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SYNTHETIC LUBRICATING AGENTS AND HYDRAULIC LIQUIDS

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This application is a continuation-in-part application of our pending patent applications Serial Nos. 208,104 (now abandoned); 208,105 (now abandoned); 208,106 (now abandoned), all three filed on July 6, 1962; Serial No. 249,120, filed on January 3, 1963; and Serial No. 357,851 (now abandoned), filed on March 11, 1964.

The present invention concerns the use of certain N-substituted melamines as synthetic lubricating agents and/or as hydraulic liquids, as well as compositions which, in addition to the melamine derivatives useable according to the invention, also contain other usual mineral or synthetic liquids as well as the usual antioxidants, thickeners, agents lowering the congealing point, high pressure additives and/or anticorrosives. The invention also concerns processes for the lubrication or hydraulic propulsion of machines or parts thereof with the new compositions containing the aforesaid melamine derivatives which can be used as lubricating agents and/or hydraulic fluids.

Very high demands with regard to heat stability are made of synthetic lubricating agents and hydraulic fluids such as are necessary, for example, in gas turbine engines especially for airplanes or the modern high temperature equipment used in the mechanical and electrical industries.

For use in gas turbine engines especially for airplanes, synthetic lubricating agents must primarily fulfill the following conditions:

(1) They must be capable of forming a lubricating film on the most various metals;

(2) They must be only slightly volatile and have extensive stability to heat;

(3) They should not have a corrosive action and, above all, they should not form acid decomposition products;

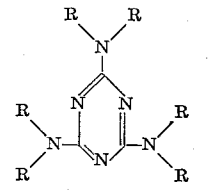
(4) They should retain their lubricating properties over as wide a temperature range as possible, i.e., their viscosity should be as little dependent as possible on temperature;

(5) They should have, in addition to these properties, on the one hand as low a solidification point as possible and on the other as high a boiling point as possible.

It is difficult to find substances which fulfill these demands to such an extent that they can be employed, for example, as lubricants for gas turbine engines. The usual lubricants do not fulfill the demands of modern motors, in particular of the aforesaid type of airplane engines, those of an ester basis because of their volatility and insufficient heat stability and those of a hydrocarbon basis because of their volatility, their solidification point and the dependence of their viscosity on temperature, referred to conventionally as ASTM slope and defined in detail further below.

It has now surprisingly been found that certain melamines suitably substituted at the nitrogen atom of the amino groups have the properties required above and thus can be used as hydraulic fluids when high demands are made and as synthetic lubricants for a particularly wide range of temperatures.

According to a first aspect of this invention, melamines suitable for use in the method and compositions according to the invention are of the formula



(I)

wherein R is a lower alkyl group with from 4 to 6 carbon atoms.

More particularly, the melamine derivatives of the above Formula I in which R is either a butyl radical or a hexyl radical are of commercial interest.

The hexa-N-substituted melamines used according to this aspect of the invention are easily produced by reacting in successive steps, by known methods, the three chlorine atoms of cyanuric chloride with primary or secondary organic amines.

In the first and/or second step, less easily reacting amines are reacted and in the third step those which react easily are reacted. The reaction is performed advantageously in inert organic solvents and diluents such as low aliphatic ketones, aliphatic or alicyclic ethers such as dibutyl ether, tetrahydrofuran or dioxan, or aromatic hydrocarbons or halogenated hydrocarbons such as benzene, toluene, xylene or dichlorobenzene in the presence of acid binding agents at suitable temperatures. Examples of acid binding agents are the alkali metal salts of lower fatty acids such as sodium acetate, also those of weaker polybasic acids such as sodium or potassium carbonate, sodium or potassium bicarbonate and, in suitable amount and form, also alkali hydroxides as well as tertiary nitrogen bases such as triethylamine, triethanolamine, pyridine, etc. The first chlorine atom of the cyanuric chloride is reacted advantageously at lower temperatures up to 15° C., the second chlorine atom is reacted at medium temperatures up to 60° C. and the third chlorine atom is reacted, if necessary, at higher temperatures, an excess of the amine being used advantageously as acid binding agent.

Aliphatic amines which can be used are the primary and secondary amines containing normal and/or branched chain alkyl groups of 4 to 6 carbon atoms.

The crude hexa-N-substituted melamines used according to the invention may contain mixtures of primary, secondary and tertiary amines. Due to their great stability to heat, they can easily be obtained in pure form by distillation. The melamine derivatives can also be purified by extraction with a selective solvent such as acetic acid, by treatment with a bleaching earth such as Tonsil AC or an absorption earth such as Celite FC or with an ion-exchanger such as Amberlite IR 120.

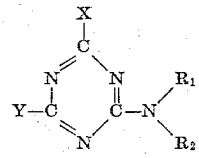
The hexa-N-substituted melamines used according to this aspect of the invention are slightly volatile oils or are of a fatty or wax-like consistency and they are distinguished by high thermostability as they decompose only at temperatures above 380° C. In this respect they have the advantage over the best products used up to now for this purpose, namely the triesters of higher fatty acids with trimethylolpropane; these cannot be used at temperatures above 320° C. In addition, the lubricants and hydraulic liquids according to the invention are more stable to hydrolysis than lubricants of an ester basis which have been used up to now.

They also have the advantage that even under extreme test conditions such as are required for gas turbine oils

for airplane engines, they form practically no acid decomposition products.

In addition, the flash point of the melamines useable according to this aspect of the invention is favorable. It was determined according to the ASTM designation: D 93–58T (The American Society for Testing Materials, 1915 Race St., Philadelphia 3, Pa.).

According to a second aspect of this invention, melamines usable according to the invention are compounds of the formula



(II)

wherein

X is a di-(lower alkyl)-amino group in which each alkyl radical has from 1 to 4 carbon atoms,

Y is a di-(lower alkyl)-amino group in which each alkyl radical has from 1 to 4 carbon atoms,

R_1 is hydrogen or alkyl of maximally 14 carbon atoms,

R_2 is an alkyl group of at least 6 and maximally 18 carbon atoms or a cyclohexyl group, the sum of the carbon atoms of R_1 and R_2 being at least 8 and not more than 28,

and R_1 and R_2 taken together with the nitrogen atom to which they are linked represent either piperidino- or hexamethyleneimino.

Very interesting as lubricants because of their good ASTM slope which is below 0.8, are the compounds of the above Formula II in which there are a total of five alkyl substituents at the three amino-nitrogen atoms, one of which substituents is an alkyl group with 18 carbon atoms.

Another subclass of compounds which are particularly interesting in view of their good lubricant properties, (ASTM slope in the range of about 0.7 and lower, and weight loss at 380° C. of less than 6%) are those compounds of the above Formula II in which there are a total of six substituent alkyl groups at the three amino-nitrogen atoms, and wherein one of these alkyl groups has from 12 to 18 carbon atoms.

This aspect of the invention further relates to a method of lubricating a substrate with a compound of the above Formula II, and to compositions which contain the aforesaid compounds as essential ingredients.

Apart from substituted, particularly alkyl-substituted amino groups, the nitrogen substituents of melamines usable according to this aspect of the invention must not contain any functional groups. In particular they contain no acid, salt-forming susbtituents or any which can be converted into such; for example, they contain neither sulfonic acid groups nor carboxyl, sulfonic acid ester, carboxylic acid ester, sulfamyl, carbamyl nor cyano groups.

If two substituents of the same nitrogen atom are bound in ring form then they form, for example, the pyrrolidine, piperidine, morpholine, hexamethyleneimine or N'-alkylpiperazine ring.

The N,N',N''-substituted melamines according to this second aspect of the invention are easily produced in an analogous manner as described in the first aspect of this invention, but using the equivalent aliphatic amines to produce the desired compounds.

Aliphatic amines which can be used for this aspect of the invention are, for example, primary and secondary amines containing normal and/or branched chain alkyl groups of 1 to 18 carbon atoms, or alkoxyalkyl groups of 3 to 20 carbon atoms, or aminoalkyl groups having advantageously a tertiary amino group, e.g., a dialkylamino, diaralkylamino, dicycloalkylamino, alkylaralkylamino, alkylarylamino, polymethyleneimino, morpholino or N'-alkylpiperidino group. As alicyclic amines can

be used, for example, cyclopentylamine, cyclohexylamine, and cycloheptylamine and dihydroabietinylamine; examples of secondary amines of this series are the corresponding bis-alicyclic amines or also secondary alkylcycloalkyl, aralkylcycloalkyl or phenylcycloalkyl amines.

The crude N,N',N''-substituted melamines according to the second aspect of the invention can contain mixtures of primary, secondary and tertiary amines which must be removed by purification in the same manner as described in the first aspect of this invention, supra.

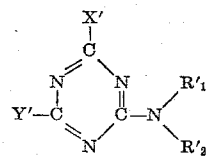
The N,N',N''-substituted melamines used according to this aspect of the invention are also slightly volatile oils or are of a fatty or wax-like consistency and they are also distinguished by similar excellent qualities as those exhibited by the compounds according to the first aspect of the invention.

They also have the advantage that even under extreme test conditions such as are required for lubricants for gas turbine engines of airplanes, they form practically no acid decomposition products. Thus, for example the volatile compounds formed from 2-diethylamino-4-dibutylamino-6-dodecylamino-1,3,5-triazine (compare compound No. 1 in the following Table III), and also the residue have an acid value of only 1 mg. KOH/g. or 0.7 mg. KOH/g. respectively after 6 hours' exposure to a temperature of 380° C., i.e., both the volatile compounds as well as the residue formed from compound No. 1 of Table III are neutral for all practical purposes after several hours exposure to heat whereas the volatile substances formed from trimethylolpropane tripelargonate under the same conditions have an acid value of 117.3 mg. KOH/g.

In addition, the flash point of the melamines usable according to this aspect of the invention is also favorable. It was determined according to the ASTM designation: D 93–58 T. In the case of compound No. 1 of Table III mentioned above, it is above 300° C. and is thus higher than that of the sebacates of alkanols, now in commercial use.

Also the density of the melamines usable according to this aspect of the invention is favorable, for example that of compound No. 1 in the following Table III is only about 0.88 and that of compound No. 16 in the same table is only 0.85. The densities of the conventional lubricants of an ester basis are higher.

According to a third aspect of the invention melamines usable according to the invention are compounds of the formula



(III)

wherein

X' is a di-(lower alkyl)-amino group in which each alkyl radical has from 2 to 4 carbon atoms,

Y' is a di-(lower alkyl)-amino group in which each alkyl radical has from 2 to 4 carbon atoms,

R'_1 is hydrogen or lower alkyl of maximally 4 carbon atoms,

R'_2 is benzyl, phenyl, alkylphenyl wherein alkyl has maximally 12 carbon atoms, alkoxy-phenyl wherein alkoxy has maximally 4 carbon atoms, or phenoxy-phenyl.

Very interesting as lubricants because of their good ASTM slope which is below 0.8 are the compounds of the above Formula III in which there are a total of four alkyl substituents as well as one aromatic or araliphatic substituent at the three amino nitrogen atoms, the araliphatic substituent being preferably a benzyl group.

Another sub class of compounds which are particularly interesting in view of their good lubricant properties (ASTM slope in the range of about 0.7, or higher values,

and high heat resistance expressed by a weight loss at up to 380° C. of less than 6%) are those compounds of the above Formula III in which these are a total of five substituent alkyl groups and one aromatic group at the three amino nitrogen atoms and said aromatic group is preferably a phenyl group.

This third aspect of the invention further relates to a method of lubricating a substrate with a compound of the above Formula III and to compositions which contain the aforesaid compounds as essential ingredients.

Apart from substituted, particularly aryl- and alkyl-substituted amino groups, the nitrogen substituents of melamines usable according to this aspect of the invention must not contain any functional groups. In particular they contain no acid, salt-forming substituents or any which can be converted into such; for example, they contain neither sulfonic acid groups nor carboxyl, sulfonic acid ester, carboxylic acid ester, sulfamyl, carbamyl nor cyano groups.

The N,N',N''-substituted melamines used according to this aspect of the invention, are easily produced in an analogous manner as described in the first aspect of this invention, but using the equivalent aliphatic amines to produce the desired compounds.

Aliphatic amines which can be used for this aspect of the invention are, for example, primary and secondary amines containing normal and/or branched chain alkyl groups of 1 to 6 carbon atoms, or alkoxyalkyl groups of 3 to 12 carbon atoms, or aminoalkyl groups having advantageously a tertiary amino group, e.g. a dialkylamino, diaralkylamino, dicycloalkylamino, alkylaralkylamino, alkylarylamino, polymethyleneimino, morpholino or N'-alkylpiperazino group.

Examples of primary aromatic amines are aniline, chloro- or bromo-aniline, alkylanilines such as toluidines, xylidines, tert-butyl or tert-amyl anilines, aminotetrahydronaphthalenes, aminodiphenyls, aminodiphenylalkanes, aminodiphenylamines, aminodiphenyl ethers, aminodiphenylthioethers and secondary amines of this series such as compounds which have been alkylated, aralkylated or alicyclically substituted at the amino nitrogen atom.

The crude N,N',N''-substituted melamines according to this third aspect of the invention can contain mixtures of primary, secondary and tertiary amines. Because of their great stability to heat, they can easily be obtained in pure form by distillation. The melamine derivatives can also be purified by extraction with a selective solvent such as acetic acid, by treatment with a bleaching earth such as Tonsil AC or an adsorption earth such as Celite FC or with an ion-exchanger such as Amberlite IR 120.

The N,N',N''-substituted melamines used according to this aspect of the invention are also slightly volatile oils or are of a fatty or wax-like consistency and they are distinguished by high thermostability as they decompose only at temperatures above 380° C. In this respect they have the advantage over the best products used up to new for this purpose, namely the triesters of higher fatty acids with trimethylolpropane; these cannot be used at temperatures above 320° C. In addition, the lubricants and hydraulic fluids according to this aspect of the invention are more stable to hydrolysis than lubricants of an ester basis which have been used up to now.

They also have the advantage that even under extreme test conditions such as are required for lubricants used in gas turbine engines or airplanes, they form practically no acid decomposition products. Thus, for example, the volatile compounds formed from 2,4-bis-dibutylamino-6-p-phenoxyphenyl-1,3,5-triazine (compare compound No. 3 in the following Table VI), and also the residue have an acid value of only 1 mg. KOH/g. or 0.7 mg. KOH/g. respectively after 6 hours' exposure to a temperature of 380° C., i.e., both the volatile compounds as well as the residue formed from compound No. 3 of Table VI are neutral for all practical purposes after several hours' exposure to heat whereas the volatile substances formed from trimethylolpropane tripelargonate under the same conditions have an acid value of 117.3 mg. KOH/g.

In addition, the flash point of the melamine usable according to this aspect of the invention is favorable. It was determined according to the ASTM designation: D 93–58 T. In case of compound 3 of Table VI mentioned above, it is 300° C. and is thus higher than that of the sebaceates of alkanols now in commercial use.

The melamines according to the three aspects of this invention are distinguished over the previously known substances recommended as lubricants for turbine engines such as, e.g., the ortho-phosphoric acid esters of organic hydroxyl compounds, by their much slighter corrosive action; they are distinguished over the esters of higher polycarboxylic acids with polyalcohols by their lesser swelling action on synthetic materials such as, e.g. on high molecular copolymers from butadiene and acrylonitrile (e.g. Hycar 38 made by Messrs. Goodrich in Akron, Ohio, U.S.A.); and they are distinguished over esters from pentaerythrite and monocarboxylic acids of medium chain length by considerably less separation of resinification and carbonization products. They are also distinguished over all these known lubricants in that, in addition to having good properties at low temperatures, they are very stable particularly at high temperatures. In addition, they are distinguished over the silicone oils, some of which are also thermostable, by their better lubricating properties and they are distinguished over polyphenyl ethers by their lower solidification point and, therefore, their greater usefulness in the modern engines now in use. The very good stability to acid and alkali of the melmine derivatives used according to the invention is also remarkable. In the liquid state, these melamine derivatives have medium to high viscosity; their great advantage lies in the fact that this viscosity is only slightly dependent on temperature.

The melamines useable according to the invention can be employed as lubricants in many ways. Properties desirable for a particular purpose can also be attained by the production of suitable mixtures of these melamines.

Thus, the melamines useable according to the invention are suitable for the lubrication of hard surfaces because, on contact with these surfaces, they form very adhesive surface films, e.g., they are suitable for lubricating the surface of metals as well as alloys thereof, the surfaces of silicates such as, e.g., glasses as well as of other materials needing lubrication such as, e.g., rubber washers.

The N,N',N''-substituted melamines useable according to the invention can be employed alone or they can also contain additives. Thus, when they are to be used at temperatures of over 150° C., to make use of their favorable stability to heat they are mixed advantageously with anti-oxidants in order to hinder the auto-oxidation which sets in above this temperature. The amount of antioxidant is about 0.01 to 5% of the melamine. Of the amines which can be used as antioxidants, generally the secondary monoamines are particularly valuable and of these especially the diarylamines with homocyclic and heterocyclic aromatic radicals as well as the aromatic diamines the substituents of which are preferably secondary amino substituents occupying either the ortho- or, preferably, the para-position.

Examples of homocyclic and heterocyclic aromatic diaryl amines which can be used as antioxidants are diphenylamines, phenylnaphthylamines, phenylacenaphthenylamines; 4,4' - dinaphthylaminodiphenyl; thiazolyl-(2)-naphthylamines; examples of aromatic diamines are N,N' - diphenyl - p - phenylenediamine, N,N'-dioctyl-p-phenylenediamine, N,N' - dicyclohexyl - p - phenylenediamine, N-sec-butyl-N'-phenyl-p-phenylenediamine, N,N'-bis-(γ-aminopropyl)-p-phenylenediamine.

Of the hydroxyl-substituted aromates which are especially employed as antioxidants at not too high temperatures (i.e., below 200–300° C. depending on type

and substratum), those are suitable which have a sterically hindered hydroxyl group as well as the derivatives of dihydroxyaryl compounds the hydroxyl groups of which are in o- or p-position to each other. Examples of particularly valuable compounds which can be used are the monophenol derivatives such as

2,4-dimethyl-6-tert-butylphenol,
2,6-di-tert-butyl-4-ethylphenol,
2,6-bis-(1'-methylcyclohexyl)-4-methylphenol,
2,6-di-tert-butyl-4-dimethyl-aminomethyl phenol,
2,2'-methylene-bis-(4-methyl-6-tert-butyl phenol),
2,2'-thio-bis-(4-methyl-6-tert-butyl-phenol),
4,4'-dihydroxy-2,2'-dimethyl-5,5'-di-tert-butyl-diphenyl sulphide and diphenyl disulphide,
2,6-bis-(2'-hydroxy-3'-tert-butyl-5'-methylbenzyl)-4-methylphenol),
1,1,3-tris-(4'-hydroxy-5'-tert-butyl-2'-methylphenyl)-butane,

derivatives of polynuclear phenols such as

2-tert-butyl-1-hydroxynaphthalene,
4,6-di-tert-butyl-5-hydroxyindane,
5-hydroxyacenaphthene,

polyvalent phenols and derivatives thereof: butyl pyrocatechol, octyl gallate, hydroquinone, butylhydroxy anisole, hydroquinone monobenzyl ether.

Of the aminohydroxyaryl compounds useable as antioxidants those derivatives in which the amino and hydroxyl groups are in p-position to each other are particularly suitable. Examples are: p-hyroxy-diphenylamine, p-hydroxyoctyl aniline, p-hydroxy-N-γ-aminopropyl aniline.

Of the heterocyclic compounds, which can be used as antioxidants the cyclic imides are the best known; in addition, however, also heterocyclic compounds having no nitrogen can be employed insofar as they are not included in the class of heterocyclic amines. Examples are: phenothiazine, 6-methoxy- or 6-ethoxy- or 6-ethylamino-2,2,4-trimethyl-1,2-dihydroquinoline or telomers thereof, 3 - hydroxy - 7,8-benzo-1,2,3,4-tetrahydroquinoline or tocopherol.

Didodecyl selenide may also be used as antioxidant.

In addition, the N,N',N''-substituted melamines useable according to the invention can also contain high pressure additives such as phosphites, phosphates, sulfonated oil, etc., barium or calcium mahagony sulfonates, anti-corrosives such as sarcosines or benzotriazoles, said high pressure additives and anti-corrosives preferably being added in amounts of at least 0.01% based on the weight of the lubricant composition, agents lowering the solidification point and, optionally, also anti-foaming agents such as the ones based on silicones and also poly-(lower alkyl substituted hexyl methacrylate), in amounts of about 0.1, or 1% and higher up to about 5% of the weight of the lubricant composition.

Anti-corrosives are added, preferably in amounts of 0.01 to 2% by weight of the melamine lubricant composition.

In addition, the invention also embraces lubricating greases made from the melamine derivatives used according thereto by the addition of the usual thickeners. Examples of such thickeners are metal soaps, bentonites, phthalocyanines, violanthrones, etc. Such additives are preferably present in the lubricant compositions according to the invention in amounts of from 10 to 45% based on the total weight of the composition.

The new synthetic lubricants can also be mixed with other lubricants, for example, with highly purified mineral oil fractions or with the so-called synthetic ester lubricants, i.e., esters of from 18 to 50 carbon atoms,

(a) Those of fatty acids with alkane-tri- and tetraols containing from 4 to 10 carbon atoms, and containing not more than one oxygen atom attached to each carbon atom, such as ω-tri-methylol alkanes,

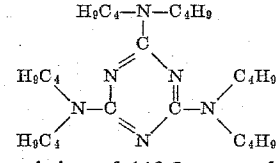
(b) those of alkanedicarboxylic acids containing 4 to 14 carbon atoms with alkanols, and

(c) complex esters comprising the neutral esterification products of the above-defined polyhydric alcohols such as trimethylolpropane and pentaerythritol with a mixture of alkanolic acids as defined above, with the molar ratio of the polyhydric alcohol and the alkanedicarboxylic acid ranging from 4:1 to 1.33:1; and further with esters of ortho-silicic acid with 2-ethylhexanol, and with silicones or lubricants containing organic phosphorus compounds.

These additives can be used in any ratio advisable for the purpose intended in correspondence with the miscibility diagram of the two components. Preferred is a content of 5 to 95%, and preferably 10 to 90%, by weight of the lubricant compounds defined in Formulas I, II and III above, the balance consisting of one of the above-mentioned conventional lubricants.

The following examples illustrate the particular suitability of the N,N',N''-substituted melamines according to the invention for use as synthetic lubricants, as hydraulic fluids as well as oils for turbine engines. Measurements are given therein according to the metric system and the temperatures are in degrees centigrade. Pressures are given in torr (mm. Hg).

Example 1.—2,4,6-tris-dibutylamino-s-triazine



A mixture consisting of 110.8 parts of 2,4-bis-dibutylamino-6-chloro-s-triazine (B.P. 162° under 0.1 torr; n_D^{25} 1.5071), 77.5 parts of dibutylamine and 12 parts of pulverized sodium hydroxide are stirred for 3 hours at 120° and then further heated and stirred for 8 hours at 150°. The mixture is then filtered, the filtrate is washed with water and fractionally distilled. 118 parts of a colorless oil are obtained which passes over at 196–199° under 0.05 torr. Refraction index n_D^{25} 1.4948; yield: 85.6% of the theoretical.

Analysis.—$C_{27}H_{54}N_6$, M.W. 462; calculated: C 70.0 percent, H 11.70 percent, N 18.20 percent. Found: C 70.10 percent, H 11.69 percent, N 18.33 percent.

This melamine derivative is a viscous liquid which is very slightly volatile and very thermostable. Its viscosity depends relatively slightly on the temperature so that it is a very valuable turbine oil.

If, instead of 2,4-bis-dibutyl-amino-6-chloro-s-triazine and dibutylamine, equimolar amounts of 2,4,-bis-dihexyl-amino-6-chloro-s-triazine and hihexylamine respectively are used, then 2,4,6-tris-dihexylamino-1,3,5-triazine is obtained in an analogous manner.

Yield: 98.5% of the theoretical. B.P. >220° under 0.03 torr.

Refraction index n_D^{25} 1.4890.

Analysis.—$C_{39}H_{78}N_6$, M.W. 630; calculated: C 74.50 percent, H 12.10 percent, N 13.32 percent. Found: C 73.94 percent, H 12.32 percent, N 13.50 percent.

Example 2

50 parts of 2,4,6-tris-dihexylamino-1,3,5-triazine having a viscosity of 13.83 centistokes at 98.8° and 50 parts of a highly purified mineral oil (viscosity SAE 10) are stirred together. The mixture has the good lubricating properties of the components and the viscosity of the mixture is only 8.92 centistokes at 98.8°.

The application range of the melamine compound used is considerably broadened by this reduction of the viscosity in that, for example, the mixture can be used, e.g., as power transmitting agent in parts of machines which are temporarily exposed to temperatures which are lower than usual working temperatures. Under such condi-

tions, the melamine derivative alone is less suitable for use.

Example 3

8 parts of copper phthalocyanine (Irgaplast Brilliant Blue BLP, Geigy Co. Ltd., Manchester, England), 4 parts of 2,4,6-tris-dibutylamino-1,3,5-triazine and 40 parts by volume of benzene are stirred rapidly for 15 minutes in an "Ultraturax" mixing apparatus (made by Janke & Kunkel, Stauffen, Baden, Germany). Another 20 parts of 2,4,6-tris-dibutylamino-1,3,5-triazine are then added and the whole is stirred rapidly for another 45 minutes.

The homogeneous mass so obtained is worked on a glass surface with a spatula until the benzene has evaporated. The mass obtained is heated for 2 hours at 150° and, after cooling again worked on glass with a spatula. The product obtained, which is a soft grease which can be worked up well, has the following lubricating properties:

Penetration (in tenths of a millimeter):
ASTM D1403–56T (year 1958)—
Unworked 281
Worked 298
Drop point:
ASTM D566–42 (year 1957)—
Worked: above 238° (I.P. 132/57)

Example 4

97.5 parts of 2,4,6-tris-dihexylamino-1,3,5-triazine, 1.5 parts of dibutyl phosphite and 1 part of phenyl-α-naphthylamine are mixed well by stirring. Compared with the pure triazine, the mixture formed has improved stability to oxidation and better load carrying property.

Similar results are obtained if anticorrosives suitable for the intended use are added in amounts of 0.01 to 2% of the 2,4,6-tris-dibutylamino-1,3,5-triazine.

Example 5

99.8 parts of 2,4,6-tris-dibutylamino-1,3,5-triazine and 0.2 part of benzotriazole are mixed. Compared with the pure triazine, the mixture obtained has a less corrosive action in particular on copper and alloys thereof.

Example 6

97 parts of 2,4,6-tris-dibutylamino-1,3,5-triazine and 3 parts of polymers of methacrylic acid ester, in particular poly-2-ethyl-hexyl-methacrylate (HF 825, Röhm & Haas Co., Philadelphia, Pa., U.S.A.) are homogeneously mixed by stirring. This mixture has a lower solidification point than the pure 2,4,6-tris-dibutylamino-1,3,5-triazine.

The choice of polymers as additives to reduce the solidification point is advantageously made according to the desired solution in the triazine derivative.

Example 7

Oxidation and corrosion test on 2,4,6-tris-dibutylamino-s-triazine.

To make this test, 100 parts by volume (88 parts by weight) of the product are heated for 6 hours at 260°, 5000 parts by volume of air per hour being simultaneously bubbled through the liquid. Two pieces of mild steel are suspended in this liquid. The metal attack is expressed in mg./sq. cm. The change in viscosity during the heating is measured at 37.8° and is given in percent (%). The acid formation during the test is expressed in mg. KOH/g.; the sludge formation in mg./100 parts by volume of product.

(a) 100 parts by volume of 2,4,6-tris-dibutylamino-s-triazine without any additives at all showed a change in viscosity of 16.8%, acid content 3.42, sludge 43, metal attack 0.05.

(b) 100 parts by volume of 2,4,6-tris-dibutylamino-s-triazine, plus 1% of Topanol CA, a commercial product of Imperial Chemical Industries, a compound of a sterically hindered phenol type, showed a change in viscosity of 13.0%, acid content 2.90, sludge 13, metal attack 0.08.

(c) 100 parts of 2,4,6-tris-dibutylamino-s-triazine plus 1% by weight of didodecyl selenide showed a viscosity change of 8.19%, acid content 0.32, sludge 13, metal attack 0.08.

Example 8

70 parts of 2,4,6-tris-dibutylamino-1,3,5-triazine and 30 parts of sebacic acid di-2-ethyl-hexanol ester are stirred together. The mixture has a viscosity of 50.1 centistokes at 37.8° and 7.5 centistokes at 98.8°. ASTM slope 0.68.

Example 9

50 parts of 2,4,6-tris-dibutylamino-1,3,5-triazine and 50 parts of the triester of pelargonic acid and 1,1,1-trimethylolpropane are stirred together. This mixture has a viscosity of 48.1 centistokes at 37.8° and 7.2 centistokes at 98.8°. ASTM slope 0.70.

Example 10

50 parts of 2,4,6-tris-dibutylamino-1,3,5-triazine and 50 parts of silicone oil DC are stirred together. The mixture has a viscosity of 68.2 centistokes at 37.8° and 14.0 centistokes at 98.9°. ASTM slope 0.50.

The silicone oil DC of Dow Corning Co. mentioned in the above example has the following viscosity values:

At 98.8°=17.33 centistokes
At 37.8°=42.24 centistokes

Example 11

50 parts of 2,4,6-tris-dibutylamino-1,3,5-triazine and 50 parts of mineral oil SAE–10 are stirred together. This mixture has a viscosity of 75.66 centistokes at 37.8° and 8.82 centistokes at 98.8°. ASTM slope 0.71.

The following Table I shows the physical data of the compounds from which the suitability of these stable, difficultly volatile melamine derivatives as hydraulic liquids and/or lubricants can be seen. Columns 2 and 3 give the viscosity measured at 100° F. (=37.8° C.) and 210° F. (98.9° C.), and column 4 shows the so-called ASTM slope.

The meaning of the ASTM slope is as follows: If in a co-ordinate system, the temperature (in degrees Fahrenheit) is given as the abscissa and the natural log of the viscosity (in centistokes) is given as ordinate, then a plotted curve is obtained which, for practical purposes, can be regarded as a straight line. Thus the viscosity for the whole temperature range can be interpolated from two points determined experimentally (conventionally the viscosities at 100° F. and 210° F. are determined). The slope of this line is a standard for the dependency of the viscosity on temperature. Therefore, the ASTM slope is the quotient of the ordinate over the abscissa of the two points measured in cm. which are obtained by plotting the actual viscosity values at various temperatures in the ASTM chart. The "ASTM Standard Viscosity-Temperature Charts for Liquid Petroleum Products" (Method D 341) are standard graphs which closely resemble the co-ordinate system described above.

The lower the figure shown for a liquid in this ASTM slope the better suited it is as lubricant. A value of over 1.0 means that the liquid in question is not very suitable. ASTM is an abbreviation for American Society for Testing Materials, 1916 Race Street, Philadelphia, Pa., U.S.A.

Columns 5 and 6 show the loss in weight in percentage within 6 hours incurred by a sample of 25 ml. when heated to 380° or 400° C. in a glass test tube of about 25 mm. diameter with simultaneous introduction of nitrogen (2 liter per hour).

Column 7 shows the alteration in the viscosity in percentage measured at 210° F. incurred by the sample when heated for 6 hours as described above.

TABLE 1

Compound	Viscosity in centistokes at—		ASTM slope	Loss in weight after 6 hours at—		Change in viscosity after 6 hours in centistokes in percent at 210° F.
	100° F. (37.8° C.)	210° F. (98.8° C.)		° C.	Percent	
2,4,6-trisdibutylamino-1,3,5-triazine	131.2	12.69	0.700	380	5.9	+11.8
				400	17.1	+39.4
2,4,6-trisdihexylamino-1,3,5-triazine	128.3	13.83	0.660	380	6.59	−13.3
				400	20.15	+6.8

The lubricity of representative lubricants according to the first aspect of the invention as compared with the lubricity of di-3,5,5-trimethyl-hexyl sebacate and several commercial lubricants was measured in a Shell four-ball apparatus. The apparatus was run for 30 minutes at 1420 revolutions per minute under a 40 kg. load and using half-inch Grade "A" S.K.F. steel balls. The starting temperature was about 40° C. The results are summarized in the following Table II:

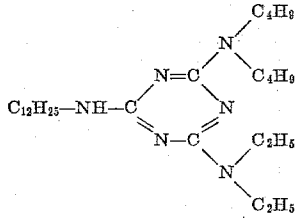
TABLE II

Substance used:	Scar diameter in mm.
2,4,6-tris-dibutylamino-1,3,5-triazine	0.452
Trimethylolpropane-tripelargonate	0.768
Di-3,5,5-trimethyl-hexyl-sebacate	0.896
Di-2-ethyl-hexyl-sebacate	0.850
Di-2-ethyl-hexyl-adipate	0.915
Methyl phenyl silicone (MS 550 of the Middland Silicone Ltd.)	1.93
Mineral oil (Mobil DTE light)	0.898

Each of the values given above is the average from three measurements.

As can be seen from the above Table II, the compounds according to the invention can be used directly for the lubrication of solid surfaces.

Example 12.—2-diethylamino-4-dibutylamino-6-dodecylamino-s-triazine



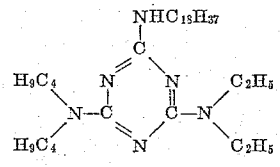
A mixture consisting of 157 parts of 2-diethylamino-4-dibutylamino-6-chloro-s-triazine, 115 parts of dodecylamine and 31.2 parts of pulverized sodium hydroxide are carefully heated at 100° while stirring. The whole is then stirred for 5 hours at 120°, diluted with 170 parts of a mixture of xylene water and refluxed for another 4 hours. Sodium chloride and excess sodium hydroxide are then removed by filtration and the filtrate is washed with water and then distilled. After distilling off the xylene, the residue is distilled in a high vacuum. At 205–207° under 0.02 torr, 208 parts of a thinly liquid mass are obtained. Its refraction index is n_D^{25}1.4980 and at −30 to −40° it is still clear and flowing.

Analysis.—$C_{27}H_{54}N_6$, M.W. 462; calculated: C 70.10%, H 11.70%, N 18.20%. Found: C 69.99%, H 11.51%, N 18.73%.

The same end product is also obtained if, instead of sodium hydroxide, potassium hydroxide or a mixture of these two hydroxides is used. A great excess of dodecylamine can replace the sodium hydroxide.

Because it is still a clear, flowing liquid at −30 to −40°, and because of its slight volatility, its very high boiling point and its great thermal stability, this compound either alone or combined with analogous compounds having similar properties is suitable as a hydraulic liquid and as lubricant under extreme conditions, for example in aero engines.

Example 13.—2-diethylamino-4-dibutylamino-6-octadecylamino-s-triazine

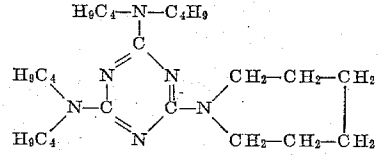


A mixture consisting of 119 parts of 2-diethylamino-4-dibutylamino-6-chloro-s-triazine (B.P.$_{.002\ torr}$ 138°, n_D^{20} 1.5142), 112 parts of octadecylamine and 20 parts of pulverized sodium hydroxide is stirred for 1 hour at 100° and for 4½ hours at 120°. The mixture is then diluted with 170 parts of xylene and stirred for another 6 hours under reflux. After removing precipitated matter by filtration and washing the filtrate with water, the solvent and excess amine are fractionally distilled at a pressure of 0.2 torr and then heated for another hour at 240° bath temperature under 0.02 torr. The residue, 194 parts, is a colorless oil having a refraction index n_D^{25}=1.5055; it crystallizes at −30°. The yield is 93.5% of the theoretical.

Analysis.—$C_{33}H_{66}N_6$; calculated: C 72.7%, H 12.10%, N 15.49%. Found: C 72.96%, H 12.31%, N 15.22%.

This melamine derivative is very thermostable; it is also only slightly volatile at very high temperatures; it is very viscous and the viscosity has only a relatively slight dependence upon the temperature. For example, the viscosity measured at 98.8°, after 6 hours heating at 380°, only changes by 0.7%. Because of these properties this compound is an excellent lubricant.

Example 14.—2,4-bis-dibutylamino-6-hexamethyleneimino-s-triazine



A mixture consisting of 109.5 parts of 2,4-bis-dibutylamino-6-chloro-s-triazine, 39.6 parts of hexamethyleneimine and 15.2 parts of pulverized sodium hydroxide is stirred while cooling. After a half hour it is heated to 120°, 150 parts of xylene are added and the whole is stirred for another 9 hours at this temperature. The usual working up and distillation produced 121 parts of a colorless oil, the main fraction boiling at 178–180° under 0.002 torr. Refraction index: n_D^{25}1.5123; yield: 93.5% of the theoretical.

Analysis.—$C_{25}H_{48}N_6$, M.W. 432; calculated: C 69.5%, H 11.12%, N 19.44%. Found: C 69.73%, H 11.23%, N 19.40%.

This melamine derivative is a viscous liquid which solidifies at −57° and is only slightly volatile and very thermostable. It is therefore suitable as hydraulic fluid for extreme working conditions and as a lubricant.

Example 15

45 parts of 2,4-bis-(di-n-butylamino)-6-piperidino-1,3,5-triazine (Table III, No. 10) having a viscosity of 15.17 centistokes at 98.8° and 55 parts of a highly purified mineral oil (Regal Oil B) are stirred together. The mixture has the good lubricating properties of the components and the viscosity of the mixture is 7.32 centistokes at 98.8°.

The application range of the melamine compound used is considerably broadened by this reduction of the viscosity in that, for example, the mixture can be used, e.g. as power transmitting agent in parts of machines which are temporarily exposed to temperatures which are lower than usual working temperatures. Under such conditions, the melamine derivative alone is less suitable for use.

Lubricant compositions having an extended range of uses are obtained in the same manner with melamine derivatives of relatively high viscosity such as, e.g., the compounds Nos. 8, 12, 13, 14, 15, 16, 17, 18, 22, 23, 24, 25 and 27 in Table III by mixing them in any ratio desired according to the intended use with Regal Oil B.

Example 16

80 parts of 2-diethylamino-4-di-n-butylamino-6-dihexylamino-1,3,5-triazine (Table III, No. 13) and 20 parts of sebacic acid di-2-ethylhexanol ester. The mixture has the good lubricant properties of the components and a viscosity of 0.713 centistoke in comparison to 9.98 centistokes at 98.8° of the melamine derivative used alone.

When the viscosity is reduced by mixing with synthetic lubricants of an ester basis the application range of melamine derivatives useable according to the invention is broadened in that such mixtures can be used, e.g. as power transmission agents, in machines which are temporarily exposed to lower temperatures than usual.

In the same way, lubricant compositions having ratios of components as desired for the intended use can be produced with the other melamine derivatives given in Table I and the diesters of sabacic acid, azelaic acid, adipic acid, etc., with alkanols having, e.g., 6 to 10 carbon atoms, esters of higher fatty acids of polyalcohols in particular triesters of ω-trimethylolalkanes and also higher molecular complex esters of dicarboxylic acids, polyalcohols in particular trimethylolpropane and alkanoic acids defined hereinbefore, so that the mixtures have the viscosity desirable for the type of application.

Example 17

87.4 parts of 2,4-bis-diethylamino-6-ditetradecylamino-1,3,5-triazine (Table III, No. 17) and 12.6 parts of a methylphenyl silicone (MS 550 produced by Midland Silicones Ltd.) are homogeneously mixed by stirring. The mixture is a lubricating oil having an excellent ASTM slope of 0.608.

The silicone oil MS 550 is characterized by the following viscosities:

	Centistokes
At 98.8°	19.6
At 37.8°	78.34

In the same way, lubricant compositions having a ratio of components as desired and having viscosity properties desired for the intended use can be produced with the other melamine derivatives given in Table I and silicone oils.

Example 18

6.5 parts of 2,4-bis-dibutylamino-6-ditetradecylamino-1,3,5-triazine (Table III, No. 18) are stirred with 35 parts of sebacic acid di-2-ethyl-hexanol ester. This mixture has a viscosity of 46.90 centistokes at 37.8° and 7.74 centistokes at 98.8°. ASTM slope: 0.64.

If, in the above example, instead of 35 parts of sebacic acid di-2-ethyl-hexanol ester, 35 parts of dinonyl adipate are used, then a mixture is obtained which has a viscosity of 49.36 centistokes at 37.8° and 7.95 centistokes at 98.8°. ASTM slope: 0.66.

Example 19

60 parts of 2,4-bis-dibutylamino-6-ditetradecylamino-1,3,5-triazine (Table III, No. 18) and 40 parts of the triester of caprylic acid and 1,1,1-trimethylol propane are stirred together. This mixture has a viscosity of 51.86 centistokes at 98.8° and 8.13 centistokes at 98.8°. ASTM slope: 0.66.

Example 20

55 parts of 2,4-bis-dibutylamino-6-ditetradecylamino-1,3,5-triazine (Table III, No. 18) are stirred with 45 parts of the triester of pelargonic acid and 1,1,1-trimethylolpropane. This mixture has a viscosity of 53.21 centistokes at 37.8° and 8.32 centistokes at 98.8°. ASTM slope: 0.66.

Example 21

3 parts of copper phthalocyanine are stirred in 25 parts by volume of benzene in an "Ultraturax" mixing apparatus (Janke & Kunkel, Stauffen, Baden, Germany). 9 parts of 2-diethylamino-4-dibutylamino-6-n-dodecylamino-1,3,5-triazine (Table III, No. 1) are slowly added to this mixture and the whole is then stirred for 45 minutes. The homogenous mass so obtained is worked on a glass surface with a spatula until the excess benzene has evaporated.

The mass obtained is heated for 45 minutes at 150° and, after cooling, is again worked with a spatula.

A good grease which can be well worked up is obtained.

Similar results are obtained by using the melamine derivatives given in Table III with the addition of the usual thickeners employed for the particular purpose.

Example 22

99 parts of 2-diethylamino-4-dibutylamino-6-dihexylamino-1,3,5-triazine (Table III, No. 13) and 1 part of iminodibenzyl are stirred together until the latter has completely dissolved. The mixture obtained has improved stability to oxidation compared with the pure triazine compound.

Similar results are obtained if antioxidants suitable for the intended use are added in amounts of .01 to 5% to the compound given in Table III. As antioxidants may also be used didodecyl selenide or 1,1,3-tris-(4'-hydroxy-5'-tert-butyl-2'-methylphenyl)-butane.

Similar results are obtained if the compounds given in Table III are mixed with high pressure additives and antioxidants suitable for the intended use in amounts of 0.01 to 5%.

Example 23

97.5 parts of 2,4-bis-dibutylamino-6-ditetradecylamino-1,3,5-triazine (Table III, No. 1), 1.5 parts of dibutyl phosphite and one part of phenyl-α-naphthylamine are mixed well by stirring. Compared with the pure triazine, the mixture formed has improved stability to oxidation and better load carrying property.

Similar results are obtained if anticorrosives suitable for the intended use are added in amounts of 0.01 to 2% to the compounds given in Table III.

Example 24

99.8 parts of 2,4-bis-dibutylamino-6-ditetradecylamino 1,3,5-triazine (Table III, No. 18) and 0.2 part of benzotriazole are mixed. Compared with the pure triazine, the mixture obtained has a less corrosive action, particularly on copper and alloys thereof.

Example 25

1250 parts of 2,4-bis-dibutylamino-6-chloro-s-triazine and 1490 parts of amine Armeen 2C (composition given below) are stirred in a 5 liter round glass under an atmosphere of nitrogen. 150 parts of pulverized sodium hydroxide are added. Due to the exothermic reaction, the temperatures rises to 135°. The whole is then stirred at 130° bath temperature for 20 hours, then washed with water at 90° until the pH is 7–8 and it is free of chlorine ions, after which it is filtered cold. Yield 87%.

In the preceding example, the filtrate contains 0.3% of secondary and primary amines and 1.65% of tertiary amines. The composition of the filtrate depends upon the composition of the amine mixture used, and may be free from primary, secondary and tertiary amines.

The amine used in this and in the following examples is a technical product which consists of 85.6% secondary amines of an average molecular weight of 423, 6.6% primary amines of an average molecular weight of 220 and 7.8% tertiary amines of an average molecular weight of 626.

The following alkyl radicals are present in the amine sample used, in the following amount expressed in percent by weight: C_8 8%, C_{10} 9%, C_{12} 47%, C_{14} 18%, C_{16} 8%, C_{18} 10%, unsaturated alkyl 0%.

This amine mixture is referred to, hereinafter, for the sake of brevity, as "Armeen 2C," under which name the same is sold.

From this it can be seen that for the reaction of 35.5 parts of labile chlorine, 415.7 parts of this amine mixture are necessary. However, each batch of Armeen 2C must be analyzed before use because the composition of the commercial product varies slightly. Depending on the special purpose, Armeen 2C can be fractionated by distillation.

Example 26

250 parts of the condensation product described in Example 25 from 2,4-bis-dibutylamino-6-chloro-s-triazine and Armeen 2C which, in this case, contains 1.6% of secondary amines of average molecular weight of 423 and 1.6% of tertiary amines of average molecular weight of 626, are diluted with 750 parts of cylo-hexane and stirred in a rapidly rotating mixing apparatus for 30 minutes at 40–45° with 110 parts of an acid-pretreated montmorillonite as purifying agent. This acid-pretreated montmorillonite is sold under such tradenames as Tonsil AC and Celite FC. The mixture is filtered and the filtrate is then treated again with 90 parts of Tonsil AC under the same conditions and again filtered. The residual cyclohexane is removed from the filtrate by distillation and heating for 1 hour at 230° under 0.1 torr. 217 parts of an almost colorless clear liquid are obtained, the total amine content of which is lower than 0.1%, which is the sensitivity limit of the potentiometric determination used.

The above-described purification can also be performed at a different temperature range, e.g., at 60–70° or at 20–25°. Alkanes such as hexane can also be used instead of cyclohexane. In cases in which the free amine content of the crude product is very low, Tonsil AC can also be used without a solvent.

Example 27

50 parts of the condensation product described in Example 25 from 2,4-bis-dibutylamino-6-chloro-s-triazine and Armeen 2C which contains 1.2% of secondary amines (average molecular weight 423) and 1.0% of tertiary amines (average molecular weight 626) are diluted with 500 parts of cyclohexane and rapidly stirred with 30 parts of Celite FC (Adsorption earth, Messrs. Johns-Manville), then filtered and again treated with fresh Celite FC until the product is free from amines. It is also possible to remove small amounts of free amines by using the hydrogen form of organic ion exchangers such as Amberlite IR 120. Here, too, hexane and methylcyclohexane can be used as diluents. Sometimes this treatment must be repeated until the end product contains no more free amines.

Example 28

650 parts of the condensation product described in Example 25 from 2,4-bis-dibutylamino-6-chloro-s-triazine and Armeen 2C which contains 0.3% secondary amines (average molecular weight 423) and 1.6% tertiary amines (average molecular weight 626), are distilled at 0.007 torr. The main fraction of 422 parts contains 0.15% of secondary amines and 1.25% of tertiary amines. The distillate is diluted with double the amount of cyclohexane and treated three times with 42 parts of Tonsil AC each time. Potentiometric analysis of the end product shows a total content of free amines of less than 0.1%, which is the sensitivity of the method. The content of secondary amines, which can be determined photometrically, is 0.01% or less, which again corresponds to the sensitivity of the method used.

Example 29

200 parts of the condensation product described in Example 25 from 2,4-bis-dibutylamino-6-chloro-s-triazine and Armeen 2C which contains 1.6% secondary amines (average molecular weight 423) and 1.6% tertiary amines (average molecular weight 626) are extracted with 50 parts of 80% acetic acid and then extracted four times, with a total of 110 parts of glacial acetic acid, washed neutral with water, filtered and dried. 165.2 parts of a product are obtained which contains less than 0.1% of free amine. In a similar way, the free amines which may be present in the triazines produced in the other examples, can be selectively extracted.

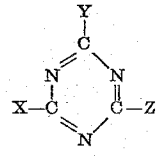
Example 30

97 parts of 2,4-bis-dibutylamino-6-di(C_xH_{2x+1})-amino-1,3,5-triazine (Table III, No. 18) wherein x has a mean value of 14, and 3 parts of a polymer of methacrylic acid ester, in particular poly-2-ethylhexyl-methacrylate (HF 825 of Messrs. Röhm & Haas Co., Philadelphia, Pa., U.S.A.), are homogeneously mixed by stirring. This mixture has a lower solidification point than the pure 2,4-bis-dibutylamino-6-ditetradecylamino-1,3,5-triazine.

Example 31

250 parts of the condensation product of 2,4-bis-diethylamino-6-chloro-s-triazine and Armeen 2C which contains 1.0% secondary amines (average molecular weight 423) and 0.9% tertiary amines (average molecular weight 626) are diluted with 750 parts of cyclohexane and treated with Tonsil AC (110 parts) exactly as described in Example 26. The filtrate obtained is also treated with 90 parts of Tonsil AC. 220.5 parts of an amine-free product are obtained. With the same bleaching earth, other s-triazines of Table III such as, e.g. Nos. 12, 16, 21, 24, 25 and 28 can be purified free of amines. Here also, hexane can be used as diluent instead of cyclohexane.

The following Tables III and IV contain data of other N,N',N''-substituted melamines usable according to the invention, which melamines fall under the general formula



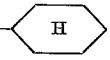
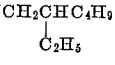
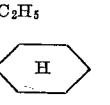
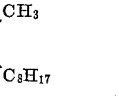
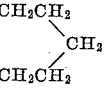
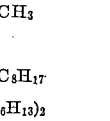
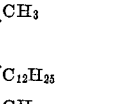
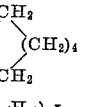
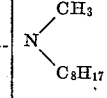
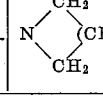
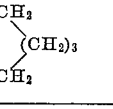
They are produced by reacting cyanuric chloride in successive steps with the primary and secondary organic amines given in the columns headed X, Y and Z in Table III according to the method described in detail in Example 12. Column 5 of Table III shows the yield attained in the last step in percent of the theoretical, columns 6 and 7 give the boiling point of the compounds under reduced pressure, column 8 shows the refractive index and column 9 the molecular weight of the compounds.

Table IV shows the physical data of the compounds from which the suitability of these stable, difficultly volatile melamine derivatives as hydraulic liquids and/or lubricants can be seen. Columns 2 and 3 give the viscosity measured at 100° F. (37.8° C.) and 210° F. (98.8° C.), and column 4 shows the so-called ASTM slope.

Columns 5 and 6 show the loss in weight in percentage within 6 hours incurred by a sample of 25 ml. when heated to 380° or 400° C. in a glass test tube of about 25 mm. diameter with simultaneous introduction of nitrogen (2 liters per hour).

Column 7 shows the alteration in the viscosity in percentage measured at 210° F. incurred by the sample when heated for 6 hours as described above.

TABLE III

No.	X	Y	Z	Percent	B.P. at—		n_D^{25}	MW
					° C.	Torr		
1	$N(C_2H_5)_2$	$N(C_4H_9)_2$	$NHC_{12}H_{25}$	90.0	205–7	0.02	1.4980	462
2	$N(C_2H_5)_2$	$N(C_4H_9)_2$	$NHC_{18}H_{37}$	93.3	>220	0.02	1.5055	546
3	$N(C_4H_9)_2$	$N(C_4H_9)_2$	NHC_8H_{17}	75.4	208–10	0.03	1.4969	462
4	$N(C_4H_9)_2$	$N(C_4H_9)_2$	$NHC_{12}H_{25}$	88.7	204–15	0.03	1.4933	518
5	$N(C_4H_9)_2$	$N(C_4H_9)_2$	$NHC_{18}H_{37}$	77.0	266–70	0.02	1.4905	662
6	$N(C_4H_9)_2$	$N(C_4H_9)_2$		92.6	190–99	0.01	1.5118	432
7	$N(C_4H_9)_2$	$N(C_4H_9)_2$		85.0	173–85	0.01	1.5000	462
8	$N(C_4H_9)_2$	$N(C_4H_9)_2$		83.9	187–98	0.02	1.5083	460
9	$N(C_4H_9)_2$	$N(C_4H_9)_2$		88.8	186–96	0.01	1.4927	476
10	$N(C_4H_9)_2$	$N(C_4H_9)_2$		92.5	178–82	0.02	1.5112	418
11	$N(C_4H_9)_2$	$N(C_4H_9)_2$	$N(C_6H_{13})_2$	92.9	198–207	0.02	1.4921	518
12	$N(C_2H_5)_2$	$N(C_2H_5)_2$		92.3	162–67	0.02	1.5023	364
13	$N(C_2H_5)_2$	$N(C_4H_9)_2$	$N(C_6H_{13})_2$	93.0	202–4	0.02	1.4937	462
14	$N(C_2H_5)_2$	$N(C_4H_9)_2$		91.5	>210	0.01	1.4903	560
15	$N(C_4H_9)_2$	$N(C_4H_9)_2$		93.5	178–80	0.002	1.5123	432
16	$N(C_2H_5)_2$	$N(C_4H_9)_2$	$N(C_{14}H_{29})_2$ [x]	98.0	>220	0.03	1.4856	686
17	$N(C_2H_5)_2$	$N(C_2H_5)_2$	$N(C_{14}H_{29})_2$ [x]	93.0	>220	0.01	1.4867	630
18	$N(C_4H_9)_2$	$N(C_4H_9)_2$	$N(C_{14}H_{29})_2$ [x]	94.1	>220	0.02	1.4855	742
19		$N(C_2H_5)_2$	$N(C_4H_9)_2$	95.4	161–3	0.04	1.4967	420
20	$N(C_2H_5)_2$	$N(C_2H_5)_2$	$N(C_8H_{17})_2$	94.5	>190	0.06	1.4931	462
21	$N(C_2H_5)_2$	$N(C_2H_5)_2$	$N(C_{12}H_{25})_2$	96.5	>200	0.02	1.4897	574
22	$N(C_4H_9)_2$	$N(C_4H_9)_2$	$N(C_8H_{17})_2$	98.1	>200	0.07	1.4908	574
23	$N(C_4H_9)_2$	$N(C_4H_9)_2$	$N(C_{12}H_{25})_2$	98.0	>200	0.05	1.4866	686
24	$N(CH_3)_2$	$N(C_4H_9)_2$	$N(C_{12}H_{25})_2$	97.4	>200	0.06	1.4892	602
25	$N(CH_3)_2$	$N(C_4H_9)_2$	$N(C_{14}H_{29})_2$ [x]	96.7	>200	0.05	1.4876	658
26	$N(C_2H_5)_2$	$N(C_4H_9)_2$	$N(C_8H_{17})_2$	95.3	>200	0.03	1.4924	518
27	$N(C_2H_5)_2$	$N(C_4H_9)_2$	$N(C_{12}H_{25})_2$	94.6	>200	0.03	1.4872	630
28		$N(C_{14}H_{29})_2$ [x]		97.1	>240	0.05	1.5000	598

NOTE.—[x] is a mixture of straight chain alkyl groups the mean carbon number of which corresponds to about 14.

TABLE IV

No.	Viscosity in centistokes at—		ASTM slope	Loss in weight after 6 hours at—		Change in viscosity after 6 hours in centistokes in percent at 210° F.
	100° F. (37.8° C.)	210° F. (98.8° C.)		° C.	Percent	
1	133.7	10.75	0.774	380	3.72	+14.7
				400	11.97	+77.0
2	158.4	13.77	0.708	380	3.03	+0.7
				400	11.70	+15.1
3	151.7	11.84	0.760	380	5.20	+35.1
				400	12.90	+104.8
4	149.0	12.91	0.721	380	5.95	+26.9
				400	14.10	+94.2
5	192.1	15.69	0.698	380	4.9	+5.9
				400	12.6	+11.9
6	989.3	31.25	0.760	380	2.7	+20.4
				400	8.4	+81.6
7	282.6	14.86	0.797	380	7.24	
				400	17.67	
8	552	24.82	0.737	380	5.33	+11.52
				400	12.91	+8.18
9	89.66	9.73	0.724	380	6.16	+5.41
				400	17.8	+24.78
10	280	15.17	0.787	380	2.46	+4.87
				400	6.99	+15.47
11	113.1	12.03	0.687	380	6.70	+3.16
				400	19.04	+7.40
12	50.23	6.06	0.702	380	3.52	+5.1
				400	45.16	+19.8
13	95.79	9.97	0.728	380	5.27	+0.73
				400	15.6	+6.15
14	106.4	12.22	0.667	380	2.54	−3.76
				400	15.3	+12.80
15	227.5	16.69	0.710	380	3.07	+6.61
				400	9.26	+22.90
16	111.1	13.12	0.647	380	5.18	−8.07
				400	19.86	+0.53
17	113.7	13.57	0.64	380	7.00	−8.28
				400	23.78	+6.55
18	128.78	15.18	0.63	380	7.17	+1.19
				400	21.88	+16.90
19	64.80	7.47	0.766	380	4.55	+9.41
				400	12.01	+21.0
20	73.05	8.38	0.741	380	6.01	+6.06
				400	15.07	+14.86
21	98.11	11.63	0.66	380	4.20	−34.55
22	107.1	11.90	0.67	380	8.23	−7.23
				400	29.13	+5.88
23	129.1	14.52	0.642	380	5.79	−2.96
				400	20.09	−10.40
24	89.19	10.87	0.675	380	4.66	−0.55
				400	15.93	+23.0
25	93.19	11.50	0.661	380	3.64	−11.39
				400	22.77	+19.05
26	72.6	8.42	0.73	380	6.01	+6.06
				400	15.07	+14.86
27	118.5	14.09	0.634	380	4.77	−11.8
28	239.5	18.08	0.691	380	4.27	−1.77
				400	12.78	+33.80

The lubricity of 5 representative compounds according to the second aspect of the invention as compared with the lubricity of di-3,5,5-trimethyl-hexyl sebacate and several commercial lubricants was measured in a Shell 4-ball apparatus. The apparatus was run for 30 minutes at 1450 revolutions per minute under a 40 kg. load and using half-inch Grade "A" S.K.F. steel balls. The starting temperature was about 40° C. The results are summarized in the following Table V:

TABLE V

Substance used— No. (from Table III):	Scar diameter in mm.
5	0.604
13	0.569
14	0.599
16	0.511
18	0.546
Di-3,5,5-trimethyl-hexyl sebacate	0.896
Di-2-ethyl-hexyl-sebacate	0.850
Di-2-ethyl-hexyl adipate	0.915
Methyl phenyl silicone *	1.953

* In this test lubrication ceased even after 2.5 minutes.

Each of the values given above is the average from three measurements.

As can be seen from the above table, the compounds according to the second aspect of the invention can be used directly for the lubrication of solid surfaces. The following test illustrates the applicability of the lubricant mentioned for the lubrication of glass surfaces:

When the compound No. 16 in Table III is applied to the ground glass surface of a stopper and the stopper is placed into the correspondingly formed orifice of a glass flask, the stopper is held fast and the flask is rotated around it at least 3.9×10^6 times at room temperature for 130 hours, without sticking due to glass to glass friction. If, instead of the compound No. 16 of Table III, a commercially available and widely used silicone high vacuum fat is employed under the same conditions then the rotated flask becomes stuck after 24 hours.

EXAMPLE 32

88 g. (100 ml.) of the product obtained according to Example 26, first paragraph, which was hydrogenated cold with H_2 over palladium to remove any residual olefinic double bonds, is heated to 260° for 6 hours. At the same time, 5000 parts by volume of air per hour are passed through the liquid. The degree by which the metal is attacked is expressed in mg./cm.^{2}. The change of viscosity which occurs during the heating is measured at 38.0° and given in percentage. The acid thus formed is measured at the end of the experiment and expressed in mg. KOH/g. The formation of sludge, i.e., the undissolved matter dispersed in the liquid reaction mixture, is determined by filtration and weigh-

ing and expressed in mg./100 ml. of the reaction product. The insoluble coating adhering to the walls of the reaction vessel, which forms during the oxidation, is designated as a varnish below and its amount was estimated visually.

The following data were obtained by carrying out the above test without use of an antioxidant additive:

	Percent
Change in viscosity	+16.0
Acid concentration	5.06
Sludge	11.4
Metal attack	0.08
Varnish	Very heavy

(a) 88 g. (100 ml.) of the product obtained according to Example 26, first paragraph, which was hydrogenated cold with H_2 over palladium to remove any residual olefinic double bonds, was mixed with 1 g. of 1,1,3-tri-(2' - methyl - 4' - hydroxy-5'-tert-butylphenyl)-butane and further treated as described above. The resulting product afforded the following data in the above test:

	Percent
Change in viscosity	+6.4
Acid concentration	0.45
Sludge	8.8
Metal attack	0.06
Varnish	Moderate

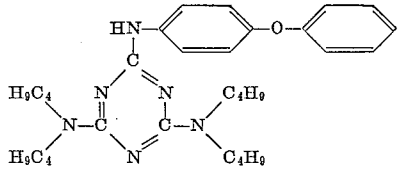
(b) 88 g. (100 ml.) of the product obtained according to Example 26, first paragraph and 1 g. of 2,6-di-(tert-butyl)-4-methyl-1-hydroxy-benzene treated as described above, afforded the following data in the above test:

	Percent
Change in viscosity	+5.6
Acid concentration	0.55
Sludge	20.1
Metal attack	0.13
Varnish	Slight

(c) 88 g. (100 ml.) of the product obtained according to Example 26, first paragraph, and 1 g. of 2-tert-octyl-iminodibenzyl treated as described above, afforded the following values in the above test:

	Percent
Change in viscosity	+4.7
Acid concentration	0.48
Sludge	7.1
Metal attack	0.14
Varnish	Slight

Example 33.—2,4-bis-dibutylamino-6-p-phenoxyphenylamino-s-triazine



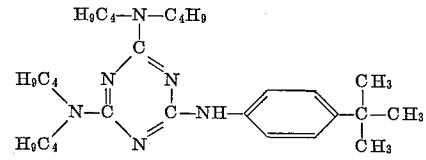
A mixture consisting of 148 parts of 2,4-bis-dibutylamino-6-chloro-s-triazine, 129 parts of p-phenoxyaminobenzene and 16 parts of pulverized sodium hydroxide is heated while stirring for 5 hours at 150° and then for 3 hours 45 minutes at 165°. The inorganic components are removed by filtration and the filtrate is fractionally distilled in vacuo. The desired triazine derivative distills at B.P. >240° under 0.02 torr (bath temperature 280–290°) without decomposition as a highly viscous liquid.

Yield: 93.4% of the theoretical.

Analysis.—$C_{31}H_{46}N_6O$, M.W. 518; calculated: C, 71.75%, H, 8.88%, N, 1623. Found: C, 71.76%, H, 8.82%, N, 1636.

Because of its very good thermostability, its slight volatility which in a test showed that under introduction of nitrogen at atmospheric pressure for 6 hours at 400°, a loss of weight of only 2.7% occurred, as well as its high viscosity, the compound is a valuable lubricant for parts of machines working at high temperatures.

Example 34.—2,4-bis-dibutylamino-6-p-tert-butylphenylamino-s-triazine



A mixture consisting of 148 parts of 2,4-bis-dibutylamino-6-chloro-s-triazine, 105 parts of p-tert-butylaniline and 16 parts of pulverized sodium hydroxide is heated while stirring for 15 minutes at 100° and then for 8 hours at 140°. The mixture is then diluted with xylene, the inorganic components are removed by filtration, the filtrate is washed with water, dried and distilled. At B.P. of 224–232° and 0.1 torr, 179 parts of a colorless oil distill.

Refraction index n_D^{25}: 1.5432; yield 97.1% of the theoretical.

Analysis.—$C_{29}H_{50}N_6$; calculated: C 72.30%, H 10.37%, N 17.43%. Found: C 72.46%, H 10.46%, N 17.47%.

Because of the very good thermostability of the compound, its slight volatility which is shown by the loss in weight which, on the introduction of nitrogen at atmospheric pressure for 6 hours at 400°, is only 10%, and because of its favorable medium viscosity and the only slight alteration thereof which occurs on heating, this melamine derivative is a suitable turbine oil for gas turbines.

Example 35

3 parts of copper phthalocyanine are stirred in 25 parts by volume of benzene in an "Ultraturax" mixing apparatus (Janke & Kunkel, Stauffen, Baden, Germany). 9 parts of 2,4 - bis - dibutylamino - 6 - p- tert - butyl-phenylamino-1,3,5-triazine are slowly added to this mixture and the whole is then stirred for 45 minutes. The homogenous mass so obtained is worked on a glass surface with a spatula until the excess benzene has evaporated.

The mass obtained is heated for 45 minutes at 150° and, after cooling, is again worked with a spatula.

A good grease which can be well worked up is obtained.

Similar results are obtained when using the melamine derivatives given in Table VI with the addition of the usual thickeners employed for particular purposes.

Example 36

99 parts of 2,4-bis-dibutylamino-6-(N-methyl-N-phenylamino)-1,3,5-triazine and 1 part of iminodibenzyl are stirred together until the latter has completely dissolved. The mixture obtained has improved stability to oxidation compared with the pure triazine compound.

Similar results are obtained if antioxidants suitable for the intended use are added in amounts of 0.01 to 5% to

the compounds given in Table VI. As antioxidants may also be used didodecyl selenide or Topanol CA of the Imperial Chemical Company.

Similar results are obtained if the compounds given in Table VI are mixed with high pressure additives and antioxidants suitable for the intended use in amounts of 0.01 to 5%.

Example 37

97.5 parts of 2,4-bis-dibutylamino-6-benzylamino-1,3,5-triazine, 1.5 parts of dibutyl phosphite and 1 part of phenyl-α-naphthylamine are mixed well by stirring. Compared with the pure triazine, the mixture formed has improved stability to oxidation and better load carrying property.

Similar results are obtained if anticorrosives suitable for the intended use are added in amounts of 0.01 to 2% to the compounds given in Table VI.

Example 38

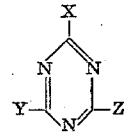
99.8 parts of 2,4-bis-dibutylamino-6-p-phenoxy-phenylamino-1,3,5-triazine and 0.2 part of benzotriazole are mixed. Compared with the pure triazine, the mixture obtained has a less corrosive action, particularly on copper and alloys thereof.

Example 39

97 parts of 2,4-bis-dibutylamino-6-benzylamino-1,3,5-triazine and 3 parts of polymers of methacrylic acid ester, in particular poly-2-ethylhexyl-methacrylate (HF 825, Röhm and Haas Co., Philadelphia, Pa.) are homogeneously mixed by stirring. This mixture has a lower solidification point than the pure 2,4-bis-dibutylamino-6-benzylamino-1,3,5-triazine.

The choice of polymers as additives to reduce the solidification point is advantageously made according to the desired solution in the triazine derivative.

The following Tables VI and VII contain examples of N,N',N''-substituted melamines of the formula



usable according to the third aspect of the invention. They are produced by reacting cyanuric chloride in successive steps with the primary and secondary organic amines corresponding to X, Y and Z according to the method described in detail in Example 33. Column 5 of Table VI shows the yield attained in the last step in percentage of the theoretical, columns 6 and 7 give the boiling point of the compounds under reduced pressure, column 8 shows the refraction index and column 9 the molecular weight of the compounds. Column 2 in Table VII contains the formulas of the compounds and column 3 and the following columns show the results of elementary analysis for carbon, hydrogen and nitrogen expressed in percent as compared with the theoretical content.

Table VIII shows the physical data of the compounds from which the suitability of these stable, difficultly volatile melamine derivatives as hydraulic fluids and/or lubricants can be seen. Columns 2 and 3 give the viscosity measured at 100° F. (37.8° C.) and 210° F. (98.8° C.), and column 4 shows the so-called ASTM slope.

Columns 5 and 6 show the loss in weight in percentage within 6 hours incurred by a sample of 25 ml. when heated to 380° or 400° C. in a glass test tube of about 25 mm. diameter with simultaneous introduction of nitrogen (2 liters per hour).

Column 7 shows the alteration in the viscosity in percentage measured at 210° F. incurred by the sample when heated for 6 hours as described above.

TABLE VI

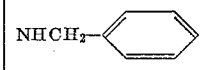
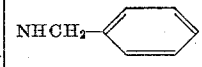
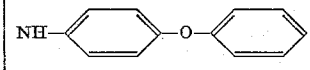
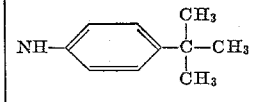
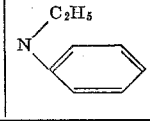
No.	X	Y	Z	Percent	BP at—		n_D^{25}	MW
					° C.	Torr		
1	$N(C_2H_5)_2$	$N(C_2H_5)_2$		85.5	180–88	0.01	1.5582	328
2	$N(C_4H_9)_2$	$N(C_4H_9)_2$		85.0	206–25	0.07	1.5323	440
3	$N(C_4H_9)_2$	$N(C_4H_9)_2$		93.4	>240	0.02	1.5500	518
4	$N(C_4H_9)_2$	$N(C_4H_9)_2$		97.1	224–32	0.1	1.5432	482
5	$N(C_4H_9)_2$	$N(C_4H_9)_2$		90.6	194–99	0.06	1.5273	454

TABLE VII

No.	Empirical Formula	Analysis, percent					
		C		H		N	
		Calc.	Found	Calc.	Found	Calc.	Found
1	$C_{18}H_{28}N_6$	65.80	65.85	8.55	8.76	25.60	25.52
2	$C_{26}H_{44}N_6$	70.9	70.9	10.0	10.14	19.1	19.46
3	$C_{31}H_{46}N_6O$	71.75	71.76	8.88	8.82	16.23	16.36
4	$C_{30}H_{50}N_6$	72.3	72.46	10.37	10.46	17.43	17.47
5	$C_{27}H_{46}N_6$	71.42	71.25	10.12	10.27	18.49	18.60

TABLE VIII

No.	Viscosity in centistokes at—		ASTM slope	Loss in weight after 6 hours at—		Change in viscosity after 6 hours in centistokes in percent at 210° F.
	100° F. (37.8° C.)	210° F. (98.8° C.)		° C.	Percent	
1	317.8	10.87	0.748	380	2.41	+77.5
				400	22.7	+262
2	269.2	15.25	0.777	380	3.7	+97.1
				400	12.28	+332.0
3	4,117.0	49.94	0.836	380	4.84	+4.6
				400	10.92	+47.7
4	15,520	73.31	0.909	380	3.62	+21.6
				400	10.01	+46.0
5	218.2	15.83	0.721	380	3.6	+19.9
				400	9.6	+102.4

The lubricity of a representative lubricant according to the invention was measured in a Shell four-ball apparatus. The apparatus was run for 30 minutes at 1450 revolutions per minute under a 40 kg. load and using half-inch Grade "A" S.K.F. steel balls. The starting temperature was about 40° C.

The compounds according to the invention can be used directly for the lubrication of solid surfaces.

Example 40

50 parts of 2,4-bis-dibutylamino-6-p-phenoxy-phenylamino-1,3,5-triazine and 50 parts of dinonyl adipate are stirred together. This mixture has a viscosity of 95.0 centistokes at 37.8° and 9.5 centistokes at 98.8°. ASTM slope 0.74.

Example 41

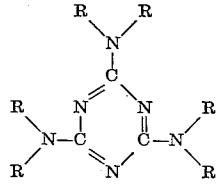
50 parts of 2,4-bis-dibutylamino-6-(N-ethyl-N-phenylamino)-1,3,5-triazine and 50 parts of silicone oil DC are stirred together. The mixture has a viscosity of 85.2 centistokes at 37.8° and 16.3 centistokes at 98.8°. ASTM slope 0.50.

The silicone oil DC of Dow Corning Co. has the following viscosity values:

	Centistokes
At 98.8°	17.33
At 37.8°	42.24

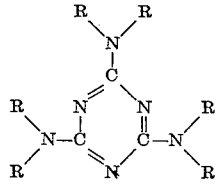
We claim:

1. A lubricant composition consisting essentially of about 10 to 90% by weight of a compound of the formula



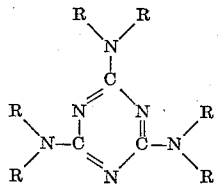
wherein each R is an identical lower alkyl group with from 4 to 6 carbon atoms and wherein the aforesaid compound is the essential lubricant in said composition and about 90 to 10% by weight of a lubricant selected from the group consisting of mineral oil, methyl phenyl silicone and the sebacic, valeric, caprylic, adipic and pelargonic acid esters of octyl and nonyl alcohols, pentaerythritol and trimethylolpropane.

2. A lubricant composition consisting essentially of about 55 to 90% by weight of a compound of the formula



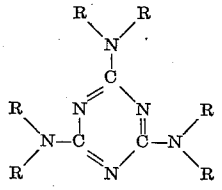
wherein each R is an identical lower alkyl group with from 4 to 6 carbon atoms and wherein the aforesaid compound is the essential lubricant in said composition, and from about 45 to 10% by weight of phthalocyanine.

3. A lubricant composition consisting essentially of a compound of the formula



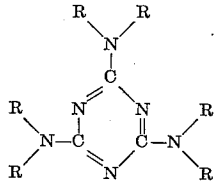
wherein each R is an identical lower alkyl group with from 4 to 6 carbon atoms and wherein the aforesaid compound is the essential lubricant in said composition, and from 0.01% to 5% by weight, based on the total amount of the composition, of an anti-oxidant selected from the group consisting of diphenylamines, phenylnaphthylamines, phenylacenaphthenylamines, 4,4-dinaphthylaminodiphenyl, thiazolyl-2-naphthylamines, aromatic diamines, hydroxy-substituted aromatics, aminohydroxyaryl compounds, heterocyclic antioxidants, and didodecyl selenide.

4. A lubricant composition consisting essentially of about 95 to 99% by weight of a compound of the formula



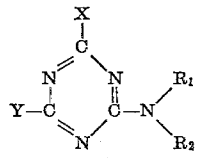
wherein each R is an identical lower alkyl group with from 4 to 6 carbon atoms, and correspondingly from 5 to 1% by weight, calculated on the total weight of the composition, of a poly-2-lower-alkyl-hexyl-methacrylate.

5. A lubricant composition consisting essentially of a compound of the formula



wherein each R is an identical alkyl group with from 4 to 6 carbon atoms and from about 0.01 to 5% by weight, calculated on the total weight of the composition, of didodecylselenide.

6. A lubricant composition consisting essentially of about 95 to 99.9% by weight of a compound of the formula

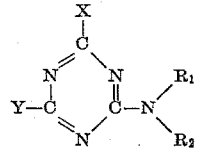


wherein

X is a di-(lower alkyl)-amino in which each alkyl radical has from 1 to 4 carbon atoms,
Y is a di-(lower alkyl)-amino in which each alkyl radical has from 1 to 4 carbon atoms,
R_1 is a member selected from the group consisting of hydrogen and alkyl of maximally 14 carbon atoms,
R_2 is a member selected from the group consisting of alkyl of at least 6 and maximally 18 carbon atoms and cyclohexyl, the sum of the carbon atoms of R_1 and R_2 when separate substituents being at least 8 and not more than 28,
R_1 and R_2 when taken together with the nitrogen atom to which they are linked represent a member selected from the group consisting of piperidino and hexa-methyleneimino;

the balance of said composition consisting of a poly-2-lower alkyl-hexyl-methacrylate.

7. A lubricant composition consisting essentially of a compound of the formula

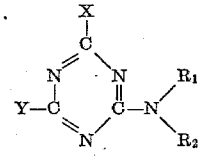


wherein

X is a di-(lower alkyl)-amino in which each alkyl radical has from 1 to 4 carbon atoms,
Y is a di-(lower alkyl)-amino in which each alkyl radical has from 1 to 4 carbon atoms,
R_1 is a member selected from the group consisting of hydrogen and alkyl of maximally 14 carbon atoms,
R_2 is a member selected from the group consisting of alkyl of at least 6 and maximally 18 carbon atoms and cyclohexyl, the sum of the carbon atoms of R_1 and R_2 when separate substituents being at least 8 and not more than 28,
R_1 and R_2 when taken together with the nitrogen atom to which they are linked represent a member selected from the group consisting of piperidino and hexa-methyleneimino;

and of from about 0.01 to 5% by weight, calculated on the total weight of the composition, of a member selected from the group consisting of didodecylselenide, 1,1,3-tri-(2'-methyl-4'-hydroxy-5'-tert-butylphenyl)-butane, 2,6-di-(tert-butyl)-4-methyl-1-hydroxybenzene, 2-tert-octylimino-dibenzyl and 5-ethyl-10,10-diphenyl-phenosilazine.

8. A lubricant composition consisting essentially of about 10 to 90% by weight of a compound of the formula



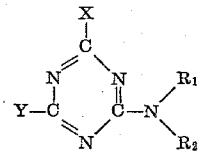
wherein

X is a di-(lower alkyl)-amino in which each alkyl radical has from 1 to 4 carbon atoms,
Y is a di-(lower alkyl)-amino in which each alkyl radical has from 1 to 4 carbon atoms,

R_1 is a member selected from the group consisting of hydrogen and alkyl of maximally 14 carbon atoms,
R_2 is a member selected from the group consisting of alkyl of at least 6 and maximally 18 carbon atoms and cyclohexyl, the sum of the carbon atoms of R_1 and R_2 when separate substituents being at least 8 and not more than 28,
R_1 and R_2 when taken together with the nitrogen atom to which they are linked represent a member selected from the group consisting of piperidino and hexamethyleneimino;

the balance of said composition consisting of a lubricant selected from the group consisting of mineral oil and a synthetic ester lubricant.

9. A thickened lubricant composition consisting essentially of about 55 to 90% by weight of a compound of the formula

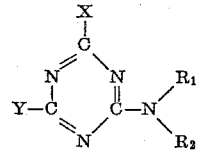


wherein

X is a di-(lower alkyl)-amino in which each alkyl radical has from 1 to 4 carbon atoms,
Y is a di-(lower alkyl)-amino in which each alkyl radical has from 1 to 4 carbon atoms,
R_1 is a member selected from the group consisting of hydrogen and alkyl of maximally 14 carbon atoms,
R_2 is a member selected from the group consisting of alkyl of at least 6 and maximally 18 carbon atoms and cyclohexyl, the sum of the carbon atoms of R_1 and R_2 when separate substituents being at least 8 and not more than 28,
R_1 and R_2 when taken together with the nitrogen atom to which they are linked represent a member selected from the group consisting of piperidino and hexamethyleneimino;

the balance of said composition consisting of phthalocyanine.

10. A thickened lubricant composition consisting essentially of about 55 to 90% by weight of a compound of the formula

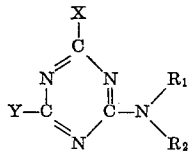


wherein

X is a di-(lower alkyl)-amino in which each alkyl radical has from 1 to 4 carbon atoms,
Y is a di-(lower alkyl)-amino in which each alkyl radical has from 1 to 4 carbon atoms,
R_1 is a member selected from the group consisting of hydrogen and alkyl of maximally 14 carbon atoms,
R_2 is a member selected from the group consisting of alkyl of at least 6 and maximally 18 carbon atoms and cyclohexyl, the sum of the carbon atoms of R_1 and R_2 when separate substituents being at least 8 and not more than 28,
R_1 and R_2 when taken together with the nitrogen atom to which they are linked represent a member selected from the group consisted of piperidino and hexamethyleneimino;

and the balance of said composition consisting of a thickener selected from the group consisting of metal soaps, bentonites, phthalocyanine pigments and violanthrone pigments.

11. A lubricant composition consisting essentially of about 10 to 90% by weight of a compound of the formula



wherein

X is a di-(lower alkyl)-amino in which each alkyl radical has from 1 to 4 carbon atoms,

Y is a di-(lower alkyl)-amino in which each alkyl radical has from 1 to 4 carbon atoms,

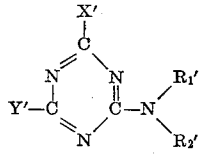
R_1 is a member selected from the group consisting of hydrogen and alkyl of maximally 14 carbon atoms,

R_2 is a member selected from the group consisting of alkyl of at least 6 and maximally 18 carbon atoms and cyclohexyl, the sum of the carbon atoms of R_1 and R_2 when separate substituents being at least 8 and not more than 28,

R_1 and R_2 when taken together with the nitrogen atom to which they are linked represent a member selected from the group consisting of piperidino and hexamethyleneimino;

and the balance of said composition consisting of a methyl phenyl silicone.

12. A lubricant composition consisting essentially of about 95 to 99% by weight of a compound of the formula



wherein

X′ is a di-(lower alkyl)-amino group in which each alkyl radical has from 2 to 4 carbon atoms,

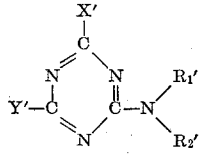
Y′ is a di-(lower alkyl)-amino group in which each alkyl radical has from 2 to 4 carbon atoms,

R_1' is a member selected from the group consisting of hydrogen and lower alkyl of maximally 4 carbon atoms,

R_2' is a member selected from the group consisting of benzyl, phenyl, alkylphenyl wherein alkyl has maximally 12 carbon atoms, alkoxy-phenyl wherein alkoxy has maximally 4 carbon atoms and phenoxy-phenyl,

and correspondingly, from 5 to 1% by weight, calculated on the total weight of the composition, of a poly-2-lower alkylhexyl-methacrylate.

13. A lubricant composition consisting essentially of a compound of the formula



wherein

X′ is a di-(lower alkyl)-amino group in which each alkyl radical has from 2 to 4 carbon atoms,

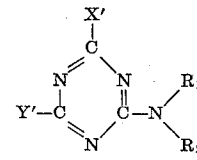
Y′ is a di-(lower alkyl)-amino group in which each alkyl radical has from 2 to 4 carbon atoms,

R_1' is a member selected from the group consisting of hydrogen and lower alkyl of maximally 4 carbon atoms,

R_2' is a member selected from the group consisting of benzyl, phenyl, alkylphenyl wherein alkyl has maximally 12 carbon atoms, alkoxy-phenyl wherein alkoxy has maximally 4 carbon atoms and phenoxy-phenyl,

and from about 0.01 to 5% by weight, calculated on the total weight of the composition, of didodecylselenide.

14. A lubricant composition consisting essentially of about 10 to 90% by weight of a compound of the formula



wherein

X′ is a di-(lower alkyl)-amino group in which each alkyl radical has from 2 to 4 carbon atoms,

Y′ is a di-(lower alkyl)-amino group in which each alkyl radical has from 2 to 4 carbon atoms,

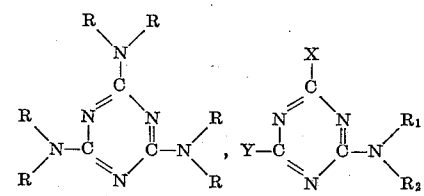
R_1' is a member selected from the group consisting of hydrogen and lower alkyl of maximally 4 carbon atoms,

R_2' is a member selected from the group consisting of benzyl, phenyl, alkylphenyl wherein alkyl has maximally 12 carbon atoms, alkoxy-phenyl wherein alkoxy has maximally 4 carbon atoms and phenoxy-phenyl,

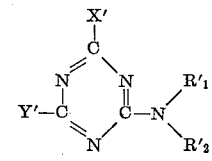
and correspondingly, about 90 to 10% by weight, calculated on the total weight, of a lubricant selected from the group consisting of mineral oil, methyl phenyl silicone, the sebacic and adipic acid esters of octyl and nonyl alcohols.

15. A lubricant composition comprising as lubricant at least 10% of

(a) a melamine derivative selected from the group consisting of the compounds of the formulas



an



wherein

each R is an identical lower alkyl group of from 4 to 6 carbon atoms,

each of X and X′ is di-lower alkyl-amino in which each alkyl has from 1 to 4 carbon atoms,

each of Y and Y′ is di-lower alkyl-amino in which each alkyl has from 1 to 4 carbon atoms,

each of R_1 and R_1' is a member selected from the group consisting of hydrogen and alkyl of maximally 14 carbon atoms,

R_2 is a member selected from the group consisting of alkyl of at least 6 and maximally 18 carbon atoms and cyclohexyl, the sum of the carbon atoms of R_1 and R_2 when separate substituents being at least 8 and not more than 28,

R_1 and R_2 when taken together with the nitrogen atom to which they are linked represent a member selected from the group consisting of piperidino and hexamethyleneimino, and

R_2' is a member selected from the group consisting of benzyl, phenyl, alkylphenyl wherein alkyl has maximally 12 carbon atoms, alkoxy-phenyl wherein alkoxy has maximally 4 carbon atoms and phenoxyphenyl, and the balance of said composition consists essentially of at least one member selected from the group consisting of

(b) from about 90 to 10% by weight of a lubricant selected from the group consist-

ing of mineral oil, synthetic ester lubricant, and methyl phenyl silicon,

(c) from 45 to 10% by weight of a pigment selected from the group consisting of phthalocyanine pigment and violanthrone pigment,

(d) from about 0.01% to 5% of an anti-oxidant,

(e) from about 0.1 to 5% of poly-(2-lower alkyl-hexyl methacrylate),

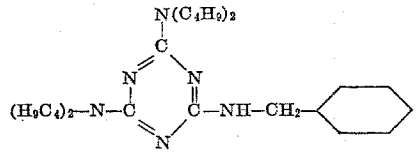
(f) from 10 to 45% of metal soap,

(g) from 10 to 45% of bentonite,

(h) from 0.01 to 5% of high pressure additive,

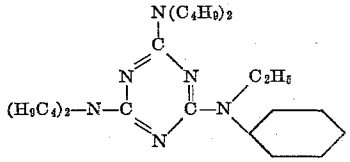
(i) from 0.01 to 2% of anticorrosive.

16. A lubricant composition consisting essentially of about 95 to 99% by weight of a compound of the formula



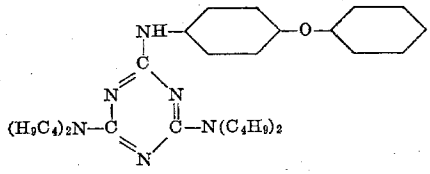
and correspondingly from 5 to 1% of a poly-2-lower alkyl-hexyl-methacrylate.

17. A lubricant composition consisting essentially of about 95 to 99% by weight of a compound of the formula



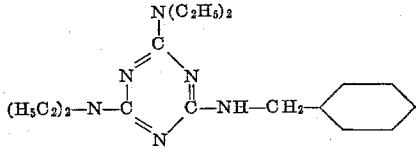
and correspondingly from 5 to 1% of a poly-2-lower alkyl-hexyl-methacrylate.

18. A lubricant composition consisting essentially of about 95 to 99% by weight of a compound of the formula



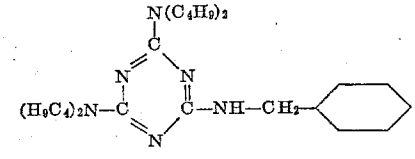
and correspondingly from 5 to 1% of a poly-2-lower alkyl-hexyl-methacrylate.

19. A lubricant composition consisting essentially of about 95 to 99% by weight of a compound of the formula



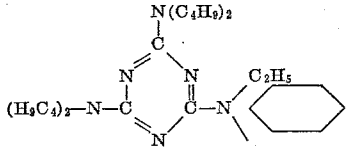
and correspondingly from 5 to 1% of a poly-2-lower alkyl-hexyl-methacrylate.

20. A lubricant composition consisting essentially of a compound of the formula



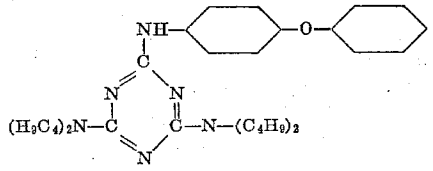
and from about 0.01 to 5% by weight, calculated on the total weight of the composition, of didodecylselenide.

21. A lubricant composition consisting essentially of a compound of the formula



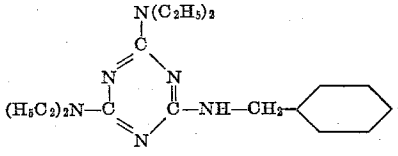
and from about 0.01 to 5% by weight, calculated on the total weight of the composition, of didodecylselenide.

22. A lubricant composition consisting essentially of a compound of the formula



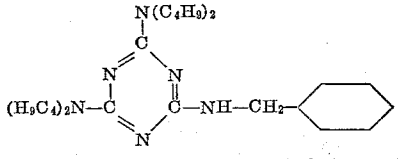
and from about 0.01 to 5% by weight, calculated on the total weight on the composition of didodecylselenide.

23. A lubricant composition consisting essentially of a compound of the formula



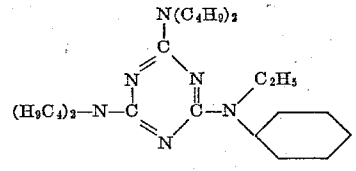
and from about 0.01 to 5% by weight, calculated on the total weight of the composition, of didodecylselenide.

24. A lubricant composition consisting essentially of about 10 to 90% by weight of a compound of the formula



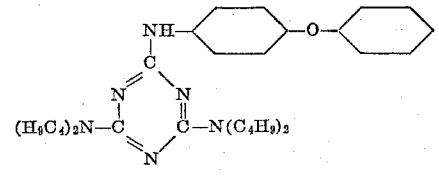
and correspondingly about 90 to 10% by weight of a lubricant selected from the group consisting of mineral oil, methylphenylsilicone, the sebacic and adipic acid, esters of octyl and nonyl alcohols.

25. A lubricant composition consisting essentially of about 10 to 90% by weight of a compound of the formula



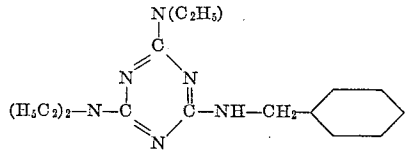
and correspondingly about 90 to 10% by weight of a lubricant selected from the group consisting of mineral oil, methylphenylsilicone, the sebacic and adipic acid esters of octyl and nonyl alcohols.

26. A lubricant composition consisting essentially of about 10 to 90% by weight of a compound of the formula



and correspondingly about 90 to 10% by weight of a lubricant selected from the group consisting of mineral oil, methylphenylsilicone, the sebacic and adipic acid esters of octyl and nonyl alcohols.

27. A lubricant composition consisting essentially of about 10 to 90% by weight of a compound of the formula



and correspondingly about 90 to 10% by weight of a lubricant selected from the group consisting of mineral oil, methylphenylsilicone, the sebacic and adipic acid esters of octyl and nonyl alcohols.

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