No. 661,489. Patented Nov. 13, 1900.

F. M. BROOKS.

BUNSEN BURNER.

(Application filed June 12, 1900.)

(No Model.)

Fig. 1.

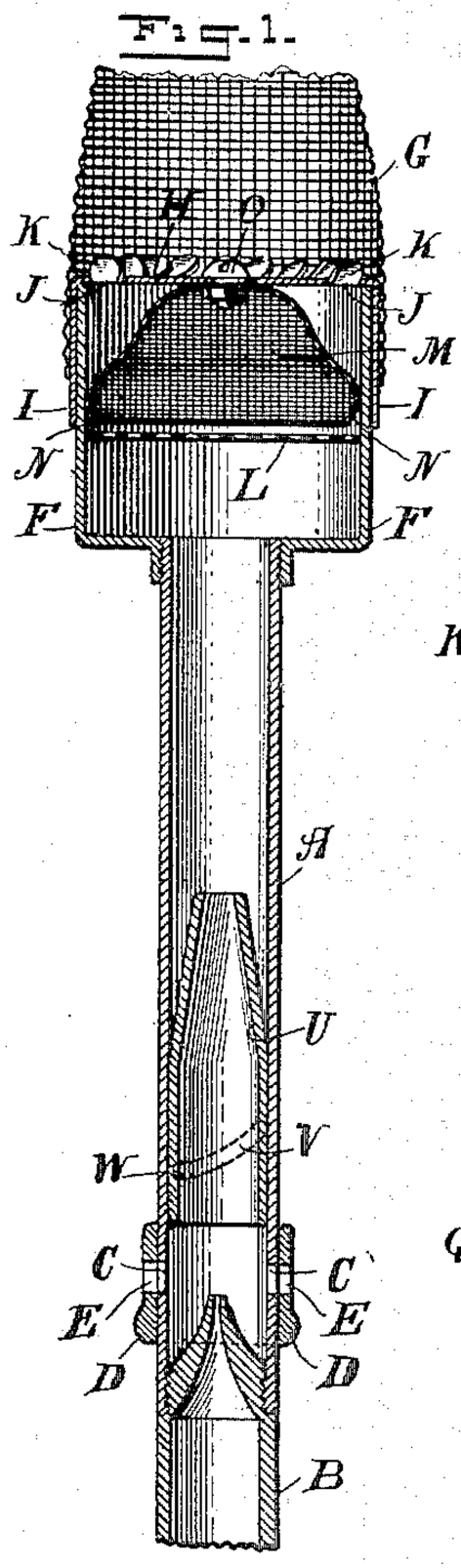

Fig. 2.

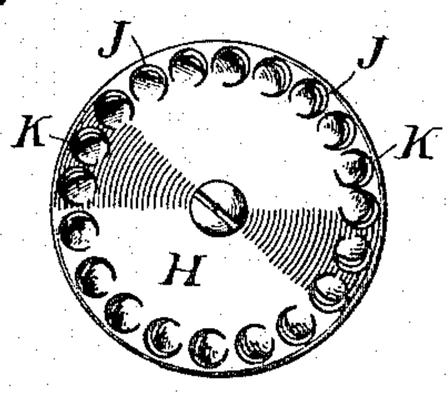

Fig. 3.

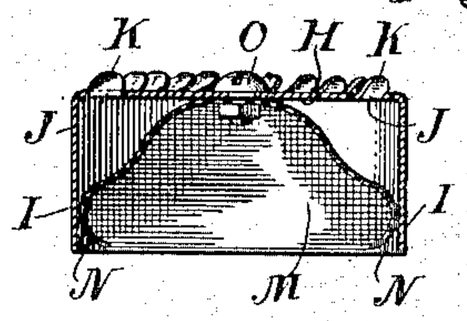

Fig. 4.

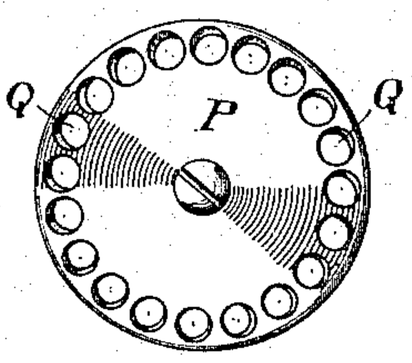

Fig. 5.

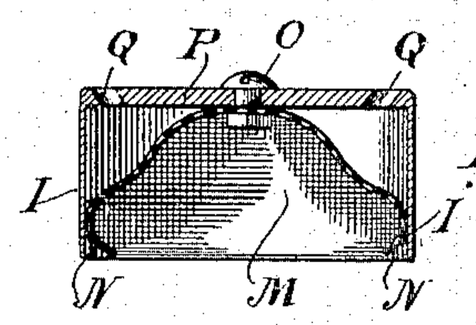

Fig. 10.

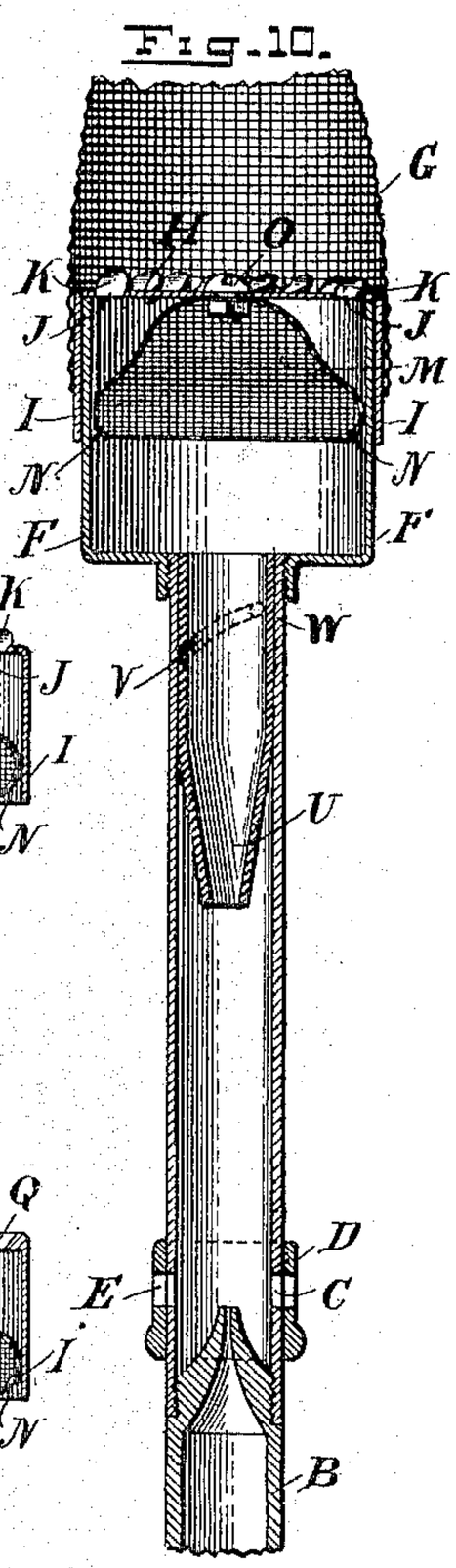

Fig. 6.

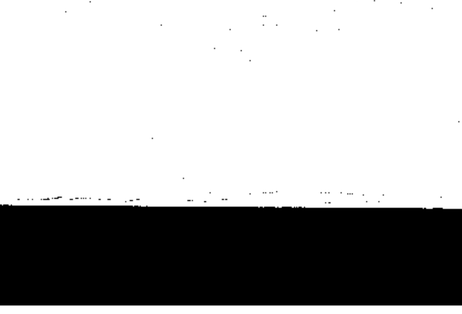

Fig. 7.

Fig. 8.

Fig. 9.

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Phillips Abbott

UNITED STATES PATENT OFFICE.

FRANK M. BROOKS, OF NEW YORK, N. Y.

BUNSEN BURNER.

SPECIFICATION forming part of Letters Patent No. 661,489, dated November 13, 1900.

Application filed June 12, 1900. Serial No. 20,094. (No model.)

To all whom it may concern:

Be it known that I, FRANK M. BROOKS, a citizen of the United States, and a resident of New York, (Brooklyn,) in the county of Kings and State of New York, (having my post-office address at No. 35 Warren street, New York city, New York,) have invented a new and useful Improvement in Bunsen Burners, of which the following is a description, reference being had to the accompanying drawings, in which—

Figure 1 illustrates a vertical sectional view of the burner. Certain parts ordinarily used with burners of this character are omitted, since they form no part of my invention. Figs. 2 and 3 illustrate a plan and a vertical sectional view, respectively, of one form of the cap for the burner, showing the gauze flame-arrester and heat-transmitter in position. Figs. 4 and 5 illustrate a plan and a vertical sectional view, respectively, of a modified form of the cap and gauze flame-arrester and heat-transmitter. Figs. 6 and 7 illustrate a plan and a vertical sectional view of still another modified form of the cap. In these figures I do not show my peculiarly-constructed flame-arrester and heat-transmitter. Figs. 8 and 9 show another form of my cap, in which the flame-arrester and heat-transmitter is likewise omitted, so constructed that the flame produced is slightly different from that produced by the other forms of cap shown. Fig. 10 illustrates a vertical sectional view of a modified construction of the invention.

Investigations and experiments made by others as well as myself since the introduction of the so-called "mantle" of refractory material have developed the fact that the brilliancy of the light produced by the mantle is largely dependent upon the completeness of the combustion of the fuel (combined air and gas) and that when the mixing of these two elements is complete, so that combustion is perfect, (or as nearly so as possible,) then if proper devices be provided to control or direct the combined gases at the point of combustion it is possible to produce a flame having what is now known as "hyperincandescent zone." This is a zone or part of the flame immediately above the surface of the burner, where the combustion is so complete that the heat is intense and the incandescence of the mantle more completely secured, whereby greater brilliancy and intensity in the light result than is otherwise possible because, as I believe, of the presence of the intense heat, which secures the great incandescence of the mantle, and partly because, owing to the complete combustion of the fuel, there is little, if any, residual product of combustion, which, if present, darkens the mantle at its upper part first, and later the obscuration extends downwardly until its illuminating power is seriously impaired.

My invention therefore relates to the parts of a burner which pertain to the above-stated features—that is to say, first, the means for securing proper supply—in other words, pressure or force—of the gas and air and the proper mixing of these two fluids before they reach the point of combustion, and, second, improvements in the burner and its related parts, whereby practically perfect combustion is obtained, resulting in the hyperincandescent zone referred to.

A represents the ordinary Bunsen tube; B, the ordinary gas-inlet nipple; C C, the air-inlets in the tube A, and D the ordinary gate or valve which controls the admission of air. It is provided with the usual openings E E, which register with the openings C in the tube.

F is the enlarged upper portion of the burner-tube, and G is the mantle.

H is a cap. (The form shown in Fig. 1 is the same as illustrated in Figs. 2 and 3.) It is composed of a hollow cup-shaped part H, the sides I being quite deep to constitute a circumferential flange or collar which fits with considerable snugness upon the exterior of the part F of the tube, so as to prevent the escape of gas at this joint. Around the edge of this cap, which may be arched, if preferred, are formed a series of openings J, made by punching holes through the metal, in such manner, however, that the severed portions K are not entirely punched out, but only about three-quarters of the way, leaving a portion (say one-quarter) of the metal uncut, which acts as a hinge, or rather support, for the severed portion, which is bent upwardly above the plane of the surface of the cap. Thus each little part K constitutes a sort of deflector superposed over each hole, and the tool which effects the cutting of the metal, as

stated, is so shaped upon its face, in conjunction with the die with which it coöperates, as to slightly twist these superposed deflectors K in such manner that the fuel as it passes upwardly through the cap will be projected in a series of jets (very slightly separated from each other) at an upward angle and also a little tangential to the circle of the cap at the place where they issue, so that if their line of projection were extended the entire circle of jets would describe a figure resembling an inverted truncated cone. Because of this construction the jets of flame are controlled in volume, each jet is practically identical in size with the neighboring jets, and owing to their tangential projection they are thrown directly against the inner surface of the mantle very slightly above the surface of the burner, whereby I secure the most intense flame and the most perfect incandescence of the mantle known to me, since the hyperincandescent zone which is produced by these intensely-hot jets of perfectly-consumed fuel impinges directly against the inner surface of the mantle and produces a complete circumferential illumination of it.

My apparatus is otherwise constructed, as will be hereinafter described, in such manner that the pressure of the gas and the amount of the incoming air may be exactly regulated and their intimate mixture effected, so that under all conditions of pressure I secure complete combustion and greatest brilliancy in the light.

In order to prevent "downward lighting," as it is called—that is to say, the dropping of the flame downwardly through the burner into the tube and perhaps even to the nipple B, (which is apt to occur upon lighting the gas or if it be partially turned down)—I prefer to use a gauze diaphragm or flame-arrester in conjunction with my burner. I sometimes employ a mere disk of gauze, (illustrated at L in Fig. 1,) and it may be located where shown or at such other place as may be preferred; but I have discovered that if the gauze flame-arrester be connected with the cap H it will act as a means to transmit the heat to the body of the burner, thus tending to reduce the extreme heat which the cap would otherwise be likely to attain and which is detrimental to the brilliancy of the mantle. In order that this newly-discovered feature may be utilized, I construct my flame-arrester and heat-transmitter in a peculiar manner, as follows, (see Figs. 2 and 3:) M is my new form of flame-arrester and heat-transmitter. It is made of wire-gauze, as usual, of such mesh and weight as preferred and is preferably bent in the concave form shown in the drawings. The lower edge N may be turned inwardly all about the arrester, so that when the cap H is inserted within the upper end of the burner-tube A the flange I of the cap may slide down on the exterior of the part F, but the inturned edge of the gauze arrester will cause it to slide down upon the inside. The arrester is or may be permanently attached to the part H by a screw and nut O or by riveting or in any other suitable manner. Under this construction the gauze being of itself a good conductor of heat (in other words, a distributer or decimator) will measurably convey the heat from the cap to the lower portion of the part F, thus reducing the heat of the cap.

In Figs. 4 and 5 I show a modified form of the cap. It is constructed the same as the one above described, excepting that the top P, through which the holes are made, is in this case made somewhat thick (say one-sixteenth of an inch, more or less) and the holes Q are bored at an angle to the perpendicular and, if desired, may also be bored somewhat tangential to the circle of the cap. The fuel passing upwardly through these openings will receive the same tangential direction and the same controlling effect as above referred to, excepting that owing to the absence of the superposed deflectors K (present in the form shown in Figs. 2 and 3) the hyperincandescent zone does not impinge as perfectly against the mantle as in the other form of construction above referred to.

In Figs. 6 and 7 I show another form in which the cap is made. In it the construction is similar to that in Figs. 2 and 3; but the holes instead of being circular are oblong, so they may more properly be described as slits, (shown at R, Fig. 6,) and they extend from the periphery of the cap (or near it) toward the center radially, the cut metal being projected above the slits, so as to form deflectors S, the same as in the other case. I have found that under certain conditions—that is to say, when the gas is of certain quality and also when the pressure is variable—the combustion is better if this form of cap be used.

In Fig. 7 I do not show my new form of flame-arrester and heat-transmitter. It may be used in conjunction with this form the same as with the others, or the old form shown at L in Fig. 1 may be used with this cap, and the same is true to all forms of cap shown.

In Figs. 8 and 9 I show still another form of cap. In it the punch which cuts the holes forces the severed metal downwardly toward the interior of the cap. The operation of this cap is, as above stated, somewhat different from that of the others, because the struggle of the gas to pass around the obstruction presented by the downwardly and inwardly extending lips T generates eddies or swirls in the gas, thus increasing the intimacy of the admixture of the gas and air, and likewise has a tendency to broaden the flame at the surface of the burner, while not seriously interfering with the tangential projection of it, whereby it is carried against the wall of the mantle.

The perforations in the cap may be made in the vertical walls thereof and in the ways above described or in other suitable manner,

and it is not essential that devices for deflecting the flame outwardly should be employed, although I prefer their use, since certain of the advantages resulting from my invention will be secured if the holes be mere perforations made through the cap.

U is the device which I employ to aid in effecting the more complete mixture of the air and gas. It may be made in various forms. In that which I have illustrated the lower part of the device is a tube parallel to the burner-tube A and adapted to slide within it. Above this tubular part the side walls are drawn inwardly, as at U′, terminating in a contracted mouth or opening U″. The devices whereby I secure the vertical adjustment of this device U are as follows: V is a slot cut in the side of the tube A, and W is a pin attached to the device U and which works through the slot V. The slot rises spirally or perpendicularly and extends the desired distance, so that as the pin, which is adapted to be grasped by the thumb and finger, is moved through the slot the device U rises or falls, as the case may be, by reason of the movement of the pin through the slot, and I prefer in order that the gas may not be permitted to escape through the slot that the lower portion of the device U be made cylindrical or parallel-sided with the tube A, as above stated, so that the slot may be at all times covered. This construction likewise insures smooth sliding movement and the retention of a proper upright position of the device at all times.

Although I prefer that the device U should be set as shown in Fig. 1—that is to say, with its contracted part presented upwardly—yet I have discovered that the apparatus will work well if it be inverted, as shown in Fig. 10, in which event it must be placed at or near the upper part of the tube A, its contracted orifice or opening being, however, in about the same location—that is to say, within substantially the central third vertically of the tube A, as in the other case. When this is the arrangement, the gas and air being retarded somewhat in their upward movement by having to pass through the downwardly-presented contracted mouth of the device U move about and intermingle in the lower portion of the tube A, and being under pressure there when they pass into the gradually-enlarging chamber above the contracted mouth they expand, thus causing freer combustion and greater heat at the burner. This action of a chamber so shaped has been referred to in patents heretofore granted as a "sucking" action, so that it may be called a "suction-chamber."

It will be observed that in my burner one of the effects of the chamber having the contracted mouth is to present an obstruction to the passage of the gas and air, so that they are put under pressure by reason of such obstruction. It is obvious, therefore, that other forms than that described may be employed and yet the advantageous results be secured, partially at least. I wish it to be understood that the fluid-obstructing device may be adjusted in any preferred manner and that I do not limit myself to the construction shown.

The amount of air admitted is properly regulated by the gate D, and the air and gas as they pass upwardly through the gradually-contracting chamber U crowd together under gradually-increasing pressure until they escape at the top of the cone under great impetus and are there projected, not into a comparatively-restricted space, as is the case in some burners that have recently been patented, but, on the contrary, into the large chamber comprising the entire upper part of the burner-tube and likewise extending down the outer side of the chamber U. Therefore, being temporarily released of the compression, the fluids under the impetus of their incoming are thoroughly intermingled, so that they become a homogeneous uniform gas.

I wish it to be understood that the construction and arrangement of the parts of the apparatus above referred to are given as examples only, because it will be obvious to those who are acquainted with this art that modifications may be made therein without departing from the essentials of the invention, and I wish it also to be understood that I am not positive that I am correct in the reasons I have suggested for the operation of the parts and the results obtained, because the operation of inflammable gases in burners of this character has for many years been a matter of extensive study by many persons, and I am not aware that even to-day the true reasons for the action of such gas in such apparatus are fully known. The statements I have made are based upon the best experience and knowledge I have been enabled up to this time to secure; but the results attained by me, whatever the cause of the same may be, are as above stated.

Having described my invention, I claim—

1. In a Bunsen burner the combination of a burner-tube, inlets for gas and air, a chamber located within the tube entirely above the air-inlets and having a contracted mouth which is located within substantially the central third of the tube, a cap at the upper end of the tube having a solid central part and holes near its periphery, and a combined flame-arrester and heat-transmitter composed of perforated metal or wire-gauze which makes direct contact with the under side of the solid central part of the cap, for the purposes set forth.

2. In a Bunsen burner the combination of a burner-tube, inlets for gas and air, a chamber at one end of the tube having a contracted mouth located within substantially the central third of the tube, means to adjust the chamber, a cap at the upper end of the tube having perforations near its periphery, and

a combined flame-arrester and heat-transmitter attached to the cap, for the purposes set forth.

3. In a Bunsen burner a detachable cap for the burner-tube having a solid central part provided with openings near its edge for the passage of the gas, and a combined flame-arrester and heat-transmitter permanently attached thereto, composed of perforated metal or wire-gauze, which makes direct contact with the under side of said solid central part of the cap, and the lower part of which has sliding contact with the interior walls of the burner, for the purposes set forth.

4. In a Bunsen burner a cap for the burner-tube having a flat plate with a solid central part and openings for the passage of the gas near its edge and a flange adapted to embrace the exterior of the tube, and a combined flame-arrester and heat-transmitter permanently attached thereto, composed of perforated metal or wire-gauze which makes direct contact with the under side of the cap the lower part of which has sliding contact with the interior of the tube, for the purposes set forth.

5. In a Bunsen burner a detachable cap for the burner-tube having a solid central part with openings near its periphery for the passage of the gas, deflectors adjacent to and which overhang the openings, a flange adapted to embrace the exterior of the tube, and a combined flame-arrester and heat-transmitter permanently attached thereto, composed of perforated metal or wire-gauze which engages with the cap and the lower edge of which is curved inwardly so as to be automatically guided into and have easy sliding contact with the interior of the tube, for the purposes set forth.

6. In a Bunsen burner a metallic cap for the burner-tube having perforations therein near its edge, partially-detached portions of the metal lying beyond the plane of the perforations and lapping the said perforations, for the purposes set forth.

7. In a Bunsen burner a detachable cap for the burner-tube embodying a plate having perforations near its edge and deflectors overhanging said perforations, whereby the flame will be directed against the mantle, and a combined flame-arrester and heat-transmitter composed of perforated metal or wire-gauze permanently attached to and which moves with the cap, for the purposes set forth.

8. In a Bunsen burner an adjustable tubular device having a reduced upper part and a contracted mouth located within the burner-tube, the contracted mouth opening at about the central third vertically of the tube, for the purposes set forth.

9. In a Bunsen burner the combination of a burner-tube, inlets for gas and air, a tubular device having a contracted mouth at one end of the tube, and a cap at the upper end of the tube having perforations whereby the gas passes through it in separate jets, for the purposes set forth.

10. In a Bunsen burner the combination of a burner-tube, inlets for gas and air, a tubular device at one end of the tube having a contracted mouth, and a cap at the upper end of the tube having perforations whereby the gas is enabled to pass through it, and means to project the flame of the gas against the mantle, for the purposes set forth.

Signed at New York, in the county of New York and State of New York, this 4th day of June, 1900.

FRANK M. BROOKS.

Witnesses:
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EDGAR R. MEAD.