Nov. 5, 1940. F. S. KOCHENDORFER ET AL 2,220,247

BURNER FOR HYDROCARBON GASES

Filed Sept. 22, 1938 2 Sheets-Sheet 1

Fig. 1.

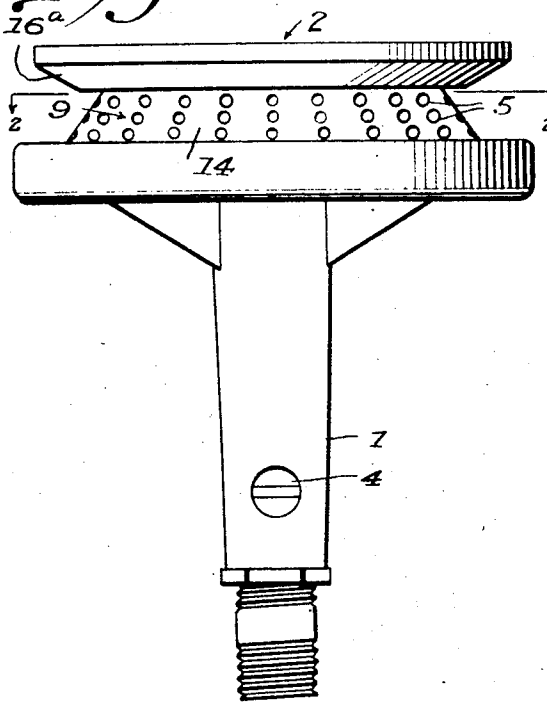


Fig. 3.

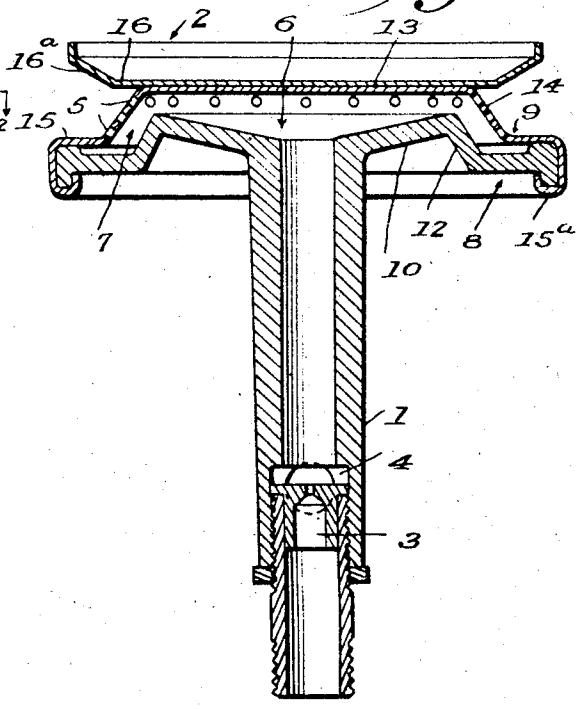


Fig. 2.

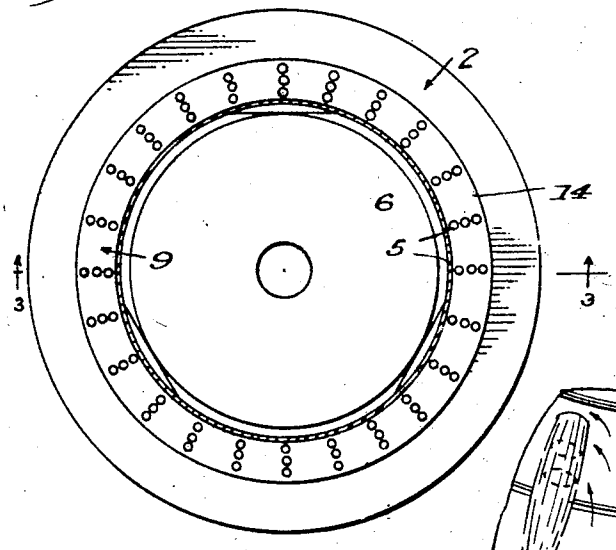


Fig. 4.

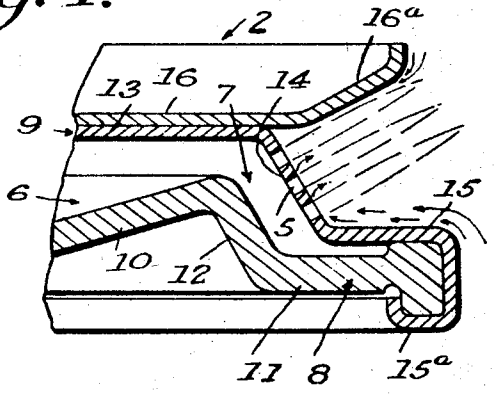
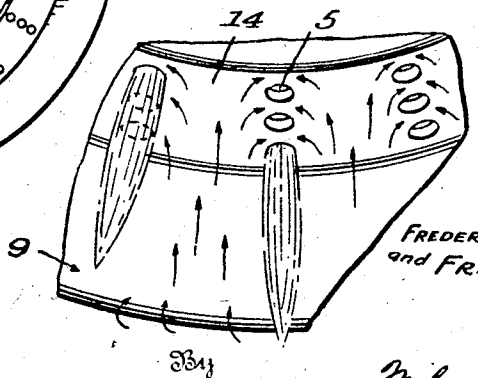


Fig. 5.



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Nov. 5, 1940. F. S. KOCHENDORFER ET AL 2,220,247

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Filed Sept. 22, 1938 2 Sheets-Sheet 2

Fig. 6.

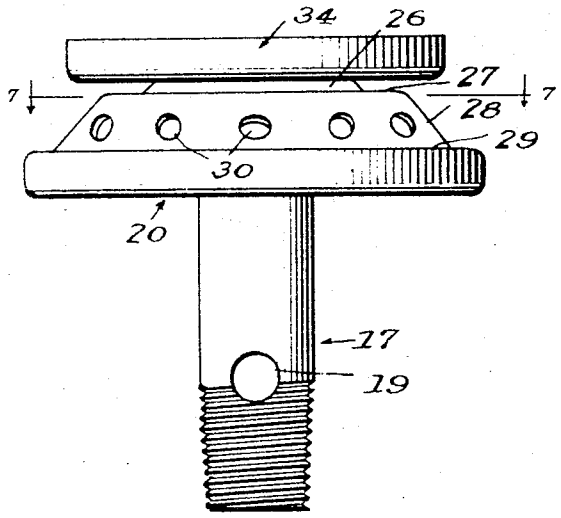


Fig. 8.

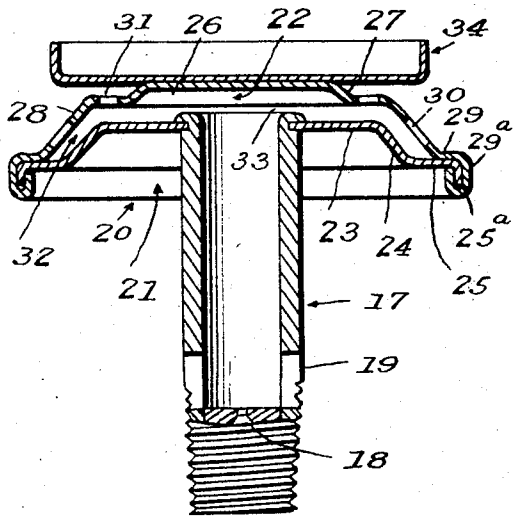


Fig. 7.

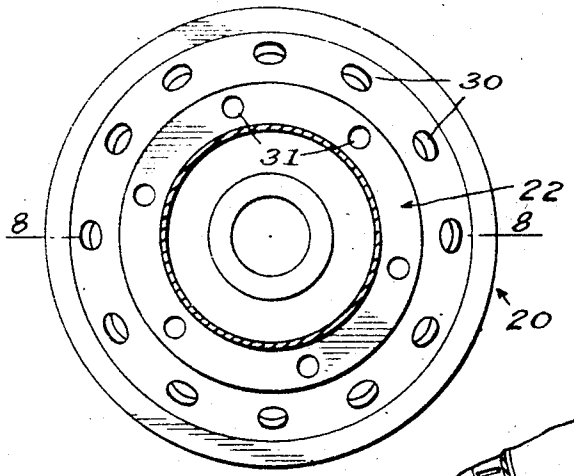
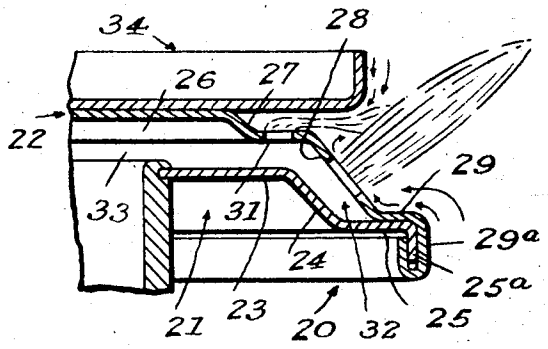


Fig. 9.



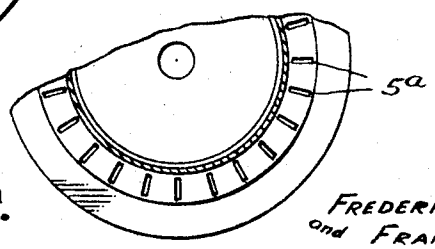


Fig. 10.

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BURNER FOR HYDROCARBON GASES

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Application September 22, 1938, Serial No. 231,264

10 Claims. (Cl. 158—116)

This invention relates to improvements in burners for hydrocarbon gases, and more particularly to burners of the type disclosed in Patent No. 2,061,561 issued November 24, 1936 to William G. Cartter.

Objects of the invention are to provide for increasing the supply of secondary air and preventing flashing-back into the burner, and to provide an improved burner that will operate quietly and with a hotter flame.

In the patent referred to above is disclosed a burner having a plurality of discharge jets along the same with a flange below the discharge jets to cooperate therewith in causing a steady flow of incoming air along the inner side of the flange and a steady outwardly flowing current of air next to the flames issuing from the discharge jets whereby the outwardly flowing current of air and the jetted mixture are retarded, and an additional supply of secondary air is carried to the exterior openings of the discharge jets. A particularly important novel feature of the present invention resides in a construction of the general kind referred to, in the spacing of the discharge jets laterally from each other a sufficient distance to leave room between the same for inwardly and outwardly flowing currents of air so that an incoming current of air enters between the discharge jets and entirely surrounds the flames, and the supply of secondary air is materially increased.

Another important novel characteristic of the present invention resides in the particular construction including, in combination, a flange above the discharge jets and a flange below the jets, each arranged to cooperate with the discharge jets to cause a steady flow of incoming air along the inner side of the flange, together with the arrangement of the discharge jets spaced apart sufficiently to create an inward flowing current of air between the same.

A further important novel feature of the invention lies in the provision of a narrow passageway or throat portion leading from the interior of the burner to the plurality of discharge jets, and which retards somewhat the flow of gas through the discharge jets and at the same time with the cooling effect of the mixing tube, diminishes to a considerable degree the danger of flash-back.

The invention, with other objects, novel features and advantages thereof, and the particular construction, combinations, and arrangements of parts comprising the same, will be understood from the hereinafter contained detailed description when considered in connection with the accompanying drawings forming part hereof and illustrating two embodiments of the invention.

In the drawings:

Figure 1 is an elevation of a burner constructed in accordance with the present invention.

Fig. 2 is a horizontal section on the line 2—2 of Figure 1.

Fig. 3 is a vertical section on the line 3—3 of Figure 2.

Fig. 4 is a fragmentary vertical section, and Fig. 5 is a fragmentary plan view, both on an enlarged scale, to illustrate the shape of the flames issuing from the discharge jets and the course of the incoming air currents relatively thereto.

Fig. 6 is an elevation of a modified construction.

Fig. 7 is a horizontal section, on the line 7—7 of Figure 6.

Fig. 8 is a vertical section on the line 8—8 of Figure 7.

Fig. 9 is a fragmentary vertical section, on an enlarged scale, of the modified construction illustrated in Figure 6.

Fig. 10 is a fragmentary top plan view of the construction of burner head illustrated in Figure 2 provided with discharge jets in the form of narrow slits.

While two preferred embodiments of the invention are illustrated in the drawings, it will of course be understood that minor changes and modifications may be made in the particular constructions shown, and the invention may be embodied in other forms as will appeal to those skilled in the art and falling within the scope of the appended claims, without departing from the spirit of the invention.

Referring to a detailed description of the particular embodiment of the invention illustrated in Figures 1 to 5 of the drawings, the construction shown comprises a mixing tube 1 and an enlarged upper head part 2. The mixing tube, which communicates with the burner head centrally thereof, has the conventional gas inlet 3 and air inlets 4.

The upper part or head of the burner is provided with a plurality of lateral discharge jets 5 and a mixture receiving chamber 6 with a narrow annular passageway or throat 7 leading therefrom to the plurality of discharge jets. The burner head is shown as formed by a bottom plate 8 and a top plate 9. The bottom plate 8

has a central upwardly and outwardly flaring part 10 and an outer annular horizontal portion 11 joined to the central part 10 by a relatively short downwardly flaring wall portion 12.

The top plate 9 has a flat central part 13, an intermediate downwardly flaring annular portion 14 and an outer annular horizontal wall portion or flange 15, the latter fitting against an outer marginal part of the horizontal wall portion 11 of the bottom plate and having an extension 15a bent around the same to secure the plates together. The flange 15, as shown, connects with the downwardly flaring portion 14 near to the rows of discharge jets 5 and extends outwardly beyond the same at an angle therewith. The discharge jets 5 preferably take the form of openings in the downwardly flaring portion 14 of the top plate 9, and in this instance are relatively small and arranged in vertical rows, as shown, but may be narrow slits if desired, as illustrated in Figure 10 of the drawings, the discharge jets being designated 5a in this view. The burner is provided with a cap member having a flat part 16, fitting against and secured to the flat central part 13 of the top plate, said cap member having an outwardly and upwardly flaring annular marginal part or flange 16a extending above and outwardly beyond the discharge jets 5.

The arrangement of the annular horizontal portion or flange 15 of the top plate and of the annular marginal part or flange 16a of the cap member relatively to the discharge jets 5 is such that each of said flanges acts to control the supply of secondary air to the flames issuing from the discharge jets to bring the point of combustion back to the exterior openings of the same. Each flange cooperates with the discharge jets in causing a steady flow of incoming air along the inner side of the flange and a steady outwardly flowing current of air next to the flames issuing from the discharge jets, whereby the outwardly flowing current of air and the jetted mixture are retarded.

In accordance with the present invention, the rows of discharge jets are spaced a sufficient distance apart so as to create an inward flowing current of air between the rows of discharge jets which inflowing current of air feeds the outwardly flowing current created by the jets of mixture. This special arrangement is highly important. By it the supply of secondary air to the jets of mixture is materially increased, the purpose of the particular arrangement being to provide for free access of secondary air to the outside of every jet of mixture, to create, as nearly as possible, the same condition of air supply that would exist with a single jet of mixture operating or blowing out into free air.

The upper end of the mixing tube 1, as shown in Figure 4, is of concave shape, forming a continuation of the adjoining concaved inner face of the central part 10 of the bottom plate 8. This increases the size of the mixture receiving chamber 6 of the burner to receive a greater volume of gas, and by its creation of eddy currents, acts to make a more perfect mixture.

The earlier device disclosed in the patent hereinbefore mentioned, to a considerable extent counteracts the noise and danger of back-flashing but in the commercial use of this earlier device, two difficulties developed. It was found that with certain forms of gas, it was almost impossible to prevent entirely the flashing-back into the burner and also that, with certain kinds of gas, the velocity of the gas passing through the burner necessary to prevent flashing-back, was so great as to force the igniting point away from the exterior opening of the discharge jet and produce more or less noise.

In our improved device hereinbefore described, with the discharge jets spaced laterally farther apart a sufficient distance to leave room for the free entrance of the incoming secondary air between the same, the incoming air entirely surrounds the individual flames, and the supply of secondary air is materially increased. This increased supply of secondary air makes it possible to use a much richer mixture, that is, one that contains a greater proportion of gas to the amount of air in the primary mixture. This difference is of great importance in that the richer mixture is much less liable to flash-back into the burner.

The narrow passageway or throat 7 of the burner serves to retard somewhat the flow of gas through the discharge jets 5 and this with the cooling effect of the mixing tube is effective in diminishing to a considerable degree the danger of flash-back.

The modified construction illustrated in Figures 6 to 9 of the drawings, is especially adapted to the smaller forms of burners. This, like the construction hereinbefore described and illustrated in Figures 1 to 5, has upper and lower annular portions or flanges arranged relatively to lateral discharge jets to control the supply of secondary air to the flames issuing therefrom to bring the point of combustion back to the exterior openings of the discharge jets. It has the lateral discharge jets spaced apart laterally around the burner a sufficient distance so as to create an inward flowing current of air intermediate the discharge jets.

It also has the feature of the constricted annular passageway leading from the mixing chamber to the discharge jets, but in this embodiment of the invention instead of the vertical rows of relatively small lateral discharge jet openings spaced circumferentially of the burner, single larger discharge jet openings are provided, and secondary vertical discharge jet openings are provided in the top wall of the burner inwardly of the lateral discharge jets.

In Figures 6 to 9, 17 designates the mixing tube having the usual gas inlet 18 and air inlets 19. 20 is the enlarged upper head part composed of a pair of plates 21 and 22. The bottom plate 21 has a flat central part 23, an outwardly and downwardly flaring intermediate part 24 and an outer horizontal part 25. The top plate 22 has an upwardly cupped central part 26, an adjoining annular horizontal portion 27, and an outwardly and downwardly flaring portion 28 joining an outer flat horizontal part or flange 29. This horizontal part or flange of the top plate fits against the outer annular horizontal part 25 of the bottom plate 21, and these parts are provided with extensions 25a and 29a, which are folded, as shown, to secure the plates together. 30 designates the lateral discharge jet openings and 31 the secondary vertical discharge jet openings formed in the top plate. 32 is the narrow annular passageway leading from the mixing chamber 33 to the discharge jet openings 30 and 31. By the upwardly cupped central part 26 of the top plate, the size of the mixing chamber 33 is enlarged in an analogous way to the enlargement of the mixing chamber by the upwardly flaring central part of the bottom plate in the construction shown in Figures 1 to 5, to receive a

greater volume of gas and by its creation of eddy currents to make a better mixture.

The burner head is provided with a cap **34** secured onto the flat top wall of the upwardly cupped central part **26** of the top plate **22**. This cap, as shown in Figure 8, projects outwardly beyond the upwardly cupped part **26** a short distance above the vertical discharge jet openings **31**. The space between the horizontal portion **27** of the top plate and the cap **34** is small, consequently the gases escaping from the vertical discharge jets do not ignite until they reach the outer edge of the burner head and they serve to insure the ignition of the mixture issuing from all of the lateral discharge jets **30**. They also add a considerable amount of gas to the quantity of gas consumed by the burner and at the same time lower the pressure within the same, and thereby lessen the liability to noise.

The horizontal portion or flange **29** of the top plate **22** and the outer part of the cap **34**, each cooperates with the lateral discharge jets **30** to control the supply of secondary air to the flames issuing from said jets, in the same way as the flanges **15** and **16a** in the construction illustrated in Figures 1 to 5, and said lateral discharge jets are spaced laterally from each other a sufficient distance to create an inward flowing current of air between the same. Both forms of the device illustrated in the drawings make each jet of mixture operate practically as in free air, both constructions also enable the use of a richer mixture and decrease the danger of flash-back, and because of the use of the richer mixtures, make it possible to reduce the velocity of flow through the discharge jets without increasing the danger of flashing-back, thus keeping the igniting point of the gas at the mouths of the discharge jets, and thereby lessening noise in the operation of the burner.

What we claim is:

1. In a burner for the consumption of hydrocarbon gases, said burner being provided with a plurality of discharge jets, a mixing tube, and inlets for the admission of gas and air to the mixing tube, and a flange on the burner extending laterally to one side of the horizontal plane of said discharge jets, said flange being secured in immediate proximity to said discharge jets near the mouths thereof and having a portion extending outwardly beyond the mouths of the discharge jets and diverging therefrom, said flange cooperating with the discharge jets in causing a steady flow of incoming air along the inner side of the flange and a steady outwardly flowing current of air next to the flames issuing from the discharge jets, said discharge jets being spaced laterally from each other a sufficient distance to create an inward flowing current of air between the same so that an incoming current of air enters between the discharge jets and entirely surrounds the flames, and the supply of secondary air is materially increased.

2. In a burner for the consumption of hydrocarbon gases, said burner being provided with a plurality of discharge jets, a mixing tube, and inlets for the admission of gas and air to the mixing tube, and a flange on the burner arranged below said discharge jets, said flange being secured in immediate proximity to said discharge jets near the mouths thereof and having a portion extending outwardly beyond the mouths of the discharge jets and diverging therefrom, said flange cooperating with the discharge jets in causing a steady flow of incoming air along the inner side of the flange and a steady outwardly flowing current of air next to the flames issuing from the discharge jets, said discharge jets being spaced laterally from each other a sufficient distance to create an inward flowing current of air between the same so that an incoming current of air enters between the discharge jets and entirely surrounds the flames, and the supply of secondary air is materially increased.

3. In a burner for the consumption of hydrocarbon gases, said burner being provided with a plurality of discharge jets, a mixing tube, and inlets for the admission of gas and air to the mixing tube, a flange on the burner arranged above said discharge jets, and a flange on the burner arranged below said discharge jets, the flange below the discharge jets being secured to the burner in immediate proximity to said discharge jets near the mouths thereof, each of said flanges having a portion extending outwardly beyond the mouths of the discharge jets and diverging therefrom, and said flanges each cooperating with the discharge jets in causing a steady flow of incoming air along the inner side of the flange and a steady outwardly flowing current of air next to the flames issuing from the discharge jets, said discharge jets being spaced laterally from each other a sufficient distance to create an inward flowing current of air between the same so that an incoming current of air enters between the discharge jets and entirely surrounds the flames, and the supply of secondary air is materially increased.

4. In a burner for the consumption of hydrocarbon gases, said burner being provided with a plurality of approximately radially disposed discharge jets, a mixing tube, and inlets for the admission of gas and air to the mixing tube, and a flange on the burner extending laterally to one side of the horizontal plane of the discharge jets, said flange being secured in immediate proximity to said discharge jets near the mouths thereof and having a portion extending outwardly beyond the mouths of the discharge jets and diverging therefrom, said flange cooperating with the discharge jets in causing a steady flow of incoming air along the inner side of the flange and a steady outwardly flowing current of air next to the flames issuing from the discharge jets, said discharge jets being spaced laterally from each other a sufficient distance to create an inward flowing current of air between the same so that an incoming current of air enters between the discharge jets and entirely surrounds the flames, and the supply of secondary air is materially increased.

5. In a burner for the consumption of hydrocarbon gases, said burner being provided with vertical rows of discharge jets about the same, a mixing tube, and inlets for the admission of gas and air to the mixing tube, and a flange on the burner extending laterally to one side of the vertical rows of discharge jets, said flange being secured in immediate proximity to the rows of discharge jets near the mouths of end discharge jets thereof and having a portion extending outwardly beyond the mouths of the discharge jets and diverging therefrom, said flange cooperating with the discharge jets in causing a steady flow of incoming air along the inner side of the flange and a steady outwardly flowing current of air next to the flames of the discharge jets, the vertical rows of discharge jets being spaced laterally from each other a sufficient distance to create an inward flowing current of air between the same so that an incoming current of air enters between

the rows of discharge jets and entirely surrounds the flames, and the supply of secondary air is materially increased.

6. In a burner for the consumption of hydrocarbon gases, said burner having an annular outwardly and downwardly flaring side wall provided with a plurality of discharge jet openings about the same, a flange on the burner extending outwardly from the top of the side wall above said jet openings, a mixing tube, and inlets for the admission of gas and air to the mixing tube, and a flange on the burner arranged below said jet openings, the flange below the jet openings being secured to the burner in immediate proximity to said jet openings near the mouths thereof, each of said flanges having a portion extending outwardly beyond the mouths of the jet openings and diverging therefrom, and said flanges each cooperating with the jet openings in causing a steady flow of incoming air along the inner side of the flange and a steady outwardly flowing current of air next to the flames issuing from the jet openings, said jet openings being spaced laterally from each other a sufficient distance to create an inward flowing current of air between the same so that an incoming current of air enters between the jet openings and entirely surrounds the flames, and the supply of secondary air is materially increased.

7. In a burner for the consumption of hydrocarbon gases, said burner having an annular outwardly and downwardly flaring side wall provided with a plurality of discharge jet openings about the same, an outwardly and upwardly flaring annular flange on the burner extending from the top of the side wall above said jet openings, a mixing tube, inlets for the admission of gas and air to the mixing tube, and a horizontal flange on the burner below said jet openings, said last mentioned flange being secured in immediate proximity to said jet openings near the mouths thereof, and each of said flanges having a portion extending outwardly beyond the mouths of the jet openings and diverging therefrom, said jet openings being spaced laterally from each other a sufficient distance to create an inward flowing current of air between the same.

8. In a burner for the consumption of hydrocarbon gases, said burner being provided with a plurality of lateral discharge jets and with secondary vertical discharge jets above and inwardly of the first mentioned discharge jets, a mixing tube and inlets for the admission of gas and air to the mixing tube, a flange on the burner extending laterally above the vertical and lateral discharge jets, and a flange on the burner arranged below the lateral discharge jets, each of said flanges cooperating with the lateral discharge jets in causing a steady flow of incoming air along the inner side of the flanges and a steady outwardly flowing current of air next to the flames issuing from the lateral discharge jets, said lateral discharge jets being spaced laterally from each other a sufficient distance to create an inward flowing current of air between the same so that an incoming current of air enters between the lateral discharge jets and entirely surrounds the flames.

9. In a burner for the consumption of hydrocarbon gases, said burner being provided with a plurality of approximately radially disposed discharge jets and with secondary vertical discharge jets around the same above and inwardly of the first mentioned discharge jets, a mixing tube and inlets for the admission of gas and air to the mixing tube, a flange on the burner extending above the vertical and radially disposed discharge jets, and a flange on the burner arranged below the radially disposed discharge jets, each of said flanges cooperating with the radially disposed discharge jets in causing a steady flow of incoming air along the inner side of the flange and a steady outwardly flowing current of air next to the flames issuing from the radially disposed discharge jets, said last mentioned discharge jets being spaced laterally from each other a sufficient distance to create an inward flowing current of air between the same so that an incoming current of air enters between the radially disposed discharge jets and entirely surrounds the flames.

10. In a burner for the consumption of hydrocarbon gases, said burner being provided with a plurality of approximately radially disposed discharge jets, a mixing chamber that decreases in depth from the central part of the burner toward the periphery thereof and is free from obstruction, and a relatively narrow annular passageway leading from the outer shallower part of the mixing chamber directly to said discharge jets, a mixing tube communicating with the mixing chamber centrally thereof, inlets for the admission of gas and air to the mixing tube, and a flange on the burner extending laterally to one side of the horizontal plane of the discharge jets, said flange being secured in immediate proximity to said discharge jets near the mouths thereof and having a portion extending outwardly beyond the mouths of the discharge jets and diverging therefrom, said flange co-operating with the discharge jets in causing a steady flow of incoming air along the inner side of the flange and a steady outwardly flowing current of air next to the flames issuing from said discharge jets, and said discharge jets being spaced laterally from each other a sufficient distance to create an inward flowing current of air between the same so that the incoming current of air enters between the discharge jets and entirely surrounds the flames, and the supply of secondary air is materially increased.

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