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C. P. DUBBS

PROCESS OF TREATING OILS

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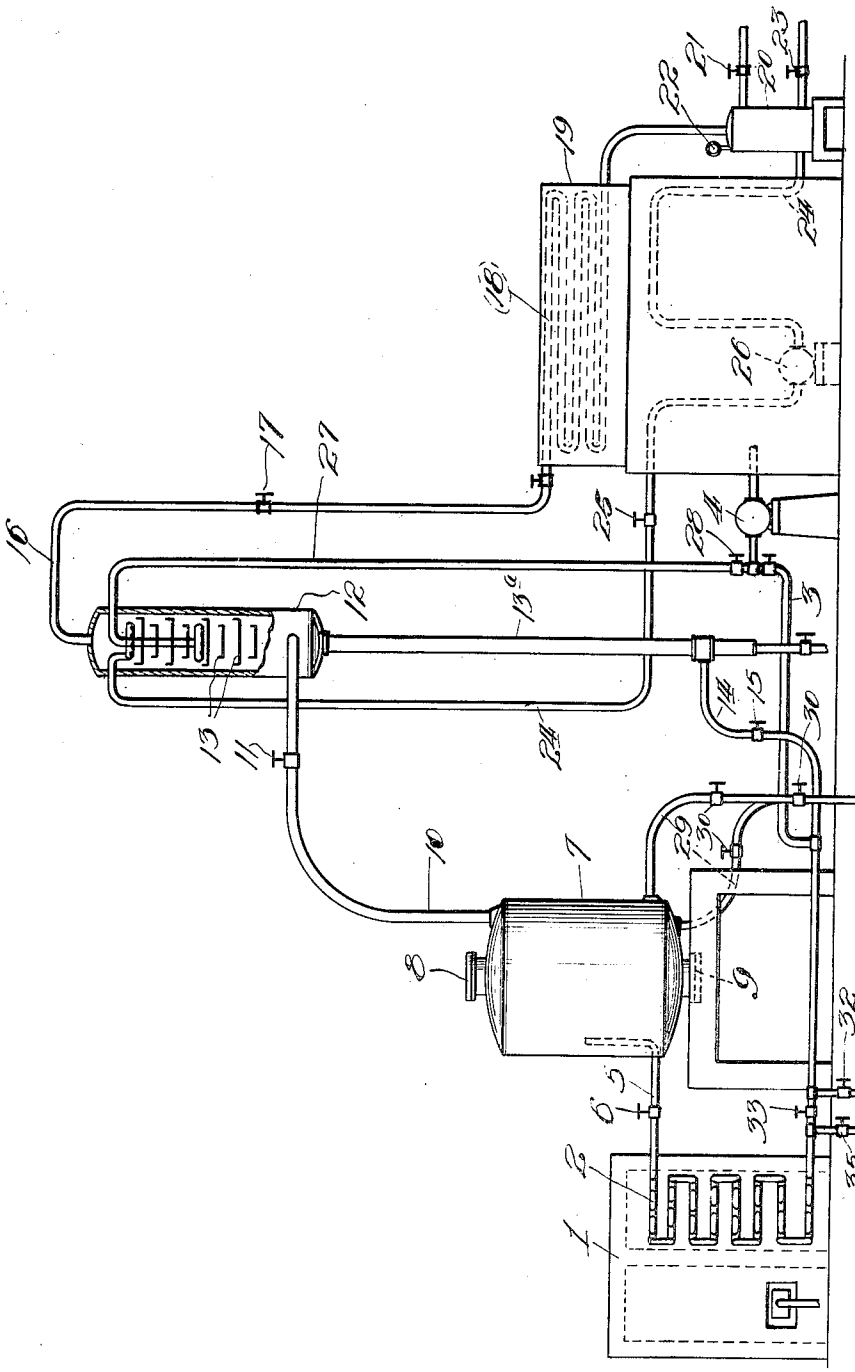

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UNITED STATES PATENT OFFICE.

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PROCESS OF TREATING OILS.

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To all whom it may concern:

Be it known that I, CARBON P. DUBBS, a citizen of the United States, residing in the city of Wilmette, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Processes of Treating Oils, of which the following is a specification.

This invention relates to improvements in treating oils, and refers more particularly to the treatment of hydrocarbon oils under heat and atmospheric or superatmospheric pressure to produce low boiling point hydrocarbons therefrom.

The invention aims to provide an oil conversion process wherein the oil is passed continuously through a coil of restricted cross section to receive its cracking heat and then delivered to an enlarged chamber where vaporization of a substantial portion thereof occurs. In this process no unvaporized oil is permitted to return from this chamber to said heating coil. The generated vapors pass from this chamber to a dephlegmator. The insufficiently cracked vapors are condensed in the dephlegmator by passing a part of the charging stock directly thereto while the remaining portion of the charging stock is fed directly toward the inlet side of the heating coil and is caused to commingle with the charging stock preheated in the dephlegmator and the reflux condensate produced therein for passage therewith through the heating coil.

More specifically the invention comprehends a process in which the charging stock fed to the dephlegmator may be an oil that has previously been subjected to a cracking treatment, such for instance, as pressure distillate.

A further embodiment of my invention is directed to the flushing of the various zones of cracking and dephlegmation to remove therefrom the major portion of free carbon and coke forming particles precipitated therein, by means of returning pressure distillate to the dephlegmating and cracking zones, or successively through each during and after the operation.

In the drawing, I have shown a single figure in side elevation and vertical section, of an apparatus adapted to carry out my invention.

Referring in detail to the drawing, 1 designates the furnace in which are supported the heating coils 2, in this instance taking the form of a continuous coil of 4 inch pipe. Raw charging stock is fed by means of the feed line 3, pump 4 to the heating coil 2. The heated oil is passed through the transfer line 5 controlled by valve 6 to the expansion chamber 7 which may take the form of a vertical shell, say 15 feet high by 10 feet in diameter, having upper and lower manhole plates 8 and 9. This chamber is provided, adjacent its upper portion, with vapor outlet 10 controlled by valve 11, leading to the bottom of the dephlegmator 12, where reflux condensation takes place. The dephlegmator 12 may be provided with the baffles 13, reflux leg 13^a, and reflux return line 14 in which is interposed the valve 15, connected to the heating coils 2, in this instance. The uncondensed vapors will pass out of the dephlegmator through vapor outlet 16, controlled by valve 17 and leading to water condenser 18 seated in condenser box 19.

The condenser coil is connected to the receiver 20, equipped with pressure relief valve 21, pressure gauge 22, liquid drawoff valve 23. Opposite the drawoff valve 23 is the pressure distillate return line 24 in which is interposed valve 25 and pump 26, by means of which the distillate may be returned during operation to the top of the dephlegmator and the light constituents thereof revaporized by subjection to the vapors coming from the expansion chamber.

The reflux from the dephlegmator 12 may be returned and mixed with the charging stock to the heating coils for retreatment. The raw oil, instead of being fed to the heating coils, may be fed to the top of the dephlegmator through the line 27 controlled by valve 28, or part to the heating coils and part to the dephlegmator. In this process it will therefore be apparent that a part of the charging stock sufficient to maintain a proper temperature in the dephlegmator to condense the insufficiently cracked vapors is fed to the dephlegmator, and this charging stock together with reflux condensate drops into the leg 13^a and by means of the pipe 14 mixes with that portion of the charging stock being directly fed to the cracking coil without a previous passage through the dephlegmator passing through the pipe 3. In this way the charging stock is split into

two streams, one stream going into the dephlegmator and the other directly to the coil, the heated stock and condensate from the dephlegmator being united with said cool stream. Furthermore, pressure distillate may be introduced to the dephlegmator 12 through the line 24 and charging stock alone passed through the line 3 without a portion thereof entering the dephlegmator. The unevaporated part of the distillate passes into the reflux leg together with condensate and with the charging stock is admitted to the coil. The expansion chamber may be provided with the residue drawoff lines 29 controlled by valves 30.

The process may be operated under a transfer temperature of between 400° to 2000° F., and the whole system maintained under atmospheric pressure or under a pressure of say 120 to 1000 pounds more or less to the square inch, or differential pressures may be employed on various parts by the manipulation of the valves shown.

The following illustrative run may be given: Using a 17.3 gravity topped crude from the Smackover field, the above process under 120 pounds pressure and 880° F. transfer temperature will produce 80% pressure distillate of about 47–48° B. gravity, which distillate upon further distillation will produce 48 to 50% of gasoline based on the original charge, conforming to the Navy specification, and having the characteristics of commercial gasoline.

As a feature of the invention, immediately subsequent to shutting down, the pump 26, if not in operation, is then put into operation to withdraw distillate from receiver 20 and force it into the top of the dephlegmator through line 24. The distillate will fall downward retarded by the pans 13, washing these pans, and removing a substantial portion of the free carbon deposited thereon, and carrying these carbon particles with it. Its course of travel will be through the reflux leg 13ª and pipe 14, valve 15 being open and through the cracking tubes 2. Part of the distillate may be withdrawn through the drawoff 31 controlled by valve 32. When a sufficient amount has been fed to the heating coils, pump 26 is stopped, and the distillate withdrawn from the heating coils through the line 34 controlled by valve 35.

By the use of this invention, it is possible to remove a very substantial portion of the free carbon which may normally have been deposited in the cracking tubes and dephlegmating connections during the operation.

Pressure gauges may be attached to various parts of the apparatus. There may be a plurality of residuum drawoffs 29. The inlet 5 may be connected to the top of the vapor chamber instead of the bottom as shown. Pyrometers may be interposed in the various lines as desired.

I claim as my invention:

1. A continuous process of oil conversion, consisting in passing a body of oil in a restricted stream through a continuous elongated passageway where said oil receives its cracking heat, in transferring the highly heated oil while in a substantially liquid condition to an enlarged chamber where vaporization of a portion of the oil occurs in discharging all unvaporized oil from said chamber without permitting the same to again enter said elongated passageway, in discharging vapors from said chamber to a reflux condenser, in passing charging stock to said reflux condenser to aid in the condensation of the insufficiently cracked vapors passing therethrough and to preheat the charging stock, in discharging uncondensed vapors from the reflux condenser, in removing condensate and charging stock from the reflux condenser, and in introducing the same together with an independent supply of charging stock to the inlet side of said elongated continuous passageway to travel therethrough, and in maintaining a superatmospheric pressure on the oil undergoing conversion.

2. A continuous process of oil conversion, consisting in maintaining a body of oil at a cracking temperature in an enlarged expansion chamber where conversion of the oil occurs, in passing generated vapors to a dephlegmator for passage therethrough, in condensing the heavy insufficiently cracked vapors in said dephlegmator by passing charging stock to the dephlegmator to heat the charging stock and cool the vapors, in discharging uncondensed vapors from the dephlegmator, in withdrawing charging stock and reflux condensate from the dephlegmator, and in uniting the same with an independent stream of charging stock admitted to the inlet side of a continuous elongated conveying means of small cross section disposed within a heating furnace to flow therethrough once only and to be then discharged into said expansion chamber, in discharging all the unvaporized oil from the expansion chamber without admitting the same to said elongated conveying means, and in maintaining a superatmospheric pressure on the oil undergoing conversion.

3. A process of oil conversion, consisting in continuously passing a stream of oil through an elongated passageway of restricted cross-sectional area where said oil is heated to a cracking temperature, in transferring the heated oil while in a substantially liquid phase to an enlarged chamber where conversion of the oil occurs, in preventing the passage of any unvaporized residue from said conversion chamber to said heating passageway, in discharging generated vapors to a reflux condenser, in introducing charging stock to said condenser to assist in the con-

densation of the insufficiently cracked vapors and heat said charging stock, in introducing the heated charging stock and reflux condensate from the reflux condenser with an independent supply of charging stock to the inlet side of said elongated passageway to travel therethrough but once while receiving its cracking heat, and in maintaining a superatmospheric pressure on the oil undergoing conversion.

4. A continuous process of oil conversion, comprising passing hydrocarbon oil through an elongated passageway of restricted cross-section where said oil is subjected to a cracking temperature, in delivering the heated hydrocarbon oil in a substantially liquid phase to an enlarged chamber, in discharging all the unvaporized oil from said chamber without again admitting the same to said elongated passageway, in passing vapors from said chamber to a dephlegmator, in introducing a stream of pressure distillate to said dephlegmator to condense the heavy insufficiently cracked vapors and to reevaporate a portion of said distillate, in passing the uncondensed vapors from the dephlegmator to a final condenser, in collecting the distillate thus produced, in withdrawing liquid products from said dephlegmator, and in passing the same with an independent stream of charging stock to the inlet side of said elongated passageway to travel therethrough to undergo treatment, and in maintaining a superatmospheric pressure on the oil in said passageway, enlarged chamber and dephlegmator.

5. A process of oil conversion, consisting in passing hydrocarbon oil in a stream but once through an elongated continuous passageway of restricted cross-section disposed within a furnace where said oil is subjected to a cracking temperature, in delivering the highly heated oil while in a substantially liquid phase to an enlarged chamber where vaporization of a substantial portion thereof occurs, in discharging all the unvaporized oil from said chamber without again admitting the same to said elongated passageway, in introducing the vapors to a dephlegmator, in condensing the insufficiently cracked vapors passing through said dephlegmator by introducing a stream of charging stock to the dephlegmator, in combining reflux condensate and charging stock from said dephlegmator with an independent stream of charging stock for introduction to the inlet side of said elongated passageway to travel therethrough but once in a continuously advancing stream, in discharging uncondensed vapors from the dephlegmator, and in maintaining a superatmospheric pressure on the oil in said system.

6. A process of oil conversion, consisting in passing a restricted stream of oil through a continuous elongated passageway where said oil receives its cracking heat, in transferring the heated oil to an enlarged receiver where conversion thereof occurs, in preventing the return of any unvaporized oil from said chamber to said continuous elongated passageway, in discharging generated vapors to a reflux condenser, in aiding in the condensation of the insufficiently cracked vapors in said condenser by passing to the condenser charging stock to be heated therein, in introducing said heated charging stock and the reflux condensate with an independent supply of charging stock to the inlet side of the elongated passageway, to pass therethrough and receive its cracking heat and in maintaining a superatmospheric pressure on the oil undergoing conversion.

7. A continuous process of oil conversion, comprising passing hydrocarbon oil through an elongated passageway of restricted cross-section where said oil is subjected to a cracking temperature, in transferring the heated oil to an enlarged chamber where conversion occurs, in passing generated vapors to a reflux condenser, in preventing the return of any unvaporized oil from said enlarged chamber to said elongated passageway, in passing a stream of hydrocarbon oil that has previously been subjected to a cracking treatment to the dephlegmator to condense the insufficiently cracked vapors and to heat said oil, in passing the uncondensed vapors from the dephlegmator to a final condenser, and in introducing to said elongated heating passageway the preheated oil from the dephlegmator and reflux condensate with an independent supply of charging stock admitted to the inlet side of said passageway to travel therethrough and undergo treatment, and in maintaining a superatmospheric pressure on the oil undergoing conversion.

8. A process of oil conversion, consisting in passing a restricted stream of oil through a continuous elongated passageway where said oil receives its cracking heat, in transferring the heated oil to an enlarged receiver where conversion thereof occurs, in preventing a return of any unvaporized oil to said elongated passageway from the receiver, in discharging generated vapors to a reflux condenser, in placing a stream of charging stock under a forced pressure, in splitting said stream and directing a portion thereof to said reflux condenser to condense insufficiently cracked vapors and to heat said portion of the stream while directing the other portion of said split stream to said elongated heating passage, and in uniting the split sections of said stream together with reflux condensate prior to the entrance of the oil to the inlet side of said passageway, and in maintaining a superatmospheric pressure on the oil undergoing conversion.

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