July 17, 1951 J. A. HARRISON 2,560,862

GAS BURNER WITH INTERNAL FUEL DISTRIBUTERS AND VARIABLE FLAME AREA

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FIG. 1

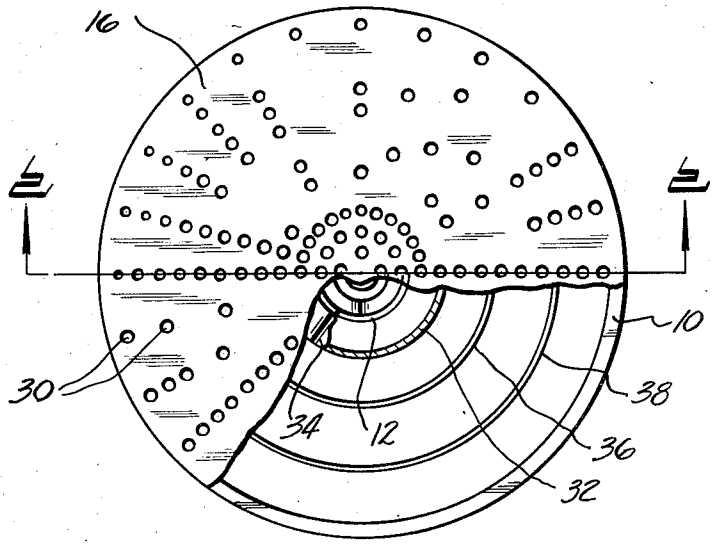
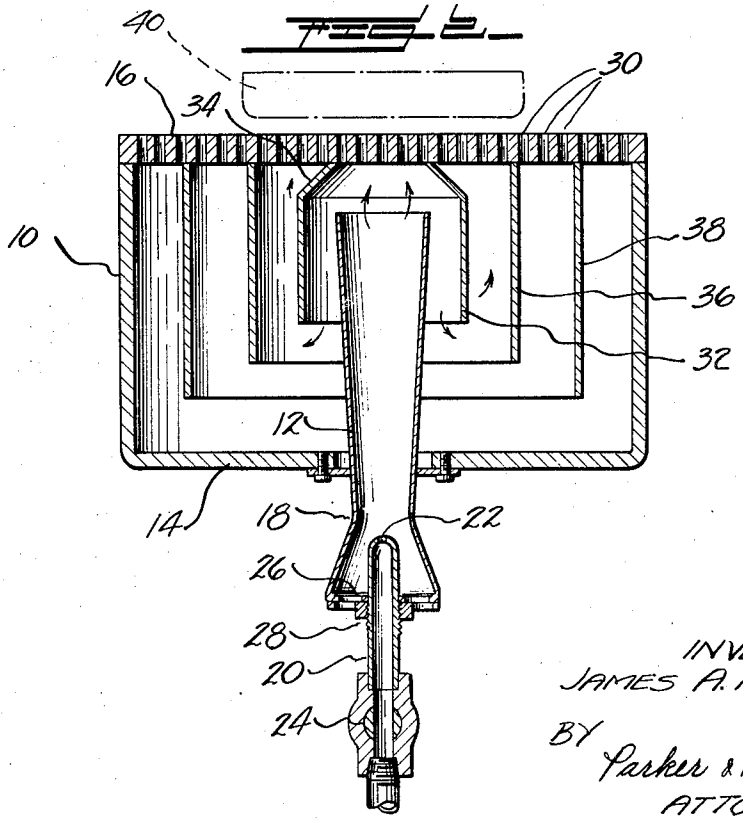


FIG. 2



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GAS BURNER WITH INTERNAL FUEL DISTRIBUTORS AND VARIABLE FLAME AREA

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16 Claims. (Cl. 158—114)

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This invention relates to heating devices and more particularly to a gas burner of variable operating capacity.

An important object of this invention is to provide a novel gas burner structure adapted for domestic and industrial uses which automatically varies the flame jet area in proportion to the volume of gas delivered. Another object of this invention is to provide an improved gas burner which in operation projects a multiplicity of flame jets for heating purposes and which is self-operable to vary the number of flame jets and the area of flame jet propagation proportionately to the quantity of gas supplied to the burner. A further object of this invention is to provide a gas burner capable of such operation which is constructed of few parts economical to manufacture and easy to assemble together.

A meritorious feature of the invention is that in operation the burner is self-operable to vary the number and area from which the flame jets issue by the simple act of controlling the gas delivery valve. Novel provision is made in the burner for regulating the flow of the gas mixture therein so that when a small amount of gas is supplied, a small area of flame is provided, and when larger amounts of gas are supplied, larger areas of flame are produced. As a result, the area of flame jet discharge may be adjusted to accommodate vessels or other articles of different sizes which are brought into heating relationship to the burner. Another feature is that the velocity of the gas in the burner remains approximately the same regardless of the amount of gas delivered to the burner.

Various other objects, advantages and meritorious features of the invention will become more fully apparent from the following specification, appended claims and accompanying drawings wherein:

Fig. 1 is a top plane view of the gas burner partly broken away to show the interior construction, and

Fig. 2 is a vertical sectional view through the gas burner structure along lines 2—2 of Fig. 1.

The invention is adaptable for use on domestic heating stoves and for use in industrial gas fired appliances. It is herein illustrated in its application to a domestic heating stove.

The gas burner structure of this invention comprises an enclosure or casing indicated at 10, which surrounds the discharge end of a gas and air delivery and mixing tube 12. The casing preferably consists of a circular side wall in the form of a sleeve, having a closed bottom 14 through

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which the tube 12 extends. A circular perforated burner head or plate 16 extends across the upper end of the sleeve. The tube 12 as indicated in the drawings enters the bottom of the casing on the axis thereof, and its discharge end terminates short of the burner plate 16. The tube is constricted intermediate its ends to form a Venturi passage 18. The bottom wall 14 may be connected to the tube at approximately its narrowest part.

Gas is delivered to the lower bell-mouthed end of the mixing tube by means of a gas supply pipe 20 having a gas discharge orifice 22 in the upper end thereof through which gas is discharged into the tube immediately adjacent to the venturi. A gas cock or valve 24 is provided in the gas delivery line to vary the volume of gas delivered. The bell-mouth opening of the tube is provided with an apertured plate 26 through which primary air is admitted for mixture with the gas in the tube. A primary air shutter 28 rotatably mounted on the gas line 20 is capable of varying the area of the openings in the plate 26 in the usual manner and thereby regulates the amount of primary air admitted into the tube.

In industrial applications of this invention, various types of automatic valves may be substituted for the manually operated gas cock 24. These valves may be controlled electrically or by fluid pressure and be made responsive to temperature changes in the gas fired appliance.

The burner head or plate 16, as shown in Fig. 1, is perforated throughout its extent by openings 30 forming a plurality of discharge orifices. These openings may be formed by drilling holes through the plate or in any other suitable way. From each orifice 30 a jet of flame may issue.

In accordance with this invention, the burner is self-operable to vary the area of flame jet propagation from the plate 16 in proportion to the amount of gas delivered to the tube. This is accomplished by the novel provision in the burner casing of flow controlling baffle or partition members which divide the interior of the casing into a plurality of subsidiary compartments successively arranged to receive a portion of the gas mixture only after the capacities of the compartments nearer to the tube are exceeded. Referring to Fig. 2, a plurality of circular baffles or partitions are arranged in the casing about the discharge end of the tube and concentric therewith. These partitions are mounted in edge abutting relationship to the burner head plate 16 and extend progressively greater distances therefrom the more remote they are from the tube.

The innermost partition 32 directly encircles

the discharge end of the tube and is provided with a conically shaped portion 34, which convergingly directs the fuel mixture to the ports 30 enclosed within its boundaries. The next innermost partition 36 extends toward the bottom wall 14 further than the partitions 32. The outermost partition 38 extends toward the bottom wall further than the partition 36 but terminates short of the bottom or back wall 14. All the circular partitions may be welded or otherwise integrally joined to the under surface of the perforated plate 16. The partitions, in cooperation with the tube and the side wall of the casing, subdivide the interior of the casing into a plurality of annularly-shaped compartments, each opening out toward the bottom wall 14. Each compartment is thus provided with a series of discharge orifices 30.

In operation, the fuel mixture discharged from the tube first enters the innermost compartment formed by the partition 32 and flows through the orifices 30 enclosed thereby. If more than sufficient mixture of gas and air is supplied to the compartment to feed the orifices confined thereby, the excess mixture will flow or spill around the lower edge of the partition 32 into the next outermost compartment. The arrows in the drawing indicate the direction of flow. Similarly, if the capacity of this compartment is exceeded, the excess fuel mixture will flow around the bottom edge of the partition 36 into the next outermost compartment, et cetera.

It is obvious that the flame jets will issue only from those orifices 30 which communicate with the compartments having a fuel mixture therein. Regulation of the gas cock 24 or other form of control valve will vary the amount of gas delivered. If it is turned to a slightly opened position, a small amount of gas and air will discharge from the tube, which mixture will be confined by the partition 32 and caused to issue in ignited condition from the small area of orifices 30 in the center of the plate 16 bounded by the partition 32. If the gas cock is opened further, the capacity of the innermost compartment will be exceeded, and the excess fuel mixture enter the next outermost compartment. Flame jets will therefore issue from the orifices 30 communicating with this compartment, and as a result a larger area of orifices will discharge flame jets from the burner head 16. When the valve 24 is fully turned on, all compartments will receive a fuel mixture, and flame jets will issue from the entire area of the burner plate 16. It is thus apparent that the area of the burner plate from which flame jets issue is directly proportional to the amount of gas delivered and that the size of this area can be increased radially from the center of the burner plate outwardly to the limits thereof proportional to the extent the gas controlled valve is turned on.

There is indicated in dotted outline in Fig. 2 a receptacle or vessel 40 which may be supported in any suitable manner above the burner, for the purpose of being heated thereby. The receptacle is shown with a lateral dimension approximately that of the partition 36. By regulating the control valve 24, it is possible to supply only a sufficient amount of fuel mixture to light the burner orifices above the compartments formed by the two partitions 32 and 36 and thereby confine the flame jet area to approximately the size of the receptacle.

Because the number of orifices 30 through which the mixture escapes is reduced proportionately to the extent the valve is regulated toward a closed position, the velocity of the gas through the mixing tube remains approximately the same. The velocity will always be high enough to be ahead of the flame propagation and thereby prevent the blow-back of the flame into the interior of the casing. As a result, the turn-down capacity of the burner is much greater than in the ordinary type of burner.

What I claim is:

1. A gas burner comprising, in combination, a tube shaped to form a venturi intermediate its ends having means for delivering gas and air into one end thereof for passage therethrough and for discharge from the other end thereof, a circular sleeve enclosing the discharge end section of the tube and arranged concentrically thereabout, said sleeve having a back circular closure member extending to the tube at approximately the venturi thereof and a front circular closure member extending across the discharge end of the tube in spaced relation thereto, said front closure member provided throughout its extent with a multiplicity of drilled openings therethrough forming ports from which burning jets of fuel issue, a plurality of circular partitions of unequal diameters all having a cross sectional area less than the ported area of said front closure member arranged concentrically in said casing in spaced apart relation and dividing the interior of the sleeve into a plurality of subsidiary compartments, said partitions extending from abutting engagement with the inside surface of said front member toward the back member but terminating in a free edge short of the latter, said partitions being of progressively longer lengths the more distant they are from the tube whereby the flow of gas from the discharge end of the tube to the more remote compartments is substantially cut off until the capacities of the compartments nearer the tube have been filled.

2. A self-operable gas distributing device comprising, in combination, a substantially closed casing having one wall thereof provided with a plurality of openings spaced over a substantial circular area thereof and forming gas distributing ports, a gas delivery tube projecting into the interior of the casing from the wall thereof opposite to said ported wall and having its discharge end terminating short of said ported wall opposite to the center of the ported area thereof, a sleeve-like member having a cross sectional area less than said ported area and mounted within the casing in concentric relation about the discharge end of said tube in edge abutting engagement with said ported wall of the casing so that a plurality of ports of said ported area are inside of the member and a plurality of ports of the ported area are outside of the member, said sleeve-like member having an axial length less than the distance separating said opposite walls of the casing but greater than the distance between said ported wall and the discharge end of the delivery tube and dividing the interior of the casing into a central compartment into which all of the gas discharged by the tube enters and into an outer annular compartment outside of the member, said compartments opening into communication with said ports at one end of the sleeve-like member and with one another around the opposite end of the sleeve-like member and so disposed with respect to the discharge end of the tube that

the outer annular compartment receives gas discharged by the tube only after the capacity of the inner central compartment is exceeded.

3. A gas burner having a self-operable variable flame jet area comprising, in combination, a hollow substantially closed burner head having spaced apart upper and lower walls, said upper wall being perforated over a substantially circular area to form a plurality of gas jet emission ports, a gas delivery tube projecting upwardly into the interior of the burner head through the bottom wall thereof and having its discharge end terminating short of the upper wall substantially opposite to the center of said ported area thereof, a sleeve-like member having a cross sectional area less than said ported area of the upper wall mounted in the interior of the burner head in concentric relation about said tube and having the upper end thereof sealed to the underside of the upper wall so that a plurality of ports of the ported area lie inside of the member and a plurality of ports of the ported area lie outside of the member, said sleeve-like member having an axial length less than the distance between the upper and lower walls but greater than the distance between the upper wall and the discharge end of the tube and dividing the interior of the burner head into a central chamber into which all of the gas delivered and discharged by the tube enters and into an annular chamber outside of the member, said chambers opening into communication with said ports at their upper ends and with one another at their lower ends and so related to the discharge end of the delivery tube that the outer annular chamber receives gas discharged by the tube only after the capacity of the inner central chamber is exceeded.

4. A gas burner comprising, in combination, a burner head having a substantially circular plate provided with a plurality of openings therethrough spaced over a substantial circular area from the center of the plate outwardly therefrom and each forming a discharge port from which a jet of ignited fuel issues, a gaseous fuel delivery tube entering the burner head and having its discharge end terminating short of said plate and opposite to the center thereof, a plurality of radially spaced apart partitions in the burner head extending substantially perpendicular to the plane of the plate and substantially concentrically overlapping the discharge end of the delivery tube, said partitions each having a cross sectional area less than the ported area of said plate, and said partitions each disposed in edge abutting relation to said plate and extending progressively greater distances away therefrom the more remote the partition is from the discharge end of the tube.

5. In a gas burner head having a ported area in the upper end thereof communicating with the interior of the head and from each port of which an upwardly directed jet of ignited fuel is adapted to issue, a gas delivery tube entering the burner head and having its discharge end directed upwardly and terminating short of the upper end of the head and opposite to the center of said ported area, a substantially circular wall in the interior of the burner head depending downwardly from the upper end thereof and concentrically overlapping upon the discharge end of the tube in radial spaced relationship thereto, said wall having a cross sectional area less than that of said ported area and so disposed with respect to the latter that some of the ports of the

ported area lie inside the area defined by the wall and other ports of the ported area lie outside of the area defined by the wall, said wall terminating in a free edge short of the bottom of the burner head and dividing the interior of the burner head into a central compartment into which all of the gas discharged by the tube enters and into an annular compartment outside of the wall, and said compartments each communicating with the ports which lie on its respective side of the wall for delivery of gas thereto and with one another around the free edge of the wall whereby in operation the outer annular compartment receives gas discharged from the tube sufficient for ignition only after the capacity of the inner central compartment is exceeded.

6. A gas burner head shaped to form a substantially closed chamber including a top portion, a bottom portion and side wall portions, said top portion provided with a plurality of gas discharge orifices arranged in radially and circularly spaced apart relationship and from each of which an upwardly directed jet of ignited fuel is adapted to issue, means for delivering gas to the burner head and for discharging the gas into the chamber substantially opposite to the center of said plurality of orifices, a substantially circular vertical wall in the chamber having the upper end thereof disposed in edge abutting relationship to the top portion such that some of said discharge orifices are located within the area defined by the wall and the remaining discharge orifices are located outside of the area defined by the wall, said wall substantially concentrically overlapping to the discharge end of said gas delivery means in radial spaced relation thereto and terminating at its lower end in a free edge spaced from the bottom portion of the burner head, said wall dividing the chamber into two compartments on either side thereof which communicate with one another around the bottom free edge of the wall and communicate with the discharge orifices in the top portion on the side of the wall on which they are located whereby in operation the outer annular compartment receives gas discharged into the casing sufficient for forming combustible jets of fuel only after the capacity of the inner central compartment is exceeded.

7. A self-operable gas distributing device comprising, in combination, a substantially closed casing including a top portion, a bottom portion and connecting side wall portions, said top portion provided with a plurality of gas discharge orifices arranged in radially and circularly spaced relationship to one another and opening into communication with the interior of the casing, means for delivering gas to the interior of the casing and for discharging the gas thereinto in an upward direction substantially opposite to the center of said plurality of orifices, a wall in the interior of the casing encircling the discharge end of said gas delivery means in radial spaced relation thereto and having its upper end disposed in edge abutting relationship to the top portion of the device such that some of the discharge orifices lie inside the area defined by the wall and the other discharge orifices lie outside of said area, said wall having its lower end terminating in a free edge below the discharge end of said gas delivery means short of the bottom portion of the casing and dividing the interior of the casing into a central compartment into which all of the gas discharged by said delivery means enters and into an annular compartment outside of the wall, said compartments each communi-

cating with one another around the lower free edge of the wall and with the orifices on its respective side of the wall whereby in operation the outer annular compartment receives gas discharged from said delivery means only after the capacity of the inner central compartment is exceeded.

8. A self-operable gas distributing device comprising, in combination, a substantially closed casing including a top portion, a bottom portion and connecting side wall portions, said top portion provided with a plurality of gas discharge orifices occupying a considerable area thereof and opening into the interior of the casing so that from each orifice an upwardly directed jet of gas is adapted to issue, a wall in the interior of the casing having the upper edge thereof in edge abutting relation to the top portion of the device such that some of the discharge orifices lie on one side of the wall and other discharge orifices lie on the opposite side of the wall, said wall extending downwardly from the upper portion of the device and terminating in a free edge spaced from the bottom portion of the device to divide the interior of the casing into two compartments on opposite sides of the wall, the space between the lower free edge of the wall and the bottom portion forming a permanently opened communicating passage between the two compartments and the discharge orifices on their respective sides of the wall, and means entering the casing and discharging gas into only one of said compartments above the level of the free edge of the wall whereby in operation the other compartment receives gas by way of said communicating passage for delivery to its respective orifices only after the volume of gas discharged into the first compartment exceeds the capacity thereof.

9. A gas burner comprising, in combination, a circular casing, a circular plate extending across one end thereof provided throughout its extent with perforations forming ports for the discharge of burning jets of gaseous fuel, a plurality of concentrically arranged spaced apart circular partitions in the casing all having a cross sectional area less than the ported area of said plate and each having one edge fixed to the plate and the other edge terminating free, said partitions dividing the casing into a plurality of circularly shaped compartments opening into the interior of the casing on the side thereof opposite to said plate and extending progressively greater distances from the plate the more remote they are from the axis of the plate, and a gas and air delivery and mixing tube entering the end of the casing opposite to the plate and on the axis thereof and having its discharge end terminating short of the center of the plate and within the innermost compartment of the casing.

10. A gas burner having a self-operable variable flame jet area comprising, in combination, a hollow burner head having the top wall provided throughout a substantially large area with perforations forming orifices for the upward discharge of combustible gaseous jets, a gaseous fuel delivery tube projecting upwardly into the burner head and terminating short of the center of the perforated area of the top wall, a plurality of substantially circular partitions of unequal diameters arranged in the burner head concentrically about said tube and in edge abutting engagement with the top wall so that each adjacent pair of partitions encloses a plurality of perforations therein, said partitions extending downwardly from the top wall in overlapping relation to the discharge end of the tube and terminating in free edges, said partitions having axial dimensions of progressively increasing lengths the more remote they are from the tube and subdividing the interior of the burner head into a plurality of circularly shaped compartments each arranged to receive a portion of the gaseous fuel delivered by the tube only after the capacity of the compartment nearer the tube has been exceeded.

11. A self-operable gas distributing device comprising, in combination, a casing having the top portion thereof provided with a plurality of gas discharge openings therethrough arranged in radially and circularly spaced apart relationship and forming gas distributing ports, a gas delivery tube projecting upwardly into the casing from the bottom portion thereof and terminating short of the top portion thereof opposite to the center of the ported area thereof, a plurality of sleeve-like members of unequal diameters having their axial dimensions varying in direct proportion to their respective cross-sectional areas, said members all occupying a cross-sectional area less than the ported area of the top portion of the casing and being mounted within the casing in overlapping concentric relation about said tube and in substantially edge abutting engagement with the inner surface of the top portion of the casing, said members subdividing the interior of the casing into a plurality of concentric annularly shaped gas chambers each communicating at its upper end with a number of ports in the top portion of the casing and at its lower end with the interior of the casing, each chamber receiving a portion of the gas discharged by the tube only after the capacity of the chamber nearer to the tube has been exceeded.

12. A self-operable gas distributing device comprising, in combination, a substantially closed casing having one wall thereof provided with a plurality of openings arranged in radially and circularly spaced relationship with one another and opening into communication with the interior of the casing to form a generally circular area of gas distributing ports, a gas delivery tube projecting into the interior of the casing from the wall thereof opposite to said ported wall and having its discharge end directed toward and terminating short of said ported wall substantially opposite to the center of the ported area thereof, a sleeve-like member having a cross-sectional area intermediate the maximum and minimum radial dimensions of said ported area and mounted within the casing in concentric relation about the discharge end of the tube and in engagement with the ported wall so that a plurality of ports lie inside of the member and a plurality of ports lie outside of the member, said sleeve-like member having an axial length less than the distance separating said opposite walls of the casing but greater than the distance separating the discharge end of the delivery tube from the ported wall and dividing the interior of the casing into a central compartment into which all of the gas discharged by the tube enters and into an annular compartment outside of the member, said compartments opening into communication with said ports at one end of the sleeve-like member and with one another around the opposite end of the member and so disposed with respect to the discharge end of the tube that the outer annular compartment receives gas

discharged by the tube only after the capacity of the inner central compartment is exceeded.

13. A gas burner comprising, in combination, a hollow body having spaced apart upper and lower wall portions and a connecting side wall portion, said upper wall portion being provided with concentrically arranged inner and outer circular rows of gas discharge ports, a gas delivery tube projecting upwardly into the interior of the burner head from the bottom wall portion thereof and having its discharge end terminating short of the upper wall portion substantially opposite to the center of said circular rows of gas discharge ports, a sleeve-like member having a radial dimension between that of the outer circular row of discharge ports and the inner circular row of discharge ports and mounted in the interior of the body in substantially concentric relation to the circular row of ports, said member having the upper end thereof sealed to the underside of the upper wall portion so that the inner circular row of ports lie inside of the member and the outer circular row of ports lie outside of the member, said sleeve-like member further having an axial length less than the distance between the upper and lower wall portions of the body but greater than the distance between the upper wall portion and the discharge end of the tube and dividing the interior of the body into a central chamber into which all of the gas discharged by the tube enters and an annular chamber outside of the member, said chambers opening into communication with their respective circular rows of ports at the upper ends thereof and with one another at their lower ends whereby in the operation of the gas burner the outer annular chamber receives gas for combustible purposes only after the capacity of the inner central chamber is exceeded.

14. A gas burner comprising, in combination, a substantially circularly shaped hollow body having spaced apart top and bottom portions and a connecting side wall portion, said top portion being provided with substantially concentrically arranged inner and outer circular rows of gas discharge ports, a substantially circular wall in the interior of the body depending downwardly from the top portion between the inner and outer circular rows of gas discharge ports and disposed in substantially concentric relation thereto, said wall terminating in a free edge short of the bottom portion of the body, and dividing the interior of the body into an inner central compartment and an outer annularly shaped compartment, said compartments each communicating with the row of ports which lie on its respective side of the wall and communicating with one another around the free edge of the wall, and a gas delivery tube centrally located in the body and projecting upwardly from the bottom portion thereof into the central compartment and terminating short of the upper portion of the body, the gas discharged by the tube first entering the central compartment and flowing to the outer annular compartment only after the capacity of the central compartment is exceeded.

15. A gas burner comprising, in combination, a substantially circularly shaped hollow body having spaced apart top and bottom portions and a connecting substantially circular outer side wall portion, said top portion being provided with substantially concentrically arranged inner and outer circular rows of gas discharge ports from each of which an upwardly directed jet of gaseous mixture is adapted to issue, a gas delivery tube centrally located in the body and projecting upwardly from the bottom portion thereof and terminating short of the upper portion of the body, and a substantially circular wall in the body depending downwardly from the upper portion thereof between the inner and outer circular rows of ports and in substantially concentric relation thereto, said wall overlapping the upper discharge end of the tube in radial spaced relation thereto and terminating at its lower end in a free edge spaced from the bottom portion of the body.

16. A gas burner comprising, in combination, a substantially circular hollow body having the top portion thereof provided with an inner and an outer circular row of discharge ports arranged substantially concentric to one another, a substantially circular wall in the hollow interior of the body depending downwardly from the top portion thereof between the inner and the outer rows of ports and terminating in a free edge short of the bottom portion of the body, said wall dividing the interior of the body into an inner central compartment and an outer annularly shaped compartment, said compartments each communicating with the row of ports which lie on its respective side of the wall and with one another around the free edge of the wall, and a gas delivery conduit communicating with an outside source of supply and entering the body, the discharge end of said conduit being centrally located in the body and projecting upwardly therewithin to discharge the gas in an upward direction into the central compartment whereby in the operation of the burner some of the gas will flow to the outer annular compartment for combustion purposes only when the capacity of the central compartment is exceeded.

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