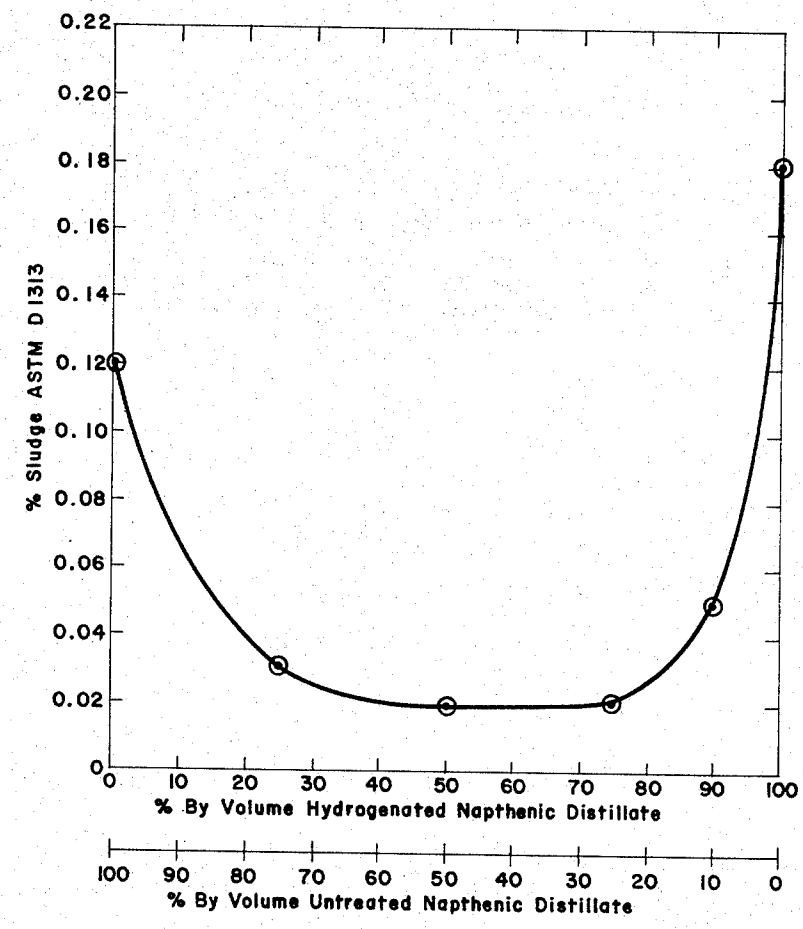
Dec. 31, 1968 A. G. ROCCHINI ETAL 3,419,497

ELECTRICAL INSULATING OIL

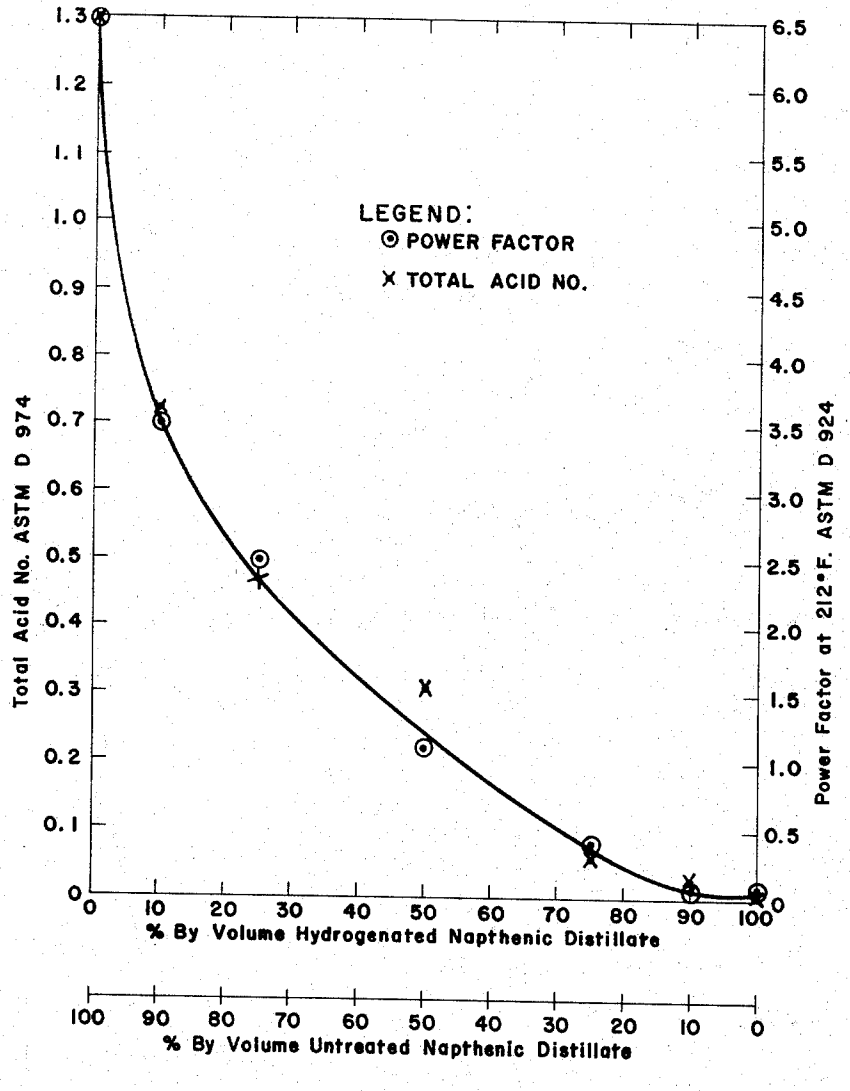
Filed July 25, 1966 Sheet 1 of 2

FIG. 1



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FIG. 2



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ELECTRICAL INSULATING OIL

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ABSTRACT OF THE DISCLOSURE

The invention relates to an electrical insulation oil, resistant to oxidation and sludging, which consists essentially of blend of an untreated highly naphthenic lubricating oil distillate and a hydrogenated highly naphthenic lubricating oil distillate, said hydrogenated highly naphthenic lubricating oil distillate being produced by contacting a highly naphthenic lubricating oil distillate with hydrogen in the presence of a catalyst such as, for example, sulfides or oxides of molybdenum and at least two iron group metals. The amount of each oil in the composition may range from 1–99% by volume.

This invention relates to an electrical insulating oil, and more particularly to a transformer oil which is highly resistant to oxidation and sludging.

An insulating oil to be acceptable for use in transformers must have a relatively low viscosity, usually not greater than about 85 SUS at 100° F., to facilitate removal of heat from transformers by convection, a relatively high flash point to minimize fire hazard and evaporation losses, and a low pour point to assure fluidity in cold weather. In view of its use in electrical equipment, an insulating oil should also have a relatively high dielectric strength and a low power factor. Moreover, an electrical insulating oil should be relatively free from acid, alkali, moisture, dirt and harmful sulfur compounds which could corrode or injure metal parts. Finally, a transformer oil of acceptable quality must exhibit a high degree of stability against the formation of deposits formed by deterioration under service conditions. Formation of deposits in a transformer oil is undesirable since such deposits tend to collect on the transformer windings, thereby causing overheating, and a decrease in dielectric strength, eventually to the point of complete failure of the oil.

Transformer oils ordinarily are distillate oils refined in such manner as to secure the specified characteristics to as great an extent as possible. While most of the desirable characteristics of an insulating oil can be obtained from a mineral oil distillate by subjecting it to various refining procedures, considerable difficulty has been encountered in producing an oil which is highly resistant to oxidation and sluding over prolonged periods of time. Many materials have been developed which when added to a transformer oil greatly improve the oxidation resistance of the oil. However, a preferred transformer oil is one which is highly resistant to oxidation and sludging without the addition of an oxidation inhibitor.

It has previously been proposed to produce an electrical insulating oil by selectively extracting the aromatic components from a mineral oil distillate with a solvent such as liquid sulfur dioxide or furfural and acid treating the raffinate with concentrated sulfuric acid or oleum. The acid treated raffinate is usually subjected to a finishing treatment with a solid adsorbent such as clay. It has also been proposed to produce an electrical insulating oil by hydrogenating a highly naphthenic distillate. Combinations of solvent extraction, acid treating and hydrogenation with and without further finishing as with a solid

adsorbent have also been proposed for producing an insulating oil. It has also been proposed to produce an insulating oil by blending an acid treated naphthenic distillate with a hydrofinished naphthenic distillate. Still further it has been proposed to produce an insulating oil by blending a napthenic distillate hydrogenated at low temperature, i.e., 550° F. to 595° F., with a naphthenic distillate hydrogenated at a high temperature, i.e., 630° to 670° F. Since insulating oils obtained by these refining methods are the product of one or more treating procedures, disadvantages associated with such treatments are encountered. These treatments, for example, are rather costly and they give rise to the loss of considerable amounts of oil. Furthermore, some treated oils have a greater tendency to oxidize than untreated oils. There is some evidence, for example, that naturally occurring oxidation inhibitors in lubricating oil distillates are destroyed during some hydrogenation processes and that materials are formed during some hydrogenations which give rise to oxidation instability.

We have discovered that an electrical insulating oil which is highly resistant to oxidation and sludging can be obtained by blending an untreated highly naphthenic lubricating oil distillate with a hydrogenated highly naphthenic lubricating oil distillate. While improved oxidation resistance and anti-sludging properties are obtained by blending the untreated and the hydrogenated component distillates without further treatment, optimum improvement is obtained by contacting the distillates with clay either prior or subsequent to being blended. The clay finished blend thus obtained is more resistant to oxidation and sludging than the hydrogenated lubricating oil distillate, the untreated distillate, or the component distillates which have been contacted with clay. The oxidation stability of the blended distillates is greater than would be expected from a knowledge of the properties of the individual distillates. By "untreated" as used herein, it is meant that the naphthenic distillate is one which is obtained by conventional atmospheric distillation of the crude oil without any other treatment of the distillate.

The lubricating oil distillate which is subjected to hydrogenation and the untreated distillate used in the present invention are highly naphthenic distillates and can be derived from any naphthenic crude oil base stock. However, the distillates advantageously are derived from the same crude oil base stock. Suitable naphthenic crude oil base stocks from which the highly naphthenic distillate used in the present invention can be obtained are crude petroleum oils from the coastal fields of Texas and Louisiana. Examples of other crude oils from which the highly naphthenic distillates used in the present invention can be obtained are Bachaquero, Taparito and Tia Juana crude oils, all of which are produced in western Venezuela.

The highly naphthenic distillate can be obtained from a naphthenic crude oil base stock by conventional atmospheric distillation. The "highly naphthenic" lubricating oil distillate is one containing at least about 70 percent by volume of naphthenes. Typical inspections of highly naphthenic lubricating oil distillates include an API gravity in the range of about 25° to about 30°, a boiling range within the range of about 500° to about 750° F., a viscosity at 100° F. in the range of about 50 to about 85 SUS, a pour point below about —40° F., an aromatic content of about 12 to about 25 percent by volume, an alkane content up to about 5 percent by volume and the remainder, i.e. about 70 to about 88 percent by volume naphthenes. An example of a preferred highly naphthenic distillate which serves as one of the component oils and which can be subjected to hydrogenation to form the other component oil has an API gravity of about 26° a

boiling range of about 545° to 710° F. a viscosity of about 60 SUS at 100° F. a pour point below about —60° F. a naphthene content of about 80 percent by volume and an aromatic content of about 20 percent by volume.

The untreated highly naphthenic lubricating oil distillate and the hydrogenated highly naphthenic lubricating oil distillate according to this invention are blended in proportions of about 1 to about 99 percent by volume of the untreated distillate with about 99 to about 1 percent by volume of the hydrogenated distillate. Especially preferred blends are those containing about 10 to about 30 percent by volume of the untreated distillate and about 70 to about 90 percent by volume of the hydrogenated distillate. The proportion of the untreated distillate and the hydrogenated distillate depends somewhat upon the properties desired in the ultimate composition. For example if one is concerned primarily with improved anti-sludging properties improved results are obtained with blends containing from about 1 to about 99 percent by volume of untreated distillate and about 99 to about 1 percent by volume of hydrogenated distillate. If, however, a blend is desired having less than about 0.05 percent sludge as determined by test method ASTM D1313, the untreated distillate should comprise about 10 to about 85 percent by volume of the blend. If one is concerned with the total acid number (ASTM D974) and/or the power factor (ASTM D924) of the blend, the untreated distillate should be employed in minor amounts. Thus, for example, if a blend is desired having a total acid number below about 0.1 and a power factor at 212° F. below about 0.5 by test methods ASTM D974 and ASTM D924, respectively, the untreated distillate should comprise not more than about 30 percent by volume of the blend. Thus, if it is desired to obtain a blend having a bomb sludge (ASTM D1313) below about 0.05, a total acid number (ASTM D974) below about 0.1 and a power factor (ASTM D924) below about 0.5, the untreated distillate should comprise about 10 to about 30 percent by volume of the blend.

FIGURE 1 is a graphic illustration of the improved anti-sludging characteristics obtained when an untreated naphthenic distillate is blended with a hydrogenated naphthenic distillate, the entire blend having been clay filtered.

FIGURE 2 illustrates the relationship between power factor and total acid number when an untreated naphthenic distillate is blended with a hydrogenated naphthenic distillate, the entire blend having been clay filtered. The points indicated by *x* designate the total acid number. The points indicated by *o* designate the power factor.

The hydrogenated lubricating oil distillate is prepared by contacting the highly naphthenic distillate with hydrogen in the presence of a catalyst comprising at least one hydrogenating component selected from the group consisting of sulfides and oxides of (a) a combination of about 2 to about 25 percent (preferably 4 to 16 percent) by weight molybdenum and at least two iron group metals where the iron group metals are present in such amounts that the atomic ratio of each iron group metal with respect to molybdenum is less than about 0.4, and (b) a combination of about 5 to about 40 percent (preferably 10 to 25 percent) by weight of nickel and tungsten where the atomic ratio of tungsten to nickel is about 1:0.1 to 5 (preferably 1:0.3 to 4), said hydrogenating component being composited with an alumina support. Specific examples of preferred catalysts are those containing about 2 percent nickel, 1.5 percent cobalt and 10 percent molybdenum supported on alumina, or 6 percent nickel and 19 percent tungsten supported on alumina, these catalysts being preferably employed in sulfided form, although they also may be employed in the oxide form. When a sulfided catalyst is used, the catalyst can be sulfided prior to contact with the highly naphthenic distillate by contacting the catalyst with a sulfiding mixture of hydrogen and hydrogen sulfide at a temperature in the range of about 550 to 650° F. either at atmospheric or elevated pressures. The catalytic hydrogenating components can be used with a variety of porous bases or supports which may or may not have catalytic activity of their own. Examples of such supports are alumina, bauxite, silica gel, as well as aluminas stabilized with small amounts of silica. Halogens, such as fluorine or chlorine, can be present in the support in combined form in amounts ranging up to 0.2 or 0.5 percent by weight of more. Other suitable supports can also be used. These catalyst components can be prepared in known manner. Especially advantageous results are obtained when the hydrogenation treatment is carried out at an average catalyst bed temperature of about 575° to about 645° F., especially 600° to 635° F., and under a combination of conditions effective to produce appreciable consumption of hydrogen but no substantial cracking. However, the process can be carried out at higher temperatures, up to about 750° F. with acceptable results. It is preferred to employ reaction pressures in the range of about 1000 to about 2000 p.s.i.g., but other pressures in the range of about 500 to about 3000 p.s.i.g. can be used. The oil is preferably contacted with the catalyst in a ratio of about 1.5 to about 3 volumes of liquid per hour per volume of catalyst, but other ratios in the range of about 0.5 to about 4 liquid volumes per hour per volume of catalyst can be used. The reaction conditions employed in the catalyst bed are interrelated to the extent that the more severe treating conditions of temperature and pressure are normally more useful with higher space velocities. Conversely, less severe conditions of temperature and pressure are normally more useful with space velocities in the lower part of the range disclosed. By way of example, excellent results are obtainable at an average catalyst bed temperature of about 600° F., an operating pressure of about 1000 p.s.i.g. and at a space velocity of about 1.5 liquid volumes of oil per hour per volume of catalyst; similarly, good results are also obtainable at an average catalyst bed temperature of about 640° F., a reaction pressure of about 1735 p.s.i.g. and at a space velocity of about 3 liquid volumes of oil per hour per volume of catalyst. The hydrogen-containing gas to oil ratio employed in the hydrogenation reaction is preferably in the range of about 1000 to 3000 s.c.f./bbl., but other ratios can be used, for example, the gas to oil ratio can be as low as 500 s.c.f./bbl. or as great as 4000 s.c.f./bbl. Very satisfactory results have been obtained with hydrogen of about 80 to 85 percent purity that has been generated in a platinum reforming reaction, but the hydrogen employed in the process need not be of this purity and, in fact, can be as low as 70 percent hydrogen or less, for example, 60 percent.

Following hydrogenation of the highly naphthenic distillate oil, the treated oil is degassed to remove light hydrocarbons and dissolved gases including hydrogen sulfide and ammonia. The degassed hydrogenated distillate is preferably dried to give a low moisture content.

The dried hydrogenated distillate and the untreated distillate can be blended together after clay contacting or percolation of the separate component distillates. However, we prefer to blend the untreated distillate with the hydrogenated distillate and then subject the entire blend to clay contacting or percolation.

Clay contacting and percolation are well known petroleum processes and involve decolorizing and stabilizing the oils by contact with finely divided clays. Clay contacting consists of rapid batch mixing of the oil and finely ground (>200 mesh) activated clay followed by filtration to remove the clay. Clay percolation comprises filtering or percolating the oil through a bed of rather coarse (16 to 60 mesh) clay. In clay contacting, the clay life may be in the order of 30 to 100 barrels of oil per ton of clay at temperatures up to about 300° F. In clay percolation or filtration, the clay life may be in the order of 100 to 400 barrels of oil per ton of clay at ambient or moderately elevated, i.e., 100° to 200° F., temperatures. Clays of the

kind normally used in clay finishing, including fuller's earth, bauxite, Millwhite, Attapulgus or Filtrol can be employed.

The preparation of a suitable hydrogenated lubricating oil distillate for use in the insulating oil of the present invention is illustrated by the following specific embodiment. In this embodiment, the charge stock is a highly naphthenic distillate oil boiling in the range of 546° to 710° F. derived from a coastal (Texas) crude oil. The highly naphthenic distillate oil charge stock has the following typical inspections.

Inspections:	Highly naphthenic distillate
Gravity	25.9
Viscosity, SUS—	
At 100° F.	59.4
At 210° F.	34.3
Flash point, OC ° F.	300
Pour point, ° F.	<−60
Interfacial tension, 77° F., dymes/cm.	37.2
Color, ASTM D1500	1.0
Sulfur (bomb), percent	0.19
Bomb sludge, ASTM D1313, percent	0.19
Neutralization No., ASTM D974—	
Total acid No.	1.3
Hydrocarbon type analysis—	
Alkanes	0.0
Non-condensed cycloalkanes	44.5
Condensed cycloalkanes	35.0
Benzene	16.3
Naphthalene	4.2

In this embodiment, the highly naphthenic charge stock is contacted with hydrogen in a reactor wherein the average reactor temperature is 600° F., the pressure is 1000 p.s.i.g., the space velocity is 1.5 liquid volumes of oil per hour per volume of catalyst and the gas circulation rate is 2000 s.c.f./bbl. The catalyst employed is 1/12 inch diameter extrudates of nickel, cobalt and molybdenum on an alumina support. A typical sample of the fresh catalyst has about 2.4 percent nickel, about 1.28 percent cobalt, about 9.85 percent molybdenum and about 0.03 percent chlorine. The catalyst is prepared by impregnation of the alumina support with water-soluble salts of the metals and calcining. The catalyst is sulfided by contact at reaction conditions with a West Texas furnace oil containing about 0.8 percent sulfur. This catalyst typically has a density of about 51.2 lbs./cu. ft. After degasification of the hydrogenated product, it is filtered through Attapulgus clay in a proportion of about 100 barrels of oil per ton of clay. Typical inspections of the unfiltered and the clay filtered hydrogenated product are as follows:

Inspections	Hydrogenated highly naphthenic distillate	
	Unfiltered	Clay filtered
Gravity, ° API	27.2	27.2
Viscosity, SUS at—		
100° F	58.3	58.3
210° F	34.1	34.1
Flash point, OC, ° F	315	300
Pour point, ° F	<−65	<−65
Power factor, ASTM D924, at—		
77° F	0.01	0.01
212° F	0.16	0.09
Dielectric strength, ASTM D877, ohms-cm. $\times 10^{12}$	38	45
Color, ASTM D1500	<0.5	<0.5
Sulfur (bomb), percent	0.03	0.05
Bomb sludge, ASTM D1313, percent	3.40	0.18
Neutralization No. ASTM D974, total acid No	0.01	0.01

From the foregoing data, it will be noted that clay treating the hydrogenated distillate improves its power factor at 212° F. and dielectric strength and also its bomb sludge. It is to be particularly noted that the charge stock distillate had a bomb sludge of 0.19 percent and that the hydrogenated distillate prior to clay filtration had a bomb sludge of 3.4 percent. After clay filtering, the hydrogenated distillate had a bomb sludge (0.18 percent) about the same as the charge stock initially.

The oxidation resistance of compositions obtained by blending an untreated naphthenic lubricating oil distillate and a naphthenic lubricating oil distillate which has been hydrogenated in accordance with the specific embodiment disclosed hereinabove is shown by the data in Table I. Data are given for individual components and blends thereof with and without clay filtering. Also shown in Table I are the results of tests for total acid number, power factor, dielectric strength and other inspections of the compositions.

TABLE I

	A	B	C	D	E	F	G	H[1]	I[1]	J[1]	K[1]	L[1]
Composition, percent by volume:												
Untreated naphthenic distillate	100				5	10	25					
Untreated naphthenic distillate, clay filtered[2]		100						10	25	50	75	90
Hydrogenated naphthenic distillate			100		95	90	75					
Hydrogenated naphthenic distillate, clay filtered[2]				100				90	75	50	25	10
Inspections:												
Gravity, ° API	25.9	25.9	27.2	27.2	27.2	27.1	26.7	27.2	26.8	26.6	26.4	27.2
Viscosity, SUS at—												
100° F	59.4	59.4	58.3	58.3	58.1	58.4	58.3	58.5	58.3	5.83	58.4	58.3
210° F	34.3	34.2	34.1	34.1	34.0	34.0	34.1	34.1	34.2	34.2	34.1	34.1
Flash point, OC. ° F	300	300	315	300	310	300	300	295	300	295	300	285
Pour point, ° F	<−60	<−60	<−60	<−60	<−60	<−60	<−60	<−60	<−60	<−60	<−60	<−60
Power factor, ASTM D924 at—												
77° F		0.10	0.01	0.01	0.09	0.09	0.28	0.01	0.01	0.01	0.02	0.06
212° F		3.60	0.16	0.09	0.43	1.20	1.80	0.09	0.40	1.10	2.50	3.50
Dielectric strength, ASTM D877, ohms-cm $\times 10^{12}$		28	38	45		38	23	48	43	42	30	30
Color, ASTM D1500	1.0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.5	0.5	1.0
Sulfur (bomb), percent	0.19	0.05	0.03	0.05	0.05	0.05	0.05	0.05	0.05	0.07	0.10	0.18
Bomb sludge, ASTM D1313, percent	0.19	0.12	3.40	0.18	0.15	0.10	0.08	0.05	0.02	0.02	0.03	0.08
Neutralization No., ASTM D974, total acid No	1.3	0.80	0.01	0.01	0.06	0.10	0.34	0.03	0.06	0.31	0.47	0.72

[1] Compositions H to L were clay filtered (100 bbls./ton of clay at room temperature) after being blended.
[2] 100 bbls./ton of clay at room temperature.

It is evident from the test results reported in Table I that the oxidation stability of the blended oils whether or not the oils have been clay filtered is greater than the oxidation stability of the individual component oils. This is indeed unexpected as one would expect the oxidation resistance of the blends to be intermediate of that of each of the component oils. It is to be noted further that maximum oxidation resistance is obtained with clay filtered blends.

The results of the bomb sludge test (ASTM D1313) as recorded in Table I for the clay filtered distillate

components and blends thereof are shown graphically in FIGURE 1 of the drawings. It will be noted that blends of untreated and hydrogenated naphthenic distillates result in compositions having more resistance to oxidation and sludging than the individual component oils. It will be observed that maximum resistance to oxidation and sludging is obtained with blends containing about 10 to about 85 volume percent of untreated naphthenic distillate and about 15 to about 90 percent by volume of hydrogenated distillate.

The results of the total acid number test (ASTM D974) and the power factor determination (ASTM D924) as recorded in Table I for the clay filtered distillates are shown graphically in FIGURE 2 of the drawings. The points indicated by *x* designate the total acid number. The points indicated by *o* designate the power factor. It will be noted that the acid number and power factor are directly related and that the acid number and power factor increase as the amount of the untreated naphthenic distillate increases in the blend. To obtain an acid number below about 0.1 and a power factor below about 0.5, the untreated naphthenic distillate should not exceed about 30 percent by volume of the blend. Thus, preferred blends are those containing about 10 to about 30 percent by volume of untreated distillate and about 70 to about 90 percent by volume of hydrogenated distillate.

Although the electrical insulating oils prepared according to the present invention are highly resistant to oxidation and sludging, the oils have good response to the addition of an oxidation inhibitor and such an inhibitor can be employed if desired. Examples of suitable oxidation inhibitors which can be employed include the polyalkyl aryl hydroxy compounds, e.g., 2,6-ditertiary butyl-4-methylphenol, 2,4-dimethyl-6-tertiary octylphenol and bis(2 - hydroxy - 3-t-butyl-5-methylphenyl)methane, etc., as well as the various amines, e.g., diphenylamine, phenyl beta naphthylamine, etc. When these oxidation inhibitors are used, they are generally employed in amounts of about 0.01 to about 1.0 percent by weight or more.

While the oil compositions of the invention are primarily useful as electrical insulating oils, it will be understood that they can be used as lubricants. When used as lubricants they may also contain an oxidation inhibitor and other additives normally used in lubricating oils including a detergent, an oiliness and extreme pressure agent, a viscosity index improver, a pour point depressant, an antirust agent, a corrosion inhibitor, an antifoam agent and the like in varying proportions.

While our invention has been described with reference to various specific examples and embodiments, it will be understood that the invention is not limited to such examples and embodiments and may be variously practiced within the scope of the claims hereinafter made.

We claim:

1. An electrical insulating oil consisting essentially of a blend of about 1 to about 99 percent by volume of an untreated highly naphthenic lubricating oil distillate and about 99 to about 1 percent by volume of a hydrogenated highly naphthenic lubricating oil distillate, said highly naphthenic lubricating oil distillates having an API gravity in the range of about 25° to about 30°, a boiling range within the range of about 500° to about 750° F., a viscosity at 100° F. in the range of about 50 to about 85 SUS, a pour point below about −40° F. and a naphthene content of at least about 70 percent by volume; said hydrogenated highly naphthenic lubricating oil distillate being produced by contacting a highly naphthenic lubricating oil distillate with hydrogen in the presence of a catalyst comprising at least one hydrogenating component selected from the group consisting of sulfides and oxides of (a) a combination of about 2 to about 25 percent by weight of molybdenum and at least two iron group metals where the iron group metals are present in such amounts that the atomic ratio of each iron group metal with respect to molybdenum is less than about 0.4, and (b) a combination of about 5 to about 40 percent by weight of nickel and tungsten where the atomic ratio of tungsten to nickel is about 1:0.1 to 5, said hydrogenating component being composited with an alumina support, said contacting being carried out at an average catalyst temperature of about 575° to about 750° F., at a space velocity of about 0.5 to about 4 liquid volumes of oil per volume of catalyst per hour, and at a pressure of about 500 to about 3000 p.s.i.g.

2. An electrical insulating oil in accordance with claim 1 wherein the blend consists of about 10 to about 30 percent by volume of the untreated distillate and about 70 to about 90 percent by volume of the hydrogenated distillate.

3. An electrical insulating oil in accordance with claim 1 wherein the untreated and the hydrogenated distillates are contacted with clay.

4. An electrical insulating oil in accordance with claim 1 wherein the hydrogenating component of the catalyst is a sulfided combination of nickel, cobalt and molybdenum.

5. An electrical insulating oil in accordance with claim 1 wherein the hydrogenating component of the catalyst is a sulfided combination of nickel and tungsten.

6. An electrical insulating oil consisting essentially of a clay treated blend of about 10 to about 30 percent by volume of an untreated highly naphthenic lubricating oil distillate and about 70 to about 90 percent by volume of a hydrogenated highly naphthenic lubricating oil distillate, said highly naphthenic lubricating oil distillates having an API gravity of about 26°, a boiling range of about 545° to about 710° F., a viscosity at 100° F. of about 60 SUS, a pour point below about −60° F. and a naphthene content of about 80 percent by volume; said hydrogenated highly naphthenic lubricating oil distillate being produced by contacting a highly naphthenic lubricating oil distillate with hydrogen in the presence of a catalyst comprising a sulfided combination of about 4 to 16 percent by weight of nickel. cobalt and molybdenum, said contacting being carried out at an average catalyst temperature of about 575° to about 645° F., at a space velocity of about 1.5 to about 3 liquid volumes of oil per volume of catalyst per hour, and at a pressure of about 1000 p.s.i.g.

7. An electrical insulating oil in accordance with claim 6 wherein the untreated and the hydrogenated distillates are derived from the same naphthenic crude oil base stock.

8. An electrical insulating oil in accordance with claim 6 wherein the clay treated blend is obtained by filtering the combined untreated and hydrogenate distillates at ambient temperature through a body of 16 to 60 mesh clay in a proportion of about 100 to about 400 barrels of oil per ton of clay.

9. An electrical insulating oil comprising a major proportion of the clay treated blend of claim 8 and from 0.01 to 1.0 percent by weight of an oxidation inhibitor.

10. An electrical insulating oil comprising a major proportion of the clay treated blend of claim 8 and a minor oxidation inhibiting amount of 2,6-ditertiary butyl-4-methylphenol.

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