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2 Sheets-Sheet 1



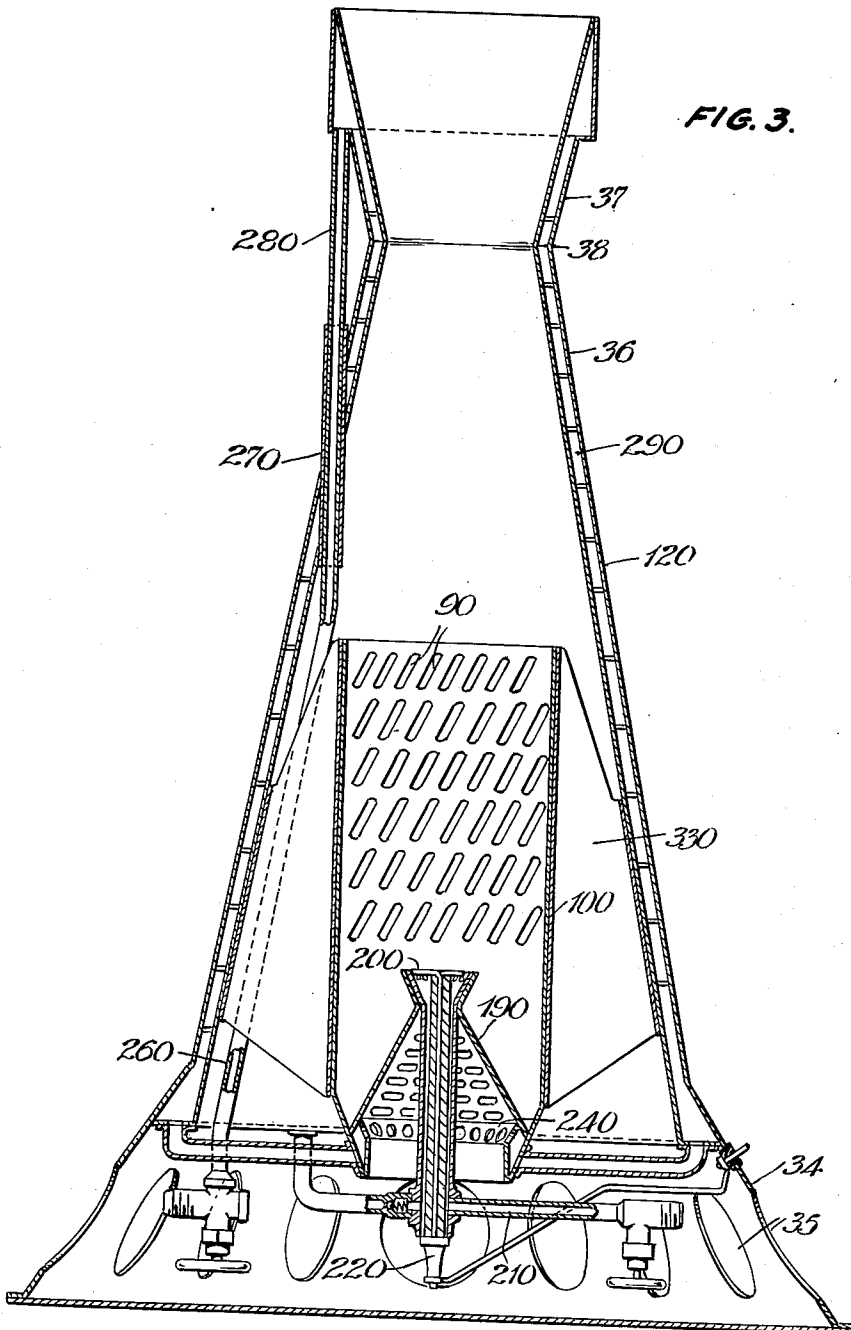
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JET-PROPULSION BURNER

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6 Claims. (Cl. 263-19)

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This invention relates to burners for vaporized oil and similar fuels and particularly refers to an arrangement of an inner burner tube and an outer housing with an air passage therebetween, the housing having a Venturi throat to control the rate of airflow throughout said passage and said tube.

It is an object of this invention to provide a burner arrangement and mode of operation that will be applicable not only to conventional space heating purposes, such as furnaces, orchard heaters, and the like, but will be so flexible and controllable in operation, simple and durable in construction, and stable in its operation or flame characteristics that it will be applicable to develop high intensity thrust forces for ram-jets and related burners, such as are used in guided missiles, jet-propelled aircraft, and the like.

Heretofore, in the more exacting services of jet-propelled aircraft, the problems of controlling the fuel-air ratio throughout the wide range of conditions of fuel consumption, temperature, air velocity, air density, thrust requirements, and the like, have resulted in complex and fragile structures that are not only expensive to build and maintain, but result in "flame-outs" or misfunctions at critical times, that lead to loss of lives and equipment by failure to maintain continuous and reliable operation. In addition, the means heretofore provided for air-fuel ratio control have been incapable of accurate or simple functioning, with the result of low fuel economy.

This invention comprehends broadly the provision of an inner burner tube, with an air inlet at one end and a perforated cone directed into the inlet, with a simple pilot burner, which may include an igniter, such as a spark plug, at the apex of the cone. Vaporized fuel is admitted inside and around the base of the cone to mix the air which is either supplied by natural draft of the combustion tube, by the relative velocity of the burner with respect to the air surrounding it, as in a jet plane or guided missile, or by artificial means, such as a compressor connected to the inlet. Surrounding the burner tube is a housing, which is also open at its inlet to the air that flows into the burner, or air may be supplied from a separate source of air pressure. A portion of the housing extends beyond the discharge end of the burner tube and comprises a Venturi throat, the smallest diameter of which is beyond the discharge end of the burner tube.

Desirably, but not necessarily, the housing itself, or a portion thereof, is movable with respect to the burner tube to position the venturi

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at the desired distance beyond the discharge end of the burner tube to control accurately the flow of air and products of combustion through the tube and housing. Further details of construction and operation will be further apparent from the attached drawings, which form a part of this specification and illustrate two preferred embodiments of the invention, and from the following descriptions of the examples shown.

In the drawings, Figure 1 is a longitudinal sectional view of a burner specifically adapted for jet-propelled aircraft. Figure 2 is a cross-sectional view on line 2-2 of Figure 1. Figure 3 is a longitudinal sectional view of a simpler form of burner such as would be used for orchard heating, fog dispelling and the like.

Referring to the drawings and particularly to Figure 1, reference number 10 designates a generally cylindrical metal burner tube supported by radial webs 11 to be concentric within an outer and somewhat longer metal housing 12. Tube 10 is provided with a tapered entrance throat 13 forming a primary air inlet. Housing 12 is similarly provided with an inlet 14 for secondary air, as will be described below. One or more side extensions or shoes 15 serve to support the entire structure, and incidentally protect the fuel piping and the hydraulic cylinder or similar means 16 which is effective for extending or retracting the movable housing extension 17 comprising a Venturi throat which is slidably supported inside housing 12 at 18.

Burner tube 10, which is perforated as at 9 throughout at least a portion of its length, is fitted with an inwardly directed perforated metal cone 19, in this example located at the juncture of the tapered entrance throat 13 with the cylindrical portion of the tube. At the apex of the cone 19 is a pilot burner 20 supplied by suitable fuel through conduit 21, and, desirably, a coaxial igniter or spark plug 22, which may be selectively energized with high tension electric current from a suitable source (not shown) through insulated conductor 23, is associated with the pilot burner. If available, a source of inflammable gas, such as butane or the like, could be supplied to conduit 21 through connection 210. Within the base of the cone 19 is an annular fuel distributor 24, desirably perforated as at 25 to admit the fuel to be burned uniformly around and inside the base of the cone. Fuel for this distributor may be already in the vapor form at this point, or if it is in liquid form, the fuel may first be vaporized by being admitted to conduit 25 from any suitable source under a

slight pressure. A sliding tubular connection 27 conveys the liquid fuel into tube 29 from which it passes into a helically baffled vaporizing chamber 29 surrounding the Venturi extension 17 of housing 12. A vapor outlet connection 30 leads from chamber 29 into a second tubular sliding connection 31, and thence through conduit 32 to the fuel distributor 24 previously described. Obviously, any other suitable vaporizing means could be substituted for the arrangement shown.

Primary air admitted through entrance throat 13 enters burner tube 10 and mixes with vaporized fuel from distributor 24, after which the mixture passes through the perforations of cone 19 to be ignited and burn in the main or cylindrical portion of tube 10. Additional or secondary air admitted through inlet 14, passing through the annular space 33, between tube 10 and housing 12, enters the tube through the perforations 9 shown in the upper end of tube 10, to mix with the partly burned gases and combustion products. This mixture emerges as a high velocity hot gas blast into the Venturi throat of housing extension 17, the position of which may be adjusted longitudinally with respect to the discharge end of burner tube 10 by means such as the hydraulic cylinder 16, to obtain optimum results.

The second example of this invention, which is shown in Figure 3, is that of a simple heating burner, designed primarily to give a generally predetermined controlled output of heated gas, for orchard heating, fog dispelling, or the like. In this arrangement, the outer housing 120 is illustrated as being formed in the shape of an upwardly tapering cone, with an outwardly flanged base 34 having a plurality of circumferentially spaced air inlet ports 35, through which both the primary air for the perforated burner tube 100 and secondary air for the annular space 330 between the tube 100 and the housing 120 may be introduced by the draft established by the combustion process. The same relationship between the various parts of the structure prevails as in the previously described example, with burner tube 100, having perforations 90, spacing webs 111, cone 190, pilot burner 200, spark plug 220 and fuel distributor 240, arranged in the same relative positions and accomplishing the same functions. In a stationary heater installation there is generally a lower rate of fuel consumption, and the nature of the fuel itself is not as limited as in a mobile unit, so that, for example, the pilot burner 200 may be supplied through valved conduit 210 with any fuel, already vaporized, such as butane or other liquefied petroleum hydrocarbon, and fuel distributor 240 of the main burner may be supplied with a relatively heavy distilled or even residuum fuel oil through valved conduit 260.

Due to the normally constant duty of a burner of the type of Figure 3 there is usually no need for making the Venturi throat of the housing beyond the discharge end of the burner tube 100 to be adjustable with regard to that tube. This simplifies and makes generally more economical the construction of housing 120 which is illustrated in this example as being formed of two conical sections 36 and 37, intersecting at 38 to form the Venturi throat. Also, and particularly at low rates of consumption of heavy fuel oils, the helically baffled vaporizing chamber 290 may desirably extend substantially throughout the length of housing 120. In addition, to facilitate cleaning of deposits which may settle out in the helically baffled chamber, the outer shell of hous-

ing 120 may be made sectional, and split longitudinally so that it may be removed for cleaning these passages.

In conclusion, it will be appreciated that these examples illustrate only two forms of this invention, which comprehends broadly the combination of an inner cylindrical perforated burner tube with a perforated, inwardly directed cone in its air inlet, within the base of which the fuel to be burned is admitted in vaporized form, and a housing surrounding the tube and extending therebeyond to form a Venturi throat, which, if desired, may be adjustable with respect to the burner tube, if the air-fuel mixture is to be controllably varied over moderate or wide ranges. It is obvious that other modifications and changes could be made in the foregoing illustrations without departing from the invention, and all such alterations and variations that come within the scope of the appended claims are considered to be embraced thereby.

I claim:

1. A jet propulsion burner for vaporized fuel comprising a generally cylindrical converging perforated tube having an imperforate tapering portion at one end, the open end thereof forming an air inlet, the discharge end of said tube being completely open and unobstructed, a perforated cone directed inwardly from said tapering portion of said tube, a pilot burner at the apex of said cone, means for supplying oil vapor inside the base of said cone, an imperforate housing surrounding said tube and extending beyond the discharge end thereof, means forming a Venturi throat in said housing, and means for adjustably positioning said Venturi throat longitudinally with respect to the discharge end of said tube.
2. A jet propulsion burner according to claim 1, with the addition of an electrical igniter for said pilot burner coaxial therewith.
3. A jet propulsion burner according to claim 1, with the addition of a second imperforate housing surrounding at least a portion of said first housing to form an annular space therebetween, baffles in said space, and means for circulating oil throughout said space to heat and to vaporize the same prior to its passage to the base of said cone.
4. A jet propulsion burner for vaporized fuel comprising a generally cylindrical perforated metal tube having an inwardly tapered imperforate portion at one end the open end thereof forming an air inlet, the discharge end of said tube being completely open and unobstructed, a converging perforated metal cone directed inwardly from said inwardly tapering portion of said tube, a pilot burner at the apex of said cone, means for supplying oil vapor around the inner circumference of said inwardly tapering portion and beneath said cone, an imperforate housing surrounding said tube and extending beyond the discharge end thereof, the opposite end of said housing being open to admit air around said tube, and means forming a Venturi throat adapted to be moved longitudinally in said housing.
5. A jet propulsion burner for vaporized fuel comprising a generally cylindrical perforated tube the forward open end of which forms an unobstructed air inlet the discharge end of said tube being completely open and unobstructed, a converging perforated cone extending into said inlet, a pilot burner at the apex of said cone, means for admitting vaporized oil inside the base of said cone, an imperforate housing surrounding said tube, an air inlet for said housing

surrounding the air inlet of said tube, the opposite end of said housing extending beyond the discharge end of said tube, and means in the extension of said housing forming a Venturi throat adapted to be moved longitudinally.

6. A jet propulsion burner for vaporized fuel comprising a perforated tube the forward open end of which forms an unobstructed air inlet, the other end being open and unobstructed to form a discharge outlet for combustion products, a converging perforated cone extending into said inlet, a pilot burner within said tube, a fuel inlet at the base of said cone and communicating with the interior thereof, a housing surrounding said tube and spaced therefrom to form an annular air passage surrounding said tube the forward end of said annular air passage comprising an unobstructed secondary air inlet, said housing being constricted in diameter at a point beyond the outlet of said tube to form a Venturi throat and means for moving said throat longitudinally back and forth to control the passage of air and products of combustion through said burner.

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