March 8, 1927. 1,620,071

C. C. CHAPPELLE

GAS BURNER

Filed May 31, 1924 2 Sheets-Sheet 1

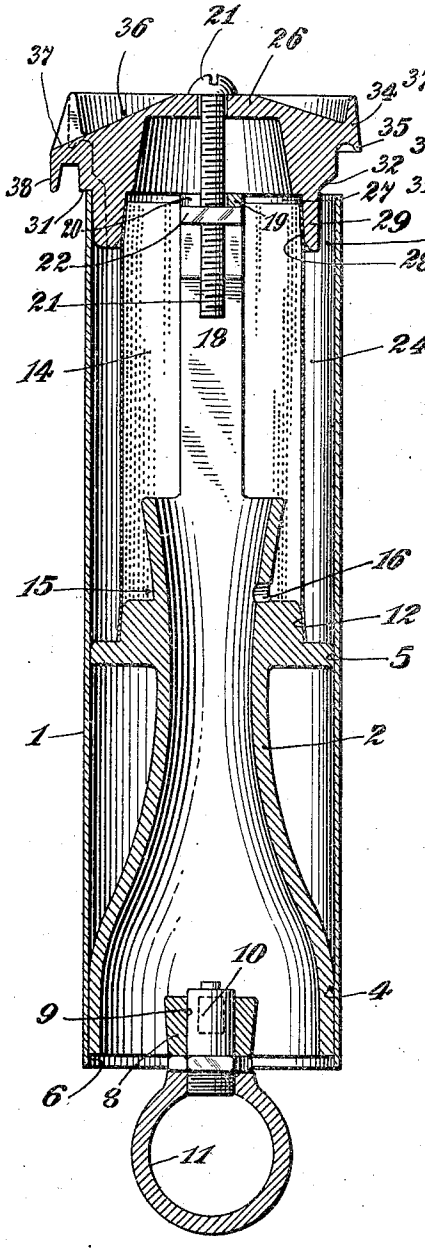


Fig. 1.

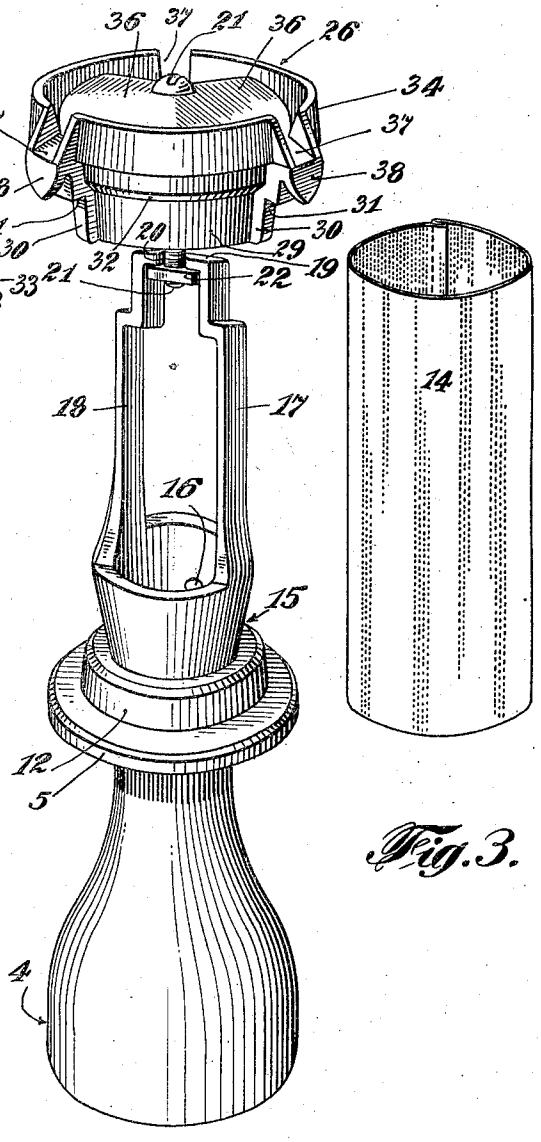


Fig. 3.

Fig. 2.

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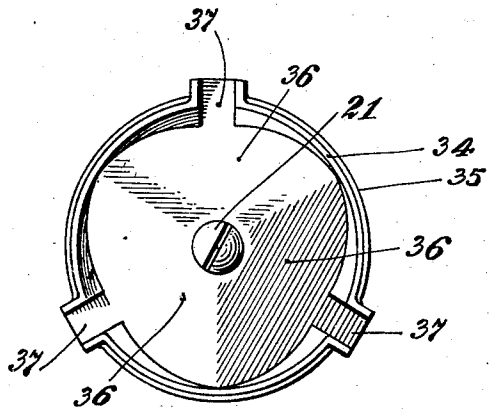


Fig. 4.

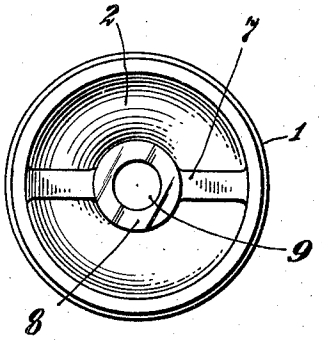


Fig. 5.

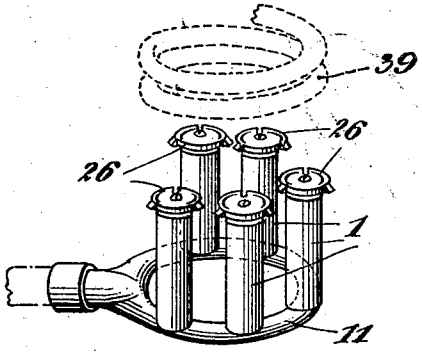


Fig. 6.

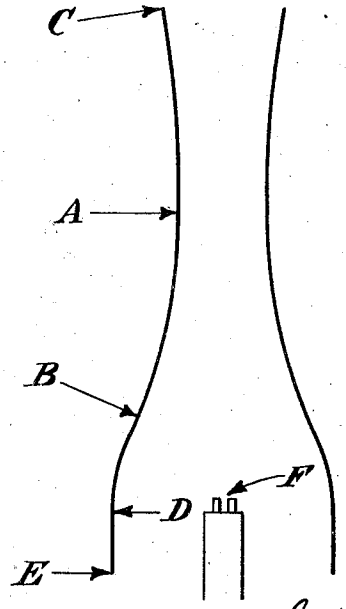


Fig. 7.

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Patented Mar. 8, 1927. 1,620,071

UNITED STATES PATENT OFFICE.

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GAS BURNER.

Application filed May 31, 1924. Serial No. 716,874.

This invention relates broadly to improvements in gas burners and more specially to an improvement in gas burners adapted for use in automatic water heaters or the like.

Heretofore in water heater burner constructions, it has been customary to manufacture the burners from cast iron parts with the burner head provided with flame openings separated by teeth or tongues in order to form a comb comprising a plurality of flame ports to isolate the incandescent gas flames in such manner as to afford an opportunity for secondary air to surround incandescent gas to obtain as nearly a complete combustion as was possible and also to prevent the flames from burning back into the body of the burner upon the flame check screen, usually carried in the body of the burner. This construction produces a large number of small cast members with large surfaces liable to be attacked by rust and to be clogged up.

In water heater constructions where a large volume of flame is necessary, the combination of the hydrogen in the gas with the oxygen of the air produces water vapor which condenses on the water coils and causes a rain of water drops to fall from the coils on the burners. This water is usually more or less acid, due to the impurities in substantially all fuel gas and this acid tends to attack the burners and rust the constructions. The acid water seems to have a special adhesive property which causes the water to form films that flow down over the burner heads and run into the burner bodies even though overhanging ledges are provided to shed the water from the burners. Where the water reaches the inside of the burner and touches the flame check screen it causes a deposit of dust or other foreign particles carried by the gas to lodge and collect on the flame check screen, thereby choking the openings in the screen and greatly decreasing the effective operation of the burner. In water heater burner constructions, one of the difficult problems has been that of providing sufficient screen area and of protecting this screen area in such manner as to overcome the difficulties specified.

A still further difficulty heretofore met has been that of constructing a burner which could be disassembled as to the screen element, without creating leaks around the screen, thereby defeating the purpose of the screen.

A still further difficulty which has been met with in burner constructions of this character is the provisions of a burner body having a gas passageway so constructed as to cause a proper co-mingling or mixing of the gas with primary air to secure proper combustion, and a proper velocity to feed the flame without danger of the flame burning back on the screen. The velocity of the mixture of gas and air is initiated by the pressure of the gas issuing from the orifice, but the final velocity and relative mixture of air may be controlled by burner construction. In view of the fact that gas pressures vary from time to time, and also in different localities, the burners heretofore constructed have been designed for fixed conditions and therefore, seldom operate efficiently.

The present invention overcomes the difficulties of the known art by providing a properly shaped burner body carrying a relatively large screen which is completely protected from the condensation water and is easily removable to clean or replace the screen when necessary. This may be accomplished in accordance with the present invention in several ways, and one embodiment comprises a cast structure mixing tube adapted to be enclosed by a ductile tube which forms expansive chamber for the gas and air and which, together with the burner head, comprises the gas outlet ports. The head of the burner is so constructed as to comprise a shield that forms one wall of an arcuate passageway and the end of the body tube forms the other wall so that the head of the burner comprises the flame spreader. The burner head is further constructed with water passageways which carry the condensation water completely away from the ports so that the dripping of the water, if it strikes the burner tube at all, finds a continuous wall which extends the full length of the burner and below any cast iron parts whereby such parts are completely covered, and the water flows off without encountering any ledges or joints. The body of the burner may carry a Venturi tube which is so constructed and proportioned to the port and screen area, that it automatically draws in the correct amount of primary air for the gas flow, thereby obviating any necessity for air shutters or regulators. The burner is

very efficient, extremely sturdy in construction, and simple in arrangement, so that it requires no regulation in setting and is economical in manufacture.

From the foregoing, it will appear that the principal object of the present invention is to provide a gas burner having a substantially cylindrical body portion carrying properly proportioned gas conduits and a protected screen of relatively large area.

Another object of the present invention is a burner of the character specified in which a substantially cylindrical screen is carried in the mixing chamber and is held in place by a detachable burner head which facilitates the removal of the screen for replacement or cleaning.

A still further object of the present invention is a burner comprising a substantially cylindrical burner head having arcuate ports therein, with a large cylindrical expansion chamber beneath the head to supply an even flow of burning mixture through the ports.

A further and very important object of the present invention is a gas burner in which the inlet area for primary air, the waist of the Venturi tube, and the outlet ports are so proportioned that the pressure of the jet of gas automatically produces a correct mixture of such velocity as to produce a Bunsen flame without danger of backfire to the safety screen.

Other and further objects of the present invention will in part be obvious and will in part be pointed out hereinafter in the specification following by reference to the accompanying drawings throughout which like parts are indicated by like characters.

It is realized that the present invention may be embodied in constructions other than those herein specifically disclosed, therefore the disclosure herewith is to be considered as illustrative and not in the limiting sense.

Figure 1 is a sectional elevation of a burner embodying a preferred form of the present invention;

Figure 2 is a detailed view of a portion of the internal constructions of the burner illustrated in Figure 1;

Figure 3 illustrates the cylindrical screen adapted to be held in position between the burner head and the mixer tube illustrated in Figure 2;

Figure 4 is a plan view of the burner head;

Figure 5 is a plan view of the bottom end of the burner;

Figure 6 illustrates a plurality of burner tubes on a burner ring beneath water coils; and

Figure 7 is a diagrammatic view illustrating the form of the mixer tube.

Referring now more especially to the drawings and particularly to Figure 7, which is a diagrammatic view of the inner walls of the mixer tube. This mixer tube is laid out on definite curves and in definite proportions which produce a construction that utilizes the energy of the incoming gas jet to draw in primary air in the correct proportion to the volume of gas for any given pressure and to produce a velocity which carries the mixed gas and air through the burner at a sufficiently high rate of speed to prevent back fire. The construction and proportion of the mixer tube, as illustrated in Figure 7, is such that the throat of the tube may be considered as a base upon which calculations are computed. The essential feature of the mixer tube requiring definite proportions and dimensions are the curves of ingress to the throat and the curves of egress from the throat. I have found that if the diameter of the throat of the Venturi mixer tube be unity, then the radius of curve of ingress should be substantially six units, and the radius of the curve of egress should be substantially eighteen units; furthermore, that the area of the throat should be substantially forty-two one-hundredths of the outlet port area. The flame check screen between the mixer tube and the parts should have sufficient opening area so as to freely pass the burning mixture without causing back pressure. It is also important that the orifice through which the gas issues should be properly spaced from the throat of the venturi. I have found that the orifice should be spaced substantially three and one-fourth units from the throat of the burner, and that the orifice and the throat be located on the same axis.

In Figure 7, the diameter of the throat A may be regarded as unity; then the radius of the curve from A to B is substantially six units, and the radius of the curve from A to C is substantially eighteen units. While the curves A—B and B—C might be extended beyond the limits shown in Figure 7, it is convenient to provide the length of each curved portion A—B and A—C as substantially two and one-half units. As a matter of choice, the curve A—B joins a reverse curve B—D of substantially two units radius and this curve blends into a straight portion D—E. The distance from the gas orifice F to the throat A is substantially three and one-fourth units. Actual practice has demonstrated that a Venturi tube designed upon the foregoing proportions produces a mixing tube in which eddy currents are practically eliminated and a proper and thorough mixture is automatically obtained over any range of gas pressure and quality encountered in commercial practice.

Referring now to Figures 1 to 5 inclusive, the body 1 of the burner may comprise a ductile metal tube, for example, copper, preferably seamless and capable of withstanding slight increase in diameter. The

Venturi tube mixer 2, preferably of cast iron, is pressed into this cylindrical body tube so that the straight bottom portion 4 of the Venturi tube tightly fits into the body tube and the waist ring or wall 5 likewise tightly fits within the body tube 1. This operation may be accomplished by an arbor press which enables the parts to be telescoped under sufficient pressure to tightly force the Venturi tube member into the ductile tube 1 forming the body so that the parts are securely held in place. The Venturi mixer tube member is forced sufficiently into the body tube to provide an overhang 6 at the bottom of the body tube so that any water of condensation striking the body and hanging on the bottom wall thereof, will not creep upwardly to come in contact with the cast iron inside the body tube. This Venturi body tube has an inner wall constructed in accordance with the form disclosed and previously described in connection with Fig. 7. The lower end of the tube carries a cross bar 7 which is provided in the center with a circular portion 8 having an opening 9 that exactly fits a spud 10 on a gas ring 11 or the like. Adjacent the waist wall 5 the Venturi tube member is provided with a circular shoulder 12 upon which a cylindrical flame check screen 14 is adapted to be carried. Adjacent the circular shelf is an annular recess 15 from which an opening 16 leads to the interior of the venturi. This opening is provided as a precaution, against any condensation water which may under very exceptional circumstances get into the burner, and to permit the escape thereof out through the bottom of the burner. Supporting arms 17 and 18 are integral with and extend upwardly from the end of the Venturi mixer tube, and are joined at the top with a cross bar 19 which is provided with a notch 20 through which an anchor bolt 21 is adapted to extend to reach an anchor nut 22 held in position between the upper end of the supporting arms. The construction just described comprises the Venturi mixer tube and at the same time forms the lower wall of an expansion chamber 24 which extends both below and above the upper end of the Venturi tube and the outer walls of this chamber are formed by the walls of the tubular body 1. This internal construction provides a rigid burner body having a convenient anchor for the burner head 26. This burner head preferably is cast of non-corrosive metal such as bronze or brass and is adapted to be anchored in place on the upper end of the body by means of the anchor bolt 21, which extends through an opening in the top of the burner and connects with an anchor nut 22 conveniently held against turning by the supporting arms 17 and 18. The burner head is also provided with an internal shoulder 27 from which extends a downwardly and outwardly tapered wall 28 into which the upper end of the flame check screen 14 tightly fits so that this screen is securely locked in position between the burner head and the shoulder 12 on the Venturi tube without machining, special fitting or cement.

The burner head is provided with a depending continuous skirt 29 which sets down into the upper end of the burner body and is spaced from the wall of the upper end of the burner body exactly the right distance to provide arcuate outlet ports 33 from which the combustible mixture issues. The relatively heavy metal in this skirt 29, prevents the flame from back-firing through the ports by absorbing heat from any flame tending to move back through the ports. The spacing which forms these ports is brought about by three spacing lugs 30 (two of which are illustrated in Fig. 2), which terminate in shoulders 31 that set upon the end of the burner tube when the burner head is anchored in position by the anchor bolt 21, thereby providing a secure and rigid construction. The burner head is provided with an outwardly extending inclined surface 32 in the form of an inverted frustum of a cone which acts as a flame spreader to divert the flames outwardly and out of contact with the burner head so that secondary air may properly reach the burning gases, and also preventing the burner head from chilling the flame and interfering with the combustion. The head is also provided with a cylindrical rim 34 that terminates with a slight overhang 35 of a larger diameter than the diameter of the body tube so that if any condensation water strikes the outside of the burner head, it will flow down the outside of the body tube and not through the ports. The top of the burner head preferably is formed of three downwardly inclined surfaces 36 which lead to spouts 37 which cut through the rim 34 and terminate in drip aprons 38 well outside of the burner 2. This top construction quickly drains away condensation water falling on the top of the burner and carries this water completely outside the burner body. The aprons 38 prevent the water film from working back onto the burner head and down through the ports into the burner body.

While the present burner is adapted for general utility purposes where a gas burner is useful, it is more especially constructed and designed for use in automatic water heaters, and when so used, the burners are usually arranged in clusters on a burner ring or gas ring 11 and beneath water coils 39 so that water of condensation from the coils falls directly on the burners. In the present construction, the burner body is devoid of external joints and therefore any water of condensation striking the side of the tube is

safely carried away. It will also be observed that the parts of the burner are securely interlocked together so that the burner may be safely shipped or handled without the parts separating, while at the same time, the screen is readily accessible and removable by merely loosening the anchor bolt and removing the burner head.

This construction lends itself to the utilizing of a very large area flame check screen so that the total area of the openings in the flame check screen available for mixed gas and air may be as large as thirteen times the area of the Venturi throat of the burner. Furthermore, the position of the expansion chamber surrounding the flame check screen is such as to facilitate the uninterrupted flow of combustible mixture to the arcuate shaped ports without substantial reduction in the velocity of the mixture. This permits the burner to be used in practice without the necessity of utilization of an air shutter to control the amount of primary air admitted because the velocities obtained by the design and construction of the Venturi tube are not lost by back pressure above the tube when the velocity is once established. Furthermore, the design and construction of the burner is such that an efficient burner may be made sufficiently short in length to set in the limited space provided in automatic water heater constructions.

Having thus described my invention, what I claim is:

1. In a gas burner, the combination of a tubular body portion, a Venturi mixing tube extending part way into said body portion, a flame check screen having an unobstructed portion extending below the upper end of the mixing tube, an extension projecting upwardly from the mixing tube, and a burner head removably anchored to said extension in position on the outlet end of said body portion and adapted to enclose the upper end of said flame check screen and removably hold the same in position, said burner head being provided with an annular skirt extending into said body portion and spaced apart therefrom to provide arcuate ports for the issuance of combustible mixture from said body portion.

2. In a gas burner, the combination of a tubular body portion, a Venturi mixer tube extending part way into said body portion, a flame check screen, a burner head anchored in position on the outlet end of said body portion and adapted to removably anchor said flame check screen in position, said burner head being provided with a smooth annular skirt extending into said body portion and spaced apart therefrom to provide arcuate ports for the issuance of combustible mixture from said body portion, and conical flame spreader means on said burner head and above said ports.

3. A gas burner comprising in combination a continuous tubular body portion, a gas and air conduit member within said body portion and being integrally provided with a partition wall adapted to divide said body portion into a supporting part and an expansion chamber, and a burner head removably anchored on the end of said body portion, said burner head having a smooth annular skirt extending into and substantially parallel with the end walls of said body portion to provide accurate arcuate ports for the combustible mixture.

4. In a gas burner, the combination of a straight tubular body, a Venturi gas and air tube completely covered by the said tubular body and having a shoulder on the upper end to support a screen, a burner head mounted on the upper end of said tubular body, means to anchor said burner head in position, and a screen seated at its lower end upon said shoulder and removably interlocked between said gas and air tube and said burner head.

5. In a gas burner, the combination of a Venturi mixer tube, the internal walls of which are curved throughout the length of the tube, a circular partition wall carried by said tube, a cylindrical walled expansion chamber surrounding the outlet end of said Venturi tube and extending below the upper end thereof, a burner head anchored in position on the outlet end of said mixing chamber, and a flame check screen having side walls substantially parallel to the body portion.

6. In a gas burner, the combination of a Venturi mixer tube, the internal walls of which are curved throughout the length of the tube, a circular partition wall carried by said tube, a cylindrical walled expansion chamber surrounding and extending below the outlet end of said Venturi tube, a burner head anchored in position on the outlet end of said mixing chamber, and a flame check screen held in position between the outlet end of said Venturi tube and said burner head.

7. As an article of manufacture, a burner head for gas burners adapted for use with water heaters and having a substantially cylindrical rim, a plurality of inclined surfaces meeting at the center of said burner head, said surfaces continuing into spouts extending through said rim, and drip aprons at the end of said spouts and being adapted to conduct condensation water from said head without liability of said water flowing over under surfaces of said head and into a burner body on which said head may be mounted.

8. As an article of manufacture, a burner head for gas burners adapted for use with water heaters and having a substantially cylindrical rim, an inclined surface on the

top of said burner head, said surface continuing into a spout extending through said rim, and a drip apron at the end of said spout and being adapted to conduct condensation water from said head without liability of said water flowing over under surfaces of said head and into a burner body on which said head may be mounted, and an annular skirt depending from beneath said burner head.

9. As an article of manufacture, a burner head for gas burners adapted for use with water heaters and having a substantially cylindrical rim, a plurality of inclined surfaces meeting at the center of said burner head, said surfaces continuing into spouts extending through said rim, and drip aprons at the end of said spouts and being adapted to conduct condensation water from said head without liability of said water flowing over under surfaces of said head and into a burner body on which said head may be mounted, an annular skirt depending from beneath said burner head, and flame spreader means above said annular skirt.

CHARLES C. CHAPPELLE.