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(54) **Method of cleaning power generation turbine of nuclear power generation equipment.**

(57) A method of removing material attached to the surface of a power generation turbine of a nuclear power generation equipment by blasting particles comprising a melamine resin along with a gas stream against said turbine surface. The melamine residue can then be incinerated to a fraction (e.g. 2 %) of the particles weight before combustion. The volume of stored waste is therefore reduced.

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Background of the Invention

This invention relates to a method of cleaning a power generation turbine of a nuclear power generation equipment, particularly a boiling water nuclear power generation equipment.

In a nuclear power generaiton plant, thermal energy generated as a result of nuclear fission is taken out from a reactor core by primary cooling water and converted in a steam plant into electric energy. For instance, in a boiling water type nuclear power generation equipment, primary cooling water is boiled by heat received from nuclear fuel, it rises along the core to be separated by a steam/water separator provided on core top into steam and water, and separated steam is supplied through a steam pipe to a direct power generation turbine. Consequently, it is necessary to clean the turbine one for a couple of years to remove material attached to it. This done for removing contaminants attached to the turbine and also inspecting damage thereto. Heretofore, the cleaning is done by a dry blasting process, in which sintered alumina is used as a polishing agent and blown along with an air stream against the turbine surface. One operation of cleaning the turbine by this process requires 3 to 6 tons of polishing material.

When sintered alumina is used as polishing material, however, the turbine surface is worn soon. The polishing material used after cleaning cannot be transported from a place, in which it is maintained. Also, it cannot be incinerated. Therefore, it is stored in a concrete. This means that a large storage area is required

The invention has an object of providing a method of removing material attached to turbine surface, which is novel and can solve the problems inherent in the conventional blasting process.

Another object of the invention is to provide a method of removing material attached to a power generation turbine of a nuclear power generation equipment, particularly boiling water type nuclear power generation equipment without causing wear of the turbine surface.

A further object of the invention is to provide a method of removing the attached material by using particles which are capable of after-treatment by incineration after use for removal of the attached material.

Summary of the Invention

According to the invention, there is provided a blasting process, which can solve the problems noted above, and in which particles comprising meramine is blown together with a gas stream against the surface of a power generation turbine of a nuclear power generation equipment to remove material attached to the turbine surface.

According to the invention, a thermosetting resin is used, which is suitably a meramine resin. The meramine resin may be of a single composition, or it may be a mixture of a meramine resin with a different thermosetting resin. The meramine resin may slightly contain a urea resin. When the content of a urea resin is high, however, the capacity of the particles to remove material is reduced, and also the ratio of breakage of particles at the time of removal of attached material is increased, thus increasing the amount of particles used. Thus, the content of a urea resin in the particles is suitably no greater than 30 % by weight. Further, the grain size of meramine resin particles is not particularly limited, but is suitably 20 to 120 meshes as prescribed by JIS R-6001-1973. The particles may have any shape. Their hardness is not particularly limited, but is suitably 3 to 4 in Mohs scale. The particles may be obtained by pulverizing solidified meramine resin masses, pellets, etc. with a pulverizer.

The particles may be blasted along with a gas stream by various blasting processes, but the dry blasting processes are best suited. Among the dry blasting processes are

(A) A gravity type blasting process, in which particles are charged into a tank held at a position higher in level than a nozzle, and particles falling on a discharge port provided at the tank bottom is blasted from the nozzle together with compressed gas.

(B) A direct pressure type blasting process, in which particles are sealed in a particle force-out tank, compressed gas is supplied to the tank, and particles discharged from a discharge port provided at the tank bottom are blasted from the nozzle together with compressed gas.

(C) A ciphon type blasting process, in which particles are charged into a tank held at a lower level than a nozzle, and particles discharged from a discharge port provided at the tank bottom by suction of compressed gas are blasted along with compressed gas from the nozzle.

Any of the above blasting processes can be used.

As compressed gas, usually compressed air is used. Usually, its pressure is set to 3 to 10 kg/cm^2 in gauge pressure, and the speed of jet of compressed gas from the nozzle is 50 to 240 m/sec. The amount of particles used for cleaning, pressure of compressed gas and speed of jet can be suitably selected in dependence on the characteristics

of particles used and state of attachment of material to the turbine.

Particles after use for removal of attached material contain the removed material such that the particles and removed material form a non-homogeneous mixture. When this mixture is incinerated in an incinerating furance, a residue of meramine resin after incineration remains with the removed material as overall residue of incineration. The exhaust gas discharged from the incinerator is discharged into atmosphere through a suitable discharge gas treatment equipment such as a filter. The residue of meramine resin particles is several per cent at most of the quantity of resin particles before incineration. The incinerator may be of various types, and it is suitable to use an electric furnace. The residue of incineration containing attached material can be treated by a suitable process such as holding in a concrete.

When particles comprising a thermoplastic resin are used, incineration of particles after use for cleaning in the incinerator causes melting of the thermoplastic resin in the incinerator and adhering the melted resin to the bottom of the incinerator. This means that the treatment of the residue after incineration is very difficult. Therefore, it is indispensable to use particles comprising a thermosetting resin.

The method according to the invention is applicable to a nuclear power generation equipment, particularly to a boiling water type nuclear power generation equipment.

Brief Description of the Drawing

The drawing is a schematic view showing a blast apparatus suited for carrying out the invention.

Detailed Description of the Preferred Embodiment

Now, an embodiment of the invention will be described in detail with reference to the drawing.

Using meramine resin particles with a grain size of 42 to 90 meshes, material precipitated and attached to the surface of a power generation turbine of a boiling water type nuclear power generation equipment was removed. The removal was carried out using direct pressure type blaster 20. Particles 10 were charged into tank 22, and compressed air was forced from a compressed air source into tank 22 and transport pipe 26. The rate of supply of compressed air from the compressed air source was set to 1 Nm^3/min., and the pressure to 5 kg/cm^2 in gauge pressure. The rate of use of particles was 300 kg/hour. Particles discharged from a discharge port provided at the bottom of tank 22 were transported by compressed air along the transport pipe and discharged from nozzle 24. The nozzle inner diameter was 5 mm, the speed of jet of compressed air from the nozzle was set to 150 m/sec., and the distance from the nozzle to the turbine surface was held at 200 to 800 mm. Particles from the nozzle were blown against the turbine surface to remove material attached to the turbine surface. The rate blowing with particles per 1 m^2 of turbine surface was set to 40 to 60 kg. No wear was recognized on the turbine surface after removal of attached material. Neither material remaining attached to the turbine surface nor particles attached thereto were recognized.

Combustion residue of particles used for the removal was only about 2 % by weight of the particles before the combustion.

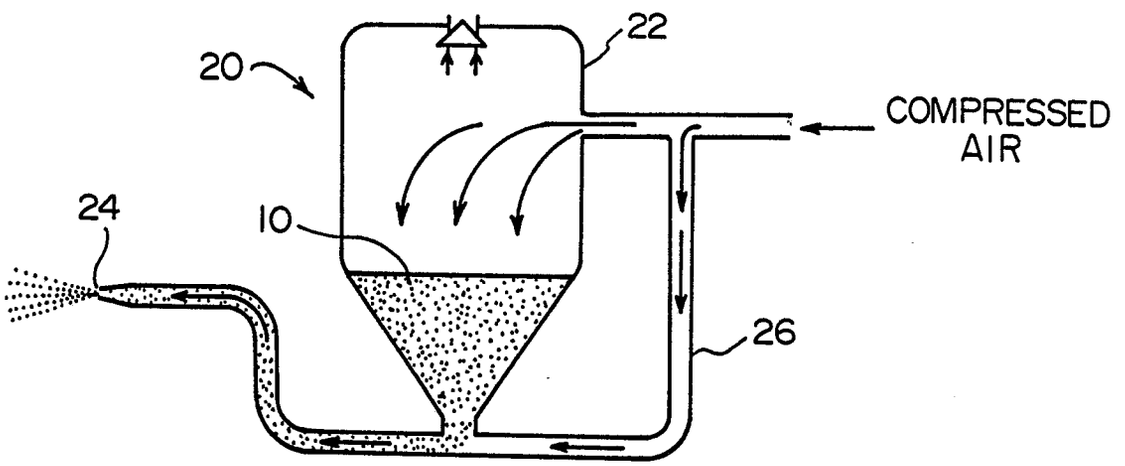
For the sake of comparison, removal of material attached to turbine surface under the same conditions as above was carried out using sintered alumina of 80 to 150 meshes. In this case, wear due to sintered alumina was recognized on the turbine surface. Since sintered alumina could not be incinerated, it was inevitable to store sintered alumina after use for removal of the attached material in concrete in all quantity.

Claims

1. A method of removing material attached to the surface of a power generation turbine of a nuclear power generation equipment by blowing particles comprising a meramine resin along with a gas stream against said turbine surface.

2. The method according to claim 1, wherein the grain size of said particles is 20 to 120 meshes.

3. The method according to one of claims 1 to 2, wherein said nuclear power generation equipment is a boiling type nuclear power generation equipment.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EUROPEAN SEARCH REPORT

Application Number

EP 89 31 2068

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	GB-A-1571239 (NOJIMAGUMI COMPANY) * page 1, line 14 - page 1, line 19 *	1	F01D25/00 B24C11/00
A	* page 4, line 14 - page 4, line 43 *	2	
Y	FR-A-2127021 (SIEMENS) * page 7; claim 1 *	1	
A		3	
A	GB-A-1173263 (CHRYSLER) * page 2, line 25 - page 2, line 61 *	1, 3	
A	PATENT ABSTRACTS OF JAPAN vol. 013, no. 036 (M-790) 26 January 1989, & JP-A-63 246210 (NIPPON CARBIDE) 13 October 1988, * the whole document *	1, 2	
A	PATENT ABSTRACTS OF JAPAN vol. 011, no. 048 (M-561) 13 February 1987, & JP-A-61 209880 (KANEBO LTD) 18 September 1986, * the whole document *	1, 2	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F01D
F04D
B24C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02 MARCH 1990	MCGINLEY C.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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