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ALKYL SUBSTITUTED METAL ARYL HY-
DROXYLATE-METAL CARBOXYLATE
SALTS AND A METHOD OF MAKING THEM

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This invention relates to the production of certain new chemical compounds or compositions which may be generally designated as wax-substituted metaloxyaromatic-metal carboxylate salts. These products may also be designated as salts of wax-substituted hydroxyaromatic carboxylic acids in which both the hydroxyl and carboxyl hydrogens are substituted with their equivalent weight of metal. Although the invention is broadly concerned with chemical compounds or compositions coming within the above-designated general classification, it contemplates as a preferred group within such general classification those compounds or compositions which are soluble or miscible with mineral oil.

Our invention is based upon the discovery that the oil-miscible wax-substituted metaloxyaromatic-metal carboxylate salts of hydroxyaromatic carboxylic acids are of multifunctional activity when blended with viscous mineral oil fractions in that they effect improvement of several unrelated and related properties of the oil. For example, this preferred oil-miscible group of compounds or compositions coming within the general field of invention contemplated herein are effective, when blended in a minor proportion with mineral oil fractions of the lubricant type, to depress the pour point, improve the viscosity index (V. I.), and inhibit oxidation of the oil. By inhibiting oxidation these oil-miscible metaloxyaromatic-metal carboxylate salts act to retard the formation of sludge and acidic products of oxidation. They also have a peptizing action on such sludge as may eventually be formed. Thus, any one of these preferred oil-miscible compounds or compositions may, for example, be used in internal combustion engine lubricants to retard or prevent the sticking of piston rings or prevent the corrosion of bearings, particularly those formed of alloy metals normally susceptible to corrosion, etc., and at the same time it will act to depress the pour point and improve the viscosity index of the oil. Through a proper choice of metal substituent (lead, copper, tin, or zinc, for example) the load-carrying capacity or "lubricity" of the oil may also be improved.

It should be understood that the use of these preferred oil-miscible compounds or compositions is not confined to lubricating oils, but they may be employed in any mineral oil fractions where one or more of the improved properties recited above is desired. In this regard it is to be further understood that the present invention is not concerned with mineral oil compositions containing these preferred oil-soluble com-

pounds, such oil compositions forming the subject matter of our copending application Serial No. 210,160, filed May 26, 1938 (now Patent 2,197,832), to which reference is made for further details in the composition of these compounds.

It is also to be understood that while our invention contemplates oil-miscible compounds or compositions of the type above referred to as a preferred class or group within the general field of invention, the invention is not limited to such oil-miscible compounds or compositions, since this whole class of new materials is possessed of valuable properties irrespective of oil-miscibility. For example, these compounds or compositions may be used as intermediaries in the production of resins, resin-like materials, rubber substitutes, etc. Certain of the compounds or compositions are possessed of valuable pharmaceutical, insecticidal, or similar properties, such, for example, as those derived from the presence of a particular metal or a particular combination of metals in the metaloxy and carboxylate groups. Numerous other uses and applications of the compounds or compositions contemplated herein will be readily apparent to those skilled in the art from the following description of their compositions and preferred methods of synthesis.

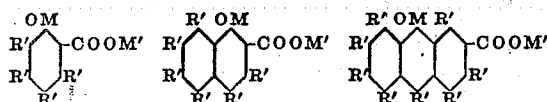
As has been previously pointed out, the compounds or compositions contemplated by this invention may be broadly designated as metaloxyaromatic-metal carboxylate salts of wax-substituted hydroxyaromatic carboxylic acids. All of the "salts" contemplated by this invention are characterized by the presence of an aromatic nucleus in which at least one nuclear hydrogen is substituted with a metaloxy group and another nuclear hydrogen is substituted with a carboxyl group wherein the carboxyl hydrogen is replaced with its equivalent weight of the same or a different metal.

The compounds or compositions contemplated by this invention are further characterized by the fact that at least one replaceable hydrogen on the aromatic nucleus is substituted with an aliphatic hydrocarbon radical or group characteristic of an aliphatic hydrocarbon of high molecular weight which we may term a heavy alkyl group. For obtaining the preferred group of compounds or compositions which are miscible with mineral oil and which possess the multifunctional oil-improving properties, we have found that this "heavy alkyl" substituent in the metaloxyaromatic-metal carboxylate salts under discussion must be derived from a predominantly straight chain aliphatic hydrocarbon of at least

twenty carbon atoms such as characterize crystalline petroleum wax. As a matter of fact, petroleum wax is considered to be a preferred source of the "heavy alkyl" substituent and it is for that reason that the compounds or compositions described herein are referred to as "wax-substituted." It is to be understood, however, that the term "wax" as used herein, is applied in a broad sense and is intended to include any pure compound or mixture of compounds predominantly aliphatic in nature and containing at least twenty carbon atoms which is susceptible of attachment to an aromatic nucleus to provide a substituent which, in the proper proportions, will impart to the characterizing aryl metal phenate-metal carboxylate group or nucleus the multifunctional oil-improving properties referred to.

In the preferred group of compounds or compositions contemplated herein, which are oil-miscible and which by virtue of their heavy alkyl (wax) substituent have multifunctional properties in mineral oil blends, it is important that the heavy alkyl (wax) substituent comprise substantial proportion of the composition or compound as a whole. This will be discussed in detail later in the specification.

In addition to the heavy alkyl (wax) substituent the compounds or compositions contemplated herein, may have additional nuclear hydrogen replaced with other substituents which in the case of the preferred oil-miscible compositions may or may not have a solubilizing effect upon the composition as a whole. For example, part of the nuclear hydrogen may be substituted with a radical selected from the group consisting of: aliphatic hydrocarbon groups having less than twenty carbon atoms, alkoxy, aroxy, aralkyl, alkaryl, chlorine, nitro, and amino radicals or groups. Compounds of the above general formula-type having mono-, di-, and tri- cyclic nuclei are illustrated by the following specific formulae:



in which at least one of the R's represents an aliphatic radical or group containing at least twenty carbon atoms and in which the remaining R's represent residual hydrogen which may be replaced with: aliphatic groups containing less than twenty carbon atoms, hydroxy, alkoxy, aroxy, alkaryl, aralkyl, aryl, chlorine, nitro, and amino radicals or groups.

It will be understood that the compounds or compositions contemplated by this invention may be pure compounds satisfying the conditions enumerated above with any one of the various mono- or polycyclic aromatic nuclei in the characterizing nuclear group. However, in manufacturing the preferred composition by the preferred procedure, as will appear later on, the final product obtained is normally or usually a mixture of different compounds the individual characteristics of which differ in their alkyl substituents (according to the different aliphatic hydrocarbons in an alkylating material such as paraffin wax); in the number of alkyl substituents on the characterizing nucleus and in the number of nuclei attached to a single long chain alkyl group. For further details in the composition of such mixtures of compounds reference is made to the aforesaid Patent 2,197,832.

As aforesaid, it is important that the metaloxo-

metal carboxylate salts of "wax" (or heavy alkyl)-substituted hydroxy-aromatic carboxylic acids preferred for use as oil-improving agents have the aryl nucleus substituted with heavy alkyl groups to an extent such that this heavy alkyl ("wax") substituent comprises a sufficient proportion of the composition as a whole to render the same oil-miscible so that it will form a mineral oil solution or colloidal suspension which will remain stable as such under normal conditions of handling and use. It appears that there is a critical range in the degree of "wax"-substitution below which these "wax"-substituted salts will not satisfy the requirements for oil-miscibility.

The critical range in the degree of wax-substitution of the aryl nucleus in the preferred compounds contemplated herein may vary with: (a) the mineral oil fraction in which the compound is used; (b) whether the aryl nucleus is mono- or polycyclic or mono- or polyhydric; (c) mono- or polysubstitution of the aryl nucleus with heavy alkyl groups; and (d) other substituents on the nucleus which may be of positive or negative or of neutral oil-solubilizing activity.

In view of the foregoing variables it would be impracticable and probably misleading to attempt to give an expression and figure which would indicate accurately the proper ratio of hydroxy-aromatic constituent to the "wax"-substituted hydroxyaromatic constituent in the starting material which would satisfy all cases taking these variables into account. As a guide for preparing these preferred compounds, however, our research indicates that in general the ratio, expressed as weight of hydroxyaromatic component in the product to the corresponding wax-substituted hydroxyaromatic nucleus or component therein, should not be greater than about seventeen parts by weight of the former to about 100 parts by weight of the latter, or about 1 per cent, when the hydroxyaromatic component is expressed in terms of its chemically equivalent weight of phenol. This ratio, hereinafter designated as the "phenolic ratio," does not take into account other substituents on the nucleus, but it will serve as a working guide for the preparation of these preferred compounds. A further general guide for the synthesis of these preferred compounds is to substitute the aryl nucleus with paraffin wax or equivalent alkyl substituent so that it is polysubstituted.

The general procedure for the preparation of the compounds contemplated herein involves the alkylation or wax-substitution of a hydroxyaromatic compound (aryl hydroxide), after which the hydroxyl hydrogen thereof is substituted with an alkali or alkaline earth metal. The resultant alkylated aryl alkali (or alkaline earth) metal hydroxylate is then carboxylated to form the alkali or alkaline earth metal salt of the alkylated hydroxyaromatic carboxylic acid. When the ultimate product is to be one containing a metal other than the alkali or alkaline earth metal contained therein following carboxylation, such other metal is substituted in the carboxyl group by double decomposition, using an alcohol-soluble inorganic or fatty acid salt of the desired metal. In this double decomposition some of the metal may replace hydrogen on the nucleus; but if such compounds are formed, they are in the minorit and in any event are not considered harmful to the product.

To form the metaloxo-aromatic-carboxylate salt, the hydroxyaromatic-carboxylate salt is re-

acted with an alcoholate or alkyl oxide of the desired metal, thereby substituting metal for the hydroxyl hydrogen.

Examples of the hydroxyaromatic compounds or aryl hydroxides which can be used as starting reactants are: phenol, resorcinol, hydroquinone, catechol, cresol, xylenol, hydroxydiphenyl, benzyl-phenol, phenyl-ethyl-phenol, phenol resins, methyl-hydroxydiphenyl, gualacol, alpha and beta naphthol, alpha and beta methyl naphthol, tolyl naphthol, xylyl naphthol, benzyl naphthol, anthranol, phenyl methyl naphthol, phenanthrol, diphenyl ether, anisole, beta-naphthyl methyl ether, chlorphenol, and the like. Preference in general is to the monohydroxy phenols otherwise unsubstituted, particular preference being given to phenol and alpha and beta naphthol.

The alkylation of the hydroxyaromatic compound with the heavy alkyl groups may be accomplished in various ways, such as by a Friedel-Crafts synthesis, using a halogenated high molecular weight aliphatic hydrocarbon compound containing at least twenty carbon atoms, or a halogenated hydrocarbon material such as chlorinated petroleum wax predominantly comprised of aliphatic hydrocarbons containing at least twenty carbon atoms. The alkylation may also be effected by reaction of the aryl hydroxide with unsaturated high molecular weight aliphatic compounds or higher alcohols in the presence of H_2SO_4 as a catalyst.

The Friedel-Crafts alkylation reaction may be used with an alkyl-aryl ether or an aralkyl-aryl ether as the starting material instead of the aryl hydroxide. In this event the ether undergoes a substantial rearrangement to form an alkylated hydroxyaromatic compound in which the alkyl or aralkyl group of the ether replaces one of the nuclear hydrogen atoms.

In the event it is desired to produce a product which contains an alkoxy or aroxy group as a substituent on the aryl nucleus, it is preferable to use an aryl hydroxide containing such substituent and effect the alkylation with a high molecular weight unsaturated aliphatic hydrocarbon (such as eicosylene, cerotene, melene, etc.) or a higher alcohol (such as myricyl alcohol, ceryl alcohol, etc.), using H_2SO_4 as a catalyst. By this procedure the hydroxyaromatic ether can be alkylated without substantial rearrangement taking place. As an alternative procedure, polyhydric phenols can be alkylated with higher alcohols or high molecular weight aliphatics or by Friedel-Crafts reaction, followed by substitution of one hydroxyl hydrogen with a low molecular weight alkyl group, which substitution can be effected by treating the alkylated polyhydric phenol with an alkali alcoholate to substitute an OH group with alkali metal and then treating with the desired alkyl halide whereby the substitution is effected.

When it is desired to obtain a nitro or amino substituent, the aryl hydroxide is alkylated or wax-substituted when free of such substituent. This is followed by nitration to introduce the nitro group. The amino group can be obtained by reduction of the nitro group.

In general it appears that any metal may be employed as the metal substituent, but preference is given to the group comprising copper, tin, iron, and cobalt.

The following description illustrates the procedure which may be followed in making those compounds which are preferred for their multifunctional oil-improving properties. As will be

apparent to those skilled in the art, compounds or compositions having a combined phenol content in excess of that necessary for oil-miscibility may be readily obtained by using a chlorinated wax having a chlorine content substantially higher than that given in the example below or by changing the ratio of the reactants (chlorwax and phenolic compound).

10 PREPARATION OF WAX-SUBSTITUTED METALOXYAROMATIC-METAL CARBOXYLATE SALTS

(1) ALKYLATION OF PHENOL

A paraffin wax melting at approximately 120° F. and predominantly comprised of compounds having at least twenty carbon atoms in their molecules is melted and heated to about 200° F., after which chlorine is bubbled therethrough until the wax has absorbed from sixteen per cent to twenty per cent of chlorine, such product having an average composition between a monochlor wax and a dichlor wax or corresponding roughly to a dichlor wax. Preferably the chlorination is continued until about one-sixth the weight of the "chlorwax" formed is chlorine. A quantity of chlorwax thus obtained, containing three (or four, with twenty per cent chlorine in the chlorwax) atomic proportions of chlorine, is heated to a temperature varying from just above its melting point to not over 150° F. and one mole of phenol (C_6H_5OH) is admixed therewith. The mixture is heated to about 150° F. and a quantity of anhydrous aluminum chloride corresponding to about three per cent of the weight of chlorwax in the mixture is slowly added to the mixture with active stirring. The rate of addition of the aluminum chloride should be sufficiently slow to avoid violent foaming, and during such addition the temperature should be held at about 150° F. After the aluminum chloride has been added, the temperature of the mixture may be increased slowly over a period of from fifteen to twenty-five minutes to a temperature of about 250° F. and then should be more slowly increased to about 350° F. To control the evolution of HCl gas the temperature of the mixture is preferably raised from 250° F. to 350° F. at a rate of approximately one degree per minute, the whole heating operation occupying approximately two hours from the time of adding the aluminum chloride. If the emission of HCl gas has not ceased when the final temperature is reached, the mixture may be held at 350° F. for a short time to allow completion of the reaction. But, to avoid possible cracking of the wax, the mixture should not be heated appreciably above 350° F., nor should it be held at that temperature for any extended length of time.

It is important, particularly where an oil-miscible product is desired, that all unreacted or non-alkylated hydroxy-aromatic material (phenol) remaining after the alkylation reaction be removed. Such removal can be effected generally by water-washing, but it is preferable to treat the water-washed product with superheated steam, thereby insuring complete removal of the unreacted material and accomplishing the drying of the product in the same operation.

A wax-substituted phenol prepared according to the above procedure, in which a quantity of chlorwax containing three atomic proportions of chlorine (sixteen per cent chlorine in the chlorwax) is reacted with one mole of phenol, may, for brevity herein, be designated as "wax-phenol

(3-16)." Parenthetical expressions of this type (A-B) will be used hereinafter in connection with the alkylated hydroxyaromatic compounds to designate (A) the number of atomic proportions of chlorine in chloraliphatic material reacted with one mole of hydroxyaromatic compound in the Friedel-Crafts reaction, and (B) the chlorine content of the chloraliphatic material. In the above example A=3 and B=16. This same designation will also apply to the salts of the carboxylic acids of these alkylated hydroxyaromatic compounds.

Wax-phenol (3-16) as obtained by the above procedure had a phenol content or a "phenolic ratio" of about thirteen per cent and wax-phenol (4-20) had a "phenolic ratio" of about 12.5 per cent. Our research indicates that this phenolic ratio in the neighborhood of thirteen per cent may be considered as representing about the maximum for satisfactory miscibility in viscous oils of the metaloxy-metal carboxylate derivatives of alkylated hydroxyaromatic compounds in which the alkyl substituent is derived from petroleum wax and the hydroxyaromatic constituent is derived from phenol (C₆H₅OH).

(2) FORMATION OF WAX-SUBSTITUTED ALKALI OR ALKALINE EARTH METAL PHENATE

As an example of this step in the preparation of our oil-improving agents, wax-substituted sodium phenate can be prepared by the reaction of wax-phenol with metallic sodium in the presence of a non-oxidizing gas. The reaction mixture is heated at 500° F. during a two-hour period with rapid stirring to produce finely divided sodium and thereby accelerate the reaction. The proportions of reactants which were used in preparing a wax-substituted alkali metal phenate according to the above procedure were:

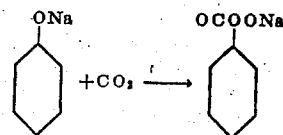
Wax-phenol (13.2% combined phenol content)-----	500
Sodium or equivalent amount of potassium-----	16
Grams	

Wax-substituted phenates of the alkali and alkaline earth metals may also be prepared by reacting a wax-phenol with the desired alcoholate or alkyl metal oxide of an alkali or alkaline earth metal. For this purpose anhydrous methyl and ethyl alcohols are usually most suitable for use in preparing the alkyl metal oxides. As an example, 500 grams of wax-phenol (3-16) of 13.2 per cent combined phenol content was reacted with sixteen grams of sodium in the form of the ethyl sodium oxide by heating the mixture to about 300° F. during a one-hour period and allowing the alcohol released in the reaction to distill off, thereby obtaining the wax-substituted sodium phenate as the final product.

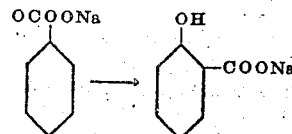
(3) CARBOXYLATION TO FORM ALKALI OR ALKALINE EARTH METAL SALT OF WAX-PHENOL CARBOXYLIC ACID

A product of the foregoing step, such as the wax-substituted sodium phenate, is heated to a temperature of about 350° F., and CO₂ is introduced at a rate sufficient to maintain this temperature. The pressure is gradually raised to about 500 pounds per square inch to complete the reaction at this temperature during a two-hour period. The carboxylation can also be carried out at atmospheric pressure by introducing a current of CO₂ at about 400° F. with stirring for about four hours. The reaction may be illus-

trated with unsubstituted sodium phenate by the following equations:



By rearrangement the carboxy group is transferred to the ring, giving the sodium salt of the phenol carboxylic acid:



Other carboxylating reactions may be used in this step of the process, such as the reaction of the alkali metal wax-phenate with carbonyl chloride or carbon tetrachloride; but since the salt formed in the presence of CO₂ is obtained in high yield and in a pure state, this is the preferred carboxylation procedure.

Because of the high viscosity of the mixture it is advantageous to dilute the wax-substituted phenol initially with one or two parts of mineral oil. When a diluent has been used, the mixture can be stirred more readily, making it suitable to introduce CO₂ at a lower temperature. In carboxylating the wax-alkali oxyaromatic compound under pressure the temperature can be more readily controlled by introducing the CO₂ under pressure at room temperature and gradually raising the mixture to about 350° F. When CO₂ is introduced under pressure at 350° F., rapid changes in viscosity occur, making it more difficult to control the temperature of the reaction mixture. The product of this step, where the starting material was wax-substituted sodium phenate, is the sodium salt of wax-substituted phenol carboxylic acid.

(4) FORMATION OF THE SALTS OF OTHER METALS

With an alkali or alkaline earth metal salt, such as the sodium salt of the foregoing step, as the starting material, the corresponding salts of the other metals can be prepared by double decomposition of the first-mentioned salt with an alcohol-soluble inorganic or fatty acid salt of the desired metal. The use of alcohol as a solvent for the salt is desirable to insure proper solution and reaction, the reaction being conveniently carried out by heating the mixture at 175° F. during a two-hour period.

The reaction product of this double decomposition or the alkali or alkaline earth metal salt obtained in the previous step is used as an intermediary for obtaining the final metaloxy-aromatic-metal carboxylate salt contemplated by this invention.

The reaction mixture employed in this double decomposition reaction may, for example, consist of one mole of the sodium salt of wax-substituted phenol carboxylic acid and one mole equivalent of the inorganic or fatty acid salt of the desired metal in alcohol solution. One part by volume of Stoddard solvent may be employed as a diluent for the mixture.

(5) FORMATION OF THE METALOKYAROMATIC-METAL CARBOXYLATE TYPE OF SALT

The substitution of the hydroxyl hydrogen in the salt of the hydroxyaromatic (phenol carboxylic) acid obtained in steps (3) or (4) de-

scribed above is obtained by reacting such salt with an alcoholic or alkyl oxide of the desired metal. The alkyl oxides may be conveniently formed by double decomposition of alkyl sodium oxide with an alcohol-soluble salt (such as a chloride) of the desired metal to form the metal alcoholate and the inorganic sodium salt.

The alkyl-substituted hydroxyaromatic acid salt may be added to the alkyl metal oxide mixture without separating the sodium salt (chloride) from the pure alkyl metal oxide. The mixture is heated during a one-hour period at 300° F., allowing the alcohol to distill to complete the formation of the metaloxyaromatic-metal carboxylate salt. The product thus obtained is separated from the inorganic reaction salts, which are insoluble, by settling, filtering, or centrifuging, without resorting to water-washing. If desired, the reaction mixture, prior to separation, may be diluted with a suitable solvent such as a light mineral oil to aid the separation of the salt, such separation being followed by distillation of the diluent to obtain the finished material.

Compounds or compositions obtained according to the foregoing procedure, in which phenol (C₆H₅OH) was used as the source of the aryl nucleus and petroleum wax as the source of the heavy alkyl (wax) substituent, may be identified as wax-substituted metalphenate-metal carboxylate salts, or as wax-substituted metaloxy-phenyl metal carboxylate salts or as the metal salts of wax-substituted phenol carboxylic acids in which both the hydroxyl hydrogen and the carboxyl hydrogen are replaced with metal. Corresponding "salts" or metal-organic compounds can be prepared from substituted phenols, and from polycyclic hydroxyaromatic compounds by following the same general procedure described above. For example, the same general procedure described above can be followed in preparing wax-substituted metaloxy-naphthyl-metal carboxylate salts or metal salts of wax-substituted naphthol carboxylic acid in which the hydroxyl and carboxyl hydrogens are both substituted with metal. A wax-substituted naphthol which may be conveniently used as the starting material for such products is one having a combined naphthol content of sixteen per cent or equivalent phenol content or "phenolic ratio" of 10.4 per cent.

The wax-substituted metaloxyaromatic-metal carboxylate salts obtained by the exemplary procedures described above are, as the result of their relatively low "phenolic ratio" or combined phenol content, all oil-miscible or oil-soluble products. Although products of this type are designated herein as preferred because of their multifunctional oil-improving properties, it is again emphasized that the invention is not limited to wax-substituted metaloxyaromatic-metal carboxylate salts which are oil miscible but is inclusive of this entire field of products irrespective of oil-miscibility.

Compounds or compositions of both the oil-miscible and non-miscible types have been prepared, and of the oil-miscible products synthesized all have been tested as additive agents for viscous mineral oils and have been found to be of multifunctional activity, improving the pour point and viscosity index and inhibiting oxidation of viscous mineral oil fractions. The following list (table) is illustrative of the various oil-miscible metal salts of wax-substituted metaloxyaromatic-metal carboxylate salts which we have prepared and tested to demonstrate their

value as additive agents for viscous mineral oils. As has been previously pointed out, the present invention contemplates metaloxy-metal carboxylate "salts" in which both the hydroxyl and carboxyl hydrogen are substituted with the same metal and "salts" in which the hydroxyl hydrogen and carboxyl hydrogen are replaced with different metals. Salts of the former type are designated in the table below as "di" salts, for example dicobaltous (phenate-carboxylate) salt of wax phenolic acid. In referring to salts of the latter type, the hydroxyl metal substituent is indicated with the suffix (OM) and the carboxyl metal substituent is indicated with the suffix (COOM'). Thus, for example, a salt of wax-substituted phenol carboxylic acid in which the hydroxyl hydrogen is substituted with copper and the carboxyl hydrogen is substituted with sodium will be referred to as cupric(OM)-sodium(COOM') salt of wax-phenol carboxylic acid. The compounds or compositions listed in the table below were prepared from wax-phenol having a combined phenol content in the neighborhood of thirteen per cent, they were miscible in viscous mineral oil fractions and showed multifunctional activity as oil-improving agents.

Table

30	Cupric(OM)-sodium(COOM') salt of wax-phenol carboxylic acid
	Di-sodium(phenate-carboxylate) salt of wax-phenol carboxylic acid
	Cobaltous(OM)-manganous(COOM') salt of wax-phenol carboxylic acid
35	Distannous (phenate-carboxylate) salt of wax-phenol carboxylic acid
	Dicobaltous (phenate-carboxylate) salt of wax-phenol carboxylic acid
	Diferic (phenate-carboxylate) salt of wax-phenol carboxylic acid
40	We claim:

1. A metal salt of an alkyl-substituted hydroxyaromatic carboxylic acid in which both the hydroxyl hydrogen and the carboxyl hydrogen are substituted with metal and in which the alkyl substituent contains at least twenty carbon atoms and is attached to the aryl nucleus.

2. A metal salt of an alkyl-substituted hydroxyaromatic carboxylic acid in which both the hydroxyl hydrogen and the carboxyl hydrogen are substituted with metal and in which the alkyl substituent contains at least twenty carbon atoms and is attached to the aryl nucleus, said composition being miscible with mineral oil and possessing the property of improving the pour point and viscosity index and inhibiting oxidation of a viscous mineral oil fraction when admixed therewith.

3. A metal salt of an alkyl-substituted phenol carboxylic acid in which both the hydroxyl hydrogen and the carboxyl hydrogen are substituted with metal and in which the alkyl substituent contains at least twenty carbon atoms and is attached to the aryl nucleus.

4. A metal salt of an alkyl-substituted phenol carboxylic acid in which both the hydroxyl hydrogen and the carboxyl hydrogen are substituted with metal and in which the alkyl substituent contains at least twenty carbon atoms and is attached to the aryl nucleus, said composition being miscible with mineral oil and possessing the property of improving the pour point and viscosity index and inhibiting oxidation of a viscous mineral oil fraction when admixed therewith.

5. A metal salt of an alkyl-substituted naphthol carboxylic acid in which both the hydroxyl hydrogen and the carboxyl hydrogen are substituted with metal and in which the alkyl substituent contains at least twenty carbon atoms and is attached to the aryl nucleus.

6. A metal salt of an alkyl-substituted naphthol carboxylic acid in which both the hydroxyl hydrogen and carboxyl hydrogen are substituted with metal and in which the alkyl substituent contains at least twenty carbon atoms and is attached to the aryl nucleus, said composition being miscible with mineral oil and possessing the property of improving the pour point and viscosity index and inhibiting oxidation of a viscous mineral oil fraction when admixed therewith.

7. A product obtained by condensing an hydroxyaromatic compound with chlorinated paraffin wax in proportions such that the hydroxyaromatic constituent in the resulting wax-hydroxyaromatic product comprises a substantially smaller proportion of said product than the wax substituent; substituting the hydroxyl hydrogen with a metal selected from the group consisting of alkali and alkaline earth metals to form a wax-substituted aryl oxide of said metal; carboxylating said aryl metal oxide to form the corresponding metal salt of a wax-substituted hydroxyaromatic carboxylic acid; and then replacing the hydroxyl hydrogen of said salt with a metal.

8. A product obtained by condensing an hydroxyaromatic compound with chlorinated paraffin wax in proportions such that the hydroxyaromatic constituent in the resulting wax-hydroxyaromatic product comprises a substantially smaller proportion of said product than the wax substituent; substituting the hydroxyl hydrogen with a metal selected from the group consisting of alkali and alkaline earth metals to form a wax-substituted aryl oxide of said metal; carboxylating said aryl metal oxide to form the salt of a wax-substituted hydroxyaromatic carboxylic acid in which the carboxyl hydrogen is substituted with said metal; replacing the metal on the carboxyl group with another metal; and finally replacing the hydroxyl hydrogen with a metal.

9. A product obtained by condensing an hydroxyaromatic compound with chlorinated paraffin wax to form a wax-substituted hydroxyaromatic compound; substituting the hydroxyl hydrogen in said wax-substituted hydroxyaromatic compound with a metal selected from the group consisting of alkali and alkaline earth metals to form a wax-substituted aryl oxide of said metal; carboxylating said aryl metal oxide to form the wax-substituted hydroxyaromatic carboxylic acid salt of said metal; and then replacing the hydroxyl hydrogen of said salt with a metal.

10. A product obtained by condensing phenol with chlorinated paraffin wax in proportions such that the wax-phenol formed has a combined phenol content not to exceed seventeen per cent; replacing the hydroxyl hydrogen of said wax-phenol with a metal selected from the group con-

sisting of alkali and alkaline earth metals to form the wax-phenate of said metal; carboxylating said wax phenate to form the corresponding metal salt of wax-phenol carboxylic acid; and finally replacing the hydroxyl hydrogen on said wax-phenol carboxylic acid with a metal.

11. A product obtained by condensing phenol with chlorinated paraffin wax in proportions such that the wax-phenol formed has a combined phenol content not to exceed seventeen per cent; replacing the hydroxyl hydrogen of said wax-phenol with a metal selected from the group consisting of alkali and alkaline earth metals to form the wax-phenate of said metal; carboxylating said wax-phenate to form the corresponding metal salt of wax-phenol carboxylic acid; replacing the metal on the carboxyl group with another metal; and finally replacing the hydroxyl hydrogen on said wax-phenol carboxylic acid with a metal.

12. The method of preparing a wax-substituted metal oxyaromatic-metal carboxylate salt which comprises: condensing a chlorinated paraffin wax with a hydroxyaromatic compound in the presence of aluminum chloride to form a wax-substituted hydroxyaromatic compound, reacting said wax-substituted hydroxyaromatic compound with a finely divided alkali metal at an elevated temperature and with rapid stirring to form a wax-substituted aryl alkali metal oxide; carboxylating the product of the preceding step to form the alkali metal salt of a wax-substituted hydroxyaromatic carboxylic acid; and finally reacting said hydroxyaromatic carboxylic acid salt with a metal alcoholate to replace the hydroxyl hydrogen of said hydroxyaromatic acid salt with the metal of said alcoholate.

13. In the method of preparing a paraffin wax-substituted metaloxyaromatic-metal carboxylate salt, the step which includes reacting a metal salt of a paraffin wax-substituted hydroxyaromatic carboxylic acid with a metal alcoholate to replace the hydroxyl hydrogen of said hydroxyaromatic acid salt with the metal of said alcoholate.

14. In the method of preparing a paraffin wax-substituted metaloxyaromatic-metal carboxylate salt, the step which includes reacting a metal salt of a paraffin wax-substituted hydroxyaromatic carboxylic acid with a metal alcoholate at a temperature in the neighborhood of 300° F. during a period of substantially one hour to replace the hydroxyl hydrogen of said hydroxyaromatic acid salt with the metal of said alcoholate.

15. A metal salt of an alkyl-substituted hydroxyaromatic carboxylic acid in which both the hydroxyl and the carboxyl hydrogens are substituted with metal and in which the alkyl substituent contains at least twenty carbon atoms and is attached to the aryl nucleus, the metal substituents being selected from the group consisting of copper, tin, iron, and cobalt.

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