

Aug. 28, 1945.

T. B. FOCKE ET AL

2,383,641

GAS BURNING APPARATUS

Filed Oct. 6, 1941

2 Sheets-Sheet 1

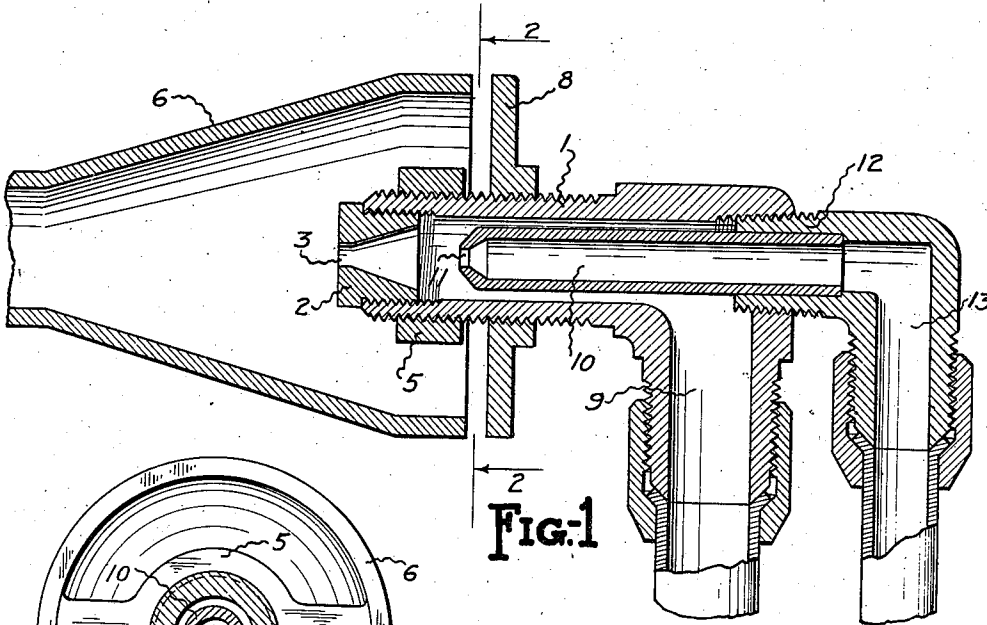


FIG-1

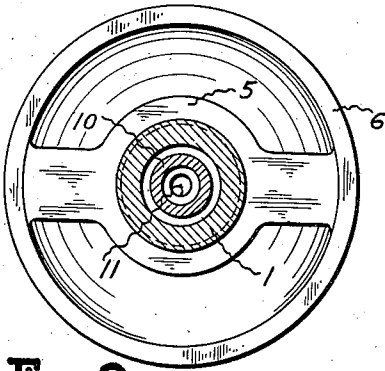


FIG: 2

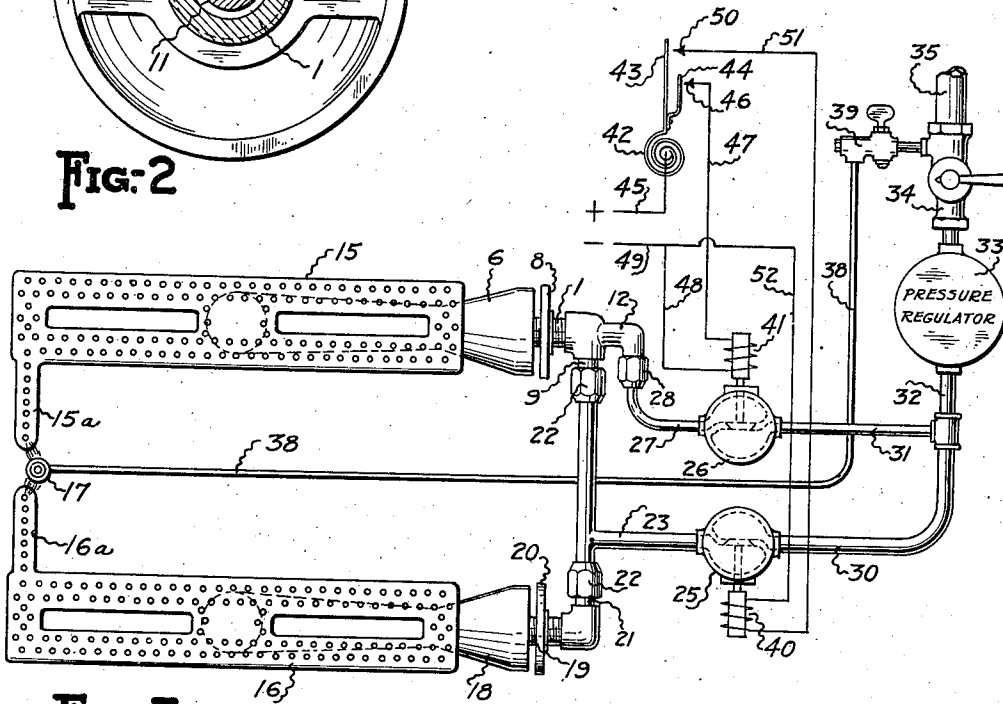


FIG-3

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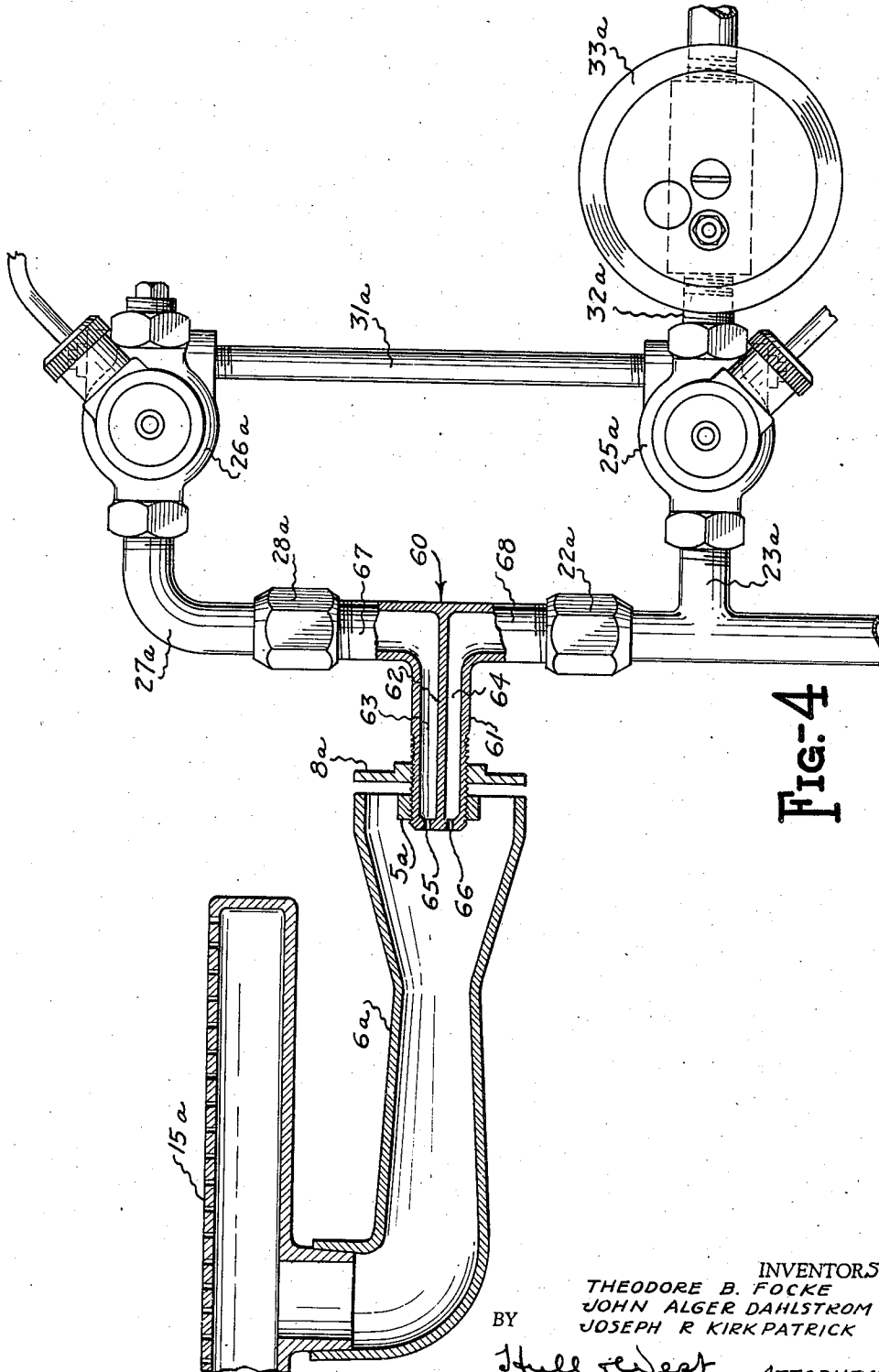


Fig. 4

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2,383,641

GAS BURNING APPARATUS

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Application October 6, 1941, Serial No. 413,728

4 Claims. (Cl. 158—105)

This invention relates to gas burning apparatus, and its primary object is to provide a burner that is peculiarly suited for use in automatically controlled domestic gas furnaces or the like, wherein the quantity of gas supplied to the burner is under the control of a room thermostat.

Another object is to provide an automatically controlled multiple gas burner system that operates smoothly, efficiently and economically, and that requires the minimum number of automatically operated valves.

More limitedly, the purpose of the invention is to provide a two-stage gas burner of relatively simple design and construction; that is economical of production; that is adapted to standard methods of installation, and which affords the advantages already stated with others hereinafter appearing.

In the accompanying drawings, Fig. 1 is a central longitudinal section through one form of the multiple nozzle of the two-stage burner and the adjacent part of the mixer or Venturi tube of the burner; Fig. 2 is a section on the line 2—2 of Fig. 1; Fig. 3 is a diagram illustrating an automatically controlled multiple burner system embodying the invention, and Fig. 4 shows a part of such a system incorporating a modification of the multiple nozzle.

A vital part of our invention is the multiple nozzle illustrated in detail in Figs. 1 and 2, and included in modified form in Fig. 4. According to Figs. 1 and 2, it comprises an outer nozzle 1 into the internally threaded forward end of which is screwed a tip 2 having a relatively small central orifice 3. Following common practice, the exterior of the nozzle 1 is threaded and is screwed through the central boss 5 of a mixer or Venturi tube 6. The air supply to the mixer or Venturi tube 6 is controlled, in the present instance, by a disk-like damper 8 that is threaded on and, therefore, adjustable along the nozzle 1 toward and from the entrance end of said tube. Adjacent its rear end, the nozzle 1 has a lateral, externally threaded extension 9. Arranged within and substantially axially of the outer nozzle 1 is an inner nozzle 10 having an orifice 11 at its forward end that is approximately in axial alignment with the previously mentioned orifice 3. The nozzle 10 is carried by a fitting 12, shown in the form of an L, the lateral extension of which is designated 13. The forward end of said fitting is threaded and is screwed into a threaded opening in the rear end of the nozzle 1. An important factor with refer-

ence to the physics of the burner is the proper spacing of the discharge end of the inner nozzle from that of the outer nozzle. The drawings show a practical and satisfactory arrangement, although reasonable tolerance may be permitted in both directions therefrom. However, the parts must be so proportioned and arranged in this respect that gas issuing from the inner nozzle will not create any perceptible aspirating effect or back pressure within the outer nozzle. As proven by actual test, these conditions may be attained by following the shape, proportion and relation of parts illustrated in Fig. 1. Further reference to this phase of the subject will hereinafter appear. Notwithstanding similarity in design, the present two-stage burner should not be confused with injector burners wherein an impelling fluid, such as steam, air or other gas, is used. In other words, the present invention is concerned only with atmospheric gas burners.

In Fig. 3, two burners are shown, the same being designated generally, by the reference numerals 15 and 16, respectively. The bodies of these burners may be of usual character, consisting of hollow castings or the like, and they are shown as provided with lateral extensions 15^a and 16^a, respectively, that lead toward a common igniter or pilot burner 17. As indicated, the pilot burner emits two jets, one toward each of said extensions. The mixture of air and gas is supplied to the burner 15 through the previously mentioned mixer or Venturi tube 6, and to the burner 16 through a mixer or Venturi tube 18 into the receiving end of which is projected a nozzle 19, similar to the outer nozzle 1 of our two-stage burner, and on which is threadedly mounted a disk-like damper 20. The nozzle 19 has a lateral inlet extension 21. This and the extension 9 of the nozzle 1 of our two-stage burner have connection, through unions 22, with a branched pipe or conduit 23 that leads from a solenoid valve 25. A second solenoid valve 26 communicates, through a conduit or pipe 27 and the previously mentioned fitting 12, with the inner nozzle 10 of the two-stage burner, the connection between said pipe or conduit and the lateral extension 13 of said fitting 12 being effected through a union 28. Gas is supplied to the valves 25 and 26 through the respective pipes or conduits 30 and 31 that lead, through a pipe section 32, containing a pressure regulator 33 and a manually operated main valve 34, from a gas supply pipe 35. Gas from the main supply in advance of the valve 34 is conducted through a

pipe 38 to the pilot burner 17, said pipe containing a valve 39. The valves 25 and 26 are biased toward closed position, as by springs (not shown).

The windings of the solenoids of the respective valves 25 and 26 are designated 40 and 41. 42 is a room thermostat having a blade 43, and a leaf spring 44 that is carried by the blade. A conductor 45, that represents one side of an electric circuit, is connected to the room thermostat 42, thereby to supply current to the blade 43 and the spring 44. The spring 44 is arranged for engagement with a contact 46 from which a conductor 47 leads to one end of the solenoid winding 41, the opposite end of which winding is connected, through a conductor 48, with a conductor 49 that represents the opposite side of the circuit. The blade 43 is arranged for engagement with a contact 50 that is connected, through a conductor 51, with one end of the solenoid winding 40, the opposite end of which has connection, through the conductor 52, with the previously mentioned conductor 49.

In considering the operation of the multiple burner system, it will be assumed that the manually operated valve 34 is open. As the parts are illustrated in Fig. 3, both solenoid valves 25 and 26 are closed and only the pilot burner 17 is in operation to project a jet of flame toward each of the burner extensions 15^a and 16^a, the valve 39 being adjusted to effect igniting jets of the desired size. As usual in such systems, the room thermostat 42 is set to maintain a given temperature value within relatively close limits, and in case of a drop in the temperature below said value, the blade 43 is caused to swing in a clockwise direction and engage the spring 44 with the contact 46, thereby permitting current to flow from the source through the conductor 45, thermostat 42, spring 44 and conductor 47, to the solenoid winding 41, and thence through conductors 48 and 49, back to the source. The solenoid of valve 26 being thus energized, the valve will be opened and gas will flow through the pipe 27 and fitting 12 to the inner nozzle 16 of the two-stage burner, the gas issuing therefrom through its orifice 11, and through the orifice 3 of the outer nozzle 1, into the Venturi tube 6 where, with the primary air entering past the damper 8, it will flow to the burner 15 and issue from all openings thereof including those in the branch 15^a, whereupon the gas will be ignited from the pilot burner 17 and the burner will operate at what may be considered low fire, such being the capacity of the inner nozzle 16. If the low fire is sufficient to raise the temperature affecting the room thermostat 42 enough to cause the blade 43 to swing in a counter-clockwise direction and withdraw the spring 44 from the contact 46, the solenoid winding 41 will be deenergized and the valve 26 will close, thus shutting off the gas supply to the burner 15.

On the other hand, should the heat output of the two-stage burner, operating at low fire, be insufficient to raise the room temperature to the predetermined value at which the room-thermostat is set, the blade 43 will continue to move in a clockwise direction (the spring 44 yielding to the excess movement of the blade) until the blade engages the contact 50, whereupon current will be delivered, also, to the solenoid winding 40 through the conductor 51, and will return therefrom to the other side of the circuit through the conductor 52. Now, with the solenoid of valve 25 energized, said valve will open and per-

mit flow of gas through the branched conduit or pipe 23 to the outer nozzle 1 of the two-stage burner and to the nozzle 19 of the burner 16. Since the two-stage burner was previously operating throughout the area thereof at the capacity of nozzle 10, the present effect will be the same as turning up the two-stage burner to high fire, and at the same time the output of the apparatus will be stepped up by the full capacity of the burner 16. The apparatus will continue to operate at high fire until the temperature affecting the thermostat 42 rises sufficiently to cause the withdrawal of the blade 43 from the contact 50, thereby to reduce the apparatus to low fire, and in case the temperature continues to go up, the spring 44 will withdraw from the contact 46, causing the valve 26 to close, resulting in discontinuance of the fire.

Obviously, the capacity of the system may be increased by extending that branch of the pipe or conduit 23 to which the burner 16 is connected, and duplicating or multiplying said burner and its connection with said pipe or conduit.

As above pointed out with respect to the multiple nozzle, illustrated in detail in Figs. 1 and 2, it is important that the inner and outer nozzles be so related that gas issuing from the inner nozzle will not create any perceptible aspirating effect or back pressure within the outer nozzle. As previously stated, this result is obtained by following reasonably closely the construction illustrated in the drawings. Substantial deviations therefrom result in certain adverse effects. For example, if the orifice 11 of the inner nozzle is too close to the orifice 3 of the outer nozzle, and gas is issuing from the inner nozzle only, an aspirating effect is produced that will draw a sufficient quantity of air in through the nozzle 19 of the second burner 16 to produce a very lean mixture. This mixture, issuing from the orifice 3 and thus delivered to the burner 15, is so lean as to render difficult or impossible the ignition of the latter burner. On the other hand, if the relative lengths of the inner and outer nozzles are such as will separate their respective orifices 11 and 3 by too great a distance, a back pressure will build up in the outer nozzle that will cause some of the gas to escape through the nozzle 19 of the burner 16 with obvious undesirable consequences. Changes in the size of the orifices will require a different spacing between them, the larger the orifices the greater the distance, so that no fixed rule can be formulated to govern the proportion and relation of the parts; but it may be said that with the length of one of the nozzles and the size of the orifices of both decided upon, the other nozzle may be made of a length that will so space its orifice from that of the other that a very slight aspirating effect will be discernible, as at the nozzle 19 in the installation shown. Obviously, a slight indication of aspiration is preferable to none at all, as it insures against any possible back pressure that would result in the escape of gas; yet the aspirating effect is so slight as to avoid such leanness of the mixture as would interfere with ignition. It may further be pointed out that the distance between the orifices of the two nozzles is not a critical one, requiring fine adjustment, but is readily obtainable well within practical, commercial tolerances.

Tendencies toward suction or back pressure are entirely avoided in the form of multiple nozzle illustrated in Fig. 4.

Except for the multiple nozzle, Fig. 4 is intended to illustrate a part of a system identical with that shown in Fig. 3. Accordingly, all parts appearing in Fig. 4 that are the same as those appearing in Fig. 3 will be designated by like reference numerals, augmented by the exponent *a*.

Referring to Fig. 4, the multiple nozzle, designated generally by the reference numeral 60, is shown as T shaped, and the branch 61 that corresponds to the stem of the T is externally threaded and screwed through the central boss 5^a of the mixer or Venturi tube 6^a that leads to the burner 15^a. By a central longitudinal partition 62, the interior of the multiple nozzle is divided into ducts or passageways 63 and 64, the former corresponding to the bore or duct of the outer nozzle 1, and the latter to the bore or duct of the inner nozzle 10, of the previously described form of the multiple nozzle. The front wall of the branch 61 is provided with orifices 65 and 66 through which the gas issues from the respective ducts or passageways 63 and 64.

The gas is supplied to said passageways through the respective lateral hollow bosses or extensions 67 and 68 which together comprise the part of the structure that corresponds to the cross of the T. Connected to the extension 67, by a union 28^a, is a pipe or conduit 27^a that leads from a solenoid valve 26^a. The other extension 68 of the multiple nozzle is connected, through a union 22^a, with one fork of a branched conduit 23^a which, through its other fork, may lead to one or more additional burner or burners, said branched conduit having connection with a solenoid valve 25^a. Gas is supplied to both solenoid valves through pipes or conduits 31^a and 32^a, the latter of which includes a pressure regulator 33^a.

The supply of air to the mixer or Venturi tube 6^a is controlled by a damper 8^a that is threaded upon and adjustable along the branch 61 of the multiple nozzle 60.

The operation of the system involving the modified form of the multiple nozzle will be readily understood from that of the form previously described.

Having thus described our invention, what we claim is:

1. In a system of the class described, a plurality of atmospheric gas burners, one of the burners including two gas nozzles, a common source of gas supply for the plurality of burners, two branch conduits leading from said source, the first of said branch conduits communicating exclusively with one of the aforesaid gas nozzles and the second communicating with the other gas nozzle and with the remainder of the burners, a valve in each branch conduit, and means for either operating the valve in the first branch conduit only, or for operating the valves in both branch conduits simultaneously.

2. In a system of the class described, a plu-

ality of atmospheric gas burners, one of the burners incorporating a mixing tube and a dual passage gas nozzle that discharges into said tubes, a source of gas supply common to the plurality of burners, two branch conduits leading from said source, the first branch conduit communicating exclusively with one passage of the aforesaid gas nozzle and the second branch conduit communicating with the other passage of said nozzle and with the remainder of the burners, a valve in each branch conduit, and means for either operating that valve which is in the first mentioned branch conduit only, or for operating the valves in both branch conduits simultaneously.

3. In a system of the class described, a plurality of atmospheric gas burners, one of the burners incorporating a mixing tube and a dual passage gas nozzle that discharges into said tube, a source of gas supply common to the plurality of burners, two branch conduits leading from said source, the first branch conduit communicating exclusively with one passage of the aforesaid gas nozzle and the second branch conduit communicating with the other passage of said gas nozzle and with the remainder of the burners, two valves, one in each branch conduit, two electrical devices, one for operating each of said valves, a room thermostat incorporating two sets of contacts that operate in a given sequence, a circuit including one set of contacts and one of said electrical devices, another circuit including the other set of contacts and the second of said electrical devices, and means for igniting the burners.

4. In a system of the class described, a plurality of atmospheric gas burners, one of said burners incorporating a mixing tube and a dual passage gas nozzle that discharges into said tube, a source of gas supply common to the plurality of burners, two branch conduits leading from said source, the first branch conduit communicating exclusively with one passage of the aforesaid gas nozzle and the second branch conduit communicating with the other passage of said gas nozzle and with the remainder of the burners, two valves, the first in the first branch conduit and the second in the second branch conduit, two electrical devices, the first for operating the first valve and the second for operating the second valve, a room thermostat incorporating a first and a second set of contacts that close in the order named as the thermostat operates in response to a drop in temperature and that open in reverse order as the thermostat operates in response to a rise in temperature, a circuit including the first set of contacts and the first electrical device, another circuit including the second set of contacts and the second electrical device, and means for igniting the burners.

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