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GAS BURNER WITH VERTICALLY SPACED OUTLET SLOTS

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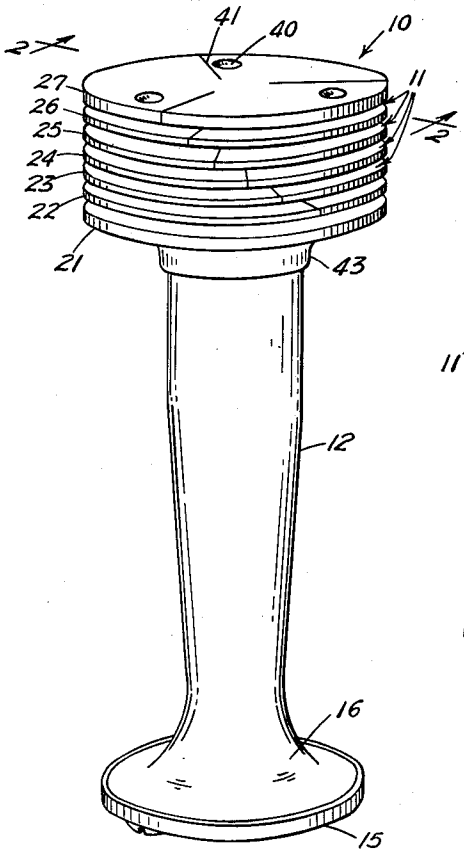


Fig. 1

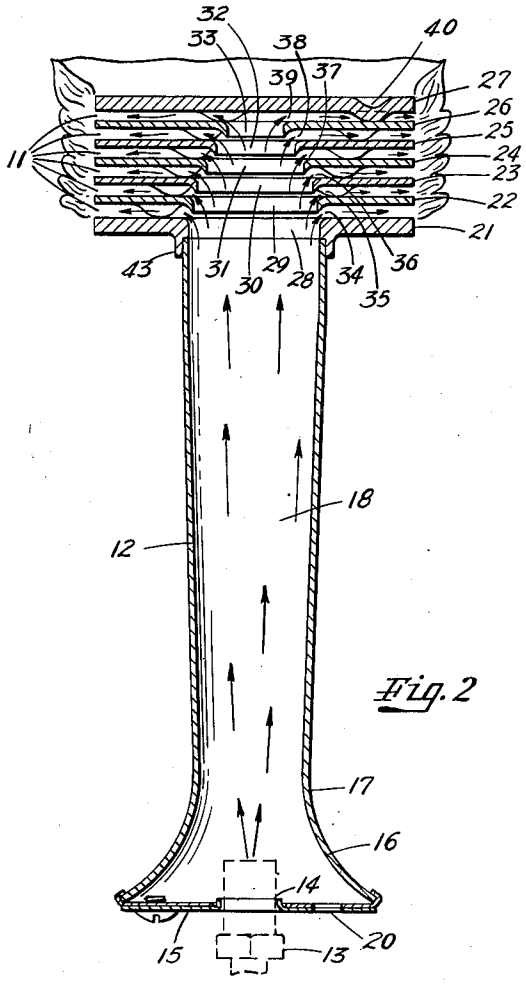


Fig. 2

INVENTOR.
Victor R. Abrams
BY
McCann & Mosher
ATTYS.

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GAS BURNER WITH VERTICALLY SPACED OUTLET SLOTS

Victor R. Abrams, Rockford, Ill., assignor to Geo. D. Roper Corporation, Rockford, Ill., a corporation of Illinois

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This invention relates to gas burners and more particularly to gas burners of the type in which gas entering a mixing tube is utilized after a minimum of controlled energy changes.

A general object of the invention is to provide a burner of the above type with an improved construction which minimizes energy losses and increases the efficiency of the burner.

Another object of the invention is to provide a burner of the above type with an improved construction which is simple, which is rugged and which is relatively inexpensive to manufacture.

Another object of the invention is to provide a burner with an improved construction which permits a relatively high turn-down ratio.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which—

Figure 1 is a perspective view of a burner embodying my invention; and

Fig. 2 is a transverse sectional view of the burner taken substantially along the line 2—2 of Figure 1.

Referring now to the drawings the invention is shown embodied in a vertical gas burner. As shown the burner comrises a port assembly 10 having a plurality of circumferentially arranged ports 11 mounted at one end of a mixing tube 12. For purposes of illustration I have shown six circumferential ports; however, any desired number of ports may be utilized. The mixing tube 12 is of a conventional aspirating type. As shown in Fig. 2, the mixing tube 12 is connected to a gas supply through a connector fitting 13 in the form of a nozzle projecting through an aperture 14 formed in a shutter plate assembly 15 disposed across a bell shaped end 16 of the mixing tube 12. In passing through the mixing tube gas flows into the bell shaped end 16, through a restricted throat portion 17 and then is permitted to expand very slightly in a flared portion 18 between the throat and the port assembly, while at the same time being intermixed with air drawn into the mixing tube 12 through an aperture 20 in the shutter plate assembly 15, to form a combustible mixture in a conventional manner. In this embodiment of the invention the circumferential ports 11 are arranged in an axial relation. Each port is arranged to permit the passage of substantially the same quantity of gas during the operation of the burner when gases in the mixing tube 12 are above critical velocity.

The ports herein are formed by assembling a plurality of discs 21—27 in spaced superposed relation so that a passageway is formed between adjacent discs for the passage of gas. For purposes of illustration the discs herein are circularly shaped flat metal stampings. It is to be understood however that the discs may be frustoconical shaped, spherical shaped or the like in lieu of being flat discs and may have any desired peripheral outline. The discs 21—26 are provided with circular openings 28—33 respectively concentrically arranged with each other and disposed in an overlapping relation from top to bottom as shown in Figure 2 to in effect form measuring orificees 34—39 inclusive for each gas passageway or port 11. The opening in each disc is so proportioned in accordance with well known practices in the art that each orifice permits entry of substantially the same volume of gas as every other orifice. It is to be understood however that the openings can be varied so that any desired or predetermined quantity of gas can be caused to flow through any particular orifice to obtain a desired distribution of gas at the respective ports to change the flame pattern. In forming the outermost port 11 the disc 27 which forms a top, in this instance, is mounted in spaced relation with the disc 26 and as shown in Fig. 2 is not provided with a central opening.

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To reduce frictional losses while the gas is passing from the mixing tube 12 to the respective ports 11, each opening 28—33 is provided with a downwardly projecting annular flange shaped to provide each orifice with an inclined edge portion. As gas flows through the mixing tube 12 into the port assembly the thin leading edge of each inclined orifice 34—39 in effect peels off the outer peripheral ring of the gas flowing through the port assembly.

Any suitable means may be used to secure the assembled stampings together in spaced relation. To this end I form each disc with three or more spaced projections 40 projecting outwardly from one side of the disc. Each successive disc when in the assembled position is positioned so that its other side abuts the projections of the adjacent disc. The discs are then rigidly secured together, as by welding.

As the temperature of the respective discs 21—27 increases when the burner is ignited there is a tendency for the discs to expand and cause distortion of the assembly. To avoid this distortion I form each disc with radially extending slots 41, herein in the form of a sheer cut extending outwardly from the central portion of each disc. The shear cuts 41 are disposed between the projections 40 and the discs are assembled

so that the shear cuts are staggered as shown in Figure 1. This construction permits contraction and expansion of the assembly without objectionable distortion.

Means is provided for mounting the port assembly 10 at one end of the mixing tube 12. For this purpose the disc 21 may be formed with an annular collar 43 projecting outwardly from one side of the disc which is shaped to fit snugly over the end of the mixing tube as shown in Fig. 2 so that the passageway 18 in the tube 12 is in registry with the openings formed in the discs 21—26.

As is well known in the art, different gases have different chemical compositions, specific gravities, and combustion characteristics and therefore require modified conditions for utilization. Consequently, the same sized port openings cannot be utilized for all gases. Thus, for example in two burners each constructed to burn 9000 B. t. u.'s per hour in which the diameter of the discs 21—27 measured 3⅛" and 1⅝", respectively, having two and six ports respectively, I have found that the distance of .040" to .060" between discs provides a port opening that gives excellent results when natural gas is utilized in the burners. However, when manufactured gas was used with the burners I have found that the distance between discs should be reduced to .025" to .030" for equivalent results.

The turn-down of this burner construction is exceptionally good. The above constructed burners for 9000 B. t. u.'s per hour were turned down to 600–800 B. t. u.'s per hour. The efficiencies of these burners were in excess of 50 percent as measured by American Gas Institute test procedures.

As is evident by viewing the drawings the burner assembly shown herein is very simple to construct, since the mixing tube 12 may be readily made from preformed tubing and the discs 21—27 can be formed as metal stampings. The assembled construction provides a burner which has a neat and attractive appearance. The burner shown herein may be utilized as a main burner when constructed in larger sizes. It has also been effectively used as a simmer burner. This burner can also be used as a 100% primary air burner. In such instances the rating of the burner, however, must be decreased somewhat.

In operation the flame from each port merges with the flame of the adjacent ports so that as shown in Fig. 2 only one continuous serrated ring of fire extending upwardly around the port assembly 10 is visible. It is to be understood that this construction provides a port assembly that is substantially unpluggable in operation. This is due primarily to the fact that the ports 11 as shown in Fig. 2 are at substantially right angles to liquid or the like that would drop from a kettle or pan when being heated by a vertical burner of this type.

While I have shown a particular embodiment of my invention it will be understood that I do not wish to be limited thereto since many modifications may be made and therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

I claim:

1. A burner for use with a mixing tube having a gasway, comprising a closed end plate spaced axially from the discharge end of the mixing tube and a plurality of axially spaced discs interposed between the discharge end of the mixing tube and said end plate to form spaced circumferential passageways therebetween, each of said discs having a central opening in registry with said gasway, the central opening in each disc being defined by an annular edge which is inturned toward the discharge end of the mixing tube to receive and direct gas from the mixing tube to each respective passageway without substantial pressure change, and the openings in adjacent discs being arranged coaxially and of a progressively smaller size in the direction from the mixing tube to said end plate, so that the annular inturned edge of each disc overlaps the central opening in the adjacent disc having a larger central opening to form annular inlets to the respective passageways shaped to receive equal quantities of gas.

2. A gas burner comprising a flat disc having an opening, a second substantially flat disc in spaced parallel relation to said first disc to form an annular peripheral flame port and having an opening of smaller dimensions than the opening in said first disc, said second disc having an edge which defines said opening in the second disc inclined in the direction of the opening in the first disc and defining with the latter an inclined inlet to said peripheral port, and a third disc in spaced parallel relation to said second disc at the side thereof remote from the first disc to form a second annular peripheral port in spaced axial relation with said other port, said inturned edge on the second disc coacting with said third disc to define a smaller inclined inlet leading to the second peripheral port, and means for mounting said discs in communication with a gas passageway with the first disc positioned toward the inlet of the gas passageway and the third disc remote therefrom.

3. A gas burner, comprising a mixing tube having a gas passage, first and second discs mounted in spaced parallel relation at the discharge end of said tube, the disc which is closer to the discharge end of the mixing tube having an opening in registry with the passage in said tube, at least one other disc disposed between said first and second discs in spaced parallel relation therewith to form circumferential axially spaced flame ports, said last disc having an opening in registry with and smaller than said opening in the first disc, said last disc having an edge which defines said opening in the last disc inturned toward the discharge end of the mixing tube and forming with the first and second discs inclined annular inlets for guiding the gas from the passage to the ports with only one change in direction.

4. A gas burner adapted for use with a mixing tube having a gasway, comprising a body closed at one end remote from the mixing tube and having a plurality of radially expansive axially disposed passageways formed by spaced discs having aligned openings, said openings being of progressively smaller size in the direction of the closed end of the body, means for maintaining said discs in rigid relation so that the disc with the smallest opening is adjacent the closed end of the body and the disc with the largest opening is adjacent the discharge end of the gasway in the mixing tube, each of said discs having an edge which defines the opening in the disc inclined in the direction of the discharge end of the mixing tube and overlapping the opening in the next adjacent disc having a larger opening, said inclined edges of adjacent discs form-

ing inclined annular inlets disposed in the gas stream from the discharge end of the mixing tube to receive an annular flow of gas from the gas stream flowing therefrom, the peripheral edges of adjacent discs defining outlets for said passageways forming circumferentially extending ports for the discharge of said gas.

5. A gas burner for use with a mixing tube, comprising a body having a plurality of radially expansive axially disposed passageways formed by spaced discs, all but one of said discs having openings of different sizes, said disc without the opening forming a top for the burner, said discs being arranged in superposed relation so that the disc with the largest opening is adjacent the mixing tube and the successive discs in the direction toward the top have successively smaller aligned communicating openings and the portion of each disc adjacent the opening overlies the opening of the next lower disc with the larger opening, each said disc being formed with an annular flange defining said opening inclined at an angle to the plane of said disc and terminating in a thin edge facing downwardly away from said disc, and means for mounting said disc to have the flanges on adjacent discs define downwardly inclined inlets facing toward the mixing tube and shaped to receive substantially the same volume of gas from a gas stream flowing through said mixing tube to said passageways.

6. A gas burner for connection to a mixing tube, comprising a body having a top and a plurality of axially spaced radially expansive passageways at right angles to the longitudinal axis of said burner, means in said body forming a plurality of annularly shaped inclined inlets arranged coaxially about the longitudinal axis of said burner and facing toward the mixing tube, each of said inlets being in communication with one of said passageways, said inlets shaped to be interposed successively in the path of movement of the periphery of the gas stream flowing to said burner beginning with the inlet adjacent the mixing tube so that there is substantially only one change in direction of the flow of gas to said passageways, and means defining a plurality of circumferential flame ports each in communication with one of said passageways, said passageways permitting the expansion of gas flowing to said burner before discharge through said flame ports.

7. The combination recited in claim 2 in which each of said discs is provided with a radially extending slot opening on the periphery of said discs and extending inwardly a substantial distance from the peripheral edge thereof.

8. A gas burner assembly comprising a mixing tube, and a flame port assembly connected to said mixing tube at the discharge end thereof in axial alignment therewith, said flame port assembly including a closed end member spaced axially from the discharge end of the mixing tube, means forming an axial passage between said end member and the discharge end of the mixing tube in communication with the latter, and means located between said end member and the discharge end of the mixing tube defining a plurality of annular passageways which are spaced apart axially in succession between the discharge end of the mixing tube and said end member and which extend respectively in planes traversing the axis of the flame port structure, each said annular passageway communicating with said axial passage and terminating at the periphery of the flame port assembly to form a plurality of axially spaced annular peripheral flame ports, each said annular passageway at its communication with said axial passage being formed by partition means spaced apart axially and inturned toward the discharge end of the mixing tube to form inclined inlets, the partition means for said annular passageways at their respective communications with the axial passage terminating progressively radially inward toward the axis of said axial passage in the direction away from the discharge end of the mixing tube.

VICTOR R. ABRAMS.

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