Patented Mar. 30, 1954

2,673,838

UNITED STATES PATENT OFFICE

2,673,838

THIXOTROPIC COMPOSITIONS

Franklin Veatch, Cleveland, and Ellis C. Persing, Jr., Shaker Heights, Ohio, assignors to The Standard Oil Company, Cleveland, Ohio, a corporation of Ohio

No Drawing. Application December 14, 1948, Serial No. 65,288

10 Claims. (Cl. 252—29)

1

This invention relates to thixotropic oil compositions comprising an oil and a hard wax-like material, more particularly, fully hydrogenated castor oil; which composition may or may not have certain solids incorporated therein.

Before discussing the nature of the above composition, its advantages and uses, together with illustrative examples, it is deemed desirable to define certain terms to be used herein, in order that the scope and meaning of the invention may be fully understood as it is further described.

The reference to "oil base" as used herein, refers to oils of both mineral as well as animal and vegetable origin, and includes any unctuous substance which is liquid. The mineral oils may be derived from petroleum or coal tar, for example, and may occur naturally or be made synthetically by polymerization of olefins, alkylation condensations, etc. They may vary in viscosity from 50 to 75 S. U. S. at 100° F. such as are characteristic of torch oils and the light household oils up through the oils having a viscosity of 4500 S. U. S. at 100° F. which are characteristic of certain bright stocks. (All viscosities herein are at 100° F. unless otherwise stated.) They include, for instance, raw oils such as waxy oils, and oils refined by various methods, such as dewaxing, acid treating or solvent refining, including the highly refined white medicinal oils.

As illustrative of the animal and vegetable oils are ordinary castor oil, lard oil, neat's-foot oil, olive oil, cocoanut oil, palm oil, soybean oil, cottonseed oil, and any of the other naturally occurring oils which are liquid at ambient temperature, as well as equivalents formed synthetically. These oils may be or include large amounts of fatty acids, mono-glycerides, etc.

Included also within the above definition are oils which have been reacted with or have dissolved therein elements or compounds for modifying their characteristics, more particularly oils having extreme pressure (E. P.) properties, and industrial oils such as cutting and grinding oils. These may, for example, have sulfur or sulfur compounds, phosphorus or phosphorus compounds, phosphorus sulfides, chlorine or chlorine-containing compounds dissolved therein or reacted therewith. The oil base may contain compounds or reaction products which have been added thereto as a so-called "additive" for the purpose of rendering the oil resistant to oxidation, to inhibit rusting, to improve resistance to corrosion, imparting E. P. properties, or other modifications. Alternatively the additive may be added separately and therefore, may not be regarded as an element of the oil base in the sense that it is present in the oil base when the hardened castor oil is dispersed therein.

2

The combination of the oil and the fully hydrogenated castor oil is a physical mixture and it is not believed to involve any chemical reaction between the components. The novel properties are thought to result from the particular physical association of the two components. For this reason the wide variations in chemical compositions of the oils do not affect the results obtained.

The other essential component is a hard wax-like material which is primarily or consists essentially of 12-hydroxystearin (glyceryl hydroxystearate) which may be formed by the hydrogenation of castor oil to a low iodine value, i. e., fully hydrogenated. While this material may be more closely related to a fat than to a wax in chemical composition, it possesses many wax-like properties; more particularly, it has a relatively high solidification point of 86 to 88° C. (187–190° F.). It is to be distinguished from most hydrogenated vegetable or animal oils since few can be hydrogenated to have a melting point much above 65° C. It is extremely hard, pearl white in color, and practically odorless. It has an acid number of 2.0, a saponification value of 175 to 185, an iodine number of 2.5 to 8.5, and an hydroxyl number of 155 to 165. It is extremely insoluble, and none of the common solvents dissolved as much as 2%. It is available under the trade name "Opalwax," and will be referred to hereinafter as "fully hydrogenated castor oil."

Compositions made by combining the oil with the fully hydrogenated castor oil according to the methods to be described hereinafter possess thixotropic properties. Thixotropy hos been extensively investigated as one aspect of rheology. It is a property possessed by a composition of being liquid under conditions of agitation and of being solid or gel-like when quiescent. Thixotropic compositions may also be defined as undergoing reversible liquid-gel transitions. A thixotropic composition is to be distinguished from one which hardens through cooling such as paraffin wax and which may be applied to a surface in a hot liquid form to harden upon cooling. A characteristic of a thixotropic composition is that the conversion from a solid or gel-like state to a liquid (and back again), is not dependent upon a change of temperature, but rather is dependent on the stresses applied to the gel, firstly to initiate the transition from the gel to the liquid state and then maintain the composition in the liquid state.

Thixotropic oil compositions are normally

solid, in that they do not flow under the conditions of stress normally imposed upon them in use, and are to be distinguished from greases, since the latter term is restricted to oils which have been thickened with a soap. The compositions of this invention, since they do not rely upon soap as a thickening agent, are, therefore, to be distinguished from greases, at least in so far as the mode of obtaining a solid consistency is concerned.

Thixotropic oil compositions have a number of uses. For instance, in the coating of metals to prevent rusting it is desirable to spray or brush an oil on a vertical metal surface while the oil is liquid under the conditions of agitation incident to brushing or spraying, and then have the oil gel and become solid as soon as quiescent so as to remain fixed on the surface and not run off. Other applications will be immediately apparent, such as the coating of metal parts during steps of manufacture to prevent rusting, coating of farm implements to prevent rust and other deterioration, and any other uses in which an oil coating to protect the material coated is desirable.

Another use of such a composition is in connection with a cutting oil. A plumber, for example, when cutting threads on a pipe, generally applies a cutting oil to the pipe or the die, and as an excess is usually used the excess drips on the floor. If this operation is being carried out in the household, and such threading operations are commonly done on the premises where plumbing is being installed, the objections are at once apparent. A thixotropic cutting oil on the other hand, by means of a suitable pump type dispenser, can be ejected as a liquid on the work or on the die, and then set up to a gel-like condition as soon as it is quiescent on the work, so as not to drip off on the floor. Another use of a thixotropic composition is as a substitute for greases, where the lubrication must adhere to the surface and not run off. Examples are die casting and forge die lubricants, slide and way lubricants, and other thickened lubricants.

Other uses include ointment bases to provide an ointment which can be rendered liquid while being rubbed on the skin, and then set to a solid when quiescent. This is a particularly advantageous use since the temperature of the skin is usually higher than the ambient temperature of the ointment, and except for any thixotropic properties, an ointment would tend to be more liquid on the skin than in the jar.

In any of the compositions contemplated herein for any uses, there may be included any compatible material as long as it does not destroy the thixotropic properties. For example, an amount of solids such as graphite, mica asbestos fibers, lamp black, aluminum powder and pigments may be included. In an ointment base any drum, perfume, coloring material may be included. The expression "consisting essentially of" is used to define the components essential for the thixotropic properties and does not exclude other components as long as they do not vitiate the purpose of the invention.

The invention will be described in connection with the following embodiments, but which are not to be construed as limitations on the invention of the scope described and hereinafter covered in the claims.

EXAMPLE I

Slushing oils.—The invention is well illustrated in connection with slushing oils and other similar oils applied to protect metal surfaces and to inhibit rust formation. Slushing oils are commonly made by mixing an oil of lubricating viscosity, such as 300 S. U. S., with petrolatum. A small amount of rosin may be included in some instances. These known slushing oils are used, for example, to coat manufactured steel which is being shipped to the final fabricators of commercial articles. They are ordinarily applied to the metal surfaces with a brush and after standing, in some instances for only a few hours and in other cases after some months, cracks appear in the oil coating film, a phenomena known as "splitting." The cracks or splits expose the metal at these points and rust protection is considerably decreased. It is characteristic of the petrolatum type slushing oils. Adjustment of the viscosity of the oil and the relative proportions of ingredients does not cure splitting and at best only alters the time that it takes to develop. In accordance with the invention a thixotropic slushing oil composition can be made which not only may be applied in relatively liquid form by brushing so as to greatly facilitate the application, but which gels quickly after standing and which is free from or has a minimum of the splitting action referred to. The following composition is illustrative:

	Per cent
Straw paraffin oil	97.5
Fully hydrogenated castor oil	2.5

These ingredients are mixed in accordance with any of the general methods to be described hereinafter. The straw paraffin oil is an acid-refined lubricating oil of 75 S. U. S. This composition when quiescent is a soft jelly type material and will just hold its shape in a glass bottle. After stirring or shaking it may be poured from the bottle as a liquid, and after again standing it assumes its jelly-like form. It is suitable for use as a slushing oil or for any other coating purpose and is substantially free from splitting.

EXAMPLE II

	Per cent
No. 300 red oil	92.5
"Oronite" sulfonate	5
Fully hydrogenated castor oil	2.5

No. 300 red oil is a Mid-Continent acid-refined oil having a viscosity of 300 S. U. S. The "Oronite" sulfonate is an alkyl aryl sodium sulfonate and may be replaced by any of the petroleum sulfonates which are well known as a class in this art for imparting anti-rust properties to a composition. The composition is useful as a slushing oil and as a rust inhibitor. It is free from splitting and has thixotropic properties. This composition also has the unusual and desirable property of setting up even more firmly when steel surfaces coated therewith are heated to temperatures as high as 130° F. as might occur in direct summer sunlight.

EXAMPLE III

	Per cent
No. 300 red oil	78.75
"Oronite" sulfonate	5
Petrolatum	15
Fully hydrogenated castor oil	1.25

The oil and the sulfonate have been described in the previous example. In this example, as compared with Example II, the amount of fully hydrogenated castor oil has been reduced in half and a substantial amount of petrolatum is em-

ployed, an ingredient commonly used in prior art slushing oils. Nevertheless this use of the small amount of fully hydrogenated castor oil imparts satisfactory thixotropic properties to the composition and markedly minimizes or eliminates splitting.

EXAMPLE IV

	Per cent
No. 225 red oil	97.5
Fully hydrogenated castor oil	2.5

No. 225 red oil is similar to the oil in Examples II and III except that it has a viscosity of 225 S. U. S. This composition is a semi-solid lubricant with a consistency of soft grease. It is suitable for the protection of tools and metal equipment against weather conditions and in some instances as a slushing oil. It is also useful in places where a very soft grease is desired. A comparison of this example with Example I will show that the composition is similar except for the greater viscosity of the oil base and the greater consistency in this mixture.

EXAMPLE V

	Per cent
Zone paraffin oil	99.5
Fully hydrogenated castor oil	0.5

Zone paraffin oil is an acid-refined oil having a viscosity of 150 S. U. S. The composition is a slightly gel-like oil with definite thixotropic flow characteristics and is suitable as a slide and way lubricant. Comparison with Examples I and IV will show that the oil base is intermediate in viscosity but the amount of fully hydrogenated castor oil is much less accounting for the less pronounced gel-like characteristics.

EXAMPLE VI

	Per cent
Solvent extracted lubricating oil S. A. E. 30	97.5
Fully hydrogenated castor oil	2.5

This composition is a more or less rigid semi-solid medium of very pronounced thixotropic properties, having the consistency of a medium grease. It can be used as a weather resisting lubricant in places where grease is ordinarily ordered. A comparison of this example with Examples I and IV shows that the use of a higher viscosity oil base increases the hardness of the final composition.

EXAMPLE VII

	Per cent
"Polarine" No. 50	97.5
Fully hydrogenated castor oil	2.5

"Polarine" No. 50 is a commercial lubricating oil having a viscosity of 1000 S. U. S. (S. A. E. No. 50). The composition is a semi-solid composition of a consistency of soft grease and useful as a lubricant where greases are used.

EXAMPLE VIII

	Per cent
Pennsylvania bright stock	99
Fully hydrogenated castor oil	1

Pennsylvania bright stock has a viscosity of 2200 S. U. S. This composition is similar to the composition in Example V, but more viscous and showing more pronounced thixotropic gel-like properties, it is useful as a slide and way lubricant. A further comparison of this example with Example V shows that the viscosity of the oil is much greater, and the amount of fully hydrogenated castor oil is larger, accounting for the more viscous and more pronounced thixotropic properties.

EXAMPLE IX

	Per cent
Wax slops	97
Fully hydrogenated castor oil	3

Wax slops is a lubricating oil fraction containing microcrystalline and paraffin wax which is difficult to separate from the oil and ordinarily little attempt is made to process it because of the difficulty of separating the wax. This oil base in some respects may be likened to an oil containing petrolatum and paraffin wax dissolved therein. The composition is an adhesive gelatinous semi-solid which becomes liquid on agitation and is applicable to surfaces with a spray type applicator. It is suitable as a rust inhibitor for application to the undersurfaces of automobiles and as a chromium plated surface preserver.

EXAMPLE X

	Per cent
Commercial cutting oil No. 1	97
Fully hydrogenated castor oil	3

The cutting oil in this example is available on the market and is a lubricating oil of medium viscosity mixed with 20% lard oil and containing 1½% of added reacted sulfur. The composition is an adhesive semi-solid lubricant having the consistency of very soft grease and readily applicable by a pump type squirt can. It is useful as a cutting oil particularly for hand tools which require no-drip characteristics.

EXAMPLE XI

	Per cent
Commercial cutting oil No. 2	95
Fully hydrogenated castor oil	5

The cutting oil in this example is available on the market and is a medium viscosity lubricating oil containing 2% of added reacted sulfur and 1½% chlorine in the form of a chlorinated wax. The composition is similar in characteristics to Example VIII but slightly more firm because of the larger amount of the fully hydrogenated castor oil. It is suitable for the same purposes.

EXAMPLE XII

	Per cent
Commercial cutting oil No. 1, 97% / Fully hydrogenated castor oil, 3%	90
Sulfur	10

The cutting oil is the same as that in Example X. The composition is a non-settling sulfur suspension in the form of a semi-solid lubricant similar to that in Example X. It is useful as a hand tool cutting oil having no drip characteristics with added torque reducing qualities.

EXAMPLE XIII

	Per cent
Wax slops, 97% / Fully hydrogenated castor oil, 3%	99
Aluminum powder	1

The wax slops are described in connection with Example IX. The composition is a silver lustre colored gel-like material applicable in the same way as the composition of Example IX and is a rust inhibitor for the rusted undersurfaces of automobiles.

EXAMPLE XIV

	Per cent
Wax slops, 97% / Fully hydrogenated castor oil, 3%	70
Asbestos fiber	30

The wax slops are defined in connection with Example IX. The composition is a matted gelatinous semi-solid with exceptionally good adhesive properties suitable as an undercoating of automobiles to check rusting.

EXAMPLE XV

	Per cent
Torch oil, 97.25% Fully hydrogenated castor oil, 2.75%	80
Powdered mica	20

Torch oil is a gas oil having a viscosity of 50 S. U. S. The composition is a semi-fluid oil with definite thixotropic properties in which mica is permanently suspended. It is suitable as a die casting lubricant for zinc and lead where even suspension of the particles is desirable.

EXAMPLE XVI

	Per cent
No. 1 bright stock	94
Fully hydrogenated castor oil	1
Powdered graphite	5

The No. 1 bright stock is a Mid-Continent bright stock having a viscosity of 4300 S. U. S. The composition is a fairly fluid oil but having thixotropic properties, and having graphite permanently suspended therein. It is applicable with a brush and suitable as a forge die lubricant.

EXAMPLE XVII

	Per cent
Ordinary castor oil	95
Fully hydrogenated castor oil	5

The composition is a semi-solid translucent material having a grease-like consistency with pronounced thixotropic properties and is suitable as an ointment base or for lubricating applications in which castor oil is used.

EXAMPLE XVIII

	Per cent
Medium white oil	97.5
Fully hydrogenated castor oil	2.5

The medium white oil has a viscosity of 200–300 S. U. S. at 100° F. and is of the type suitable for medicinal use. The composition is a white semi-solid thixotropic structure of grease-type consistency. It is suitable as an ointment base for instance, to which a sun filtering compound can be added for making a sunburn protective cream. It is also suitable as a substitute for a soft grease in the food industry where a grease would be desirable such as in sealing cans, but which cannot now employ a grease because of the taste which would be imparted to food by the soap in the grease.

Method of preparation

In preparing any and all of the above compositions the oil base and the fully hydrogenated castor oil should be admixed under certain preferred conditions. When the composition is to include added materials, such as an anti-rust additive, or semi-solids, such as aluminum powder, mica, or graphite, these can be mixed in later or at the same time that the oil base and the fully hydrogenated castor oil are mixed.

The fully hydrogenated castor oil is not soluble in the oil base under the usual temperature conditions of use and must be incorporated therewith so as to be in an extremely finely dispersed form, if the composition is to have the optimum thixotropic properties. The extent of the thixotropy is, among other things, a function of particle size. It is desirable that the particle size of the fully hydrogenated castor oil in the oil base be extremely small (sub-microscopic) so that there is substantially no light scattering or Tyndall effect.

A preferred method of making the compositions is to melt the fully hydrogenated castor oil in a portion of the oil base at a temperature above the melting point of the fully hydrogenated castor oil, such as 95 to 100° C. At this temperature it is soluble in the oil base. This hot solution of the fully hydrogenated castor oil is then added to the remainder of the oil base with agitation so that the mixture assumes a temperature below the melting point of the fully hydrogenated castor oil. Additional chilling may be used. One such method is to feed a stream of 50 to 90 parts of the oil base at room temperature or below and a stream of 50 to 10 parts of hot oil base containing the melted fully hydrogenated castor oil so that the two streams enter a gear pump. The intense agitation obtained as the two streams pass through the gear pump and the cooling due to the relatively large stream of cooler oil base results in the requisite fine dispersion.

Another method may be used in which the fully hydrogenated castor oil is melted in all of the oil base, and the entire solution rapidly chilled with agitation, such as can be done with a turbomixer. It will be understood that other equivalent methods may be used in which rapid chilling, preferably with agitation, so as to obtain the requisite small particle size.

In order to determine and compare the thixotropic properties of the composition of the invention with those of the prior art a test was developed which measured the static forces in fundamental units. Prior studies of thixotropic compositions have been made primarily with various types of viscosimeters which deal with the dynamic behavior of the compositions during or after transition from the gel to the liquid phase. The test developed, however, measures the time and the stresses required to initiate the transition from the gel to the liquid phase. This initiation of the breakdown may be regarded as the static yield value. This is the important value with which to appraise the usefulness of a thixotropic composition. For example, after a thixotropic slushing oil has been applied to the surface of a machine and gelled, what forces, such as shock or jar, will cause the gel to liquefy so that it would move on or from the surface?

In accordance with this test a plate of definite area in square centimeters is immersed in the thixotropic composition to be tested and connected to a left-hand side of a balance, and the right-hand side is weighted to balance so that no force is exerted on the plate when immersed in the thixotropic composition. A sample of the thixotropic composition is placed in a beaker and allowed to stand at least one hour to reset. The plate is immersed so as to minimize and equalize any gel breakdown over the immersed area of the plate. Weights are then applied to the right-hand side of the balance to such an extent and such a rate that the plate on the left-hand side of the balance is lifted from the thixotropic composition 1 mm. in 10 seconds. The static yield stresses in dynes per square centimeter can be readily determined because the immersed area of the plate is in square centimeters and the force in a given time is readily converted to dynes.

Measurements show that the yield forces are a linear function of the area of the plate immersed and that there is no necessity for zero corrections.

Applying this test to a composition made up of No. 300 red oil an acid treated oil of a viscosity of 300 S. U. S. with various amounts of fully hydrogenated castor oil (in accordance with the invention) and petrolatum (in accordance with the prior art) gave the following results.

Gelling Agent	Percent Present	Yield Stress (dynes/cm²)
Fully hydrogenated Castor Oil	1.0	86
	2.0	160
	2.5	210
	3.5	370
	5.0	1,760
	10.0	4,500
Petrolatum	25.0	32
	27.5	38
	30.0	51

Plotting the percent gelling agent against the logarithm of the yield stress shows that the petrolatum-containing composition gives almost a straight line relationship. However it shows that there is a threshold requirement of about 15% petrolatum. When less than this is used the mixtures are non-thixotropic. It also indicates that the amount of the yield stress obtainable is not very high even when exceptionally large amounts of the petrolatum are used.

On the other hand the compositions containing the fully hydrogenated castor oil pass through the zero point, indicating that even extremely small amounts of the fully hydrogenated castor oil impart a proportionate degree of thixotropy. The slope of the curve is such as to show that extremely high static yield values can be obtained without resorting to large amounts of the fully hydrogenated castor oil.

It has also been observed that some prior art thixotropic compositions tend to creep, that is, they yield after a certain length of time during which stress is applied, even though they do not yield immediately, say in 10 seconds after the stress is applied. In order to evaluate this property, compositions containing fully hydrogenated castor oil and petrolatum in amounts to give similar viscosities of a Brookfield viscosimeter were compared. The results are shown in the following table:

Gelling Agent	Brookfield Viscosity		Yield	
	Initial	30 Minute	Stress in dynes/cm.²	Time in Minutes
2.5% Fully hydrogenated Castor Oil	16,600	4,700	30	3,000.0
30% Petrolatum	12,200	6,300	24	1.0
Do	12,200	6,300	34	0.83

From this it will be seen that when hardened castor oil is employed in the small amount of 2½% as compared with 30% petrolatum and upon the application of equal yield stress, the time for creep is almost infinitely greater in the case of a composition made in accordance with the invention.

I am aware that it has been proposed hereinbefore to make a thixotropic lubricating jelly by the mixing of a high viscosity index oil, such as an oil having a 95 V. I. with a relatively large proportion of an amorphous wax alone or with other waxes such as crude montan wax. These are made by mixing at a high temperature and merely allowing the mixture to cool. For instance, about 61 parts of the 95 V. I. oil, 20.1 parts of amorphous wax (155° F., M. P.) and 1 to 5 parts of crude montan (170° F., M. P.) are heated until fluid and allowed to cool. According to this prior art, crude montan wax alone will not form thixotropic jellies with this oil, and while refined montan wax alone with this oil will form a thixotropic jelly, 10 parts of the refined montan wax are required. In contrast with this state of the prior art, my invention does not require the use of a high V. I. oil and requires much smaller amounts of the fully hydrogenated castor oil to obtain excellent thixotropy. Furthermore, the method by which my compositions are made also shows the unique properties of fully hydrogenated castor oil in this regard, since my compositions, if made by the prior art processes referred to would not contain the fully hydrogenated castor oil in such small particles as to have the optimum thixotropic properties.

The amount of the fully hydrogenated castor oil required in accordance with my invention is generally not over 5% to obtain a semi-solid composition of grease-like texture and in most instances amounts of the order of 1 to 3% are satisfactory in accordance with my invention to obtain definite thixotropic properties.

While I have described my invention with reference to fully hydrogenated castor oil as the best mode of achieving the desirable results, I do not intend to exclude equivalent materials or other modifications or variations within the following claims.

We claim:

1. A thixotropic oil having a gel-like to solid consistency when quiescent and fluid properties under conditions of agitation, consisting essentially of fully hydrogenated castor oil dispersed as solid particles of submicroscopic size in a liquid oil base, said hydrogenated castor oil being present in an amount to impart thixotropy to the oil, but not over 5% by weight of the composition.

2. A thixotropic oil in accordance with claim 1 in which the oil is a mineral oil of lubricating viscosity.

3. A thixotropic oil in accordance with claim 1 in which the hydrogenated castor oil is present in an amount within the range from 0.5 to 5%.

4. A thixotropic oil in accordance with claim 1 which contains a rust inhibitor.

5. A thixotropic oil in accordance with claim 1 having a compatible finely-divided solid suspended therein.

6. A thixotropic oil in accordance with claim 1 having graphite suspended therein.

7. A thixotropic slushing oil having a gel-like to solid consistency when quiescent and fluid properties under conditions of agitation, consisting essentially of fully hydrogenated castor oil dispersed as solid particles of submicroscopic size in a liquid mineral oil base of a viscosity of 75 to 3000 S. U. S. at 100° F., and containing 1% to 10% of a petroleum sulfonate rust inhibitor, said hydrogenated castor oil being present in an amount to impart thixotropy to the oil, but not over 5% by weight of the composition.

8. A method of making a thixotropic oil composition which comprises heating solid fully hydrogenated castor oil in a liquid oil base to a temperature above the melting point of the fully hydrogenated castor oil to dissolve the same in the oil base, and cooling said heated mixture to a temperature below the melting point of the fully hydrogenated castor oil to disperse the same in the oil base as solid particles of sub-

microscopic size, said hydrogenated castor oil being in an amount not over 5% to impart a gel-like to solid thixotropic consistency to said composition when quiescent and fluid properties under conditions of agitation.

9. A method of making a thixotropic oil composition which comprises heating solid fully hydrogenated castor oil in a liquid oil base to a temperature above the melting point of the fully hydrogenated castor oil to dissolve the same in the oil base, and quickly cooling said heated mixture with agitation to a temperature below the melting point of the fully hydrogenated castor oil to disperse the same in the oil base as solid particles of submicroscopic size, said hydrogenated castor oil being in an amount not over 5% to impart a gel-like to solid thixotropic consistency to said composition when quiescent and fluid properties under conditions of agitation.

10. A method of making a thixotropic oil composition which comprises heating solid fully hydrogenated castor oil in a liquid oil base to a temperature above the melting point of the fully hydrogenated castor oil to dissolve the same in the oil base, and quickly cooling said heated mixture by mixing the same with an additional amount of said oil base at a lower temperature to reduce the mixture with agitation to a temperature below the melting point of the fully hydrogenated castor oil to disperse the same in the oil base as solid particles of submicroscopic size, said hydrogenated castor oil being in an amount not over 5% to impart a gel-like to solid thixotropic consistency to said composition when quiescent and fluid properties under conditions of agitation.

FRANKLIN VEATCH.
ELLIS C. PERSING, JR.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,457,169	Howe et al.	May 29, 1923
1,617,077	Nill et al.	Feb. 8, 1927
1,795,993	Bransky	Mar. 10, 1931
2,356,863	McLaren et al.	Aug. 29, 1944
2,412,634	Schwartz	Dec. 17, 1946
2,447,506	Jubanowsky	Aug. 24, 1948
2,493,483	Francis et al.	Jan. 3, 1950
2,537,629	Brown	Jan. 9, 1951

FOREIGN PATENTS

Number	Country	Date
576,089	Great Britain	Mar. 19, 1946