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PROCESS OF TREATING LUBRICATING
OILS WITH PHENOL AT HIGH TEMPER-
ATURES

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The present invention relates to a process of treating lubricating oils with phenol and will be fully understood from the following description:

In my prior Patent 1,860,823, issued on May 31, 1932, a process for treating lubricating oils has been described, comprising agitating the oil with undiluted liquid phenol below the temperature at which the phenol becomes completely miscible with the oil, settling, separating the oil layer from the phenol layer, and removing absorbed phenol from the oil layer. This treating process improves the gravity of the oil, reduces the sulfur content and also greatly improves the so-called viscosity index. The viscosity index is determined by the method described in the article entitled "Viscosity variations of oils with temperatures" by E. W. Dean and G. H. B. Davis, in the Chemical and Metallurgical Engineering, October, 1929 number. This index is a measure of the ability of a lubricating oil to remain viscous at high temperatures; as well known oils lose rapidly their viscosity with increase in temperature. The oil with a high viscosity index will, however, lose its viscosity less rapidly than an oil with a low viscosity index when the temperature is increased. Good grade Pennsylvania lubricating oils have a viscosity index of 100. The present invention is an improvement of the process described in my above mentioned patent which allows obtaining especially good results with high viscosity and high viscosity index stocks. Some of the advantages of the process are, however, obtained with stocks which do not belong to this class.

Prior treatments with phenol have usually been carried out at temperatures above, say, 110° F. and below about 180° or 200° F. I have discovered that certain stocks, such as the high viscosity and viscosity index lubricating stocks above mentioned, are preferably treated at temperatures higher than about 220° F. Treating temperatures of 250° F. or even higher give very good results with such stocks. By treating a Mid-Continent steam refined stock at 180° F. it was only possible to obtain a viscosity index improvement to about 95. By increasing the treating temperature to over 200° F. it was possible to obtain a viscosity index of 100, this being accomplished with less phenol and giving a greater yield of treated oil than with a low temperature yield. The principal advantages of high temperature phenol treating are the following:

1. The viscosity index shows a more pronounced improvement.

2. The carbon residue, which is measured by the so-called Conradson carbon test, is materially decreased.

3. In many cases the viscosity at 210° F. of the treated oil is increased above that of the charge. This phenomenon is quite extraordinary since in phenol treating processes the viscosity at 210° F. of the treated stock is usually lower than that of the untreated stock.

4. The settling time is reduced.

The reduction of the settling time is very important for the practical operation of the process, since an unduly long settling time will considerably reduce the capacity of the treating unit, as is easily understood. Very pronounced improvement of the viscosity index is also an important factor in my present process, especially in cases where this improvement can not be obtained by other means.

The present process is preferably carried out with undiluted phenol, although small amounts of other organic solvents, whether selective or non-selective, may also be present. Thus, for example, other phenolic bodies, such as cresols, may be admixed with the phenol but only in such proportions as not to reduce the miscibility temperature of the phenol with the oil too far, since too much reduction of the miscibility temperature will make a high temperature treatment impossible. The phenol may also contain extract removed from the oil in a prior treating step.

In some cases where the viscosity index of the stock is not sufficiently high to permit treating with 100% phenol, the use of small quantities, such as per cent of water, alcohol, glycerol, or glycol, etc. in the phenol will make the treating successful. Such diluents lower the absorption power of the phenol so that equivalent yields can be obtained as with a lower temperature treat.

The details of the high temperature phenol treating operation are very similar to those described in my prior patent. The oil is agitated with the phenol and then allowed to settle until the separation of the two layers takes place. The phenol layer is then separated from the oil layer and the phenol is removed from both layers by means of distillation or other means. The treating may be carried out in batch or in continuous operation. The oil may also be given several batch treats, in which case the counter-current principle is advantageously applied. The amount of phenol used may vary considerably, say from 50% to 300%.

The following example will illustrate my process:

A steam reduced Pennsylvania lubricating stock is given six 50% batch treats with phenol of 104 melting point at 200° F. and another sample of the same stock is similarly treated at 250° F. The settling times and the yields are the following:

Batch No.	Treating temperature 200° F.	Treating temperature 250° F.
1.....	40 minutes..	45 minutes
2.....	4 hours.....	15 minutes
3.....	4½ hours.....	55 minutes
4.....	40 minutes..	20 minutes
5.....	35 minutes..	35 minutes
6.....	50 minutes..	35 minutes
Yield dephenolized oil.....	68%	32%

The inspection data of the untreated and the treated oils are as follows:

	Untreated oil	Treated at 200° F.	Treated at 250° F.
Gravity ° A. P. I.....	24.7	27.6	27.7
Flash, ° F.....	590	610	-----
Vis. Saybolt at 130° F.....	1527	1188	1206
Vis. Saybolt at 210° F.....	230	201	243
Viscosity index.....	104	107	121
Pour/solidific. point, ° F.....	30/25	30/25	40/35
Conradson, carbon, percent.....	3.19	1.70	1.40

This comparative table shows that while a treating temperature of 200° F. improves the viscosity index from 104 to 107 only, the same index is improved to 121 when the treating is carried out at 250° F. Also, the Conradson carbon residue is lower for the oil which has been treated at high temperature. The table furthermore illustrates the fact that the high temperature treat increases the viscosity of the treated oil at 210° F. over that of the untreated oil. Finally, the settling times are much shorter at

250° F. than at 200° F. The yield of finished oil is lower for the 250° F. treating temperature than for 200° F. This, however, is more than counterbalanced by the other advantages obtained in the high temperature treat.

The present invention may be modified in different ways and is therefore not to be limited by the example given for illustration, but only by the following claims in which it is my intention to claim all novelty inherent in the invention.

What I claim is:

1. The process of treating hydrocarbon lubricating oil stock of high viscosity index, which comprises agitating the oil with a liquid phenol at a temperature above about 220° F. and below the temperature at which the phenol becomes completely miscible with the oil, separating the oil layer from the phenol layer, and removing absorbed phenol from the oil layer.

2. Process according to claim 1 in which the hydrocarbon lubricating oil is a high viscosity stock.

3. Process according to claim 1 in which the phenol contains a small amount of diluent.

4. Process according to claim 1 in which the treating is carried out at a temperature of about 250° F.

5. The process of treating hydrocarbon lubricating oil stock of high viscosity index, which comprises agitating the oil with undiluted liquid phenol above a temperature of about 220° F. and below the temperature at which the phenol becomes completely miscible with the oil, separating the oil layer from the phenol layer, and removing absorbed phenol from the oil layer.

6. Process according to claim 5 in which the hydrocarbon lubricating oil is a high viscosity stock.

7. Process according to claim 5 in which the treating is carried out at a temperature of about 250° F.

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