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(54) **Extreme pressure additive for use in metal lubrication.**

(57) It is known to use chlorinated paraffins as an extreme pressure lubricant additive in lubricating metals. Such additives are highly corrosive, however, and for that reason are not suitable for a number of uses, such as in the lubrication of internal combustion engines. The present invention overcomes the corrosive problems of the previous chlorinated paraffin additives. The present invention involves the mixing of a substantial portion of chlorinated paraffins with a smaller portion of an alkaline earth metal sulfonate, such as calcium or barium sulfonate, and preferably a base mineral oil and solvent. The resulting additive can be added to standard motor oil to improve its extreme pressure performance in internal combustion engines.

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EXTREME PRESSURE ADDITIVE FOR USE IN METAL LUBRICATION

This invention relates generally to the field of lubricant additives, and more specifically relates to the field of extreme pressure additives suitable for addition to motor oils and other lubricants.

It is known that certain chlorine-based compounds, such as those chlorine derivates of paraffinic hydrocarbon compounds referred to as chlorinated paraffins, can serve as lubricant additives to improve the performance of the lubricant under extreme pressure. Under normal lubricating conditions, the two metal surfaces will be separated by a thin film of lubricant which provides the required reduction in friction. Under situations of extreme pressure between the two metal surfaces, all the liquid lubricant is forced from the area of contact between the surfaces. Where an extreme pressure additive such as chlorinated paraffin is present, however, it has been found that the resultant heat generated between the two surfaces causes chlorine atoms to be liberated from the additive and to combine with the surface metal, such as iron, to form a chloride, such as iron chloride. This surface coating of chloride has a much lower coefficient of friction than the dry metal surface. The iron chloride surface coating tends to fill in depressions in the surface, resulting in smoother surfaces at the point of interaction and reduced friction and wear.

Chlorinated paraffins have been used as extreme pressure additives in such applications as metal-working. However, the corrosive nature of chlorinated paraffin has made it generally unsuitable for use in internal combustion engine applications or other corrosion-sensitive applications. Under heating, the chlorinated paraffins release hydrochloric acid, which is corrosive.

The present invention provides an extreme pressure additive largely composed of chlorinated paraffins but having reduced corrosive properties. It is therefore suitable for use in internal combustion engine lubricants or other applications where corrosion must be avoided.

According to one aspect of the invention, there is provided an extreme pressure lubricant additive comprising a large amount of chlorinated paraffin and a small amount of an alkaline earth metal sulfonate, preferably calcium or barium sulfonate. A mineral oil, with or without mineral spirits, may be used as a base oil for the additive and a solvent may be added to improve the shelf life of the product. In one aspect of the invention the additive comprises between thirty and seventy volume percent chlorinated paraffins and from .5 to 10 percent by volume calcium sulfonate. According to a further aspect of the invention, the additive comprises approximately 51.5 volume percent chlorinated paraffins, approximately 31 volume percent of a solvent, approximately 15.5 volume percent of a mineral oil, approximately 1 volume percent of mineral spirits and approximately 1 volume percent of a calcium sulfonate. Further according to the invention a lubricant suitable for use as a motor oil in internal combustion engines is provi ded by adding one part of the above extreme pressure lubricant additive to between 10 and 30 parts of standard motor oil. According to a preferred aspect of the invention,. approximately one part of the extreme pressure additive is added to twenty parts standard motor oil. Also according to the invention, the above extreme pressure lubricant additive may be added to various greases, hydraulic fluid, cutting oil, gear box oil, automatic transmission fluid, air-conditioner refrigerant or penetrating oil to improve the extreme pressure performance of such lubricants. According to a further aspect of the invention, the extreme pressure lubricant additive may be added to gasoline or diesel fuel conditioners to provide an improved gasoline or diesel fuel conditioner.

Further according to the invention there is provided a method of producing an extreme pressure additive for lubricants comprising the steps of:

a) blending a chlorinated paraffin in an amount approximately 51.5 percent by volume of the final product with a base mineral oil in an amount approximately 15.5 percent by volume of the final product.

b) mixing a calcium sulfonate in an amount approximately 1 percent by volume of the final product with mineral spirits in an amount approximately 1 percent by volume of the final product; and

c) blending the chlorinated paraffin/mineral oil mixture with the calcium sulfonate/mineral spirits mixture and approximately 31 percent by volume of a solvent.

The portion of solvent may be partially mixed with the initial paraffin/mineral oil mixture.

The preferred form of chlorinated paraffin used in the present invention is the product marketed by C-I-L Inc. under the trade name CERECLOR trade mark 63L which has a stated molecular formula of $C_{15.5}$ $H_{26.8}Cl_{16.31}$. (The product is known to be mildly corrosive in contact with steel and to decompose into hydrochloric acid and hydrogen chloride). Other grades of CERECLOR are also suitable. The chlorinated paraffin in an amount approximately 51.5 percent by volume of the final additive product is mixed with a base mineral oil in an amount approximately 15.4 percent by volume by blending thoroughly at slow speeds to avoid foaming. The mixture may be heated to approximately 150°F to promote the mixing process and prevent subsequent separation of the consitutuent components. A preferred mineral oil is marketed by Shell Canada Limited under the trade name VITREA trade mark No. 220. The calcium sulfonate is next mixed separately with mineral spirits. The preferred proportion is approximately 1 percent calcium sulfonate by volume of the final additive product, and approximately 1 percent by volume of the mineral spirits. The preferred product for the calcium sulfonate is marketed under the trade mark LUBRIZOL trade mark 78 by the Lubrizol Corporation. It is a highly basic calcium sulfonate, approximately 400 TBN having a calcium weight percent between 15.0 and 16.0 and a sulfur weight percent between 1.25 and 1.8. The preferred mineral spirit product is marketed by Shell Canada Limited under the trade mark SHELL SOL trade mark and has a composition of 89-94 percent by volume of saturates, and 6-15 percent by volume aromatics, and a maximum 0.1 percent by volume sulfur.

The calcium sulfonate/mineral spirits mixture is then blended with the chlorinated paraffin/mineral oil mixture and an aromatic solvent is an amount of approximately 30.9 percent by volume of the final mixture. The purpose of the solvent is to improve the shelf life of the product by thinning the mixture so that the paraffin remains in suspension for a longer period before separating out into layers. A suitable aromatic solvent is that sold under the trade mark CYCLOSOL*53 by Shell Canada Limited. In order to mask the oil and solvent smells, a small amount of an industrial scent, such as Felton* Solvent Mask C #962 manufactured by Felton International may be added in an amount of approximately 1 litre of mask per 45 gallon drum of chlorinated paraffins. The solvent may also be partly added to the initial CERECLOR/mineral oil mixture.

The blending is preferably done so that the product is not permitted to foam. Again, the ingredients may be blended at an elevated temperature of about 150° to avoid crystallization or sedimentation of the components. The result of this final blending process is the extreme pressure additive of the invention.

A sample of the lubricant additive of the invention has provided the following analysis. These factors are variable depending on the grade of chlorinated paraffin used and the precise proportion of components.

Specific Gravity @ 70°F (21.1°C)	1.15
Pour Point	-27°F (-32.8°C)
Viscosity @ 40°C	72.9 SUS (13.8 cSt.)
Viscosity @ 100°C	37.5 SUS (3.41 cSt.)
Flash Point (PMCC)	108°F (42.2°C)
TBN (ASTM D2896)	6.73

Copper Corrosion (ASTM D130) for 1 hour @ 254°F (123.3°C)		1a
Dielectric Strength		26.5 kv
Water Content		0.00 %
Spectrographic Analysis	Iron	7
	Chromium	7
	Copper	2
	Lead	33
	Aluminum	9
	Silicon	4
	Tin	13
	Sodium	10
	Magnesium	11
	Silver	1
	Nickel	5
	Zinc	11
	Calcium	1000+

In tests conducted, the invention has shown good compatability with all three standard types of motor oil. To test corrosion loss, mild steel blanks were left in the product for seven days at between 210°F (98.9°C) and 220°F - (104.4°C). When left in ESSO UNIFLO* 10/40 oil, there was no corrosion loss measured. When the additive of the invention was added in the amount of 6 percent by volume to the UNIFLO* there again was no corrosion loss measured.

The effectiveness of the invention as an extreme pressure lubricant can be readily demonstrated using an extreme pressure testing machine. This machine utilizes an electric motor to rotate a steel bearing race. A stationary steel bearing is brought into contact with the rotating bearing race. This is done by removably inserting the bearing into the end of a rotating arm which is allowed to rest in contact with the rotating bearing. The arm is in turn levered by a second rotating arm to the end of which weights may be applied. The effect of the arrangement of the arms is to provide a multiple lever effect so that a small weight applied to the end of the latter arm is greatly magnified through the principle of the lever through to the point of contact with the rotating bearing race. Because of the small area of contact, a very great pressure is applied by the stationary bearing to the rotating bearing race. The bearing race is initially allowed to rotate in a bath of a standard motor oil, and the end of the arm with the test bearing is allowed to rest on the rotating race without additional pressure. On examination of the test bearing, it is found that a small scar, approximately one millimeter in width is formed in the surface of the bearing due to the friction. The test bearing is then rotated to apply a fresh surface to the bearing race, and again the test bearing is allowed to contact the rotating race, only this time a weight of approximately four pounds is applied to the end of the multiple-lever apparatus to apply more pressure to the point of contact. Upon examination of the test bearing, a large scar has been formed in the surface of the bearing, approximately four millimeters in width.

The procedure is then repeated, only an amount of the extreme pressure lubricant additive of the invention is added to the motor oil bath in which the bearing race is rotating. Again, the test bearing is rotated to present a fresh surface to the bearing race and is allowed to rest in contact against the rotating race without additional pressure. Upon examination of the test bearing, it is found that the initial amount of scarring has been greatly reduced. When the test is repeated with a four-pound (1.81 kg.) weight at the end of the lever mechanism, the scarring is still less than was present in the initial oil-only situation without additional pressure, with the scar now being less than one millimeter in width. Indeed, rather than being a deep gouge out of the surface of the bearing, as was the case with the oil-only bath, the point where the test bearing contacted the bearing race rotating in the oil-plus-additive bath appears to the eye to be a small polished area on the surface of the bearing. Even if the weight at the end of the lever mechanism is increased by a factor of six from the four-pound (1.81 kg.) weight, the size of the scar on the test bearing does not increase significantly and still is not significantly greater in width than was the case in the oil-only bath situation where no additional pressure was added. Indeed, the surface of the scar is shown to be polished compared to the pitted scar present in the oil-only situation.

In addition to serving as an extreme pressure additive for motor oils, the lubricant additive of the invention may also be added to other lubricants and fluids such as greases, (where approximately 10 percent by volume of the additive is preferred), metal cutting lubricants, industrial gear lubricants, hydraulic oils (excluding hydraulic brake fluid), automatic transmission fluid, power steering fluid, penetrating oil, air-conditioner refrigerant, and as a coating for brass. In all these applications, the additive of the invention serves to reduce friction and metal wear under extreme pressure situations, and also serves to reduce corrosion. It has also been found that by adding the extreme pressure additive product of the invention to a gasoline or diesel fuel conditioner, the performance of the internal combustion engine is improved through lubrication of the moving metal parts which come into contact with the fuel in the upper end of the engine.

While calcium sulfonate has been specified as the appropriate sulfonate to counteract the corrosive properties of the chlorinated paraffins, other alkaline earth metal sulfonates having similar properties, such as barium sulfonate, would also be suitable for use in the invention. While a preferred embodiment of the invention has been described, the scope of the invention should not be limited thereto but is defined by the following claims.

Claims

1. An extreme pressure lubricant additive comprising:

a) Between 30 and 70 percent by volume of a chlorinated paraffin; and

b) Between .5 and 10 percent by volume of an alkaline earth metal sulfonate.

2. The extreme pressure lubricant additive of claim 1 wherein said chlorinated paraffin forms between 40 and 60 percent by volume of said composition.

3. The extreme pressure lubricant additive of claim 2 wherein said alkaline earth metal sulfonate forms between .5 and 3 percent by volume of said composition.

4. The extreme pressure lubricant additive of claim 1 wherein said chlorinated paraffin comprises approximately 51.5 percent by volume of said composition and said alkaline earth metal sulfonate comprises approximately 1 percent by volume of said composition.

5. The lubricating composition of claims 1, 2, 3 or 4 wherein said alkaline earth metal sulfonate is calcium sulfonate or barium sulfonate.

6. An extreme pressure lubricant additive comprising:

a) Between 30 and 70 volume percent chlorinated paraffin;

b) Between 30 and 70 volume percent of a mineral oil, mineral spirits or solvent; and

c) Between .5 and 10 volume percent of an alkaline earth metal sulfonate.

7. The extreme pressure lubricant additive of claim 6 wherein said chlorinated paraffins comprise approximately 50 percent by volume of said extreme pressure lubricant additive.

8. The extreme pressure lubricant additive of claim 7 wherein said alkaline earth metal sulfonate comprises between 1 and 3 percent by volume of said extreme pressure lubricant additive.

9. The extreme pressure lubricant additive of claims 6, 7 or 8 wherein said alkaline earth metal sulfonate is calcium sulfonate or barium sulfonate.

10. An extreme pressure lubricant additive comprising:

a) Approximately 51.5 percent by volume of a chlorinated paraffin;

b) Approximately 31 percent by volume of a solvent;

c) Approximately 15.5 percent by volume of a mineral oil;

d) Approximately 1 percent by volume of calcium sulfonate; and

e) Approximately 1 percent by volume of mineral spirits.

11. A motor oil comprising:

a) Between ten and thirty parts by volume of a conventional motor oil; and

b) One part by volume of the extreme pressure lubricant additive of claims 1, 3, 6, 8 or 10.

12. A motor oil comprising:

a) Twenty parts by volume of a conventional motor oil; and

b) One part by volume of the extreme pressure lubricant additive of claims 1, 3, 6, 8 or 10.

13. A method of producing an extreme pressure lubricant additive comprising the steps of:

a) Blending 40 to 60 volume percent of chlorinated paraffin with 10 to 20 volume percent of a mineral oil;

b) Blending between .15 and 3 volume percent of a mineral spirit with .5 to 10 volume percent of an alkaline earth metal sulfonate; and

c) Blending the mixtures of steps a) and b) with between 20 and 40 volume percent of a solvent.

14. A gasoline or diesel fuel conditioner comprising the additive of claims 1, 3, 6, 8 or 10.

15. An extreme pressure lubricant additive comprising:

a) A major amount of a chlorinated paraffin; and

b) A minor amount of an alkaline earth metal sulfonate.