(No Model.) 2 Sheets—Sheet 1.

A. M. BRAINARD.

HYDROCARBON VAPOR OR GAS BURNER.

No. 332,871. Patented Dec. 22, 1885.

Fig. 1.

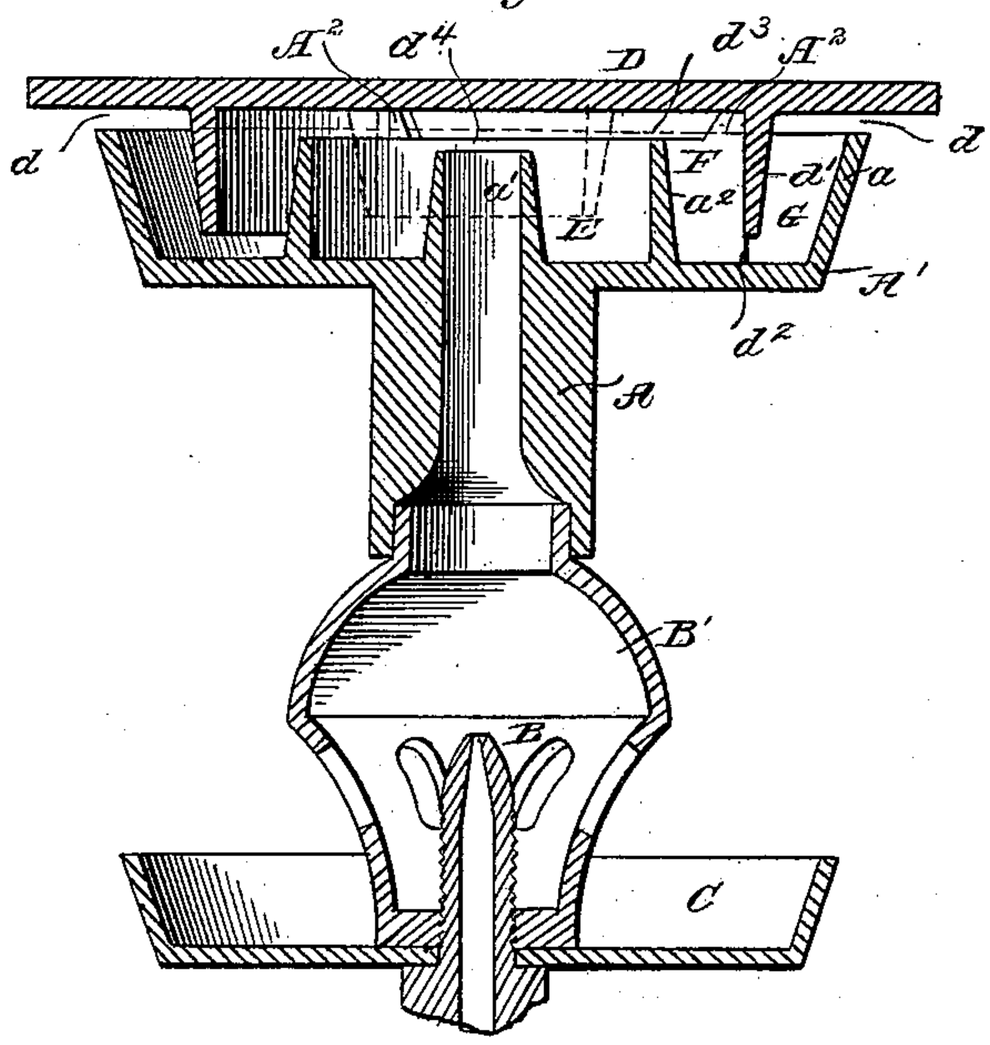
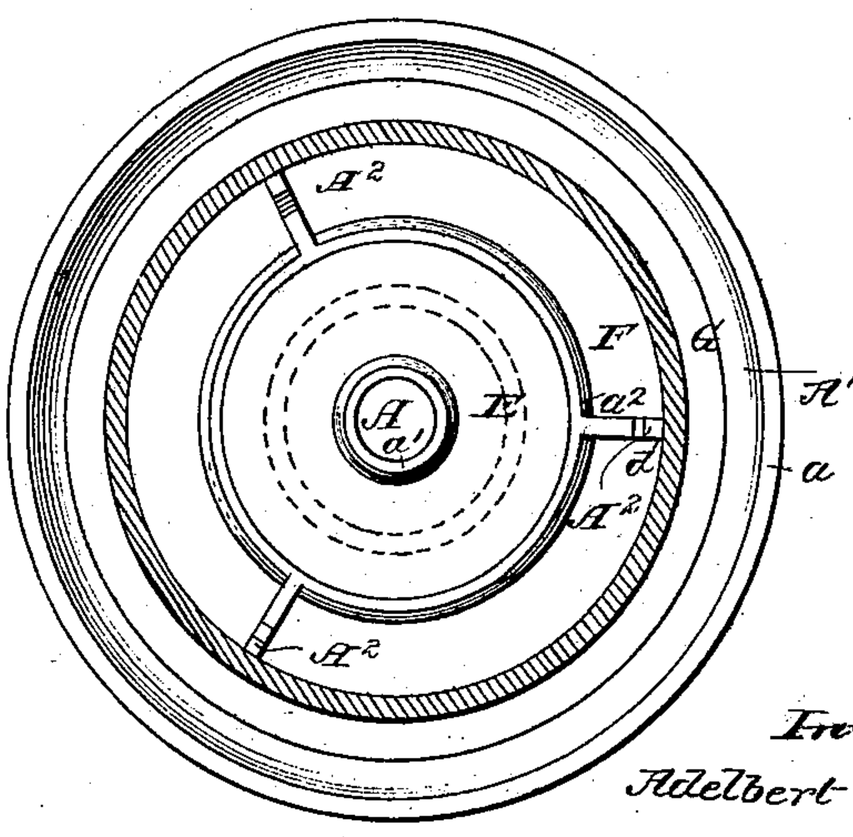


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

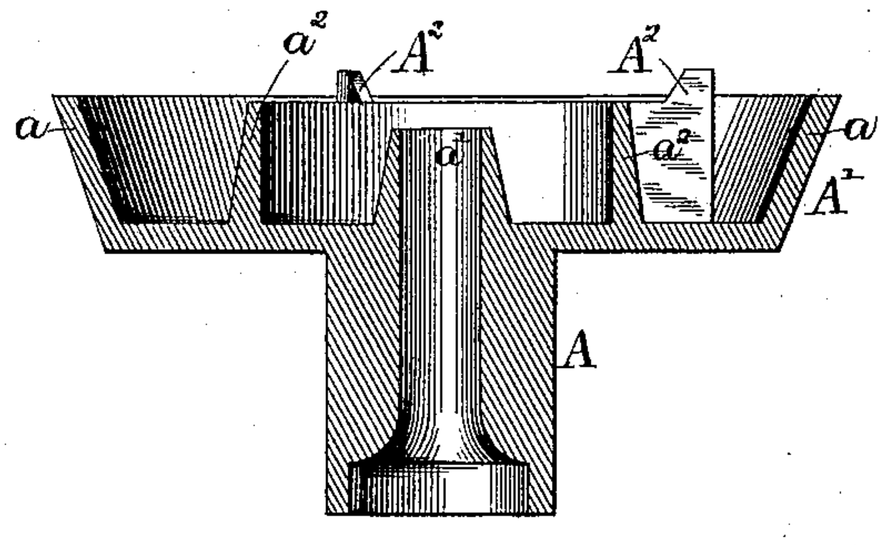
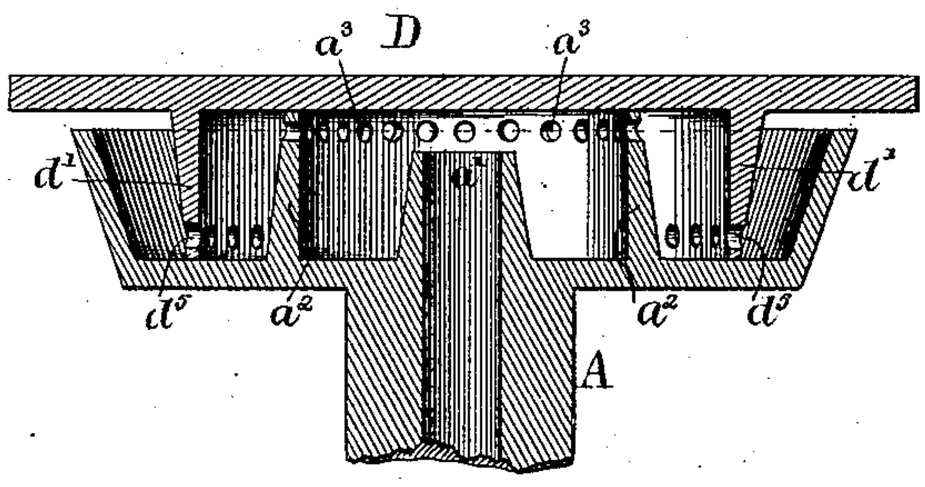


Fig. 4.



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UNITED STATES PATENT OFFICE.

ADELBERT M. BRAINARD, OF CHICAGO, ILLINOIS.

HYDROCARBON VAPOR OR GAS BURNER.

SPECIFICATION forming part of Letters Patent No. 332,871, dated December 22, 1885.

Application filed September 3, 1884. Serial No. 142,121. (No model.)

To all whom it may concern:

Be it known that I, ADELBERT M. BRAINARD, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Hydrocarbon Vapor or Gas Burners; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to that class of burners for hydrocarbon vapor or gas having a mixing-chamber provided with a continuous peripheral exit-opening, whereby a continuous flame is produced—such, for instance, as is described in an application No. 71,195 for Letters Patent filed by me on the 6th day of September, 1882.

The object of this invention is to provide an improved construction in burners of the class above mentioned, whereby a more perfect mixing of the air and vapor or gas is obtained, and whereby said air and gas are caused to issue from the burner in a smooth and steady stream; and the invention consists in the matters hereinafter described, and pointed out in the claim.

The principal feature of improvement in this invention consists in a construction in a mixing-chamber divided by suitable partition-walls into two or more compartments or secondary mixing-chambers communicating with each other by means of apertures in the said partition-walls, such as is shown in the said application No. 71,195, whereby the areas of the apertures in the partition-walls are increased gradually from the outlet to the exit opening in the manner and with the advantages hereinafter fully pointed out.

In the accompanying drawings, Figure 1 is a vertical section through the axis of a burner embodying my invention. Fig. 2 is a cross-section on a horizontal plane passing through the burner below the deflector-plate, taken upon line *x x* of Fig. 1. Fig. 3 is a separate detail sectional view of the cup and supply-tube of the burner. Fig. 4 is a sectional view of the upper part of the burner, showing another form of the latter.

As illustrated in the drawings, A is an induction-tube, and B is an injector, which is connected with a suitable generating-chamber, and which operates in connection with the perforated injector-chamber B′ to deliver an admixture of air and vapor to the induction-tube A, through which it passes to a mixing-chamber located at the top of the burner, the injector and the mixing-tube operating in a manner similar to the corresponding parts shown in the application above mentioned. A drip-cup, C, of the usual construction, is herein shown as attached to the nozzle B below the injector-chamber B′.

The mixing-chamber above mentioned is formed, as herein shown, by means of a shallow cup, A′, attached to the upper end of the induction-tube A, concentric therewith, and a deflecting plate or disk, D, located over the cup A′, and supported concentrically thereon by means of projections or studs A^2, herein shown as cast upon the cup A′. The said cup and plate are relatively so arranged that a narrow circumferential opening or slot is formed between the upper edge of the side wall, *a*, of the cup and the lower surface of the margin of the plate, through which the mixed air and gas from the mixing-chamber escape to the flame.

The cup A′, as herein shown and preferably constructed, is cast integral with the induction-tube A. The tube A is prolonged at its upper end so as to form a cylindric projection, *a′*, which extends upwardly within the mixing-chamber to a point a short distance below the bottom surface of the deflecting-plate D, and the mixing-chamber is divided into three annular compartments or secondary mixing-chambers, E, F, and G, by means of annular vertical flanges a^2 and *d′* upon the cup A and plate D, respectively, the said flanges terminating at short distances from the lower surface of the plate D and the inner horizontal surface of the cup A′, so as to form continuous narrow annular passages d^2 d^3, through which pass the mingled air and gas delivered to the

central part of the mixing-chamber through the tube A in their outward movement to the exit-opening *d* of the burner. By the construction in the extension *a'* upon the upper end of the induction-tube another relatively-narrow annular passage, *d*⁴, is formed between the upper edge of the said extension and the lower edge of the plate D, through which the mingled air and gas are delivered from said tube to the inner chamber, E.

The purpose of dividing the mixing-chamber into several compartments or secondary chambers connected by narrow openings, as described, is to effect a more thorough mixing of the air and gas before they reach the flame. Such mixing principally results from the facts that the gas and air are alternately forced in a thin stream through the passages between the chambers and allowed to expand in the latter, and that, being delivered forcibly into the chambers, they are given a circulatory movement therein calculated to admix them thoroughly. The passage of the air and gas through the series of chambers also tends to equalize the pressure in the several parts of the burner, so that the gas will flow smoothly and regularly and with equal force from all portions of the exit-aperture, whereby a practically silent and motionless flame is produced.

For the purpose of thoroughly mixing and equalizing the flow of the air and gas, as above described, it is not essential that the exact number of or construction in the secondary mixing-chambers herein shown should be used. The apertures in the partition-walls may, for instance, consist of a series of perforations, instead of being continuous, as shown in Fig. 4, wherein the annular inner flange, *a*², of the cup extends upwardly to the under side of plate D, and the annular flange *d'* of said plate extends downwardly to the bottom of the cup, the flange *a*² being provided with an annularly-arranged series of perforations, *a*³, near its top edge, and the flange *d'* being provided with a similar series of perforations, *d*⁵, near its lower edge. The projections A² are of course not required in this form of burner, and can be dispensed with; also, the mixing-chamber may be divided into two or more than two compartments or secondary chambers, for example, by a third flange, E, (shown in dotted lines) the addition of which increases the number of compartments to four, the number of chambers desirable being dependent upon the diameter of the burner and other considerations.

It will be observed that by the use of the oppositely-projecting flanges *d'* and *a*² to form the partition-walls between the chambers the annular passages *d*² and *d*³, connecting the chambers F and G, are located alternately at the upper and lower parts of the mixing-chamber, so that the mixed air and gas will enter the compartments at points diagonally opposite the exit-apertures thereto, whereby a circulatory movement of the air and gas is maintained within the chambers, and a thorough mixing thereof results.

In the form of burner herein shown it will be observed that the mixed air and vapor delivered to the inner annular compartment, E, from the induction-tube A by the action of the injector B are thrown forcibly upward against the under surface of the plate D, and are thereby deflected to the lower part of the said compartment, from whence they pass upwardly and through the annular passage *d*³ to the compartment F. An annular depending flange may be located within the compartment E, as indicated in dotted lines in Fig. 1, so as to divide said compartment into two annular chambers; but such flange is not usually found necessary for the successful operation of a burner of the general size and proportions shown.

In a mixing-chamber provided with two or more compartments connected by continuous passages it has been found that the stream of mixed air and vapor is caused to make its exit from the burner in a much more uniform and equable current, and that a more perfect flame is thereby produced, when the several openings are made gradually larger from the inlet to the exit opening of the chamber. For this reason the several annular passages *d*² and *d*³ formed by the flanges *d'* and *a*² and the passage *d*⁴ and the exit-passage *d* are so proportioned with relation to each other that the area afforded by said passages is gradually increased from the inlet to the exit apertures of the mixing-chamber. This difference in areas may obviously be obtained in the form of burner herein shown by varying either the diameter or the height of the several flanges, the extension *a'*, and the outer wall, *a*, of the cup.

The exact relative amount of enlargement of the areas of the successive openings giving the best results will obviously vary in burners of different forms and proportions, and is usually determined by experiment. In the burner illustrated in the drawings, in which the opposing surfaces of the disk D and the cup are plane and parallel, and the height or depth of the projections *a'*, the flanges *d'* and *a*², and the outer wall, *a*, of the cup are varied for the purpose of varying the area of the several openings formed thereby, it has been found, when the burner is about three and one-half inches in diameter and of the same general proportions as those shown in the drawings, that very perfect results are obtained when the flanges *a*² are about one-sixteenth of an inch higher than the nozzle or extension *a'*, and the upper edge of the wall *a* of the cup one thirty-second of an inch higher than the flange *a*².

I claim as my invention—

In a hydrocarbon vapor or gas burner, a mixing-chamber having a single continuous peripheral exit-opening, and divided into two

or more compartments by apertured partition-walls interposed between the inlet and exit openings of the said mixing-chamber, the areas of the apertures in the partition-walls and the exit-opening being increased gradually from the inlet to the exit opening, substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

ADELBERT M. BRAINARD.

Witnesses:

C. CLARENCE POOLE,

G. F. LANAGHEN.