Dec. 7, 1926. 1,609,457

J. M. BROWN

APPARATUS FOR BURNING FLUID FUEL

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Fig. 1.

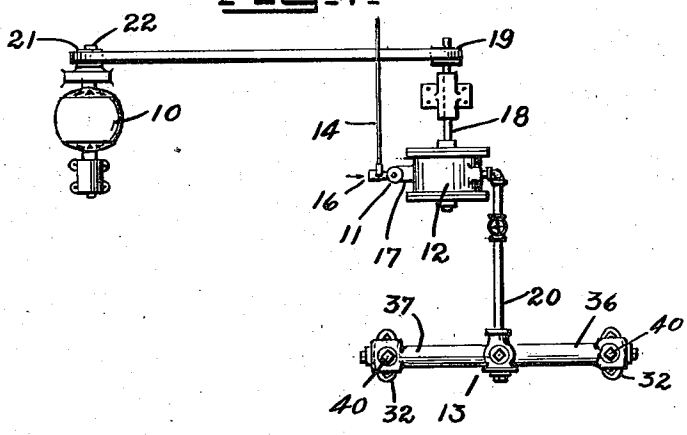
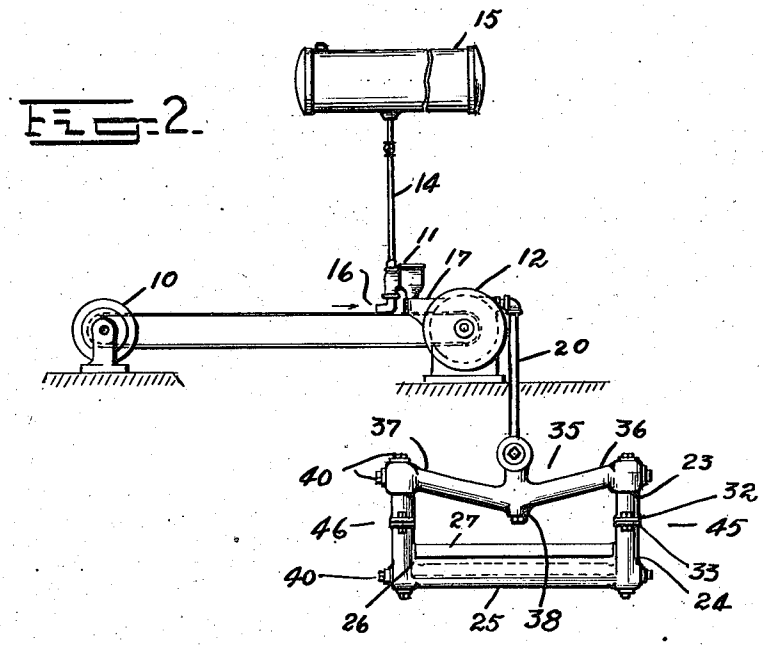


Fig. 2.



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Fig. 3.

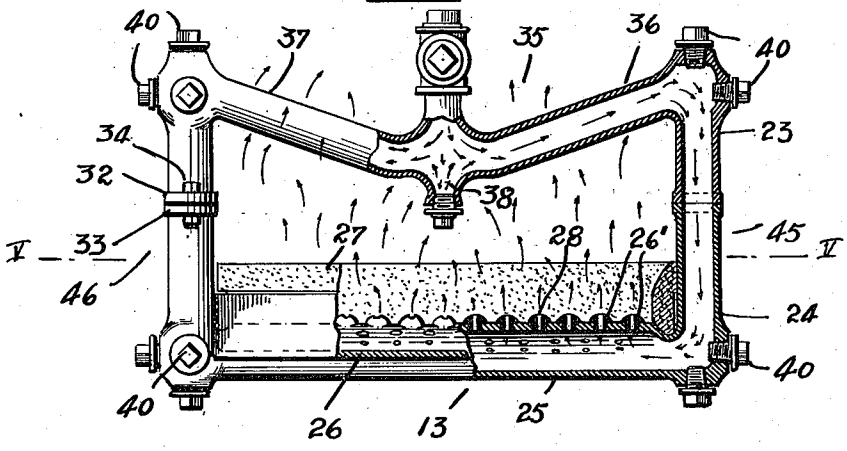


Fig. 4.

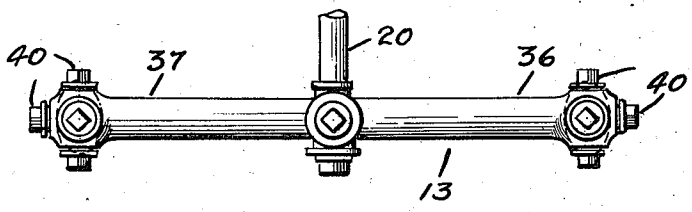


Fig. 5.

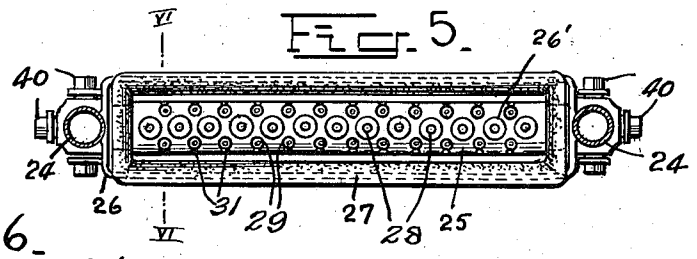
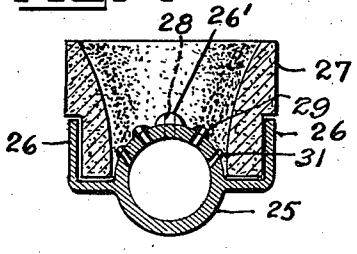


Fig. 6.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR BURNING FLUID FUEL.

Application filed March 1, 1924. Serial No. 696,187.

This invention relates to a method of and an apparatus for burning fluid fuel and more particularly to the utilization of a viscous fluid, such as low grade oil.

An object of the invention is to provide a burner of high efficiency and of simple construction.

Another object of the invention is to provide a burner for effecting a complete combustion of a fuel by pre-heating to a high temperature a fuel mixed with a gas just prior to the ignition of such mixture.

Another object of the invention is to provide a fuel burning system having a minimum number of operating parts and low maintenance cost.

A further object of the invention is to provide a fuel burner which is capable of effecting the burning of fuel with a minimum formation of carbon.

Another object of the invention is to provide a fuel oil burner which is capable of "cracking" the fuel oil prior to its ignition.

Various other objects and advantages of the invention will be apparent from the following description.

The desirability of using a fluid fuel as a heat-generating medium is dependent upon the efficiency of such fuel, that is, the amount of British thermal units attained per unit of volume of the fuel. The ideal condition, of course, is the complete combustion of the fuel, and it follows that if such a stage is reached no residue in solid form, such as carbon or unburned particles of oil, will result.

It has been found that heretofore in burners wherein a rich or a lean mixture of fuel, such, for example, as crude oil and air, is used, an increment of carbon is deposited upon the walls of the combustion chamber, flue, or other places. This deposit absorbs minute quantities of unignited oil, becoming in time saturated until finally an explosion or ignition occurs, often with serious results.

The present invention aims to not only avoid the possibility of the above disadvantages, but at the same time to provide a burner of high efficiency by approaching the ideal condition in so far as complete combustion is concerned.

The above described conditions are, when practising my invention, attained by bringing together and mixing the fuel and another fluid at a point comparatively remote from the point of combustion. The mixed fuel is then propelled into a fire trough or pot and ignited. I have found it desirable to pre-heat the fuel at such a high temperature prior to combustion in order to convert it into a highly active gaseous condition, or into its low-boiling point constituents, and for that purpose lead the fuel to the fire-pot by such a route that the fuel is passed through an extremely highly heated region prior to combustion. Considerable advantage is derived from the pre-heating operation. The density of the mixture of fuel passing to the fire-pot can be controlled and as the mixture enters the pre-heater it is converted to a highly gaseous state just prior to combustion. This action or chemical change prevents the ejection of the less volatile constituents of the fuel oil through the burner, which would include relatively large solid particles, some of which might escape the full effect of the heat during the combustion period, and thus be precipitated on the walls of the combustion chamber and flue. As above stated, a deposit of such particles of oil together with the carbon deposit in the various recesses and crevices of a furnace constitute a potential force that is often released by ignition and results in a disastrous explosion.

I have also found that more complete combustion is attained by passing the carburetted fuel through a conduit of relatively small effective area in transverse section and connecting this conduit with a relatively large capacity pre-heating chamber in which is located a "hot-spot" against which the fuel oil is projected. I attribute the advantages attained by the burner partly to this construction and believe that the rapid expansion of the mixture as it enters the large chamber is augmented by the high temperature present and the issuing fuel is brought to a high degree of combustibility.

Furthermore, the peculiar arrangement of the expansion chamber makes it possible to pass the mixture over what may be termed a "hot-spot," that is, at a given area of the conduit the heat is concentrated. Thus as the mixture becomes subjected to this heated area the undivided fuel particles that have heretofore been prevalent in pipe systems

are broken up and the deposit that may adhere to the wall of the chamber reduced to a minimum.

This invention may be better understood by referring to the accompanying drawings, in which

Fig. 1 is a diagrammatic plan view of the oil burning system.

Fig. 2 is an elevation of the burner element combined with the system.

Fig. 3 is an elevational view of my burner elements, parts being shown in section.

Fig. 4 is a top view of the burner shown in Fig. 3.

Fig. 5 is a view taken on line V—V in Fig. 3, and

Fig. 6 is an enlarged sectional view taken on line VI—VI, in Fig. 5.

A fuel-burning system may, in accordance with my invention, comprise a suitable source of energy, as for example a motor 10, any desirable type of mixing device, such for example as a carburetor 11, a rotary pump 12, and a burner 13.

Fuel may be fed by gravity or otherwise to the carburetor or mixer by a pipe 14 connected with a fuel supply tank 15. The mixer may be provided with the usual regulated air inlet 16 and the vapor outlet 17 thereof may be in communication with the pump 12. Any well known type of rotary pump may be used having the shaft 18 thereof provided with a pulley 19 driven by a belt connection with a pulley 21 secured to the shaft 22 of the motor.

The burner 13 may comprise upper and lower portions 23 and 24, respectively, and may be connected to the outlet side of the pump 12 by a conduit or manifold 20, and a mixture may thus be driven to the burner.

In the embodiment of the burner illustrated, the lower portion 24 may comprise a perforated nozzle 25, which, in the present construction, is provided with lateral webs or shelves 26 integral therewith, upon which a fire-brick 27 having a central upwardly flaring opening is positioned. The fire-brick may, if desirable, be formed of sections, and when in position constitutes in conjunction with the webs 26 a trough-shaped crater which may be termed the fire-pot of the burner. The nozzle 25 is provided with a plurality of relatively large diameter perforations 28 (see Fig. 3) spaced at intervals along the upper surface. At each side of the perforations 28 is another row of smaller diameter perforations 29 and a row of still smaller holes 31 is provided at each side of the nozzle and so arranged as to be adjacent to the fire-brick 27. These latter holes are drilled or cast at such an angle that when the gaseous fuel is ejected therefrom the flames will impinge upon the fire-brick 27 and maintain it at a high temperature, thus if the flow of fuel is momentarily terminated, it would when resumed become ignited. These holes 31, therefore, serve as pilot jets, while the ports 28 and 29 eject the main portion of the fuel and cause the intense blue flame which gives off the major portion of the heat, and also serve to maintain the pre-heater at an extremely high temperature.

The perforations in the nozzle may be provided with teats 26′ formed of a high heat resistant and non-corrosive material, such as tungsten steel, and the like.

The ends of the lower or nozzle portion 24 of the burner 13 are provided with flanges 33 which may be bolted to companion flanges 32 at the ends of the upper portion 23.

The flanges may be maintained in a steam-tight fit by bolts 34 passing through holes which will permit sufficient relative movement of the lower portion 23 of the burner resulting from the expansion and contraction caused by the changes in temperature.

The upper portion 23 of the burner is constructed to afford a passage-way for the fuel to enter the nozzle 25 and a relatively large section 35 of this passageway is disposed in the path of travel of radiated heat waves which have been indicated in the drawing by arrows and against which the flames, emerging from the perforations or fuel ejector ports, may impinge. This section may be generally termed a pre-heater, and the side passages, i. e., the portions 45 and 46 adjacent to the flanges, may serve to maintain the gases generated in the pre-heater in such a state.

The fuel passing through the section 35 of the burner, is therefore subjected to the high temperature emanating from the fire-pot and the molecules thereof become agitated and result in the conversion of the vaporized fuel into a highly active gaseous state. This gas immediately, by reason of the close proximity of the section 35 to the nozzle 25, enters the fire-pot for ignition and approaches the perfect state of complete fuel combustion and a high degree of heat generation is attained per unit of fuel consumed.

The pre-heater is preferably formed of two or more portions 36 and 37 which diverge toward the nozzle and meet at a common point or pocket, the pocket being disposed centrally, longitudinally of the nozzle 25. The pipe 20 which conducts fuel from the pump 12 communicates with the inclined portions 36 and 37 at the pocket in which the fuel divides for passage through the respective portions to be ejected from the nozzle. The pocket 38 by reason of my construction is in closer relation to the fire than the portions 36 and 37, and provides what may be designated as a chamber or "hot-spot" to crack such solid particles as

may be carried by the vapor mixture and thus greatly reduce the possibility of the fuel passage becoming clogged and also the improper operation due to insulating carbon deposits upon the walls of the conduits.

Although as above set forth the carbon deposit upon the inner walls of the burner is small and is generally removed through the chemical reactions taking place within the pre-heater, it is nevertheless desirable to provide means of access to the various passageways. Such means may comprise threaded plugs 40, suitably located so as to permit direct passage through the main portions of the burner, which may thus be cleaned by a brush or by a steam jet.

The efficient operation of my burner may be attributed to the peculiarity of my construction in that the vaporized oil is led through a small pipe and projected against a "hot-spot" and there converted into an extremely high gaseous state, in which condition the fuel oil is divided into its more volatile constituents. Upon striking the "hot-spot", the volume of gas increases tremendously, and this sudden expansion is taken care of by making the manifold of considerably larger diameter than the inlet pipe 14. From the foregoing it is apparent that the flow capacity of the discharge conduit or manifold is greater than the flow capacity of the inlet pipe or fuel passageway 14. By reason of the central location of the entrance pipe with respect to the manifold and the upwardly diverging character of the manifold arms 36 and 37, the expanding gases which are of much lower specific gravity than the vaporized fuel oil entering the manifold, tend to rise, so that the upwardly converging conduits permit the expanded gas to travel in the desired path through the same and downwardly in the vertical portions 45 and 46 of the burner until they reach the fire-pot, when again they are expanded and rapidly rise upwardly through the burner openings to be ignited into a blue flame of intense heat. This movement of the vaporized and expanded fuel may be termed a "forced circulation" of the gas.

Although a preferred construction of my invention has been illustrated and described, it is to be understood that persons skilled in the art may make modifications therein, but it is to be appreciated that such modifications as come within the terms of the appended claims are contemplated by me as falling within the spirit and scope of my invention.

What I claim is:—

1. An oil burner comprising a chamber having a portion thereof adapted to be heated to a temperature high enough to convert a mixture of oil and air into gaseous products, means for heating said portion of the chamber to the required temperature, an inlet conduit connected to said chamber for discharging a mixture of oil and air directly against the heated portion of the chamber, a discharge conduit connected to said chamber for removing the gaseous products formed therein, the flow capacity of said discharge conduit being greater than the flow capacity of said inlet conduit, and means connected to said discharge conduit for burning the gaseous products.

2. The combination in an oil burner of means for producing a mixture of oil and air in predetermined proportions, a fuel passageway connected to said means, preheating means associated with said passageway for preheating said mixture of oil and air to form gaseous products therefrom, a discharge passageway connected to said preheating means, the flow capacity of said discharge passageway being greater than the flow capacity of said fuel passageway, and means connected to said discharge passageway for burning the gaseous products produced in said preheating means.

3. An oil burner comprising means for providing a mixture of fuel oil and air in predetermined proportions, a fuel passageway connected to said means, means associated with said fuel passageway for converting said mixture of oil and air into gaseous products, a discharge conduit for said gaseous products, the flow capacity of said discharge conduit being greater than the flow capacity of said fuel passageway, and a burner adapted to burn gaseous products connected to said discharge conduit.

4. An oil burner comprising a chamber, means for providing within said chamber a zone of intense heat, an inlet conduit connected to said chamber for conducting a mixture of oil and air to said zone of intense heat, a discharge conduit connected to said chamber, the flow capacity of said discharge conduit being greater than the flow capacity of said inlet conduit, and means connected to said discharge conduit for burning the resultant fuel.

5. A crude oil burner comprising means for atomizing fluid oil and mixing the same with a predetermined quantity of air, a feed pipe, a pre-heater connected thereto, said pre-heater comprising a plurality of pipes converging downwardly and meeting to form a "hot spot", the upper ends of said pipes terminating in downwardly extending pipes, and a burner nozzle connected to said downwardly extending pipes.

6. A fluid fuel burner comprising means for atomizing fluid oil and mixing the same with a predetermined quantity of air, a nozzle, substantially vertical pipes connected to each end thereof, a pre-heating and expansion chamber connecting said vertical pipes and disposed above said noz-

zle, the mid portion of said pre-heating and expansion pipe being positioned closer to said nozzle than the remaining portions and constituting a "hot-spot", and an inlet pipe connected to said pre-heater adjacent said "hot-spot".

7. An oil burner comprising means for atomizing fluid oil and mixing the same with a predetermined quantity of air, an inlet pipe of relatively small diameter for vaporized fuel, an expansion chamber of larger diameter than said inlet pipe, said inlet pipe entering said expansion chamber substantially centrally thereof, said expansion chamber having two upwardly and outwardly extending arms, a downwardly extending conduit disposed at the end of each of said arms, and a burner supported by the lower ends of said conduits.

In testimony whereof, I have hereunto subscribed my name this 26th day of February, 1924.

JOHN MURTON BROWN.