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2,955,084

PROCESS OF TREATING HYDROCARBONS AND PRODUCT

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This invention relates to a process of improving hydrocarbon stocks, such as lubricating oil stocks, asphalt stocks, etc. by treatment thereof with a base in the presence of air, and to the resulting products obtained by this process.

Many of the commercially used lubricants are formed from hydrocarbon base stocks which are derived from natural sources, such as petroleum. For many purposes, so-called additives must be included with the hydrocarbon base stock in order to provide a lubricant having desirable characteristics, particularly detergency. The solvent-extracted oils, for example, are generally provided with two additives or a multi-functional additive in order to impart corrosion inhibition and other desirable lubricant characteristics. The addition of these additives is associated with a higher cost of the finished lubricant. The preparation of a lubricant directly from the hydrocarbon base stock by chemically finishing or refining the entire stock to provide the wanted properties at a commercially interesting cost has been a particularly baffling problem.

Similarly, a number of additives have been developed for addition to asphalt to improve its properties, especially its adherence to aggregate. However, the preparation of an asphalt directly which has satisfactory adhesion has been an unsolved problem.

It has been proposed heretofore that hydrocarbon base stocks be oxidized with the aid of oxidizing agents in the presence of air followed by neutralization. While such oils are useful, for instance, as soluble oils, they are unsatisfactory as lubricating oils since in many instances their oxidation instability is very great. The oxidized product may contain peroxides, which are usually harmful for engine use. Further, oxidized oils obtained by such a process have a strong odor.

In accordance with this invention, a hydrocarbon stock is treated with a base in the presence of oxygen. In the case of a lubricating stock the product has qualities desirable in detergent lubricating oils. The products have a high detergency and surprisingly good oxidation stability, showing that the product is different from that resulting from the ordinary oxidation process followed by neutralization. In the case of asphalt stocks the product has better adhesivity. Evidently the process proceeds in a somewhat different way, and may be characterized as a mild, controlled oxidation in an alkaline medium.

The reaction of the hydrocarbon base stock with the base may be conducted with direct admixture of the reactants or, if desired, by their admixture in the presence of a diluent which may be subsequently removed, but a diluent is not necessary. The reaction is usually complete in about two hours or less time, generally from one to two hours. The reaction time is a function of the temperature, the amount of oxygen, the amount of base that is to react, the nature of the oil, the subdivision of the reactants, and the efficiency of mixing.

The hydrocarbon stock is reacted with the base in any desired amount, depending on the weight of the stock. Desirably between about 0.5 and about 2% base would

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be used, where a clear product is desired. If a cloudy material can be tolerated, then much more base can be used, e.g., 3% or more, and in fact there is no upper limit except that more than will react with the oil would not be used, of course. Generally at least about 1% should be used to achieve the beneficial properties due to increase in ash content, although smaller amounts show appreciable improvement.

If the hydrocarbon stock is relatively unreactive, it may be helpful to include a small amount of water in the reaction mixture. Water increases the ash content of the stock, from which it is concluded that water increases the extent of the reaction with the oil. Any amount of water will improve the product but usually from 0.25 to 25% water would be used.

The treatment of the stock with the base is carried out in the presence of oxygen, and no definite upper limit can be placed on the amount of oxygen which is used although more oxygen would be used in the case of the more highly paraffinic stocks. Pure oxygen can be used, and also oxygen liberated from oxidizing agents, but air is preferred because of cost and ease of introduction into the reaction mixture, which can be regulated to suit the convenience and govern the foaming of the reaction mixture. In general, the more oxygen or air that is employed, the further the reaction will proceed, and in the case of oils, the higher the ash content of the oil, until the limiting point when all of the components of the oil which are reactive with the base will have been taken up. This will vary with the oil. From 0.17 to 6 liters of air per 100 grams of oil per hour have been used with excellent results. If desired, inert gases such as hydrogen, nitrogen or carbon dioxide can be blended with the oxygen or air, but this is not necessary. The reaction can be carried out under pressure, e.g., the pressure generated when a closed vessel is used.

The reaction temperature will vary to some extent with the hydrocarbon stock. Generally, the temperature of the reaction should be about 350° F., but should be below the temperature at which the reaction product would be decomposed and below the boiling point of the stock. This is a limitation on the lower boiling point of the stock as well. A temperature of about 350° F. has been found in many cases to give an optimum improvement in the ash content of the oil and therefore is preferred. The treated oil is preferably centrifuged or filtered to remove sludge and by-products. If a volatile diluent is used, it can be removed by evaporation.

The hydrocarbon oil stock to which the process is applied can be any available hydrocarbon stock of low or high boiling point and low or high viscosity. The reaction temperature is established by the boiling point of the stock, and vice versa, to minimize loss of volatiles, but low boiling stocks can be reacted as well under pressure to minimize this loss. If a high viscosity material is disadvantageous, the viscosity can be cut by addition of a diluent.

Solvent-extracted and solvent-refined oils, i.e., oils treated in accordance with conventional modern methods of solvent-refining lubricating oils, can be used when a product having lubricating properties is desired. Asphalt stocks can be used in the production of asphalt cement, cutback asphalt, and asphalt emulsion bases having an increased ash content and, in many instances, an improved resistance to stripping. Lubricating oil stocks also can be used in the production of greases using the oil treated in accordance with the invention. In the preparation of such greases, smaller amounts of the gelling agent are required to thicken the oil to the desired grease viscosity, particularly when inorganic gelling agents are used, such as the silica aerogels, fumed silica, colloidal silica, clays, and the like. When the base is a

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lubricating oil stock, it may have a viscosity at 100° F. of 10 to 500 centistokes, such as is used as the base for the SAE Nos. 10 to 50 oils. In addition the bright stocks having a viscosity up to 6000 SSU at 100° F. may be used. The oil may be obtained as a distillate or from synthetic material, such as petroleum and oils produced by cracking, polymerization, hydrogenation and the like methods.

There is some evidence that oils with some aromatics, that is the ordinary solvent-refined or lightly acid-treated oils, are more desirable than the highly paraffinic oils such as white oils. The aromatic oils are more reactive with the base and will react satisfactorily in the presence of limited amounts of oxygen, such as while nitrogen

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compound is not critical, and flake potassium hydroxide which contains 12% water is used in the examples.

In order to illustrate and point out some of the advantages of the invention, but in no sense as a limitation thereof, the following specific embodiments are included:

EXAMPLES 1 to 9

The hydrocarbon oils listed in the table below were reacted with 1.2% by weight of flake potassium hydroxide (containing 12% water) for 2 hours at 350° F. Throughout the reaction, nitrogen gas was blown through the mixture. The mixture was exposed to air which may have been drawn in by the vortex action of the stirrer. The results were as follows:

Table I

Example	Oil	Aniline Pt., ° F.	Percent Yield	Percent SO ₂ -Ash	OD	pH	Alkaline number	
							Strong	Total
1	SAE No. 20 lubricating oil, solvent-refined.		97.7	0.905	17.5	12.82	1.25	4.99
2	Solvent-extracted bright stock 78 SSU at 210° F.	255	92.6	0.884	23.2	12.25	0.40	4.98
3	Solvent-extracted neutral oil 300 SSU at 100° F.	238	98.1	0.884	4.4	12.35	1.38	4.12
4	Solvent-extracted neutral oil 140 SSU at 100° F.	222	98.1	0.750	5.4	12.55	1.30	3.96
5	A highly paraffinic hydrocarbon oil.	188.7	95.5	0.650	6350	11.95	0.79	3.95
6	Acid-treated neutral red oil 300 SSU at 100° F.		94.8	0.615	3920	13.15	0.94	3.68
7	A light white oil having a low proportion of aromatics		88.7	0.195	1.5	11.85	0.26	1.13
8	Paraffin wax		96.2	0.005		Insoluble		

alone is blown through the mixture so that the amount of oxygen present is very limited. Oils which have a lower aromatic content, such as light white oil, and similar paraffinic oils, will react adequately if air is blown through the mixture either with or without nitrogen. An ash-containing sludge which may form in some instances when the highly paraffinic oils are reacted appears to be formed when aromatic oils are treated but does not precipitate because it is more soluble in such oils. This is interpreted as meaning that the insoluble material is aromatic in nature. If this soapy material is less soluble in the oil, then of course the final product will have a lower final ash content.

A more highly aromatic oil for treatment can be obtained synthetically by recovering the aromatic fraction from other oils and blending it with the stock to be treated in any desired proportion.

Asphalt contains a high proportion of aromatics largely in the form of condensed rings. The preferred stock used in the process therefore should have at least some aromaticity, as distinguished from aromatics-free stocks such as paraffin wax.

The base employed is any metal compound reactive with hydrocarbon oils. The preferred metal compounds are those of groups I, II and III of the periodic table, such as potassium, zinc, barium and aluminum, especially the alkali and alkaline earth metals. The hydroxides and oxides of these metals are useful, but it may be possible in some instances also to use the sulfides, carbides, cyanamides and other salts reactive with the oil. Sodium hydroxide, lithium hydroxide, barium hydroxide, potassium hydroxide and potassium carbonate are illustrative. Potassium hydroxide has been used in flake form in many of the following examples in order to study the effect of other variables. The water content of the base

These results show that the aromatic oils (solvent-refined or lightly acid-treated) of Examples 1 to 4 and 6 are somewhat more reactive than the paraffinic oils with a low aromatic content, such as the oils of Examples 5 and 7. Paraffin wax did not yield a soluble product. However, adequate reactivity of all of the oils tested with the potassium hydroxide was obtained. Those oils which did not react as completely would react more completely if the amount of air present were increased, in other words, if air were blown through the mixture rather than nitrogen.

To 600 grams of a light white oil was added 1.2% flake KOH (12% water) and the mixture reacted for 2 hours at 350° F. During the reaction 2½ liters of air per 100 grams of oil per hour were blown through the mixture. The yield was 84% of a product (Example 9) having an OD of 1.8, a pH of 12.2, an alkaline number of 2.50 and containing 0.425% ash.

These results show that some reaction with the light white oil is obtained when air is blown through the reaction mixture. These results should be compared with Example 7, where very little reaction occurred in the absence of air blowing.

The products obtained in the above experiments were useful as detergent lubricating oil bases.

EXAMPLES 10 TO 15

The following experiments were carried out to show the effect of potassium hydroxide concentration on the reaction. A solvent-extracted neutral oil, 300 SSU at 100° F., was employed. The reaction time was 2 hours, and the temperature 350° F. The reaction mixture was blown with nitrogen throughout, keeping the amount of air at a minimum. The amount of potassium hydroxide (flake, 12% H₂O) used was as indicated in the table.

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Table II

Example	Percent KOH	Percent Yield	Percent SO ₄ =Ash	OD	pH	Alkaline Number	
						Strong	Total
10-----	0.8	97.7	0.655	9.6	13.32	0.76	3.20
11-----	1.2	98.1	0.884	4.4	12.35	1.38	4.12
12-----	2.0	90.2	0.650	5.4	12.10	1.11	3.51
13-----	2.0	-----	1.075	7.5	12.13	0.52	6.36
14-----	3.0	-----	0.726	4.8	12.00	0.38	4.23
15-----	5.0	-----	0.756	10.7	12.10	0.21	4.39

¹ Centrifuged to remove insoluble material, not filtered.

These results show that when increasing amounts of potassium hydroxide were employed, more and more insoluble material was formed. This insoluble material was soapy in nature, containing potassium, and resulted in a lower final ash content, showing the potassium was not going into the desired product. It is evident that no advantage from the standpoint of ash increase was obtained when more than 2% potassium hydroxide was used. The products obtained after reaction with 2, 3 and 5% potassium hydroxide were difficult to filter but can be readily centrifuged.

It is thought that these insolubles appear because of

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tions. In these experiments, filtration was rapid even where very high amounts of base were used.

Table III

Example	Percent KOH	Percent SO ₄ =Ash	OD	pH	Alkaline Number	
					Strong	Total
16-----	2.0	0.818	24.5	11.90	0.56	4.49
17-----	5.0	1.520	12.6	15.13	2.20	8.77
18-----	8.0	1.820	18.9	11.89	1.43	10.46

It is evident that 8% potassium hydroxide does not represent the upper limit of amount of base which can be used with aromatic oils.

EXAMPLES 19 TO 23

The following examples were carried out to demonstrate the effectiveness of various bases in the reaction of the invention.

A solvent-extracted neutral oil, 300 SSU at 100° F. (600 g.) was employed. The reaction time was 2 hours and the reaction temperature was 350° F. The reaction mixture was blown with nitrogen throughout, keeping the amount of air at a minimum. The amount of base used was as indicated in the table:

Table IV

Example No.	Base	Moles ¹	Percent Yield	Percent Ash (SO ₄ -)	OD	pH	Alkaline No.
19-----	Flake KOH-----	0.113	98.1	0.884	4.4	12.35	4.12
20-----	Pellet KOH-----	0.113	97.2	0.325	6.5	11.99	1.55
21-----	K ₂ CO ₃ -----	0.113	93.8	0.305	89.4	10.17	1.12
22-----	Pellet NaOH-----	0.113	98.2	0.225	78.5	9.27	0.57
23-----	LiOH·H ₂ O-----	0.113	97.3	0.125	30.0	9.44	0.49

¹ 600 g. oil charge.

the presence in the oil of non-aromatic fractions which are poorer solvents for the soaps than are the aromatic oils. These results should be compared with the results in the following examples.

EXAMPLES 16 TO 18

The following experiments were carried out with the aromatic fraction of a solvent-extracted neutral oil, 140 SSU at 100° F. This fraction was obtained by passing a pentane solution of the oil through silica gel, whereby the aromatics were adsorbed on the gel. The gel was eluted with benzene and the aromatic fraction obtained reacted with the amounts of the potassium hydroxide (flake, 12% H₂O) indicated in the table. The time of reaction was 2 hours and the temperature 350° F. The reaction mixture was blown with nitrogen throughout the reaction.

The results show that increasing the amount of potassium hydroxide in this case increased the ash content. This confirms that the non-aromatic fractions are poorer solvents for the soaps formed by the reaction of the invention than are the more highly aromatic frac-

These results show that potassium carbonate, sodium hydroxide and lithium hydroxide are effective since the products had a high pH and a relatively high alkaline number. The potassium carbonate most nearly approaches potassium hydroxide in effectiveness but sodium hydroxide and lithium hydroxide also are satisfactory. The ash contents of these products are comparable. Flake potassium hydroxide (12% water) was the most effective of the bases used.

EXAMPLES 24 TO 26

The following experiments were carried out to show the effect of water during the course of the reaction. The base used was barium hydroxide containing varying amounts of water. A solvent-extracted neutral oil, 300 SSU at 100° F., was used (600 grams). The reaction time was 2 hours and the temperature 350° F. The reaction mixture was blown with air (1 liter per 100 grams of oil per hour) throughout the reaction time and then stripped by blowing with air at the rate of 2.67 liters per 100 grams of oil per hour. The amount of barium hydroxide used was as indicated in the table:

Table V

Example No.	Base	Moles	Percent Yield	Percent Ash (SO ₄ -)	OD	pH	Alkaline No.	Detergency
24-----	Ba(OH) ₂ ¹ -----	0.1015	90.7	0.150	18.4	8.83	0.50	1.6
25-----	Ba(OH) ₂ ·8H ₂ O ¹ -----	0.1286	92.7	0.320	37.5	7.56	0.19	1.4
26-----	Ba(OH) ₂ ·8H ₂ O ¹ + 3% H ₂ O-----	0.1286	81.0	1.120	195.0	9.90	3.40	4.0

¹ Air stripping, 2.67/100 g. oil/hr.

The results show that the greater the amount of water in the reaction mixture, the greater the extent of the reaction. The ash content of the product with the most water (Example 26) is ten times that of the product prepared without added water (Example 24) and the alkaline number is seven times the number of the latter. The detergency also is greater.

EXAMPLES 27 TO 30

These experiments show the influence of reaction tem-

Thus it is evident that reaction time is a function of reaction temperature (cf. Examples 27 to 30).

EXAMPLES 35 TO 42

The reaction of potassium hydroxide with a solvent-extracted oil, 300 SSU at 100° F., was studied to determine the influence of air. The reaction was carried out at 350° F. for 2 hours, using 1.2% potassium hydroxide and blowing with nitrogen throughout, with the introduction of the amount of air indicated in the table.

Table VIII

Example	Air, liters	Air, liters per 100 grams per hour	Percent Yield	Percent SO ₄ =Ash	OD	pH	Alkaline No.	
							Strong	Total
35	0	0	95.5	0.070	37.0	10.96	0.00	0.24
36	2	0.165	96.9	0.285	28.7	12.19	0.10	1.61
37	4	0.33	97.6	0.505	14.6	12.09	0.15	2.79
38	8	0.66	95.7	0.515	26.8	19.94	0.20	2.88
39	16	1.33	95.8	0.675	11.6	12.21	0.40	4.04
40	32	2.66	92.5	0.820	10.0	12.62	0.56	4.98
41	48	4.00	94.6	0.40	5.6	11.64	0.51	2.59
42	64	5.32	93.8	0.34	5.4	11.55	0.26	1.45

perature. Potassium hydroxide (flake, 12% H₂O) was reacted with a solvent-extracted neutral oil, 300 SSU at 100° F., for 2 hours. The amount of potassium hydroxide was 1.2% in each experiment, and the reaction mixture was blown with nitrogen throughout.

Table VI

Example	Temp. ° F.	Percent Yield	Percent SO ₄ =Ash	OD	pH	Alkaline Number	
						Strong	Total
27	200	96.7	0.035	8.2	10.61	0.00	0.16
28	275	98.3	0.185	12.0	11.00	0.01	0.83
29	350	98.1	0.884	4.4	12.35	1.38	4.12
30	400	96.0	0.560	17.6	13.00	0.49	2.66

¹ Cloudy.

These results show that the optimum temperature is 350° F., at which temperature the reaction is essentially complete after 2 hours. At lower temperatures, a longer time would be required for completion. At higher temperatures, the ash content appears to be slightly reduced.

EXAMPLES 31 TO 34

To show the importance of reaction time, 1.2% potassium hydroxide was reacted with a solvent-extracted neutral oil, 300 SSU at 100° F., for the time indicated in the table. The reaction temperature was 350° F. and the reaction mixture was blown with nitrogen throughout.

Table VII

Example	Time (hrs.)	Percent Yield	Percent SO ₄ =Ash	OD	pH	Alkaline Number	
						Strong	Total
31	0.5	97.3	0.087	7.1	11.01	0.00	0.35
32	1.0	96.1	0.600	11.6	12.02	0.17	3.44
33	2.0	98.1	0.884	4.4	12.35	1.38	4.12
34	5.0	90.3	0.820	21.4	10.72	0.0	3.62

These results show that the reaction is essentially complete after 2 hours at 350° F. Further reaction for as long as five hours tends actually to reduce the ash content.

EXAMPLES 43 TO 47

Because of the general unsuitability of oxidized oils it could not be predicted that the reaction product of the invention would possess qualities desirable in detergent lubricating oils notwithstanding the high ash content. Test results using the Polyveriform Test as described in Patent No. 2,464,233 were therefore run.

Although a corrosion and oxidation inhibitor would have to be added, the results below show that the potassium hydroxide treatment has not adversely affected the other properties of the base oil. This is unexpected inasmuch as products obtained by oxidizing oils using a conventional oxidation process followed by neutralization are unsatisfactory as lubricating oils. This is shown by Example 45 in the table below:

Table IX

Example No.	Oil of Example 1 (Untreated)	Oil of Example 1 (KOH-treated)	Oxidized SAE 30 Oil	Oil of Example 3 (Untreated)	Oil of Example 3 (KOH-treated)
43	44	45	46	47	
Cu-Pb corrosion, mgms.	19.3	28.9	30.7	227.4	82.4
Vis. increase, SSU at 100° F.	170	68.7	825	126	263
Neut. No.	3.92	0.84	12.0		
Percent C ₁ -insolubles	0.57	0.21	5.97	0.025	0.029
Sludge rating	A	A	A	A	A
Lacquer rating	A	A	A	A	A

Example 44 is superior to 43 in oxidation stability (viscosity increase and neutralization number). Example 47 is superior to Example 46 in corrosion inhibition. In neither 44 nor 47 are the other properties too adversely affected.

Example 45 was prepared from 30% of a lime-neutralized SAE No. 30 oil which had been oxidized for 8 hours at 285° F. in the presence of 0.2% manganese

Uversol (naphthenate) and 0.2% sodium carbonate. This oil was very poor in oxidation stability, evidenced by the high viscosity increase and neutralization number. This shows the treatment of the invention results in a reaction different from an oxidation.

These tests are not intended to show the detergency of the oil. They are intended to show only that the treatment does not adversely affect the properties measured by the Polyveriform Test.

In order to show the detergency of the oil it was subjected to a dispersancy test, which consists in determining the highest weight of carbon black which a 5% solution of the oil in benzene will hold in suspension. This test is carried out as follows: A 5% by volume solution of the oil in benzene is prepared and 100 ml. of this solution is placed in a 100 ml. glass-stoppered graduate. 0.2 gram of carbon black is added and the graduate shaken for 15 seconds. The mixture then is observed in front of a light source for a break point which marks the interface between the settled carbon particles and the suspension, and is seen as a thin layer of completely transparent liquid containing no carbon particles which travels down the graduate as the carbon particles settle. The graduate is allowed to stand for 5 minutes and the weight of carbon black increased by 0.2 gram additions each 5 minutes thereafter until a break point appears. The highest weight carbon black which does not produce a break point is a measure of the dispersancy.

In this test the oil of Example 33 had a dispersancy of 2.6. The untreated oil had a dispersancy of 0.2.

EXAMPLE 48

The following example illustrates the preparation of a grease employing an oil treated with potassium hydroxide in accordance with the invention.

The oil base stock used was a solvent-extracted neutral oil having a viscosity of 2,000 SSU at 100° F. The oil was reacted with 2% by weight of flake potassium hydroxide (12% water) for 2 hours at 350° F. while blowing 1 liter of air per 100 grams of oil per hour through the reaction mixture. The product contained 0.74% ash and had a pH of 13.03 and an alkaline number of 4.39.

Two greases were prepared, one using the oil treated as set forth above and the other using the untreated oil according to the following formulation:

Table X

Percent components:	
9.0 Santocel ARD (silica aerogel) -----	72.0
0.9 Amine "O", 1- β -hydroxyethyl-2-heptadecenyl imidazoline -----	7.2
1.0 Paratac, ¹ high molecular weight isobutylene polymer -----	8.0
0.5 Parafflow, ² a hydrocarbon wax naphthalene condensate of the Friedel-Crafts type ----	4.0
0.5 Ortholeum 300 ³ a mixture of complex organic amines having both antioxidant and metal-deactivating properties -----	4.0
88.1 Oil (463-100) -----	704.8
	800.0

¹ Vis. at 210° F., S.S.U. -----	1300
Flash point, ° F. -----	400
Pour point, ° F. -----	10
Specific gravity, 60/60° F -----	0.892
² Vis., 210° F., S.S.U. -----	110
Flash point, ° F -----	450
Pour point, ° F -----	20
Conradson carbon, wt. percent -----	0.889
Specific gravity, 60/60° F -----	0.889
³ Appearance -----	Brown flakes.
Melting range, ° F -----	125-160.
Miscibility with oils and greases -----	In all proportions above 160° F.

The greases thus obtained were tested with the following results:

Table XI

	KOH Treated Oil	Comparable Oil—Untreated Oil
Initial Shell Pen.	107	127
24 hr. Shell Pen.	71	125
ASTM Pen:		
Strokes worked:		
0 -----	207	283
60 -----	233	291
2500 -----	254	
After standing 7 days ASTM Pen.	198	
Dynamic H ₂ O Stability Initial Pen.	71	
600 Strokes, 100% H ₂ O -----	(1)	

¹ Inverted (soupy).

The results show that a stiffer grease is obtained using the potassium hydroxide-treated oil in accordance with the invention. Thus, it is possible to use less silica aerogel to obtain a grease of comparable consistency using the oil treated in accordance with the invention.

EXAMPLE 49

Asphalt cement was reacted with 1.2% potassium hydroxide (flake, 12% H₂O) for 2 hours at 350° F. The reaction mixture was blown with nitrogen throughout. To remove unreacted potassium hydroxide, the mixture was allowed to stand for 1 hour at 350° F. and then decanted. The results were as follows:

Table XII

	Asphalt Cement	
	Untreated	KOH Treated
pH -----		14.74
Alkaline number:		
Strong -----		4.81
Total -----		11.69
Stripping test, percent coated -----	40	96
R & B softening point (° F.) -----	113	156
Pen at 77°-100 g.—5 sec. -----	78	33
Pen at 100°-100 g.—5 sec. -----	226+	72
Pen at 32°-200 g.—60 sec. -----	23	18
Duct. at 77°-5 cm./min -----	100+	13
Duct. at 60°-5 cm./min -----	65	5.5

A true reaction with the base rather than a solution or dispersion was shown by the absence of carbon disulfide insolubles.

In order to take into account the decrease in penetration during reaction, a higher penetration asphalt would be used as a starting material to yield a final product of satisfactory penetration.

The asphalt cement showed high antistripping activity. The product remained 96% coated after the test.

In addition to the uses illustrated in the examples, the treated oils of the invention are suitable bases for engine preservative oils, transformer oils and gear oils. The improved lubricants prepared from lubricating oil base stocks can be used in blends together with other lubricants or lubricant addition agents, e.g., with soap or the like in the grease, or with the addition of corrosion inhibiting lubricating oil additives for use as a lubricating oil. If desired, an agent for improving clarity can be added, for example lecithin, lauryl alcohol and the like. An agent for preventing foaming can be included, such as tetraamyl silicate, an alkyl orthocarbonate, orthoformate or orthoacetate, or a polyalkyl silicone oil.

The oils can also be used as cutting and grinding oils and as soluble oils. In these uses they are free from the characteristic odor of ordinary oxidized oils either before or after neutralization. They are thus not found objectionable by workmen using them with metal cutting machines where odor is a problem because the oil is exposed.

In view of the foregoing disclosure, variations and modifications of the invention will be apparent to those

skilled in the art, and it is intended to claim such variations and modifications broadly except as do not come within the scope of the appended claims.

We claim:

1. A method of processing hydrocarbon base lubricating oil having a viscosity at 100° F. of from 10 to 500 centistokes to yield a product having a higher ash content and a greater detergency which comprises reacting the oil with an amount within the range from about 0.5 to about 3% by weight of the oil of a strong metal base selected from the group consisting of metals of groups I and II of the periodic table at about 350° F. for a time sufficient to effect reaction but less than two hours while blowing with nitrogen in the presence of oxygen.
2. A process in accordance with claim 1 in which the oil is a solvent-refined lubricating oil.
3. A process in accordance with claim 1 which includes blowing the reaction mixture with air during the reaction.
4. A process in accordance with claim 1 in which the base is a potassium base.
5. A process in accordance with claim 1 in which the base is a barium base.
6. A method of processing hydrocarbon base lubricating oil having a viscosity at 100° F. of from 10 to 500 centistokes to yield a product having a higher ash content

and a greater detergency which comprises reacting the oil with an amount within the range from about 0.5 to about 3% by weight of the oil of flake potassium hydroxide at about 350° F. for about two hours, sufficient to effect reaction, while blowing with air in a volume within the range from about 0.17 to about 6 liters per 100 grams of oil per hour.

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