CLAIMS

1. A lubricant composition effective to reduce engine sludge, the lubricant composition comprising

a base oil of lubricating viscosity;

nitrogen provided by a dispersant system and an antioxidant system;

about 1 to about 8 weight percent of the dispersant system including ~~at least one~~a first hydrocarbyl substituted succinimide dispersant obtainable by reacting a hydrocarbyl substituted acylating agent with a nitrogen source wherein the hydrocarbyl substituent of the first dispersant has a number average molecular weight of at least about 1900 and a second hydrocarbyl substituted succinimide dispersant obtainable by reacting a hydrocarbyl substituted acylating agent with a nitrogen source wherein the hydrocarbyl substituent of the second dispersant has a number average molecular weight less than 1900;

about 0.3 to about 4 weight percent of the antioxidant system including at least ~~one~~an alkylated diphenyl aminic antioxidant and a hindered phenolic antioxidant;

a weight ratio of nitrogen provided by the dispersant system to total nitrogen in the lubricant composition of about 0.6:1 to about 0.8~~5~~:1; ~~and~~

at least about 75% of the nitrogen provided by the dispersant system is a primary or secondary nitrogen and not post-reacted;

a weight ratio of nitrogen provided by the aminic antioxidant of the antioxidant system to the total nitrogen in the lubricant composition of about 0.15:1 to about 0.4:1;

a weight ratio of nitrogen provided by the dispersant system to nitrogen provided by the aminic antioxidant of about 1.8:1 to about 5.3:1; and

wherein the lubricant composition exhibits an average engine sludge of about 7 to about 10 merits pursuant to CEC L-107-19.

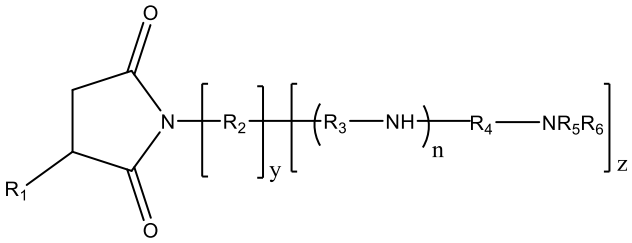
~~2. The lubricant composition of claim 1, further comprising a weight ratio of nitrogen provided by at least one aminic antioxidant of the antioxidant system to the total nitrogen in the lubricant composition of about 0.15:1 to about 0.4:1; and/or further comprising a weight ratio of nitrogen provided by the dispersant system to nitrogen provided by the at least~~

~~one aminic antioxidant of about 1.8:1 to about 5.3:1; and/or further comprising an average engine sludge of about 7 to about 10 merits pursuant to CEC L-107-19.~~

~~3.~~2. The lubricant composition of claim 1, further including a phosphorus source including one or more phosphorus-containing compounds independently selected from a thiophosphate, a dithiophosphate, a metal phosphate, a metal thiophosphate, a metal di-thiophosphate, a phosphate, a phosphite, a phosphonate, salts thereof, and mixtures thereof.

~~4.~~3. The lubricant composition of claim 1, further including a detergent system including at least one metal containing detergent providing up to about 3500 ppm metal to the composition and having a combined total base number of 0 to about 500.~~;~~

~~5.~~4. The lubricant composition of claim 1, wherein each of the hydrocarbyl substituted succinimide dispersants of the dispersant system has a structure of Formula I:



(Formula I);

wherein

R_1 of the first dispersant is a hydrocarbyl group having a number average molecular weight of about ~~350~~ 1900 to about 5,000 and R_1 of the second dispersant is a hydrocarbyl group having a number average molecular weight of about 350 to about 1900;

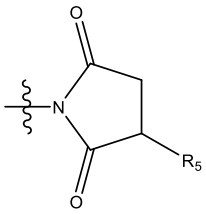
R_2, R_3, and R_4 are independently divalent C_1-C_6 moieties;

each of R_5 and R_6, independently, is hydrogen, a C_1-C_6 alkyl group, or together with the nitrogen to which they are attached form a 5- or 6-membered ring optionally fused with one or more aromatic or non-aromatic rings;

n is an integer from 0 to 8; and

y and z are each integers and wherein y + z = 1.

~~6.~~5. The lubricant composition of claim ~~4~~5, wherein R_5 and R_6 together with the nitrogen to which they are attached form a radical of Formula II



(Formula II).

~~7.~~6. The lubricant composition of claim 1, wherein the hydrocarbyl substituted acylating agent is maleic anhydride; and the nitrogen source is a polyalkylene polyamine selected from a mixture of polyethylene polyamines having an average of 5 nitrogen atoms, diethylene triamine, triethylene tetramine, tetraethylene pentamine, pentaethylene hexamine, or combinations thereof~~; and the hydrocarbyl substituent has a number average molecular weight of about 1000 to about 2,500~~.

~~8.~~7. The lubricant composition of claim ~~1~~6, ~~wherein the dispersant system includes at least two hydrocarbyl substituted succinimide dispersants; and/or wherein a first hydrocarbyl substituted succinimide dispersant is obtainable by reacting a hydrocarbyl substituted acylating agent with a nitrogen source wherein the hydrocarbyl substituent of the first dispersant has a number average molecular weight of at least about 1900 and a second hydrocarbyl substituted succinimide dispersant is obtainable by reacting a hydrocarbyl substituted acylating agent with a nitrogen source wherein the hydrocarbyl substituent of the second dispersant has a number average molecular weight less than 1900; and/or~~ wherein only one of the hydrocarbyl substituted succinimide dispersants is post-treated with a boron source and/or maleic anhydride.

~~9.~~8. The lubricant composition of claim ~~8~~7, wherein the dispersant system includes about 2 to about 4 times more of the non-post treated dispersant than the post-treated dispersant~~; and/or wherein the dispersant systems provides no more than about 300 ppm of total boron to the lubricant composition~~.

9. The lubricant composition of claim 7, wherein the dispersant systems provides no more than about 300 ppm of total boron to the lubricant composition.

10. The lubricant composition of claim 2~~3~~, wherein the phosphorus source is present in an amount to provide about up to about 900 ppm of phosphorus to the lubricating composition.

11. The lubricant composition of claim 2~~3~~, wherein the one or more phosphorus-containing compounds is independently selected from a metal phosphate, a metal thiophosphate, a metal dithiophosphate, or combinations thereof.

12. The lubricant composition of claim 11, wherein the one or more phosphorus-containing compounds is a metal dithiophosphate and includes 12 to 32 total carbon atoms within alkyl groups thereon, wherein each of the alkyl groups independently averages 3 to 8 carbon atoms~~; and/or wherein the one or more phosphorus-containing compounds include a first metal dithiophosphate with the alkyl groups derived from secondary alcohols and a second metal dithiophosphate with the alkyl groups derived from primary alcohols; and/or wherein the metal of the one or more phosphorus-containing compounds is independently selected from the group consisting of aluminum, lead, tin, molybdenum, manganese, nickel, copper, titanium, tungsten, zirconium, or zinc~~.

13. The lubricant composition of claim 11, wherein the one or more phosphorus-containing compounds include a first metal dithiophosphate with the alkyl groups derived from secondary alcohols and a second metal dithiophosphate with the alkyl groups derived from primary alcohols.

14. The lubricant composition of claim 11, wherein the metal of the one or more phosphorus-containing compounds is independently selected from the group consisting of aluminum, lead, tin, molybdenum, manganese, nickel, copper, titanium, tungsten, zirconium, or zinc.

~~13. The lubricant composition of claim 1, wherein at least one antioxidant providing nitrogen to the lubricant composition is an aminic antioxidant selected from an aromatic amine, an alkylated diphenylamine, a phenyl-α-napthylamine, alkylated phenyl-α-naphthylamines, hindered non-aromatic amines, or combinations thereof.~~

~~14. The lubricating composition of claim 13, wherein the lubricating composition includes a second antioxidant selected from a phenolic antioxidant, a sulfurized olefin, aminic antioxidants, or combinations thereof.~~

15. The lubricant composition of claim 3~~4~~, wherein the detergent systems include one or more metal containing phenates, sulfur-containing phenates, sulfonates, calixarates, salixarates, salicylates, carboxylic acids, phosphorus acids, mono- and/or di-thiophosphoric acids, alkyl phenols, sulfur coupled alkyl phenol compounds, methylene bridged phenols, or combinations thereof.