

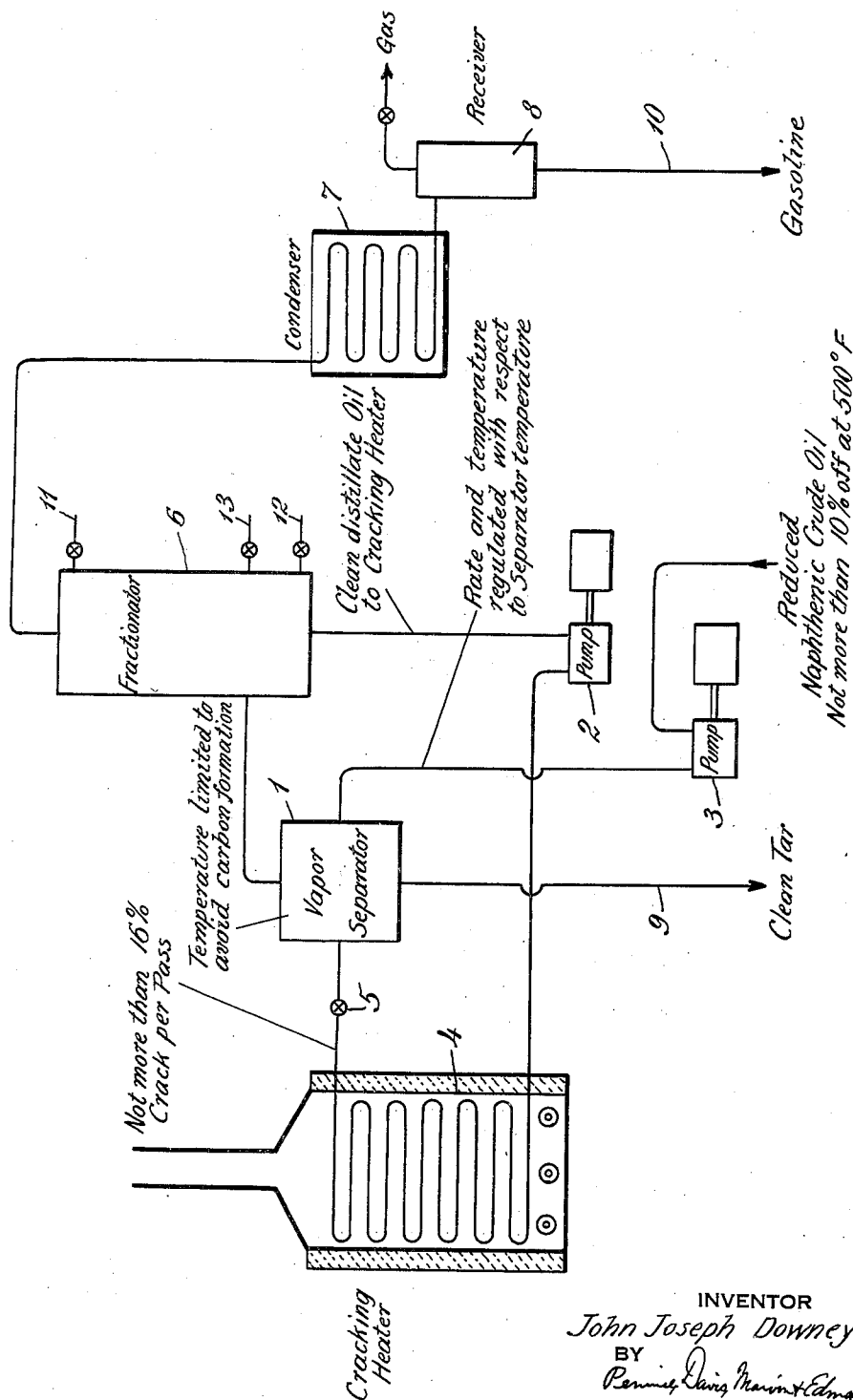
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MANUFACTURE OF GASOLINE AND FUEL OIL

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MANUFACTURE OF GASOLINE AND FUEL OIL

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1 Claim. (Cl. 196—50)

It has hitherto been proposed, in the production of gasoline from reduced crude petroleum, that is crude petroleum from which lower boiling components have been separated by distillation, to crack a clean distillate stock produced from the reduced crude oil by bringing together the hot oil products of the cracking and the reduced crude oil and condensing, usually in a fractionator, the clean distillate stock to be cracked from the resulting vapor mixture after separation of residual components of the cracked products and the reduced crude oil. This proposal has proven very desirable with many reduced crude oils, but it has not been successful as applied to naphthenic stocks such as the reduced crude petroleum commonly produced in California, primarily because of excessive carbon formation either so limiting the period of operation between cleanings as to make operation uneconomic or rendering the residual tar of low quality, frequently unmerchantable as fuel oil.

I have found that this scheme of operation can be advantageously applied to such reduced naphthenic crude oils if three factors involved are properly correlated. These three factors are (1) the boiling range of the distillate stock produced from the reduced crude oil, (2) the degree of cracking per pass through the cracking heating and (3) the temperature in the separator in which the hot cracked products are brought together and in which the residual tar and the vapor mixture from which the stock supplied to the cracking heating is condensed are separated.

Although carbon formation is an important part of the problem involved, it is not all of the problem. The operation must be balanced to be economically useful or technically possible in any real sense. Reduced California crude petroleum, for example, contain a smaller proportion of components recoverable as a distillate stock than do comparable Mid-Continent stocks. Consequently, the imposition of a high degree of cracking per pass requires a larger proportion of a California stock than of a Mid-Continent stock for the production of the clean distillate oil to be supplied to the cracking heating although the heat available for distillation of such stock in the hot cracked products from the cracking heating may be no greater and may be less. At the same time, the permissible degree to which cracking per pass can be carried is much more limited with California stocks, for example, than with Mid-Continent stocks, even though equally clean.

According to my invention, these three factors previously mentioned are correlated as follows: The naphthenic crude petroleum is reduced to a degree such that not more than 10% of the reduced crude boils off up to 500° F., as measured by an Engler distillation, before it is supplied to the combined operation. The crack per pass, through the cracking heating in the combined operation, is limited not to exceed about 16%, measured as increase in content of material distilling off up to 400° F., by Engler distillations, comparing the material entering and the material leaving the cracking heating. The reduced crude oil is introduced into the separator, into which the hot cracked products discharged from the cracking heating are discharged, at a rate sufficient and at a temperature low enough to maintain a temperature in the separator low enough to prevent substantial formation of carbon. Excessive carbon formation is thus avoided and at the same time a balanced operation can be secured. With this limited crack per pass, sufficient heat is available in the hot cracked products to distill sufficient clean stock from the introduced reduced crude oil to satisfy the thus limited requirements of the cracking heating even though the temperature of the reduced crude oil as introduced is limited to avoid carbon formation, the proportion of reduced crude oil necessary to prevent substantial carbon formation in the separator decreasing with its temperature.

An operation embodying the invention is diagrammatically illustrated in the accompanying drawing, and one such operation will be described in connection therewith. Various forms of apparatus appropriate for practice of the invention are well known.

In the accompanying drawing, 1 represents a vapor separator, 2 and 3 are pumps, 4 is a cracking heater, 5 is a pressure regulating and reducing valve, 6 is a fractionating tower, 7 is a condenser and 8 is a receiver and gas separator. A reduced naphthenic crude oil, of which not more than 10%, or better not more than 5%, boils off up to 500° F., and having a gravity of 15°–18° A. P. I., for example, is introduced into the vapor separator 1 by means of pump 3 while hot oil products are discharged into this separator from the cracking heater 4. The stream of oil forced through this heater by means of pump 2 is heated therein to a cracking temperature of 925°–975° F. under a superatmospheric pressure of 400–600 pounds per square inch, as discharged, for example. The hot oil products from the

heater are expanded through valve 5 into the separator 1 in which a pressure of 50-75 pounds per square inch is maintained. The crack per pass through the heater is limited by limiting the period of time at which the oil stream is at cracking temperature in the heater. The reduced crude oil is introduced into the separator 1 at a rate sufficient to maintain a maximum temperature not exceeding about 825° F. therein. No sufficient volume of liquid to involve substantial carbon formation is permitted to accumulate in separator 1. Liquid tar is discharged from the separator 1 through connection 9. The vapor mixture passing from the separator to the fractionator 6 is separated therein into a gasoline fraction, which passes through condenser 7 into the receiver 8 in which condensed gasoline is separated from gas, and a higher boiling clean distillate stock supplied to the cracking heater 4 by means of pump 2. The gasoline product is discharged through connection 10. The fractionator may be controlled by an appropriate refluxing medium introduced through connection 11. Excess condensate can be discharged from the lower end of the fractionator through connection 12. Additional clean distillate stock can be supplied through connection 13.

The proportion of clean distillate oil recoverable from the reduced crude oil introduced into the separator tends to increase as the temperature of the reduced crude oil as introduced increases, and the reduced crude oil may be preheated prior to introduction into the separator to increase the proportion of clean stock available to be supplied to the cracking heater. However, such preheating must be limited to avoid substantial carbon formation. The reduced crude oil itself is subject to decomposition producing carbon if overheated and as the temperature of the introduced reduced crude oil rises, the temperature in the separator may rise, when the operation is otherwise kept in balance, to a point involving carbon formation in the separator. The reduced crude oil introduced into the separator must not be preheated to a temperature involving substantial carbon formation through either of these causes. Referring to the operation illustrated in the drawing, for example, the reduced crude oil supplied by means of pump 3 may be preheated, to a limited extent, by heat exchange with the vapor mixture flowing from the separator

1 to the fractionator 6 before introduction into the separator 1, or it may be so preheated by heat exchange with condensate circulated from the lower end of the fractionator 6 back to the fractionator 6. Additional clean distillate stock can also be recovered from the introduced reduced crude oil, notwithstanding such limitation with respect to the temperature at which it is introduced, by subjecting the tar discharged from the separator to evaporation under a pressure lower than that prevailing in the separator, under a vacuum for example, and the additional clean distillate stock so recovered can then be supplied directly to the cracking heater or to the cracking heater through the fractionator.

Not only is the combined operation of my invention efficient and economic with respect to gasoline production from reduced naphthenic crude petroleum, but it also makes possible the production of a clean tar desirable as a fuel oil, as such or in blends with gas oil, as road oil and as a material to be blown for asphalt production. I have produced, by operations embodying my invention, tars containing less than 0.1% sediment by extraction and 99.8-99.9% soluble in carbon bisulphide and in carbon tetrachloride.

I claim:

In the production of gasoline from reduced naphthenic crude petroleum of the type commonly produced in California, the improvement which comprises reducing the crude oil to a degree such that not more than 10% of the reduced crude oil boils off up to 500° F., introducing the reduced crude oil into a vapor separator, heating a stream of clean distillate stock to a cracking temperature approximately 925-975° F. under superatmospheric pressure and introducing the resulting stream of hot oil products into said separator, discharging a liquid tar from said separator, taking off a vapor mixture from said separator, condensing a clean distillate stock from this vapor mixture and supplying it to said cracking heating, limiting the crack per pass of said stream of clean distillate stock through said cracking heating not to exceed about 16% and introducing the reduced crude oil into said separator at a rate sufficient and at a temperature low enough to maintain a temperature therein not exceeding about 825° F. and low enough to prevent substantial formation of carbon.

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