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SOLID LUBRICANT

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This invention relates to improvements in solid lubricants and more particularly to that class of hard lubricants designed to be used in cake form for lubricating locomotive driving journals and other bearings of heavy members working at high speed.

One of the objects of this invention is to produce a lubricating grease of high oil and low water content with a melting point of over 400° F. which will have increased hardness and a dense consistency to enable it to be formed in blocks or cakes by pressing or molding and to retain its shape during all ordinary handling and shipping.

Another object of the invention is to produce a lubricating grease which while sufficiently adhesive in nature to adhere to and provide at all times a proper lubricating film for the working parts to which it may be applied, will be of increased hardness and solidity, the particles having a high degree of coherence so that when used under a temperature sufficiently high to reach the melting or flow point of the grease, only the contact surface of the grease will immediately melt to flow to the part to be lubricated while the mass of the grease other than the contact portion will remain in an unmelted state.

Another object of the invention is to produce a solid lubricating grease which, when melted to a fluid state, upon cooling, will return to its original densely solid structural condition without impairment of its lubricating qualities.

By this invention, we also produce a densely solid grease having a fibrous structure substantially free from moisture and having a melting point of 400° F. or over.

Another object of the invention is to enable the production of a lubricating grease having substantially the hardness and consistency of hard soap, comprising a relatively high percentage of mineral oil, a relatively low percentage of soap stock in the form of sodium stearate, and a low water content and having a melting point of 400° F. or over.

In carrying out our invention, we preferably provide for use in relatively warm climates a formula substantially as follows:—

	Percent
Heavy mineral oil cylinder stock (paraffine base)	52.18
Stearic acid	39.23
Granular caustic soda	6.87
Water	1.72

For colder climates, we preferably use a grease formula with a higher oil content, as follows:—

	Percent
Heavy mineral oil cylinder stock (paraffine base)	54.12
Stearic acid	37.64
Granular caustic soda	6.59
Water	1.64
	100.00

In making our improved grease, we utilize an open-top, steam-jacketed kettle of large enough capacity to prevent the mass from overflowing the kettle, and we preferably first introduce the stearic acid, then the oil, heated to permit convenient handling, is then run into the kettle, after which sufficient heat is applied to melt the stearic acid, such heat preferably being applied at approximately 200° F. during this period. Agitation is begun so soon as the stearic acid cakes are partially melted to assist in the melting, and when the stearic acid is completely melted, the mixing is substantially completed at the same time. The alkali, preferably comprising as indicated in the above formula, granular caustic soda, which has been previously prepared by heating with a small quantity of water to bring it into substantially paste form, is now added to the stearic acid and oil, agitation being continued during the introduction of this alkaline paste.

Shortly after the addition of the alkaline paste, a very violent reaction takes place with a boiling and rising of vapors, and an autogenous generation of heat, the temperature of the mass being raised to approximately 230° F. During this reaction, water in the form of steam is expelled from the mass. The heat is preferably turned off just prior to the addition of the alkaline paste, the agitation, however, being continued during the reaction of saponification. The mass of material greatly increases in bulk and rises toward the top of the kettle, giving off, as aforesaid, water in the form of steam. So soon as the reaction is complete, the bulk of the material begins to decrease and descend in the kettle and to pull away from the sides. At this time, the material is a relatively dry, spongy, or gummy mass. Heat with agitation is now applied, a temperature of approximately 350° F. being preferred, for the purpose of softening the compound to bring it into a smooth doughy form or homogeneous mass in which form it

may be caused to flow and be drawn from the kettle. Agitation is preferably continued throughout this period until the compound is removed from the kettle.

The finished product after cooling, comprises a solid, relatively hard and compact grease of dense and fibrous structure, the particles having a very high degree of coherence, and the density and stiffness being substantially equal to the average hard soap. This dense structure is desirable for the reasons hereinabove specified and we find that there is no tendency in the mass, of segregation or the formation of oil pockets frequently found in lubricating greases, but on the contrary, a homogeneous soap-like mass is produced. Furthermore, the use of stearic acid as the saponifying base enables the introduction of an increased percentage of cylinder stock to be added to the lubricant than would be possible, for example, with other fatty oils.

We have found that such a compound has a melting point of approximately 450° F. An average analysis represented by the examination of three samples of the above-mentioned lubricant gives the following:—

	Percent
Sodium stearate	46.97
Free alkali (NaOH)	0.44
Heavy mineral cylinder stock (paraffine base)	51.79
Water and undetermined matter	0.80
	100.00

We preferably use refined, well-pressed stearic acid in order to produce a hard dense grease of a higher melting point than can otherwise be obtained and also to enable the incorporation in such a hard grease of an increased quantity of mineral oil as hereinabove specified.

We find that this grease has greatly increased efficiency in use in the bearings of locomotive driving journals and the like and particularly in the journal boxes under spring pressure; furthermore that under ordinary conditions, this grease gives perfect lubrication and under extraordinary conditions, as for example, when there is such a mechanical irregularity in the mechanism lubricated as to cause excessive heat, the outer surface of the cake of lubricating grease will be melted and flow to the part required while the mass of the grease, due to its poor heat-conductivity and cohesiveness, will remain in normal unmelted condition, thus resulting in a great economy of grease and preventing too rapid discharge of the grease and the subsequent failure of lubrication by the particular charge of grease. Furthermore, we have ascertained that when our compound is used under conditions of high temperature, as for example, in the bearings of locomotive driving journals that are located adjacent to the fire box or ash pan of the boiler, this lubricant will not, in any way, be impaired by the action of excessive heat at these points and due to the high oil content of this grease, a relatively smaller quantity thereof will be required in any given period of time.

It will be understood also that the physical characteristics of the grease including the fibrous structure which is due to the saponification of the stearic acid, will result not only in an increased cohesion of the particles to enable the grease to maintain its stable solid or caked form, but will also provide a sufficient degree of adhesion which will cause to be deposited upon the surfaces to be lubricated, a better film of lubricant than has heretofore been possible to obtain.

Having described my invention, I claim:—

1. The process of manufacturing solid lubricants which comprises mixing a viscous hydrocarbon oil with stearic acid at the melting temperature of the latter, reacting with sodium hydrate in sufficient quantity to saponify the acid with free alkali of less than one percent (1%) and heating the product to complete the reaction.

2. The process of manufacturing solid lubricants which comprises mixing a viscous hydrocarbon oil with stearic acid at the melting temperature of the latter, reacting with sodium hydrate in sufficient quantity to saponify the acid with free alkali of less than one percent (1%) previously prepared in paste form by heating granular caustic soda with a small quantity of water, and heating the product to complete the reaction.

3. A solid lubricant consisting of, a paraffin base cylinder stock, approximately 52%, sodium stearate approximately 46.5%, free alkali 0.5% and water 1%.

4. A solid lubricant having a fibrous structure and consisting of a paraffine base cylinder stock 52%, a higher fatty acid soap 46.5%, free alkali 0.5% and water 1%.

5. A solid boiled lubricating grease principally composed of a dehydrated mixture of a heavy viscous hydro-carbon oil and a sodium stearate soap freed from glycerol, said grease having approximately the hardness and consistency of the average hard soap.

6. A solid boiled lubricating grease principally composed of a dehydrated mixture of a heavy viscous hydro-carbon mineral oil and a sodium stearate soap, said two ingredients being present in approximately equal proportions, and said grease having approximately the hardness of the average hard soap.

7. A solid lubricant principally composed of a dehydrated mixture of heavy viscous hydro-carbon oil and sodium stearate soap prepared from stearic acid and caustic soda, said two ingredients being present in approximately equal proportions and comprising substantially the entire grease with the exception of water and free alkali in quantities of less than one percent (1%) each, said grease having approximately the hardness and consistency of the average hard soap and having a melting point of the order of 400° F.

8. A solid boiled lubricating grease principally composed of a dehydrated mixture of cylinder stock and sodium stearate soap freed from gylcerol, said cylinder stock and soap being present in approximately equal proportions, and said grease having approximately the hardness and consistency of the average hard soap, and also having a fibrous structure.

9. A solid boiled lubricating grease principally composed of a dehydrated mixture of cylinder stock and the products of reaction under heat of stearic acid with caustic soda in a quantity sufficient to neutralize the acid with an excess of alkali of not more than one percent (1%), said grease having approximately the hardness and consistency of the average hard soap.

10. A solid boiled lubricating grease principally composed of cylinder stock and the product of reaction under heat of well-pressed stearic acid with caustic soda in paste form in a quantity sufficient to neutralize the acid with an excess

of alkali of not more than one percent (1%), said grease having approximately the hardness and consistency of the average hard soap.

11. A solid boiled lubricating grease having a soap content comprising sodium stearate free from glycerol approximately 47%, cylinder stock approximately 52% with less than 1% of water, said grease having a hardness and consistency of approximately the average hard soap.

12. A solid boiled lubricating grease produced from approximately the following materials:—

	Percent
Heavy mineral cylinder stock (paraffine base)	52.18
Stearic acid	39.23
Granular caustic soda	6.87
Water	1.72

and having approximately the following average analysis:—

	Percent
Sodium stearate	46.97
Free alkali (NaOH)	0.44
Heavy mineral cylinder stock (paraffine base)	51.79
Water and undetermined matter	0.80
	100.00

13. A solid substantially dehydrated lubricating grease comprising viscous hydrocarbon oil and sodium stearate soap freed from glycerol, said two ingredients being present in approximately equal proportions and comprising substantially the entire grease with the exception of water and free alkali in quantities of less than one percent (1%) each.

14. A solid substantially dehydrated lubricating grease comprising viscous hydrocarbon oil and sodium stearate soap freed from glycerol, said two ingredients being present in approximately equal proportions and comprising substantially the entire grease, said grease having approximately the consistency of hard soap and having a melting point above 400°.

15. A solid substantially dehydrated lubricating grease comprising a paraffine base cylinder stock and sodium stearate soap freed from glycerol, said two ingredients being present in approximately equal proportions and comprising substantially the entire grease.

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