No. 725,110. PATENTED APR. 14, 1903.

E. C. MERRILL.

GAS BURNER.

APPLICATION FILED MAR. 25, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1

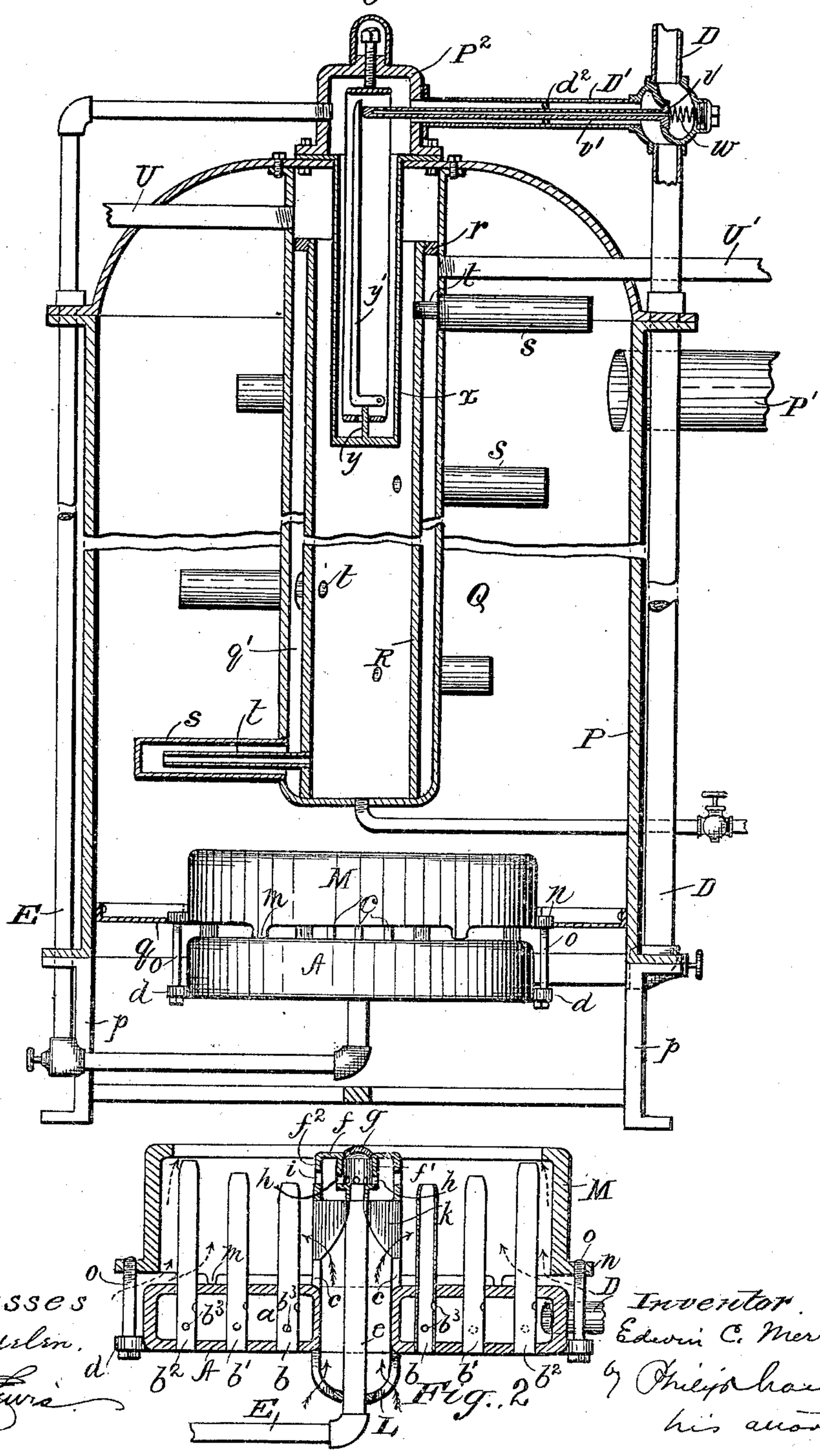

Fig. 2

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

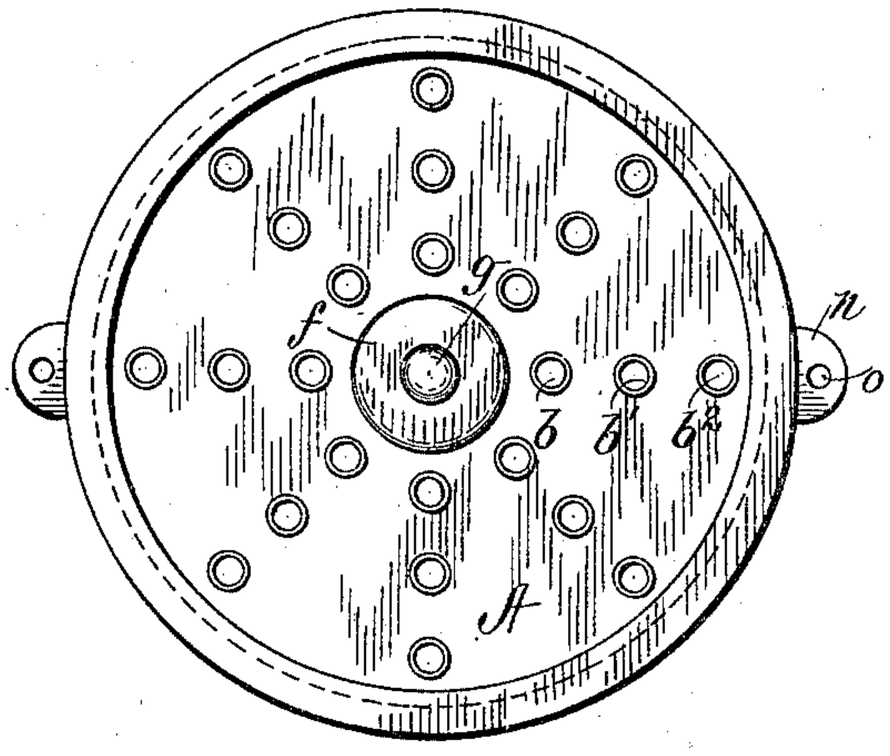
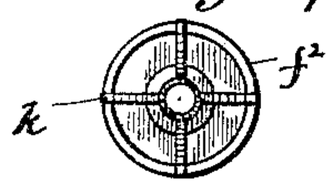


Fig. 4.



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UNITED STATES PATENT OFFICE.

EDWIN C. MERRILL, OF PITTSBURG, PENNSYLVANIA.

GAS-BURNER.

SPECIFICATION forming part of Letters Patent No. 725,110, dated April 14, 1903.

Application filed March 25, 1901. Serial No. 52,802. (No model.)

To all whom it may concern:

Be it known that I, EDWIN C. MERRILL, a resident of Pittsburg, Pennsylvania, have invented a new and useful Improvement in Gas-Burners, which invention is fully set forth in the following specification.

This invention has reference to gas-burners for heating purposes, the principal objects being, first, to prevent what is commonly known as "back-burning," or, in other words, to prevent the mixture of air and gas from becoming ignited and burning in the passages or inclosed spaces of the burner in advance of the discharge-openings thereof; second, to provide a burner adapted to produce intense heat—suitable for use, for example, in instantaneous water-heaters—from which it follows that the burner must be capable of consuming a proportionately large volume of gas.

Back-burning, which is common to most gas-burners at present used for heating purposes, not only greatly detracts from the heat-producing power of the burner, but attacks and injures joints and also the metal or other material of which the burner is made, rendering the life of the burner comparatively short. Furthermore, and equally objectionable, the burning of the mixture within the passages or inclosed spaces of the burner causes deposits of carbon to be made therein, quickly impairing the operation and efficiency of the burner and necessitating frequent cleaning or removal of the deposit.

The greater the pressure of the gas within the chambers or spaces of the burner, and hence the greater the pressure and velocity at which the air and gas mixture is discharged from the burner-openings, the greater the volume of gas consumed and heat produced. The mixture of air and gas should therefore be formed as near as possible to the burner-openings, so that it will be discharged from said openings at or near the full pressure in the main gas-supply. It follows that any mixing of air and gas in advance of the burner, as is common in most burners of this general type, will cause a corresponding diminution in the pressure at the burner-openings and in the heat-producing power of the burner.

The burner of my invention renders back-burning impossible and attains a maximum pressure at the burner-openings. It also embodies many structural features of advantage and importance, all of which may be most readily understood by reference to the accompanying drawings, showing the preferred embodiment of the invention.

Figure 1 is a vertical sectional view, partly in elevation, illustrating the application of the burner to an instantaneous water-heater. Fig. 2 is a sectional view of the burner. Fig. 3 is a plan view thereof, and Fig. 4 is a bottom view of the pilot-burner.

Referring to Fig. 2, A is a hollow annular casing, within which is an annular chamber a. The upper and lower walls of the casing are provided with openings for the reception of vertical tubes b b' b^2, which are open at both ends and preferably contracted at their upper or discharge end, as shown. The lower ends of the tubes are flush with the under side of the casing, while their upper ends project above the upper side of the casing, the length of projection of tube b^2 being greater than that of tube b' and that of b' greater than that of b. From chamber a the gas passes into pipes b b' b^2 through perforations b^3. As shown in the drawings, each pipe has two perforations b^3, arranged one above the other and at an angle of ninety degrees with reference to each other, so that each perforation is located opposite an imperforate part of the pipe. It follows that the gas projected under pressure through perforations b^3 and striking the opposite imperforate wall of the tube will be spread out and scattered, greatly facilitating its admixture with the air ascending through the tube. While the annular form of casing A and chamber a is preferred, any other convenient and suitable form may be employed.

Four vertical projections c are located around the inner edge of annular casing A, while two lugs d are located on the periphery thereof, the casing A, projections c, and lugs d being cast in one piece. A main gas-supply pipe D leads into chamber a.

E is a small gas-supply pipe leading into a short vertical pipe e, which latter leads to and forms part of a pilot-burner. The pilot-burner consists of an inverted cup-like part f, having an opening through the top thereof about which depends a flange f', which is connected to the upper end of pipe e. The

opening through part *f*, which is left for convenience in casting, is closed by a cover *g*, which may be tightly driven into place. Small discharge-openings *h* through flange *f'* are arranged opposite larger openings *i* through the outer wall f^2 of part *f*, and both openings *h* and *i* are arranged in radial alinement with the groups of tubes *b*, *b'*, and b^2. Four depending legs or webs *k*, Figs. 1 and 4, connecting the lower edge of flange f^2 with the short pipe *e*, rest at their lower extremities upon the four projections *c*, respectively. A spider L, embracing pipe *e* and bearing against the under side of casing A, serves to hold said pipe in proper position. Part *f*, flanges *f'* and f^2, webs or legs *k*, and pipe *c* are preferably cast in one piece.

M is an annular guard or deflector of about the same diameter as casing A, having on its lower edge three depending lugs *m*, which bear against the upper surface of said casing. An inturned flange around the upper edge of the guard lies just above the upper end of tubes b^2. Two ears *n* on the periphery of guard M receive bolts *o*, which pass upwardly through the lugs *d* on casing A and act to securely hold the guard in place on the latter.

The burner operates as follows: The gas at full pressure enters chamber *a* through closed pipe D. As the gas in chamber *a* is unmixed with air and as there is no way for air to become mixed with the gas while it is in said chamber to form a combustible mixture therein, back-burning in the chamber is rendered impossible. From chamber *a* the gas is projected at full pressure through perforations b^3 into tubes *b* *b'* b^2, where it is mixed with air, as already described. A further mixing with air takes place at the upper end of the tubes, where the mixture is ignited and burns, causing a strong draft, first, upward through said tubes; second, upward about the tubes through the spider L, the center of casing A, and between the projections *c* and legs *k*, as indicated by the arrows in full lines, and, third, upward about the tubes through the space between the lower edge of guard M and top of casing A, as indicated by the arrows in dotted lines. The contraction of tubes *b* *b'* b^2 at their upper ends acts to prevent back-burning in said tubes. At the pilot-burner the gas passes from pipe *e* into the small chamber beneath cap *g* and thence through the small openings *h* in flange *f'*. Air circulating upwardly mixes with the gas in the space between flanges *f'* and f^2, forming a combustible mixture, which passes out through openings *i* in flange f^2 and burns in a flame sufficient to light the mixture discharged from tubes *b*, *b'*, and b^2.

Referring now to Fig. 1, wherein I have shown my improved burner applied to an instantaneous water-heater, P is the outer casing of the water-heater, closed at its upper end, but open at its lower end and supported upon legs *p*. The burner is supported in the casing by an annular partition *q*, which divides the interior of the casing about the burner and deflects all upward circulation of air through the burner. A flue P' carries off the products of combustion. A large cylindrical jacket Q, closed at its lower end, depends from the top of the casing and has within it a smaller concentrically-arranged tube R, which rests against the closed bottom of jacket Q. An annulus *r* closes the space between the upper extremity of tube R and the inner wall of jacket Q. Spirally-arranged pipes *s*, closed at their outer ends, project from jacket Q and open at their inner ends into the space *q'* between the jacket and tube. Smaller pipes *t*, open at both ends, project from tube R outwardly into pipes *s*, respectively. Cold water entering the upper end of jacket Q through inlet-pipe U passes downwardly through tube R, outwardly through pipes *t*, and inwardly through tubes *s* (where it is principally heated) into the annular space *q'*, and thence out of the upper end of said space through outlet-pipe U'.

The gas-supply pipe E for the pilot-burner communicates at its upper end with the interior of a cap P^2 on casing P. The gas-supply pipe D for the burner proper has a branch D', leading into cap P^2. A valve *v*, located at the junction of pipes D and D', has a stem *v'* running through the latter and bearing in a partition d^2 therein. A longitudinal perforation extends through valve *v* and its stem *v'*. Spring *q* tends to hold valve *v* to its seat, in which position it cuts off the supply of gas to the main burner, but permits gas to pass to the pilot-burner through the longitudinal perforation through stem *v'*, into cap P^2, and thence through pipe E.

Any suitable automatically-operated means may be utilized for opening valve *v* against the pressure of spring *w* for allowing gas to pass to the main burner. In the drawings I have shown a thermostatic regulator similar to that of my Patent No. 486,727, dated November 22, 1892. *x* is an expansible tube sensitive to changes in temperature and closed at its lower end, suspended within jacket Q and tube R beneath cap P^2. In this position when water is passing through the heater the cold water entering by pipe U comes into immediate contact with the expansible tube, so that so long as hot water is being drawn from the heater the tube *x* will retain its normal length and, acting through a projection *y* at the closed end of tube *x* and a lever *y'*, pressing against the end of valve-stem *v'*, will hold valve *v* open. As soon, however, as the use of hot water is lowered to such point as to permit hot water to accumulate in the apparatus about tube *x* the latter will expand, releasing the pressure on lever *y'*, permitting spring *w* to close valve *v*, cutting off the gas-supply to the main burner.

It will thus be seen that the operation of the heater is regulated automatically by the temperature of the water in contact with expansible tube *x*.

What I claim is—

1. A gas-burner consisting of a gas-chamber, a closed pipe or passage for conducting gas directly into said chamber, and a plurality of mixing-tubes passing through the chamber, said tubes being open at both ends and each having transverse perforations through its wall by which gas enters the tube from the chamber.

2. A gas-burner consisting of a gas-chamber, a pipe or passage for conducting gas directly into said chamber, a plurality of mixing-tubes passing through and projecting from the chamber at one end, said tubes being open at both ends and having perforations through which gas enters the same from the chamber, and a guard or deflector about the projecting ends of all the tubes having an opening or openings at its lower edge through which air may circulate upwardly within the guard and about the projecting ends of the tubes.

3. A gas-burner consisting of a gas-chamber having a central opening through which air may circulate upwardly, a pipe or passage for conducting gas directly into said chamber, a plurality of mixing-tubes passing through and projecting from the chamber at one end, said tubes being open at both ends and having perforations through which gas enters the same from the chamber, and a guard or deflector about the projecting ends of all of the tubes having an opening or openings at its lower edge through which air may circulate upwardly within the guard and about the projecting ends of the tubes.

4. In a gas-burner, a hollow casing and a closed pipe or passage for supplying gas to the chamber within said casing, a plurality of mixing-tubes passing through openings in the upper and lower walls of said casing and projecting above the same, said tubes being open at both ends and each having transverse perforations through its wall by which gas enters the tube from the chamber.

5. In a gas-burner, a hollow casing having an open central part through which air may circulate upwardly, a closed pipe or passage for supplying gas to the chamber within said casing, a plurality of mixing-tubes passing through and projecting above the chamber, said tubes being open at both ends and each having transverse perforations through its wall by which gas enters the tube from the chamber.

6. In a gas-burner, a hollow annular casing and a pipe or passage for conducting gas into the same, a plurality of mixing-tubes passing through openings in the upper and lower walls of said casing and projecting above the same, said tubes being open at both ends having perforations through which gas enters the same from the chamber, and an annular guard about the projecting ends of the tubes having an opening or openings at its lower edge through which air circulates upwardly about the tubes.

7. In a gas-burner, a hollow annular casing and a closed pipe or passage for conducting gas into the same, a plurality of mixing-tubes passing through openings in the upper and lower walls of said casing and projecting above the same, said tubes being open at both ends having perforations through which gas enters the same from the chamber, and an annular guard about the projecting ends of the tubes, having an opening or openings at its lower edge through which air circulates upwardly about the tubes.

8. In a gas-burner, a gas-chamber, and a tube or tubes open at both ends passing through said chamber and having a plurality of perforations through which gas enters the same from the gas-chamber, said perforations being disposed one above another and each opposite an imperforate part of the tube.

9. A gas-burner consisting of a gas-chamber, a closed pipe or passage for conducting gas directly into said chamber, a mixing-tube open at both ends passing through the chamber and having transverse perforations through its wall to admit gas from the chamber.

10. In a gas-burner, a hollow annular casing and a pipe or passage for conducting gas into the same, a plurality of mixing-tubes passing through openings in the upper and lower walls of said casing and projecting above the same, said tubes being open at both ends and each having transverse perforations through its wall by which gas enters the tube from the chamber, a pilot-burner located above the center of the annular casing and having a burner opening or openings in the side walls thereof for projecting the flame into proximity with the upper ends of the mixing-tubes, and a gas-supply pipe for the pilot-burner passing upwardly through the central opening of the annular casing.

11. In combination, a main burner having a plurality of burner-openings, a pilot-burner located centrally with reference to said burner-openings and comprising a gas-chamber having perforations in its side walls, an outer wall having burner-openings therein opposite the perforations in the wall of the gas-chamber and forming an intervening space in communication with the atmosphere and in which the gas is mixed with air before passing through the burner-openings.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

EDWIN C. MERRILL.

Witnesses:
WM. K. GRAY,
WM. C. CHARLTON.