Patented Nov. 13, 1934

1,980,200

UNITED STATES PATENT OFFICE

1,980,200

MOTOR FUEL

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No Drawing. Application February 12, 1932, Serial No. 592,653

12 Claims. (Cl. 44—9)

This invention relates to improvements in motor fuels and more particularly to gasolines containing substances to prevent discoloration and the formation of gummy substances therein during storage or use.

Crude motor fuels and gasolines as commercially produced at the present time are extremely complicated mixtures of saturated and unsaturated aliphatic compounds together with some aromatic compounds. The unsaturated compounds, in the forms in which they are produced, are particularly desirable constituents to have in a motor fuel by reason of their high fuel value. On standing in contact with air and in use, gasolines containing some of these constituents become colored and rapidly form resinous, gummy, insoluble and non-volatile products. Colored products destroy the appearance and saleability of the fuel. The resinous, gummy and insoluble products deposit in the containers to form coatings therein, cause sticking of the valves, clogging of the jets and decrease the efficiency of the fuel, in many instances, making it valueless.

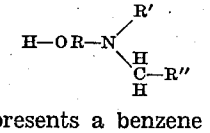
Because of the disadvantageous features of gasolines containing these constituents, they generally have been treated to substantially entirely remove such constituents before storage or sale thereof and consequently their value has been lowered. The methods, in most common use at the present time for removing these constituents, comprise treatment of the crude gasoline with sulphuric acid or fuller's earth in a vapor phase process. Such treatments of the motor fuels are expensive and increase the cost thereof and furthermore ordinarily fail to completely remove the desired constituents.

The failure of such removal processes has given rise to the development and the use of stabilizers or gum inhibitors which are intended to prevent the formation of objectionable products and discoloration in the motor fuels. The inhibitors in use at the present time have proved to be not as efficient as desired, requiring the addition of relatively large amounts thereof to the fuel. The addition of these compounds to gasoline is further complicated due to the fact that they are relatively insoluble therein. Furthermore, some of these inhibitors give an objectionable color to the gasoline. For example, 4-amino phenol precipitates badly from gasoline and colors it an intense red.

My invention has for an object the production of a motor fuel containing a substance which will inhibit the discoloration and formation of gum therein. A further object is to incorporate into a motor fuel a substance which will make it possible to use, as a fuel for internal combustion engines, liquid hydrocarbons, such as gasoline, that contain larger amounts of unsaturated hydrocarbons. A still further object is to enable the production of such improved motor fuels at a lower cost than the fuels at present on the market. Further objects are to produce a new composition of matter and to advance the art. Other objects will appear in the following description of my invention.

My invention is based upon my discovery that certain di-substituted amino phenols are powerful stabilizers and gum inhibitors for motor fuels such as gasoline. While free amino phenols have been used as inhibitors, the results from their use have not been particularly desirable. I have found that when the hydrogens of the amino group of amino phenols are replaced by hydrocarbon groups the resulting compounds have increased stabilizing or gum inhibiting properties, are markedly more soluble in solvents of low dielectric constant such as benzol and gasoline and have but little or no tendency to discolor on storage and exposure to light.

The subject matter of my present invention comprises motor fuels such as gasoline containing small amounts of stabilizers or gum inhibitors which consist of amino phenols in which all of the hydrogens of the amino groups have been replaced by hydrocarbon groups of such constitution and so arranged that at least one group includes an aliphatic carbon atom joined directly to the nitrogen. These compounds may be represented by the type formula:



wherein R represents a benzene nucleus which may be substituted, R′ represents an alkyl or aralkyl group and R″ represents an alkaryl, aryl, or aralkyl group. R and R″ may also be defined as a hydrocarbon radical of the benzene type. By the term alkyl, I mean to include closed hydrocarbon ring nuclei other than aromatic. Among the compounds of this class which have been found to be particularly effective as stabilizers and gum inhibitors for motor fuels are 4-dibenzyl amino phenol, and 4-methyl benzyl amino phenol.

In most motor fuels, only very minute quantities, on the order of 0.005%, of these compounds need be employed. However, more or less than these amounts may be added in accordance with

the nature and amount of unsaturated compounds and preformed gum present in the motor fuel to be treated. Preformed gum in the motor fuel usually requires the addition of larger amounts of the inhibitors due to the accelerating action of the gum.

The method of adding the inhibitor to the fuel is not important. The inhibitor may be dissolved in a solvent such as methanol or benzol and the solution dissolved in the fuel or the motor fuel may be allowed to percolate through a mass of the inhibitor to dissolve the required amount directly from the mass.

In order to clearly point out the invention, motor fuels or gasolines were tested in accordance with the "oxygen gum test" proposed by Voorhees and Essinger in their paper entitled "Importance and Significance of Gum in Gasoline," appearing in "Processes of the American Petroleum Institute," volume 10, Section II, page 169, of 1929. This test comprises heating 25 cc. of gasoline to 100° C. under an oxygen atmosphere in a glass rubber stoppered flask on a boiling water bath, continuing the heating to a point beyond the induction period, then removing the volatile matter in a steam atmosphere and directly weighing the gum formed. When gasolines are heated as described for a sufficient length of time, gum begins to form. The period of time required for the beginning of this phenomenon is known as the induction period. Gasoline when heated beyond this point, rapidly forms large quantities of gum. A stabilizer and gum inhibitor extends the induction period and tends to decrease the amount of gum formed.

The inhibitors of the present invention have the desired characteristics to a marked degree as may be shown by the following examples:

Example 1.—An unsaturated gum-free gasoline containing 0.005% by weight of 4-methyl benzyl amino phenol was heated for 4 hours under the preferred conditions of the "oxygen gum test." Simultaneously, 25 cc. of the same gasoline containing no stabilizer or gum inhibitor was subjected to heat under identical conditions. As a result of these tests, the gasoline containing the gum inhibitor showed the formation of only 6 mg. of gum for each 25 cc. while the uninhibited gasoline showed the formation of 188 mg. of gum.

Example 2.—An unsaturated gasoline containing 0.005% by weight of 4-dibenzyl amino phenol, upon subjection to the same conditions as in Example 1, formed 3 mg. of gum per 25 cc. of gasoline while the uninhibited control sample formed 222 mg. per 25 cc.

Other compounds of this class which merit special attention are:

2-methyl benzyl amino phenol
4-ethyl benzyl amino phenol
4-ditolu benzyl amino phenol
4-di-B-phenyl ethyl amino phenol
4-benzyl tolu benzyl amino phenol
2-dibenzyl amino phenol
3-dibenzyl amino phenol

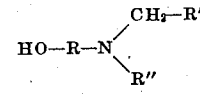
The isomeric forms of these compounds may also be mentioned.

I have found that the inhibitors forming the subject matter of my invention produce excellent results in gasoline even in the small amounts specified. They permit the use of less completely refined gasoline containing larger amounts of unsaturated and like compounds thereby decreasing the cost of producing and increasing the value of the gasoline. They are readily soluble in gasoline and the like and hence do not readily precipitate therefrom on storage or exposure and are therefore distinguishable in their action from the free amino phenols and other known inhibitors. The compounds used in accordance with this invention do not objectionably color the gasoline.

While I have disclosed specific embodiments of my invention, it is to be understood that such embodiments are given merely by way of illustration. Various modifications thereof within the spirt of my invention will be readily apparent to those skilled in the art. Accordingly, my invention is to be limited solely by the appended claims construed as broadly as permissible in view of the prior art.

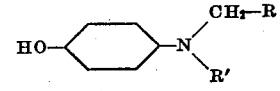
I claim:

1. A motor fuel comprising cracked hydrocarbon distillates normally tending to deteriorate and form gum on storage and having incorporated therein in amount sufficient to inhibit the formation of gum a substance having the formula



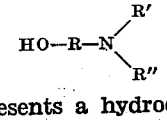
wherein R represents a hydrocarbon radical of the benzene type, R′ represents a hydrocarbon radical of the benzene type and R″ represents a member selected from the group consisting of alkyl and aralkyl radicals.

2. A motor fuel comprising cracked gasoline normally tending to deteriorate and form gum on storage and having incorporated therein in amount sufficient to inhibit the formation of gum a substance having the formula



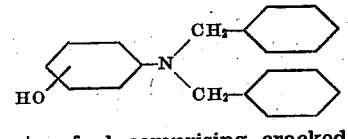
wherein R represents a hydrocarbon radical of the benzene type and R′ represents a member selected from the group consisting of alkyl and aralkyl radicals.

3. The method of preserving cracked gasoline normally tending to deteriorate and develop gums on storage which comprises incorporating therein a gum inhibitor having the formula



wherein R represents a hydrocarbon radical of the benzene type, R′ represents a benzyl radical and R″ represents a member selected from the group consisting of a benzyl radical and an alkyl radical, in a small quantity not exceeding more than about 0.005%.

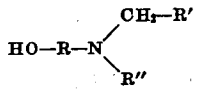
4. A motor fuel comprising cracked hydrocarbon distillates normally tending to deteriorate and develop gum on storage and having dissolved therein, in quantity sufficient to inhibit such deterioration and gum formation a substance having the formula



5. A motor fuel comprising cracked gasoline normally tending to deteriorate and develop gum on storage and having incorporated therein a dibenzyl aminophenol, in quantity sufficient to inhibit said gum formation.

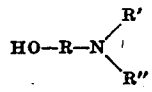
6. A cracked gasoline normally tending to deteriorate and form gum on storage and containing para dibenzyl aminophenol as a gum inhibitor in a small quantity not exceeding more than about 0.005%.

7. A motor fuel comprising cracked hydrocarbon distillates normally tending to deteriorate and form gum on storage and having incorporated therein in an amount sufficient to inhibit such deterioration and gum formation a substance having the formula



wherein R represents a hydrocarbon radical of the benzene type, R' represents a hydrocarbon radical of the benzene type and R'' represents an alkyl radical.

8. A motor fuel comprising cracked gasoline normally tending to deteriorate and form gum on storage and having dissolved therein in quantity sufficient to inhibit such deterioration and gum formation a substance having the formula



wherein R represents a hydrocarbon radical of the benzene type, R' represents a benzyl radical and R'' represents an alkyl radical.

9. A motor fuel comprising cracked gasoline normally tending to deteriorate and develop gummy substances on storage and having incorporated therein a methyl benzyl aminophenol, in quantity sufficient to inhibit said gum formation.

10. A motor fuel comprising cracked hydrocarbon distillates normally tending to deteriorate and develop gummy substances on storage and having incorporated therein para methyl benzyl aminophenol, in quantity sufficient to inhibit said gum formation.

11. The method of preserving cracked hydrocarbon distillates which normally tend to deteriorate and develop gums on storage which comprises incorporating therein a di(tolu benzyl) amino phenol in quantity sufficient to inhibit such deterioration and gum formation.

12. A motor fuel comprising cracked gasoline normally tending to deteriorate and develop gummy substances on storage and having incorporated therein 4-di(tolu benzyl) amino phenol, in quantity sufficient to inhibit such deterioration and gum formation.

CHESTER W. HANNUM.