July 18, 1933. W. DOBLE 1,918,326

BURNER

Filed March 6, 1931

FIG_1_

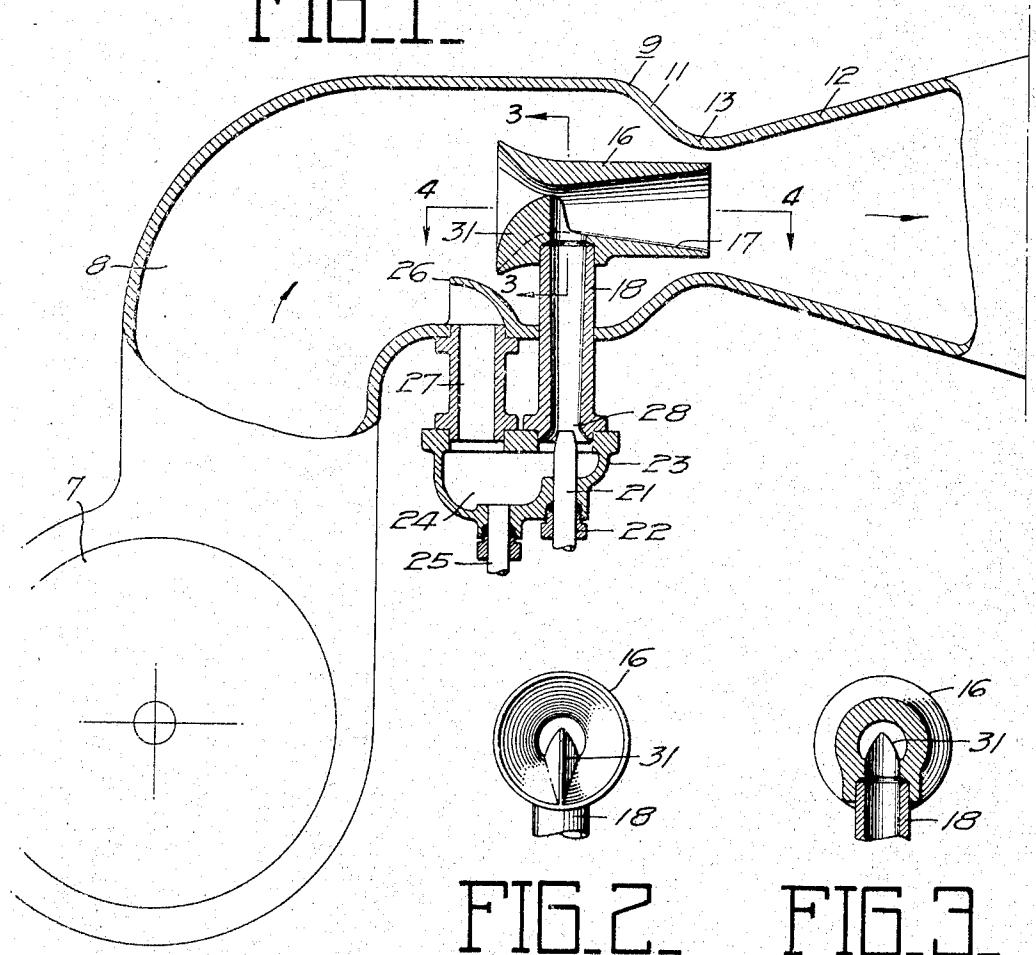


FIG_2_

FIG_3_

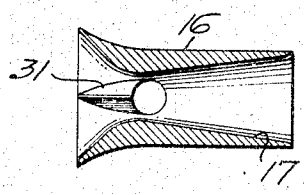


FIG_4_

INVENTOR.
Warren Doble
BY White, Prost, Flaherty & Lothrop
ATTORNEYS.

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UNITED STATES PATENT OFFICE

WARREN DOBLE, OF EMERYVILLE, CALIFORNIA

BURNER

Application filed March 6, 1931. Serial No. 520,619.

This invention relates to a burner wherein a forced draught of high velocity air is employed to furnish a combustible mixture of air and a fluid fuel, such as gasoline, engine distillate, fuel oil, kerosene, powdered coal and the like.

The invention is particularly concerned with the formation of a homogeneous fuel-air mixture to the end of securing very efficient combustion from burners of the type in which the low pressure created by a high velocity air stream in a suitable conduit, as at the throat of a venturi, is utilized to draw a fuel into the air stream rushing through the venturi. Present burners of this type do not furnish a completely homogeneous mixture, and, as a result of this, the fire burns unevenly, with poor combustion efficiency and considerable noise.

It is in general the broad object of the present invention to devise a burner which is capable of providing a substantially homogenous fuel-air mixture to the end of promoting combustion efficiency, reducing the noise of the fire and lowering the rate of fuel consumption.

The invention possesses other advantageous features and objects, some of which with the foregoing will be set forth at length in the following specification wherein I have outlined the preferred form of the burner of my invention.

In the drawing, Figure 1 is an elevational view, partly in cross section, of a burner embodying my invention.

Figure 2 is a view looking in the direction of flow of air in Figure 1, the view illustrating the construction and positioning of certain of the elements of the burner.

Figure 3 is a section taken along the line 3—3 of Figure 1.

Figure 4 is a section taken along the line 4—4 of Figure 1.

My invention comprises the discovery that the heterogeneous character of the fuel-air mixture secured by aspirating fuel into a high velocity air stream is largely due to the resistance or apparent reluctance of the air stream to admit the fuel and the provision of means for overcoming this difficulty whereby a homogeneous fuel-air mixture is secured. Thus, a burner employed prior to this invention usually included a Venturi tube through which air was rapidly passed. A fuel supply pipe extended into the throat of the venturi so that the low pressure at the throat drew fuel through the pipe into the air stream in the venturi. This burner provided an air-fuel mixture suitable for subsequent ignition. However, the burning was uneven, noisy and not of a very high efficiency. I have discovered that by causing the formation of a low pressure area, substantially free of eddy currents, adjacent to and immediately about the discharge of the fuel supply conduit, the burning of the fuel is even, the noise is diminished and the combustion improved.

This low pressure area formation, which I term cavitation, can be visualized as the forming of a hole in the rushing air stream into which the fuel enters. The relatively fast moving air stream confined in the conduit resists the attempted insertion of the fuel. By causing cavitation to occur in this stream, which has a velocity of the order of 100 miles per hour, and introducing the fuel, or rich fuel-air mixture as is done with the embodiment of the invention disclosed, into the cavity formed, the incorporation of the fuel in the air stream is so accomplished that an air-fuel mixture is secured which is truly homogeneous.

In the apparatus which I have developed for successfully carrying out my invention, an air stream is furnished under pressure from a suitable source as from a blower 7 through a conduit 8 which includes a Venturi section 9. The Venturi section includes an upstream portion 11 and a downstream portion 12, which converge to form a throat 13. A Venturi tube 16 is positioned within the conduit 8 and is positioned with its downstream portion 17 discharging at approximately the throat 13 of the Venturi section. The Venturi tube 16 is preferably carried upon a fuel pipe 18 which serves to support it in suitable spaced relationship. Often the limitations imposed on the design by surrounding mechanisms and space re-

quirements dictate that the Venturi tube 16 be disposed in a horizontal position.

Fuel is supplied to the fuel pipe 18 from a float chamber, not shown, or other source of fuel supply, by means of a delivery pipe 21 which extends through a stuffing gland 22 provided in a sump member 23. The member 23 is formed to provide a sump 24 in which excess fuel from the delivery pipe 21 can collect and be removed through a drain 25.

The fuel delivery pipe and the float chamber are preferably located a considerable distance away from the venturi 16 in order to lessen the absorption of heat by the fuel, as in practise the temperature of the venturi 16 is relatively high. The problem of feeding fuel to the pipe 21 also indicates that the pipe should be as low as possible; that is, below the venturi 16. The sum of these general requirements is that the delivery pipe 21 is preferably a vertical tube located considerably below and at right angles to the horizontal Venturi section 9. This arrangement, however, affords deleterious results unless the burner of my invention is employed.

Means are provided for diverting a portion of the air stream in the conduit 8 and these means include a scoop member 26 formed upon the conduit to direct air from the conduit through a duct 27 and the sump 24. The delivery pipe 21 extends within the fuel pipe 18, the fuel pipe preferably having a Venturi contour and the pipe 21 terminating at the throat portion 28 of the fuel pipe 18. The withdrawal of fuel from the float chamber and incorporation with the air stream is aided by diverting a portion of the air stream from the conduit to pass through the Venturi fuel conduit. The three Venturi tubes, thus provided, enable fuel to be aspirated readily into the air stream and allow fuels of high specific gravity to be burned successfully.

In operation, the apparatus so far described is not capable of furnishing an air-fuel mixture of the homogeneity desired for subsequent ignition as upon issuance from the Venturi section 9. By means of my discovery, however, this apparatus can be made suitable for furnishing the desired homogeneous mixture. To this end, therefore, means are provided for operating upon the air stream rushing over and about the discharge of the fuel pipe 18 where it opens into the air stream to create a low pressure area so that a hole or cavity is formed in the air stream into which the fuel enters without meeting with or having to overcome the resistance from the high velocity air stream.

In the preferred form of the apparatus here disclosed I provide a stream lined body 31 to which I usually apply the term of "splitter". This body, as is shown in Figures 1 and 2, is formed within the Venturi tube 16 to extend downwardly to the edge of the Venturi tube ahead of the outlet of the conduit 18. The body, as is shown in Figures 2 and 4, is stream-lined and tapered upwardly to an apex at about two-thirds the throat diameter of the Venturi tube 16. This effects a splitting of the air stream passing over and about the outlet of the conduit 18 so that a cavity is formed in the air stream on the lee side of the body. The fuel is sheared from the fuel stream in the conduit 18 to enter uniformly into the air stream to furnish finally an air-fuel mixture of a very homogeneous character. The formation of the cavity in the stream is accomplished without the creation of the undesirable eddy currents which were present in the burners heretofore utilized.

It is to be noted that the body 31 is not only stream lined to split the air stream to form a cavity over and about the point of fuel introduction but is also stream lined as to allow for a quick convergence of the diverted streams after the point of fuel introduction is passed, without the formation of undesirable eddy currents. This results in the fuel being rapidly incorporated and sustained by the air stream.

While I have indicated the employment of the Venturi tube 16, this is not an absolute necessity since the introduction of fuel into the air stream can be effected without it, particularly on lighter fuels. However, the utilization of the splitting means or body 31 is necessary to secure a homogeneous air-fuel mixture instead of the otherwise heterogeneous, uneven and uncertain mixture supplied by present burners.

It is to be understood that my invention can be embodied in other forms than I have here disclosed within the scope of the claims.

I claim:

1. In a burner including a conduit having a Venturi section through which an air-stream is passed, a Venturi tube positioned in the conduit ahead of the Venturi section and adapted to discharge air passing therethrough substantially at the throat portion of the Venturi section, a fuel conduit extending through the conduit and opening into the Venturi tube adjacent the throat thereof, the fuel conduit serving to convey fuel into the Venturi tube, and means for effecting cavitation of air passing through the Venturi tube substantially over the fuel conduit opening in the Venturi tube whereby a substantially homogeneous air-fuel mixture is supplied from the Venturi section for subsequent ignition.

2. In a burner including a conduit having a Venturi section through which an air stream is passed, a Venturi tube positioned in the conduit ahead of the Venturi section and adapted to discharge air passing there-

through substantially at the throat portion of the Venturi section, a fuel conduit extending through the conduit and opening into the Venturi tube adjacent the throat thereof, the fuel conduit serving to convey fuel into the Venturi tube, and a stream lined member positioned in the Venturi tube adjacent the fuel conduit opening for effecting cavitation of air passing through the Venturi tube substantially over the fuel conduit opening in the Venturi tube whereby a substantially homogeneous air-fuel mixture is supplied from the Venturi section for subsequent ignition.

3. A fuel and air-mixing device comprising a Venturi tube, a source of air under pressure for causing a flow of air through said Venturi tube, a source of fuel, a fuel nozzle connected with said source of fuel, a mixing tube into which said fuel nozzle projects a stream of fuel; said mixing tube receiving air from said source of air under pressure; said mixing tube projecting a fuel and air mixture into the throat of said Venturi tube substantially at right angles to the flow of air through said Venturi tube, said Venturi tube being provided with a protuberance arranged in its inlet end and extending into its throat to shield the fuel mixture from the mixing tube which enters the throat of said Venturi tube.

4. A fuel and air-mixing tube having a throat wherein the velocity is high and the pressure is low, a second fuel and air-mixing tube communicating with said throat at substantially a right angle to the motion of fuel and air passing through the said first mixing tube, a deflector arranged in the inlet end of said first mixing tube and extending to the aperture in the throat of said first mixing tube, where the fuel and air mixture from the second mixing tube enters the first mixing tube, said deflector being arranged to guide the air which enters said first mixing tube such that the flow of air and fuel mixture issuing from the second mixing tube will be subjected to the flow of air in the throat of the first mixing tube gradually as it crosses the throat of the first mixing tube.

5. A fuel and air mixing device comprising a mixing tube which injects a fuel and air mixture into the throat of a Venturi tube substantially at right angles to the flow through said Venturi tube, and a tapered baffle arranged in the inlet end of said Venturi tube and having a width at the throat surface of the Venturi tube substantially equal to the width of the fuel and air mixture issuing from the mixing tube, and said baffle extending across the throat of said Venturi tube and tapering in width in a direction across said Venturi tube to substantially no thickness at the end of the baffle far from the inlet aperture for the fuel and air mixture issuing from the mixing tube.

6. A fluid mixing device comprising a first tube through which fluid passes, a second tube through which fluid passes, said second tube discharging fluid into said first tube, the flow of fluid in said second tube being substantially at right angles to the flow of fluid in said first tube, a tapered baffle arranged in said first tube and having a width at the inner surface of said first tube substantially equal to the width of the opening in said first tube through which the fluid from said second tube passes, said baffle extending substantially across said first tube and tapering in width in a direction across said first tube to substantially no width.

WARREN DOBLE.