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APPARATUS FOR COKING BITUMINOUS LIQUIDS AND THE LIKE

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Fig. 1.

Fig. 2.

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APPARATUS FOR COKING BITUMINOUS LIQUIDS AND THE LIKE

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6 Claims. (Cl. 202—117)

This invention relates to apparatus for distilling hydrocarbons or bituminous liquids especially thick or viscous substances such as coal tar pitch, oil residuum, asphalt and the like whereby coke is produced together with light oils and gases of high fuel value.

In the usual methods for distilling these types of materials coking stills are used, the heat being supplied by combustion gases to the outer surface of the still walls. A great deal of time is required in driving out the volatilizable ingredients and much heat is consumed due particularly to the thick layer of poorly conducting coke which gradually builds up on the inner surface of the stills nearest to the source of heat. Furthermore the coke remaining at the end of the distillation must be removed by the tedious expenditure of hand labor,—picks, bars and scrapers being generally used.

Other methods have been proposed for distilling bituminous substances to coke. One of these uses a body of molten metal in the coking still to prevent the coke from building up on the still walls. This method has limited use, however, because of the losses of metal forming the molten body and because of the great amount of time required for the distillation. Another method applies the principle of "flashing" the highly heated bitumen under pressure into a zone of lower pressure which permits the distillable volatiles to separate out. This however does not destructively distill the bitumens to coke but produces a high-carbon pitch with a higher melting temperature.

My process utilizes the principle of effecting the transfer of the necessary heat by means of radiant heat which is directed from highly heated surfaces onto the bitumen such as thin layers in widely extended form and films, or in a finely divided state. To do this I may distribute thin layers of the bitumen onto the surface of a hot bed of coke which passes under very hot heat-radiating surfaces.

Another way of applying my process is to spray the bitumen or permit it to rain down through a tall retort having highly heated walls. The coke formed by virtue of the radiated heat is precipitated as a carbon dust or granules at the base of the retort.

In one form of my invention I use tall retorts which may be in the form of externally heated pipes or ovens. Passing through the retorts are devices for carrying the bitumen in thin films. These devices may be chains of great length or they may be endless chains, on which the bituminous material is coked. The chains as herein illustrated dip into troughs of the melted bitumen either at the top or the bottom of the retorts, or both, and on arriving at the opposite end the coke produced in the treatment is flaked off by passing the chains around sheaves of small radius. Instead of using single strand chains I may use metallic belts or even screens of different mesh in order to provide a flexible supporting member to which the bitumen will cling largely in films or drops while carbonizing. Bitumen may also be applied to the flexible member at points intermediate the ends of the retorts.

The vapors of light oils and gases which are formed may be drawn out of the retorts either at the top or at the base depending on the type of volatiles desired. If the volatiles are removed after passing through the zone of highest temperature, the light oils and gases will be relatively rich in aromatics and illuminants. Steam, gas, or other vapors may be introduced to mix with the volatiles and to assist if desired in quickly scavenging them from the retorts.

The accompanying drawing shows a form of apparatus for carrying out my invention. Figure 1 is a vertical section along the line 1—1 of Figure 2, and Figure 2 is a vertical section along the line 2—2 of Figure 1.

A tall retort consists of a brick setting 1 around an oven 2 enclosing one or more chains (hereinafter described), and is herein illustrated as of rectangular cross section and inclosing several chains. The oven walls 3 are spaced fairly close together and are preferably of silica tile or carborundum. The oven walls 3 are heated by hot products of combustion derived from burning fuel gases in the flues 4 surrounding the oven and within the setting 1. The gases are introduced at the base of the flues by gas burners and supply fittings 5. A checker work 6 is preferably placed in the bottom of the flues 4. The products of combustion are withdrawn from the tops of the flues at outlets 7 placed at intervals in flue covers 8. It may be preferable to direct the hot gases downwardly through the flues in some cases where it is desired to have the hottest zone at the top.

On top of the retorts is fastened the upper sheave housing 9 which is preferably of metal so fabricated to make a gas-tight integral part of the entire unit. Within the housing are sheaves 10, 11 and 12 and their respective shafting and bearings. These three sheaves are preferably supplied with worm gears 13 at their outer ends which are driven at the same speed by worms 14

mounted on the same shaft. Below these sheaves are two other sheaves, or idlers 15 and 16 with the necessary shafting and bearings.

A chain or other flexible metallic member 17, shown as a dotted line, passes around the sheaves in the route shown. Arrows show the direction in which the chain is illustrated as moving and thus as it passes over sheave 12, under 16 and over 11, the extreme bending of the chain will cause much of the coke scale to flake off. A coke apron and trough 18 is provided for collecting the pieces of released coke. Within the trough 18 is a screw conveyor 19 by which the coke is moved to the end of the retort setting and drops through a hole into a gas-tight coke bin (not shown).

The chain on passing around sheave 11 next passes down into pitch trough 20 and under sheave 15 by which it becomes coated with a layer of pitch. It then moves over sheave 10 and down a long bight substantially vertically through the hot-walled oven 2 wherein the distillation and coking reactions take place. As a convenient method of keeping the trough 20 supplied with pitch I provide an external auxiliary trough 21 which is in open communication with trough 20 by means of the submerged opening 22. A valve-controlled pipe 23 provides means for maintaining a substantially uniform depth of pitch in the troughs 20 and 21. The heat dissipated from the retort setting will maintain the pitch in a liquid condition in the troughs.

The chain being covered with liquid pitch is moved down through the retort at such rate that the pitch is distilled to coke on reaching the bottom of the retort. It is preferable in distilling a relatively fluid bitumen to cause it to move downwardly through the retort so that as the material becomes very fluid on being raised to a high temperature it will tend to run or drip down onto parts of the chain containing the more rigid or "dry" coke. Other types of material may be treated more successfully by distilling while moving upwards, or in both directions.

At the bottom of the retort setting is fastened the lower sheave housing 24 within which are drive sheaves 26 and 27, and idler 28 with their respective shafts, bearings, and gears as shown. As the chain passes under driven sheaves 26 and over idler 28 the coke scale will be flaked off and will be collected in trough 29 from which the conveyor 30 removes the coke and drops it into gas-tight metal bin 31. Suitable drive gear 32 is provided for operating the screw conveyor 30. On passing around idler 28 the chain passes into pitch trough 33 and under drive sheave 27 by which the chain is covered with molten pitch. The chain then passes substantially vertically up through oven 2 in which the pitch is distilled to coke and thence over sheaves 12, 16, etc. as already described. The auxiliary trough 34 and submerged opening 35 serve to keep trough 33 filled to the proper level. A pipe controlled by valve 36 provides suitable means for maintaining a supply of pitch in the troughs.

At the extreme right of Figure 2 is shown part of another assembly of chain, sheaves, and housings which serve an adjacent section of the same retort oven. The form of apparatus herein illustrated may include a plurality of chains, and auxiliaries above described, operating on the same oven of great length and resembling somewhat the well known by product coke ovens. My invention, however, contemplates much higher ovens.

When belts or screens are used as the flexible metallic member, I substitute flat rollers for the sheaves described and may turn the housings with the rolls at right angles to the position illustrated in order that the broad surface of the belts will face the hot walls. The upwardly and downwardly moving portions of the belts may also pass through separate ovens, as for example 2 and 2′ shown in Figure 1. Also the oven 2 may be divided by partitions into compartments separating the several units from each other as well as separating each unit into two parts so as to keep the operation of the upwardly and downwardly moving elements separate.

I may build up thick layers of coke on the chain by holding the chain stationary for short periods of time while successive layers of bitumen are applied and permitted to distill to coke. The bitumen is applied intermittently by bitumen valves 36′ and connections 37 and 38 which are directly over the vertical bights of the chain. When the layer of coke has reached the proper thickness the chain is fed forward to release the adhering coke.

The gases and vapors are withdrawn from vapor offtake 39.

Having thus described certain embodiments of the invention, what is claimed is:

1. A coking retort including a reservoir adapted to hold a liquid fuel, a continuous metallic support movable in a path which dips into said reservoir to thereby receive a coating of the liquid fuel, the path of said support including a flight adjacent to but out of contact with walls defining the area of the retort, at least one of said walls of the retort being adapted to be heated to thereby effect a radiant heating of the liquid fuel carried by the support for distilling the same, and means for heating said wall.

2. A coking retort including a reservoir adapted to hold a liquid fuel, a continuous metallic support movable in a path which dips into said reservoir to thereby receive a coating of the liquid fuel, the path of said support including a flight adjacent to but out of contact with walls defining the area of the retort, at least one of said walls of the retort being adapted to be heated to thereby effect a radiant heating of the liquid fuel carried by the support for distilling the same, means for heating said wall, and means for defining the path of travel of the support at a point after its passage by the heating wall to effect a short turn in the path to thereby crack and dislodge any hardened residue existing on the support as a result of the distillation.

3. A coking retort including a reservoir adapted to hold a liquid fuel, a continuous flexible metal support moving in a path which dips into said reservoir to thereby receive a coating of the liquid fuel, the path of said support including a flight adjacent to but out of contact with the walls defining the area of the retort, which portion of the path extends in a vertical direction, the walls of the retort adjacent the vertical path of travel of the support being adapted to be heated to thereby effect a radiant heating of the liquid fuel on the support for distilling the same, and means for heating said walls.

4. A coking retort including reservoirs adapted to hold a liquid fuel, a continuous flexible metal support moving in a path having separate portions each of which dips into one of said res-

ervoirs to thereby receive a coating of the liquid fuel, the path of said support including a separate flight after each dipping portion traveling adjacent to but out of contact with the walls defining the area of the retort, said flight portions of the path each extending in a vertical direction, the walls of the retort adjacent the vertical paths of travel of the support being adapted to be heated to thereby effect a radiant heating of the liquid fuel on the support for distilling the same, and means for heating said walls.

5. A coking retort including a reservoir adapted to hold a liquid fuel, a continuous metallic support movable in a path which dips into said reservoir to thereby receive a coating of the liquid fuel, the path of said support including a flight adjacent to but out of contact with walls defining the area of the retort, at least one of said walls of the retort being adapted to be heated to thereby effect a radiant heating of the liquid fuel carried by the support for distilling the same, means for heating said wall, means for defining the path of travel of the support at a point after its passage by the heating wall to effect a short turn in the path to thereby crack and dislodge any hardened residue existing on the support as a result of the distillation, and a moving conveyor for causing the removal of the dislodged residue.

6. A coking retort including a reservoir adapted to hold a liquid fuel, a continuous flexible metal support moving in a path which dips into said reservoir to thereby receive a coating of the liquid fuel, the path of said support including a flight adjacent to but out of contact with the walls defining the area of the retort, which portion of the path extends in a vertical direction, the walls of the retort adjacent the vertical path of travel of the support being adapted to be heated to thereby effect a radiant heating of the liquid fuel on the support for distilling the same, means for introducing fuel to be burned for heating said walls, and means for effecting the discharge of the gas and vapors from the retort.

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