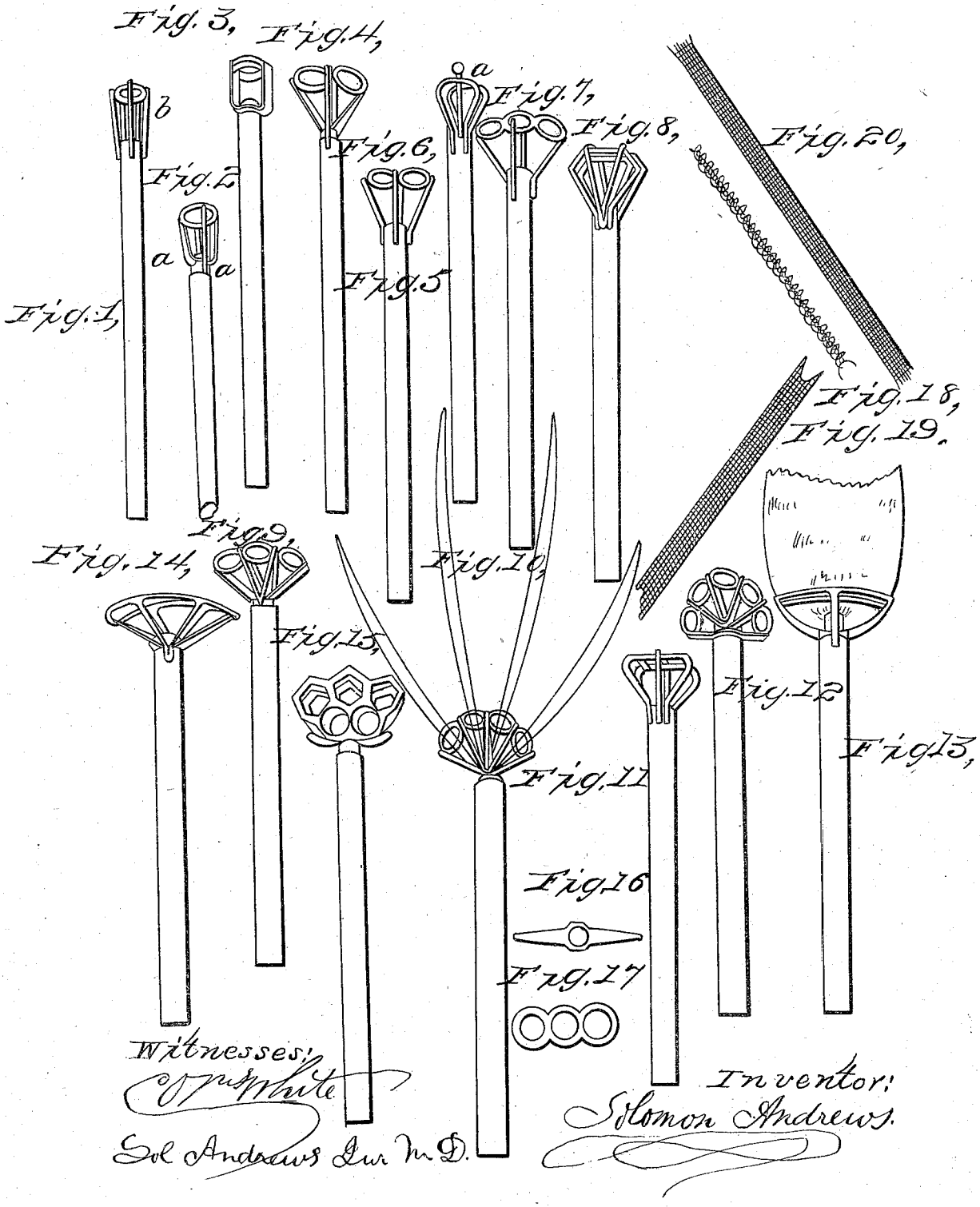
S. ANDREWS.

Gas Lamp Burner

No. 21,239. Patented Aug. 24, 1858.

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# UNITED STATES PATENT OFFICE.

SOLOMON ANDREWS, OF PERTH AMBOY, NEW JERSEY.

## VAPOR-LAMP BURNER.

Specification of Letters Patent No. 21,239, dated August 24, 1858.

*To all whom it may concern:*

Be it known that I, SOLOMON ANDREWS, M. D., of the city of Perth Amboy, county of Middlesex, and State of New Jersey, have invented a new and useful Improvement in Gas-Lamp Burners, which invention I denominate a "Balustrade Burner or Generator," because open or balustrade work is the chief principle of its construction, and on that in a great measure depends its power of generating the gas which it burns; and I do hereby declare that the following is a full, clear, and exact description of the principle of construction and operation of the same, reference being had to the annexed drawings in perspective, of full size, and making a part of this specification.

Figures 1, 2, 3, are one jet burners. Figs. 4, 5, 6, are two jet burners. Figs. 7, 8, 9, are three jet burners. Figs. 10, 11, are four jet burners. Fig. 12, is a five jet burner. All these I denominate star burners, in contradistinction from the broad flame burners. The flames of a star or jet burner are delineated in Fig. 10, and a broad or flat flame at Fig. 13. Figs. 13, 14, 15 are either for five jet, or bat-wing union or fish tail burners, there being a double balustrade, so that the conductors shall not interfere with the combustion of the gas. This Fig. 15 is a double balustrade made of one piece of metal, bent up and soldered on the nipple. In all these figures the wick tube is plainly distinguishable as shown at (*a*) Fig. 1, and the caloric conductors at (*b*). At Fig. 16, is a flat conductor suited to the nipple, and it is shown on the tubes in Figs. 2, 3, 9, 10, 12, 13, 14. Fig. 17, conductor rings, of pierced metal, which are seen on the tubes at Figs. 2, 4, 5, 7, 9, 10, 12.

A variety of forms of these burners have been here shown but all made upon the same principle viz., metallic conductors surrounding the flame in whole or in part, attached at or near the closed end of a tube, with intervening spaces, so as not to interfere with the free admission of air to the issuing jet of vapor or gas to produce a more perfect combustion; and which tube may be of any desirable length open at the other end to admit the fluid from which the gas is generated, the said tube being in fact a gas retort. This tube should be quite thin, and light, whatever may be its diameter, and it should also be made of some bad conducting metal, or other suitable substance, whether it be a bad conductor in quality, or in diminished quantity of material, so that the heat may be concentrated at the end where the conductors are attached.

The conductors may be of wire, as at Figs. 1, (which has a wire ring,) 6, 8, 11, or strips of plate metal, as at Fig. 3, or plate metal pierced with holes, as at Fig. 15, or a combination of them as at Figs. 2, 4, 5, 7, 9, 10, 12, 13, 14, the object of the open spaces being to admit atmospheric air to the flame as freely as possible, while at the same time a sufficient portion of metal is to be kept near to the flame to receive caloric from it by radiation, and to conduct it by contact, to the tube or retort. The more perfectly this principle is carried out the better will be the operation of the burners; and the different modifications of their construction to attain the best proportions of conductors to receive and conduct caloric, and open spaces to admit air to the flame, or flames, and the positions and distances of the conductors from the flames, are too numerous for one man to contrive and experiment upon in a lifetime. But the principle of construction being settled, it will readily occur to the mind of a competent workman that if each of the flames be entirely surrounded by good conducting metal, and yet not interfere with the free admission of air to the issuing jet of gas, he will have approximated this most desirable end. Hence the star burners Figs. 2, 4, 9, 10, 12, and the flat flame burners Figs. 13, 14, in the drawing annexed, would seem to be better than the others, and in practice they appear so to operate.

To add to the generating power of the balustrade burner I plate with silver the end of the bad conducting metal tube, where the conductors are attached, from one eighth to one quarter of an inch of its length, which distributes the caloric more rapidly and equally to the fluid within it, while the bad conducting tube helps to concentrate the heat at the plated end.

The conductors are better made of silver, but this metal when pure is soft, thus very liable to injury by use, and is apt to melt the silver solder. Alloyed or coin silver answers better as to stiffness, and conducts caloric about as well, but it burns black and unsightly and oxidizes, in the heat of the flame. German silver resists oxidation

well, is stiffer than any other metal I have used alone, and when thickly plated with pure silver by the electrogalvanic process, remains white after burning; the solder is protected, the caloric well conducted, and being more economical than even alloyed silver answers better for practical use. Copper alone becomes brittle, besides its rapid destruction by oxidation, but when well plated with silver answers extremely well—much better than brass which is equally soft after burning and not so good a conductor. Silver and aluminum, about in equal proportions, is even better than pure silver for this plating; and when put on in the crystalline form it is better than the reguline, because it presents to the flame so many points to receive the heat by radiation. The aluminum also renders the surface harder, and more durable, and it resists the action of sulfur on the matches often used in lighting which silver will not do. This plating with silver and aluminum, put on thick, makes decidedly the best burner I have made, and it seems to stand more heat than any equally good conducting metal. Silver and platina, is next best.

The gas orifices are made in the end of the tube around which the conductors are soldered, and are of any variety known such as jet, union burner, bat-wing, fish-tail, or swallow-tail, according to fancy, and the conductors are so arranged as to be adapted to such burner, surrounding the flame either in whole or in part, as shown in all the figures of the drawing, receiving as much heat as possible from the lower part of the flame or flames without obstructing a full supply of air for perfect combustion opposite these conductors. To insure this a conductor should not be nearer a flame than about one twentieth of an inch, and no conductor need be longer than five eighths to three quarters of an inch beyond the tube.

When a ring is made to surround a single jet, it should not be less than one quarter of an inch in diameter, lest it cut the flame in two parts and so prevent combustion at that immediate point where it is most desirable; and three to five sixteenths of an inch is a proper distance apart for two balustrade conductors, where a broad flat flame, or several jets, issue between them, when the compound fluid made of alcohol and camphene is used for the generation of gas. Where other hydrocarbons are used these dimensions may be less.

On the end of the tube I make a nipple as shown at (*a*) Fig. 2, and which may be seen in several of the figures. This is an elongation of the tube, but of less diameter to prevent the wick entering the nipple. One object of this nipple is to make a small reservoir for gas beyond the reach of the wick, so that it shall not obstruct the orifices by contact. The conductors are generally attached to this nipple, but of this I shall say more hereafter.

Within the tube I use a wick made of very fine wire, or a wire gauze roll, a nest of tubes, or cotton, woolen, linen, or indeed any fibrous material wound upon a proper stem, or in the usual manner upon a double forked wire. In the latter case I put a spiral wire tube upon the double fork before winding on the fibrous wick, as shown at Fig. 18, the object of which is to preserve an open space within the wick, to insure a full and ready supply of fluid to the wick, and also to put out the gas lights, for safety, whenever the tube is lifted out of the lamp. The same end is accomplished by winding the cotton or other wick upon a narrow strip of wire gauze, or pierced metal doubled over like a flattened or elliptical tube, as shown at Fig. 19. With the wire wick, the gauze wire, or nest of tubes, this hollow space is not necessary, as the capillary attraction is not sufficient to prevent the fluid falling in the tube sufficiently to extinguish the light. Hard twisted fibrous material will produce the same effect, or cotton wick put in very loosely, but the light is thus diminished. When the nest of tubes is used they should be fluted, or at least every other one. That which I consider decidedly the best wick, is a combination of the wire gauze roll and cotton fiber. The roll is shown at Fig. 20. It fills about one third the diameter of the tube, reaches its whole length, and projects below sufficiently to take hold of, or to reach to the bottom of the lamp. The ends of the longitudinal wires in the outer coil of this gauze roll, serve to hold the cotton wick as it is wound upon them from end to end, forward and back, until the entire roll is thus covered on its surface with the cotton wick. The two ends of the gauze roll are thus unobstructed by the cotton, so that the fluid has full ingress at the bottom, and the vapor and gas free egress at the top, directly into the gas chamber. Its action for the extinguishment of the light when lifted is thus made very perfect, and while it affords a free and unobstructed interior, from end to end, it keeps the cotton fiber on its exterior in close contact with the inner surface of the wick tube, so that the fluid may absorb all the heat conveyed to it. It also acts as an extinguisher of the flame whenever the lamp falls, or is upset, or broken, by the sudden rush of fluid into the heated portion of the tube so as to cool it, and thus for an instant to interrupt the issuing jet; or else by a sudden and momentary withdrawal of the fluid, producing a contraction in the interior of the tube, which produces the same effect. This compound wick increases the length of flame, and force of jet, very considerably over any

other plan of wick I have tried. The lamp lights much easier than with the entire metal wick, and quite as quick as with the entire cotton wick. It is not, when thus made, the least important part of this improved burner.

The falling of the fluid in the wick tube when it is lifted out of the lamp, I consider of very great importance, because its purpose is to extinguish the light, and thus to save human life. Ignorant and careless persons will sometimes fill a lamp by its own light, holding the top, which they have just lifted out of the lamp, with one hand, and with the other hand pouring the fluid from the can into the lamp, immediately below the flame. Whatever vapor exists in the otherwise empty lamp, is thus driven out by the pouring fluid, and must necessarily come in contact with the flame, and igniting, set fire to the fluid running from the can, bursting it in all probability. By far the largest number of the so called accidents from the use of burning fluid, arise from this source, and to prevent as far as possible any such carelessness, or temptation to fill a lamp by its own light, I use this, or equivalent devices, to extinguish it. One of these devices is a small weight attached to the bottom end of the wick, and resting on the bottom of the lamp, which pulls it down like a piston, invariably extinguishing the light when the tube is lifted. The danger from other accidents by falling, upsetting, or breaking of a lamp, is also thus obviated.

The nipple or gas chamber, already referred to may be considered almost a *sine qua non* for practical use. If the wick is in contact with the orifices, as in most other gas lamp burners, or if the fluid is allowed occasionally when filling the lamp, or otherwise, to come in contact with the orifices, (as it will frequently do when the light is blown out, the heated column of fluid rising even to an eighth of an inch above the wick in the tube,) on relighting the lamp a small amount of coal tar, resin, or other carbonaceous matter, will be deposited in and about the orifices and so obstruct them; for more or less deposit will always be made in the place where the destructive distillation goes on. This obstruction of orifices invariably occurs where no gas chamber exists, and they require then to be opened with an instrument. The same causes will produce a like effect in the gas chamber or nipple, but as before stated the wick is prevented from entering it, and thus one chief cause is removed. Its length (being about one quarter of an inch) will prevent the heated fluid rising to the orifices above the wick when the light is blown out. But should it occur (say by turning the lamp bottom upward) by making this nipple or chamber of very thin metal, and attaching the conductors above its base, as seen in the drawing in Figs. 2, 3, 4, 9, 10, 12, 15, when lighted it becomes so heated as to burn up at once all this obstructing matter, so that the pressure of the gas will blow them out clean; more especially is this the case when the nipple is silver or plated therewith. These small and apparently insignificant matters, of the nipple or gas chamber,—it being made of thin metal—a good conductor—and with the conductors attached above its base, I consider indispensable to the general use of the gas lamp; for people will not bear the vexation of opening the orifices whenever they light a lamp. Another mode of making this gas chamber without a nipple, is to extend a center conducting rod down through the top of the tube, as shown at (*a*) Fig. 6, about one quarter of an inch, so that the wick shall be prevented reaching the end of the tube. This will leave a chamber around the rod, and the heat will be communicated by contact of the rod directly to the top of the tube, which is the gas chamber, and so preserve the orifices from obstruction as I have stated. In Figs. 1, 5, 7, 8, 11, the gas chamber may be formed by a pin, crossing the tube a little below the top.

I am aware that other gas burners have been made where the heat of the flame generated the gas to supply itself, within a tube or cavity which the flames surrounded, as in my original gas lamp patents, in 1831, and 1832. But I am not aware that any one has been made before this my invention, where the flame was surrounded by the caloric conductor; or where a single vertical jet of gas, issuing from a small orifice, continued to generate gas for its own supply, except in the balustrade burner above described; nor that any and every known form of jet, or fancy burner, has been before made to supply itself with gas. This single jet balustrade burner will illustrate the whole principle of my improvement in self generating gas burners, and all the little requisites in its construction, or in other words the combination of many apparently insignificant items, are necessary to its perfect development, to obtain the greatest length of flame, the amount of pressure required, the more rapid and complete formation of gas, its most perfect combustion, and a regular steady flame. These I shall now recapitulate as follows, viz.: A bad conducting metal wick tube, made very thin and light. Good conducting metal conductors surrounding the flame in whole or in part—soldered to the top end of the tube. These conductors to be a certain distance from the flame, and of certain dimensions so as to receive sufficient heat by radiation, conducting it to the liquid in the tube by contact, and yet not so as to obstruct a full supply of atmospheric air to the flame. A gas chamber of

thin, but good conducting metal, to prevent obstruction of the gas orifices, and the attachment of the conductors near these orifices. A hollow wick, and open at both ends, to afford a full and ready supply of liquid to the interior of the wick, and of the vapor and gas to the gas chamber, while the wick is kept in close contact with the tube. As small an amount of metal as possible to accomplish these ends; by which combination the generation of gas commences quick, with a lighted paper or match, and the concentration of as much heat as is required, is secured in the end of the tube or gas retort, which is the great desideratum.

More perfect still will be the operation of this improved gas burner, when used in connection with my "Improvement in gas-burning lamps," patented on the 3rd of June, 1856, in which specification and drawing I have set forth in part the within described improvement in the burner or generator. To accomplish all this, the radiated heat of only three quarters of an inch of the lower or blue end of a flame is required, whatever may be its length, or its breadth. I have obtained a length of flame in a single jet, steady, regular and without smoke seven inches long, and a breadth in a bat-wing or fish-tail burner of three inches with a corresponding height, and more may be had if wanted.

I claim as my invention—

1. The combination of the wick tube, the gas chamber, and the caloric conductors, in a gas lamp, as within described, or its equivalent.

2. I claim a cotton or other fibrous wick made hollow by a wire gauze tube or its equivalent, for the uses and purposes specified.

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Witnesses:

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