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PROCESS OF CRACKING OIL

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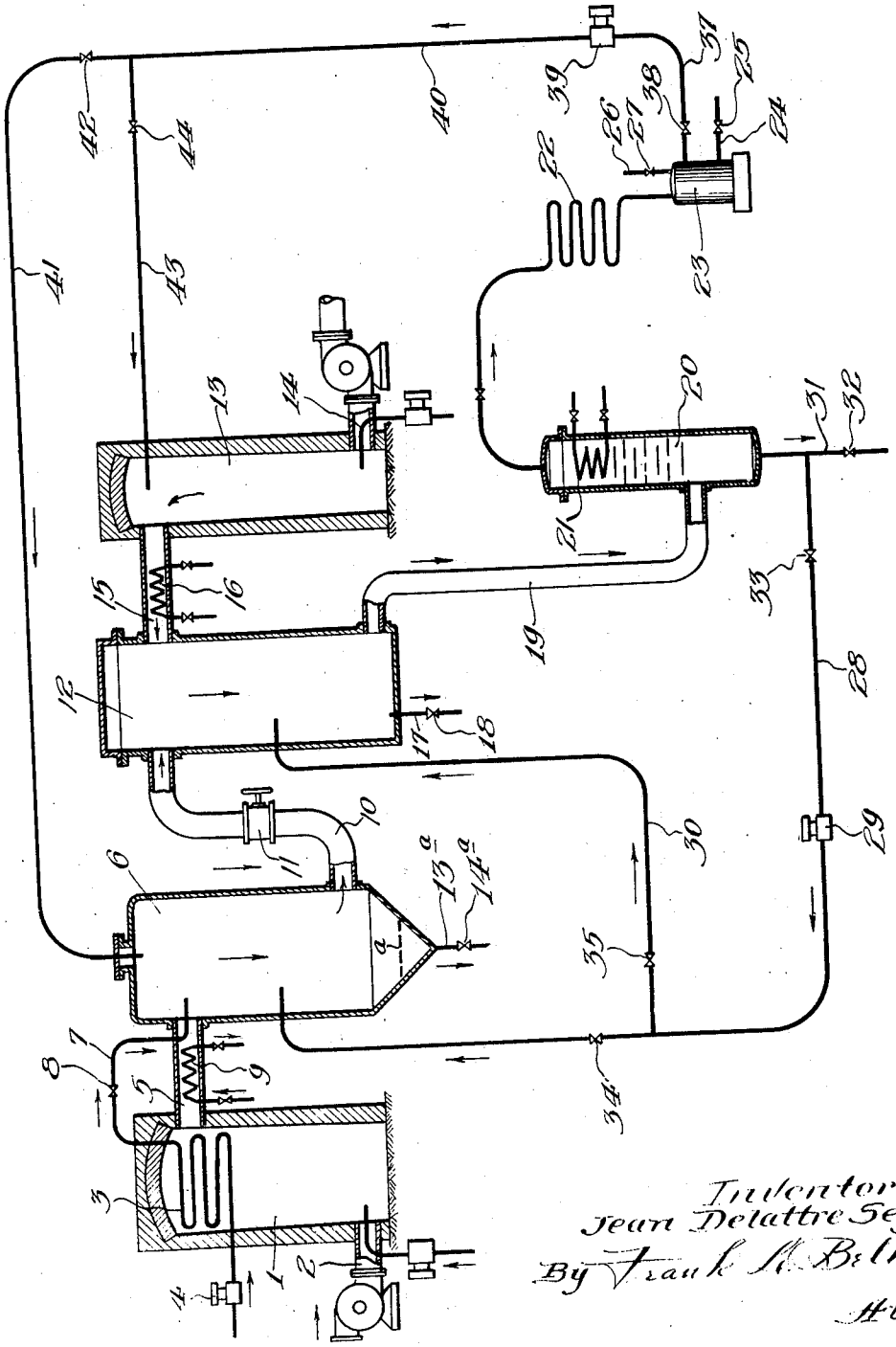

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PROCESS OF CRACKING OIL

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This invention relates to improvements in process of cracking oil, and is more particularly directed to what is generally known as vapor phase cracking. In the present invention, the crude petroleum or other hydrocarbon oil to be treated is first preferably subjected to a relatively mild cracking and separated therein into a relatively large percentage of vapors on the one hand and into a liquid residue on the other hand. This initial cracking step is intended to produce a residue, which is relatively free from carbon containing particles, but which also contains those heavier constituents, which if subjected to vapor phase cracking would tend to undue production of coke or carbon. The vapors more or less free from coke or carbon forming constituents are then subjected to a more severe vapor phase cracking reaction.

In order to understand the invention, I have shown the accompanying drawing in which an apparatus is diagrammatically shown suitable for carrying out the invention. This drawing is, as stated, diagrammatic and in no sense to scale.

Referring to the drawing, 1 designates a furnace provided with a burner, under pressure. In the upper portion of the furnace is located a heating coil 3, provided with inlet pump 4 leading to any suitable source of oil supply.

The gases of combustion pass through the flue 5 into the initial cracking chamber 6. The preheated oil is introduced into the upper end of the chamber, as shown through the pipe 7, having throttle valve 8.

The temperature of the gases of combustion is regulated through the cooling coil 9 through which may be circulated any suitable cooling medium. The temperature of the gases is preferably sufficiently reduced so that the oil in the chamber 6 is heated to an oil temperature of say 700 to 900° F., more or less; vaporization takes place in the chamber 6 and the vapors together with the gases of combustion pass through the conduit 10, having throttle or pressure reducing valve 11 into the vapor phase cracking chamber 12. The liquid residue is continuously drawn out of the chamber 6 through the draw-off pipe 13a, having throttle valve 14a. It is preferable to maintain a relatively low liquid level in the chamber 6, for example, as shown at the dotted line "a." A pressure of say 50# may be maintained in the chamber 6 by suitably regulating the valves 11 and 14, pump 4 and burner 2.

The vapors in the chamber 12 are superheated, say to a temperature of 1000° F., or more by means of the furnace 13 and burner 14. This burner 14, as well as burner 2, are equipped with suitable pumps, so that combustion can take place under the pressure of the system. In order to prevent over-heating of the vapors in the chamber 12, the temperature of the gases from the furnace 13 as they pass through the conduit 15 may be controlled by means of the cooling coil 16 through which a suitable cooling medium may be circulated. The vapor phase cracking chamber 12 may be provided with a drain-pipe 17, having throttle valve 18. The vapors in the chamber 12 are, as heretofore stated, subjected to this vapor phase cracking reaction at relatively elevated temperatures, thereby producing substantial quantities of unsaturates, aromatics or anti-knock compounds. The vapors and gases pass out of the lower portion of chamber 12 through the conduit 19 into the lower side of a dephlegmator 20. The temperature of this dephlegmator may be controlled by a suitable coil 21 through which may be circulated cold oil or other cooling medium. The temperature of the dephlegmator 20 is so controlled that the sufficiently cracked vapors as, for example, gasoline like bodies, will not be condensed and pass through the condenser coil 22 into the receiver 23. This receiver 23 is provided with distillate draw-off pipe 24 having throttle valve 25 and gas outlet pipe 26, having throttle valve 27. The insufficiently cracked vapors are condensed in the dephlegmator 20 and may be returned as reflux condensate to the chamber 6 by means of the pipe 28 and pump 29, or, if desired, the reflux condensate, in whole or in part, may be returned to the chamber 12 through the pipe 30 or, if desired, part of the reflux may be drawn out of the system through

branch 31. In order that the reflux may be handled as above stated, I provide the valves 32, 33, 34 and 35, as shown.

If desired, the uncondensible gases from the receiver 23, in whole or in part, may be returned to the system by means of the gas line 37, having throttle valve 38, pump 39 and feed line 40; thence, from feed line 40, either to the chamber 6, through branch 41, having throttle valve 42 or to the chamber 13 through branch 43, having throttle valve 44. The arrangement is such that the uncondensible gases may be returned either to chamber 6 or chamber 13 or to both chambers. The oil to be treated may be crude, topped crude, fuel oil or distillates. The extent to which the cracking reaction will take place will vary with the kind of charging stock treated and the products desired. It will be noted, however, that the cracking in the chamber 6 may be controlled entirely independently of the extent of the cracking that may take place in the vapor phase chamber 12.

In certain cases, it may be desirable to introduce a catalyst into the cracking chambers as, for example, iron oxide, nickel or Monel metal.

I claim as my invention:

1. A process of cracking hydrocarbon oil consisting in subjecting the oil to an initial cracking step, separating the oils into vapors relatively free from coke forming constituents and into residue, isolating said residue from the process subjecting such vapors freed of said residue to a vapor phase cracking reaction as a second cracking step, in both the said steps subjecting the oil constituents to the direct physical contact action of temperature controlled combustion gases, passing the vapors from the second cracking step to a reflux condenser, separating the sufficiently and insufficiently cracked vapors in said reflux condenser and recracking the reflux condensate.

2. A process for cracking hydrocarbon oil consisting in subjecting the oil to an initial cracking step, separating the oils into vapors relatively free from coke forming constituents and into residue, isolating said residue from the process, subjecting such vapors freed of said residue to a vapor phase cracking reaction as a second cracking step, in both the said steps subjecting the oil constituents to the direct action of separately temperature controlled combustion gases, passing the vapors from the second cracking step to a reflux condenser, separating the sufficiently and insufficiently cracked vapors in said reflux condenser and recracking the reflux condensate, and introducing incondensible gases which have passed out of the reflux condenser back into contact with the oil being cracked.

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