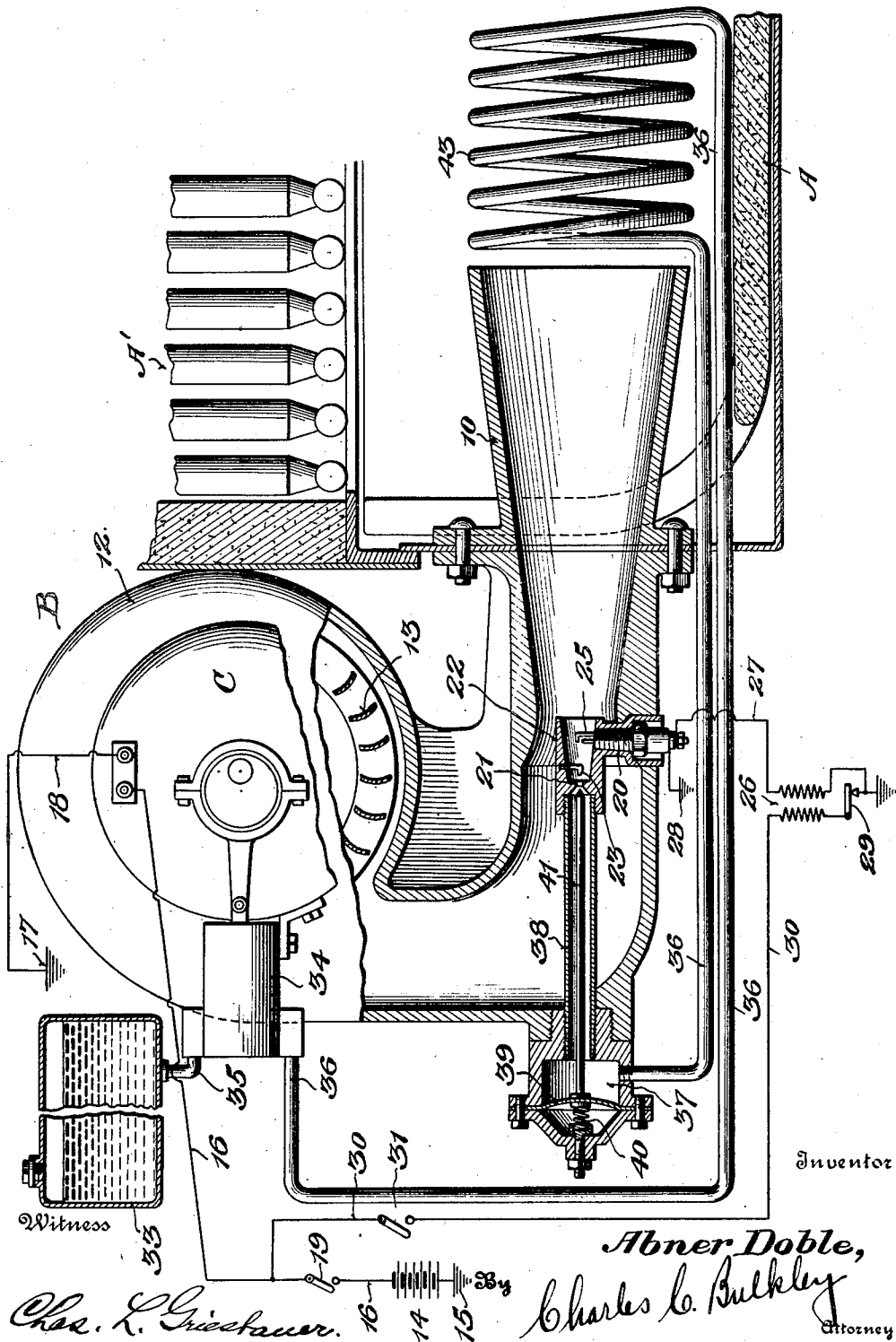


A. DOBLE.
METHOD OF BURNING LIQUID FUELS.
APPLICATION FILED SEPT. 15, 1917.

1,402,747.

Patented Jan. 10, 1922.



UNITED STATES PATENT OFFICE.

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DOBLE-DETROIT STEAM MOTORS CO., OF DETROIT, MICHIGAN, A CORPORATION
OF DELAWARE.

METHOD OF BURNING LIQUID FUELS.

1,402,747.

Specification of Letters Patent.

Patented Jan. 10, 1922.

Application filed September 15, 1917. Serial No. 191,563.

To all whom it may concern:

Be it known that I, ABNER DOBLE, a citizen of the United States of America, and resident of Detroit, Wayne County, Michigan, have invented a certain new and useful Improvement in Methods of Burning Liquid Fuels, of which the following is a specification.

My invention relates to the art of burning heavy hydrocarbons, such as kerosene and distillate, as fuel in connection with the rapid generation of steam for use in the propulsion of automobiles, and it is my purpose to instantly ignite and burn heavy hydrocarbons from an initially cold state and without initial gasification or pre-vaporization.

In the drawing I illustrate a mechanism by which I accomplish this object and my invention will be described with reference by way of illustration to this mechanism.

Referring to the drawing:

The figure is a view, partly in section, partly in elevation and partly diagrammatic, of a fuel ignition mechanism and burner illustrative of one manner in which my invention may be carried out.

I illustrate a portion of the combustion chamber or fire-pot A, which in practice is bowl-shaped and positioned beneath a steam generator A' of a steam driven automobile power plant. This combustion chamber is made of or lined with refractory material, and the fuel properly mixed with air is projected into it by means of the burner mechanism which causes the fuel to be violently circulated and swirled in said chamber to bring about complete combustion of the fuel. The fuel burning mechanism extends into this chamber from one side thereof. I provide a tubular member 10 which extends horizontally into the combustion chamber and which is suitably bolted in position. The outer end of this tube is connected to the horizontally turned outlet of an air blower B and this tube together with the blower outlet form a Venturi mixing tube. The blower delivers volumes of air through the venturi passage and which supplies all of the air necessary to support combustion in the fire-pot. This blower may be of any suitable type for the purpose. In this structure it comprises a casing 12 having a rotary blade wheel 13 therein arranged to deliver volumes of air at comparatively low pres-

sure. The blower is driven by a small electric motor C mounted at one side of the casing and supplied with current from the battery 14 or any other suitable source. One terminal of the battery is grounded at 15 and the other connected by conductor 16 with one terminal of the motor. The other terminal of the motor is grounded at 17 by conductor 18. The motor circuit includes an operator's switch 19 by which it may be controlled. Within the Venturi tube at the throat thereof is a fuel nozzle. This nozzle is mounted on a post 20 screwed into the wall of the blower outlet. It has a nozzle opening 21 at its rear end for the emission of the fuel, and this nozzle has a cone-shaped member 22 extending forwardly from the opening and forming a small chamber surrounding said opening. A small pin or projection 23 is positioned just in front of the nozzle opening and when the fuel in liquid form is projected from the nozzle opening under considerable pressure, it strikes this pin and is mechanically broken up and thus extremely finely atomized. Heavy hydrocarbons such as kerosene and distillate can, I have found in practice be ignited by an electric spark from an initially cold or normal temperature condition by spraying the fuel in a finely atomized state and providing a mixture with air. A mixture of the character which is rich in fuel and lean in air, although ignitable by an electric spark, is incompletely combustible, productive of soot and smoke and odor, and it will not produce sufficient volume and degree of heat necessary for the production of steam to meet the horse-power requirements. This mixture which is capable of spark ignition is produced in the structure shown, as before intimated, by the spraying of the fuel under pressure from the nozzle and isolating the spray in its inception by the cone-shaped nozzle chamber so that it becomes mixed with air only to a limited extent. While in this condition the rich, finely atomized mixture is ignited by an electric spark produced at the terminals 25 of a suitable spark plug which is screwed into the nozzle supporting post 20 with its electrodes positioned just within the mouth of the chamber 22. This spark may be produced in any desired manner. In the structure shown it is produced by an ordinary sparking coil 26. The secondary winding of this coil is grounded at one ter-

minal, and its other terminal is connected by conductor 27 with one terminal of the spark plug. The other spark plug terminal is grounded at 28. The primary winding of the coil has one terminal connected to ground through its interrupter 29 and its other terminal connected by conductor 30 with the conductor 16 which leads from the battery. An operator's switch 31 is provided in the spark coil circuit so that the operator may control the spark independently of the motor. The operation of the switch 19 however controls both motor and spark. The control of the mechanism may be automatic if desired. Having thus instantly ignited the fuel at normal temperature by means of a spark without pre-gasification or pre-heating, however, I change the characteristics of the fuel by converting it into a gas, utilizing the heat of the spark ignited flame for this purpose.

The liquid fuel is supplied from a fuel tank 33 by means of a small pump 34 mounted upon and driven from the motor shaft, and this pump provides the necessary pressure on the fuel for spraying the liquid from the nozzle. The pressure may be supplied by any suitable means although the advantage of the motor driven pump is that the pump runs only when the motor and blower are running. The pump takes the liquid fuel through the pipe 35 and delivers it under pressure through pipe 36 to the chamber 37 of a diaphragm valve mechanism and thence through the pipe 38 to the nozzle. The valve chamber has a diaphragm 39 which is acted upon by an adjustable spring device 40 and this diaphragm has a long valve stem 41 extending through pipe 38. The valve stem is seated in the nozzle opening and controls the flow of fuel there-through. The diaphragm is adjusted to respond and open the nozzle only when there is the proper pressure on the fuel. Thus the mechanism is automatic to close the nozzle and prevent the flow or leakage of fuel when

the pump is not operating or providing sufficient pressure. The fuel pipe 36 includes a coiled portion 43 through which the fuel circulates on its way to the nozzle. This coil is positioned within the combustion chamber just in front of the Venturi tube where it is subject to the heat of the burning fuel, hence in passing through this heating coil the liquid will be converted into a gas and will issue from the nozzle as a gas and become mixed with the volumes of air supplied by the blower.

In starting with the parts all cold however the liquid fuel will first be sprayed from the nozzle and instantly be ignited in this cold condition. The flame will play upon the heating coil and gradually convert the liquid into a gas which will then be ignited by said initial flame and thereafter sustain combustion and the continued gasification of the fuel. One extremely important advantage of my invention is elimination of the difficulties and unreliability of a constantly burning pilot which must be initially supplied with gasified fuel. By my method and apparatus the pre-heating and initial gasification of the fuel is avoided, the fuel can be instantly ignited and the spark discontinued until again needed.

What I claim is:—

The method of initiating and sustaining combustion in heavy non-volatile liquid fuels, which consists in spraying the liquid at normal temperature by forcing it under pressure from a suitable nozzle to produce a mixture capable of ignition at normal temperature by an electric spark, igniting said mixture by an electric spark, and, while said fuel is burning, gradually converting the liquid fuel into a gas by the heat of the flame before it emerges from said nozzle, and continuing combustion by supplying said gas and volumes of air to said flame.

Signed by me at Detroit, Mich., this 11 day of September 1917.

ABNER DOBLE.