United States Patent [19]

Van Der Waaij et al.

[11] **3,777,736**

[45] **Dec. 11, 1973**

[54] **TRANSPORTER FOR SUBSTANTIALLY GERMFREE TRANSPORT OF BIG LIVING ORGANISMS**

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[22] Filed: **Mar. 16, 1971**

[21] Appl. No.: **124,767**

[30] **Foreign Application Priority Data**

Mar. 16, 1970 Netherlands 7003728

[52] **U.S. Cl.** ..... **128/1 R**, 55/DIG. 29, 55/385, 55/473, 55/484, 98/31

[51] **Int. Cl.** **B01d 46/12**

[58] **Field of Search** ..... 55/DIG. 29, 469, 55/470–473, 385, 484; 98/31; 128/1 R

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[57] **ABSTRACT**

A transporter for substantially germfree transport of big living organisms from an operating-theatre to a clean room, which transporter contains a space wherein a laminar down-flow of clean air is maintained by mounting an adjustable air-conditioning equipment provided with a power source of its own and with a connection to an other source of energy, the air-conveying channels surrounding the space on four of the five walls and an entrance to the space being provided with a mechanism for opening and closing that is coupled to the air-conditioning equipment.

8 Claims, 2 Drawing Figures

FIG. 1

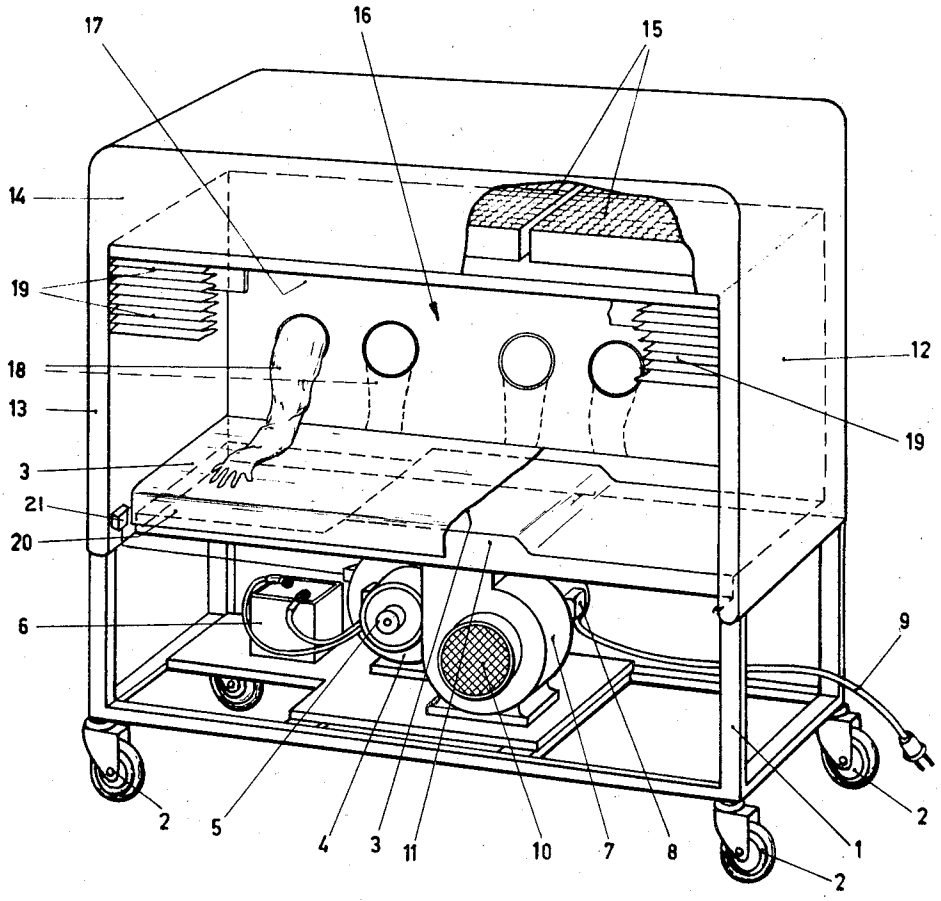
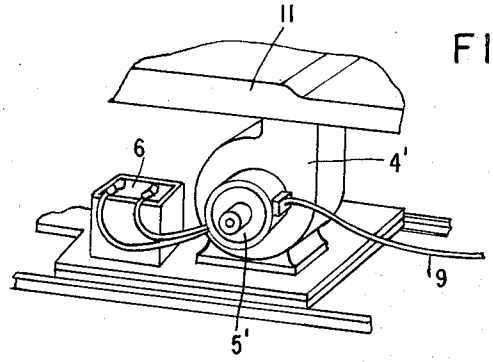


FIG. 2



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TRANSPORTER FOR SUBSTANTIALLY GERMFREE TRANSPORT OF BIG LIVING ORGANISMS

The invention relates to a transporter for substantially germfree conveying big living organisms, in particular a germfree stretcher for serious cases.

BACKGROUND OF THE INVENTION

Besides objects which have to meet particular requirements as regards accuracy and cleanness, living organisms, too, are more and more treated in conditioned rooms. These rooms are known in the art as "clean rooms" and are characterized by a system of air-conditioning according to the principle of laminar flow, i.e., in the room a flow of air is maintained, which comes from hepa (high efficiency particulate air) filters into the ceiling or a side-wall and passes by the room in the laminar flow before it disappears through discharge openings or grids in the floor or in an opposite side-wall. The velocity of the air in the clean room is more than 45 cm per second and the filters retain 99.97 percent of all particles bigger than 0.3 microns, so that practically all bacteria are retained and cannot penetrate any more from the discharge openings either.

Especially operating theaters in hospitals are more and more built as clean rooms, because patients with serious injuries, surgical patients and transplantation patients often have an increased susceptibility to infections. Contaminations with bacteria therefore should be avoided during operation and post-operatively. In practice, however, building an entire hospital wing as a clean room cannot be realized and therefore the patients must be transported from the operating-theatre through an unconditioned atmosphere into a sick-room that is built as a clean room or otherwise contains a tent-shaped bed-arrangement. The latter constitutes a complete enclosure around the bed and has a provision of its own for air through the hepa filters.

It is an object of the invention to provide a transport-isolator for conveying individuals with a strongly reduced defense capacity from one clean room to an other. Transporters for conveying dead bodies are known in the art. They contain a space filled and completely closed from a clean room. Then it can be rolled to an other clean room and opened there. This cannot be done with big living organisms in such a relatively small space, because this space cannot be closed without drawbacks for the living organisms inside. Therefore, according to the invention a transport device is provided with an air-conditioned space. The air-conditioning equipment according to the principle of laminar flow is, during conveyance, operating preferably on a power source of its own.

The space in the transporter is quite small, yet a relatively large entrance should allow of being closed and opened, a different laminar flow occurs in the space when it is in the open state and a modification in the flows occurs upon opening and closing. Owing to this, bacteria might come into the space through the entrance, which must be prevented.

SUMMARY OF THE INVENTION

Therefore, according to the invention this device is provided with an adjustable air-conditioning equipment that preferably is coupled with the mechanism for opening and closing.

When it is in the open state a larger amount of air is required to keep the space germfree than when it is in the closed state and because opening and closing of the device takes place when it is in the stationary position, the air-conditioning equipment according to the invention is preferably subdivided in a part that operates individually on a power source of its own and a larger other part whose power source is situated outside the device and is connected during the stationary position.

The fan or fans with their driven gear(s) and prefilters, if any, and damping-rooms, if any, of the air-conditioning equipment are provided in the base of the device and according to the invention four of the five walls of the space can be formed by the inner-walls of a horizontal distributing-box over the fans and of two channels, inclining upwards, at the ends of the distributing-box and the bottom-wall of a horizontal distributing-chamber, which is connected to the channels and in which the hepa filters are provided. For the conveyance of the patients the opening must be provided at a long side-wall, whereas the opposite long side-wall of the room is formed by a transparent flexible plastics screen in which sleeves with gloves are provided for handling the patient when bringing him in and taking him out.

Preferably the entrance to the space should be closed with a hanging folding-curtain. Of this the inner side is, both in the closed and the open position, exclusively exposed to the laminar flow in the space and never comes into contact with the outer side, while the air is always able to flow out below the bottom edge.

After the inside of the transport-isolator has been sterilized, it can be rolled in closed position into an operating-theater and after it has been opened the patient can be placed from the operating-table into the space, whereafter closing is effected and conveying can begin. The exterior of the device need not be made germfree, however, if in the wall of the operating-theatre there is a passageway, which opens into the open air and which corresponds with the entrance to the space in the transporter. The same holds true for taking the patient out in a sick-room or a tent-shaped bed-arrangement. Then conveying need not be effected by nursing-staff dressed in sterile cap and gown, whereas nevertheless upon bringing the patient in and taking him out, with the aid of sleeves and gloves, built into the flexible side-wall, help can be offered from the outside to staff, in the clean room, operating-theatre or sick-room, which has been dressed in sterile cap and gown.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an embodiment of a stretcher-shaped transporter according to the invention.

FIG. 2 is a perspective view of a variant of the same embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

According to FIG. 1, a frame 1 of the device is mounted on four castor-wheels 2, which in the same way as with a hospital-bed, can rotate around vertical shafts and can be blocked so as to obtain a fixed position. Frame 1 has dimensions that as regards length and breadth correspond with the hospital bed. The height

of the device is, however, determined by the dimensions of the door openings that have to be passed.

At standard bed-height a carrying-plate 3 is provided and upon it a mattress can be placed on which a patient is laid down.

Under carrying-plate 3 in the base of frame 1 a fan 4 with motor 5 is arranged, which is fed from a battery 6 or an other independent power source.

By the side of this fan 4 a second bigger fan 7 with motor 8 is mounted, but this is fed from a wall-socket via an insulated wire 9. The second fan 7 can only be put into operation when the transporter is stopped near a wall-socket.

Before the inlet, fans 4 and 7 are provided with damping-rooms 10 and pre-filters, if desired. The fans discharge into a horizontal distributing-box 11 under carrying-plate 3. To this box flat channels 12 and 13 are connected, which bend around carrying-plate 3 and incline upwards as head-walls to a horizontal distributing-chamber 14 over carrying-plate 3. Owing to the supply from both ends out of channels 12 and 13, the distribution of air in distributing-chamber 14 is particularly even. The bottom of this distributing-chamber 14 is formed by a number of hepa filters 15, from which a laminar flow of germfree air, directed downward, flows into a space 16 over carrying-plate 3. At a long side at the back, space 16 is closed by a transparent flexible plastic screen 17, which is provided with four sleeves with gloves 18. Screen 17 fits airtight to the back edge of carrying-plate 3 and is connected airtight with the inner wall of ditributing-box 11 as well as the inner walls of channel 12 and 13, which are inclined upward, and the bottom-wall of distributing-chamber 14. Space 16 is completely determined by the said walls of the air-conditioning equipment and by screen 17 and consequently is in connection with the atmosphere only at its front.

In the oblong opening formed at the front, at the bottom-wall of distributing-chamber 14 a folding-curtain 19 is hung, which fits to the inner-walls of channels 12 and 13, inclining upward, and in the closed position is let down as far as below, and along, a rounded front edge 20 of carrying-plate 3, a slit remaining between curtain 19 and front edge 20. Neither in open nor in closed position will the inner side of this curtain 19 ever come into contact with air other than that out of filters 15.

With curtain 19 in the pulled-up position as seen in the single figure, space 16 is disinfected by spraying it with peracetic acid. Insulated wire 9 is connected and the bigger fan 7 produces, in space 16, a laminar flow of germfree air, which flows out through the opening at the front and under curtain 19. If desired, the exterior of the transporter can also made germfree by a spraying.

When space 16 has been made entirely germfree curtain 19 is closed, smaller fan 4 being automatically switched on and big fan 7 switched off by known switch devices, not shown. For, when the curtain is in the closed position, less air is needed for the inflow and for keeping space 16 germfree and moreover, in the narrow slit that remains open between front edge 20 and curtain 19 the speed of the air must not become too great.

As shown symbolically at 21, the switching on and off of the fan motors can be effected by switch devices that are operated either by the curtain itself or from the driving mechanism of the curtain, if it is not manually pulled up, or from a programmation of the device, with push buttons or the like.

The transporter, made germfree, is rolled into the operating-theatre right to the patient and insulated wire 9 is connected again to a wall-socket. As soon as curtain 19 must be pulled up the bigger fan 7 is switched on, as a result of which a maximum inflow of air is effected in space 16 and no bacteria can force their way into it through the entrance. The patient is laid into space 16 and in doing so the sleeves with gloves 18 can be used in order to lay the patient down in the proper way. Once the patient is in his place, then curtain 19 is closed and the bigger fan is switched off, while smaller fan 4 is put into operation from its own power source, battery 6.

The amount of germfree air the smaller fan produces is sufficient to maintain a completely laminar inflow in space 16 and the air flows out in the slit between curtain 19 and bent front edge 20 of carrying-plate 3 at a level that is considerably lower than the patient and at a velocity that is high enough so as to prevent germs from entering through the slit and low enough so as not to cause any trouble. When the smaller fan is in operation, insulated wire 9 can be disconnected and conveying can begin.

When the transporter has arrived in a sick-room, insulated wire 9 is again connected to a wall-socket and the curtain can be pulled up again by switching on bigger fan 7. As soon as the curtain has been opened completely the patient is taken out of space 16 and transferred to a bed, gloves 18 again being used if required.

When the operating-theatre is provided with a passageway with an opening that corresponds with the entrance to space 16, the transporter can be arranged at the outside of the operating-theater with its entrance in front of the passageway.

Upon fitting it must preferably be arranged that the upper side and the vertical sides of the transporter fit closely to the wall of the operating-theater so that the air is blown out downward. As soon as curtain 19 has been pulled up and big fan 7 is in operation again, the passageway can be opened. The patient can be brought in by nursing-staff in the operating-theatre, dressed in sterile cap and gown, transporting-staff that has not been dressed in sterile cap and gown being enabled to assist from the outside, without further precautions, with the aid of gloves 18. Consequently the exterior of the device need not have been made germfree, whereas conveying nevertheless takes place germfree.

In sick-room with a passageway the reversed procedure is followed. With a tent-shaped bed-arrangement the entrance to space 16 is connected to an opening in the tent and through this the patient is laid into the bed.

For clearness' sake in the figure the fans and their driving gears are shown but normally these are hidden from view by plating. In order to suck as much clean air as possible it may be desirable to connect to damping-rooms 10 a supply channel that leads upward, for instance along a head-wall, so that the air is sucked from the transporter at its top.

It is quite possible that one fan 4' will suffice that operates on an adjustable motor 5' at a small capacity as illustrated in FIG. 2, it is fed by the power source of its own (that is, by the battery 6) and at a great capacity it is fed by a main line from the outside. Nevertheless two fans, each with a motor of its own, are preferred

because in the event of disturbances then always one of the two can be put into action. As has been indicated above, the transporter can be provided in a manner known in the art with electric switches and locking means, which ensure that the various operations can take place in the order required without any mistakes being made.

We claim:

1. A transporter for conveying large living organism under sterile conditions comprising:

a. an upright movable frame;

b. means on said frame defining a substantially enclosed space in which the organism can be received, said means including a first horizontally disposed longitudinally extending air distributing box, spaced apart air channels connected to and extending upward from the ends of said first air distributing box and forming head walls, a second air distributing box overlying and in spaced relationship to said first air distributing box and being disposed generally parallel thereto, said second air distributing box having a plurality of hepa filters forming a lower wall in said distributing box, said second air distributing box being connected to said air channels, and a first longitudinally extending side wall connected to said first and second air distributing boxes and to said air channels at first side edges thereof;

c. a member for supporting the organism in the substantially enclosed space, said member being connected between said head walls and overlying said first air distributing box;

d. an air conditioning device supported on said frame below said first air distributing box, said device having a self-contained, first electrical energy source supported by said frame, fan means connected to said first air distributing box, first means for connecting said first source to said fan means for selectively operating the latter at a relatively low output, second means for connecting an external, second electrical energy source to said fan means for selectively operating the latter at a relatively high output, whereby, when said fan means are operated, air can be circulated through said first air distributing box to said air channels and said second air distributing box, and then through said hepa filters into the substantially enclosed space.

2. An arrangement as defined in claim 1, wherein said first electrical energy source is a battery.

3. An arrangement as defined in claim 1, wherein said fan means include a sole fan and an adjustable motor connected to said fan for driving the latter.

4. An arrangement as defined in claim 1, wherein said fan means include a first fan with a first motor connected thereto and a second fan with a second motor connected thereto, said first motor selectively connected to said first source by said first means and said second motor selectively connected to said second source by said second means.

5. An arrangement as defined in claim 4, further comprising switch devices associated with said two electrical energy sources and said curtain to be actuated by said curtain, whereby said two electrical energy sources can be selectively connected to one or the other of said first and second motors.

6. An arrangement as defined in claim 1, whrein said first side wall is a transparent flexible plastic screen having a plurality of openings therethrough, and further comprising glove means connected to said screen at the openings and extending into the substantially enclosed space.

7. An arrangement as defined in claim 1, further comprising a foldable curtain which is hung along its upper portion to said second air distributing box and is movably guided between said head walls adjacent side edges thereof which are opposite from said first side wall, said curtain being selectively movable between an upper position adjacent said second air distributing box to a lower position adjacent said first air distributing box, whereby when said curtain is in said upper position an entranceway is provided into the substantially enclosed space and in said lower position this entranceway is closed.

8. An arrangement as defined in claim 7, wherein said curtain in its lower position is disposed in spaced relationship to said first air distributing box and there is an elongated air space between said curtain and said first air distributing box.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,777,736 Dated December 11th, 1973

Inventor(s) Dirk van der Waaij, Hendrik J. Erkelens, Pieter A. Bossers and Franciscus J. Kruiswijk

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading of the patent, line 8, change "Nederlands Oranisatie" to --Nederlandse Organisatie--; line 10, change "Vande" to --van de--. Column 4, line 52, before "sick-room" insert --a--; line 62, change "It" to --As illustrated in Figure 2, it--; line 63, after "5'" insert --;--; line 63, delete "as"; line 64, delete "illustrated in FIG.2". Column 6, line 22, change"whrein" to --wherein--.

Signed and sealed this 23rd day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.