HYDROXY PIVALYL HYDROXY PIVALATE ESTERS AND METHOD OF TREATING TEXTILE FILAMENTS THEREWITH

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References Cited

UNITED STATES PATENTS

3,464,922 9/1969 Bernholz et al. 252/8.6
3,644,143 2/1972 Flett 252/8.6 X

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ABSTRACT

The disclosure is directed to hydroxy pivalyl hydroxy pivalate esters, to textile finishes therefrom, and to the method of applying these finishes to synthetic linear organic polymer filaments. For example, the hydroxy pivalyl hydroxy pivalate mixed diester of capric, lauric, myristic, palmitic, stearic, and oleic acids in an aqueous emulsion may be used as a finish for thermoplastic fibers.

21 Claims, No Drawings
HYDROXY PIVALYL HYDROXY PIVALATE ESTERS AND METHOD OF TREATING TEXTILE FILAMENTS THEREWITH

This is a continuation-in-part of our prior copending application Ser. No. 236,963, filed Mar. 22, 1972 now abandoned. The present invention relates to finishes for filaments of synthetic linear organic polymers. The present invention further relates to a method of applying these finishes to synthetic linear organic polymer filaments.

Synthetic linear organic polymers, for example, polyamides such as nylon as well as polyester are commonly formed into filaments by the process of melt-spinning, and the resultant filaments are drawn in the solid state in order to develop a high degree of tenacity so that they become suitable for textile purposes. To facilitate the drawing of the filaments and other textile processing to which they may be submitted, it is necessary to apply a finish to the newly melt spun material, in order to reduce friction during passage of the filaments over metal surfaces in textile machinery. Such reduction in coefficient of friction between the fiber-to-metal surfaces prevents filament abrasion. The finishes must be capable of lubricating the filaments so that they do not break during drawing. In the case of multifilament yarn it is furthermore necessary that the finish provide some degree of balanced cohesion between the constituent filaments of the yarn. This cohesion is particularly important in flat warp knitting. It is also very desirable that the finish have a high degree of oxidation resistance, including resistance to both discoloration and formation of insoluble resinous or polymeric compounds. It is further desirable that the finish exhibit high temperature stability and resistance to smoke generation at temperatures encountered during the processing of the synthetic linear organic polymer filaments. These latter characteristics are particularly applicable to the "hot stretching" operation used during the production of synthetic linear organic polymers.

It is an object of the present invention to provide finishes for filaments of synthetic linear organic polymers. Another object of the present invention is to provide finishes for filaments of synthetic linear organic polymers to reduce the coefficient of friction between fiber-to-metal surfaces.

A further object of the present invention is to provide finishes for filaments of synthetic linear organic polymers to provide balanced cohesion between the fiber-to-fiber surfaces.

A still further object of the present invention is to provide finishes for filaments of synthetic linear organic polymers that exhibit thermal stability and resistance to smoke generation, particularly during hot-stretch processing to orient the polymer in order to obtain maximum uniformity of tensile strength, such as in nylon and polyester tire cord production.

A still further object of the present invention is to provide a method of applying finishes to filaments of synthetic linear organic polymers.

A further object is to provide an improvement in the manufacture of filaments and yarns of synthetic linear organic polymers by treating such filaments or yarns with a finishing composition having lubricity and resistance to oxidation and discoloration at elevated temperatures.

A further object is to provide a tire yarn lubricating composition which will lead to high temperature processing continuity, and yield polyester tire cords having excellent adhesion to rubber and a high resistance to flex fatigue.

The above objects and still further objects of the invention will immediately become apparent to those skilled in the art after consideration of the following preferred embodiments thereof, which are provided by way of example and not by way of limitation.

Briefly, the above objects are provided by the use of hydroxy pivalyl hydroxy pivalate (HPHP) esters which contain stable neopentyl configurations in their chemical structure. These chemical structures exhibit low volatility and high thermal stability, the latter resulting in reduced fiber strength loss during high temperature processing and high temperature service conditions. HPHP is formed by reacting hydroxy pivalyl alcohol with hydroxy pivalic acid and is also referred to in the literature as neopentylglycol monohydroxy pivalate. HPHP is commercially available from Eastman Chemical Products, Inc. A method of making HPHP is also set forth in U. S. Pat. No. 3,057,911.

Accordingly, the present invention comprises finishes for filaments of synthetic linear organic polymers which are hydroxy pivalyl hydroxy pivalate (HPHP) esters represented by the general formula:

\[
\begin{align*}
R_1\text{OCH}_2\text{CH}_2\text{O}-\text{CH}_2\text{-O-CH}_3
\end{align*}
\]

wherein, \(R_1\) and \(R_2\) are radicals alkanolic or alkenolic monocarboxylic acid having from 2 to 24 carbon atoms and preferably taken from the fatty acids. Both simple HPHP esters, i.e., those where \(R_1\) and \(R_2\) are the same radical, and mixed HPHP esters are contemplated in the present invention. While it is preferred that the radicals \(R_1\) and \(R_2\) be derived from saturated and unsaturated straight chain acids, groups derived from branched chain acids such as the neo acids, for example neononanoic acid, etc., or iso acids such as isostearic acid, are contemplated. Typical specifications of some of the aforesaid products are summarized in Table 1 hereinafter.

A high molecular weight glycol, HPHP, by virtue of stable neo configurations (at \(C^2\) and \(C^4\), in the above formula) in its chemical structure, exhibits high thermal stability and low volatility. This suggests that other neoglycol esters will also provide thermally stable fiber finishes.

The methods of preparation of the HPHP esters are known in the art of esterification. In general, two moles of acid or acid mixture is reacted, generally, with refluxing, with one mole HPHP in the presence of toluene or other suitable diluent. The uncatalyzed reaction occurs at temperatures ranging from 150°C. to 265°C. and over a period of time ranging from 4 to 12 hours until the theoretical amount of water of reaction is released and collected. The reaction may also be catalyzed with, for instance, an aromatic sulfonic acid, such as para toluene sulfonic acid, which will substantially reduce the reaction time. The resultant substantially completely esterified HPHP ester is then recovered, such as by stripping under vacuum, to obtain the ester product having a low free fatty acid value.
Some suitable illustrative esters coming within the scope of this invention are HHPF mono acetate-
monoooleate, HHPF dioleate, HHPF distearate, HHPF
dilaurate, HHPF diheptanoate, HHPF di-caparate,
HHPF mononoleate, HHPF monopalmitate, HHPF
mono iso-nonanoate-monostearate, etc. Mixed acids
can be also employed to prepare HHPF esters.

<table>
<thead>
<tr>
<th>TYPICAL SPECIFICATIONS OF HHPF ESTERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HHPF Ester of Free Fatty</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Oleic Acid</td>
</tr>
<tr>
<td>Stearic Acid</td>
</tr>
<tr>
<td>Palmitic Acid</td>
</tr>
<tr>
<td>Palmitic 30%</td>
</tr>
<tr>
<td>Lauric 70% Acid</td>
</tr>
<tr>
<td>Lauric Acid</td>
</tr>
<tr>
<td>Nonanoic Acid</td>
</tr>
<tr>
<td>Iso Nonanoic Acid</td>
</tr>
<tr>
<td>Heptanoic Acid</td>
</tr>
</tbody>
</table>

The finishes may be applied directly to the filaments of the synthetic linear organic polymers or dissolved in a solvent or as an aqueous emulsion. In general, the method of application is governed by the percentage of lubricant, type of polymer, type of process, and the type of equipment available. The mode of application of the finish to the yarn filaments will depend upon the system which is most suited to the method of synthetic linear polymer processing. Generally, from 0.5 to 15 percent finish by weight of the organic polymer is applied thereto. The finish may be further applied by internal addition to the organic polymer prior to melt spinning of it with subsequent bleeding to the surface.

In preparing an aqueous emulsion containing the finish, any singular surfactant or combination of surfactants compatible with the finish capable of forming a stable emulsion may be utilized. A sample aqueous emulsion is prepared, using conventional procedures, with the following proportional ingredients:

**EXAMPLE A**

- 60 parts HHPF esters
- 10 parts glycerol monoooleate
- 15 parts ethoxylated about 25 mole castor oil
- 15 parts polyethylene glycol 400 dilaurate
- 85 parts water, all of the above by weight.

Other suitable surfactants are sulfated glycerol trioileate, ethoxylated tridecylic alcohol and polyglycerol esters such as decaglycerol tetraoleate, triethanolamine oleate, decaglycerol dilaurate, decaglycerol dicaprylate, ethoxylated (8–15 mole) nonyl phenol, etc., which can be used singly or in combination as can those set forth in the above example. Generally, the aqueous emulsion contains from 1 to 25% nonaqueous solids which in turn consists of from 50 to 80 parts of the finish and 50 to 20 parts of the emulsifier. All percentages herein are by weight.

Suitable solvents for use in applying the finishes includes the lower molecular weight alkanols, such as ethanol or propanol, ketones such as acetone, and hydrocarbons such as toluene or petroleum ether. The solvent selected should be compatible with the polymer to which it is applied.

Other ingredients such as antistatic agents, emulsification acids, lubricant acids to impart cohesion properties, etc. may be used in conjunction with the finishes of the present invention provided they do not seriously affect or alter the characteristics of said finishes.

The invention includes the application of the finishes to the filaments and the filaments which have been so treated. The term "filaments" is to be understood as including monofilamentous and multifilamentous yarn whether twisted or not.

The synthetic linear organic polymers include polymers such as polyhexamethylenglycol sebacamide, poly-

kappa-aminoundecanoic acid, polyeipsilon-
caprolactam, etc., acrylic polymers made largely from acrylo-nitrile, polyolefins such as polyethylene, poly-
ethylene, polypropylene, etc., polyesters such as poly-
ethane terephthalate, and other polyesters formed by reaction of a dihydric alcohol and a diacid, etc., and polyureas such as polyhexamethylene urea, etc.

The following examples further describe the invention.

**EXAMPLE 2**

Various HHPF esters formed according to the formulation previously set forth were tested for thermal stability, resistance to smoke generation and discoloration in comparison to commercial butyl stearate textile fiber finish. Both the esters of the present invention and the control finish were subjected to strong oxidizing conditions, namely, each material was placed as a very thin film in an aluminum dish which was exposed to high temperature under atmospheric conditions.

The results in Table 2 clearly illustrate the high thermal stability, greater resistance to discoloration and low amount of smoke generation exhibited by the HHPF esters as compared to the commercial butyl stearate finish.

| TABLE 2 |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | Stearate | Oleate | Palmitate | Laurate | Heptanoate | Butyl Stearate |
| 20 min. at 160°C |            |        |          |         |           |                 |
| Weight loss %   | Nil      | Nil    | Nil      | 0.6    | 1.3        | Light          |
| Fuming Discoloration | None     | None   | None     | None   | None      | Light          |
| 20 min. at 260°C |            |        |          |         |           |                 |
| Weight loss %   | 0.5      | 0.75   | 0.7      | 1.0    | 13.0      | Light          |
| Fuming Discoloration | None     | None   | None     | None   | None      | Light          |
|                  |            |        |          |         |           | Medium         |

**TABLE 2**
5
EXAMPLE II

The fiber-to-fiber friction characteristics of 840/192 denier polyester yarn were tested by the solvent application of 1% HPHP ester by weight of the yarn in comparison to a control yarn from which the finish had been scoured. Conditions of test were a temperature of 70°F. and a relative humidity of 25 percent. The attenuation was as follows:

<table>
<thead>
<tr>
<th>Turn of Yarn</th>
<th>14% (340°) times 20 gms.</th>
<th>Chart Speed</th>
<th>2.5 mm/sec.</th>
<th>Speed of Yarn</th>
<th>0.2 mm/sec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (scoured)</td>
<td>90</td>
<td>35</td>
<td>90</td>
<td>35</td>
<td>90</td>
</tr>
<tr>
<td>HPHP di oleate</td>
<td>65</td>
<td>50</td>
<td>65</td>
<td>50</td>
<td>65</td>
</tr>
<tr>
<td>HPHP di heptanoate</td>
<td>60</td>
<td>50</td>
<td>60</td>
<td>50</td>
<td>60</td>
</tr>
</tbody>
</table>

The results emphasize significant reduction in coefficient of friction between the polyester filament treated with the finishes of the present invention. The charted interval between slip-sticks is indicative of relative cohesion. The greater the charted interval, the greater the measure there is in lubricity, and conversely for smaller intervals. It can therefore be seen that the relative cohesion or lubricity between the consecutive fibers is significantly improved upon the addition of the HPHP ester to the filament.

EXAMPLE III

The fiber-to-metal friction characteristics of 840/192 denier polyester yarn which had been treated with a 1% solvent application of the HPHP ester, versus such characteristics of a scoured (without finish) yarn. Conditions of the test were as follows:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>72°F</th>
<th>Relative Humidity</th>
<th>25%</th>
<th>Speed of Yarn</th>
<th>100 m/min.</th>
<th>Total Weight of Pulley</th>
<th>100 gms.</th>
<th>Radiants</th>
<th>5</th>
</tr>
</thead>
</table>

The differential friction in grams, which is indicative of greater friction as it increases, is expressed in grams:

<table>
<thead>
<tr>
<th>Finish</th>
<th>Differential Friction</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (Scoured Control)</td>
<td>190</td>
</tr>
<tr>
<td>HPHP di oleate</td>
<td>110</td>
</tr>
<tr>
<td>HPHP heptanoate</td>
<td>115</td>
</tr>
</tbody>
</table>

The foregoing results indicate the superior fiber-to-metal lubricity of HPHP esters.

EXEMPLE IV

The smoke, fire and flash characteristics (A.O.C.S. Method Ce-9a-48) of the HPHP esters were compared to those of a commercial butyl stearate filament finish. The results which are as follows illustrates the minimized tendency of HPHP esters to cause smoke formation:

<table>
<thead>
<tr>
<th>Finish</th>
<th>Smoke,°F</th>
<th>Flash,°F</th>
<th>Fire,°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butyl stearate</td>
<td>245</td>
<td>380</td>
<td>400</td>
</tr>
<tr>
<td>HPHP di ester of -</td>
<td>375</td>
<td>590</td>
<td>625</td>
</tr>
<tr>
<td>Stearic Acid</td>
<td>410</td>
<td>585</td>
<td>640</td>
</tr>
<tr>
<td>Oleic Acid</td>
<td>375</td>
<td>555</td>
<td>605</td>
</tr>
<tr>
<td>Palmitic acid</td>
<td>375</td>
<td>555</td>
<td>605</td>
</tr>
</tbody>
</table>

EXAMPLE V

10 Cords of 3 ply 1,300 denier polyester yarn treated with commercial finish (control) and with a self-emulsifiable composition of present invention were molded into test specimens using a rubber carcass stock.

The stock may be for example of natural, SBR or natural-SBR stock. After removal from the mold, adhesion can be determined by measuring the force required to separate the cord from the rubber. The measurement may be made at room temperature or at an elevated temperature and the force required for separation reported in pounds.

To determine U-adhesion, the treated cords were molded for 20 minutes at 290°F. into the rubber in a suitable mold which produced U-shaped loops of cord embedded in ¼ inch depth of rubber. These cord rubber assemblies were heated to 250°F. in a special attachment for tensile tester and the force necessary to pull one end of the U out of the rubber was measured at a rate of separation of 30 cms/minutes.

Cord fatigue life can be determined by the test described in ASTM Method D-885. In this test, the specimen is subjected to alternating compression and tension forces and the fatigue life is the number of cycles (commonly kilocycles) required to cause failure.

EXAMPLE VI

A tire cord treated with the finish of this invention (HPHP di stearate) and similar tire cord treated with commercial finish were maintained at 300°F. for 48 hours in a sealed tube with oxygen (1 lb. pressure). Percentile breaking strength retention based on the original breaking strength prior to aging was expressed as thermal stability. A higher figure indicates the greater strength retention and less deterioration of the cord by finish at elevated temperature.

Breaking strength was measured according to ASTM Test Method D-2256.
EXAMPLE VII

Aqueous emulsion was prepared according to the formulation set forth in Example A. The HPHP esters of the following acids were used: acetic, propenoic, butyric, crotonic, valeric, caproic, caprylic, capric, lauric, myristic, palmitic, stearic, arachidic, behenic, lignoceric, lauroleyl, myristoleic, palmitoleic, oleic, gadoletic, erucic, ricinoleic, linoleic, linolenic, eleostearic, licanic, arachidonic, and clupanodonic were used. Good properties as set forth above were noted.

EXAMPLE VIII

Example VII was repeated using 99 parts by weight of water and 1 part by weight of the remaining materials. Good properties as set forth above were noted.

EXAMPLE IX

Example VII was repeated using 75 parts by weight of water and 25 parts by weight of the remaining materials. Good properties as set forth above were noted.

EXAMPLE X

Example VIII was repeated using 50 parts by weight of the finish (HPHP esters) and 50 parts by weight of the surface active emulsifier. Good properties as set forth above were noted.

EXAMPLE XI

Example VIII was repeated using 80 parts by weight of the finish and 20 parts by weight of the surface active emulsifier. Good properties as set forth above were noted.

EXAMPLE XII

Example IX was repeated using 50 parts by weight of the finish (HPHP esters) and 50 parts by weight of the surface active emulsifier. Good properties as set forth above were noted.

EXAMPLE XIII

Example IX was repeated using 80 parts by weight of the finish and 20 parts by weight of the surface active emulsifier. Good properties as set forth above were noted.

The above discussion relates to filamentous materials as stated for use in a continuous operation wherein the filaments do not remain in a bath of the emulsion during treatment. In accordance with a second embodiment of the invention, it is desired to coat staple fibers of about one and one-half inches in length with the emulsion disclosed hereinabove by a non-continuous process wherein the staple fibers are placed in a vat or the like for an extended period of time and then removed. In this process, the amount of finish (diester) plus surfactant is from about 0.4 to about 2 percent by weight with the remainder water. Again, the ratio of finish to surfactant is from 50 to 80 percent by weight finish and 50 to 20 percent by weight surfactant.

Though the invention has been described with respect to specific preferred embodiments thereof, many variations and modifications will immediately become apparent to those skilled in the art. It is therefore the intention that the appended claims be interpreted as broadly as possible in view of the prior art to include all such variations and modifications.

What is claimed is:

1. An aqueous emulsion for application to synthetic linear organic polymer filaments in a continuous operation which consists essentially of:
   a. a hydroxy pivalyl hydroxy pivalate diester represented by the formula:
      
      \[
      \text{CH}_3
      \begin{array}{c}
      -\text{OCH}_2
      \end{array}
      \begin{array}{c}
      -\text{CH}_2
      \end{array}
      \begin{array}{c}
      -\text{OCH}_2
      \end{array}
      \begin{array}{c}
      -\text{CH}_3
      \end{array}
      
      \text{R}_1\text{OCH}_2
      \begin{array}{c}
      -\text{CH}_2
      \end{array}
      \begin{array}{c}
      -\text{O}\quad
      \end{array}
      \begin{array}{c}
      -\text{CH}_2\text{OR}_2
      \end{array}
      \begin{array}{c}
      -\text{CH}_3
      \end{array}
      \]

      wherein \( \text{R}_1 \) and \( \text{R}_2 \) are taken from the class consisting of radicals of alkanolic and alkenolic monocarboxylic acids having from 2 to 24 carbon atoms,
   b. A surface active emulsifier compatible with said diester, and
   c. water,

   said emulsion containing from about 1 to about 25 percent nonaqueous solids, said nonaqueous solids containing from about 50 to about 80 percent of said diester and from about 50 to about 20 percent of said surface active emulsifier, all of the above by weight.

2. An aqueous emulsion as set forth in claim 1, wherein said acids acids have 8 to 24 carbon atoms.

3. An aqueous emulsion according to claim 1, wherein said diester is taken from the class consisting of hydroxy pivalyl hydroxy pivalate diastearate, hydroxy pivalyl hydroxy pivalate dioleate, hydroxy pivalyl hydroxy pivalate dipalmmitate, hydroxy pivalyl hydroxy pivalate dilaurate, and hydroxy pivalyl hydroxy pivalate diheptanoate.

4. An aqueous emulsion according to claim 1, wherein said diester is taken from the class consisting of hydroxy pivalyl hydroxy pivalate diastearate, hydroxy pivalyl hydroxy pivalate dioleate, hydroxy pivalyl hydroxy pivalate dipalmmitate, hydroxy pivalyl hydroxy pivalate dilaurate and hydroxy pivalyl hydroxy pivalate diheptanoate.

5. An aqueous emulsion according to claim 1, wherein said surface active emulsifier is taken from the class consisting of glycerol monooleate, ethoxylated (about 25 moles) castor oil, polyethylene glycol 400 dilaurate, sulfated glycerol trioleate ethoxylated tridecyl alcohol, and the polyglycerol esters decaglycerol tetraoleate, triethanolamine olate, decaglycerol dilaurate, decaglycerol dicaprylate and ethoxylated (8-11 moles) nonyl phenol.

6. An aqueous emulsion according to claim 2, wherein said surface active emulsifier is taken from the class consisting of glycerol monooleate, ethoxylated (about 25 moles) castor oil, polyethylene glycol 400 dilaurate, sulfated glycerol trioleate ethoxylated tridecyl alcohol, and the polyglycerol esters decaglycerol tetraoleate, triethanolamine olate, decaglycerol dilaurate, decaglycerol dicaprylate and ethoxylated (8-11 moles) nonyl phenol.

7. An aqueous emulsion according to claim 3, wherein said surface active emulsifier is taken from the class consisting of glycerol monooleate, ethoxylated (about 25 moles) castor oil, polyethylene glycol 400 dilaurate, sulfated glycerol trioleate ethoxylated tridecyl alcohol, and the polyglycerol esters decaglycerol tetraoleate, triethanolamine olate, decaglycerol dilaurate, decaglycerol dicaprylate and ethoxylated (8-11 moles) nonyl phenol.
8. An aqueous emulsion according to claim 4, wherein said surface active emulsifier is taken from the class consisting of glycerol monooleate, ethoxylated (about 25 moles) castor oil, polyethylene glycol 400 dilurate, sulfated glycerol trioleate ethoxylated tridecyl alcohol, and the polyglycerol esters decaglycerol tetraoleate, triethanolamine oleate, decaglycerol dilurate, decaglycerol dicaprylate and ethoxylated (8-11 moles) nonyl phenol.

9. An aqueous emulsion for application to staple fibers in a non-continuous which consists essentially of:
   a. a hydroxy pivalyl hydroxy pivalate diester represented by the formula:

   \[
   \text{CH}_3 \quad \text{O} \quad \text{CH}_3 \quad \text{O} \quad \text{CH}_3 \quad \text{O} \quad \text{CH}_3 \quad \text{O} \quad \text{CH}_3
   \]

   wherein \( R_1 \) and \( R_2 \) are taken from the class consisting of radicals of alkanoic and alkenoic monocarboxylic acids having from 2 to 24 carbon atoms, and
   b. a surface active emulsifier compatible with said diester, and
   c. water.

   said emulsion containing from about 0.4 to about 2 percent non-aqueous solids, said non-aqueous solids containing from about 50 to about 80 percent of said diester and from about 50 to about 20 percent of said surface active emulsifier, all of the above by weight.

10. An aqueous emulsion for application to staple fibers in a non-continuous process as set forth in claim 9, wherein said acids have from 8 to 24 carbon atoms.

11. An aqueous emulsion according to claim 9, wherein said diester is taken from the class consisting of hydroxy pivalyl hydroxy pivalate diololate, hydroxy pivalyl hydroxy pivalate diololate, hydroxy pivalyl hydroxy pivalate dipalmitate, hydroxy pivalyl hydroxy pivalate dilulate, and hydroxy pivalyl hydroxy pivalate diheptanoate.

12. An aqueous emulsion according to claim 10, wherein said diester is taken from the class consisting of hydroxy pivalyl hydroxy pivalate diololate, hydroxy pivalyl hydroxy pivalate diololate, hydroxy pivalyl hydroxy pivalate dipalmitate, hydroxy pivalyl hydroxy pivalate dilulate, and hydroxy pivalyl hydroxy pivalate diheptanoate.

13. An aqueous emulsion according to claim 9, wherein said surface active emulsifier is taken from the class consisting of glycerol monooleate, ethoxylated (about 25 moles) castor oil, polyethylene glycol 400 dilurate, sulfated glycerol trioleate ethoxylated tridecyl alcohol, and the polyglycerol esters decaglycerol tetraoleate, triethanolamine oleate, decaglycerol dilurate, decaglycerol dicaprylate and ethoxylated (8-11 moles) nonyl phenol.

14. An aqueous emulsion according to claim 10, wherein said surface active emulsifier is taken from the class consisting of glycerol monooleate, ethoxylated (about 25 moles) castor oil, polyethylene glycol 400 dilurate, sulfated glycerol trioleate ethoxylated tridecyl alcohol, and the polyglycerol esters decaglycerol tetraoleate, triethanolamine oleate, decaglycerol dilurate, decaglycerol dicaprylate and ethoxylated (8-11 moles) nonyl phenol.

15. An aqueous emulsion according to claim 11, wherein said surface active emulsifier is taken from the class consisting of glycerol monooleate, ethoxylated (about 25 moles) castor oil, polyethylene glycol 400 dilurate, sulfated glycerol trioleate ethoxylated tridecyl alcohol, and the polyglycerol esters decaglycerol tetraoleate, triethanolamine oleate, decaglycerol dilurate, decaglycerol dicaprylate and ethoxylated (8-11 moles) nonyl phenol.

16. An aqueous emulsion according to claim 12, wherein said surface active emulsifier is taken from the class consisting of glycerol monooleate, ethoxylated (about 25 moles) castor oil, polyethylene glycol 400 dilurate, sulfated glycerol trioleate ethoxylated tridecyl alcohol, and the polyglycerol esters decaglycerol tetraoleate, triethanolamine oleate, decaglycerol dilurate, decaglycerol dicaprylate and ethoxylated (8-11 moles) nonyl phenol.

17. A method of applying a finish to a synthetic linear organic polymer filament, which comprises the steps of:
   a. providing a synthetic linear organic polymer filament, and
   b. applying a finish to said filament which consists essentially of:
   c. a hydroxy pivalyl hydroxy pivalate diester represented by the formula:

   \[
   \text{CH}_3 \quad \text{O} \quad \text{CH}_3 \quad \text{O} \quad \text{CH}_3 \quad \text{O} \quad \text{CH}_3 \quad \text{O} \quad \text{CH}_3
   \]

   wherein \( R_1 \) and \( R_2 \) are taken from the class consisting of radicals of alkanoic and alkenoic monocarboxylic acids having from 2 to 24 carbon atoms.

18. A method as set forth in claim 17 wherein said application in step (b) includes applying said finish to said fiber by internal addition to the organic polymer prior to melt spinning of said filament.

19. A method as set forth in claim 17, wherein said application in step (b) includes applying said finish directly to said filament.

20. A method as set forth in claim 17 wherein said application in step (b) comprises dissolving said finish in a solvent and then applying the resulting solution to said filaments.

21. A method as set forth in claim 17 wherein said application in step (b) comprises forming an aqueous emulsion of said finish and subsequently applying the aqueous emulsion to said filaments.