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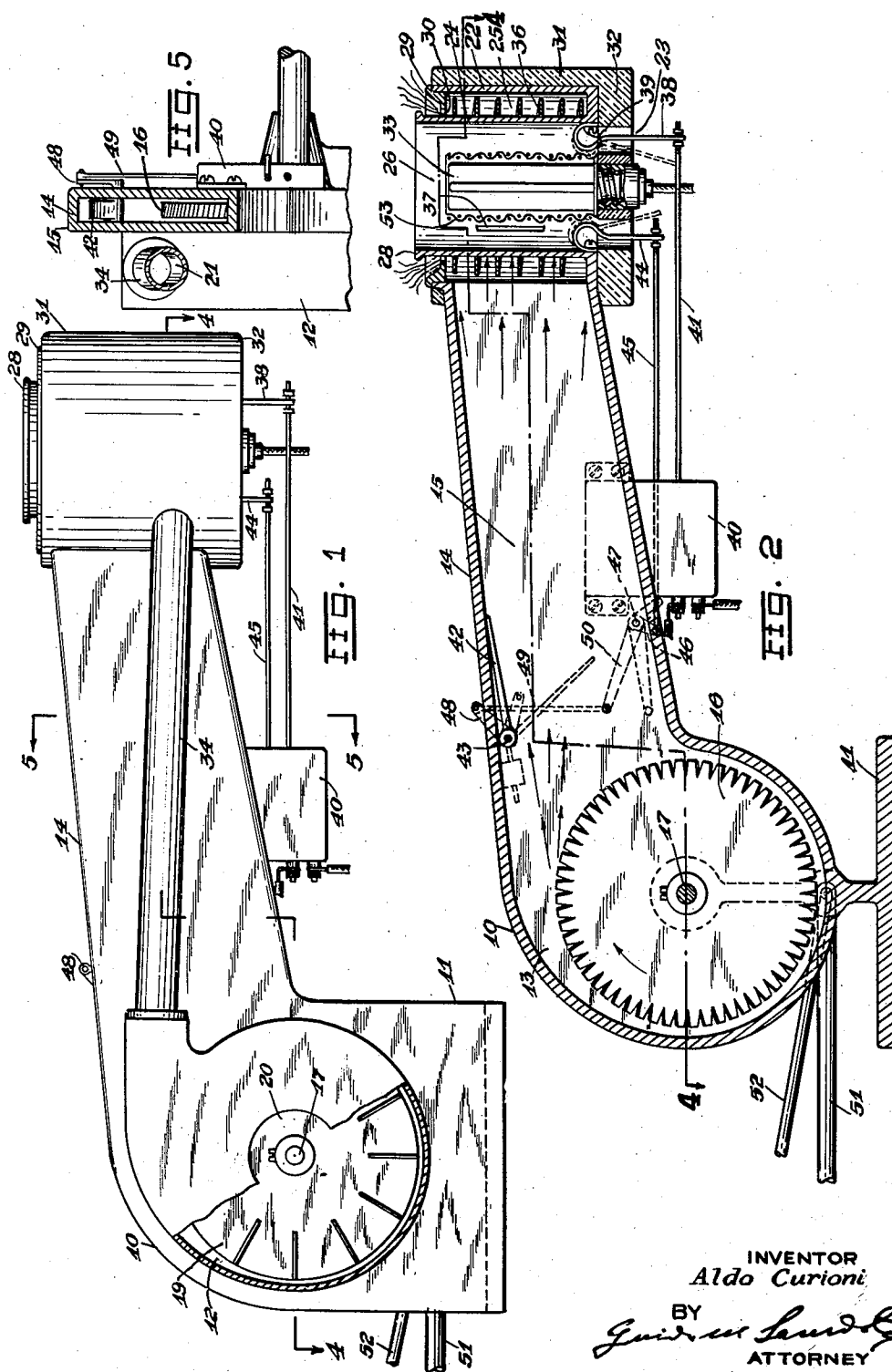
A. CURIONI

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OIL GASIFIER AND BURNER

Filed March 13, 1934

3 Sheets-Sheet 1



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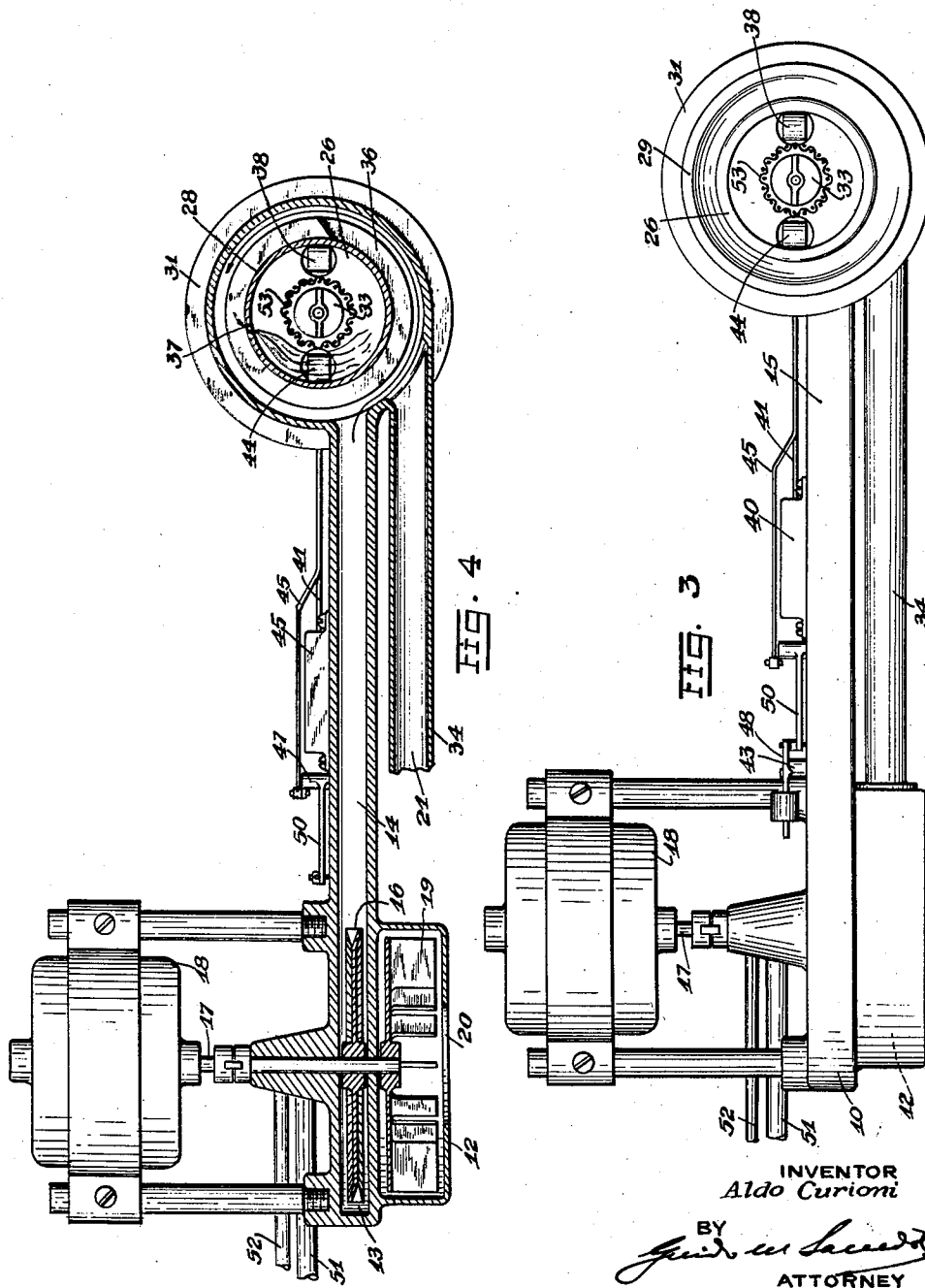
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3 Sheets-Sheet 2





## UNITED STATES PATENT OFFICE

2,073,552

## OIL GASIFIER AND BURNER

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7 Claims. (Cl. 158—53)

This invention relates to burning apparatus for liquid fuels and more particularly refers to improvements in oil burners of the type where liquid fuel is gasified before combustion.

The problems involved by the burning of liquid fuels are closely related to their chemical composition and to their physical characteristics, particularly as to their content of tar and other heavy fractions and to their volatility. It is generally conceded that in the case of any liquid fuel the best combustion efficiency can be reached if the fuel is gasified before combustion, because this makes it easier to supply and mix with the fuel the quantity of air required for its complete combustion.

The gasification of so-called volatile fuels such as gasoline, for instance, is a comparatively simple matter; it is also a comparatively simple matter to convey the gas obtained by a mixture of air and a vaporized volatile fuel from a generating apparatus to a burner located at a distance therefrom without the danger of condensation taking place in the meantime. Heavier fuels, however, offer in this respect considerable difficulty, and most oil burning devices have, therefore, been designed for combustion of the fuel in its liquid form.

I have found that if a relatively heavy fuel is atomized and projected directly against a very hot surface, so as to be vaporized in its entirety, and air is immediately added to and mixed with the oil vapor thus produced, the result is a combustible gas, capable of complete combustion; and that if said gas is maintained at a high temperature up to the point where its actual combustion takes place, no condensation occurs, so that uninterrupted and efficient operation of the oil burning apparatus can be obtained, even with the heaviest grades of oils.

In endeavoring to meet in a practical way the conditions just described, I have, therefore, developed the oil gasifier and burner forming the subject of this invention; its primary object being to provide a novel and improved apparatus, extremely simple in design and construction, adapted to effectively gasify and burn relatively heavy liquid fuels without producing any material amount of residues.

Another object is to provide in an apparatus of the character specified, a novel and improved type of burner proper, adapted to automatically maintain the high temperature of the gasifying portion thereof, once the combustion of the fuel has been started.

A further object is to provide in an oil gasify-

ing and burning apparatus, means simple in design and reliable in operation for automatically igniting the fuel when the operation of the device is first started.

A still further object is to provide a novel and improved oil gasifier and burner, in which the mixing of the air necessary for combustion with the sprayed and vaporized liquid fuel is caused to take place in a thorough and efficient manner so that a gas of a uniform composition will be generated and delivered to the burner proper.

Other objects and advantages of the present invention will more fully appear as the description proceeds and will be set forth and claimed in the appended claims.

My invention is illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is a side elevation with parts broken away showing the oil spraying means of my improved apparatus;

Fig. 2 is a vertical section thereof;

Fig. 3 is a plan view of the same;

Fig. 4 is a sectional plan view of the same through line 4—4 of Fig. 2;

Fig. 5 is a vertical cross section of the same through line 5—5 of Fig. 1;

Fig. 6 is a diagrammatic illustration of a thermoelectric control circuit, which may be used in connection with my device;

Fig. 7 is a detail vertical section of a float valve, which may be used for controlling the supply of fuel to the device; and

Fig. 8 is a plan view, with parts broken away of a cooking stove provided with a plurality of gasifying burners, embodying my invention.

The device illustrated in Figs. 1 to 4 comprises a casing 10, formed with a body portion 11, divided into a fan chamber 12 and a fuel chamber 13, and a tubular portion 14, outwardly extending from the upper part of chamber 13, said tubular portion being substantially rectangular in cross section, relatively narrow in a horizontal sense, and carrying at its outer end the burner portion of the apparatus.

Fuel chamber 13 is preferably of the same width as the passage 15 within tubular extension 14, and houses a splash wheel 16, mounted on a shaft 17, actuated by an electric motor 18. On the same shaft is also mounted a fan 19, which is housed within chamber 12, said chamber being provided with an inlet 20 and an outlet 21.

The burner portion of the apparatus is made in the form of an open top cylindrical shell 22, 55

integral with tubular extension 14, which communicates therewith, the bottom of said shell being provided with a central opening 23, defined by an upwardly extending inner tubular shell 24, concentric with shell 22, and forming therewith an annular chamber 25.

The upper end 26 of said inner shell 24 preferably reaches to a point somewhat higher than the upper edge 27 of outer shell 22, and is formed with an outwardly extending flange 28. On the upper edge 27 of outer shell 22 is set a ring-shaped member 29, surrounding the upper portion of inner shell 24, leaving an annular passage 30 for the gas to issue to the combustion zone. Said ring-shaped member is made of metal, having a relatively heavy section, so as to store heat produced by the combustion of the fuel. The outer shell 22 is preferably heat insulated by a surrounding member 31, made of heat insulating material, said member being provided with a bottom 32 on which is mounted an electric heating unit 33, upwardly extending therefrom, centrally of inner shell 24.

The center of the burner portion proper is preferably somewhat laterally displaced with respect to the vertical plane passing through passage 15 of tubular extension 14, as Figs. 3, 4, clearly show; and an air conduit 34 connects outlet 21 of chamber 12 to the annular gasifying chamber 25 at a point 35 further spaced from the center of said burner portion at the same side as tubular extension 14. By virtue of this construction the eccentric impact of the atomized fuel against the surface of inner shell 24 tends to deflect the fuel so that it will travel through said annular chamber in a counterclockwise direction, with respect to Figs. 3 and 4; and the air supplied by the fan to said chamber, the flow of which is substantially tangential to said chamber, will travel around said chamber with a rapid whirling motion in the same direction and will thus become thoroughly mixed with the fuel particles and form a combustible gas therewith.

When the device is in operation the splash wheel 16, which rotates in a clockwise direction, and which has its lower portion submerged in the liquid contained at the bottom of chamber 13, acts as an impeller, projecting the liquid in spray or comminuted form, with great force directly into passage 15 of tubular extension 14. The liquid particles will thus strike the hot surface of inner shell 24 and will be converted into vapor, which will become mixed with the air supplied through conduit 34 forming a combustible gas therewith, which will ultimately issue through annular slot 30 at the top.

During its whirling motion within annular chamber 25 the gaseous mixture is preferably subjected to the action of a spiral web 36, inserted within annular chamber 25, which will cause said mixture to gradually rise towards the top of the burner.

The intermediate portion of inner shell 24, at a point circumferentially spaced from the air inlet 35, is formed with a vertical slot 37, which is directed at a slant so as to facilitate the entrance of part of the gas whirling within chamber 25, into the tubular chamber formed by inner shell 24, in a direction substantially tangential to the inner surface of said inner shell.

The operation of the device is started by energizing the heating unit 33, which will initially heat the inner shell 24. As soon as the motor is started, the rotation of the splash wheel 16

and fan 19 will cause atomized oil and air to be projected into chamber 25 and to acquire a rapid whirling motion therein. At this stage, most of the fuel will become mixed with the air in its atomized, but not yet fully vaporized, form, but part of this mixture entering through slot 37, the tubular chamber formed by inner shell 24, and continuing to whirl therein, will eventually come into contact with the heating unit and will become ignited. It is, of course, possible to bring the shell or hot impact member to the vaporizing temperature solely by the heat emitted by the heating unit, before the motor is started to actuate the splash wheel. This makes for quicker generation of the combustible gas, and, therefore, for improved operation; however, when fuels having a relatively high flash point are used, it will still be necessary for the combustible gas to come in actual contact with the heating unit, in order to produce rapid ignition. The initial flame, which will be in direct contact with the inner surface of inner shell 24, will quickly bring the temperature of said shell to a very high point, so that the liquid fuel subsequently sprayed against its outer surface will be instantly vaporized, and the combustible mixture formed by it with the air will become ignited and generate a flame issuing from the top of the burner.

At this stage it will no longer be necessary to maintain the energization of heating unit 33 because the combustion of the portion of gas issuing through slot 37 will continue to maintain the high temperature of inner shell 24; the heating unit will, therefore, be deenergized and this may be done automatically in any suitable manner, for instance, by the action of a thermostatic element 38, attached at 39 to the base of inner shell 24, said thermostatic element being adapted to actuate a switch enclosed within a casing 40 by means of a connecting rod 41, as will later be explained.

It is obvious that while I prefer to use an electric heating unit for ignition, whenever possible, rather than a sparking device involving the use of a transformer, it is within the scope of my invention to employ any suitable means for igniting the fuel-air mixture at the start.

The quantity of fuel sprayed against the hot surface of shell 24 can also be controlled in a simple manner by means of a shutter 42, pivotally mounted at 43, within passage 15. It is obvious from the drawings that if said shutter is lowered from the position shown, it will cut off part, or all, of the spray directed against the outer end of tubular extension 14, so that since the quantity of air delivered by fan 19 is constant, the gas generated will be richer or poorer, according to the position of shutter 42. When the device is used for purposes where it is desirable to vary the intensity of the flame at will, said shutter can be operated by hand; and when a more or less constant flame should be maintained the operation of said shutter can be controlled by means of a thermostatic element 44, which when the temperature of shell 24 goes beyond a certain point will shift a rod 45 towards the right, causing angular displacement of a bell crank lever 46, pivotally mounted at 47, in a counterclockwise direction, and, therefore, causing angular displacement of shutter 42 in a clockwise direction, the shaft 43 of said shutter carrying a lever 48, the outer end of which is connected by a rod 49 to the outer end of arm 50 of bell crank lever 46.

Fuel is admitted to chamber 13 through a tube 51 which may be connected to a source of supply through the intermediary of a float valve, in the usual manner.

I have found that the combustion of the fuel will be improved if a minute quantity of water is allowed to drip within chamber 13 and to be sprayed against the hot surface of shell 24, together with the oil. This is possibly due to the fact that in striking the hot surface the water will become dissociated into its two component elements, oxygen and hydrogen, and the hydrogen combining with the carbon of the fuel increases its volatility or otherwise assists its complete vaporization, while the oxygen will, of course, assist the combustion thereof.

I, therefore, show another tube 52, through which water may be admitted to said chamber 13, in such limited quantities as will be found desirable.

It will be observed that the electric heating unit, being located at the center of inner shell 24 is to a certain extent protected against direct contact with the flame whirling about the inner surface of said part 24. However, it is desirable that the electric heating unit be shielded from direct contact with the flame as much as possible, because while its function is to initiate the combustion of the fuel stream issuing through slot 37, once the combustion has been started the action of the electric heating unit is no longer required. I, therefore, prefer to surround the electric heating unit with a metallic screen 53, made of relatively wide mesh wire netting; that is, a type of wire netting containing a relatively small quantity of metal per square inch, so as to avoid the absorption and dissipation of heat by the wire screen, such as take place in miners' lamps, which would tend to prevent the ignition of the gas by the electric heating unit when the operation is first started. On the other hand, a rather coarse screen, such as I advocate, will act as an effective protection for the electric heating unit against the whirling flame within shell 24.

As stated above, the function of thermostatic element 38 is to cause the deenergization of the electric heating unit when the temperature of inner shell 24 has been raised to a certain point.

This thermostatic control can be effected by causing thermostatic element 38 to actuate a switch controlling the circuit of the electric heating unit. In Fig. 6 it is seen that electric heating unit 33 is inserted in the circuit of two wires, one of which 54 is connected to the main supply wire 55 and the other one, 56, is connected to a terminal 57 of a switch having another terminal 58, connected by a wire 59 to the other main supply wire 60. If the switch bar 61 is in the position shown, where it bridges the gap between terminals 57, 58, the electric heating unit will be energized, whereas if said switch bar is caused to move to its inoperative position, the electric heating unit will become deenergized.

For purposes of illustration, I show switch bar 61 as forming part of a quick make and break switch, said bar being pivotally mounted at 62 and having an extension 63, connected by a snap-over spring 64 to a switch actuating arm 65, pivotally mounted at 66.

Switch actuating arm 65 is connected by a link 67 to a controlling lever 68, pivotally mounted at 69, said controlling lever being actuated by connecting rod 41, pivotally connected thereto

at 70 and extending to thermostatic element 38, as shown.

It will be seen that when the extension of the thermostatic element 38 causes its stem portion to move towards the left, its movement will be transmitted to switch control arm 68 and to switch actuating arm 65. When the angular displacement of the switch actuating arm will have reached a certain amplitude, snap-over spring 64 will cause switch bar 61 to interrupt the circuit by a snap action, as will be understood.

One of the dangers incident to the operation of ordinary oil burners is the possibility of a sudden interruption of the current in the supply lines. I, therefore, advocate the provision of an auxiliary source of power, adapted to be put in service in order to meet such an emergency and preferably automatic means for controlling said auxiliary source of power. For instance, in Fig. 6, the motor 18 is shown as being energized by wires 71, 72, connected to main supply lines 55—60, respectively, said circuit of supply wires being controlled by a switch 73. The auxiliary source of power is represented by a battery 74, connected by a wire 75 to main supply wire 55 at 76, and connected by another wire 77 to main supply wire 60 at 78. It will be observed that the circuit of battery 74 is also controlled by switch 73, so that the battery circuit can be energized only when switch 73 is closed.

Wire 75 is interrupted at a certain point by a gap 79, the two ends of which are defined by contact points 80, 81, said gap being normally bridged by a contact head 82, carried by an extension 83 of the core of an electromagnet 84, said contact head 82 being forced against contact points 80, 81 by a spring 85.

At the opposite end the electromagnet core carries another extension 86, provided with a contact head 87, adapted to bridge a gap 88 in supply wire 60 by contacting the two gap terminals 89, 90. However, due to the action of spring 85, said contact head 87 is normally held in the open gap position shown, where the circuit of wire 60 is interrupted. Electromagnet 84 is shunted between supply wires 65 and 60, so that when switch 73 is closed, in order to initiate the operation of the apparatus, electromagnet 84 will be energized and will cause its core to move towards the left, closing the circuit of wire 60 and opening the circuit of wire 65. The only active circuit will, therefore, be that of the main supply wire. Should the current flowing through the said main supply line become interrupted, electromagnet 84 will become deenergized and contact head 82 will close the circuit of wire 75, while contact head 87 will open the circuit of wire 60. Since switch 73 is still closed, however, battery 74 can now supply current to the motor circuit through its wires 75, 77, until such time when, should the service on the main supply line be resumed, electromagnet 84 will again become energized and will restore normal operating conditions.

As stated above, the fuel is admitted to chamber 13 from a suitable source of supply through the intermediary of a float valve maintaining said fuel at the proper level within chamber 13. The float valve can be of any suitable design, but I prefer to use the type of valve shown in Fig. 7, where 91 designates the hollow body of the valve, 92 the tube leading to the top of said body from the fuel source of supply, said tube extending downwardly from the top of said valve body to form an axial extension 93, the lower end of which

94 is spaced a certain distance from the bottom 95 of chamber 96 within the valve body. A float 97 surrounds extension 93 of the supply tube, the central opening 98 of said float having a diameter somewhat larger than the diameter of tubular extension 93. Said float is provided with a downwardly directed tubular extension 99, closed at its lower end 100, said tubular extension 99 also having a diameter larger than tubular extension 93 and forming therewith an annular passage 101. The lower end of extension 99 is filled with a certain quantity of mercury 102. When the body of fuel 103 within chamber 96 is at about its normal level, as shown at 104, the upper level 105 of body of mercury 102 is lower than the lower end 94 of supply tube 93, so that fuel can continue to be admitted within chamber 96. As the level of the fuel body within said chamber rises, the float is forced upwardly so that eventually the mercury will reach the mouth of lower end 94 of tubular extension 93 and will prevent any further flow of fuel therethrough.

Such a type of valve has the advantage over the ordinary needle valve that it is very sensitive and cannot possibly become clogged.

As previously stated, I prefer to also admit within chamber 13 certain relatively small quantities of water, which may be allowed to reach said chamber drop by drop to become mixed with the fuel therein. Of course, it is desirable that the supply of water be automatically regulated in conjunction with the supply of fuel, therefore, in Fig. 7 I illustrate a possible arrangement whereby the water supply can be controlled by the same float valve which controls the supply of fuel. Referring to said figure, it will be seen that float 97 is equipped with an upwardly extending stem 106, the upper end of which extends beyond the top of valve body 91 and is articulately connected at 107 to the arm 108 of a lever 109, pivotally mounted at 110 onto a bracket 111 projecting from valve body 91. The water supplied to water drip tube 52 is controlled by a needle valve 112 within chamber 113 of casing 114, said needle valve being carried by an upwardly extending rod 115 passing through the tube of said casing 114 and having its upper end articulately connected at 116 to the outer end of lever 109. It will be seen that by virtue of this arrangement the vertical displacement of float 97 will be transmitted to needle valve 112, so that the supply of water to tube 52 will cease when the supply of fuel through tube 93 will become interrupted by the action of the float valve. In this manner it becomes possible to preserve a relatively uniform proportion between the quantities of fuel and water supplied to the burner.

My improved gasifier-burner can be used in batteries of two or more, adapted to be actuated by a single motor. For instance, in Fig. 8 I show a cooking stove 117, provided with four of my burners 118, 119, 120, 121, the splash wheel-fan units of said burners being rotatably mounted on a single shaft 122, actuated by motor 123. Each splash wheel-fan unit 124 can be connected to or disconnected from shaft 122 by means of a clutch 125, actuated by a hand lever 126, pivotally mounted at 127. When said lever is moved to the clutch engaging position, the corresponding splash wheel-fan unit will become operative and at the same time the circuit controlling the electric heating unit of the corresponding burner will also be made operative by the operation of a

switch arm 128 connected to lever 126 by a link 129, said switch lever closing the circuit of the heating unit at 130.

It will be observed that the design of my apparatus is such that the fuel can issue through the burner only in gasified form, so that if for any reason combustion should cease, the fuel splashed against element 24 will merely collect at the bottom of annular chamber 25 and will return to the bottom of chamber 13; any danger of flooding the burner or the surrounding space is, therefore, eliminated.

From the foregoing it will be seen that I provide a novel arrangement of an extremely simple character, whereby the perfect combustion of oils of even low grade is assured, so that important advantages from the standpoint of both economy and safety of operation are realized.

The construction of my apparatus may vary in its details from that shown without departing from the inventive idea; the drawings, therefore, will be understood as being intended for illustrative purposes only and not in a limiting sense.

I accordingly reserve the right to carry my invention into practice in all those ways and manners, which may enter, fairly, into the scope of the appended claims.

I claim:

1. In a gasifying and burning apparatus for liquid fuels, a burner comprising an outer and an inner shell forming an annular gasifying and mixing chamber, having an air inlet and having a gas outlet at its upper end, an igniting unit within said inner shell, means for spraying liquid fuel directly against the outer surface of said inner shell, means for supplying a current of air under pressure through said inlet to said chamber, so as to form a fuel-air combustible mixture with said fuel, before it issues from said outlet, means for directing part of said mixture within, and against the inner surface of said inner shell in proximity to said igniting unit to initiate its combustion and thus raise the temperature of said inner shell to the point required for the vaporization of the fuel, and heat insulating means surrounding said outer shell.

2. In a gasifying and burning apparatus for liquid fuels, a burner comprising an outer and an inner shell forming an annular gasifying and mixing chamber having a gas outlet at the upper end thereof, means operable to spray liquid fuel directly against the outer surface of said inner shell, means operable to supply a current of air under pressure tangentially to said chamber at a point adjacent to the fuel delivery, whereby the air induces a flow of the oil vapors and mixes therewith in an annular path about the axis of said chamber prior to its discharge therefrom, means for directing part of said mixture within said inner shell and in proximity to the inner surface thereof, and an igniting unit operatively positioned within said inner shell to ignite that part of the mixture delivered therein.

3. In a gasifying and burning apparatus for liquid fuels, a burner comprising an outer and an inner shell forming an annular gasifying and mixing chamber having a gas outlet at the upper end thereof, means operable to spray liquid fuel directly against the outer surface of said inner shell, means operable to supply a current of air under pressure tangentially to said chamber at a point adjacent to the fuel delivery, whereby the air induces a flow of the oil vapors and mixes

therewith in an annular path about the axis of said chamber prior to its discharge therefrom, means for directing part of said mixture within said inner shell and in proximity to the inner surface thereof, an igniting unit operatively positioned within said inner shell to ignite that part of the mixture delivered therein, and a spiral web within said chamber, directing said fuel-air mixture towards said outlet.

4. In a gasifying and burning apparatus for liquid fuels, a burner comprising an outer and an inner shell forming an annular gasifying and mixing chamber, having an air inlet and having a gas outlet at its upper end, an igniting unit within said inner shell, means operable to spray liquid fuel directly against the outer surface of said inner shell, means operable to supply a current of air under pressure through said inlet to said chamber so as to form a fuel-air combustible mixture with said fuel, before it issues from said outlet, means for directing part of said mixture within and against the inner surface of said inner shell in proximity to said igniting unit to initiate its combustion and thus raise the temperature of said inner shell to the point required for the vaporization of the fuel, and means for shielding said igniting unit against direct contact with the flame within said inner shell.

5. A gasifying and burning apparatus for liquid fuels, comprising a body having a fuel chamber and a fan chamber, a splash wheel within said fuel chamber, a fan within said fan chamber, means for simultaneously operating said splash wheel and fan, a tubular member extending from the periphery of said fuel chamber, a burner, including an outer and an inner shell forming an annular gasifying and mixing chamber communicating with said tubular member, said gasifying and mixing chamber having a gas outlet at the upper end thereof, a conduit extending from said fan chamber and terminating in an approximately tangential inlet to said mixing chamber, whereby the air induces a flow of the oil vapors and mixes therewith in an annular path about the axis of said chamber prior to its discharge therefrom, a vertical slot through said inner shell directed at an angle to the surface thereof, for admitting part of said fuel-air mixture within said inner shell, substantially at a tangent to the inner surface thereof, and an igniting unit operatively positioned within said inner shell to ignite the mixture delivered therein whereby the burning mixture therein will raise the tem-

perature of said inner shell to the point required for the vaporization of the fuel directed against its outer surface.

6. A gasifying and burning apparatus for liquid fuels, comprising a body having a fuel chamber and a fan chamber, a splash wheel within said fuel chamber, a fan within said fan chamber, means for simultaneously operating said splash wheel and fan, a tubular member extending from the periphery of said fuel chamber, a burner, including an outer and an inner shell forming an annular gasifying and mixing chamber communicating with said tubular member, said gasifying and mixing chamber having a gas outlet at the upper end thereof, a conduit extending from said fan chamber and terminating in an approximately tangential inlet to said mixing chamber, whereby the air induces a flow of the oil vapors and mixes therewith in an annular path about the axis of said chamber prior to its discharge therefrom, a vertical slot through said inner shell directed at an angle to the surface thereof, for admitting part of said fuel-air mixture within said inner shell, substantially at a tangent to the inner surface thereof, and an igniting unit operatively positioned within said inner shell to ignite the mixture delivered therein whereby the burning mixture therein will raise the temperature of said inner shell to the point required for the vaporization of the fuel directed against its outer surface, and means controlling the amount of sprayed fuel reaching the surface of the vaporizing member.

7. In a gasifying and burning apparatus for liquid fuels, a burner unit comprising a pair of concentric shells forming an annular vaporizing and mixing chamber therebetween, the upper ends of said shells cooperating to form a restricted annular outlet for the combustible mixture formed in said chamber, said chamber having a fuel inlet, said chamber also having a tangential air inlet near the bottom thereof, said shells having means whereby the inner shell is maintained at a high temperature by the combustion of the combustible mixture adjacent said inner shell, thereby constituting said inner shell an impact fuel vaporizing chamber, means operable to spray liquid fuel directly against the surface of said vaporizing member, and means operable to supply a current of air under pressure through said air inlet and to form a fuel air combustible mixture with the resulting vaporized fuel.

ALDO CURIONI. 55