July 25, 1939. G. F. NAAB ET AL 2,167,183

GAS BURNER

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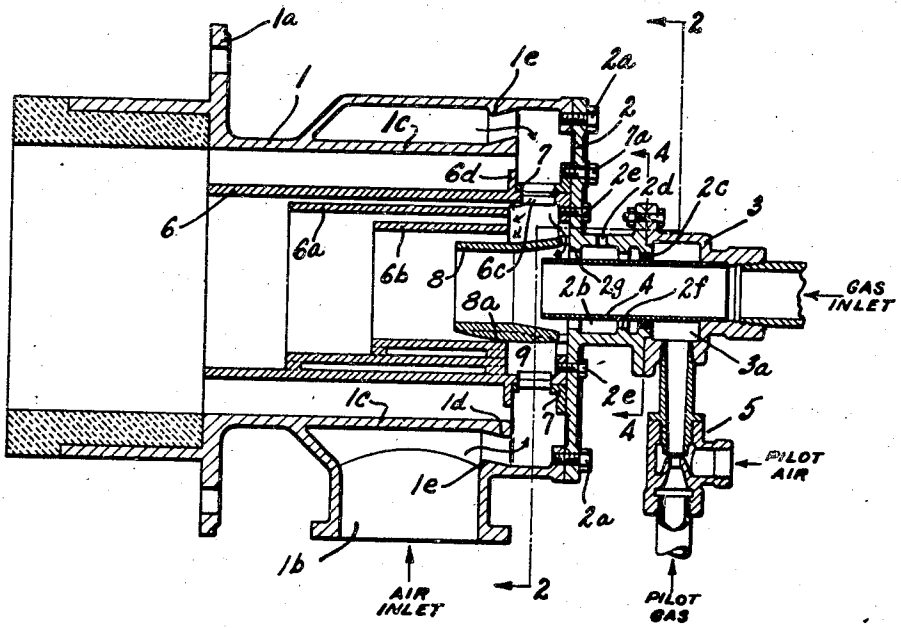
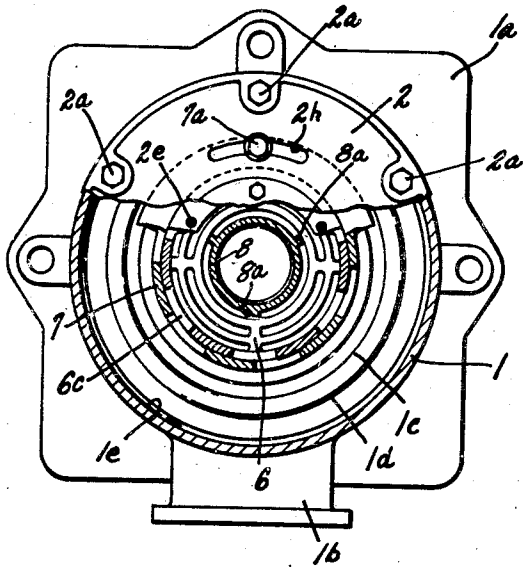


FIG. -1

FIG. -2



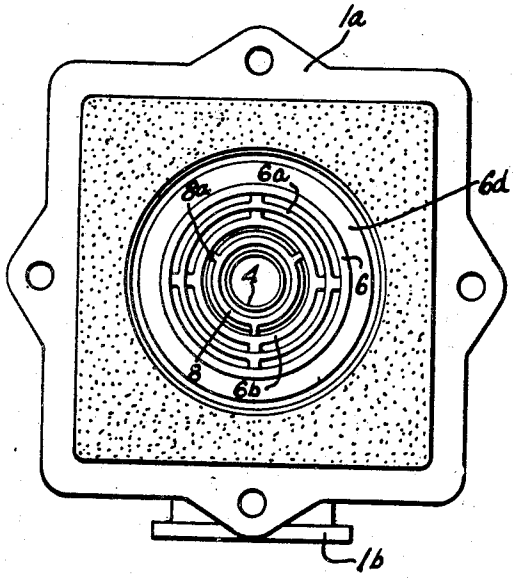


FIG. - 3

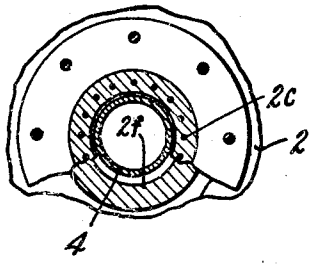


FIG. -4

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GAS BURNER

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Application November 14, 1936, Serial No. 110,890

11 Claims. (Cl. 158—110)

This invention relates to burners for progressive combustion of natural or artificial gas fuels whereby heat is liberated at relatively constant and relatively low temperature in a long luminous flame.

Such burners are known as luminous flame burners and include means providing for a delayed or gradual mingling with the fuel of the air which supports its combustion.

The object of this invention is to provide improvements in such means for controlling mingling of air and fuel. Further objects are to provide a burner structure of improved simplicity for the purpose, easily assembled, and as easily disassembled for replacement of parts eventually deteriorated by the intense heat generated in service. Another object is to provide an improved pilot or auxiliary for the burner, easily ignitable and allowing easy inspection of its flame, and arranged for continuous functioning during operation of the burner to maintain combustion in the latter.

More particularly, the invention provides, as will appear, an intimate mingling and gradual merging relation between pilot and main burner flames, the latter being produced by a gas stream as a core about which the air for its combustion is introduced only progressively in restricted amounts, and the pilot flame is arranged between this core and the first increment of air. Further, air streams are added to the gas stream with parallel motion so as to maintain velocity through the burner yet without accelerating combustion, and the air streams have progressively increasing velocity—all to the end, as further objects of the invention, that combustion will be retarded and the burner flame extended a maximum amount.

The exact nature of this invention together with further objects and advantages thereof will be apparent from the following description taken in connection with the accompanying drawing in which Fig. 1 is a view in typical longitudinal section showing an embodiment of the invention; Fig. 2 is a transverse section of the same as in the planes of line 2—2, Fig. 1; Fig. 3 is a mouth end view of the same; and Fig. 4 is an enlarged section as in the plane of line 4—4, Fig. 1.

With reference now to the drawing, 1 is a casing preferably of cast metal and generally hollow, having at its open mouth end, a flange 1*a* by which it may be mounted on a furnace wall, and a ceramic lining—all as is generally usual in the art. The casing has a lateral opening for air inlet connection 1*b* and opposite this opening an endless baffle 1*c*. The rear end of the casing is provided with a removable closure 2, mounted by bolts 2*a* or in any other convenient manner. It will be apparent that the described arrangement is such that the baffle 1*c* forms part of a central passage leading toward the mouth of the casing, and also causes air in coming from the inlet 1*b* to flow about the baffle and toward the closure and thence to the passage. The baffle is preferably provided at its rear extremity with a lip 1*d* to direct the air toward the periphery of the closure 2, and the casing may have a corresponding lip 1*e* for the same purpose. The parts may be of circular section as indicated in the drawing, so that the passage within the baffle and leading out through the mouth end of the casing is cylindrical.

The closure 2 has a central portion extending rearwardly to carry a part 3 having a rearward gas inlet connection, and a pipe 4 is set into this part for delivering such fuel through the closure and to the passage within the baffle 1*c*. The rearwardly extending part of the casing is hollowed to clear the pipe 4 and to provide an enlarged chamber 2*b* thereabout. The part 3 has a chamber 3*a* about the pipe, communicating with the chamber 2*b* through an annular series of openings 2*c* in the end of the closure 2, this end having a central opening to receive and preferably slightly clear the pipe 4. The part 3 is also provided with a lateral connection for a pilot fuel mixer 5, this mixer having suitable connections as indicated for pilot air and pilot gas. The closure 2 is provided with a lateral opening 2*d* to its chamber 2*b*, and an annular baffle 2*f* extends in the chamber into the paths of jets issuing from the openings 2*c*, to provide turbulence within the chamber. The wall part 2*g* forms a restricted annular mouth for outlet from the chamber, about the end of the pipe 4.

Mounted on the closure 2 as by the bolts 2*e* turned into its illustrated internal flange, to extend within the casing 1, is separating wall means arranged to provide progressive mingling of incoming air with incoming fuel. Such wall means comprises a series of endless wall members shown as cylindrical and including an outer member 6, a member 6*a* therewithin, and an inner member 6*b*. These wall members are of progressive length as shown in Fig. 1, the innermost being the shortest, and those within the outermost having adjacent ends spaced from the closure 2. The wall members are interconnected by webs indicated in Figs. 1 and 2, whereby their concentricity is maintained, and they obviously provide a series of annular air passages therebetween.

The outermost wall member 6 has a peripherally spaced series of lateral ports 6c, and thereadjacent an outwardly turned flange 6d. Mounted on this wall member between the closure 2 and the flange 6d is a sleeve valve 7 ported to correspond with the ports 6c and adjustable about the wall member 6 for control of the latter. For adjustment of this valve from outside the burner, the closure 2 is arcuately slotted as at 2h to receive a bolt 7a turned into a flange on the valve 7.

A nipple 8 having a rearward end bearing against the closure 2 and clearing the pipe 4, and a mouth end extending within the innermost wall member 6b, provides a sub-chamber 9 rearward of the wall members and having air inlet by the ports 6c of the outermost wall member. The rear end of the nipple 8 is castellated or otherwise deformed to permit flow of air radially inwardly adjacent the mouth end of the pipe 4 and the nipple is provided with three external ribs 8a seating within the rear end of the innermost wall member 6b so that the nipple is effectively positioned and centered between the separating wall assembly and the closure 2.

Operation will be as follows. The pilot air and gas being turned on by suitable valves not shown, a pilot mixture is delivered to the chamber 3a, and flows in jets through the openings 2c and immediately about the pipe 4 into the chamber 2b. The jets from these openings impinge upon the baffle 2f, which drives them into the thin annular stream about the pipe, so that a state of high turbulence is maintained within the chamber 2b. Through the opening 2d this pilot mixture is ignited and observed until it is properly adjusted as to strength and pressure by manipulation of such valves. A pilot flame is thus had about the mouth of the pipe 4, within the nipple 8, and immediately adjacent the openings at the base of the nipple.

The main gas and air supplies are then turned on. The gas flows straight through the burner, becoming ignited by the surrounding pilot flame as it leaves the mouth of the pipe, where it burns as much as is permitted by the slight amount of air entering the rear end of the nipple from the sub-chamber 9.

More particularly, the annular pilot flame emerging from the mouth of the chamber 2b, is disposed as a layer between the cylindrical core of gas emerging from the pipe 4 and the substantially annular stream of air introduced at the base of the nipple 8 from the sub-chamber 9. Thus the pilot flame is thinned out and extended along the nipple, yet fed by fuel from within and air from without, and gradually and without interruption merges into and substantially becomes the main burner flame, so that the burner operates with great stability.

As the gas core, together with its outer layer of flame and products of partial combustion, leaves the nipple, it mingles with an additional surrounding layer of air admitted through the annular space between the nipple and the innermost wall member 6b. Further progression through the burner admits further air successively from about the wall member 6b, from about the wall member 6a and ultimately from about the outermost wall member 6.

The gas is introduced through the pipe 4 at low velocity and the valve 7 is so adjusted that air at low velocity mingles with the gas before air at higher velocity. In each stage of combustion the outer surface of the main gas column is heated sufficiently to ignite the incomplete mixture of gas and air, and the heat generated by such partial combustion decomposes part of the hydrocarbon constituents into carbon and hydrogen. These partly burned gases are ultimately brought into contact with the main air flowing at slightly higher speed through the burner about the wall member 6, and eventually complete their combustion beyond the mouth of the burner.

The large passages within the burner for both air and gas allow low velocities and prevent rapid mixing so that the secondary combustion may take place over a relatively large area with substantially even heat distribution over the whole length of flame travel from the burner.

It will be observed that the parts which are subjected to the most intense heat in service, may be easily replaced. Upon removal of the closure 2 the wall means 6 may be demounted from it, which releases the nipple 8 and permits removal of the pipe 4.

What we claim is:

1. In a burner of the class described, means providing a stream of gas, means providing a supply of air for combustion of said gas, progressively about said stream, in increments having flow in the direction of said stream and of progressively increasing velocities, and means providing a pilot flame immediately about said stream adjacent the first of said increments to there initiate said combustion.

2. In a burner of the class described, a casing having a closure at one end and a gas supply pipe mounted in said closure, said closure being arranged to provide a chamber about said pipe with a passage about said pipe leading to the hollow of said casing, means providing a pilot mixture in said chamber whereby a pilot flame may be maintained at the mouth of said passage, said pipe having its mouth located adjacent said passage mouth.

3. In a burner of the class described, a casing having an open mouth end arranged for mounting on a furnace wall, a removable closure for its opposite end, a lateral air inlet, and a concentric transversely endless baffle arranged to form a central passage leading toward said mouth and to cause incoming air to flow first about said baffle and toward said closure and thence to said passage toward said mouth, the furnace end of said baffle being joined with said casing, means for delivering fuel centrally through said closure to said passage, and wall means mounted upon said closure and extending within said passage, concentrically thereof, for controlling the mingling of said air with said fuel.

4. In a burner of the class described, a casing having a mouth end arranged for disposition at a furnace wall, a removable closure at its opposite end, and means providing air supply within said casing adjacent said closure, means for delivering fuel centrally through said closure into said casing, and wall means comprising a plurality of wall members arranged concentrically one about another within said casing to provide a passage between them for air about said fuel, one of said wall members being mounted upon said closure and another wall member being mounted upon said first named wall member.

5. In a burner of the class described, a casing having a mouth end arranged for disposition at a furnace wall, a removable closure at its opposite end, and means providing an air supply within said casing adjacent said closure, means

for delivering fuel centrally through said closure into said casing, and wall means mounted upon said closure and arranged to provide progressive mingling of said air with said fuel and comprising a concentric series of wall members of progressively greater extent in the direction of fuel flow.

6. In a burner of the class described, a casing having an open mouth end arranged for mounting on a furnace wall, a removable closure for its opposite end, a lateral air inlet, and a concentric transversely endless baffle arranged to form a central passage leading toward said mouth and to cause incoming air to flow first about said baffle and toward said closure and thence to said passage toward said mouth, the furnace end of said baffle being joined with said casing, means for delivering fuel centrally through said closure to said passage, wall means mounted upon said closure and arranged to provide progressive mingling of said air with said fuel, and comprising a plurality of wall members arranged within said baffle to provide an annular subchamber bounded endwise by said closure and some of said wall members and peripherally bounded by a larger wall member, said larger wall member having port means located adjacent said closure to communicate with said subchamber.

7. In a burner of the class described, a casing having a mouth end arranged for disposition at a furnace wall, a removable closure at its opposite end, and means providing air supply within said casing adjacent said closure, means for delivering fuel centrally through said closure into said casing, a transversely endless wall member carried by said closure, and a nipple mounted by bearing relation between said closure and said wall member.

8. In a burner of the class described, a casing having a mouth end arranged for disposition at a furnace wall, a removable closure at its opposite end, and means providing air supply within said casing adjacent said closure, means for delivering fuel centrally through said closure into said casing, a transversely endless wall member carried by said closure, and a nipple positioned in abutting relation with said closure and having external ribs seating within said wall member end to permit inlet of air thereto.

9. In a burner of the class described, a casing having a mouth end arranged for disposition at a furnace wall, a closure at its opposite end, pipe means for delivering fuel through said closure into said casing, and means providing an air supply within said casing adjacent said closure and about said pipe means, means within said casing for delaying mingling of said air with said fuel, and pilot burner means carried by said closure and providing combustion immediately about said pipe means.

10. In a burner of the class described, a casing having a mouth end arranged for disposition at a furnace wall, a closure at its opposite end, pipe means for delivering fuel through said closure into said casing, and means providing an air supply within said casing adjacent said closure and about said pipe means, means within said casing for delaying mingling of said air with said fuel, and pilot burner means carried by said closure and providing combustion immediately about said pipe means, said pilot burner means including a wall providing an annular enclosure about said pipe means outside said casing and having an ignition opening to said enclosure.

11. In a burner of the class described, a central fuel inlet pipe having its internal walls substantially straight and parallel and uninterrupted whereby to provide a smooth-flowing fuel stream, means providing a supply of air for combustion of said fuel in increments at points progressively located along said fuel stream and at the periphery of said stream, said means having walls adjacent the point where the air enters said stream parallel to said first named walls and uninterrupted whereby to provide smooth-flowing air streams outside said fuel stream and substantially parallel to it, and means providing a pilot flame immediately about said fuel stream adjacent the first of said increments to there initiate said combustion.

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