

UNITED STATES PATENT OFFICE

2,346,356

HEAVY DUTY LUBRICANT

Robert E. Burk, Cleveland Heights, Ohio, assign-
or to The Standard Oil Company, Cleveland,
Ohio, a corporation of Ohio

No Drawing. Application June 11, 1940,
Serial No. 339,928

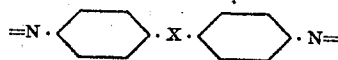
10 Claims. (Cl. 252-49)

Lubricants for heavy duty or extreme pressure usage have been based on sulphur or chlorine. There is no general agreement as to the exact mode of action of these, as to whether there is some reaction with the metal bearing surface such as to result in a lapping and smoothing of the surface and decreasing unit loads, or whether there is the formation of a film which is more difficult to score than the metal surfaces, or whether the action may be due to interposing between the rubbing surfaces solid particles which act like rollers or skids. Sulphur and chlorine have disadvantages militating against usage in particularly effective amounts, and in some cases they are precluded entirely. I have found that extreme pressure lubrication, such as for gears, and notably hypoid gears, etc., can be attained advantageously by other means than sulphur or chlorine, or where desired by such means in conjunction with these. Other objects and advantages will be apparent as the description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described, and particularly pointed out in the claims, the following description setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

The oil should be a heavy oil, as for instance 60-160 sec. Saybolt Universal at 210° F. With this I incorporate a small amount of an agent providing phosphorus. This may be ordinary yellow phosphorus, P₄S₃, etc. Extreme pressure lubricants are used under conditions that tolerate more corrosive action than is the case for engine oils for instance. But I have found that undesired corrosive action of phosphorus in such lubricants can be inhibited, and by inclusion of an agent for inhibiting corrosion by such component a much more desirable lubricant in general is realized, and even in the presence of sulphur or chlorine or halogen-containing compounds, as for instance halogenated paraffin, halogenated carnauba wax, chlorinated toluene, chlorinated naphthalene, chlorinated diphenyl, chlorinated fatty acids, as stearic or oleic, chlorinated soaps, etc. The amount of phosphorus or phosphorus compound may be less than 0.4 per cent, and in general 0.01 to 2 per cent. When used in combination with sulphur or halogen compound, higher concentrations are feasible. For this, I have found as desirable agents, tetra-

methyldiaminodiphenylmethane, diaminodiphenylmethane, aceto-acetanilide, phenylalphanaphthylamine, aluminum soap and alcoholates, mercapto-benzothiazoles, phosphate and phosphite esters and other nitrogen, sulphur or oxygen-containing compounds. In general, diaminodiphenylmethane derivatives containing the group-



are desirable, wherein X is carbon, nitrogen, sulphur, oxygen, phosphorus, aluminum, boron, arsenic, antimony, and for conciseness all such materials are referred to hereinafter as "an agent inhibiting corrosion."

For example: With a heavy base lubricating stock of 90 sec. Saybolt Universal at 210° F., there is incorporated 0.1 per cent of phosphorus and 0.25 per cent of tetramethyldiaminodiphenylmethane. This lubricant tested on a Cornell machine went to a load of 4000 pounds and torque 54.

As another example: With a similar lubricating stock there is incorporated 0.05 per cent of phosphorus and 0.25 per cent of tetramethyldiaminodiphenylmethane.

As another example: With a similar lubricating stock there is incorporated 0.025 per cent of phosphorus and 0.15 per cent of tricresyl phosphite.

As another example: With a similar lubricating stock there is incorporated 0.05 per cent of phosphorus and 0.25 per cent of chlorinated wax ("Angolinol").

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A heavy duty lubricant comprising a heavy lubricating oil and small amounts of P₄S₃ and tetramethyldiaminodiphenylmethane.

2. A heavy duty lubricant comprising a heavy lubricating oil and small amounts of tetramethyldiaminodiphenylmethane and an inorganic phosphorus-providing agent from the group consisting of phosphorus and phosphorus sulphide.

3. A heavy duty lubricant comprising a heavy lubricating oil and small amounts of an inorganic phosphorus-providing agent from the group consisting of phosphorus and phosphorus sulphide, another extreme pressure agent, and a diamino-diphenylmethane derivative.

4. A heavy duty lubricant comprising a heavy lubricating oil and small amounts of an inorganic phosphorus-providing agent from the group consisting of phosphorus and phosphorus sulphide, and a diaminodiphenylmethane derivative.

5. A heavy duty lubricant comprising a heavy lubricating oil and small amounts of an inorganic phosphorus-providing agent from the group consisting of phosphorus and phosphorus sulphide, a halogen-containing compound having extreme pressure characteristics, and a diaminodiphenylmethane derivative.

6. A process of preserving a lubricating film under heavy pressure, which comprises subjecting a heavy lubricating oil to the action of P_4S_3 and tetramethyldiaminodiphenylmethane while under load.

7. A process of preserving a lubricating film under heavy pressure, which comprises subjecting a heavy lubricating oil to the action of tetramethyldiaminodiphenylmethane and an inorganic phosphorus-providing agent from the group consisting of phosphorus and phosphorus sulphide, while under load.

8. A process of preserving a lubricating film 25

under heavy pressure, which comprises subjecting a heavy lubricating oil to the action of an inorganic phosphorus-providing agent from the group consisting of phosphorus and phosphorus sulphide, another extreme pressure agent, and a diaminodiphenylmethane derivative, while under load.

9. A process of preserving a lubricating film under heavy pressure, which comprises subjecting a heavy lubricating oil to the action of small amounts of an inorganic phosphorus-providing agent from the group consisting of phosphorus and phosphorus sulphide, and a diaminodiphenylmethane derivative, while under load.

10. A process of preserving a lubricating film under heavy pressure, which comprises subjecting a heavy lubricating oil to the action of small amounts of an inorganic phosphorus-providing agent from the group consisting of phosphorus and phosphorus pentasulphide, a halogen-containing compound having extreme pressure characteristics, and a diaminodiphenylmethane derivative, while under load.

ROBERT E. BURK.