

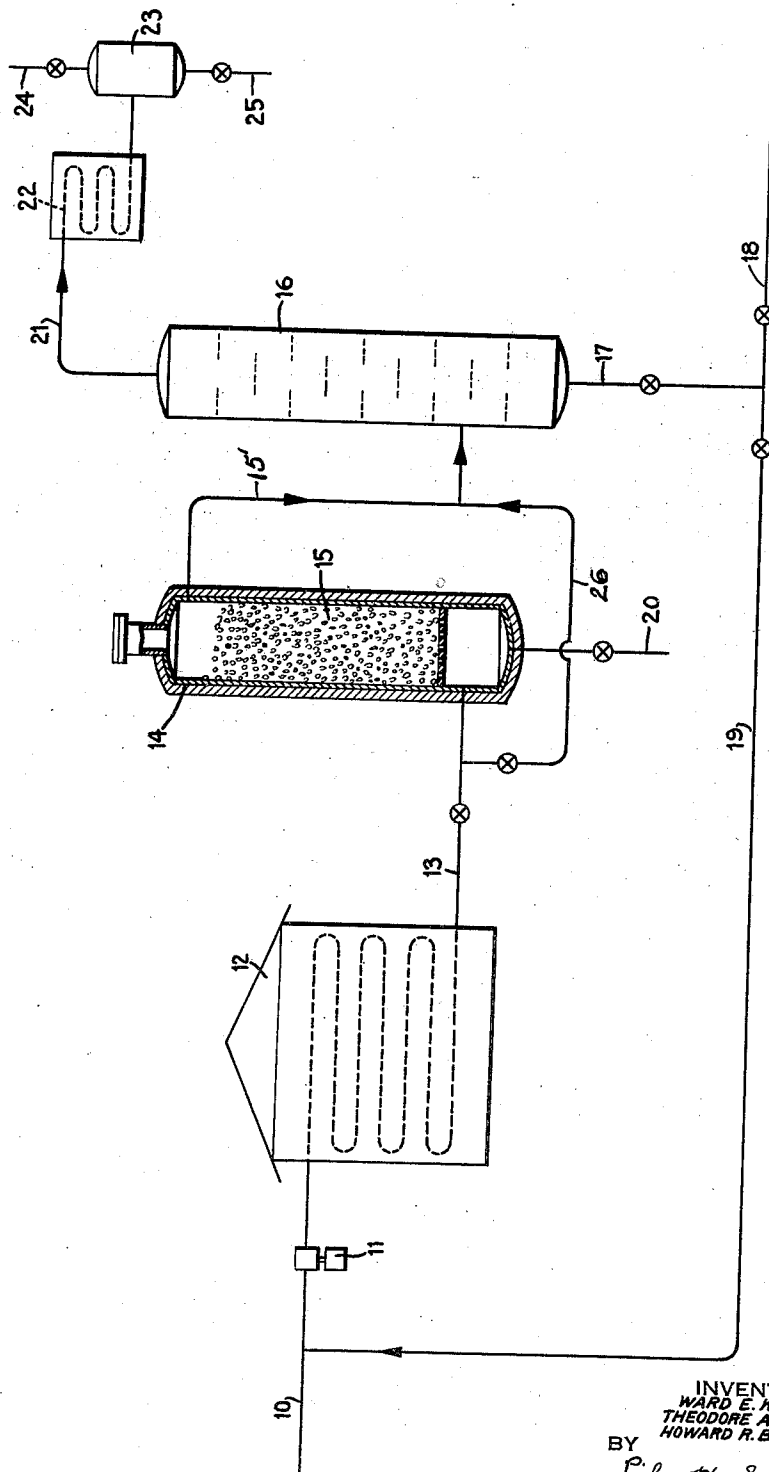
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PROCESS OF IMPROVING MOTOR FUEL

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PROCESS OF IMPROVING MOTOR FUEL

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This invention relates to a process for treating internal combustion motor fuel to improve the anti-knock properties thereof and pertains more particularly to a process for improving the anti-knock properties of motor fuel in the presence of a special catalyst.

One of the principal objects of our invention is to provide a process for improving the anti-knock properties of motor fuel wherein the improvement may be effected with minimum loss in yield and with a minimum formation of by-products unsuitable for motor fuel.

A further object of our invention is to provide a catalytic process for improving the anti-knock properties of motor fuel which is more flexible in operation and which enables a selected treatment of separate fractions of the motor fuel. A further object of our invention is to provide an improved catalyst for effecting the improvement in the anti-knock properties of the motor fuel.

It has heretofore been proposed to subject hydrocarbons within the gasoline boiling range or a fraction containing principally hydrocarbons within the gasoline boiling range to treatment in the presence of a catalyst to improve the anti-knock properties thereof. We have found that greater benefits may be obtained if the hydrocarbons are treated in the presence of a catalyst hereinafter described.

In accordance with our invention the hydrocarbons to be treated, which may comprise straight-run or cracked gasoline, heavy naphtha or a fraction consisting principally of gasoline constituents, are first heated to a temperature range, for example, from 850° to 950° F., and thereafter passed in contact with a catalyst composed of a relatively large percentage of an oxide taken from the eighth group of the periodic table admixed with a relatively smaller percentage of an oxide from the third group such as aluminum and boron oxide, for example, and preferably including a small percentage of sodium or potassium oxide.

The catalyst above specified is preferably in the form of a gel and may be made by precipitating and drying the hydroxides of the metal constituents. For example, ferric and aluminum hydroxides are first precipitated from dilute solutions of iron and aluminum salts, preferably nitrates, with ammonia or potassium hydroxide at a temperature of about 60° C. The hydroxides are then admixed, the proportion ranging from 85 to 97 per cent ferric hydroxide and from 2 to 14 per cent aluminum hydroxide, preferably 94 per cent of ferric hydroxide to 5 per cent alumi-

num hydroxide, and the mixture then washed and filtered. The residue is then kneaded to remove as much water as possible and a small amount, preferably about 1 per cent, of potassium hydroxide added to the mixture during the kneading operation. The catalyst may be then dried first at about 100° C. and finally at about 150° C.

The invention will be better explained with reference to the accompanying drawing which is a schematic illustration of an apparatus suitable for carrying the invention into effect.

Referring to the drawing, the reference character 10 designates a charging line through which the stock to be treated is passed by means of pump 11 to a heating zone which may be in the form of a furnace 12. The oil, during its passage through the heating zone, is heated to a temperature in excess of 850° F. and preferably to a temperature range from 850° F. to 950° F. As before mentioned, the original oil may be gasoline, heavy naphtha, or a fraction consisting principally of gasoline constituents. The oil, after being heated to the desired temperature within the heating furnace 12, is passed through transfer line 13 into the bottom of reaction chamber 14 in which is positioned a bed of catalytic material 15 of the character hereinbefore described. Vapors formed as a result of the heating of the oil in furnace 12 pass upwardly through the bed of catalytic material and are subjected to treatment for improving the anti-knock properties thereof. Any unvaporized residue resulting from the heating operation or the treating operation is withdrawn from the bottom of the reaction chamber 14 through line 20. The reaction products thereafter pass overhead through line 15' to a fractionating tower 16 wherein constituents boiling above those desired in the final distillate are condensed. Condensate formed in the tower is withdrawn therefrom through line 17 and may be withdrawn from the system through line 18 or returned to the heating furnace 12 through lines 19, 10 and pump 11.

Vapors remaining uncondensed in tower 16 pass overhead through line 21 to condenser 22, wherein the desired distillate condenses, and thence to a receiving tank 23 wherein the distillate separates from fixed gases. Fixed gases may be withdrawn from receiving drum 23 through line 24 and the distillate withdrawn through line 25 to a stabilizer not shown.

While, for simplicity, we have shown but one reaction chamber 14, containing the catalytic material before described, it will be understood

that a plurality may be provided, connected in series or in parallel and operated simultaneously or alternately as desired. Moreover, in lieu of a catalytic chamber the catalytic material may be positioned within the tubes located in the furnace 12 in which case the products from the heating coil may pass directly through lines 13 and 26 to the fractionating tower 16 without passing through a chamber 14. It will also be understood that the reaction chamber will be lagged to prevent radiation losses and maintain the desired reaction temperature within the chamber.

As a guide in carrying out the invention to the best advantage the following example will be helpful, it being understood that the invention is not limited to the specific example given.

A heavy naphtha fraction having an initial boiling point of 150° F., an end point of 415° F., an average boiling point of 321° F., and 90 per cent off at 374° F. and having an octane rating of 37 as determined by the Research Method, was passed through a bed of catalytic material consisting of 94 per cent iron oxide, 5 per cent aluminum oxide and about 1 per cent potassium oxide, while at a temperature of 930° F. The average time of contact of the vapors with the catalytic material was 1.8 seconds. The reaction products were thereafter fractionated to form a 394° F. end point product which was found to have an octane number of 50 as compared to the original 37 of the fresh feed. Under the time and temperature conditions of operation no material improvement in the octane rating of the product would be expected in the absence of the catalyst.

Having described the preferred embodiment of the invention it will be understood that it embraces such other modifications and variation as come within the spirit and scope thereof and that it is not our intention to limit the invention except as necessary to distinguish from prior art.

We claim:

1. A method of improving the anti-knock properties of internal combustion motor fuel which comprises passing a hydrocarbon motor fuel through and in contact with a bed of catalytic material formed by admixing 94 parts of ferric hydroxide, 5 parts of aluminum hydroxide and 1 part of potassium oxide and drying at a temperature of about 150° C., maintaining said fuel during its passage through said bed at a temperature above 850° F., cooling the treated products and separating therefrom a liquid motor fuel having higher anti-knock properties than the initial feed stock.

2. A method of improving the anti-knock properties of internal combustion motor fuel which comprises passing a hydrocarbon motor fuel product through and in contact with a bed of catalytic material formed by admixing 94 parts of ferric hydroxide, 5 parts of aluminum hydroxide and 1 part of potassium oxide and drying at a temperature of about 150° C., maintaining said fuel during its passage through said bed at a temperature ranging from about 900° F. to about 950° F., cooling the treated products and separating therefrom a liquid motor fuel having higher anti-knock properties than the initial feed stock.

3. A method of improving the anti-knock properties of internal combustion motor fuel which comprises passing a hydrocarbon motor fuel product through and in contact with a bed of catalytic material formed by admixing 94 parts of ferric hydroxide, 5 parts of aluminum hydroxide and 1 part of potassium oxide and drying at

a temperature of about 150° C., maintaining said fuel during its passage through said bed at a temperature of about 930° F., cooling the treated products and separating therefrom a liquid motor fuel having higher anti-knock properties than the initial feed stock.

4. A method of improving the anti-knock properties of a hydrocarbon fraction consisting principally of gasoline constituents which comprises contacting the hydrocarbon fraction with a catalytic material formed by admixing 85 to 97% of ferric hydroxide, 14 to 2% of aluminum hydroxide and about 1% of potassium hydroxide and drying the admixture at a temperature of about 150° C., maintaining said hydrocarbon fraction in contact with said catalyst for a few seconds while at a temperature within the range of about 850-950° F., cooling the treated products and separating therefrom a liquid motor fuel having higher anti-knock properties than the charged fraction of hydrocarbons.

5. A method of improving the anti-knock properties of a hydrocarbon fraction consisting principally of gasoline constituents which comprises passing the hydrocarbon fraction through and in contact with a bed of catalytic material containing about 94 parts of iron oxide, about 5 parts of aluminum oxide and about 1 part of an alkali metal oxide, maintaining said hydrocarbon fraction in contact with said catalyst for a few seconds while at a temperature within the range of about 850-950° F., cooling the treated products and separating therefrom a liquid motor fuel product having higher anti-knock properties than the charged fraction of hydrocarbons.

6. A method of improving the anti-knock properties of a hydrocarbon fraction consisting principally of gasoline constituents which comprises contacting the hydrocarbon fraction with a catalytic gel containing about 94 parts of iron oxide, about 5 parts of aluminum oxide and about 1 part of potassium oxide, maintaining said hydrocarbon fraction in contact with said catalyst for a short interval of time while at a temperature within the range of about 850-950° F., cooling the treated products and separating therefrom a liquid motor fuel having higher anti-knock properties than the charged fraction of hydrocarbons.

7. A method of improving the anti-knock properties of a hydrocarbon fraction consisting principally of gasoline constituents which comprises contacting the hydrocarbon fraction with a catalytic material consisting of an oxide of a metal selected from the group consisting of iron, nickel and cobalt, admixed with a small amount of an oxide selected from the group consisting of aluminum oxide and boron oxide, and further admixed with a very small amount of an oxide selected from the group consisting of sodium oxide and potassium oxide, maintaining said hydrocarbon fraction in contact with said catalyst for a short period of time while at a temperature within the range of about 850-950° F., cooling the treated products and separating therefrom a liquid motor fuel having higher anti-knock properties than the charged fraction of hydrocarbons.

8. A method of improving the anti-knock properties of a hydrocarbon fraction consisting principally of gasoline constituents which comprises passing the hydrocarbon fraction through and in contact with a bed of catalytic material containing about 94 parts of iron oxide, about 5 parts of aluminum oxide and about 1 part of an alkali metal oxide, maintaining said hydrocarbon fraction in contact with said catalyst for a few seconds

onds while at a temperature within the range of about 850-950° F., passing the treated hydrocarbon fraction into a fractionating zone, withdrawing uncondensed vapors from the top part of said fractionating zone, withdrawing condensed products from the bottom part of said fractionating zone and recycling a part of them for further contact with the catalytic material.

9. The method of improving the anti-knock properties of a hydrocarbon fraction consisting principally of gasoline constituents which comprises contacting the hydrocarbon fraction with a catalytic material formed by mixing 85 to 97% of ferric hydroxide, 14 to 2% of aluminum hydroxide and about 1% of potassium hydroxide and drying the admixture at a temperature of about 150° C., maintaining said hydrocarbon fraction in contact with said catalyst for a short interval of time while at a temperature within the range of 850-950° F., cooling the treated products and separating therefrom a liquid motor fuel having higher anti-knock properties than the charged fraction of hydrocarbons.

10. A method of improving the anti-knock properties of a hydrocarbon fraction consisting principally of gasoline constituents which comprises contacting the hydrocarbon fraction with a catalytic material formed by mixing 85 to 97% of an hydroxide selected from the group consisting of ferric hydroxide, nickel hydroxide and cobalt hydroxide, 14 to 2% of aluminum hydroxide, and about 1% of an hydroxide selected from the group consisting of sodium hydroxide and potassium hydroxide and drying the admixture at an elevated temperature sufficient to convert substantially all of the hydroxides into oxides, maintaining said hydrocarbon fraction in contact with said catalyst for a short interval of time while at a temperature within the range of 850-950° F., cooling the treated products and separating therefrom a liquid motor fuel having higher anti-knock properties than the charged fraction of hydrocarbons.

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