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Feb. 22, 1944. F. G. TREAT 2,342,228

GAS BURNER

Filed Jan. 30, 1942 2 Sheets-Sheet 1

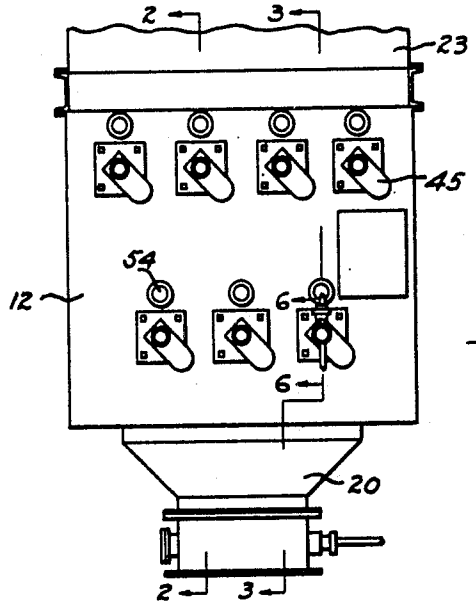


Fig. 1

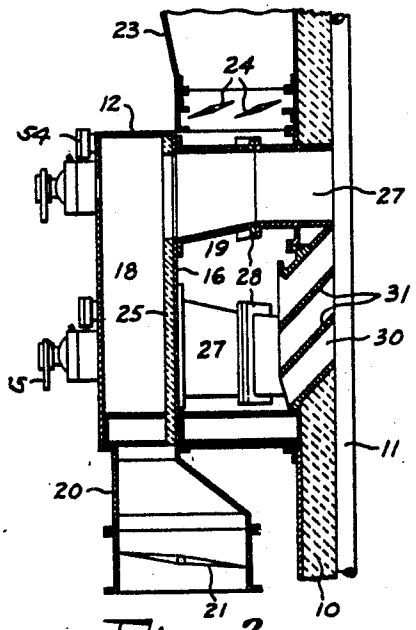


Fig. 2

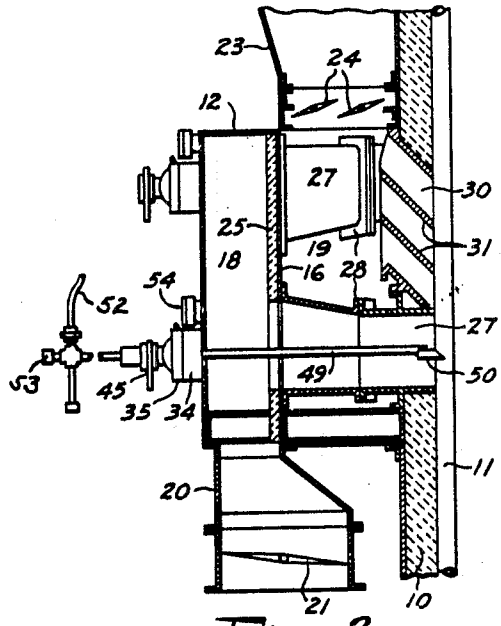


Fig. 3

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Search Room

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GAS BURNER

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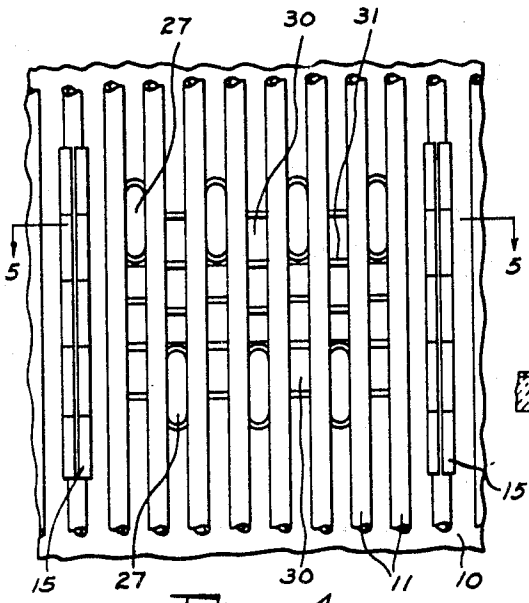


Fig. 4

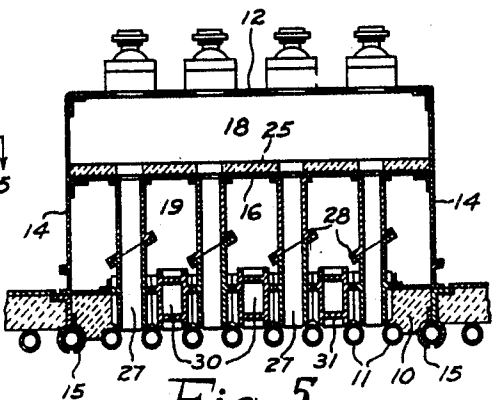


Fig. 5

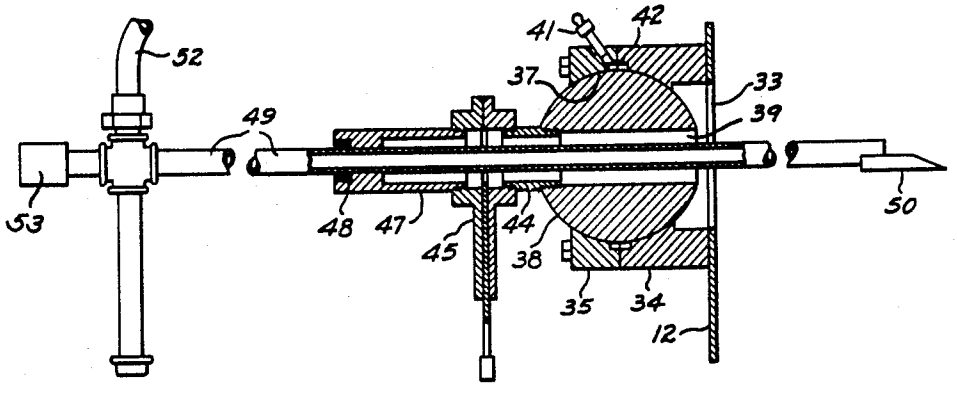


Fig. 6

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158. LIQUID & GASEOUS FUEL
7

Patented Feb. 22, 1944

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UNITED STATES PATENT OFFICE

2,342,228

GAS BURNER

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Application January 30, 1942, Serial No. 428,903

4 Claims. (Cl. 158—7)

This invention relates to gas burners, and more particularly to burners for use with blast furnace gas and having provision for introducing fuel and air into a furnace between spaced upright water tubes which serve to support and cool the furnace walls.

Blast furnace gas has a comparatively small heating value per unit volume, and it is therefore necessary to provide a large flow area for the discharge of the gas into the furnace in order to avoid excessive gas velocities. Because of the obstruction afforded by the water tubes, it is a difficult matter to provide the flow area required for large burner capacities. Before the blast furnace gas reaches the burners it has usually passed through a washer which removes some of the impurities. However, a considerable quantity of solid matter is nevertheless carried in suspension by the gas, and this material is wet from the action of the washer. When this wet material comes into contact with hot surfaces it adheres thereto and becomes baked thereon, so that its removal is difficult. This is particularly the case when the matter is deposited on surfaces of refractory material, there being a considerable danger of breaking the refractory when attempting to clean the deposits therefrom.

It is accordingly one object of the invention to provide a burner particularly adapted for use with a furnace having spaced upright water wall tubes and capable of handling large quantities of blast furnace gas, together with the air required to support combustion.

It is a further object of the invention to provide a blast furnace gas burner which is free from hot refractory surfaces on which impurities may become deposited.

It is a further object of the invention to provide a blast furnace gas burner having metal fuel discharge nozzles and a simple and effective means for cleaning deposited matter from these nozzles.

It is a further object of the invention to provide a blast furnace gas burner which will bring about a high degree of turbulence, with rapid and efficient combustion, and a comparatively short flame.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

Referring to the drawings illustrating one embodiment of the invention, and in which like reference numerals indicate like parts,

Fig. 1 is a front elevation of a gas burner;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a section on the line 3—3 of Fig. 1;

Fig. 4 is a rear elevation of the burner;

Fig. 5 is a section on the line 5—5 of Fig. 4; and

Fig. 6 is an enlarged section on the line 6—6 of Fig. 1.

The embodiment illustrated comprises a furnace wall 10 of refractory material and a series of spaced upright water wall tubes 11 adjacent the inner or rear surface of the wall to support and cool the same in a well-known manner. At the outer or front side of the wall there is provided a box-like structure or casing 12 having two spaced upright side walls 14 (Fig. 5) which are secured to two of the water tubes 11 by means of clamping members 15. An upright metal plate or partition 16 divides the interior of the casing 12 into a front chamber 18 for fuel and a rear chamber 19 for combustion air. Blast furnace gas is delivered upwardly into the bottom of the chamber 18 by means of a duct 20 having a damper 21, and air (preferably preheated) is delivered downwardly into the top of the chamber 19 by means of a duct 23 having dampers 24. Heat insulating material 25 is provided on the front surface of the plate 16 to prevent the deposit of solid matter thereon from the gas, this plate of course being heated by the air in the chamber 19.

The gas is delivered from the chamber 18 into the furnace through a series of substantially horizontal nozzles 27 which extend through the air chamber 19 and discharge the gas rearwardly through the spaces between the water tubes 11. These nozzles are arranged in an upper horizontal row and a lower horizontal row, with the nozzles in one row staggered with respect to the nozzles in the other row, as shown particularly in Fig. 4. Each nozzle provides a gas flow passage which is considerably elongated vertically to ensure a comparatively large cross-sectional area. Preferably each nozzle is made with a front and a rear section which are connected by a flanged joint 28 extending obliquely with respect to the partition 16, as best shown in Fig. 5. This facilitates assembly and replacement of the parts, as will be explained hereafter.

The air for combustion of the fuel is delivered from the chamber 19 into the furnace through a series of nozzles 30 arranged to discharge the air rearwardly through the spaces between the water tubes 11 and preferably into contact with the fuel jets. The air nozzles are arranged in

an upper horizontal row and a lower horizontal row, and they alternate with the fuel nozzles in the corresponding rows. In order to promote turbulence and mixing, the air nozzles are directed at an angle with respect to the horizontal, as shown particularly in Figs. 2 and 3. Thus for each fuel nozzle 27 in the upper row there is an air nozzle 30 therebeneath to direct an air jet at an upward inclination into contact with the fuel jet, and for each fuel nozzle 27 in the lower row there is an air nozzle 30 thereabove to direct an air jet at a downward inclination into contact with the fuel jet. Each nozzle 30 provides an air flow passage which is considerably elongated vertically to afford a comparatively large cross-sectional area. In order to ensure the desired directional flow for the air, inclined vanes 31 are provided within the air nozzles. It will be noted from Figs. 2 and 3 that each air nozzle engages the corresponding fuel nozzle to form a supporting structure for the refractory material of the wall 10 above the burner.

When the burner is in operation, the fuel nozzles 27 will be heated by radiation from the furnace, and the inner surfaces of these nozzles will gradually become coated with firmly adhering deposits of solid material carried in suspension by the fuel gas. The embodiment illustrated includes means to facilitate the removal of these deposits without interrupting the burner operation. For this purpose the front wall of the casing 12 is provided with an opening 33 (Fig. 6) in front of each fuel nozzle 27. Each of these openings is surrounded by an annular member 34 secured to the outside of the casing and carrying a ring 35, these parts being shaped to provide a socket 37 for a spherical member 38 having a bore 39 extending diametrically therethrough. The ring 35 is provided with a nipple 41 through which grease may be introduced into an annular groove 42 in the socket 37 to form a seal about the spherical member 38. The front or outer end of the bore 39 is screw-threaded to receive a pipe nipple 44 on which a gate valve 45 is mounted. This gate valve is screw-threaded to receive a sleeve 47 provided at its outer end with an annular packing box 48 through which a pipe or nozzle 49 extends. A scraping tool or chisel 50 of hard metal is mounted on the rear end of the pipe 49, and a flexible hose 52 is connected to the front portion of this pipe to supply steam or other suitable fluid thereto. A block 53 is mounted on the front end of the pipe 49 so that it may be struck with a mallet or sledge to aid in dislodging deposits from the nozzles 27. Above each member 34 there is provided a small glazed observation window 54 through which the operator may see the interior of the corresponding fuel nozzle.

It will now be apparent that the above described construction provides a universal mounting for the pipe 49, so that this pipe may be swung in any direction required and also shoved back and forth axially through the sleeve 47, causing the tool 50 to scrape deposited material from the interior of the fuel nozzle. At the same time steam will be discharged through the pipe 49 to blow the loosened material into the furnace. When the fuel nozzle has been cleaned, the steam will be shut off and the pipe 49 pulled forwardly to bring the tool 50 into the sleeve 47, whereupon the valve 45 will be closed. The sleeve 47 can then be unscrewed from the gate valve and no leakage of gas will occur. Only one sleeve and cleaning tool is required for the entire burner, since these parts can be mounted on each of the gate valves 45 one after another.

In the operation of the burner staggered jets of gas will be discharged from the fuel nozzles 27, and a jet of hot combustion air will be directed against each fuel jet from the adjacent air nozzle 30. This provides a high degree of turbulence, resulting in very rapid and efficient combustion, with a comparatively short flame. The fluid velocities can be relatively low, because ample flow area is provided by the nozzles, and this is accomplished without the need for bending the water wall tubes. There are no refractory surfaces on which solid material may deposit from the fuel stream, and such deposits as do form on the interior of the fuel nozzles can be easily removed. The insulation 25 will prevent deposits on the plate 16. To replace the air or fuel nozzles, a workman may enter the air chamber 19 through the air duct 23, after first removing the dampers 24. It will be clear from Fig. 5 that the inclined flanged connections 28 greatly facilitate the removal and replacement of the fuel nozzles 27, since the front section of each nozzle can be moved laterally without any sliding action over the flanges. With this construction a plastic sealing compound can be applied to the flange surfaces and will not be rubbed off at assembly. When a fuel nozzle is removed, the workman can close the corresponding opening from the gas chamber 18 by means of a piece of sheet metal, thereby positively excluding from the air chamber any gas which might leak past the damper 21. It will be noted that the only parts of the burner which are exposed to radiant heat are the fuel and air nozzles. These parts can be cast from a suitable heat-resisting alloy and they will have a comparatively long life, particularly in view of the partial shielding effect of the water tubes 11. By utilizing the burner nozzles to support the refractory wall above the burner, a simplified construction is obtained.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A gas burner comprising a casing, an upright partition within the casing and dividing the interior thereof into a front chamber and a rear chamber, means to supply gas to the front chamber, means to supply air to the rear chamber, an upper and a lower horizontal row of gas discharge nozzles extending from the front chamber rearwardly through the rear chamber, the nozzles in one row being staggered relative to the nozzles in the other row, and air nozzles alternating with the gas nozzles in each row and arranged to discharge air from the rear chamber rearwardly adjacent to the jets of gas.

2. A gas burner comprising a casing, an upright partition within the casing and dividing the interior thereof into a front chamber and a rear chamber, means to supply gas to the front chamber, means to supply air to the rear chamber, gas discharge nozzles extending from the front chamber rearwardly through the rear chamber, air nozzles arranged to discharge air from the rear chamber adjacent to the jets of gas, and heat insulating material on the front face of the partition to prevent contact of the gas therewith and sticking of solids thereto.

3. A gas burner comprising a casing, an upright partition within the casing and dividing the interior thereof into a front chamber and a rear chamber, the partition having a series of openings therein, means to supply gas to the front

chamber, means to supply air to the rear chamber, gas discharge nozzles secured to the partition to connect with the said openings and extending rearwardly through the rear chamber, and air nozzles arranged to discharge air from the rear chamber rearwardly adjacent to the jets issuing from the gas nozzles.

4. A gas burner comprising a casing, an upright partition within the casing and dividing the interior thereof into a front chamber and a rear chamber, the partition having a series of openings therein, means to supply gas to the front chamber, means to supply air to the rear chamber, gas discharge nozzles extending rearwardly from the said openings and through the rear chamber, each nozzle being made with a front section and a rear section connected by a flanged joint extending obliquely with respect to the said partition, the front section on each nozzle having a flanged connection with the said partition, and air nozzles arranged to discharge air from the rear chamber rearwardly adjacent to the jets issuing from the gas nozzles.

FRANKLIN G. TREAT.