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GRAVITY-FED GAS BURNER

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Fig. 2.

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GRAVITY-FED GAS BURNER

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8 Claims. (Cl. 158-99)

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This invention relates generally to burners and more particularly to burners for burning artificial and natural gas.

The gas burner comprising this invention is particularly adapted for domestic water heaters.

The principal object of this invention is the provision of a gas burner arranged to efficiently burn artificial or natural gas.

Another object is the provision of a gas burner that may be efficiently employed to produce a horizontal as well as a vertical flame.

Another object is the provision of a gas burner for producing a cylindrical flame disposed horizontally or vertically.

Another object is the provision of a distributing box for connecting the venturi to the burner head.

Another object is the provision of an efficient and economical gas burner.

Another object is the provision of a burner constructed to operate with a fixed supply of secondary air and having a plurality of orifices of definite cross sectional area, the area of each orifice being determined by the heat value of the gas to be employed to maintain a constant output of heat units per hour from the burner.

This invention further contemplates the use of orifices having extreme limits of cross sectional area with graduated intermediate steps therebetween.

Another object is the provision of a burner mechanism having a ring-shaped head with an annular gas outlet port and arranged to limit the amount of secondary air admitted around the perimeter of the head to induce the flow of a sufficient amount of secondary air through the center of the head to produce a hollow cylindrical flame.

Another object is the provision of a burner having a down draft Venturi tube.

Another object is the provision of a burner having a circular gas port and an inverted Venturi tube.

Another object is the provision of a burner which eliminates flash back and the noise of lighting or extinguishing when the burner is quickly turned on or off.

Other objects and advantages appear in the following description and claims.

A practical embodiment illustrating the prin-

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ciples of this invention is shown in the accompanying drawings wherein:

Fig. 1 is a front elevational view partly in section of the burner comprising this invention.

Fig. 2 is a side elevational view partly in section of the burner.

Fig. 3 is a detailed view of a modification of the valve member.

Fig. 4 is an end view of the gas mixing bell chamber.

Referring to the drawing, the burner comprises four principal parts, the bell mixing chamber 10, the Venturi tube 11, the distributing box 12 and the burner head 13. The bell mixing chamber 10 is circular and is provided with a transversely disposed cylindrical chamber 14 formed integral with the bell casting 10. One end of the chamber 14 is threaded to receive the end of the gas supply pipe 15. The other end of the chamber 14 is closed by the plug valve member 16 which is shaped to snugly fit the walls of the chamber 14 and extend therebeyond to provide a knurled head 17 for rotatably adjusting the position of the plug valve 16.

The plug valve 16 is provided with an arcuate groove 18 inwardly adjacent the head 17 to receive the end of the set screw 20 which retains the plug valve 16 within the chamber 14. The ends of the arcuate slot 18 also limit the degree of rotation of the plug valve 16 to 180° as indicated in Fig. 2.

The inner end of the plug valve 16 is provided with a bore 21 which opens directly to the gas chamber 14 and is provided with holes or ports 22 and 23 lying in the same transverse plane, arranged to register with the port 24 in the cylindrical wall of the chamber 14, and which is axially aligned with the Venturi tube 11.

When the plug valve 16 is turned clockwise as shown in Fig. 2 the end of the arcuate slot 18 engages the set screw 20 which position aligns the valve port 22 with port 24. If the plug valve 16 is rotated in a counterclockwise direction until the other end of the slot 18 strikes the set screw 20 the valve port 23 becomes axially aligned with the opening 24.

It will be noted that the valve port 22 is larger in diameter than the valve port 23 and the opening 24 in the cylindrical wall of the chamber 14 is larger in diameter than either of the two valve

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ports that may be registered with it. The large diameter valve port 22 is cut to admit artificial gas having a definite B. t. u. content that is dispensed at a predetermined pressure and is suitable for producing the desired flame with the available primary and secondary air capable of being supplied by the burner. The gas may be an artificial manufactured gas or a bottle gas such as butane. A natural gas ordinarily contains a higher B. t. u. content and it therefore requires a smaller orifice or port 23 to produce the desired flame with the available amount of primary and secondary air capable of being furnished by the same burner.

The primary air is admitted through the sector openings 25 at the end of the bell mixing chamber 10 on either side of the transverse cylindrical wall of the chamber 14 as indicated in Fig. 2. The circular disk shutter 26 is provided with similar arcuate openings 27 which mate in alignment with the openings 25 when the shutter 26 is rotated to the proper position as shown in Fig. 4. The shutter 26 fits against the flat end of the bell mixing chamber 10 and is pivoted on and clamped in position by the screw 28 which threadably engages in a tapped hole in the outer wall of the chamber 14 in alignment with the port 24 in the inner wall of said chamber. Thus different angular positions of the shutter 26 adjust the amount of primary air that is admitted to the bell mixing chamber 10.

The Venturi tube 11 is formed integral with and is disposed axially of the bell mixing chamber 10 and the throat 30 of the venturi is thus in alignment with the opening 24 in the transverse cylindrical chamber 14. The Venturi tube is straight and becomes increasingly larger in diameter from the throat 30 to the rectangularly shaped distributing box 12. The gas flowing down the Venturi tube impinges against the transverse wall of the box 12 which diffuses it laterally. The abrupt change in volume and transverse wall of the box 12 is found to uniformly distribute the mixture of gas and air to the annular burner head 13 which is disposed at substantially right angles to the Venturi tube 11.

The burner head 13 is an annular hollow ring connected to the box 12 and provided with an annular gas outlet 31. Small pins 32 are inserted in the walls of the burner head in spaced relation across the outlet 31 to hold the alternate corrugated and flat ribbons 33 and 34 flush with the mouth of the outlet 31. The corrugations of the ribbon 33 form the gas ports in the outlet 31.

The ring head 13 of the burner provides a large central opening 35 through which secondary air flows for supporting combustion within the cylindrical flame produced by the burner. Radial extending lugs 36 on the ring head 13 hold it in spaced relation with the combustion chamber wall 37 which is indicated by the cylindrical tube shown in Figs. 1 and 2. The lugs 36 maintain an annular space 38 around the burner head 13 for supplying secondary air for the outer part of the cylindrical flame.

The size of the mixing bell 10, the venturi 11, the box 12 and the ring head 13 are so proportioned that the proper amount of primary and secondary air is provided for gas having the characteristics requiring orifices of the size provided in the plug valve 16 for either artificial or natural gas and a cylindrical flame is produced. If this flame is burned in the open the cylindrical flame has a tendency to contract toward the end thereof but when inserted into the end of a com-

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bustion chamber which permits the lugs 36 to properly center the head of the burner and produce the annular opening 38 that limits the amount of secondary air admitted around the burner head, a cylindrical flame of uniform dimension along its length is formed, because of the induced additional secondary air flow through the central opening 35. If an elbow were used to connect the venturi with the head of the burner one side of the cylindrical flame will be longer than the other. However the rectangular box 12 distributes the gas properly to the ring head 13 and the flame is uniform around its perimeter for the full length thereof.

In place of providing independent orifices 22 and 23 for gas having different heating characteristics a single V-shaped slot 40 may be provided in the side wall of the plug 16 which acts in conjunction with the port 24 to produce an orifice of definite size that may be made larger or smaller depending upon the direction that the valve plug is rotated. The V-slot 40 extends 180° around the wall of the plug 16 and is symmetrical with the groove 18. This modification is shown in Fig. 3. Thus if the B. t. u. content and the pressure of the gas supply varies the valve plug 16 may be rotated the proper degree to change the size of the orifice formed by the V-slot 40 to obtain the proper amount of gas in accordance with the combustible characteristics of the gas. The extremities of the V-slot 40 are of such dimension that they may be used for artificial and natural gas in the same manner as the orifices 22 and 23.

Butane contains approximately 3200 B. t. u.'s, propane approximately 2400 B. t. u.'s, natural gas approximately 1550 B. t. u.'s, and artificial gas and air carbureted butane or propane about 500 B. t. u.'s per cubic foot. Thus the orifice for butane would have the smallest cross sectional area and the orifice for artificial gas or the air carbureted gases would have the largest cross sectional area. Assuming that these two orifices represent the limits in the cross sectional area required for the emission of gas to the burner and are represented by the orifices 23 and 22 respectively or the extremities of the V-shaped slot 40, two intermediate orifices should be graduated in cross sectional area for propane and natural gas to produce the same output of heat units per hour from the burner. In fact the areas of these orifices for a burner of given secondary air flow characteristics are proportional to the B. t. u. content of the gas to be employed. Thus the orifice plug or valve 16 is provided with definite orifices for matching the substantially constant secondary air characteristics of the burner to produce the same output of heat units per hour from the burner depending upon the gas selected. The appliance which the burner serves is designed to have a definite heat unit rate, such as 30,000 B. t. u.'s per hour, which is the most efficient operating rate for the appliance which has predetermined and substantially constant secondary air characteristics.

The Venturi tube 11 of the burner illustrated in Figs. 1 and 2 should be disposed vertically or above the burner head. The burner may be referred to as an inverted or down draft burner. This arrangement is an important object of this invention. Ordinarily a Venturi tube is positioned vertically below the burner head or lies horizontally. In the latter position the burner head may be disposed at right angles or in axial alignment with the Venturi tube. Flash back and the noise of quickly lighting or extinguishing

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the flame of the burner may occur with either of these arrangements, however when the burner head is above the venturi and mixer the tendency of flash back and noise is greater, yet it does not occur as readily when the gas is manually turned on or off. When the gas is shut off quickly the gas within the burner having velocity continues to move to the burner ports and the mixture becomes leaner. When the venturi is vertically disposed under the burner head the draft aids the movement of the gas and the natural rising of the lighter than air gas produces a greater tendency for the gas to flash back and make noise.

It has been found that if the mixing chamber and the Venturi tube are extended above the burner head, the velocity of the gas remaining within the burner is the only force which tends to continue the flow of the lean mixture to the burner port. This force is counteracted by the natural tendency for the gas to rise which causes the lean mixture to flow away from the burner port, resulting in slowly extinguishing the flame and thus preventing it from flashing back or producing a noise when turned off. This advantage is particularly important when using artificial or air carbureted gases which explode loudly under conditions of flash back or quickly lighting and extinguishing the flame. The ribbon gas port is also believed to contribute to the improvement of eliminating flash back and noise as this type of burner port offers less resistance to the flow of gas therethrough and consequently the inverted venturi has a tendency to create a draft in the opposite direction to that of the flow of the gas to the burner head.

I claim:

1. An atmospheric down draft gas burner for producing a horizontal flame consisting of a horizontally disposed hollow cylindrical burner head constructed to receive a mixture of air and gas, means defining a gas port on one end of said cylindrical burner head with its axis horizontally disposed for discharging the gas and air mixture to produce a horizontal flame, vertically disposed conducting means connected at its lower end to said hollow burner head, and means defining a mixing chamber on the upper end of said conducting means above the level of the hollow burner head to deliver a mixture of gas and air to the burner head.

2. An atmospheric down draft gas burner for producing a horizontal flame consisting of a horizontally disposed hollow cylindrical burner head constructed to receive a mixture of air and gas, means defining a gas port on one end of said cylindrical burner head with its axis horizontally disposed for discharging the gas and air mixture to produce a horizontal flame, vertically disposed conducting means connected at its lower end to said hollow burner head, means defining a mixing chamber on the upper end of said conducting means above the level of the hollow burner head to deliver a mixture of gas and air to the burner head, means defining a horizontally disposed tubular combustion chamber into which the end of the hollow burner head is inserted, and radial spacers on the hollow burner head to center it in said combustion chamber.

3. An atmospheric down draft burner consisting of a horizontally disposed cylindrical ring head burner, means defining a gas port in one end of the ring head burner having its axis disposed horizontally, an upwardly extending Venturi tube at the other end of the ring head burner, means to connect the lower end of the Venturi tube with

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the ring head burner to carry a gas mixture to the latter, means defining a gas and air mixing chamber connected to the upper end of the Venturi tube, means defining primary air openings in the mixing chamber, means defining a gas orifice in the mixing chamber to direct the gas down the Venturi tube and induce the flow and mixture of primary air with the gas down the Venturi tube and through the connecting means into the ring head burner and out the port where it burns as a flame.

4. An atmospheric down draft burner consisting of a vertically disposed Venturi tube having a mixing chamber at its upper end, means defining a lateral conducting passageway connected at one end to the lower end of the Venturi tube, and a hollow burner head attached to the other end of said lateral passageway and having its axis horizontally disposed and means defining ports to discharge horizontal flames supplied by a mixture of gas and air from said lateral connection.

5. An atmospheric down draft gas burner consisting of a vertically disposed Venturi tube having a mixing chamber at its upper end for receiving gas and air and discharging the mixture down the Venturi tube to its outlet end, a hollow burner head having its axis horizontally disposed and means defining a gas port of substantially the same cross sectional area as the outlet end of the Venturi tube, corrugated ribbon in the port dividing it into a plurality of small ports, and means defining a lateral conducting passageway between the outlet end of the Venturi tube and the burner head for conveying the mixture of gas and air thereto.

6. An atmospheric gas burner for producing a horizontally disposed flame consisting of a vertically disposed Venturi tube, a mixing bell connected to the upper end of the tube to receive gas and air which are mixed and discharged down through the tube, a ring head burner having its axis disposed at right angles to the axis of the tube and having means defining a central opening, said ring head burner having means defining an annular gas port disposed about said central opening to produce a circular flame concentric with the axis of the ring, and a distributing box connecting the lower end of the tube and the ring head to produce a uniform discharge of the combustible mixture through the gas port to form a cylindrical flame.

7. The structure of claim 6 which also includes means defining a tubular combustion chamber for receiving the gas port end of said ring head burner, and a plurality of annularly spaced radially disposed lugs on the perimetral surface of the ring head burner for centrally spacing the latter in the tubular combustion chamber to provide an outer annular secondary air supply passage concentric with the cylindrical flame and the inner secondary air supply admitted through the center opening of the ring head.

8. An atmospheric gas burner of the character described, the combination of a vertically disposed Venturi tube, a mixing bell connected to the top of the tube and constructed to receive a combustible mixture of gas and air which flows down through the tube, a distributing box at the lower end of the tube providing a space of increased volume relative to the cross section of the tube and having a transverse wall against which the air and gas impinge, a hollow ring head burner spaced from the axis of the tube and with the axis of the ring disposed at right angles to

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the axis of the tube for horizontally projecting a circular flame concentric with the axis of the ring, means defining a central opening through the hollow ring head burner, and a lateral conducting means between the box and the hollow ring head burner to carry and uniformly distribute the combustible mixture to the ring head burner.

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