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HYDROCARBON BURNER

Filed Nov. 12, 1928

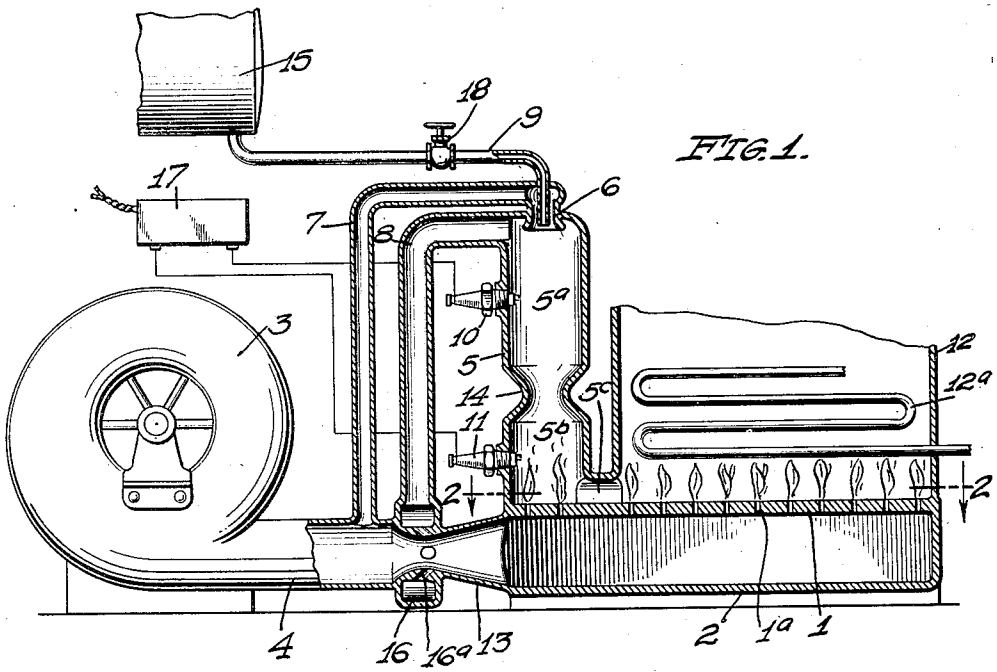
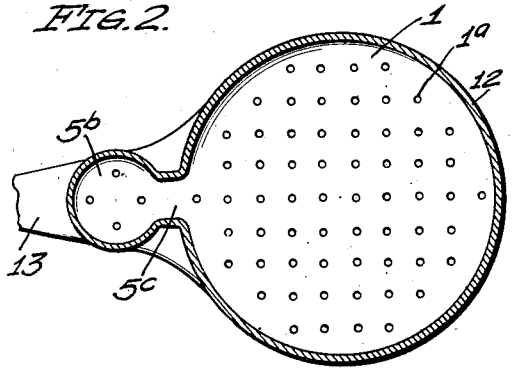


FIG. 1.

FIG. 2.



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UNITED STATES PATENT OFFICE

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HYDROCARBON BURNER

Application filed November 12, 1928. Serial No. 318,746.

My present invention relates to hydrocarbon burners, and more particularly to such burners for burning low grade fuel oils.

The objects of this invention are: first, to provide a very efficient, economical and compact burner of this class; second, to provide a burner of this class by which may be obtained any desired flame temperature, and combustion with high and the required carbon dioxide content; third, to provide a burner of this class requiring extremely low air pressure for efficient and economical combustion of the fuel and for obtaining a flame of high temperature; fourth, to provide a novel arrangement of elements for initially atomizing and vaporizing the fuel oil and for carrying away immediately the disassociated elements of the fuel; fifth, to provide a novel efficient fuel oil feed whereby the clogging of the fuel oil line is reduced to a minimum; sixth, to provide a novel and unitary means for feeding of air to the fuel nozzle, withdrawing fuel gases from the gasifying chamber, and for distributing fuel gases to the vaporizing and main burners; seventh, to provide a burner in which only the proper amount of air is mixed with the fuel oil; eighth, to provide a novel arrangement of elements for igniting the main burner; and, ninth, to provide as a whole a novel burner and one which is simple and economical to make and to operate.

With these and other objects in view, as will appear hereinafter, my invention consists of certain novel features of construction, combination and arrangement of parts and portions, as will be hereinafter described in detail and more particularly set forth in the appended claims, reference being had to the accompanying drawings and to the characters of reference thereon which form a part of this application in which;

Figure 1 is a side elevational view partially in section of my burner in one form together with associate parts, the view being diagrammatically only for the purpose of illustration, and Fig. 2 is a fragmentary sectional view thereof taken through 2—2 of Fig. 1.

Like characters of reference refer to similar parts and portions throughout the views of the drawings.

My burner, as illustrated in the drawings, consists essentially of a burner grid 1, a fuel gas distributing chamber member 2, a fan 3, a conductor 4 connecting the fan 3 to the chamber of the distributing chamber member 2, a fuel gasifying chamber member 5, a liquid fuel distributing and atomizing nozzle 6, an air conductor 7 connecting the conductor 4 with the nozzle 6, a fuel gas conductor 8 connecting the gasifying chamber member 5 to the conductor 4, a fuel oil conductor 9, and spark plugs 10 and 11 for igniting, respectively, the gases at the upper and lower ends of the gasifying chamber member 5.

The burner grid 1 is shown in the drawings as positioned at and forming the lower end of a boiler 12 and for heating the coils or other medium 12*a* therein. The grid 1 is provided with a multiplicity of orifices 1*a* through which is adapted to pass the fuel gas from the distributing chamber member 2 which is positioned at the lower side of and forms a part of the grid 1. To one side of the chamber member 2 is connected the one end of a mixing venturi 13 which forms a part and a continuation of the air conductor 4 extending from the fan 3. The fan 3 may be of any desired form but is adapted to produce a specific amount of air at specific static pressure for the ignition of and efficient burning of low grade fuels.

The gasifying chamber member 5 may be a tubular member of relatively large diameter positioned at one side of the boiler 12 and extending upwardly from a burner grid, which in this instance is a lateral extension of the burner grid 1. The gasifying chamber member 5 is provided with a diametric constriction 14 which forms a reduced opening for the passage of the gases of combustion from the lower end of the chamber member 5 into the gasifying chamber 5*a* at the upper portion of the member 5. The fuel distributing and atomizing nozzle 6 extends through and into the upper end of the chamber 5*a* of the gasifying chamber member and flares outwardly at its downwardly extended inner end. The portion of the nozzle 6 extending

beyond the upper end of the member 5 is preferably enlarged and is connected with this enlarged portion by the conductor 7 with the air conductor 4 between the venturi 13 and the fan 3. Into the nozzle 6 and preferably centrally therein extends the discharge end of the liquid fuel conductor 9 which receives its supply of liquid fuel from the reservoir 15, by gravity or by any other desired means. The discharge or nozzle end of the fuel conductor 9 which is positioned within the nozzle 6 is preferably of the normal diameter of the fuel oil conductor so as to minimize clogging of the fuel line to a minimum.

The vaporized or gasified fuel within the chamber 5*a* is conducted from the upper end of such chamber through the conductor 8 which communicates at its opposite or lower end with and at the constricted portion of the venturi 13. The connection of the conductor 8 with the venturi may be made by conducting the gases from the conductor 8 into an annular channel 16 surrounding the outer portion of the venturi at the constricted portion and then conducting the gases from the annular channel by a plurality of angular orifices 16*a* into the venturi immediately beyond the portion of the greatest speed of gases flowing therethrough.

The atomized or disassociated fuel within the chamber 5*a* is ignited by the spark plug 10 extending through the side wall thereof and connected with a suitable ignition coil 17. The gases at the lower end of the gasifying chamber member 5 are ignited by the spark plug 11 also connected with the ignition coil. The main burner or heating portion of the burner directly at the lower end of the boiler is ignited by the burning gases at the lower end 5*b* of the chamber member 5, the flame passing from the chamber 5*b* through a lighter port 5*c* connecting the interior of the boiler receptacle with the chamber 5*b*.

The operation of my burner is as follows:

When the air pressure source or fan 3 is operated, air under pressure is forced through the conductor 7 to the fuel oil distributing and atomizing nozzle 6 into which a small amount of fuel oil from the fuel line 9 is introduced by gravity or other means, resulting in sufficient atomization of the fuel oil as to be ignited by the spark plug 10, which atomized fuel burns initially with a yellow flame in the gasifying chamber 5*a*. As other air is forced through the venturi 13, a vacuum is created in the conductor 8 causing excess air to be drawn through the burner grid into the chamber 5*b* and the constricted opening 14. The atomized fuel in the chamber 5 burns with a yellow flame only long enough to raise the temperature within the chamber 5*a* to the required degree for gasifying the atomized or disassociated liquid fuel. The full amount of liquid fuel is then introduced through the fuel line 9 causing gasifying of such fuel and smothering of the yellow flame in the chamber 5*a*. This gasified fuel from the chamber 5*a* is carried, by the partial vacuum created in the conductor 8, through said conductor into the venturi 13 in which the gasified fuel is mixed with the proper amount of air, without excess of air. Such mixed gases in a highly combustible state and which forms the fuel gas, are conducted to the distributing chamber which supplies the burner grid. The gas passing through the grid is ignited by the spark plug 11 in the chamber 5*b*, the flame being carried through the lighter port 5*c* for lighting the main fire of the grid. The continuation of the gasifying of the liquid fuel within the chamber 5*a* is accomplished by a portion of the hot gases of combustion from the burner grid, namely, that portion entering directly the chamber 5*b* and drawn through the opening 14. It will be noted that the flow of the hot gasifying gases through the opening 14 is in the opposite direction or in a direct counter-flow to the liquid fuel and air under pressure introduced at the opposite end of the chamber 5*a*, thus causing the fuel, partially broken up and disassociated at the nozzle 6 and distributed within the chamber 5*a*, to be gasified in an efficient manner while in suspension within the chamber 5*a*. Thus the elements of the fuel are carried away as rapidly as they are disassociated and gasified and are simultaneously mixed with a certain amount of the product of combustion, thereby causing a change in the chemical formula of the fuel resulting in an efficient fuel gas and whereby the deposition of free carbon or soot in any part of the burner is eliminated, or at least reduced to a minimum.

The atomizing and fuel distributing nozzle 6 is so designed as to require only very slight air pressure for performing its designated function.

It will be here noted that although I have confined the description of my apparatus to one using fuel oil and particularly a low grade fuel oil, the various and principal features of my present invention are applicable to burners using other fuel such as atomized coal and the like, or gases, and by defining the conductor 9 as a fuel conductor, I include generally any means for conveying fuel to the chamber 5*a*.

Though I have shown and described a particular construction, combination and arrangement of parts and portions and a specific application of my burner to a boiler or a more or less specific boiler, I do not wish to be limited to this particular construction, combination and arrangement, nor to the particular application of my burner, but desire to include in the scope of my invention, the construction, combination and arrange-

ment substantially as set forth in the appended claims.

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

1. In a burner of the class described, a burner means, an air pressure source communicating therewith, a gasifying chamber member communicating with and adapted to receive gases of combustion therefrom and also communicating with and adapted to receive air from said air pressure source, a fuel conductor connecting with the chamber of the chamber member, and a gasified fuel conductor communicating with the chamber of the chamber member and with the air pressure source.

2. In a burner of the class described, a burner means, an air pressure source communicating therewith, a gasifying chamber member communicating with and adapted to receive gases of combustion therefrom and also communicating with and adapted to receive air from said pressure source, a fuel conductor connecting with the chamber of the chamber member, a gasified fuel conductor communicating with the chamber of the chamber member and with the air pressure source, and spark plugs adapted to ignite gases within the gasifying chamber and the gases from the burner means.

3. In a burner of the class described, a burner means, a gasifying chamber member adapted to receive gases of combustion from the burner means, an air pressure conductor communicating with said gasifying chamber, a fuel conductor communicating with said gasifying chamber in association with said air pressure conductor, and a gasified fuel conductor communicating with the chamber of the chamber member and with the burner means.

4. In a burner of the class described, a burner means, an air pressure source communicating therewith, a gasifying chamber member communicating with and adapted to receive gases of combustion therefrom and also communicating with and adapted to receive air from said air pressure source, a fuel conductor connecting with the chamber of the chamber member, and a gasified fuel conductor communicating with the chamber of the chamber member and with the air pressure source, the flow of the gases of combustion from the burner means into said chamber being opposed to the flow of air and liquid fuel therein.

5. In a burner of the class described, a burner means, a gasifying chamber member adapted to receive gases of combustion from the burner means, an air pressure conductor communicating with said gasifying chamber, a fuel conductor communicating with said gasifying chamber, a fuel conductor communicating with said gasifying chamber in association with said air pressure conductor, and a gasified fuel conductor communicating with the chamber of the chamber member and with the burner means, the flow of the gases of combustion from the burner means into said chamber being opposed to the flow of air and liquid fuel therein.

6. In a burner of the class described, a gasifying chamber, means for supplying a current of hot gases of combustion to one end of the chamber, and a source of non-gaseous fuel communicating with the opposite end of the chamber, said fuel from the latter source being directed centrally toward and into immediate contact with the gases of the current of hot burned gases of combustion from the former source and in opposed direction thereto.

7. In a burner of the class described, a gasifying chamber, means for supplying a current of hot gases of combustion to one end of the chamber, a source of non-gaseous fuel communicating with the opposite end of the chamber, and an air conductor communicating with said chamber at the connection therewith of said non-gaseous fuel source, the air from the air conductor being adapted to distribute the fuel from the fuel source into the chamber and into the current of hot gases of combustion from the opposite end of the chamber.

8. In a burner of the class described, a gasifying chamber, means for supplying a current of hot gases of combustion to one end of the chamber, a source of non-gaseous fuel communicating with the opposite end of the chamber, and an air conductor communicating with said chamber at the connection therewith of said non-gaseous fuel source, the air from the air conductor being adapted to distribute the fuel from the fuel source into the chamber and into the current of hot gases of combustion from the opposite end of the chamber, the direction of flow of the air and the liquid fuel being opposed to the direction of flow of the hot gases of combustion within the chamber.

9. In a burner of the class described, a gasifying chamber member having therein a fuel gasifying chamber, an air nozzle directed thereinto from one end, a fuel nozzle positioned within the air nozzle and extending in the same direction therewith, the air from the air nozzle being adapted to atomize and distribute the fuel from the fuel conductor within the gasifying chamber, and means for directing a separate source of hot gases of combustion into the gasifying chamber from the opposite end thereof for gasifying the distributed atomized fuel.

10. In a burner of the class described, a gasifying chamber member having therein a fuel gasifying chamber, an air nozzle directed thereinto from one side, a fuel nozzle positioned within the air nozzle and extend-

ing in the same direction therewith, the air from the air nozzle being adapted to atomize and distribute the liquid fuel from the fuel conductor within the gasifying chamber, and means for directing hot gases of combustion into the gasifying chamber for gasifying the distributed atomized liquid fuel, the direction of flow of the air in the liquid fuel from their respective nozzles being directly opposed to the general flow of the hot gases of combustion within the gasifying chamber.

11. In a burner of the class described, a burner means, a gasifying chamber member having intermediate its ends a constricted portion dividing the chamber member into two chambers connected by a constricted opening, one chamber positioned over the burner means and adapted to receive burned gases of combustion therefrom, a liquid fuel conductor directed into the other chamber and into the current of gases of combustion flowing through said constricted opening, and a fuel gas conductor connected with the latter chamber and through which the gasified fuel from the latter chamber is adapted to flow.

12. In a burner of the class described, a burner means, a gasifying chamber member having intermediate its ends a constricted portion dividing the chamber member into two chambers connected by a constricted opening, one chamber positioned over the burner means and adapted to receive burned gases of combustion therefrom, a liquid fuel conductor directed into the other chamber and into the current of gases of combustion flowing through said constricted opening, and a fuel gas conductor connected with the latter chamber and through which the gasified fuel from the latter chamber is adapted to flow, the latter conductor communicating with said burner means.

13. In a burner of the class described, a burner means, a gasifying chamber member having intermediate its ends a constricted portion dividing the chamber member into two chambers connected by a constricted opening, one chamber positioned over the burner means and adapted to receive burned gases of combustion therefrom, a liquid fuel conductor directed into the other chamber and into the current of gases of combustion flowing through said constricted opening, a fuel gas conductor connected with the latter chamber and through which the gasified fuel from the latter chamber is adapted to flow, the latter conductor communicating with said burner means, and an air pressure source communicating with the burner means and adapted to mix the gases from the latter conductor with air and to draw the gases from the latter conductor.

14. In a burner of the class described, a burner means, a gasifying chamber member having intermediate its ends a constricted portion dividing the chamber member into two chambers connected by a constricted opening, one chamber positioned over the burner means and adapted to receive burned gases of combustion therefrom, a liquid fuel conductor directed into the other chamber and into the current of gases of combustion flowing through said constricted opening, a fuel gas conductor connected with the latter chamber and through which the gasified fuel from the latter chamber is adapted to flow, the latter conductor communicating with said burner means, and an air pressure source communicating with the burner means and adapted to mix the gases from the latter conductor with air and to draw the gases from the latter conductor, said air pressure source communicating also with the latter chamber for atomizing and distributing the liquid fuel from the liquid fuel conductor.

15. In a burner of the class described, a burner means having a fuel gas distributing chamber at its inner side, a unitary air pressure source, a unitary conductor connecting said air pressure source with said fuel gas distributing chamber and provided therein with a venturi, a gasifying chamber member having a gasifying chamber communicating with said burner means and adapted to receive hot gases of combustion therefrom, a fuel conductor extending into said gasifying chamber, and a gasified fuel conductor extending from said gasifying chamber to the air conductor and communicating therewith at the venturi therein for drawing the gasified fuel from the gasifying chamber through said gasified fuel conductor and for mixing the gases therefrom with air from said air pressure source.

16. In a burner of the class described, a burner means having a fuel gas distributing chamber at its inner side, a unitary air pressure source, a unitary conductor connecting said air pressure source with said fuel gas distributing chamber and provided therein with a venturi, a gasifying chamber member having a gasifying chamber communicating with said burner means and adapted to receive hot gases of combustion therefrom, a fuel conductor extending into said gasifying chamber, a gasified fuel conductor extending from said gasifying chamber to the air conductor and communicating therewith at the venturi therein for drawing the gasified fuel from the gasifying chamber through said gasified fuel conductor and for mixing the gases therefrom with air from said air pressure source, and a second air conductor connected with the first air conductor between the air pressure source and the venturi and directed into said gasifying chamber around the fuel oil conductor.

17. In a burner of the class described, a burner grid having an extended portion and a fuel supply communicating with one side of

the burner grid, a gasifying chamber member positioned over the extended portion of the burner grid, said chamber member having therein a chamber immediately adjacent the extended portion of the burner grid and provided in its side with a lighting port, a spark plug extending into said chamber adapted to ignite the fuel gases received therein from the extended portion of the burner grid, and adapted indirectly to light the fuel gases, from the main portion of the burner grid, through said lighting port.

18. In a burner of the class described, a burner grid having an extended portion and having a fuel gas distributing chamber at its inner side for supplying simultaneously the main and the extended portion of the burner grid with fuel gas, a gasifying chamber member positioned over the extended portion of the burner grid and provided in its side with a lighting port, said chamber member having therein a chamber immediately adjacent the extended portion of the burner grid, a spark plug extending into said chamber adapted to ignite the fuel gases therein and adapted indirectly to light the fuel gases from the main portion of the burner grid through said lighting port, said gasifying chamber member having at its outer end a gasifying chamber communicating with the first mentioned chamber in the gasifying chamber member, a gasified fuel conductor extending from said gasifying chamber for drawing gasified fuel therefrom, and means for drawing the gasified fuel from the latter conductor, for mixing the gases therefrom with air and for forcing the resulting fuel gas into said fuel gas distributing chamber and through said grid.

19. In a burner of the class described, a chamber member having a mixing chamber therein, a burner means forming a source of hot gases of combustion, said burner means communicating with one end of the mixing chamber for directing gases of combustion into the mixing chamber, a main source of fuel directed into said mixing chamber from the opposite end in directly opposed relation to the direction of flow of the gases of combustion, and in direct contact therewith for vaporizing the same, and means for conducting a portion of the resulting vaporized fuel to the burner means.

20. In a burner of the class described, a burner grid having an extended portion and having a fuel gas distributing chamber at its inner side for supplying simultaneously the main and the extended portion of the burner grid with fuel gas, a gasifying chamber positioned over the extended portion of the burner grid, said chamber member having therein a chamber immediately adjacent the extended portion of the burner grid and provided in its side with a lighting port, a spark plug extending into said chamber adapted to ignite the fuel gases received therein from the extended portion of the burner grid and adapted indirectly to light the fuel gases from the main portion of the burner grid through said lighting port, a non-gaseous fuel supply directed into and in direct contact with hot gases of combustion in said gasifying chamber, and a conductor extending from the gasifying chamber to the inlet end of the gas distributing chamber for supplying the burner grid with fuel.

21. In a burner of the class described, a chamber member having a mixing chamber therein, a burner means forming a source of hot gases of combustion, said burner means communicating with one end of the mixing chamber for directing gases of combustion into the mixing chamber, and a main source of fuel directed into said mixing chamber from the opposite end in directly opposed relation to the direction of flow of the gases of combustion and in direct contact therewith for vaporizing the fuel.

In testimony whereof, I have hereunto set my hand at Columbus, Ohio, this 9th day of November, 1928.

RUSSELL R. WATERMAN.