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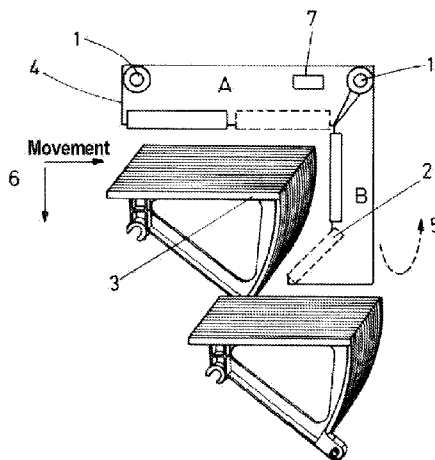
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(54) Title: ESCALATOR ROBOTIC CLEANING DEVICE



(57) Abstract: Escalator robotic cleaning device comprising a horizontal plate and a "J"-shaped structure attached to each other by means of a hinge system which allows the relative movement of both of them for cleaning moving escalators. The horizontal plate and the "J"-shaped structure are adapted to be able to support cleaning modules using steam, suction systems or cryogenic technologies for the impeccable cleaning of the surfaces, according to the user needs. Furthermore, the equipment has been adapted for the positioning and easy replacement of several attachments such as brushes, rollers, sponges and mops.



ESCALATOR ROBOTIC CLEANING DEVICE**OBJECT OF THE INVENTION**

5 The present invention refers to a machine or robotic cleaning device for cleaning moving escalators. More particularly, a robotic cleaning device is described comprising a computerized system which enables robotic operation thereof, without an operator being required during the whole cleaning cycle.

10 BACKGROUND OF THE INVENTION

The current escalator cleaning mechanisms depend on the use of power supply cables in order to be able to move the motor thereof. Furthermore, it is necessary that during the cleaning operation there is an operator supervising and completing said operation.

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Another drawback of the current escalator cleaning systems is that most of the devices do not cover the whole surface of the steps.

Patent US-8376124 B1 granted to Berto discloses equipment for manually cleaning
20 escalators. Said equipment comprises a mechanism featuring elongated brushes for cleaning the steps. This equipment extends a set of bristles along the longitudinal axis thereof which are intended for cleaning the step surface. The equipment also comprises a plurality of pulleys and a set of resilient tensionable belts which actuate the drive motor.

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Patent No. US-8337625 B2 granted to Gehm discloses a system for cleaning escalators which comprises a set of parallel bands using a cleaning material to gather dirt from the moving step. These bands are formed by a set of cleaning pads which are attached to a rotating brushes cleaning system.

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Patent No. US-6527103 B2 granted to Neszmerak, discloses a system for cleaning escalators which allows waste to accumulate in a waste collecting plate.

Patent No. US-5715565 granted to Kern, discloses a system for cleaning escalators which is formed by a set of elements among which there is a roller brush rotationally driven which is integrated in a casing, a device provided with a cleaning solution, a suctioning device for removing dirt particles and a brush moving in the escalator moving
5 direction. In this system, the roll brush moves rotationally, such that dirt is removed as the device comprising the cleaning solution is used for releasing the cleaning solution and removing dirt residues in the area. At the same time the suction device removes the exceeding dirt particles and the brush moving in the escalator direction finishes the cleaning process.

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Patent No. US-5042641 A granted to Soldat, discloses a machine for cleaning moving escalators. This system comprises a set of brush and grooves which clean the escalators as people walk on them. Bristles perform a counter-movement to that of the brush and that makes the surface be cleaned twice at practically all the step height.

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Patent No. US-8689392 B2 granted to Kawamura, discloses a vacuum cleaner for cleaning dust and dirt in a given surface. This machine prevents dust from being dispersed during the vacuuming process.

20 Patent number US-7979959 B2 granted to Graves discloses an accessory for a cleaning device which includes a head and a suction opening downward oriented. The rotating mechanism provides a movement between the head and the opening which allows rotation so that enables the surface cleaning.

25 Patent number US-7401378 B2 granted to Hobbs, consists of a vacuum apparatus having a vacuum pump mechanism for courtyards. The vacuum pump mechanism is adapted for any type of cleaning, such as it is the case of debris removal, and this is achieved by adapting different attachments, depending on the type of cleaning or the courtyard area intended to be cleaned.

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Patent number US-7284297 B2 granted to Shanor, discloses a support for the current mechanisms for cleaning floors and comprises a vacuum cleaning mechanism.

DESCRIPTION OF THE INVENTION

The present invention solves the problems described from the inventions of the state of the art, since it is provided with a power source having batteries, it comprises a mechanism for adjustment thereof to the escalator glasses so that it does not need the support of an operator throughout the process, and furthermore the configuration thereof adapts to the step shape.

The main object of the present invention is to allow the automatized cleaning of moving escalators. The cleaning device disclosed comprises a horizontal plate and a "J"-shaped structure being attached to each other by means of a hinge system which allows the "J"-shaped structure to pivot around an axis of the flat plate.

The lower part of the horizontal plate is adapted for coupling of several cleaning attachments thereto, such as brushes, rollers, sponges, mops, etc. All these attachments are interchangeable and can be replaced once the service life thereof is finished. It can also be contemplated, at the inner part of this horizontal plate, the arrangement of cleaning modules using steam, suction or cryogenic technology by using CO₂ pellets and pressurized air jets, which can be adapted depending on the user needs.

The "J"-shaped structure has the same technical characteristics as those described for the horizontal plate, specifically adapted to this "J"-shaped structure (by adapting the size and arrangement of the attachments and cleaning modules).

Another object of the present invention is that the cleaning device described performs a robotic operation by means of a computerized system. Thus, the requirement of counting with an operator during the cleaning cycle is avoided.

Another object of the present invention is to enable continuous movement of the escalator while the process for cleaning the two surfaces of each step is performed. This is achieved thanks to the hinge system for the attachment of the horizontal plate and the "J"-shaped structure.

Another object of the present invention is to enable the previous programming for the automatic operation of the cleaning device. Thereby, it preferably comprises a digital control panel.

- 5 It can also comprise a wireless communication system configured for sending a notification for the user about the cleaning process state and completion thereof directly to said user mobile device.

10 It is another object of the present invention to control the cleaning modules operation through a servo-motor unit which is supplied with power by a battery being rechargeable by means of electrical connection.

15 It is another object of the present invention to enable a better stability during the whole cleaning process by means of two sets of suction pads for adhering to the escalator side glass surface.

DESCRIPTION OF THE DRAWINGS

20 To implement the present description and in order to provide a better understanding of the characteristics of the invention, according to a preferred embodiment thereof, a set of drawings is attached as part of this description, with an illustrative but not limitative purpose, which represents the following:

25 Figure 1.- It shows a side view of the escalator robotic cleaning device with cleaning modules.

Figure 2.- It shows a top view of the escalator robotic cleaning device in which the suction pad system has been represented.

30 Figure 3.- It shows a top view of the escalator robotic cleaning device in which the cleaning modules can be seen.

Figure 4.- It shows a side view of the escalator robotic cleaning device without cleaning modules.

Figure 5.- It shows a scheme of the system for connecting the escalator robotic cleaning device through a battery.

5 Figure 6.- It shows a view of the control panel through which all the processes of the robotic cleaning device are managed.

Figure 7.- It shows a system for connecting the robotic cleaning device to an electric source.

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PREFERRED EMBODIMENT OF THE INVENTION

The following is a description, with the help of figures 1 to 7, of an exemplary embodiment of the present invention. Said figures are not to scale. The current dimension and shape of the components may vary. Only the relevant details of the escalator robotic cleaning device are shown.

Figure 1 shows a side view of the escalator robotic cleaning device depicting the horizontal plate (A) and a "J"-shaped structure (B). The horizontal plate (A) and "J"-shaped structure (B) are independent and attached to each other by a hinge system (5) which allows the pivoting movement of the "J"-shaped structure (B) around an end of the horizontal plate (A).

Preferably, the horizontal plate (A) is configured to accommodate at least a first cleaning module (4) and the "J"-shaped structure (B) is configured to accommodate at least a second cleaning module (2).

As it has been described above, the first cleaning module (4) and the second cleaning module (2) can be several cleaning attachments such as brushes, rollers, sponges, mops, etc., they can be cleaning modules operated by steam, suction or cryogenic technology by means of CO₂ pellets and pressurized air jets, or a combination thereof.

The tilting movement of the “J”-shaped structure makes it possible that, when each step (3) of the escalator advances, the “J”-shaped structure (B), upon tilting, gives way thereto and allows it to keep on going down (6).

- 5 In an exemplary embodiment as that shown in figure 1, the cleaning device comprises a rechargeable battery (7) which supplies it with power.

The robotic cleaning device preferably comprises a suction pad system (1) for the support thereof to the glass sides of the escalator. This suction pad system (1) makes it possible for the robotic cleaning device to keep the position thereof in the escalator during the cleaning operation.

Figure 2 represents a top view of the horizontal plate (A) of the robotic cleaning device. It shows the suction pad system (1) preferably comprising at least two bars longitudinally passing through the horizontal plate (A) and which comprise suction pads at the ends thereof.

The suction pads are configured for allowing the robotic cleaning device to be fastened to the glasses which can generally be found in the escalators sides. Similarly, these suction pads allow attaching thereof to other types of surface which may be at the sides of the escalators to be cleaned.

The suction pad system allows the robotic cleaning device position to be fixed during the whole cleaning operation so it is not necessary for it to be held by an operator.

25 On the other hand, figure 3 shows a top view of the robotic cleaning device in which the cleaning modules have been represented (2, 4).

Figure 4 shows a view similar to that of figure 1 in which the escalator robotic cleaning device can be seen from a side thereof. This figure does not show the cleaning modules (2, 4) so that the cleaning device configuration can be shown more easily. It shows the horizontal plate (A), the hinge system (5) and the “J”-shaped structure (B). The configuration of the horizontal plate (A) and the “J”-shaped structure makes it possible

for the cleaning device to correctly adapt to the shape of each step (3) and guarantee a correct cleaning.

Figure 5 shows a scheme of the system for connecting the cleaning device through a battery (7). Said scheme represents the scheme for a cleaning device comprising a computerized system.

More specifically, the cleaning device comprises a wireless communication system (Wireless), which can be configured, for example, for sending a notification for the user about the cleaning process state and completion thereof directly to a mobile device.

In this embodiment of figure 5, the cleaning device additionally comprises a control panel, which preferably is as represented in figure 6. Said control panel is configured for managing all the processes of the robotic cleaning, that is, it controls the cleaning modules (2, 4).

Figure 7 shows a scheme of the system for manually connecting the robotic cleaning device. In this exemplary embodiment the escalator robotic cleaning device comprises a servo-motor unit for controlling the cleaning modules (2, 4) which is supplied with power by a battery being rechargeable by means the electrical connection.

CLAIMS

- 1.- Escalator robotic cleaning device comprising:
- a horizontal plate configured to accommodate at least a first cleaning module,
 - 5 - a “J”-shaped structure configured to accommodate at least a second cleaning module,
 - a hinge system for attaching the horizontal plate to the “J”-shaped structure which allows tilting of said “J”-shaped structure with respect to an end of the horizontal plate,
 - means for attaching the robotic cleaning device to the escalator.
- 10 2.- Escalator robotic cleaning device according to claim 1 wherein the attaching means is a suction pads system comprising at least two bars longitudinally passing through the horizontal plate and comprising suction pads at the ends thereof.
- 3.- Escalator robotic cleaning device according to claim 1 further comprising a
15 computerized system.
- 4.- Escalator robotic cleaning device according to claim 1 further comprising a digital control panel.
- 20 5.- Escalator robotic cleaning device according to claim 1 comprising a wireless communication system configured for sending a notification for the user about the cleaning process state and completion thereof directly to a mobile device.
- 25 6.- Escalator robotic cleaning device according to claim 1 further comprising a servo-motor unit for controlling the cleaning modules and which is supplied with power by a battery being rechargeable by means of electrical connection.

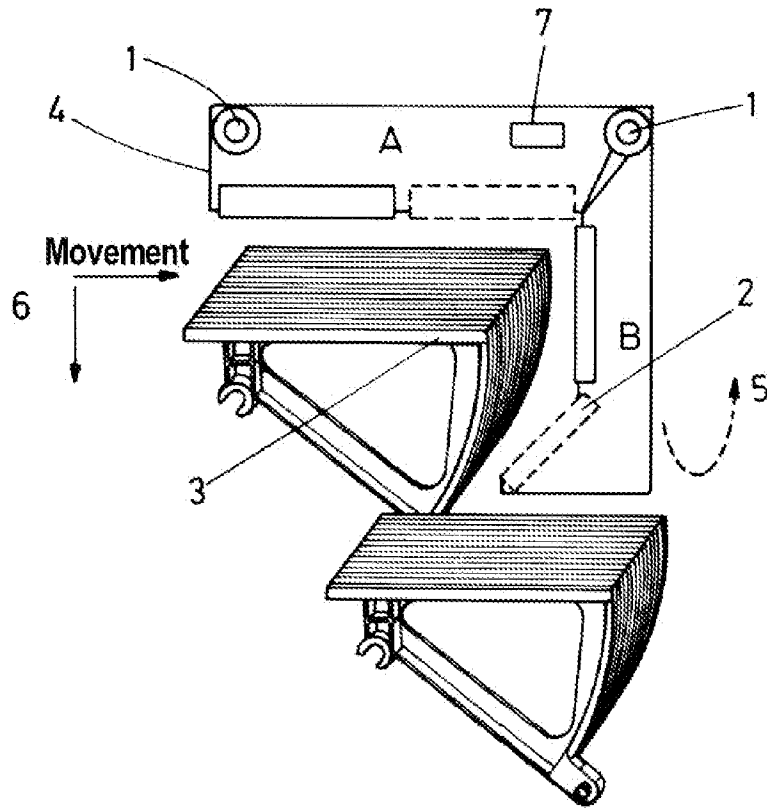


FIG.1

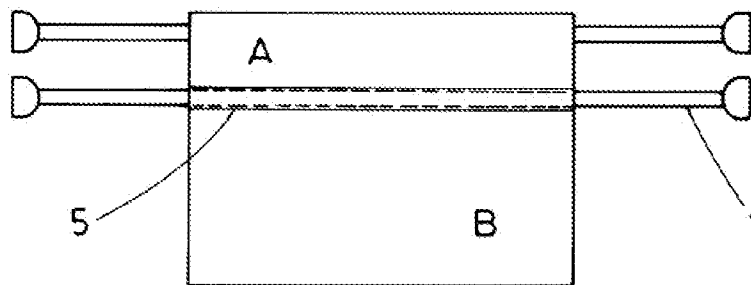
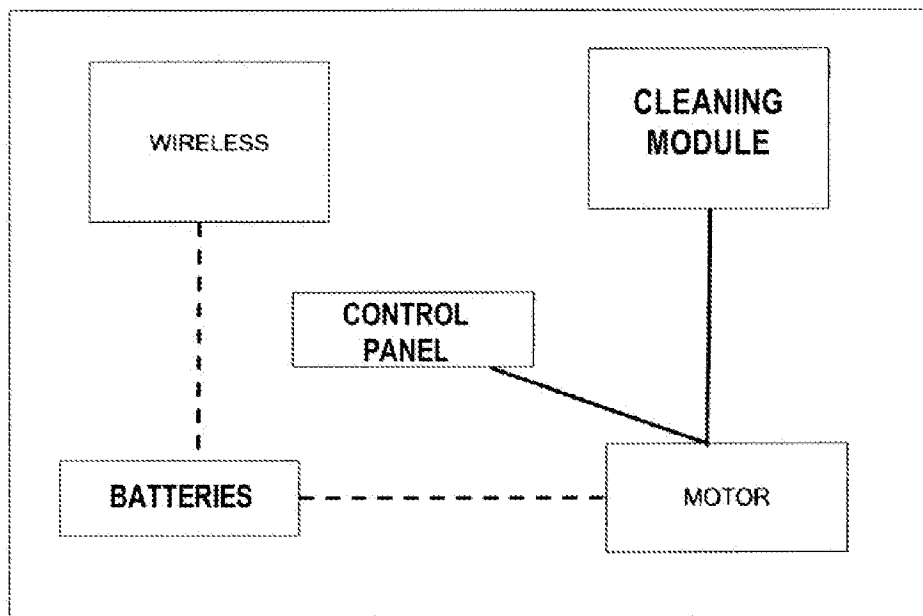
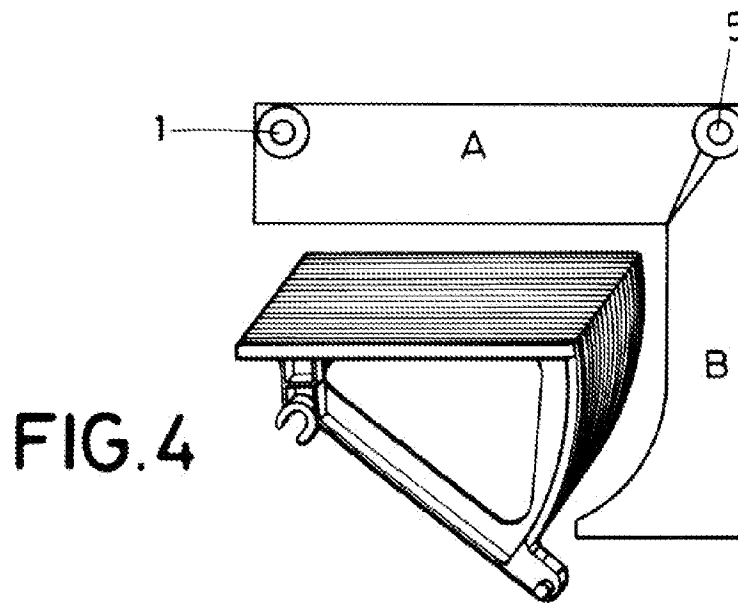
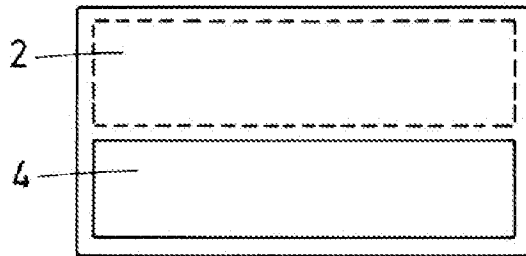


FIG.2



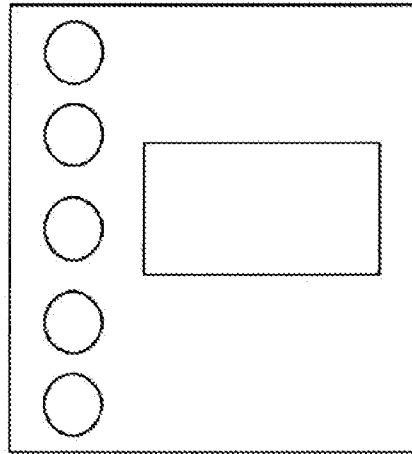


FIG. 6

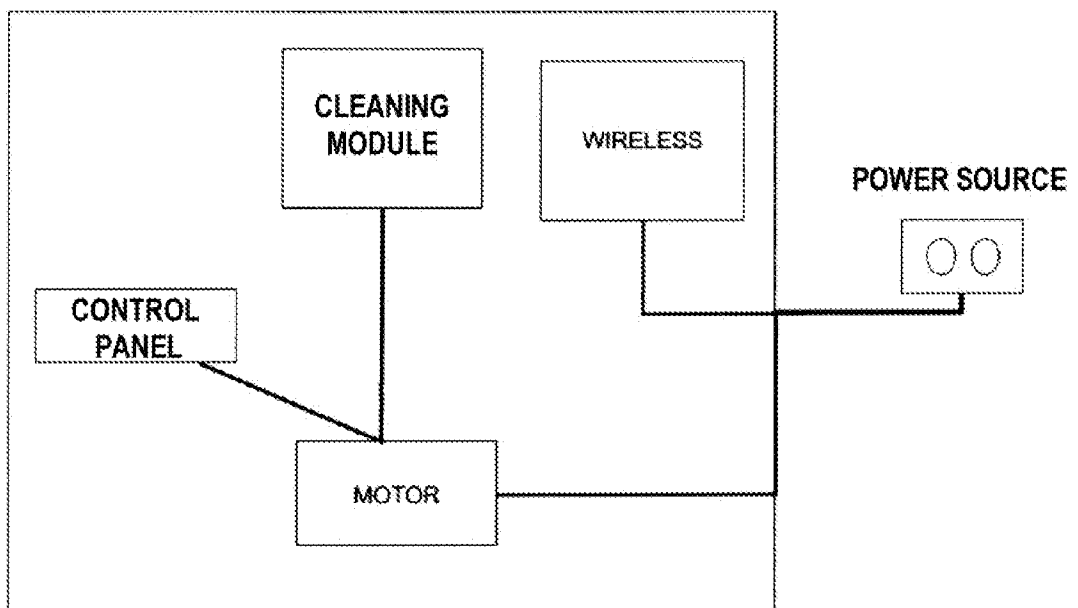


FIG. 7