Claims

1. A method of removing deposits from a diesel engine ~~having a high pressure fuel system~~, the method comprising combusting in the engine a diesel fuel composition comprising an engine cleaning additive and a quaternary ammonium salt additive, wherein the engine cleaning additive is the product of a Mannich reaction between:

   (a) an aldehyde;

   (b) ammonia, hydrazine or an amine; and

   (c) an optionally substituted phenol;

   wherein the or each substituent of the phenol component (c) has an average molecular weight of less than 400; and wherein the quaternary ammonium salt additive is formed by the reaction of a nitrogen containing species having at least one tertiary amine group and a quarternizing agent; wherein after running the engine for 12 hours, the engine has a power output of at least 97% of the power output obtained when using clean injectors~~wherein the engine has a pressure in excess of 1350bar~~.

2. A method according to claim 1 wherein component (b) is a polyethylene polyamine having from 2 to 8 nitrogen atoms.

3. A method according to any preceding claim wherein the engine cleaning additive is present in the diesel fuel composition in an amount of at least 30ppm.

~~4. A method according to any preceding claim wherein the diesel fuel composition further comprises a quaternary ammonium salt additive formed by the reaction of a nitrogen containing species having at least one tertiary amine group and a quarternizing agent.~~

~~5~~4. A method according to ~~claim 4~~ any preceding claims, wherein the nitrogen containing species comprises:

   (i) the reaction product of a hydrocarbyl-substituted acylating agent and a compound comprising at least one tertiary amine group and a primary amine, secondary amine or alcohol group;

   (ii) a mannich reaction product comprising a tertiary amine group; and

   (iii) a polyalkylene substituted amine having at least one tertiary amine group.

~~6~~5. A method according to ~~claim 4 or claim 5~~ any preceding claim wherein the quaternising agent is selected from dialkyl sulphates, benzyl halides, hydrocarbyl substituted carbonates hydrocarbyl epoxides in combination with an acid, or mixtures thereof.

~~7~~6. A method according to any preceding claim wherein the diesel fuel composition further comprises one or more nitrogen-containing detergents.

~~8~~7. A method according to claim ~~7~~ 6 wherein the diesel nitrogen-containing detergent is the reaction product of a hydrocarbyl-substituted carboxylic acid acylating agent and an amine.

~~9~~8. A method according to any preceding claim wherein the diesel fuel composition further comprises a metal-deactivating compound.

9. A method according to any preceding claim wherein the diesel fuel composition comprises a metal-containing fuel-borne catalyst species to aid with the regeneration of particulate traps.

10. A method according to claim 9, wherein the catalyst species comprises a metal selected from iron, cerium, Group I and Group II metals including calcium, strontium, platinum and manganese.

11. A method according to any preceding claim wherein the diesel fuel composition comprises from 0.1 to 10ppm of a metal containing species.

12. A method according to any preceding claim wherein the diesel engine has a high pressure fuel system, having a pressure in excess of 1350 bar.

~~10~~13. A method according to any preceding claim wherein after running the engine for 24 hours there is an increase in power output of at least 3%.

~~11. A method according to any preceding claim wherein the diesel fuel composition comprises from 0.1 to 10ppm of a metal containing species.~~

~~12. The use of an engine cleaning additive to remove deposits from a diesel engine having a high pressure fuel system, wherein the engine cleaning additive is the product of a Mannich reaction between:~~

~~(a) an aldehyde;~~

~~(b) ammonia, hydrazine or an amine; and~~

~~(c) an optionally substituted phenol;~~

~~wherein the or each substituent of the phenol component (c) has an average molecular weight of less than 400; and wherein the engine has a pressure in excess of 1350 bar.~~

~~13~~14. The use of a combination of a quaternary ammonium salt and an engine cleaning to remove deposits from a diesel engine ~~having a high pressure fuel system~~, wherein the engine cleaning additive is the product of a Mannich reaction between:

(a) an aldehyde;

(b) ammonia, hydrazine or an amine; and

(c) an optionally substituted phenol;

wherein the or each substituent of the phenol component (c) has an average molecular weight of less than 400, and wherein the quaternary ammonium salt additive is formed by the reaction of a nitrogen containing species having at least one tertiary amine group and a quarternizing agent; and wherein after running the engine for 12 hours, the engine has a power output of at least 97% of the power output obtained when using clean injectors.~~and wherein the engine has a pressure in excess of 1350 bar~~.

~~14. The use of a combination of a nitrogen-containing detergent and an engine cleaning additive to remove deposits from a diesel engine having a high pressure fuel system, wherein the engine cleaning additive is the product of a Mannich reaction between:~~

~~(a) an aldehyde;~~

(b) ammonia, hydrazine or an amine; and

(c) an optionally substituted phenol;

wherein the or each substituent of the phenol component (c) has an average molecular weight of less than 400; and wherein the engine has a pressure in excess of 1350 bar.

15. A diesel fuel composition comprising an engine cleaning additive and a quaternary ammonium salt, wherein the engine cleaning additive is the product of a Mannich reaction between:

(a) an aldehyde;

(b) ammonia, hydrazine or an amine; and

(c) an optionally substituted phenol;

wherein the or each substituent of the phenol component (c) has an average molecular weight of less than 400; and wherein the quaternary ammonium salt additive is formed by the reaction of a nitrogen containing species having at least one tertiary amine group and a quarternizing agent.

16. A diesel fuel composition according to claim 15 wherein the nitrogen containing species comprises:

(i) the reaction product of a hydrocarbyl-substituted acylating agent and a compound comprising at least one tertiary amine group and a primary amine,secondary amine or alcohol group:

(ii) a mannich reaction product comprising a tertiary amine group; and

(iii) a polyalkylene substituted amine having at least one tertiary amine group.

17. A diesel fuel composition according to claim 15 or claim 16 wherein the quaternising agent is selected from dialkyl sulphates, benzyl halides, hydrocarbyl substituted carbonates hydrocarbyl substituted carbonates hydrocarbyl epoxides in combination with an acid, or mixtures thereof.