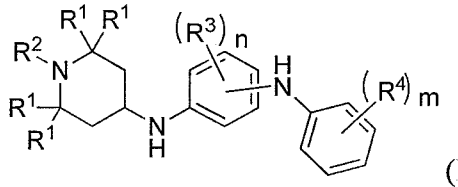
WHAT IS CLAIMED IS:

1. A lubricating oil composition comprising an oil of lubricating viscosity and an oil soluble synergistic mixture of antioxidants, said mixture comprising:

   a) 0.2 to 2 wt. %, based on the total weight of the lubricating oil composition, of a hindered amine antioxidant according to formula (I):



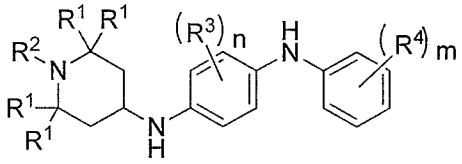
(I),

   wherein each R^1 is independently selected from a substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; R^2 is selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; each R^3 is independently selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; each R^4 is independently selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; n is an integer from 1 to 4; and m is an integer from 1 to 5; and

   b) 0.1 to 2 wt. %, based on the total weight of the lubricating oil composition, of a molybdenum succinimide complex; and

   c) 0.2 to 2 wt.%, based on the total weight of the lubricating oil composition, of a dialkylated diphenylamine antioxidant different from that of formula I.

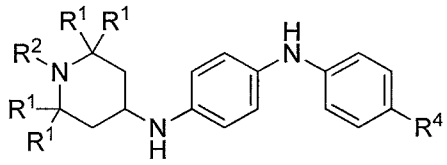
2. The lubricating oil composition according to claim 1, wherein the hindered amine antioxidant has the following formula (II):



(II),

wherein each R^1 is independently selected from a substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; R^2 is selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; each R^3 is independently selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; each R^4 is independently selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; n is an integer from 1 to 4; and m is an integer from 1 to 5.

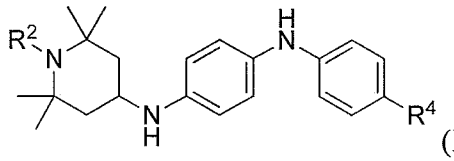
3. The lubricating oil composition according to claim 1, wherein the hindered amine antioxidant has the following formula (III):



(III),

wherein each R^1 is independently selected from a substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; R^2 is selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; and R^4 is selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group.

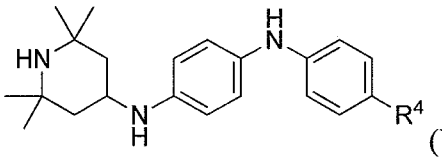
4. The lubricating oil composition according to claim 1, wherein the hindered amine antioxidant has the following formula (IV):



(IV),

wherein R^2 is selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; and R^4 is selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group.

5. The lubricating oil composition according to claim 1, wherein the hindered amine antioxidant has the following formula (V):



(V),

wherein R^4 is selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group.

6. The lubricating oil composition according to claim 1, wherein the dialkylated diphenylamine antioxidant is selected from the group consisting of di-butyldiphenylamine, di-octyldiphenylamine, di-nonyldiphsnylamine, t-butyl-t-octyldiphenylamine, and mixtures thereof.

7. The lubricating oil composition according to claim 1, further comprising an oil-soluble, phosphorus-containing, anti-wear compound selected from the group consisting of metal dithiophosphates, phosphorus esters, amine phosphates and amine phosphinates, sulfur-containing phosphorus esters, phosphoramides and phosphonamides.

8. The lubricating oil composition according to claim 7, wherein said phosphorus esters are selected from the group consisting of phosphates, phosphonates, phosphinates, phosphine oxides, phosphites, phosphorites, phosphinites, and phosphines.

9. The lubricating oil composition according to claim 7, wherein the oil-soluble, phosphorus-containing, anti-wear compound is a metal dithiophosphate.

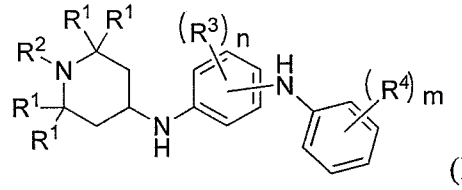
10. The lubricating oil composition according to claim 9, wherein the metal dithiophosphate is a zinc dialkyldithiophosphate.

11. The lubricating oil composition according to claim 1, further comprising supplemental antioxidant selected from the group consisting of hindered phenols, hindered bisphenols, sulfurized phenols, sulfurized olefins, alkyl sulfides, polysulfides, dialkyl dithiocarbamates and phenothiazines.

12. A method for improving oxidation and reducing deposit formation in an engine comprising the steps of: first lubricating said engine with the lubricating oil composition according to claim 1, and then operating said engine.

13. A lubricating oil composition comprising an oil of lubricating viscosity and an oil soluble synergistic mixture of antioxidants, said mixture comprising:

a) 0.2 to 2 wt. %, based on the total weight of the lubricating oil composition, of a hindered amine antioxidant according to formula (I):



(I),

wherein each R^1 is independently selected from a substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; R^2 is selected from the group consisting of a

hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; each R^3 is independently selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; each R^4 is independently selected from the group consisting of a hydrogen atom or a, substituted or unsubstituted, branched or linear, C_1-C_{20} hydrocarbyl group; n is an integer from 1 to 4; and m is an integer from 1 to 5; and

b) 0.1 to 2 wt. %, based on the total weight of the lubricating oil composition, of a molybdenum succinimide complex; and

c) 0.2 to 2 wt.%, based on the total weight of the lubricating oil composition, of a dialkylated diphenylamine antioxidant different from that of formula I; and

wherein antioxidants (a) and (c) are present in an amount to yield an oxidation inhibition of at least 10%, according to the Oxidator Bx test, over a lubricating oil composition comprising either antioxidant (a) or (c) alone.

14. The lubricating oil composition according to claim 13, wherein the dialkylated diphenylamine antioxidant is selected from the group consisting of di-butyldiphenylamine, di-octyldiphenylamine, di-nonyldiphsnylamine, t-butyl-t-octyldiphenylamine, and mixtures thereof.

15. The lubricating oil composition according to claim 13, further comprising an oil-soluble, phosphorus-containing, anti-wear compound selected from the group consisting of metal dithiophosphates, phosphorus esters, amine phosphates and amine phosphinates, sulfur-containing phosphorus esters, phosphoramides and phosphonamides

16. The lubricating oil composition according to claim 1, comprising:

a) 0.2 to 1.5 wt.%, based on the total weight of the lubricating oil composition, of the hindered amine antioxidant of formula (I);

b) 0.1 to 1 wt.%, based on the total weight of the lubricating oil composition, of the molybdenum succinimide complex; and

c) 0.2 to 1.5 wt.%, based on the total weight of the lubricating oil composition, of the dialkylated diphenylamine antioxidant different from that of formula (I).

17. The lubricating oil composition according to claim 1, comprising:

a) 0.2 to 1 wt.%, based on the total weight of the lubricating oil composition, of the hindered amine antioxidant of formula (I);

b) 0.1 to 1 wt.%, based on the total weight of the lubricating oil composition, of the molybdenum succinimide complex; and

c) 0.2 to 1 wt.%, based on the total weight of the lubricating oil composition, of the dialkylated diphenylamine antioxidant different from that of formula (I).

18. The lubricating oil composition according to claim 13, comprising:

a) 0.2 to 1.5 wt.%, based on the total weight of the lubricating oil composition, of the hindered amine antioxidant of formula (I);

b) 0.1 to 1 wt.%, based on the total weight of the lubricating oil composition, of the molybdenum succinimide complex; and

c) 0.2 to 1.5 wt.%, based on the total weight of the lubricating oil composition, of the dialkylated diphenylamine antioxidant different from that of formula (I).

19. The lubricating oil composition according to claim 13, comprising:

a) 0.2 to 1 wt.%, based on the total weight of the lubricating oil composition, of the hindered amine antioxidant of formula (I);

b) 0.1 to 1 wt.%, based on the total weight of the lubricating oil composition, of the molybdenum succinimide complex; and

c) 0.2 to 1 wt.%, based on the total weight of the lubricating oil composition, of the dialkylated diphenylamine antioxidant different from that of formula (I).