ABSTRACT

This invention describes an improved gas burner assembly, in which the entire burner assembly is enclosed in a housing which is supported from a flat plate, which is mounted to the steel outer wall of the furnace. The plate is spaced from the furnace to provide entry of air to the burner. The air flows radially along the outer wall of the furnace, cooling the wall, and then into the primary and secondary air inlets of the burner. The housing serves to contain and dampen the high noise level of the burner created by the high speed flow of gas through the nozzle. The noise can still further be reduced by lining the inside of the housing with acoustic insulation. This improved construction can be applied to any type of gas burner.

7 Claims, 6 Drawing Figures
NOISELESS RADIANT WALL BURNER

CROSS REFERENCE TO RELATED PATENT

The subject matter of our U.S. Pat. No. 2,667,216 titled Radiant Gas Burner Assembly is of interest to this application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is related to the field of large-volume gas burner assemblies for furnaces, such as described in our U.S. Pat. No. 2,667,216. It is particularly related to gas burner assemblies and furnaces in which the gas flow creates a high noise level, and in which the temperature of the outer wall of the furnace is undesirably high.

2. Description of the Prior Art

In the prior art the gas burner assembly generally is inserted in a furnace wall through an oversize opening in the wall. The gas and primary air inlets and mixing zone are outside of the furnace wall, where the noise due to the high velocity gas jet is radiated to the space or room exteriorly of the furnace. The construction of the furnace generally comprises a wall of refractory material such as ceramic blocks with the furnace enclosure on the inside, and a covering of steel plates on the outside wall. Even though the refractory is thick, heat transmission therethrough from the volume of radiant gas at the tip of the burner, to the steel plates on the outside wall makes the exterior undesirably hot.

SUMMARY OF THE INVENTION

This invention is directed to correcting both of these difficulties of the prior art, namely, to (a) reduce the high noise level resulting from the operation of the burner, and (b) to cool the outer wall of the furnace.

These objects are accomplished in the teaching of this invention by enclosing the entire burner assembly in a housing, to provide acoustic isolation and by designing the mounting of the housing along the outer wall of the furnace so as to cause the combustion supporting air which flows into the burner to flow in contact with the wall, and thus to cool it. The flow paths are designed to provide good heat transferring contact between the inlet air and the furnace wall.

The details of construction and further objects and advantages of this invention will be readily evident from the following detailed description of the several embodiments taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows the prior art construction of large gas burner assemblies.

FIG. 2 is a sectional view of one embodiment of this invention.

FIG. 3 is an elevational view taken along the line 3—3 of FIG. 2.

FIGS. 4, 5 and 6 show alternate embodiments of this invention.

DESCRIPTION OF THE PRIOR ART DEVICE

Before going into the details of the improvements of this invention, FIG. 1 shows the general construction of a prior art gas burner assembly. The burner 10 is inserted into the furnace area 12 through an opening 28 in the wall of the furnace. Centering spacers 30 help support the burner nozzle. The furnace wall 14 is generally constructed of a steel outer wall 22, which is called the outer surface of the furnace wall, with a thick lining of refractory or ceramic blocks or bricks 16, which form the furnace wall. The furnace side of the wall is called the inner surface of the furnace wall. The block 18 through which the burner is inserted is preferably of ceramic material. The plate 24 supporting the burner 10, as by welding at 25, is fastened to the outer steel wall 22 by bolts 26. Temperature expansion material 20 seals the joint between the block 16 and block 18.

The gas enters the burner through pipe 32, passes through a gas port 34 and into the throat 38 of the burner pipe. The gas issues from the port 34 at near critical velocity and creates a high-intensity, high-pitched noise, the level of which may reach a high objectionable decibel level.

The high velocity gas stream creates a low pressure in the throat of the pipe, which draws air through the opening 36 between the mouth 39 and the primary air door 35 as shown by the arrow 37. The opening 36 is adjusted by moving the door 35 so that an optimum volume of combustion supporting air is provided, which, when mixed thoroughly in the pipe 41 issue from the gas tip 40 to be burned. An adjustable air door 43 serves to permit a volume of secondary air to enter the opening 28 and to pass therethrough around the burner tip and into the furnace.

At the exit 40 of the gas pipe, there is a cloud of hot burning gas which radiates in all directions. Since it is so close to the wall 19 of block 18, a disproportionately large portion of the radiant energy is incident on surface 19. Heat is conducted through the block to plate 24 which becomes undesirably hot. This is particularly true in the case of radiant wall furnaces, where the hot combustion gases are driven against the face of the burner tile which may include ribs or ridges 29 on the inner surface of the block 18 (FIG. 2). Temperatures as high as 2,400°F. may be reached at the face or ridges, which require the cooling action of this invention.

This type of radiant burner is fully described in our U.S. Pat. No. 2,667,216. However, this invention is not limited to use with this type of burner but is useful in all types of furnaces and with all types of burners.

This was generally the situation prior to this invention, which we will now describe.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 2 and 3, the burner assembly 10 is inserted through opening 28 in burner block 18 into the furnace, as in FIG. 1. The burner is enclosed by a housing which comprises mounting plate 50, cylindrical wall 52 and cover plate 54. The aft end of the burner is clamped to this cover plate 54 by bolts 57. The mounting plate is attached to the outer steel wall 22 by means of spacers 53 and bolts 51, which support the housing and burner assembly. The outer tip 42 of the burner is supported by lugs 30 to center the burner in the burner block opening 28.

The primary air gate 35 and gas port 34 being inside the housing 52 confine thereto the noise of the rapidly
moving gas and air stream. To further absorb the noise, the inside of the housing is lined with acoustical insulation 66, held in place by perforated sheet 64. Many materials, such as glass wool, are available in the industry for this purpose, as is well known in the art.

The mouth 39, throat 38, and expansion area 47 and extension pipe 41 are designed for optimum flow of the fuel-air mixture in accordance with well known principles, which form no part of this invention.

The block 18 is cut back at its outer surface 18', providing a recessed space 48 in the outer wall. The cylindrical wall 52 projects 58 into this depressed area. This provides a tortuous path for the entering air, which generally follows the arrows 59, 60, 61, and 62 into the primary air opening 36. In passing over the surface 18', the block is cooled and the air is preheated. Secondary air 41 can pass between plate 68 and the recessed surface 18' into and through opening 28 into the furnace. The amount of this air 41 is adjusted by moving the annular plate or ring 68 (which closely fits the pipe 41) as, for example, by means of rods 69 and 70 which pass through the cover plate 54. Similarly the rod 67, which operates the primary air door 35, passes through the plate 54. The gas tip 42 is shown in a different form from that of FIG. 1 and relates to the radiant style of burner as described in our U.S. Pat. No. 2,667,216. The pipe 41 is closed by a conical surface 44, which deflects the gas-air mixture radially outwardly through a plurality of spaced openings 46 into the radial ridges 29. Of course, this invention is used with any design of gas burner to provide beneficial effects of cooling the front wall and absorbing noise.

One of the features of this embodiment is that it provides a tortuous path for the air, to place it in close, heat-transferring contact with the furnace wall.

In FIG. 4 is shown another embodiment particularly adaptable to designs where the burner block 18 is substantially flush with the outer wall. This provides a direct path for the air, shown by arrows 73 across the outer face 18'a of block 18 into the burner air inlets.

In FIGS. 5 and 6 another embodiment is shown with a still more tortuous path for the combustion supporting air. Here the outer wall 18b of the block 18 includes a plurality of narrow radial slots 74, as shown more clearly in FIG. 6, which is an elevation view of the outer wall 18b of the block 18, taken along section 6—6 of FIG. 5. Here the air will have a vastly increased cooling capability or heat transfer due to the flow along and against the walls of the grooves or slots 74.

While we have shown in FIG. 2, as the preferred form of our invention, a housing which not only encloses the burner assembly, but also acts as a mechanical support for the burner, it will be clear that the housing of FIG. 2 could be used with the burner of FIG. 1 which would be supported independently of the housing, and still retain the benefits of preheating the combustion supporting air and quieting the burner.

While we have shown a number of embodiments of this invention, it will be clear that one skilled in the art will be able to design other embodiments by following the principles of this invention, all of which are believed to be part of this invention, the scope of which is to be determined from the scope of the appended claims.

What is claimed:

1. In a gas burner assembly for furnaces in which a stream of high velocity fuel gas issues from an orifice to aspirate combustion supporting air into, and mix with said air, in a mixing section of a burner pipe, said burner pipe inserted through an oversize opening through a portion of the wall of said furnace, said mixed gas issuing from the tip of said burner pipe to form a flame inside said furnace, the heat from which travels through said furnace wall to the outer surface thereof, the improvement comprising, means to cool said outer surface, preheat said combustion-supporting air and to reduce the noise issuing from said burner assembly, comprising:
   a. housing means substantially covering that portion of said burner assembly extending outward from said outer wall of said furnace, said housing including a mounting plate,
   b. said mounting plate fastened to said outer wall of said furnace through spacer means which provide a selected width of opening between said outer wall and said mounting plate for the entry of combustion supporting air to said burner, and
c. means to direct the flow of said combustion supporting air into heat-transferring air-warming contact with said outer wall of said furnace.

2. The improvement of claim 1 including acoustical-energy-absorbing material inside said housing.

3. The improvement of claim 1 including means to mechanically support said burner assembly from said housing means.

4. The improvement of claim 1 including a recess in said outer surface of said furnace wall, and deflector means on said housing to direct the air flowing into said housing into heat-transferring contact with said recessed surface.

5. The improvement of claim 1 including radial grooves in said outer surface of said furnace wall, and means to direct the combustion supporting air flowing into said housing to flow into said grooves.

6. The improvement of claim 1 including radial ridges on the inner surface of said furnace wall in the vicinity of said burner, said ridges adapted to be heated to incandescence by the burning fuel-air mixture.

7. In a gas burner assembly for furnaces in which a stream of high velocity fuel gas issues from an orifice to aspirate combustion supporting air into, and mix with said air, in a mixing section of a burner pipe, said burner pipe inserted through a large opening through a ceramic block forming a portion of the wall of said furnace, said mixed gas issuing from the tip of said burner pipe through radial openings to form a flame inside said furnace, said ceramic block containing radial ribs extending outward from the inner surface of said ceramic block, said ribs adapted to be impinged upon, and to be heated, thereby, by said flame, part of the heat of said flame traveling through said ceramic block to the outer surface of said block, the improvement comprising; means to cool the outer surface of said block, preheat the combustion-supporting air, and to reduce the noise issuing from said burner assembly, comprising:
   a. housing means substantially covering that portion of said burner assembly extending outward from the outer surface of said furnace wall, said housing including a mounting plate,
b. said mounting plate fastened to said outer surface of said furnace wall through spacer means which provide a selected width of opening between said outer surface and said mounting plate for entry of combustion-supporting air to said burner, and

c. means to direct the flow of said combustion-supporting air into heat-transferring and air-warming contact with the outer surface of said ceramic block.