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BURNER WITH FLAME SHAPING MEANS

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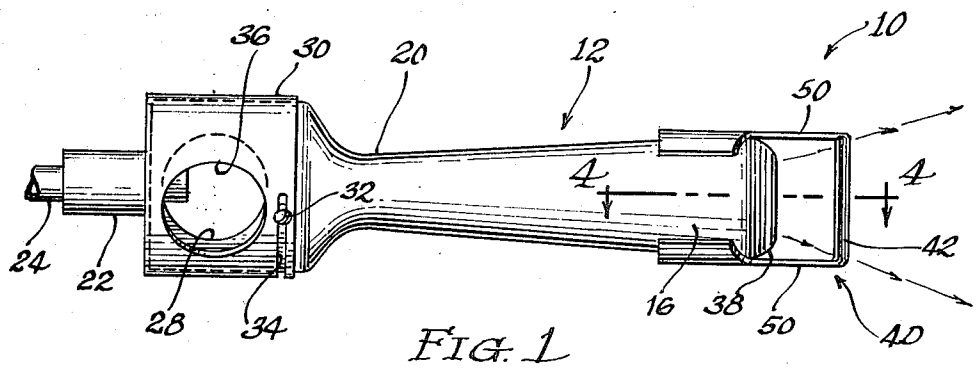


FIG. 1

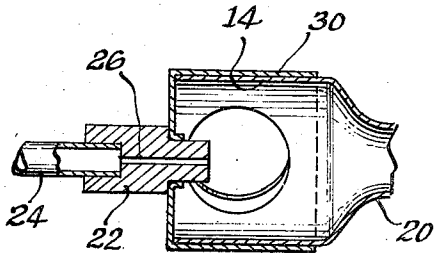


FIG. 2

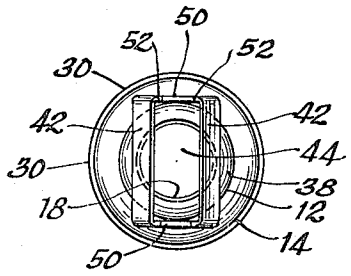


FIG. 3

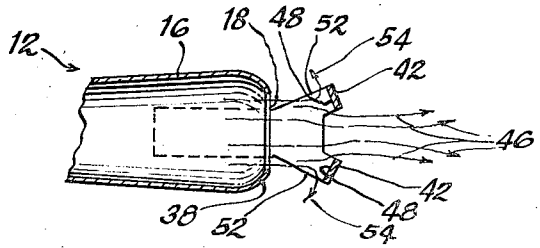


FIG. 4

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BURNER WITH FLAME SHAPING MEANS

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3 Claims. (Cl. 158—113)

This invention relates to burners for gaseous fuel, such as natural gas, manufactured gas, and so-called "bottled" gas derived from liquified petroleum gases.

One principal object of the present invention is to provide a new and improved burner adapted to produce a flame of a particular, desired shape, such as a thin, flat shape.

A further object is to provide a new and improved burner adapted to produce a flame that will fit into a heat exchanger of desired shape, particularly a flat oblong shape.

It is another object to provide a new and improved burner of the foregoing character which employs a mixing tube of circular cross section and with a single circular exit port, together with means for shaping the burner flame so that it will be flat and oblong in cross section.

A further object is to provide such a new and improved burner which is capable of producing an efficient, smokeless flame.

Another object is to provide such a new and improved burner that will produce an extremely high heat output.

Still another object is to provide such a new and improved burner which is so arranged that the flame will not be likely to flash back through the mixing tube.

Further objects and advantages of the present invention will appear from the following description, taken with the accompanying drawings, in which:

Fig. 1 is a side elevational view of an illustrative embodiment of the invention in the form of a burner for gaseous fuel.

Fig. 2 is an elevational sectional view of the portion of the burner adapted to receive the fuel and air.

Fig. 3 is an end elevational view looking toward the right hand or exit end of the burner shown in Fig. 1.

Fig. 4 is a horizontal sectional view of the exit end of the burner, taken generally along a line 4—4 in Fig. 1.

As already indicated, Fig. 1 illustrates a burner **10** adapted to utilize gaseous fuel, such as natural gas, manufactured gas, or liquified petroleum gas, for example. The burner **10** may be employed for various purposes. For example, the burner **10** has been found to be very advantageous for use as a source of heat in household clothes dryers. In such dryers, the burner is employed to heat air which in turn is utilized to dry the clothes.

Such a dryer or the like may include a heat exchanger which defines a chamber for the burner flame. The mechanical design of various household clothes dryers may make it advantageous to form the heat exchanger with this chamber in various shapes. For example, the heat exchanger may be formed with a fairly flat or narrow flame chamber which is oblong in cross section. The illustrated burner **10** may be employed very advantageously in connection with such a heat exchanger, because the illustrated burner is adapted to produce a flat, wide flame that will fit into such a flat, oblong flame chamber. Tailoring the shape of the flame to fit into the heat exchanger in this manner makes it possible to run the burner with maximum heat output, without danger that the

flame will generate an objectionable amount of carbon monoxide.

It will be seen that the illustrated burner **10** comprises a mixing tube **12** of circular cross section. The illustrated mixing tube **12** has an entrance portion **14** adapted to receive fuel and air. In this instance the entrance portion **14** is cylindrical in shape.

At its opposite end, the mixing tube **12** is formed with an exit portion **16** which terminates in a single, circular exit port **18** adapted to discharge a stream of mixed fuel and air. A venturi throat portion **20** is interposed between the entrance and exit portions **14** and **16** of the mixing tube **12**.

Gaseous fuel is introduced into the entrance portion **14** by a nozzle **22** connected to a supply pipe or conduit **24**. It will be seen that the nozzle **22** has an orifice **26** that is disposed axially in the entrance portion or housing **14** and is directed toward the axis of the venturi throat **20**.

Air is admitted to the entrance housing **14** by suitable openings therein, such as the illustrated pair of circular openings **28** on opposite sides of the entrance housing **14**. A cylindrical shutter **30** is adjustably mounted around the entrance housing **14** to regulate the flow of air through the openings **28**. The shutter **30** may be rotated through a suitable range, such as 90 degrees, for example, and may be locked in its adjusted position by means of a clamping screw **32** tapped into the housing **14** and extending through a peripheral slot **34** formed in the shutter **30**. It will be seen that the shutter **30** is formed with a pair of circular openings **36** adapted to be registered in varying degrees with the openings **28** in the entrance housing **14**.

The exit portion **16** of the mixing tube **12** is generally of slightly flaring form, but is curved inwardly at its extreme end to define an inturned annular flange **38** disposed around the exit port **18**. This curved flange **38** tends to focus or narrow the flame by directing the mixed fuel and air toward the axis of the port **18**.

In accordance with the present invention, the burner **10** is provided with flame shaping means, such as the illustrated target **40**. As shown, the target **40** comprises a pair of spaced vertical bars **42** which extend transversely to the length of the mixing tube **12** and are spaced outwardly beyond the exit port **18**. It will be seen that the bars **42** are interposed in the path of the stream of fuel and air discharged by the port **18**. An oblong, rectangular open space **44** is formed between the bars **42** and is aligned with the axis of the port **18**. Thus, the bars **42** deflect the stream of fuel and air so that the main portion of the stream passes through the open space **44** between the bars **42** in a flat oblong form, as indicated by the arrows **46** in Fig. 4.

It is preferred that the target bars **42** be flat and oblong in cross section and be arranged with inner flat surfaces **48** facing generally toward the exit port **18**, but extending at angles lying between the transverse and longitudinal directions. It will be seen that the left and right hand bars **42** are oppositely angled so as to be symmetrical about a vertical plane extending through the axis of the port **18**. Starting from their outer edges, the bars **42** angle away from the port **18** so that the inner surfaces **48** will deflect the stream of fuel and air through the rectangular opening **44** between the bars **42**. As illustrated, the flat surfaces **48** make an acute angle with the transverse direction. The actual angle of the bars **42** may vary, but is shown as about 30 degrees to the transverse direction.

To support the bars **42**, the target **40** is formed with a pair of supporting arms **50** which are welded or otherwise secured at their inner ends to the mixing tube **12**. It will be seen that the arms **50** extend longitudinally beyond

the outer end of the mixing tube and are connected to the ends of the bars 42. In this instance, the bars 42 and the arms 50 are formed integrally out of sheet metal. The mixing tube 12 and the shutter 30 are also preferably made out of sheet metal.

It will be seen from Fig. 4 that the supporting arms 50 are provided with two forked portions 52 which support the bars 42. Thus, the supporting arms 50 are generally Y-shaped as viewed broadside.

In the operation of the burner, the nozzle 22 directs gaseous fuel through the entrance housing 14 and into the venturi portion 20. The action of the venturi portion 20 draws air into the mixing tube 12 through the openings 28 and 36 in the housing 14 and the shutter 30. The gas and air are mixed in the mixing tube 12 and are discharged in a stream from the single exit port 18.

The main portion of the stream from the exit port 18 passes through the oblong opening 44 between the bars 42 of the target 40. This portion of the stream of fuel and air forms the main portion of the burner flame. The flame has its base immediately in front of the target bars 42. Thus, the target 40 has the effect of displacing the base of the flame outwardly from the exit port 18. The main portion of the flame is flat and oblong in cross section. A focusing effect is produced by the opposite angling of the target bars 42. The flatness of the flame is due to a considerable extent to this focusing effect. The shape of the flame is also due to a considerable extent to the oblong shape of the opening between the bars 42.

Small side flames are produced adjacent the base of the main flame by portions of the stream of fuel and air which are deflected outwardly by the bars 42, as indicated by the arrows 54 in Fig. 4. The disposition and angling of the bars 42 is such that the edge portions of the stream of fuel and air are deflected outwardly, as indicated by these arrows, instead of passing through the opening 44 between the bars 42. Some of the fuel and air pass between the forks 52 of the supporting arms 50 so as to feed these side flames.

The side flames have an important stabilizing effect upon the main portion of the burner flame. The provision of the side flames tends to prevent the main portion of the flame from being blown outwardly, away from the target bars 42, by secondary air drawn into the base of the flame.

In addition to forming the flame into a flat, oblong shape, the target 40 has the effect of preventing the flame from flashing back through the mixing tube 12. Thus, the target 40 increases the effective depth of the single exit port 18. The provision of the target greatly stabilizes the burner flame and permits operation at high rates of fuel flow without trouble from the flame's flashing back or blowing out.

In shaping the flame, the target acts in cooperation with the curved flange around the exit port. This cooperative action also contributes to the ability of the burner to prevent the flame from flashing back into the mixing tube.

The burner is effective and stable in operation, yet is reasonably easy to manufacture and low in cost. The burner provides a flat, wide flame that will fit into oblong heat exchangers. High heat output may be obtained from the burner without causing instability of the flame or producing objectionable amounts of carbon monoxide.

Various modifications, alternative constructions and equivalents may be employed without departing from the true spirit and scope of the invention as exemplified in the foregoing description and defined in the following claims:

I claim:

1. In a burner for gaseous fuel, the combination comprising a fuel-air mixing tube having an entrance portion, an exit portion, and a venturi throat portion therebetween, means for directing fuel axially into said entrance portion toward said venturi throat portion, means for admitting air into said entrance portion for mixing with the fuel, said exit portion terminating in a single axial exit port therein for discharging a stream of fuel and air, said exit portion curving inwardly around said port to define an inturned annular flange therearound, a flame shaping target made of sheet metal and having a pair of supporting arms mounted on said exit portion at diametrically opposite points and extending longitudinally therefrom beyond said flange and said port in spaced generally parallel relation, a pair of flat narrow bar portions extending between said arms transversely thereto and spaced outwardly from said port in the path of the stream of fuel and air therefrom, said bar portions being spaced apart laterally and having inner lateral edges defining a rectangular open space therebetween disposed axially of said port, said bar portions being flat throughout their extent and being spaced apart from each other a distance substantially less than the diameter of said port to overlap said port and intercept the mixture discharged therefrom, said bar portions having outer lateral edges opposite said inner edges and spaced outwardly from said tube to define lateral openings between said tube and said bar portions, the distance between said outer lateral edges of said bar portions being generally equal to but slightly greater than the diameter of said port so that said bar portions will deflect a portion of the mixture laterally, said bar portions having flat surfaces facing generally toward said port but inclined oppositely at angles between transverse and longitudinal directions, said angles being acute with respect to the transverse direction.

2. In a burner for gaseous fuel, the combination comprising a fuel-air mixing tube, means for discharging a stream of fuel into one end of said mixing tube and directed toward the opposite end thereof, means for admitting air to said one end of said mixing tube, said tube having a single exit port at said opposite end thereof for discharging a stream of fuel and air therefrom, said mixing tube having a smoothly curved annular inturned flange thereon around said exit port, a flame-shaping target mounted on said tube and having a pair of supporting arms extending longitudinally therefrom beyond said opposite end thereof, a pair of spaced generally parallel bars extending between said arms transversely thereto and spaced in front of said exit port in the path of the stream of fuel and air therefrom, said bars being oblong in cross section and having flat sides extending at an angle between the transverse and the longitudinal, said angle being acute with respect to the transverse, each of said bars having generally parallel inner and outer lateral edges, said inner lateral edges of said bars being spaced apart from and generally parallel to each other to define a generally rectangular opening therebetween disposed axially of said tube, said outer lateral edges being spaced outwardly from said tube to define lateral openings therebetween, said bars being flat throughout their extent and being spaced apart from each other a distance substantially less than the diameter of said port to overlap said port and intercept the mixture discharged therefrom, the distance between said outer lateral edges of said bars being generally equal to but slightly greater than the diameter of said port so that said bars will deflect a portion of the mixture laterally.

3. In a burner for gaseous fuel, the combination comprising a fuel-air mixing tube having an entrance portion, an exit portion, and a venturi throat portion therebetween, means for directing fuel axially into said entrance portion toward said venturi throat portion, means for admitting air into said entrance portion for mixing with the fuel, said exit portion terminating in a single axial exit port therein for discharging a stream of fuel and air, a flame shaping target having a pair of supporting arms mounted on said exit portion at diametrically opposite points and extending longitudinally therefrom beyond said port in spaced generally parallel relation, a pair of flat

bar portions extending between said arms transversely thereto and spaced outwardly from said port in the path of the stream of fuel and air therefrom, said bar portions being spaced apart laterally and having inner lateral edges defining a rectangular open space therebetween disposed axially of said port, said bar portions being flat throughout their extent and being spaced apart from each other a distance substantially less than the diameter of said port to overlap said port and intercept the mixture discharged therefrom, said bar portions having outer lateral edges opposite said inner edges and spaced outwardly from said tube to define lateral openings between said tube and said bar portions, the distance between said outer lateral edges of said bar portions being generally equal to but slightly greater than the diameter of said port so that said bar portions will deflect a portion of the mixture laterally,

said bar portions having flat surfaces facing generally toward said port but inclined oppositely and symmetrically at angles between transverse and longitudinal directions.

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