; of balance-weights, with shifting centers of gravity, to adjust the pressure at which the ignition or extinction is to take place; of a perforated plug, working within an orifice and fixed upon a diaphragm hermetically, but loosely fitted, and placed within the passage of the gas; of a double hood, with alternating holes.

My invention consists, first, in a main burner having an auxiliary burner, at which a minute flame is maintained, by means of which the gas at the main burner is ignited, the two being connected with the main pipe by means of a regulating device that will supply the gas to the main burner at the maximum pressure, and cut it off from the auxiliary burner at the minimum pressure, and vice versa, so as to keep the gas burning at one or the other burner at all times, as and for the purposes to be fully hereinafter set forth; second, in a new and improved regulating device for alternately supplying the gas to the main burner and auxiliary burner as the pressure of the gas varies in the pipes, as will be hereinafter fully specified; third, in the improved regulating-gear consisting of a series of levers with shifting weights, connected with the regulating device, by which the decrease and increase of pressure may be regulated, substantially as hereinafter set forth; fourth, in a double hood or chamber provided with alternating holes surrounding the auxiliary burner, for the purpose of supplying the same with air and shielding it from drafts, substantially as described; fifth, in a diaphragm furnished with a plug, and attached to an inverted bell, in combination with a sliding valve, to regulate the flow of gas to the main and auxiliary burners, substantially as herein described.

In the accompanying drawings, Figures 1, 2, and 3 are vertical sections of my improved self-lighting gas apparatus for street-lamps, showing the three different positions of the sliding tube. Fig. 4 is a plan view of the same. Fig. 5 is a side view of part of the apparatus. Fig. 6 is a front elevation of the apparatus.

In Figs. 1, 2, 3, and 6, A is a conical tube, through which the gas enters, and by means of which the apparatus is fitted to the pipe of the street-lamps for the lighting and extinction whereof it is to be used. B is an iron casing, having at its bottom an annular recess, C. This casing, instead of being made of solid iron, may consist of two sheets of iron plate placed inside one another, so that the interior one forms the inside of the recess. This annular recess or groove C is filled with mercury to about three-quarters of its depth. An iron float or small gas-holder, D, is dipped in the mercury in such a manner as to shut the gas off hermetically. On the casing B a cover, E, is mounted, upon which the cylindrical guide-piece F is screwed. To the top of the float D a tube, G, made of hard metal, is attached. The top end of this tube consists of a solid head-piece, H, and the tube G itself is so fitted into the guide-piece F as to slide up and down with facility, and without allowing any gas to pass between the sides. Within the side of the tube G holes are pierced at three different places, N, L, and K, and in connection

with the lowest of these holes circular recesses K^1 are provided. Within the guide-piece F a longitudinal canal, I, is made parallel to the central one, in which the tube G slides, and these two canals communicate with one another by means of the transversal openings K and L, which are closed up from without by means of the regulating-screws K^2. Above the head-piece H the central canal is enlarged, so as to allow the head-piece to pass up and down. To the top of the central canal the burner-pipe M is fitted, while the lateral canal, I, is provided with a small bent pipe, M′, the opening of which is diminutive. Thus M is the main, and M′ the auxiliary burner-pipe. Both are inclosed in two hoods, O^1 O^2, superposed to one another, and furnished with small alternating air-holes, in such a manner as to secure a constant supply of air, while excluding every draft from the interior of the hood. At the top of this double hood or casing a double opening is made for the burner proper, and for the igniting-flame proceeding from the auxiliary burner to pass through. To the top of the float D, and diametrically opposite to one another, two supports, P, are fitted, Fig. 6, which pass through the top of the casing E, and are attached to the hoop Q, which passes around the guide-piece F, and is connected with the lever-arms Q^1 Q^2. To the cover E of the casing B a support, R, is attached, having a semicircular top, through which the conical ends of the set-screws R′ R′ enter, so that the horizontal axis of this support and of the screws forms the fulcrum of the lever-arm Q^1. This lever-arm has a fork at its end, in which the cranked lever U moves freely upon a spindle, U′, and a balance-weight, V, is attached to the top of the cranked lever U. The lower end of the lever U is fork-shaped. Upon the cover E a horizontal arm, T, is mounted, which has a groove at its end for a movable arm or limb, T^1, to slide to and fro, the position of which is adjusted by a set-screw, T^2, traveling in the groove. To the extremity of the limb T^1 a long pin, T^3, is fixed, which moves freely in the forked end of the lever U. To the lower surface of the float D, Figs. 1, 2, and 3, an annular plate, D′, is attached, between which and the end of the tube G a packing-ring, G′, is fitted. Around the annular plate a diaphragm, B^1, made of an animal membrane, of leather, of thin metal, or any other flexible material, is hermetically attached. This diaphragm carries a circular metal plate, B^2, upon which the conical plug *y* is fixed. This plug moves freely within the lower open end of the tube G, or within the ring G′, into either of which it may be fitted. It is perforated by a series of holes, the size of which corresponds to the size of the thin metal plate B^2, upon which the pressure of the gas acts directly, while both these holes and the weight of the thin plate together are in their turn proportionate to the quantity of gas to be consumed. Through the pressure exerted beneath, and the counter-pressure acting above the thin plate B^1, the conical plug *y* is kept in its proper position, so that, according as the pressure increases or decreases, the open end of the tube G is closed up more or less, and by this means both the flame and the consumption of gas are preserved at a uniform rate, irrespective of the pressure at which the gas enters the apparatus.

The part of the apparatus just described acts as a regulator of the flame and simultaneously as a receptacle of gas, inasmuch as the quantity of gas consumed at a uniform rate per hour must naturally be known if once the number of hours be fixed during which the lamps are to remain lighted.

In Fig. 1 I have shown my apparatus with its various organs placed in the position they will occupy in the day-time when the main flame is not lighted. At this stage the gas enters through the joint A, beneath the float D, into the casing B, and thence proceeds to the pipe G. All the openings being shut off by the solid parts of the sides of the guide-piece F, save the canals K in the tube, which communicate with the transversal opening in the guide-piece, it is obvious that the gas can only pass through these apertures, and into the longitudinal canal I, and the auxiliary pipe M′. This gas being ignited on the auxiliary burner M′, a small flame is kept up, which is adjusted by the screw K^2 in such a manner that it may be brought to a diminutive size, and made almost invisible. This auxiliary flame keeps itself up as long as the main flame is not lighted. The double hood O^1 O^2 protects the auxiliary flame from every blast of wind, as has been explained in the foregoing.

In Fig. 2 the second stage is illustrated, at which the main flame is ignited. Upon the pressure of the gas at the works, and thence within the pipes, being raised toward nightfall, or at such other time as may be thought proper for the purpose of lighting the street-lamps, the float D is raised some distance, but not high enough to cause its bottom edge to emerge from the mercury, by which the gas is shut off hermetically. As the float D is lifted, the tube G rises. The orifice K then remains in communication with the opening K^1 in the side of the guide-piece, and the orifice L is brought opposite the canal I, while the top of the orifices N is placed in communication with the opening beneath the burner-pipe M, by which means some gas is allowed to enter the main burner. At this stage all the three sets of orifices are in communication with their burners. The quantity of gas passing into the auxiliary burner M′, through the orifices K K^1, is increased by that which enters through the openings L. The auxiliary flame being thence increased in size, shoots up through the openings of the two hoods O^1 O^2, and, upon touching the main burner M, ignites the gas which proceeds through the same. While this is going on, the float D, and along with it the tube G, continue their upward motion, and

during their progress the moment arrives when the openings K^1 and L are completely cut off from their corresponding orifices in the tube G, while the top orifices N are set entirely free for the gas to pass through them. At this stage, which is illustrated in Fig. 3, the main flame has risen to full size, and the auxiliary one has been extinguished. As soon as the pressure is reduced again, the float D, and consequently the tube G, descends again. The orifices K K^1 L L′ are again brought opposite to one another, as shown in Fig. 2, and a double current of gas presses again through the burner-pipe N, and lights itself at the main flame. As the float D and the tube G resume their lowest position, as shown in Fig. 1, the orifices N and L are shut off again, and no more gas passing then into the pipe M, the main flame is extinguished, and the auxiliary one being fed only through the set of orifices K K^1, is reduced to its minimum size.

Instead of arranging the tube G in the manner shown in Figs. 1, 2, and 3, a stationary tube may be fixed to the cover E of the casing B, and a movable tube, connected with the float D, be so fitted around the stationary one as to slide up and down, according as the gas pressure increases or decreases. In this case, the orifices may, with slight changes, be made to work in a manner similar to the one hereinbefore described, and the compensating gear may be fitted to the sliding tube directly. Moreover, to consolidate the supports P P, (shown in Fig. 6,) they may be joined together by means of cross-stays connected with the sliding tube, whereby all undue shaking or vibration is obviated, and greater efficiency imparted to the apparatus.

For the various degrees of pressure required for lighting and extinguishing street-lamps, the working of the apparatus is regulated by the variations effected in the position of the shifting weights S and V, and of the limb T^1, which is fixed by means of the set-screw T^2. The principal object of these organs is to enable the main flame being lighted instantaneously, as soon as a certain degree of pressure is reached, and extinguished with the same rapidity, as soon as a certain reduction in the pressure has taken place.

These varying pressures may be fixed, according to local requirements, within the range of the variation admissible in each individual instance.

The object of the shifting-weight S is to load the float D according to the degree of pressure desired for the ignition of the main flame. The adjustment of the position of the cranked lever U by means of the set-screw T^2 is accessory to the loading of the float D, and to the fixing of the degree of pressure; but the principal object is to determine and fix the difference between the varying degrees of pressure required for ignition and extinction. Assuming, for instance, the apparatus as shown in Fig. 1 to be so regulated as to require a gas-pressure of one and six-tenths inch to lift the float D along with the tube G, and the hoop Q, connected with it by means of the supports P P; in this case, while the hoop Q with its arm Q^2 carrying the weight S is lifted, the arm Q^1 pivoting upon the screws R′ R′ descends, and in doing so causes the spindle U′, connected with the lever U, to convert its slanting position into a vertical one by the aid of the movable limb T^1, by which the fork U is supported.

By this contrivance we arrive at the following important results: first, without the use of the lever U the float D would have its upward motion arrested at a certain point before the main flame is fully ignited, and the auxiliary flame completely extinguished, because, as soon as the gas begins to issue from the main burner, the pressure below the float D diminishes, and a further increase of pressure is required to effect a complete ignition. This drawback is met by the changing positions of the lever U, by means of which the lighting of the main flame, once begun, is completed forthwith. This effect is produced by the change in the position of the arm U′, which becomes more erect as the float D begins to rise, and by which the decrease of the pressure beneath the float is compensated, and a decrease in the counter-pressure brought about. The mode and manner in which this is achieved is clearly shown in the accompanying illustrations. In Fig. 1 the arm U′ produces the fullest counter-pressure; in Fig. 2 this arm is placed in a vertical position, and is, consequently, at its dead-point. It then produces no further counter-pressure, and the reduced pressure below the float D is sufficient to raise it to its full height, and so to complete the ignition. At this stage the arm U′ changes its vertical position for one slanting to the right, as shown in Fig. 3, and by the pressure of its weight V depresses the lever-arm Q^1, and raises the arm Q^2 until the main flame is fully ignited.

Secondly, by means of the screw T^2, the cranked lever U may be fixed at any angle, in accordance with the requirements of the case, so as to occupy a horizontal position at the dead-point of the weight V, as shown in Fig. 2, or to fall below or rise above this position, as illustrated in Figs 1 and 3. According to the angle at which this lever is fixed, the difference between the gas-pressure for igniting, and the one for extinguishing, the main flame adjusts itself. For instance, the more the arm U′ inclines to the right, the more counter-pressure the weight V exercises as against S, and the more it assists in keeping up the position of the tube G, so that the pressure below the float D must be reduced more and more before the weight S and the float D can overcome the force of the counter-weight V, and the float and the tube can be made to redescend and extinguish the main flame. In that event, for instance, this flame would require a pressure of one and six-tenths inch for ignition, and eight-tenths for extinction.

This is a very good advantage, as it frequently happens that the gas-pressure working in certain lamps descends during the night below the day-pressure; therefore, if the apparatus were to extinguish the light at the same pressure at which it ignites it, the lights would often go out just at the time when they are most needed, or else, if the igniting-pressure were fixed sufficiently low to overcome this inconvenience, the lamps might be lighted in the day-time, when the day-pressure exceeds the lowest night-pressure. This drawback is entirely obviated by my apparatus, enabling me to draw a line between the pressure required for extinguishing, and that required for igniting, the lamps. Thus, for instance, assuming I fix the pressure for ignition at one and six-tenths, and for extinction at six-tenths inch, and adjust my regulating-gear accordingly, in that event my flam s ignite in the evening when a pressure of one and six-tenths is given at the gas-works, provided the pipes be wide enough to transmit the full pressure; for, if this be not the case, a somewhat higher pressure would have to be given for a minute or two. Once lighted, my lamps will keep burning steadily during the whole night, even though the pressure were to fall as low as sixty-five hundredths inch, and they will only go out when the pressure is reduced to six-tenths inch in the morning. Once put out, they would not light again, even though a pressure of one and five-tenths inch were to be brought to bear on them during the day-time. They only ignite when the full night pressure of one and six-tenths inch is reached.

By means of the same contrivance it is easy to make arrangements for certain lamps to go out at a certain time of night—say, at twelve o'clock—and the others to burn till the morning. This is done by regulating the former at a higher extinguishing-pressure than the latter. The pressure at the gas-works must then be reduced at a corresponding rate at midnight, and brought down to its minimum in the morning.

Such variations of pressure as may show themselves in different lamps during the same space of time, being produced by differences in the level, or by the narrowness of the pipes, do not affect the working of my system in any way, as each apparatus is regulated—not according to the pressure at the works, but—according to the pressure to be reached in the lamp to which such apparatus is fitted. For instance, if at a pressure of one and six-tenths at the works the lamp A receives a pressure of one and four-tenths and the lamp B a pressure of one and two-tenths inch, and if at a pressure of six-tenths at the works A gets five-tenths and B four-tenths, then A must be regulated at one and four-tenths and five-tenths and B at one and two-tenths and four-tenths inch pressure for igniting and extinguishing, respectively.

In the act of extinguishing the lamps the working of the regulating-gear is the reverse of what it is in lighting. As the float D descends the decrease in the efflux of gas increases the pressure beneath it, and without the working of the lever U a further decrease of the pressure would have to take place in the pipe before the float D could descend completely, so as to put the main flame out altogether. It is precisely by the action of the lever U that this inconvenience is obviated. As the arm U approaches its dead-point it exercises less and less counter-pressure against the weight S. Therefore this weight presses upon the float with increased force, and hastens its descent, and as soon as the dead-point is passed the downward motion of the float is completed, the weight V assisting in producing this effect.

It is obvious that the same end might be achieved by any other method of regulation, either by means of levers, eccentric wheels, or any similar appliances, so long as the shifting of the center of gravity, and by this means a corresponding variation in the degree of pressure be effected.

In employing membranes or diaphragms I would not attach them in the usual fashion of a conical cloak, but as a cloak of a cylinder, having a solid base and top, upon which the full power of the gas-current can play, so that no power is lost in the conical attachment.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of a float, D, carrying a vertically-sliding tube, G, provided with openings, a canal, I, parallel to the tube G, and communicating with the same by openings, a main burner arranged above the sliding tube, and an auxiliary burner arranged above the canal I, substantially as described, for the object specified.

2. The regulating device for supplying the gas alternately to the main and auxiliary burner, consisting of bell D, sitting in annular chamber C, and provided with diaphragm B^1, in combination with the sliding valve G, moving in guide-piece F, and provided with apertures, as described, for opening communication to the burners, substantially as herein set forth.

3. The combination, with the bell D, of levers Q and U, connected together and with the bell, and provided with shifting or adjustable weights, for regulating the pressure of gas, substantially as described.

4. The combination, with the auxiliary burner, of the double hood or chamber O^1 O^2 surrounding the said burner, for supplying the same with air and preventing drafts, substantially as described.

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