Nov. 8, 1932. F. V. RISINGER 1,887,140

HYDROCARBON BURNER

Filed Oct. 28, 1929

Fig. 1.

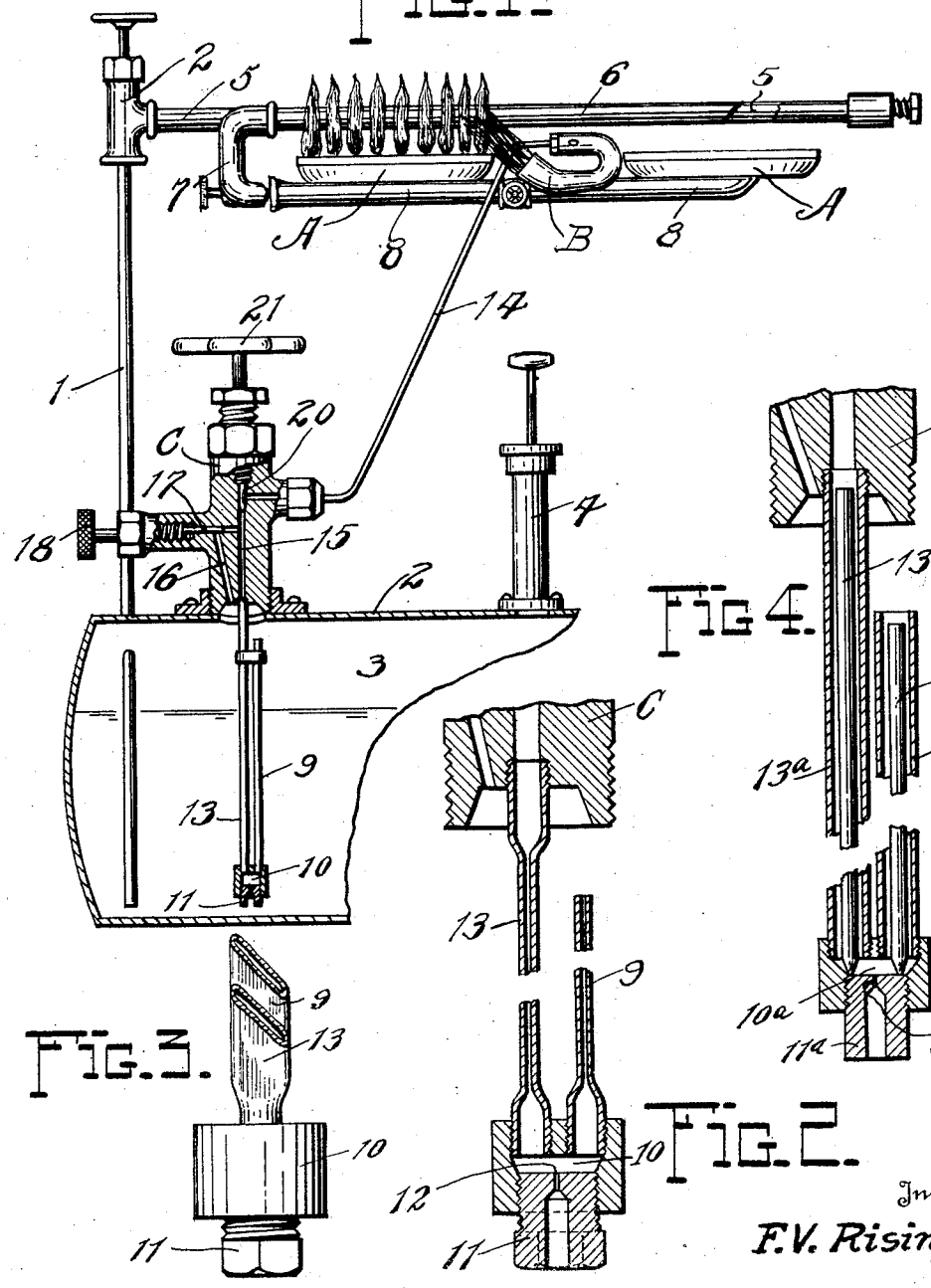



Fig. 4.




Fig. 3.




Fig. 2.




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Patented Nov. 8, 1932 1,887,140

# UNITED STATES PATENT OFFICE

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## HYDROCARBON BURNER

Application filed October 28, 1929. Serial No. 403,060.

This invention has to do with burners of the hydrocarbon fuel type such as may be used for cooking or heating purposes generally, and comprises a design of such burners adapted primarily for the use of gasoline as a fuel.

An essential feature of the invention is comprised by the special construction of starting burner employed in conjunction with a generator of the super-heated type. The starting burner of my invention is designed with a special view to obtaining a quick ignition of the fuel. Burners of this class such as heretofore devised, have required a considerable period of time in which to obtain proper vaporization of the fuel and therefore quick starting has been difficult to achieve.

In carrying out my invention, I associate with my starting burner, a novel form of atomizer and a special type of control valve, these parts being so arranged in cooperating that I am enabled to obtain almost instantaneous ignition at the starting burner of the fuel gas which issues therefrom, this action conducing to the commercial value of my invention for obvious reasons. My atomizer is unique in construction in that it involves a supply passage or conduit, and a delivery passage or conduit, the former for supplying air to a mixing chamber, and the latter for delivering atomized air and fuel to the valve control means, intermediate the atomizer and the starting burner. The mixing chamber of the atomizer is provided with an exceedingly fine receiving opening for the liquid fuel which is to be mixed with the air in the atomizing process. The employment of the said passages of exceedingly minute cross-sectional area, and a corresponding size orifice to admit the hydrocarbon to the mixing chamber, are essential to my invention for the production of effective atomization of the fuel that is to be supplied to the starting burner. It is to be borne in mind however, that hydrocarbons are of different grades, and otherwise vary in characteristics so that it is highly desirable and from a practical viewpoint, necessary, that there be a special control provided to vary the quantity of air that may be a part of the atomized fuel, beyond those limits which may be set by the relative proportioning of the minute air supply and delivery passages of the atomizer in conjunction with the orifice that supplies the hydrocarbon to the mixing chamber. With the foregoing in view, I have designed my invention with a special air control valve which I shall call an auxiliary valve, and which permits of fine variation in the character of the mixture of the air and liquid fuel that passes to the starting burner. It is by this effective control that I obtain the proper vaporization of the hydrocarbon gaseous fuel with its mixed air content, to produce the quick starting action of the starting burner previously referred to.

The special type of main heating burner employed by me involves as novel subject matter, the employment of liquid fuel conduits, preferably arranged in parallel relation, though not necessarily so, for conducting the liquid fuel to the main burner by movement in reverse directions while subjected to the heat of the starting burner so as to obtain proper starting vaporization within the generator which is comprised of said conduits.

In the accompanying drawing, I illustrate preferred and modified forms of my invention.

Figure 1 is a view of a gas burning apparatus in accordance with the invention, the main burner including the generator, being shown primarily in front elevation whilst the hydrocarbon tank and the control valve device and a portion of the atomizer are shown in section, the tank also being broken away.

Figure 2 is an enlarged view of much exaggerated size, showing more particularly the atomizer feature of the invention.

Figure 3 is a view in side elevation showing the form of the mixing chamber at the lower end of the atomizer, the connected conduits being broken away and shown in section.

Figure 4 is a sectional view of a modified form of atomizer, wherein I produce the minute cross-sectional passages for the air and the mixed air and hydrocarbon, by using rods within the larger cross-sectional pipes.

My invention is of exceedingly simple con-

struction, and described in detail comprises a main burner generally designated at A, and this burner may be duplicated or a series of greater or less number of them used as shown in Figure 1 of the drawing. The burner or burners A are supplied with fuel in substantially liquid condition by means of a pipe 1 leading into the gasoline or hydrocarbon supply tank 2. In the length of this pipe 1 is provided a control valve 2, which when open will permit the hydrocarbon in the tank 2 to be forced therefrom by air stored up in the air space 3 of the tank, by means of any suitable pressure generating device, such as the air pump 4 to be manually operated, or any power driven pump or similar means that might be utilized. From the valve chamber of the valve 2, the liquid fuel is adapted to pass in a horizontal direction through a pipe 5 in which it progresses in a rightward direction and then passes in a reverse direction through a pipe 6, thence downward as at 7 to the horizontal pipe 8 on which the burners A are mounted, said burners being equipped with suitable exit openings forming jets from which the gas to be burned issues.

By having the conduits or pipe members 5 and 6 extending an appreciable distance in opposite directions the liquid fuel is maintained for a considerable time in what may be termed an extensive heating zone and proper vaporization of said fuel is thus ensured prior to its issuing in gaseous form thoroughly vaporized at the jets of the burners A.

Figure 1 shows at B a starting burner with its burner orifice disposed so that the flame issuing therefrom will be directed against the pipes or conduits 5 and 6 of the main burner device. The atomizing and valve control apparatus associated with this starting burner B is a most essential feature of the present invention. It will be seen that I have arranged in the hydrocarbon tank 2 an atomizer shown best in Figure 2 as comprising an air supply pipe 9, a mixing chamber 10, a plug 11 formed with a very fine liquid fuel inlet orifice 12, and a liquid fuel and air delivery pipe or passage 13. It is highly essential to my invention that the orifice 12 be of minute proportions, and that the passages in the pipes or conduits 9 and 13 be of minute cross-sectional area in order that only an exceedingly fine stream of liquid fuel and gas may pass upwardly to the control valve device and onward through the conduit 14 to the starting burner B.

I have found by very considerable experiments that the use of tubes or conduits with passages as large as an eighth of an inch or perhaps somewhat smaller, for atomizing purposes corresponding to those of my atomizer, will not produce an efficient vaporizing or atomizing action in relation to the mixing of the air and the hydrocarbon so that when the mixed fuel reaches the starting burner it will issue in gaseous condition enabling quick or substantially instant ignition. I have found that the proper proportioning of the air and the liquid fuel to accomplish instant starting of ignition at the starting burner depends upon the cross-sectional area of the air supply pipe 9, the air and hydrocarbon delivery pipe 13, and the orifice 12, whether arranged in the manner and of the construction which I show, or not. It might be possible if in the use of gas burning apparatus of the type of my invention, only one grade or quality of hydrocarbon is dealt with the thorough atomization of the fuel might be obtained by a proper control of the minuteness of formation of the passages in the conduits 9 and 13, and the orifice 12. But the situation in commercial practice is that different grades of hydrocarbon fuels must be capable of being handled by an apparatus such as my invention proposes to provide, and on this account, I employ a special control valve C such that I provide auxiliary air passage means for carrying air to the main fuel passage 15 of the valve so that I obtain an exceedingly great nicety of regulation of the air proportion factor of the fuel content. In the manner, I secure not only proper atomization of my fuel, air and hydrocarbon mixture, but I secure additionally, a control enabling ideal proportioning of the amount of air entering the mixture to secure the best results commercially.

With the foregoing in mind, the valve C is provided with a by-pass 16 of angular form, the lower end of which is in communication with the air space 3 of the tank 2, the upper end of which intersects and communicates with the main fuel passage 15, and the intermediate portion of which is adapted to be opened and closed, to a greater or less extent, by the valve 17 of the needle type controlled by the handle 18.

The upper portion of the valve casing at the outflow end of the passage 15 is connected by a suitable coupling 19, with the conduit 14 previously mentioned. Entering the passage 15 at its upper end portion, is a main needle valve 20 controlled by its handle 21. The needle valve 20 is simply a general control valve by which the amount of gas comprising the mixed air and hydrocarbon produced by the atomizer shown in Figure 2, and supplied to the starting burner B is controlled.

In Figure 4, I have illustrated a construction by which I am enabled to obtain in a simple way that minuteness of formation of the passages of the atomizing conduits 9*a* and 13*a*, which is so desirable for the purposes of my invention. In this instance, the mixing chamber 10*a* and the orifice 12*a* and

the plug 11*a* are substantially like the corresponding parts previously set forth, but the pipes forming the conduits 9*a* and 13*a* are relatively large. The passages within said pipes are rendered small however, by the use of rods 13*b* and 9*b* in the conduits 13*a* and 9*a* respectively. Of course, in Figure 4, the size of the said passages of the conduits 9*a* and 13*a*, is much exaggerated for I again emphasize that the fineness of these passages respecting their cross-sectional area is highly essential to my invention.

The operation of the main burner or burners A has been previously set forth. The action of the starting burner B as supplied with fuel from the tank 2 is simple. Air under pressure in the air chamber 3 of the tank enters the air conduit 9 or 9*a* as the case may be. It is mixed with the hydrocarbon in the mixing chamber 10, taking up the hydrocarbon in exceedingly fine globules received in the mixing chamber, through the orifice 12 or 12*a*, as the case may be. The stream of air and the subsequent mixture of air and hydrocarbon is so finely divided that it becomes thoroughly atomized as it passes upwardly into the valve passage 15 of the valve C.

For different grades of hydrocarbon the relative amount of air and liquid fuel to be mixed in order to obtain instantaneous or substantially instant ignition at the starting burner B, may have to be regulated in order that a greater or less quantity of the air may be admitted to the atomized mixture which enters the pipe or conduit 14, and flows to the burner B. Under these conditions, the valve 17 is utilized and communication of the by-pass 16 with the main passage 15 is controlled by said valve 17 in the manner specified, and for the purpose just mentioned.

Referring to Figs. 2 and 3 of the drawing, it will be observed that I disclose the use of pipes 9 and 13 which have been flattened in order to produce the attenuation of the stream of fluids passing therethrough. I may use any method for flattening these tubes, but as a preferred method, a thin metal strip of known cross section is inserted in a tube of a predetermined diameter and the walls of the tube then rolled down upon the metal strip. Removing the strip will leave a uniform passage of a predetermined cross sectional area, and it is to be understood that the cross sectional area of these tubular passages bears a distinct relation to the cross sectional area of the inlet passage 12. As before premised, this is an important feature of my invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In hydrocarbon fuel burning apparatus, in combination, a fuel burner, a fuel supply conduit for the burner, an atomizer for supplying carbureted fuel to said conduit for substantially instant ignition and comprising an air supply conduit, a mixing chamber into which said air supply conduit leads, a hydrocarbon and air delivery conduit leading from the mixing chamber and communicating with the fuel supply conduit leading to the burner, means for supplying air under pressure to the said air supply conduit so that the air will take up a certain amount of the hydrocarbon at the mixing chamber and so that the said mixed air and hydrocarbon will be delivered in thoroughly atomized condition to the burner, and means for supplying auxiliary air to the combined air and hydrocarbon mixture supplied to the fuel supply conduit aforesaid and at the same pressure as the air is supplied to said air supply conduit.

2. In hydrocarbon fuel burning apparatus, in combination, a fuel burner, a fuel supply conduit connected with the burner, and an atomizer for supplying atomized fuel to the burner for substantially instant ignition, comprising an air supply conduit, a mixing chamber into which the air conduit leads and provided with a hydrocarbon orifice, a hydrocarbon and air delivery conduit leading from the mixing chamber and communicating with the fuel supply conduit connected with the burner, means for supplying air under pressure to the air supply conduit so that the air will pick up a certain amount of the hydrocarbon at the mixing chamber, and so that the mixed air and hydrocarbon will be delivered in a thoroughly atomized condition to the burner, a control valve body connecting the fuel supply conduit of the burner to the atomizing device aforesaid, the said valve body comprising an auxiliary air passage for admitting the auxiliary air to mix through the combined atomized air and hydrocarbon delivered by the delivery conduit aforesaid, and valve means controlling the auxiliary passage for air.

3. In hydrocarbon fuel burning apparatus in combination, a fuel burner, a fuel supply conduit connected with the burner, an atomizer for supplying vaporized fuel to the burner for substantially instant ignition, comprising an air supply conduit, a mixing chamber into which the air conduit leads and provided with a hydrocarbon orifice, a hydrocarbon and air delivery conduit leading from the mixing chamber and communicating with the fuel supply conduit connected with the burner, means for supplying air under pressure to the said air supply conduit so that the air will take up a certain amount of hydrocarbon at the mixing chamber, and so that the said mixed air and hydrocarbon will be delivered in a thoroughly atomized condition to the burner, a control valve body connecting the fuel supply conduit of the burner

to the atomizing device aforesaid, said valve body comprising an auxiliary air passage for admitting auxiliary air to mix with the combined atomized air and hydrocarbon delivered by the delivery conduit aforesaid, valve means controlling the auxiliary passage for air, and a main valve controlling the quantity of the atomized fuel which passes to the burner through the fuel supply conduit.

4. In hydrocarbon fuel burning apparatus, in combination, a hydrocarbon supply tank, means for maintaining air under pressure in the tank to act upon the hydrocarbon, an atomizer in the tank having an air supply pipe communicating with the pressure air in the tank, a mixing chamber connected with air supply pipe and submerged in hydrocarbon in the said tank and having a fine orifice through which the hydrocarbon enters the mixing chamber, a hydrocarbon and air delivery conduit leading from the mixing chamber, a valve device into which the last mentioned conduit leads, and to which it is connected, said valve device having a main passage to receive atomized fuel from the hydrocarbon and air delivery conduit, a fuel supply pipe connecting the valve device with starting burner means, and means for controlling admission of an auxiliary supply of air from the pressure air in the tank to the main passage of the valve device.

5. Apparatus as claimed in claim 4 wherein the last mentioned means comprises a bi-pass in the valve device connecting with the main passage thereof and communicating with the air pressure space in the tank aforesaid, together with a valve governing the operative area of the bi-pass so as to increase or diminish the quantity of auxiliary air that may be supplied to the atomized fuel delivered to said main passage of the valve device from the air and hydrocarbon delivery conduit aforesaid.

6. In combination, a hydrocarbon fuel burner, means for conducting the said fuel in carbureted form to said burner, an atomizer for supplying the said fuel in vaporized form to the conducting means, the atomizer embodying a tubular conducting means, with an opening above the surface of the liquid for admitting air under pressure and an opening below the surface of the liquid for admitting hydrocarbon fuel atomized with said air, and means for supplying auxiliary air to the combined air and hydrocarbon mixture at the same pressure as on the air admitted at said opening above the surface of the liquid.

7. In hydrocarbon fuel burning apparatus, in combination, a fuel burner, a conduit for supplying fuel to the burner, an atomizer for supplying carbureted fuel to the burner, an atomizer for supplying vaporized fuel to said conduit for substantially instant ignition, comprising a conducting means having a submerged inlet for the hydrocarbon and an inlet not submerged, for supplying air under pressure, so that the air will take up a certain amount of the hydrocarbon while passing through the said conducting means, and so that the said air and hydrocarbon will be delivered in a thoroughly atomized condition to the burner, and means for supplying auxiliary air to the combined air and hydrocarbon mixture in the fuel supply conduit aforesaid and at the same pressure as the air is supplied to the said conducting means.

8. In hydrocarbon fuel burning apparatus, in combination, a fuel burner, a fuel supply conduit connected with the burner, an atomizer for supplying vaporized fuel to the burner for substantially instant ignition comprising a tube of substantially hollow cross section flattened to produce a thin conduit of relatively minute cross section to facilitate its atomizing function, a mixing chamber into which said conduit leads and provides with a hydrocarbon orifice, a hydrocarbon and air delivery conduit leading from the mixing chamber and communicating with the fuel supply conduit connected with the burner, and means for supplying air under pressure to the said air supply conduit so that the air will take up a certain amount of the hydrocarbon in the mixing chamber and so that the said mixed air and hydrocarbon will be delivered in thoroughly atomized condition to the burner.

In testimony whereof I affix my signature.

FRANK V. RISINGER.