

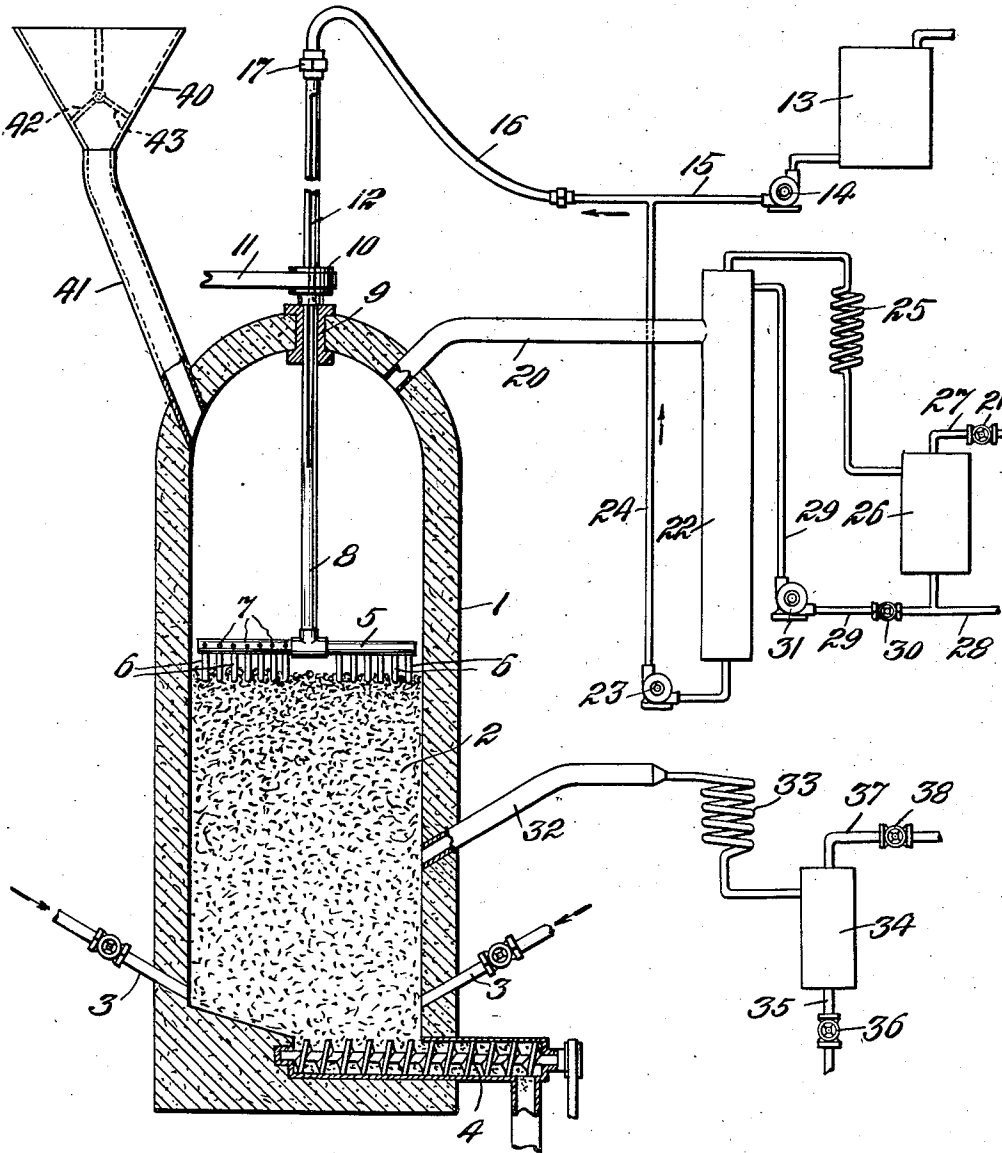
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METHOD OF DISTILLING PETROLEUM RESIDUES OR THE LIKE

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METHOD OF DISTILLING PETROLEUM RESIDUES OR THE LIKE

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4 Claims. (Cl. 196—55)

This invention relates to a method of distilling petroleum residues or the like.

In the refining of petroleum, it has long been common practice to top off the readily volatile constituents of the crude and then crack the residue by heat, usually under pressure. If the cracking is continued to the extent necessary to produce the desired high yields, there is deposited on the walls of the stills a hard tenacious crust. This crust builds up in thickness until it becomes necessary to interrupt the cracking operations and remove the crust from the walls of the stills. This is a troublesome and expensive operation. If the cracking is not continued to the end-point there remains a by-product of low value commonly known as "pressure tar."

Another process which has been used to some extent involves spraying petroleum residues onto a bed of coke which rests on the floor of a still and which is heated from below. In carrying out this method, the bed upon which the petroleum is deposited becomes, after a time, a dense mass, so that it is necessary to discontinue operations in order to remove the bed and start afresh.

In Fig. 1 of United States Letters Patent No. 2,314,112, issued on my co-pending application Serial No. 394,658, filed May 22, 1941, there is disclosed a method which avoids the principal disadvantages of these known methods and according to which granular material is pre-heated and is fed onto a shelf, petroleum residue being sprayed onto the bed of granular material thus formed to produce coke-coated granular material and vapors. Although this method is satisfactory in many respects, it has the disadvantage that the rate of feed of petroleum depends on the temperature and amount of the pre-heated granular material supplied.

My present invention provides a method of distilling petroleum residues and the like in which the coke formed by the decomposition of the petroleum residue is burned in the still to supply the heat for distilling and coking the petroleum residue. According to my invention, I provide a deep bed of coke in a chamber which serves both as a still and as a furnace. The coke in the upper portion of the bed is kept loose and petroleum residue or the like is fed to the top of the bed. Air is admitted to the bottom of the bed and the coke in the lower part of the bed is burned so as to maintain practically constant temperature at the top of the bed. By controlling the rate of feed of the petroleum residue and the rate of combustion, operations can be conducted so that the coke which is formed and which grad-

ually settles into the combustion zone will supply the heat needed to distill and coke the petroleum residue.

When the petroleum residue is relatively rich in coke-forming constituents, more coke may be produced than is needed to furnish the heat required for distilling and coking the petroleum residue. In this case, the excess coke can be withdrawn from the bed. On the other hand, when the petroleum residue treated contains a relatively large proportion of high-boiling volatile constituents, the heat supplied by the combustion of the coke can be augmented by burning gas along with the coke formed by the decomposition of the petroleum residue.

In the preferred mode of practicing my invention the upper portion of the bed is rabbled and the petroleum residue is applied to the rabbled surface in the manner described in my above-identified co-pending application. The petroleum residue can thus be fed continuously to the top of the bed while combustion takes place continuously in the lower part of the bed. The vapors produced are cracked or partially cracked in a space adjacent the top of the bed.

Other features, objects and advantages of the present invention will in part be pointed out and in part become apparent in connection with the following detailed description of one mode of practicing my invention, reference being made to the accompanying drawing which shows, somewhat diagrammatically, an apparatus for carrying out my method.

In the drawing there is shown at 1 a chamber constructed of refractory material. A deep bed of loose granular coke 2 is maintained in the chamber. Pipes 3 are provided for supplying air for supporting combustion of the coke in the bottom of the chamber. For purposes mentioned, gas, such as coal gas or natural gas, may be supplied through one of the pipes 3. In case ash is formed, or in case an excess of coke results, these may be withdrawn from the furnace at any suitable level, for instance by means of a screw conveyor 4 located below the combustion zone.

For feeding petroleum residue or the like to the top of the bed and for keeping the upper portion of the bed loose, radial arms 5 having fingers 6 and ports 7 are provided as described in my above-identified co-pending application. The fingers rake the upper portion of the bed and the ports feed petroleum to the loose coke in back of the fingers 6. The arms 5 are connected to a hollow shaft 8 which is mounted

in a bearing 9 and which is driven in any convenient way, for instance by means of a pulley 10 and a belt 11. The shaft 8 is preferably rotated and the petroleum is preferably fed at such a rate that the petroleum deposited on any given portion of the bed is coked to substantial dryness before that portion is again raked by the fingers 6.

The shaft 8 is connected to the pulley 10 through a key way 12 so that it can rise and fall with changes in the level of the upper surface of the bed. The petroleum residue or the like may be preheated to any temperature below coking temperature in any suitable device 13. It is then fed by pump 14 through line 15 and flexible tube 16 to the hollow shaft 8, which is connected to the flexible tube by a suitable coupling 17.

The vapors produced are withdrawn from the top of the chamber through a pipe 20. The pipe 20 leads into a dephlegmator 22 where any volatilized tar is condensed and recycled through pump 23 and line 24 into the line 15 where it mixes with the charging stock. The vapors and fixed gases pass through the dephlegmator 22 into a condenser 25 and thence into a separator 26 from which the fixed gases are exhausted through a line 27. These gases may, if desired, be collected and used in any convenient way. The condensate may be passed to storage through line 28, or a portion of it may be recycled into the dephlegmator through line 29 under control of valve 30 and pump 31.

If desired, a portion of the fixed gases produced by the burning of the coke may be withdrawn through a pipe 32, through a condenser 33, and then through a separator 34. Any condensate may be withdrawn from the separator 34 through a pipe 35 under control of valve 36. The fixed gases may be withdrawn from the separator 34 through a pipe 37 under control of a valve 38. By controlling the removal of the fixed gases, the temperature at the top of the bed can be controlled. By suitable adjustment of the valves 21 and 33 the distillation can be carried out under pressure.

In carrying out my method I start operations by introducing a bed of granular coke into the apparatus. By granular coke I mean loose, hard particles of carbonaceous material, but I do not mean that the coke is necessarily very fine. I have found that pea size (about $\frac{1}{4}$ inch) is a very good size to use. As the operations continue new coke is formed and gradually descends into the combustion zone. It is thus unnecessary to feed additional coke into the apparatus when using tars which form sufficient coke to provide the necessary heat. If desired, however, granular coke can be introduced into the furnace through a double hopper 40 and tube 41, under control of gates 42 and 43. Coal which is not readily convertible into coke by the usual methods can be coked in my apparatus. When such coal is introduced through the hopper 40 I prefer to premix it with a suitable amount of petroleum residue.

Operations are conducted so that the temperature in the combustion zone is in the order of 2000° to 2800° F. and so that the temperature in the top of the bed is in the order of about 1100° to 1600° F. The higher temperatures are preferred.

Through my invention it is possible to decompose low-grade tars of little commercial value to produce coke and a liquid condensate which consists predominantly of aromatic hydrocarbons. It has been described in connection with the treatment of petroleum residues, but it may be applied to the treatment of other tarry materials such as, for example, pressure tars, coal tars, tars from the double solvent extraction of petroleum and the like. It may be employed for treating low-grade tars whatever their source. For simplicity, the term "tar" as used in the appended claims includes such materials whether obtained from petroleum or from other sources.

No claim is made herewith to the apparatus disclosed inasmuch as this is claimed in my co-pending application Serial No. 407,409, filed August 17, 1941.

The terms and expressions which have been employed are used as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described, or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed.

What I claim is:

1. Method of distilling tar which comprises maintaining a deep bed of loose granular coke, burning coke in the bottom of the bed, and distributing tar over successive portions of the top of the bed so that the tar on each portion is converted to vapors and coke before more tar is fed to this portion of the bed.

2. Method of distilling tar which comprises maintaining a deep, stationary bed of loose granular coke, rabbling the upper portion of the bed, burning coke in the bottom of the bed, and feeding tar to successive portions of the surface of the bed after they have been rabbled.

3. Method of distilling tar which comprises maintaining a deep, stationary bed of loose granular coke, intermittently rabbling successive portions of the upper portion of the bed, feeding tar continuously to the surface of the bed so that it always strikes a freshly rabbled portion thereof, permitting the tar fed to each portion of the bed to become substantially dry before again rabbling this portion of the bed, and burning coke in the bottom of the bed to maintain substantially constant temperature conditions in the top of the bed.

4. Method of distilling tar which comprises maintaining a bed of loose granular coke, heating the top of the bed from below to coking temperature, rabbling the upper portion of the bed, and feeding tar to successive portions of the surface of the bed after they have been rabbled.

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