Aug. 15, 1950 W. ROBERTS 2,518,937

HEAD STRUCTURE FOR GUN TYPE OIL BURNERS

Filed June 22, 1946

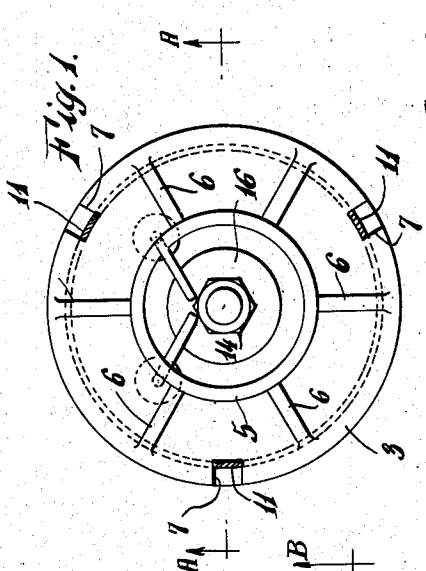


Fig. 1.

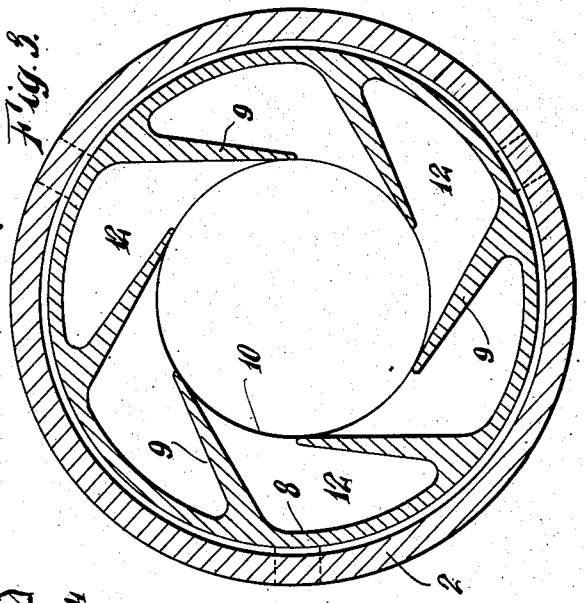


Fig. 3.

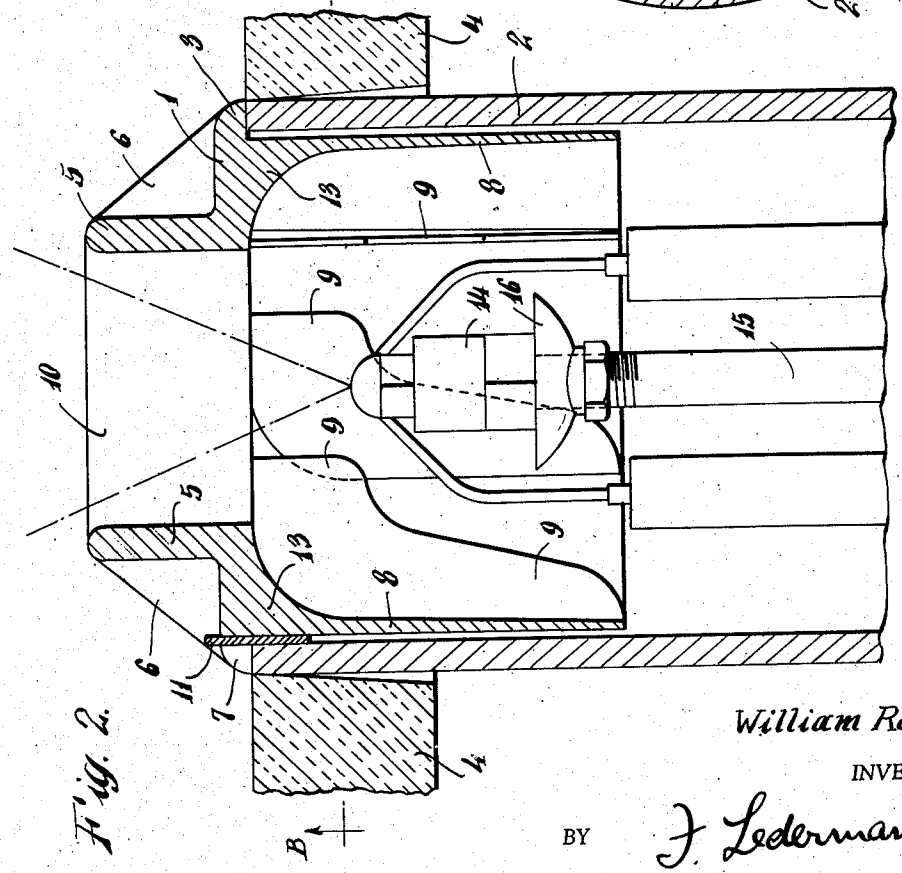


Fig. 2.

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Patented Aug. 15, 1950 2,518,937

UNITED STATES PATENT OFFICE

2,518,937

HEAD STRUCTURE FOR GUN TYPE OIL BURNERS

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Application June 22, 1946, Serial No. 678,625

4 Claims. (Cl. 158—76)

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The object of this invention is to improve the combustion-efficiency of the pressure atomizing or gun-type oil burner.

Since combustion efficiency, rapid combustion and high flame temperature are inter-related and dependent on a high initial temperature of the components of combustion, there is provided in practicing the invention a tubular combustion head, which being partly exposed to heat radiation from the furnace chamber, preheats air and fuel and produces a highly combustible mixture of heated air and oil vapor.

Combustion starts and is maintained within the head during the ignition period.

The outstanding characteristic feature of the invention is the separation of the process of combustion timely and locally from the process of mixing air and fuel, which separation is accomplished by changing the status of combustion from burning the fuel internally to burning it externally of the combustion head without changing the apex of the fuel spray.

By accelerating the flow of the burning mixture within the head and by discharging the diffused gaseous mixture at such velocity that, at the end of the ignition period, internal combustion ceases and flash combustion occurs at the exit of the head, the process of mixing is timely and locally separated from the process of combustion and valuable time is gained for preheating air and fuel and for producing, prior to combusion, a highly combustible mixture of heated air and oil vapor.

By limiting the duration of internal combustion to the ignition period and by efficiently transferring the heat absorbed by the head to the air, the head is maintained at a moderate high temperature and is kept from overheating.

These means are fully described in the specification and illustrated in the accompanying drawing in which is:

Fig. 1 a front end view of the preheater or combustion head.

Fig. 2 a section at the line A—A of Fig. 1 on an enlarged scale, showing the preheater in relation to a furnace wall.

Fig. 3 a section at the line B—B of Fig. 2.

The preheater or combustion head 1 is shown attached to the discharge barrel or air tube 2 of an oil burner so as to rest by means of a flange 3 on the rim of the discharge barrel or air tube, which is shown inserted in the front wall 4 of the fire-box or combustion chamber of a furnace.

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The forward part or firing nozzle 5 of the preheater, extending outside of the fuel spray (indicated by dotted lines) and into the combustion chamber, is provided with ribs 6 and slots 7 (Fig. 1). The inner part or air stream heater member 8 of the preheater, extending into the discharge barrel in annularly spaced relation thereto, is provided with annular series of straight ribs or fins 9 disposed on the wall of part 8 in tangential position to the cylindrical bore 10 of the discharge end 5 of the preheater (Fig. 3).

The heat absorbed by part 5, extending into the combustion chamber, is conducted to part 8 and transferred by the ribs 9 of large heating surface to the air contacting the ribs.

As the temperature of the air supplied by the burner for supporting combustion depends on the temperature of part 8 and ribs 9, part 8, in order to prevent the loss of heat to the discharge barrel, is spaced from the discharge barrel and the preheater is secured to the oil burner coaxial of the discharge barrel by keys or spacers 11 inserted in slots 7 (Figs. 1, 2) between the wall of part 8 and the discharge barrel.

The air entering spaces or channels 12 (Fig. 3) between the angular ribs 9 is diverted radially by the curved wall section 13 of extension 8 (Fig. 2) and passing along ribs 9 enters the central region of the preheater at an angle corresponding to the angle of ribs 9 to the wall of part 8.

The fuel is preheated by the radiation of heat to the spray-nozzle adapter 14 and converted into a gas upon discharge into the preheated air.

The transfer of heat to air and fuel is greatly increased by placing on fuel line 15 a deflector 16, which, by diverting the air from the center of the preheater towards the wall of part 8, increases the temperature of the adapter 14 and causes practically the whole volume of air supplied by the oil burner to come in contact with heated parts of the preheater.

By causing the preheated air to whirl in a plane in angular relation to the preheater axis and starting the whirling motion at the apex of the fuel spray and by effectively prolonging it at increased air density in the contracted discharge end 5 of the preheater a homogeneous, highly combustible mixture of preheated air and gasified fuel oil is produced which mixture, requiring less time for completing chemical union than an ordinary mixture at room temperature, will burn at greatly improved efficiency when discharged into the combustion chamber at increased velocity. Because of the large capacity

of the part 8, the air flows at relatively low velocity therein for ample preheating and thorough mixing with the final atomized oil as promoted by the annular deflector wall 13 or by the means for causing a circular travel of the air, or both, and with the flame being thus caused to begin rearward of the firing nozzle 5 or closely adjacent to the oil atomizing orifice for additional preheating and substantial vaporization of the oil. A substantial acceleration of the mixture of preheated air and fuel at the constricted nozzle 5 of the present most desirable or most advantageous arrangement of parts as shown by the drawing, which is drawn substantially to scale, facilitates the formation of a highly combustible mixture within the preheater prior to its discharge into the furnace chamber.

The electrodes conventionally operate for only two or three minutes and thus cause combustion to begin at the atomizing orifice, and thereafter the flames advance so as to begin at the forward end of the firing nozzle to avoid overheating the latter and to afford a longer air and oil intermixing path.

The preheater not located in the path of the flame in the combustion chamber but partly exposed to the heat of combustion is maintained at a temperature not affecting its material by the efficient transfer of heat to the air passing through the preheater.

With the object of achieving smokeless combustion the present-day oil burner is generally operated with a high percentage of excess air at the expense of efficiency.

This invention by simple means improves combustion, causes the flame to change its colour from red to white, facilitates smokeless combustion at reduced air supply, and reduces fuel consumption and eliminates the formation of carbon in furnace and stack.

The invention includes a method of vaporizing and burning oil by preheating oil and air and imparting heat to an atomized freely expanding stream of oil while intermixing the same with a whirling mass of air, to produce a gaseous combustible mixture in a small compact space which derives its heat directly from the combustion chamber itself. It will be understood that the annular wall 13 may produce a whirling but in lesser degree than the ribs 9.

I claim:

1. In a gun type oil burner having an air tube and an oil spray nozzle positioned wholly within said air tube, said spray nozzle being spaced from a free discharge end of said air tube, a tubular combustion head for fitting to said discharge end comprising an air stream heater member adapted to extend coaxially within said air tube spaced radially therefrom and to surround the oil spray nozzle when fitted to said tube, a firing nozzle terminating said heater member and extending beyond said air tube discharge end, and means carried by said combustion head securing the latter to said air tube with the heater member extending in radially spaced position, said firing nozzle being formed with a bore of reduced cross sectional area with respect to that of said heater member for increasing the velocity of flow of a mixture of oil and air from the oil spray nozzle and the air tube, said heater member being formed with internal longitudinally extending ribs in tangential relation to an imaginary extension of the inner surface of said bore of the firing nozzle and terminating at the inner rim of said firing nozzle for preheating the air, said ribs being so constructed and arranged with respect to the walls of said heater member as to deliver the preheated air in a whirling motion into atomized oil from the oil spray nozzle within a region of said heater member adjacent said inner rim of said firing nozzle.

2. A tubular combustion head for oil burners, comprising an air stream heater portion, and a firing nozzle portion extending forwardly from and coaxially and integrally formed with said heater portion, said firing nozzle having a bore of reduced cross sectional area with respect to that of said heater portion, the latter being formed with internal fins longitudinally extending in tangential relation to an imaginary extension of the inner surface of the bore of the firing nozzle and terminating at the inner rim of said firing nozzle.

3. An apparatus of the character described comprising an air tube of a gun type oil burner having a discharge end, a nozzle for spraying oil in a cone positioned within said tube spaced inwardly from said end, a combustion head coaxially fitted into said discharge end in radially spaced relation thereto and adapted to extend into a furnace chamber to receive heat radiation therefrom, said head including an air stream heater member extending within said air tube in radially spaced relation, said heater member being terminated by a firing nozzle extending beyond said air tube discharge end, said firing nozzle having a substantially cylindrical bore reduced in cross-sectional area with respect to that of said heater member for increasing the velocity of flow of discharge from the oil spray nozzle and air heater member prior to entering the furnace chamber, said heater member being formed with internal fins longitudinally extending in a tangential relation with respect to an imaginary extension of the inner surface of said firing nozzle bore, said heater member having a curved inner surface gradually decreasing in cross-sectional area joining the bore of the firing nozzle, said fins terminating at said curved inner surface, for preheating the air stream and for delivering the latter in a whirling motion at right angles to the combustion head longitudinal axis into an apex region of the oil spray cone, and means for securing said combustion head to said air tube discharge end in said spaced relation.

4. An apparatus of the character described comprising an air tube of a gun type oil burner having a discharge end and a nozzle for spraying oil in a cone positioned within said tube spaced from said end, a combustion head coaxially fitted into said discharge end and adapted to extend into a furnace chamber to receive heat radiation therefrom, said head including an air stream heater member extending within said air tube in radially spaced relation terminated by a firing nozzle extending beyond said air tube discharge end, said firing nozzle having a bore reduced in cross sectional area with respect to that of said heater member for increasing the velocity of flow of a mixture from said oil spray nozzle and air heater, internal fins extending longitudinally the heater member in tangential relation to an imaginary extension of the inner surface of the bore of the firing nozzle and terminating at the inner rim of said firing nozzle for preheating the air and for delivering the preheated air in a whirling motion into the apex region of the oil spray cone.

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