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BLOCK GREASE COMPOSITIONS

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This invention relates to improved greases and more particularly to block greases having improved resistance to glazing and charring.

Block greases are customarily employed where high bearing temperatures, such as are found in the open journal bearings of paper mill dryers and the trunnion bearings of rotary kilns are encountered. Under such operating conditions, breakdown of the grease structure and oxidation of the organic components of the block grease are increased, with the result that the grease is rapidly consumed, loses its efficiency as a lubricant, chars and often glazes on the bearing surface of the grease block.

The object of the present invention is to prepare a block grease having a low consumption rate, good lubrication at working temperatures, and which is resistant to hardening, glazing, and charring.

Other objects and advantages of the invention will be apparent during the course of the following description.

I have discovered that an improved block grease is obtainable by incorporating in a block grease composition a substantial proportion of hydrogenated rosin soap. The hydrogenated rosin soaps, I have found, have the property of resisting decomposition at the elevated temperatures encountered in the use of block greases so that the resulting composition has a lower consumption rate and a greater resistance to glazing and charring than a corresponding block grease composition in which no hydrogenated rosin soap is used.

I have found that my invention is applicable to substantially any block grease composition by substituting for a portion of the normal soap content of the block grease a corresponding proportion of a hydrogenated rosin soap. With higher proportions of hydrogenated rosin soap, higher resistance to heat decomposition, charring and glazing is obtained. I have obtained good results when as high as half of the total soap content of the block grease composition has been substituted by a hydrogenated rosin soap. Effective resistance to glazing and charring was obtained along with a low consumption rate. In general, good results can be obtained by incorporating as little as about 10 per cent by weight or as high as 25 per cent by weight of hydrogenated rosin soap, based on the total grease composition.

Rosin, sometimes called colophony, is the residue obtained on distilling turpentine from hard pine resin. Abietic acid, $C_{20}H_{30}O_2$, is the chief constituent of rosin and is obtained from the latter by distillation. Abietic acid contains two double bonds, and is a carboxylic acid. Hydrogenated rosin is obtained essentially by the addition of hydrogen to the double bonds of abietic acid. The amount of hydrogen added may be sufficient to saturate the two unsaturated bonds of abietic acid, or it may be any amount to produce substantial partial hydrogenation. I have found that hydrogenated rosin of about 40 per cent of saturation to and including fully hydrogenated rosin is satisfactory for use in my invention for purposes of making my alkali hydrogenated rosin soaps. Thus, I have found that soaps of both fully hydrogenated rosin and partially hydrogenated rosin are useful for the purpose of my invention and by the term "hydrogenated rosin soap" as used hereinafter and in the appended claims I mean to include fully hydrogenated and partially hydrogenated rosin soaps.

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I have found that a particularly useful form of hydrogenated rosin for the purposes of my invention is hydrogenated to about 60 per cent of capacity and has a melting point of about 168° F.

The hydrogenated rosin soaps I prepare from hydrogenated rosin by reacting an alkali or alkaline earth basic compound with said hydrogenated rosin in the amounts necessary to obtain an approximately neutral product. In using a soap of hydrogenated rosin in my formula, I prefer to use an alkali soap, and more particularly the sodium soap of hydrogenated rosin because of its cheapness and ready availability.

The "total soap content," and by this term as used hereinafter, I mean to include the metallic soap of fatty acids plus the metallic soap of hydrogenated rosin, of my improved block grease may vary between 50 per cent and 20 per cent of the total weight of the grease ingredients. The fatty acid soaps used are obtained by the reaction of metallic soaps or alkaline earth compounds with fatty acids, such as stearic, palmitic, oleic, and linoleic acids. In general, I prefer to use oleic acid for a general utility block grease because of the resulting increased grease plasticity, or decrease of grease brittleness, when compared to a grease made with a hydrogenated rosin soap alone or mixed with sodium stearate soap. In a particularly advantageous form of my invention I use a ratio of about equal quantities by weight of fatty acid soap and hydrogenated rosin soap. However, this soap ratio is adjustable to meet various types of open journal and bearing surface conditions. Thus, for example, very hot bearing surfaces conducive to excessive char-

ring and glazing require a grease with a higher hydrogenated rosin soap content as compared to the fatty acid soap content.

The mineral oil I use may have any viscosity between 100 and 500 S. U. S. (Saybolt Universal seconds) at 100° F., but in the most advantageous form of my invention I use an oil with about 200 S. U. S. at 100° F. I find that an oil of this viscosity produces a block grease that yields a desirable continuous grease film on the bearing surfaces at the temperatures usually encountered in open journals.

Anti-oxidants may be added to my formula. However, good results are obtainable without their use, especially where the temperature of the bearing surfaces is not excessive. From experience I find that the hotter the bearing surfaces, the greater are the advantages of adding small amounts of anti-oxidants. While I prefer an anti-oxidant such as diphenylamine, numerous other anti-oxidants may be used. For example, I may use 2,4-diamino-diphenylamine, although this latter anti-oxidant was not as efficient as my preferred diphenylamine anti-oxidant. On the other hand, I may use anti-oxidants of the alkali insoluble alkyl phenol class, such as 2,4,6-trialkyl phenol. In fact, any alkyl phenol containing a total of four or more carbon atoms in the two alkyl groups ortho to the phenolic group I find useful as an anti-oxidant. In general, compounds of the classes of diarylamine or alkali insoluble alkyl phenols I have found to be effective anti-oxidants in my block grease composition.

In preparing my block grease, I may prepare the fatty acid soap and the hydrogenated rosin soap separately or together. If the respective soaps have been previously individually prepared, preparation of the "total soap content" becomes a simple matter of adding the required amounts of each component. The separate soaps are compounded with the aid of heat and stirring into a suitable mineral oil to produce the desired block grease. However, in my preferred method of incorporating soap in my block grease, I prepare the combined fatty acid and hydrogenated rosin soaps in situ. This method of soap formation being in situ is conducive to ease of handling and economy of time, as well as resulting in a smooth, non-fibrous block grease composition. In preparing my soap in situ I add the fatty acid, alkali solution and part of the oil to the pressure kettle and heat until the saponification reaction is complete, after which the contents of the pressure kettle are emptied into an open vessel, at which point the remaining oil is added. The grease is then maintained at a constant temperature well above the boiling point of water until the moisture content is substantially lowered to a desired amount, at which point the anti-oxidant, if desired in the formula, is added.

The following particular example will serve to illustrate the principle of this invention:

Example

A block grease of the following composition was prepared:

	Per cent by weight
Petroleum oil (S. U. S. viscosity of 200 at 100° F.)	70.6
Hydrogenated rosin	12.7
Oleic acid	12.7
Sodium hydroxide	3.8
Diphenylamine	0.2

In preparing this block grease, about 40 per cent of the total mineral oil, all of the hydrogenated rosin, and all of the fatty acid were added to a pressure kettle containing the caustic soda in aqueous solution of 40 per cent strength. The temperature of the kettle was raised to about 350° F. through a time interval of 1¼ hours. Heating with stirring was continued for about 1 hour at approximately 350° F. and 100 lbs. per square inch pressure. The kettle contents were discharged into an open vessel where substantial dehydration was effected by heating with stirring, to approximately 270° F. with gradual addition of the remaining mineral oil. The temperature was then gradually raised to approximately 450° F. in about 4 hours and held at this temperature for about 1 hour under vacuum to complete the dehydration, and also to remove any entrained air which latter tends to make a grease porous and also tends to increase oil separation. The diphenylamine was lastly added to this mixture ten minutes before pouring into blocks.

A second block grease was made exactly as in the example but in this latter case a rosin soap was used in lieu of the hydrogenated rosin soap. Comparative tests on these two grease compositions were made.

The melting point (American Society for Testing Materials D566–42) of the rosin soap block grease was low, being only 360° F. as compared to a melting point of 430° F. for the corresponding block grease wherein hydrogenated rosin soap was used.

In a block grease consumption test run at a journal temperature of 230° F. to 240° F. at 210 feet per minute at 1,000 grams applied pressure using 2⅜ inches by 2⅜ inches blocks, the amount of block grease consumed when using wood rosin soap was 132.6 grams, whereas the amount of corresponding block grease using hydrogenated rosin soap in lieu of rosin soap was only 4 grams.

Similarly, consistency-temperature data regarding the hereinabove corresponding block greases showed the following results:

Consistency-Temperature	Hydrogenated Rosin Soap Block Grease	Wood Rosin Soap Block Grease
Unworked (room temp.)	64	76
Worked (room temp.)	193	203
Unworked at 140° F.	72	134
Unworked at 180° F.	80	170
Unworked at 220° F.	88	186
Unworked at 260° F.	93	190

These data were obtained by the method of the American Society for Testing Materials D217–38T.

Inasmuch as greases showing the least consistency changes over a wide temperature range are preferred in the block grease art due to the corresponding low consumption factor, it is evident that the hydrogenated rosin soap block grease is of superior merit in this respect as well, when compared to the analogous block grease formula in which wood rosin soap is used in lieu of hydrogenated rosin soap.

It is to be understood that my invention, herein described, is not to be limited to the details recited herein by way of example, and that various changes in the composition may be resorted to, without departing from the spirit of my invention or the scope of the subjoined claims.

What I claim as my invention is:

1. An improved block grease possessing anti-

charring and anti-glazing properties and having a low consumption factor comprising an intimate anhydrous mixture of about 70 per cent mineral oil of a viscosity of about 200 S. U. S. at 100° F., about 15 per cent sodium soap of a hydrogenated rosin of at least about 40 per cent saturation, about 15 per cent of sodium soap of oleic acid, and about 0.2 per cent diphenylamine.

2. An improved block grease possessing anti-charring and anti-glazing properties and having a low consumption factor comprising an intimate anhydrous mixture of about 50 per cent to about 80 per cent of a mineral oil of about 100 S. U. S. at 100° F. to about 500 S. U. S. at 100° F. and about 50 per cent to about 20 per cent of soap base, the said base comprising approximately equal quantities of sodium hydrogenated rosin of at least about 40 per cent saturation and sodium oleate with about 0.2 per cent diphenylamine.

3. An improved block grease possessing anti-charring and anti-glazing properties and having a low consumption factor comprising an intimate anhydrous mixture of about 50 per cent to about 80 per cent of a mineral oil of about 100 S. U. S. at 100° F. to about 500 S. U. S. at 100° F. and about 50 per cent to about 20 per cent of soap base, the said base comprising approximately equal quantities of a soap of a hydrogenated rosin of at least about 40 per cent saturation and a fatty acid soap, and a diarylamine in an amount sufficient to substantially inhibit oxidational deterioration.

4. An improved block grease possessing anti-charring and anti-glazing properties and having a low consumption factor comprising an intimate anhydrous mixture of about 50 per cent to about 80 per cent of a mineral oil of about 100 S. U. S. at 100° F. to about 500 S. U. S. at 100° F. and about 50 per cent to about 20 per cent of a soap base, the said base comprising approximately equal quantities of a soap of a hydrogenated rosin of at least about 40 per cent saturation and a fatty acid soap, and an alakli-insoluble alkyl phenol in an amount sufficient to substantially inhibit oxidational deterioration.

5. An improved block grease possessing anti-charring and anti-glazing properties and having a low consumption factor comprising an intimate anhydrous mixture of about 50 per cent to about 80 per cent of a mineral oil of about 100 S. U. S. at 100° F. to about 500 S. U. S. at 100° F. and about 50 per cent to about 20 per cent of a soap base, the said base comprising approximately equal quantities of a soap of a hydrogenated rosin of at least about 40 per cent saturation and a fatty acid soap, and an oxidation inhibitor selected from the class consisting of a diarylamine and an alkali-insoluble alkyl phenol in an amount sufficient to substantially inhibit oxidational deterioration.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,399,063	Schantz	Apr. 23, 1946

FOREIGN PATENTS

Number	Country	Date
414,612	Germany	June 2, 1945

OTHER REFERENCES

Dreshfield et al., Staybellite—A Hydrogenated Rosin for Size, article in Paper Trade Journal, July 17, 1941, pages 40 to 42 (Tappi section—pages 34 to 36).

Certificate of Correction

Patent No. 2,450,149. September 28, 1948.

PAUL R. McCARTHY

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 2, line 41, for the word "soaps" read *alkali*; column 6, line 34, list of references cited, for the date "June 2, 1945" read *June 2, 1925*; line 37, for "Staybellite" read *Staybelite*;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of December, A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

charring and anti-glazing properties and having a low consumption factor comprising an intimate anhydrous mixture of about 70 per cent mineral oil of a viscosity of about 200 S. U. S. at 100° F., about 15 per cent sodium soap of a hydrogenated rosin of at least about 40 per cent saturation, about 15 per cent of sodium soap of oleic acid, and about 0.2 per cent diphenylamine.

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3. An improved block grease possessing anti-charring and anti-glazing properties and having a low consumption factor comprising an intimate anhydrous mixture of about 50 per cent to about 80 per cent of a mineral oil of about 100 S. U. S. at 100° F. to about 500 S. U. S. at 100° F. and about 50 per cent to about 20 per cent of soap base, the said base comprising approximately equal quantities of a soap of a hydrogenated rosin of at least about 40 per cent saturation and a fatty acid soap, and a diarylamine in an amount sufficient to substantially inhibit oxidational deterioration.

4. An improved block grease possessing anti-charring and anti-glazing properties and having a low consumption factor comprising an intimate anhydrous mixture of about 50 per cent to about 80 per cent of a mineral oil of about 100 S. U. S. at 100° F. to about 500 S. U. S. at 100° F. and about 50 per cent to about 20 per cent of a soap base, the said base comprising approximately equal quantities of a soap of a hydrogenated rosin of at least about 40 per cent saturation and a fatty acid soap, and an alakli-insoluble alkyl phenol in an amount sufficient to substantially inhibit oxidational deterioration.

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