Patented Mar. 7, 1939

2,149,788

# UNITED STATES PATENT OFFICE

2,149,788

## TREATING LUBRICANTS

Albert S. Orr, Upper Darby, Pa., assignor to Gulf Oil Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

No Drawing. Application November 7, 1936, Serial No. 109,793

14 Claims. (Cl. 87—9)

This invention relates to treating lubricants and it comprises a method of improving lubricating oils, etc., wherein a minor amount of an aryl sulphonyl chloride, such as benzene sulphonyl chloride, etc., is dissolved in the oil in amounts between 0.1 to 10 per cent by weight on the mineral oil; and it also comprises the improved lubricating compositions so obtained, comprising a major amount of mineral oil as a lubricating base and a minor amount of an aryl sulphonyl chloride, etc., as a modifying or improvement agent, and having a good film strength and resistance to oxidation, such lubricants being particularly useful and satisfactory for lubricating metal bearing surfaces under the relatively high temperatures, speeds and pressures inherent in modern automobile engines and the like; all as more fully hereinafter set forth and as claimed.

In modern mechanical equipment for generating and transmitting power, particularly in the automotive field, the bearings are subjected to relatively high pressures and rubbing speeds. The pressures or transmitted loads are substantially higher than were usual in the old engineering practice. While recent developments in the design of such equipment have produced equipment of superior mechanical efficiency, new difficulties have been encountered in lubrication. Ordinary lubricating oils are no longer wholly satisfactory under the severe operating conditions and fail under the higher pressures, higher rubbing speeds and other service conditions. For one thing, the film strength of ordinary lubricants, even those of high grade, is so low that a lubricating film ruptures under the high pressures to which modern gear or bearing surfaces are now often exposed. There is a demand for new types of lubricants which in the form of thin films are capable of withstanding these high pressures.

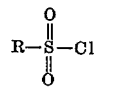
Because of the high rubbing speed and great load, the operating temperatures are high and this greatly accelerates the oxidation and decomposition of mineral lubricants. The decomposition products of mineral lubricants can be highly corrosive to many of the bearing metals used in modern machines. Straight mineral lubricants may thus fail because of rupture of the lubricating film or because of corrosion of the lubricated surfaces, or through a combination of both causes.

I have now found that an addition of aryl sulphonyl chloride to an oil materially improves it in these respects. Benzene sulphonyl chloride is an advantageous aryl sulphonyl chloride. When a minor amount is dissolved in a mineral lubricating oil, a lubricant is obtained having a much higher film strength; capable of withstanding relatively high pressures and otherwise satisfactory for lubrication of modern mechanical equipment. Ordinarily between 0.1 to 10 per cent or the aryl sulphonyl chloride is sufficient to produce the desired improvement in a mineral oil lubricant.

The aryl sulphonyl chlorides are soluble in mineral lubricating oils and may therefore be readily incorporated. For instance, 10 per cent of benzene sulphonyl chloride may be incorporated into any of the usual motor oils by stirring the materials together at temperatures between 80° and 235° F.; about half an hour being sufficient to produce homogeneity and a uniform blend.

In lieu of benzene sulphonyl chloride, other aryl sulphonyl chlorides such as para-toluene sulphonyl chloride may be likewise employed. By employing 10 per cent of benzene sulphonyl chloride or other aryl sulphonyl chloride, a marked increase in film strength is obtained.

Aryl sulphonyl chlorides are understood to have the following structural formula:



R may be any aromatic group such as benzene, naphthalene, anthracene, etc. R may also be a substituted aryl group in which the aromatic group is combined with one or more alkyl groups, as in toluene, xylene, etc. R may also be a substituted aryl group in which the aromatic ring is combined with a halogen, nitro, amino, hydroxy, or other non-hydrocarbon radical. Such substitution in the aryl group modifies such physical properties of the aryl sulphonyl chloride as specific gravity, melting point, boiling point, solubility, etc. The action of aryl sulphonyl chlorides in improving the film strength, increasing oxidation resistance and decreasing the corrosive effect of a lubricant depends mainly on the sulphonyl grouping, however.

I have further found that the improved lubricants so obtained have also an increased resistance to oxidation. By dissolving 0.1 per cent or more of an aryl sulphonyl chloride in mineral lubricating oils, oxidation at high temperatures, say at about 360° F. is greatly retarded.

Improved lubricating oils under the present invention containing a fraction of a per cent of an aryl sulphonyl chloride are excellent motor oils for lubricating the cadmium-silver alloy bearings of modern automobile engines. In many of the

modern automobile engines the bearings are binary and ternary alloys of cadmium with silver and copper, of cadmium with nickel or of lead with copper and nickel, etc. Erosion and corrosion, either or both incident to the use of some ordinary oils with these types of bearings may be avoided or reduced by the use of oils under the present invention.

Under the present invention various mineral lubricating oils may be advantageously improved. In making the improved lubricants, any of the usual mineral lubricating oils may be employed, such as those from paraffinic or naphthenic stocks. Highly refined paraffinic oils may be employed in preparing improved lubricants by this invention. Motor oils obtained by the solvent extraction of naphthenic stocks may be likewise improved. In preparing improved motor oils ordinarily the oils of the usual S.A.E. classifications are employed. By dissolving minor amounts of aryl sulphonyl chlorides in such lubricants, improved compounded lubricants are readily obtained.

Aryl sulphonyl chlorides are compatible with and may be introduced into greases and other lubricants containing soaps of any of the metals, such as calcium, sodium, aluminum, zinc, lead, etc., which are now in general use. The compounded greases have an improved film strength.

The following examples are illustrative embodiments of the methods and products broadly set forth ante and are not limitive of the invention:

*Example 1.*—This example illustrates a preparation of an improved lubricating oil from a mineral lubricating oil having the following properties:

| | |
|---|---|
| Gravity: °API | 22.8 |
| Viscosity, SUV 210° F | 131 |
| Color, NPA | dil. |
| Sulfur (B) percent | 0.51 |
| Neutralization No. | 0.06 |

To 90 pounds of the above mineral oil there is added 10 pounds of benzene sulphonyl chloride. The mixture is maintained at 80° F. and agitated for about 30 minutes. There is obtained a uniform blended lubricant having improved film strength. The film strength of the improved lubricant is more than seven times that of the lubricating oil employed.

*Example 2.*—The blending of the benzene sulphonyl chloride with the mineral oil may be effected at elevated temperatures and this is illustrated in the following example:

To 90 parts of the same mineral oil as employed in Example 1 there is added the same amount of benzene sulphonyl chloride (10 pounds) and the mixture is heated to 235° F. with stirring for about half hour. The hot blended lubricant is then cooled and stored in suitable containers. Again, the compounded lubricant has a markedly higher film strength.

*Example 3.*—This example illustrates the improvement of a highly refined paraffinic lubricating oil; a paraffinic lubricating oil having the following properties:

| | |
|---|---|
| Gravity: °API | 28.0 |
| Viscosity, SUV 210° F | 118 |
| Color, NPA | 2.75 |
| Sulfur (B) percent | -- |
| Neutralization No. | Nil |

To 90 pounds of the above mineral oil there is added 10 pounds of benzene sulphonyl chloride and the mixture is stirred at 80° F. for 30 minutes. The improved lubricant so obtained is resistant to oxidation and is capable of withstanding a relatively high bearing load.

*Example 4.*—The mineral lubricating oil employed in Example 1 may be likewise improved by using para-toluene sulphonyl chloride in lieu of the benzene sulphonyl chloride.

To 90 pounds of said mineral oil there is added 10 pounds of para-toluene sulphonyl chloride and the mixture is warmed to 180° F. and agitated until a uniform blend is obtained. About 30 minutes is required. The improved lubricant so obtained has a relatively high film strength.

Other mineral lubricating oils may be similarly treated. The amount of aryl sulphonyl chloride may be varied in these examples as set forth ante. For instance, as little as 0.1 per cent may be used in some cases and with substantial improvement in the properties of the blended lubricant. Various other aryl sulphonyl chlorides may be used in lieu of those given for purposes of illustration. However, benzene sulphonyl chloride and para-toluene sulphonyl chloride are satisfactory and are ordinarily employed.

The improvement obtained by the present invention is illustrated by a comparison of the film strengths of the original oil and of the compounded lubricants obtained; the film strengths being determined by means of any of the standard tests, such as the Almen test. The following tables give such a comparison:

*Table I*

| | Original oil | Example 1 | Example 2 | Example 3 |
|---|---|---|---|---|
| Almen rating, 600 R.P.M.: | | | | |
| Lever load—pounds | 4 | 30 | 30 | 30 |
| Torque—lb. ft./10 | 4 | 21 | 32 | 30 |
| Unit load—lb./sq. in. | 2,000 | 15,000 | 15,000 | 15,000 |

| | Original oil | Example 4 |
|---|---|---|
| Almen rating, 600 R. P. M.: | | |
| Lever load—pounds | 8 | 30 |
| Torque—lb. ft./10 | 10 | 18 |
| Unit load—lb./sq. in. | 4,000 | 15,000 |

The above measurements show the remarkable improvement in film strength obtained by the present invention. By dissolving the aryl sulphonyl chlorides in the mineral oil lubricants their film strength may be improved from 300 to 800 per cent.

The improved mineral oils obtained by the present invention may be further compounded with other ingredients to obtain special lubricants. They may be compounded with vegetable, animal and fish oils including bodied fatty oils such as blown rape-seed oil. For instance, a marine engine oil may be prepared employing a lubricating base comprising a so treated mineral oil and a minor amount of blown rape-seed oil, say about 25 parts of bodied fatty oil to 75 parts of mineral oil. That is, the present invention is useful in improving compounded mineral oil lubricants as well as mineral lubricating oils per se. Some of the improved lubricants obtained by the present invention may also contain a minor amount of fatty oils in addition to the mineral oil and aryl sulphonyl chloride. By incorporating an aryl sulphonyl chloride with such lubricants, their film strength and other properties may be likewise improved.

What I claim is:—

1. As a composition of matter, useful as a lubricant, a uniform composition comprising a major amount of a mineral oil and a minor amount of an aryl sulphonyl chloride dissolved therein.

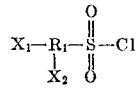
2. The lubricating composition of claim 1 wherein said composition contains from 0.1 to 10 per cent of the aryl sulphonyl chloride.

3. The composition of claim 1 wherein said aryl sulphonyl chloride is benzene sulphonyl chloride.

4. The composition of claim 1 wherein said aryl sulphonyl chloride is toluene sulphonyl chloride.

5. The composition of claim 1 wherein said composition contains 10 per cent of benzene sulphonyl chloride.

6. As a composition of matter, useful as a lubricant, a uniform composition comprising a major amount of a mineral oil and not more than 10 per cent on the oil of an aryl sulphonyl chloride dissolved therein, said sulphonyl chloride having the following formula:



wherein $R_1$ is an aryl group of the class consisting of benzene, naphthalene and anthracene, $X_1$ is hydrogen or an alkyl group and $X_2$ is hydrogen, halogen and a substituent group of the class consisting of an alkyl, nitro, amino and hydroxy groups.

7. The composition of claim 6 wherein said sulphonyl chloride is benzene sulphonyl chloride.

8. The composition of claim 1 wherein said lubricant is an improved motor oil and wherein said mineral oil is a motor oil containing sufficient of said aryl sulphonyl chloride dissolved therein to substantially increase the film strength of said motor oil and render the same capable of withstanding relatively high pressures.

9. As an improved mineral oil lubricant useful as a marine engine oil, the lubricating composition comprising a major amount of mineral oil and minor amounts of an aryl sulphonyl chloride and of fatty oil blended therewith.

10. The composition of claim 9 wherein said fatty oil is a bodied oil.

11. The composition of claim 9 wherein the said fatty oil is a blown rapeseed oil.

12. As an improved marine engine oil, the lubricating oil composition comprising approximately 75 parts of mineral oil and 25 parts of blown rapeseed oil, said oil composition containing between 0.1 and 10 per cent of an aryl sulphonyl chloride by weight on the said mineral oil dissolved therein.

13. A method of lubricating bearing surfaces in internal combustion engines when subjected to conditions of operation which comprises maintaining between bearing surfaces, one of which is an alloy formed chiefly of a metal selected from the class consisting of cadmium and copper, a film of lubricating oil which initially produces an effective lubricating action but which would normally tend to corrode the aforesaid alloy and maintaining the effectiveness of the lubricating oil by incorporating therein an aryl sulphonyl chloride in a small but sufficient proportion substantially to retard the corrosion.

14. The improved method of lubricating special alloy bearings of claim 13 wherein said aryl sulphonyl chloride is benzene sulphonyl chloride.

ALBERT S. ORR.

# DISCLAIMER

2,149,788.—*Albert S. Orr*, Upper Darby, Pa. TREATING LUBRICANTS. Patent dated March 7, 1939. Disclaimer filed January 10, 1941, by the assignee, *Gulf Oil Corporation.*

Hereby enters this disclaimer to claims 1, 4, 9, and 10 of said Letters Patent.

[*Official Gazette February 11, 1941.*]