Claims

1. A selective catalytic reduction system (2) applying diesel oil (40,40') as reductant for converting nitrogen oxides (NOx) in diesel engine exhaust, through a NO reduction process by means of a catalyst, into diatomic nitrogen (N_2) and water (H_2O) in a diesel engine (4), wherein the selective catalytic reduction system (2) is configured to be installed and used in a two-stroke diesel engine or a four-stroke diesel engine for marine purposes, wherein the selective catalytic reduction system (2) comprises:

- an oil injection system (6);
- a reactor (10);
- a number of selective catalytic reduction catalysts (109, 109') provided in a section (14, 16, 16', 16'', 16''') comprising a plurality of layers (S_1, S_2, S_3, S_4, S_5, E_1, E_2, S_1', S'_2, S_3', S_4', S_5', S_1'', S_2'', S_3'', S_4'', S_5'') provided in a non-zero distance from each other, **characterised in** that the selective catalytic reduction system (2) comprises a number of selective catalytic reduction catalysts (109, 109') provided in separated layers in a first section (14), wherein the selective catalytic reduction system (2) comprises at least one additional section (16) comprising a number of selective catalytic reduction catalysts (109, 109') in separated layers, wherein the at least one additional section (16) is provided in a non-zero distance from the first section, wherein the reactor (10) is configured to house the sections (14, 16) in order to facilitate the NO reduction process, wherein the distance (d_1, d_2, d_3, d_4) between the layers (S_1, S_2, S_3, S_4, S_5, S_1', S_2', S_3', S_4', S_5', S_1'', S_2'', S_3'', S_4'', S_5'', E_1, E_2) is selected to ensure that a minimum average residence time for the exhaust is provided between each layer, wherein the minimum average residence time for moving a gas molecule from one layer (S_n) to the next layer (S_{n+1}) is no smaller than 0.025 seconds, preferably no smaller than 0.04 seconds, and most preferably no smaller than 0.135 seconds.

2. A selective catalytic reduction system (2) according to claim 1, **characterised in** that at least 3 layers are provided in the reactor (10).

3. A selective catalytic reduction system (2) according to one of the preceding claims, **characterised in** that a plate member (84, 84') is provided between at least some of the adjacent sections (14, 16, 16', 16'', 16''').

4. A selective catalytic reduction system (2) according to one of the preceding claims, **characterised in** that the selective catalytic reduction catalysts (109, 109') are arranged in the layers (S_1, S_2, S_3, S_4, S_5, S_1', S_2', S_3', S_4', S_5', S_1'', S_2'', S_3'', S_4'', S_5'', E_1, E_2) each having a thickness within the range 40-120 mm, preferably in the range 50-100 mm, such as 60-90 mm.

5. A selective catalytic reduction system (2) according to one of the preceding claims, **characterised in** that the selective catalytic reduction catalysts (109, 109) are selected among the following: Ce/Cu-ZSM-5, Ce-Zr/Cu-ZSM-5, Ce/Fe-ZSM-5 or Ce-Zr/Fe-ZSM-5, Ce/Mg-ZSM-5 or Ce-Zr/Mg-ZSM-5.

6. A selective catalytic reduction system (2) according to one of the preceding claims, **characterised in** that the selective catalytic reduction system (2) comprises a tubular structure (86) extending centrally along the longitudinal axis of the reactor (10).

7. A selective catalytic reduction system (2) according to one of the preceding claims, **characterised in** that the selective catalytic reduction system (2) comprises a diffuser (88).

8. A selective catalytic reduction system (2) according to one of the preceding claims, **characterised in** that the selective catalytic reduction system (2) comprises a heat recovering unit.

9. A selective catalytic reduction system (2) according to one of the claims 1-8, **characterised in** that an oxidation catalyst (136) arranged to oxidise one or more compositions in the exhaust gas (190).

10. A selective catalytic reduction system (2) according to claim 9, **characterised in** that the selective catalytic reduction system (2) comprises a flow-

through type diesel oxidation catalyst and a soot particle filter.

11. A selective catalytic reduction system (2) according to claim 9, **characterised in** that the oxidation catalyst (136) is a wall flow type particle filter comprising walls coated with a catalyst configured to oxide at least CO or HC.

12. A selective catalytic reduction system (2) according to claim 9, **characterised in** that the oxidation catalyst (136) is provided downstream the selective catalytic reduction catalysts (109, 109') and a particulate filter (138).

13. A selective catalytic reduction system (2) according to one of the claims 11 or 12, **characterised in** that the selective catalytic reduction system (2) comprises or is connected to a generator (144).

14. A method for nitrogen oxides (NOx) reduction in diesel engine exhaust, said method comprising the step of using a selective catalytic reduction system (2) configured to be applied for selective catalytic reduction of NOx in an exhaust stream either after a four-stroke diesel engine or between the exhaust receiver and the exhaust turbine(s) on a two-stroke diesel engine and applying diesel oil (40,40') as reductant for converting nitrogen oxides (NOx) through a NO reduction process by means of a catalyst into diatomic nitrogen (N_2) and water (H_2O) in a diesel engine (4), wherein the method comprises the step of providing evaporated diesel oil (40, 40') in a reactor (10), wherein a NOx conversion is carried out including a NO reduction followed by a heterogeneous catalyzing process followed by a homogeneous catalyzing process by applying a number of selective catalytic reduction catalysts (109, 109') provided in a section (14, 16, 16', 16'', 16''') having a plurality of layers (S_1, S_2, S_3, S_4, S_5, E_1, E_2 , S_1', S'_2, S_3', S_4', S_5', S_1'', S_2'', S_3'', S_4'', S_5'') , **characterised in** that the selective catalytic reduction system (2) comprises a number of selective catalytic reduction catalysts (109, 109') provided in separated layers in a first section (14), wherein the selective catalytic reduction system (2) comprises at least one additional section (16) comprising a num-

ber of selective catalytic reduction catalysts (109, 109') in separated layers, wherein the at least one additional section (16) is provided in a non-zero distance from the first section, wherein the reactor (10) is configured to house the sections (14, 16) in order to facilitate the NO reduction process, wherein the distance (d_1, d_2, d3, d_4) between the layers (S_1, S_2, S_3, S_4, S_5, E_1, E_2 , S_1', S'_2, S_3', S_4', S_5', S_1'', S_2'', S_3'', S_4'', S_5'') is selected to ensure that a minimum average residence time for the exhaust is provided between each layer, wherein the minimum average residence time for moving a gas molecule from one layer (S_n; E_1) to a next layer (S_{n+1}; E_2) is no smaller than 0.025seconds, preferably no smaller than 0.04, and most preferably no smaller than 0.135.

15. A method according to claim 14 , **characterised in** that the method comprises the step of cracking at least a portion of the evaporated diesel oil, carrying out a heterogeneous NOx conversion that causes formation of the radical $NH4^+$, wherein the radical $NH4^+$ is used for carrying out homogeneous NO_x conversion.

16. A method according to one of the preceding claims 14 or 15, **characterised in** that the method is applied for selective catalytic reduction of NOx in an exhaust stream either after a four-stroke diesel engine (4) or between the exhaust receiver (78) and the exhaust turbine(s) (82) on a two-stroke diesel engine (4).

17. A method according to one of the claims 14-16, **characterised in** that the method comprises the step of applying an oxidation catalyst (136) arranged to oxidise one or more compositions in the exhaust gas (190).

18. A method according to claim 17, **characterised in** that the method comprises the step of applying a wall flow type particle filter comprising walls coated with a catalyst configured to oxide at least CO or HC.

19. A method according to claim 17, **characterised in** that the method comprises the step of applying a flow through type diesel oxidation catalyst and a

particle filter.

20. A method according to claim 17, **characterised in** that the method comprises the step of applying an oxidation catalyst (136) provided between the selective catalytic reduction catalysts (109, 109') and a particulate filter (138).

21. A method according to one of the preceding claims 17 to 20, **characterised in** that method comprises the step of applying a generator (144) connected to a turbine (230, 232) to produce electrical energy.

22. A method according to one of the previous claims 17 to 21, **characterised in** that the method comprises the step of applying a distillation apparatus (150) to produce distilled water, wherein the distillation apparatus (150) is connected to the selective catalytic reduction system (2).