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WIRE ROPE LUBRICANT

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This invention relates to compositions comprising petrolatum and oxidized asphalt which are suitable for use as wire rope lubricants.

Wire rope requires lubrication of the strands and wires of which it is composed since in operation there will be considerable motion between their surfaces. For instance, an elevator cable which runs pulley wheels or drums is subjected to constant bending and flexing. In the operation of outdoor equipment such as a yard crane or a dragline in earth moving, the lubricant should not only prevent rubbing wear between the strands but must also protect the strands and wires against rust or corrosion.

Wire rope, e.g., cable, is widely used in materials-handling work. This includes high lift service, pulling operations, short lift work, and long haul work. The elevator and the mine hoist are examples of high lift service. Pulling operations include the dragline, excavating machine, dredge, and car puller. Short lift work, in turn, is exemplified by the yard or traveling crane, and long haul work by the suspension and moving cables used in cable cars and ski lifts.

An industrial wire rope lubricant must be able to operate satisfactorily in extremes dictated by the particular use, climate and location. Thus, there can be extreme variations in temperature as, for instance, in a steel mill crane which handles hot ingot molds or equipment which must be used in a desert or artic type climate. The particular use might entail high pressures between strands and wires. Such a situation might come about when the rope has to work over small diameter drums or sheaves. Work of this type involves continuous bending and straightening out of the rope. In many instances, wire rope will be subjected to contaminants such as water, acids, acid fumes, dirt, and dust. These contaminants are especially present in outdoor service or around industrial plants where there can be chemical fumes and the like.

Many wire ropes are manufactured by winding the metal strands around a fiber core or another smaller wire core. The core aids in providing strength and resistance to pressure where the requirements for stretch and elasticity are not too exacting. A wire cord is used where the rope may be subject to temperatures which would be high enough to char a fiber core. In normal temperature service the fiber core serves not only as a strand support but also as a lubrication aid because it becomes a reservoir for reserve lubricant when the latter is able to penetrate the rope structure completely. Under such conditions the lubricant, in turn, serves as a fiber core preservative in the prevention of bacterial reactions. A well lubricated core also provides assurance that the innermost wires will be protected against rusting and abnormal wear. An otherwise dry core could absorb moisture and promote corrosion within the rope.

A good lubricant must be able to provide protection against these conditions. Other wire rope lubricant characteristics which can be of significance include the ability

to (1) resist melting and running off at high storage and operating temperatures, (2) resist cracking and splitting in cold weather, (3) be sufficiently tacky to resist dripping and flying off, (4) repel water and resist emulsification, (5) resist collecting dust and dirt, (6) resist removal from the rope by the action of the elements, and (7) not be affected by acid, salt water, acid fumes, or other industrial pollutants. Although any or all of these properties can be of importance depending on the particular use, probably the most important is the first one.

It has now been discovered and forms the substance of this invention that compositions can be prepared which have outstanding utility as wire rope lubricants. These lubricants are of the solid or greaselike type. In this type of wire lubricant it is important that there be obtained a certain relationship between penetration values and softening point values. The penetration values referred to herein are needle penetration values at 77° F. unless otherwise designated. By softening point is meant the temperature at which the composition tends to become liquid. Penetration is the term used to designate the relative hardness of the composition. Thus, on a relative scale, a low penetration figure means that the composition is relatively hard and a high penetration value means that the composition is relatively soft. The softening point is the most critical factor since a good wire rope lubricant must be able to withstand melting and running off in wide extremes of all climatic and environmental temperatures. Thus, an outstanding wire lubricant would be equally efficacious in a hot desert environment as well as a cold snow and ice environment. A relatively high softening point insures that the lubricant will not melt and run off the wire rope under extremely hot conditions and a relatively high penetration value accompanying this softening point value insures that the lubricating composition will not become brittle with a tendency to chip or break at very cold temperatures.

It has been known in the art to use either petrolatum or asphalt based compounds as wire rope lubricants. It has now been discovered that when from about 1 to 15, e.g. 7 to 12, wt. percent of a petrolatum having a softening point of from 120° to 175° F., e.g. 140° to 175° F., and a penetration value of from 70 to 120, e.g. 80 to 100, at 77° F. is blended with a major proportion of an oxidized asphalt having a softening point of from 140° to 180° F., e.g. 160° to 175° F., and a needle penetration value at 77° F. of from 20 to 75, e.g. 32 to 60, a composition is obtained which unexpectedly has softening points which are higher than either one of its components. The resulting product has softening points from 180 to 210 and needle penetration (at 77° F.) values of from 35 to 200. In many instances a wire rope lubricant user will prefer to have relatively high penetration values accompanying high softening point properties. The reason for this is that the higher the penetration of the lubricant, the less danger there is of brittleness at low temperatures. However, in the event low temperature operations are not contemplated and therefore high penetration values are not necessary, it is possible by proper selection of components to obtain wire rope lubricants with softening points above 180° F. but with needle penetration values of from about 45 to 150. The significance of lower needle penetrations is that the lubricant tends to be less sticky and tacky and thus somewhat less likely to cause stain-

ing or dirtying. Thus, where a user has no concern with brittleness and desires little staining or dirtying in operation, the lower needle penetration value lubricants offer an advantage. The lubricants with relatively low needle penetrations are very generally obtained by using the oxidized asphalts from the lower end of the penetration ranges of from 20 to 75, that is, from about 20 to 45. Oxidized asphalts having penetration values above about 45 tend to combine with the petrolatum to give lubricants which exhibit higher penetrations than would be expected from the penetration values of the components.

It has been further discovered that the particular quantities disclosed above are quite critical. When more than about 15 wt. percent of the petrolatum is used the resulting composition has an undesirable grainy appearance and feel. This is due to the fact that the asphalt tends to precipitate out or "salt out" of the petrolatum.

Oxidized asphalt is the product obtained by subjecting relatively high viscosity residual oil produced from vacuum distillation of asphaltic crude to air blowing at temperatures of from 400° to 500° F. The air blowing is continued until sufficient asphaltenes have been produced in the reaction mixture to result in the desired levels of softening point and penetration. Oxidized asphalt is also commercially known as "blown" asphalt. The method of obtaining softening points is described in ASTM–D–36–26. The method of determining penetration values is described in ASTM–D–5–52.

Petrolatums are usually solid at ambient temperature and contain both solid and liquid hydrocarbons. They may be considered as colloidal systems in which the solid hydrocarbon components are the external phase and the liquid components are the internal phase. The solid portion has taken up the liquid phase resulting in an amorphous mass. Petrolatums may vary widely in physical characteristics depending on the source, method of extraction, and degree of refinement. Petrolatums for use in the invention are preferably obtained as an unrefined bottom residuum from the distillation of a mixture of petrolatums.

Although not necessary for many uses, it is contemplated that the compositions of the invention can have incorporated therein rust and corrosion preventive agents such as sorbitan monooleate or a neutral barium dinonyl naphthalene sulfonate sold commercially as NA-SUL-BSN or the like. NA-SUL-BSN consists of 50 wt. percent of a neutral barium dinonyl naphthalene sulfonate of the type described in U.S. Patent No. 2,764,548 and 50 wt. percent light mineral oil. In using such commercial blends formulated with a mineral oil, the final lubricant tends to have a higher penetration value than if the additive blend were not present. However, there is no appreciable change in softening point values. These rust and corrosion preventive substances are preferably incorporated in the lubricant in amounts ranging from about 0.5 to 10, e.g. 1 to 3, wt. percent. Extreme pressure agents can also be included in the composition where heavy duty type applications are involved. Other conventional additives can also be used.

The invention is further illustrated by the following examples which show preferred techniques of carrying out the invention.

Example I

Ninety wt. percent of an oxidized asphalt having a softening point of 169° F. and a penetration at 77° F. of 55 was blended with 10 wt. percent of a petrolatum having a softening point of 160° F. and a penetration of 93. The melting point of the petrolatum was 168° F. and it had a cone penetration value of 34 at 77° F. The two components were mixed together until a uniform, smooth appearing mixture was obtained. This mixture was then evaluated for softening points and needle penetrations at 77° F. The softening point obtained was 203° F. The penetration value obtained was 200.

Example II

Ninety seven wt. percent of the Example I composition was blended with 3 wt. percent of sorbitan monooleate. The resulting composition had physical properties similar to those of the Example I composition. The composition of Example II had a softening point of 202° F. and a penetration of 77° F. of 265.

Example III

Ninety seven wt. percent of the Example I composition was blended with 3 wt. percent of the NA-SUL-BSN already described. The resulting composition had a softening point of 190° F. and a penetration at 77° F. of 297.

In order to evaluate the rust preventive characteristics and resistance to removal of the lubricant from the wire by the action of the elements the following test was carried out. Four segments of steel wire rope were coated with the following materials: the composition of Example I, the composition of Example II, the composition of Example III and the oxidized asphalt used in preparing Examples I, II and III. The coated segments of wire rope were then placed in a completely exposed area on a roof of a three-storey building in Bayonne, New Jersey and left for a period of about eight months (ending January 18, 1961). At the end of this eight-month period these samples were removed from the roof and evaluated visually. An examination of wire rope segments following removal of the coating with propane revealed all specimens to be completely rust free and, therefore, fully protected throughout the duration of the test. It was known that oxidized asphalts provide a barrier against moisture penetration. The above tests demonstrate that the compositions of the invention provide an equally effective barrier against moisture penetration.

Example IV

In order to evaluate the tendency of the composition to resist cracking and splitting at temperatures of about −30° F., the following tests were performed on the compositions of Examples I, II and III. This test was carried out as follows: One-half inch wide, flat strips of tin plate, 5 inches in length were coated on both sides with about 1/32 inch layer of each composition and allowed to remain at room temperature (75° F.) for approximately 24 hours. The coated strips were then inserted in stoppered glass pour jars. The jars were placed in a constant temperature cold bath maintained at −30° F. for 16 hours. Each sample was then quickly withdrawn and immediately bent through 180° around a pipe of one inch diameter and the condition of the coating observed. No cracking or peeling on bending at −30° F. was observed for any of the coatings.

Example V

In order to demonstrate the preparation of compositions having high softening points with relatively low penetration values, Example I was repeated exactly except that the oxidized asphalt used had a softening point of 168° F. and a penetration value of 36. The resulting composition had a softening point of 180 and a penetration value of 45. All penetration values in the specification, unless otherwise indicated, refer to those obtained using the method of ASTM–D–5–52. All softening points in the specification refer to those obtained using the method of ASTM–D–36–26.

What is claimed is:

1. A composition suitable for use as a wire rope lubricant comprising 1 to 15 wt. percent of a petrolatum having a softening point of from 120 to 175° F. and a needle penetration of from 70 to 120 at 77° F. and a major proportion of an oxidized asphalt having a softening point of from 140 to 180 and a penetration value of from 20 to 75 at 77° F.

2. A composition according to claim 1 wherein the quanttiy of said petrolatum is from about 7 to 12 wt. percent.

3. A composition according to claim 1 wherein said petrolatum has a softening point of from 140 to 175° F. and a needle penetration value of from 80 to 100 at 77° F. and wherein said oxidized asphalt has a softening point from 160 to 175° F. and a needle penetration value of from 32 to 60 at 77° F.

4. A composition according to claim 1 wherein said oxidized asphalt has a softening point of about 169 and a penetration of about 55 at 77° F.

5. A composition according to claim 1 wherein said petrolatum has a softening point of about 160° F. and a needle penetration value of about 93 at 77° F.

6. A method of lubricating wire rope which comprises applying the composition of claim 1 to said wire rope.

7. A composition comprising a major proportion of the composition of claim 1 and 0.5 to 10 wt. percent of sorbitan monooleate.

8. A composition comprising a major proportion of the composition of claim 1 and 0.5 to 10 wt. percent of a neutral barium dinonyl naphthalene sulfonate.

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