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EXTREME PRESSURE LUBRICANT

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1 Claim. (Cl. 87—9)

This invention relates to lubricants suitable for lubrication under extreme pressure conditions.

It is well known that the high pressures occurring in certain types of gears and bearings may cause a film of lubricant to rupture with consequent damage to the machinery. It has been shown that mineral lubricating oils can be improved with regard to their load carrying capacity by the addition of certain substances to a degree, which enables them to successfully resist being completely forced out from between rubbing surfaces under extreme pressures. Excessive wear, scuffing and seizure, which normally follow a break in the film of lubricant can thus be prevented even under the most unfavourable pressure and speed conditions. Oils possessing this highly resistive property are called extreme pressure lubricants.

Among the substances that have been proposed for incorporation into the lubricating oils for the purpose of improving their extreme pressure properties, there is a class of oil-insoluble solid compounds which by themselves can be used as lubricants in a limited way. Examples of this class of compounds are graphite, zinc oxide, lead sulfide, talc, clay, etc., all of which are being used in suspension of lubricating oils.

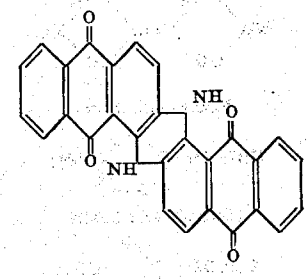
We have now discovered another useful class of substantially oil insoluble compounds, which by themselves have little or no lubricating powers, but which are capable of improving the extreme pressure properties of mineral lubricating oils. This class consists essentially of fairly high molecular weight organic substances possessing several polar radicals such as —OH, —COOH, —NH_2, =NH,—SH, =S, =C=, etc., and a high thermal stability at least equal to that of the mineral lubricating oil to which the dope is added. Molecular weights range from about 200 to an upper unknown limit. The compounds are cyclic in structure, containing several rings, at least one of which is aromatic. In addition they contain nitrogen usually in the form of a derivative of an aromatic amino compound, and most of them have the properties of dyes substantially insoluble in mineral oils. While some of these dyes are soluble in mineral oils to the extent of imparting color to the oil, their solubility is well below 0.1%.

The compounds of our invention have several advantages over other oil insoluble compounds used heretofore to impart extreme pressure properties to lubricating oils. Not only have our compounds a much greater effect than, for instance, the widely used graphite, but being of organic nature they produce no ash, and are therefore often preferable to some otherwise very useful substance, such as lead sulfide. Many of our compounds, being free from a tendency to be corrosive or to liberate corrosive substances even at high temperatures and under conditions encountered in crankcases of internal combustion engines while in operation, can be safely incorporated into lubricants used in internal combustion engines, so that the preparation of safe crankcase oils possessing extreme pressure properties has now been made possible. The quantities of our compounds required to impart extreme pressure properties usually vary from about 0.1 to 10% by weight, and must be in excess of the solubility limit of the compounds in the lubricating oils.

Particular substances which are useful for our invention are:

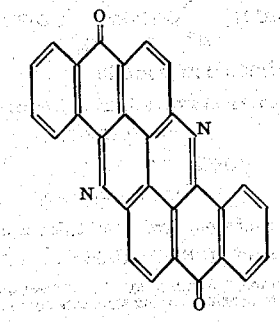
Anthraquinone derivatives such as:

Indanthrene

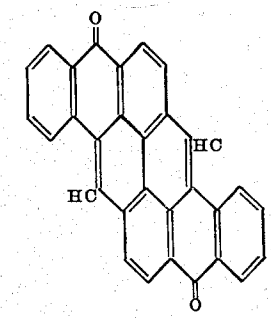


Hydroxy derivatives of indanthrene

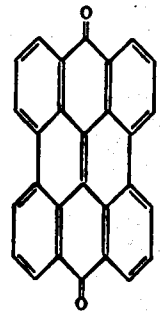
Flavanthrene



Pyranthrone

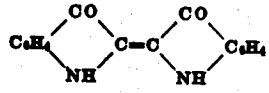


Mesonaphthodianthrone

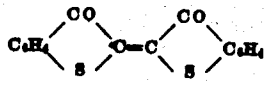


Indigo derivatives and related compounds:

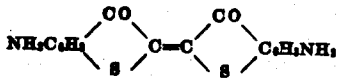
Indigo



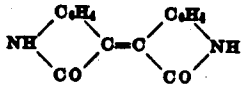
Thioindigo



Diamido thioindigo

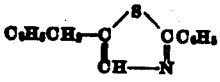


Indirubine

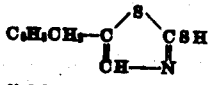


Thiazols

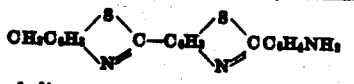
Phenyl-bens-thiazol



Mercapto bens-thiazol

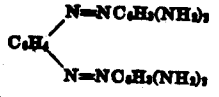


Toluidene di-dehydrothiotoluidene (Primuline)



Azo and diazo compounds

Tetrazo m-phenylene diamine (Bismark Brown)



Nigraniline, produced by oxidation of aniline

$C_6H_5N{=}C_6H_4N{=}C_6H_4N{=}C_6H_4N{=}\ldots NHC_6H_4NH_2$

Nigrosine, produced by the interaction of aniline and nitro benzine, having structure similar to nigraniline

From the point of view of thermal stability many of the anthraquinone derivatives are of particular value.

Most commercially available dyes contain considerable proportions of inorganic impurities, usually sodium chloride, which of course is extremely harmful in lubricating oils and must be removed, for instance by washing with water, prior to blending with the oil.

The process of admixing the compounds of our invention to lubricating oils may be carried out according to known principles. The powdered compounds may simply be stirred into the oil, or a stock suspension may be prepared by running a rich mixture of compounds in oil through a colloid mill, and then admixing some of the stock suspension to lubricating oils.

Sometimes it may be desirable to introduce peptizing agents to prevent the compounds from settling; anticorrosion agents may be of advantage in combinations with certain compounds which have a corrosive tendency, for instance tetrazo m-phenylene diamine chlorhydrate, or mercaptobenzthiazol. Antioxidants may be used to prevent the premature oxidation of some of the additions.

In the following illustrative examples the effects on the film strength of a lubricating oil due to the addition of some of the above described compound is shown. The four-ball apparatus by Boerlage, which was described in "Engineering" vol. 136 (1933) page 46 was used for testing; this apparatus is capable of measuring the comparative metal wear at various pressures, as well as the pressures at which the test metals weld in the presence of the test lubricant.

The data below are typical:

Substance added	Percent by weight	Welding pressure in kg.	Diameter of wearing surface in mm.
Straight mineral oil		150	2.2 at 100 kg.
Nigrosine base	6	600+	2.53 at 600 kg.
Indigo	10	300	2.10 at 250 kg.
Indanthrene	4	600	2.2 at 350 kg.
Tetraso m-phenylene diamine chorhydrate.	2	600+	1.30 at 600 kg.
Nigraniline	2	500	1.86 at 400 kg.
Mercaptobenzthiazol	2	300	2.07 at 250 kg.

As will be noted from those data, while the quantities required to obtain a pronounced effect vary considerably with the individual substance, the improvement in the lubricating property of the oil is quite great.

We claim as our invention:

An extreme pressure lubricant consisting essentially of a mineral lubricating oil containing not less than 0.1% finely divided nigraniline.

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