

July 1, 1941.

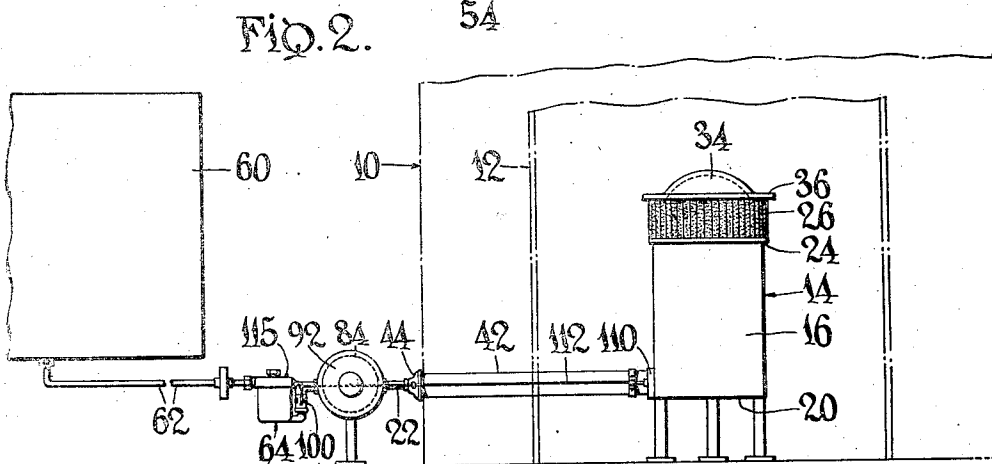
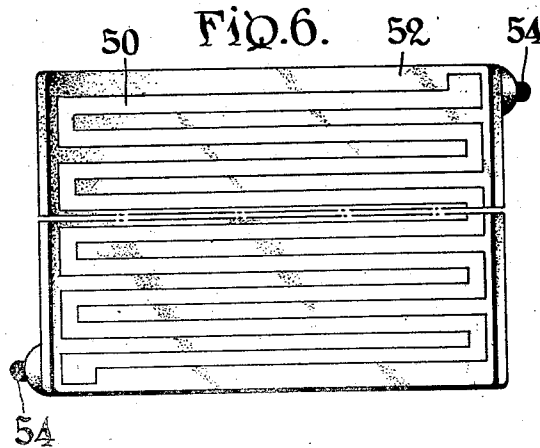
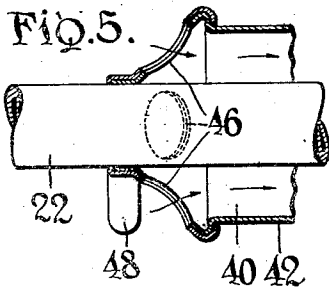
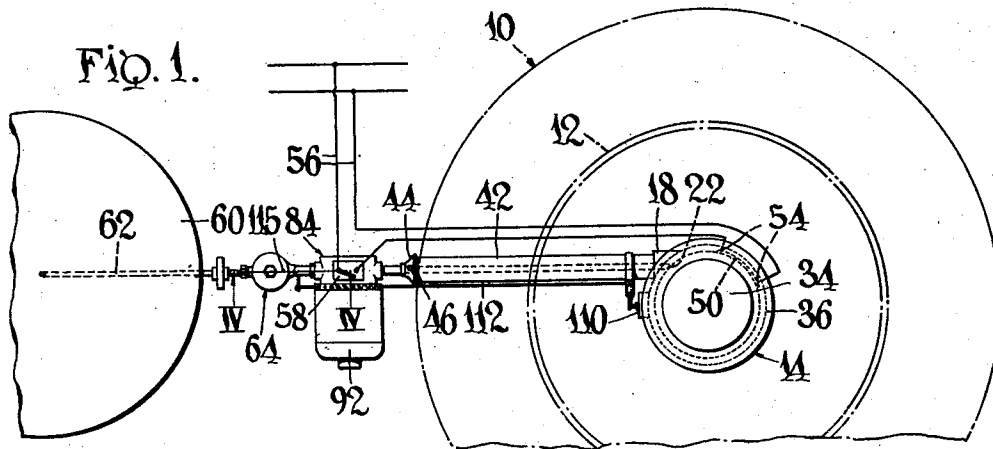
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2,247,977

OIL BURNING APPARATUS

Filed Jan. 3, 1938

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

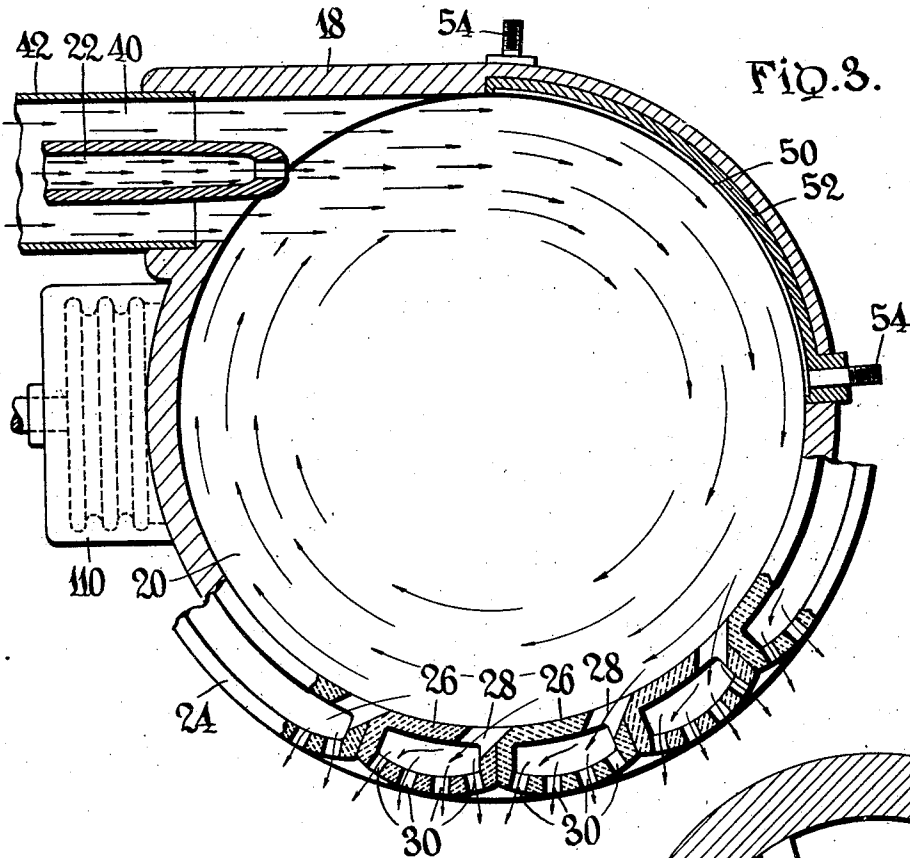


FIG. 3.

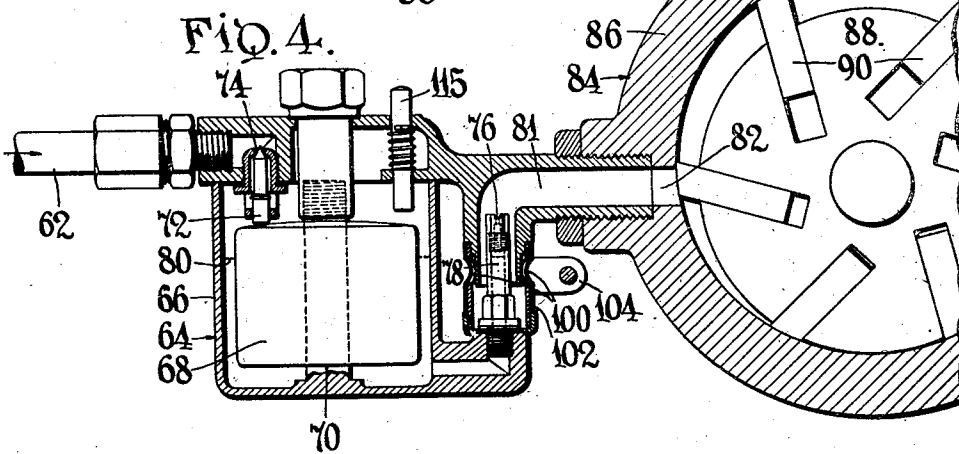


FIG. 4.

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OIL BURNING APPARATUS

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1 Claim. (Cl. 158—1)

This invention relates to heating appliances, and more particularly to installations suitable for burning liquid fuels. In general, the invention relates to a novel oil burning appliance which is adapted to be inserted in the fire box of a furnace, such as a domestic heating furnace, for converting said furnace into an efficient oil burning heating unit. The invention also contemplates improvements in apparatus designed originally as fuel oil heaters.

One object of the present invention is to provide an improved heater structure wherein complete combustion of the fuel is effected before unburned portions of the fuel come into contact with the furnace walls, and whereby transfer of a maximum portion of the developed heat to the heat output elements of the structure is effected by a combination of heat radiation and convection processes.

Another object of the invention is to provide an oil heater apparatus including means for supplying the fuel and air mixture to the nozzle in an improved and uniformly consistent manner, whereby maximum combustion efficiency is obtained along with maximum quietness of operation and elimination of the possibility of flare backs.

Another object of the invention is to provide an oil and air mixing apparatus which is capable of being regulated with respect to oil-to-air ratio in an improved and simplified manner.

Another object of the invention is to provide in an oil heating apparatus means for automatically regulating the oil-to-air ratio in response to changes in combustion conditions within the combustion chamber of the apparatus in such manner as to procure maximum operating efficiency and quietness of operation.

Another object of the invention is to provide an improved fuel igniting means for oil burning heaters.

Another object of the invention is to provide a fuel burning apparatus capable of obtaining complete combustion of the fuel input and maximum heat transfer performance.

These and other objects and advantages will be more fully hereinafter disclosed in the claim and specification which is of only one form of the invention.

In the drawings:

Fig. 1 is a diagrammatic fragmentary plan of an apparatus incorporating the principles of the invention;

Fig. 2 is a fragmentary elevation of the apparatus illustrated in Fig. 1;

Fig. 3 is a horizontal section, on a larger scale through a portion of the apparatus shown in Fig. 1;

Fig. 4 is a vertical section taken substantially along the line IV—IV of Fig. 1;

Fig. 5 is a detailed view on an enlarged scale of a portion of the secondary air intake mechanism of the apparatus.

Fig. 6 is an enlarged view in elevation of the igniter mechanism of the apparatus.

The present invention has been shown in connection with a domestic hot air heating plant, but it is to be understood that this type of heater installation is only to be taken as representative, and that the principles of the invention may have equal application in connection with any other kind of heater device. In the present instance a heater 10 provided with a cylindrically shaped fire box 12 is provided with a novel combustion hood 14 disposed interiorly of the fire box. As illustrated in Figs. 2 and 3, the combustion hood comprises a lower imperforate cylindrical hollow chamber portion 16 made of cast iron or ceramic material or the like and having a tangentially-disposed fuel inlet portion 18 formed adjacent its closed bottom end 20. A fuel nozzle 22 is arranged to discharge within the inlet port 18 at a point substantially in line with the inner periphery of the combustion hood.

As will be described more completely hereinafter, the nozzle 22 is adapted to discharge a stream of fuel vapor comprising a homogenous mixture of air and fluid or pulverized solid fuel substance into the interior of the combustion hood under a relatively low pressure, and in such manner that the fuel stream is directed against the adjacent inner wall portion of the chamber member 16, by which it is given a circular swirling line of motion. The upper end of the chamber 16 is open, and the marginal edge thereof is provided with shoulder means 24 supporting thereon a plurality of upstanding hollow fuel dispersing columns 26. The columns 26 are arranged in side by side relation and are provided with intake openings 28 through the inner wall portions thereof, by means of which the gaseous mixture rising within the combustion chamber 16 may gain access to the interiors of the columns 26. The outer wall portions of the columns 26 are provided with a plurality of relatively smaller outlet ports 30 which may be arranged in any desired spaced relationship and of any desired dimensions so as to procure maximum combustion efficiency effects as will be described more

fully hereinafter. A dome shaped cover 34 formed of cast iron or ceramic or other suitable material is disposed upon the upper ends of the columns 26 in such manner as to provide lateral supporting means for the columns 26 and a closure for the upper end of the combustion hood. The inner face of the cover 34 is shaped as shown of generally curved contour and is provided with a flat marginal flange portion 36 which extends substantial distances transversely of the columns 26 both inwardly and outwardly of the line of the columns to provide a pair of annular shoulders or baffle members adjacent the upper ends of the columns 26 for controlling the flow of burning fuel in the upper portion of the combustion hood.

Thus, a combustion hood is provided comprising an imperforate lower chamber portion for preheating and imparting a circular swirling motion to a mixture of incoming fuel and air, and an upper combustion portion having foraminated walls for storing and reflecting heat of combustion to the end that the foraminous section becomes incandescent and the complete burning of all of the incoming fuel substances is expedited. The combustion columns 26 thus provide means for insuring complete combustion of all of the fuel substance entering the hood.

The inlet port 18 and the nozzle 22 are so proportioned and arranged as to provide an annular secondary air inlet chamber 40 around the nozzle 22. As illustrated in Fig. 5, an extension tube 42 of the inlet port may be provided at its outer end, exteriorly of the heater casing 10, with an adjustable air inlet shutter 44 provided with registerable air inlet openings 46. A manually operable arm 48 extends laterally from the shutter for adjustable operation thereof, whereby the ratio of air through the openings 46 to the fuel moving through the nozzle 22 may be regulated at will.

An igniter mechanism for starting combustion of fuel discharged into the combustion hood is provided in the form of an electrically resistant element 50 formed of such material as to become incandescent upon the passage of a low-voltage current of electricity therethrough. The element 50 is mounted upon an insulating block 52 embedded within a wall portion of the combustion chamber 16 at a position directly opposite the line of fuel discharge through the nozzle 22. Terminal posts 54 extend through the insulating block 52 and provide means for connecting opposite ends of the element 50 in series with conductors 56 leading from a source of low voltage electric current (not shown). A circuit make-and-break switch 58 is provided for control of the circuit through the element 50. In accordance with well known principles of the electrical art the switch 58 is preferably arranged to be operated to an "on" position by means of a thermostat element responsive to changes in temperature of the air in the room being heated in such manner that when the temperature drops to a predetermined degree, the thermostat will actuate a linkage mechanism which in turn will move the switch to its "on" position, as will be explained more fully hereinafter. The source of fluid pressure upon the fuel inlet line may also be automatically controlled by means of the room temperature responsive thermostat, in such manner that when the room temperature lowers to a predetermined degree the fuel feed pressure is opened up and the igniting element 50 is simultaneously energized to become incandescent to the

end that the fuel stream striking thereagainst becomes ignited. A time relay or other suitable means may be provided in connection with the igniter switch 58 to automatically procure its movement to an "off" position after a predetermined lapse of time, so that the element 50 is only in service as actually required to cause ignition of the fuel during the starting up process.

For use in connection with the burning of fuels of the liquid type such as fuel oil, an improved feed regulating means is provided. As illustrated more particularly in Figs. 1, 2 and 4, a source of fuel such as a feed supply tank 60 may be connected by means of an outlet tube 62 to a float controlled mixer 64 adapted to deliver a supply of uniformly proportioned and mixed oil and air in the form of a mist or vapor to the discharge nozzle 22. The mixer comprises generally a constant level oil reservoir and a discharge orifice disposed at a predetermined elevation above the level of the oil in the reservoir and an air inlet duct arranged adjacent the oil orifice and connected to the inlet port of a suction pump, the outlet port of which is connected to the discharge nozzle 22. As illustrated herein, the mixer comprises a bowl shaped hollow body portion 66 within which is disposed a hollow float 68 slidably mounted upon a centrally located guide bar 70 for maintaining the float in stable condition. A needle valve 72 is adapted to cooperate with an oil inlet port 74 to regulate the flow of oil from the supply tank 60 into the interior of the chamber 66 in response to actuation by the float 68. It is apparent that as the supply of oil in the mixer reservoir rises toward the predetermined level limit the float rises in accordance therewith and urges the needle valve upwardly toward a seated position against the port 74 thus shutting off the further supply of oil to the reservoir until such time as the float 68 moves downwardly in response to a withdrawal of oil from the reservoir. By means of this mechanism therefore a constant head may be maintained on the oil within the mixer reservoir.

An oil outlet orifice in the form of a small opening 76 in the end of a tubular jet 78 is provided for outlet of the oil from the mixer reservoir. As illustrated in Fig. 4, the orifice 76 is positioned at a slightly higher elevation than the indicated line of oil level 80, in the mixer reservoir, so that in the absence of differential pressure conditions upon the oil within the outlet orifice, the oil within the orifice will assume the level of the oil within the reservoir, and hence will not emerge from the orifice.

An outlet duct 81 for the mixer is provided in the form of a tubular channel embracing at one of its ends, in spaced relation therefrom, the oil jet 78 and communicating at its other end with the inlet port 82 of an atomizing pump 84 comprising a stator casing member 86 and an eccentrically mounted rotor 88 equipped with extensible vanes 90 in accordance with conventional fluid pump construction. The discharge port of the pump 84 is connected directly to the fuel nozzle 22. A suitable motor 92 for motivating the pump 84 is provided and as explained hereinabove may be automatically controlled by means of a room temperature responsive thermostat in such manner that the pump operates whenever the room temperature is below a predetermined degree and shuts off whenever the temperature reaches a predetermined degree.

The mixer outlet duct 81 is provided at its

lower end with air inlet passages 100 through the walls thereof, and an adjustable shutter 102 in the form of a tubular casing enveloping the duct 81 is provided with similar openings and is adapted to be axially rotated by means of a laterally extending crank arm 104 to regulate the flow of air through the openings 100. It will be apparent that as the rotor revolves the fluid within the pump is transported from the inlet side toward the outlet port and fresh air to replace the displaced vapor is drawn through the openings 100 and the duct 81 and by the oil orifice 76. As is well known in the hydraulic art, such fluid flow around the orifice 76 creates a pressure differential upon opposite sides thereof and induces flow of oil therethrough. The parts are so proportioned and arranged that under normal pump operating conditions the fluid flow through the duct 81 is of such nature as to induce a flow of oil through the orifice in the form of a rapidly moving spray, thus procuring complete dispersion of the fuel oil in finely divided form in the accompanying primary air stream to the end that the fuel pump is supplied with an oil and air mixture in the form of a vapor or mist. This fuel vapor is propelled through the nozzle 22 by action of the pump and discharged through the outlet orifice thereof into the combustion hood 14. As described hereinabove, the flow of fuel vapor through the nozzle 22 induces a corresponding flow of secondary air through the inlet openings 46 and the tube 30.

Thus, means have been provided for supplying the fuel oil to an oil and air mixing device at a constant head and transporting the fuel oil in a finely vaporized condition to the point of combustion in combination with two independent sources of adjustable air-to-oil ratio. Thus means have been provided for the introduction of the heater fuel and combustion air into the combustion hood in delicately balanced relation to the end that complete combustion of the available fuel may be obtained without the undesirable presence of excess quantities of air. This feature, in combination with the feature made possible by means of the combustion hood construction, wherein intensified temperature of combustion within the hood is assured for complete volatilization and combustion of all of the fuel substance before it emerges from the combustion hood, makes possible a system of heating that is capable of maximum combustion and heat transfer efficiency.

The adjustable shutter 102 for the primary air inlet opening is preferably arranged so as to be automatically actuated to different positions of air intake quantities in response to temperature changes within the combustion hood 14. As illustrated in Figs. 1 and 2, a thermostat element 110 may be arranged adjacent a wall portion of the chamber 16 and connected by means of a linkage system 112 to the crank arm 104 of the primary air inlet shutter to reduce the ratio of primary air to oil during the starting up process and to increase the ratio of primary air to oil under normal operating conditions, thus facilitating the starting up process and automatically acquiring maximum combustion efficiency under normal running conditions.

A reservoir flooding means for arbitrarily raising the level of oil within the body of the mixer may be provided in the form of a spring maintained rod 115 extending through a wall of the mixer casing. By depressing the rod 115, the float 68 is arbitrarily lowered in relation to the

level of the oil within the reservoir, and thus it is possible to temporarily increase the head of the reservoir, oil to the end that the oil-to-air ratio of the vapor issuing from the nozzle is increased.

This may be useful in connection with the starting up operation to facilitate ignition of the fuel stream. The upper end portion of the combustion hood, being formed of combustion columns 26 described hereinabove, provides means for muffling the flow of fuel and air mixture there-through, and at the same time provides means for insuring adequate fuel ignition temperatures at this point, to the end that a perfectly quiet and complete combustion of all of the fuel substance delivered by the apparatus is effected. The fuel inlet openings 28 of the combustion columns 26 being directed angularly with respect to the inner periphery of the hood, divide the fuel stream and divert it into the enlarged interior chambers of the combustion columns from whence it escapes in subdivided form through the multiple outlet openings 30. Thus the heated gases of the fuel stream follow tortuous but free paths through the combustion columns and during the starting up process the heat from the ignited flame becomes stored in the material of the combustion columns up to the point when the combustion columns become incandescent and constitute heat reflecting elements. At this stage the apparatus has assumed the normal operating condition and as explained hereinbefore, the thermostat device 110 automatically reduces the oil-to-primary air ratio and the flame in the combustion hood moves upwardly away from the nozzle 22 to the region of the combustion columns. The lower portion of the combustion hood then becomes a preheating and premixing chamber for the fuel vapor and combustion proceeds to take place largely within the upper portion of the hood in the region of the combustion columns. These columns, being heated by the action of heat reflection, now function as igniters to provide temperatures in the region thereof in excess of the temperature required for complete volatilization and combustion of the fuel substances. As explained hereinabove, this feature in combination with the feature of providing a consistently uniform and properly balanced oil-to-air ratio in the fuel stream insures maximum combustion efficiency and complete heat transfer performance. The novel construction of the combustion columns combines utmost quietness of operation with the above described efficiency of operation. The inlet ports 28 are substantially in line with the flow of fuel in the combustion hood, and the flow of fuel through the columns 26 is natural and not subject to accidental reversals upon changes in fluid velocity conditions in the hood. Thus, flare backs are prevented.

As illustrated in Fig. 6, the igniter element 50 is preferably provided in the form of a zig-zag grid elongated in the direction of the fuel discharge from the nozzle 22. By reason of this construction the fuel stream has a relatively long time of contact with the igniting element, and the parts are so shaped that the element presents no substantial obstruction to the free flow of fluid thereagainst.

Although only one form of the invention has been described and shown herein it is understood that the invention is not so limited but that various changes can be made therein without departing from the scope and spirit of the invention claimed.

We claim:

A combustion chamber for oil burners comprising a hollow cylindrical body composed of a base section of imperforate wall form and having a fuel inlet adjacent the bottom thereof and a foraminous refractory section superposed thereon and a top plate superposed upon said refractory section and functioning as an end closure therefor, said top plate being formed with a dome shaped intermediate section and a marginal edge portion extending radially and outwardly from said refractory section in the form of a flange therearound to provide baffle means for con-

trolling flow of combustion gases through the wall of said refractory section, said foraminous section being composed of a plurality of upright contiguous hollow tubular members formed of refractory material and having lateral openings through the tube wall portions thereof for allowing flow of combustion gases from the interior of said combustion chamber into the interior of said tube members and then outwardly thereof and under said top plate marginal edge flange portion.

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