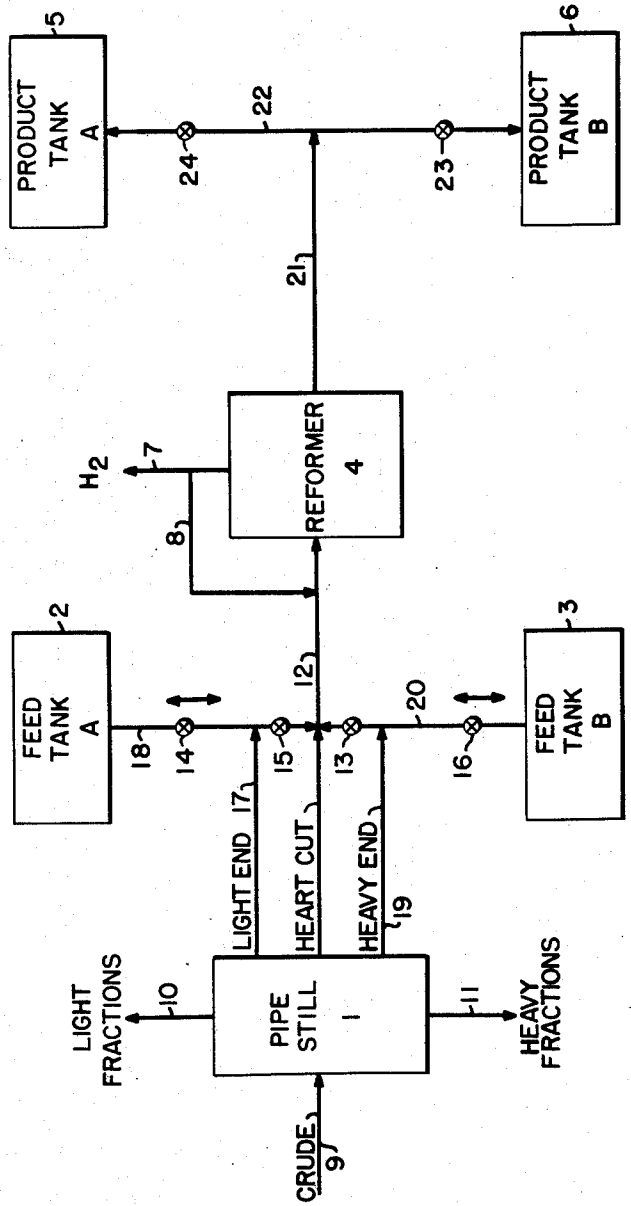
Jan. 8, 1963 R. P. CAHN 3,072,561

BLOCKED HYDROCARBON CONVERSION OPERATION
PERMITTING REDUCED TANKAGE
Filed Dec. 30, 1959



Robert P. Cahn Inventor

By

L. A. Strimbeck

Patent Attorney

United States Patent Office 3,072,561 Patented Jan. 8, 1963

3,072,561

BLOCKED HYDROCARBON CONVERSION OPERATION PERMITTING REDUCED TANKAGE

Robert P. Cahn, Elizabeth, N.J., assignor to Esso Research and Engineering Company, a corporation of Delaware

Filed Dec. 30, 1959, Ser. No. 863,014
5 Claims. (Cl. 208—80)

This invention is concerned with a blocked operation wherein two hydrocarbon streams of different boiling ranges are alternately fed to a conversion process to produce two types of products. The "heart cut blocked" operation of the present invention permits considerable savings in tankage investments.

The present invention reduces tankage requirements by feeding a heart cut continuously to the conversion process and blocking a "light end" or "heavy end" through the unit, and separately recovering the corresponding products. The tankage requirements for these "ends" are considerably less than in conventional systems. The present invention is particularly applicable to those situations where an overlap in the product characteristics is permissible. This invention can, however, be practiced in situations where it is desirable to separate the products obtained during each cycle of operation.

In brief compass, the present invention comprises a process wherein hydrocarbons are converted by the alternate feeding to, and conversion in, a conversion zone a first hydrocarbon stream and a second hydrocarbon stream, the initial boiling point of the second stream being at least 40° F. lower than the final boiling point of the first stream. The improvement of this invention comprises separating a heart cut fraction from the two streams that boils within the range of the initial boiling point of the second stream and the final boiling point of the first stream and continuously feeding this to the conversion zone while also alternately feeding the remainder of the first stream or the remainder of the second stream to the conversion zone.

The following description of the drawing attached to and forming a part of this specification will serve to make this invention clear. The drawing schematically depicts a hydroforming process embodying the teachings of this invention. While the invention is described with reference to a naphtha hydroforming operation which usually operates on feeds boiling in the range of C_4 to 430° F., it it applies equally as well to any one of several well known hydrocarbon conversion processes, such as steam cracking thermal cracking or reforming, gas oil catalytic cracking, hydrofining, hydrodesulfurizing of naphthas, isomerizing and aromatizing, and the like.

The drawing illustrates a process for producing components for a regular gasoline and a more volatile premium gasoline. The light feed is more severely treated to obtain a larger octane improvement, with smaller yields. Both the light and heavy products are passed to pools and blended to produce a regular and a premium gasoline. 2300 barrels per day of a regular gasoline are produced by blending, having a Research octane number of 92 with 1.5 cc. TEL/gal., an RVP of 12 p.s.i.g. when containing 10% blended C_4's (40% off at 158° F., 54% off at 212° and 95% off at 356°). 2800 barrels per day of premium gasoline are produced by blending, having a Research octane number of 100 with 1.7 cc. TEL/gal., an RVP of 12 p.s.i.g. when containing 7% blended C_4's (35% off at 158° F., 54% off at 212° and 93% off at 320° F.).

The process equipment comprises a pipe still **1** or means for separating the feed, tanks **2** and **3** for alternately storing the blocked out feed, reforming system **4** and product storage tanks **5** and **6**. Reforming system **3** has

a design capacity of 5800 barrels per day and contains a total of 80 tons of 0.6 wt. percent platinum on eta alumina catalyst. It is operated in a semi-regenerative fashion with four reactors. The unit is shut down for regeneration every 2–3 months. Hydrogen produced in the process is removed by line **7** and a portion thereof is recycled by line **8** as is necessary.

A Middle East crude is introduced into pipe still **1** by line **9** at a rate of 40,000 barrels per day. Material boiling below 160° F. and material boiling above 350° F. are removed and sent to further processing by lines **10** and **11**, respectively.

In a normal blocked operation, a 160/280 light cut and then a 280/350 heavy cut would alternately be introduced into the reforming system **4** from pipe still **1** on a 30 day cycle operating 6 days on heavy feed and 24 days on light feed. This requires that 28,000 barrels of tankage be provided for the light cut and 28,000 barrels of tankage for the heavy cut.

In the present invention, a 220/310 heart cut fraction is separated in the pipe still and continuously passed by line **12** to the reforming system when it is in operation. A 160/220 light ends fraction and a 310/350 heavy ends fraction are also separated and alternately fed to the reforming system along with the heart cut on a 30 day cycle. During operation A, that part of the cycle when the light ends are fed, the heavy ends are passed to tankage, i.e. valve **13** is closed and valves **14**, **15** and **16** are open. Light ends flow from the pipe still and feed tank A through lines **17** and **18**, respectively, to line **12** and thence to the reforming system **4**. During operation B when the heavy ends are being fed, valve **15** is closed and valves **14**, **13** and **16** are open with the light ends flowing to feed tank A for storage. The heavy ends flow from pipe still **1** and from feed tank B by lines **19** and **20**, respectively, to line **12** and thence to the reforming sysem. During operation B the regular gasoline is passed from the reforming system by lines **21** and **22** to product tank B with valve **24** being closed. During A operation the premium gasoline is collected in product tank A with valve **24** being open and valve **23** being closed. The system illustrated requires that feed tank A have a capactiy of only 14,000 barrels and feed tank B a capacity of only 16,000 barrels.

It can be appreciated that the two products from the hydroformer have different essential characteristics. The light product can have a Research Clear octane number in the range of 90 to 102 and boil in the range of 160° to 320° F., with a mid-boiling point in the range of 200 to 250° F. The heavy product can have a Research Clear octane number in the range of 70 to 100 and boil in the range of 200 to 430° F., with a mid-boiling point in the range of 250 to 350° F.

Table 1 gives operating conditions for the portions A and B of the blocked operation and also gives a range of conditions for normal hydroforming operations.

Table I

	Operation A	Operation B	Range
Days on stream	24	6	
Temperature, Avg., ° F	930	870	850 to 1,000
Pressure, Avg., p.s.i.a.	400	400	250 to 650
Overall Feed Rate, w./h./w.	0.55	0.6	0.4 to 3
Hydrogen partial pressure, p.s.i.	210	285	200 to 400
C_5-430 yield, vol. percent on fresh feed	61	85	50 to 90
C_5-430 Research Clear octane number	98	88	

In a steam cracking operation one may wish to alternately feed a C_5/300 feed and then a 200/430 feed.

In this case, the teachings of this invention can be followed by continuously feeding a 200/300 heart cut and alternately feeding a light C_5/200 cut and a heavy 300/430 cut. In a hydrofining process the two feeds may comprise a 350/500 fraction and a 430/650 fraction. Thus, in accordance with this invention a 430/500 heart cut fraction can be continuously fed to the process with a 350/430 fraction and a 500/650 fraction being blocked.

Having described this invention, what is sought to be protected by Letters Patent is succinctly set forth in the following claims.

What is claimed is:

1. In a process wherein hydrocarbons are converted by the alternate feeding to and conversion in a conversion zone of a first stream and a second stream of hydrocarbons, the initial boiling point of said second stream being at least 40° F. lower than the final boiling point of said first stream wherein a free hydrogen containing gas is also introduced into said conversion zone, the improvement which comprises fractionating a naphtha boiling in the range of about C_4 to 430° F. to separate the same into a heart-cut fraction having a boiling range of about 200 to 300° F., a light ends fraction and a heavy ends fraction, alternately combining the light ends fraction with the heart-cut fraction to form said first stream and charging the same to the hydrocarbon conversion zone while simultaneously passing the heavy ends fraction to storage and collecting the products of said first stream conversion, and then combining the heavy ends fraction with the heart-cut fraction to form said second stream and charging the same to the hydrocarbon conversion zone while simultaneously passing the light ends fraction to storage and collecting the products from said second stream conversion, wherein said conversion zone contains a reforming catalyst and operates at an average temperature in the range of 850° to 1000° F., a pressure in the range of 250 to 650 p.s.i.a., a feed rate in the range of 0.4 to 3 w./h./w. and a hydrogen partial pressure in the range of 200 to 400 p.s.i., and wherein said first product has a Research Clear octane number in the range of 90 to 102, boils in the range of 160 to 320° F., with a mid-boiling point in the range of 200° to 250° F., and wherein said second product has a Research Clear octane number in the range of 70 to 100, and boils in the range of 200° to 430° F., with a mid-boiling point in the range of 250° to 350° F.

2. In a process wherein hydrocarbons are converted by the alternate feeding to and conversion in a conversion zone of a first stream and a second stream of hydrocarbons, the initial boiling point of said second stream being at least 40° F. lower than the final boiling point of said first stream, the improvement which comprises fractionating a wide boiling range feed to separate the same into a heart-cut fraction having a boiling range of at least 40° F., a light ends fraction and a heavy ends fraction, alternately combining the light ends fraction with the heart-cut fraction to form said first stream and charging the same to the hydrocarbon conversion zone while simultaneously passing the heavy ends fraction to storage, and collecting the products of said first stream conversion and then combining the heavy ends fraction with the hart-cut fraction to form said second stream and charging the same to the hydrocarbon conversion zone while simultaneously passing the light ends fraction to storage and collecting the products from said second stream conversion.

3. In a process wherein hydrocarbons are converted by the alternate feeding to and conversion in a conversion zone of a first stream and a second stream of hydrocarbons, the initial boiling point of said second stream being at least 40° F. lower than the final boiling point of said first stream, the improvement which comprises fractionating a naphtha boiling in the range of about C_4 to 430° F. to separate the same in to a heart-cut fraction having a boiling range of about 200 to 300° F., a light ends fraction and a heavy ends fraction, alternately combining the light ends fraction with the heart-cut fraction to form said first stream and charging the same to a catalytic hydroforming reaction conversion zone, wherein free hydrogen containing gas is also introduced into said zone, while simultaneously passing the heavy ends fraction to storage, and collecting the products of said first stream conversion and then combining the heavy ends fraction with the heart-cut fraction to form said second stream and charging the same to said conversion zone while simultaneously passing the light ends fraction to storage and collecting the products from said second stream conversion.

4. In a process wherein hydrocarbons are converted by steam cracking by the alternate feeding to and conversion in a conversion zone of a first stream and a second stream of hydrocarbons, the initial boiling point of said second stream being at least 40° F. lower than the final boiling point of said first stream, the improvement which comprises fractionating a hydrocarbon stream boiling in the range of about C_5 to 430° F. to separate the same into a heart-cut fraction having a boiling range of about 200 to 300° F., a light ends fraction having a boiling range of about C_5 to 200° F. and a heavy ends fraction having a boiling range of about 300 to 430° F. alternately combining the light ends fraction with the heart cut fraction to form said first stream having a boiling range of about C_5 to 300° F. and charging the same to the hydrocarbon conversion zone while simultaneously passing the heavy ends fraction to storage, and collecting the products of said first stream conversion and then combining the heavy ends fraction with the heart cut fraction to form said second stream having a boiling range of about 200 to 430° F. and charging the same to the hydrocarbon conversion zone while simultaneously passing the light ends fraction to storage and collecting the products from said second stream conversion.

5. In a process wherein hydrocarbons are converted by hydrofining by the alternate feeding to and conversion in a conversion zone of a first stream and a second stream of hydrocarbons, the initial boiling point of said second stream being at least 40° F. lower than the final boiling point of said first stream, the improvement which comprises fractionating a hydrocarbon stream boiling in the range of about 350° to 650° F. to separate the same into a heart-cut fraction having a boiling range of about 430 to 500° F., a light ends fraction having a boiling range of about 350 to 430° F. and a heavy ends fraction boiling in the range of about 500 to 650° F. alternately combining the light ends fraction with the heart-cut fraction to form said first stream boiling in the range of about 350 to 500° F. and charging the same to the hydrocarbon conversion zone while simultaneously passing the heavy ends fraction to storage, and collecting the products of said first stream conversion and then combining the heavy ends fraction with the heart-cut fraction to form said second stream boiling in the range of about 430 to 650°, and charging the same to the hydrocarbon conversion zone while simultaneously passing the light ends fraction to storage and collecting the products from said second stream conversion.

References Cited in the file of this patent

UNITED STATES PATENTS

2,067,030	Van Peski	Jan. 5, 1937
2,249,461	Diwoky	July 15, 1941
2,255,399	Subkow et al.	Sept. 9, 1941
2,335,684	Mayer	Nov. 30, 1943
2,636,909	Oblad	Apr. 28, 1953
3,002,917	Hamilton	Oct. 3, 1961