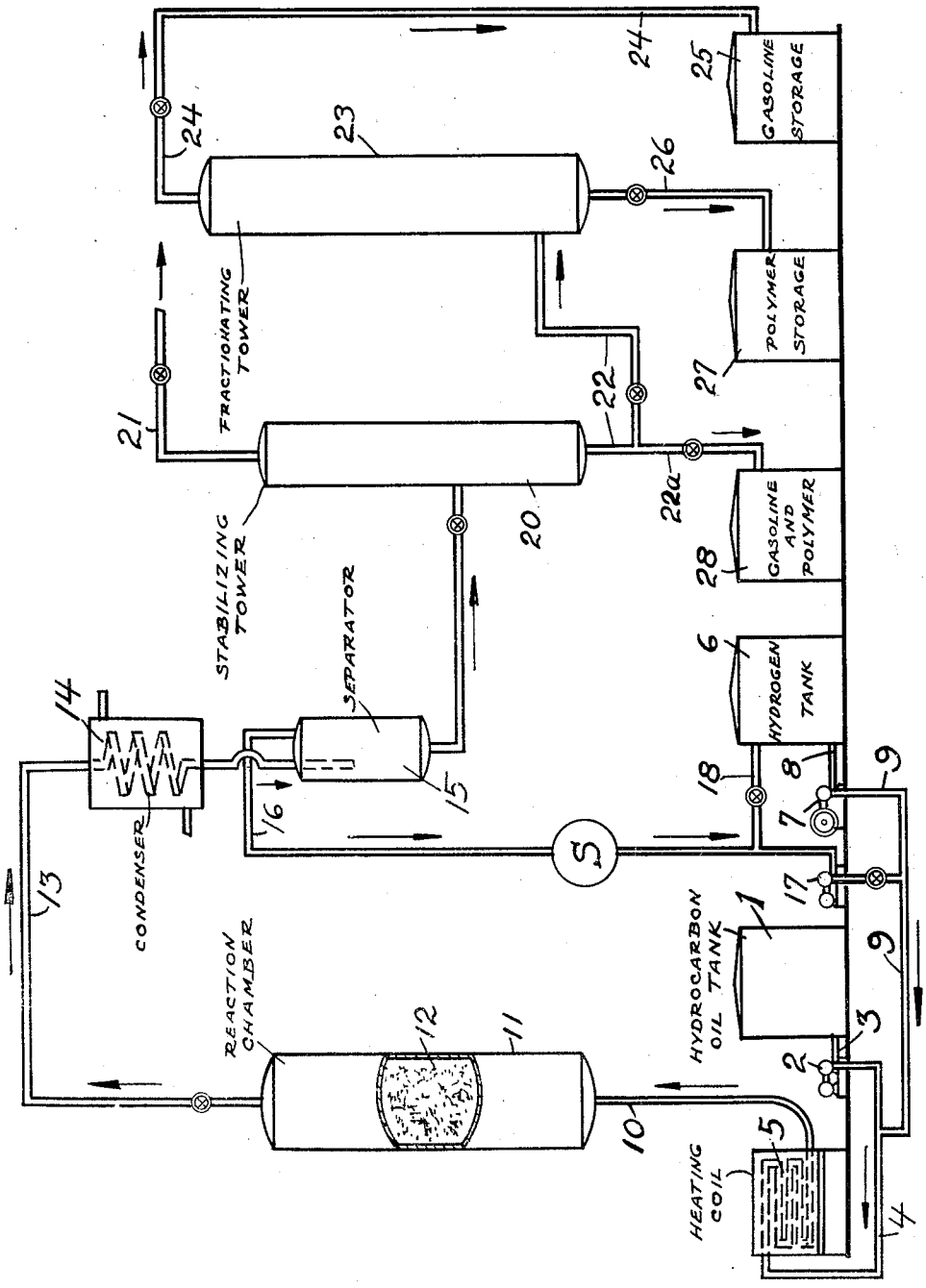
Jan. 30, 1945. R. L. MATHIASEN 2,368,482

ADDITION AGENT FOR MOTOR FUELS

Filed July 30, 1941



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Patented Jan. 30, 1945 2,368,482

UNITED STATES PATENT OFFICE

2,368,482

ADDITION AGENT FOR MOTOR FUELS

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Application July 30, 1941, Serial No. 404,577

2 Claims. (Cl. 196—150)

This invention relates to an improved addition agent for motor fuels and to the method for preparing the same and is more particularly concerned with an improved "solvent oil."

At the present time it is customary to add small amounts of a substance called a solvent oil to motor fuels for use in internal combustion engines. The principal purpose of this solvent oil is to keep gummy or gum-forming constituents present in most motor fuels in a fluid condition so that said gummy materials will not accumulate on the valves, valve stems and other internal parts of the motor. The solvent oil, while dissolved in the motor fuel, is not intended to be burned in the motor along with the fuel but should be sufficiently high-boiling so that it will remain behind in the motor to act as an upper-cylinder lubricant. It should of course be added only in very small amounts so as to affect as little as possible the volatility and other important characteristics of the motor fuel.

The material ordinarily used as a solvent oil is a light naphthenic lubricating oil derived from coastal or Colombian crudes. It has a Saybolt viscosity at 100° F. of about 100 seconds, and is characterized by a high Kauri-butanol value, and a high solvent power for the gummy constituents of motor fuels. It has a boiling range from about 400 to 850° F. and is added in amounts of between about 0.1 and 1.0% by volume which are sufficient to accomplish the desired purpose without otherwise affecting the performance of the motor fuel.

I have now found that the high boiling polymers formed when a naphtha or a hydrocarbon oil consisting essentially of hydrocarbons boiling in the gasoline range is subjected to catalytic reforming in the presence of substantial quantities of added or recirculated hydrogen provide an excellent material for use as a solvent oil. These high boiling polymers are ordinarily removed from the reformed product because of their low A. P. I. gravity and high boiling point. They are characterized by high octane number, high aromaticity and extremely high solvent power for gummy constituents and in addition act to inhibit the formation of gummy constituents. I have found that these polymers are always characterized by high aromaticity no matter what may be the chemical characteristics of the initial feed stock subjected to catalytic reforming in the presence of hydrogen. The end-point of the initial feed stock determines to a large extent the boiling range of the heavy polymers obtained so that it can readily be seen that by regulating the end point of the initial feed stock to catalytic reforming in the presence of hydrogen, polymers of different boiling ranges may be obtained.

The method by which the heavy polymers to be used as solvent oil according to the present invention are prepared will be fully understood from the following description when read with reference to the accompanying drawing which is a semi-diagrammatic view in sectional elevation of one type of apparatus suitable for the purpose.

Referring to the drawing, numeral 1 designates a supply tank of a hydrocarbon oil consisting essentially of hydrocarbons boiling in the gasoline range. This hydrocarbon oil may have been obtained from any source and it is immaterial whether it is predominately paraffinic, olefinic, naphthenic or aromatic in character. The exact end point of the hydrocarbon oil may be selected according to the boiling range of the polymers which it is desired to obtain, as pointed out above. Pump 2 withdraws oil from tank 1 through line 3 and forces it through line 4 into a heating means 5. Numeral 6 designates a supply tank of hydrogen or a gas containing between 30 and 90 mol percent of free hydrogen. Compressor 7 withdraws hydrogen from tank 6 through line 8 and forces it through line 9 into line 4 carrying hydrocarbon oil to the heating means 5. In this way a mixture of oil and hydrogen is formed before it passes through the heating means. It will be understood that the oil and hydrogen may, however, be heated separately if desired. The heated mixture of oil and hydrogen flows from heating means 5 through line 10 into a reaction chamber 11 which contains a catalytic material 12 which promotes reforming.

Reaction chamber 11 is maintained at a temperature between 850 and 1050° F. and under a pressure between slightly above atmospheric and about 500 pounds per square inch. The oil is passed through the reaction chamber at a rate between 0.3 and 5.0 volumes of liquid oil per volume of catalyst per hour and is accompanied through the reaction chamber by from 1000 to 4000 cubic feet per barrel of oil of a gas containing between 30 and 90 mol percent of free hydrogen. The larger volumes of gas will be used with the lower concentrations of free hydrogen therein and vice versa. The catalyst 12 may be selected from a wide variety of different materials. By way of example may be mentioned mixtures of aluminum oxide in any of its various forms with from 1 to 40% by weight of the oxides or sulfides of molybdenum, chromium, tungsten,

vanadium, cobalt or nickel. Particularly effective catalysts comprise a major proportion of alumina gel or peptized alumina gel and from 1 to 20% by weight of molybdenum oxide or chromium oxide.

Products of reaction leave reaction chamber 11 through line 13, pass through a cooling means 14 and discharge into a separating means 15 wherein gaseous and liquid products are separated. The gaseous products of reaction which will consist essentially of hydrogen and will contain small amounts of low molecular weight hydrocarbons such as methane, ethane and propane are removed from separating means 15 through line 16 and may be recycled directly to line 9 by means of booster compressor 17 or may be returned to tank 6 through lines 16 and 18. In some cases, particularly when the quantity of hydrocarbons in the gaseous products is relatively high, it is desirable to pass the gaseous products before being recycled through a scrubbing means denoted by the letter S which is adapted to separate gaseous hydrocarbons from hydrogen.

The liquid products of reaction are removed from separating means 15 through line 19 and introduced into a stabilizing means 20 wherefrom the hydrocarbons which are too volatile for inclusion in gasoline are removed through line 21 and passed to the refinery fuel line or otherwise disposed of. The remainder of the liquid products is removed from stabilizing means 20 through line 22 and introduced into a fractionating or rerun tower 23. A fraction boiling in the range of gasoline is removed from the rerun tower 23 through line 24 and collected in a tank 25. The heavy polymers, comprising those hydrocarbons boiling above the range of gasoline, are removed from rerun tower 23 through line 26 and collected in a tank 27. These polymers will ordinarily consist of highly aromatic hydrocarbons boiling above about 400° F. and constitute the improved solvent oil of the present invention.

In utilizing the polymers as solvent oil they are added to the motor fuel in amounts between 0.1 and 1.0% by volume. The exact amount added will depend largely upon the maximum permissible end point of the motor fuel. It is preferable in many cases to segregate from the polymers a fraction boiling between about 400 and 850° F. in order to eliminate the very high boiling materials which may cause gum formation and raise the end point of the motor fuel to an unduly large extent.

Inasmuch as the process by which the polymers are prepared also results in the production of a motor fuel of high octane number and other desirable characteristics, it is advantageous to allow the heavy polymers formed in said process to remain in the product to act as solvent oil. In this way the rerunning of the product may be eliminated, thus appreciably reducing the cost of operation. When it is desired to allow the polymers to remain in the gasoline produced by catalytic reforming in the presence of hydrogen the products removed from stabilizing tower 20 through line 22, instead of being forwarded to rerun tower 23, may be passed through line 22a and collected in a tank 28.

It will be understood that when the polymers are to be allowed to remain in the products of catalytic reforming, the end point of the feed stock to the catalytic reforming may be so adjusted that the quantity and boiling range of the polymers produced will be such as to produce a final product of the required end point. On the other hand, if it is found that the quantity of polymers and the boiling range thereof exceed the required limits, the final product containing said polymers may be blended with a sufficient quantity of another gasoline not containing polymers so that the blend will contain the required amount.

In the operation of the process it will be found that the catalyst 12 gradually loses its activity in promoting the desired reactions because of the formation or deposition thereon of carbonaceous contaminants such as coke. The catalyst 12 will therefore require periodic regeneration to restore its activity. Regeneration of the catalyst may be accomplished in any convenient manner, for example by passing hot, inert gases containing regulated small quantities of air or oxygen over the catalyst mass to cause combustion of the carbonaceous contaminants. Because of the requirement for periodic regeneration of the catalyst, it is frequently desirable to provide two or more reaction chambers similar to reaction chamber 11 so that while the catalyst in one reaction chamber is undergoing regeneration, the flow of oil and hydrogen may be diverted to another reaction chamber containing fresh or freshly regenerated catalyst.

As pointed out above, the catalytic reforming is conducted in the presence of hydrogen for a time and under such conditions that there is no overall net consumption of free hydrogen therein and there is preferably an overall net production of free hydrogen. For this reason, it is possible to operate the process without the continuous addition of hydrogen from an extranec .s source because the hydrogen or gases containing the same may be continuously recirculated.

It will be understood that many modifications may be made in the operation of the process. For example, instead of using catalyst in a fixed or stationary form, as illustrated in the drawing, the catalyst may be used in finely divided or powdered form suspended in the oil vapors and hydrogen. One particularly advantageous type of operation with a powdered catalyst is that in which the catalyst is used in what may be called "fluid" form in which the suspension of catalyst in vapors behaves in much the same way as a fluid. When powdered catalyst is used it will be understood that the regeneration thereof cannot be in situ but must be effected outside the reaction chamber in a separate vessel.

The following examples illustrate the application of the invention:

Example 1

A light naphtha having an end point of 288° F. derived from a Colombian crude is subjected to catalytic reforming in the presence of hydrogen at a temperature of 921° F. The polymer fraction obtained from the product amounted to 8.5% based on the feed and had the following characteristics:

Initial boiling point, °F	288
52% off @ °F	302
Gravity, °A. P. I	30.4
Army octane No	99.8

This polymer is a highly satisfactory solvent oil for a 400° F. end point gasoline.

Example 2

A heavy naphtha having an end point of 419° F. and derived from a West Texas crude is sub-

jected to catalytic reforming in the presence of hydrogen. The polymer fraction obtained from the product has the following characteristics:

Gravity, °A. P. I.	7.4
Aniline point, °F.	—70
Sulfur, %	0.11
Refractive index @ 20° C.	1.6117
Initial boiling point, °F.	427
50% off @ °F.	555
84% off @ °F.	760

This polymer, while boiling above the gasoline range, is a highly satisfactory solvent oil when blended in small amounts, less than 1%, with a gasoline.

This invention is not limited by any theories of the mechanism of the reactions nor by any details which have been given merely for purposes of illustration but is limited only in and by the following claims in which it is intended to claim all novelty inherent in the invention.

I claim:

1. An improved motor fuel comprising gasoline containing 0.1 to 1% of the high boiling polymers produced in the catalytic reforming in the presence of hydrogen of a hydrocarbon oil boiling in the gasoline range which polymers are characterized by high aromaticity and an initial boiling point of at least 288° F. and an A. P. I. gravity not higher than 30.4.

2. An improved motor fuel comprising gasoline containing 0.1 to 1% of the high boiling polymers produced in the catalytic reforming in the presence of hydrogen of a hydrocarbon oil boiling in the gasoline range which polymers are characterized by high aromaticity, an A. P. I. gravity of 7.4, an aniline point of —70° F., a refractive index of 1.6117 and a boiling range between 400 and 850° F.

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