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FLUSHING OIL

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4 Claims. (Cl. 252—162)

1

This invention relates to improved solvents. More particularly, this invention relates to improved solvents for removing sludge from the crankcases of internal combustion engines.

This application is in part a continuation of my copending application, Serial Number 334,741, filed May 13, 1940, now U. S. Patent 2,312,445, issued March 2, 1943.

The vast improvements that have recently been made in spark ignition internal combustion engines, for example, automotive and aviation engines, and in compression ignition engines such as Diesels, have intensified lubrication problems. With modern engines, crankcase temperatures are higher, bearing clearances are smaller, bearing loads are higher and bearing materials are different than in engines of older design. These changes, and many others, have made the proper lubrication of modern engines a problem of considerable difficulty.

Due to high crankcase temperatures, oxidation of the lubricant in modern engines is very severe. Frequently, the metals of modern bearing alloys act as catalysts and accelerate the rate of lubricating oil oxidation to a noticeable degree. The products of this oxidation reaction are apparently good emulsifying agents and result in the formation of sludge which consists largely of a lubricating oil-water emulsion containing the aforementioned oxidation products, carbon and carbonaceous particles, metal particles, dust and the like. This sludge is very deleterious, causing excessive bearing wear and even frequently plugs oil channels, thus stopping lubricant flow entirely. Additionally, this sludge collects on surfaces within the crankcase and gradually hardens into a mass which reduces heat transfer and has other bad effects.

Because of sludge formation and the bad effects thereof, it is good practice to remove periodically accumulations of sludge and the like from the crankcases of internal combustion engines. In the automotive field this is especially advisable in the spring and fall when changing to heavier and lighter grade lubricants respectively. To accomplish this, it has in the past been customary to circulate a sludge solvent or softener, usually in admixture with a light lubricating oil, through the otherwise empty crankcase, the engine being running or not, depending upon the exact construction thereof. The material recovered from the crankcase is usually filtered and recycled. In the past the finding of a convenient source of a good solvent for sludge and the like has been a problem.

2

An object of this invention is to provide improved solvents for removing sludge from the crankcases of internal combustion engines.

A further object of this invention is to provide an essential component of solvent mixtures for removing sludge from the crankcases of internal combustion engines.

Additional objects of this invention will become evident as the description thereof proceeds.

I have found that by using selected portions of the product formed in the catalytic reforming of heavy naphtha as a flushing oil or as a flushing oil component, highly efficient materials for the removal of sludge from the crankcases of internal combustion engines result.

The process of catalytically reforming heavy naphtha is now generally known to those skilled in the art and hence only a brief description thereof is necessary. In this process, a heavy naphtha, for example, a petroleum cut having an initial boiling point in the approximate range 200° F. to 250° F. and an endpoint in the approximate range 400° F. to 450° F., is contacted in the vapor phase under reaction conditions with a suitable catalyst. Operating temperatures are usually in the range 875° F. to 1050° F. In general, hydrogen is added to the heavy naphtha charge to the unit, from 1 to 5 moles of hydrogen being added per mole of heavy naphtha charge being used. It should be emphasized that this hydrogen is not essential and if used is not consumed (in fact, the catalytic reforming process produces hydrogen in large volumes). The addition of hydrogen results in many advantages, most important, perhaps, being a sharp reduction in the rate of decline in catalyst activity with time. The reaction is generally conducted under moderate superatmospheric pressure, for example, 100 to 300 pounds per square inch. As catalysts, 10% molybdenum oxide on activated alumina or 10% chromium oxide on activated alumina are commonly employed. The products from the reactor are separated and usually a portion of the hydrogen in the gaseous portion thereof is recycled to the reactor as previously mentioned. The

liquid products are fractionated, taking overhead a catalytically reformed gasoline of say 400° F. endpoint and eliminating higher boiling material as bottoms. These bottoms usually constitute from 2 to 5% of the total liquid product and boil up to about 750° F.

In a preferred embodiment of this invention, a portion of the above mentioned bottoms, for example, of approximately 400° F. to 500° F. boiling range, forms an especially suitable material for accomplishing the objects of this invention. The bottoms may be augmented or not, as desired, with a light lubricating oil. If a large yield of this solvent cut is desired, it may be desirable to charge a heavy naphtha of rather high endpoint, for example, in the range 450° F. to 475° F. to the catalytic reforming unit. In the preferred embodiment of this invention, a light lubricating oil, for example, a lubricating oil of 30 to 300 seconds S. U. viscosity at 100° F., preferably of about 100 to 200 seconds viscosity, is mixed with an appreciable amount, for example, 10% or more, preferably in the neighborhood of 25% to 50% or more of a portion of the above mentioned bottoms to form the desired flushing oil.

It has been customary to evaluate flushing oils on the basis of their kauri-butanol values. (For a description of the method for determining kauri-butanol values, reference may be had to Gardner, Physical and Chemical Examination of Paints, Varnishes, Lacquers, Colors. Washington, 1933, pages 692–3.) However, this determination is no absolute criterion of the value of a material for use as flushing oil or as a flushing oil component since many compounds of high or even infinite kauri-butanol value are of little use or absolutely useless as flushing oils or flushing oil components. The fundamental requirement of a flushing oil or an essential flushing oil component is obviously that it remove sludge. Experiments have shown that catalytic reformer bottoms or portions thereof are outstanding in this respect. A series of tests have shown that sludges removed from crankcases, sludges removed from oil filters as well as several standardized synthetic sludges are rapidly dispersed by catalytic reformer bottoms (24 seconds or less). While all portions of catalytic reformer bottoms are much more efficient in dispering sludge than any presently used materials for the purpose, it has been found that various portions of the catalytic reformer bottoms differ considerably in ability to disperse sludge, these differences being a function of the kauri-butanol values of the portions themselves. Thus, the lighter portions of the catalytic reformer bottoms, specifically, those boiling up to a tower top temperature of 475° F. are more efficient as flushing oils or flushing oil components than heavier portions, for example, those boiling from just above the already mentioned lighter portion up to a tower top temperature of 535° F. The kauri-butanol value of the lighter portion is well above 150, that of the heavier portion is somewhat above 100. A given volume of the lighter portion was able to disperse 5 times as much sludge as an equal volume of benzene while the heavier portion was able to disperse only 3.5 times as much sludge as an equal volume of benzene.

The following examples show a few specific solvents prepared in accordance with this invention.

Example 1

One volume of a portion of catalytic reformer bottoms having an A. S. T. M. distillation range of 415° F. to 495° F. and a kauri-butanol value of 125 was mixed with an equal volume of 200 seconds viscosity S. U. at 100° F. naphthenic oil. The mixture had a kauri-butanol value of 80 and was equal to benzene as a sludge dispersant.

Example 2

One volume of that portion of catalytic reformer bottoms taken overhead while the distillation tower top temperature ranged from 410° F. to 470° F. and having a kauri-butanol value of 165 was mixed with three volumes of the 200 seconds viscosity oil mentioned in Example 1. The kauri-butanol value of the mixture was somewhat above 60. The resulting mixture, while not as efficient in dispersing sludge as the mixture of Example 1, was highly effective.

Example 3

The crankcase of a 1941 car with eight cylinders in line was drained when the speedometer indicated slightly more than 15,000 miles. The oil pan was removed. This had patches of rather soft sludge here and there on the surface thereof. The oil screen was partially blocked. The pan was replaced and 5 quarts of the mixture of Example 2 were added. After running the engine for 30 minutes, the flushing oil was drained and the pan again removed. It was covered with a thin layer of dark sediment and oil easily removed with a rag. The screen was clean.

Example 4

The mixture of Example 1 was pumped cold through an old oil filter. The exit material was filtered to remove sediment and water and was then recycled. After passing the equivalent of 10 gallons of the flushing oil through the filter the exit oil was free from sediment and haze due to water.

Similarly, catalytic reformer bottoms or portions thereof afford excellent high solvency naphthas although in general these materials boil within the usual gasoline range; one such high solvency naphtha, for example, boils in the approximate range 345° F. to 405° F. Obviously, if desired, such a fraction can be eliminated as bottoms, taking overhead a rather low endpoint gasoline. If desired, a rather high endpoint heavy naphtha may be charged to the catalytic reformer and sludge solvent may be eliminated as bottoms, taking a high solvency naphtha off as a side cut from the tower. As is well known to those skilled in the art, high solvency naphthas are much used in the formulation of paints, lacquers and the like.

Be it remembered that while the instant invention has been described by means of certain examples thereof it is to be understood that these are illustrative only and the scope of said invention is to be in no way limited to the disclosures of such specific examples thereof.

I claim:

1. A flushing oil for cleaning the crankcases of internal combustion engines comprising, a fraction from the products of the catalytic reforming of heavy naphtha, said fraction boiling within the approximate range 400° F. to 535° F. and exhibiting a kauri-butanol value in excess of 100.

2. A flushing oil for cleaning the crankcases of internal combustion engines comprising, a

fraction from the products of the catalytic reforming of heavy naphtha, said fraction boiling in the approximate range 400° F. to 535° F. and exhibiting a kauri-butanol value in excess of 100, in admixture with a mineral lubricating oil.

3. A flushing oil for cleaning the crankcases of internal combustion engines comprising a fraction boiling within the approximate range 400° F. to 500° F. from the catalytic reforming of heavy naphtha and exhibiting a kauri butanol value in excess of 100 in admixture with a mineral lubricating oil having a viscosity within the range 30 to 300 Saybolt Universal seconds at 100° F.

4. A flushing oil for cleaning the crankcases of internal combustion engines comprising a fraction boiling within the approximate range 400° F. to 500° F. from the catalytic reforming of heavy naphtha and exhibiting a kauri butanol value in excess of 100 in admixture with a mineral lubricating oil having a viscosity within the range 100 to 200 Saybolt Universal seconds at 100° F.

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