Oct. 9, 1928. 1,686,711

H. D. SCHRADER

GAS BURNER

Filed May 31, 1927 2 Sheets-Sheet 1

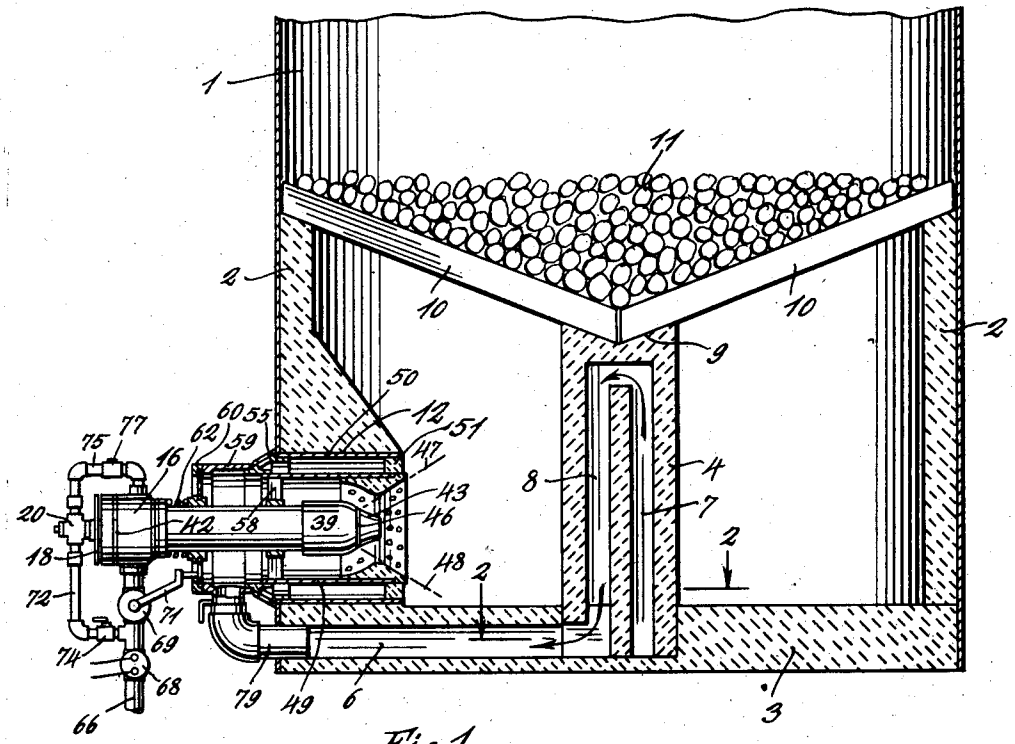


Fig. 1.

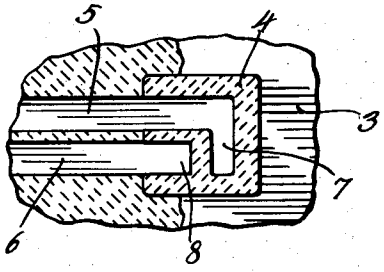


Fig. 2.

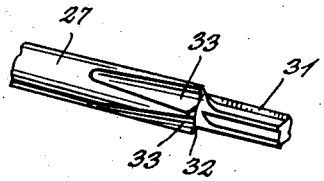


Fig. 3.

Inventor

Harold D. Schrader.

By A. O'Brien

Attorney

Oct. 9, 1928. 1,686,711

H. D. SCHRADER

GAS BURNER

Filed May 31, 1927 2 Sheets-Sheet 2

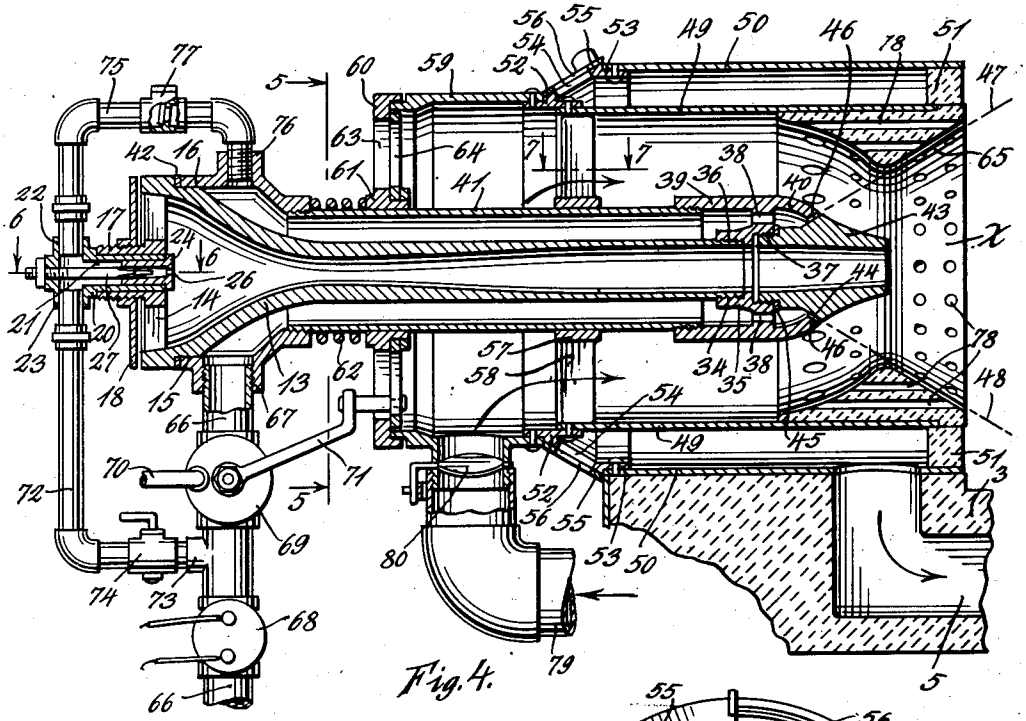


Fig. 4.

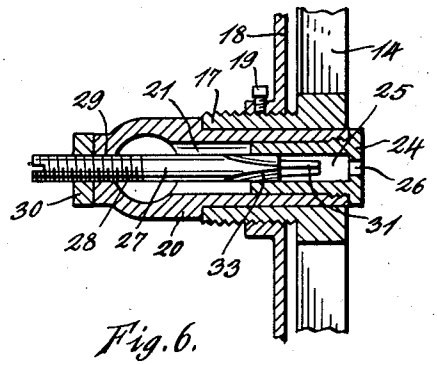


Fig. 6.

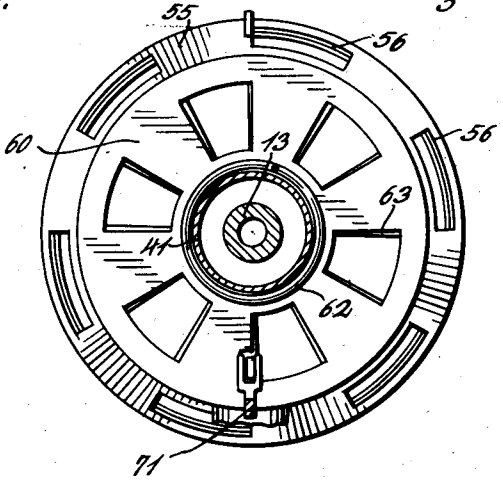


Fig. 5.

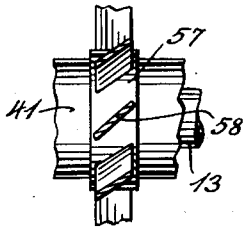


Fig. 7.

Inventor

Harold D. Schrader.

By A. J. O'Brien

Attorney

Patented Oct. 9, 1928. 1,686,711

UNITED STATES PATENT OFFICE.

HAROLD D. SCHRADER, OF DENVER, COLORADO.

GAS BURNER.

Application filed May 31, 1927. Serial No. 195,285.

This invention relates to improvements in gas burners.

It is the object of this invention to produce a gas burner which will have a great heating capacity and a high efficiency and which will be of simple and substantial construction.

It is a further object of this invention to produce a gas burner combining two separately operating burners one of which employs a Venturi tube and in which the air is mixed with the gas at or near the intake end of the tube and the other of which discharges the gas near the tip of the former burner and for which the air is inspirated by the action of the gas as it leaves the burner.

It is a still further object of this invention to produce a gas burner of great flexibility that shall be particularly well adapted for use in connection with small commercial appliances and house heating furnaces and boilers.

The above and other objects that may become apparent as the description proceeds are attained by means of an arrangement and a combination of parts that will now be described in detail and reference for this purpose will now be had to the accompanying drawings in which the preferred embodiment of my invention has been shown and in which:

Fig. 1 is a vertical diametrical section through the lower end of the furnace, showing my improved burner in place therein;

Fig. 2 is a section taken on line 2—2, Fig. 1;

Fig. 3 is a detail showing the construction of the gas adjusting valve member;

Fig. 4 is a vertical longitudinal section through the burner;

Fig. 5 is a section taken on line 5—5, Fig. 4;

Fig. 6 is a section taken on line 6—6, Fig. 4; and

Fig. 7 is a section taken on line 7—7, Fig. 4.

My improved gas burner has been illustrated in connection with a furnace whose cylindrical wall has been designated by numeral 1. The lower portion of this furnace has been shown as lined with a layer of fire brick or clay 2. The bottom of the fire box is formed by a circular slab 3 of fire clay from whose center a square or other shaped column 4 extends upwardly. The slab 3 is provided with two parallel passages 5 and 6 which communicate respectively with the vertical openings 7 and 8 of column 4. The upper end of column 4 has a conical recess 9 which supports the inner ends of the radial bars 10 whose outer ends are supported on the upper end of the cylindrical wall 2. A collection of broken fire brick or other highly refractory material 11 is supported on the bars 10 and when these are heated to incandescence, they resemble a bed of live coals and serve to store and to radiate heat. The furnace wall 1 and lining 2 are provided with registering openings 12 for the reception of the burner assembly which will now be described in detail.

The burner consists of a Venturi tube 13 whose end is provided with a transverse wall having a plurality of openings 14. The outer surface of the flared end of this tube has a cylindrical portion 15 which is adapted to receive one end of the mixing head 16. The transverse wall of the Venturi tube has a hub 17 that projects rearwardly and whose outer surface is threaded for the reception of the air regulating plate or shutter 18 which will be moved towards or away from the transverse wall when it is rotated and which can be clamped in adjusted position by means of a set screw 19. Hub 17 has a cylindrical opening within which is slidably mounted the primary burner regulating valve body 20. This body has a cylindrical axial opening 21 which communicates with the transverse opening that passes through the lateral extensions 22 and 23. A nozzle 24 has a threaded engagement with the wall of opening 21. This nozzle has an axial opening 25 that terminates in the smaller opening 26. A stem 27 has a threaded portion 28 which cooperates with a threaded opening 29 in the outer end of the wall body. A lock nut 30 serves to hold this stem in adjusted position. Stem 27 has the same outside diameter as the opening 25 and is provided with a tip 31 which is of the same size as the opening 26 and is fluted like a reamer. The maximum diameter of the tip 31 is less than that of the stem 27 and terminates in a shoulder 32. That portion of the stem adjacent the shoulder 32 is provided with tapering grooves 33 which form passages for the gas. When the stem is rotated so as to move into the nozzle 24, the area through which the gas may flow is gradually decreased until when the grooves 33 are entirely within the nozzle the flow of gas will be entirely shut off. If hole 26 becomes stopped, it can be opened by turning the stem 27 until the point 31 extends entirely through the opening 26. The position of stem 27 is adjusted to suit the conditions un-

der which the burner operates. The inner end of the Venturi tube is threaded, as indicated by numeral 34. A burner head body has a central hub portion 35 which has a central opening consisting of two threaded sections 36 and 37 of different diameters. Section 36 is adapted to cooperate with the threads 34 on the Venturi tube. A perforated wall or partition 38 connects hub 35 with the cylindrical portion 39 which extends to both sides of this partition. The front end of the cylindrical partition is inwardly tapered in the manner indicated by numeral 40. A pipe 41, whose inside diameter is greater than the outside diameter of the Venturi tube has its front end connected with the cylindrical part 39 and its rear end connected with the front end of the mixing head 16. The burner head body, the pipe 41 and the mixing head 16 are first assembled after which the Venturi tube is inserted through the open end of the assembly and screwed into the threaded opening 36. A gasket 42 is located on the cylindrical surface 15 between the end of the mixing head and the external shoulder at the end of surface 15. When the parts are assembled as described, an elongated annular chamber is formed between pipe 41 and tube 13. A burner nozzle 43 has one end provided with a threaded section that engages with the threads in opening 37 and has a conical surface 44 that is parallel with the parallel surface forming the end of part 40. By means of a washer 45 of suitable thickness the conical surface on the nozzle and the cooperating surface on part 40 can be spaced any distance desired so as to obtain an annular opening 46 for the escape of gas, which will flow therefrom in a conical sheet represented by lines 47 and 48.

The assembly that has just been described is located within a cylindrical casing formed by a cylindrical member 49 which is smaller in diameter than and located concentrically within a similar cylinder 50. The two cylindrical members 49 and 50 are held in spaced relation at their inner ends by a ring 51 and at their other ends by a casting having a cylindrical section 52 and a cylindrical flange 53 and an inclined wall 54, that connects one end of flange 53 with the center portion of the cylindrical section 52. A damper ring 55 is mounted for rotation on the outer surface of the inclined wall 54 and is provided with openings 56 that correspond in position and size to similar openings in the inclined wall 54. By rotating the ring 55 the effective areas through which air may enter between members 49 and 50 can be adjusted to any extent desired. Secured to pipe 41 is a hub 57 having a plurality of radially projecting spokes or blades 58 that resemble fan blades. The outer ends of these blades engage the inner surface of member 49 and serves to center the burner assembly. Another cylindrical tubular section 59 is connected with the outer end of part 52. A circular plate 60 has a hub 61 that has a central opening through which pipe 41 extends and is urged towards the end of member 59 by means of a spring 62. Plate 60 has a number of radial openings 63. A rotatable damper plate 64 is mounted on a forward extension of the hub 61 and is provided with openings that correspond to openings 63 and which can be moved so as to register with the latter. By rotating plate 64 the effective area of openings 63 can be altered as desired. Located within the front end of the cylindrical member 49 is a ring 65 of refractory material. This ring has its inner surface curved in the manner shown in Fig. 4 and the surface marked "X" is parallel with lines 47 and 48.

Gas under the appropriate pressure is conducted to the device through pipe 66, which is connected with the proper gas supply. Pipe 66 is connected to the mixing head 16 at 67 and is provided with an electrically operated valve 68, that can be controlled from a distance, and with a pressure controlled valve 69 which is connected with the boiler by means of pipes 70. A lever or arm 71 has one end connected with the valve mechanism of valve 69 and the other connected with the plate 64 and rotates the plate so as to close the openings 63 whenever valve 69 closes. A pipe 72 has one end connected with pipe 66 at 73 and the other to member 20 at 23. A stop cock 74 controls the flow of gas through this pipe. Another pipe 75 has one end connected with the mixing head at 76 and the other connected with member 20 at 22. This pipe is provided with a check valve 77 that permits gas to flow from the interior of the mixing head to the regulating valve, but prevents it from flowing in the opposite direction.

Let us now assume that the parts have been assembled in the manner described and that gas is flowing into the primary burner through the nozzle opening 26. The flow of gas inwardly through the Venturi tube produces a suction that causes air to flow past the regulating plate 18, through the openings 14 and to become mixed with the gas. The combustible mixture of gas and air, when ignited at the burner tip 43, forms a hot flame. Part of the gas for the primary burner flows through pipe 72 and valve 74 and the remainder through pipe 75. Gas will also flow through the annular space between the outside of the Venturi tube and the inside of pipe 41 and out through the narrow opening 46. This thin sheet of gas will issue in the shape of a hollow cone and pass parallel with and close to surface "X". The flow of gas from opening 46 produces a suction that causes air to flow inwardly through holes 63, between

blades 64 and thence through holes 78 in the refractory ring 65. The suction produced by the flow of gas also causes a stream of air to flow inwardly through openings 56 through openings 5, 7, 8 and 6, pipe 79 past the butterfly valve 80 into the space between pipe 41 and the interior of the cylindrical member 49 where it is mixed with the cold air that enters through openings 63. The air that flows through the passageways 7 and 8 in the column 4 gets very hot as this support is located directly in the path of the flame and is usually incandescent. By properly adjusting the disks 64 and 55 any desired proportions of cold and hot air can be obtained. As the cold and the hot air pass the blades 58, they are given a rotary motion that causes them to mix thoroughly.

When the pressure in the boiler exceeds a predetermined value, valve 69 closes and when this occurs the openings 63 will also be closed by the disk 64 which is operatively connected with this valve by means of the arm 71. Whenever valve 69 closes the secondary burner will cease to function and at the same time the only gas that will reach the primary burner will be that which flows through pipe 72 and this can be adjusted so that the heat produced by the primary burner will be just about sufficient to maintain the temperature of the furnace or the pressure of the boiler constant. When valve 69 opens after having been closed, the primary burner will serve to ignite the gas. A pilot light (not shown) is provided for igniting the primary burner.

By combining the burners in the manner shown, a greater flexibility is obtained than if a single burner were used as with the two burners these can be so adjusted that a quick increase in the heat can be obtained when both are operating and when the primary burner is used alone, this can be regulated so as to produce almost enough heat to maintain the temperature at the desired value after it has been brought there by the combined action of both burners.

Having described my invention what I claim as new is:

1. A compound gas burner comprising a primary burner formed in part from a Venturi tube and a secondary burner having an annular passageway formed by the outer surface of the Venturi tube and by the inner surface of a pipe concentric therewith and independently controlled means for admitting air and gas to the interior of the tube and to the annular space.

2. A compound gas burner comprising, in combination, a Venturi tube having its base flaring and of a greater diameter than the main portion of the tube, the outer surface of the flared end having a cylindrical surface provided with a shoulder, a pipe enclosing the Venturi tube, a mixing head secured to the pipe, said head having a cylindrical portion adapted to fit onto the cylindrical surface, a gasket located between the shoulder and the end of the mixing head and means for connecting the other end of the Venturi tube to the adjacent end of the pipe and for forcing the end of the mixing head against the gasket.

3. A compound gas burner comprising, in combination, a Venturi tube having its base flaring and of a greater diameter than the main portion of the tube, the outer surface of the flared end having a cylindrical surface provided with a shoulder, a pipe enclosing the Venturi tube, a mixing head secured to the pipe, said head having a cylindrical portion adapted to fit onto the cylindrical surface, a gasket located between the shoulder and the end of the mixing head, and a burner head provided with two concentric cylindrical portions connected by a perforated partition, the larger cylindrical portion being connected with the pipe and the other with the Venturi tube.

4. A compound gas burner comprising, in combination, a Venturi tube having its base flaring and of a greater diameter than the main portion of the tube, the outer surface of the flared end having a cylindrical surface provided with a shoulder, a pipe enclosing the Venturi tube, a mixing head secured to the pipe, said head having a cylindrical portion adapted to fit onto the cylindrical surface, a gasket located between the shoulder and the end of the mixing head, a burner head provided with two concentric cylindrical portions connected by a perforated partition, the larger cylindrical portion being connected with the pipe and the other with the Venturi tube, means for admitting air and gas into the flared end of the Venturi tube and means for admitting gas into the annular space between the Venturi tube and the pipe.

5. A compound gas burner comprising, in combination, a Venturi tube having its base flaring and of a greater diameter than the main portion of the tube, the outer surface of the flared end having a cylindrical surface provided with a shoulder, a pipe enclosing the Venturi tube, a mixing head secured to the pipe, said head having a cylindrical portion adapted to fit onto the cylindrical surface, a gasket located between the shoulder and the end of the mixing head, a burner head provided with two concentric cylindrical portions connected by a perforated partition, the larger cylindrical portion being connected with the pipe and the other with the Venturi tube, means for admitting air and gas into the flared end of the Venturi tube and means for admitting gas into the annular space between the Venturi tube and the pipe, and a nozzle secured to the burner head, said nozzle having an opening in line with the Venturi tube, a portion of the outer surface of the nozzle being conical and adapted to form

with the burner head a circular passage for the escape of gas from the annular passageway.

6. A compound gas burner comprising, in combination, a Venturi tube having its base flaring and of a greater diameter than the main portion of the tube, the outer surface of the flared end having a cylindrical surface provided with a shoulder, a pipe enclosing the Venturi tube, a mixing head secured to the pipe, said head having a cylindrical portion adpated to fit onto the cylindrical surface, a gasket located between the shoulder and the end of the mixing head, a burner head provided with two concentric cylindrical portions connected by a perforated partition, the larger cylindrical portion being connected with the pipe and the other with the Venturi tube, means for admitting air and gas into the flared end of the Venturi tube and means for admitting gas into the annular space between the Venturi tube and the pipe, a nozzle secured to the burner head, said nozzle having an opening in line with the Venturi tube, a portion of the outer surface of the nozzle being conical and adapted to form with the burner head a circular passage for the escape of gas from the annular passageway, a cylindrical closure enclosing the pipe, means for spacing the pipe and burner from the closure, means slidably connected with the pipe and adapted to engage the end of the cylindrical closure and means comprising a spring for holding the slidable means against the end of the cylindrical closure.

7. A compound gas burner comprising a primary burner composed of a Venturi tube, a detachable nozzle at one end and means at the other end for admitting air and gas, a secondary burner comprising a pipe enclosing the Venturi tube and spaced from the latter so as to form an annular passage, a burner head secured to the pipe and the tube at one end, a mixing head connecting the pipe and tube at the other end, means for admitting gas into the annular space, said burner head having a transverse perforated partition and a circular flange extending forwardly from the partition into close proximity to the outer surface of the nozzle whereby a passageway is provided for the escape of gas, a cylindrical housing enclosing said pipe, means for spacing the pipe from the housing and means for admitting air into the space between the pipe and the housing.

8. A compound gas burner comprising a primary burner composed of a Venturi tube, a detachable nozzle at one end and means at the other end for admitting air and gas, a secondary burner comprising a pipe enclosing the Venturi tube and spaced from the latter so as to form an annular passage, a burner head secured to the pipe and the tube at one end, a mixing head connecting the pipe and tube at the other end, means for admitting gas into the annular space, said burner head having a transverse perforated partition and a circular flange extending forwardly from the partition into close proximity to the outer surface of the nozzle whereby a passageway is provided for the escape of gas, a cylindrical housing enclosing said pipe, means for spacing the pipe from the housing, means for admitting air into the space between the pipe and the housing, a cylindrical member surrounding the cylindrical housing and spaced from the latter, means for connecting the ends of the cylindrical member with the cylindrical housing, means for admitting air into the space between the cylindrical member and the housing and a conduit extending from the last mentioned space to the space between the pipe and the cylindrical housing, a portion of said conduit being located in the path of the flame from the burners.

In testimony whereof I affix my signature.

HAROLD D. SCHRADER.