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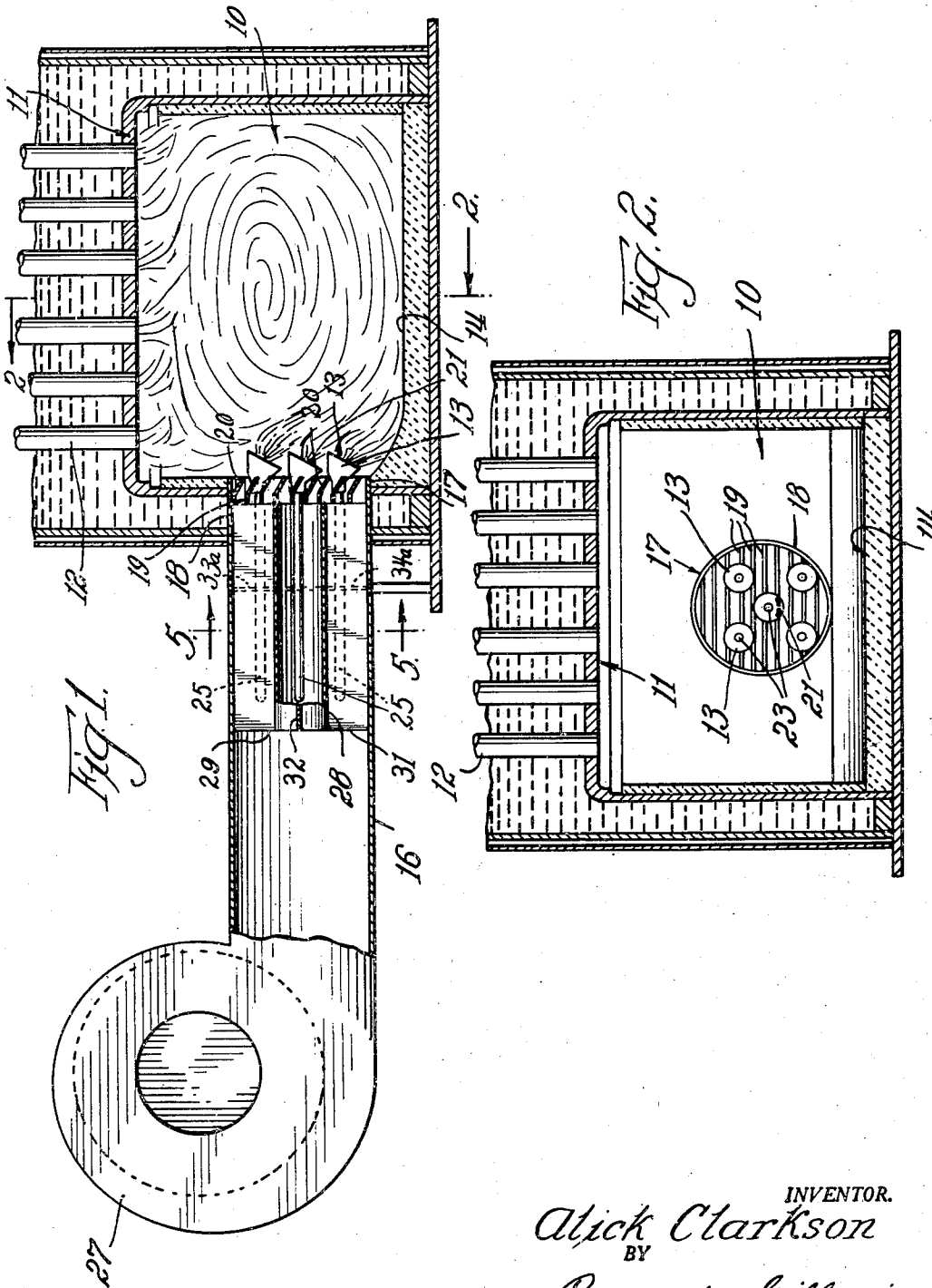
A. CLARKSON

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LOUVERED AIR REGISTER FOR OIL BURNERS

Filed Oct. 21, 1944

3 Sheets-Sheet 1



INVENTOR.
Alick Clarkson
BY
Barnett & Gillespie
Attys.

March 29, 1949.

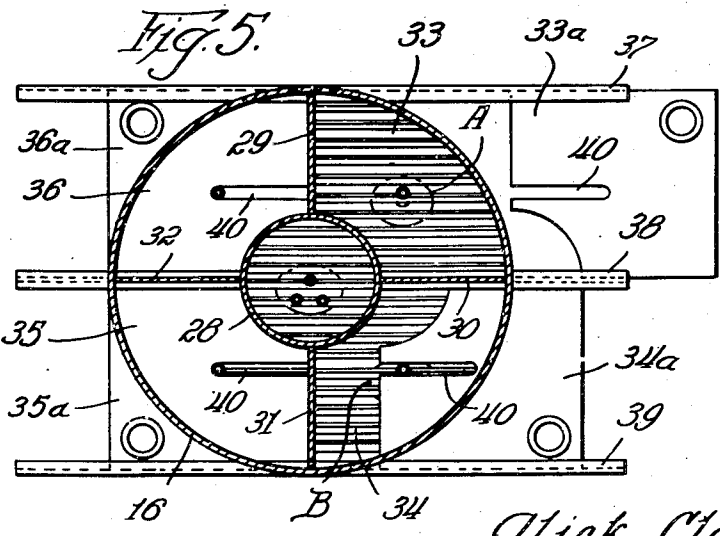
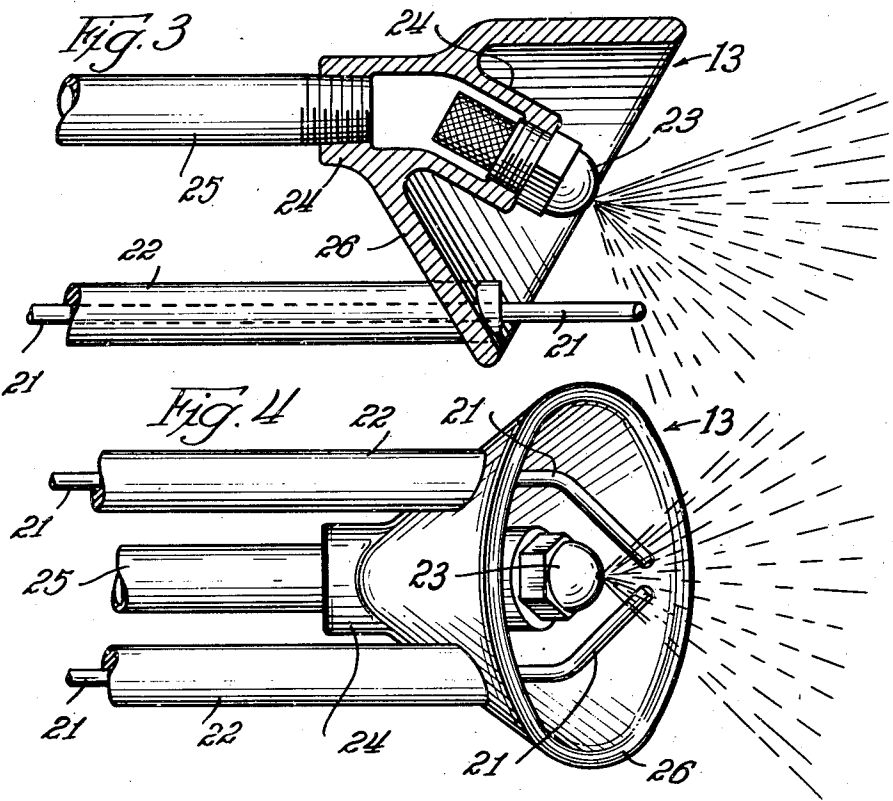
A. CLARKSON

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LOUVERED AIR REGISTER FOR OIL BURNERS

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INVENTOR.
Alick Clarkson
BY
Barnett & Gillette
Att'ys.

March 29, 1949.

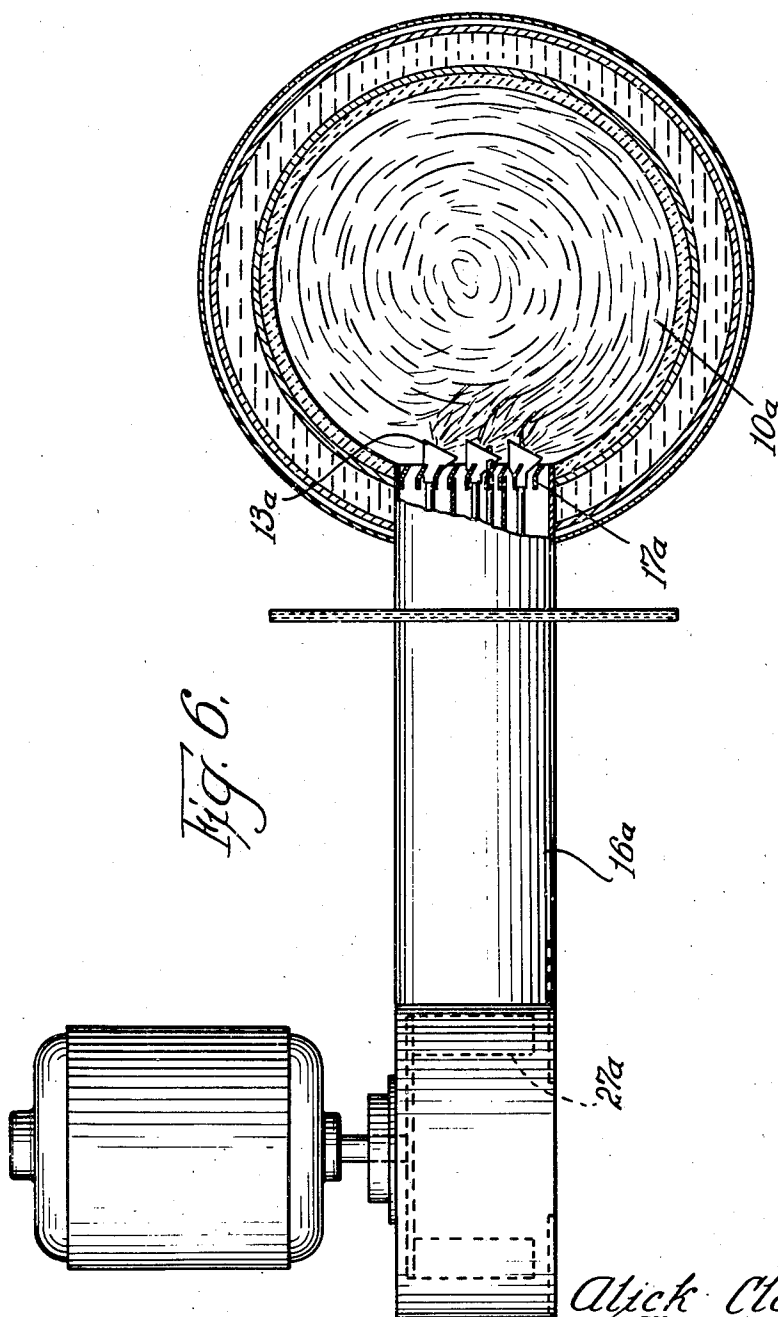
A. CLARKSON

2,465,712

LOUVERED AIR REGISTER FOR OIL BURNERS

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3 Sheets-Sheet 3



INVENTOR.

Alick Clarkson

BY

Barnett & Gillespie
Att'ys.

UNITED STATES PATENT OFFICE

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LOUVERED AIR REGISTER FOR
OIL BURNERSAlick Clarkson, Bloomington Township,
Du Page County, Ill.

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4 Claims. (Cl. 158—1.5)

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This invention relates to an improved air register for directing a stream of combustion air into the fire chamber of a furnace or other form of heater in which liquid or gaseous fuels are burned.

Heretofore, the size and shape of the fire chamber of an oil burning furnace has determined the manner in which the fuel and combustion air are introduced into the furnace. If the fire chamber should be of rectangular form, the liquid fuel spray accompanied by an enveloping stream of combustion air would be ordinarily directed horizontally through the fire chamber. Consequently, the size of the fire chamber, under the previous practice, determined the length of the flame and therefore determined the amount of fuel that could be burned efficiently without producing excessive amounts of soot. If the fire chamber were cylindrical, the fuel and air sufficient to produce a relatively short flame might be introduced, under the old practice, through the central fire door of the furnace or a somewhat longer flame of vortex form might be produced by delivering the fuel and air into the fire chamber through a conduit positioned tangentially to the inner face of the chamber, but there has been no means heretofore provided for forming a vortex form of flame in a rectangular fire chamber. Likewise, there has been no means heretofore provided for forming a vortex form of flame in a cylindrical fire chamber when the fuel and air are delivered into such chamber by means of multiple fuel nozzles and air distributing louvers positioned in a centrally disposed fire door or opening. In fact, the provision of a vortex flame in a rectangular fire box or in a cylindrical fire box under the above mentioned conditions were regarded as impractical, since the combustion air, being ordinarily delivered in a single stream, could not be satisfactorily deflected from the path defined by the delivery pipe into the necessary curved path to form a vortex flame and at the same time uniformly distribute the combustion air at all sides of such flame. If the air is deflected from a straight path by forming the delivery pipe with an abrupt bend, the force of the moving air tends to compress its greater portion into a stratum near the long radius of the bend. In other words, the air forms a high pressure zone along the long radius of the bend and a low pressure zone along the short radius of the bend. Under such conditions the envelope of air surrounding the spray of fuel will be of greater density at one side of the spray than at the other.

One of the principal objects of the present invention is to provide an improved means for

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delivering the combustion air into a fire chamber through a central fire door or opening and to deflect the stream of air in a manner to provide a swirling or vortex form of flame in which the combustion air is uniformly distributed throughout the flame.

Another object is to provide a louvered grill of simple and inexpensive construction which will accomplish the above general object and which can be utilized in connection with a single fuel nozzle or with a plurality of such nozzles.

A further object is to provide in connection with a louvered grill and a plurality of fuel nozzles, a simple and inexpensive means of reducing and/or cutting off the air supply to one or more nozzles.

According to the present invention the liquid fuel is delivered into a fire chamber by means of one or more atomizing nozzles. The nozzles are arranged to extend through the central fire opening leading into the combustion chamber and are arranged at suitable angles to cause the atomized fuel to be directed toward the bottom or, as an alternative, toward a side wall of the chamber at such angle that the flame will assume a curved or vortex path.

The combustion air is delivered into the fire chamber through a louvered grill. The louvers serve to stratify the main stream of air to form separate streams of smaller volume at opposite sides of each fuel nozzle so that each spray of atomized fuel will have an adequate supply of air to support complete combustion. The several louvers are preferably formed with angular portions which serve to deflect each stratum of air in the same general direction as the fuel discharged from the nozzle and thereby insures uniform distribution of the combustion air for each of the several sprays of fuel. If desired, the air may be shut off from certain portions of the grill when one or more nozzles have been shut off. However, in such case provision is made for supplying a reduced amount of air to said inactive area of the grill to prevent overheating of the louvers.

The invention is illustrated somewhat diagrammatically in connection with two specific embodiments in the accompanying drawing wherein:

Fig. 1 is a vertical sectional view taken through a fire chamber of rectangular construction and showing a plurality of fuel nozzles together with a louvered air register positioned to direct fuel and air downwardly into said fire chamber.

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1 looking in the direction of the arrows.

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Fig. 3 is a fragmentary vertical section through one of the fuel delivery nozzles.

Fig. 4 is a fragmentary bottom plan view of the nozzle shown in Fig. 3.

Fig. 5 is a vertical cross section through the air delivery duct and showing certain air valves closed and others open and partially open; and

Fig. 6 is a horizontal sectional view of a cylindrical fire chamber, provided with fuel and air delivery means constructed in accordance with my invention.

Referring first to Figs. 1 to 5, inclusive, of the drawings:

The reference numeral 10 designates a fire chamber, of rectangular form, of a water heating furnace of the vertical flue type. The crown sheet of the furnace is indicated by the reference numeral 11 and the vertical flues by the reference numeral 12. According to the embodiment herein illustrated, liquid fuel is delivered into the fire chamber 10 through several, preferably five, atomizing nozzles disposed in coplanar arrangement and designated 13. The five nozzles are utilized in the present embodiment so that a large volume of fuel can be introduced into the fire chamber. In order to make it practicable to burn a large quantity of fuel in the relatively small rectangular fire chamber 10, each of the fuel nozzles is directed downwardly at an angle toward the bottom surface 14 of the fire chamber. The particular method of atomization is not important, for example the fuel may be atomized by pressure in the fuel line itself or by means of compressed air, or other fluids now used for the above purpose. The combustion air for the fuel is delivered under suitable pressure through a conduit 16 leading into the fire chamber through a louvered air register 17 arranged in the fire door opening 18 of the furnace. The air register is provided with a plurality of louvers, each of which is provided with a horizontally disposed portion 19 adapted to separate the main stream of combustion air into a plurality of separate streams or strata so as to retain a uniform distribution of the air adjacent each of the several fuel nozzles and to supply each nozzle with a quantity of stratified combustion air. The said louvers are also provided, in each case, with an angular portion designated 20 adapted to deflect the several strata of air downwardly in a direction parallel to the path of travel of the sprays of liquid fuel discharged from the nozzles 13. The downwardly directed streams of atomized fuel and combustion air are deflected upwardly by the air pressures adjacent the bottom surface of the fire chamber, so that the flame from the burning fuel is carried in a general circuitous course, as indicated in Fig. 1, with the result that the flame is of sufficient length to insure complete combustion of the fuel particles before they enter the flues 12 and, therefore, increase the efficiency of the furnace as a whole and minimize the deposit of soot.

The invention, as illustrated, shows the use of five fuel nozzles, but the number of nozzles used is not important. The principle of the invention can be applied to any number of nozzles. An electric ignition device is applied to only one nozzle, preferably the nozzle positioned near the center of the group. The electric ignition device may be of any known construction, for example, the construction embodying a pair of electrodes 21 which extend through porcelain tubes 22 and are formed at their ends with angularly disposed portions to provide a spark gap positioned in the

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path of the liquid fuel discharged from the nozzle. The electrical igniter will ordinarily be operated only for a brief period during the starting of the furnace, although it can, if desired, be operated continuously. The ignition of the fuel discharged from the central nozzle serves to ignite the fuel discharged from all of the other nozzles.

The nozzles 13 each include a tip 23 screwed into a body casting 24 which is formed to extend at a suitable angle from the fuel supply pipe 25. The said body portion of the nozzle includes also a conical hood 26 which surrounds the nozzle tip 23. The said hood functions to prevent the stream of combustion air from duct 16 from flowing too closely to the nozzle tip 23 and thereby permits the flame to burn at a location close to the nozzle tip.

In order to permit suitable regulation of air delivery and to shut off portions of the air when one or more of the fuel nozzles are not in use, the air delivery conduit leading from blower 27 to the air register 17 is divided into a plurality of separate passages for delivering the air to individual burner nozzles. The air delivery passage for the central nozzle is defined by conduit 28. Partitions 29, 30, 31 and 32 extend outwardly from the conduit (see Fig. 5) to divide the space surrounding the central conduit 28 into four air delivery conduits 33, 34, 35 and 36 leading to the several fuel nozzles. Inasmuch as the central nozzle, in the present illustration, functions as an ignition pilot for the other nozzles, the central air conduit 28 is left open to deliver air to the central nozzles during the entire operation of the burner. However, the amount of air delivered through the other conduits 33, 34, 35 and 36 may be controlled by means of valves 33^a, 34^a, 35^a and 36^a. In this way the amount of air delivered to one or more nozzles may be reduced or, if desired, may be shut off.

The air valves are preferably formed to slide in guideways 37, 38 and 39. By reference to Fig. 5 it will be seen that the valve 33^a is entirely open so that a full supply of air will be delivered to the nozzle designated A. The valve 34^a is positioned to deliver a reduced amount of air to nozzle designated B and the valves 35^a and 36^a are closed.

In order to prevent overheating of the louvers of the air register, when the air control valves are closed, each valve is provided with a slot 40, or other suitable aperture, to permit a small amount of air to pass through the valve for the purpose of cooling the said louvers of the air register.

Referring now to the modified embodiment shown in Fig. 6:

In this embodiment the nozzles designated 13^a may be and preferably are of the same construction as shown in Figs. 1 to 5, inclusive, but are arranged to direct the atomized sprays of fuel in a direction toward the inner wall of a cylindrical fire chamber 10^a. The louvers 17^a of the modified embodiment are likewise arranged to direct the several strata of combustion air for each nozzle at an angle substantially parallel to the path of travel of the fuel spray discharged from the nozzle so that the flame from the combustible mixture will follow the curvature of the inner face of the fire chamber.

It will be seen from the foregoing description that the principles of the present invention, whereby the fuel and combustion air may be deflected from a horizontal path into a curved path within the fire chamber, are applicable to fire chambers of either rectangular construction or

cylindrical construction and that in either case the fuel and air can be conveniently introduced into the fire chamber through a centrally disposed opening.

I claim:

1. The combination with the fire chamber of a furnace having an opening therein for the delivery of liquid fuel and a quantity of combustion air into the chamber, of means for directing said fuel and said combustion air in a circuitous path comprising a plurality of fuel delivering nozzles arranged at angles to direct atomized sprays of fuel toward an inner surface of the chamber, a conduit communicating with said opening for delivery of air under pressure into said chamber, means dividing the delivery end of said conduit into separate air delivery passages for each of the nozzles, and means for varying the flow of air through certain of said passages.

2. The combination with the fire chamber of a furnace having an opening therein for the delivery of liquid fuel and a quantity of combustion air into the chamber, of means for directing said fuel and said combustion air in a circuitous path comprising a plurality of fuel delivering nozzles arranged at angles to direct atomized sprays of fuel toward an inner surface of the chamber, a conduit communicating with said opening for delivery of air under pressure into said chamber, means dividing the delivery end of said conduit into separate air delivery passages for each of the nozzles, and valves arranged in certain of said passages for controlling the amount of air delivered to certain of said fuel nozzles.

3. The combination with the fire chamber of a furnace having an opening therein for the delivery of liquid fuel and a quantity of combustion air into the chamber, of means for directing said fuel and said combustion air in a circuitous path comprising a plurality of fuel delivering nozzles arranged at angles to direct atomized sprays of fuel toward an inner surface of the chamber, a conduit communicating with said opening for delivery of air under pressure into said chamber, means dividing the delivery end of said conduit into separate air delivery passages for each of the nozzles, valves arranged in certain of said passages for controlling the amount of air delivered to certain of said fuel nozzles, and angularly disposed louvers positioned at the discharge end of each air delivery passage for deflecting the combustion air into a path corresponding to the path of the fuel sprays from said nozzles.

4. The combination with the fire chamber of

a furnace having an opening therein for the delivery of liquid fuel and a quantity of combustion air into the chamber, of means for directing said fuel and said combustion air in a circuitous path comprising a plurality of fuel delivering nozzles arranged at angles to direct atomized sprays of fuel toward an inner surface of the chamber, a conduit communicating with said opening for delivery of air under pressure into said chamber, means dividing the delivery end of said conduit into separate air delivery passages for each of the nozzles, and valves arranged in certain of said passages for controlling the amount of air delivered to certain of said fuel nozzles and each of said valves provided with a restricted opening therein to permit a small amount of air to pass when the valve is closed.

ALICK CLARKSON.

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