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(54) Method and assembly for preventing sticking of fine-graded, moist material in the handling equipment of such material

(57) The present invention relates to a method and assembly for preventing sticking of fine-graded, moist material such as clay or sludge to screens, shovels and other units of earth handling equipment. The handling of moist and fine-graded materials is often greatly hampered by sticking of such materials to the handling equipment. Pure clay in particular sticks extremely tenaciously on all surfaces and, having a soft and easily deformable consistency, tends to adhere to a surface rather than to allow itself to be detached from the surface under an external force. This leads to plugging of screening and blending equipment and accumulation of clay on shovels and other equipment used for handling the clay. Most sludges also act in a similar manner. The invention is based on heating at least a portion of the equipment elements to be in contact with the material being treated to a temperature higher than the boiling point of water.

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Description

The present invention relates to a method according to the preamble of claim 1 for preventing sticking of fine-graded, moist material such as clay or sludge to screens, shovels and other units of earth handling equipment.

The invention also concerns an assembly suited for implementing said method.

Moist clay, as well as partially dried waste sludge in wood and mining industries and the sludges of water treatment plants must be processed in a number of ways before they can be utilized in horizontal constructions or recycled as cleaned raw material. The most important steps in such a treatment are the blending of neutralizing and consistency-modifying agents/materials with the basic material as well as the crushing or screening of the material in order to modify its composition. According to the needs of horizontal construction, the basic material such as clay, for instance, can be blended with sand, peat, coarse plant waste or other porosity-improving or moisture-reducing materials. Simultaneously, different kinds of nutrients can be added. For treatment, the material must be transferred from the storage or collection site to the material treatment equipment. This operation is performed using various types of shovels/buckets or, for longer haul distances, the beds of transfer vehicles.

When wet and fined-graded materials are to be handled, sticking of the material in the treatment equipment is a major problem. If the material contains coarser aggregates, they will scrape the surfaces of the treatment equipment clean, whereby the material handling will be easier. However, it frequently happens that a certain geographic area contains a large amount of pure, fine-graded clay that is suitable for use as raw material in horizontal constructions or that must be moved aside to make room for new constructions. Pure clay sticks extremely tenaciously on all surfaces and, having a soft and easily deformable consistency, tends to adhere to a surface rather than allowing itself to be detached from the surface under an external force. This leads to plugging of screening and blending equipment and accumulation of clay on shovels and other equipment used for handling the clay. Clay already adhered to the equipment is extremely difficult to clean away, and usually, the only practicable method for cleaning the equipment is by scraping them free from clay with manual tools combined with washing using abundant amounts of water. Particularly in disc screens of the type disclosed in FI Pat. No. 94,729 and other similar constructions, clay tends to accumulate on the shafts and in the interdisc spaces thus rapidly plugging the screen. Plugging of the screen makes efficient processing of earth materials impossible. Many waste sludges and wet wastes consisting of fine-graded material behave in a similar manner as clay, which makes their handling difficult and expensive, or even economically unprofitable.

In the magazine "Koneviesti", Vol. 7/87, is described a shovel intended for handling moist material under freezing conditions. This is problematic due to freezing of the material on the shovel. Herein, the freezing problem is solved by heating the shovel above the freezing point of the material being handled, which usually means heating above 0 °C. The shovel is heated by means of the return oil circulation of the excavator's hydraulic circuit. A similar kind of heating by the exhaust gases of a vehicle has been conventionally used in the rock beds of hauling vehicles. However, such a heating technique does not prevent the adherence of a sticky and moist material by any means and the heat content of hydraulic oil return circulation or vehicle engine exhaust gases is insufficient for elevating the temperature of equipment surfaces to a reasonably high level.

It is an object of the present invention to provide a method capable of preventing the sticking of a fine-graded, moist material in the handling equipment of such a material.

The object of the invention is achieved by heating at least a portion of the equipment elements to be in contact with the material being treated to a temperature higher than the boiling point of water.

More specifically, the method according to the invention is characterized by what is stated in the characterizing part of claim 1.

Furthermore, the assembly according to the invention is characterized by what is stated in the characterizing part of claim 6.

The invention offers significant benefits.

The invention makes it possible to prevent sticking of clay and similar materials in the handling equipment thus offering a significant improvement of the operating efficiency as the need for breaks of time-consuming and laborious cleaning operations are eliminated. Furthermore, materials that are difficult to handle with known techniques may now be treated more economically, thus permitting full utilization of materials which conventionally are categorized as wastes awkward to dump. The invention is particularly suited for handling clay, whereby it allows fine-graded, pure clay to be treated into refined, high-quality material for horizontal constructions. Similarly, various types of waste sludges can be treated advantageously by screening equipment designed according to the invention into a form suited for, for example, composting.

In the following the invention is described in greater detail with the help of a detailed description.

The invention is based on preventing the adherence of a sticky material by energetic heating. In fact, the adherence of clay or other wet, fine-graded material of sticky nature can be prevented by heating such surfaces of equipment that are to come in contact with such a sticky material to a temperature above the boiling point of water. Thus, the material is prevented from sticking, because the hot areas will be coated with a dry layer of material having the water evaporated away. As the ad-

herence tendency of dry clay or other dry, fine-graded material is weak, such an interface layer can effectively prevent the sticking of the material being treated. The dry interface layer can be very thin, and in reality, a continuous exchange between the dry and the wet material will occur in the interface layer. When the first formed, dry interface layer is scrubbed off from the heated equipment surface, the fresh material coming into contact with the surface will rapidly loose its moisture content and thus form a new dry interface layer on the equipment surface. Correspondingly, if due to a temporary lack of heating, for instance, the equipment has accumulated layers of a more permanent sticking nature, the reapplied heating will rapidly form a new dry interface layer that detaches the adhered material from the surface of the equipment. The detachment is aided by the formation of steam in the interface layer.

The treatment equipment can be heated entirely, or alternatively, only those parts of the equipment can be heated in which the sticking of the treated material will cause disturbance to the function of the equipment. In such a case, it may be sufficient to heat, e.g., the shafts of the screen equipment only, whereby the discs of the screen will be indirectly heated, and correspondingly, the heating of shovel bottom only, whereby the material will separate readily from shovel. The surface temperature of the heated equipment elements must be elevated above 100 °C. As the steel grade used in machine elements may loose its qualities, particularly its hardness, if heated above 200 °C for extended periods of time, the machine element temperature should not be allowed to exceed this limit. Advantageously, the equipment elements to be heated should be brought to a temperature in the range of 150 - 200 °C, where the evaporation of moisture occurs rapidly and yet there is no risk of decreased strength or hardness in the equipment materials due to the heating.

The heating of equipment and machine elements may be carried out using steam, heated water or oil, electric heater means, and in some cases, by passing an electric current through the machine elements or heating them by inductive means. The invention can be applied to a plurality of different equipment such as blenders, screens, shovels, rock beds of transport vehicles and other material transport and handling equipment.

Claims

1. A method of preventing sticking of a fine-graded, moist material in the treatment equipment of such materials, **characterized** in that at least a portion of the equipment elements to be in contact with the material being treated are heated to a temperature higher than the boiling point of water.

2. A method as defined in claim 1, **characterized** in that at least a portion of the handling equipment elements to be in contact with the material being treated are heated to a temperature in the range of 150 - 200 °C.

3. A method as defined in any of the foregoing claims, **characterized** in heating the shafts and screen discs of a disc screen.

4. A method as defined in any of foregoing claims 1 - 2, **characterized** in heating at least a portion of a material handling shovel is heated.

5. A method as defined in any of foregoing claims 1 - 2, **characterized** in heating at least a portion of a material transport bed.

6. A method as defined in any of foregoing claims 1 - 2, **characterized** in heating elements of a blender.

7. A method as defined in any the foregoing claims, **characterized** in that said elements are heated with circulating hot oil.

8. A method as defined in any of foregoing claims 1 - 6, **characterized** in that said elements are heated with circulating steam.

9. A method as defined in any of foregoing claims 1 - 6, **characterized** in that said elements are heated with circulating water.

10. A method as defined in any of foregoing claims 1 - 6, **characterized** in that said elements are heated with electric heater means.

11. A method as defined in any of foregoing claims 1 - 6, **characterized** in that said elements are heated with inductive means.

12. An assembly for preventing the sticking of a fine-graded, moist material in the treatment equipment of such materials, **characterized** in that said assembly comprises means for heating at least a portion of the equipment elements to be in contact with the material being treated to a temperature higher than the boiling point of water.

13. An assembly as defined in claim 12, **characterized** in that said heater means comprise a circulating-oil piping.

14. An assembly as defined in claim 12, **characterized** in that said heater means comprise a circulating-water piping.

15. An assembly as defined in claim 12, **characterized** in that said heater means comprise a circulating-

steam piping.

16. An assembly as defined in claim 12, **characterized** in that said heater means comprise electric heater means.

17. An assembly as defined in claim 12, **characterized** in that said heater means comprise inductive heater means.