

April 28, 1964

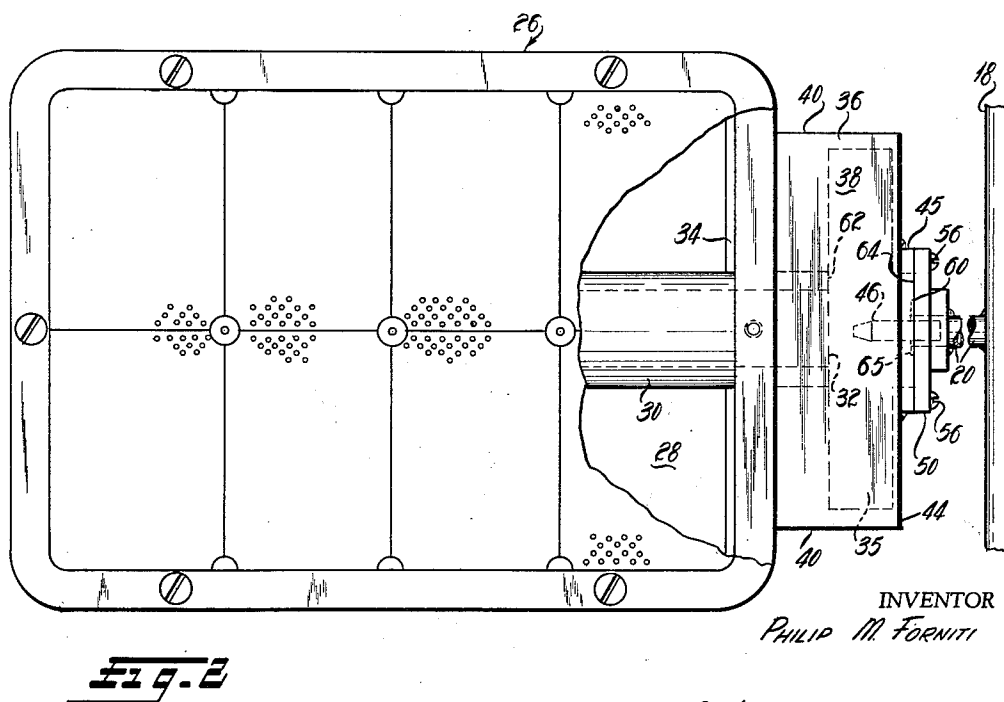
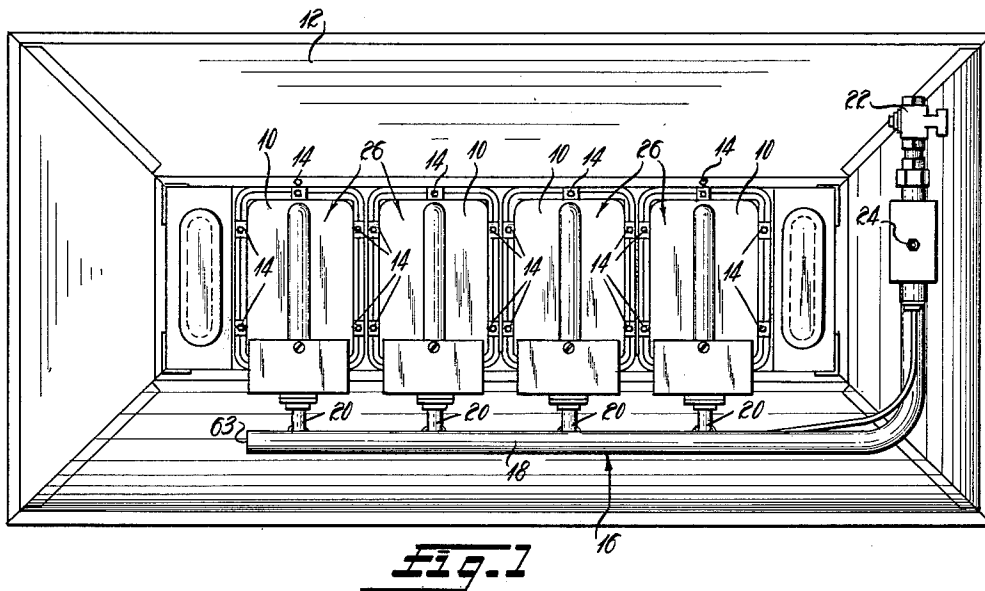
P. M. FORNITI

3,130,482

METHOD OF CONSTRUCTING AND ASSEMBLING BURNERS

Filed Oct. 7, 1959

2 Sheets-Sheet 1



INVENTOR
PHILIP M. FORNITI

BY

Strauch, Nolan & Neale

ATTORNEYS

April 28, 1964

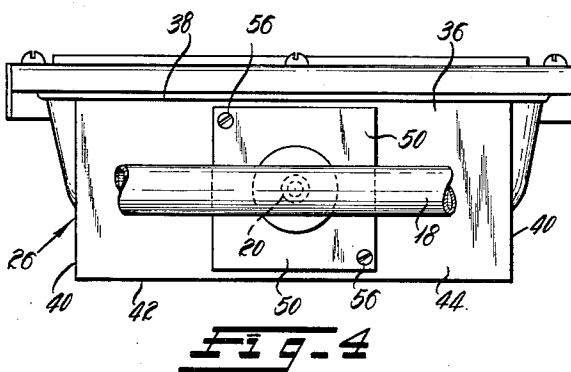
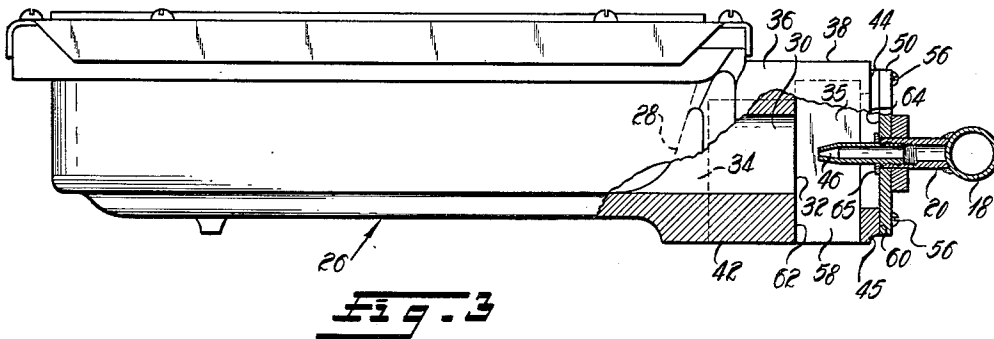
P. M. FORNITI

3,130,482

METHOD OF CONSTRUCTING AND ASSEMBLING BURNERS

Filed Oct. 7, 1959

2 Sheets-Sheet 2



INVENTOR
PHILIP M. FORNITI

BY

Stauch, Ylan + Ylan

ATTORNEYS

1

3,130,482

METHOD OF CONSTRUCTING AND ASSEMBLING BURNERS

Philip M. Forniti, Cleveland, Ohio, assignor to Hupp Corporation, Cleveland, Ohio, a corporation of Virginia

Filed Oct. 7, 1959, Ser. No. 844,915

4 Claims. (Cl. 29—157)

This invention relates to gas burners and more particularly to gas burners which have a radiation surface rendered incandescent by the combustion of fuel on or adjacent to the radiation surface.

Burners of the type with which the instant invention is concerned are shown in United States Patent 2,775,294 and in copending applications Serial Nos. 707,983 and 597,185, filed January 9, 1958 and July 11, 1956, respectively and both now abandoned. In general such burners are provided with a mixing and distributing chamber, one wall of which is formed by a plurality of perforated burner elements such as ceramic blocks or metallic structure through which a fuel and air mixture passes. Combustion occurs on or adjacent the outer surface of the burner elements and raises the temperature of the outer burner surface to a level at which heat energy in the infrared spectrum is emitted.

Combustion in such a burner is effected with 100% primary air supplied from the mixing chamber. Accordingly, it is of critical importance for optimum efficiency that the fuel-air ratio be at its predetermined optimum value and that the fuel-air mixture be substantially homogeneous as it is supplied to the burner blocks and that the mixture be supplied at uniform pressures and quantities to all parts of the burner surface. Toward this end, the burner is provided with a mixing tube which extends along a substantial portion of the longitudinal axis of the mixing chamber. The fuel-air mixture is introduced into the mixing tube by means of a fuel nozzle which is aligned with the inlet opening of the mixing tube, air being aspirated into the mixing tube through an opening in the burner adjacent the nozzle as the fuel is injected from said nozzle into the mixing tube.

If the fuel and air are not supplied in proper ratio or are not supplied to the burners as a homogeneous mixture, the use of such burners is significantly limited due to the fact that combustion of the fuel injected into the gas burner is incomplete, resulting in significant production of carbon monoxide. In some cases burners of this type have been provided which meet the rigid specification for indoor use. This has been accomplished only by the use of expensive and time consuming manufacturing and assembling techniques. Since a potentially large market for such burners is for use in such enclosed areas, the foregoing combustion problem has presented a serious commercial drawback.

It is accordingly a primary object of the present invention to provide a relatively low cost burner of the type described above in which substantially complete combustion will take place.

It is another object of this invention to provide a burner in which high efficiency of combustion can be obtained without significantly increasing the cost of production or operation of said burner.

It is still another object of the present invention to provide a novel method of constructing and assembling a gas burner of the type described above to substantially eliminate the formation of carbon monoxide and other products of incomplete combustion of the burner fuel.

Additional objects of the present invention are to

2

provide a method of constructing and assembling a gas burner of the type described above which:

(1) eliminates the human error in the construction of such a device;

(2) permits precise and automatic realignment of burner parts upon replacement of one or more of such parts; and

(3) eliminates misalignment of parts resulting from burner usage or from the application of normal extraneous forces.

Additional objects and advantages will become apparent as the description proceeds in connection with the accompanying drawings in which:

FIGURE 1 is a top plan view of a battery of gas burners constructed in accordance with the present invention showing the relationship of the burner elements to the manifold assembly;

FIGURE 2 is a bottom plan view of a single gas burner, partly broken away to show the relationship between the fuel nozzle and the mixing tube;

FIGURE 3 is a side elevational view of the burner shown in FIGURE 2 but inverted and partly broken away to show the relationship between the fuel nozzle and the mixing tube; and

FIGURE 4 is an end elevation of the burner as it appears in FIGURE 3.

In accordance with the present invention, it has been discovered that (1) the axial alignment of the fuel nozzle relative to the longitudinal axis of the mixing tube of the gas burner and (2) the distance separating the end of the nozzle and the inlet end of the mixing tube, are absolutely critical and that even slight variations in these two relationships from the optimum may result in serious combustion problems and the attendant production of significant amounts of dangerous carbon monoxide gas. Applicant has further devised a novel low cost method of constructing and assembling gas burners of the type heretofore described adapted to assure the obtaining and continued maintenance of the optimum relationship between the fuel nozzle and the mixing tube.

As shown in FIGURE 1, a series of horizontally mounted gas burners 10 are arranged adjacent one another in a supporting frame 12 and suitably fastened thereto by means of screws 14. The burners 10 are arranged in parallel relationship and are connected to a gas manifold assembly 16 which consists essentially of a main conduit 18, branch conduits 20, a valve 22 and a control 24, suitably supported by frame 12.

As shown in greater detail in FIGURES 2-4, each of the gas burners comprises a burner body or housing 26 which is preferably of one-piece cast construction and which includes a dished chamber 28 of generally rectangular configuration. Formed integrally with housing 26 and extending along its longitudinal axis is a mixing tube 30. At its outer or inlet end 32, mixing tube 30 extends through the end wall 34 of housing 26 and into a space 35 defined by the inside of a boss 36 formed integrally with the adjacent end of housing 26. Boss 36 has a top wall 38, side walls 40, a bottom wall 42 and an end wall 44. End wall 44 has a mounting projection 45 integrally formed thereon, both the mounting projection and end wall 44 having a central opening to permit passage into space 35 of a fuel nozzle 46.

Gas manifold assembly 16 consists of a plurality of flanges 50 carried by branch conduits 20 which, in turn, are connected in fluid flow relationship to a main conduit 18. Mounted normally relative to each flange 50 is a fuel nozzle 46, which, when said flange is secured to one of the mounting projections 45 by means of bolts

56, is positioned in space 35 in coaxial alignment with the outer end 32 of a mixing tube 30. Flow of gaseous fuel from nozzle 46 entrains air entering through an opening 58 in bottom wall 42 of boss 36 which is positioned directly below the nozzle.

Certain details of this structure are shown in the patent and copending applications hereinbefore referred to. As stated above, applicant has discovered that the relationship of each fuel nozzle 46 with its associated mixing tube 30 is critical and that slight variations in this relationship from the optimum may result in significant variations in the efficiency of combustion in the gas burner and a marked increase in the attendant production of toxic carbon monoxide. More specifically, applicant has discovered that the greater the deviation of each fuel nozzle 46 from absolute coincidence with the longitudinal axis of its associated mixing tube 30, the less efficient combustion will be, and, accordingly, the greater the quantity of carbon monoxide produced. Applicant has further found that the distance between the end of the nozzle 46 and the inlet end 32 of the mixing tube 30 is also critical and can significantly affect the combustion efficiency (though this distance will necessarily vary depending upon the type of fuel used and the size of aspirating opening 58 in boss 36).

It has become a practice in the construction of burners of the type described above to generally align the longitudinal axis of the fuel nozzle with the longitudinal axis of the mixing tube and to so mount the nozzle so that the nozzle tip is approximately a certain predetermined distance from the inlet of the mixing tube. Such constructions are, however, approximate at best, not only because the absolute criticality of the foregoing relationship has not been recognized but, even more important, because methods of fabrication of the burner assembly have been such as to preclude the possibility of obtaining the critical relationship at reasonable cost. Also, the fact that prior art burners have contained fuel nozzle assemblies having a number of separate parts which are apt to loosen upon being jarred, through use or through replacement of parts, has made it difficult to maintain the desired relationship if, in fact, the relationship was ever obtained in the first instance.

The combustion problem is substantially completely eliminated by applicant's novel method which is described below:

The cast burner housing 26, shaped as shown in FIGURES 2, 3 and 4 but having the roughened surface invariably resulting from a rough casting, is secured in a jig (not shown) and at least the portion of the interior of the mixing tube 30 nearest its outer end 32 is reamed out by a conventional reamer. Using the finished interior of mixing tube 30 as a guide, the front face 60 of mounting projection 45 is faced exactly normal to the longitudinal axis of the finished portion of mixing tube 30. Front face 62 of the outer end 32 of mixing tube 30 is also faced in the same manner so that it too will be normal to the longitudinal axis of the finished portion of mixing tube 30, again using the finished portion of mixing tube 30 as a guide to obtain a normal relationship. Surface 62 should be faced sufficiently to separate it from surface 60 by a predetermined distance.

These facing operations may be performed in any conventional manner, the only limitation being that the finished portion of mixing tube 30 must be used as a guide to insure that the faced surfaces 60 and 62 will be normal to the mixing tube's longitudinal axis. A convenient method involves the use of a unitary reamer having rigidly secured thereto or integrally formed therewith two spaced facing tools, one for surface 62 and one for surface 60. The facing tools are oriented relative to the reamer to perform a facing operation normal to the axis of the surface being reamed. Alternatively, a conventional facing tool may be used by providing a guide extension which is inserted into mixing tube 30 to estab-

lish a cutting plane normal to the longitudinal axis of the mixing tube.

Next, two bolt holes are tapped in mounting projection 45, in precise relation with the axis of the mixing tube 30. This relationship may be established by suitable jigs or by using the finished interior of tube 30 as a guide for the tap. The holes should be so tapped that there will be no slack between them and bolts 56 to be threaded into them.

Gas manifold assembly 16 is constructed by providing a main conduit 18, one of those ends 63 is pinched and welded together, and welding to it along its length a series of internally threaded branch conduits 20, one such conduit for each gas burner to be used. The longitudinal axes of conduits 20 must all be normal to the longitudinal axis of main conduit 18 and lie in the same plane. This may be accomplished by means of a suitable jig assembly. Since conduits 20 will all be of the same length, their free ends will also lie in the same plane. The distance separating the longitudinal axes of conduits 20 should be identical to the anticipated distance between the longitudinal axes of the mixing tubes 30 of adjacent gas heaters 10 in the heater assembly.

A flange 50 should next be provided for each of conduits 20 and three holes drilled in each of the flanges. One of the three holes should be centrally located on each flange and should be slightly larger than the outer diameter of each of conduits 20 to permit the positioning of the flanges around the ends of the conduits. The two additional holes in each of the flanges should be of a size identical to the two bolt holes in mounting projection 45 and should be positioned relative to one another and to the exact center of the centrally located hole in exactly the same manner in which the two bolt holes in each mounting projection 45 are positioned relative to one another and to the longitudinal axis of the finished portion of mixing tube 30. By employing a suitable jig having guides to locate not only the manifold conduit but the location of the two outer holes in each of flanges 50 relative to its associated conduit 20, the flanges can be welded to the free ends of the conduits not only so that surfaces 64 of all the flanges will be absolutely coplanar and perfectly normal to conduits 20 but, additionally, so that the position of the two outer holes in each flange relative to the longitudinal axis of its respective conduit 20 will be identical to the corresponding relationship of the bolt holes in mounting projections 45 relative to the longitudinal axes of the finished portions of mixing tubes 30. The outer holes in each of flanges 50 should preferably be used in conjunction with the jig and its associated guides as locating points to obtain the aforementioned relationship. As will be apparent, alignment of the holes in flanges 45 and 50 will be facilitated if they are made symmetrical about the central openings in said flanges.

Nozzles 46, each of which has the outer surface of its non-discharge end threaded, are then threaded into conduits 20 sufficiently so that when each flange 50 is in full surface contact with the face of its associated mounting projection 45, the discharge tip of nozzles 46 will be the desired critical distance away from the outer end 32 of mixing tube 30. This distance may be conveniently determined by providing a stop 65 at a predetermined position on the outer surface of each nozzle to limit its movement into its associated conduit 20.

From the foregoing, it will be apparent that each of the nozzles 46 will be absolutely normal to its respective flange 50 and will be coaxial with its respective conduit 20. In view of this fact, the longitudinal axis of each of the nozzles 46 will be coplanar with and parallel to one another and will be separated from one another by the same distance which separates the longitudinal axes of the finished portions of mixing tubes 30 in each of gas burners 10. By proper positioning of the stop on each nozzle, the exposed lengths of all the nozzles beyond flanges 50 may be made identical.

5

Flanges 50 are then placed in full surface contact with the faced surfaces of mounting projections 45 and the respective bolt holes in each of said elements are aligned with one another. The gas manifold assembly 16 is then rigidly secured to gas burners 10 by means of bolts 56 which are inserted in the bolt holes. After this has been done, the gas burners 10 are secured tightly in supporting frame 12 by tightening screws 14. By providing proper clearance between screws 14 and the holes in supporting frame 12, sufficient tolerance may be provided for variations in configuration of the gas burner structures and/or supporting frame structure.

By following the above-recited procedure, it is clear that the axes of nozzles 46 will be exactly coincident with the corresponding longitudinal axes of mixing tubes 30 and that the outer tips of nozzles 46 will be the desired predetermined critical distance from the inlet ends 32 of said mixing tubes.

The foregoing method of construction and assembly provides numerous advantages over comparable prior art methods. As aforesaid, the most significant advantage is the marked improvement in combustion efficiency as compared with prior mass-produced burners and the attendant decrease in carbon monoxide formation. Furthermore, the elimination of adjustable parts in the gas manifold assembly (as compared with prior gas manifold assemblies) and the substantial elimination of the human error in the obtaining of the critical relationships between the elements of the assembly and of the gas burner precludes possible misalignment of the structures after continued use and insures the maintenance of the proper critical relationship notwithstanding the necessity of replacing portions of the structure after the initial installation.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A method of constructing and assembling a gas burner of the type having a radiation surface rendered incandescent by the combustion of fuel thereon or adjacent thereto, said gas burner comprising a housing forming a mixing chamber for gaseous fuel and air, a mixing tube within said housing adapted to convey a mixture of fuel and air into said mixing chamber, said mixing tube having an inlet adjacent one end of said housing to provide a substantially cylindrical locating surface therein, a boss on said one end of said housing providing an air aspirator opening at said inlet end of said mixing tube, said method comprising the steps of providing an unfinished gas burner housing, forming a first gauging surface on said boss normal to the longitudinal axis of said locating surface and using said locating surface as a guide, providing a fluid conduit and a flange, forming an opening in said flange centrally thereof and locating means in predetermined relation with said opening, securing said conduit in said opening with the axis of said conduit normal to said flange and in predetermined relation to said locating means whereby said flange provides a second gauging surface, mounting a fuel nozzle on said conduit coaxially of said conduit and in predetermined relation to said second gauging surface, providing locating means on said first gauging surface so positioned that when said first and second gauging surfaces are placed in full surface contact and the respective locating means on said surfaces are aligned with one another, the fuel nozzle will extend into said gas burner and have its longitudinal axis in substantially exact coincidence with the longitudinal axis of said mixing tube, placing said first and second gauging surfaces

6

in full surface contact, aligning said locating means, and securing said surfaces rigidly to one another in this position.

2. A method for constructing and assembling a battery of gas burners having a common supply manifold, each gas burner being of the type having a radiation surface rendered incandescent by the combustion of fuel thereon or adjacent thereto, each gas burner including a housing forming a mixing chamber for gaseous fuel and air, a mixing tube within said housing adapted to convey a mixture of fuel and air into said mixing chamber, said mixing tube having an inlet adjacent one end of said housing providing a cylindrical locating surface therein, said housing having a boss providing an air aspirator opening at said one end thereof adjacent said inlet end of said mixing tube, said method comprising the steps of providing a plurality of said gas burner housings, forming a first gauging surface on the boss of each of said gas burner housings normal to the longitudinal axis of said locating surface using said locating surface as a guide, forming at least two threaded locating openings in said gauging surface in predetermined relation with the longitudinal axis of said locating surface using said locating surface as a guide, providing a plurality of branch pipes and a plurality of attaching flanges, forming central openings in each of said flanges and at least two additional locating openings in the same relation to said flange opening as said openings in said first gauging surface are with respect to the longitudinal axis of said locating surface, securing said branch pipes in the central openings in the respective flanges with the axis of each branch pipe being normal to its associated said flange and in predetermined relation to said locating openings whereby said flanges provide second gauging surfaces, securing said branch pipes to said common manifold with the axes of said branch pipes disposed in a first plane and said second gauging surfaces being disposed in a second plane normal to said first plane, mounting a fuel nozzle in each of said branch pipes in predetermined relation with each of said second gauging surfaces, securing said first and second gauging surfaces together in full surface contact by means of screws extending through the locating openings on said second gauging surfaces into said openings on said first gauging surfaces whereby each of said fuel nozzles will extend into a gas burner housing with its longitudinal axis in substantially exact coincidence with the longitudinal axis of the locating surface of said mixing tube, and securing each of said housings to a common frame.

3. A method for constructing and assembling a battery of gas burners having a common supply manifold, each gas burner being of the type having a radiation surface rendered incandescent by the combustion of fuel thereon or adjacent thereto, each gas burner including a housing forming a mixing chamber for gaseous fuel and air, a mixing tube within said housing adapted to convey a mixture of fuel and air into said mixing chamber, said mixing tube having an inlet adjacent one end of said tube providing a locating surface therein, said housing having a boss providing an air aspirator opening at said one end thereof adjacent said inlet end of said mixing tube, said method comprising the steps of providing a plurality of said gas burner housings, forming a first gauging surface on the boss of each of said gas burner housings normal to the longitudinal axis of said locating surface using said locating surface as a guide, providing a plurality of branch pipes and a plurality of attaching flanges, forming central openings in each of said flanges and at least two additional locating openings in predetermined relation with said central opening, securing said branch pipes in the central openings in the respective flanges with the axis of each branch pipe being normal to its associated flange and in predetermined relation to said locating means whereby said flanges provide second gauging surfaces, securing said branch pipes to said common manifold with the axes of said branch pipes disposed in a first plane and said sec-

7

ond gauging surfaces being disposed in a second plane normal to said first plane, mounting a fuel nozzle in each of said branch pipes in predetermined relation with each of said second gauging surfaces, providing locating means on said first gauging surfaces so positioned that when said first and second gauging surfaces are placed in full surface contact and the respective locating means on said surfaces are aligned with one another, the respective fuel nozzles will extend into said gas burners with their longitudinal axes in substantially exact coincidence with the longitudinal axes of said mixing tubes, placing said first and second gauging surfaces in full surface contact, aligning said locating means, and securing said gauging surfaces rigidly to one another in this position.

8

4. The method recited in claim 3 additionally comprising the securing of all the gas burners to a common support after said first and second gauging surfaces have been secured to one another.

5

References Cited in the file of this patent

UNITED STATES PATENTS

1,359,405	MacCamey	Nov. 16, 1920
1,941,476	Jensen	Jan. 2, 1934
2,395,868	Hahn	Mar. 5, 1946
2,775,294	Schwank	Dec. 25, 1956
2,870,830	Schwank	Jan. 27, 1959

10