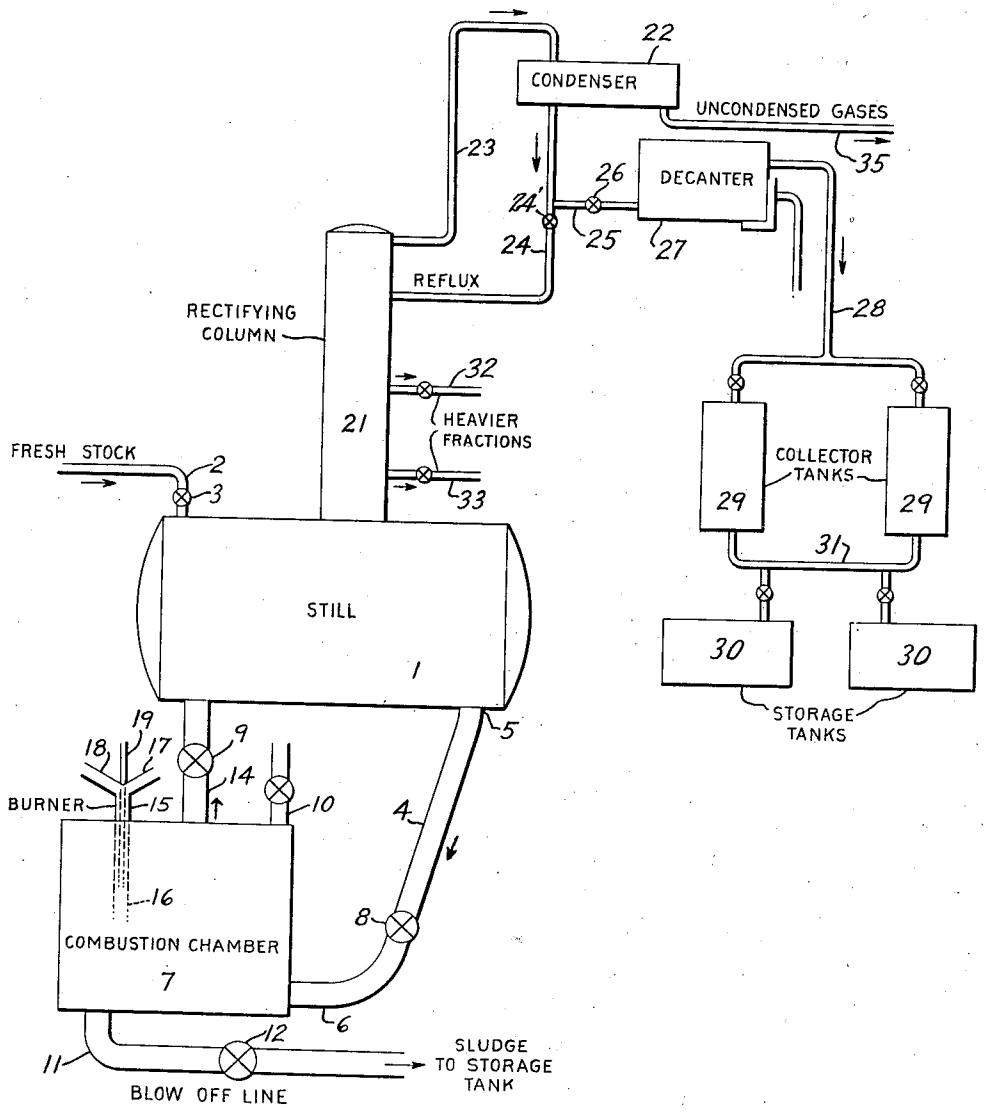
Jan. 2, 1934. F. W. STEERE 1,942,191

PROCESS FOR THE HEAT TREATMENT OF LIQUIDS

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Fig. 1.



INVENTOR

BY Frank W. Steere

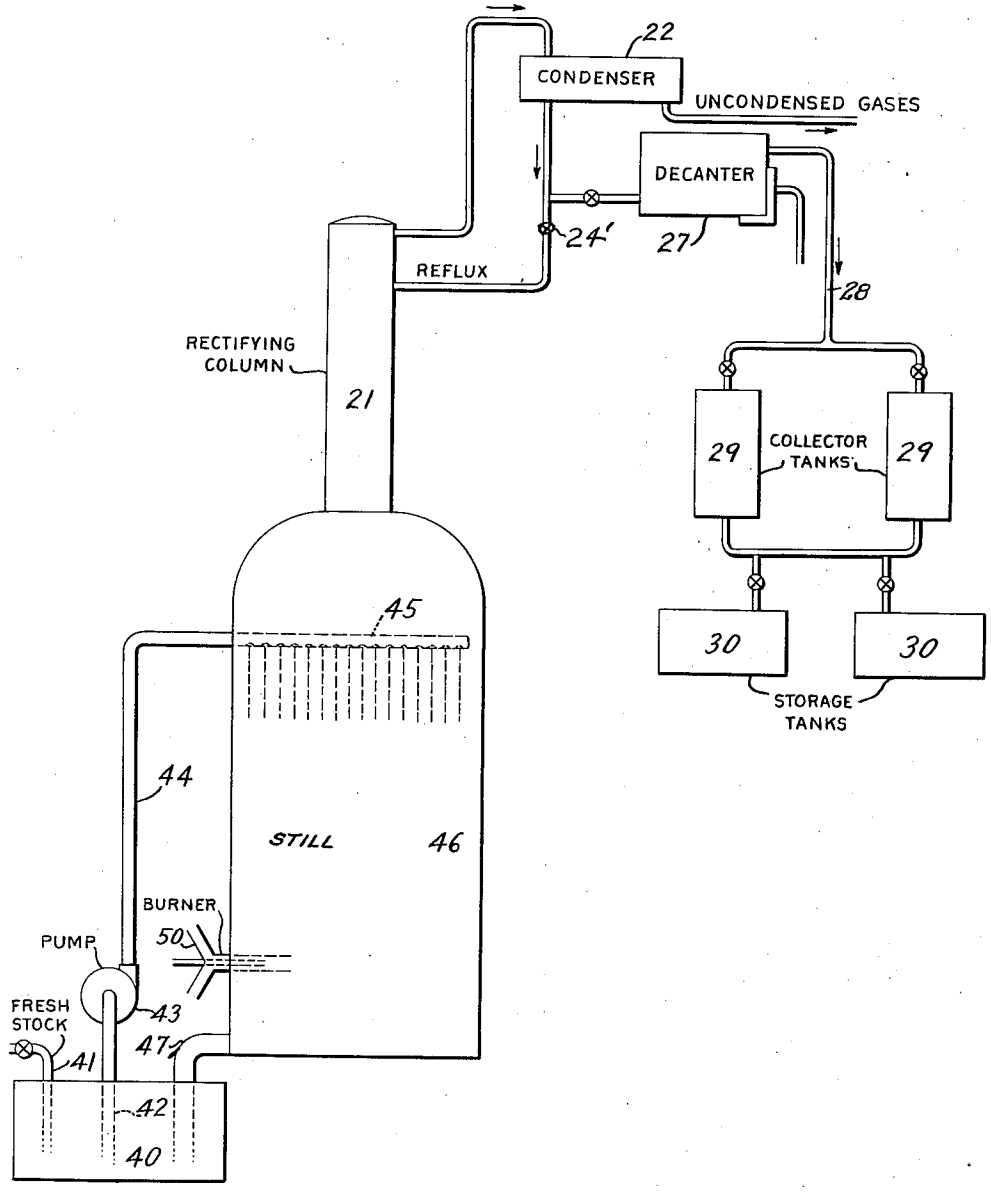
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Fig. 2.



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UNITED STATES PATENT OFFICE

1,942,191

PROCESS FOR THE HEAT TREATMENT OF LIQUIDS

Frank W. Steere, Scarsdale, N. Y., assignor, by direct and mesne assignments, of one-half to Semet-Solvay Engineering Corporation, New York, N. Y., a corporation of New York, and one-half to Air Reduction Company, Inc., New York, N. Y., a corporation of New York

Application May 23, 1929. Serial No. 365,301

5 Claims. (Cl. 196—67)

This invention relates to the heat treatment of substances generally as described in my copending application filed of even date herewith, Serial No. 365,300, and the particular embodiment of the invention described and claimed herein relates to the heat treatment of liquids, and more particularly the distillation and cracking of oils.

One object of the embodiment of my invention described and claimed herein is to provide a process for economically and efficiently heat treating liquids. Another object is to provide a process for cracking and distilling oils to obtain maximum yields of light oils and a combustible gas as a by-product of the distillation operation.

The present invention eliminates to a large extent the disadvantageous features of distilling and cracking oils and heat treating liquids as heretofore practiced. According to present-day practice, liquids are heat treated and oils are distilled and cracked by the indirect application of heat. In contradistinction, this invention comprises a process for the heat treatment of liquids by contacting the liquids with the hot gaseous products formed by reacting oxygen and carbonaceous materials, preferably in direct contact with the liquids and while controlling the temperature of the reaction, by introducing a suitable heat absorbing medium.

The nature and objects of this invention will be better understood from a description of particular illustrative embodiments thereof, for the purpose of which description reference should be had to the accompanying drawings forming a part hereof, and in which:

Fig. 1 is a diagrammatic layout or flow sheet showing an arrangement of apparatus for distilling oils and illustrating a preferred embodiment of this invention; and

Fig. 2 is a diagrammatic layout or flow sheet showing a modified arrangement of apparatus for practicing my invention.

Referring to the drawings, 1 indicates a still of the type customarily used for the distillation of petroleum oils, this still being provided with a fresh stock supply pipe 2 having a valve 3 therein. Still 1 also has an outlet main 4 connected to the base thereof at 5, end 6 of main 4 being connected to a combustion chamber 7. A valve 8 is positioned in the main 4. The combustion chamber 7 has a safety valve control outlet 10 at the top, a discharge or blow-off line 11 at the base, line 11 being provided with a suitable valve 12, and is connected with the base of still 1 by a pipe 14 controlled by valve 9.

According to the present invention, the combustion chamber 7 is provided with a so-called "burner" 15. This burner preferably consists of three interconnected pipes communicating with a burner tip 16, one pipe 17 being used to supply carbonaceous material, as, for example, powdered coal, oil, combustible gas and the like, another pipe 18 being used to supply oxygen, and the third pipe 19 being used to supply a suitable heat-regulating medium, preferably steam.

The still 1 is provided with a rectifying column 21 communicably connected to a condenser 22 by a pipe 23, condenser 22 having a condensate return pipe 24 leading back to the column 21. A draw-off or drain pipe 25 having a valve 26 therein connects the return pipe 24 with a decanter 27, and when valve 24' in pipe 24 is closed decanter 27 is in turn connected by a pipe 28 with collector tanks 29, which are connected to storage tanks 30 by valve control pipe 31. A gas draw-off pipe 35 leads from the condenser 22 and is connected to suitable gas treating and purifying devices or to a gas holder (not shown). As the arrangement and construction of the rectifying column, condenser, decanter, collector tanks and storage tanks are well known in this art, further description thereof is considered unnecessary.

In the modification shown in Fig. 2, a tank 40 is provided with a valve control fresh stock supply pipe 41. A pipe 42 leads from substantially the base of tank 40 to a pump 43, which in turn is connected to a pipe 44 terminating in a spray header 45 positioned within still 46. Preferably the spray header 45 extends transversely across the still 46 at substantially the top thereof. This still is connected at its base by a return pipe 47 with the tank 40. Extending through one side of the still 46 is a burner 50 of identical construction with the burner 15, hereinbefore described.

The still 46 is provided with a rectifying column 21, condenser 22, decanter 27, collector tanks 29 and storage tanks 30 and suitable connections constructed and arranged as described in connection with the identical apparatus of Fig. 1.

In operation (Fig. 1) valve 8 in pipe 4 is opened and fresh stock is supplied through pipe 2 to the still 1. This stock flows through the main 4 into combustion chamber 7. Burner 15 is then supplied with oxygen, steam and carbonaceous material, as powdered coal or oil, which react to form water gas at a very high temperature. This water gas contacts with the body of oil formed in the combustion chamber 7, distilling off the light and heavy oils, and the mixture of water gas and

resultant oil vapors passes up through pipe 14 into contact with the oil in still 1, distilling the oil in the still, and the resultant mixture of gases and oil vapors passes into the rectifying column 21. The valve 9 in pipe 14 is opened immediately after the operation is commenced and the mixture of gas and volatiles coming up through pipe 14 obstructs the passage of oil down through pipe 14 and causes a flow of oil into and through pipe 4. By suitably regulating the supply of fresh stock to still 1, a constant flow of material from this still to the combustion chamber 7 and a flow of water gas admixed with products of distillation from the combustion chamber 7 through pipe 14 and through still 1 is maintained.

The heavy oil vapors condensing in the rectifying column fall back into the still 1, flow with the oil therein through main 4 into the combustion chamber 7 and are contacted with the hot gases resulting from the reaction of oxygen, steam and carbonaceous material of burner 15, so that the oils of high molecular weight are decomposed into bodies of lower boiling points and the oil vapors pass through pipe 14 and still 1 into the rectifying column 21. Due to the direct contact of the hot gaseous reacting products from the burner 15 with the oil, immediate distillation and cracking of the oil results, and by using the rectifying column to return a predetermined portion of the heavier oils for redistillation and cracking, maximum yields of light oils may be obtained. The rectifying column is preferably provided with condensate draw-offs 32 and 33 for removing desired heavier oil fractions.

The uncondensed gas and vapors pass from column 21 through pipe 23 to condenser 22 where the mixture of gas and vapor is cooled and the condensable constituents removed, a portion of the condensate being returned to the rectifying column through reflux line 24 for heat interchange with the gas and vapors in the column 21. The remainder of the condensate is withdrawn through pipe 25 and led into a decanter 27, where separation of impurities from the oil results, and the desired light oil fraction is passed from the decanter to collector tanks 29 and therefrom to storage tanks 30.

The uncondensed gas consisting of water gas and oil gas mixture is passed through pipe 35 from the condenser 22 to suitable gas treating and purifying devices not shown. The sludge or residue in combustion chamber 7 is drawn off at convenient intervals through blow-off line 11 and passed to a storage tank (not shown).

The operation of the modified arrangement of apparatus shown in Fig. 2 closely resembles the operation hereinabove described. Pump 43 provides a circulating medium for the oil, pumping the oil from tank 40 through spray header 45 into substantially the top of still 46, the oil flowing down through the hot zone produced by the reaction of steam, oxygen and carbonaceous material of burner 50 contacting with the products of this reaction and thus being distilled and cracked. The undistilled residue flows from still 46 through pipe 47 into the tank 40 and is again circulated by the pump 43. The water gas resulting from the operation of burner 50 with the oil vapors pass up through the still into rectifying column 21. The heavier oil vapors condensing in the rectifying column fall back into still 46 and are admixed with the oil flowing from header 45 and contact with the hot gases from burner 50 so that the oils of higher molecular weight are decomposed into bodies of lower boiling points, the oil vapors passing up into the rectifying column, and treated as above described in connection with the description of column 21 and connected apparatus of Fig. 1.

Preferably steam, carbonaceous fuel, as powdered coal or oil, and oxygen are fed to the burner. These materials react to form water gas at a very high temperature, this water gas passing through the oils, distilling and cracking the oils and passing with the volatiles from the oils through the rectifying column. From thence the uncondensed constituents of the water gas admixed with the uncondensed volatiles from the oils pass into the condenser, the resultant uncondensed gas being led through the gas offtake to a holder or suitable gas treating and purifying devices. This uncondensed gas coming from the condenser is a combustible gas resembling somewhat carburetted water gas and may have a ready market as such or may be used as the carbonaceous fuel reacted with the steam and oxygen in the burner. The function of the steam, however, is to primarily absorb the heat evolved by the reaction of oxygen with carbonaceous material and to act as a carrier for this heat, and while steam is preferred, particularly in view of the endothermic action of the steam with oxygen and carbonaceous material to produce water gas, a valuable product, other heat controlling or absorbing media may be used, as, for example, hydrogen, nitrogen, water gas and the like.

While the invention has been above described primarily in connection with the distillation and cracking of oils, it will be understood that it is not limited thereto and is applicable to the heat treatment of liquid substances generally, as, for example, the dehydration of liquids, coking of pitches, and wherever the direct application of heat to liquids where the presence of a combustible gas is not objectionable, would serve a useful purpose.

By the term "oxygen" as used in the specification and claims, it is intended to include oxygen mixed with other gas and particularly oxygen mixed with air. In the treatment of some liquids the presence of nitrogen may be objectionable, and in such cases oxygen having no nitrogen content would be used. In many cases, however, the presence of nitrogen is not objectionable and, accordingly, the term "oxygen" as used herein is not intended to exclude oxygen content of air.

While preferred embodiments of this invention have been shown and described, it will be understood that various changes in the details thereof may be made and this invention is not to be limited to the disclosure herein, but only by the scope of the appended claims.

I claim:

1. A process for the heat treatment of liquids which comprises reacting oxygen, steam and powdered coal in contact with a body of said liquid.

2. A process for the heat treatment of a carbonaceous liquid which comprises reacting powdered coal and oxygen in contact with said liquid while supplying steam to the zone of combustion to control the temperature thereof.

3. A process for the distillation and cracking of oils which comprises circulating said oils to form a continuous stream, subjecting said stream to direct contact with the hot gaseous products of a reaction between oxygen, steam and powdered coal, passing the resultant gas

and vapors through a rectifying column to condense heavy hydrocarbons, and passing the gas and the remaining vapors from this column into and through a condenser to separate light liquid hydrocarbons and water from the condensable gases.

4. A process for the distillation and cracking of oils which comprises cyclically circulating said oils to form a continuous stream, subjecting said stream to direct contact with the hot gaseous products of a reaction between oxygen, steam and the combustible gas obtained from the distillation of oil, passing the resultant gas and vapors through a rectifying column to condense heavy hydrocarbons, and passing the gas and the remaining vapors from the column into and through a condenser to separate light liquid hydrocarbons and water from the incondensable gases.

5. The process for distilling and cracking of oils which comprises cyclically circulating said oils to form a continuous stream, subjecting said stream to direct contact with the hot gaseous products of a reaction between oxygen, steam and combustible carbonaceous material, passing the resultant gas and vapors through a rectifying column to condense heavy hydrocarbons, and passing the gas and the remaining vapors from the column through a condenser to separate light liquid hydrocarbons and water from the incondensable gases.

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