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GAS MAKING WITH EMULSIFIED FUEL

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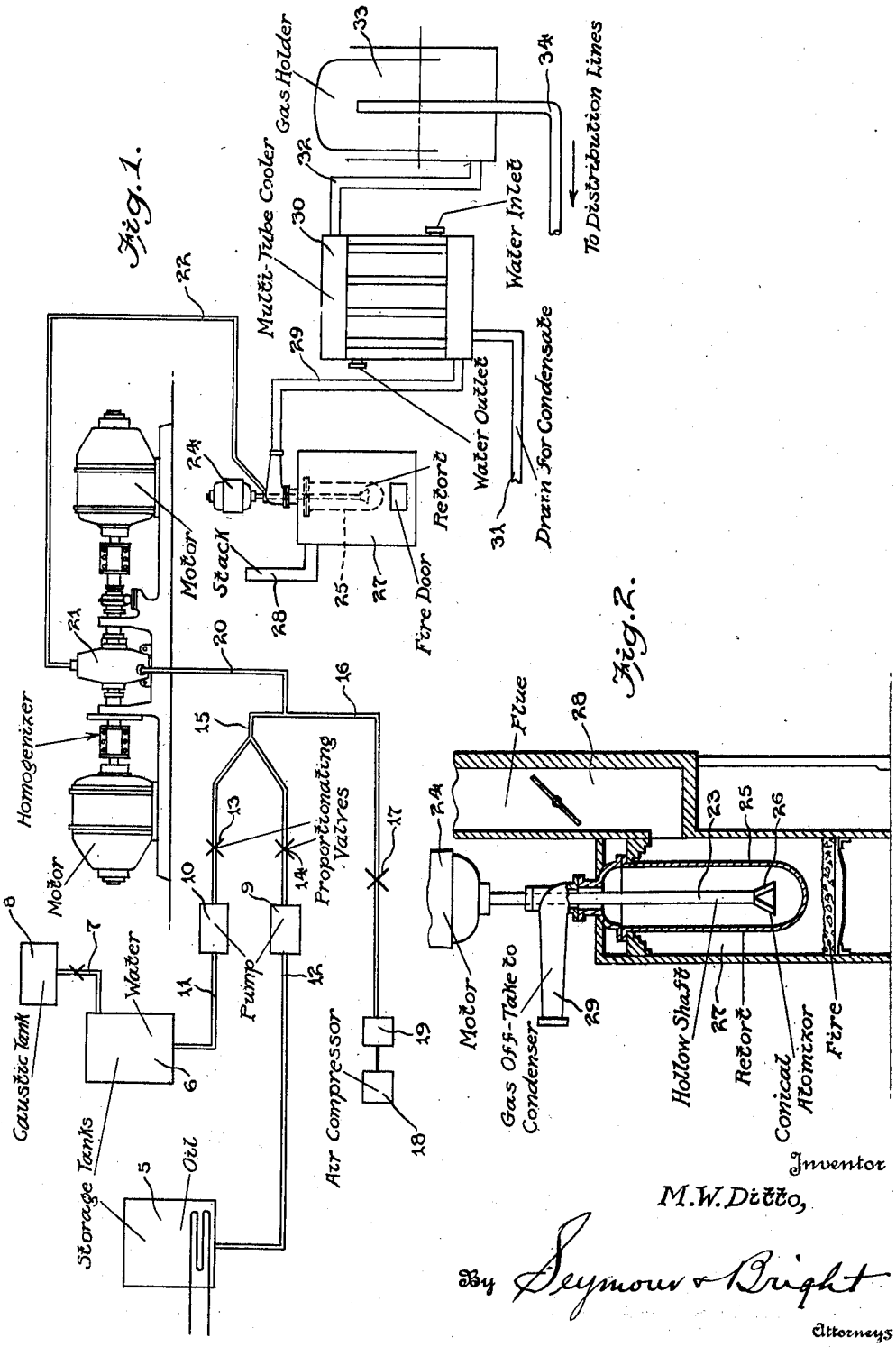

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GAS MAKING WITH EMULSIFIED FUEL

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2 Claims. (Cl. 48—215)

This invention relates to improvements in processes for the emulsifying of hydrocarbon oils and the manufacture of fixed hydrocarbon gas therefrom.

One of the salient objects of the invention is to provide a system whereby very heavy oils, preferably residuum oil obtained in an oil refinery after the gasoline, kerosene, gas oil and other fractions have been distilled off from the original crude, may be utilized in the manufacture of gas, for example. These oils have initial vaporizing points above 400° F., and are now mostly used for fuel oil purposes. I have discovered that if such oils are placed in fluid condition and thoroughly mixed with a base gas, such as air, and an aqueous liquid such as water, that this mixture is admirably adapted as a charging stock in the manufacture of gas.

Another object is to furnish a system of this character, in which the proportions of the constituents of the mixture may be accurately controlled, so as to enable the operator to obtain fixed hydrocarbon gases containing as high as 1200 B. t. u. per cubic foot.

With the foregoing objects outlined and with other objects in view which will appear as the description proceeds, the invention consists in the novel features hereinafter described in detail, illustrated in the accompanying drawing, and more particularly pointed out in the appended claims.

Referring to the drawing,

Fig. 1 is a diagrammatic view of the improved apparatus.

Fig. 2 is a vertical sectional view partly in elevation, of the heater unit of the same.

In the drawing, 5 and 6 respectively, designate relatively large storage tanks, the first to contain oil and the second to contain water, the latter being connected by a valved pipe 7 to a caustic tank 8, the latter containing an aqueous solution of potassium or sodium caustic, to make the water alkaline to the extent of about 1%.

The heavy oil having an initial vaporizing point of about 400° F. is heated to a temperature of about 180° F., in order that it may flow through the pipe lines of the apparatus.

Pumps 9 and 10 are interposed in the conduits 11 and 12, leading from the tanks 5 and 6, and these conduits are provided with valves 13 and 14 for proportioning the pumped liquids before they enter a common discharge pipe 15. The latter is connected to an air pipe 16 having a suitable control valve 17, and connected to an air compressor 18. Air from this compressor enters a storage tank 19 from which the compressed air in proper amount is fed through the pipe 16 and mixed with the oil and water.

A conduit 20 leads the mixture to a homogenizer 21, a machine now in common use for the recombining of butter fat with milk to form a cream. Such homogenizers are also used for various other purposes at the present time, and they function to thoroughly admix materials entering the same.

A conduit 22 leads the mixture from the homogenizer to the hollow shaft 23 of an electric motor 24, such shaft extending into a retort 25 and terminating at its lower end in a conical diffuser 26 which acts to atomize the mixture as it enters the retort. The latter may be heated by any suitable means, for instance, it may be arranged in a fire chamber 27 that is connected to a flue or stack 28 for the discharge of the products of combustion.

The gasified mixture from the upper end of the retort discharges through a take-off pipe 29 that leads to a water-cooled condenser 30. Condensates from the latter drain off through the pipe 31, while the gaseous mixture thus relieved of such condensates, may flow through a conduit 32 into a gas holder 33 that leads to a distributing line 34.

In practicing the process in connection with this novel apparatus, I take from the tank 5, preheated heavy oil of the character heretofore mentioned, and force the same by the pump 9, and in proper proportion, into the pipe 15, and in the latter, this oil is premixed with the alkaline water which is forced by the pump 10 from the tank 6. On the discharge side of the pumps, the air line 16 leads into the pipe 15, and the air is at a slightly higher pressure than the liquids, and the premixed materials reach the homogenizer aerated to the extent of from 10 to 25% in volume. As the aerated mixture passes through, and the fluids are combined in the homogenizer, the oil is in a colloidal state, and entrains the water within small colloidal capsules, to form an end product that has been saponified. This emulsified mixture, on being discharged from the homogenizer, passes to the retort 25 which is externally heated, and the mixture in discharging through the nozzle 26, is atomized. As the motor 24 rapidly rotates the nozzle 26, it will be understood that the emulsified mixture is broken up into a fine spray. This atomized mixture is exposed to the radiant heat emanating from the walls of the retort, and is instantaneously converted into vapors and gases.

Assuming that the gas used to aerate the water and oil is atmospheric air, it has present a certain amount of oxygen, and as the walls of the retort are maintained at a temperature of from between 1600° to 1800° F., the mixture rapidly reaches a temperature far in excess of the ignition temperature of any of the hydrocarbons present. Therefore, some combustion takes place between the hydrocarbons, the carbon and the oxygen present.

It is well known that water is more easily decomposed into its constituent parts in the presence of hydrocarbon in a high temperature vapor phase. In decomposition, a large part of the hydrogen, while it is nascent, will combine with the heavy hydrocarbons to form more simple hydrocarbons, and with carbon to form carbon monoxide, and in some instances, tar acids are also formed. In practicing my process, I prefer to have a slight excess of water, which, in the last stage of the process, can be condensed back into the liquid state.

I use an insufficient amount of air or oxygen for complete combustion, but sufficient only for an endothermic reaction, and due to this partial combustion, and the application of the external heat, the resulting chemical reaction converts the materials used into a fixed hydrocarbon gas having the desired B. t. u. per cubic foot; it being understood that the B. t. u. may be varied by changing the proportions of the materials fed to the homogenizer.

In view of the fact that the quantity of oxygen present can be accurately controlled, it is possible, within reasonable limits, to control the heat value of the gas and the amount of inerts such as nitrogen, resulting from the aerated fluid. In the event it is desirable to prohibit the flow of any inerts, pure oxygen can be used for aeration, and in some instances, it will be found advisable to use a mixture of oxygen, with carbon dioxide as an inert gas.

From the foregoing it will be understood that the invention relates particularly to the production of fixed hydrocarbon gas, and not to the production of water gas or a combination of hydrogen and carbon monoxide gas. The production of low heat value gas from a mixture of oil and water, or steam, treated in a high heat chamber, is old and well known to gas engineers, and I make no claim to the same here. In accordance with my invention, an emulsion is prepared of oil and water, in which is entrained a fixed gas such as atmospheric air, and this emulsion is injected into the heated retort in a finely divided or atomized state, and there subjected to a temperature range which does not permit the formation of free or amorphous carbon. However, the temperatures used crack the oil in the vapor state to fixed gases in the presence of water vapor in conjunction with oxygen. A typical analysis of the resulting gases is herewith incorporated.

	Percent
Illuminants or heavy hydrocarbons (liquefiable)	49.5
Carbon monoxide (CO)	.9
Hydrogen (H_2)	10.1
Methane (CH_4)	24.8
Ethane (C_2H_6)	5.1
Carbon dioxide (CO_2)	0.8
Oxygen (O_2)	2.4
Nitrogen (N_2)	6.4
	100.0

It will be noted that it is all high heat value, and that the liquid hydrocarbons at atmospheric temperatures and pressures, can only be removed by absorption or compression and refrigeration. When this is done, most of these liquefied hydrocarbons will belong to the aromatic and olefine series.

It is relatively easy to produce a low heat value water gas from hydrocarbon vapors, but more difficult to maintain relatively high heat values. To accomplish the latter, it is essential that there be a very intimate mixture of oil and water, so that when the combined vapor is submitted to sufficient heat, the dissociation of the water vapor and the dissociation of the hydrocarbon molecule takes place simultaneously at their respective critical temperatures.

The presence of atmospheric air in the emulsion supplies sufficient oxygen to aid the exothermic reaction during the period of dissociation of the water vapor. By the use of the emulsion with the entrained gas, the mass of vapor is raised more rapidly to the point of dissociation into more simple molecules than is possible by a mixture of oil vapor and steam.

Pursuant to the invention, an emulsion composed of hydrocarbons in the liquid state, water in the liquid state, and a fixed gas containing oxygen is preformed in such manner that each bubble of gas is microscopically small, and the emulsion is injected through high pressure pulverizing nozzles, so that it is put in vapor state mechanically, previous to the period when it is vaporized by heat.

It has been found impossible to regulate the proportions of oil and water by metering nozzles and valves to get a uniform result, and that is the main reason why I have gone to the premixture of the elements in definite proportions before discharging the emulsion in atomized condition into the heating zone.

I am aware that many method have been devised for the treating of oil and water mixtures, but I believe I am the first to emulsify oil and then to rapidly heat the same while it is in a mechanically vaporized condition, whereby the reactions can be controlled by the amount of water added to the oil. So far as I know, it is also novel to subject an emulsified mixture of this character to partial combustion in the presence of a combustible gas, while also subjecting the same to externally applied heat.

By way of reiteration, I may state that in accordance with this invention, gas may be manufactured from heavy oils which cannot be handled by the refineries for refining purposes, and this oil is emulsified and atomized before heat treatment which treatment converts the same into a fixed gas. Obviously, it is possible by the present invention, to also refine the oil after being put into emulsified condition in the homogenizer.

From the foregoing it is believed that the operation of the system and the advantages thereof may be readily understood by those skilled in the art, and it is manifest that changes may be made in the details disclosed, without departing from the spirit of the invention, as expressed in the claims.

What I claim and desire to secure by Letters Patent is:

1. In a process of the character described, premixing an admixture of heavy hydrocarbon oil and water with air to aerate the liquids to an extent of from 10 to 25% in volume, homog-

enizing these fluids and thus producing an emulsion, and then subjecting the emulsion to sufficient heat to convert the same into a fixed combustible hydrocarbon gas.

2. In a process of the character described, premixing an admixture of heavy hydrocarbon oil and water with air to aerate the liquids to an extent of from 10 to 25% in volume, homogenizing these fluids and thus producing an emulsion, subjecting the emulsion in atomized condition to a temperature of about 1600° F. to 1800° F., and thereby producing a fixed hydrocarbon gas.

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