(No Model.) 3 Sheets—Sheet 1.

J. H. WÜSTER.

APPARATUS FOR EXTINGUISHING, LIGHTING, AND REGULATING GAS LAMPS.

No. 363,781. Patented May 24, 1887.

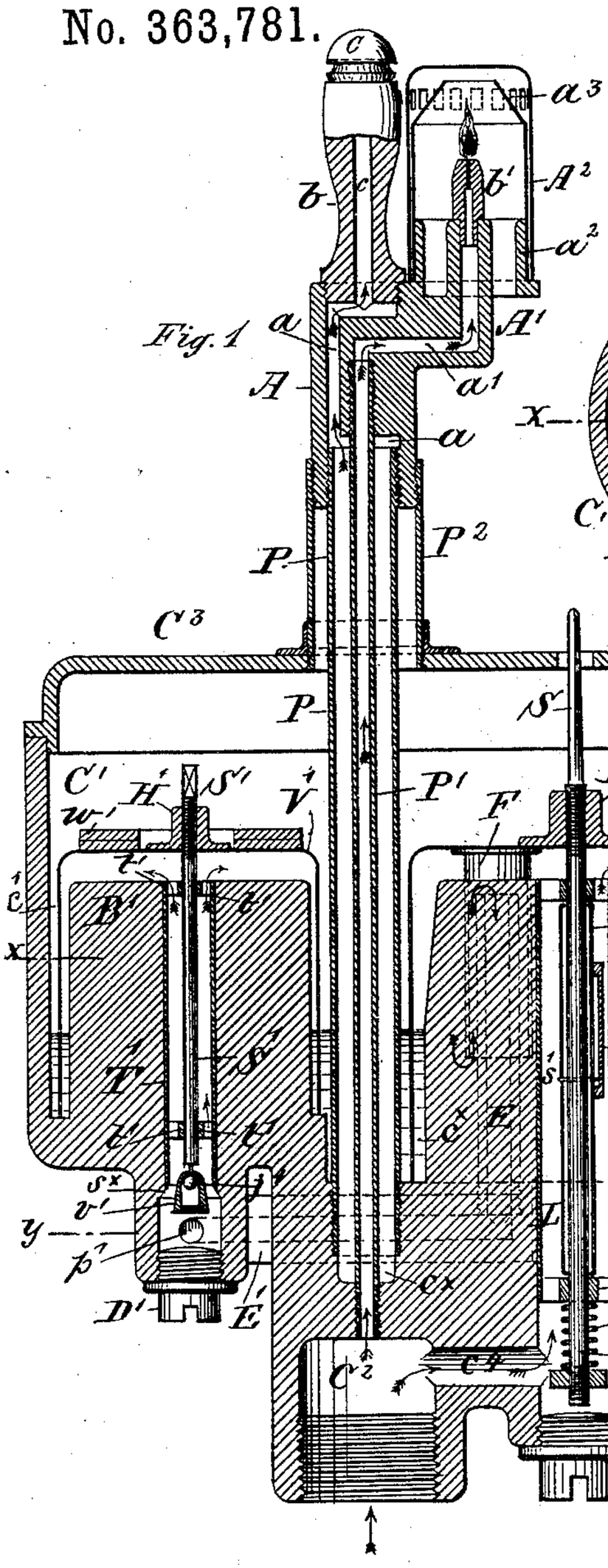


Fig. 1

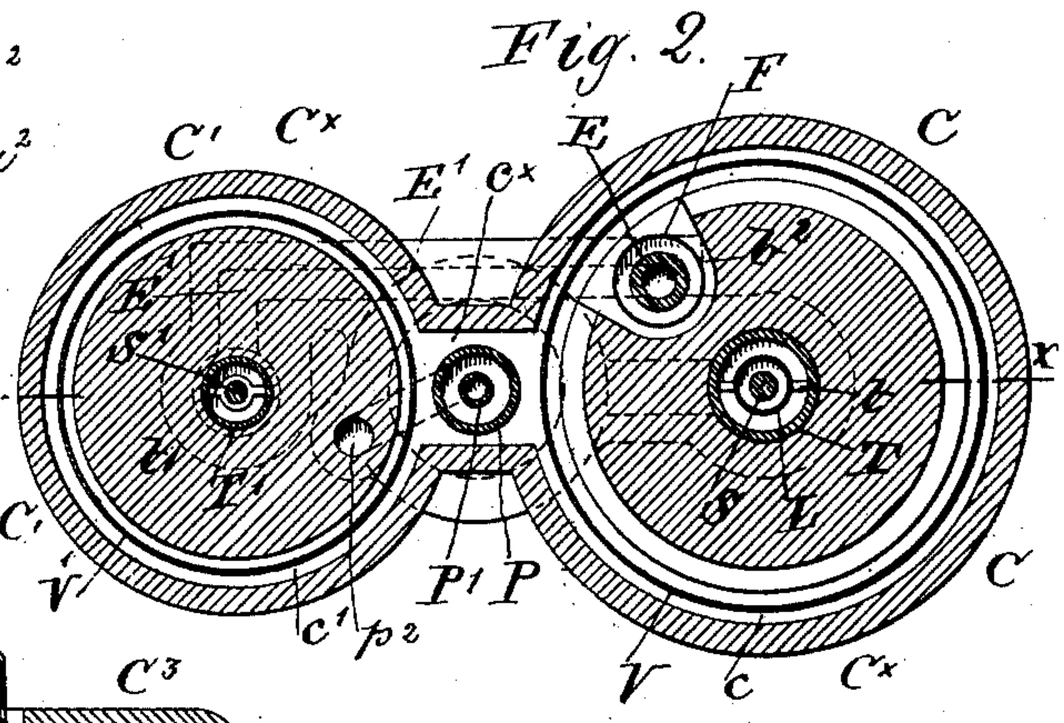


Fig. 2

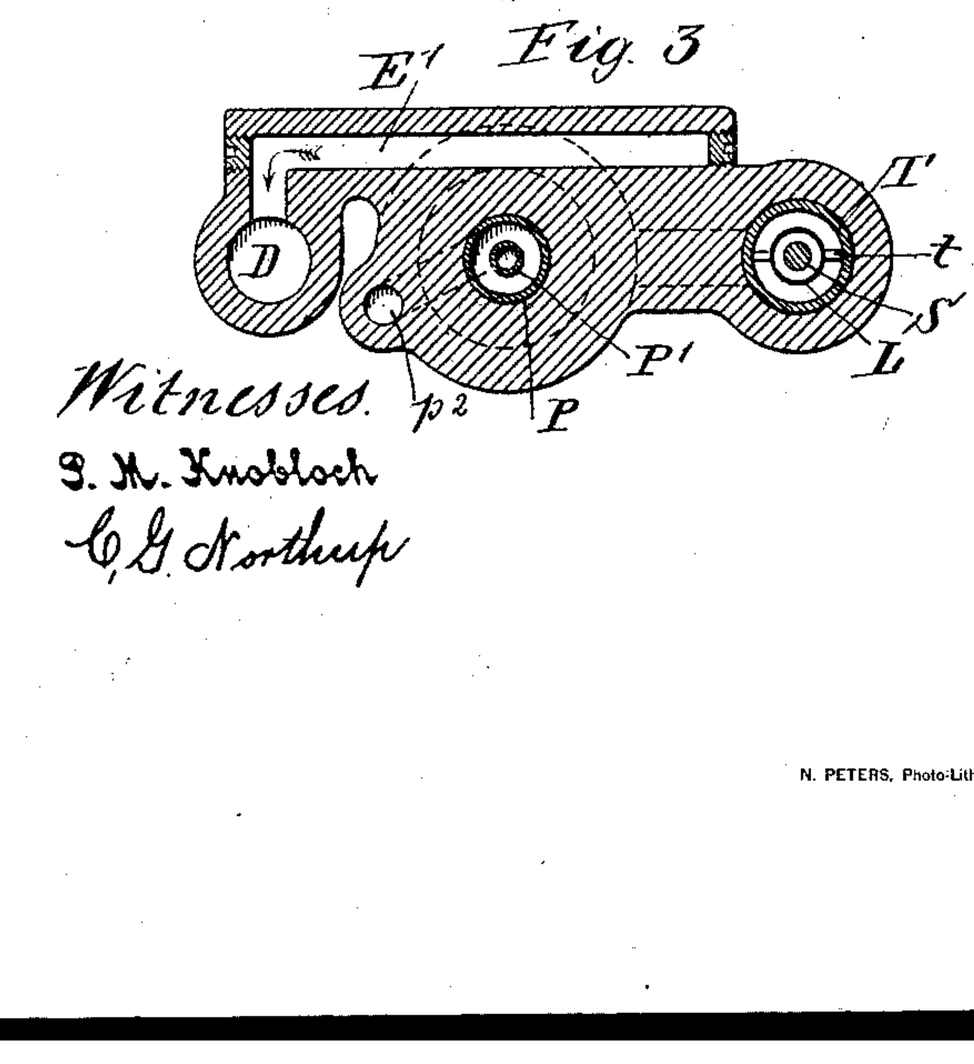


Fig. 3

Fig. 4

Witnesses.
J. H. Knobloch
C. G. Northrup

Inventor
Johann H. Wüster
by Henry Orth
atty

(No Model.) 3 Sheets—Sheet 2.

J. H. WÜSTER.

APPARATUS FOR EXTINGUISHING, LIGHTING, AND REGULATING GAS LAMPS.

No. 363,781. Patented May 24, 1887.

Fig. 5.

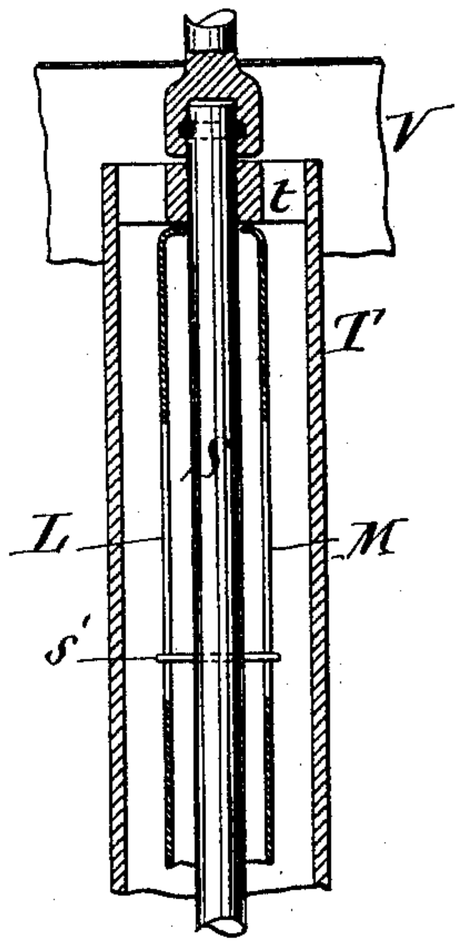


Fig. 9

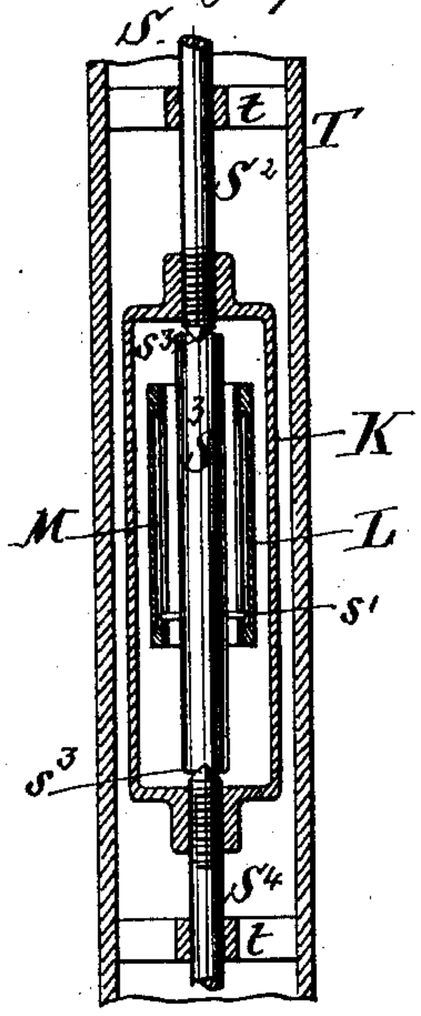


Fig. 10

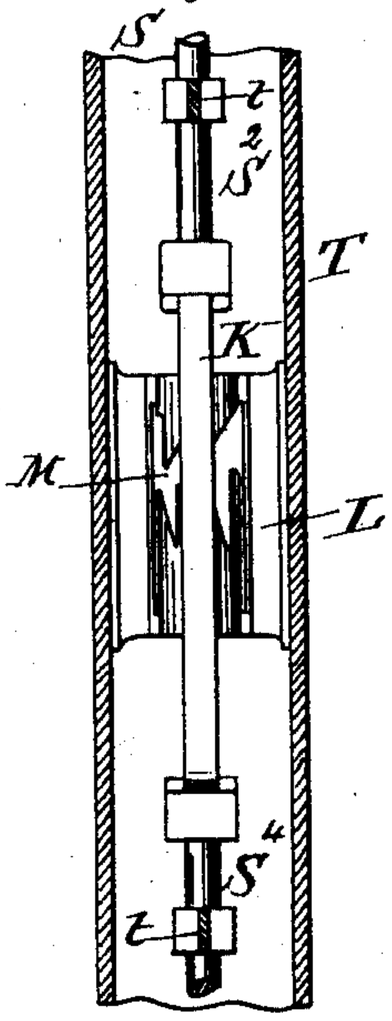


Fig 6

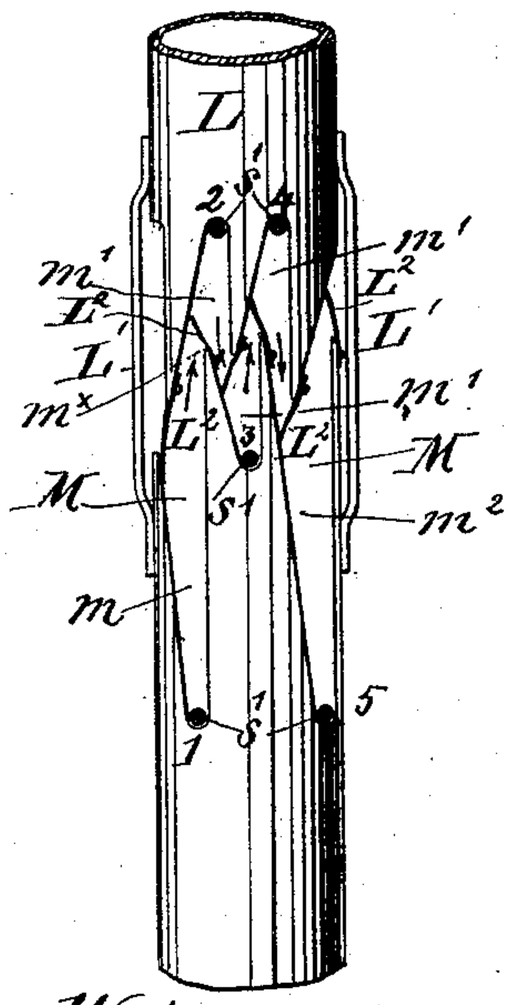


Fig. 7

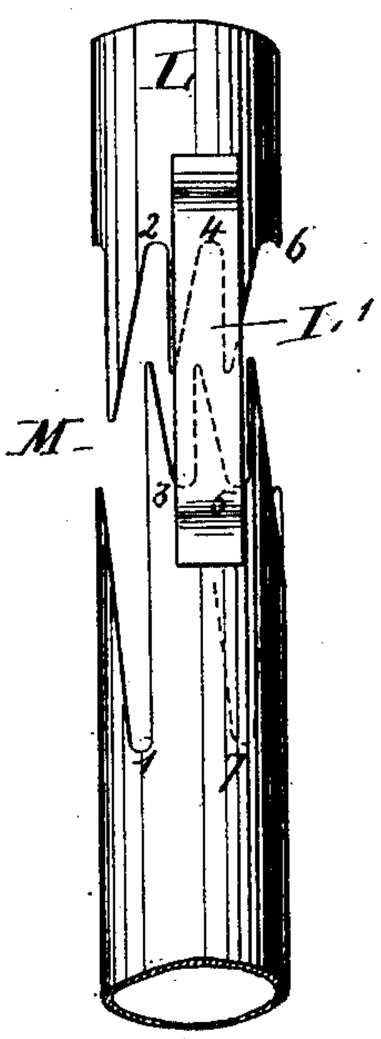
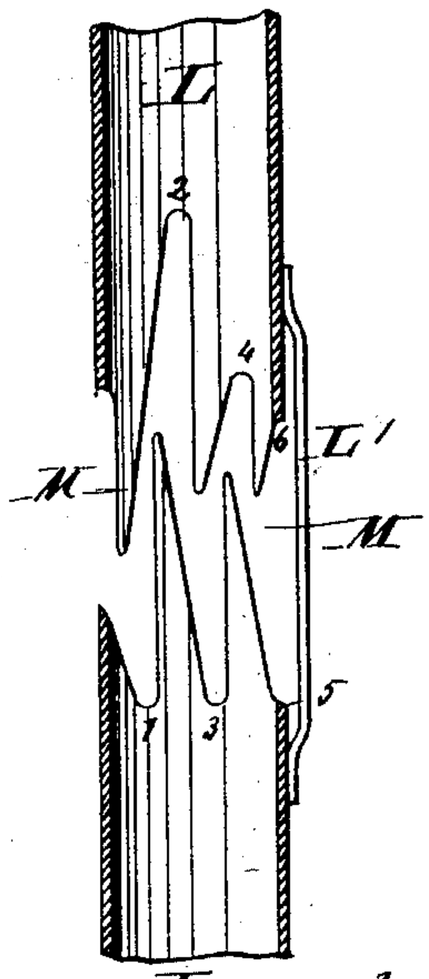


Fig. 8



Witnesses
S. N. Knoblock
C. G. Northrup.

Inventor
Johann H. Wüster
by Henry Orth
atty.

(No Model.) 3 Sheets—Sheet 3.

J. H. WÜSTER.

APPARATUS FOR EXTINGUISHING, LIGHTING, AND REGULATING GAS LAMPS.

No. 363,781. Patented May 24, 1887.

Fig. 11.

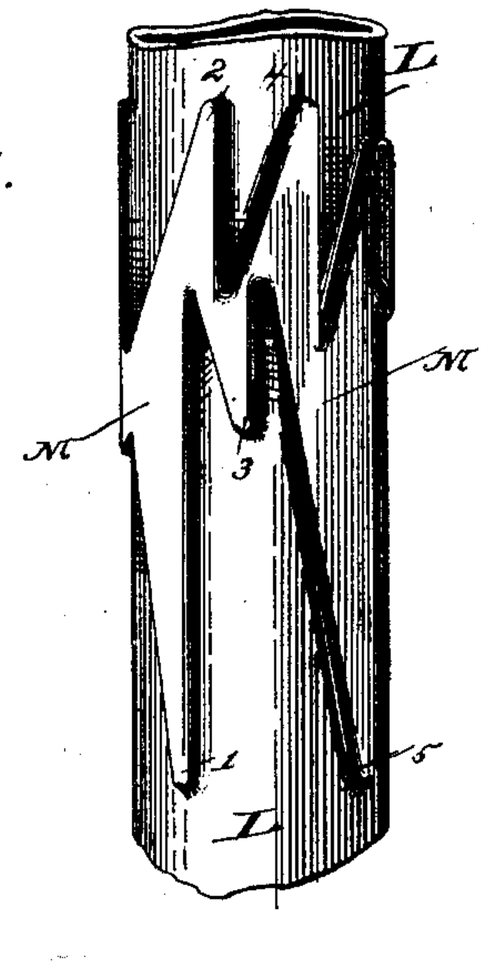
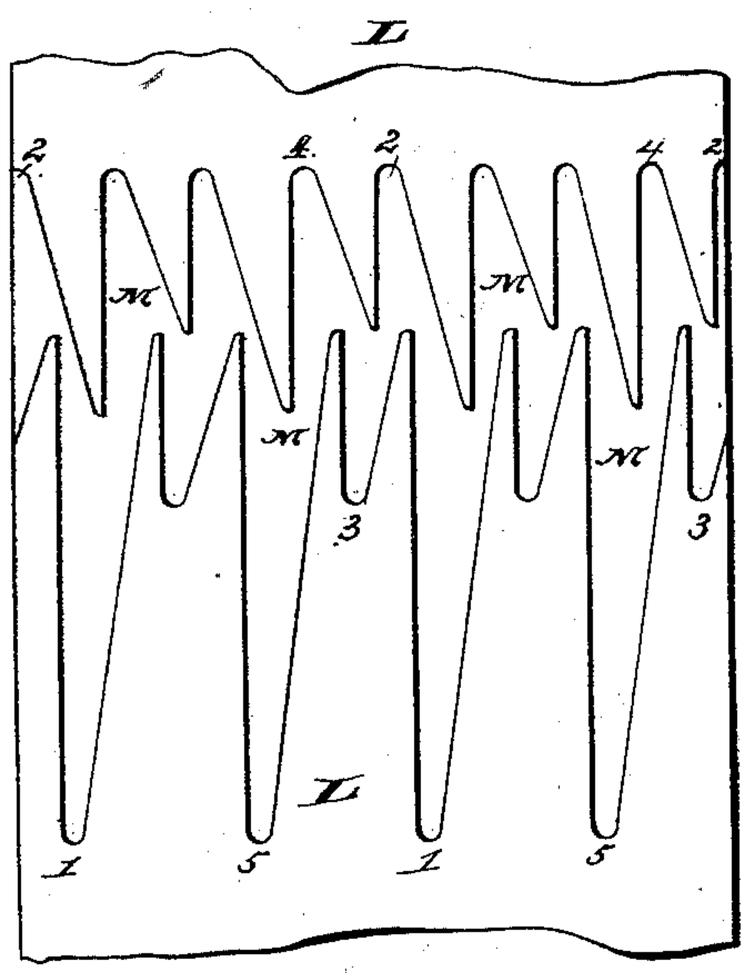


Fig. 12.



Witnesses.
Wm R Davis.
H. E. Poulter

Inventor.
Johann H. Wüster,
per Henry Orth
Attorney.

UNITED STATES PATENT OFFICE.

JOHANN HEINRICH WÜSTER, OF YBBS, AUSTRIA-HUNGARY.

APPARATUS FOR EXTINGUISHING, LIGHTING, AND REGULATING GAS-LAMPS.

SPECIFICATION forming part of Letters Patent No. 363,781, dated May 24, 1887.

Application filed August 27, 1886. Serial No. 212,000. (No model.) Patented in England July 21, 1886, No. 9,456; in Germany August 11, 1886, No. 39,166, and in France August 11, 1886, No. 177,914.

To all whom it may concern:

Be it known that I, JOHANN HEINRICH WÜSTER, a subject of the King of Prussia, residing at Ybbs, in the Province of Lower-Austria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Apparatus for Automatically Lighting, Extinguishing, and Regulating Gas-Lamps, (for which Letters Patent have been obtained in Germany under date of August 11, 1886, No. 39,166; in France under date of August 11, 1886, No. 177,914, and in England under date of July 21, 1886, No. 9,456;) and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

Referring to the drawings, Figure 1 is a vertical axial section of my improved automatic gas lighting, extinguishing, and pressure-regulating devices. Figs. 2 and 3 are horizontal sections thereof, taken on lines *x x* and *y y* of Fig. 1, respectively. Fig. 4 shows a slight modification in the arrangement of the gas-induction and cut-off devices by a vertical axial section. Fig. 5 shows by a like view a modified arrangement of the valve-controlling devices. Figs. 6, 7, and 8 are detached detail views of the device employed for controlling the movements of the cut-off valve; and Figs. 9 and 10 are sectional elevations showing further modifications in the arrangement of said controlling devices. Figs. 11 and 12 show in elevation and projection, respectively, the tube L, provided with a grooved guideway.

This invention relates to apparatus for automatically lighting and extinguishing gas-lamps, and with which I have combined an automatic pressure-regulator.

The object of the invention is to provide a simple and efficient attachment for gas-burners, more especially adapted for use in street-lamps and the system of public illumination, whereby the gas may be automatically ignited and extinguished and the pressure at the burner regulated.

To these ends the invention consists in the peculiar construction of the lighting and extinguishing devices, and in the combination therewith of pressure-regulating devices, substantially as hereinafter fully described, and as set forth in the claims.

The apparatus comprises a casing, $C^{\times}$, having the general form of twin cylinders in communication with each other by an intermediate passage, $c^{\times}$, said casing being closed at top by a suitable cap or cover, C^{3}, screwed, bolted, or otherwise secured thereto, (as said cap need not necessarily be connected with the casing,) so as to form gas-tight joints.

C and C′ indicate the two cylinders, the cylinder C being of slightly greater diameter than the cylinder C′. They are so constructed as to form annular chambers *c c′* around cylindrical bosses or projections B B′, respectively, said chambers communicating with each other by an intermediate passage, $c^{\times}$, above referred to.

To the cap or cover C^{3} is screwed the burner-pipe P^{2}, and to said burner-pipe is screwed a coupling, A, in which are formed two passages, *a* and *a′*.

The main burner *b* is screwed to coupling A in the end of passage *a*, and an auxiliary burner, *b′*, is screwed or otherwise secured to a tubular arm, A′, extending laterally and vertically from the coupling A, and constituting the terminal of the passage *a′*. A flange, a^{2}, surrounds said arm A′, and on said flange is seated a tubular guard or shield, A^{2}, provided with peripheral openings a^{3} near its upper end.

The relative arrangement of the burners *b b′* and the guard or shield A^{2} is such that when gas issues from the main burner *b* it will be ignited by the flame of the auxiliary burner *b′*, which is kept continually burning, the flame required being a very small one for the purpose in view.

The casing $C^{\times}$ has a tubular projection, which

constitutes the receiving-chamber C^2, said projection being screw-threaded interiorly for the reception of the correspondingly-threaded end of the gas-pipe in communication with the gas-main, from which pipe the apparatus is supported within the lamp.

I have deemed it unnecessary to show either the pipe from which the apparatus is supported or the lamp itself, as the invention can be readily comprehended without them.

The chamber C^2 is in direct communication with the auxiliary burner b' through a pipe, P', that connects the chamber C^2 with the passage a'. The pipe P' is contained within a pipe, P, that connects the main burner b with the gas-supply, as hereinafter described.

The casing $C^\times$ is partially filled with mercury or other suitable non-congealable fluid to form a luting for the supply and cut-off valve V and the pressure-regulating valve V'. These valves are bell or cup valves, made, preferably, of thin sheet metal, secured to heads H and H', respectively, which heads have a screw-threaded hole for the reception of the valve-stems S and S', respectively.

The valves, as shown in Fig. 1, are fitted over the bosses B B', and dip into the mercury bath. Each of the bosses B B' has an axial cylindrical passage or bore, in which is fitted a tube provided with guide-bearings for the valve-stems, and said passages extend entirely through the casing, the outer ends thereof being screw-threaded interiorly for the reception of flanged plugs D D', by means of which said passages are closed.

The tube T', secured in the axial passage of the boss B', has guide-bearings t', through which the valve-stem S' of the pressure-regulating valve V' passes, and in which bearings said stem is free to move vertically.

Below the tube T' the passage in which said tube is fitted is enlarged, and forms a conical seat, $s^\times$, for a corresponding valve, v', connected with the lower end of the valve-stem S' by a pivotal connection, preferably by a ball-and-socket joint, j', as shown in Fig. 1, so that when the pressure of gas under the cup-valve V' exceeds a normal pressure the said valve will be lifted to close, or more or less close, the tube T' through the medium of the valve v'.

The passage or bore of the boss B' below the cone-valve v' is in communication, through port p', with a horizontal passage, E', through which the gas arrives from the supply and cut-off valve V, as presently explained.

The normal pressure under which the gas is to be supplied to the main burner is regulated by weighting the valve V' by means of disk-weight w', as shown in Fig. 1, or in any other suitable manner.

The upper end of the valve-stem S' of valve V' is squared for the application thereto of a key, whereby said stem may be screwed up or down in the valve-head H' to adjust the position of the cone-valve v' relatively to its seat and relatively to the vertical movement of the pressure-regulating valve V', to give the valve v' more or less play under given pressures. It is obvious that by means of this arrangement the pressure at which the gas is delivered to the burner b may be kept practically constant, thereby insuring a steady light and avoiding waste of gas.

In the boss B' is formed a vertical passage, p^2, Fig. 2, that communicates with the pipe P and supplies the gas from under the valve V' to the main burner b. In the end of the passage E', through which the gas from the supply and cut-off valve V passes to the pressure-regulating valve, is screwed a vertical pipe, E, that extends upwardly along the boss B in a recess, b^2, formed in the same nearly to the upper edge of said boss, and the upper end of the pipe is inclosed in an inverted tube or pipe, F, secured to the under side of the valve V, as shown in Fig. 1.

The pipe F is of such a length as to dip into the mercury bath when the pressure of the gas falls considerably below the normal pressure, or when it is desired to cut off the gas from the burner b by lowering the pressure to such an extent that the valve V will not be lifted sufficiently high to carry the lower edge of the pipe F above the level of the mercury.

Inasmuch as the gas supplied to the burner b from under the supply and cut-off valve V has to pass through pipe E and passage E' before it reaches the pressure-regulating valve, it will be obvious that so long as the pipe F dips into the mercury no gas can pass from valve V to valve V'. In Fig. 4 I have shown a modification of this arrangement, in which the pipe F is arranged concentrically with the tube T, the boss B being cored to form an annular chamber, B^3, which is partially filled with mercury, into which said pipe F dips, the tube T being tightly seated in the boss, so that no mercury can flow below the same. In the boss B is formed a vertical passage, B^4, that communicates directly with the passage C^4, through which the gas is admitted. In this arrangement the gas is not in constant contact with the controlling devices of the valve V, which devices will be presently described.

The receiving-chamber C^2 communicates with the vertical bore or passage B^2 in boss B' by a passage, C^4, so that the gas entering C^2 from the main will not only flow to the auxiliary burner b' directly through the small pipe P' and passage a', but also through the large passage C^4 to the bore B^2 in boss B. In said bore is fitted a tube, T, similar to the tube T' in the bore of boss B', said tube T being also provided with guide-bearings t for the valve-stem S of valve V. The latter valve may also be weighted like the valve V', to regulate the pressure at which said valve is lifted to allow the gas supplied thereto to flow to the pressure-regulating valve and thence to burner b. This may also be effected by means of a coiled spring, s, on the lower end of the valve-stem S,

one end of said spring bearing against the under side of the lower bearing-sleeve, *t*, while its other end bears upon the upper face of a nut, *d*, screwed to stem S, by means of which nut the tension of the spring may be regulated, as will be readily understood.

The valve-stem S of valve V is shown as projecting through the cap or cover C^3 of the casing $C^\times$, so that it may be rotated without removing the cover to adjust the valve to different pressures. This, however, is not absolutely necessary, and said valve stem may be made shorter and its end squared. It will readily be seen that, instead of manipulating the nut to increase or decrease the tension of the spring *s*, this may be effected by manipulating the valve-stem itself; and as the valve V may require more frequent adjustment than the valve V′, I prefer to make the stem thereof of such length as to cause it to project through the cap or cover of the case, as described.

From the description of the arrangement of the valves and the gas-passages from the main to the auxiliary burner and through the valves to the main burner, it will be readily understood that no gas can pass into that space of the casing outside of or surrounding the valves; hence, as above stated, it is not necessary that the cap or cover C^3 should fit gas-tight onto the casing $C^\times$.

It will be readily understood that if the supply and cut-off valve V is adjusted so as to be lifted under a given pressure sufficiently high to allow the gas to flow freely to the pressure-regulating valve, and that if said pressure were to decrease considerably from any cause, all the lights connected with the main in which such a reduction in the pressure takes place would be extinguished, since the supply and cut-off valve would fall sufficiently to immerse the lower edge of the pipe F in the mercury, thus cutting off all supply to the main burners *b*. It is therefore necessary that means should be provided whereby this sinking or falling of the valve under an accidental and material reduction in the pressure in the mains may be effectually prevented, and these means necessarily constitute one of the most important elements of the apparatus, and consequently one of the most important features of my invention.

Various means may be employed for holding the valve V at a given elevation to prevent the tube or pipe F from dipping into the mercury bath—as, for instance, any rigid stop may be employed. In this case, however, the extinguishing of the lights could not be effected automatically, as it would require a direct manipulation of the valve to disengage the same from its stop. One part of my invention comprehends means for automatically lighting and extinguishing gas-lamps, whether the pressure is a normal one or whether the pressure has fallen below a normal pressure from any cause, provided that a given high pressure can be produced before and after the lamps have been lighted; and this consists in relatively increasing and decreasing the pressure of the gas upon the valve to move the same from one point in its course or throw to another or to its seat. This may be effected in various ways, either by providing shifting-bearings at different elevations for the stop of the valve, by which the latter is held against downward movement, said bearings shifting automatically under the pressure of the gas upon the valve to allow said valve to move or fall from a higher to a lower bearing, or by providing rigid bearings at different elevations, and combining therewith a shifting-stop connected with the valve and operated by the pressure on said valve.

I will first describe the arrangement of shifting-bearings for controlling the movements of the supply and cut-off valve V, referring more particularly to Figs. 1, 6, 7, 8, 11, and 12, the latter showing on an enlarged scale a portion of the tube in which the bearings for the stop of the valve are formed.

A pin, *s′*, passes transversely through the valve-stem S, about midway of its length, the ends of the pin projecting from opposite sides of said stem, on which is loosely mounted a tube, L, that is held against vertical motion by the guide-bearings *t t* of the tube T; and to reduce the friction between the tube and said bearings as much as possible, the opposite ends of tube L are bent inwardly, as shown in Fig. 1. In the periphery of the tube is formed an irregular slot, M, of a zigzag form, in the formation of which the tube is necessarily severed, the two sections being connected by two straps, L′, as shown. The zigzag slot or guideway is so arranged as to form bearing-points intermediate of the extremes of the branches of said guideway—that is to say, some of the branches of the guideway do not extend downward or upward, as the case may be, as far as other branches, and the latter are so arranged that branches of the same length will be formed at diametrically-opposite points in the periphery of the tube. For instance, if the lamps in a circuit are to be simultaneously lighted and extinguished by one increase in the pressure in the mains for each operation followed by a corresponding reduction in said pressure, then the guide-slot is formed by two diametrically-opposite long branches and two diametrically-opposite short branches, the bearing-points of the upper end of said branches lying in the same peripheral plane, as shown in Fig. 6, the tube L making one-eighth of a revolution for each increase and succeeding decrease in the pressure in the operation of lighting and extinguishing the lamps, or one-half of a revolution during the two operations, which are effected as follows, referring to Figs. 1 and 6:

Supposing the valve V to be at the limit of its downward movement, as shown in Fig. 1, under a pressure in the mains below the normal pressure, the ends of the pin *s′* lying in the

bearings *l* in the lower end of the longer branches *m* of the zigzag guide slot or way M. If the lamps are to be lighted, the pressure in the mains is increased above the normal pressure, so as to carry the valve to the limit of its upward movement. As the valve-stem and pin move upwardly in the branches *m* to the upper bearings, 2, thereof, the ends of said pin will impinge on the inclined faces of the upper part of said branches *m* and impart to the tube L one-eighth of a revolution. The pressure in the mains is immediately reduced to the normal pressure, thereby causing the valve V to descend, the pin *s'* moving down the branch M' of slot M until it reaches the bearings 2. In this downward movement of the valve the tube L will again make one-eighth of a revolution. The pipe F is now held at a sufficient elevation above the level of the mercury to allow the gas to flow freely to the pressure-regulating valve, and will remain in the described position so long as the lamps are lighted. We have therefore one increase above the normal pressure in the mains and a following decrease to the normal or supply-pressure to light all the lamps in a circuit. A like increase, followed by a corresponding decrease to or below the normal or supply pressure, will extinguish all the lamps in the circuit, the tube L again making one-quarter of a revolution. It will be seen that upon an increase in the pressure, which must be sufficient to carry the valve-pin *s'* from 3 to 4, said valve-pin will move from 3 to 4, and by a succeeding decrease said valve will descend until the pin *s'* reaches the bearings 5, when the end of the inverted tube F will be immersed in the mercury, and the supply of gas to the pressure-regulating valve will be cut off without interfering with the supply of gas to the auxiliary burner. In these movements the pin *s'*, in riding first up the inclined edge of branch N', will impart to the tube F one-eighth of a revolution, and in its following downward movement said pin will move along the edge of the branch M^2 of guide slot M, thereby imparting another eighth of a revolution to tube F, as above set forth.

From what has been said it will be seen that both in lighting and extinguishing the lamps, an increase followed immediately by a decrease in the pressure of the gas is required to carry the valve from the lower bearings to the highest bearings and then to an intermediate bearing in lighting and to carry the said valve from said intermediate bearings to the higher bearings and thence to the lower bearings in extinguishing the lamps.

To insure the proper movements of the pin *s'* in the guide-slot M, and to prevent its return from one of the branches thereof into branches out of which it has previously moved, I arrange light and flexible leaf-springs L^2, that intersect the branches. The leaf-springs are secured to the edge of one of the branches and bear with their free end upon the opposite edge of the adjacent or connecting branch, said free ends lying in the direction of motion of the pin, so that the latter is free to move up one branch or down another, the springs L^2 yielding to the pressure of said pin *s'*, which latter, however, will be held against backward movement by said free ends of the springs, as shown in Figs. 6, 7, and 8.

The operation of lighting and extinguishing the lamps may be varied by various constructions of the short and long branches of the guide-slot M in the periphery of the tube L—as, for instance, by twice increasing the pressure from a minimum to a maximum pressure for each operation. Such an arrangement I have shown in Fig. 7, where the pin *s'*, under the first or supply pressure will move from 1 to 2, and under the next decrease from 2 to 3. Under the next or second increase in the pressure the pin will move from 3 to 4, and under the next or second reduction in the pressure the pin will move from 4 to 5. Under the third increase in the pressure the pin will move from 5 to 6, and, finally, said pin, under the last reduction in pressure, will move from 6 to 7.

Another different arrangement of guide-slots is shown in Fig. 8, which will be readily understood from what has been said above. It is obvious that the described arrangement of controlling devices may be variously modified and yet produce the same result. For instance, the tube L may be rotatably connected with the bell or cup-valve V, so as to perform the function of valve-stem, and a stationary rod provided with the cross-pin may be arranged within the tube L, and thus produce the same results; or the tube L may be rigidly secured in tube T, and the valve-stem S may be rotatably connected with the valve V, as shown in Fig. 5. A still further modification of the arrangement of the controlling devices is shown in Figs. 9 and 10, in which a compound valve-stem, S, is employed. Said valve-stem is composed of three sections, S^2 S^3 S^4, the section S^2 being rigidly secured to the valve V and connected to section S^4 by a yoke or frame, K, provided with screw-threaded openings, in which the ends of the sections S^2 S^4 are screwed. As shown, the said ends terminate in a cone, s^3, and fit in cone-bearings s^4, formed in the opposite ends of section S^3 of the valve-stem S, so as to permit the latter section to rotate freely, the controlling-tube L being rigidly secured to tube T. Finally, it is obvious that, instead of slotting the tube L to form a zigzag or guide way around its periphery, this guide-way for the pin may be formed by grooves in the inner periphery of the tube, such grooves being formed by means of dies, or in any other suitable manner, so as to properly guide and control the movement of the valve V, as shown in Figs. 11 and 12.

From what has been said it will be seen that all the lamps supplied from one and the same source may be automatically lighted and ex-

tinguished, no matter what the pressure may be in the mains, provided the initial pressure is sufficient to lift the valve V, to establish communication between it and the burner, and provided that when the lamps are to be extinguished said initial pressure can be restored in the mains.

Having now particularly described and ascertained the nature of the said invention, I declare that what I claim is—

1. The combination, with a gas-burner, of automatic extinguishing devices comprising a valve-casing, a supply-duct therein connected with the burner, a bell or cup valve operated by the pressure of the gas and carrying an inverted pipe fitting loosely over the supply-duct, a pin or lug projecting from opposite sides of the valve stem, a liquid seal for the valve and its inverted pipe, and a tube inclosing the valve-stem and having a zigzag guide groove or slot formed in its periphery, into which the ends of the pin project, said groove or slot having long and short branches, the ends of which form bearings for the pin to support the valve and inverted pipe at different elevations relatively to the liquid seal, substantially as and for the purpose specified.

2. The combination, with a gas-burner, of automatic lighting and extinguishing devices comprising an auxiliary burner, a valve-casing provided with an inlet-duct for the gas from the main, a duct connected therewith and with the auxiliary burner to supply the same directly from the main, a separate duct for the main burner, a bell or cup valve operated by the pressure of the gas and carrying an inverted pipe fitting loosely over the main burner-duct, a pin or lug projecting from opposite sides of the valve-stem, a liquid seal for the valve and its inverted pipe, and a tube inclosing the valve-stem, provided with a zigzag guideway in its periphery, having long and short branches to support the valve and its inverted pipe at different elevations relatively to the liquid seal, substantially as and for the purpose specified.

3. The combination, with a gas-burner, of extinguishing devices comprising a valve-casing, a supply passage or pipe therein, a bell or cup valve operated by the pressure of the gas and carrying an inverted pipe fitting loosely over the supply-passage, a valve-stem composed of three sections, of which the intermediate section is revoluble between the extreme sections, a pin or lug projecting from opposite sides of the revoluble section of the valve-stem, a luting or liquid seal for the valves and inverted pipe carried thereby, and a controlling device consisting of a tube having in its periphery a zigzag guideway, into which the ends of the pin project, said guideway having long and short branches, the ends of which form bearings for the pin to support the valve and its inverted pipe at different elevations relatively to the liquid seal, substantially as and for the purpose specified.

4. The combination, with a gas-burner, of automatic extinguishing devices comprising a valve-casing provided with a gas passage for admitting gas thereto from the main, a slightly-conical boss projecting vertically from the bottom of the casing, having an axial gas-duct opening into the inlet-duct and casing, respectively, a supply duct or pipe connected with the burner, one end whereof extends along the boss, said boss and casing forming a cell for a liquid seal, a bell-valve inverted over said boss, a pipe connected with the valve and inverted over the inlet end of the burner-pipe, said valve having a stem provided with a pin, s', arranged within the axial gas-duct of the boss, and a tube, L, on the valve-stem provided with a zigzag guide groove or slot M in its periphery, into which the ends of the pin s' project, said guide groove or slot having long and short branches, the ends of which form bearings for the ends of said pin s', substantially as described, for the purpose specified.

5. The combination, with the gas-burner, the valve-casing, a boss projecting vertically from the bottom thereof and having an axial gas-duct communicating with the casing and the gas-main, and the supply-pipe for the burner extending alongside the boss, of a bell-valve and a short pipe, F, secured thereto, inverted over the boss and the end of the burner-pipe, respectively, the valve-stem S, provided with a cross-pin, s', said valve-stem sliding in bearings t in the axial duct of the boss, a tube surrounding the valve-stem provided with a zigzag peripheral guide groove or slot, M, into which the ends of the pin s' project, and the spring s on the lower end of said valve-stem, said spring abutting against the lower bearing of the valve-stem, and a nut secured to said stem, substantially as and for the purpose specified.

6. The combination, with a main burner and an auxiliary burner, a valve-casing having a gas-duct to admit the gas from the main, a supply-pipe connected with the said duct and auxiliary burner extending axially through the casing, a supply-pipe for the main burner concentric with the auxiliary burner-pipe, the bosses B B′, projecting from the bottom of the casing, each having an axial gas-duct opening at one end into the casing and connected at the other with the inlet-duct connected with the main, and with a branch duct, E, extending along the boss B, respectively, said boss B′ having a passage formed therein, communicating with the main burner supply-pipe, said bosses being arranged relatively to the walls of the casing to form a cell for a sealing-liquid around them, of the valve V, the pipe F, secured thereto and inverted over the boss B and end of the branch duct E, respectively, the valve-stem S, having cross-pin s', the tube L, having zigzag guide groove or slot M, the valve V′, inverted over boss B′, and the valve v' controlled by said valve V′, said parts being arranged and operating substantially as and for the purpose specified.

7. The combination, with the casing C, the boss B, having axial duct T, of the valve V,

having stem S, extending into said duct, said stem being composed of two rigid sections connected by a yoke, K, and a revoluble section, s^3, stepped on the rigid sections provided with a cross-pin, s', and the tube L, surrounding the revoluble sections of the valve-stem and provided with a zigzag guide-groove, M, into which the ends of the pin project, said parts being constructed and operating substantially as and for the purpose specified.

In testimony whereof I affix my signature in presence of two witnesses.

JOHANN HEINRICH WÜSTER.

Witnesses:
OTTO MAASS,
EDMUND JUSSEN, Jr.