phenolic or aminic antioxidants, metal deactivators, pour point depressants, antifoaming agents, and viscosity index improvers.

[0013] U.S. Patent No. 6,174,842 ("the '842 patent") discloses a lubricating composition containing (a) a major amount of lubricating oil, (b) an oil-soluble molybdenum compound substantially free of reactive sulfur, (c) an oil-soluble diarylamine and (d) an alkaline earth metal phenate. The '842 patent further discloses that the composition can further include a zinc dihydrocarbyl dithiophosphate as an anti-wear agent. In addition, Oil Blend 18 disclosed in Example 2 of the '842 patent contained an anti-wear agent and was evaluated for exhaust valve recession in a Cummins Natural Gas Engine test.

[0014] It is desirable to develop improved natural gas engine lubricating oil compositions which can prevent or inhibit exhaust valve recession in natural gas fueled internal combustion engines employing a lubricating oil composition substantially free of at least any zinc compound.

SUMMARY OF THE ~~INVENTION~~DISCLOSURE

[0015] In accordance with one embodiment of the present ~~invention~~disclosure, a natural gas engine lubricating oil composition is provided comprising (a) a major amount of an oil of lubricating viscosity, (b) one or more phosphorus-containing anti-wear additives other than a zinc dithiophosphate, (c) one or more ashless dispersants, (d) one or more metal-containing detergents, and (e) one or more antioxidants, wherein the natural gas engine lubricating oil composition contains no more than about 0.03 weight percent of phosphorus, based on the total weight of the natural gas engine lubricating oil composition, and further wherein the natural gas engine lubricating oil composition is substantially free of any zinc compounds.

[0016] In accordance with a second embodiment of the present ~~invention~~disclosure, a natural gas engine lubricating oil composition is provided consisting essentially of (a) a major

amount of an oil of lubricating viscosity, (b) one or more phosphorus-containing anti-wear additives other than a zinc dithiophosphate, (c) one or more ashless dispersants, (d) one or more metal-containing detergents, and (e) one or more antioxidants, wherein the natural gas engine lubricating oil composition contains no more than about 0.03 weight percent of phosphorus, based on the total weight of the natural gas engine lubricating oil composition, and further wherein the lubricating oil composition is substantially free of any zinc compounds.

[0016a] In another embodiment, there is provided a natural gas engine lubricating oil composition comprising (a) a major amount of an oil of lubricating viscosity, (b) one or more phosphorus-containing anti-wear additives other than a zinc dithiophosphate, wherein the one or more phosphorus-containing anti-wear additives is a mixture containing a hydrocarbyl phosphate and a hydrocarbyl phosphite (c) one or more ashless dispersants, (d) one or more metalcontaining detergents, and (e) one or more antioxidants, wherein the natural gas engine lubricating oil composition has a sulfated ash content of 0.1 to 1.25 wt. % as determined by ASTM D 874 and contains no more than 0.03 weight percent of phosphorus, based on the total weight of the natural gas engine lubricating oil composition, and further wherein the natural gas engine lubricating oil composition is substantially free of any zinc compounds.

[0017] In accordance with a third embodiment of the present ~~invention~~disclosure, there is provided a method for preventing or inhibiting exhaust valve seat recession in a natural gas fueled engine, the method comprising lubricating the engine with a natural gas engine lubricating oil composition comprising (a) a major amount of an oil of lubricating viscosity, (b) one or more phosphorus-containing anti-wear additives other than a zinc dithiophosphate, (c) one or more ashless dispersants, (d) one or more metal-containing detergents, and (e) one or more antioxidants, wherein the natural gas engine lubricating oil composition contains no more than about 0.03 weight percent of phosphorus, based on the total weight of the natural gas engine lubricating oil composition, and further wherein the natural gas engine lubricating oil composition is substantially free of any zinc compounds.

[0017a] In another embodiment, there is provided a method for preventing or inhibiting exhaust valve seat recession in a natural gas fueled engine, the method comprising lubricating the engine with a natural gas engine lubricating oil composition comprising (a) a major amount of an oil of lubricating viscosity; (b) one or more phosphorus-containing anti-wear additives other than a zinc dithiophosphate, wherein the one or more phosphorus-containing anti-wear additives is a mixture containing a hydrocarbyl phosphate and a hydrocarbyl phosphite, (c) one or more ashless dispersants, (d) one or more metal-containing detergents, and (e) one or more antioxidants, wherein the natural gas engine lubricating oil composition has a sulfated ash content of 0.1 to 1.25 wt. % as determined by ASTM D 874 and contains no more than 0.03 weight percent of phosphorus, based on the total weight of the natural gas engine lubricating oil composition, and further wherein the natural gas engine lubricating oil composition is substantially free of any zinc compounds.

[0018] In accordance with a fourth embodiment of the present ~~invention~~disclosure, there is provided a method for enhancing the life of an exhaust valve in a natural gas fueled engine as evidenced by protection or inhibition in exhaust valve seat recession in the natural gas fueled engine, the method comprising lubricating the engine with a natural gas engine lubricating oil composition comprising (a) a major amount of an oil of lubricating viscosity, (b) one or more phosphorus-containing anti-wear additives other than a zinc dithiophosphate, (c) one or more ashless dispersants, (d) one or more metal-containing detergents, and (e) one or more antioxidants, wherein the natural gas engine lubricating oil composition contains no more

than about 0.03 weight percent of phosphorus, based on the total weight of the natural gas engine lubricating oil composition, and further wherein the natural gas engine lubricating oil composition is substantially free of each of any zinc compounds.

[0019] In accordance with a fifth embodiment of the present ~~invention~~disclosure, the use of a natural gas engine lubricating oil composition comprising (a) a major amount of an oil of lubricating viscosity, (b) one or more phosphorus-containing anti-wear additives other than a zinc dithiophosphate, (c) one or more ashless dispersants, (d) one or more metal-containing detergents, and (e) one or more antioxidants, wherein the natural gas engine lubricating oil composition contains no more than about 0.03 weight percent of phosphorus, based on the total weight of the natural gas engine lubricating oil composition, and further wherein the natural gas engine lubricating oil composition is substantially free of any zinc compounds for the purpose of preventing or inhibiting exhaust valve seat recession in a natural gas fueled engine is provided.

[0020] By lubricating a natural gas fueled internal combustion engine with a natural gas engine lubricating oil composition comprising (a) a major amount of an oil of lubricating viscosity, (b) one or more phosphorus-containing anti-wear additives other than a zinc dithiophosphate, (c) one or more ashless dispersants, (d) one or more metal-containing detergents, and (e) one or more antioxidants, wherein the natural gas engine lubricating oil composition contains no more than about 0.03 weight percent of phosphorus, based on the total weight of the natural gas engine lubricating oil composition, and further wherein the natural gas engine lubricating oil composition is substantially free of any zinc compounds, exhaust valve seat recession in the natural gas fueled engine is believed to be prevented or inhibited.