

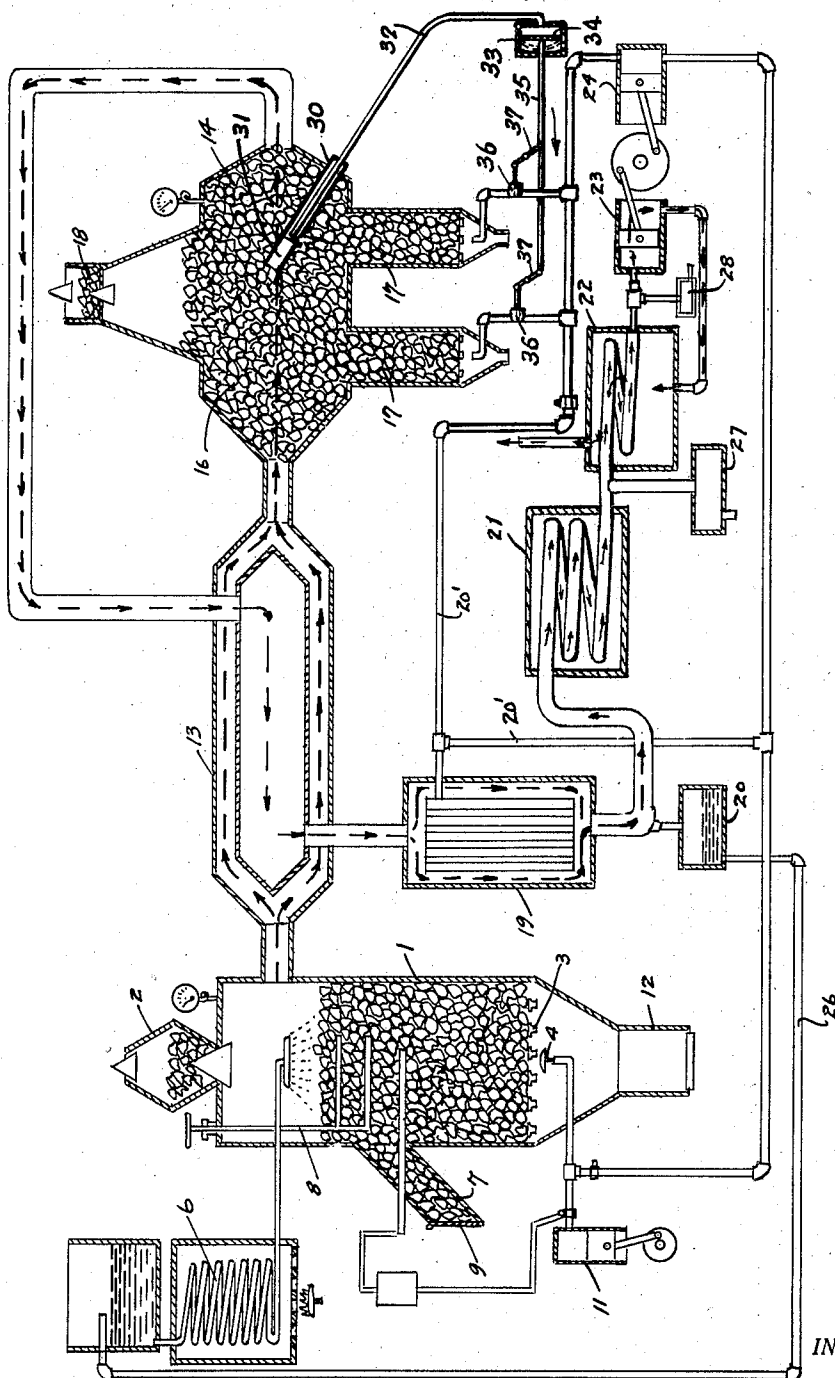
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PROCESS FOR DISTILLING AND CRACKING OILS

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UNITED STATES PATENT OFFICE.

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PROCESS FOR DISTILLING AND CRACKING OILS.

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To all whom it may concern:

Be it known that I, VERGIL T. SMITH, a citizen of the United States, and a resident of San Francisco, county of San Francisco, State of California, have invented a new and useful Process for Distilling and Cracking Oils, of which the following is a specification.

The present invention relates to improvements in process for distilling and cracking of hydrocarbon oils, especially of such of a heavy grade. The proposed process is of the two-unit type in one of which units the oil to be cracked is distilled while in the second unit the oil vapors produced in the first unit are cracked while in the vapor phase.

The apparatus for the proposed process consists essentially of two retort units of the gas producer type one of which is a distilling retort and the other a cracking retort. Heat for accomplishing the proposed reactions of distillation and cracking is furnished by the combustion of solid carbonaceous fuel, preferably coke, within the two retorts. Distillation and cracking of oil is obtained by direct contact with heated fuel and gases; proper temperature of fuel being maintained and automatically regulated by continuous combustion of fuel in definite areas of retorts. The retort units with attached heat interchangers and condensers etc. operate as a single system continuously and with exceptions as to details of equipment are the basis of the process upon which novelty is claimed.

The preferred form of the invention is illustrated in the accompanying drawing which shows an arrangement of apparatus, mostly in vertical section, by means of which my process may be executed. While I have shown only the preferred form of my invention it should be understood that various changes or modifications may be made within the scope of the claims hereto attached without departing from the spirit of the invention.

(1) is the primary distilling retort. For simplicity it may be considered as a simple gas producer. In operation the retort is charged with fuel from the charging hopper (2) to a proper level in the retort. The fuel bed of coke is then kindled at the grates (3) the air for combustion entering under pressure at the nozzle (4) beneath the

grates. Upon the top of the fuel bed reaching the distilling temperature of the oil to be cracked, the oil which is preheated in the coil (6) is pumped or forced in upon the top of the fuel bed, the vapors distilling off by contact with the hot fuel. Any coke or asphaltic residue from the oil is deposited upon the fuel, being itself burned as fuel as it drops through the retort.

Combustion of the oil is prevented by the non-oxidizing atmosphere maintained at all times in the distilling zone by the presence of waste gases from the combustion zones. The oil is fractionally distilled partly by surface evaporation as it flows over the heated fuel by gravity. There is a constantly increasing temperature from the top to the bottom of the retort and the various fractions of the oil are distilled off as they reach their zone of distilling temperature. The height of the fuel bed is maintained by the addition of fuel from the charging hopper (2), any excess formed by deposition of carbon from the oil being drawn from the discharge chamber (7) adapted to be closed by the gate (9). Means are provided for breaking up the fuel bed due to excessive deposition of asphaltic material in the top of retort by the hand-operated agitator (8). Proper provision is also made for admitting air under any desired pressure by the air pump (11) and by other means described hereinafter and also for withdrawing ashes or clinker through the bottom of the retort, as shown at (12).

The oil vapors and combustion gases pass from the distilling retort (1) through a heat interchanger (13) into the secondary or cracking retort (14), which is a modified gas producer. In construction it is a horizontal chamber (16) with multiple combustion chambers (17). The coke fuel completely fills the retort and is maintained full by addition from a charging hopper (18) in the top of the retort. The coke in the horizontal chamber acts as an absorbing medium for the heat generated in the combustion chambers in the base of the retort and in operation is automatically maintained at the cracking temperature of the oil being treated by control of the volume of air admitted to the combustion areas. This automatic control of temperature is effected by means of

the thermostat (33). The thermostat rod (30) containing an enclosed gas chamber (31) extends into the body of coke, the gas chamber lying in the path of the oil vapors.

5 A hollow metal tube communicates from the gas chamber (31) to the flexible diaphragm (34) in the thermostat (33). The pressure generated by expansion of the gas in chamber (31) due to increase in temperature of

10 the surrounding coke is transmitted to the flexible diaphragm (34) causing it to sub-tend and actuate the rod (35) to which it is connected. The rod (35) is connected by a system of levers (37) to the air control

15 valves (36) and actuates them in proportion to the movements of the diaphragm (34). Hence the supply of air entering the combustion areas is directly and automatically controlled by the temperature existing in

20 the horizontal path of the oil vapors at the location of chamber (31). The oil vapors issuing from the primary distilling retort are passed through this horizontal coke bed and cracked, the free carbon resulting from

25 the decomposition of the oil separating out and depositing upon the coke fuel which in turn is burned upon it reaching the combustion areas in the base of the retort. Means are provided for admitting fuel to the retort

30 chamber. The cracked vapors from the secondary retort pass through the heat inter-changer (13) preheating the vapors from the primary retort. From the interchanger the vapors and gases pass through a waste

35 heat steam boiler (19) maintained at constant temperature by constant pressure for fractional condensation of oil vapors and for generation of steam used in blasting the grates during combustion of fuel to reduce

40 excessive temperature and prevent formation of clinker from the ash in the fuel. The heavy distillates resulting from this process are collected in the tank (20) and the steam generated is distributed through the pipes

45 (20'). From the waste heat boiler the gases pass through a cooler (21), which condenses portions of the oil vapors not condensed in the waste heat boiler. From the cooler the fixed gases still under pressure pass through

50 a second cooler (22) and thereafter this pressure is utilized to drive an engine (23) which is coupled to a compression pump (24) furnishing the principal supply of air required for the combustion of the fuel.

55 The expansion of the gas in the engine results in a great drop in temperature of the gases which is utilized in the refrigeration of the expanded gas in the cooler (22) for removal of any light oil vapors by condensation. Means are provided in the pipe (26)

60 for returning the heavy uncracked distillate condensed in the waste heat boiler to the distilling retort for further cycling through the apparatus.

65 The light cracked distillate condensed in

the condenser is drawn off from the receiving tank (27) and mixed with the light naphtha from the receiving tank (28) for further refining.

For best results the apparatus should be 70 operated under 3 to 6 atmospheres of pressures on account of the lower gas losses resulting from the cracking of the oil and the higher quality of the cracked products.

The advantages of the proposed process 75 lie in its extremely high fuel economy on account of direct application of heat for distillation and cracking; and also the ability of the process to handle very heavy oils of high asphaltic or carbon content. Deposition 80 of carbon from the cracking is upon the fuel itself and not upon the walls as in the case of externally heated retorts where formation and accumulation of carbon cause 85 mis-functioning and failure of apparatus. In fact, the deposition of carbon from the oil in my process is an advantage, inasmuch as it furnishes fuel for the required operation and is in such shape that it can be utilized to greatest advantage at its point of 90 formation.

The principal feature of the present invention lies in the application of direct heat 95 for cracking and distilling the oil, heat being obtained by the internal combustion of solid fuel inside the retort which acts as a receiver of carbon formed by cracking as well as a distributor for the oil and vapors and contact surface requisite to the cracking 100 reaction.

The cracking operation is preferably carried out at temperatures of 900°-1300° Fahr.

I claim:

1. The process of distilling and cracking 105 oil which consists in engaging the oil with a bed of combustible carbonaceous material increasing in temperature in the direction of the flow of oil whereby the oil is vaporized and in guiding the vapors so produced through a bed of combustible carbonaceous 110 material maintaining a constant temperature in the direction and path of flow of the vapors for cracking the same.

2. The process of distilling and cracking 115 oil which consists in engaging the oil with a bed of combustible carbonaceous material heated by burning same at the bottom and increasing in temperature in the direction of the flow of oil whereby the oil is vaporized and in guiding the vapors so produced 120 through a bed of combustible carbonaceous material heated by burning same at the bottom and maintaining a constant temperature in the direction and path of flow of the vapors for cracking the same. 125

3. The process of distilling and cracking 130 oil which consists in causing the oil to descend into a bed of combustible carbonaceous material heated by burning the same at the bottom and increasing in temperature to-

ward the bottom whereby the oil is vaporized and in guiding the vapors so produced laterally through a bed of combustible carbonaceous material heated by burning the same at the bottom and maintaining a constant temperature in the direction and path of flow of the vapors for cracking the same.

4. The process of distilling and cracking oil which consists in causing the oil to descend into a bed of combustible carbonaceous material increasing in temperature toward the bottom whereby the oil is vaporized and in guiding the vapors so produced laterally through a bed of combustible carbonaceous material maintaining a constant temperature in the direction and path of flow of the vapors for cracking the same.

5. The process of cracking oil vapors which consists in guiding the same through a body of combustible carbonaceous material heated by burning the same at the bottom

and maintaining a constant temperature in the direction and path of flow of the vapors.

6. The process of cracking oil vapors which consists in guiding the same laterally through a body of combustible carbonaceous material and in heating the latter by burning the same at the bottom in the presence of a controlled supply of compressed air.

7. The process of distilling and cracking oil which consists in engaging the oil with a bed of combustible carbonaceous material increasing in temperature in the direction of flow of oil whereby the oil is vaporized, in guiding the vapors so produced through a bed of combustible carbonaceous material maintaining a constant temperature in the direction and path of flow of the vapors for cracking the same, and in guiding the cracked vapors past the uncracked vapors for preheating the latter.

VERGIL T. SMITH.