Feb. 2, 1965 D. D. GROSS 3,168,131

FUEL BURNER NOZZLE

Filed June 6, 1961

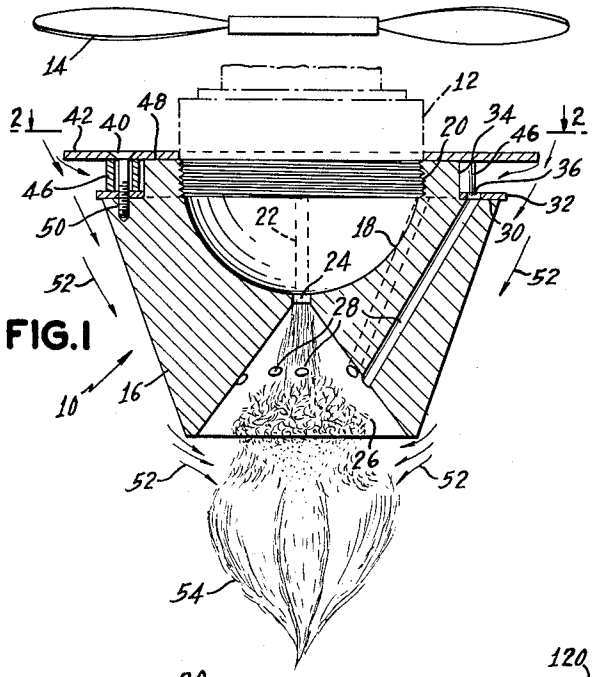


FIG. 1

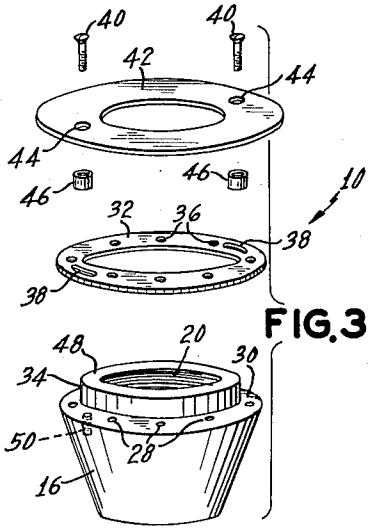


FIG. 3

FIG. 4

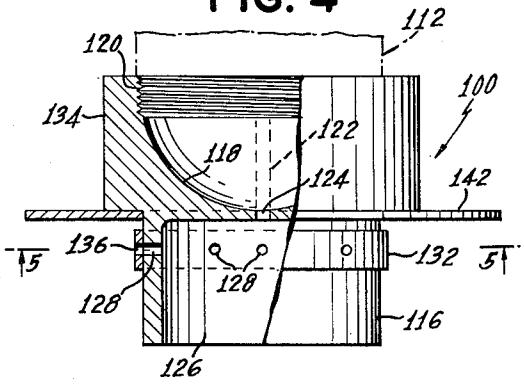
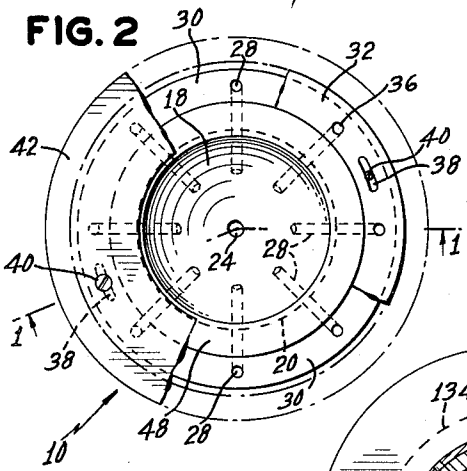


FIG. 2



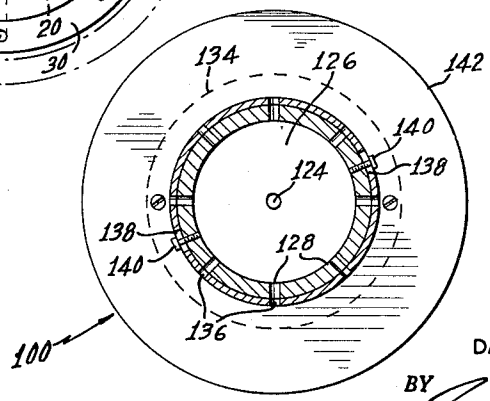


FIG. 5

INVENTOR.
DANIEL D. GROSS

BY Jerome Bauer

ATTORNEY

United States Patent Office

3,168,131

Patented Feb. 2, 1965

3,168,131

FUEL BURNER NOZZLE

Daniel D. Gross, 7 Sparrow Lane, Levittown, N.Y., assignor of one-sixth each to Milton L. Tolmach, East Williston, N.Y., Gwenne Dominick, Brooklyn, N.Y., and Al Levey, New Rochelle, N.Y.

Filed June 6, 1961, Ser. No. 115,236

6 Claims. (Cl. 158—76)

This invention relates to fuel burners and more particularly to nozzles for fuel burners.

The desideratum of this invention is to provide a nozzle for use in fuel burners that will increase the admixture or combining of fuel and air in such manner as to enhance the combustion thereof, resulting in an increase in the area and heat of the flame.

In prior known fuel burner systems, not specifically limited to oil burners, there has been a well recognized problem of properly atomizing or dispersing the fuel and mixing the same with the proper quantity of air to achieve the maximum combustion of the mixture. Numerous devices have been tried in attempting to solve this problem. Certain of these included the mechanical pulverization of the fuel prior to its combustion.

It is an object of the present invention to provide a simple, inexpensive, yet extremely efficient fuel burner nozzle by which fuel and air may be properly mixed in very fine quantities to enhance the combustability of the same.

Another object of the invention is to provide a fuel burner nozzle in which the fuel is directed into a mixing chamber, subjected to a lower or negative pressure with respect to the air about the chamber to more completely divide and separate the molecules of the fuel, and permitting the same to mix and combine with a sufficient amount of air to facilitate its enhanced combustion.

To this end, a feature of this invention resides in the details of structure of the fuel burner nozzle that serve to create a lower or negative air pressure gradient in the mixer chamber with respect to the air pressure moving downstream of the chamber, thereby applying a force on the fuel particles that tend to finely separate and cause the same to admix or combine with a proper amount of air to enhance its combustion.

Other and further objects of this invention reside in the structures and arrangements hereinafter more fully described with reference to the accompanying drawing in which:

FIG. 1 is a side view taken substantially along lines 1—1 of FIG. 2 and illustrating the fuel burner nozzle constructed in accordance with the teaching of the invention,

FIG. 2 is an end view taken in the direction of lines 2—2 of FIG. 1 with portions thereof partially cut away,

FIG. 3 is an exploded perspective view of the details of the fuel burner nozzle shown in FIGS. 1 and 2,

FIG. 4 is a side view, partially in section, of a modified fuel burner nozzle constructed in accordance with the teaching of the invention, and

FIG. 5 is a cross section of FIG. 4 taken along lines 5—5.

Referring now to the embodiment shown in FIGS. 1, 2 and 3, the fuel burner nozzle thereshown is generally identified by the numeral 10. It is adapted to be attached as a unit to the fuel supply nozzle 12 of any well known fuel burner having a supply of fuel as oil or gas. Such fuel burner apparatuses generally include a blower mechanism for creating a draft about the nozzle 12 that is connected with the supply of fuel of the burner. So that a clearer explanation may be had of the instant invention, there is illustrated in FIG. 1 a blower in the form of a propeller-shaped member 14 for supplying a stream of air moving under pressure about and longitudinally along the

fuel burner nozzle 10. Hence, the fuel burner nozzle of the instant invention is adapted to be positioned in the path of the fast moving stream of air pressure.

The fuel burner nozzle 10 comprises a body member 16, the outer surface of which may be said to be frustoconically shaped, tapering inward in the direction downstream of the moving air stream created by the operation of the blower 14. The body member 16 is contoured at 18 to congruously receive the usual fuel supply nozzle 12 of the fuel burner apparatus to which the instant inin-vention is adapted to be attached. For this reason, therefore, the interior of the hollowed contour 18 is threaded at 20 and is adapted to be screwed about and into secure engagement with the supply nozzle 12. The nozzle 12 is normally provided with a conduit 22 that is connected with a supply of combustible fuel (not shown). In like manner, the interior of the body member 16 is provided with a fuel inlet 24 that becomes aligned with the conduit 22 when the threads 20 of the nozzle 10 are snugly and securely engaged with those of the conventional supply nozzle 12.

Defined within the body member 16 is a mixer chamber 26. The mixer chamber 26 is shaped in the form of a cone with the fuel inlet opening 24 being at the top or narrowed end thereof while the wall of the chamber tapers outward and opens at its base at the downstream narrowed end of the body member 16. In practice, it has been found that the included angle of the conical wall of the chamber 26 may be varied depending upon the size of the fuel burner to which it is attached and to the volume of fuel to be burned during a given period. However, unusually good results have been obtained when such included angle has been in the order of 60°.

The chamber 26 is provided with at least one but usually a plurality of air passageways 28, the ends of which terminate in the chamber in relatively spaced circumferential relationship about the wall thereof. The air passageways 28 extend through the body member 16 and supply the mixer chamber 26 with air to be combined with the combustible fuel entering the chamber by way of the fuel inlet 24. In the present construction, the air passageways 28 extend along the length of the body member 16 and open at a shoulder 30 thereof.

Positioned on the shoulder 30 is a shutter element 32, the interior opening of which fits about the narrowed neck 34 of the body member. The shutter element 32 seats on the surface of the shoulder 30 for rotation relative thereto in a manner presently to be described. Being adjustably movable on the shoulder 30 of the body member 16, the shutter element 32 functions as a valve and is provided with a plurality of metering openings 36 defined in its annularly shaped body. The openings 36 are adapted to be aligned with the open ends of the air passageways 28 that terminate at the shoulder 30. Thus, by relative movement of the shutter element 32, a fine and careful metering of the extent or amount of air that may pass through the passageways 28 into the chamber 26 can be accomplished. Defined in diametrically opposite portions of the body of the shutter element 32 are curved elongated slots 38 that are adapted to receive therethrough a respective one of a plurality of screws 40 that serve to connect the same with the body member 16 and with a deflector or shielding means 42.

The deflector or shielding means 42 is an annularly shaped member that is provided with a plurality of countersunk holes 44 each of which is adapted to receive a respective one of the screws 40. Each one of a pair of spacer sleeves 46 is positioned about the shanks of a respective one of the screws 40 to properly space the shielding means 42 from the shutter element 32 while permitting the same to be secured in position resting against the upper ledge 48 of the body member 16. A

pair of tapped holes **50** are provided in the shoulder **30** of the body member **16** to receive a respective one of the threaded ends of the screws **40**.

When the shielding means **42** and shutter element **32** are secured in spaced relationship by the spacer sleeves **46** to the body member **16** by way of the screws **40**, the assembly of the fuel burner nozzle **10** is complete. If it is desired to fully open or partially close the extent of the upper ends of the air passageways **28** in order to adjustably control and vary the amount of air that will pass therethrough into the chamber **26**, it is merely necessary first, to slightly loosen the screws **40** from their holes **50** thereby permitting adjustment of the shutter element **32**. After the proper adjustment of the element **32**, the screws **40** are again tightened down into their tapped holes **50** to securely lock and prevent movement of the shielding means **42** and the shutter element **32** relative to the body member **16**.

The shielding means **42** is larger in size than that of the body member **16**. Because the body member **16** is here shown in conical form, the shielding means **42** has a circular outer periphery. As the description proceeds, however, it will be recognized that it is merely necessary that the shielding means be larger in size or so shaped with respect to the body member **16** that the open upstream ends of the air passageways **28** be shielded from communication with the high pressure of the surrounding airstream. It is the function of the shielding means to deflect the air stream created by the blower **14** from direct communication with and movement into the air passageways **28** thereby serving to shield the air passageways **28** from the full force or pressure of the moving air stream.

In practice, the blower **14** operates to create an air stream that moves under pressure along the length of the fuel burner nozzle **10**. As the air moves downstream, its path is deflected from direct movement into the air passageways **28** and thus the air passageways are shielded from communicating the full and direct pressure of the moving air stream into the chamber **26**. However, the deflector **42** does deflect the air sufficiently to create small eddy currents of air that accumulate and quickly lose their momentum therebehind. Subsequently, the air languishing dormantly between the deflector **42** and shutter **32** is caused to move into the passageways **28** and the chamber **26** by virtue of a suction that is created in the chamber **26** and passageways **28**. It will be recognized that as the air moves downstream from the blower **14**, along the conical shape of the body member **16** in the direction of the arrows **52**, it creates a suction in the chamber **26** that draws into the chamber the air dormantly trapped in the area between the shielding means **42** and the shutter element **32**.

Thus, there is created a gradient of air pressure between the mouth or open end of the chamber **26** and the interior of such chamber. This gradient of air pressure is lower or negative in the chamber **26** with respect to the air pressure at the open end or mouth of the chamber. Although the resultant reaction that this negative pressure created in the chamber **26** performs is not fully ascertainable, tests and observations indicate that the lower or negative pressure created in the chamber has a tendency to create a vacuum that acts on the incoming fuel to tear apart and separate the molecules of the fuel as it enters the chamber at the inlet **24**. This causes the separated molecules of fuel to disperse and mix or combine evenly in a fine array with the air entering the chamber at the air passageways **28**.

Because the suction and draft created in the direction downstream of the body member **16** at the mouth of chamber **26** is so great, the flame **54** fairly leaps out of the mouth of the chamber **26**. Its intense flame, fanned by the air stream, is of such great extent that it covers substantially the whole of the mouth of the mixer chamber and is torn therebeyond. This separation of the flame **54** from the chamber **26** and body **16** completely prevents the flame from heating any part of the nozzle **16** while the air stream moving over the body continually prevents a back heating of the body by the flame.

The circumferential spacing and location of the air passageways **28** about the wall of the chamber **26** and downstream of the fuel inlet **24** permits the proper infusion, mixture and combination of air with the particles of fuel immediately after the fuel has been finely dispersed. The fuel becomes finely dispersed before it reaches the air passageways **28** since the vacuum or negative pressure gradient is greatest in the rear of the fuel inlet **24** of the chamber **26**. However, continued dispersion of the fuel particles, even after mixture with the air is accomplished as the same is sucked and caused to move outward of the conically flaring mouth of the chamber by virtue of the high pressure created by the air stream of the blower **14** in the area **52**.

The embodiment shown in FIGS. 4 and 5 functions in substantially the same manner as that previously described with respect to FIGS. 1, 2 and 3. Hence, in order to avoid a redundant and repetitive explanation, the details of the modified embodiment are numbered in the 100 series but with the same tens and units numerals as those contained in FIGS. 1 to 3.

The fuel burner **100** of FIGS. 4 and 5 comprises a body member **116**, the outer surface of which is cylindrically shaped. The body member **116** is provided with a widened neck **134** that is threaded at **120** to receive the usual or conventional fuel supply nozzle **112** of any fuel burning apparatus. The fuel supply nozzle **112** seats within a congruously contoured portion **118** so that its supply conduit **122** is aligned with a fuel inlet **124** that opens into a mixer chamber **126**. The mixer chamber **126** is defined within the cylindrically shaped body member **116** and is generally also cylindrical in shape.

A plurality of air passageways **128** extend through the body member **116** and provide a communication of substantially dormantly atmospheric air to the interior of the chamber **126** in a direction downstream or longitudinally spaced from the fuel inlet **124**. The extent or size of the air passageways **128** or the amount of air that the same may communicate to the chamber **126** is capable of being metered or varied by a ring-shaped rotatably adjustable shutter element **132** that functions as a valve and is positioned about the body member **116**. The shutter element **132** is provided with a plurality of metering openings **136** that are adapted to be aligned with respective ones of the passageways **128** and for movement relative thereto by the rotation of the shutter element **132** to vary the amount of air that will move through the same. Guided rotation of the shutter element **132** and subsequent securement of the same from accidental rotation is afforded by the screws **140** passing through the elongated slots **138**.

In order to deflect the full force or pressure of the air stream moving down lengthwise along the fuel burner nozzle **100** and to shield the passageways **128** from receiving and then communicating the force of such air stream to the chamber **126**, there is provided a deflector or shielding means **142**. As in the prior embodiment **10**, the shielding means **142** is of larger peripheral extent than the air receiving ends of the passageways **128** thereby effectively shielding such passageways from the forces or pressure of the air stream. This results in creating a higher air pressure or gradient about and at the open end or mouth of the chamber **126** than that created within the chamber **126**.

The deflector or shielding means **142** thus permits the creation of a pressure gradient between the interior of the chamber **126** and at the mouth thereof. The function that is accomplished as a result of this construction has been observed to be similar to that described with respect to the embodiment **10** of FIGS. 1, 2 and 3. The longitudinal spacing between the air passageways **128** and the

fuel inlet **124** permits sufficient lapse of time for the proper diffusion, even separation and dispersal of the molecules of the fuel before the name mixes with the relatively slow moving low pressure air entering the chamber **126** by way of the air passageways **128**.

The constructions of embodiments **10** and **100** thus enable more complete separation or atomization of the fuel particles, a fine and even dispersal of such particles in the mixing chamber, and a complete and effective admixing and combination of the fine fuel particles with the air moving into the chamber at a relatively slow speed. It has been observed that each air passageway **28** and **128** has, in effect, become an individual burning nozzle and which, because of the gradient or differences in air pressures to which the chamber **26** or **126** is subjected, flames as at **54** in embodiment **10**, a point well beyond the mouth of the chamber. As a consequence, the nozzle bodies **16** and **116** are unaffected by the flame and are constantly cool.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to several preferred embodiments thereof, it will be understood that various omissions and substitutions and changes in the form and details of the devices illustrated and in their operations may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.

I claim:

1. In a fuel burner having means for producing a stream of air, a nozzle, said nozzle comprising a body positioned in said stream of air and having a chamber with an opening at one end positioned downstream of and in a direction away from said air stream producing means, the air stream moving about the outside of said nozzle body toward and about said opening and therebeyond, fuel inlet means in direct communication with said chamber and spaced from said opening, air passage means defined in said body between said opening and said air stream producing means and converging toward said chamber to communicate air into said chamber from said stream of air to a portion of said chamber in the space between said fuel inlet means and said opening of said chamber, means fixed with respect to said nozzle between said air stream producing means and said air passage means in the direct path of the air stream to shield said air passage means from the direct movement of air from the air stream whereby air moving through said air passage means and into said chamber is at a pressure less than the pressure of the stream of air moving about said body and said opening.

2. In a fuel burner having means for producing an air stream, a nozzle, said nozzle comprising a body having a plurality of outer surfaces in the path of movement of said air stream, a chamber defined in said body and having an opening therein positioned downstream of and in a direction away from said air stream producing means, the air stream moving about said outer surfaces toward and about said opening and therebeyond, fuel supply means to supply fuel directly into said chamber spaced from said opening, a plurality of air passageways having inlets defined in one of said plurality of outer surfaces between said opening and said air stream producing means, said air passageways being arranged in converging relationship to supply air into said chamber in the space between said fuel supply means and said opening of said chamber, and another of said outer surfaces on said nozzle being larger than said one outer surface and being in the direct path of said air stream between said air stream producing means and said inlets to shield said inlets from the direct path of movement of the air stream whereby the air stream is diverted from direct movement into said air passageways so that air communicated to said chamber through said air passageways is at a pressure less than the pressure of the air stream moving about and beyond the opening of said chamber.

3. In a fuel burner having means for producing an air stream, a nozzle, said nozzle comprising a body having a plurality of spaced surfaces in the path of movement of said air stream, a chamber in said body having an opening, means to supply fuel directly into said chamber and spaced from said opening, a plurality of restricted air passageways each exhausting air into said chamber and having an inlet defined in one of said spaced surfaces, said plurality of air passageways being arranged in converging relationship with each other to supply air into said chamber in the space between said fuel supply means and said opening of said chamber at a pressure less than the pressure of the air stream moving about said body and beyond said opening of said chamber, means on said nozzle to vary the size of said air passageway inlets, another of said spaced surfaces being on said nozzle between said air stream producing means and said inlets of said air passageway, said other of said spaced surfaces being larger than said one surface whereby said inlets of said air passageways are protected from the direct movement of the air stream thereinto.

4. In a fuel burner having means to produce an air stream, a nozzle comprising a body in said air stream and tapering inward in a direction downstream of said air stream, a conically shaped chamber in said body tapering outward and being open at one end thereof in a direction away from and downstream of said air stream, the air stream moving about the outside of said nozzle body toward and about said opening and therebeyond, fuel inlet means in direct communication with said chamber at the narrow end thereof, a plurality of air passages of uniform diameter relatively spaced from each other and defined in a circle in a portion of said body, said air passages extending through said body in communication with said air stream and having their outlets arranged in said chamber in converging relationship to provide air communication between said air stream moving about said body to said chamber between said fuel inlet and open end, and means immovably fixed on said nozzle to shield said air passages from the direct movement of air of said air stream thereinto, said shield means being larger than said portion of said body in which said air passages are defined.

5. In a fuel burner nozzle as in claim 4, and means on said nozzle to vary the amount of air moving through said air passages and into said chamber.

6. In a fuel burner having means for producing a moving air stream, a nozzle, said nozzle comprising a body in the path of the moving air stream, a chamber in said body having an opening in an end thereof in a direction opposite said air stream producing means downstream of said moving air stream and, fuel inlet means in said chamber spaced from said opening thereof, said body having an outer peripheral surface in the path of movement of said air stream, the air stream moving about the outer peripheral surface of said body toward and about said opening and therebeyond, air passage means defined in said body having inlets opening at said outer peripheral surface between said opening and said air stream producing means, said air passage means being arranged to converge therefrom and to open into said chamber to supply air to the space between said fuel inlet and said opening of said chamber, and shielding means fixed with respect to said body between said air passage inlets and said air stream producing means whereby the air stream moving toward said chamber opening moves about said shielding means and is shielded thereby from direct movement into said inlets as the air stream moves about said outer peripheral surface and past said chamber opening so that air supplied from said air stream through said air passage means to said chamber space has a pressure that is negative with

respect to the pressure of the air stream moving about and beyond said opening.

References Cited by the Examiner

UNITED STATES PATENTS

878,590	2/08	York et al.	158—1.5
1,172,755	2/16	Wilson	158—1.5
1,374,683	4/21	Reid	158—1.5
1,576,537	3/26	Peabody	158—1.5
1,751,236	3/30	Gontard	158—1.5
1,828,326	10/31	Lanser	158—1.5

1,921,937	8/33	Marshall	158—1.5
2,111,432	3/38	Macchi	158—1.5 X
2,390,056	12/45	Cleaver et al.	158—1.5
2,981,320	4/61	Reed	158—1.5

FOREIGN PATENTS

210,834	8/60	Austria.
1,247,656	10/60	France.

JAMES W. WESTHAVER, *Primary Examiner.*

FREDERICK L. MATTESON, JR., PERCY L. PATRICK, MEYER PERLIN, *Examiners.*