# AN APPARATUS AND METHOD FOR DEHUMIDIFYING A BUILDING

## TECHNICAL FIELD AND BACKGROUND ART.

The present invention relates to an apparatus and a method for dehumidifying a building.The invention refers to the sector of sanitising masonry buildings, i.e. dehumidification based on the principle of electro-osmosis. On the market today there are several sanitation systems that, aside from the different commercial names, are based on the electro-osmotic principle. Such systems exploit the following physical principle. Water rises from the ground within walls penetrating in capillary fashion, by effect of the difference in electrical potential that is established between the subsoil, at the level of the plane of foundation, and the wall structure above the ground, difference in potential that is influenced by the nature of the materials whereof the wall to be sanitised is composed, by the quantity of water present in the soil and by the composition of the salts carried in the form of a solution by the rising humidity.

In this light, electro-osmosis dehumidification systems entail the application of a direct electrical voltage to the portion of wall to be dehumidified, in order to cause in that area an inversion of the polarity of the system, allowing to sanitise the wall by reversing the electrical flow responsible for the rise of the humidity.

Therefore, the segment of humid wall to be sanitised is confined with two low voltage electrical conductors (no more than 4 or 5V), defining a

positive electrode and a negative electrode. The positive electrode is placed in contact with the wall at a height of about one and one half meter. Therefore, the degraded plaster is removed, up to a height exceeding the highest point reached by the risen humidity.

The negative electrode is always positioned at the humid area, but in the lowest possible position, i.e. level with the surface of the ground.

In this way the artificial electrical field thus created reverses towards the ground the rising flow of the humidity, which, conveyed in a capillary manner, returns to its original place.

One of the main advantages that this method aims to achieve is low invasiveness. The system does not intervene on the structure of the wall in a traumatic manner, as do mechanical systems (cutting) and chemical systems (injections), thus eliminating a priori any potential problem of a static nature.

However, the prior art solutions described above present some disadvantages and limitations.

First of all, prior art solutions are still partially invasive, because they require housing a conductor transversely in the wall to define the positive electrode. This entails possible problems for the passage of pipelines, other electrical cables and, when erecting or renovating the building, the presence of said positive electrode hinders the work (for example) of electricians and plumbers. Moreover, if the electro-osmotic system is applied to an existing building, it is necessary to operate by opening paths on the walls. Clearly, this operation is particularly negative and at times impossible in the case of buildings with particular

artistic value (consider, for example, restoration issues).

DISCLOSURE OF THE INVENTION.

An object of the present invention is to eliminate the aforesaid drawbacks and make available an apparatus and a method for dehumidifying a building exploiting the principle of electro-osmosis, but with no need to insert any conductor into the wall, whilst allowing a particularly efficient dehumidification of the wall.

Said object is fully achieved by the apparatus of the present invention, which is characterised by the content of the appended claims and in particular in that, in combination:

- the negative electrode is electrically connected to the undisturbed ground underlying the building;
- the positive electrode is electrically connected to the building at the level of the ground surface.

The method of the present invention is characterised in that it comprises the following steps:

- preparing a supply of direct electrical voltage connected to a positive electrode and to a negative electrode;
- electrically connecting the negative electrode to the undisturbed ground underlying the building;
- electrically connecting the positive electrode to the building at the level of the ground surface;
- applying a predetermined voltage between the positive electrode and the negative electrode.

BRIEF DESCRIPTION OF DRAWINGS.

This and other characteristics shall become more readily apparent from the following description of a preferred embodiment, illustrated purely by way of non limiting example in the accompanying drawing tables, in which:

- figure 1 schematically shows a plan view of a building with an apparatus according to the present invention applied;
- figure 2 schematically shows a section view of the apparatus of figure 1.

BEST MODE FOR CARRYING OUT THE INVENTION.

In the figures, the reference number 1 indicates an apparatus for dehumidifying a building 2 by electro-osmosis, according to the present invention. The building comprises a plurality of walls 3.

In the illustrated example, the building is surrounded by a sidewalk 4 or by any other element able to constitute a continuous wall mass with the building 2 and in particular with the walls 3 of the building.

The apparatus 1 comprises a supply 5 of direct electrical voltage, able to deliver a direct electrical current.

The power supply 5 comprises for example an electrical unit, or a digital electronic unit for the delivery of electrical current, of the direct impulse type, preferably able to assure an inversion of polarity of the voltage.

Operatively, the power supply 5 operates at a voltage of between 2V and 60V. Preferably, the power supply 5 operates at a voltage of at least 5V (e.g. between 5V and 48V).

Moreover, the apparatus comprises a positive electrode 6, connected to the positive pole of the power supply 5, and a negative electrode 7,

connected to the negative pole of the power supply 5.

Therefore, between the positive electrode 6 and the negative electrode 7 a direct voltage, preferably exceeding 5V, is established.

The negative electrode, originally, is electrically connected to the undisturbed ground 8 underlying the building 2, in order to define an earth connection and it is preferably constituted by at least one pile shoe 9 made of metal (or otherwise made of a material with high conductivity).

The term "undisturbed ground" means a portion of ground that is not affected by works linked to the construction or renovation of the building, so it is a portion of ground that is not altered by construction work. Therefore, undisturbed ground has markedly higher conductivity than the ground affected by work, because of the crushing of the ground over time, due to the weight of the overlying ground itself.

Hence, connecting the negative electrode 7 to the undisturbed ground (8) allows a particularly effective electrical connection.

The negative electrode comprises for example as many pile shoes 9 as there are walls 3 to be dehumidified (or a plurality of pile shoes 9 located along the perimeter of the building at a distance of about 5 m from each other).

Moreover, advantageously, the negative electrode can also comprise a single pile shoe 9, driven into the ground 8 at a particularly large depth (e.g., at least 180 cm).

In any case, the depth of insertion of the pile shoes 9 into the ground is preferably greater than 120 cm.

In the illustrated example, originally, the pile shoe 9 comprises an isolating coating 10 applied to its own portion (said portion being preferably equal to about 80% of the surface of the pile shoe 9) to insulate the pile shoe from the building 2, whilst below the superficial level of the ground (preferably at a depth of between 120 cm and 150 cm) the pile shoe 9 has a portion in direct contact with the ground 8 to define an electrical connection therewith.

In this light, it should be noted that, originally, the negative electrode 7 is electrical isolated from the building 2.

Originally, the positive electrode 6 is electrically connected to the building 2 at the level of the ground surface, i.e. about at height zero. It should be noted that the level of the ground 8 may undergo variations (typically of some centimetres or tens of centimetres) between the interior and the exterior of the building.

The expression "electrically connected to the building" means that the positive electrode 6 is electrically connected directly to the building (e.g. to the wall) or also, more preferably, to an element external to the building 2 but constituting a continuous wall mass therewith.

In the illustrated example the positive electrode 6 is inserted in the sidewalk 4.

Preferably, the positive electrode 6 is a bare conductor buried in a cement mortar placed in a housing obtained along the perimeter of the building. Said housing can be obtained at the intersection between wall and floor, with a covering element (like a skirting board in oblique position), but it can also be obtained by digging a path in the wall (but

always at the level of the ground 8).

Preferably, a conductor for connecting the pile shoes 9 to the power supply 5 is an isolated conductor positioned in the same housing. This enables, advantageously, to save time and space during the installation.

Preferably, the positive electrode 6 is a conductor comprising titanium treated in such a way as to avoid electrolysis phenomena.

Preferably, the positive electrode 6 is a conductor defining a loop that surrounds the building 2 (as schematically shown in figure 1). However, the positive electrode 6 may be connected to the building along the perimeter but only on three sides, or otherwise without closing said loop.

In particular, the positive electrode is a conductor (preferably wire-like) positioned at a distance from the walls 3 defining the perimeter of the building 2 preferably of between five centimetres and about two meters (or even at greater distances in the presence of sidewalks).

The positive electrode 6 can be made of different materials, e.g. titanium, and have different shapes in relation to the type of wall to be treated.

The present invention also makes available a method for dehumidifying a building 2 by electro-osmosis.

Said method comprises the following steps:

- preparing the supply 5 of direct electrical voltage connected to the positive electrode 6 and to the negative electrode 7;
- connecting the negative electrode 7 to the ground 8 underlying the building 2;
- electrically connecting the positive electrode 6 to the building 2 at the level of the ground surface 8;

- applying a predetermined voltage between the positive electrode 6 and the negative electrode 7.

Preferably, said predetermined voltage is at least 5V.

Preferably, the step of electrically connecting the negative electrode to the ground entails electrically isolating the negative electrode 7 from the building 2.

Moreover, the step of electrically connecting the negative electrode 7 to the ground provides for driving at least one pile shoe 9 into the ground 8 underlying the building. For example, a single pile shoe 9 driven to a depth of at least 180 cm can be connected to the ground, or alternatively, a plurality of pile shoes 9 an be connected to the ground (e.g. as many pile shoes 9 as there are walls 3 to be dehumidified in the building 2), driven preferably to a depth of between 120 and 150 cm under the surface level of the ground.

It should be noted that preferably the step of electrically connecting the positive electrode 6 to the building 2 comprises placing a conductor defining a loop surrounding the building 2.

Moreover, said step entails placing said conductor at a distance of between five centimetres and about two meters from the walls 3 defining the perimeter of the building 2 (externally to the perimeter defined by the building 2).

The present invention provides the following advantages.

First of all, it enables to apply the electrodes only to the perimeter walls excluding the partitions and any main inside walls. Moreover, the presence of conductors inserted into the walls to be sanitised is avoided.

Therefore, the sanitising intervention is totally non invasive and it can be applied without problems even in critical cases such as restoration operations. Moreover, the presence of superficial conductors that drain in the wall.

The apparatus is particularly simple to apply, with no risk of hindering work in construction sites and minimising the inconvenience of the intervention.

The effectiveness of the apparatus and of the method is particularly high, in terms of time necessary for the installation of the system and the dehumidification of the building.

These advantages are achieved thanks to the fact that, with the present invention, originally the entire building out of the ground constitutes, de facto, a positive electrode, whilst the ground is de facto the negative electrode. Therefore, the action of the present invention, originally, is not concentrated only on a portion of wall, but it involves the entire building as a whole.

An additional advantage of the present invention is given by the installation cost, which are halved relative to the solutions currently in use.

CLAIMS

**1.** Method for dehumidifying a building (2),

characterised in that it comprises the following steps:

- preparing a supply (5) of direct electrical voltage connected to a positive electrode (6) and to a negative electrode (7);
- connecting the negative electrode (7) to the undisturbed ground (8) underlying the building (2);
- electrically connecting the positive electrode (6) to the building (2) at the level of the ground surface ;
- applying a predetermined voltage between the positive electrode (6) and the negative electrode (7).

**2.** Method as claimed in claim 1, wherein the step of electrically connecting the negative electrode (7) to the ground (8) comprises electrically isolating the negative electrode from the building (2).

**3.** Method as claimed in claim 1 or 2, wherein the step of electrically connecting the negative electrode (7) to the ground (8) comprises driving at least one pile shoe (9) into the undisturbed ground underlying the building.

**4.** Method as claimed in claim 3, wherein said driving entails arranging said at least one pile shoe (9) to a depth of at least 120 cm below the surface level of the ground (8).

**5.** Method as claimed in any of the previous claims, wherein the step of electrically connecting the positive electrode (6) to the building (2) comprises placing a conductor defining a loop surrounding the building.

**6.** Method as claimed in claim 5, wherein said conductor is placed at

a distance from the walls (3) defining the perimeter of the building (2) in the range between five centimetres and ten metres.

**7.** Method as claimed in any of the previous claims, in which said predetermined voltage is at least 5V.

**8.** An apparatus (1) for dehumidifying a building (2), comprising a supply (5) of direct electrical voltage connected to a positive electrode (6) and to a negative electrode (7) to apply a predetermined voltage therebetween,

characterised in that, in combination:

- the negative electrode (7) is electrically connected to the undisturbed ground (8) underlying the building;

- the positive electrode (6) is electrically connected to the building (2) at the level of the ground surface.

**9.** An apparatus as claimed in claim 8, wherein the negative electrode (7) is electrically isolated from the building (2).

**10.** An apparatus as claimed in claim 8 or 9, wherein the negative electrode (7) comprises at least one pile shoe (9) driven into the undisturbed ground (8) underlying the building.

**11.** An apparatus as claimed in claim 10, wherein said at least one pile shoe (9) is positioned at a depth of at least 120 cm below the surface level of the ground (8).

**12.** An apparatus as claimed in claim 10 or 11, wherein said at least one pile shoe (9) comprises an isolating coating applied to a portion thereof, to isolate the pile shoe from the building (2).

**13.** Method as claimed in any of the previous claims 8 to 12, wherein

the positive electrode (6) is a conductor defining a loop surrounding the building.

**14.** An apparatus as claimed in claim 13, wherein the positive electrode (6) is a wire-like conductor positioned at a distance from the walls (3) defining the perimeter of the building (2) in the range between five centimetres and ten metres.

**15.** A method as claimed in any of the claims 8 to 14, wherein said predetermined voltage is at least 5V.

ABSTRACT

An apparatus (1) for dehumidifying a building (1), by electro-osmosis comprises a supply (5) of direct electrical voltage connected to a positive electrode (6) and to a negative electrode (7) to apply a predetermined voltage between said electrodes; the negative electrode (7) is electrically connected to the ground (8) underlying the building, whilst the positive electrode (6) is electrically connected to the building (2) at the level of the surface of the ground.

Known apparatuses to sanitise a building by electro-osmosis entail greater problems and they are more invasive during installation, because they necessarily require the introduction of conductor into the wall; moreover, they are more costly and less effective, because their action does not involve the entire building but only the portion of wall included between the electrodes.

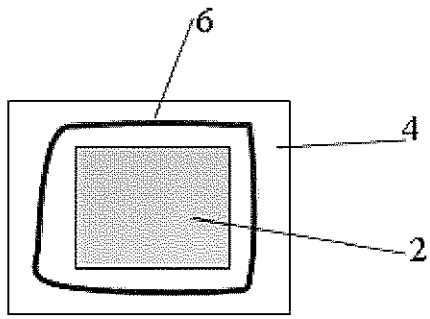


FIG. 1

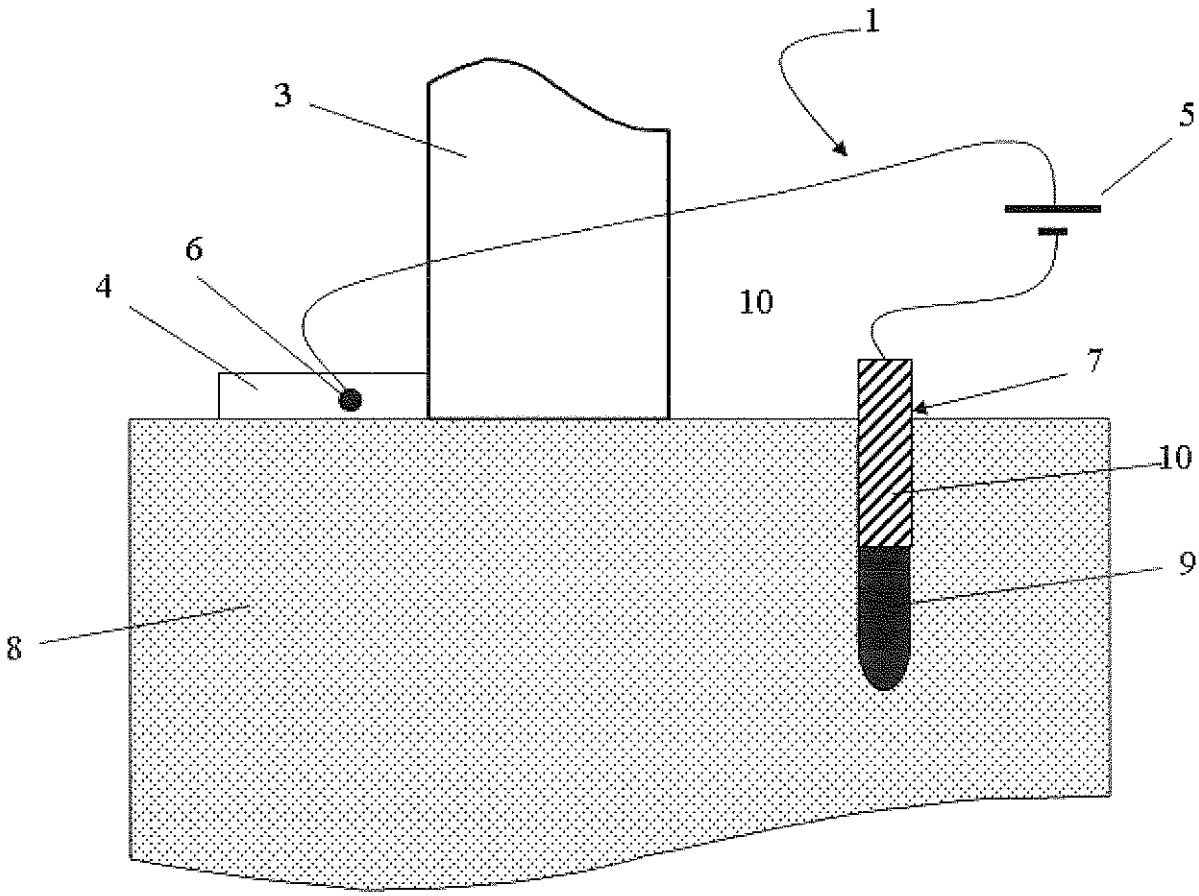


FIG. 2