Case No. 3940-01

What is claimed is:

1. A bridged dimeric or oligomeric phenolic compound comprising:

at least one monomer unit (a) of phenol or an alkyl-substituted phenol wherein the alkyl group contains 1 to 8 carbon atoms, or mixtures thereof;

at least one monomer unit (b) of an aliphatic hydrocarbyl-substituted phenol wherein the aliphatic hydrocarbyl group contains at least about 25 carbon atoms, or mixtures thereof; and

at least one sulfur-containing or carbon-containing bridging group;

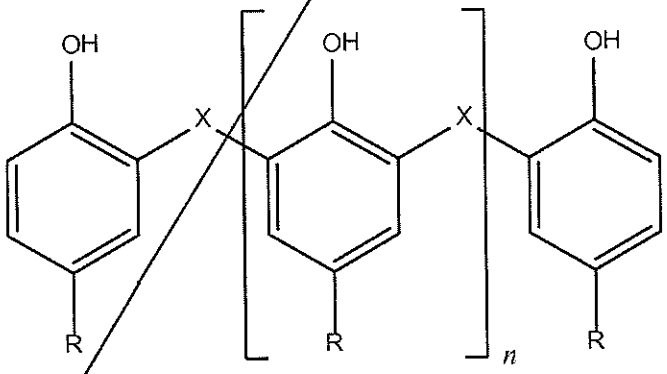
or a salt of said oligomeric material;

wherein the average number of carbon atoms in said alkyl groups and said aliphatic hydrocarbyl groups is about 10 to about 100 (or about 12 to about 50, or about 14 to about 36 or about 14 to about 20 or about 18 to about 36).

2. The bridged dimeric or oligomeric phenolic compound of claim 1 being substantially free of (or containing less than about 5 or 3 or 1 or 0.3 or 0.1 mole percent of) monomer units of C_{12}-alkyl phenol.

3. The bridged dimeric or oligomeric phenolic compound of claim 1 or claim 2 containing one or more bridging groups of one or more sulfur atoms or of methylene groups, or mixtures thereof.

4. The bridged dimeric or oligomeric phenolic compound of any of claims 1 to 3 wherein the oligomeric material is represented by the structure



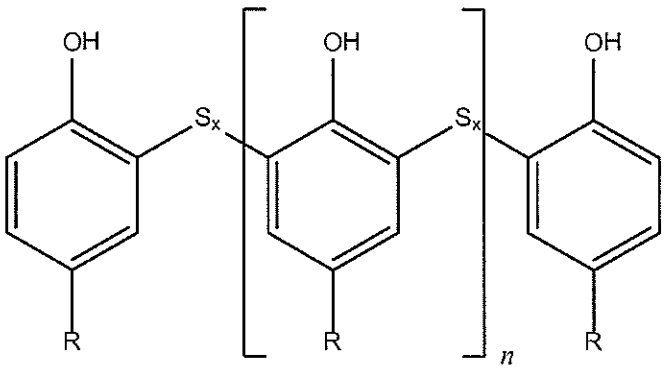
or isomers thereof, wherein:

each R is independently hydrogen or an aliphatic hydrocarbyl group, provided that at least one R represents an aliphatic hydrocarbyl group containing at least about 25 carbon atoms and at least one R represents hydrogen or a hydrocarbyl group of 1 to about 4 carbon atoms;

each X is independently a methylene group or a bridge of one or more sulfur atoms represented by S_x where x is 1 to 4, especially 1 or 2; and

n is 0 to about 8.

5. The bridged dimeric or oligomeric phenolic compound of any of claims 1 to 4 wherein the oligomeric material is represented by the structure



wherein:

each R is independently hydrogen or an aliphatic hydrocarbyl group, provided that at least one R represents an aliphatic hydrocarbyl group containing at least about 25 carbon atoms and at least one R represents hydrogen or a hydrocarbyl group of 1 to about 4 carbon atoms;

S_x represents a bridge of one or more sulfur atoms, where each x is independently 1 or 2; and

n is 1 to 6.

6. The bridged dimeric or oligomeric phenolic compound of claims 4 or 5 wherein n is 1 to 6 and wherein one or two R groups are aliphatic hydrocarbyl groups containing about 30 to about 200 (or about 35 to about 80) carbon atoms and the remaining R groups are methyl.

7. The bridged dimeric or oligomeric phenolic compound of any of claims 1 through 6 wherein the aliphatic hydrocarbyl group containing at least about 25 carbon atoms is an oligomer or polymer of propylene or of isobutylene.

8. The bridged dimeric or oligomeric phenolic compound of any of claims 1 through 7 being in the form of a metal salt.

9. The bridged dimeric or oligomeric phenolic compound of claim 8 wherein the metal salt is a calcium salt, a magnesium salt, or a sodium salt.

10. The bridged dimeric or oligomeric phenolic compound of any of claims 1 through 9 being in the form of an overbased metal salt.

11. The bridged dimeric or oligomeric phenolic compound of any of claims 1 through 10, being substantially free of (or containing less than about 5 or 2 or 1 or 0.5 or 0.1 mole percent of) monomer units of unsubstituted phenol.

12. A product prepared by reacting at least one monomer (a) of phenol or an alkyl-substituted phenol wherein the alkyl group contains 1 to 8 carbon atoms, or mixtures thereof; and

at least one monomer (b) of an aliphatic hydrocarbyl-substituted phenol wherein the aliphatic hydrocarbyl group contains at least about 25 carbon atoms, or mixtures thereof;

with a bridging agent comprising sulfur or an aldehyde or ketone,

wherein the amounts of (a) and (b) are such that the average number of carbon atoms in said alkyl groups and said aliphatic hydrocarbyl groups is about 10 to about 100 (or about 12 to about 50, or about 14 to about 36 or about 14 to about 20 or about 18 to about 36).

13. The product of claim 12 wherein the phenol or alkyl-substituted phenol of component (a) comprises an alkyl-substituted phenol wherein the alkyl group contains 1 to 4 carbon atoms.

14. A bridged dimeric or oligomeric phenolic compound comprising:

at least one monomer unit (a) of phenol or an alkyl-substituted phenol wherein the alkyl group contains 1 to 8 carbon atoms, or mixtures thereof;

at least one monomer unit (b) of an aliphatic hydrocarbyl-substituted phenol wherein the aliphatic hydrocarbyl group contains at least about 25 carbon atoms, or mixtures thereof; and

at least one sulfur-containing or carbon-containing bridging group;

or a salt of said oligomeric material;

wherein the average number of carbon atoms in said alkyl groups and said aliphatic hydrocarbyl groups is about 10 to about 100 (or about 12 to about 50, or about 14 to about 36 or about 14 to about 20 or about 18 to about 36),.

15. A lubricating composition comprising an oil of lubricating viscosity and a bridged dimeric or oligomeric phenolic compound of any one of claims 1 through 14.

16. The lubricating composition of claim 15 further comprising at least one of detergents other than bridged dimeric or oligomeric phenolic compounds, dispersants, antiwear agents, antioxidants, zinc dialkyldithiophosphates, viscosity modifiers, pour point depressing agents, and anti-foam agents.

17. The lubricating composition of claim 15 or claim 16 further comprising an overbased calcium sulfonate detergent having a TBN (oil-free basis) of at least about 300.

18. A method of lubricating a mechanical device, comprising supplying thereto the lubricant composition of any one of claims 15 to 17.

19. The method of claim 18 wherein the mechanical device comprises an internal combustion engine.

What is claimed is:

1. A bridged dimeric or oligomeric phenolic compound comprising:

at least one monomer unit (a) of phenol or an alkyl-substituted phenol wherein the alkyl group contains 1 to 8 carbon atoms, or mixtures thereof;

at least one monomer unit (b) of an aliphatic hydrocarbyl-substituted phenol wherein the aliphatic hydrocarbyl group contains at least 25 carbon atoms, or mixtures thereof; and

at least one sulfur-containing bridging group;

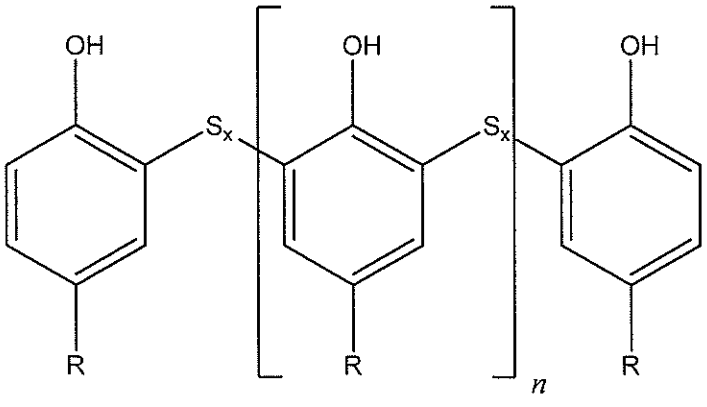
or a salt of said oligomeric material;

wherein the average number of carbon atoms in said alkyl groups and said aliphatic hydrocarbyl groups is 10 to 100, or 12 to 50, or 14 to 36 or 14 to 20 or 18 to 36.

2. The bridged dimeric or oligomeric phenolic compound of claim 1 being substantially free of, or containing less than 5 or 3 or 1 or 0.3 or 0.1 mole percent of, monomer units of C_{12}-alkyl phenol.

3. The bridged dimeric or oligomeric phenolic compound of claim 1 or claim 2 containing one or more bridging groups of one or more sulfur atoms.

4. The bridged dimeric or oligomeric phenolic compound of any one of claims 1 to 3 wherein the oligomeric material is represented by the structure



wherein:

each R is independently hydrogen or an aliphatic hydrocarbyl group, provided that at least one R represents an aliphatic hydrocarbyl group containing at least 25 carbon atoms and at least one R represents hydrogen or a hydrocarbyl group of 1 to 4 carbon atoms;

S_x represents a bridge of one or more sulfur atoms, where each x is independently 1 or 2; and

n is 1 to 6.

5. The bridged dimeric or oligomeric phenolic compound of claim 4 wherein n is 1 to 6 and wherein one or two R groups are aliphatic hydrocarbyl groups containing 30 to 200, or 35 to 80, carbon atoms and the remaining R groups are methyl.

6. The bridged dimeric or oligomeric phenolic compound of any one of claims 1 through 5 wherein the aliphatic hydrocarbyl group containing at least 25 carbon atoms is an oligomer or polymer of propylene or of isobutylene.

7. The bridged dimeric or oligomeric phenolic compound of any one of claims 1 through 6 being in the form of a metal salt.

8. The bridged dimeric or oligomeric phenolic compound of any one of claims 1 through 7 being in the form of an overbased metal salt.

9. The bridged dimeric or oligomeric phenolic compound of any one of claims 1 through 8, being substantially free of, or containing less than 5 or 2 or 1 or 0.5 or 0.1 mole percent of, monomer units of unsubstituted phenol.

10. A product prepared by reacting at least one monomer (a) of phenol or an alkyl-substituted phenol wherein the alkyl group contains 1 to 8 carbon atoms, or mixtures thereof; and

at least one monomer (b) of an aliphatic hydrocarbyl-substituted phenol wherein the aliphatic hydrocarbyl group contains at least 25 carbon atoms, or mixtures thereof;

with a bridging agent comprising sulfur,

wherein the amounts of (a) and (b) are such that the average number of carbon atoms in said alkyl groups and said aliphatic hydrocarbyl groups is 10 to 100, or 12 to 50, or 14 to 36, or 14 to 20, or 18 to 36.

11. The product of claim 10 wherein the phenol or alkyl-substituted phenol of component (a) comprises an alkyl-substituted phenol wherein the alkyl group contains 1 to 4 carbon atoms.

12. A lubricating composition comprising an oil of lubricating viscosity and a bridged dimeric or oligomeric phenolic compound of any one of claims 1 through 11.

13. The lubricating composition of claim 12 further comprising at least one of detergents other than bridged dimeric or oligomeric phenolic compounds, dispersants, antiwear agents, antioxidants, zinc dialkyldithiophosphates, viscosity modifiers, pour point depressing agents, and anti-foam agents.

14. The lubricating composition of claim 12 or claim 13 further comprising an overbased calcium sulfonate detergent having a TBN (oil-free basis) of at least 300.

15. A method of lubricating a mechanical device, comprising supplying thereto the lubricant composition of any one of claims 12 to 14.