

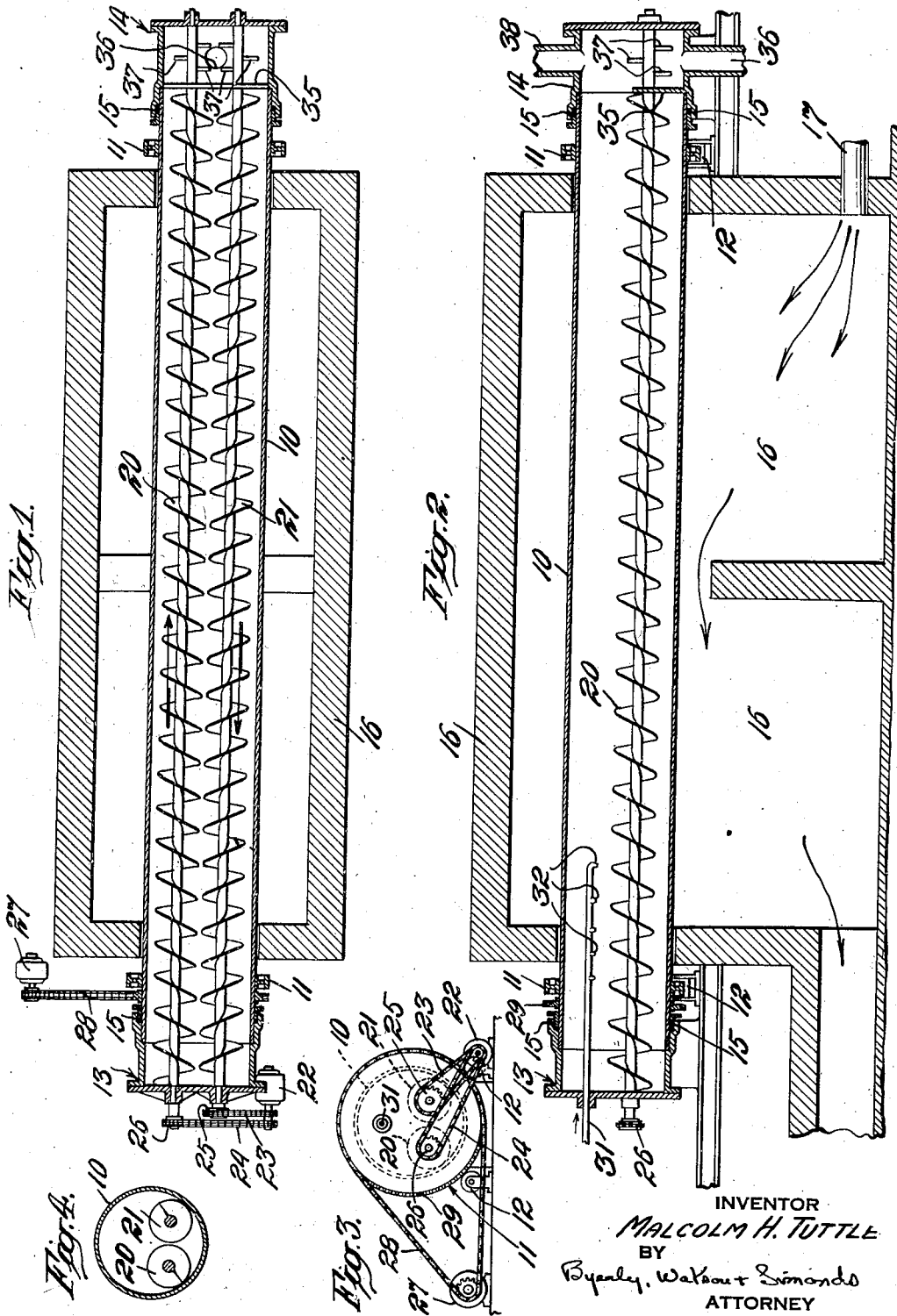
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APPARATUS FOR COKING PETROLEUM RESIDUES

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## APPARATUS FOR COKING PETROLEUM RESIDUES

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2 Claims. (Cl. 202—118)

This invention relates to an apparatus for coking petroleum residues.

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, an uncracked residuum, commonly referred to as pressure tar, is left as a waste product.

It has heretofore been proposed to coke tarry materials by spraying them onto a stationary bed of coke heated from below. This process has the disadvantage, among others, that the coking operations must be interrupted from time to time in order to remove the coke from the floor of the still.

It has also been proposed to preheat the coke and feed it through a zone where petroleum is sprayed onto it. Some of the proposals to this effect are unfeasible because the mass becomes gummy and sticks to the apparatus; others are impractical because the apparatus is expensive to build and inefficient in operation.

My present invention provides a new and improved method of coking and distilling petroleum residues while avoiding the foregoing disadvantages. According to my present invention a petroleum residue in liquid state is fed onto the top of a bed of coke which is heated to suitable temperature, the bed is rotated to constantly refresh the upper surface thereof with relatively dry particles of coke, and at the same time the bed is steadily pushed toward a point of discharge while the surface on which the bed rests is scraped. While the bed as a whole is fed toward the point of discharge at a constant rate, portions of the bed are refluxed. My method is advantageously carried out by placing the bed of coke in a slowly rotating drum in which two separate screw conveyors are mounted, one of the screws feeding the material toward the discharge end and the other refluxing portions of the material at a relatively slow rate. The level of the material in the drum is maintained constant by means of a weir adjacent the discharge end of the drum.

Other features, objects and advantages of my

invention will be pointed out or will become apparent from the following detailed description of one preferred embodiment illustrating my invention, reference being had to the accompanying drawing wherein:

Fig. 1 is a horizontal section through an apparatus in accordance with my invention;

Fig. 2 is a vertical section through the same apparatus;

Fig. 3 is an end view looking toward the left-hand end in Fig. 1; and

Fig. 4 is a cross-section through the drum.

The apparatus illustrated includes a hollow steel drum 10 which is mounted through circular flanges 11 in suitable bearings 12. The ends of the drum are closed by stationary end sections 13, 14 fitted to the drum by packing rings 15 of any convenient construction. The main portion of the drum lies within a furnace 16 for heating the contents of the drum to coking temperature, for instance by combustion of gas admitted at 17.

A screw conveyor 20 is provided for pushing the material in the drum toward the discharge end of the apparatus and a screw conveyor 21 is provided for refluxing portions of the material toward the end of the apparatus at which petroleum residue or the like is introduced. The screw 20 is rotated at higher speed than the screw 21, for instance by means of a motor 22, chains 23 and 24, and sprockets 25 and 26. It will be understood that instead of driving two like screws at different speeds, the same effect can be obtained by using screws of different pitch or different capacity and by driving them at the same speed. The screws are located side-by-side in the lower part of the drum, and are arranged so that their outer edges scrape the wall of the drum. The drum is rotated, for instance by means of a motor 27, a chain 28, and a sprocket 29, at a speed slower than the speed of rotation of either of the screws.

A pipe 31, mounted in the end section 13, extends into the drum and has ports 32 facing downwardly toward the bed of loose granular material in the drum. While the pipe 31 is shown as terminating near the inlet end of the drum, it will be understood that this feed pipe may extend further into the drum. It may be desirable to feed a relatively large amount of petroleum residue to the bed of coke near the end of the drum, and a relatively small amount of petroleum residue near the center of the drum. Adjacent the discharge end of the apparatus there is provided a weir 35 which extends across the bottom of

the stationary section 14. The top of this weir lies at a level below the top of the screws. The coke which passes over the top of the weir 35 is discharged through pipe 36. In order to prevent clogging of the material in the discharge end of the apparatus, suitable fingers 37 are secured to the screw shafts. The vapors and fixed gases from the petroleum residue are withdrawn through a pipe 38 and the condensible vapors are recovered in any known, or convenient manner.

In carrying out my method the drum is filled with granular coke, for instance one-quarter inch in size, up to the level of the top of the weir and the bed is heated to coking temperature, e. g., 1100-1600° F. The drum and the screw conveyors are then placed in operation, and the petroleum residue is fed to the top of the bed through the inlet pipe 31. As the operations continue the larger coke particles rise to the top and are discharged over the weir. At the same time new particles of coke are being formed and are growing in size so that a constant bed of coke is maintained in the apparatus. The temperatures employed, the rate of feed of petroleum residue or the like, the rates of rotation of the drum and of the screw conveyors can readily be controlled according to the nature of the particular tar treated.

Due to the rotation of the drum, and also to the refluxing action, dry coke particles are constantly raised from the bottom of the bed and are spread over the surface of the bed to which the petroleum residue is applied. Since the drum is scraped by the screws it is not essential that no wet petroleum residue contact the drum in order to avoid the building up of a crust on the metal. Hence a high rate of feed is permissible, and at the same time it is possible to produce practically dry coke.

It will be observed that the rotation of the drum has a tendency to convey material from one screw to the other, depending upon the direction and speed of rotation of the shell. Hence, the rate of passage of the material through the shell can be closely controlled within limits depending upon the particular materials handled. It will also be observed that as the vapors pass through the shell from the inlet end to the outlet end they are subjected to high temperatures. In this way, the petroleum vapors produced can be cracked to produce distillates of varying amounts and compositions depending upon the temperatures employed.

The present invention has been described in connection with the treatment of petroleum residues, but it may be applied to the coking of other tarry materials such as, for example, coal tars, pressure tars, tars from the Duo Sol or other solvent extraction processes, and the like, which are adapted to be separated or decomposed by heat into coke and vapors. Indeed, it is particularly adapted for treating low grade tars whatever their source. If these materials are highly viscous or normally solid they may be preheated to suitable temperature below the coking temperature, for instance, to about 700°-800° F. For simplicity, the term "tar" as used in the claims includes such materials whether obtained from petroleum or from other sources.

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. Apparatus for coking tar comprising a rotating drum having a discharge end, a furnace housing the major portion of said drum, a conduit extending through one end of the drum and adapted to feed liquid material to the interior of the drum, and a pair of screw conveyors mounted in said drum, one of which is constructed and arranged to feed material in the drum toward the discharge end and the other of which is constructed and arranged to reflux portions of said material.

2. Apparatus for coking tar comprising a rotating drum having a discharge end, a furnace housing the major portion of said drum, a pair of screw conveyors mounted in said drum, one of which is constructed and arranged to feed material in the drum toward the discharge end and the other of which is constructed and arranged to reflux portions of said material, a weir adjacent the discharge end of the drum adapted to control the level of the material in the drum, and a conduit extending through the other end of said drum along a plane above the top of said weir and adapted to feed liquid materials to the interior of said drum.

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