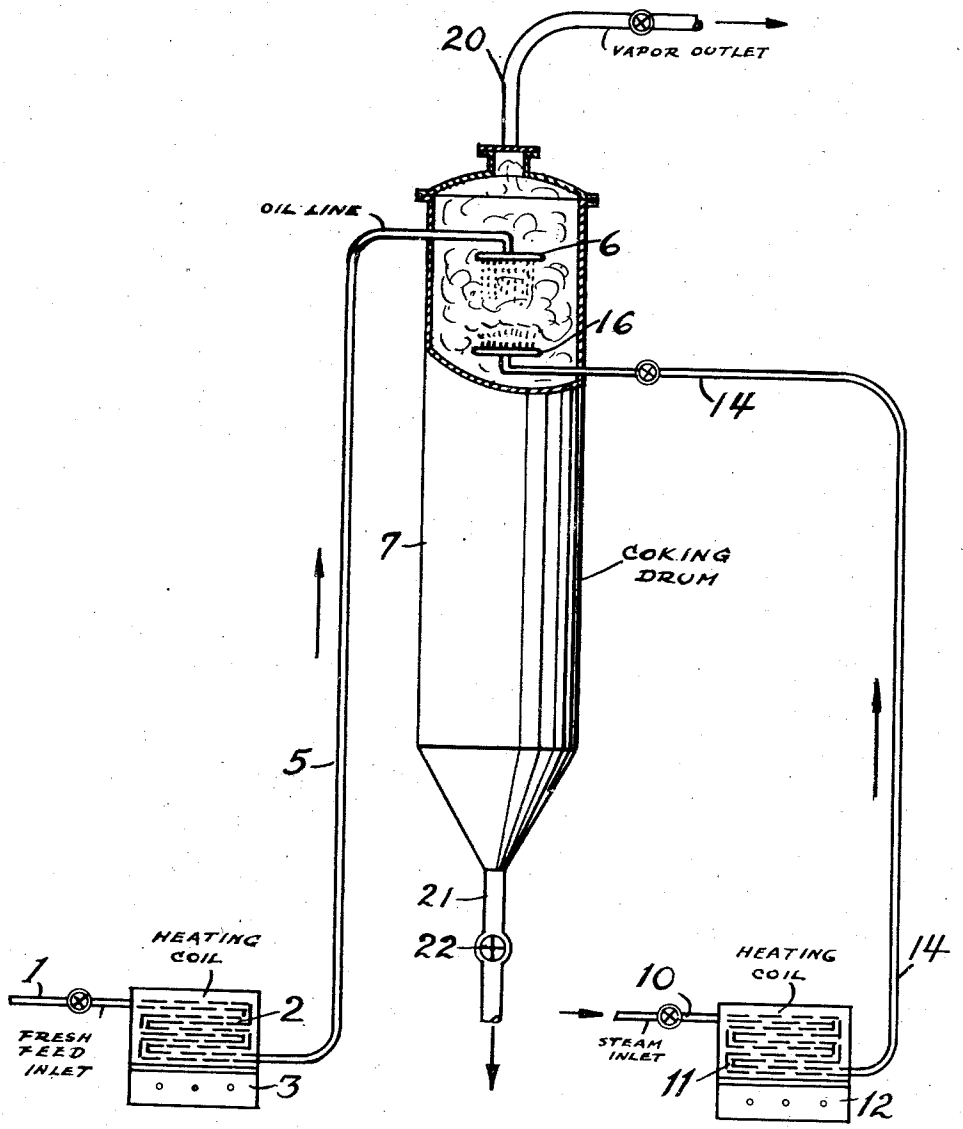
May 26, 1942. P. E. KUHL 2,284,581

ART OF TREATING HYDROCARBONS

Filed March 7, 1940



Paul E. Kuhl, Inventor

By J. C. Small Attorney

Patented May 26, 1942 2,284,581

UNITED STATES PATENT OFFICE

2,284,581

ART OF TREATING HYDROCARBONS

Paul E. Kuhl, Madison, N. J., assignor to Standard Oil Development Company, a corporation of Delaware

Application March 7, 1940, Serial No. 322,699

2 Claims. (Cl. 196—55)

The present invention relates to improvements in treating hydrocarbons, particularly relatively high boiling hydrocarbons such as reduced crudes, to form gas oil and gasoline and, at the same time, to produce a coke which is soft, granular and, under optimum conditions, free-flowing.

More particularly, the present invention relates to improvements in the coking of a hydrocarbon oil in the presence of a relatively finely divided absorptive or porous solid material such as acid treated or natural clays, ground coke, charcoal, bauxite, sawdust and the like.

It is an object of the present invention to devise a method wherein a petroleum oil is reduced by subjection to cracking conditions to a gas oil, hydrocarbons boiling in the gasoline range, and a relatively free-flowing coke which does not adhere to metallic surfaces and which, therefore, does not deposit on the inner walls of a coking drum, in which the operation is carried out, or is easily removed therefrom if it does deposit on said walls, and these results are accomplished by carrying out the coking operation under certain optimum conditions of temperature, oil feed-rate to the coking zone, temperature and the amount of steam employed, and to a less degree the pressure maintained within the coking drum, and, finally, to the use of an absorbent material such as the ground coke which is introduced into the hydrocarbon oil prior to the introduction of the hydrocarbon oil into the coking zone.

Other and further objects of the present invention will appear from the following detailed description and drawing.

The single figure of drawing diagrammatically represents a side elevation partly in section of a suitable apparatus in which my invention may be carried into effect.

Referring to the drawing, the oil to be treated is introduced into the system through line 1, heated in coil 2 in furnace 3, and then transferred by pipe 5 to a nozzle 6 located at the top of coking vessel 7. Charcoal or other adsorbent material is preferably mixed with the oil in line 1. Obviously, the nozzle openings of element 6 must be large enough to prevent clogging of the same. A nozzle orifice size of $\frac{1}{16}$ of an inch is satisfactory. Steam is introduced into the system through line 10, heated in coil 11 located in furnace 12. This steam is then forced through line 14 into a nozzle 16 disposed beneath nozzle 6 in the upper portion of vessel 7. Vapors are withdrawn through line 20. Many other suitable devices may be used in place of that shown.

In a prior application of Walter F. Rollman and Lecnard S. Bonnell, Serial No. 319,396 filed February 17, 1940, there are disclosed the optimum conditions for carrying out a coking operation to produce coke which is soft and granular. The present invention constitutes further improvements over the invention described and claimed in the above-named application. It has been found, for example, if there is added to the oil to be reduced to coke, gas oil and gasoline a substantial quantity of charcoal, say from 10% ot 40% charccal having a particle size of from 60 to 400 mesh, that when the oil is heated to a temperature of about 900° F. the unvaporized portions of the oil are adsorbed by the charcoal and as the coking operation proceeds the formation of lumps of wet coke or the tendency of tarry particles to adhere to metal surfaces is obviated since the heavy tarry liquids are adsorbed by the particles of charcoal so that a coke which is readily friable or granular is obtained. It has been found that the best operating conditions for carrying out the process are as follows:

1. Amount of charcoal added to reduced crude which in the run made had an A. P. I. gravity of 17°, was 40% by weight.

2. Particle size of charcoal, 200 mesh.

3. The feed rate of oil to the coking zone was 0.5 volume of cold oil per volume of zone per hour.

4. Temperature of oil fed to zone, 900° F.

5. Steam at a temperature of 900° F. was also fed to the zone.

6. Amount of steam, 20% by weight of oil.

7. Average temperature of 850° F. maintained in the zone during the run.

8. A pressure of about 20 lbs. per square inch absolute was maintained in the zone.

While the above conditions are optimum for carrying out the present process, it has been found that good results on heavy oils are secured by operating within the following range of conditions:

1. Amount of charcoal, 10% to 40% by weight based on the oil.

2. Particle size of charcoal, 60 to 400 mesh.

3. The feed rate of oil may vary from 0.1 to 2.0 volumes of cold oil per volume of reaction space per hour.

4. The steam fed to the zone my vary from 3% to 40% by weight based on the weight of oil fed to the zone.

5. The temperature of the oil fed to the zone may vary from 850° F to 1000° F.

6. The temperature of the steam fed to the zone may vary from 500° F. to 1000° F.

7. The average temperature maintained in the zone may vary from 800° F. to 950° F.

8. The pressure in the zone may vary from 15 to 150 lbs. per square inch absolute.

While good results are obtained using charcoal, it is pointed out that clay, bauxite, coke, pumice, or any other known absorbent porous material also may be used.

It is understood that the above conditions are not intended to be limiting and are varied depending upon the feed stock characteristics. Particularly, the amount of adsorbent material added is related to the Conradson carbon of the feed stock. For example, as little as 0.5% by weight of adsorbent has been found to be highly beneficial in reducing the tendency of coke to adhere to the metal or form coke masses when heat processing distillate oils.

The invention claimed is:

1. A continuous method of forming from a relatively high boiling petroleum oil fractions of lower boiling range than the original oil, which comprises admixing said oil with 10% to 40% by weight of an adsorbent material having a particle size within the range of from 60 to 400 mesh, heating the oil to a temperature within the range of from 850° F. to 1000° F., feeding the oil to an elongated coking zone at a feed rate of from about 0.1 to 2.0 volumes of cold oil per volume of reaction space per hour, causing said oil to pass in atomized form through the coking zone causing steam at a temperature within the range of from about 500° F. to 1000° F. to flow in contacting relation with said oil countercurrently to said oil through said coking zone, the amount of steam fed to the coking zone being within the range of from about 20% to 40% by weight based on the oil fed to the zone, maintaining a pressure, in the zone, within the range of from about 50 to 150 lbs. per square inch absolute, and recovering hydrocarbons in vapor form from one end of said zone and a friable coke from the other end of said zone.

2. A continuous method of forming from a relatively high boiling petroleum oil fractions of lower boiling range than the original oil, which comprises admixing said oil with 40% by weight of an adsorbent material having a particle size of 200 mesh, heating the oil to a temperature of 900° F., feeding the oil to a coking zone at a rate of 0.5 volume of cold oil per volume of zone per hour, causing the atomization of said oil within the coking zone and causing it to flow through said zone, feeding steam at a temperature of 900° F. to said zone and causing said steam to flow countercurrently and in contacting relationship with said oil, the amount of steam fed to the coking zone being about 40% by weight of the oil, maintaining an average temperature of about 850° F. and a pressure of about 20 lbs. per square inch absolute in the zone, and recovering cracked hydrocarbon vapors together with uncracked vapors and a friable coke.

PAUL E. KUHL.