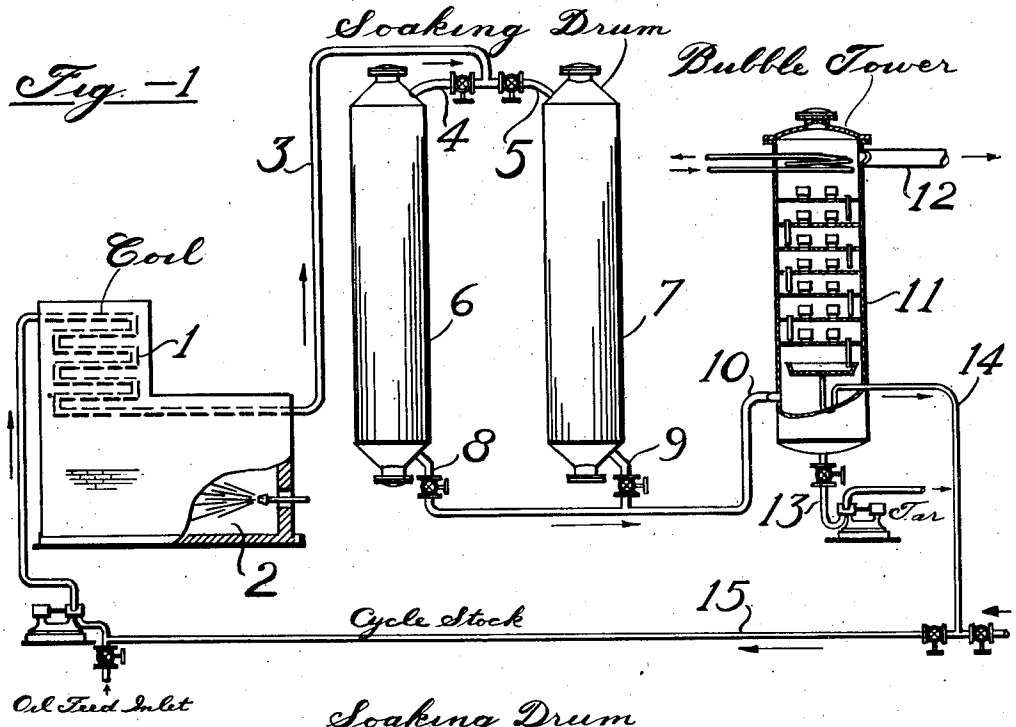
June 25, 1935. H. SYDNOR 2,006,188

METHOD OF CRACKING

Filed Dec. 6, 1929

Fig. —1



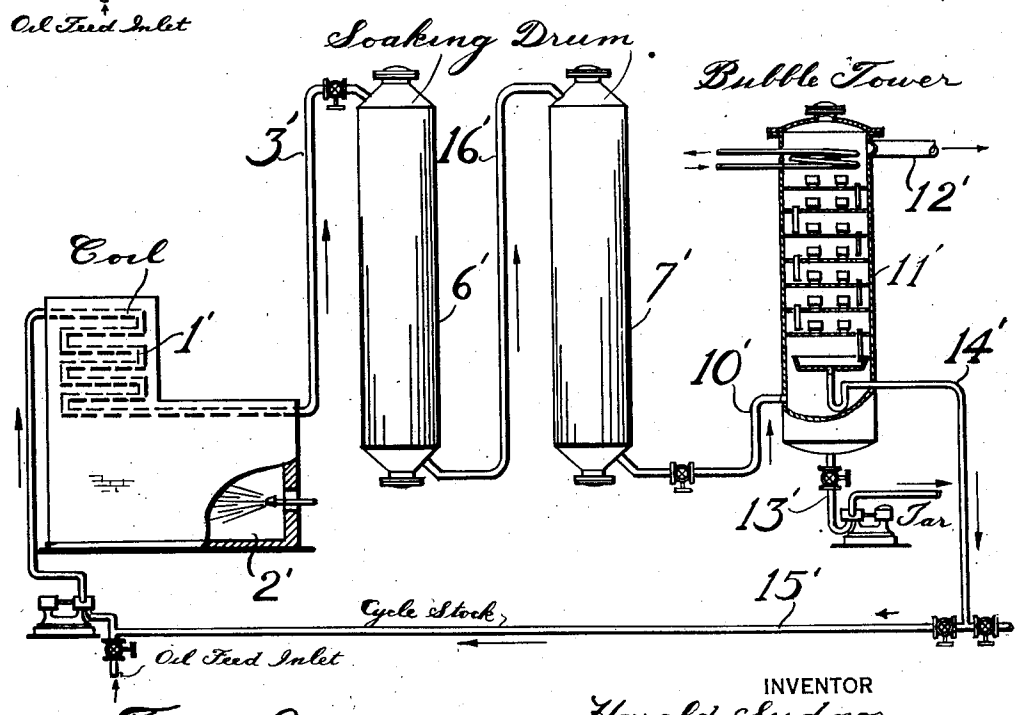


Fig. —2

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METHOD OF CRACKING

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Application December 6, 1929, Serial No. 412,193

1 Claim. (Cl. 196—58)

This invention relates to an improved method of cracking petroleum products and will be fully understood from the following description in conjunction with the accompanying drawing.

The main object of the invention is to produce, from poor stocks, gasoline having good knock rating without the deposition of large amounts of coke in the reaction chamber, usually called soaking drum.

In the drawing

Figure 1 represents a diagrammatic elevational view of the apparatus with two soaking drums connected in parallel and

Figure 2 represents a similar view of the apparatus with two soaking drums in series.

When the operation is carried out in the apparatus shown in Figure 1, the mixed feed, consisting of the fresh feed to be cracked and the cycle stock, is pumped through heating coil 1 arranged in furnace and heated to cracking temperature. The hot oil is discharged through line 3 and branch lines 4 and 5 into the top of the soaking drum 6 and 7 in which most of the cracking takes place. The cracked effluents leave through valved lines 8 and 9 at the bottom of the soaking drums, are united in line 10 and discharged into the bubble tower 11 in which separation at reduced pressure takes place according to the boiling range. The gas and the light distillate leave the bubble tower through line 12 are condensed in a condenser (not shown) separated and stored. The tar is pumped off through the bottom line 13 and cooler (not shown) into a storage tank (not shown). The middle fraction or cycle stock is removed by line 14 part of it or the whole being returned by line 15 to coil 1 for further cracking.

In Figure 2 the same numerals, primed, designate identical parts. The operation is similar to that described with Figure 1 with the only difference that the two soaking drums are now connected in series—the hot oil from coil 1' is introduced through line 3' at the top of the soaking drum 6' in which it undergoes cracking. The cracked effluent leaving drum 6' at the bottom is discharged through line 16' into drum 7' at the top thereof, undergoes further cracking and leaves through valved bottom line 10' to be discharged at reduced pressure into bubble tower 11'.

The novelty of the process consists in the combination of two steps: (1) introduction of the hot oil at the top of the soaking drums and removal of the cracked effluent at the bottom thereof, (2) the use of several soaking drums connected in parallel or in series. In the drawing only two soaking drums have been shown but more of them may be used if necessary in one unit. In the latter case they may be connected partly in series partly parallel. Thus, for instance, when 3 soaking drums are used I may pass the entire heated oil through the first drum in downward direction, and pass the cracked effluent through the other two drums connected in parallel, the direction of flow being again downward.

The intensity of cracking may be measured by the amount of gasoline produced per hour, calculated as percentage of the mixed feed pumped to the coil per hour. This percentage of gasoline, which is usually called conversion per pass, depends, besides the intensity of cracking, also on the percentage of the cycle stock in the mixed feed, but when this last mentioned percentage is kept approximately constant, the conversion per pass indicates the intensity of cracking. Now, there are certain stocks which, when produced by mild or not intensive cracking yield a poor quality gasoline which causes "knocking" in the internal combustion engine. On the other hand, when the same stock is cracked in a usual tube and tank unit provided with one soaking drum, under intensive cracking conditions, too much coke is formed and deposited in the soaking drum, necessitating frequent shutdowns of the unit.

By my invention intensive cracking can be maintained and a good grade of gasoline obtained from poor stocks without excessive coke formation. The following table serves for comparison of two operations: (1) run No. 1 carried out in a usual tube and tank unit in which the hot oil from the heating coil was introduced at the bottom of the single soaking drum used and the cracked effluent removed through a single line at the top of the drum, and (2) run No. 2 carried out according to the present invention with two soaking drums in parallel as shown in Figure 1 of the drawing. The oil submitted to cracking was a Talang Akar (Sumatra) paraffin distillate from which paraffin has been removed by pressing without much refrigeration.

Table

	Run No. 1	Run No. 2
Coil outlet temperature °F	870	875
Pressure on soaking drum, lbs./sq. in.	750	750
Feed rate, gallons per hour	15,000	12,300
Yields		
Gasoline, percent by volume on fresh feed	39.0	41.2
Cycle gas oil, percent by volume on fresh feed	24.2	16.2
Tar, percent by volume on fresh feed	19.2	27.4
Gas, percent by weight on fresh feed	17.8	19.3
Coke, percent by weight on fresh feed	2.8	1.1
Tar gravity, °A. P. I.	10.9	11.1
Percent fresh feed in mixed feed	51.1	53.6
Conversion per pass	19.9	22.1

Engine tests showed that the gasoline produced in run No. 2 was of a much better quality and less inclined to induce knocking than the gasoline of run No. 1. It will be noticed that the conversion per pass was higher in run No. 2. As a

further advantage, the coke production in run No. 2 was only 39% of the coke production in run No. 1.

It will be understood by those skilled in the art that under the given conditions of pressure and temperature the hot oil was not completely vaporized in the soaking drum, respectively soaking drums, and passed therethrough partly in liquid phase. My process is especially advantageous in cases where, under the given operating conditions, liquid may accumulate in the soaking drum either by incomplete vaporization or in consequence of polymerization, and such accumulated liquid may produce excessive amount of coke under the desired intensity of cracking.

Although I have described my process with special reference to the cracking of petroleum oils, it will be understood that the same process can be applied to the cracking of other oils, such as for instance shale oils for the production of lower boiling oils from higher boiling ones.

I claim:

The method of cracking hydrocarbon oil which comprises heating the oil to cracking temperature in a zone of restricted cross-section, then passing all the oil directly from said zone downward through a plurality of substantially vertically arranged cracking zones of large cross-section, in which a substantial amount of cracking takes place, without additional application of heat, the cracking zones of large cross-section being substantially maintained free of oil in the liquid phase by discharging liquid and vapor from the lower part of one zone of large cross-section into the upper part of another such zone, passing the resulting liquid and vapor from the lower part of the last-mentioned zone at reduced pressure into a rectifying zone, and segregating the desired cracked product.

HAROLD SYDNOR.