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(54) **Electric heating machine for reducing the damp of wet cement in a screed**

(57) The present invention relates to an electric heating machine to reduce the damp of wet cement in a screed by means of heat exchange with a liquid.

Such electric machine comprises an inlet duct for the entrance of the liquid inside the machine, and an outlet duct for the exit of the liquid from it. Such ducts are communicating.

The electric machine comprises, in addition, heat exchange devices, in fluid communication with the inlet duct and able to increase the temperature of the incoming

liquid and circulation devices, able to make the liquid travel from the inlet duct to the outlet duct and vice versa through a circuit in thermal contact with the damp cement of the screed.

In addition, the electric machine is portable and comprises attachment and release mechanisms of the ducts, such as to enable the easy connection and detachment of the machine from the circuit.

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Description

[0001] The present invention relates to an electric heating machine, able to reduce the damp of wet cement in a screed.

[0002] In the construction process of real estate it is known of to pour an essentially flat layer of cement comprising at least one binding agent onto the slab. Before commencing the subsequent phase of laying the tiles on such layer, the so-called "screed", it needs to lose a consistent part of the water needed to pour it.

[0003] In the case in which the construction built foresees a heating system with panels embedded in the screed, it is known of to make hot water circulate through the ducts present in the panels by means of special devices, so as to reduce the time needed for the water to evaporate.

[0004] The devices used in the art to perform such operation are hand-made and present a number of drawbacks.

[0005] Specifically, gas-fuelled burners are used which thus require the transport of gas cylinders to the place of use and their presence on site also during the night, with consequent risk to those handling or working in the presence of inflammable and potentially explosive material.

[0006] Often, moreover, safety regulations are not observed, in that a specific fume extraction system should be provided.

[0007] The present invention thus sets out to resolve the drawbacks of the known technique and especially, those described above.

[0008] Such objective is achieved by an electric heater according to claim 1 and by a drying assembly according to claim 24.

[0009] The present invention will now be described in detail with the help of the attached figures, wherein :

[0010] - figure 1 shows a schematic diagram of the assembly which the present invention relates to, in one possible embodiment.

[0011] - figure 2 shows a longitudinal cross-section of a detail of the assembly in figure 1.

[0012] With reference to the aforesaid figures, reference numeral 2 globally denotes an electric heater for reducing the damp of wet cement in a screed by means of heat exchange with a liquid.

[0013] The electric heater 2 comprises an inlet duct 3, for the entrance of the liquid inside the machine 2, and an outlet duct 4, for the exit of the liquid from it. The ducts 3, 4 are reciprocally communicating.

[0014] In other words, at least a part of the liquid entering the inlet duct 3 comes out of the outlet duct 4.

[0015] According to one embodiment variation, the inlet duct 3 is able to convey the incoming liquid along a longitudinal entrance axis Y, essentially coinciding with the axis around which the tubular wall of such duct extends.

[0016] The electric machine 2 comprises, moreover

heat exchange devices, in fluid communication with the inlet duct 3 and able to increase the temperature of the incoming liquid.

[0017] According to a preferred embodiment, the heat exchange devices comprise at least one heat exchanger 9, which has one heat exchanger wall 10 identifying a heating compartment 11.

[0018] In the variation shown in figure 2, the heat exchanger wall 10 is tubular and extends around a heat exchanger axis X.

[0019] In such embodiment variation, moreover, the longitudinal entrance axis Y and heat exchanger axis X are parallel and coincident.

[0020] In a further variation, the axes X, Y are staggered angularly and incident.

[0021] Preferably, the cross-section of transit of the liquid inside the heating compartment 11, is greater than that of the inlet duct 3, so as to slow down the flow of the liquid entering the compartment 11.

[0022] In other words, for the same heating power delivered, a reduction of speed of the flow of liquid entering the compartment 11 entails an increase of the time during which the liquid remains in the heat exchanger 9, and therefore a more efficient heat exchange.

[0023] According to one preferred embodiment, the heating compartment 11 comprises deviator devices, able to create a path at least partially winding inside the heat exchanger 9.

[0024] For instance, the deviator devices are able to angularly deviate the incoming liquid in relation to the longitudinal entrance axis Y.

[0025] In other words, the incoming liquid is deviated in relation to the longitudinal entrance direction Y, so as to force such liquid to remain in the heat exchanger for a longer time but most of all to come closer to the wall of the heat exchanger 10.

[0026] In fact, as will be described in detail below, according to one advantageous embodiment, the heat exchanger wall 10 is the part of the heat exchanger having the highest temperature, thus ensuring the best heat exchange.

[0027] According to a preferred variation, the deviator devices comprise at least one deviator wall 12', 12" positioned at the inlet and/or outlet of the heating compartment 11.

[0028] For instance, the wall 12', 12" is shaped like a disc or pan, having a smaller diameter than the cross-section of the heating compartment 11.

[0029] Preferably, the heat exchanger 9 comprises a pair of walls 12', 12" both at the entrance and exit of the compartment 11.

[0030] According to one embodiment, the deviator wall 12', 12" is able to transform the flow of incoming liquid from axial to radial in relation to the longitudinal entrance axis Y, as shown in figure 2.

[0031] According to a preferred variation, the heat exchanger 9 comprises in addition a resistor or coil 13, able to increase the temperature of the incoming liquid.

[0032] Preferably, the resistor 13 is electric and has a high heating capacity, for instance 1500 or 2500 Watt.

[0033] According to a further variation, the resistor 13 is positioned outside the heating compartment 11, in thermal contact with the heat exchanger wall 10.

[0034] In other words, if the heat exchanger wall 10 has good heat conductivity, as for instance happens with a metal wall, the temperature of the wall 10 is essentially the same as that of the resistor 13. This way, by using the heat conduction through and along the heat exchanger wall 10 it is possible to obtain a bigger heat exchange surface than the outer surface of a normal resistor.

[0035] For instance, the resistor 13 is braze-welded to the heat exchanger wall 10, to improve reciprocal thermal contact.

[0036] According to one embodiment, the resistor 13 is wound in a spiral manner around the heat exchanger axis X, for instance at a constant pitch, as shown in figure 2.

[0037] According to a further embodiment, the heat exchanger 9 comprises in addition an insulating coating (not shown), able to reduce the dispersion of heat through the heat exchanger wall 10.

[0038] Preferably, the insulating coating is positioned on the surface of the resistor 13 opposite that facing the heat exchanger wall 10, so as to form a thermally insulated compartment.

[0039] In other words, according to this embodiment, the resistor 13 is positioned in the thermally insulated compartment included between the heat exchanger wall 10 and the insulating coating.

[0040] The electric machine 2 comprises, moreover a tank 5, positioned downline of the heat exchange devices in relation to the direction of transit of the liquid.

[0041] Such tank 5 is able to hold the heated liquid coming from the exchange devices and is in fluid communication with the outlet duct 4.

[0042] In other words, the liquid coming from the exchange devices flows into the tank 5, so that this constitutes a storage vessel for the hydraulic circuit.

[0043] For instance, the tank 5 may be insulated so as to reduce heat dispersion outwards.

[0044] According to one embodiment, the tank 5 comprises a tank wall 6, which defines a collection compartment 7, where the heated liquid is collected.

[0045] The electric machine 2 comprises further circulation devices, such as for instance a pump or circulator 15, able to make the liquid travel from the inlet duct 3 to the outlet duct 4, and vice versa through a circuit in thermal contact with the damp cement of the screed.

[0046] In other words, the circuit comprises a path which extends inside the machine 2, between the inlet duct 3 and the outlet duct 4, and extends outside it too, along a drying duct 8, in thermal contact with the damp cement of the screed, that is through the floor heating panels.

[0047] According to a preferred embodiment, the drying duct 8 comprises the pipes of a plumbing system

and/or the coils of a panel heating system.

[0048] In other words, after laying the heating pipes on the slab, they are embedded in the wet cement, so that it loses its humidity in the shortest time possible. The transit of a liquid, such as hot water inside the pipes considerably reduces the time needed for this operation.

[0049] Furthermore, since drying is not dependent exclusively on environmental factors such as sunlight or weather conditions, the time required for performing works can be calculated more accurately.

[0050] Moreover, the electric machine 2 is portable, and the ducts 3, 4 comprise means of attachment and release such as to easily permit the connection and detachment of the machine 2 from the circuit.

[0051] In other words, the electric machine 2 is of sufficiently limited weight/size to be easy to transport to the place of use.

[0052] Moreover, the presence of attachment and release mechanisms suitable for easily engaging to those of a pre-existing external circuit, permits a reduction of assembly and dismantling times of the machine having such circuit.

[0053] Preferably, the attachment and release mechanisms are of the type snap-on/off.

[0054] According to a preferred embodiment, the machine 2 comprises, in addition, anti-bacterial means, able to limit/prevent the formation of algae, fungi and/or similar, in the circuit, for instance in the tank 5 and/or in the heating compartment 11.

[0055] For instance, the anti-bacterial means comprise a coating of an anti-bacterial agent on the surfaces of the walls 10, 6 facing the heating compartment 11 and/or collection compartment 7.

[0056] For instance, the bactericide agent comprises copper.

[0057] In one embodiment, the anti-bacterial means comprise an anti-bacterial element 14, positioned inside the heating compartment 11 and extending parallel to the heat exchanger axis X.

[0058] In the embodiment shown in figure 2, the anti-bacterial element comprises a cylinder mounted coaxially to the heat exchanger wall 10

[0059] In a preferred variation, the electric machine 2 comprises a pair of deviator walls 12', 12'', and the anti-bacterial element 14 extends between them.

[0060] Preferably, the electric machine 2 comprises temperature measurement devices, such as for instance a thermocouple, able to measure the temperature inside the circuit.

[0061] Even more preferably the electric machine 2 comprises, in addition, pressure measurement devices, such as a pressure gauge, able to measure the pressure inside the circuit.

[0062] As will be explained in detail shortly, knowing the pressure and/or temperature values inside the circuit makes it possible, for example, to detect any leaks immediately or to prevent a pressure limit from being exceeded, beyond which the components of the system

would be likely to break.

[0063] According to an advantageous embodiment, the temperature and/or pressure measuring devices are located along the outlet duct 4.

[0064] According to another embodiment of the invention, the electric machine 2 comprises, in addition, valve devices, such as, for instance, solenoid valves or manual valves which can be activated so as to allow/prevent the flow of liquid inside and/or outside the circuit.

[0065] Preferably, the electric machine 2 comprises, in addition, safety and management devices, able to make adjustments for the safety and functioning of the machine 2.

[0066] Even more preferably, the safety and management devices are operatively connected to the heat exchange devices, the circulation devices, the temperature measuring devices, the pressure measuring devices and/or valve devices.

[0067] Below, by way of example, some of the operations which the safety and management devices are able to perform are described.

[0068] For instance, during the start-up phase of the electric machine 2, overly intense evaporation of the water from the damp screed must be avoided to prevent the formation of cracks. Consequently, during this phase the safety and management device keeps the resistor 13 turned off so as to make water at essentially room temperature circulate through the circuit.

[0069] For instance, in the phases subsequent to start-up it is, rather, preferable to perform heating for periods of time at programmed temperatures and times, creating temperature ramps for example depending on the time. Such ramps may be observed by the safety and management device which acts on the resistor 13, or the circulator 15.

[0070] For instance, in the case of leaks of liquid in the circuit, the pressure measuring devices are able to detect the resulting loss of pressure and send a signal to the safety and management device, which stops the circulator 15 or acts on the valve devices so as to close off sections of the circuit and prevent it from emptying, or turns off the resistor 13 to prevent it from burning.

[0071] For instance, if an operator tried to start the electric machine 2 without any liquid inside the circuit, the safety and management device would prevent such operation, blocking the power supply of the resistor 13 and/or circulator 15.

[0072] For instance, if the pressure measuring devices should detect an anomalous rise in pressure, for example of over 3 bar, the safety and management device would process the signal coming from the pressure measuring devices to open the vent valve 17, so as to reduce the pressure.

[0073] According to one advantageous variation, the safety and management device comprises an electronic system which be controlled manually and/or automatically to perform said functioning and safety adjustments.

[0074] The technical problem is overcome, moreover,

by a drying assembly 1 comprising an electric heating machine 2 according to any of the previous embodiments, and at least one drying duct 8.

[0075] Such drying duct 8, already described above, may be fluidically connected to the inlet 3 and outlet ducts 4 of the electric machine 2 so as to form a circuit, and is suitable for being placed in thermal contact with the wet cement of the screed.

[0076] Innovatively, the machine which the present invention relates to is easy to transport to wherever it is to be used and can be connected/detached very rapidly.

[0077] Advantageously, the machine which the present invention relates to makes it possible to work in safety, both during the transport phase and during use.

[0078] Advantageously, the machine which the present invention relates to enables completely safe functioning during the night too, when security staff are not on duty.

[0079] Advantageously, the machine which the present invention relates to has the components most subject to wear, such as the circulator and the resistor, in an accessible position for replacement or regular maintenance operations.

[0080] Advantageously, the heat exchanger and the resistor shown permit the best heat exchange with the liquid with the least possible external occupation of space by the heat exchanger.

[0081] Advantageously, the presence of anti-bacterial means makes it possible to prevent the formation of colonies of bacteria in the circuit, which in the long term would reduce the cross-section of transit in the ducts, and therefore place greater strain on the circulation mechanisms.

[0082] A person skilled in the art may make modifications to the embodiments of the machine and of the assembly described above so as to satisfy contingent aims while remaining within the sphere of protection as defined by the appended claims.

[0083] Each of the characteristics described as belonging to a possible embodiment is protected independently of the other forms of embodiment described.

Claims

1. Electric heating machine (2) for reducing the damp in the wet cement of a screed by means of heat exchange with a liquid, comprising:

- an inlet duct (3) for the entrance of the liquid inside the machine (2), and an outlet duct (4) for the exit of the liquid from it, said ducts (3, 4) being communicating;
- heat exchange devices, in fluid communication with the inlet duct (3) able to increase the temperature of the incoming liquid;
- a tank (5), positioned downline of the heat exchange devices in relation to the direction of

transit of the liquid, able to hold the liquid coming from the exchange devices and in fluid communication with the outlet duct (4); and
- circulation devices able to make the liquid travel from the inlet duct (3) to the outlet duct (4), and vice versa through a circuit in thermal contact with the damp cement of the screed;

said machine being portable and the ducts (3, 4) comprising, in addition, attachment and release mechanisms such as to easily permit the connection and detachment of the machine (2) from the circuit.

2. Machine (2) according to claim 1, wherein the heat exchange devices comprise at least one heat exchanger (9), having a heat exchanger wall (10), for instance tubular, identifying a heating compartment (11).
3. Machine (2) according to claim 2, wherein the cross-section of transit of the liquid inside the heating compartment (11) is greater than that of the inlet duct (3), so as to slow down the speed of flow of the incoming liquid.
4. Machine (2) according to any of the claims from 2 to 3, wherein the heating compartment (11) comprises deviator devices, able to create a path at least partially winding inside the heat exchanger (9).
5. Machine (2) according to claim 4, wherein the deviator devices comprise at least one deviator wall (12', 12'') positioned at the inlet and/or outlet of the heating compartment (11).
6. Machine (2) according to any of the claims from 2 to 5, wherein the heat exchanger (9) comprises a resistor or coil (13), able to increase the temperature of the incoming liquid, for instance braze-welded to the heat exchanger wall (10).
7. Machine (2) according to claim 6, wherein the resistor (13) is positioned outside the heating compartment (11), in thermal contact with the heat exchanger wall (10).
8. Machine (2) according to claim 6 or 7, wherein the resistor (13) is wound in a spiral manner around the heat exchanger axis (X).
9. Machine (2) according to any of the claims from 6 to 8, wherein the resistor (13) is electric.
10. Machine (2) according to any of the previous claims, comprising in addition anti-bacterial means, able to limit/prevent the formation of algae, fungi and/or similar, in the circuit, for instance in the tank (5) and/or in the heating compartment (11) for instance, an anti-

bacterial element (14), positioned inside the heating compartment (11) and extending parallel to the heat exchanger axis (X).

- 5 11. Machine (2) according to claim 5 and according to claim 10, comprising a pair of deviator walls (12', 12''), and wherein the anti-bacterial element (14) extends between them.
- 10 12. Machine (2) according to any of the previous claims, comprising in addition
 - temperature measurement devices, such as for instance a thermocouple, able to measure the temperature inside the circuit positioned along the outlet duct, and
 - pressure measuring devices, such as a pressure gauge, able to measure the pressure inside the circuit, positioned along the outlet duct.
- 15 13. Machine (2) according to any of the previous claims, comprising in addition valve devices, such as for instance solenoid valves or manual valves which can be activated so as to allow/prevent the flow of liquid inside and/or outside the circuit.
- 20 14. Machine (2) according to any of the previous claims comprising, in addition, a safety and management device, able to make adjustments for the safety and functioning of the machine (2).
- 25 15. Drying assembly (1) comprising:
 - an electric heating machine (2) according to any of the claims from 1 to 23; and
 - at least one drying duct (8), fluidically connected to the inlet (3) and outlet (4) ducts so as to form a circuit, placed in thermal contact with the damp cement of the screed.
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