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EXTREME PRESSURE LUBRICANT

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11 Claims. (Cl. 87—9)

This invention relates to methods of improving the film strength or load-carrying power of lubricating oils.

The use of smaller gears and greater power in modern automobiles has increased the gear tooth pressures to a point where in many cases pure petroleum lubricants are no longer able to keep the metal surfaces apart. As a result the surfaces of the gears may actually fuse or weld together in spots, resulting in rapid wear and scoring which soon makes the gears very noisy, and ultimately may cause a complete failure. Similar problems are encountered in the lubrication of other bearing surfaces which are subjected to high pressures.

It is known that the addition of materials such as carbon tetrachloride, sulfur or lead soaps will increase the film strength of lubricants, but these materials have disadvantages such as corrosiveness, instability in the presence of moisture, or an abrasive action, etc., which often makes them unsatisfactory for commercial lubricants.

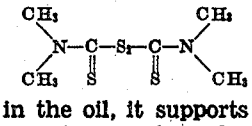
I have found that the addition of oil-soluble compounds containing at least one carbon atom attached directly to both nitrogen and sulfur and preferably to more than one nitrogen or sulfur greatly increase the film strength of lubricants. The following list of specific compounds is illustrative of those which may be used for this purpose: 2-mercaptobenzothiazole; the reaction product of mercaptobenzothiazole and formaldehyde (presumably hydroxy methylene mercaptobenzothiazole); benzothiazyl disulfide; 2-chlor benzothiazole; tetramethyl thiuram disulfide; tetraethyl thiuram disulfide; dimethyl diphenyl thiuram monosulfide; tetraphenyl thiuram disulfide; the lead salt of mercaptobenzothiazole; the zinc salt of diphenyl dithiocarbamic acid; benzothiazyl thio benzoate; thiocarbanilid; 2-chlor 6-nitro benzothiazol; 2-chlor naphthothiazole; etc. Some of the chemicals, such as the benzothiazyl disulfide and some of the lead salts, tend to thicken or gel lubricants which contain considerable amounts of naphthenic or unsaturated compounds, so they are particularly useful in making greases. The solubility of the chemicals will vary to some extent with the viscosity and chemical nature of the oil. Two per cent mercaptobenzothiazole, for example, does not dissolve completely in an S. A. E. 30 paraffin-base motor oil, even after heating to 120° C. for several hours. However, it does dissolve at elevated temperatures in a summer black oil and in a compounded oil made by adding tallow to a Gulf Coast oil. When the solutions of the chemical in the latter two oils are cooled, however, there is some tendency to form gels. This is reduced by the addition of strong bases such as piperidine or other amines and it is increased by the presence of acids such as stearic, benzoic, etc.

The term "oil soluble" as used in this patent is understood to mean that the chemical is soluble in the particular oil or grease used under the temperature conditions prevailing in service. The term "lubricant" is intended to include both animal and vegetable fats and oils as well as oils and greases derived from shale, petroleum, etc.

The solubility of the chemicals in the oil is due, in some cases, to a chemical reaction which often increases the effectiveness of the chemicals in raising the load-carrying power or film strength of the lubricant. Probably because of this reaction the effectiveness of many of the chemicals may be increased by heating them with the oil to temperatures above 200° F. before use. In other cases the chemicals may only be active when the oil is hot, due to the increased rate of diffusion and greater reactivity at the higher temperatures.

In the following examples illustrating specific embodiments of this invention, the film strength of the lubricants is expressed as the maximum load which can be applied to the lever arm of a Timken lubricant tester without producing scoring on the ring.

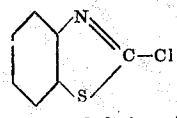
In one test, the film strength of an S. A. E. 50 naphthenic base motor oil is 10 lbs. on the Timken tester. After one per cent of tetramethyl thiuram disulfid



is dissolved in the oil, it supports a load of 75 lbs. without causing scoring. In another test, the score point of a paraffin base motor oil is raised from about 12 to 72 lbs. by the addition of one per cent of mercaptobenzothiazole.

The apparent effectiveness of these chemicals as measured by the Timken lubricant tester varies with the viscosity of oil used as with the kind of oil. This may be due in part to the reaction of the chemicals with certain constituents of the oil and in part to the fact that the Timken lubricant tester is not sensitive in the region of low film strengths. In a test of a pale neutral oil having an original score point of about five pounds, the increase in film strength on adding two per cent 2-chlorbenzothiazole is too small to

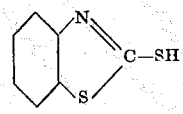
be measured, but the addition of two per cent 2-chlorbenzothiazole.



to a compounded gear lubricant containing tallow and fatty acids raises the score point from 15 to 52 pounds and five per cent of this compound raises the score point to over 100 pounds.

When five percent of 2-chlorbenzothiazole is added to a summer black oil, the score point is raised from 14 to 20 lbs. However, if the oil and chemical are heated to a temperature of around 240° F. for five or ten minutes, only 2 per cent of the chemical is required to raise the score point to 25 lbs.

The results obtained with the Timken tester have been verified by service tests. For example, one per cent of mercaptobenzothiazole



was added to a naphthenic base motor oil when hot. This oil was then used in the motor of a Dodge roadster which had just been fitted with new piston rings, and the bearings had been tightened. The motor was examined after running for 600 miles, and it was found that the bearings and rings had acquired an unusually smooth glaze and polish at the spots which took the pressure, and there was less wear than usual after this length of service.

These examples merely illustrate specific embodiments of this invention, and are not intended to limit its scope.

I claim:

1. A composition comprising an oleaginous lubricant and about 1 to 5% of an oil-soluble compound containing at least one carbon atom attached directly to both nitrogen and sulfur.

2. A composition comprising an oleaginous lubricant and about 1 to 5% of an oil-soluble compound containing at least one carbon atom attached directly to both nitrogen and sulfur and to more than one atom of one of these elements.

3. A composition comprising an oleaginous lubricant and about 1 to 5% of an arylene-thiazole compound.

4. A composition comprising an oleaginous lubricant and about 1 to 5% of mercaptobenzothiazole.

5. A composition comprising an oleaginous lubricant and about 1 to 5% of mercaptobenzothiazole and an organic acid.

6. A composition comprising an oleaginous lubricant and about 1 to 5% of chlorbenzothiazole.

7. A composition comprising an oleaginous lubricant and about 1 to 5% of a substituted thiuram sulfide.

8. A composition comprising an oleaginous lubricant and about 1 to 5% of a tetrasubstituted thiuram disulfide.

9. A composition comprising an oleaginous lubricant and about 1 to 5% of tetramethyl thiuram disulfide.

10. A composition comprising a lubricating oil and 1% to 5% mercapto benzo thiazole.

11. A composition comprising a lubricating oil and a small proportion, sufficient to impart extreme pressure characteristics to said oil, of mercapto benzo thiazole.

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