Aug. 28, 1934. C. J. RAMSBURG 1,971,834

COKING HEAVY PETROLEUM OIL

Filed Aug. 5, 1931 4 Sheets-Sheet 1

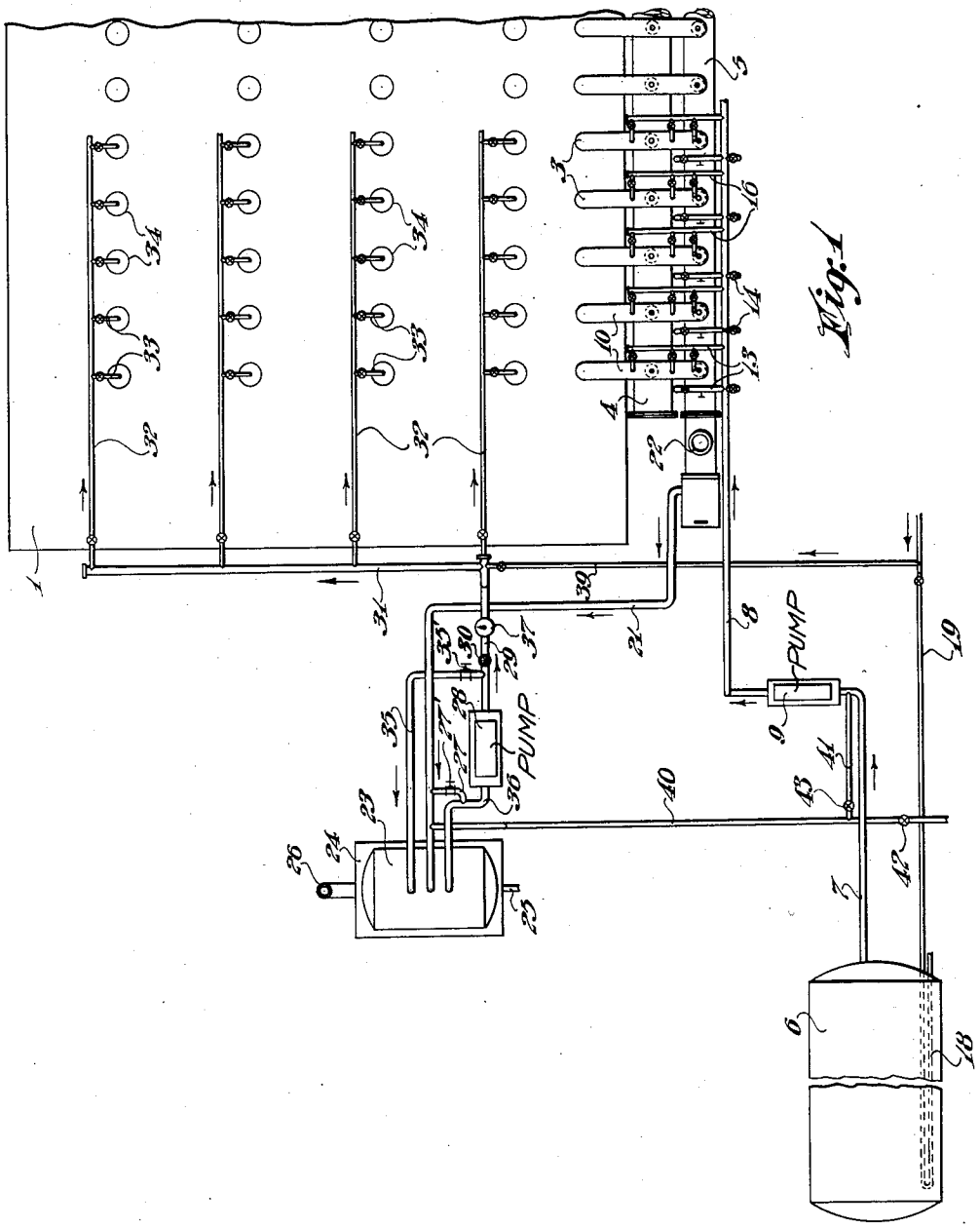


Fig. 1

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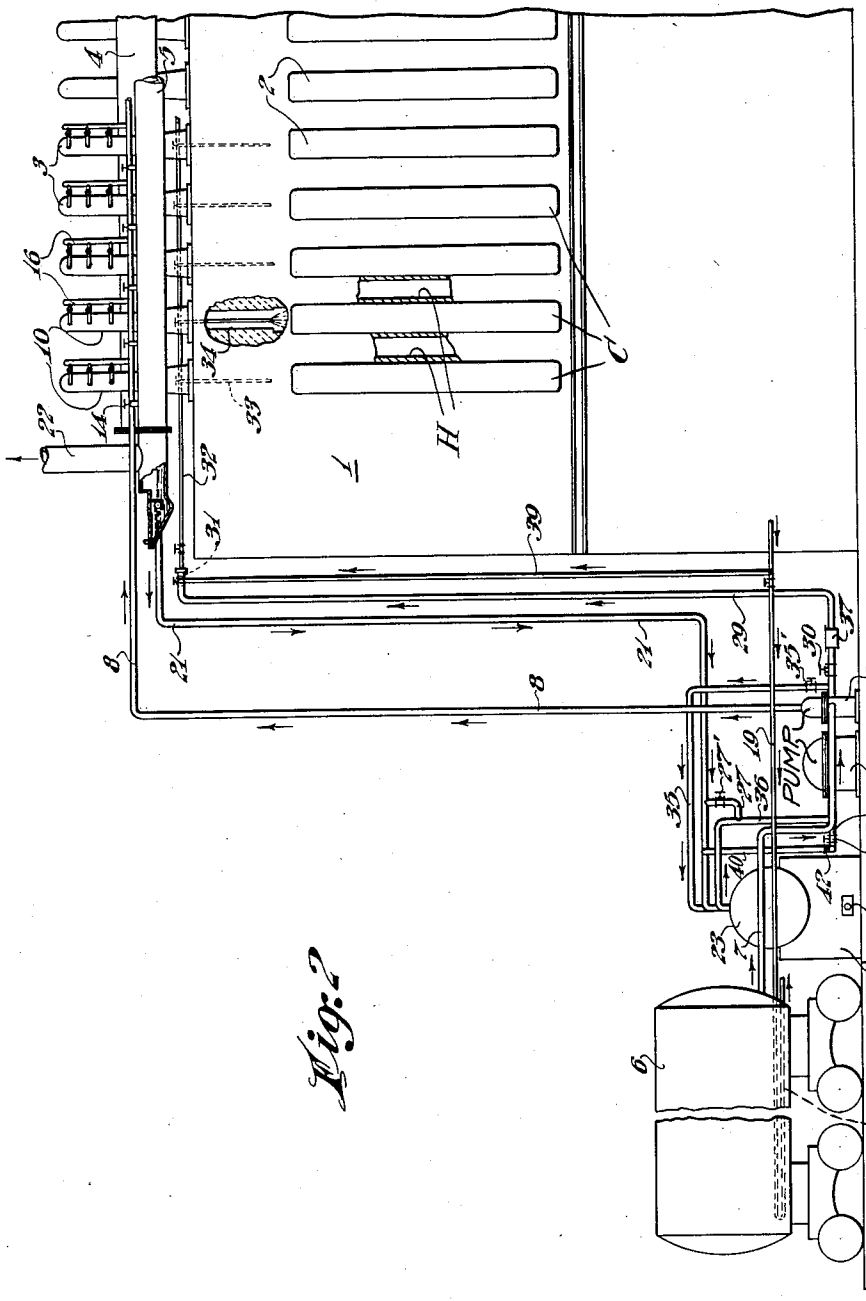


Fig. 2

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Fig. 3

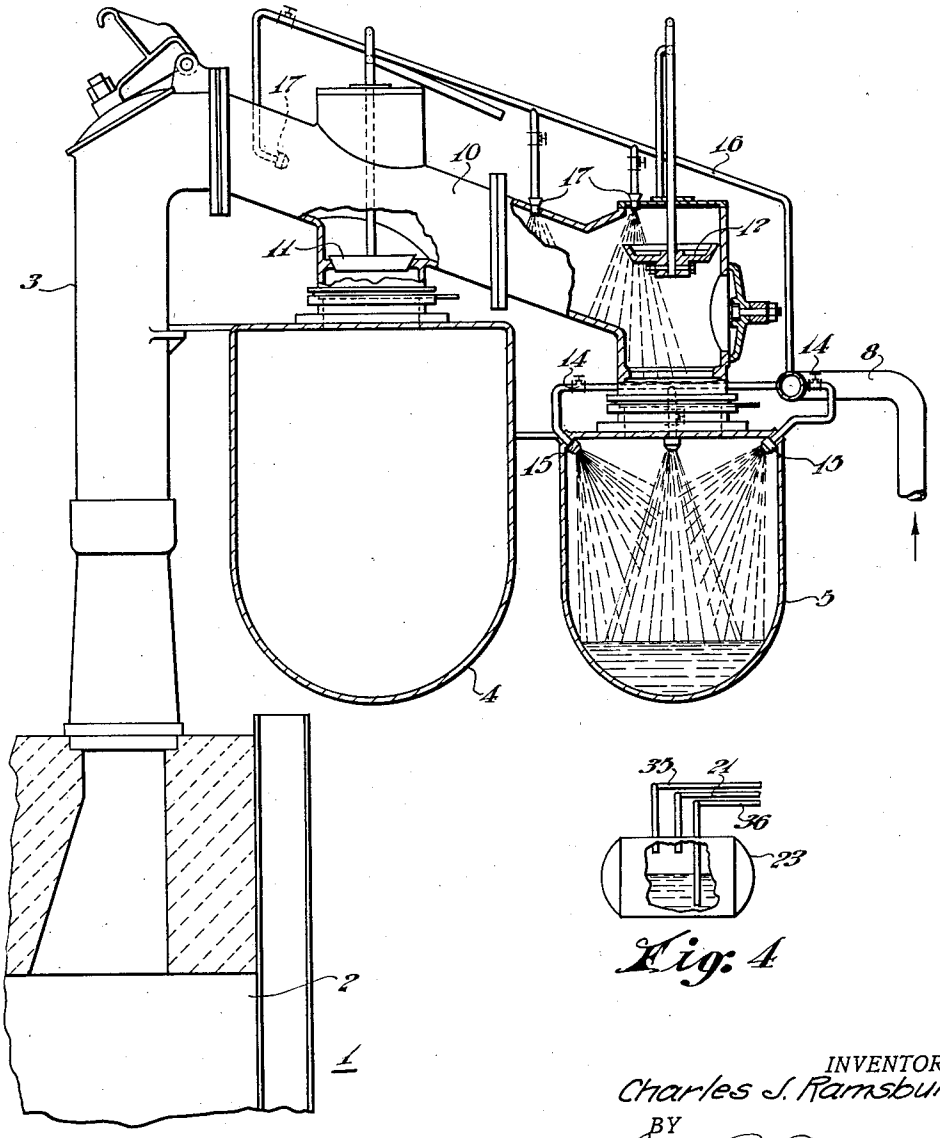


Fig. 4

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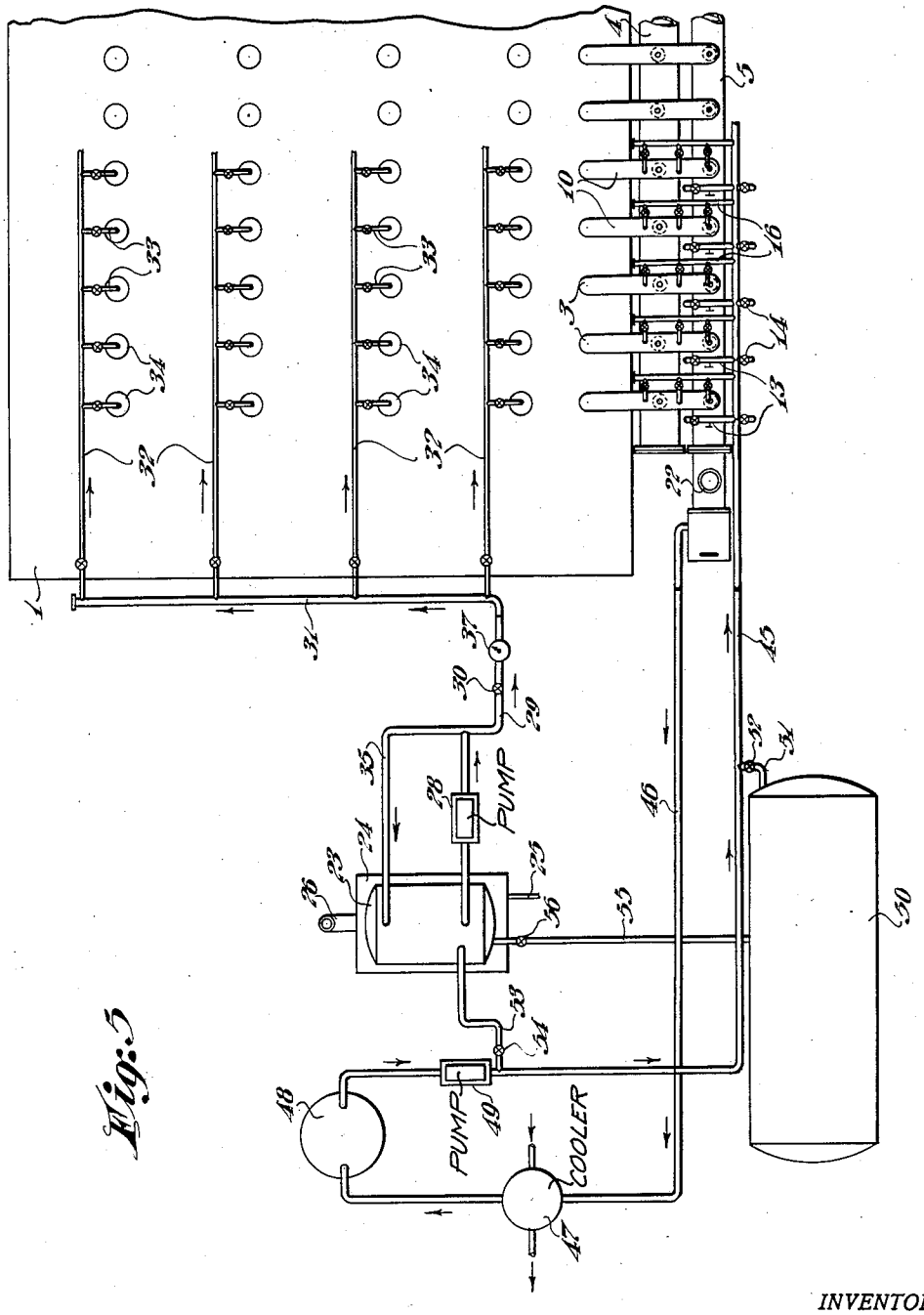


Fig. 5

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1,971,834

UNITED STATES PATENT OFFICE

1,971,834

COKING HEAVY PETROLEUM OIL

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Application August 5, 1931, Serial No. 555,228

1 Claim. (Cl. 202—30)

This invention relates to the manufacture of gas and coke from hydrocarbonaceous materials.

Considerable success has been attained in the manufacture of coke from pitches by spraying them in molten condition into coking chambers and after a suitable coking period, removing the coke formed, by pushing it in a manner similar to that generally employed in the manufacture of coke from coal. It is somewhat more difficult, however, to obtain a desirable coke from hydrocarbon oils, such as for instance petroleum oils, which coke will compare favorably in every respect with pitch coke.

Heretofore in the manufacture of gas from oil, large amounts of tar were produced for which there is comparatively very little demand.

An object of the present invention is to provide a process whereby it is possible to produce on a large scale only gas and coke from oil.

Another object of the present invention is to provide a method of obtaining a high B. t. u. gas and an improved coke product from hydrocarbon oils.

A further object is to provide a method of operating a by-product coke-oven battery comprising a plurality of coking chambers connected to a gas and vapor collecting main by which method gas, and a satisfactory oil-coking product may be obtained.

The process of the present invention includes mixing hydrocarbon oil containing a relatively low proportion of coke-forming constituents with a hydrocarbon oil containing a relatively high proportion of coke-forming constituents and coking the resulting mixture. More specifically the process includes contacting vapors formed by coking a heavy hydrocarbon oil with hydrocarbon oil which is to be coked and thereby condensing the said vapors which form tarry condensates miscible with the contacting oil. The mixture of tarry condensates and contacting oil is introduced into a coking chamber and is reduced to coke. The gases produced are collected and used for fuel purposes.

The oil to be used in the present process is preferably a heavy petroleum oil or so-called bunker oil. The flash point of the oil is preferably over substantially 150° F. The viscosity varies up to 300 seconds at 122° F. in accordance with the Saybolt-Furol test. A satisfactory oil is one having a specific gravity around 0.97. By way of example, the boiling point range of a satisfactory oil is as follows: first drop off at 521° F.; 9% by weight off at 750° F.

Other oils such as gas oils and tar oils may be employed in the present process. However, when coking coal-tar materials, including coal-tar pitch or oils, it is more satisfactory to use coal-tar oils for contacting vapors resulting from the coking operation, than it is to use petroleum oils.

Apparatus which may be adapted to the present process is shown in the accompanying drawings, in which

Figure 1 is a plan view of one form of apparatus;

Fig. 2 is an elevational view partly in cross section of the apparatus shown in Fig. 1;

Fig. 3 is an elevational view partly in cross section of a portion of the apparatus shown in Figs. 1 and 2;

Fig. 4 is an elevational view partly in cross section of another portion of the apparatus; and

Fig. 5 is a plan view of a modified form of apparatus.

Similar reference characters are used in the various figures to indicate similar apparatus.

The apparatus shown in Figs. 1 and 2 comprises a coke-oven battery 1 made up of a plurality of coking chambers 2 connected by standpipes 3 to collecting mains 4 and 5, and oil circulating means to be described below.

The coke-oven battery to be used in the present process is preferably of the Becker type shown and described in U. S. Patent No. 1,374,546 dated April 12, 1921. The walls H of the oven chambers C are lined with refractory material and are heated by hot gases which pass through flues between the individual coking chambers.

Fresh oil to be coked is passed from a tank-car 6 through a pipe 7 and is pumped through pipe 8 by means of pump 9 to be sprayed into the collecting main 5.

The coke-oven battery shown in the drawings is equipped with two collecting mains so that, in the event that coal is to be coked in some of the coking chambers and oil in the remaining coking chambers, the coal gas may be collected separately from the oil gas. For this purpose the standpipe of the type shown in Fig. 3 is employed, having a crossover pipe 10 equipped with a valve 11 for controlling the flow of vapors into the main 4 and also equipped with a valve 12 for controlling the flow of vapors into the main 5. In the present apparatus the main 4 is used for collecting gases and vapors from the coal coking ovens and the main 5 for collecting the gases and vapors from the oil coking ovens.

The pipe 8 may extend any distance along the main 5 and is provided with branch pipes 13 controlled by valves 14 and leading to sprays 15 for

spraying oil into the main 5. The pipe 8 is also provided with branch pipes 16 which conduct oil to sprays 17 for spraying oil into the crossover pipes 10.

The temperature of the oil fed to the sprays through the pipe 8 should be such that the vapors from the oil-coking ovens are readily condensed. Preferably, particularly if a heavy hydrocarbon oil is employed, the temperature should be just above the point required to permit easy flowing of the oil. To reduce the viscosity of the oil, particularly in cold weather, it may be heated in the tank car 6 by means of a steam coil 18 to which steam is fed through a pipe 19.

The mixture of flushing oil and condensates formed in the main 5 passes out of the main through a pipe 21 and the uncondensed oil gases pass out of the main 5 through a gas pipe 22 which conducts the gases to a gas treating plant or a gas holder, not shown.

The oil flowing through pipe 21 passes into a heating tank 23 which is set in a furnace 24 provided with a burner 25 and a stack 26. In this tank 23, the oil is preheated before passing it to a coking chamber to be coked. The oil may be preheated to a temperature of from about 200° F. to about 500° F. or, in other words, not above its boiling temperature.

In certain cases the oil may be conveyed directly from the collector main directly to the coking chambers. The contacting of the oil with the gases in the main raises the temperature of the oil and no further heating is necessary. For this purpose the oil from the pipe 21 is shunted through a pipe 27 controlled by a valve 27', to the pipe 36 at the suction side of the pump 28 and is pumped to the coking chambers, the valve 35' being closed and the valve 30 open.

By the above flushing operation an oil passing from the tank car 6 through the collector main 5 and into the heating tank 23, increases its coke-forming constituents and is rendered more desirable for coke manufacturing purposes.

The oil from the heating tank 23 is pumped by means of pump 28 through a pipe 29 controlled by a valve 30 and to a manifold 31. From the manifold 31 the oil is fed through branch pipes 32 which conduct the oil to spray pipes 33 in the charging holes 34 in the top of the ovens 2.

In order to obtain a ready flow of oil it may be continuously pumped in and out of the tank 23 through pipes 35 and 36. A meter 37 is provided for determining the flow of oil to the ovens. The pipes 31 and 32 may be sloped to permit drainage, or steam from a pipe 39 may be fed therethrough to remove oil in case the circulation thereof is stopped.

Oil coming from the main 5 through the pipe 21 may be returned to the said main by means of pipes 40 and 41 by closing the valve 42 and opening the valve 43. In this way fresh oil from the tank 6 is mixed with oil which has previously been used for flushing the main 5 and the mixture is used for flushing. Oil may be withdrawn from the system through pipe 40 by opening the valve 42.

In the apparatus shown in Fig. 5 the oil used for flushing the collecting main is repeatedly brought into contact with the vapors from the coke oven and the circulated flushing oil is kept in a system separate from that used for introducing oil to the coke ovens. Means are provided for continuously or intermittently removing the circulated oil and for passing it to the coke ovens. It is seen that by such an arrangement the amount of material withdrawn from the flushing system may be made to correspond to the increase of material in the circulating system or in other words correspond to the amount of tar made during any given coking period.

In the apparatus shown in Fig. 5, the flushing oil circulating system comprises a pipe 45 which conducts oil to the collecting main 5 through a spraying system similar to that shown in Figs. 1 and 2. The oily material produced in the main 5 is removed therefrom by means of a pipe 46 which conducts it through a cooler 47 and then into a collecting or settling tank 48.

The cooler 47 is supplied with any suitable cooling medium which may be continuously passed through the cooler. Material from the tank 48 is pumped by means of a pump 49 through the pipe 45 back to the collecting main 5. Fresh oil may be supplied to the flushing oil circulating system from a tank 50 through a pipe 51 connected to the pipe 45 and controlled by a valve 52.

Oil to be coked may be withdrawn continuously or intermittently from the flushing oil return pipe 45 through a pipe 53 controlled by a valve 54 and connected to the heating tank 23. The heated material from the tank 23 is conducted to the coking chambers by means of apparatus similar to that shown in Figs. 1 and 2. If desired, fresh oil may be mixed with the material withdrawn from the flushing system and the mixture may be passed to the coking chambers to be coked. For this purpose fresh oil is passed from the tank 50 to the tank 23 through a pipe 55 controlled by a valve 56.

Coking of the oil is carried on in methods similar to those described in U. S. Patents Nos. 1,942,978 and 1,942,980, or in U. S. Patent No. 1,715,240 to H. Koppers. The oil may be continuously or intermittently sprayed into a coking chamber until a suitable working charge has been introduced. After the charge is completed the coking is continued until no vapors are evolved and until the coke has been properly shrunk.

In the introduction of the oil certain precautions may be taken as, for instance, the oil may be introduced at such a rate that it becomes substantially solid substantially as fast as it accumulates in the oven or it may be fed into the oven at such a rate that it is converted to a partially coked but yet plastic condition as fast as it is introduced. In some cases the material may be rapidly passed into the oven in stages and between each stage the material may be heated until the rapid evolution of vapors has subsided.

By way of example, oil previously heated to about 500° F. may be introduced into a coking oven at the rate of about 250 gallons per hour. The coking chamber for most purposes is heated to a temperature above 1,000° F. and preferably from substantially 1400° F. to 2200° F. The vapors passing to the collecting main are cooled therein to about 200° F. The amount of oil necessary to do this depends upon the rate of charging the oven and upon the temperature of the gases and vapors coming from the oven.

A satisfactory rate for spraying the flushing oil into the collecting main is from substantially 1500 to 3,000 gallons per hour per oven. The flushing oil that is to be recirculated in the flushing system may be further cooled to about 150° F. before it is sprayed into the collecting main.

The pressure in the coking chambers and in the collecting main is substantially atmospheric.

By the foregoing processes, when using an oil which ordinarily yields about 20% coke or in some cases as low as 9 to 10%, the coke yield may be readily doubled. Furthermore, a higher quality oil coke is obtained which is readily removed from a coking chamber and which is highly desirable for commercial purposes. Besides coke, gas having a high B. t. u. value of about 1000 to 1600 per cubic foot is produced. The collection of large amounts of tar is eliminated and there is a consequent saving of storage space, since any tar produced is converted into more valuable products which find a ready market.

I claim as my invention:

A process of treating and coking heavy petroleum oil or so-called bunker oil ordinarily yielding 9–20% coke so as to double the yield of coke therefrom in a coking retort oven battery of the type comprising a series of alternate narrow coking chambers and combustion flue heating walls therefor arranged side-by-side in a horizontal row, and having a gas and vapor collecting main exposed to atmospheric cooling for collecting and conveying distillation gases from said coking chambers to gas treating apparatus or use, which method comprises: gradually accumulating and simultaneously coking in one of said coking chambers by extraneous combustion in the heating walls for said oven the heavy petroleum oil; freely flowing the distillation gases from the oil coking operation off through said collecting main, subjecting the distillation gases while still hot from said coking operation to an intensive continuous spray with a recirculating stream of heavy petroleum oil to lower the temperature of said gases to about 200° F. and to remove the tarry condensates, the volume of said oil being such as to gradually accumulate and build up the percentage of tarry constituents of the heavy petroleum oil to such an amount as will substantially double the yield of coke therefrom, withdrawing said tar enriched oil in amounts corresponding to the amount of tar made from the coking oil during any given coking period, introducing fresh heavy petroleum oil into the circulating stream of oil to maintain the aforesaid volume, passing said withdrawn oil into the coking chamber, and coking the same therein as aforesaid.

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