

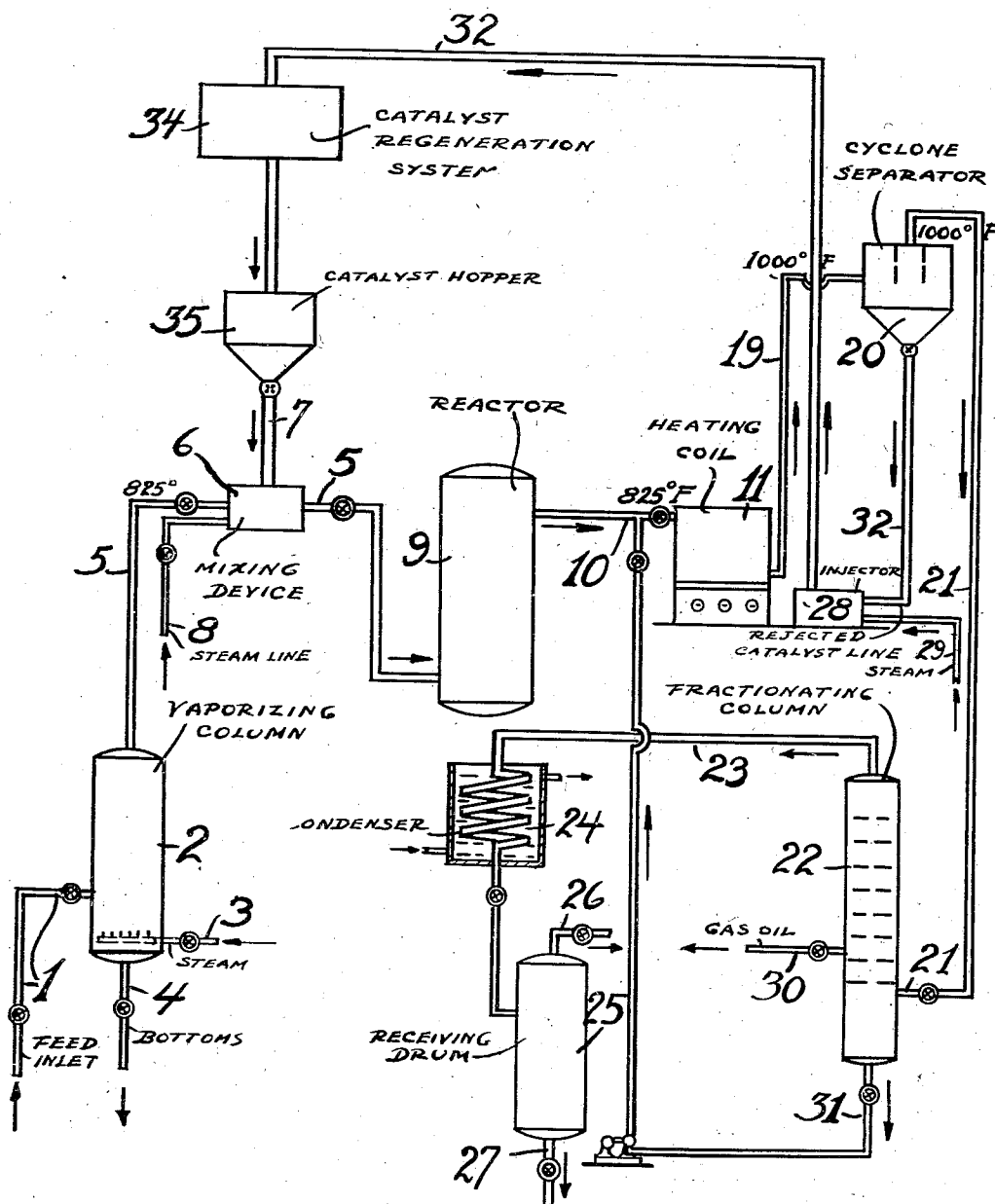
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CHEMICAL PROCESS

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CHEMICAL PROCESS

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The present invention relates to improvements in the conversion of relatively high boiling petroleum hydrocarbons to gasoline-like products. More particularly, the present invention relates to improvements in the catalytic cracking of relatively high boiling hydrocarbons such as gas oil in which the gas oil is at a relatively low cracking temperature during the greater portion of the time it is undergoing cracking and thereafter is heated to a relatively high cracking temperature for a short period of time just prior to the discharge of the cracked vapors from the reaction zone to the fractionating equipment.

One object of the present invention is to crack relatively heavy hydrocarbons in the presence of a powdered catalyst suspended in the vaporized hydrocarbons under such conditions as to produce gasoline-like fractions in high yields.

A more specific object of the present invention is to carry out a catalytic cracking operation under conditions such that during the major portion of the cracking reaction the temperatures and the time of contact are adjusted so as to minimize the formation of butane and normally gaseous hydrocarbons and to thereafter increase the temperature of the reaction products containing the catalyst to a sufficiently high level to cause vaporization and removal of hydrocarbons adsorbed on the catalyst.

Another important object of the present invention is to effect an economy with respect to the quantity of catalyst employed. That is to say, it is an important feature of the present invention to so adjust operating conditions as to enable the use of a smaller quantity of catalyst than has been heretofore employed.

Other objects of the invention will be apparent from the ensuing description.

In carrying the present invention into effect, I provide a process in which a residuum such as reduced crude is vaporized then mixed with a powdered catalyst and thereafter discharged into a reactor where the hydrocarbons are subjected to cracking conditions. Thereafter the reaction products are discharged into a heating coil where the temperature is rapidly increased to a point sufficiently high to vaporize residual heavy hydrocarbons absorbed on the catalyst surface. The catalyst is separated from the hydrocarbon vapors in one or more cyclone separators or equivalent devices operating in series, regenerated and returned to the process.

The accompanying drawing is a diagrammatic illustration in partial vertical section of a suitable apparatus in which the present invention may be carried out.

Referring in detail to the drawing, fresh feed is introduced into the system through line 1. This fresh feed may be a heavy residuum, such as a West Texas reduced crude, having an A. P. I. gravity of 21°. The fresh feed is discharged into

a vaporizing column 2. Steam to assist in the vaporization of the fresh feed is introduced into the bottom of tower 2 through line 3. The bottoms from this tower are withdrawn through line 4 and by suitable treatment may be converted into bunker fuel or some similar material. The overhead product is withdrawn from tower 2 through line 5 and forced into an injector 6. Fresh or regenerated catalyst is introduced into the injector 6 through line 7 where it is dispersed in the oil vapors. Steam to assist in the dispersion may be introduced into injector 6 through line 8. The vapors entering injector 6 may be at a temperature of about 825° F. The amount of steam which is employed is not sufficient to change the temperature of the vapors and its use in the process is purely optional. However, the catalyst which is introduced into injector 6 is at a temperature of about 1000° F. and the intermixing of the hydrocarbon vapors and the catalyst causes the temperature of the mixture to attain a value of about 875° F. when it is discharged from injector 6 into line 5. The amount of catalyst employed is preferably about 3 parts of catalyst by weight to 1 part of oil. The catalyst may be a siliceous material such as an acid treated clay or it may be a silica gel or one of the known plural gels such as alumina-silica gel. The size of the catalyst is preferably such that at least 90% of it will pass through a 300 mesh screen. The hydrocarbons containing the catalyst dispersed or suspended therein are discharged into a reactor 9 which may be of the shell type or some suitable construction. Here in drum 9 the main cracking reaction takes place. The vapors are resident in this reactor 9 for a period of time within the range of from about 15 to 150 seconds. The outlet temperature of the reaction products withdrawn through line 10 is about 825° F. and at this temperature the vapors are discharged into a fired coil 11 where the temperature of the vapors is increased to about 1000° F. The vapors are resident in this coil 11 from 3 to 10 seconds. A pressure of about 15 pounds per square inch gauge is maintained on the vapors in drum 9 while a somewhat lower pressure is maintained in coil 11, say a pressure of about 10 pounds per square inch gauge. The reaction products are withdrawn from coil 11 through line 19 and discharged into a separating device such as a cyclone separator 20. The temperature of the vapors in this cyclone separator is about 1000° F. Two or more and preferably four cyclone separators may be employed in series. The vapors substantially freed of their catalyst content are discharged into line 21 leading to fractionating tower 22 where the same are fractionated to give an overhead product containing hydrocarbons boiling within the gasoline range and lighter hydrocarbons including normally gaseous hydrocarbons and 2% bottoms

