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APPLIANCE FOR PRODUCING PERFECT COMBUSTION OF GAS.

(Application filed Nov. 30, 1900.)

(No Model.)

Fig. 1.

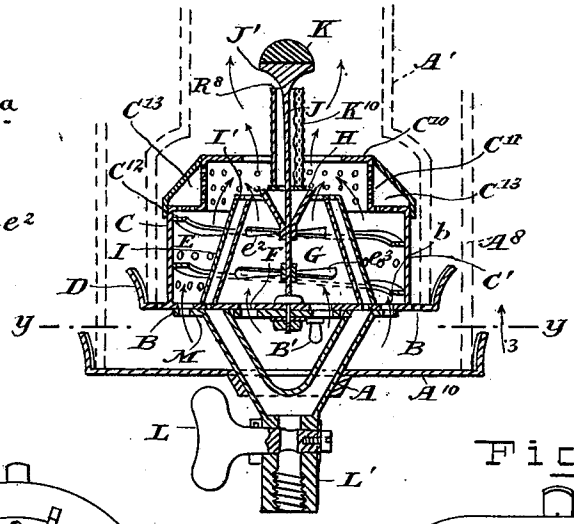


Fig. 1ª

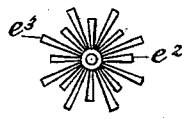
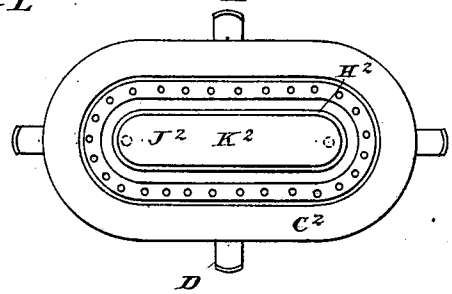


Fig. 4.



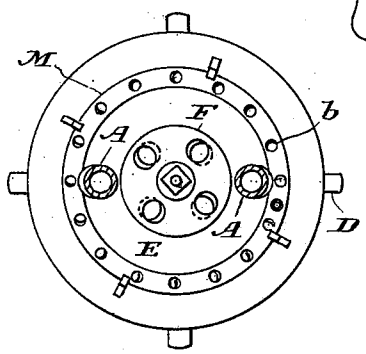


Fig. 3.

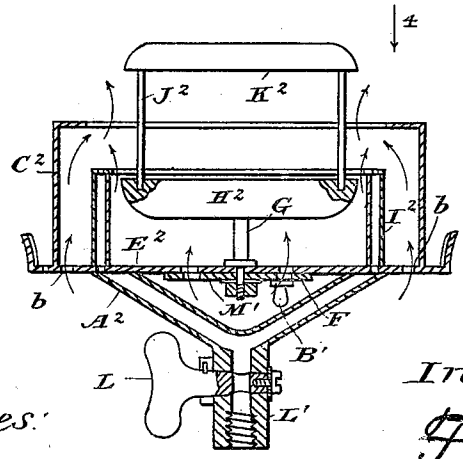


Fig. 2.

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UNITED STATES PATENT OFFICE

FREDERICK M. BENNETT AND JONATHAN O. FOWLER, JR., OF NEW YORK, N. Y., ASSIGNORS TO THE SOLAR (NO-MANTLE) INCANDESCENT LIGHT COMPANY OF WEST VIRGINIA.

APPLIANCE FOR PRODUCING PERFECT COMBUSTION OF GAS.

SPECIFICATION forming part of Letters Patent No. 666,894, dated January 29, 1901.

Application filed November 30, 1900. Serial No. 38,189. (No model.)

To all whom it may concern:

Be it known that we, FREDERICK M. BENNETT and JONATHAN O. FOWLER, Jr., citizens of the United States, and residents of New York, in the county and State of New York, have invented a certain new and useful Appliance for Producing Perfect Combustion of Gas, of which the following is a specification.

Our invention relates to an apparatus for burning illuminating gas or vapor of the regenerative type, which may be broadly stated as an improvement upon the so-called "Argand" burner; and it has for its object the provision of an appliance of the kind set forth simple in construction, inexpensive to manufacture, and which operates noiselessly, steadily, and efficiently in practical use.

Our appliance is designed to burn the vapor of bodies rich in carbon and hydrogen or gas from carbonaceous deposits—such as oil, coal, or petroleum—mixed with the proper quantity of air for the production of light or heat.

Our device may be utilized for the production of heat with or without light—*i. e.*, with either a blue or white flame, according to the quantity of air admitted—and also to produce light either as a result of combustion or incandescence, or both.

To attain the desired end, this our invention consists in the construction, arrangement, and operation of parts herein set forth.

In order to enable our invention to be fully understood, we will proceed to explain the same in connection with an apparatus for producing light by burning gas by reference to the drawings, which accompany and form a part of this specification, in which—

Figure 1 represents a side elevation, partly in section, of one of our gas-burners. Fig. 2 is a similar view of another burner constructed according to our invention. Figs. 3 and 4 are views of the bottom portions of the two burners, taken on a horizontal plane about that of the line *y y*, Fig. 1; and Fig. 1ª is a view in detail of our air-deflectors.

Like letters of reference indicate like parts in all the views.

We have found it desirable to make a burner that shall produce a more perfect combustion and a greater intensity of light than has heretofore been accomplished with the same amount of illuminating-gas, gasolene, carbon-oil vapors, or other similar illuminating agent and at the ordinary pressure at which gas is ordinarily furnished. We accomplish this without the use of an artificial or extraneous draft, as mechanical blowers. In our burner the admission of the air to the gas is so adjusted that in the mixture obtained the amounts of oxygen and hydrogen are practically in the proportions of the chemical equivalents of these two gases. The mixed air and gas issues from the burner under greater pressure than that furnished by the normal pressure of the gas-distributing system and with greater speed than that with which the gas would ordinarily pass through the burner, while at the same time the consumption of gas is economical and the action of the lamp is steady.

Within the preferably circular flame of our burner and also adjacent to the same there is a zone of superior incandescence formed, which zone we call the "hyperincandescent" zone and which is very much more intense and also somewhat hotter than the ordinary flame. In our burner we ordinarily place refractory material which is exceedingly close to this hyperincandescent zone, so that it will be in direct contact with the highly-heated air and the products of combustion rising from the flame, whereby the refractory material also becomes hyperincandescent, thus furnishing with the same consumption of gas a more intense light or the same amount of light given by other burners with a less consumption of gas. We have accordingly devised a burner wherein the air and gas are first heated separately in proper proportions and to the proper degrees, and then the column of flame is treated with air, the same being thrown against it both from within and without, whereby complete combustion is secured and a light of great whiteness and intense brilliancy is obtained, and we have therefore constructed according to our invention an organization of the class de-

scribed embodying the preferred construction of parts and their mutual relationship, combination, arrangement, and organization in a composite body or structure, as hereinafter described.

Referring particularly to the drawings, A denotes, preferably, a plurality of pipes or passages, forming the lower portion of our burner proper, in which the gas is heated and which is provided with a stop-cock, as L, and an interiorly-threaded extension L'. The passages A conduct into a cylindrical chamber I or burner proper, provided at its upper portion with preferably a plurality of small orifices I', through which the gas escapes for purposes of combustion, preferably at an angle, so as to move with a gyratory movement either in the same direction of or against the air column. Within the chamber E, containing the expansile chamber I, are located our preferably stationary air-deflectors e^2 e^3, constructed similar to the blades of a propeller, which deflectors serve to deflect the air sidewise and to give the air passing through the chamber E a gyratory motion. Our burner is also provided with an integral horizontal plate or chimney-holder B, provided with flaps D, and also with a number of perforations *b* (the central orifices serving to supply air to the center of the burner and to cool the gas-pipe) which may be partially or entirely closed by a concentric valve-plate M, provided with perforations F, constructed and arranged to register with the orifices *b* and lying against and beneath the plate B, which plate M may be rotated and the air-ports regulated by means of the adjusting-pin B'. We thus break up the current of air and so prevent the disagreeable hissing sound which is common in the form of burners ordinarily designated as "Argand" burners, and we also assist in obviating the effects of drafts upon the burner.

We provide a chamber I, as stated, within the chamber E of our burner, into the bottom of which the air is fed through the perforations F, and at the upper part thereof an outlet for the air is formed by the annular space or orifice formed in the top of the cap C, located above the deflector H, attached to the stem G, and the annular or hollow chamber I. The said cap C, inclosing the burner proper, I, sometimes provided with perforations C', rises from the plate B and has at the upper extremity thereof an annular flange or ledge or step C^{10}, forming a partially-closed top, with an opening concentric with the burner. The said annular flange C^{10}, together with the interior recessed perforated portion C^{11}, constituting an air-superheating chamber C^{13}, form a plurality of integral steps or ledges, the purpose of which is to force the heated air laterally against the column of heated gas rising from the burner and to cause the air and gas to become intimately mixed before ignition. The cap C, provided with the three aforesaid parallel steps or ledges B C^{10} C^{11}, may be stamped up out of one piece of sheet metal and the inclined upper portion of the cap may be snapped on. The heated air is caused to assume a gyratory motion (preferably in the same direction as that passing through the chamber I) by means of the preferably spirally-formed air-deflector C^{12}. The air being thus fed or incorporated in the column of gas both from within and without the same, preferably with a rotatory movement, imparts great steadiness to the flame, the same not being readily affected by drafts, &c., and affords a ready means of thoroughly mixing the heated air and heated gas in the proper proportions and degrees to produce perfect combustion and to give an intense white flame of great brilliancy.

A solid or tubular vertical stem G, which may serve to heat air or gas, or both, and constructed of refractory material, rises preferably from the plate B at the center of the burner, being mounted upon or connected with the valve M and may be provided with a deflector H, preferably of inverted-cone shape, and the continuation J of the stem G is ordinarily made of a highly-refractory material and usually provided with a flaring head or enlargement J', upon which we preferably place a highly-refractory material K. We ordinarily also surround the stem J with a cylinder R^8, preferably made of a refractory material, as a fireproof body, and provided with a coating or facing K^{10}, of highly-refractory material. Any suitable refractory material that will attain a white heat or become incandescent may be employed for this purpose. A chimney A', also preferably provided with a step or ledge, is suitably supported by the plate or holder B, as shown, and another chimney A^8, resting on the plate or holder A^{10} and provided with a central orifice, serves, together with the other chimney, to form a channel wherein the air may receive its preliminary heating before being mixed with the gas.

By means of the construction set forth we are able to produce a solid luminous body of fire of a steadiness and height of flame hitherto unattained and which is equal or superior in height and intensity of illumination to the best of the lamps known ordinarily as "incandescent" burners when in their best condition. We accomplish this, however, without the aid or use of any mantles or hoods whatever, the body of the flame itself having the general appearance of a mantle, and we accordingly produce by our burner what we term a "flame-mantle," in which burner there are, as stated, no perishable mantles to renew. By the use of our burner we also avoid the frequent breakage of chimneys and globes, which so frequently occurs with the use of burners of the incandescent or mantle type.

The burner represented in Figs. 2 and 4 is like that one just described, except that it is constructed and arranged to form a flat or oblong burner, and it also has a longer or ob-

long chamber E^2, the plate B^2, cap C^2, cylinder I^2, deflectors H^2 and K^2, and the supply-pipes A^2 being elongated, and the deflector K^2 also being supported by two stems J^2 in lieu of one stem J, as in Figs. 1 and 3.

It is manifest that various omissions of some particulars could be made without materially affecting the essential features of our invention or the operation of the remaining parts, and we do not, therefore, wish to be limited to the specific structural details of the organization set forth herein. Obviously the elements of the structure described may be located at an angle to the plane in which they are shown. We accordingly use the words "horizontal," "vertical," and the like in a relative sense.

The method of operating our invention is clear from the foregoing description. The gas entering the burner through the tubes A is heated to some extent thereby and afterward becomes more rarefied while passing through the conical chamber I, with or without being conducted up into the interior of the stem G. The air is heated while passing between the chimneys A′ and A^8 and through the perforations *b* and F of the plate or holder B and becoming divided or broken up, as it were, passes up through both the interior central portion of the burner and also within the cap C and outside the cylinder I with a gyratory motion. The interior column of air is further heated and also deflected by the deflector H, near the orifices I′, adjacent to which point the ascending exterior column of air, having in the meantime been further heated and also deflected by the cap C and chimney A′, meets the flame of the burner. The exterior column of air then rises with the flame, while the heated air of the central draft is again thrown against the flame by the head J′ of the stem J. The expansile and mixing chambers E and I serve to produce a combustible mixture of air and vapor of superior incandescence, in which the amounts of oxygen and hydrogen are practically in the proportions of their chemical equivalents, and in the heating zone of superior incandescence thus formed, which we term the "hyperincandescent" zone, we place suitable highly-refractory material, preferably by surrounding the stem J with a mass of non-conducting absorbent refractory material arranged adjacent to it, but so as to leave space for the passage of the gases of combustion around said stem—as, for example, the refractory materials K and K^{10}. The non-conducting refractory material thereby becomes radiantly hot or white in color and constitutes an incandescent mass, which adds to the intensity of our luminous flame. Thus, in short, the complete intermingling of the heated air and gas in the proper proportions produces an intense flame of a great height, while the refractory materials, which become of a white heat or incandescent, add, as stated, greater whiteness and brilliancy to the flame. It will be observed that in our burner the heated air is supplied for the combustion of the gas by utilizing the heat of the burning gas itself in a definitely-adjusted quantity by the air-passages formed by the chimney A′, plate B, and cap C, and the chimney A^8, plate A^{10}, and the burner-body I, and that the gas is thus prevented from being too highly heated before ignition, and also that the orifices I′ are located some distance apart, whereby the efficiency of our burner is highly increased, as the efficiency of gas as an illuminating agent depends both upon properly heating the air mixed with the gas and upon the volume of heated air that is thrown against the flame both from within and without the same, and also upon maintaining the gas at a sufficiently low temperature before ignition to prevent the decomposition of the hydrocarbon before ignition and the too-rapid combustion of the carbon during burning. For different qualities of lighting-gas and for different pressures the air-ports may be adjusted differentially by manipulating the pin B′ in order to produce the best burning mixture. The air contained within the chamber, ordinarily triangular in cross-section, located in the upper interior portion of our cap C, becomes superheated and is forced through the annular orifices of said chamber against the flame. The partial vacuum thus formed keeps drawing up the moderately-hot air through the lower orifices of the said chamber up into the said compartment for purposes of superheating the same. By thus treating the column of flame both from within and without with air the requisite supply of oxygen is supplied, whereby perfect and complete combustion is obtained, and a light of great whiteness in color and also of exceeding power and brilliancy is secured, as well as of a height of intensely-luminous flame hitherto unattained.

The commercial advantages of our burner consist in the production of a given quantity of light with the consumption of a quantity of gas much less than that necessary to produce an equal candle-power by the use of ordinary burners and also in the height and in the purity and brilliancy or intensity of the flame, the same being of a clear white and mellow light, thus constituting an improvement upon what has already been accomplished in this class of illuminating apparatuses.

As it is evident that many changes in the construction, form, proportion, and relative arrangement of parts might be resorted to without departing from the spirit and scope of our invention, we would have it understood that we do not restrict ourselves to the particular construction and arrangement of parts shown and described, but that such changes and equivalents may be substituted therefor, and that

What we claim as our invention is—

1. In a burner, a perforated plate and chim-

ney-holder, means for adjusting the size of said perforations at will, and a cap inclosing the burner and provided with an opening in the top, and also with a step or ledge, in combination with a gas-tube, a valve, gas-passages, and an annular chamber within the burner, the burner being provided with small outlet-orifices, and also with a central stem provided with a deflecting portion.

2. In a burner, a perforated plate and chimney-holder, means for adjusting the size of said perforations at will, and a cap inclosing the burner and provided with an opening at the top, and also with a step or ledge, in combination with a gas-tube, a valve, gas-passages, and an annular chamber within the burner.

3. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the outer edges of which are connected with an inclined portion or plate, in combination with a chimney cylinder or funnel and with refractory material located within said chimney.

4. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the outer edges of which are connected with an inclined portion or plate, in combination with a central stem provided with deflecting means.

5. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the outer edges of which are connected with an inclined portion or plate, in combination with a chimney cylinder or funnel provided with a step or ledge.

6. In a burner, a plate and chimney-holder and cap inclosing the burner, and provided with a plurality of steps or ledges, the outer edges of which are connected with an inclined portion or plate, and a thereunder-located cross-plate, in combination with a gas-tube, a valve, gas-passages and an annular gas-burner.

7. An annular burner, and a cap inclosing said burner, and provided with an integral chimney-holder, and also with a plurality of steps or ledges, the outer edges of which are connected with an inclined portion or plate.

8. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the lower being of larger diameter than the upper, in combination with means to deflect the air sidewise with a rotary movement located within the said cap.

9. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the lower being of larger diameter than the upper, in combination with means to deflect the air sidewise with a rotary movement located both within and without the said cap.

10. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the lower being of larger diameter than the upper, in combination with means to deflect the air sidewise with a rotary movement located adjacent to the said cap.

11. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the outer edges of which are connected with an inclined portion or plate, in combination with means to deflect the air sidewise with a rotary movement located within the said cap.

12. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the outer edges of which are connected with an inclined portion or plate, in combination with means to deflect the air sidewise with a rotary movement located both within and without the said cap.

13. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the outer edges of which are connected with an inclined portion or plate, in combination with means to deflect the air sidewise with a rotary movement located adjacent to the said cap.

14. A burner, and a cap inclosing said burner, and provided with air-deflecting means, and also with an air-superheating chamber located in the interior top portion of the cap.

15. A burner, and a cap inclosing said burner, and provided with air-deflecting means, and also with an air-superheating chamber provided with interior orifices, and located in the interior top portion of the cap.

16. An annular burner provided with an open central portion, a cap to inclose said burner and constructed and arranged to form an air-passage between the burner and cap, a superheating air-chamber located in the upper interior portion of said cap, and means to throw the said superheated air against the flame at the point of combustion.

17. An annular burner provided with an open central portion, and a cap to inclose said burner and provided at its upper interior portion with a superheating air-chamber, provided with air-inlet orifices in the lower part thereof, and with annular air-outlets to throw the said superheated air against the flame at the point of combustion.

18. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the outer edges of which are connected with an inclined portion or plate, in combination with a central stem.

19. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the outer edges of which are connected with an inclined portion or plate, in combination with a chimney cylinder or funnel and with deflecting means located within said chimney.

20. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the outer edges of which are connected with an inclined portion or plate, in combination with two chimney cylinders or

funnels forming an intermediate air-channel communicating with the interior of the cap.

21. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the outer edges of which are connected with an inclined portion or plate, in combination with two chimney cylinders or funnels, one provided with a step or ledge, and the two forming an intermediate air-channel communicating with the interior of the cap.

22. A burner, and a cap inclosing said burner, and provided with a plurality of horizontal steps or ledges, the lower being of larger diameter than the upper, in combination with a central stem, a cylinder of refractory material surrounding said stem but spaced therefrom, and a chimney.

23. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the lower being of larger diameter than the upper, in combination with two chimney cylinders or funnels forming an intermediate air-channel communicating with the interior of the cap.

24. A burner, and a cap inclosing said burner, and provided with a plurality of steps or ledges, the lower being of larger diameter than the upper, in combination with two chimney cylinders or funnels, one provided with a step or ledge, and the two forming an intermediate air-channel communicating with the interior of the cap.

25. An annular burner, and a cap inclosing said burner, and provided with air-deflecting means, in combination with a chimney cylinder or funnel, and with a central vertical stem and cylider of refractory material surrounding said stem but spaced therefrom.

26. An annular burner provided with an open central portion, and a cap inclosing said burner, and provided with a plurality of integral horizontal steps or ledges, the outer edges of which ledges are connected with an inclined portion or plate, in combination with a chimney cylinder or funnel.

27. A burner, and a cap inclosing said burner, and provided with a plurality of horizontal steps or ledges, and also with an air-superheating chamber located in the interior top portion of the cap, the lower step or ledge being of larger diameter than the upper, and also with an integral horizontal chimney-holder.

28. A burner, and a cap inclosing said burner, and provided with a plurality of horizontal steps or ledges, the upper ledge being constructed and arranged to throw the air against the flame at a right angle at the point of combustion, and the lower ledge being of larger diameter than the upper, in combination with a chimney, and with deflecting means located within said burner.

29. A burner, and a cap inclosing said burner, and provided with a plurality of horizontal steps or ledges, the upper ledge being constructed and arranged to throw the air against the flame at a right angle at the point of combustion, and the next lower ledge being of larger diameter than the upper one, and the said cap being also provided with an additional integral stepped horizontal chimney-holder, the aforesaid three ledges of said cap being constructed and arranged to lie in exact parallel position, the whole cap being stamped up out of one piece of sheet metal.

In testimony of the foregoing specification we do hereby sign the same, in the city of New York, county and State of New York, this 17th day of October, A. D. 1900.

FREDERICK M. BENNETT.
JONATHAN O. FOWLER, JR.

Witnesses:
HARRY H. HOLMES,
E. B. BOLTON.