July 20, 1965 H. SCHNEIDER ETAL 3,195,872

BURNER CONSTRUCTIONS FOR HOT BLAST STOVES

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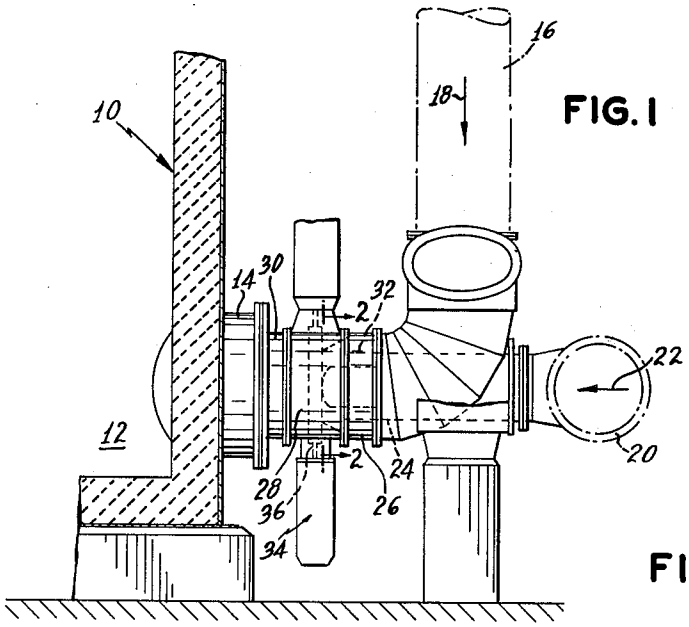


FIG. 1

FIG. 3

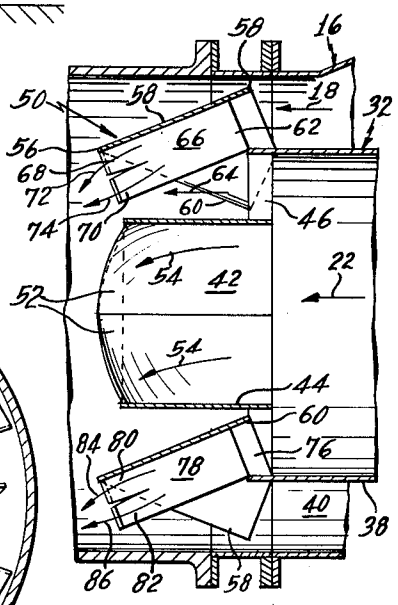
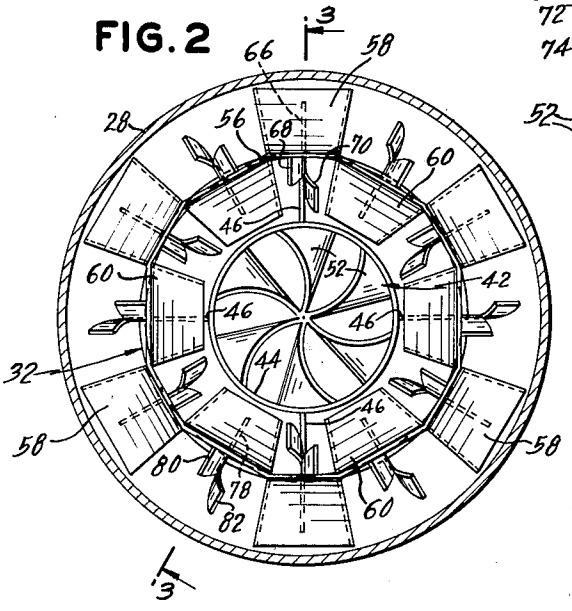


FIG. 2



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FIG. 4

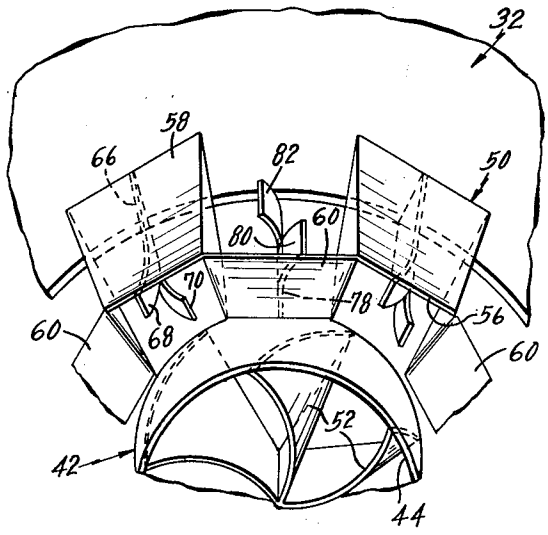


FIG. 6

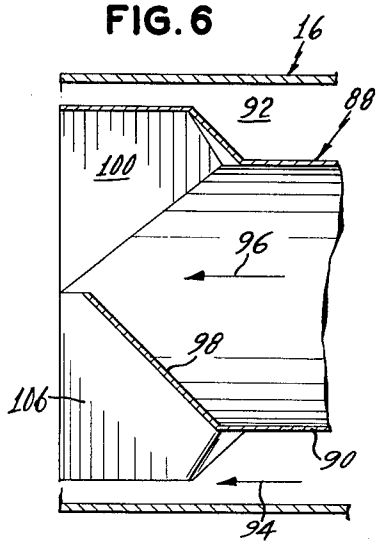
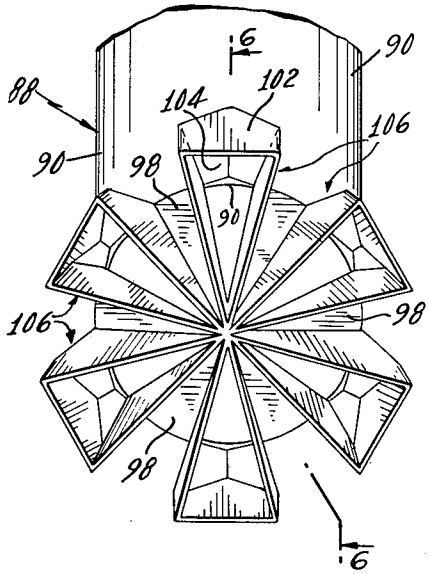


FIG. 5



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United States Patent Office 3,195,872 Patented July 20, 1965

3,195,872

BURNER CONSTRUCTIONS FOR HOT BLAST STOVES

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Filed Feb. 4, 1963, Ser. No. 255,793
12 Claims. (Cl. 263—19)

The present invention relates generally to hot blast stoves for blast furnaces or the like, and particularly to burners for hot blast stoves.

In prior art hot blast stoves, the combustion gas and the combustion air are supplied through separate conduits to a burner head at the combustion chamber of the blast stove, where they are mixed. In order to effect a good mixture of the gas and air, the conduits are usually provided with special terminal conformations. When the hot blast stove is in the "ON BLAST" condition, extremely high temperatures are generated in the combustion chamber, and the burner head and output terminals of the gas and air conduits are subjected thereto. As a result, the burner head and the associated output terminals must be protected against the high temperatures. This requires that they be fabricated from special heat-resistant metals such as relatively expensive steel alloys. Moreover, since separate conduits are used for the air and the gas, there resulted the necessity for the use of a relatively complicated and expensive burner shut-off valve which could operate in both conduits for controlling the passage of the air and gas to the hot blast stove. In order to effect such control, the valve had to be placed forwardly of the burner head in the direction of flow of the air and the gas so that the burner head was interposed between the blast stove and the shut-off valve therefor, and subjected directly to the high blast temperatures.

In view of the foregoing, it is an object of the present invention to obviate the foregoing disadvantages of the prior art.

It is another object of the present invention to provide a construction wherein the burner head is protected from the high temperatures generated during the "ON BLAST" condition of the hot blast stove.

It is another object of the present invention to provide a construction wherein the burner shut-off valve can be interposed between the hot blast stove and the burner head.

It is still another object of the present invention to provide a construction which eliminates the necessity for the utilization of a relatively complex burner shut-off valve and which permits for the use of a burner shut-off valve of generally simplified construction.

It is a further object of the present invention to provide a burner head which can be fabricated from relatively inexpensive sheet metal.

It is a still further object of the present invention to provide a highly novel and efficient burner head which effects a superior mixture of the combustion gas with the combustion air.

Other and further objects and advantages of the present invention will be readily apparent to those skilled in the art from a consideration of the following specification taken in connection with the appended drawings.

In the drawings which illustrate the best modes presently contemplated for carrying out the invention:

FIG. 1 is a more or less schematic or diagrammatic representation of a hot blast stove provided with a burner head pursuant to the present invention;

FIG. 2 is a sectional view, on an enlarged scale, taken on line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 2;

FIG. 4 is a fragmentary detail, on an enlarged scale, of the burner head;

FIG. 5 is a perspective view of another embodiment of a burner, pursuant to the present invention, viewing the outlet end thereof, the gas conduit being omitted; and

FIG. 6 is a sectional view taken on the line 6—6 of FIG. 5, including the gas conduit.

Referring now to FIGS. 1–4 of the drawings, in detail, there is shown a hot blast stove 10 of the type illustrated and described in United States Patent No. 3,039,522, dated June 19, 1962, and assigned to the assignee hereof. Said stove is adapted to be heated so that it may subsequently have air passed therethrough in order to supply hot blast to a blast furnace as described in United States Patent No. 2,931,635, dated April 5, 1960, and assigned to the assignee hereof. The stove 10 is provided with a combustion chamber 12 into which a suitable combustion mixture of gas and air is introduced through a conduit 14. Gas for the combustion mixture is supplied through the gas main 16, as shown by arrow 18, and air for the combustion mixture is supplied through the air main 20, as shown by the arrow 22. The output end 24 of the air main is inserted into the gas main, as best illustrated in FIG. 1, the output end of the gas main being indicated by the reference numeral 26.

A burner 28 is interposed between the outlet end 26 of the gas main 16 and the conduit 14. The latter is connected to the combustion chamber, by means of an adaptor conduit section 30.

Pursuant to a feature of the present invention, a burner head 32 is provided at the outlet end 24 of the air conduit 20 and extends into the burner 28. As hereinafter explained in detail, the burner head 32 provides an intimate mixture of the combustion gas and the combustion air which is supplied to the combustion chamber. The burner 28 is provided with a burner shut-off valve 34. Valve 34 is provided with an operating member or fluid-flow shut-off means 36 which, in the operative condition of the valve, extends into the burner 28 and serves to close the latter to prevent the flow of the gas-air mixture therethrough from the burner head 32. It will be understood that in the inoperative condition of the valve, the valve closure member 36 offers no impediment to the flow of the combustion mixture through the burner. The closure member need not be a complex element since it is not used, as in the prior art, to close separate gas and air conduits. On the contrary, since the burner 28 is in the form of a single conduit section, the closure member 36 therefore is consequently of a simplified construction. The closure member 36 is formed of a heat resistant material and serves, in the closed or operative condition thereof, both as a shut-off element to cut off the supply of the combustion mixture to the stove 10 as well as a heat shield when the stove is "ON BLAST." As a shield, the closure element is interposed between the stove and the burner head 32 to protect the latter from the high temperatures generated in the stove when "ON BLAST." As a result, the burner head need not be formed of relatively expensive heat resistant alloy steel or similar special material.

Pursuant to the present invention, the burner head 32 is formed of a suitable sheet metal, preferably non-alloy steel, which is less expensive than the heat resistant material used in the prior art and which, consequently, permits for more flexibility in the design thereof. As here shown, the burner head 32 comprises a tubular body portion 38 which is mounted coaxially within the gas main 16 so as to define an outer passageway 40, between the outer surface of said tubular body portion and the inner surface of the gas main. Passageway 40 serves as the gas flow

channel through which the gas flows to the burner, as shown by arrow 18 in FIG. 3. The tubular body portion, per se, constitutes a passageway for air flow toward the burner, as indicated by arrow 22. In order to provide for an intimate mixture of the gas flow along the exterior of tube 38 and the air flow along the interior thereof so as to blend the gas and air into a proper combustion mixture, the tube is provided at its outlet end with mixing means generally indicated by the reference numeral 42.

Mixing means 42 comprises an inner tubular formation 44 coaxially disposed within the tube 38 by means of fins 46 and an outer formation 50 which encompasses the inner formation. The inner formation 44 functions as an air nozzle through which air flows and is provided with swirl baffles 52 which deflect the air flow through the nozzle into a rotary path, as indicated by arrows 54 in FIG. 3. The outer formation 50 is provided on the marginal edge 56 of the tubular element 38 to define a first series of circumferentially spaced guide channels 58 and a second series of circumferentially spaced guide channels 60 which are interposed between the channels 58. Channels 58 and 60 all extend in a direction oblique to the axis of tubular element 38 with channels 58 being directed radially inwardly of said tubular element and channel 60 being directed radially outwardly thereof. Each channel 58 is provided with an entrance or inlet 62 within the gas passageway 40 so as to direct the gas flow inwardly from said passageway into air flowing through the burner head between the outer surface of the inner tube 44 and the inner surface of the tube 38, as indicated by arrow 64. A baffle 66 disposed in each channel 58 is provided with deflectors 68 and 70 which break up the gas flow therethrough into separate streams, as indicated at 72 and 74, so as to facilitate the mixture thereof with the rotary air streams flowing through out of tube 44. Each channel 60 has an entrance 76 in the air flow path between the outer surface of inner tube 44 and the inner surface of the outer tube 38, so as to direct air outwardly from the passageway therebetween into the gas flow passageway between the outer surface of tube 32 and the inner surface of conduit 16. A baffle 78 disposed in each channel 60 is provided with deflectors 80 and 82 which break up the air flow therethrough into separate streams, as indicated at 84 and 86, so as to facilitate the mixture thereof with the gas flow stream about the tube 38. Consequently, it will be apparent that due to the various guide channels and baffles which break up the air and gas into a multiplicity of differently directed streams which then interact with each other a highly superior gas-air combustion mixture is achieved.

Referring now to FIGS. 5 and 6, there is shown a modified burner head 88 mounted within the gas conduit 16. Burner head 88 is also formed of a suitable sheet metal, preferably non-alloy steel, and comprises a tubular body portion 90 which is mounted coaxially within the gas main 16 so as to define an outer passageway 92 between the outer surface of tube 90 and the inner surface of the gas main. Passageway 92 serves as the gas flow channel through which the gas flows to the burner as shown by arrow 94. The interior of tube 90 serves as the air flow passageway, as indicated by arrow 96. At its outlet end, tube 90 is provided with the radially spaced inwardly directed integral baffles 98 which are interposed between circumferentially spaced guide channels 100 defined by integral conformation 102 provided on the tube 90. Said conformations define triangular outlets 104 for channels 100. It will be apparent that due to the baffles 98 and the conformations 102 the air flow through the tube 90 is broken up into a plurality of jet-like air streams which flow into the gas flow stream about the tube 90. The spaced conformations 102 define channels 106 therebetween which are defined also by the baffles 98 therebetween. Said channels 106 serve as guide channels for the gas flow and break the latter up into separate streams for interaction with the air flow streams emanating from the outlets 104 to provide for a superior mixture of the air and gas.

In view of the foregoing, it will be apparent that in both of the illustrated embodiments the gas flow and the air flow is each broken up into a plurality of separate streams which are then intermingled with each other to provide the combustion mixture.

While there has been illustrated and described the presently preferred embodiments of the invention, it will be understood that various changes and modifications can be made therein without departing from the basic inventive concept thereof, as set forth in the appended claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A burner head comprising a first tubular member provided with mixing conformations formed at one end thereof and defining a first fluid flow path, a second tubular member surrounding the first tubular member and defining with the first tubular member a second fluid flow path, said mixing conformations comprising a first series of elongated guide channels having inlet ends located within the first tubular member and outlet ends located in the second fluid flow path and directing fluid from the first fluid flow path into the second fluid flow path, and a second series of elongated guide channels having inlet ends located between the first and second tubular members and outlet ends located in the first fluid flow path and directing fluid from the second fluid flow path into the first fluid flow path.

2. A burner head as in claim 1, said guide channels of said first series interposed between the guide channels of said second series.

3. A burner head as in claim 1, and baffle means provided within each of said guide channels for directing the streams in the guide channels into separate predetermined flow directions.

4. A burner as in claim 1, said burner head having means to effect a rotary movement of the streams from said first flow path.

5. A burner head as defined in claim 1, said burner head having means coaxially disposed with respect to, and adjacent, the end of the first tubular member, said means having swirl fins to provide a rotary movement to a portion of said first flow path.

6. A burner head as defined in claim 1, said first series of channels being formed with means defining jet outlets.

7. A burner head as defined in claim 1, said second series of guide channels having baffles which extend towards the axis of said first tubular member.

8. A burner head as defined in claim 6, said second series of guide channels having baffles which extend towards the axis of said first tubular member.

9. In a hot blast stove adapted to be heated and to supply hot blast to a blast furnace, gas conduit means for supplying gas to said stove, air conduit means for supplying air to said stove, one of said conduit means having an outlet portion disposed coaxially within the other of said conduit means, gas-air mixing means provided on said coaxially disposed outlet portion and comprising a first series of elongated guide channels having inlet ends located within the air conduit and outlet ends located in the path of the gas from the gas conduit and directing fluid from the air conduit into the path of the gas from the gas conduit, and a second series of elongated guide channels having inlet ends located in the gas conduit and outlet ends located in the path of the air from the air conduit and directing fluid from the gas conduit into the path of the air from the air conduit.

10. A hot blast stove as set forth in claim 9, said one conduit means being an air conduit and the said other conduit means being a gas conduit.

11. A hot blast stove as set forth in claim 9, including valve means provided in said other conduit means between

said mixing means and said stove, said valve means being operable when the stove is on blast to shut off the gas-air mixture from said stove and to protect said mixing means from the heat of said stove.

12. A blast stove as in claim **9**, said guide channels having means for forming the gas and air in the said guide channels into a plurality of separate streams.

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