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PROCESS FOR CRACKING PETROLEUM OIL

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PROCESS FOR CRACKING PETROLEUM OIL

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This invention relates to a process for cracking petroleum oil by means of heat and pressure, and has as its object to permit only vapors of given end point to pass out of the system. In this process, the reflux condensate from one still is returned to the next still of the series where it is retreated. Any desired number of stills may be used, although in the present instance I have only shown three. It may be desirable in certain cases where particularly refractory oil is being treated to use as many as six to eight stills.

In the drawing, the single figure is a view, partly in vertical section and partly in side elevation, of an apparatus suitable for carrying out my process.

Referring in detail to the drawing, 1 designates a suitable furnace support, provided with burners 2, 3 and 4. In this furnace are mounted a series of stills 5, 6 and 7 heated by the respective burners, which stills in the present instance are shown of the shell or cylindrical type. These stills are or may be all of the same size for the purpose of uniformity of construction. Oil is fed to the first still 7 through pump 8, the inlet side of which is connected to feed line 9 and the discharge side to delivery line 10, leading to the still 7. Suitable throttle valves 11 are interposed in the lines 9 and 10. The still 7 is connected to the still 6 by liquid drawoff line 12 and in turn the still 6 is connected to liquid overflow line 13. Each of these stills is provided with a liquid residue drawoff line 14, each pipe 14 having a suitable throttle valve (not shown). Vapors pass out of the vapor space of the still 7 through vapor line 15 into the lower end of reflux condenser 16. The upper end of the pipe 15 is provided with a spaced cap member 17 the arrangement of such as to permit the vapors generated in the still 7 to pass into the reflux condenser but preventing the reflux condensate from falling back into the pipe 15. The reflux condensate is drawn off from the bottom of the reflux condenser 16 through return line 18 into the drum or still 6. The vapor trap 19 is provided in the line 18 so as to permit the liquid to flow down through the pipe but preventing vapors from flowing up through it. The still 6 is provided with the vapor outlet pipe 20, extending into the lower end of reflux condenser 21, which pipe 20 is provided with a spaced cap member 22 similar to member 17. Reflux condensate is drawn off from the bottom of dephlegmator 23 through return line 24 and a vapor trap 25 to the still 5. The vapor space of the still 5 is provided with a vapor outlet pipe 26 leading into the lower end of dephlegmator 27. The dephlegmator 27 is provided with the vapor outlet pipe 28, which extends into the lower end of dephlegmator 21 and is provided with a spaced cap member 29 for the same purpose as described in connection with the pipe 15.

The upper end of reflux condenser 21 is provided with the vapor outlet pipe 30 which extends into the lower end of reflux condenser 16 and is provided with a similar spaced cap member 31. The upper end of the reflux condenser 16 is provided with the vapor outlet pipe 32 having throttle valve 33, which pipe 32 leads to condenser coil 34 sealed in condenser box 35. This condenser coil 34 is connected to the upper end of receiver 36, which receiver is provided with liquid level gauge 37, pressure gauge 38, gas outlet pipe 39 having throttle valve 40 and liquid drawoff pipe 41 having throttle valve 42.

The operation of the process is as follows: Gas oil or fuel oil obtained from crude petroleum is fed either continuously or intermittently to the still 7, and there subjected to a temperature of say, 650 degs. F. and maintained under a vapor pressure of 150 pounds. The vapors generated in the still 7 will pass into the reflux condenser 16. The lightest vapors will pass out of this condenser through the vapor line 32. Such vapors as are condensed will be returned through reflux condensate pipe 18 back to the still 6. This still may be heated to a temperature of say, 700 degs. F. The uncondensed portion will pass into the reflux condenser 21, and the heavier portions condensed and returned by the line 23 to the still 5. The lightest portions will pass out through the line 30 into the reflux condenser 16 where a portion of them may be condensed and returned by the line 18 to the still 6. The uncondensed por-
tions will pass out through the pipe 32. The vapors which are generated in the still 5 are compelled to pass through all three reflux condensers and a portion of them will be condensed in each condenser and returned to the system. The reflux condensers may be maintained at desired temperatures, for example, reflux condenser 16, at a temperature of 400 degs. F., thus permitting only 400 end point gasoline to leave the system. Condenser 21 may be maintained at a temperature of 500 degs. F. and condenser 27 at a temperature of 600 degs. F. The temperatures of the reflux condensers may be controlled by providing suitable aerial condensation or by being controlled by jacketing them in a well known manner with water jackets through which water can be fed in such quantities as to regulate the temperature of the dephlegmator.

By means of this process, 50% or more of the oil treated may be converted into gasoline of 400 end point, which will be collected in the receiver 36.

The process is further advantageous in that the reflux condensates, being harder to crack than the original oil, are returned to the still of higher temperature than that from which they originally came. This will tend to reduce the formation of unsaturated compounds as it will not be necessary to heat the lightest oil which comes off from the still 7 to so high a temperature as might be necessary where the reflux condensate is returned to the still.

I claim as my invention:
1. A process of cracking oil, consisting in passing the oil through a series of stills of successively increasing temperature, taking off vapors from each still, passing them to a reflux condenser individual to each still, returning the reflux condensate separated from vapors removed from a still of lower temperature directly to a still of higher temperature, passing the vapors which are not condensed in the reflux condenser connected to a still of higher temperature directly through the reflux condenser connected to a still of lower temperature and finally taking off the vapors from the reflux condenser connected to the still of lower temperature.

2. A process for cracking hydrocarbon oil, consisting in maintaining a bulk supply of oil in an enlarged zone at a cracking temperature, in continuously passing unvaporized portions of the oil from said enlarged zone to additional enlarged zones, in which such oil accumulates in pools, in subjecting the oil in such additional enlarged zones to a higher temperature than that at which the oil is maintained in said first enlarged zone, in taking off vapors from said first enlarged zone, in subjecting such vapors to a dephlegmating action, in separately taking off vapors from said additional enlarged zones and in subjecting such vapors to successive dephleg-