No. 715,549. Patented Dec. 9, 1902.

# H. B. CARY.

## HYDROCARBON BURNER.

Application filed Oct. 8, 1901.

(No Model.)

Fig. 1

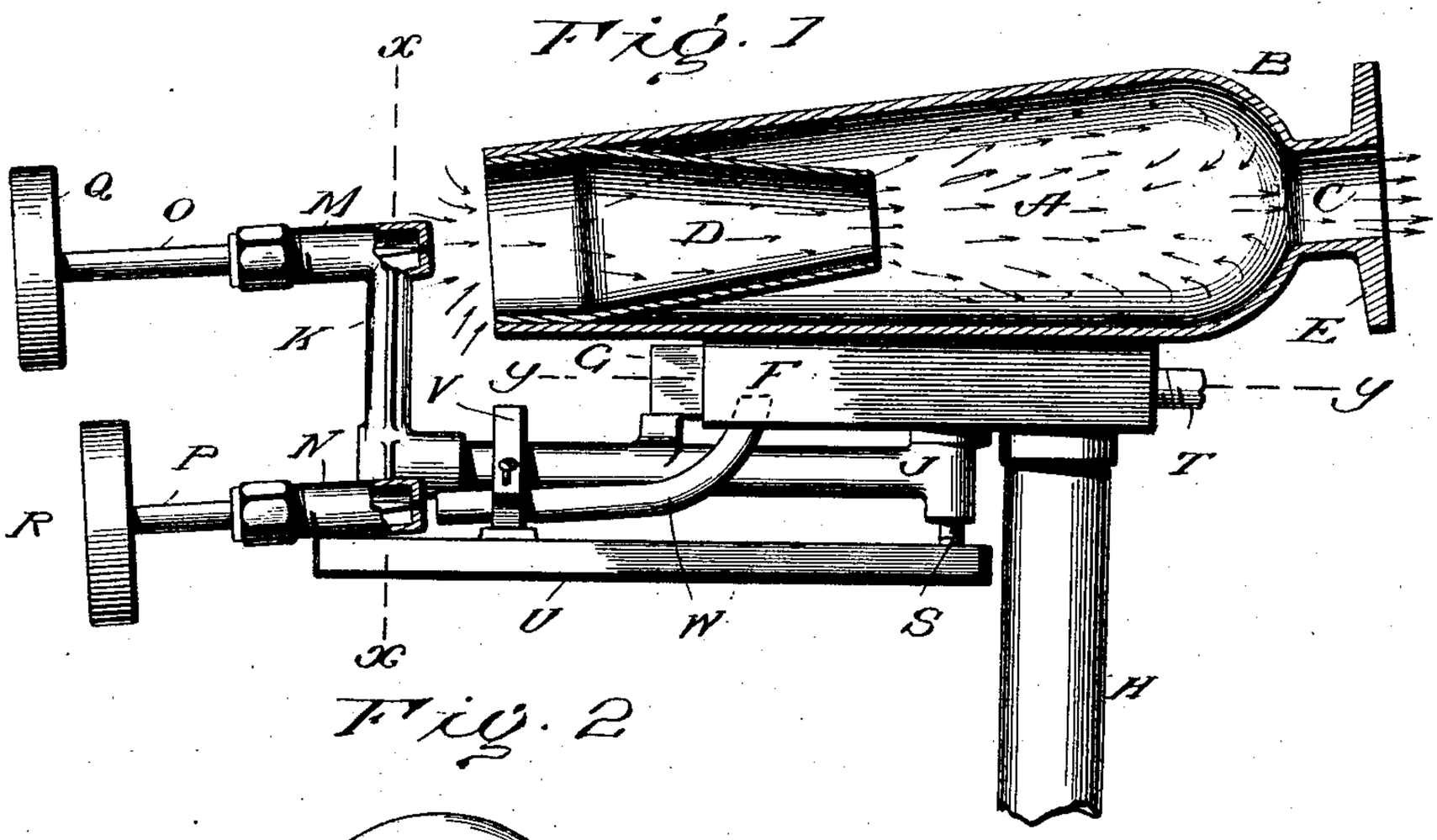



Fig. 2

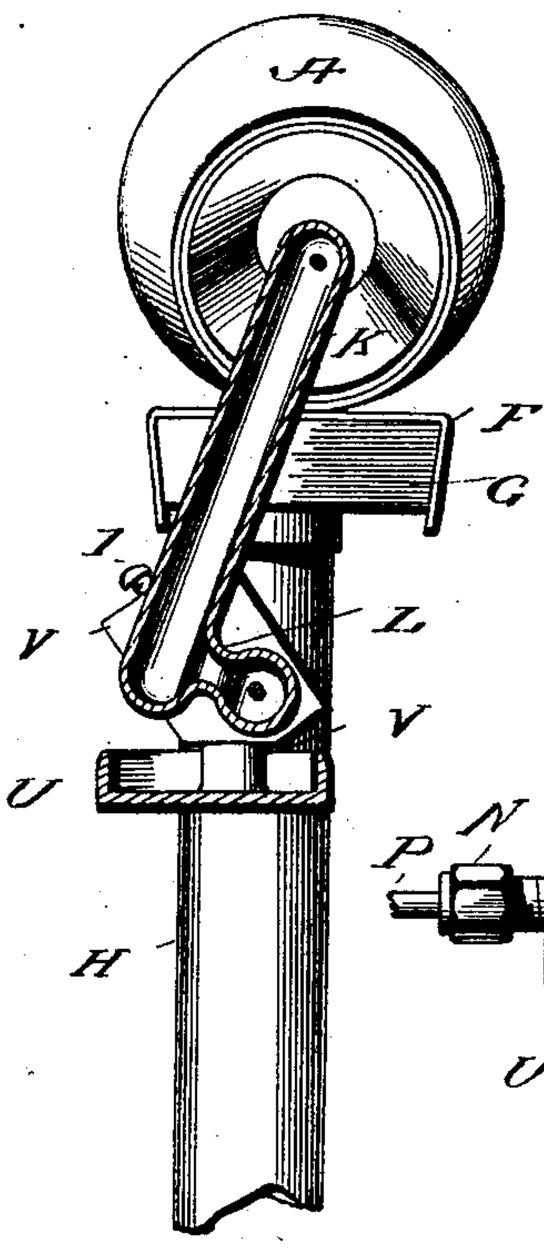
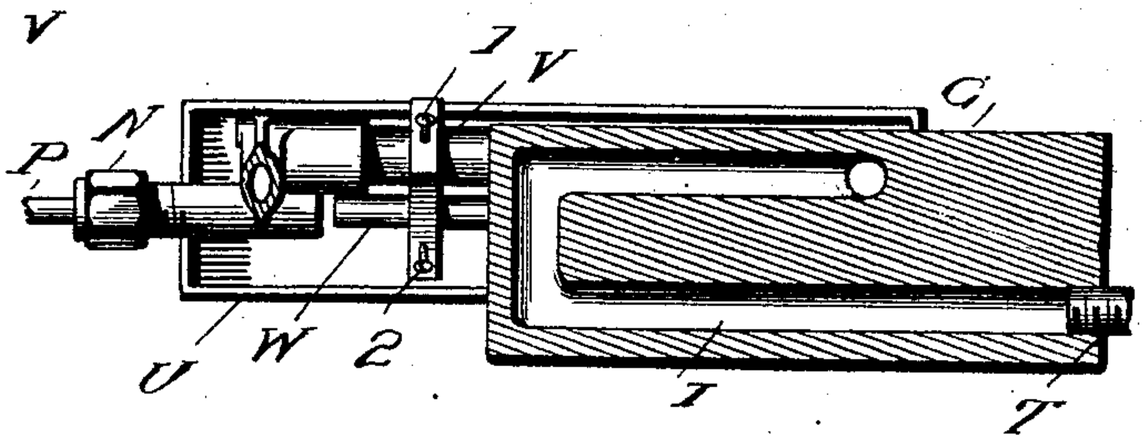



Fig. 3

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# UNITED STATES PATENT OFFICE.

HENRY BOUNDS CARY, OF LOS ANGELES, CALIFORNIA.

## HYDROCARBON-BURNER.

SPECIFICATION forming part of Letters Patent No. 715,549, dated December 9, 1902.

Application filed October 8, 1901. Serial No. 78,021. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY BOUNDS CARY, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Hydrocarbon-Burners; 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.

My invention relates to certain new and useful improvements in that class of gas-burners known as "Bunsen" burners, and particularly to that type of the same shown and described in Letters Patent granted to me July 3, 1890, and January 8, 1901, and numbered, respectively, 653,166 and 665,670.

In Patent No. 653,166 is shown and described a mixing-chamber with an inwardly-projecting ring within the exit end of the chamber, which is designed to aid in thoroughly mixing the hydrocarbon vapors and the entrained air, a generating-chamber surrounding the exit, and an inwardly-tapering funnel or cone shaped tube at the front end of the mixing-chamber and in front of a vapor-injector. In this construction the volatilization of the hydrocarbon is dependent upon the heat generated by the flame when used in the open air and upon such flame and the radiated heat from the furnace when used in connection with a furnace. The object of the invention described in said patent was primarily to control the proportions of hydrocarbon and oxygen admitted to the mixing-chamber and to thoroughly associate and intermix the same before it reached the burning zone. I have found from practice that while said construction accomplished the ends sought to a greater extent than heretofore possible the variation as to proportions of volatilized hydrocarbon and oxygen depends upon the predetermined construction and fixed relation of the parts and that the associated hydrocarbon vapor and oxygen in the mixing-chamber is liable to expand or roll radially over the outer face of the projecting ring in the exit end of the mixing-chamber, and thus retard the flame in its progress to the furnace and to also intensify the heat within the generating-chamber to an undesirable degree.

In the Letters Patent No. 665,670 is shown and described a means for quickly and readily generating the vapor in the generating-chamber for starting a burner such as that shown in Letters Patent No. 653,166.

My present invention has for its object to so construct the mixing-chamber and so arrange it with relation to the vapor-injector that the difficulties hereinbefore referred to shall be avoided, that the proportions of hydrocarbon vapor and entrained air may be controlled and varied whenever desired or necessary by simply adjusting the relation between the coacting parts of the burner and without altering its construction, and that the entrained air and hydrocarbon vapors shall be more completely and thoroughly mixed and more satisfactorily delivered to the flame zone.

My invention has for a further object to so construct and arrange the generator for volatilizing the hydrocarbon as to remove it from the undue influence of the radiated heat of the furnace when used in connection with such to secure a uniform volatilization of the hydrocarbon and to secure the greatest economy in the use of the hydrocarbon.

With these ends in view my invention consists, first, in the peculiar construction of the mixing-chamber, by means of which I am enabled to produce the same at greatly-reduced cost and to secure the most satisfactory and desirable association of the hydrocarbon vapors and the constituents of the entrained air; second, in arranging the mixing-chamber and the jet-piece in adjustable relation with each other, whereby the proportions of entrained air and hydrocarbon vapors may be absolutely controlled to secure any desired character of flame or degree of heat; third, in providing a vapor-generating chamber separable and independent from the mixing-chamber and applying a constant and uniform heat of any desired degree to the generating-chamber, thus securing uniform and economical vaporization of the hydrocarbon used, and, fourth, in the details of construction hereinafter described for carrying out the broad ideas involved in my invention.

In order that those skilled in the art to which my invention appertains may know how to make and use my improved burner and fully appreciate all of its advantages, I will proceed to describe the construction and operation of the same, referring by letters to the accompanying drawings, in which—

Figure 1 is a side elevation of my improved burner with the mixing-chamber shown in section. Fig. 2 is a vertical section taken on the line *x x* of Fig. 1, and Fig. 3 a horizontal section on the line *y y* of Fig. 1.

Similar letters of reference indicate like parts in the several figures of the drawings.

A represents the mixing-chamber, the wall of which tapers gradually and outwardly from the inlet toward the exit and is then contracted in dome shape, as shown at B, to an axial tubular exit C, in cross-section substantially of the same area as the contracted exit of a funnel or cone shaped induction-tube D, such as shown and described in my Letters Patent No. 653,166, hereinbefore referred to. The tubular portion C of the mixing-chamber terminates with an annular flange E, adapted for contact with a furnace when the burner is used in connection with one. The under side of the chamber A is provided with a dovetail or other shaped projection F, which may be made integral therewith or separately and secured thereto in any desired manner.

G is the generating-chamber, secured in any suitable manner to an ordinary hydrocarbon-supply pipe H, which is provided with the usual swivel and adjustable joints. The generating-chamber is formed with a channel I, which traverses from one end in a longitudinal direction, then across the other end and back, as shown at Fig. 3, (to give the greatest extent of generating-surface,) and is there connected with a vapor-conduit pipe J, joined at its rear end to a jet-piece having two branches K and L, terminating in two jet-nozzles M and N, respectively, provided with needle-valves O P, controlled by hand-wheels Q R. The vapor-pipe J may be provided with a drain-plug S, if desirable. The generating-chamber, like the mixing-chamber, is for the purposes of economy in manufacture made of cast-iron, and the vapor-chamber I may be cored out or bored and closed by plugs T. A priming-pan U for starting the generation of vapor is secured to the under side of the vapor-conduit J in any suitable manner, but preferably by a plate V, passed over the conduit and secured thereto by a set-screw 1. This plate V is set obliquely and a short tube W is secured therein by a set-screw 2. This tube W has its rear end in axial and adjustable relation with the vapor-nozzle N, while the other vapor-nozzle M is in axial alinement with the induction-tube D.

From the construction shown and described it will be seen that the burner is started by igniting a priming supply of hydrocarbon oil in the pan U and heating the hydrocarbon in the conduit J, whereupon the vapor generated therein travels to the jet-piece, and the needle-valve in the nozzle M being closed the generated vapor is injected through the nozzle N into the tube W, which is so adjusted through the medium of the set-screw 2 that the supply of entrained air is properly controlled. Said air and the hydrocarbon vapor entering the tube W is then ignited at its upper end under the generating-chamber G, and the vaporization of the hydrocarbon contained therein is begun and continued by the heat resulting from the flame at the end of tube W, which is maintained during the operation of the burner. When the vaporization is such as required, the needle-valve O in the nozzle M is opened and the vapor is injected into the tube C of the mixing-chamber A and with the mixed entrained air is liberated from the contracted forward end of the tube into the gradually-increasing area of the mixing-chamber A, the associated vapor and air expanding as it travels longitudinally both as a result of its natural tendency and under the axially-projected force of the following vapor and air, thus further mixing and associating all the constituents. On its onward movement it contacts with the converging wall of the dome B, which partially retards its progress and rolls it back against and into the central portion of the incoming body, thus thoroughly tumbling, rolling, and mixing all the atoms and constituents, as illustrated by arrows shown within the chamber A. When thoroughly and intimately mixed—like smoke—the vapor passes unobstructedly through the tubular exit C under the general prevailing axial pressure induced through the tube D and escapes into the fire zone in such condition as to instantly burn.

In order that the relative proportions of the constituents of the hydrocarbon vapor and the entrained air may be intelligently and scientifically controlled, so that every heat unit may be utilized at the exit, and at the same time the character of the flame and corresponding intensity of its heat be regulated, the mixing-tube A and the jet-nozzle M are, as heretofore explained, adjustable relatively with one another. By reason of such adjustability if it is desired that the vapor delivered at the exit C of the mixing-chamber should be richer in carbon than oxygen constituents the jet-nozzle M and the end of the mixing-chamber A are brought comparatively close together, thus lessening the opportunity for intake of air, and the needle-valve O is likewise adjusted in harmony with the result desired. If, on the contrary, it is desired to have less carbon and more oxygen, the carbon-nozzle and the mixing-chamber are adjusted farther apart and to such extent as desired, and likewise the needle-valve O may be correspondingly adjusted, so that it will be seen that by the adjustment of the relation between the mixing-chamber and the

nozzle M, either with or without the adjustment or change of the needle-valve O, the constituent elements of the vapor emitted at the exit end of the burner may be absolutely controlled.

In addition to the much-desired possibility of controlling the character of the burning vapor and the quality of heat thereby generated great economy ensues in the use of my improved burner not only from the ability to reduce or increase the quantity of entrained air with reference to a uniform supply of vapor or a reduction of the same when under certain conditions a full supply is unnecessary, but by reason of the control of the generating heat under the mixing-chamber and the elimination therefrom of the radiated heat from the furnace (when the burner is used with a furnace) the degree of vaporization within the generating-chamber is under absolute control, and consequently an unnecessary quantity of hydrocarbon is not used.

Many changes in the mere details of construction—such, for instance, as that enabling the adjustment between the mixing-chamber and the hydrocarbon-nozzle M or the means for connecting the pan U to the vapor-conduit and giving adjustability to the tube W—may be made without departing from the spirit of my invention, which resides in the generic features heretofore explained.

Having described the construction and operation, as well as the advantages, of my improved burner, what I claim as new, and desire to secure by Letters Patent, is—

1. In a hydrocarbon-burner, a mixing-chamber adapted to receive hydrocarbon vapor and entrained air, and having a continuous and closed wall of gradually-increasing area for a given distance from the initial or intake end, and then gradually contracted toward and terminating in an axial delivery-exit, whereby the hydrocarbon vapor and entrained air, in transit from the intake end and toward the outlet or exit of said chamber, are confined and mixed in substantially the manner hereinbefore set forth.

2. In a hydrocarbon-burner, a mixing-chamber adapted for hydrocarbon vapor and entrained air, having a continuous or closed wall gradually increasing in area for a given distance and then gradually contracted toward and terminating in an axial outlet, and provided at the intake end with a converging intake-conduit in air-tight relation with the wall of the mixing-chamber, substantially as hereinbefore set forth.

3. In a hydrocarbon-burner, a mixing-chamber adapted for intake of hydrocarbon vapor and other desirable fluids, and having a converging intake-conduit terminating in a chamber of gradually-increasing area for a given distance, then gradually contracted toward and terminated in an axial elongated outlet, substantially as and for the purposes set forth.

4. In a hydrocarbon-burner, a mixing-chamber of gradually-increasing area for a given distance, and then gradually contracted toward an axial outlet, and provided with an intake for hydrocarbon vapor and entrained air, a generating-chamber, means for heating the same, and a vapor-nozzle located in proper relation with the intake of the mixing-chamber, said mixing-chamber being adjustably connected with the generating-chamber, substantially as and for the purposes set forth.

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

HENRY BOUNDS CARY.

Witnesses:
D. G. STUART,
WM. C. MCINTIRE.