Jan. 6, 1931. W. A. J. KREAGER 1,787,632

BURNER

Filed Oct. 20, 1928

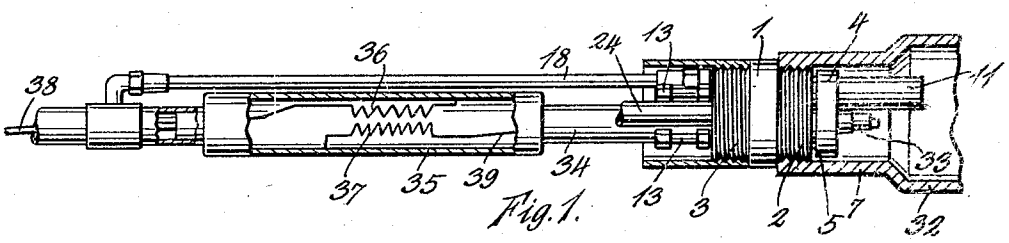


Fig. 1.

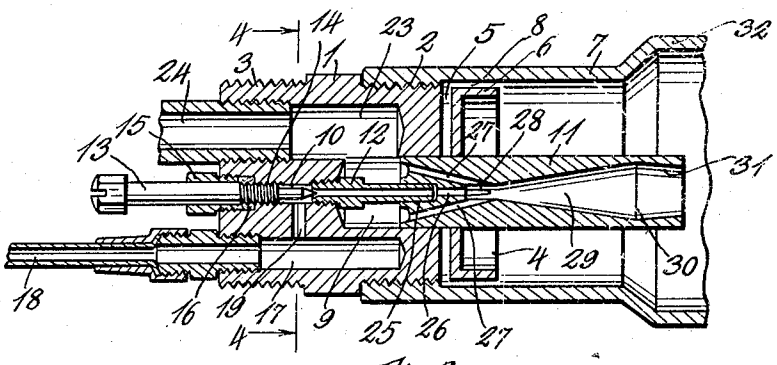


Fig. 2.

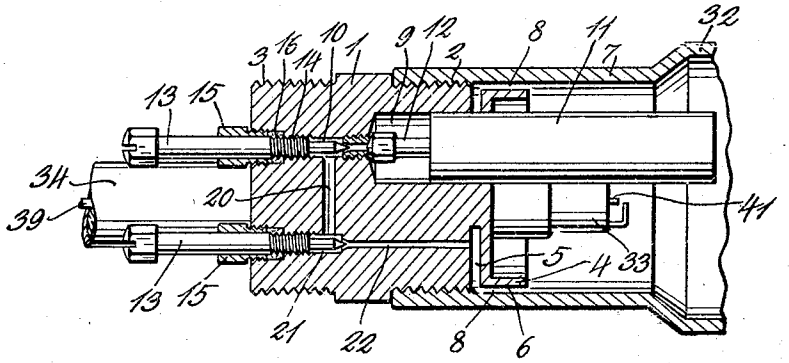


Fig. 3.

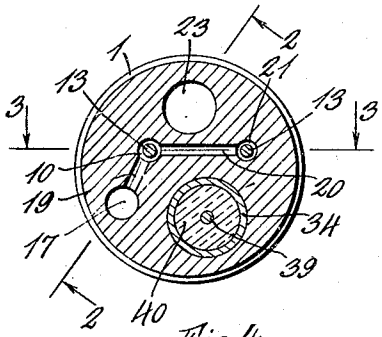


Fig. 4.

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# UNITED STATES PATENT OFFICE

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## BURNER

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This invention relates to improvements in burners, and has reference more particularly to a burner that can be used with any form of fluid hydrocarbon, such as gas or oil.

It is the object of this invention to produce a simple and efficient burner that shall be especially well adapted for use in refineries where crude oil is available or with natural gas and which shall be so constructed that there will be a complete combustion of the fuel so as to make available for use all of the heat units present in the fuel.

This invention, briefly described, consists of a burner head having a tubular nozzle extending from one end thereof and provided at the other end with openings which are adapted to be connected with a source of air under pressure and with a source of fuel supply. The compressed air is directed into an axial opening in the nozzle with which opening a number of smaller openings communicate at one end and have their other end connected with the fuel supply. The nozzle is provided with an opening of a peculiar shape which produces a suction effect when compressed air is applied and which serves to cause the proper amount of fuel to be drawn into the nozzle. In addition to this means are provided for enveloping the flame in a layer of air from the same source as that which supplies the nozzle so that the flame itself will burn in the same manner as it would if burning in the open air.

Having thus briefly described the invention, the same will now be described in detail and reference for this purpose will be had to the accompanying drawing, in which the preferred embodiment of the invention has been illustrated, and in which:

Fig. 1 is a view partly in elevation and partly in section showing one of my improved burners;

Fig. 2 is a sectional view taken on line 2—2, Fig. 4;

Fig. 3 is a section taken on line 3—3, Fig. 4; and

Fig. 4 is a section taken on line 4—4, Fig. 2.

In the drawing numeral 1 represents a burner head which is preferably formed from one solid piece of brass or other suitable material. The outer surface of the burner head is preferably provided with two threaded portions, one at each end, which have been designated by reference numerals 2 and 3. One end of the burner head is recessed as indicated by numeral 4 and has a radial cut or groove 5 which extends inwardly so as to provide a thin radial opening through which air may be passed by means which will be hereinafter more fully described. The outside diameter of the recessed portion which has been designated by numeral 6, is somewhat less than the root diameter of the threads on the threaded portion 5 so that when the burner is put in place in the cylindrical hub 7 an annular air space 8 will be provided between the outer surface 6 and the inner surface of hub 7. The burner head is provided with an opening 9 which extends inwardly from the recessed end and which communicates at its inner end with a smaller opening 10. A tubular nozzle 11 is inserted into the opening 9 in the manner shown in Figs. 2 and 3. The forward end of opening 10 is threaded for the reception of the threaded end of the nozzle 12. A valve 13 has a threaded portion 14 that engages the threaded interior portion of opening 10. The forward end of valve 13 is pointed and is adapted to extend into the opening in the inner end of nozzle 12 and serves to regulate the amount of air that can flow into the nozzle. A nut 15 surrounds the valve 13 and forms one part of a stuffing box 16 by means of which leakage is prevented at this point. The burner head is also provided with an opening 17 which extends forwardly from the end of the head opposite to that from which the nozzle projects. This opening is connected to a source of compressed air by means of a pipe 18 and is in communication with opening 10 by means of a passage 19. Referring now to Fig. 3, it will be seen that a passage 20 connects opening 10 with the interior of opening 21, which extends inwardly from the outer end of the burner head. From the bottom of opening 21, a smaller opening 22 extends forwardly and connects with the radial cut 5. A valve constructed exactly the same as the one designated 13 and which has

been given the same reference numeral serves to control the flow of air into opening 22. A fuel supply opening 23 extends inwardly from the outer end of the burner head and this is connected with a source of fuel by means of a pipe 24. The inner end of opening 23 is in communication with the opening 9 in the manner shown in Fig. 2. The fuel supply is preferably under a slight pressure and therefore opening 9 adjacent the outer end of nozzle 11 will be in communication with a supply of fuel.

Attention will now be called to the construction of the nozzle 11 which may be formed from a cylindrical member of suitable length and of such a diameter that it will fit the opening 9. This nozzle has an axial opening the inner end of which has been designated by reference numeral 25 and which receives the end of nozzle 12 in the manner shown. Immediately adjacent the inner end of nozzle 12 the opening is smallest and this portion has been designated by numeral 26. A plurality of inclined openings 27 extend from the rear end of the nozzle 11 to the axial opening with which they communicate at point 28. From the point where openings 27 enter the axial opening, and where the latter is smallest it increases in size as it extends forwardly to form a tapering section designated by numeral 29. This conical portion terminates at 30 where it is largest and from this point towards the forward end of the nozzle the walls taper inwardly as indicated by numeral 31. It will thus be noted that the portion of the opening of the nozzle 11 forward of the point 28 has the shape of two reversely arranged conical frustums whose bases are in contact as shown at 30. When compressed air is permitted to flow forwardly through nozzle 12 and through opening 26, a suction will be produced which tends to make fuel flow from openings 9 and 23 through openings 27 into the axial opening which is bounded by sides 29 and 31. The suction produced is proportional to the velocity of the air, and therefore, the fuel will be supplied in a quantity which varies directly with the amount of air provided, and in this manner the proper fuel mixture is obtained with air pressures of greatly varying values. The arrangement just described is of great importance in burners of this type for the reason that it automatically proportions the mixture of air and fuel so that the burner will work properly with air pressures of different values, and this, therefore, makes it unnecessary to regulate carefully the air pressure except for the purpose of increasing or decreasing the amount of heat to be generated. The auxiliary air supply which enters through opening 22, radial cut 5 and the annular space 8 envelopes the flame and provides a supply of air that is in excess of that actually necessary for complete combustion, so that at all times a sufficient supply of oxygen will be present to permit all the combustible material contained in the fuel to be fully oxidized. Due to the complete oxidization or combustion of the fuel a very high thermal efficiency is obtained.

This burner can be used for any purpose whatsoever and in the drawing it has been shown as secured to the hub portion 7 that extends rearwardly from a cylindrical combustion chamber 32.

In order to facilitate the starting of the flame, I have provided the burner with a spark plug 33, which is attached to the inner end of a tubular member 34. The inner end of pipe 34 is connected with a larger cylindrical member or pipe 35, within which is located the primary coil 36 and the secondary coil 37 of an induction coil. One end of the primary is grounded to the tubular member 35 and the other end is insulated and connects with an insulated conductor 38 that extends to a circuit interrupter or to an alternating source of electromotive force by means of which the primary coil is energized. One end of the secondary coil is also grounded to tubular member 35 and the other end which has been designated by numeral 39 extends through tubular member 34 from which it is insulated by means of a thick wall of insulating material 40 which prevents the high tension current from jumping to the walls of pipe 34. The outer end of conductor 39 is electrically connected with the central electrode 41 of the spark plug. When the induction coil is energized, a jump spark will be produced which will ignite the mixture of air and fuel that emerges from the nozzle 11. Due to the fact that the induction coil is located very near to the nozzle, the secondary conductors can readily be properly insulated and this greatly simplifies the problem of insulation for the reason that the low potential conductor 38 does not require any high degree of insulation and the source of low potential current may therefore be located at any distance, whereas, if a long secondary circuit were used, the problem of insulation would be very complicated.

From the above description it will be apparent that I have produced a burner of a simple construction that is practically self-contained and which can be quickly applied to or removed from a furnace or combustion chamber. This burner is adapted for use with liquid or gaseous fuel and can be operated in horizontal or vertical position. Owing to the special means provided for producing a proper mixture of air and fuel, the peculiar frusto conical shape of the burner nozzle opening heretofore described and to the presence of the auxiliary air supply by means of which the flame is enveloped in air, a complete combustion of all the combustible

matter of the fuel is obtained, which gives a high thermal efficiency and prevents the formation of monoxide and objectionable carbon black or other carbonaceous deposits which usually form when incomplete combustion takes place. And in this connection it should be explained that much reliance is placed on the peculiar shape of the opening of the nozzle 11 forward of the point 28 where the fuel enters, for the remarkable thermal efficiency of the burner, since this feature cooperates with the other structural features to place the fuel in condition for the attainment of such result. The cut or groove 5 serves to distribute the air circumferentially so that it will emerge through the annular space 8 in a stream of uniform thickness and velocity. The depth of groove 5 is naturally immaterial but it is desirable to have an annular groove or some equivalent means for distributing the air uniformly throughout space 8.

Having described the invention what is claimed as new is:

In a device for burning fluid hydrocarbon fuel comprising, a burner head (1) having an opening (9) extending into the front end thereof, a tubular nozzle (11) having its rear end located in the opening, the other end of the head having two openings (23 and 17) one (23) of which is adapted to be attached to a source of fluid hydrocarbon and the other (17) of which is adapted to be attached to a source of compressed air, the opening containing the nozzle being in communication with the fuel opening (23) the burner head being also provided with another opening (10) in its rear end which opening is in communication with the interior of the nozzle and with the interior of the compressed air supply opening (17), a valve for controlling the flow of air to the nozzle, the burner head having an annular groove near its front end, said groove being in communication with the air supply opening (17), a valve for controlling the flow of air from the air supply to the annular groove, that part (6) of the burner head lying to the front of the annular groove being of smaller diameter than the part to the rear thereof, and a tubular casing (7) secured to the burner head and extending forwardly beyond the nozzle.

In testimony whereof I affix my signature.

WILLIAM A. J. KREAGER.