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BENEFICIATION OF LOW VOLATILE
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land, Ohio, a corporation of OhioNo Drawing. Application June 28, 1940,
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10 Claims. (Cl. 252-47)

This invention relates to improvement of hydrocarbons, and particularly those which are to function as lubricants; and it is among the objects of the invention to provide increased resistance against break-down in usage involving drastic temperature or bearing pressure conditions or both. Other objects and advantages will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described, and particularly pointed out in the claims, the following description setting forth in detail certain illustrative embodiments of the invention, these being indicative however, of but a few of the various ways in which the principle of the invention may be employed.

I have found that if there be incorporated with a petroleum product a small amount of a compound containing a furan nucleus the properties are materially changed and improved. Such added compound may also contain nitrogen. Illustrative of desirable compounds are furfural, hydrofuranide, trifurfurylamine, and for some usages the reaction products of furfural with amines, etc. Furfural for example has two replaceable hydrogen atoms and these may be substituted by alkylation, yielding particularly desirable agents also for instance. The furan compounds may be incorporated in amounts of 0.01 to 1 per cent, or even up to 2 per cent, although such large amount is generally unnecessary.

I have found, peculiarly, that if in addition to the furan compound, there also be incorporated a small amount of phosphorus or a sulphide of phosphorus, as P_4S_3 , etc., the product has properties out of proportion to the mere additive effects of the respective substances. I have found also that with such combinations it is of great advantage to also include a small amount of a soluble ethanalamine, such as triethanalamine, as for instance 0.25 per cent or somewhat less. The amount of the phosphorus may be 0.001-0.25 per cent, and especially for example 0.01-0.05 in lubricating oils. P_4O_3 may be used in amounts of 0.001-2 per cent.

These products are outstandingly resistant against breakdown in high temperature usage, and in lubricants for instance are found to withstand high temperature engine usage with remarkably small change in body or viscosity and with very little deposit. They are found also to possess very marked extreme pressure or film-holding properties. There appears to be a unique

relationship between the furan compounds and hydrocarbons as distinguished from esters.

As an example: With a lubricating stock of S. A. E. 20 viscosity, of Mid-Continent source, there is incorporated 0.5 per cent of furfural. This product subjected to test in internal combustion engine conditions at a standard of 300° F. and time sixty-five hours, and free exposure to air at standardized rate, showed a viscosity increase of only 19, and lacquer deposit 7.4 mg., and naphtha insolubles 1.4 per cent, and appearance rating B plus (A being perfect or the initial un-changed oil). In contrast, the same stock of oil without the furfural, subjected to this test, showed a viscosity increase of 258, lacquer deposit 54.6 mg., naphtha insolubles 9.2, and appearance rating D.

As another example: With a similar oil there is incorporated 1.0 per cent of hydrofuranide. This product, tested like the foregoing showed a viscosity increase of 21, lacquer deposit 2.6, naphtha insolubles 2.4, and appearance rating B plus.

As another example: With a similar oil there is incorporated 0.25 per cent of hydrofuranide, and 0.05 per cent of P_4S_3 .

As another example: With a similar oil there is incorporated 0.5 per cent of trifurfurylamine.

As another example: With a similar oil there is incorporated 0.5 per cent of furfural, 0.05 per cent of P_4S_3 , and 0.25 per cent of ethanalamine.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A lubricant comprising a hydrocarbon oil of lubricating viscosity and a small amount of furfural, a small amount of an agent from the group consisting of phosphorus and phosphorus sulphides, and a small amount of a soluble ethanalamine.

2. A lubricant comprising a hydrocarbon oil of lubricating viscosity and a small amount of a compound containing the furan nucleus and nitrogen, a small amount of an agent from the group consisting of phosphorus and phosphorus sulphides, and a small amount of a soluble ethanalamine.

3. A lubricant comprising a hydrocarbon oil of lubricating viscosity and a small amount of a compound containing the furan nucleus and nitrogen, and a small amount of an agent from

the group consisting of phosphorus and phosphorus sulphides.

4. A lubricant comprising a hydrocarbon oil of lubricating viscosity and a small amount of trifurfurylamine, and a small amount of an agent from the group consisting of phosphorus and phosphorus sulphides.

5. A lubricant comprising a hydrocarbon oil of lubricating viscosity and a small amount of hydrofuramide, and a small amount of an agent from the group consisting of phosphorus and phosphorus sulphides.

6. A lubricant comprising a hydrocarbon oil of lubricating viscosity and a small amount of furfural, and a small amount of an agent from the group consisting of phosphorus and phosphorus sulphides.

7. A lubricant comprising a hydrocarbon oil of lubricating viscosity and a small amount of a compound containing the furan nucleus and nitrogen.

8. A lubricant comprising a hydrocarbon oil of lubricating viscosity and a small amount of trifurfurylamine.

9. A lubricant comprising a hydrocarbon oil of lubricating viscosity and a small amount of hydrofuramide.

10. A lubricant comprising a hydrocarbon oil of lubricating viscosity and a small amount of furfural.

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