CLAIMS

[Claim 1] A cleaning method of removing scales deposited on a heat transfer tube in a marine boiler by ejecting a blasting material to the heat transfer tube, comprising:

removing scales deposited on said heat transfer tube by using a plant blasting material or a resin blasting material as a blasting material; and

leaving unremoved an oxide film formed on a surface of said heat transfer tube.

[Claim 2] A cleaning method according to claim 1, wherein said blasting material is ejected under a pressure ranging from 0.4 to 0.65 MPa.

[Claim 3] A cleaning method according to claim 1, wherein said plant blasting material comprises a granular material comprising walnut shells or apricot seeds or peach seeds crushed to a predetermined grain diameter.

[Claim 4] A cleaning method according to claim 3, wherein said predetermined grain diameter of said plating blasting material is in a range from 500 to 700 μm.

[Claim 5] A cleaning method according to claim 1, wherein said resin blasting material comprises a grain material comprising nylon or polycarbonate or urea resin or melamine resin which is formed into a predetermined grain diameter.

[Claim 6] A cleaning method according to claim 5, wherein said predetermined grain diameter of said resin blasting material is in a range from 420 to 595 μm.

[Claim 7] A cleaning method according to any one of claims 1 through 6, further comprising:

wetting a surface to be cleaned of said heat transfer tube after removing the scales deposited on said heat transfer tube by ejecting the blasting material to said heat transfer tube; and

removing scales deposited on said heat transfer tube by ejecting the blasting material again to said heat transfer tube.

[Claim 8] A cleaning method according to claim 7, wherein said surface to be cleaned is wetted by spraying water thereto.

[Claim 9] A cleaning method according to claim 1, wherein a nozzle unit is used to eject said blasting material to a region where heat transfer tubes are closely arranged in a staggered grid pattern or a straight grid pattern.

[Claim 10] A cleaning apparatus for removing scales deposited on a heat transfer tube in a marine boiler by ejecting a blasting material to the heat transfer tube, comprising:

a tank filled with a blasting material;

a blasting material regulator for pressurizing said blasting material in said tank with compressed air supplied from a compressed air source; and

a nozzle unit connected to said blasting material regulator, for ejecting said blasting material together with the compressed air;

wherein said blasting material comprises a plant blasting material or a resin blasting material to remove scales deposited on said heat transfer tube and to leave unremoved an oxide film formed on a surface of said heat transfer tube.

[Claim 11] A cleaning apparatus according to claim 10, further comprising:

an atomizer for spraying water to a surface to be cleaned of said heat transfer tube.

[Claim 12] A cleaning apparatus according to claim 10, further comprising:

a blasting material drawing duct for drawing the blasting material which has been ejected to said heat transfer tube;

a recovery tank for recovering the blasting material drawn by said blasting material drawing duct; and

a dust collector connected to said recovery tank, for collecting dust from exhaust air which draws the blasting material.

[Claim 13] A cleaning apparatus according to claim 10, wherein said nozzle unit uses a soft material in a region which is possibly brought into contact with said heat transfer tube.

[Claim 14] A cleaning apparatus according to claim 10, wherein said nozzle unit comprises a nozzle for ejecting said blasting material and an adapter for holding said nozzle.

[Claim 15] A cleaning apparatus according to claim 14, wherein said adapter is made of aluminum.

CLAIMS

[Claim 1] A cleaning method of removing scales deposited on a heat transfer tube in a marine boiler by ejecting a blasting material to the heat transfer tube, comprising:

removing scales deposited on said heat transfer tube by using a plant blasting material as a blasting material; and

leaving unremoved an oxide film formed on a surface of said heat transfer tube;

wherein said blasting material is ejected under a pressure ranging from 0.4 to 0.65 MPa;

wherein said plant blasting material comprises a granular material comprising walnut shells or apricot seeds or peach seeds crushed to a predetermined grain diameter; and

wherein said predetermined grain diameter of said plant blasting material is in a range from 500 to 700 μm.

[Claim 2] A cleaning method of removing scales deposited on a heat transfer tube in a marine boiler by ejecting a blasting material to the heat transfer tube, comprising:

removing scales deposited on said heat transfer tube by using a resin blasting material as a blasting material; and

leaving unremoved an oxide film formed on a surface of said heat transfer tube;

wherein said blasting material is ejected under a pressure ranging from 0.4 to 0.65 MPa;

wherein said resin blasting material comprises a grain material comprising nylon or polycarbonate or urea resin or melamine resin which is formed into a predetermined grain diameter; and

wherein said predetermined grain diameter of said resin blasting material is in a range from 420 to 595 μm.

[Claim 3] A cleaning method according to claim 1 or 2, further comprising:

wetting a surface to be cleaned of said heat transfer tube after removing the scales deposited on said heat transfer tube by ejecting the blasting material to said heat transfer tube; and

removing scales deposited on said heat transfer tube by ejecting the blasting material again to said heat transfer tube.

[Claim 4] A cleaning method according to claim 3, wherein said surface to be cleaned is wetted by spraying water thereto.

[Claim 5] A cleaning method according to claim 1, wherein a nozzle unit is used to eject said blasting material to a region where heat transfer tubes are closely arranged in a staggered grid pattern or a straight grid pattern.

[Claim 6] A cleaning apparatus for removing scales deposited on a heat transfer tube in a marine boiler by ejecting a blasting material to the heat transfer tube, comprising:

a tank filled with a blasting material;

a blasting material regulator for pressurizing said blasting material in said tank with compressed air supplied from a compressed air source; and

a nozzle unit connected to said blasting material regulator, for ejecting said blasting material together with the compressed air;

wherein said blasting material comprises a plant blasting material or a resin blasting material to remove scales deposited on said heat transfer tube and to leave unremoved an oxide film formed on a surface of said heat transfer tube;

wherein said blasting material is ejected under a pressure ranging from 0.4 to 0.65 MPa;

wherein said plant blasting material comprises a granular material comprising walnut shells or apricot seeds or peach seeds crushed to a predetermined grain diameter; and

wherein said predetermined grain diameter of said plant blasting material

is in a range from 500 to 700 μm;

wherein said resin blasting material comprises a grain material comprising nylon or polycarbonate or urea resin or melamine resin which is formed into a predetermined grain diameter; and

wherein said predetermined grain diameter of said resin blasting material is in a range from 420 to 595 μm.

[Claim 7] A cleaning apparatus according to claim 6, further comprising:

an atomizer for spraying water to a surface to be cleaned of said heat transfer tube.

[Claim 8] A cleaning apparatus according to claim 6, further comprising:

a blasting material drawing duct for drawing the blasting material which has been ejected to said heat transfer tube;

a recovery tank for recovering the blasting material drawn by said blasting material drawing duct; and

a dust collector connected to said recovery tank, for collecting dust from exhaust air which draws the blasting material.

[Claim 9] A cleaning apparatus according to claim 6, wherein said nozzle unit uses a soft material in a region which is possibly brought into contact with said heat transfer tube.

[Claim 10] A cleaning apparatus according to claim 6, wherein said nozzle unit comprises a nozzle for ejecting said blasting material and an adapter for holding said nozzle.

[Claim 11] A cleaning apparatus according to claim 10, wherein said adapter is made of aluminum.