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PNEUMATIC TOOL LUBRICANT

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This invention relates to a new and improved lubricant for pneumatic tools, such as percussion type drills and similar high speed compressed air machines and steam machines. More particularly, this invention relates to a lubricating composition comprising mainly a viscous hydrocarbon oil blended with minor proportions of a non-drying thickened fatty oil and of a high molecular weight linear organic polymer for providing efficient lubrication to surfaces of fast moving machine parts and to their guides, such as rapidly reciprocating pistons and their cylinder walls, the lubricant on such surfaces being exposed during the machine operation to erosive action by forceful streams of gases and condensate which accompany the use of gases like compressed air or steam.

Pneumatic tools present peculiar problems in lubrication. In general, they are rugged portable machines subjected to rough handling. Although they need constant and efficient lubrication at all times, they cannot be equipped very easily with automatic lubricant feeding systems which are delicate or which have large supply reservoirs. Added difficulties in lubricating these machines arise from the rapid jarring movements of, and high gas velocities against lubricated parts, since these mechanical actions tend to separate the lubricant from the metal surfaces. Variations of temperatures occur in different parts of these machines. Gas expansion causes intense cooling in the surrounding parts and condensation of water vapor present in the usual gaseous or pneumatic fluids, compressed air and steam, while impacts and friction cause relatively intense heating in other parts. Moisture condensed from a pneumatic fluid in the machine tends to wash away a film of lubricant non-resistant to this action, and temperature variations affect the fluidity of lubricants which have viscosities sensitive to these variations. When used outdoors and in mines, these machines are subject to environmental temperatures which intensify these temperature variations. Lubricants are undesirable if they flow too freely over the heated parts of the tool, also, if they have sufficiently high viscosity in contact with the heated parts but congeal in contact with cooler parts or in the lubricator.

An object of the present invention is to provide a pneumatic tool lubricant with which can be achieved a high standard of lubricating efficiency and economy in a wide range of operating conditions. From careful study and experience, this object is best attained by compounding a lubricant which possesses specially combined properties of: 1, high viscosity index, 2, oxidation resistance, 3, correct viscosity for penetration between moving surfaces of finely machined parts, 4, ability to be atomized readily into the air line of a line lubricator, 5, ability to wet a metal surface in the presence of water without becoming churned to a foamy mass, 6, ability to resist moisture and adhere to metallic surfaces even when emulsified, and, 7, other qualities determined by specific requirements of the service.

Materials have been compounded in the past to make lubricants having advantageous properties in one respect or another, but lubricants with the desired combination of qualities, particularly those of adhesiveness and moisture resistance have not been available. In accordance with the objects of this invention, an improved lubrication of pneumatic tools is obtained by a composition which is able to give a lubricating film protection on working parts under rapid mechanical action regardless of moisture deposition.

Broadly, this invention involves the blending of a viscous hydrocarbon oil, such as a petroleum lubricating oil fraction, with a non-drying viscous oxidized or thickened fatty oil and with a small amount of a hydrocarbon polymer which normally is substantially solid. By a proper selection and proportioning of these ingredients, a blend can be obtained having suitable viscosity and pour point characteristic to assure proper flowing and penetration and which protectively stays on rubbing surfaces under severe operating conditions.

Preferably, the principal ingredients of blends found to have wide adaptability for use in many kinds of air driven percussion type tools including outdoor equipment during all seasons of the year are a mineral lubricating oil having a viscosity in the range of about 100 to 925 Saybolt seconds at 100 degrees F. and a pour point below about +10° F., a non-drying thickened fatty oil, and a semi-solid to solid isobutylene polymer. As the mineral oil ingredient, a lubricating oil fraction from a naphthenic crude, such as from a Colombian or Coastal crude answers the purpose well. Blown rape seed oil is particularly suitable as the non-drying thickened fatty oil. The semi-solid to solid polymer is prepared according to methods known in the art for polymerizing isobutylene to very high molecular weights in the range of about 50,000 to 60,000 or to as high as about 200,000, as determined by the Staudinger viscosity test. One method preferably consists in reacting isobutylene in the presence of boron fluoride at temperatures below about −40° F., and preferably below −50° F. Under such conditions, a tough, elastic, almost colorless, and substantially solid mass is rapidly formed. Chemically, hydrocarbon polymers thus formed are characterized as being highly saturated to the extent that they have an iodine number below 20, as capable of withstanding

decomposition for more than 5 minutes at 200° C., and as having a linear structure. About 0.1 to 0.5% of this material is readily dissolved in the blend of hydrocarbon oil and non-drying thickened fatty oil and when thus dissolved forms a homogeneous mixture having a stable cohesiveness to be perceived in the formation of long strings or threads when the mixture is pulled apart. This cohesiveness is stable to light, air, heat, and moisture.

For the sake of illustration, although not desiring to be limited thereby, examples will be given of preferred ingredients and their proportions to form a percussion type air drill lubricants found completely satisfactory by extensive laboratory tests and practical tests under rigorous field operations in rock drilling.

Examples

A blend is made up containing in weight percentages about 85 to 99% of a naphthenic base petroleum lubricating oil, having an appropriate viscosity and pour point, about 0.1 to 0.5% of isobutylene polymer, having a molecular weight of about 50,000 to 60,000, and commercial blown rape seed oil which goes to make up substantially the remaining part of the blend. The percentage of thickened fatty oil is in the range of 1 to 14% and varies somewhat inversely with the percentage of petroleum lubricating oil, and polymer, i. e., with about 85.9% of petroleum lubricating oil and 0.1% of the polymer, about 14% of the thickened fatty oil may be used.

A typical blend appropriate for rock drills in temperate climates contains 92.7% petroleum lubricating oil, 7% blown rape seed oil, and 0.3% of the isobutylene polymer. These proportions form a blend having characteristics illustrated in the following table when the base petroleum oil has the characteristics shown therewith:

	Viscosities in Saybolt seconds—		Viscosity index	Maximum pour point, ° F.
	At 100° F.	At 210° F.		
Base oil	314	48.4	38	—5
Blend	492	59.2	85	—25

This type of lubricant meets the usual viscosity requirements for service throughout the year. It has a decidedly lower pour point than the usually permitted maximum. More generally, this type of blend having a Saybolt viscosity at 100° F. of 490 to 515 seconds at 100° F. and a maximum pour point of —10° F. may be obtained when the mineral base oil has a Saybolt viscosity in the range of 300 to 315 seconds and a pour point of about —5° F.

Lubricants may be made up in accordance with this invention for more unusual conditions of employment by varying the base petroleum oil as illustrated in the following table:

	Viscosities in Saybolt seconds—		Viscosity index	Maximum pour point, ° F.
	At 100° F.	At 210° F.		
Base oil	110	38.4	30	—20
Blend	182	46.6	115	—50
Base oil	880	67	33	0
Blend	1,000	82	81	—15

Each of the blends described on the foregoing tables contains substantially the same proportions of a mineral lubricating oil, 92.7%, commercial non-drying thickened fatty oil, 7.0%, and polymer, 0.3%. Each of these blends has a very satisfactory low pour point and a high viscosity index, which is the measurement of variation in viscosity with temperature changes of the oil according to the procedure described in the article by Dean and Davis, Chemical and Metallurigical Engineering, vol 36, 1929, page 618.

Although particular compositions with specific ingredients and proportions have been described, the invention is not limited thereto. The invention can also be carried out with other fatty oils of vegetable or animal origin having qualities similar to those of blown rape seed oil. Non-drying thickened fatty oils having high viscosities may be prepared from rape seed oil, cotton seed oil, maize oil, seal oil, and sperm oil by air-blowing, or by other known methods of thickening, such as catalytic or electrical polymerization which reduce the iodine numbers of such oils to below 75. To prepare the ordinary commercial non-drying thickened fatty oils by air blowing, air is blown into a natural fatty oil with stirring for a period of about 15 to 30 hours at a temperature of about 170° F. until the desired specific gravity or viscosity of the thickened oil is reached. Rape seed oil, for example, would be treated in this manner until its specific gravity is raised from about 0.914 to between about 0.968 and 0.990 as determined at 60° F.

The proportioning of the thickened fatty oil to the mineral oil depends largely upon the viscosities of these ingredients and the desired viscosity for the blend, particularly when a pour depressant is used for ultimately reducing the pour point of the blend. The mineral oil need not be so restricted as to its source if the pour point of its blend with the fatty oil is not required to be of the order obtained in the specific examples. Lubricating oils with flash points above the flash point of a gas oil from all types of crude oils may be used. Synthetic lubricating oils with low pour points may be used. Although the mineral lubricating oils are preferably selected from naphthenic base crudes, some dewaxed paraffinic base oils may also be used.

In using mineral oils having relatively higher pour points, a small amount of synthetic pour point depressants may be added, particularly those containing long alkyl group branches. These alkyl groups should have preferably 10 to 30 carbon atoms in straight chains, and may be joined to other long alkyl groups or a cyclic group, preferably to a polycyclic group, e. g., a naphthyl or a naphthol group. The method of synthesizing these products is well known in the art and described in United States Patent No. 1,815,022, granted to G. H. B. Davis July 14, 1931. In general, this method involves the reaction of chloroparaffins with one another or with aromatics, such as napthalene, in the presence of a Friedel-Crafts type of catalyst. These pour point depressants in a concentration of only about 0.5 to 3% lower the pour points of compositions described in the preceding examples by more than 5° F.

The description of the aforementioned compositions as being particularly intended for use in percussion air drills, in which specific requirements may exist for low pour points, adhesiveness, and constancy of viscosity under widely varying temperature conditions, is not intended to limit the invention to such a specific use for these compositions. Blends prepared in accordance with this invention are useful for other pur-

poses, such as, jack hammers, stoppers, drifters, wagon drills, chippers, tampers, riveters, pavement breakers, and similar mechanisms having high speed reciprocating pistons motivated by compressed air or steam.

Lubricant compositions of this invention may be applied through any of the systems of lubrication usually employed with pneumatic tools. Hand oiling is still common, but special line lubricators for injecting small quantities into the air stream at a point about ten feet from the tool are increasing. Line lubricators assure lubrication without attention over longer periods. Field experience has proved that the stable homogeneous product of this invention atomizes readily into the air line when used in line oilers and permits a uniform consumption with finer control valve adjustment. The stability and uniformity of this product under exposure to air, steam, and water has been repeatedly demonstrated. Other products which have been tried tend to form solid or semi-solid gels which may clog the oil feed line and result in damage.

Other ingredients may be added in minor amounts, as might be desired for further improving the lubricant, but such agents as sludge dispersers, oxidation inhibitors, corrosion inhibitors and oiliness agents are in general unnecessary.

I do not desire to be limited to any given specific illustration of the invention because there may be relatively wide variation in the kinds and proportions of the materials used without departing from the broader scope of the invention. I desire to be limited only by the following claims in which it is my intention to claim all novelty as broadly as the prior art permits.

I claim:

1. A pneumatic percussion type drill lubricant having adhesive and moisture resistant characteristics, having a viscosity of about 490 to 515 Saybolt seconds at 100° F., a maximum pour point of about —10° F., and comprising in major proportion a hydrocarbon lubricating oil having a viscosity of about 300 to 315 Saybolt seconds at 100° F., 1 to 14% of blown rape seed oil, and 0.1 to 0.5% of isobutylene polymer having a molecular weight of about 50,000 to 60,000.

2. A compressed-air driven rock drill lubricant having a viscosity in the range of about 490 to 515 Saybolt seconds at 100 F., a maximum pour point of about —25° F. and comprising about 92.7% of a naphthenic base lubricating oil having a viscosity in the range of about 300 to 315 Saybolt seconds at 100° F., about 7.0% of blown rape seed oil, and about 0.3% of isobutylene polymer having a molecular weight in the range of about 50,000 to 60,000.

3. A lubricant having a stable cohesiveness and adapted for use in lubricating compressed air and steam motivated engines having high speed reciprocating pistons and requiring an adhesive and moisture resistant lubricant which comprises a major proportion of a petroleum lubricating oil having a viscosity in the range of about 100 to 925 Saybolt seconds at 100° F., about 0.1 to 0.5% of isobutylene polymers having molecular weights essentially above 50,000, and from 1 to 14% of a non-drying thickened fatty oil having an iodine number below 75; said lubricant having a viscosity in the range of 150 to 1000 Saybolt seconds at 100° F. and a maximum pour point below 10° F.

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