Jan. 4, 1966

L. J. MORGAN

3,227,202

GAS BURNER

Filed March 10, 1964

3 Sheets-Sheet 1

Fig. 1.

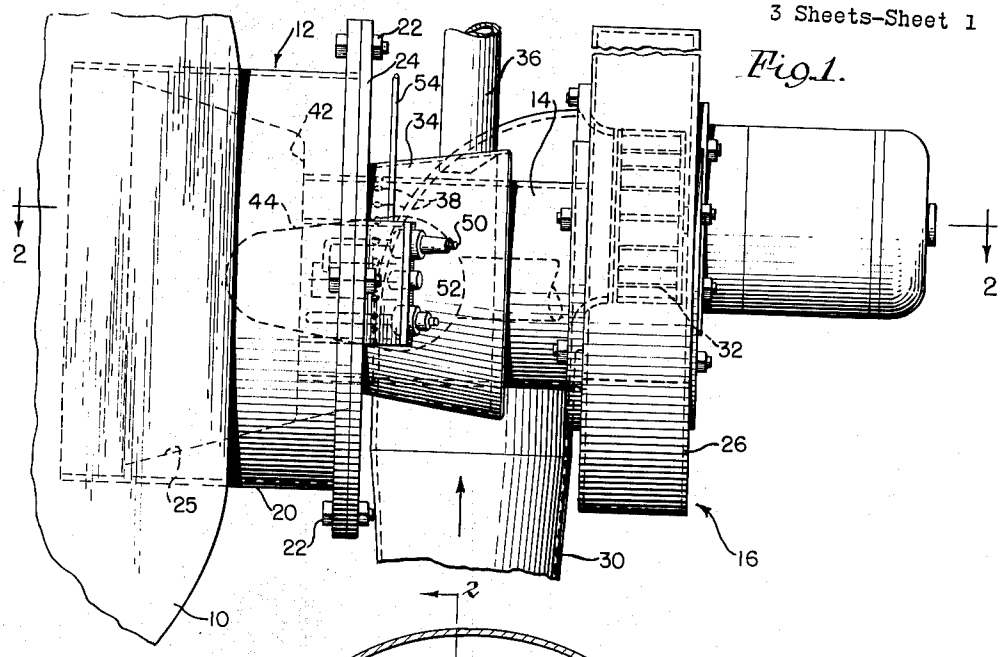
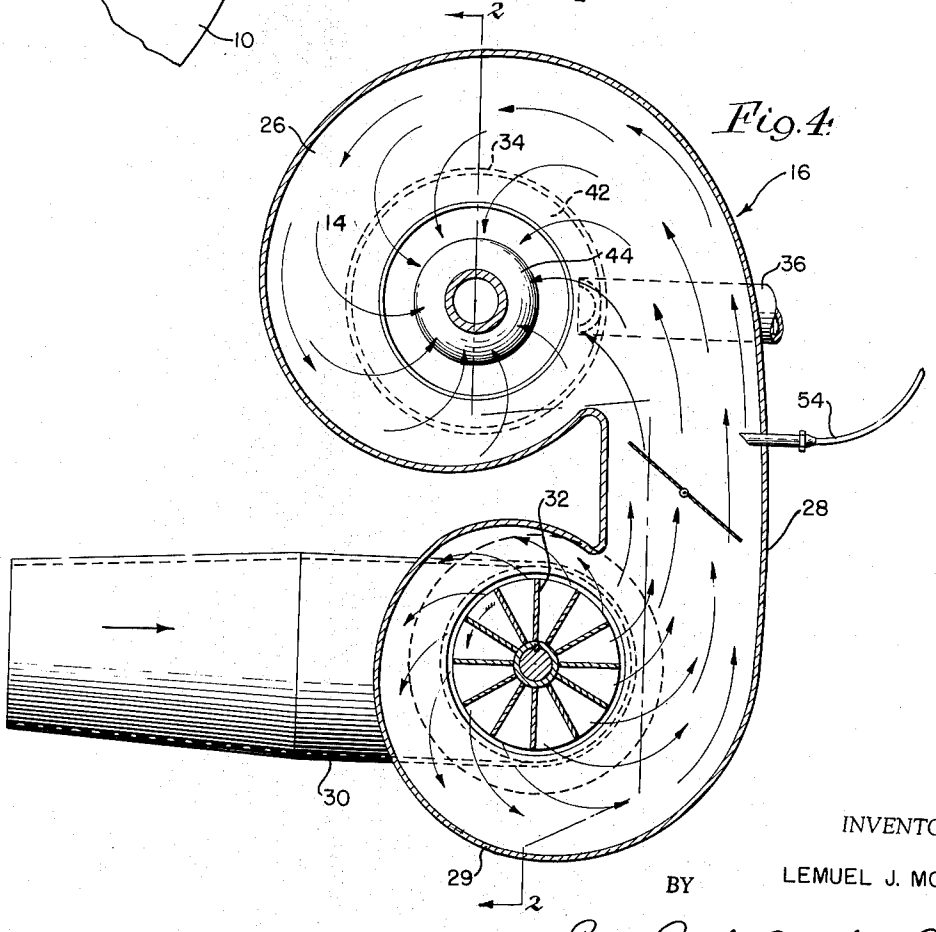


Fig. 4.



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Jan. 4, 1966 L. J. MORGAN 3,227,202

GAS BURNER

Filed March 10, 1964 3 Sheets-Sheet 2

Fig. 2.

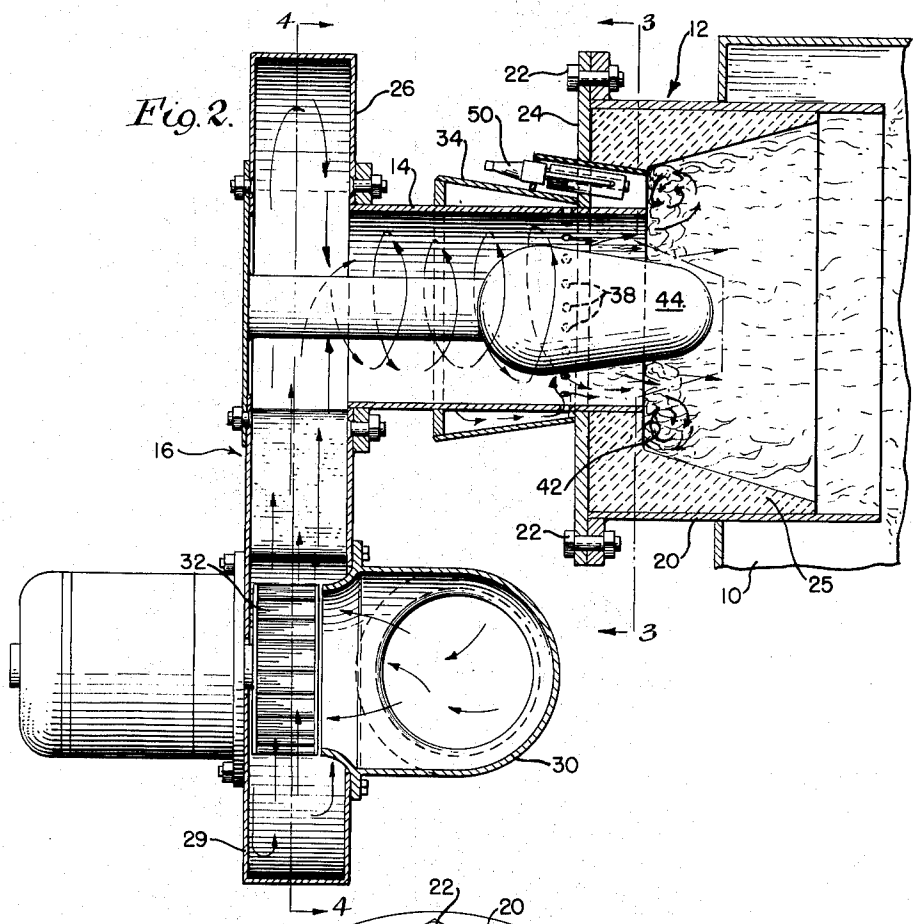
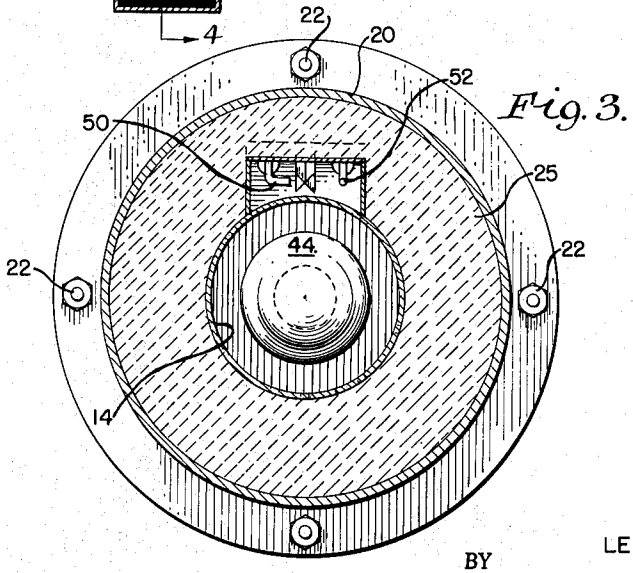


Fig. 3.



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GAS BURNER

Filed March 10, 1964 3 Sheets-Sheet 3

Fig. 5.

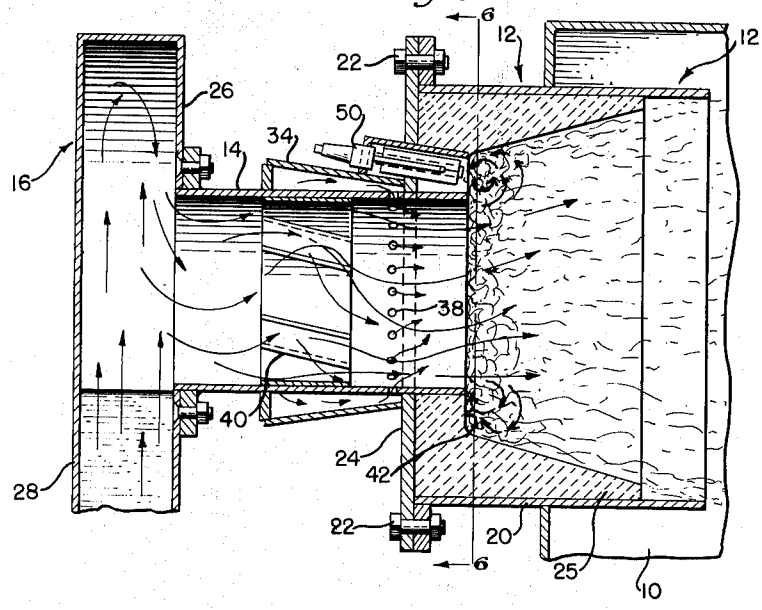
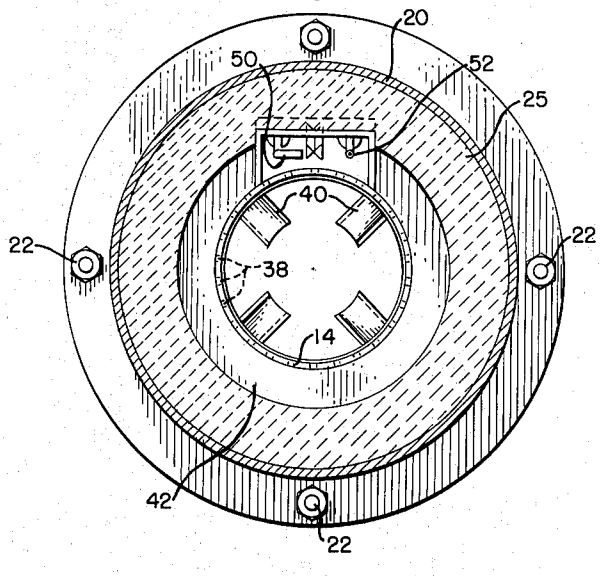


Fig. 6.



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GAS BURNER

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2 Claims. (Cl. 158—7)

This invention relates to gas-fired water heaters or hot water supply boilers; and more particularly to improvements in the gas burner mechanisms thereof.

It is a primary object of the present invention to provide an improved gas-air mixing and flame-holding arrangement in gas-fired combustion devices, such as water heating apparatus, furnaces, or the like.

Another object is to provide an improved gas burner as aforesaid providing increased fuel combustion efficiencies,

Another object is to provide an improved arrangement as aforesaid having improved flame-holding characteristics, thereby minimizing possibility of flame-out service interruptions.

Still another object is to provide for a burner arrangement as aforesaid an improved "supervisory" control system.

Other objects and advantages of the invention will be apparent from the following specification and the accompanying drawing, wherein:

FIG. 1 is a fragmentary side elevational view of a gas burner arrangement of the present invention;

FIG. 2 is a fragmentary sectional view thereof taken as suggested by lines **2**—**2** of FIGS. 1 and 4;

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

FIG. 4 is a sectional view taken along line **4**—**4** of FIG. 2;

FIG. 5 is a fragmentary sectional view corresponding to a portion of FIG. 2 but showing a modified form of burner arrangement of the invention; and

FIG. 6 is a sectional view taken on line **6**—**6** of FIG. 5.

As shown by way of example in the drawing herewith, the invention may be embodied in a water heater including a water storage tank or casing **10**. The burner component of the invention is illustrated by way of example to generally include a combustion chamber portion **12**; a gas-air mixing and inlet nozzle **14**; and an air supply fan-duct arrangement as indicated at **16**. Accessory gas control, pilot, ignition, and duct control damper devices, and the like are also shown; as will be described and explained more fully hereinafter.

As shown herein, the fuel combustion chamber portion of the device comprises a cylindrical shell **20** having a flange bolted as indicated at **22** to a face plate **24** and carrying therewithin a ceramic lining **25**. The shell face plate and ceramic lining are formed to provide a central bore into which fits one end of the burner nozzle **14** which communicates at its other end with the interior of a "snail-shell" shaped end portion **26** of the air supply housing which is indicated generally at **16**. This housing also includes an intermediate conduit portion **28** and a second "snail-shell" shaped lower end portion **29** having an air inlet opening in communication with an air supply conduit **30**. The shell portion **29** of the housing encloses a radial blower type fan **32** which operates to pump air through the conduit portion **28** and in a swirling pattern into the burner nozzle **14** and therethrough into the combustion chamber portion as outlined by the ceramic lining **25**.

The burner nozzle is enclosed by a gas supply cuff or manifold **34** into which the fuel gas is supplied as by means of a supply conduit **36** (FIGS. 1, 4). The nozzle member **14** is perforated as shown at **38** (FIGS. 1, 2, 5) to discharge the gas in peripherally dispersed manner

through the wall of the nozzle **14** into the air stream swirling therethrough, and thence into the combustion chamber. As shown in FIGS. 5, 6, if it is desired to augment the swirling (and therefore thorough mixing) movement of air and gas through the nozzle and into the combustion chamber, a helical vane device such as shown at **40** may be disposed inside the nozzle. In any case, in accord with the arrangement of the invention the air-gas mixture is discharged into the combustion chamber in a helically swirling path as indicated by the flow direction indicating arrows of the drawing.

It is a particular feature of the present invention that the nozzle **14** discharges the swirling air-gas mixture into a sectionally larger combustion chamber, whereby an annular eddy current producing shoulder is provided around the entrance into the combustion chamber as indicated at **42**. This induces development of a ring of side-tracked burning fuel all around the incoming gas-air stream, thereby establishing a toroidal-shaped body of flame inside the annular "cave" which surrounds the entrance to the combustion chamber. This insures ignition of the fuel-air mixture passing therethrough and "holding" of the flame at the entrance to the combustion chamber; thereby preventing flame-outs and insuring the holding of the flame within the prescribed combustion range. Also, this fuel transmission system provides optimum homogenization and molecular dispersion of the gas-air components, whereby maximum combustion efficiencies are effected. If it is desired to augment the combustion-efficient eddy current pattern of gas-air flow into the combustion chamber, a streamlined baffle or "core bulb" as indicated at **44** (FIGS. 1–4) may be employed to prevent straight-through passage of a gas-air stream at the center of the nozzle and/or the combustion chamber.

Suitable accessories will of course be employed in conjunction with the mechanism hereinabove described. For example, an igniter device as indicated at **50** may be provided for starting the combustion cyle, and a supervisory control will of course be employed to control the starting operation and to insure cut-off of gas flow in event of flame-out or other functional failure. For example, a "flame-rod" or thermionic sensor as indicated at **52** may be employed in conjunction with a suitable pilot and water temperature sensing and regulating system. Typically, the control system will include a push-button start-stop control and time delay mechanism whereby when the control is manually set to "start" (or when a thermostat calls for more heat) the blower **32** will first be energized to start pumping air through the housing **16** and the nozzle **14** into the combustion chamber. The time delay device will, after a preset interval, energize the pilot gas supply device and the igniter. An air bleed line may be arranged to lead from the housing **16** to supply air to the pilot device as indicated at **54** (FIG. 4). Then when the flame rod **52** detects a combustion condition as a result of the pilot flame operation at the throat of the nozzle **14**, it will operate the main gas supply control valve to permit gas to flow into the manifold **34** and thence into the nozzle for mixing with the air passing into the furnace.

Thus it will be appreciated that by virtue of the arrangement of the present invention the air supply is delivered into and through the burner nozzle in the form of a helically swirling column of air. Then when it passes the perimetral shoulder formed by the juncture of the relatively smaller diameter nozzle and the larger diameter combustion chamber, it expands into the annular "cave" or recess formed by the shoulder and establishes therein an annular mass of burning fuel surrounding the main body of the air-fuel mixture passing into the combustion chamber. This annular mass of burning fuel not only

continues to swirl helically, but it is also interiorly swirling as seen in side view due to the imposed eddy current effect, as illustrated by the directional arrows of FIGS. 2 and 5 of the drawing herewith. Hence, a superior blending of the fuel-air ingredients is achieved, thereby providing a superior "flame-holding" device disposed in intimate association with the body of the fuel-air mixture passing into the combustion chamber.

It will of course be appreciated that although only a few forms of the invention have been illustrated and described herein, various changes may be made therein without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. A fuel-air combustion device comprising, in combination,

an air supply housing including a pair of end portions, each having a pair of generally parallel side walls joined by curved wall means defining a scroll-like chamber having a tangential opening, a conduit joining said end portions at their tangential openings, one of said end portions having an air intake opening in one side wall thereof, a fan in said one end portion for inducting air through said air intakke opening for discharge through said conduit tangentially having an air discharge opening disposed in one side wall thereof, a cylindrical burner nozzle connected to said one side wall of said other end portion at the air discharge opening therein,

a combustion chamber axially aligned with said burner nozzle and having an end wall provided with an opening; said burner nozzle projecting into said combustion chamber through said end wall opening thereof and said combustion chamber being of greater diameter at said end wall than said burner nozzle to provide an annular cave surrounding the corresponding end of said burner nozzle,

means for introducing fuel circumferentially around said burner nozzle in that portion of the burner nozzle between said air supply housing and said combustion chamber and a streamlined bulbous baffle device disposed centrally within said burner nozzle adjacent the opening in said end wall of the combustion chamber and having its smaller end extending into said combustion chamber, said fuel introducing means comprising a cuff surrounding said burner nozzle, a fuel inlet conduit discharging into said cuff, and said burner nozzle having a series of openings within the confines of said cuff and adjacent said baffle device.

2. A fuel-air combustion device comprising, in combination,

an air supply housing including an air delivery chamber having a pair of generally parallel side walls joined by curved wall means defining therewith a scroll-like chamber having a tangential inlet opening,

means for forcing air into said air delivery chamber through the inlet opening thereof,

a combustion chamber having an end wall disposed in spaced, opposed relation to one side wall of said air delivery chamber, said combustion chamber being of circular section and said end wall having a circular opening of smaller diameter than the combustion chamber to provide an annular cave surrounding such opening,

said air delivery chamber having an opening in one side wall thereof aligned with said opening in the end wall of said combustion chamber,

a cylindrical burner nozzle connected to said one side wall and projecting into said combustion chamber through said end wall opening thereof to define a passage leading from said opening in the side wall of said air delivery chamber to said combustion chamber,

means for delivering fuel circumferentially around said burner nozzle between said air delivery chamber and said combustion chamber, and a streamlined bulbous baffle device disposed centrally within said burner nozzle adjacent the opening in said end wall of the combustion chamber and having its smaller end extending into said combustion chamber, said fuel introducing means comprising a cuff surrounding said burner nozzle, a fuel inlet conduit discharging into said cuff, and said burner nozzle having a series of openings within the confines of said cuff and adjacent said baffle device.

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