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APPARATUS FOR BURNING OIL AS GAS

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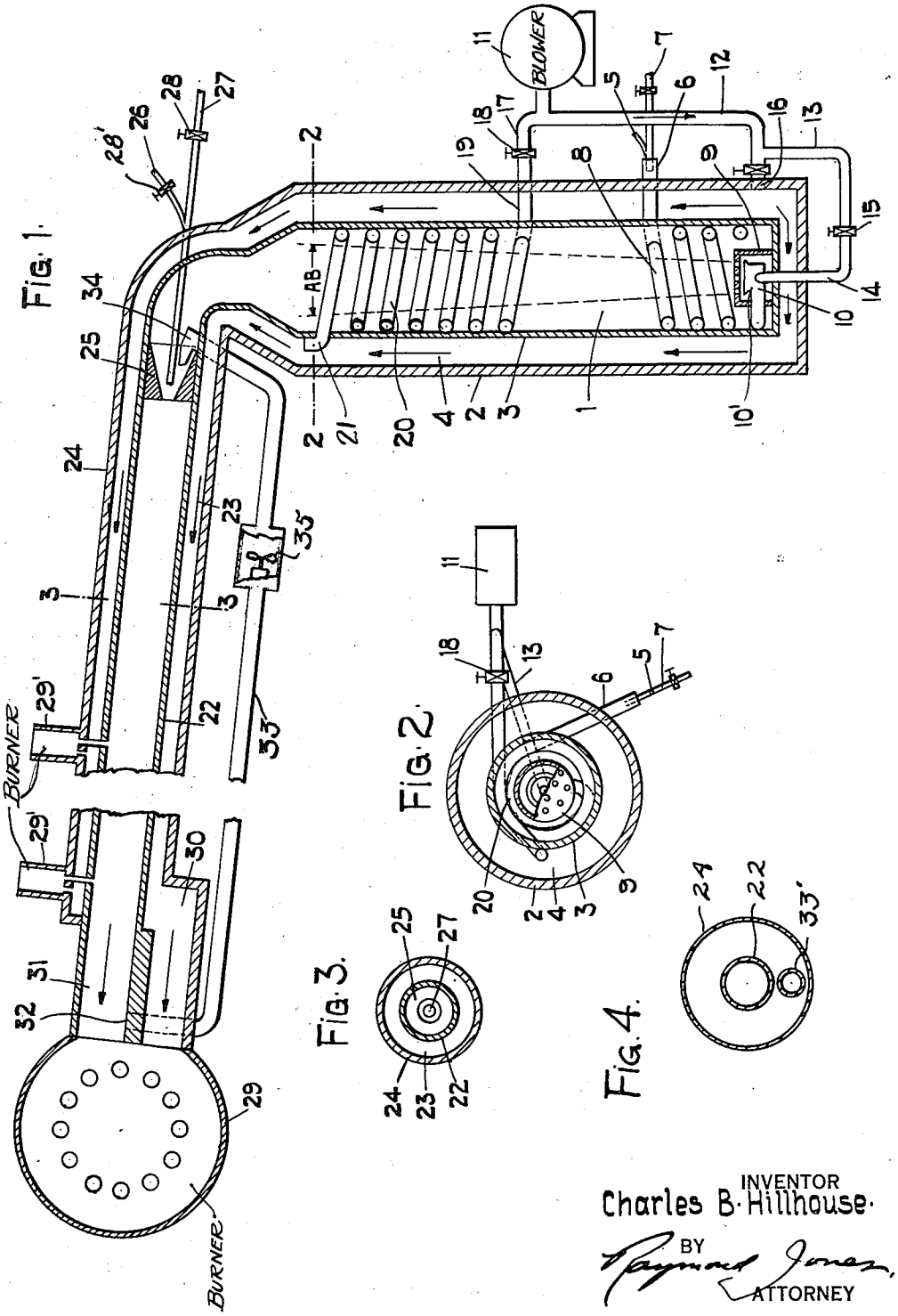


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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APPARATUS FOR BURNING OIL AS GAS

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6 Claims. (Cl. 158—53)

My invention relates to an apparatus for burning oil as gas, and more particularly to an apparatus for combustion of oil wherein a portion of the fuel to be burned, preferably oil or other hydrocarbon, is caused to combust in a manner to produce hot combustible gases which are mixed at a suitable temperature with a larger portion of fuel to gasify it, and these mixed gases may be burned with sufficient air at some distance from the zone of gasification to produce the main zone of combustion.

A main object of the invention is to provide an apparatus wherein a portion of the fuel, preferably oil, is heated and burned as a preliminary step with insufficient air for complete combustion so as to produce combustible gas and, thereafter, another portion of fuel is intimately mixed with the hot products of partial combustion and gas to gasify the main portion of fuel mixed therewith.

Another object is to provide an apparatus wherein the main portion of oil is gasified and maintained gasified in a suitably heated state while mixed with the gases formed by the partial combustion of the smaller portion of oil until the mixture is permitted to meet preheated air in the burner or burners.

Another object is to provide means to control the temperature of the gases formed by partial combustion so that, when the larger portion of oil is sprayed into or mixed with these gases, there will be sufficient sensible heat in the gases to gasify the main portion of oil, but not enough sensible heat to cause any detrimental deposition of carbon at the time or point of mixing particularly where the burners are situated at a considerable distance from the point of production.

This application is a continuation in part of my application, Serial No. 689,767, filed July 10, 1933, allowed September 1, 1934, and relates to a preferred form of apparatus for carrying out the method covered by said prior application. In the present application, the smaller portion of oil to be preheated is conducted through a spirally formed metal tube which is positioned to surround the hot combustion zone in a manner to preheat this smaller portion of oil before it is discharged into the zone where this smaller portion of oil is partially combusted. I provide also a means in the form of spirally arranged cooling coils located in a manner to regulate the temperature of the hot gases of partial combustion and, thereby indirectly, the temperature at which the larger portion of oil, or fuel, is gasified. Additional means are provided to maintain the gasified oil in a heated state until the gasified oil and gases of partial combustion are mixed with sufficient air in the main fuel burner. This additional means may comprise air that has been preheated by proximity to the partial combustion zone for the purpose of maintaining a reduced temperature thereof; and which air, so preheated, is applied and used to maintain the main portion of gasified oil in a suitably heated state by indirect heat exchange relation thereto preferably as a hot jacket around the mixed gases. This preheated air is finally consumed, all or in part, by being mixed into the made gases in the main burner or burners; which, owing to the application of heat as a surrounding jacket, may be positioned at a distance from the gasifier described, thereby producing a more efficient method of combustion. If the distance between the point of gasification and the burner is short and ample means are applied to prevent material loss of heat from the gas mixture, I may dispense with the use of the heat applied as a surrounding jacket.

In the accompanying drawing,—

Figure 1 shows a vertical cross-section of an oil burner constructed to carry out the method described;

Fig. 2 shows a cross-section on line 2—2 of Fig. 1;

Fig. 3 shows a cross-section on line 3—3 of Fig. 1; and

Fig. 4 shows a modification wherein means are provided to maintain the temperature of the return gases.

In the preferred form of apparatus shown, a gasification chamber 1 is shown as having an outer heat insulating wall 2 and an inner refractory wall 3 to provide an air conducting space 4. The smaller portion of oil that is to be gasified, or partially combusted, is supplied under a suitable pressure from a conduit 5 into a spray tube 6. A device 7 is adapted to inject the oil by air flow therethrough. The tube 6 leads into chamber 1 and the oil spray therefrom is conducted through a spirally arranged pipe 8 into a burner 9 to which it is fed from a nozzle 10. This oil is preheated in spiral pipe 8 which surrounds the partial combustion zone above burner 9. A blower 11 supplies air to a conduit 12 which is connected to a conduit 13 which terminates in an air feed pipe 14 within burner 9. A valve 15 serves to control air supply to burner 9 in sufficient amount to cause

partial combustion, that is, enough air is used to burn all the carbon in that portion of oil to CO, but not enough air to combust the hydrogen nor make any CO_2. Air from pipe 14 draws in heated oil from the spiral 8 at the throat 10' of nozzle 10. If desired, starting of burner 9 may be facilitated by heating oil in pipe 8 with electric heating coils therein.

Air from conduit 12 enters the space 4 at inlet 16 and passes upwardly around the heated wall 3 to become preheated. Air from the blower 11 passes also through a conduit 17 and valve 18 and an inlet 19 into a spirally arranged conduit 20 that surrounds the zone of combustion from burner 9. The air in conduit 20 extracts heat from this zone of combustion in an amount regulated by valve 18 and leaves the conduit 20 by an outlet 21 which communicates with the space 4.

The preheated air in space 4 passes upwardly and is conducted along a path to surround the gas outlet conduit being confined in a space 23 formed between the conduit 22 and a heat insulated wall 24. The gases from chamber 1 pass upwardly through an outlet throat 25 into the conduit 22. The larger portion of oil fuel is supplied from a pipe 27 and is sprayed into the throat 25 by means of an oil injecting device 26, the oil flow being controlled by the valves 28 and 28'.

Oil sprayed into the throat 25 is gasified and is maintained in a gasified state by application thereto of heated air in the space 23 which air functions as a heated insulating medium, hence this oil gas may be efficiently conducted an appreciable distance from the chamber 1 to a suitable burner 29 or auxiliary burners 29'. Heated air from the space 23 is supplied to the burner through air inlet 30 and the oil gas is supplied through the gas inlet 31.

The air passing through the spiral conduit 20 serves to draw off excess heat from the gases of partial combustion in the chamber 1 before having the larger portion of oil fuel sprayed into these gases at the throat 25 so that the mixture will assume the exact temperature desired. The temperature of the gases and gasified oil admitted to the conduit 22 is so regulated that the mixture will have a temperature of about 600 degrees F. or below a temperature at which there will be any dissociation of carbon to form a deposit. The chamber 24, 24 is, in effect, separate from the combustion chamber 1, 2 and may be structurally associated with the latter in any desired manner providing that hot gases generated in the latter may be passed into the chamber 22, to gasify oil sprayed thereinto.

In order to maintain a complete gas cycle, my invention includes the feature of maintaining a supply of made gas from the burner in excess of that required for any maximum demand of the burner or burners and any gas not consumed at the burner is returned to the point where the new oil-gas is being formed. To accomplish this purpose, the excess gas is drawn off at a point adjacent the burner through an outlet 32 into a return conduit 33 and is discharged at an outlet nozzle 34 into the gas stream that enters conduit 22. A blower 35 may be used in conduit 33 to facilitate return of this unused gas.

In Fig. 4, the gas return conduit 33' is shown as enclosed within the jacket 24 in a manner to maintain the temperature of the returned gas substantially equal to the temperature of the gas in the conduit 22. If desired, the conduit end 34 may be positioned in front of the throat 25 instead of in the rear thereof, as shown.

In the operation of my device, oil from spiral conduit 8 is supplied to nozzle 10 and air in regulated amounts from air inlet 14. This vaporized or partly vaporized oil and air is partially combusted, that is, the air is in insufficient amount to combust the hydrogen or make any CO_2, although all of the carbon is burned to form CO. The zone of combustion is indicated by dotted lines A—B. Air from conduit 17 is forced through the spiral conduit 20 to be preheated and extract heat from the hot gases of partial combustion. This air is then passed into space 4 and out of the gas generator and into the space 23 to flow along the conduit 22. There is little or no interchange of heat between the hot air jacket and the made gases when not over 200 degrees F. difference in temperature exists between them when only a short time has elapsed for transfer of the gas to the burner. The portion of oil from conduit 26 is sprayed into the throat 25 and is gasified and is maintained in that form due to the stabilizing action of heated air in the space 23 surrounding this gas. This heated air all or in part, in turn, is supplied to the burners to combust with made gases admitted from fuel passage 31.

The temperature to be aimed at for the mixture of sprayed oil and gases of partial combustion should be about 600 degrees F. so to be secure from any carbon deposition. To prevent any breakdown of the unstable oil gases before reaching the burner 29, the pipe 22 conveying the above mixture is encased in another pipe 24 making a double shell. The hot air between these shells is maintained at about 450 degrees F. Due to the relation of made oil gas and heated air and the stabilizing action of the heated air upon the temperature of the oil gas, the oil gas may be conveyed to a burner or burners located at some distance from the gasifier without appreciable change in character of the final mixture of generated oil gases. One of the essential features of this apparatus is to control the temperature of the zone of gases of partial combustion A—B so that when the larger portion of oil is sprayed into them, there will be enough sensible heat in the gases to gasify the oil but not enough to cause any deposition of carbon. This is brought about by the cooling effect of the air which is passed through the spiral conduit 20.

This gasification does not make a fixed gas but the gas or gases are permanent so long as they are kept at a temperature sufficiently high to prevent their liquification. For instance, gasoline is a gas at its temperature of distillation but at atmospheric pressure and normal temperature takes a liquid form. So what I am doing when I apply generated hot combustible gas to a spray of oil, when the resulting or final temperature is about 650 degrees F., is to gasify the oil and not merely vaporize it. Therefore, I propose to keep that latter gas at a temperature above its reversion point, and burn a mixture of true gases in the burners, though it is not necessarily a mixture of fixed gases at atmospheric pressure and normal temperature.

The temperature of the hot gases of partial combustion may be from 900 degrees to 1000 degrees F. at the instant of spraying oil into same, but the temperature of conversion or lowest temperature after production of the mixture of gases will be not over about 650 degrees, whereby there will be no tendency to produce deposition of carbon as might occur at higher temperatures than 650 degrees F.

While the apparatus disclosed is intended to illustrate a preferred form of the apparatus, it is to be understood that variations thereof are contemplated such as will be embraced within the scope of the appended claims.

What I claim is:

1. A device for burning oil comprising a chamber, means to supply oil to said chamber, means to partially burn said oil to produce a hot combustible gas, a burner, a conduit connecting said chamber to said burner, a jacket compartment around said chamber, a jacket compartment around said conduit, and means to force air within the first-named compartment to heat the air, said compartments being in communication to permit the heated air to flow into the second-named compartment.

2. A device for burning oil comprising a chamber, a main burner, a conduit connecting the chamber and burner, an auxiliary burner for fuel within said chamber for maintaining a zone of hot combustible gas in said chamber, means for passing liquid fuel into the zone of hot gas to gasify said fuel, the gasified fuel being supplied to the main burner through said conduit and means for by-passing a portion of the made gas from a point adjacent the junction of the conduit and the main burner to a point adjacent the juncture of the conduit and the chamber and feeding said portion of gas into the stream of hot newly made gas.

3. In an oil burning device, a gasification chamber, a main burner, a gas conduit connecting the chamber and burner, means for converting liquid fuel to gas in said chamber, said gas being supplied to the main burner through said gas conduit, and a return conduit between the main burner and the chamber, said return conduit serving to return to the chamber all excess gas not consumed at the main burner, a jacket surrounding the gas conduit, means to supply a heating medium within the jacket, the return conduit being positioned in the space between the gas conduit and the jacket.

4. In an oil burning device, a combustion chamber, an auxiliary burner in said chamber, means to supply fuel to said burner and partially burn same to produce a hot combustible gas, a casing surrounding said chamber and spaced therefrom, means to supply air between the chamber and casing to heat the air, means to spray liquid fuel into the hot combustible gas to gasify the sprayed fuel, a main burner, a conduit for conducting made gases from the chamber to the main burner, a jacket around said conduit, the heated air from within the casing being passed between the conduit and the jacket.

5. In a device as set forth in claim 4, a return conduit interconnecting the outlet of the conduit to the outlet of the chamber, and means for forcing gas not consumed at the main burner through the return conduit to the chamber.

6. An oil burner comprising a chamber, means for partially burning a portion of fuel to form a hot combustible gas, means to feed, in spray form, a portion of oil into the hot combustible gas to gasify said oil, a conduit positioned within said chamber in position to contact the hot gas of partial combustion, means for passing a supply of cooling air through said conduit to extract heat from said hot gas, a main burner, a conduit for passing the made gases to the burner, and means for passing the heated air from said first-named conduit in indirect heat exchange relation with the made gases in said last-named conduit.

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