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(54) **DEVICE FOR DISINFECTING THE AIR IN UNDERGROUND RAILWAY CARRIAGES**
VORRICHTUNG ZUR ENTKEIMUNG DER LUFT IN U-BAHN-WAGGONS
INSTALLATION DESTINÉE À LA DÉCONTAMINATION DE L'AIR DANS LES VOITURES DE MÉTRO

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Description

TECHNICAL FIELD

[0001] The invention relates to the means for passenger railcar air disinfection with the help of bactericidal ultraviolet (UV) radiation and may be used for the ventilation and conditioning systems of ground and underground transport, mainly for subway trains.

PRIOR ART

[0002] Known is a passenger railcar air conditioning device, which consists of a compression type chilling machine, air purification filters, outside and recirculation air input devices, adjusting chokes, outside and recirculation air mixing chamber, devices for air distribution from delivery air ducts throughout the passenger space, devices for air elimination from the railcar, electric power supply. In the channels of the air path of the ventilation system are installed disinfecting ultraviolet (UV) radiation devices, which are connected to the electric power supply. The disinfecting devices may be installed in the recirculation air flow behind the purification filter before the air entry into the air cooler or fan, or in the outside air flow behind the purification filter before the air entry into the air cooler or fan, or installed in the flow of the mixture of outside and recirculation air behind the purification filter before the air entry into the air cooler or fan, or installed in the delivery air duct before the devices for air distribution throughout the passenger space, or in all the above places simultaneously. However, disinfection of the entire air flow is irrational and requires high energy costs for providing the required UV radiation dose (RU No 2278794, B61D27/00, 2004).

[0003] Known is a device for air disinfection by UV radiation in the railway transport ventilation and conditioning systems. The device consists of a body with inlet and outlet windows for air, inside which, via impact dampers, is installed a bactericidal UV lamp. The inlet window is closed by a grid assembled from profile elements covered with a photocatalyst layer. The grid prevents the UV radiation escape outside and additionally purifies the air in the photocatalysis process. The device is built into the recirculation channel of the passenger railcar ventilation and conditioning system. In the passenger railcar air supply system, provision is made for the fresh air to be taken to the

railcar air distribution system from the outside, and then it is distributed throughout the compartment. After contact with people, the flow of the air infected with microorganisms goes from the railcar through the inlet window into the UV radiation zone,

where, after interaction with photocatalyst and under the influence of the bactericidal radiation of the UV lamps, it is disinfected and purified for recirculation and reuse. The disinfected air is then eliminated through the outlet window and, with the help of the conditioner fan, is supplied

to the railcar compartment again. As a source of bactericidal UV radiation are used powerful low pressure gas discharge amalgam lamps (RU U No 78074, A61L2/10).

[0004] Document GB 2 415 627 refers to an air purifier which comprises a housing, the housing having a plurality of air inlets and a plurality of air outlets, an ultraviolet radiation tube means located within said housing between said air inlets and air outlets for generating ultraviolet rays, at least one extractor fan means drawing air into said housing through said air inlet, over the ultraviolet radiation means and out of the housing through the air outlet. An air collector is provided between said extractor fan and said housing. A high negative voltage discharge/carbon fibre is located between the ultraviolet radiation tube and the air outlet to produce and increase the quantity of anions. The purifier may be provided with protection means to prevent extreme ultraviolet radiation being emitted from the housing to protect the eyes of the user.; The system may emit ultraviolet radiation at a wavelength of 253.7nm. The UV tube may be replaceable and the system may be placed in an air-conditioning device. Also claimed is an air purifier comprising inlets and outlets, a filter, an ultraviolet radioactive ray chamber for housing an ultraviolet radiation means, a carbon fibre for regenerating anions, the housing including a rectangular hole-site which fastens an external power line, the air purifier further comprising a switch to turn the power on or off.

[0005] Document DE 20 2004 008874 discloses an air purifier for a car or other vehicle for removing viruses, bacteria and other micro organisms from air. The air purifier comprising a housing containing at least one extractor fan, a carbon filter and an ultraviolet radiation tube. Air is taken into the device via an air intake trellis which functions to remove dust and other particles from the air, and exits the device via an exhaust frame trellis. The UV tube is easily removable and replaceable and the housing shields the users eyes from any radiation.

[0006] A drawback of the known device is that the field of its application is limited by the sanitary requirements to the air supply of the passenger railway transport, which air supply system is based on the fact that pure outside air enters it initially and usually there is a recirculation channel, which allows just disinfecting the recirculation air only.

DISCLOSURE OF THE INVENTION

[0007] The basis of the present invention is the task to create device for efficient disinfection in the ventilation and conditioning systems of such transport facilities where the inflow of the pure air is realized from a limited space - for example, for subway railroads located in a tunnel. The technical result achieved when implementing the invention consists in implementing the possibility of disinfecting the air in the subway railroads, as well as in reducing the disinfection process energy costs.

[0008] The said technical result is achieved by a device

according to claim 1. On the top surface of the body is applied a sound-absorbing layer fixed on the body with the help of a grid, and on the bottom surface is applied a layer of the vibration-absorbing material. The edge of the body has a downward incline.

BRIEF DESCRIPTION OF DRAWINGS

[0009] In fig. 1 and 2 are shown the views of the subway railcar air disinfection device, top and side (in section), and in fig. 3 - bottom view. Body 1 of the device is made open from the top and has recess 2 formed by the bend of the body wall throughout its width. Bactericidal UV lamp 3, fixed on impact dampers 4, is positioned in the body recess, which prevents UV radiation escape to the passenger compartment and conditioner. Between the lamp and the body there is gap 5 for passing of the air flow under the lamp. One of the body edges 6 has partial incline 7 downwards for ensuring smooth expansion of the air channel. At the bottom, the lamp is covered with removable cover 8 fixed to the body so that air flow can pass between the body and the cover.

[0010] At the top, on the body is applied sound-absorbing layer 9, pressed to the body with protective grid 10. The layer is made from a UV radiation resistant material. At the bottom, on the body is applied layer 11 of vibration-damping material.

BEST MODE FOR CARRYING OUT THE INVENTION

[0011] The device operates as follows. The device is built into the air channel in the near-roof space of a subway railcar at the outlet of the conditioner in such a manner that the UV lamp is oriented perpendicularly to the flow of the treated air, and the edge of the body, having a downward incline, is distant along the flow from the inlet of the treated air. The UV lamp operation is controlled by a separate starting controller (SC), connected with it by cable. The external dimensions of the device are approximately 600x900x120 mm, SC - 270x105x62 mm.

[0012] As a source of bactericidal radiation is used a 170 W low pressure gas discharge amalgam lamp. The air flow passing through the air duct is subjected to the bactericidal radiation with a wavelength of 254 nm, and is disinfected. Due to the fact that the lamp is positioned in the recess, it is not overcooled by the passing air flow, the intensity of its radiation does not reduce and constantly ensures the UV radiation dose required for efficient disinfection. Moreover, such position of the lamp protects from UV radiation escape into the compartment and conditioner.

[0013] The gap between the lamp and the body, as well as between the cover and the body, allows the air flow to freely pass under the device, which ensures uniform distribution of the disinfected air in all zones of the passenger compartment.

[0014] Making the edge of the body with an incline allows smooth increasing of the channel section for air

passing through the device, due to which the pressure loss and aerodynamic noise level are substantially reduced. At the bottom, the lamp is covered with a cover fixed on the body, which prevents UV radiation from passing into the passenger compartment and conditioner. The cover is installed in such a manner that there is a possibility for air passing between the body and the cover, which ensures uniform radiation and disinfection of the treated air flow both above and under the lamp.

[0015] Then, through the ventilation holes, the disinfected air goes to the passenger compartment, from which, during movement, it is moved to the tunnel and mixes with the ambient air. Then the fans supply air from the tunnel to the conditioner, creating partial recirculation of the air.

[0016] The presence of the vibration-absorbing layer (for example, vibration-damping fireproof materials VDF with aluminum foil coating) and fixing of the lamp on the impact dampers allows reducing vibration that occurs during movement of the train and the air along the channel and is transmitted to the device's elements down to the acceptable values, and the sound-absorbing material (Supersilika-M2) along with the structural elements (body edge downward incline) reduces the pressure loss and the aerodynamic noise level of the air flow, which increases the comfort of the device's operation. The device is conveniently positioned in the under-roof space of the railcar, while the removable cover ensures easy access to the lamp for maintenance and replacement of the lamp.

[0017] The present invention allows maintaining the epidemiologically safe for the passengers level of insemination of the air with microorganisms in accordance with the sanitary and hygienic norms of the subway with low energy costs for its disinfection.

Claims

1. Device for disinfection of air in the ventilation and conditioning system of a railcar, the device comprising a body (1) with impact dampers (4), a bactericidal UV lamp (3) fixed into the body (1) via the impact dampers (4), and a means of protection against UV radiation escape, wherein the body (1) is made open from the top with a recess (2), the bactericidal UV lamp (3) is positioned in the recess (2) so that between the body (1) and the lamp (3) there is a gap (5), and wherein a removable cover (8) is fixed at the bottom of the body (1) under the lamp so that air flow can pass between the cover (8) and the body (1), the cover (8) and the recess (2) being used as a means of protection against UV radiation escape, the device being **characterized in that** one of the body (1) edges has a downward incline (7) relative to the top of the body, for ensuring smooth expansion of the air channel, the edge of the body (1) having the downward incline

(7) is distant along the flow from an inlet of the treated air, and
the device is adapted to be built into an air channel in the near-roof space at an outlet of the ventilation and conditioning system of the railcar.

2. Device according to claim 1 **characterized in that** at the top, on the body (1), is applied a layer (9) of sound-absorbing material resistant to UV radiation.
3. Device according to claim 2 **characterized in that** on the sound-absorbing material resistant to UV radiation a grid (10) is fixed.
4. Device according to claim 1 **characterized in that** at the bottom, on the body (1), is applied a layer (11) of vibration-absorbing material.

Patentansprüche

1. Vorrichtung zur Entkeimung der Luft in der Lüftungs- und Klimaanlage eines Bahnwaggon, wobei die Vorrichtung ein Gehäuse (1) umfasst mit

Stoßdämpfern (4), einer bakteriziden UV-Lampe (3), die mittels der Stoßdämpfer (4) in dem Gehäuse (1) befestigt ist,
und einem Mittel zum Schutz vor austretender UV-Strahlung, wobei das Gehäuse (1) von oben offen mit einer Vertiefung (2) ausgebildet ist, die bakterizide UV-Lampe (3) in der Vertiefung (2) angeordnet ist, so dass zwischen dem Gehäuse (1) und der Lampe (3) ein Zwischenraum (5) ist, und wobei eine entfernbare Abdeckung (8) an der Unterseite des Gehäuses (1) unter der Lampe so befestigt ist, dass ein Luftstrom zwischen der Abdeckung (8) und dem Gehäuse (1) durchströmen kann,
wobei die Abdeckung (8) und die Vertiefung (2) als Mittel zum Schutz vor austretender UV-Strahlung verwendet werden,
wobei die Vorrichtung **dadurch gekennzeichnet ist, dass**
einer der Ränder des Gehäuses (1) eine bezüglich der Oberseite des Gehäuses nach unten geneigte Schräge (7) aufweist, so dass eine ungehinderte Erstreckung des Luftkanals ermöglicht wird,
wobei der Rand des Gehäuses (1), der die nach unten geneigte Schräge (7) aufweist, von einem Einlass der behandelten Luft in Richtung der Strömung entfernt angeordnet ist, und die Vorrichtung dafür eingerichtet ist, in einen Luftkanal in den Raum in Deckennähe an einem Auslass der Lüftungs- und Klimaanlage des Bahnwaggon eingebaut zu werden.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** an der Oberseite an dem Gehäuse (1) eine Schicht (9) von schallabsorbierendem Material aufgebracht ist, das resistent gegen UV-Strahlung ist.
3. Vorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** auf dem schallabsorbierenden Material, das resistent gegen UV-Strahlung ist, ein Gitter (10) befestigt ist.
4. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** an der Unterseite an dem Gehäuse (1) eine Schicht (11) von schwingungsabsorbierendem Material aufgebracht ist.

Revendications

1. Dispositif pour la désinfection de l'air dans le système de ventilation et de climatisation d'un wagon, le dispositif comprenant un corps (1) avec des amortisseurs de choc (4), une lampe UV bactéricide (3) fixée à l'intérieur du corps (1) par l'intermédiaire des amortisseurs de choc (4), et un moyen de protection contre une fuite de rayonnements UV, dans lequel le corps (1) s'ouvre par le haut avec un évidement (2), la lampe UV bactéricide (3) est positionnée dans l'évidement (2) de sorte qu'entre le corps (1) et la lampe (3) se trouve un interstice (5), et dans lequel un couvercle amovible (8) est fixé au niveau du fond du corps (1) sous la lampe de sorte qu'un flux d'air puisse passer entre le couvercle (8) et le corps (1), le couvercle (8) et l'évidement (2) étant utilisés en tant que moyen de protection contre une fuite de rayonnements UV, le dispositif étant **caractérisé en ce que** l'un des bords du corps (1) présente une inclinaison vers le bas (7) par rapport au haut du corps, pour assurer la dilatation sans à-coups du canal d'air, le bord du corps (1) ayant l'inclinaison vers le bas (7) est distant le long du flux d'une entrée de l'air traité, et le dispositif est adapté à être construit à l'intérieur d'un canal d'air dans l'espace proche du toit au niveau d'une sortie du système de ventilation et de climatisation du wagon.
2. Dispositif selon la revendication 1 **caractérisé en ce qu'au** niveau du haut, sur le corps (1), est appliquée une couche (9) de matériau absorbant le son résistant aux rayonnements UV.
3. Dispositif selon la revendication 2 **caractérisé en ce que** sur le matériau absorbant le son résistant aux rayonnements UV est fixée une grille (10).
4. Dispositif selon la revendication 1 **caractérisé en ce qu'au** niveau du fond, sur le corps (1), est appliquée une couche (11) de matériau absorbant les vibrations.

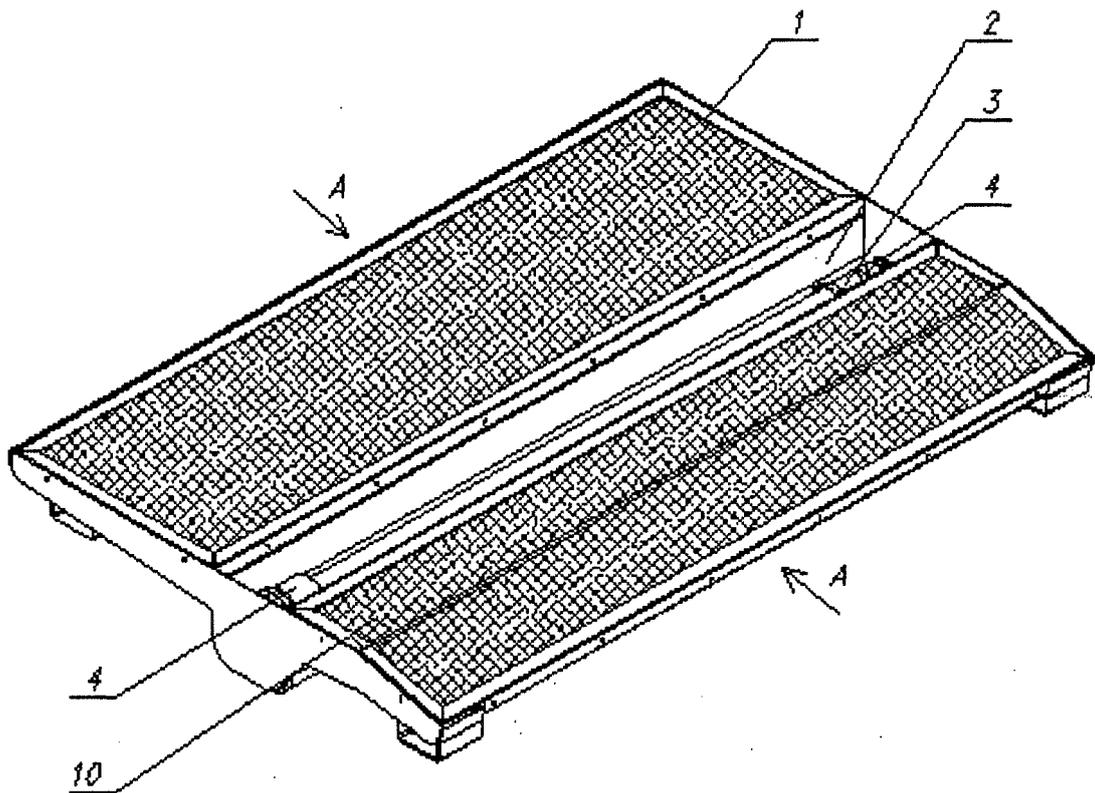


FIG 1.

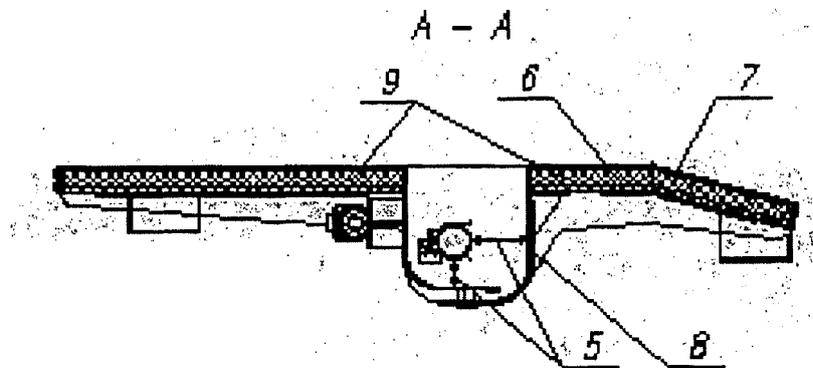


Fig 2.

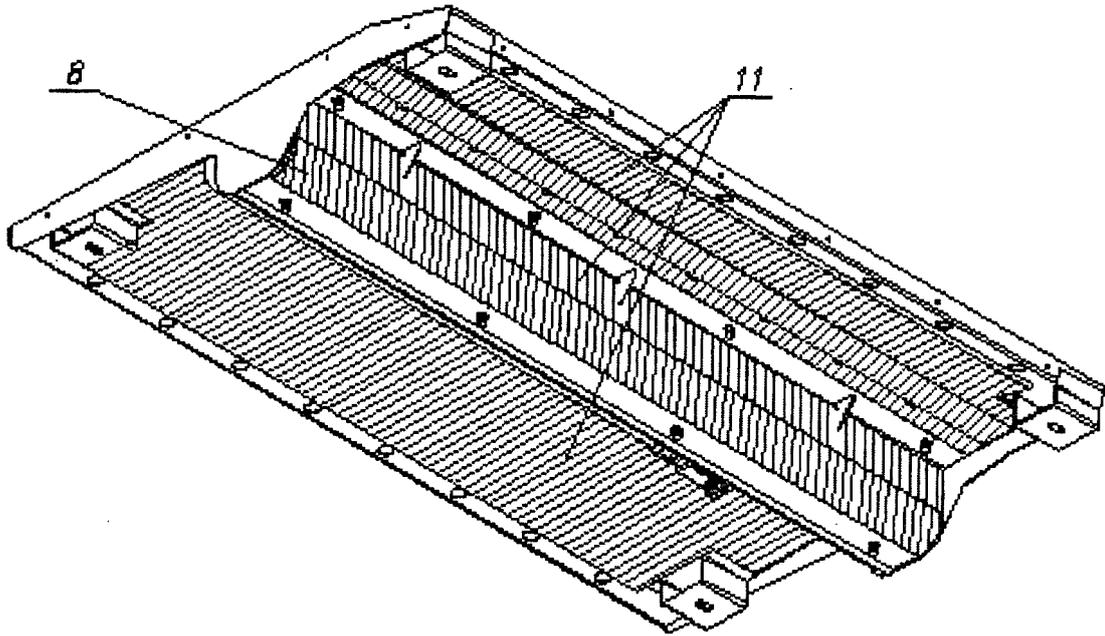


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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