Feb. 4, 1936. L. A. MEKLER 2,029,783

COKING OF HYDROCARBON OILS

Filed Dec. 28, 1931

Fig. 1.

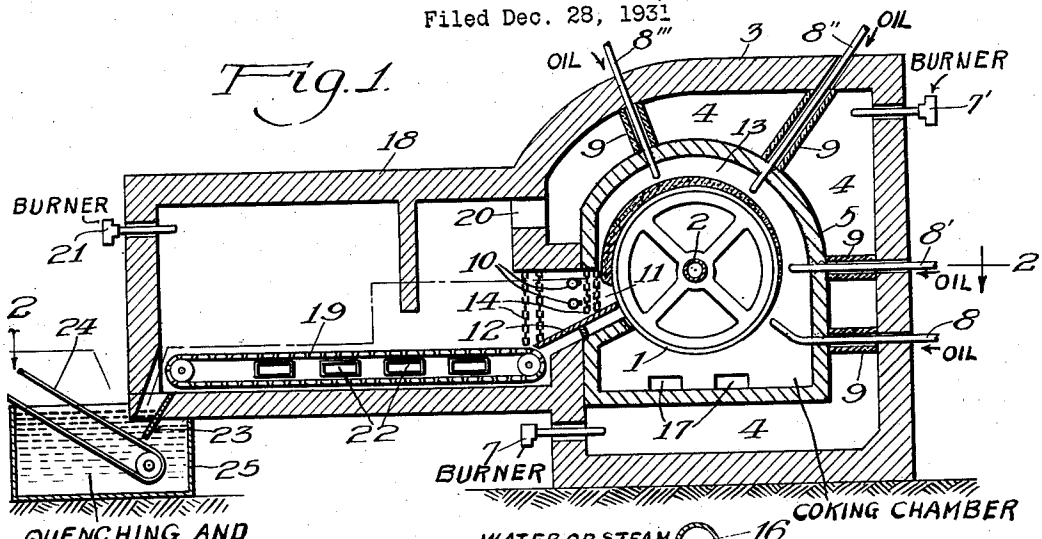
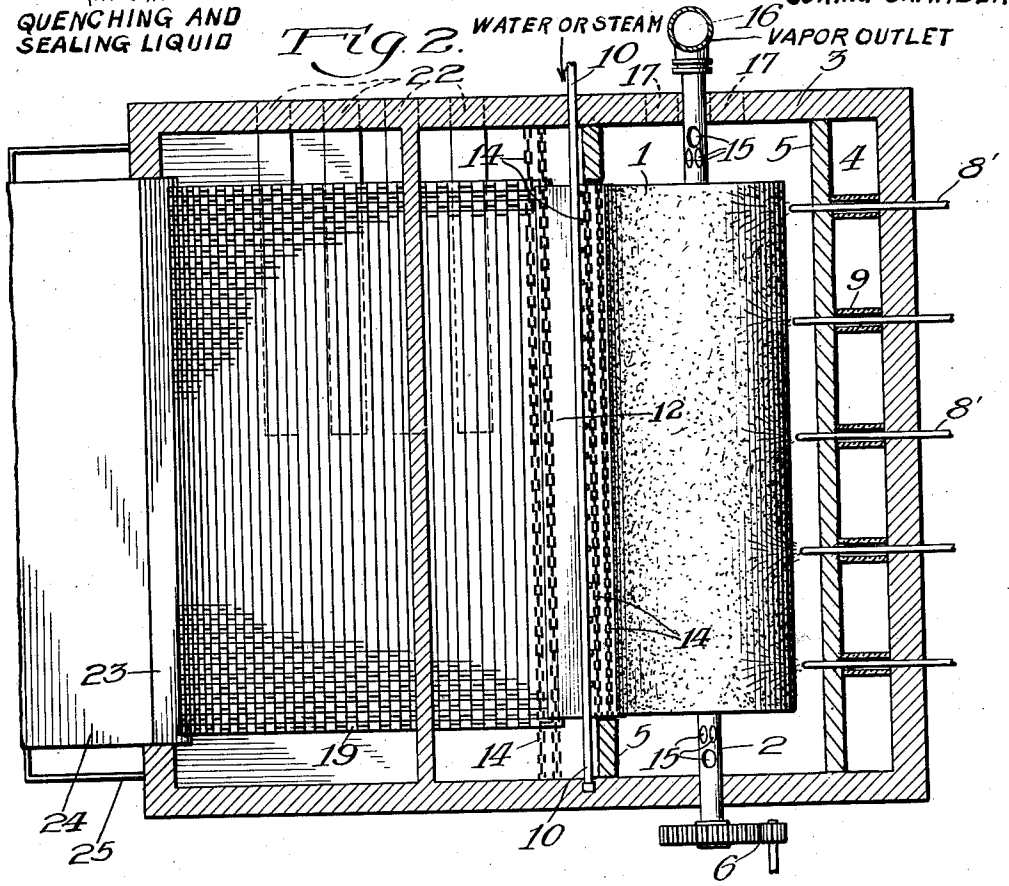


Fig. 2.



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COKING OF HYDROCARBON OILS

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5 Claims. (Cl. 202—5)

This invention relates to the treatment of hydrocarbon oils, and more particularly refers to an improved process for the continuous coking or carbonization of relatively heavy oils.

The present invention provides an improved process for the continuous production of petroleum coke of a relatively low volatile content. Aside from the continuity of operation provided by the present invention, some of the additional advantages are:

An improved method and means of heating the material undergoing coking or carbonization whereby radiant heat is supplied directly to the mass of material being treated, at the same time keeping said material out of contact with combustion products, and thereby permitting the collection of hydrocarbon vapors evolved during the coking operation in an uncontaminated state.

An improved method and means of removing the coke or carbonaceous products from the zone in which it is formed, comprising cooling said carbonaceous material, permitting it to crack and break away from the surface upon which it adheres and is built up during the coking operation. This feature obviates the use of scrapers or similar mechanical devices which are subject to excessive wear and distortion under the high temperature generally employed in carbonizing operations, and offers the additional advantage of permitting the removal and collection of the carbonaceous products in relatively large lumps, minimizing the formation of fines and obviating the necessity of briquetting the fuel.

An improved method and means by which a layer of coke of increasing dimensions is progressively built up upon a moving surface, the fresh material supplied to said layer being that exposed to highest temperatures, which permits the production of a product of substantially uniform structure throughout its mass as compared with carbonaceous products of other processes.

The invention also provides for the additional carbonizing or baking of the coke or carbonaceous material, when so desired, after its removal from the primary coking zone.

The novelties and features of the present invention will be more apparent with reference to the accompanying diagrammatic drawing, illustrating one specific form of apparatus embodying the principles of the invention, and from the following description of the drawing.

Fig. 1 is a cross-sectional side elevation of the coking apparatus, and

Fig. 2 is a sectional plan view taken along planes indicated by the line 2—2 of Fig. 1.

Referring more in detail to the drawing, a cylindrical shell 1 supported on a hollow central shaft 2 is located within furnace 3 and is separated from the combustion zone 4 of the furnace by means of a muffle 5, which is preferably constructed of suitable material of relatively high heat conductivity, such as silicon carbide, fused or molded silica, fused or molded alumina, or the like. Any suitable motivating means (not shown) is provided for rotating the coking shell 1 through a gearing arrangement, for example, such as that indicated at 6.

Combustible materials are supplied to the combustion zone 4 of furnace 3 through any suitable burner or burners indicated at 7, additional heat being supplied within the upper portion of the combustion zone, if so desired, by means of an additional burner or burners 7'. The walls of muffle 5 assume a degree of incandescence upon heating, permitting the transmission of radiant heat through said walls to the outer surface of shell 1, and more particularly, to the materials sprayed upon this shell, as will be later more fully described.

Suitable spraying devices, such as indicated at 8, 8', 8'' and 8''', permit the introduction of oil to be coked into the coking and carbonizing zone, and introducing it preferably in the form of a spray onto the outside surface of the coking shell 1 at progressive points around its circumference. The spraying devices are preferably jacketed and cooled with water or steam, particularly at the points where they extend through combustion zone 4, and in addition they are preferably protected from the flame and hot combustion products in this zone by suitable refractory sleeves 9.

Suitable sprays 10 are provided, as illustrated, through which a cooling medium, such as water or steam, may be sprayed onto the surface of a carbonaceous material upon shell 1 at a point in the travel of shell 1 such as indicated approximately at 11. Cooling of the layer of carbonaceous material upon the surface of shell 1 in the manner described causes it to contract and crack, sheering away from the surface of the shell, to be caught upon the inclined plane 12 and discharged from the coking chamber 13.

A series of chain doors 14 permit the passage of coke or carbonaceous material from the coking zone but substantially prevent or retard the egress of hydrocarbon vapors from this zone as

well as the ingress of combustion products to this zone.

Hydrocarbon vapors evolved during the coking operation in chamber 13 may be removed therefrom through hollow central shaft 2, gaining access to the interior of this shaft through perforations 15 and passing through a suitable stationary vapor line 16 to any desired further treatment.

Ports 17 in the lower portion of coking zone 13 permit the removal of any carbonaceous material that may collect upon the floor of muffle 5. Accumulations of coke upon the inner surfaces of the walls of muffle 5 may be removed by the introduction of air, by well known means (not shown), to the coking zone during which time the supply of oil to this zone is preferably discontinued, vapors and gases being wasted during the coke removing operation.

The coke or carbonaceous material from coking zone 13 may be the final product of the system, or it may, if desired, be subjected to further heat treatment in furnace 18. In the latter case, coke is discharged from coking chamber 13 onto a suitable conveyor 19, preferably of chain grate or similar construction, and preferably constructed of a suitable high temperature metallic alloy. Combustion products from combustion zone 4 of furnace 3 pass through ducts 20 into furnace 18 and, if desired, additional heat may be supplied to this zone by means of fuel introduced through a suitable burner or burners 21. Combustion products preferably pass downward through the bed of coke undergoing treatment on conveyor 19 and are removed from furnace 18 together with hydrocarbon vapors evolved during their baking operation through ducts 22 to a stack (not shown) or to suitable scrubbing means (not shown) for the removal of hydrocarbons. Preferably, however, sufficient air is supplied to furnace 18 to permit the substantial combustion of any hydrocarbon vapors evolved in this zone. The finished carbonaceous materials from furnace 18 may pass through port 23 onto a conveyor 24 of any suitable form which is preferably immersed in water or other suitable liquid medium contained within sealing arrangement 25, serving to quench the coke and also sealing furnace 18 to prevent ingress of air at this point.

As a specific example of the operation of the process of the present invention, a residual oil resulting from cracking having a specific gravity of approximately 0.98 and a coke content by laboratory analysis of approximately 30% is the material to be treated. The coking cylinder is slowly rotated in counter clockwise direction and, prior to starting the feed of oil to the system, the coking cylinder is heated to a temperature of about 1,000° F. A portion of the oil is then sprayed onto the outer surface of the cylinder through the spray most adjacent to the floor of the furnace and additional quantities of the oil are sprayed on top of the resulting carbonaceous material at progressive points around the circumference of the coking cylinder during its rotation. The speed of rotation of the cylinder is regulated to permit substantial coking of each spray of oil prior to the spraying of additional oil onto the surface of the latter. Firing of the furnace is so controlled that a substantially uniform temperature of about 1000° F. is maintained around the entire circumference of that portion of the cylinder to which carbonaceous material adheres. The introduction of small quantities of water through the spray provided at the outlet from the coking zone cools the carbonaceous mass sufficiently to effect its removal from the cylinder, the coke being cooled, for example, to a temperature of approximately 700° F. The coke is subsequently heated during its passage upon the conveyor through the secondary heating zone to a temperature of about 1,000° F., the speed of the conveyor being regulated to maintain the coke at substantially this temperature for approximately 20 minutes.

An operation such as outlined may yield a total liquid and coke recovery of approximately 75% of the charging stock, the remainder being chargeable to uncondensable gas and loss. The liquid products may comprise, for example, about 15% of motor fuels having a high antiknock value, about 5% of heavy tars, and about 30% of intermediate products suitable, for example, as cracking stock. The coke produced has a volatile content of about 8% and is recovered in substantially lump form suitable for use as fuel without briquetting.

I claim as my invention:

1. A process for coking heavy hydrocarbon oils, which comprises continuously discharging the oil onto the exterior surface of a cylinder rotating within a heating zone, the oil being sprayed onto the surface at spaced points in the path of rotation of the cylinder, generating a coking heat in the heating zone exteriorly of said cylinder and transmitting the same directly to the oil discharged onto the cylinder, regulating the speed of rotation of the cylinder to effect substantial coking of each spray of oil between the point of discharge thereof onto said surface and the point of discharge of the next succeeding oil spray onto the surface, and removing the coke from the exterior surface of the cylinder.

2. A process for coking heavy hydrocarbon oils, which comprises discharging the oil onto the exterior surface of a cylinder rotating within a heating zone, generating a coking heat in the heating zone exteriorly of said cylinder and transmitting the same directly to the oil discharged onto the cylinder, continuing the discharge of oil onto the cylinder until a substantial quantity of the coke has formed thereon, and removing the coke from the exterior surface of the cylinder, by spraying a cooling medium onto a portion of the coke layer accumulated on the cylinder.

3. A process for coking heavy hydrocarbon oils, which comprises discharging the oil onto the exterior surface of a cylinder rotating within a heating zone, generating a coking heat in the heating zone exteriorly of said cylinder and transmitting the same directly to the oil discharged onto the cylinder, continuing the discharge of oil onto the cylinder until a substantial quantity of the coke has formed thereon, and removing the coke from the exterior surface of a portion of the coke layer accumulated on the cylinder, and then conveying the coke through a second heating zone and drying the same therein.

4. A coke producing process, which comprises discharging heavy hydrocarbon oil onto a continuously moving surface in a radiant heat zone, the oil being sprayed into said zone and onto said surface at a plurality of spaced points in the path of travel of the surface, burning fuel in said zone out of contact with the moving surface and developing a region of radiant heat adjacent substantially the entire portion of said surface, cok-

ing the oil on said surface by the radiant heat thus developed, regulating the speed of travel of said surface to effect substantial coking of each spray of oil between the point of discharge thereof onto the surface and the point of discharge of the next succeeding oil spray onto the surface, each succeeding spray being applied to a previously coked layer whereby a plurality of layers of coke are formed, and removing the coke from the moving surface.

5. A coke producing process, which comprises discharging heavy hydrocarbon oil onto a continuously moving surface in a heating zone in which is disposed a stationary heat radiating surface substantially coextensive with the area of moving surface in the heating zone, the oil being sprayed into said zone and onto the moving surface at spaced points in the path of travel of the moving surface, maintaining said stationary surface at a coking temperature, radiating a coking heat directly from the stationary surface to the oil on the moving surface, regulating the speed of travel of the moving surface to effect substantial coking of each spray of oil between the point of discharge thereof onto the moving surface and the point of discharge of the next succeeding oil spray onto the moving surface, each succeeding spray being applied to a previously coked layer whereby a plurality of layers of coke are formed, and removing the coke from the moving surface.

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