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3,156,292

GAS BURNER WITH SECONDARY AIR SUPPLY

Filed April 24, 1961

3 Sheets-Sheet 1

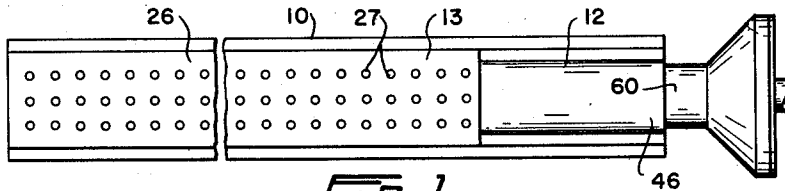


FIG. 1.

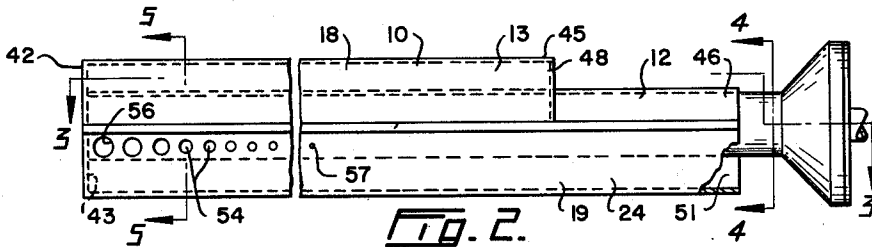


FIG. 2.

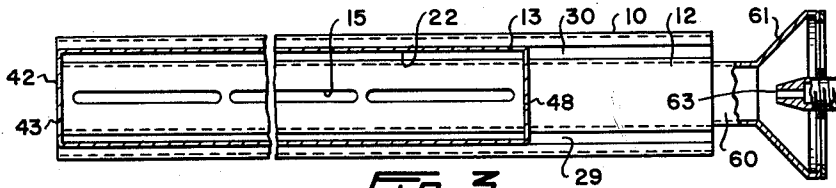


FIG. 3.

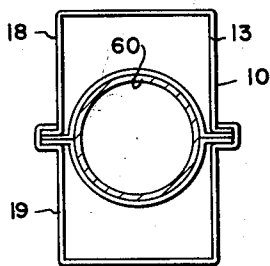


FIG. 4.

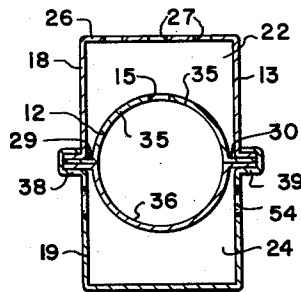


FIG. 5.

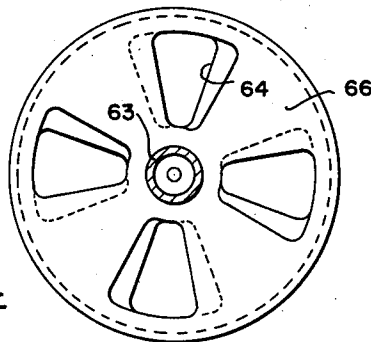


FIG. 6.

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GAS BURNER WITH SECONDARY AIR SUPPLY

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3 Sheets-Sheet 3

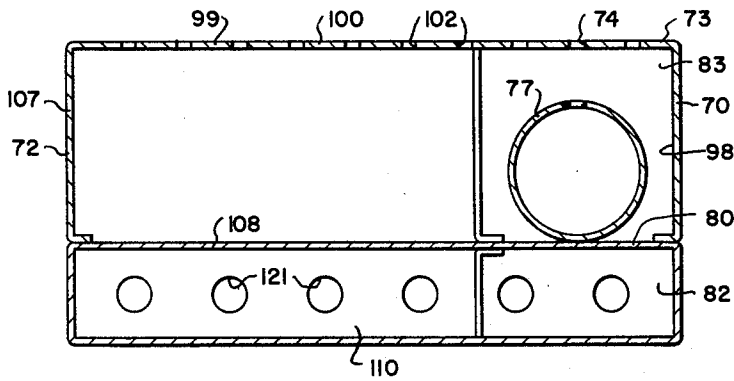


Fig. 13.

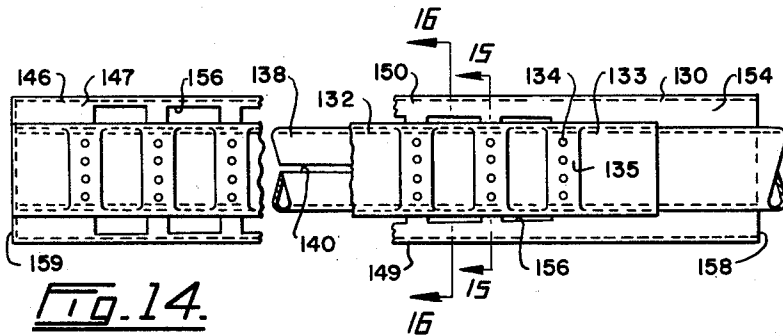


Fig. 14.

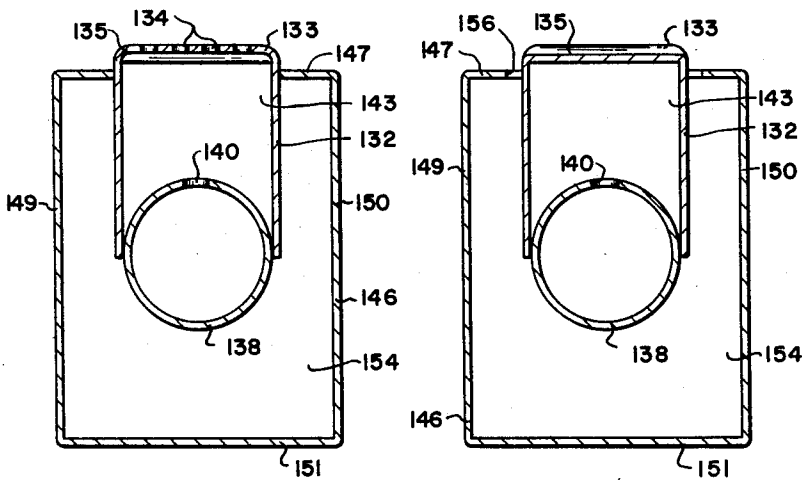


Fig. 15.

Fig. 16.

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GAS BURNER WITH SECONDARY AIR SUPPLY

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6 Claims. (Cl. 158-114)

This invention relates to gas burners, and particularly to relatively long burners operating in restricted places where a secondary air supply is required.

An object of the present invention is the provision of a gas burner that will meter gas along its entire length to ensure an evenly burning flame all the way therealong.

Another object is the provision of a long gas burner including means for supplying secondary air to burning gas at the inner end of said burner in order to prevent suffocation of the inner jets due to lack of oxygen.

A further object is the provision of a gas burner of a length previously not thought possible for efficient operation.

All gas burners used in domestic furnaces today are subject to regulations which control the pressure of gas and the diameter of the supply pipe which connects with the furnace controls. At peak demand the maximum gas pressure permissible is seldom, if ever, reached. Yet the diameter of the direct supply pipe is coincidental with maximum pressure. In order to cope with these precautionary regulations, gas burners marketed today are restricted in length and, therefore, in performance. Most of them have a flame-area length of approximately 14½ inches. A relatively few have a flame-area length of 16 inches, but in overall performance these do not operate with the same efficiency as the shorter burners as the rear flames of the longer burners suffer from air shortage causing intermittent periods of suffocation of the rear flames, thus making them pop on and off. Also, the flames at the inner end of the longer burners are shorter than those at the forward end as the latter has first claim on incoming gas which is not evenly proportioned throughout the length of the burner. This condition contributes to inefficiency. Moreover, the length of burner efficiency exercises influence over furnace design, whereas the reverse should be the principle followed.

The present invention overcomes this unequal distribution of gas and free air by metering the gas or gas-air mixture practically along the entire length of the flame-area of the burner and supplying secondary air to the gas outlets, thereby making practical a much longer burner that will operate with efficiency.

The present long burners have been tested many times in the confined quarters of a furnace pre-heater, not only in a straight, horizontal design, but also in an L-shape, with the hook part at the rear where oxygen and gas starvation has previously existed. A continuous blue flame burned evenly along the entire burner surface for prolonged periods during each test. At no time did the burner under test suffer from either a shortage of gas-air mixture or oxygen. Moreover, the burner length of the tested burner exceeded 21 inches and operated efficiently at different calorific levels, varying from 20,000 B.t.u.'s to 40,000 B.t.u.'s without altering the diameter of the orifices, but by merely changing the capacity of the supply jet feeding the burner. At the higher capacity the length of the flames increased, but at all levels the flame remained consistently blue in color, thereby providing efficiency in combustion.

A gas burner according to the present invention comprises an elongated closed casing having a top with burner outlet means therein throughout substantially the length thereof. This casing forms a distribution chamber immediately beneath the outlet means thereof. A supply channel extends along the casing and has restricted gas

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outlet means opening into the distribution chamber extending longitudinally thereof and beneath the casing top. The restricted gas outlet means is preferably in the form of a narrow slot extending longitudinally of the supply channel or pipe, but it may be a plurality of small aligned orifices. This channel is adapted to supply a gas-air mixture through the gas outlet means to the distribution chamber throughout a substantial portion of the length thereof. As the gas outlet means of the supply channel is restricted, there is always a sufficient supply of the gaseous mixture throughout the entire length of the channel. Furthermore, it is preferable to have the total area of the gas outlet means of the channel greater than the total area of the burner outlet means of the casing.

Examples of this invention are illustrated in the accompanying drawings, in which,

FIGURE 1 is a plan view of a preferred form of gas burner,

FIGURE 2 is a side elevation of this burner,

FIGURE 3 is a horizontal section taken on the line 3-3 of FIGURE 2,

FIGURE 4 is an enlarged cross section taken on the line 4-4 of FIGURE 2,

FIGURE 5 is an enlarged cross section taken on the line 5-5 of FIGURE 2,

FIGURE 6 is an elevation of the outer end of the burner,

FIGURE 7 is a plan view of an alternative form of gas burner,

FIGURE 8 is an elevation of the outer end of the burner of FIGURE 7,

FIGURE 9 is an elevation of the inner end of the latter burner,

FIGURE 10 is a side elevation of the burner of FIGURE 7,

FIGURE 11 is an enlarged section taken on the line 11-11 of FIGURE 7,

FIGURE 12 is an enlarged cross section taken on the line 12-12 of FIGURE 7,

FIGURE 13 is a longitudinal section taken on the line 13-13 of FIGURE 7,

FIGURE 14 is a fragmentary plan view of still another alternative form of gas burner,

FIGURE 15 is a cross section taken on the line 15-15 of FIGURE 14, and

FIGURE 16 is a cross section taken on the line 16-16 of FIGURE 14.

Referring to FIGURES 1 to 6 of the drawings, 10 is a preferred form of gas burner comprising a supply channel or pipe 12 and a casing 13 which are co-extensive. Channel 12 has restricted gas outlet means 15 which in this example is in the form of a slot that extends longitudinally of the channel within the casing 13.

Casing 13 is formed by an upper section 18 and a lower section 19 respectively above and below pipe 12. Upper section 18 forms a distribution chamber 22, while lower section 19 forms a duct 24, said chamber and duct extending longitudinally of pipe or channel 12. The casing also has a top 26 with burner outlet means 27 therein throughout substantially the length thereof. The burner outlet means is preferably in the form of a plurality of orifices as clearly shown in FIGURE 1, but they may be in the form of slits or the like, if desired. Suitable means is provided for separating chamber 22 and duct 24 from each other and this may be in the form of flanges 29 and 30 projecting laterally from duct 12 and connected to the side walls of casing 13. It is preferable to make the total area of slot 15 greater than the total area of orifices 27.

Channel 12 and casing 13 may be formed in any convenient manner. One very satisfactory way of doing this

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is to form channel 12 in upper and lower semi-circular sections 35 and 36 having mating lateral flanges which together form flanges 29 and 30 mentioned above. The upper and lower sections 18 and 19 of casing 13 oppose each other and have side flanges 38 and 39 which are crimped or pressed over pipe flanges 29 and 30 to form the complete unit.

Inner end 42 of casing 13 is closed by a wall 43. Channel or pipe 12 preferably extends to this wall so that said wall closes the pipe or channel. The opposite or outer end 45 of the casing may extend all the way to the adjacent end 46 of channel 12, but it is preferable to terminate the upper section 18 of the casing short of channel end 46, as clearly shown in FIGURE 2, in which case the outer end 45 of the casing is closed by a wall 48, which fits over the top of channel 12. The lower section 19 of the casing preferably extends to channel end 46, and is open to form an entrance 51.

The duct 24 formed by lower section 19 of casing 13 has a discharge outlet adjacent the inner end 42 of said casing. In this example, the discharge outlet is in the form of a plurality of orifices 54 formed in either or both of the side walls of lower section 19. These orifices may all be the same size, but it is preferable to grade them from a comparatively large orifice 56 at the inner end of the duct outwardly to a small orifice 57 spaced from said end, as clearly shown in FIGURE 2.

A mixing tube 60 fits into the outer end 45 of channel 12, and has a conical outer end 61. A gas jet 63 is mounted centrally of this conical end in the usual manner, and said end has a plurality of openings 64 therein, the effective sizes of which are adjusted by movably mounting shutters 66. This is standard practice in gas burner equipment. A gas supply pipe, not shown, is connected to jet 63 when this apparatus is in operation.

When burner 10 is mounted in a heating unit and jet 63 connected to a gas supply pipe, it is ready for operation. When the gas is turned on, gas and air mix in tube 60 and travel along channel 12. As slot 15 is small relative to the cross sectional area of the channel, it forms a restricted outlet from said channel extending the length of distribution chamber 22. As a result of this construction, the gaseous mixture is supplied to the entire chamber, and this mixture passes out of the chamber through the orifices 27 which are provided throughout the length of top 25 of said chamber, or throughout any desired portion of said top. Channel 12 acts as distributor and provides gas sufficient for all the orifices 27. The gas emerging from the orifices is burned in the usual manner. Burner 10 may or may not be provided with air duct 24. If it does not have the air duct, the burner may still be longer than the burners of the prior art in view of the fact that channel 12 provides gas for orifices 27 at the inner end of the burner as well as the outer end thereof. However, if the burner is relatively long, it is necessary to provide secondary air for combustion at its inner end. Duct 24 with its discharge outlet at the inner end thereof in the form of orifices 54 provides air for this purpose. The air travels along duct 24 and emerges through orifices 54, rising around the outside of casing 13 to provide the necessary air or oxygen for the flames at the gas orifices near the inner end of the burner.

FIGURES 7 to 13 illustrate an alternative form of gas burner 70 which includes all of the main elements of burner 10. Burner 70 includes a casing 72 having a top 73 with burner outlet means in the form of a plurality of burner orifices 74 therein. This casing includes a channel or pipe 77 extending longitudinally therethrough and having restricted gas outlet means in the form of a longitudinal slot 78 in the top thereof spaced below casing top 73. A wall 80 extends across casing 72 at or near the bottom of channel 77 to form air duct 82 along the bottom of the casing. The top part of the casing forms a distribution chamber 83 which is in communication

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with the interior of channel 77 through the restricted opening or slot 78.

The upper section of casing 72 terminates at 85 spaced inwardly from the outer end 86 of the lower section of said casing, and a wall 87 closes the casing end 85. Pipe or channel 77 projects outwardly beyond end 85 of the upper section of the casing, and a mixing tube 90 fits into the outer end of the channel or pipe. This tube has an outwardly flared outer end 92 carrying the usual gas jet 93 and adjustable air inlet 94.

Casing 72 of burner 70 is formed in a main section 98 which is the equivalent of burner 10 described above, and with an end section 99 extending at an angle to said main section. End section 99 is formed with a top 100 that is an extension of casing top 73, said top 100 having a plurality of gas orifices 102 formed therein. Casing section 99 also has side walls 105 and 106, outer end walls 107, and a bottom 108. If desired, an air duct 110 may be provided beneath bottom 108, said duct being in communication with air duct 82. It will be noted that wall 105 extends at 112 across the inner end 113 of main casing section 98 to close said end and the adjacent end of duct 82. Channel or pipe 77 is cured at 115 and opens at 116 into the adjacent end of casing section 99. Duct 77 is adapted to discharge a gaseous mixture into casing section 99 to feed the burner orifices 102 thereof.

If desired, discharge orifices may be provided in the side walls of casing 72 near the inner end 113 thereof similar to orifices 54 of burner 10. In this case, it is not absolutely necessary to provide air duct 110 beneath section 99. However, it is preferable to provide duct 110 along with or in place of said discharge orifices, in which case a plurality of discharge orifices 120 and 121 are provided in walls 105 and 106 in communication with said air duct.

The main section 98 of gas burner 70 functions in the same manner as burner 10. Gas and air are mixed in tube 90 and then directed into and along duct 77. The gaseous mixture passes upwardly through the restricted slot 78 into distribution chamber 83 whence it passes out through burner orifices 74 to be burned. It is preferable that the total area of slot 78 be greater than the total area of the orifice 74 of main section 98 of the burner. Gas traveling along channel 77 is discharged into casing end section 99, and this gas is fed through burner orifices 102 in the same manner as in ordinary gas burners. However, if desired, channel 77 may extend to end 107 of section 99, in which case this portion of the channel would have a restricted slot extending longitudinally thereof in its top, the same as slot 78.

If duct 110 is provided, secondary air passing out through discharge orifices 120 and 121 flows upwardly around the outside of the casing to the flames above orifices 101. These discharge orifices also provide air for the flames at the inner end of main section 98 of the burner.

FIGURES 14 to 16 illustrate another alternative form of gas burner 139 including a closed ended inner casing 132 having a top 133 with burner outlet means therein in the form of burner orifices 134, said orifices preferably being arranged in spaced transverse rows formed in transverse ridges 135 pressed upwardly from top 133. The casing includes a channel or pipe 138 extending longitudinally thereof and forming a bottom for the casing, said channel or pipe having restricted gas outlet means in the form of a longitudinal slot 140 in the top thereof and spaced below casing top 133. Casing 132 forms a distribution chamber 143 which is in communication with the interior of channel 138 through the restricted opening or slot 140.

An outer casing 146 encloses and is spaced from pipe 138 and the lower portion of casing 132. The outer casing has a top 147 that extends laterally from casing 132 near the top thereof to two side walls 149 and 150 which extend downwardly to a bottom 151 for the outer casing.

The outer casing forms an air duct 154 which almost surrounds inner casing 132. A plurality of openings 156 are formed in outer casing top 147 throughout the length thereof and beside the portion of inner casing 132 that projects above top 147 at both sides of the inner casing. These openings may be the same size, but it is preferable progressively to increase the size thereof from adjacent entrance end 158 to inner end 159 of burner 130.

Mixed gas and air are supplied to pipe 138 in any suitable manner, such as in either of burner 10 or 70, while the outer end of casing 146 is open to permit air to enter said casing.

Burner 130 functions in much the same manner as the other two burners. A gas-air mixture travels along channel 138 and passes upwardly through the restricted slot 140 into distribution chamber 143, from which it passes through burner orifices 134 to be burned. It is preferable to make the total area of slot 140 greater than the total area of orifices 134. Secondary air from duct 154 flows upwardly through openings 156 in casing top 147 to burning gas along the top of the burner. The air openings 156 may be provided throughout the length of the burner, as shown, or they may be provided along any desired portion thereof, usually near its inner end. If said openings 156 are progressively larger towards the inner end of the burner, the volume of secondary air supplied to the burning gas becomes greater towards said inner end.

It has been found that the gas burners described above operate satisfactorily with different gas pressures without the necessity of altering the sizes of the burner orifices in the tops of the casings. If the capacity of the gas jet is changed, the flames above the gas orifices merely increase or decrease in length depending upon the change.

What I claim as my invention is:

1. A gas burner comprising a horizontal pipe having outer and inner ends and restricted gas outlet means extending longitudinally of the top thereof, an elongated closed casing formed over the pipe and having outer and inner ends near the pipe outer and inner ends respectively, said casing having a top spaced from the pipe top and with burner outlet means therein, said casing forming a distribution chamber, an entrance at the outer end of the pipe through which air is admitted into the pipe, and means for directing a combustion gas into the air at the pipe entrance, said pipe being adapted to direct an air-gas mixture through the gas outlet means to the chamber throughout a substantial portion of the length thereof, whereby said chamber provides an even distribution of air-gas mixture through said burner outlet means for burning along the casing top, and an air duct formed over the bottom of the pipe with an inlet and an outlet respectively near the outer and inner ends of the pipe, said duct being adapted to supply air to the burner outlet means outside the casing and near the inner end thereof.

2. A gas burner comprising a horizontal pipe having outer and inner ends and restricted gas outlet means extending longitudinally of the top thereof, an elongated closed casing enclosing the pipe and having outer and inner ends near the pipe outer and inner ends respectively, said outer end of the pipe projecting from the casing, said casing having a top spaced from the pipe top and with burner outlet means therein, means extending longitudinally of the casing dividing said casing into an upper distribution chamber and a lower air duct, an entrance at the outer end of the pipe through which air is admitted into the pipe, and means for directing a combustion gas into the air at the pipe entrance, said pipe being adapted to direct said gaseous mixture through the gas outlet means to the chamber throughout a substantial

portion of the length thereof, whereby said chamber provides an even distribution of air-gas mixture through said burner outlet means for burning along the casing top, and said duct having an inlet and outlet respectively near the outer and inner ends of the pipe and being adapted to supply air to the burner outlet means outside the casing and near the inner end thereof.

3. A gas burner comprising an elongated closed casing formed with an end section extending at an angle to a main section, said casing forming a distribution chamber and having a top with burner outlet means therein throughout substantially the length thereof, a supply channel extending along the main section of the casing and opening into the end section thereof, said channel having restricted gas outlet means opening into the distribution chamber formed by the main section of the casing and extending longitudinally thereof beneath said top, means for admitting air into said supply channel, and means for directing a combustion gas into the air being admitted to the supply channel, said channel being adapted to supply an air-gas mixture through the gas outlet means to the chamber throughout a substantial portion of the length thereof and to the end section of the casing through the end of the casing opening into said end section, whereby said chamber provides an even distribution of air-gas mixture through said burner outlet means and in the casing end section for burning along the casing top, and an air duct at the casing with a discharge outlet along the bottom of the end section thereof to supply air to the burner outlet means outside the casing and at said end section.

4. A gas burner comprising a horizontal pipe having outer and inner ends and restricted gas outlet means extending longitudinally of the top thereof, an elongated inner casing formed over the pipe and having outer and inner ends near the pipe outer and inner ends respectively, said casing having a top spaced from the pipe top and with burner outlet means therein, said casing forming a distribution chamber, an entrance at the outer end of the pipe through which air is admitted into the pipe, means for directing a combustion gas into the air at the pipe entrance, said pipe being adapted to direct an air-gas mixture through the gas outlet means to the chamber throughout a substantial portion of the length thereof, and an outer casing enclosing the pipe and the lower portion of the inner casing and forming an air duct extending longitudinally of said pipe and inner casing, and a top on the outer casing near the inner casing top and having openings therein throughout at least a portion of the length of said outer casing, said duct being adapted to supply air through said opening to the burner outlet means outside the inner casing.

5. A gas burner as claimed in claim 4 in which the opening in the outer casing top is progressively larger towards the inner end of the burner.

6. A gas burner as claimed in claim 4 in which the burner outlet means of the inner casing top is in spaced transverse ridges projecting upwardly from said top.

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