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AIR PREHEATING BURNER

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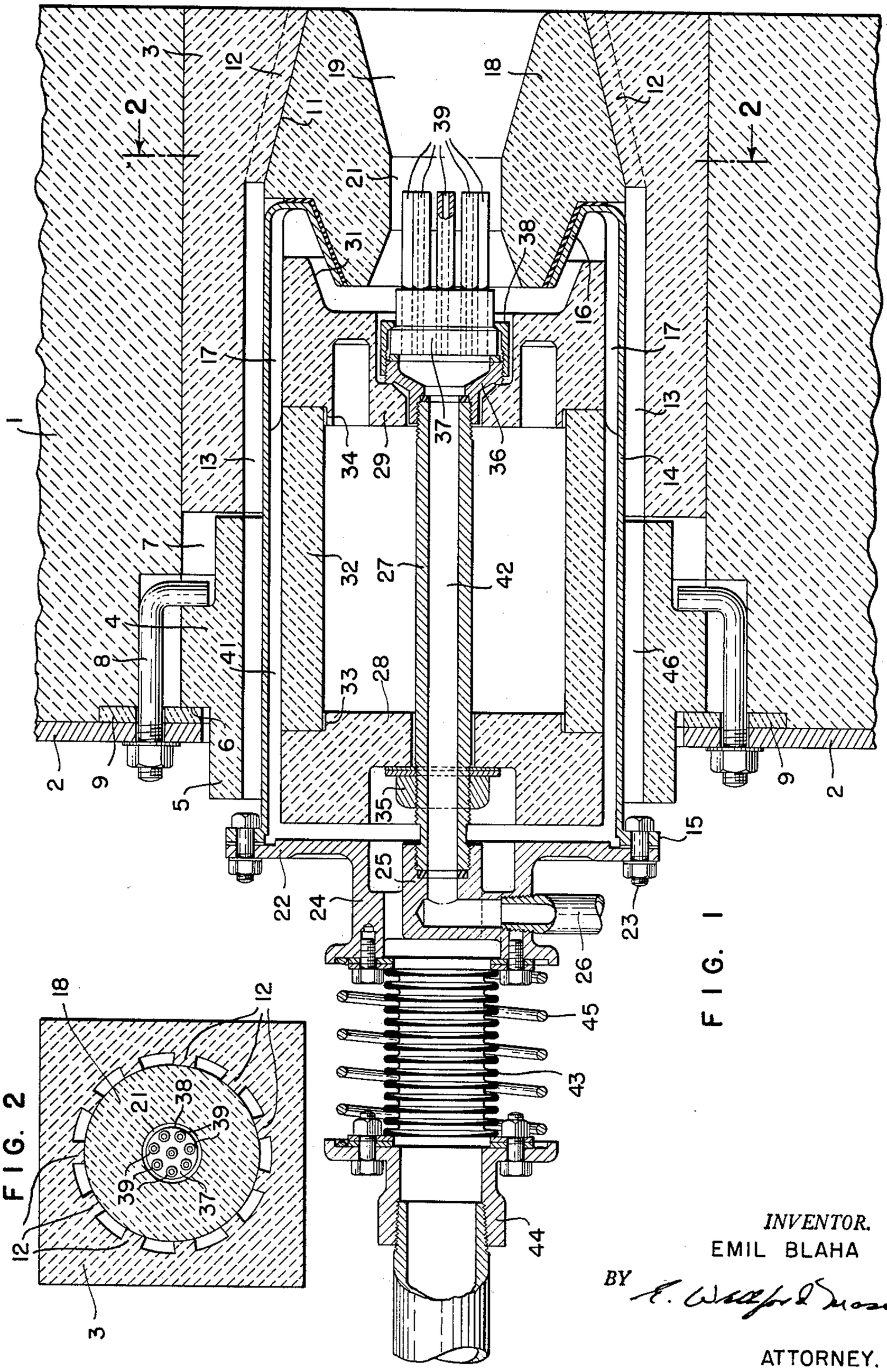

FIG. 1

FIG. 2

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AIR PREHEATING BURNER

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The present invention relates to industrial gas burners, and more particularly to a burner in which the air is preheated, as it is flowing through the burner, from products of combustion that are drawn directly from the furnace.

It is common to use preheated air for supplying burners, thereby to increase the furnace temperature. In most cases, however, the air is preheated by some type of heat exchange apparatus that is away from the burner, and is supplied thereto through suitably insulated pipes. This requires that a large amount of auxiliary equipment be used with the furnace.

It is an object of the invention to provide an industrial burner which is so constructed that the air for combustion is preheated as it is flowing through the burner.

It is a further object of the invention to provide a burner in which the parts can move relative to each other as a result of expansion and contraction of the various parts.

A further object of the invention is to provide a burner in which the fuel and air are supplied under low pressure to mix as they leave the burner, and burn without substantial turbulence in the furnace chamber.

In carrying out the invention, there is provided a burner block, inserted in a furnace wall, which receives a burner body. The burner body is provided with separate passages through which fuel and air are supplied, to be brought into contact with each other immediately prior to the time they are discharged into a furnace. A space is provided between the burner block and burner body through which hot gases from the furnace pass to heat the air as it is flowing through the burner. The gas supply is protected from the heat in order to prevent premature ignition.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

In the drawings:

FIG. 1 is a section through the burner, and

FIG. 2 is a section taken on line 2—2 of FIG. 1.

Referring to the drawings, there is shown a furnace wall 1 which is constructed in the usual fashion of brick and insulating material, and which is encased by a sheet metal backing plate 2. A burner block 3 is built into the wall, and has its front end flush with the inner surface of the furnace. Aligned with and back of the burner block is a hollow jacket tile 4, the rear end of which extends beyond backing plate 2, as shown at 5. This tile is located in the furnace wall by means of a shoulder 6, which engages a gasket 9. The tile is held in place by the end of a hook 8, which is received in a cut out portion 7 formed on the surface of the tile. A number of these hooks are provided around the tile, and they are tightened by means of suitable nuts to hold the tile in place and against the gasket.

The burner block 3 and tile 4 are provided with concentric axially extending openings that are adapted to receive a burner body assembly in them. It is noted that the front end of the opening in the burner block is contracted in the form of a cone, as shown at 11. The inner surface

of the conical end is provided with a plurality of radial ribs 12, some of which extend only to the end of the conical surface, whereas others extend back, as shown at 13, to the outer end of the burner block. The burner assembly that is received in the opening of the burner block includes a cylindrical metal burner body 14 of a diameter such that it can be received snugly by the inner faces of ribs 13. This body is provided on its outer end with a radially extending flange 15, and has its inner end formed with a re-entrant portion 16, as best shown in the drawing. This body is also provided with a plurality of inwardly extending ribs 17 adjacent to its inner end. A port block 18 is cemented, as shown, to the re-entrant portion 16 of the body. This block has an outer surface, which is conical, and which is complementary to the inner surface of ribs 12. The block is also provided with a central opening 19 that is generally in the shape of a venturi, and which is provided with a throat section 21.

Received in the body 14 and assembled therewith are parts forming air and gas passages. These parts are mounted on a backing plate 22, which is fastened to flange 15 by bolts 23. The backing plate is provided with a cylindrical portion 24 that serves as an inlet for air. This portion has extending into it a hollow, angular member 25 that serves as an inlet for gas, and is supplied with a fuel gas through a pipe 26 connected therewith.

A support in the form of a pipe 27 is threaded into the end of member 25 and extends forwardly toward the burner block. Mounted on this support is a rear ceramic disc 28 and a front ceramic disc 29 that has its face cut out, as indicated at 31, to substantially the same contour as the inner surface of re-entrant portion 16. A cylinder 32, also of ceramic material, is supported on shoulders 33 and 34 of discs 28 and 29 respectively. The discs and the cylinder, preferably cemented together, are held in assembled relation, and at a proper position, along support 27 by means of a nut 35 and a sleeve 36, which has an enlarged shoulder engaging the end of disc 29. The end of the sleeve 36 serves to locate a burner screen 37, which consists of a refractory disc having a plurality of axial holes or ports, shown herein as eight. The screen is held in place on sleeve 36 by means of a cap 38, as best shown in the drawing. Each of the holes or ports in the burner screen receives a tube 39 extending in an axial direction, and which, when the parts are propertly assembled, terminates substantially midway along the throat section 21 of the opening of port block 18.

After the parts above described have been assembled on the back plate 22, they are moved to the right in FIG. 1 of the drawing and fastened in position by the bolts 23. When in their assembled relation, an annular air passage 41 is formed between the inner surface of jacket 14 and the outer surface of cylinder 32, which passage connects with the opening 19 of block 18. A gas passage 42 is formed through the center of support 27, the burner screen 37 and tubes 39. Air is supplied to cylindrical portion 24 of the back plate through a bellows 43 forming a flexible connection, which has one end fastened to the end of portion 24, and which has its other end fastened to a fixed support 44. Suitable gaskets are provided between the ends of the bellows and the parts to which they are attached. The entire assembly is forced resiliently into position in the burner block by means of a spring 45 that surrounds the bellows, and which has its ends bearing against suitable flanges provided on cylindrical part 24 and the support 44. It is noted that the space 46, between the exterior of jacket 14 and the opening through tile 4 and the burner block between the ribs 12, serves as an exhaust passage for products of combustion from the furnace chamber.

In assembling the burner, the burner block, which may be square as shown, or round, is built into the refractory

of the furnace wall, as is tile 4. The nuts on the ends of hooks 8 are tightened up to pull the shoulder 6 of the tile tightly against gasket 9 and the backing plate of the furnace, in order to make a gas tight joint. This is done, since any leakage of furnace gases, which may occur through cracks in the furnace wall, will ordinarily be discharged through the openings in back plate 2 that are made for the burners.

In assembling the burner, port block 18 is first cemented to the front end of jacket 14, and the parts mounted on plate 22 assembled. Support 27 is of the proper length, so that the annular air passage 41 is continued around past ribs 17 and between re-entrant portion 16 of the jacket and the front end of disc 29. These parts, along with the plate 22, are then moved into position in the openings of the burner block, with the outer conical surface of port block 18 held snugly against the inner surface of ribs 12. The various parts that are mounted on backing plate 22 are assembled with proper alignment being obtained on the front end by engagement of disc 29, with the ribs 17, while the rear end is held concentric with the burner jacket by means of support 27. The bellows is then bolted to portion 24 and fixed member 44, so that the burner assembly is resiliently pressed into position in the burner block. This construction permits relative movements of the various parts, if such is necessary due to their expansion and contraction as a result of operation of the burner. It is noted that the engagement between the port block 18 and the ribs 12 accurately aligns the front end of the assembly with the burner block, while the ribs 13 hold the entire assembly concentric therein.

In the operation of the burner, gas is supplied through pipe 26, while air is supplied through the fixture 44, with the desired ratio of gas and air being obtained by a conventional ratio controller. Ordinarily the gas pressure will be in the neighborhood of 2″ W.C., while the air pressure will be in the neighborhood of 1½″ W.C. Under these low pressures, the gas and air will flow through their respective passages, and will meet in a substantially non-turbulent condition at the throat 21 at the opening in port block 18. The gas and air will gradually mix, so that burning will take place with a relatively lazy flame at a short distance in front of the face of the burner block. The length of the flame, and the point at which ignition starts, can be varied by varying the pressure of the gas and air supplies.

Ordinarily a furnace is operated with its heating chamber at a super-atmospheric pressure, and it is intended that the burners of this application should be used in furnaces so operated. Since this is the case, furnace gases will escape through the passages provided by ribs 12, and will flow backwardly away from the burner through passage 46, to be discharged adjacent to flange 15. As the hot furnace gases flow through passage 46, they will transfer heat through metal jacket 14 to the air which is flowing through passage 41, thus preheating the air in the burner as it is flowing toward the furnace. The products of combustion are reduced sufficiently in temperature by the time they are exhausted, so that they will be cool enough to avoid damage to that portion of the burner outside of the furnace. The use of hot products of combustion to preheat the air as it is flowing through the burner itself, instead of using various conventional recuperators, reduces appreciably the amount of equipment that is necessary for a high temperature preheated air burner.

From the above, it will be seen that I have provided a preheated air burner which can be assembled so that the parts will be accurately located with respect to each other, and so that the burner can be removed for inspection and repair with a minimum of work.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit and scope of the invention set forth in the appended claims, and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

What is claimed is:

1. In a burner, a hollow cylindrical body, a cylindrical structure in and extending almost all the way through said body and spaced therefrom to form an annular passage, a hollow cylindrical member attached to one end of said body and having an axially extending central passageway therethrough, said structure, body and member being so shaped that one end of said annular passage communicates with the center of said member; means to supply air to said annular passage to flow through the center of said member, means forming a passage for fuel gas extending through said structure coaxial with said member, said means forming said fuel gas passage being spaced from said annular passage, said last mentioned means including means to direct fuel gas axially as a jet into the center of said member, and means to direct hot gases around the exterior of said body.

2. The combination of claim 1 in which said means to direct hot gas includes a refractory block having an opening therein larger in diameter than said body, and means to hold said body and member concentrically in said opening.

3. The combination of claim 2 in which the end of the opening in said block which receives said member is contracted, and in which said member has a complementary surface engaging therewith, whereby said body and member will be definitely located in said block, and means resiliently to force the complementary surface of said member against the contracted end of the opening in said block.

4. In a burner, the combination of a ceramic burner block adapted to be built into a furnace wall, said block having an opening extending perpendicularly therethrough with that end of the opening which is adapted to be toward the interior of the furnace wall being contracted with a conical surface, said block being provided with a plurality of ribs projecting radially into said opening and extending in the direction thereof, a burner body of heat conducting material and of a size to be received in said opening with a space between them and having a portion to engage said ribs to be centered thereby and of a length to project beyond the outer end of said opening, said body having attached thereto a ceramic portion complementary to the conical portion of said opening to be positioned axially by the ribs projecting therefrom, means to hold said body in position in said opening, said complementary portion being provided with a central axial opening, means including the inner surface of said body forming an annular air passage in said body adjacent to the surface thereof larger in diameter than said axial opening and including means and a portion of said body forming a radial passage to connect said annular passage with said central axial opening, and means forming an axially extending gas passage in said body separated and spaced from said annular passage and terminating in an axial direction in said central axial opening, the space between said body and the wall of the opening of said block forming a passage for hot furnace gases.

5. In a burner, a ceramic burner block having oppositely disposed first and second faces,

said block being provided with an opening extending perpendicularly between said faces, the surface of said opening being provided with inwardly projecting ribs that extend in the direction of said opening,

a hollow metal burner body received in such opening, said body having a closed end and an open end, means in said body forming with said body an annular air passage extending from said closed end to said open end,

an annular ceramic member attached to the open end of said body and also received in said opening, said means in cooperation with said body forming said annular passage directing air through the center of said member as an axial stream,

the spaces between said ribs forming passages along said burner body and annular member through which furnace gases can flow from said first to said second face in heat exchange relation to said annular passage,

means to supply air to said annular passages through said closed end, and

means forming a passage for fuel gas in said body spaced from and centrally of said annular passage and terminating in a port directed through the center of said annular ceramic member, the gas mixing with the air as it is discharged through said member.

6. In a burner, a burner block having a first and a second opposing faces, said block being provided with a substantially cylindrical opening extending between said faces, the surface of said opening being provided with a plurality of inwardly projecting ribs extending in an axial direction, a substantially cylindrical burner body received in said opening and centered therein by said ribs with said ribs forming passages from said first face to said second face around said body, said body being provided at one end with a wall having a central aperture, means substantially filling said body and forming therein a relatively narrow annular passage between said means and said body and terminating in said central aperture, an annular ceramic member in the opening of said block and attached to said wall with the central opening of said member coaxial with said aperture, a second wall closing the other end of said body, means to supply air through said second wall to said annular passage, means forming

a passage for fuel gas extending axially through said body, said last mentioned means terminating in a port in the central opening of said member, and means to hold said burner body in position in said burner block.

7. The combination of claim 5 in which the wall of one end of the opening in said burner block converges, with the ceramic member being inserted from the opposite end of said opening, said ceramic member having a portion complementary to the converging end of said opening, and means to hold said ceramic member in said opening with a yielding force.

8. The combination of claim 5 in which said means forming a passage for said fuel includes means to break said fuel gas into a plurality of jets displaced through said stream of air.

9. The combination of claim 8 in which the central opening of said annular ceramic member has a shape that is substantially a venturi and in which said means to break the fuel gas into a plurality of jets discharges said jets into the throat of the venturi.

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