

July 4, 1944.

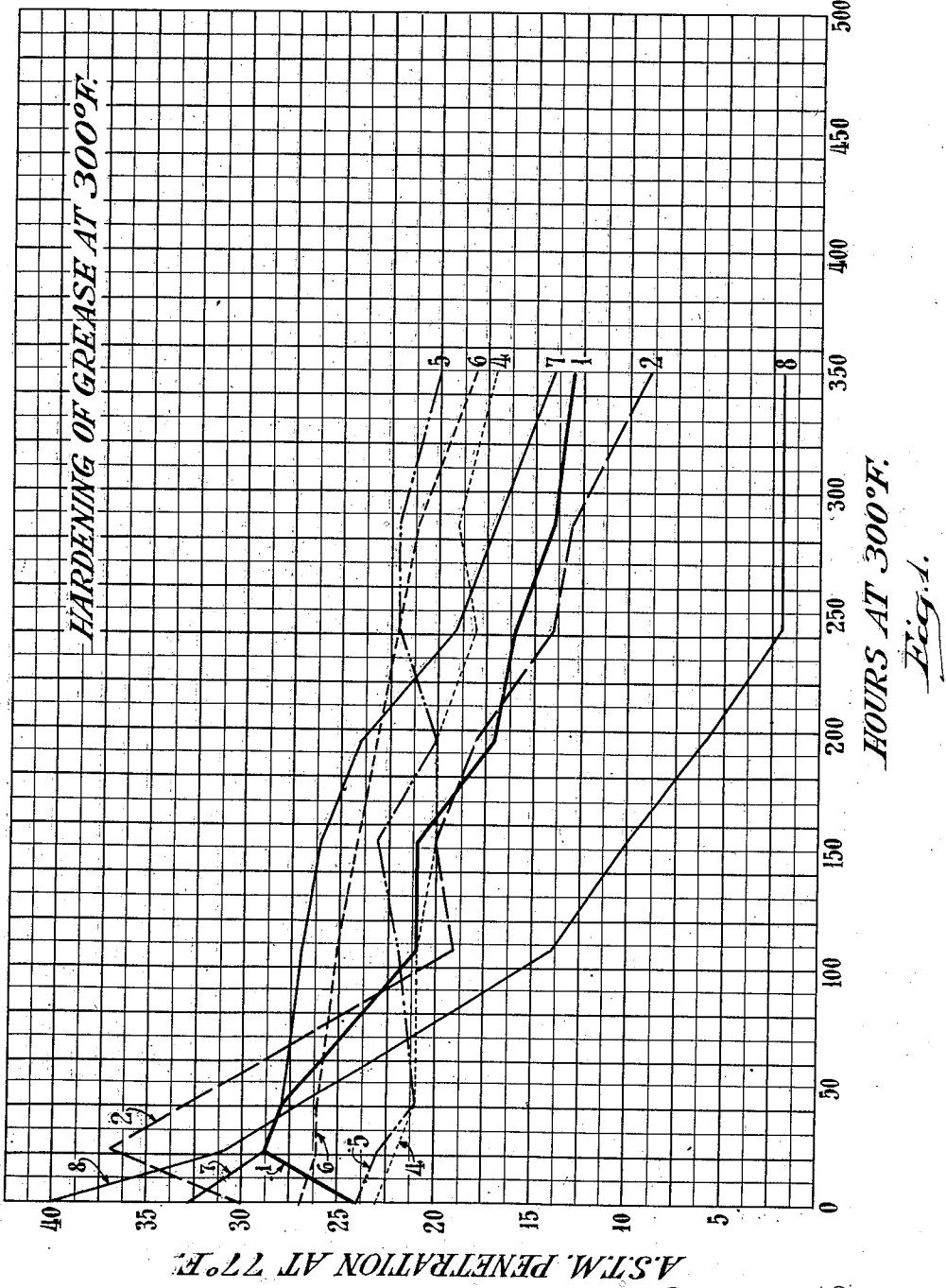
R. A. SWENSON

2,352,811

LUBRICANT

Filed June 27, 1941

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

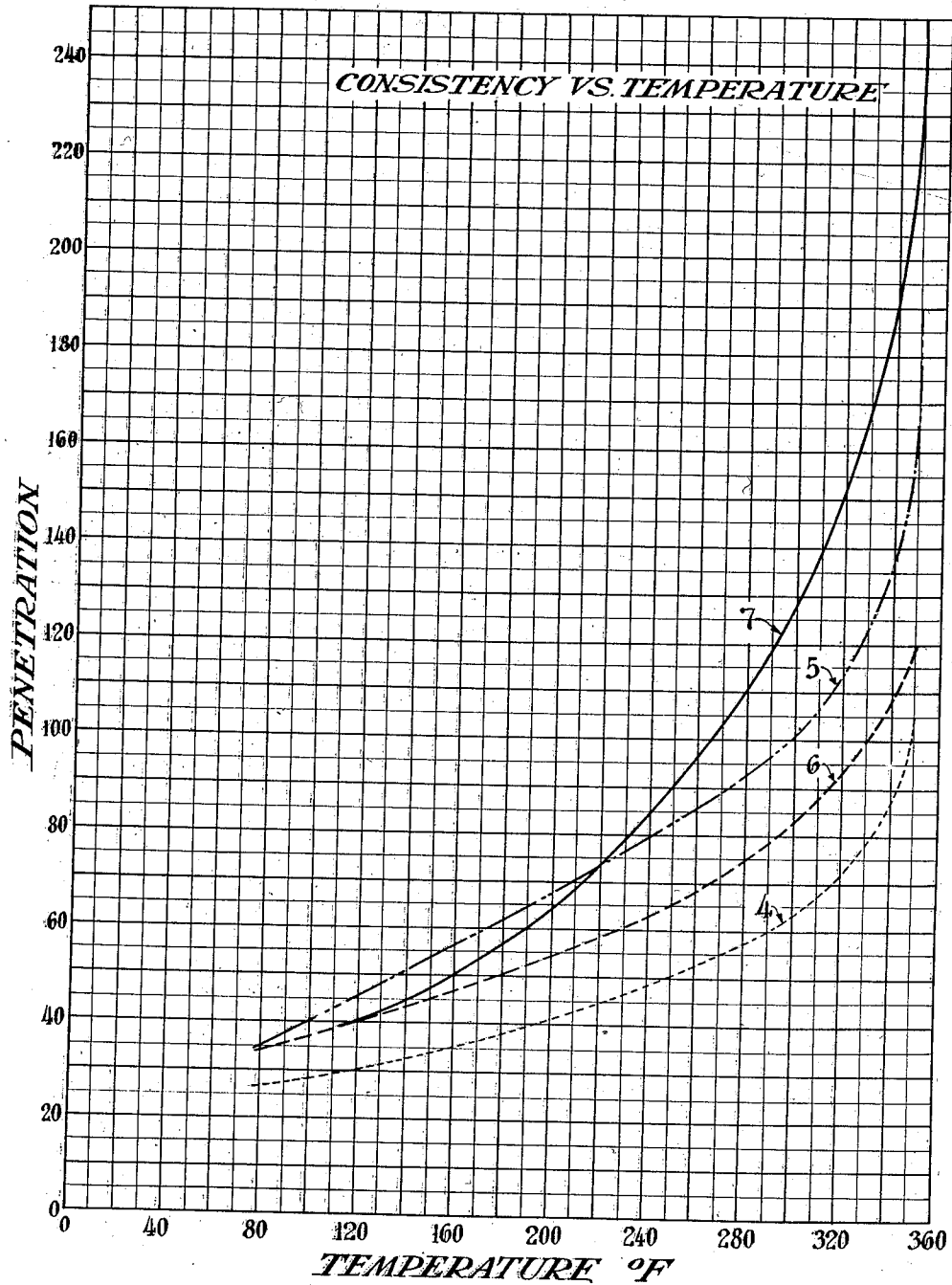


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UNITED STATES PATENT OFFICE

2,352,811

LUBRICANT

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Application June 27, 1941, Serial No. 400,024

10 Claims. (Cl. 252—33)

This invention relates to block greases and to methods for making the same and has particular reference to greases known as driving journal compounds.

Greases of the driving journal compound type must fulfill rigid specifications due to the severe conditions of use. It is customary in lubricating driving journals to apply the grease in the form of a cake or block to the rotating shaft and to hold the same in place by means of a spring and follower plate. Therefore they must have high melting points in order to retain their shape and consistency at elevated temperatures caused by radiated or conducted heat developed by friction between the metal surfaces. Greases of this type must remain sufficiently plastic for extended periods of time in order to insure proper lubrication of the shaft—that is to say, the grease must be highly resistant to oxidation so as not to harden at elevated temperatures in the presence of oxygen. When a block of grease becomes oxidized and hard, lubrication of the metal parts is prevented, resulting in increased temperatures which ultimately cause carbonization of the grease. This carbonization causes complete failure of lubrication, and subsequent damage to the driving journal. Greases of this type must not develop oil leakage at elevated temperatures, leaving a hard soap residue having little or no lubricating properties.

In the past certain driving journal compounds approaching the above-mentioned desired properties have been prepared from oil, fat and/or fatty acid and caustic. During the preparation of the greases the caustic forms soaps with the fats or fatty acids. Other driving journal compounds have been prepared by oxidizing the oil and fat and/or fatty acid before the grease was compounded.

The present invention relates to the incorporation of a small amount of solubilizing or plasticizing agent, and more particularly to the addition of an oil-soluble soap, preferably a soap of petroleum-derived acids, to the usual components forming the driving journal grease—that is to say, in addition to the soap usually formed during saponification of the fat. I have found that fire kettle driving journal grease containing this solubilizing or plasticizing agent does not require preoxidation of the oil or fat components prior to compounding the grease.

The soaps which may be added in lieu of the pre-oxidation step may be such oil-soluble metal soaps as "mahogany" soap or oil-soluble naphthenates of lead, aluminum, calcium, etc. Although mahogany soap, which is the sodium soap of mahogany acids, is preferred, other metallic soaps of the mahogany acids such as potassium, calcium, barium, aluminum, iron and lead soaps and the like can be used.

While the term "mahogany acids" is well

known in the art, it is believed that a description of a method of obtaining such material is desirable. In the preparation of highly refined petroleum oils, the oils are treated successively with a number of portions of concentrated or fuming sulfuric acid. A variety of sulfur-containing compounds are formed by the chemical reactions of the treating operations, including sulfonic acids, organic esters of sulfuric acid, etc. Most of these compounds are relatively insoluble in the oil under the treating conditions, and therefore separate from the oil, together with unreacted acid, as a sludge which is separated from the oil after each acid treatment. Some of the sulfonic acids are preferentially oil-soluble; these remain in the oil and can be removed therefrom by neutralizing the acid-treated oil with caustic soda, caustic potash or ammonia to form sulfonic acid soaps or sulfonates, and extracting these sulfonates from the oil by treatment with 50% to 80% aqueous alcoholic solutions or other suitable means. Because of the characteristic mahogany color of these sulfonates they are known as "mahogany soaps" and will hereinafter be referred to as such. The mahogany soaps may also be obtained by extracting the sulfuric acid treated oil prior to neutralization with an aqueous solution of an alcohol whereby the mahogany acids are extracted from the oil, and treating the extract obtained with a neutralizing agent such as, for example, NaOH, KOH or NH_4OH , to convert mahogany acids to the corresponding mahogany soaps.

The addition of small amounts of the above-mentioned soaps produces driving journal greases having qualities greatly superior to those of hitherto known driving journal greases.

It is an object of the present invention to provide new and improved greases of the driving journal compound type and new and improved methods for preparing same.

Another object of the invention is to provide a grease of the type described having an improved resistance to oxidation.

Still another object of the present invention is to provide a grease having a more uniform consistency during variations in temperature.

A further object is to prepare a grease of the driving journal compound type which does not require the pre-oxidation of the oil or fatty material.

A still further object of the present invention is to provide an improved process whereby the time usually required for preparing this type of grease is greatly reduced. Other objects will be apparent as the description of the present invention proceeds.

In order to understand the invention more clearly reference is made to the drawings forming a part of this specification in which,

Figure 1 shows the degree of hardening of

different greases at 77° F. after having been heated to 300° F. for varying periods of time, and

Figure 2 shows the consistency of different greases at temperatures between 77° F. and 350° F.

As stated above, certain greases of the driving journal type are prepared by the oxidation of the oil prior to the saponification step. According to the present invention it is possible to dispense with the oxidation step altogether by adding a small amount of a solubilizing or plasticizing agent consisting of an oil soluble soap such as soaps of sulfonated animal and vegetable oils, soaps of mahogany acids, and oil soluble soaps of naphthenic acids. These soaps may be the sodium, potassium, calcium, barium, lead, aluminum, iron and other metal soaps of the various acids mentioned above. It is particularly pointed out that these solubilizing agents do not replace the soaps usually present in a driving journal compound, but rather are used in addition to those soaps.

Although the specific application of my invention is for a driving journal grease which may vary in soap content from about 30% to about 60%, this method of plasticizing soda soap greases may be used in any sodium soap grease that contains from about 1% to about 60% soap in addition to the plasticizing agent itself. The amount of solubilizing agent required will depend on the particular agent chosen for this purpose and the kind and amount of soap in the grease. The amount of solubilizing agent may vary from about 1% to about 20% of the total mix.

Greases of the driving journal type according to the present invention are made from about 30% to about 60% fatty material, from about 5.0% to about 10% caustic soda, about 1% to about 20% solubilizing or plasticizing agent and the balance oil. The oil used may have various properties, depending on the exact nature of the product desired; for instance, steam refined oil (530° F. flash), or any oil having a viscosity of between about 150 and about 250 seconds Saybolt Universal at 210° F. can be used. The fatty material may consist of fats such as blended animal fat, tallow or the like or various fatty acids can be used in place of the fat or a mixture of the two can be used. The fatty acid may be unsaturated, partially unsaturated or preferably saturated, such as hydrogenated fish oil fatty acid or a pitch obtained therefrom in accordance with the procedure described in U. S. Letters Patent Nos. 2,229,367 and 2,229,368. It has been found that a combination of one of the above oils and a fat or a fatty acid, or a mixture of them together with caustic and a solubilizing agent according to the present invention produces a grease which is superior to previously known driving journal greases. Broadly, those greases made with saturated fatty acids alone are particularly resistant to oxidation, while those made with fats or mixtures of fats and fatty acids have excellent appearance, high resistance to working and excellent softening time, as well as very good resistance to oxidation at elevated temperatures. One practical advantage of using hydrogenated fish oil fatty acid or fat or a pitch obtained therefrom resides in the fact that the total soap content, including the solubilizing agent, can be lowered below 50% without detracting from the desired properties of the grease. This reduced total soap content is in no small part responsible for the very fine resistance to oxidation.

Greases of the type described can be prepared

by mixing together the fat and/or fatty acid, petroleum oil and solubilizing agent and heating this mixture. Following this the caustic, such as sodium hydroxide, is added and the mixture is heated further, so that the product will be in a liquid state for filling containers and the like. By this process considerable time is saved since it is not necessary to pre-oxidize the oil or the fat, and furthermore because foaming which was a serious disadvantage of the previously known processes, is avoided. In the following more detailed description of the invention reference will be made to penetration and softening time.

Penetration is an indication of hardness and consistency and in the following data it has been based on the A. S. T. M. penetration test, D 217-38 T. Softening time, on the other hand, is an index of quality from the service standpoint and is measured by the following described test. A cylinder of driving journal compound one-half inch in diameter and above five-eighths inch long is heated on a metal plate contained in an oil or mercury bath. The temperature of the bath is controlled to give the desired temperature at point of contact between the plate and grease sample which is subjected to the weight of an 85 gram cylinder, thus providing a pressure on the driving journal compound comparable to the pressure to which the same is subjected in actual operation when it is forced by a spring against a hot bearing. Softening time is defined as the time in seconds required to flatten the test cylinder one-fourth inch under these conditions. In the following Table I examples 1 to 6 describe the materials used in preparing driving journal compounds according to the present invention. Examples 7 and 8 describe two driving journal compounds prepared according to previously known processes and are submitted here for purposes of comparison with the new compounds.

TABLE I
Percentages

	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8
Fat (tallow).....	50	.....	.....	10	20	20	46	247.5
Fat (animal blended).....	.....	50	.....	.....	.....	.....	.....	.....
Fatty acid (sat'd).....	.....	.....	35	.....	20	.....	.....	.....
Fatty acid (partially un-sat'd).....	.....	.....	.....	38	.....	27	.....	.....
Dry Caustic (added as 48° Bé. solution).....	8	8	6	8	8	8	8	6.0
Plasticizer (mahogany soap).....	6	6	12	6	6	6	6	.....
Steam refined oil (530° F. flash).....	36	36	47	38	46	39	46	246.5

¹ Viscosity increased 12% by oxidation.

² Fat and oil (cylinder stock) oxidized to give 60% viscosity increase at 210° F.

In the following table certain penetration data are given as well as the softening time and pressability of the foregoing greases:

TABLE II

	Penetration at 77° F.			Softening time at 300° F. (85 g. weight)	Pressability
	Uncut surface	Cut surface	150 g. added, cut surface		
Ex. 1.....	27	41	4,000	Very good.
Ex. 2.....	33	46	1,100	Do.
Ex. 3.....	20	28	4,000	Fair-sticky.
Ex. 4.....	15	26	7,200	Very good.
Ex. 5.....	23	33	2,700	Fair.
Ex. 6.....	25	34	5,400	Good.
Ex. 7.....	23	34	400	Fair-sticky.
Ex. 8.....	41	84	400	Sticky.

An additional method of improving the plastic properties of the greases is to use a quantity of caustic slightly in excess of that theoretically required to saponify the fat. It is believed that the excess caustic reacts partially or wholly with the small amount of glycerine which is formed in the saponification of the fat. This reaction product also acts as a solubilizing or plasticizing agent. Therefore, it has been found that 10 to 20% of the finished grease should consist of soap from a fat such as tallow and excess caustic to react with the glycerine liberated.

With particular reference to the drawings forming a part of this specification, Figure 1 shows the hardening effect of increased temperatures for various periods of time on each of the examples noted above. It is evident that the products of examples 4, 5 and 6 are better, that is, superior in resistance to oxidation, to the product of example 7, and that the products of examples 1 and 2 are comparable to example 7 in resistance to oxidation. It will be noted that all of the examples are far superior to example 8. Figure 2 shows the effect of various temperatures on the consistency of the greases as measured by the penetration. It will be noted that examples 4 and 6 are vastly superior to example 7, while example 5 is only slightly less satisfactory than examples 4 and 6.

The method of manufacture of these greases is as follows: A mixer of conventional type is charged with all of the fat and/or fatty acid, petroleum oil and oil-soluble soap such as mahogany soap, and while these ingredients are being stirred, the mixer is heated to approximately 180° F. to 220° F., at which temperature all of the caustic such as sodium hydroxide is added as a 48° Baumé solution. The batch is heated at about 220° F. to about 230° F. until dry; then the temperature is raised as rapidly as conditions permit to approximately 500° F. for filling. At this temperature the batch is in a liquid state, so it can be filled into pans to solidify. Alternatively, the grease may or may not be heated to fire kettle temperatures of about 350° F. to about 600° F. before filling. The filling temperature is independent of the maximum processing temperature and may be varied to meet specific applications.

While the present invention has been described with particular reference to railroad driving journal greases, it may also be applied advantageously in the manufacture of mill greases and the like. Although particular reference has been made to certain preferred embodiments of the present invention, it is to be understood that these are by way of illustration and not by way of limitation. The scope of the present invention is to be limited only by the appended claims.

I claim:

1. A hard, block grease of the type employed for the lubrication of driving journals prepared from about 30 percent to about 60 percent of a fatty material, about 5 percent to about 10 percent caustic soda, about one percent to about 20 percent oil-soluble metal sulfonate derived from petroleum oil and the balance mineral oil.

2. A hard, block grease as claimed in claim 1 wherein the balance consists of a mineral oil having a viscosity of from about 150 seconds to about 250 seconds Saybolt Universal at 210° F.

3. A hard, block grease of the type employed for the lubrication of driving journals prepared from about 50 percent fatty material, about 8 percent caustic soda, about 36 percent petroleum oil and about 6 percent mahogany soap.

4. A hard, block grease of the type employed for the lubrication of driving journals, prepared from about 40 percent fatty material, about 8 percent caustic soda, about 46 percent steam-refined oil and about 6 percent mahogany soap.

5. A hard, block grease of the type employed for the lubrication of driving journals prepared from about 38 percent fatty material, about 10 percent fat, about 8 percent caustic soda, about 38 percent steam-refined oil and about 6 percent mahogany soap.

6. A driving journal compound comprising a hard block grease prepared from about 30 percent to about 60 percent of a saturated fatty material, about 5 percent to about 10 percent caustic soda, about 1 percent to about 20 percent of an oil-soluble metal sulfonate derived from petroleum oil, and the balance mineral oil having a viscosity of from about 150 seconds to about 250 seconds Saybolt Universal at 210° F.

7. A driving journal compound comprising a hard block grease prepared from about 30 percent to about 60 percent of hydrogenated fish oil fatty acid, about 5 percent to about 10 percent caustic soda, about 1 percent to about 20 percent of an oil-soluble metal sulfonate derived from petroleum oil, and the balance mineral oil having a viscosity of from about 150 seconds to about 250 seconds Saybolt Universal at 210° F.

8. A hard block grease of the type employed for lubricating driving journals which grease comprises an amount within the approximate range of 30% to 60% of an alkali metal soap of a fatty acid material and an amount within the approximate range of 1% to 20% of mahogany soap, the remainder consisting essentially of viscous lubricating oil.

9. The grease of claim 8 in which at least a substantial part of the fatty acid material comprises hydrogenated fish oil fatty acid material.

10. The grease of claim 8 wherein the amount of mahogany soap in the grease is in the general vicinity of 6%.

REUBEN A. SWENSON.

CERTIFICATE OF CORRECTION.

Patent No. 2,352,811.

July 4, 1944.

REUBEN A. SWENSON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 24, claim 5, for "fatty material" read --fatty acid--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of August, A. D. 1944.

Leslie Frazer

(Seal)

Acting Commissioner of Patents.